BU 2500 – en

CANopen bus interface

Supplementary manual options for NORD - Frequency Inverters

NORD DRIVESYSTEMS

Table of Contents

List of illustrations

1 Introduction

1.1 General

1.1.1 Documentation

Name: **BU 2500**

Material number **6082502**

Series: **Field bus system CANopen®**

1.1.2 Document History

Issue	Order number	Software version	Remarks
BU 2500, October 2016	**6082502**/ 4116	V 2.2 R2	• Combination of manuals BU 0060 EN, October 2012, Part number 607 0601 / 4112 and BU 0260 EN, September 2009, Part number 607 2601 / 3809 • Extensive revision
BU 2500, August 2019	**6082502**/ 3419	V 2.2 R2	• Corrections
BU 2500, October 2019	**6082502**/ 4319	V 2.2 R2	• Correction version

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 CANopen® 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.

CANopen® 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
AK	Order label/response label
Bus module	Bus module
CAN	Controller Area Network
COB	Communication Object
COB ID	Communication Object Identifier
DIN	Digital input
DIP	Dual In-Line Package (= double row housing), compact switch block
DO	Digital output
EDS	Electronic Data Sheet
EMCY	Emergency, abbreviation for CANopen error message
EMC	Electromagnetic compatibility
I / O	Input/Output
FI	Frequency inverter
IND	Index
IP	Internet protocol
I/O	Input, Output
IW	Actual value
LSB	Least Significant Byte, (smallest address)
OSI	Open Systems Interconnection, communication with open systems
OV	Object directory
NMT	Network Management
PDO	Process Data Object
PDO Rx	Reception PDO
PDO Tx	Transmission PDO
PPO	Parameter/Process Data Object
PZD	Process data
RO	Read Only
Rx	Receive
SDO	Service Data Object
PLC	Programmable Logical Controller
STR	String value
STW	Control word
SW	Setpoint
SYNC	Synchronisation Object
Tx	Transmit
U8 (U16, U32)	8 Bit (16 bit, 32 bit) unsigned, without prefix
USS	Universal serial interface
ZSW	Status word

2 Safety

2.1 Intended use

CANopen bus interfaces from Getriebebau NORD GmbH & Co. KG are interfaces for CANopen 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-CAO	Series SK 180E SK 200E SK 200E-FDS SK 540E
SK TU4-CAO-C	
SK TU4-CAO-M12	
SK TU4-CAO-M12-C	
SK CU4-CAO	
SK TU3-CAO	SK 500E series

CANopen bus interfaces from Getriebebau NORD GmbH & Co. KG are used for communication by the frequency inverter with a PLC in a CANopen 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 1.2 "Other applicable documents".

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 CANopen basics

3.1 Characteristics

CANopen is an open communications profile for industrial automation systems. It is based on the CAN bus system (CAN = Controller Area Network), which describes Layers 1 (physical layer) and 2 (data communication) of the OSI model (Open Systems Interconnection Model = reference model for network protocols as system architecture (ISO 11898). The CANopen profiles (application layer, plug assignment and transfer rates) are defined in Layer 7 of the OSI model, which is based on CAN.

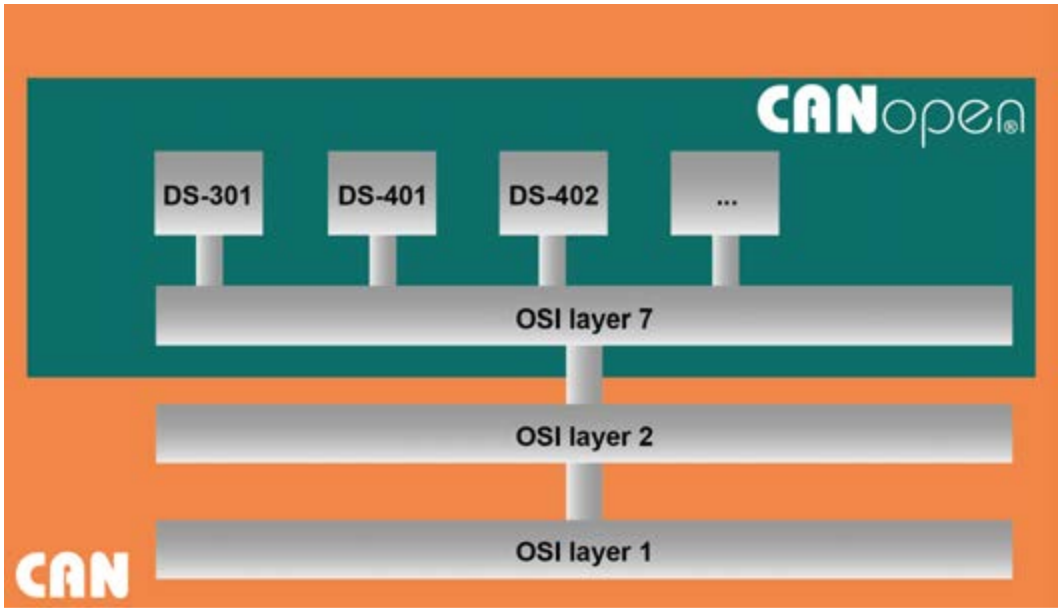


Figure 1: OSI layer model

Item	Description
OSI layer 1	Layer 1, physical layer, defines the hardware, coding, speed etc. of data transfer
OSI layer 2	Layer 2, link layer, defines the communication physics (access method in the field bus and data backup).
OSI layer 7	Layer 7, application layer, defines the interface to the application program with the application-orientated commands.
DS-301	Communication profile DS-301
DS-401	Device profile DS-401, I/O module
DS-402	Device profile DS-402, drive units

CANopen is managed by the association of users and manufacturers "CAN in Automation" (CiA) and is published in the European standard EN 50325-4

CANopen is not a conventional Master-Slave system. In addition to client-server services, the producer-consumer concept is also used. Field bus access rights are not assigned by a higher level control unit, but rather, each bus participant is equally entitled to transfer data as soon as the bus is free (Multi-Master capability). In case of simultaneous access by several participants, access is granted to the subscriber with the highest priority. The priority is assigned by a label (ID) of the message which is to be transferred.

CANopen® is a registered trademark of CAN in Automation (CiA).

CANopen devices can be integrated into a CANopen field bus system without configuration, however a unique bus address and a baud rate must be specified. The node address (node identifier) of a CANopen device, by which the field bus participant is identified, results from the bus address and the baud rate.

Performance description

Standards	CAN ISO 11898; CANopen: EN 50325-4	
Possible number of bus participants	max. 127	
Transfer rate	1 Mbit/s	
Supported profiles	Communication profile DS-301, drive profile DS-402	
Data transmission	Transmission and reading of process and parameter data	
Wiring	Pre-assembled CAN bus cable	
Cable length	Depending on transmission speed:	
	kBit/s	**Bus length**
	1000	30 m
	500	100 m
	250	250 m
	125	500 m
	62.5	1000 m

3.2 Topology

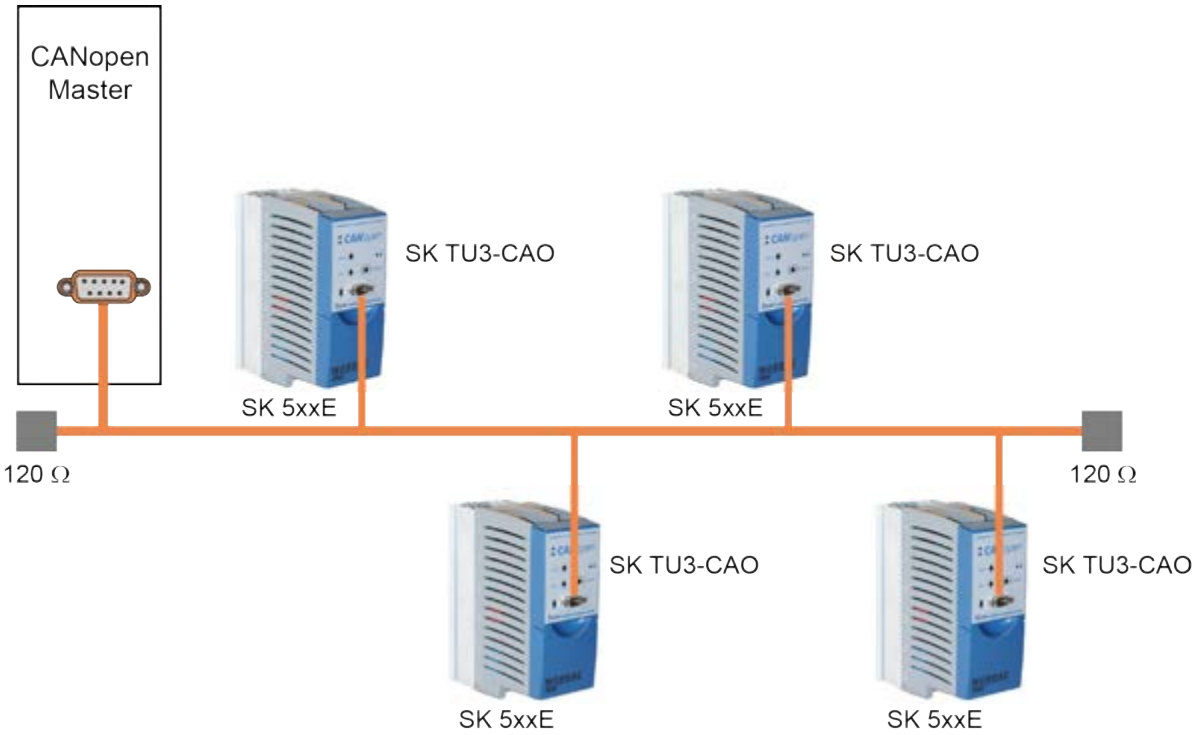


Figure 2: CANopen linear topology (example for up to 64 bus participants)

CANopen bus interfaces from Getriebebau NORD GmbH & Co. KG are connected in a linear structure. All bus participants must communicate with the same baud rate.

Branches from a linear bus are possible using router nodes. The number of bus participants can be increased to a maximum of 127 by using repeaters.

3.3 Bus protocol

The data which are to be communicated via the field bus are embedded in standard CAN-specific frames. The frames differ according to the length of the so-called "identifier" with which the CAN frame is identified:

- Standard frame = 11-bit (CAN specification 2.0A)
- Extended frame = 29-bit (CAN specification 2.0B)

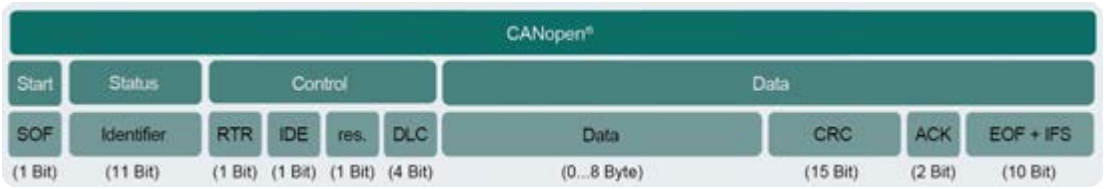


Figure 3: CANopen standard frame – 11-bit identifier

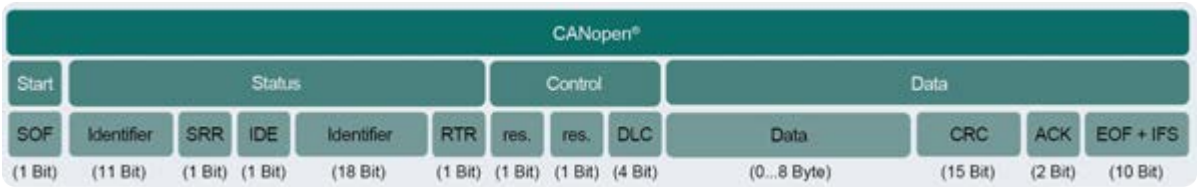


Figure 4: CANopen extended frame – 29-bit identifier

Field	Designation	Description
Start	**SOF**	Start Of File = Dominant data bit for synchronisation
Status	**Identifier**	Label for transferring the priority and access rights of the recipient bus participant
	RTR[1]	Remote Transmission Request = Recessive data bit to differentiate between the dominant data bit and the recessive data request telegram
	SRR	Substitute Remote Request = Replaces the RTR bit of the standard frame and is also used to confirm receipt by the recipient to the sender (telegram received correctly)
	IDE[1]	Identifier Extension = Extension of the identifier
Control	**res.**	Reserved field
	DLC	Data Length Code = Information about the length of the data telegram
Data	**Data**	Data telegram
	CRC	Cyclic Redundancy Check = Checksum which is used to detect errors
	ACK	Acknowledge = Confirmation of correct receipt by other bus participants
	EOF	End Of File = End of the data telegram (7 recessive bit)
	IFS	Inter Frame Spacing = Code for the transfer time of a correctly received message

1 For a standard frame with an 11-bit identifier, this is part of the "Control" field

3.3.1 CANopen protocols

CANopen protocol	Description
NMT protocol	The NMT protocol (Network Management protocol) is used to execute commands from the status machine (e.g. starting and stopping devices).
Module Control protocol	The Module Control protocol is used by the NMT master to change the status of devices. The COB ID (identifier for a communication object) of a CAN frame in the Module Control protocol is always zero; i.e. the function code and the node ID are "0" so that all bus participants can process the data which is transferred. The actual node ID of the participant to which the data is to be transferred is sent via the data area (in the second byte). If this ID is "0", all bus participants are switched to the commanded state.
Heartbeat protocol	The readiness of bus participants for operation is monitored with the heartbeat protocol. A heartbeat producer (usually a slave) sends a message at regular intervals with the function code "1110b" and its node ID (COB ID = 700h + node ID) The data section of the frame contains a byte which indicates the status of the node. If the heartbeat consumer does not receive this message within a certain time (defined in the object directory of the device) the consumer can, e.g. reset the device or display an error message.
Bootup protocol	The transition of CANopen devices from "Initialisation" to "Pre-Operational" status is made during the startup phase (bootup) of the bus system. During the transition, a single heartbeat message is transferred to the bus in the bootup protocol.
SDO protocol	In the SDO protocol (Service Data Object protocol) values are set and read from the object directory (OV) of a remote device. The device whose object directory is accessed is the SDO server and the device which has access to the remote device is the SDO client. Reading access to an object directory results in an SDO upload and writing into a directory entry results in an SDO download.
PDO protocol	In the PDO protocol (Process Data Object protocol) the real time process data are processed by the bus participants.
SYNC protocol	In the SYNC protocol (Synchronisation Object protocol) the SYNC producer sends the synchronisation signal to the SYNC consumer.
TIME protocol	The optional TIME protocol (Time Stamp protocol) is a high resolution synchronisation protocol for the transfer of a special time stamp message in order to compensate for time deviations in local clocks.
EMCY protocol	Via the EMCY protocol (Error Object protocol) fatal internal device errors are reported to the other bus participants with high priority. The EMCY error codes and the additional information specific to the device are defined in the device profile.

3.3.2 Communication objects

CANopen data communication is carried out with communication objects (COB = Communication Objects):

- Service Data Objects (SDO) for parameterisation of object directory entries
- Process Data Objects (PDO) for communication of real time data
- Network Management objects for control of the NMT status machine
- Synchronisation Objects (SYNC), time stamps and error messages (EMCY)

The communication objects are specified in the object directory (OV) which acts as the interface between the application and the CANopen communication device. Each communication object in the object directory is designated with a 16-bit index. An index may contain up to 255 sub-indices (8-bit). The assignment to a particular index is defined in the CANopen profiles DS-301 (communication profile) and DS-402 (application profile).

<table>
<tr><td>Object Directory (OV)</td><td>The objects which are specified in the object directory contain data, parameters or functions. Access is via Service Data Objects (SDO). An object is addressed via the index (16-bit) and the sub-index (8-bit). The object directory is divided into the following ranges:
<table>
<tr><th>Index range</th><th>Use</th></tr>
<tr><td>0001h…009Fh</td><td>Data types (special case)</td></tr>
<tr><td>00A0h…0FFFh</td><td>Reserved</td></tr>
<tr><td>1000h…1FFFh</td><td>Communication profile</td></tr>
<tr><td>2000h…5FFFh</td><td>Manufacturer-specific objects</td></tr>
<tr><td>6000h…9FFFh</td><td>Up to 8 standardised device profiles</td></tr>
<tr><td>A000h…AFFFh</td><td>Process images from CANopen gateways (CiA 302-7)</td></tr>
<tr><td>C000h…FFFFh</td><td>Reserved</td></tr>
</table></td></tr>
<tr><td>Service Data Objects SDO</td><td>Service Data Objects are used for confirmed transfer of data of any length between two network participants. The SDO client is the initiating participant and has direct access to the object directory entries of the SDO server (read and write). SDO communication is used for parameterisation and diagnosis.</td></tr>
<tr><td>Process Data Objects PDO</td><td>Transfer of process data is made without confirmation. Process data can contain a maximum of 8 bytes. The meaning of the process data is specified by the identifier and the PDO mapping which is set. A Process Data Object is always produced by a producer (transmitter), but can be transferred to several consumers (recipients).</td></tr>
<tr><td>PDO mapping</td><td>The objects "1600h"…"1603h" or "1A00h"…"1A03h" of the object directory specify which objects (setpoints/actual values) are to be transferred in the PDO telegrams.</td></tr>
<tr><td>Identifier</td><td>Each CANopen message has an identifier (standard 11-bit, extended 29-bit), which is used for addressing and assignment of priority.
CANopen defines a pre-set identifier assignment which enables communication between a higher level device and up to 127 other devices.
Structure of the 11-bit identifier:
<table>
<tr><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td colspan="4">Function code</td><td colspan="7">Node identifier (1…127)</td></tr>
</table></td></tr>
</table>

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.

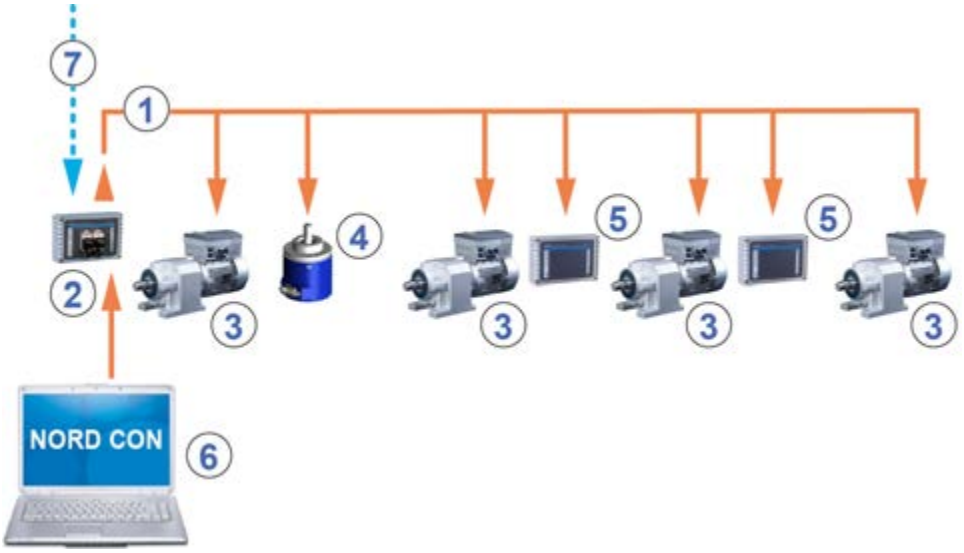


Figure 5: Example of the structure of a NORD system bus

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	1	1
Input/output extensions	8	8	—	8
CANopen encoder	4	4	1	1
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 NORDCON software

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

- Connection of the NORDCON computer to a frequency inverter for **point-to-point USS bus communication**. The NORDCON software only communicates with the frequency inverter to which it is connected.
- Connection of the NORDCON 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 NORDCON computer to a bus interface or frequency inverter for **system bus communication (CANopen)** with a maximum of 32 participants (31 devices plus NORDCON). This requires an installed system bus:
  - Wired,
  - Termination resistors set,
  - System bus participants addressed, USS addresses set to the factory setting ("0"). If the NORDCON 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 NORDCON software is connected acts as a gateway.

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 5.3 "Integration into the bus master"
Assign the bus address	Section 5.3 "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 5.4 "Example: Commissioning the CANopen 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 5.3 "Integration into the bus master"). 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 CANopen field bus is described in the corresponding technical information:

Bus interface	Frequency inverter	Documentation
SK TU3-CAO	SK 5xxE series	Technical Information/Data Sheet TI 275900075
SK TU4-CAO	SK 1x0E and SK 2xxE series	Technical Information/Data Sheet TI 275281101
SK TU4-CAO-M12		Technical Information/Data Sheet TI 275271201
SK TU4-CAO-C		Technical Information/Data Sheet TI 275281151
SK TU4-CAO-M12-C		Technical Information/Data Sheet TI 275281251
SK CU4-CAO		Technical Information/Data Sheet TI 275271001
SK CU4-CAO-C		Technical Information/Data Sheet TI 275281501

5.2 Cable material

The frequency inverter is usually connected to the CANnord system by a twisted, shielded two-wire cable. The guaranteed transfer speeds or transfer distances can only be achieved without errors if the specific cable parameters are complied with.

Bus cable length	Resistance	Cable cross-section	Possible transfer rates
Up to 25m	70 mΩ/m	≥ 0.25 mm2, AWG23	1 Mbit/s
25 - 50m	70 mΩ/m	≥ 0.25 mm2, AWG23	800 kBits/s
50 - 80m	< 60 mΩ/m	≥ 0.34 mm2, AWG22	500 kBits/s
80m - 230m	< 40 mΩ/m	≥ 0.5 mm2, AWG21	250 kBits/s
230m – 480m	< 26 mΩ/m	≥ 0.75 mm2, AWG18	125 kBits/s
480m – 1km	< 20 mΩ/m	≥ 1 mm2, AWG…	50 kBits/s

Table 1: Transfer speeds versus cable length

The interface complies with ISO 11898. The maximum permissible voltage on the CAN_L and CAN_H cables is -8V … +8V.

5.3 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 CANopen field bus systems.

5.3.1 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 CANopen bus interface and the frequency inverter can be downloaded from our website www.nord.com, directly under the link NORDAC_Options.

The file (e.g. "SK2xxE.eds") contains a description of the device characteristics of the bus interface, the communication objects (COB) and the parameters of the bus interface and the connected frequency inverters.

File	Bus interface	Frequency inverters
SK5x0E.eds	SK TU3-CAO	SK 5xxE series
SK540E_TB.eds		SK 540E series
SK2xxE.eds	SK CU4-CAO	SK 2xxE series
SK5xxE.eds		SK 5xxE series
SK54xE.eds		SK 54xE series
SK180E.eds		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.

5.3.2 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 CANopen field bus system
- Set the bus address of the bus interface

5.3.3 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 6.5 "Transfer of process data".

5.3.4 CANopen field bus address

In order for the bus interface and the connected frequency inverters to be detected by the bus master, the bus address and the baud rate, and if necessary the termination resistor (if the bus interface is the last participant on the bus) must be set on the bus interface.

The setting is made via DIP switches, 🕮 Technical Information/Data Sheet.

The address and the baud rate are read out by the bus interface when the bus interface is connected to the power supply ("POWER ON").

The address which is set can be read out with parameter **P180 CANopen address** and the set baud rate with parameter **P181 CANopen baud rate** (🕮 Section 7.1.4 "CANopen information parameters").

5.4 Example: Commissioning the CANopen bus module

The following example contains an overview of the necessary steps for commissioning the bus interface in a CANopen 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-CAO	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)
CANopen field bus	6	Set up the bus interface for field bus communication.	🕮 Sections 5.1 "Connecting the bus interface" to 5.3 "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"
CANopen 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 transferred via PDOs (Process Data Objects) and the parameter data via SDOs (Service Data Objects).

CANopen data transfer is carried out in little-endian format (literally "little-ender format"). This is an order system for reading bytes into the register and memory, in which the LSB (Least Significant Byte) is in the first place and is saved in the lowest memory address. For example, the control word "047Eh" ("ready for switch-on") is transferred to the frequency inverter as "7E04h" in little-endian format.

6.1.1 Process data

- Process data are the control word and up to 3 setpoints, as well as the status word and up to 3 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 6.5 "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 acyclically without priority.

6.2 NMT network management

After conclusion of the individual initialisation phase, all participants in a CANopen field bus system can be set to one of three operational states.

- Pre-Operational
- Operational
- Stopped

Control of the operating states is carried out by the transfer of commands by an NMT master.

Status	Description	Command		
		Identifier	Data byte 0	Data byte 1
Pre-Operational	The bus participant enters this state after initialisation. In this state the bus participant can be configured, i.e. transfer of SDOs (parameter data) is possible; the PDO channel is blocked.	00h	80h	00h
Operational	The field bus is ready for operation. PDOs and SDOs can be transferred	00h	01h	00h
Stopped	PDO and SDO transfer blocked; only NMT commands can be transferred.	00h	02h	00h

6.3 Structure of application data

Data transfer is by exchange of telegrams. The structure of a CANopen telegram corresponds to the CAN telegram format (🕮 3.3 "Bus protocol").

Start field (SOF)	Status field (Identifier)	Control field (Control)	Data field (Application data)	Backup field (CRC)	Confirmation field (ACK)	End field (EOF)
1-bit	12-bit/32-bit	6-bit	0…64-bit	18-bit	2-bit	7-bit

The different structures of the application data field enables the exchange of two different types of telegram:

- PDO (Process Data Objects) for communication of process data,
- SDO (Service Data Objects) for communication of parameter data.

A PDO uses the data field exclusively for process data information and is therefore able to transfer 8 bytes of process data with each telegram.

An SDO divides the data field into a 4 byte configuration area and a 1 - 4 byte data area. This enables access to the object data directory and therefore to the function of the bus participant (e.g. frequency inverter) as well as parameterisation of the device. However, the possible extent of the data content is restricted:

Control byte	Index		Sub-index	Data			
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**
E.g. "Download"	E.g. "Parameter number"		E.g. " Array"	E.g. "Parameter values"			

6.3.1 Process Data Objects PDO

Process data objects are used to exchange process-relevant data, which contain up to 5 setpoints or actual values in addition to the control word or status word.

These are communicated via configurable modes (transmission types)

- event-controlled, e.g. after the elapse of a set time,
- on demand (Polling via Remote Frame) or
- synchronously via a SYNC telegram (without data content).

Process data objects are communicated with high priority to ensure that time-critical process data are processed preferentially (real time capability). Furthermore, process data telegrams are communicated without confirmation, which also contributes to the real time capability of the system.

Process data objects can only be processed by CANopen participants which are in the status "Operational". Safety mechanisms in the CAN protocol such as "Bit stuffing", "CRC" and "Framecheck" ensure the correct reception of process data objects.

6.3.2 Service Data Objects SDO

Service data objects are used to exchange parameter data (changes in the object directory of a bus participant) and status queries. They are used to configure the function of a bus participant (e.g. parameterisation of connected frequency inverters) and specification of the application-specific sequence of the process data of a PDO telegram (PDO mapping).

Service data objects are transferred with low priority, so that process-critical PDO telegrams and EMCY messages can receive preferential treatment. Service data objects can be communicated in segments if the necessary application data are too large for a single SDO. Receipt of service data telegrams is acknowledged by the recipients.

SDOs are processed by CANopen bus participants which are in the status "Pre-Operational" or "Operational".

6.4 CAN identifier and COB ID

Each CANopen data telegram has an 11-bit identifier with which the addressing and assignment of priority is made:

Bit 10	Bit 9	Bit 8	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Function code[1]				Node identifier (1…127)[1]						

[1] The function code and node identifier give the COB ID of a PDO or SDO

Identifiers can be assigned via the CANopen object directory (📖 Section 6.7 "Object directories"):

Object	Function code	Resulting COB ID	OI entry
NMT	0000	0	—
SYNC	0001	80h	1005h…1007h
Time stamp	0010	100h	1012h, 1013h
Emergency	0001	81h…FFh	1014h, 1015h
PDO1 (Tx)	0011	181h…1FFh	1800h, 1A00h
PDO1 (Rx)	0100	201h…27Fh	1400h, 1600h
PDO2 (Tx)	0101	281h…2FFh	1801h, 1A01h
PDO2 (Rx)	0110	301h…37Fh	1401h, 1601h
PDO3 (Tx)	0111	381h…3FFh	1802h, 1A02h
PDO3 (Rx)	1000	401h…47Fh	1402h, 1602h
PDO4 (Tx)	1001	481h…4FFh	1803h, 1A03h
PDO4 (Rx)	1010	501h…57Fh	1403h, 1603h
SDO (Tx)	1011	581h…5FFh	1200h
SDO (Rx)	1100	601h…67Fh	1200h
NMT Error Control	1110	701h…77Fh	1016h, 1017h

CANopen bus interfaces from Getriebebau NORD GmbH & Co. KG have 5 PDO channels (transmit and receive) and 4 SDO channels. However, less channels are provided in the so-called "Predefined Connection Set" of the CANopen communication profile DS-301, so that address conflicts result with devices which use the "Predefined Connection Set". To avoid address conflicts, the channels which are additionally required are divided into the address range "64...127".

Information — **Object links in the CANopen master**

In order for the bus interfaces SK CU4-CAO and SK TU4-CAO to be able to transmit and receive object data via the CANopen field bus, 4 words (e.g. a control word and 3 setpoints) must always be transferred. If, e.g. only 2 words (control word and setpoint 1) are required for a command, the two other words (setpoint 2 and setpoint 3) must be filled with zeros. This means that in the CANopen control project all 4 objects (e.g. control word and setpoints 1...3) must always be linked, even if only 2 words are to be transferred. Otherwise the data will not be evaluated by the bus interface.

The assignment and setting of the COB ID is normally carried out via the parameters **P160 COB ID On/Off** and **P161 COB ID** (🕮 Section 7.1.2 "CANopen standard parameters"). The following table shows the factory settings of the bus interfaces SK CU4-CAO and SK TU4-CAO which enable the exchange of process data between the bus interface and up to 4 frequency inverters which are connected via the NORD system bus (gateway function).

Object	Availability	COB ID	Assigned device
NMT	Enabled	0	FI1, FI2, FI3, FI4 bus interface
SYNC	Enabled	80h	FI1, FI2, FI3, FI4 bus interface
Emergency	Enabled	80h + node address	FI1, FI2, FI3, FI4 bus interface
PDO1 (Tx)	Enabled	180h + node address	FI1
PDO1 (Rx)	Enabled	200h + node address	FI1
PDO2 (Tx)	Enabled	280h + node address	FI2
PDO2 (Rx)	Enabled	300h + node address	FI2
PDO3 (Tx)	Enabled	380h + node address	FI3
PDO3 (Rx)	Enabled	400h + node address	FI3
PDO4 (Tx)	Enabled	480h + node address	FI4
PDO4 (Rx)	Enabled	500h + node address	FI4
PDO5 (Tx)	Disabled	1C0h + node address	Bus interface
PDO5 (Rx)	Disabled	240h + node address	Bus interface
SDO1 (Tx)	Enabled	580h + node address	FI1, bus interface
SDO1 (Rx)	Enabled	600h + node address	FI1, bus interface
SDO2 (Tx)	Disabled	2C0h + node address	FI2
SDO2 (Rx)	Disabled	340h + node address	FI2
SDO3 (Tx)	Disabled	3C0h + node address	FI3
SDO3 (Rx)	Disabled	440h + node address	FI3
SDO4 (Tx)	Disabled	4C0h + node address	FI4
SDO4 (Rx)	Disabled	540h + node address	FI 4
NMT Error Control	Enabled		FI1, FI2, FI3, FI4 bus interface

Information **Node addresses of other field bus participants**

For the addressing of CANopen field bus participants from other manufacturers, for node addresses >64 it must be ensured that these are not already occupied by devices from Getriebebau NORD GmbH & Co. KG.

6.5 Transfer of process data

The control word (STW) and up to 5 setpoints (SW) are transferred from the bus master to the frequency inverter and the status word (ZSW) and up to 5 actual values (IW) are transferred from the frequency inverter to the bus master as process data (PZD).

Transfer of process data is via Process Data Objects (PDO). Up to 4 transmission PDOs (Tx) and 4 receive PDOs (Rx) are available for NORD frequency inverters

PDO transfer type	Data type	Frequency inverter
PDO Tx	Control data	Receives data
PDO Rx	Status data	Transmits data

The process data telegram for the communication of process data objects contains 8 bytes of process data:

Direction of transmission	Transmitted data					
	SK 1x0E, SK 2xxE and SK 5xxE frequency inverters				Only SK 54xE frequency inverters	
	1st word	2nd word	3rd word	4th word	5th word	6th word
	8 Byte					
To bus interface	Control word	Setpoint 1	Setpoint 2	Setpoint 3	Setpoint 4	Setpoint 5
From bus interface	Status word	Actual value 1	Actual value 2	Actual value 3	Actual value 4	Actual value 5

The meaning of the data which is transmitted is specified by the identifier (COB ID) and the PDO mapping which is set.

The bus master reads the length and structure of the process data from the device description file (📖 Section 5.3 "Integration into the bus master").

Special modifications to the PDO communication (e.g. setting of the COB ID, assignment of Transmission Types, etc.) can be made via the standard CANopen parameters of the bus interface 📖 Section 7.1.2 "CANopen standard parameters".

6.5.1 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.

6.5.2 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

6.5.3 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.

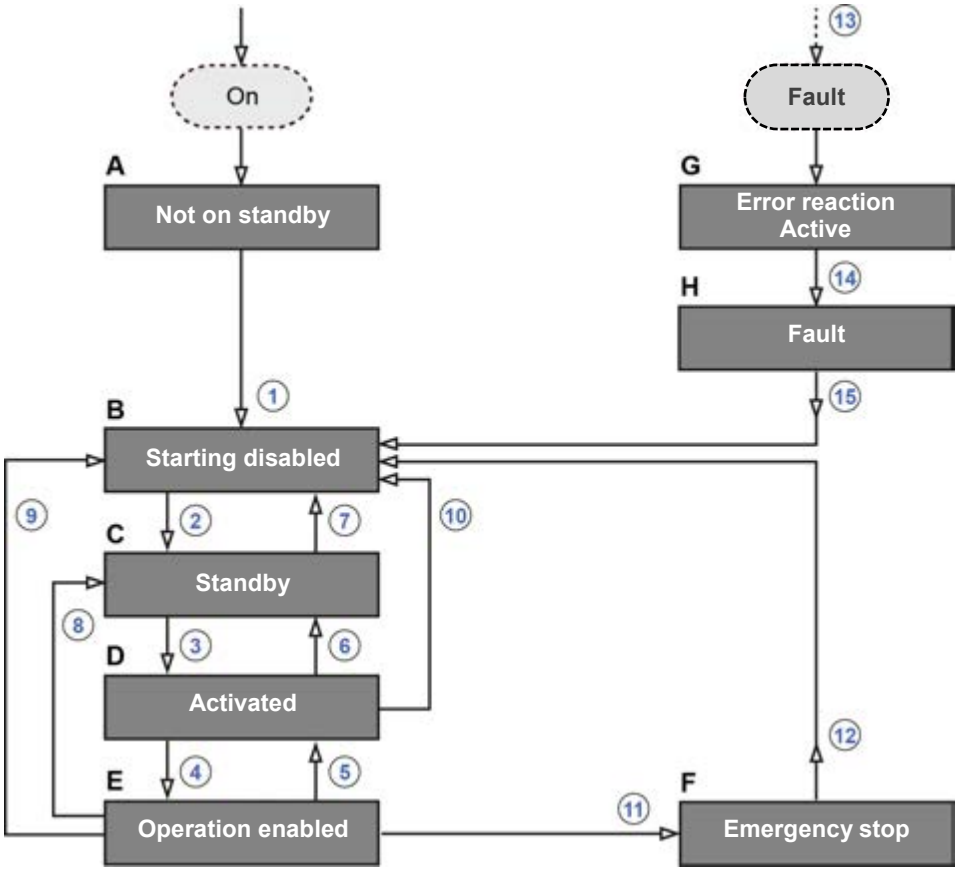


Figure 6: Frequency inverter status machine

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 6.5.1 "Control word".

[1] Complete list of control bits (Bit 0…15) 📖 Section 6.5.1 "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 6.5.2 "Status word".

6.5.4 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.

6.5.5 Changing the PCO COB ID

The COB ID of a PDO can only be changed if the relevant bus participant is in the status "Pre-Operational"(📖 Section 6.2 "NMT network management").

Setting of the COB ID is normally carried out via the parameters **P160 COB ID On/Off** and **P161 COB ID** (📖 Section 7.1.2 "CANopen standard parameters"). Alternatively, setting of the COB ID can be made via the SDO parameter channel, as each transmission and reception PDO has its own parameters for this:

Process Data Object	PDO Rx	PDO Tx
PDO for frequency inverter FI1	1400h Sub 1	1800h Sub 1
PDO for frequency inverter FI2	1401h Sub 1	1801h Sub 1
PDO for frequency inverter FI3	1402h Sub 1	1802h Sub 1
PDO for frequency inverter FI4	1403h Sub 1	1803h Sub 1
PDO for bus interface	1404h Sub 1	1804h Sub 1

The parameter for setting the COB ID is a 32-bit value, which contains further information in addition to the COB ID:

Bit number	Value	Meaning	Note
31	0	PDO is active	Bit 31 must be set to zero, otherwise the PDO will be deactivated.
	1	PDO is switched off	
30	1	Values cannot be changed	
29…11	0		
10…0	X	PDO COB ID	

If the COB ID of a PDO Tx is changed, e.g. to the value "201h", the value "40000201h" must be entered in the relevant parameter.

The changed COB ID only becomes valid when the corresponding bus participant is set to the status "Operational".

6.5.6 PDO Transmission Types (operating modes)

The Transmission Type specifies when a "PDO Tx" is sent and when a "PDO Rx" is processed. The specification is made via the objects "Receive PDO Communication Parameter" (Index 1400h…1404h) and "Transmit PDO Communication Parameter" (Index 1800h…1804h) of the object directory (🕮 Section 6.7 "Object directories").

Possible transmission types for NORD frequency inverters:

PDO	Transmission Type	Value
Tx	0	PDO is sent after receipt of a SYNC command if the data and status have changed since the last SYNC command.
	1…240	PDO is sent after receipt of 1...240 SYNC commands, regardless of whether the status of the data has changed since the last SYNC command.
	252, 253	Reserved
	254, 255	The PDO is transmitted immediately if the data status has changed (standard setting).
Rx	0…240	The data of the PDO Rx are only processed after receipt of the next SYNC command.
	252, 253	Reserved
	254, 255	Data from the PDO Rx is processed immediately (standard setting).

The Transmission Type is set via the CANopen standard parameter **P162 PDO Transmission Type** (🕮 Section 7.1.2 "CANopen standard parameters").

6.5.7 PDO mapping

The objects "Receive PDO Mapping Parameter" (Index 1600h…1603h) and "Transmit PDO Mapping Parameter" (Index 1A00h…1A03h) of the object directory (📖 Section 6.7 "Object directories") specify which objects (setpoints/actual values) are transmitted via the PDO telegrams.

The order of the control word, setpoints, status word and actual values is made with the following objects:

Object	Index	Sub-index
Control Word (STW)	3000h	—
Status Word (ZSW)	3001h	—
Setpoint 1	3002h	1
Setpoint 2		2
Setpoint 3		3
Setpoint 4		4
Setpoint 5		5
Actual value 1	3003h	1
Actual value 2		2
Actual value 3		3
Actual value 4		4
Actual value 5		5

[1] Only for SK 54xE frequency inverters

Example:

PDO data byte			
1	**2**	**3**	**4**
Control Word (16 Bit)		Setpoint 1 (16 Bit)	

The PDO mapping is set wit the parameter **P165 PDO Mapping Para**.

Information

All Getriebebau NORD GmbH & Co. KG frequency inverters support dynamic mapping and dummy mapping. With integration of the NORD device description file (📖 Section 5.3 "Integration into the bus master") no modifications are needed for the exchange of data. By mapping the PDO with 16 Bit width, dummy mapping is not necessary.

Standard setting

PDO	Length	COB ID	1st word	2nd word	3rd word	4th word
PDO1 (Tx)	4 Byte	180h + node address	ZSW	IW1	—	—
PDO1 (Rx)	4 Byte	200h + node address	STW	SW1	—	—
PDO2 (Tx)	8 Byte	280h + node address	ZSW	IW1	IW2	IW3
PDO2 (Rx)	8 Byte	300h + node address	STW	SW1	SW2	SW3
PDO3 (Tx)	8 Byte	380h + node address	ZSW	IW1 (32 Bit)		IW2
PDO3 (Rx)	8 Byte	400h + node address	STW	SW1, (32 Bit)		SW2
PDO4 (Tx)	2 Byte	480h + node address	ZSW	—	—	—
PDO4 (Rx)	2 Byte	500h + node address	STW	—	—	—

In the standard setting, all PDO Rx are activated. Transmission to the corresponding COB ID determines whether only one setpoint or up to three setpoints are evaluated.

Only PDO1 Tx is activated, all other PDO Tx are deactivated. The corresponding PDO Tx must be activated if several actual values have to be communicated.

Example: Activating PDO2 Tx

Necessary SDO transmission via the parameter channel (📖 Section 6.6 "Parameter data transmission"):

- Set the relevant frequency inverter into the NMT operation status "Pre-Operational"
- Deactivate PDO1 (via Bit 31 in the relevant parameter), to reduce the load on the bus → SDO Tx (Index "1800h", sub-index "1", data "C0000181h")
- Activate PDO2 → SDO Tx (Index "1801h", sub-index "1", data "400000281h")
- Set the relevant frequency inverter into the NMT operation status "Operational"

Frequency inverters SK 511E…SK 535E via internal RJ45 interface:

PDO	Length	COB ID	1st word	2nd word	3rd word	4th word
PDO1 (Tx)	8 Byte	180h + node address	ZSW	IW1	IW2	IW3
PDO1 (Rx)	8 Byte	200h + node address	STW	SW1	SW2	SW3
PDO2 (Rx)	4 Byte	300h + node address	IW1 (32 Bit) of an absolute encoder			

Frequency inverters SK 540E…SK 545E via internal RJ45 interface:

PDO	Length	COB ID	1st word	2nd word	3rd word	4th word
PDO1 (Tx)	8 Byte	180h + node address	ZSW	IW1	IW2	IW3
PDO1 (Rx)	8 Byte	200h + node address	STW	SW1	SW2	SW3
PDO2 (Tx)	5 Byte	280h + node address	IW4	IW5		
PDO2 (Rx)	5 Byte	300h + node address	WAF 4	WAF 5		
PDO3 (Rx)	4 Byte	400h + node address	IW1 (32 Bit) of an absolute encoder			

6.5.8 Application-specific mapping

In addition to the standard PDO mapping (🕮 Section 6.5.7 "PDO mapping") the data which are to be transferred with the PDO can be specified in an application-specific mapping.

Information — **Operating state "Pre-Operational"**

For application-specific mapping the bus interface must be set in the NMT operating status "Pre-Operational" (🕮 Section 6.2 "NMT network management").

Example

The control word and setpoint 3 (each with 16 Bit) are to be transferred to the frequency inverter with the object "Transmit PDO mapping parameter" (Index 1A00h).

- The CAN identifier "432h" is used for the transmission.
- Transmission is carried out synchronously with every third SYNC object.
- CAN identifiers (🕮 Section 6.4 "CAN identifier and COB ID") are used for the SDO.

Changing the mapping of "PDO1 Tx"

1. **Deactivating PDO mapping**: In index 1A00h, sub-index 0, set the number of mapping objects to "0".

	CAN identifier	Data
Transmit	0600h	2F 00 1A 00 00 xx xx xx h
Received	0580h	60 00 1A 00 xx xx xx xx h

2. **Entering mapping objects**: Enter the index, sub-index and object length of the application object into the PDO mapping parameter structure (Index 1A00h). A maximum of 8 bytes of data can be assigned for each PDO.

Application object	Index	Sub-index
FI1 control word	3000h	1
FI1 Setpoint 3	3002h	3

The mapping parameters of the first object, index 1A00h must have the following structure:

Sub-index	Index	Sub-index	Object length (Bit)	Comments
0	2	—	—	Number of mappings
1	3000h	1	10h	FI1 control word
2	3002	3	10h	FI1 Setpoint 3

Information — **Entering the sub-index**

The number of valid sub-indices are only entered into sub-index 0 after the mapping parameters in sub-index 1 ... 8 have been entered.

Save the following objects with SDO transfers:

Map object 3000h		
	CAN identifier	**Data**
Transmit	0600h	23 00 1A 01 10 01 00 30h
Set object 1A00h, sub-index 1, to object 3000h, sub-index 1, and 16-bit data width		

Map object 3002h		
	CAN identifier	**Data**
Transmit	0600h	23 00 1A 02 10 03 02 30h
Set object 1A00h, sub-index 2, to object 3002h, sub-index 3, and 16-bit data width		

Enter number of mapping objects = 2, into sub-index 0		
	CAN identifier	**Data**
Transmit	0600h	2F 00 1A 00 02 xx xx xx h
Received	0580h	60 00 18 01 xx xx xx xx h

Changing communication parameters

1. **Deactivating PDO1 Tx**: Write the value "80 00 00 00h" in the communication object "Transmit PDO Communication Parameter", index 1800h, sub-index 1:

	CAN identifier	Data
Transmit	0600h	23 00 18 01 00 00 00 80 h
Received	0580h	60 00 18 01 xx xx xx xx h

2. **Setting the communication parameters for PDO1 Tx**: Write the communication parameters into the structure of the communication object "Transmit PDO Communication Parameter", index 1800h, sub-index 1...3. In addition, define Transmission Type 3 (synchronous communication with every third SYNC object 🕮 Section 6.5.6 "**PDO Transmission Types (operating modes)**"):

Transmit PDO Communication Parameter, index 1800h		
Sub-index	**Value**	**Meaning**
0	3	Number of entries
1	0432h	COB ID used by PDO
2	3	Transmission Type
3	0	Inhibit Time

Sub-index 3, Inhibit Time = 0		
	CAN identifier	**Data**
Transmit	0600h	2B 00 18 03 00 00 xx xx h
Received	0580h	60 00 18 03 xx xx xx xx h

Sub-index 2, Transmission Type = 3		
	CAN identifier	**Data**
Transmit	0600h	2F 00 18 02 03 xx xx xx h
Received	0580h	60 00 18 02 xx xx xx xx h

Sub-index 1, specify COB ID of the PDO = 0432h and change from invalid to valid		
	CAN identifier	**Data**
Transmit	0600h	23 00 18 02 32 04 00 00 h
Received	0580h	60 00 18 01 xx xx xx xx h

As soon as the bus interface is set to the status "Operational" with the command "Start Remote Node", the PDOs become active and the PDO Tx object can be used for the transmission of data.

6.6 Parameter data transmission

Access to all parameters of the bus interface and the connected frequency inverters is made via service data objects (SDO). Access is via "Handshake" between client and server, i.e. after an SDO telegram is transmitted, the response must be waited for before a new message can be sent.

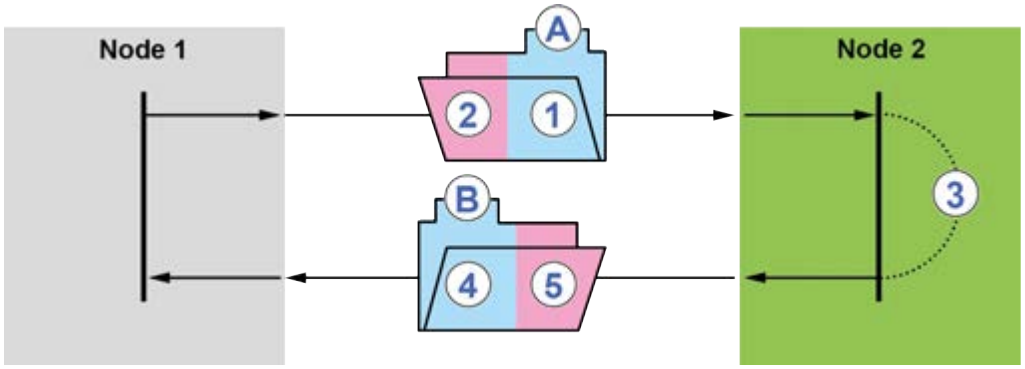


Figure 7: Telegram traffic – SDO data exchange

Item	Meaning
A	Order telegram
1	Parameter order (object specification)
2	Object data
3	Processing
B	Response telegram
4	Parameter response (object specification)
5	Object data

Transmission and reception addresses for SDO access (from the bus master):

Direction of	Address
Transmit	600h + node address
Received	580h + node address

Information **Max. 100,000 permissible writing cycles**

If parameter changes are made (order by the bus master), the maximum number of permissible writing cycles to the frequency inverter EEPROM (100,000 cycles) must not be exceeded. I.e. continuous cyclical writing must be prevented.

For certain applications it is sufficient if the values are only saved in the RAM of the frequency inverter. The corresponding setting is made via parameter **P560 Save in EEPROM**.

If the bus interface parameters are changed, these are only saved in the EEPROM if access was made via the NORD CON software or the ParameterBox, or if the changes were made via service data objects.

6.6.1 Writing parameter data via SDO

The following example shows the writing of a parameter value (set parameter **P102 acceleration time** to the value "1.03 s") into a connected frequency inverter:

Control byte	Index		Sub-index	Reference data			
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**
2Bh	66h	20h	01h	67h	00h	00h	00h

Control byte

The control byte specifies the data length and the order:

2Bh Transmit 16 Bit value

23h Transmit 32 Bit value

60h Response: Error-free telegram received. Parameter communication is aborted in case of any other response.

Index

The index states the parameter number of the frequency inverter. Parameter numbers above "2000h" are mapped:

Parameter P102 = 66h → 2000h + 66h → 6620h

Sub-index

The sub-index states the parameter index (array value). The selected parameter set and the array element of the parameter are coded in this area.

Array element	Sub-index parameter set 1	Sub-index parameter set 2	Sub-index parameter set 3	Sub-index parameter set 4
[-01])	01h	02h	03h	04h
[-02])	05h	06h	07h	08h
[-03])	09h	0Ah	0Bh	0Ch
[-04])	0Dh	0Eh	0Fh	10h

For parameters which neither depend on parameter sets nor consist of array elements, the sub-index is "00h"

Application data

The values of the selected parameter are transferred in the application data area.

16-bit value 67 00 00 00h

1.03 s = 0067h

32-bit value 76 BC 2A 00h

2800,758 rev = 002ABC76h

6.6.2 Reading parameter data via SDO

To read the parameter data, a read order (control byte "40h") is sent from the bus master to the frequency inverter. This specifies which parameter and which array element or parameter set is to be read. The application data area remains empty ("00h").

In the response telegram the status byte specifies the length of the response data (response 16/32-bit) and the application data area contains the parameter value which is read out.

Example: Read out parameter P102, response 1.3 s)

Control byte/ Status byte	Index		Sub-index	Reference data			
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**
Requirement							
40h	20h	66h	01h	00h	00h	00h	00h
Response							
4Bh	20h	66h	01h	67h	00h	00h	00h

Control byte

The control byte states the order:

40h Read value

Response

4Bh Deliver the 16-bit value which is read out

43h Deliver the 32 -bit value which is read out

80h Response to an incorrect query

6.6.3 Interruption of SDO communication

If problems occur with the SDO communication (e.g. if the value range is exceeded), an abort telegram is transferred (control byte "80h") as the response to an order. The cause of the interruption is specified in byte 4...7.

Control byte	Last index used			Error code			
Byte 0	**Byte 1**	**Byte 2**	**Byte 3**	**Byte 4**	**Byte 5**	**Byte 6**	**Byte 7**
80h	00h	18h	01h	02h	00h	01h	06h

For a list of possible error codes please refer to 📖 Section 8.3.2 "Error codes – interruption of SDO communication".

6.7 Object directories

All available objects are contained in the device description file (🕮 Section 5.3 "Integration into the bus master").

6.7.1 Principal CANopen assignment of object indices

Index range	Use
0000h	Not used
0001h…001Fh	Static data types
0020h…003Fh	Complex data types
0040h…005Fh	Complex data types specific to manufacturer
0060h…007Fh	Static data types specific to the device profile
0080h…009Fh	Complex data types specific to the device profile
00A0h…0FFFh	Reserved
1000h…1FFFh	Communication profile
2000h…5FFFh	Manufacturer-specific objects
6000h…9FFFh	Up to 8 standardised device profiles
A000h…AFFFh	Process images from CANopen gateways (CiA 302-7)
C000h…FFFFh	Reserved

6.7.2 Communication objects – CANopen profile DS-301

Index	Sub-index	Object	Description	Unit	Access	Type
1000h	—	Device type	Device type and functionality	—	RO	U32
1001h	—	Error register	Error index	—	RO	U8
1002h	—	Status register	Status of the module	—	RO	U32
1003h	ARR	Pre-defined Error	Error signalled by an Emergency Object	—	—	U8
	0	Number of errors	Number of errors: Writing "0" deletes the error list	—	RW	U8
	1	Error code	Error number	—	RO	U32
1005h	—	COB ID SYNC	Identifier for SYNC messages (Default "80h")	—	RW	U32
1008h	—	Device name	Device name	—	RO	STR
1009h	—	Hardware version	Hardware version	—	RO	STR
100Ah	—	Software Version	Software version	—	RO	STR
100Ch	—	Guard Time	P166 Timeout Control ("0" = Off)	ms	RW	U16
100Dh	—	Life time factor	Life Time = Life Time Factor x Guard Time	—	RW	U16
1010h	—	Store parameters	Permanently save user settings For this, the signature "save" (small case ASCII – MSB LSB, 65h, 76h, 61h, 73h) must be written in index 1010h, sub-index 1. The saving process runs in the background and is confirmed with an SDO response telegram. **Information** If the CANopen address is changed with the DIP switches after the user settings have been saved, the saved user settings will continue to be used. The user settings are reset to the factory settings by object 1011h.	—	RW	U32
1011h	—	Restore default parameters	Reset the user settings to the factory settings. For this, the signature "load" (small case ASCII – MSB LSB, 64h, 61h, 6Fh, 6Ch) must be written in index 1011h, sub-index 1. The factory settings are loaded after the next and every further "Power ON" command (until the next save command, see parameter **P152**).	—	RW	U32
1014h	—	COB ID Emergency Object	Identifier of Emergency Object ("80h"+Node-ID)	—	RW	U32
1015h	—	Inhibit Time EMCY	Minimum repeat time	ms	RW	U16
1017h	—	Producer Heartbeat Time	Heartbeat cycle time	ms	RW	U16
1018h	REC	Identity object	General device information	—	—	U32
	0	Largest sub-index	Number of array elements	—	RO	U8
	1	Vendor ID	Manufacturer code	—	RO	U32
	2	Product code	Device version (product number)	—	RO	U32

Index	Sub-index	Object	Description	Unit	Access	Type
	3	Revision number	Software version and revision number	—	RO	U32
	4	Serial number	Serial number	—	RO	U32
1200h	REC	Default Server SDO	SDO Server	—	—	U8
	0	Largest sub-index	Number of array elements	—	RO	U8
	1	COB ID Server>Client (rx)	SDO Rx identifier("600h" + node address) for FI1 and bus interface (Parameter **P161** [-02])	—	RO	U32
	2	COB ID Server>Client (tx)	SDO Tx identifier("580h" + node address) for FI1 and bus interface (Parameter **P161** [-02])	—	RO	U32
1201h	REC	Default Server SDO	SDO Server	—	RW	U8
	0	Largest sub-index	Number of array elements	—	RW	U8
	1	COB ID Server>Client (rx)	SDO Rx identifier("340h" + node address) for FI2 and bus interface (Parameter **P161** [-05])	—	RW	U32
	2	COB ID Server>Client (tx)	SDO Tx identifier("2C0h" + node address) for FI2 and bus interface (Parameter **P161** [-04])	—	RW	U32
1202h	REC	Default Server SDO	SDO Server	—	RW	U8
	0	Largest sub-index	Number of array elements	—	RW	U8
	1	COB ID Server>Client (rx)	SDO Rx identifier("440h" + node address) for FI3 and bus interface (Parameter **P161** [-07])	—	RW	U32
	2	COB ID Server>Client (tx)	SDO Tx identifier("3C0h" + node address) for FI3 and bus interface (Parameter **P161** [-06])	—	RW	U32
1203h	REC	Default Server SDO	SDO Server	—	RW	U8
	0	Largest sub-index	Number of array elements	—	RW	U8
	1	COB ID Server>Client (rx)	SDO Rx identifier("540h" + node address) for FI4 and bus interface (Parameter **P161** [-09])	—	RW	U32
	2	COB ID Server>Client (tx)	SDO Tx identifier("4C0h" + node address) for FI4 and bus interface (Parameter **P161** [-08])	—	RW	U32

6.7.3 Device objects – CANopen profile DS-402

SK xU4-CAO bus interfaces support the drive profile DS-402 ("Velocity Mode") for the processing of speed setpoints and the corresponding accelerations.

Information **Using drive profile DS -402**

The following measures must be implemented in order to use the drive profile DS-402.

- Set parameter **P168 Drive profile**, Array [-01] to "1" (Profile On).
- Map the PDO to the objects which are used (e.g. PDO Rx "6040h" und "6042h" and PDO Tx "6041h" and "6044h").

The digital inputs and outputs for use of the drive profile can only be mapped into a PDO via the objects "60FDh" and "60FEh". Direct processing of these inputs and outputs via the connected frequency inverters is not possible.

Index	Sub-index	Object	Description	Unit	Access	Type
603Fh	—	Error code	Error description	—	RO	U32
6040h	—	Control word	Control word	—	RO	U16
6041h	—	Status word	Status word	—	RO	U16
6042h	—	VI_target_velocity	Speed setpoint	rpm	RW	I16
6043h	—	VI_velocity_demand	Speed setpoint after ramp	rpm	RO	I16
6044h	—	VI_control_effort	Actual speed value	rpm	RO	I16
6046h	ARR	VI_velocity_min_max_ amount	Max./Min. speed value	—	RO	—
	1	VI_velocity_min_amount	Min. speed value	rpm	RW	U32
	2	VI_velocity_max_amount	Max. speed value	rpm	RW	U32
6048h	REC	VI_velocity_acceleration	Speed acceleration	—	RO	—
	1	Delta_speed	Delta speed	rpm	RW	U32
	2	Delta_time	Delta time	s	RW	U16
6049h	REC	VI_velocity_deceleration	Speed reduction	—	RO	—
	1	Delta_speed	Delta speed	rpm	RW	U32
	2	Delta_time	Delta time	s	RW	U16
60FDh	—	Digital inputs profile PDO data (00 0X 00 00)	Bit: Meaning 0…15: Reserved 16: Digital input 1 (SK xU4-CAO) 17: Digital input 2 (SK xU4-CAO) 18: Digital input 3 (SK xTU4-CAO) 19: Digital input 4 (SK xTU4-CAO) 20…31: Reserved	—	RO	U32
60FEh	—	Digital outputs profile	Bit: Meaning 0…15: Reserved 16: Digital output 1 (SK xTU4-CAO) 17: Digital output 2 (SK xTU4-CAO) 18…31: Reserved	—	RW	U32

6.7.4 PDO objects

Index	Sub-index	Object	Description	Unit	Access	Type
1400h … 1404h	REC	Receive PDO Communication Parameter	PDO Rx characteristics	—	RW	—
	0	Largest sub-index	Number of array elements	—	RO	U8
	1	COB ID used by PDO	COB ID PDO Rx (Parameter **P161**)	—	RW	U32
	2	Transmission type	PDO operating mode (Parameter **P162**)	—	RW	U8
	3	Not used	Not used			
	4	Reserved	Reserved			
	5	Not used	Not used			
1600h … 1603h	REC	Receive PDO Mapping Parameter	PDO Rx mapping	—	RW	—
	0	Largest sub-index	Number of array elements	—	RW	U8
	1	PDO mapping	Mapped objects FI1…FI4 (Parameter **P165**)	—	RW	U32
	2					
	3					
	4					
1604h	REC	Receive PDO Mapping Parameter	PDO Rx mapping	—	RW	U32
	0	Largest sub-index	Number of array elements	—	RW	U8
	1	PDO mapping	Bus interface (Parameter **P165**, Array [-34])	—	RW	U32
	2					
	3					
	4					
1800h … 1804h	REC	Transmit PDO Communication Parameter	PDO Tx characteristics	—	RW	—
	0	Largest sub-index	Number of array elements	—	RO	U8
	1	COB ID used by PDO	COB ID PDO Tx (Parameter **P161**)	—	RW	U32
	2	Transmission type	PDO operating mode (Parameter **P162**)	—	RW	U8
	3	Inhibit Time	Minimum transmission time (Parameter **P163**)	100 µs	RW	U16
	4	Reserved	Reserved			
	5	Event Timer	Cyclic transmission timer (Parameter **P164**)	ms	RW	U16
1A00h … 1A03h	REC	Transmit PDO Mapping Parameter	PDO Tx mapping	—	RW	—
	0	Largest sub-index	Number of array elements	—	RO	U8
	1	PDO mapping	Mapped objects FI1…FI4 (Parameter **P165**)	—	RW	U32
	2					
	3					
	4					
1A04h	REC	Transmit PDO Mapping Parameter	PDO Tx mapping	—	RW	U32
	0	Largest sub-index	Number of array elements	—	RO	U8
	1	PDO mapping	Bus interface (Parameter **P165**, Array [-33])	—	RW	U32
	2					
	3					
	4					

6.7.5 Frequency inverter objects

Index	Sub-index	Object	Description	Unit	Access	Type
2000h … 23E7h	—	Manufacturer Spec. Parameters	Frequency inverter parameters(🕮 Frequency inverter manual)	—	—	—
Parameter **P165 PDO Mapping Para** (🕮 Section 7.1.2 "CANopen standard parameters")						
3000h	0	Largest sub-index	Number of elements	—	RO	U8
	1	Control word	Control word for FI1	—	RW	U16
	2	Control word	Control word for FI2	—	RW	U16
	3	Control word	Control word for FI3	—	RW	U16
	4	Control word	Control word for FI4	—	RW	U16
3001h	0	Largest sub-index	Number of elements	—	RO	U8
	1	Status word	Status word FI1	—	RO	U16
	2	Status word	Status word FI2	—	RO	U16
	3	Status word	Status word FI3	—	RO	U16
	4	Status word	Status word FI4	—	RO	U16
3002h	0	Largest sub-index	Number of elements	—	RW	U8
	1	Setpoint 1	Setpoint 1 for FI1	—	RW	U16
	2	Setpoint 2	Setpoint 2 for FI1	—	RW	U16
	3	Setpoint 3	Setpoint 3 for FI1	—	RW	U16
	4[1]	Setpoint 4	Setpoint 4 for FI1	—	RW	U16
	5[1]	Setpoint 5	Setpoint 5 for FI1	—	RW	U16
	6	Setpoint 1	Setpoint 1 FI2	—	RW	U16
	7	Setpoint 2	Setpoint 2 FI2	—	RW	U16
	8	Setpoint 3	Setpoint 3 FI2	—	RW	U16
	9[1]	Setpoint 4	Setpoint 4 FI2	—	RW	U16
	10[1]	Setpoint 5	Setpoint 5 FI2	—	RW	U16
	11	Setpoint 1	Setpoint 1 FI3	—	RW	U16
	12	Setpoint 2	Setpoint 2 FI3	—	RW	U16
	13	Setpoint 3	Setpoint 3 FI3	—	RW	U16
	14[1]	Setpoint 4	Setpoint 4 FI3	—	RW	U16
	15[1]	Setpoint 5	Setpoint 5 FI3	—	RW	U16
	16	Setpoint 1	Setpoint 1 FI4	—	RW	U16
	17	Setpoint 2	Setpoint 2 FI4	—	RW	U16
	18	Setpoint 3	Setpoint 3 FI4	—	RW	U16
	19[1]	Setpoint 4	Setpoint 4 FI4	—	RW	U16
	20[1]	Setpoint 5	Setpoint 5 FI4	—	RW	U16

Index	Sub-index	Object	Description	Unit	Access	Type
3003h	0	Largest sub-index	Number of elements	—	RO	U8
	1	Actual Value 1	Actual value 1 FI1	—	RO	U16
	2	Actual Value 2	Actual value 2 FI1	—	RO	U16
	3	Actual Value 3	Actual value 3 FI1	—	RO	U16
	4[1]	Actual Value 4	Actual value 4 FI1	—	RO	U16
	5[1]	Actual Value 5	Actual value 5 FI1	—	RO	U16
	6	Actual Value 1	Actual value 1 FI2	—	RO	U16
	7	Actual Value 2	Actual value 2 FI2	—	RO	U16
	8	Actual Value 3	Actual value 3 FI2	—	RO	U16
	9[1]	Actual Value 4	Actual value 4 FI2	—	RO	U16
	10[1]	Actual Value 5	Actual value 5 FI2	—	RO	U16
	11	Actual Value 1	Actual value 1 FI3	—	RO	U16
	12	Actual Value 2	Actual value 2 FI3	—	RO	U16
	13	Actual Value 3	Actual value 3 FI3	—	RO	U16
	14[1]	Actual Value 4	Actual value 4 FI3	—	RO	U16
	15[1]	Actual Value 5	Actual value 5 FI3	—	RO	U16
	16	Actual Value 1	Actual value 1 FI4	—	RO	U16
	17	Actual Value 2	Actual value 2 FI4	—	RO	U16
	18	Actual Value 3	Actual value 3 FI4	—	RO	U16
	19[1]	Actual Value 4	Actual value 4 FI4	—	RO	U16
	20[1]	Actual Value 5	Actual value 5 FI4	—	RO	U16
3004h	0	Digital outputs	Control of digital outputs	—	RW	U16
3005h	0	Digital inputs	Status of digital inputs	—	RO	U16

1 Only SK 54xE frequency inverters

6.8 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 NORD-specific field-bus specific information parameters:

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

Bus interface SK TU3-CAO does not have any of its own parameters. It is set via the parameters of the connected frequency inverter (for details 🕮 Frequency inverter manual).

The NORD standard parameters **P151** to **P154** must be set on the bus interfaces SK CU4-CAO and SK TU4-CAO. In addition, depending on the use and configuration, the CANopen standard parameters **P160**…**P168** must be set.

Information — **Save in EEPROM**

- With writing access via the NORD CON software, the parameters are saved in the EEPROM.
- With access via CANopen (e.g. **P151** = Object index "2097h") the data are only saved in the EEPROM if the SAVE command (object index "1010h") is sent!

Information — **Parameter access via CANopen**

With access via CANopen, "2000h" must be added to the parameters. Counting of the sub-indices starts with "1".

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.

Information — **Parameter numbers**

With access to the NORD standard parameters via CANopen, the value "2000h" must be added to the parameter numbers. Counting of the sub-indices starts with "1".

Information — **Saving parameter settings**

- With writing access to the NORD standard parameters via the NORD CON software, the settings are saved in the EEPROM.
- With access to the NORD standard parameters via CANopen (e.g. **P151** = Object index "2097h") the data are only saved in the EEPROM if the "save" command (object index "1010h") is sent.

P150	**Set relay**
Setting range	0…4
Factory setting	{ 0 }
Bus interface	**SK TU4-CAO**
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-CAO, SK TU4-CAO**
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	0 = Monitoring Off

P152	Factory setting
Setting range	0…1
Factory setting	{ 0 }
Bus interface	**SK CU4-CAO, SK TU4-CAO**
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-CAO, SK TU4-CAO**
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-CAO, SK TU4-CAO**	
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 CANopen standard parameters

Field-bus specific settings of the bus interface are made via the CANopen standard parameters.

P160	COB ID On/Off				
Setting range	0…3				
Arrays	[-01] = Sync Message		[-06] = PDO 1[1] (FI1)		
	[-02] = SDO 1 (FI1, Read Only)		[-07] = PDO 2[1] (FI2)		
	[-03] = SDO 2 (FI2)		[-08] = PDO 3[1] (FI3)		
	[-04] = SDO 3 (FI3)		[-09] = PDO 4[1] (FI4)		
	[-05] = SDO 4 (FI4)		[-10] = PDO 5[1] (bus interface)		
Factory setting	{ [-01] = 3 }	{ [-02] = 3 }	{ [-03] = 0 }	{ [-04] = 0 }	{ [-05] = 0 }
	{ [-06] = 3 }	{ [-07] = 3 }	{ [-08] = 3 }	{ [-09] = 3 }	{ [-10] = 0 }
Bus interface	**SK CU4-CAO, SK TU4-CAO**				
Description	Specification of the assignment of service data objects and process data objects (SDO and PDO) for the connected frequency inverters and bus interface.				
Note	Objects, index "1200h"… "1203h", "1400h"…"1404h" and "1800h"… "1804h", each with sub-index "1", 🕮 Section 6.7 "Object directories".				

Setting values

Value	Meaning	Note
0	Transmit/Receive from	Array [-01] "0" = Off, "1"… "3" = On
1	Receive channel On	
2	Transmit channel On	
3	Transmit/Receive On	

[1] Writing access only permissible in the "Pre-Operational" state

P161	COB ID	
Setting range	0…7FFh	
Arrays	[-01] = COB ID Sync Message	[-10] = PDO 1 Tx[1] (FI1)
	[-02] = SDO 1 Tx (FI1, Read Only)	[-11] = PDO 1 Rx[1] (FI1)
	[-03] = SDO 1 Rx (FI1, Read Only)	[-12] = PDO 2 Tx[1] (FI2)
	[-04] = SDO 2 Tx (FI2)	[-13] = PDO 2 Rx[1] (FI2)
	[-05] = SDO 2 Rx (FI2)	[-14] = PDO 3 Tx[1] (FI3)
	[-06] = SDO 3 Tx (FI3)	[-15] = PDO 3 Rx[1] (FI3)
	[-07] = SDO 3 Rx (FI3)	[-16] = PDO 4 Tx[1] (FI4)
	[-08] = SDO 4 Tx (FI4)	[-17] = PDO 4 Rx[1] (FI4)
	[-09] = SDO 4 Rx (FI4)	[-18] = PDO 5 Tx[1] (bus interface)
		[-19] = PDO 5 Rx[1] (bus interface)
Factory setting	{ [-01] = 0080h }	{ [-10] = 0180h + Address }
	{ [-02] = 0580h + Address }	{ [-11] = 0200h + Address }
	{ [-03] = 0600h + Address }	{ [-12] = 0280h + Address }
	{ [-04] = 02C0h + Address }	{ [-13] = 0300h + Address }
	{ [-05] = 0340h + Address }	{ [-14] = 0380h + Address }
	{ [-06] = 03C0h + Address }	{ [-15] = 0400h + Address }
	{ [-07] = 0440h + Address }	{ [-16] = 0480h + Address }
	{ [-08] = 04C0h + Address }	{ [-17] = 0500h + Address }
	{ [-09] = 0540h + Address }	{ [-18] = 01C0h + Address }
		{ [-19] = 0240h + Address }
Bus interface	**SK CU4-CAO, SK TU4-CAO**	
Description	Assignment of a COB ID to service data and process data objects (SDO and PDO).	
Note	Objects, index "1005h", "1200h"… "1203h", "1400h…"1404h" and "1800h"… "1804h", receive objects (Rx) each with sub-index "1", transmit objects (Tx) each with sub-index 2, 🕮 Section 6.7 "Object directories".	

[1] Writing access only permissible in the "Pre-Operational" state

P162	PDO Transmission Type	
Setting range	0…255	
Arrays	[-01] = PDO 1 Tx (FI1)	[-06] = PDO 3 Rx (FI3)
	[-02] = PDO 1 Rx (FI1)	[-07] = PDO 4 Tx (FI4)
	[-03] = PDO 2 Tx (FI2)	[-08] = PDO 4 Rx (FI4)
	[-04] = PDO 2 Rx (FI2)	[-09] = PDO 5 Tx (bus interface)
	[-05] = PDO 3 Tx (FI3)	[-10] = PDO 5 Rx (bus interface)
Factory setting	{ [-01] … [-10] = 255 }	
Bus interface	**SK CU4-CAO, SK TU4-CAO**	
Description	Specification of the transfer type for process data objects (🕮 Section 6.5.6 "**PDO Transmission Types (operating modes)**".).	
Note	Objects, index "1400h…"1404h" and "1800h"… "1804h", each with sub-index "2", 🕮 Section 6.7 "Object directories".	

P163	TxPDO Inhibit time
Setting range	0…3276.7 ms
Arrays	[-01]…[-04] = PDO 1 (FI1) … PDO 4 (FI4)
	[-05] = PDO 5 (bus interface)
Factory setting	{ [-01]…[-05] = 10 ms }
Bus interface	**SK CU4-CAO, SK TU4-CAO**
Description	Specification of the minimum pause between two PDO transmissions (Transmit PDO Tx) with the same COB ID. In networks with numerous subscribers, the bus load can be influenced with this value. The standard value is 10 ms (value multiplied by 100 µs).
Note	Objects, index "1800h"…"1804h", sub-index "3", 🕮 Section 6.7 "Object directories".

P164	TxPDO Event time
Setting range	0…32767 ms
Arrays	[-01]…[-04] = PDO 1 (FI1) … PDO 4 (FI4)
	[-05] = PDO 5 (bus interface)
Factory setting	{ [-01] … [-05] = 250 ms }
Bus interface	**SK CU4-CAO, SK TU4-CAO**
Description	Definition of the delay time after the elapse of which the process data are transferred. Once this value is exceeded, the PDOs are transmitted cyclically. The standard setting is 250 ms (value multiplied by 1 ms).
Setting values	0 = Off (no time delay)
Note	Objects, index "1800h"…"1804h", sub-index "5", 🕮 Section 6.7 "Object directories".

P165	PDO Mapping Para				
Setting range	0…FFFFFFFFh				
Arrays	[-01]…[-04] =	PDO 1 Tx Value 1 … 4	[-05]…[-08] =	PDO 1 Rx Value 1 … 4	FI 1
	[-09]…[-12] =	PDO 2 Tx Value 1 … 4	[-13]…[-16] =	PDO 2 Rx Value 1 … 4	FI 2
	[-17]…[-20] =	PDO 3 Tx Value 1 … 4	[-21]…[-24] =	PDO 3 Rx Value 1 … 4	FI 3
	[-25]…[-28] =	PDO 4 Tx Value 1 … 4	[-29]…[-32] =	PDO 4 Rx Value 1 … 4	FI 4
	[-33] =	PDO 5 Tx Value 1	[-34] =	PDO 5 Tx Value 1	1)

Factory setting				
	{ [-01] = 30000110h }	{ [-02] = 30020110h }	{ [-03] = 30020210h }	{ [-04] = 30020310h }
	{ [-05] = 30010110h }	{ [-06] = 30030110h }	{ [-07] = 30030210h }	{ [-08] = 30030310h }
	{ [-09] = 30000210h }	{ [-10] = 30020410h }	{ [-11] = 30020510h }	{ [-12] = 30020610h }
	{ [-13] = 30010210h }	{ [-14] = 30030410h }	{ [-15] = 30030510h }	{ [-16] = 30030610h }
	{ [-17] = 30000310h }	{ [-18] = 30020710h }	{ [-19] = 30020810h }	{ [-20] = 30020910h }
	{ [-21] = 30010110h }	{ [-22] = 30030710h }	{ [-23] = 30030810h }	{ [-24] = 30030910h }
	{ [-25] = 30000410h }	{ [-26] = 30020A10h }	{ [-27] = 30020B10h }	{ [-28] = 30020C10h }
	{ [-29] = 30010410h }	{ [-30] = 30030A10h }	{ [-31] = 30030B10h }	{ [-32] = 30030C10h }
	{ [-33] = 30050010h }	{ [-34] = 30040010h }		

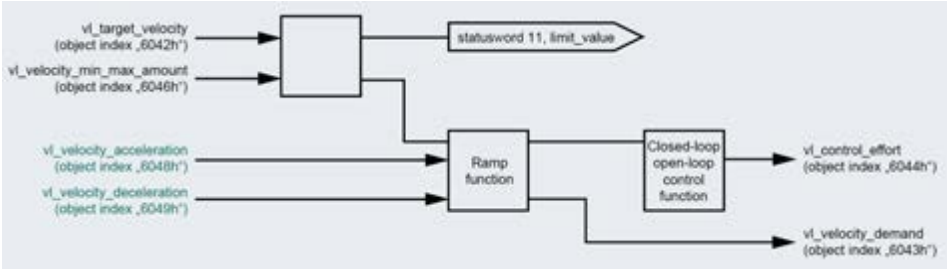
Bus interface	**SK CU4-CAO, SK TU4-CAO**
Description	Specification of objects (setpoints/actual values) which are transferred via PDO telegrams 🕮 Section 6.5.7 "PDO mapping"
Note	Objects, index "1600h"…"1604h", and "1A00h"…"1A04h", each with sub-index "1"…"4", 🕮 Section 6.7 "Object directories".

[1] Arrays [-33] and [-34] are settings for the bus interface itself, therefore only 2 byte.

P166	Timeout Control	
Setting range	0…32767 ms	
Arrays	[-01] = Guard Time	[-02] = Prod. Heartbeat Time
Factory setting	{ [-01]…[-02] = 0 ms }	
Bus interface	**SK CU4-CAO, SK TU4-CAO**	
Description	Array [-01]: Defines a time interval for the monitoring of the field bus devices (slaves) by the bus master (node-guarding).	
	Array [-02]: Setting of the transmission interval (heartbeat) of the field bus device (slave)	
Setting values	0 = Off (no interval)	
Note	Objects, index "100Ch" and "1017h", 🕮 Section 6.7 "Object directories".	

P167	Life Time Factor
Setting range	0…255
Factory setting	{ 0 }
Bus interface	**SK CU4-CAO, SK TU4-CAO**
Description	Entry of the factor for monitoring of the bus master by the field bus device (slave). "Guard Time" (Parameter P166, Array [-01] multiplied by "Life Time Factor" determines the watchdog duration for mutual monitoring of the slave and bus master.
Setting values	0 = Of (Watchdog duration = Guard Time)
Note	Object, index "100Dh", 🕮 Section 6.7 "Object directories".

P168	Drive profile				
Setting range	0…16383				
Arrays	[-01] =	Profile ("0" = Off, "1" = On)			
	[-02] / [-03] =	Acceleration (v) / (t)	[-04] / [-05] =	Deceleration (v) / (t)	FI 1
	[-06] / [-07] =	Acceleration (v) / (t)	[-08] / [-09] =	Deceleration (v) / (t)	FI 2
	[-10] / [-11] =	Acceleration (v) / (t)	[-12] / [-13] =	Deceleration (v) / (t)	FI 3
	[-14] / [-15] =	Acceleration (v) / (t)	[-16] / [-16] =	Deceleration (v) / (t)	FI 4
Factory setting	{ [-01] = 0 }	("0" = Off, "1" = On)			
	{ [-02], [-04], [-06], [-08], [-10], [-12], [-14], [-16] = 1500 }				
	{ [-03], [-05], [-07], [-09], [-11], [-13], [-15], [-17] = 2 }				
Bus interface	**SK CU4-CAO, SK TU4-CAO**				
Description	Setting of the profile parameters "acceleration" and "deceleration" ("Velocity Mode", drive profile DS-402) (change achieved in [rpm] divided by the time which has elapsed during the change [s]).				
Note	Objects, index "6048h" and "6049h", each with sub-index "1" and "2", 🕮 Section 6.7 "Object directories".				



Source: Velocity Mode CiA DSP 402 V1.1

Activation of the drive profile (Array [-01] = "1" affects all of the frequency inverters which are connected to the NORD system bus. The drive profile is only valid in parameter set 1. If the drive profile is activated, objects index "3004h"..."3004" are replaced with the objects index "6040h"..."6044h".

The drive profile is not supported by SK 5xxE frequency inverters which are connected to the NORD system bus via the internal RJ45 interface.

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 CU4-CAO, SK TU4-CAO**
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 CU4-CAO, SK TU4-CAO**
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 CU4-CAO, SK TU4-CAO**
Description	Display of the bus interface identifier.

Display values

Value	Meaning	
0	CU4 (internal)	Bus interfaceSK CU4-CAO,
1	TU4 (external)	Bus interfaceSK TU4-CAO

P173	Module status
Display range	0…FFFFh
Bus interface	**SK CU4-CAO, SK TU4-CAO**
Description	Displays the operating state of the bus interface.

Display values

Bit	Meaning
0	Initialisation (Bus status "PREOPERATIONAL")
1	Bus status "OPERATIONAL"
2	Timeout Node guarding (Watchdog NMT Master)
3	Timeout (time set in parameter **P151**)
4	CANopen "Warning"
5	CANopen "Bus Off"
6	System bus "Warning"
7	System bus "Bus OFF"
8	FI 1 status
9	
10	FI2 status
11	
12	FI3 status
13	
14	FI4 status
15	

Status for frequency inverter Bit 8…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

P174	Digital input status
Display range	0…255 (00000000…11111111b)
Bus interface	**SK CU4-CAO, SK TU4-CAO**
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]

[1] Only bus interface , SK TU4-CAO

P175	Relay status
Display range	0…3 (00…11b)
Bus interface	**SK TU4-CAO**
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			
	[-02] =	Control word	[-03]…[-05] =	Setpoint 1…3	to FI1
	[-06] =	Control word	[-07]…[-09] =	Setpoint 1…3	to FI2
	[-10] =	Control word	[-11]…[-13] =	Setpoint 1…3	to FI3
	[-14] =	Control word	[-15]…[-17] =	Setpoint 1…3	to FI4
Bus interface	**SK CU4-CAO, SK TU4-CAO**				
Description	Display of data received from the CANopen-Busmaster.				

P177	Process data Bus Out				
Display range	-32768…32767				
Arrays	[-01] =	Bus module inputs			
	[-02] =	Status word	[-03]…[-05] =	Actual value 1…3	from FI1
	[-06] =	Status word	[-07]…[-09] =	Actual value 1…3	from FI2
	[-10] =	Status word	[-11]…[-13] =	Actual value 1…3	from FI3
	[-14] =	Status word	[-15]…[-17] =	Actual value 1…3	from FI4
Bus interface	**SK CU4-CAO, SK TU4-CAO**				
Description	Display of the data sent from the bus interface to the CANopen-Busmaster.				

7.1.4 CANopen information parameters

CANopen information parameters are used to display statuses and settings which are specific to the field bus.

P180	CANopen address
Display range	1…63
Bus interface	**SK CU4-CAO, SK TU4-CAO**
Description	Display of the unique bus address (Node ID) which is set with the DIP switches of the bus interface (🕮 Technical Information/Data Sheet).
Note	If no address is set via the DIP switches (all switches in the "OFF") position, this parameter shows the address "127".

P181	CANopen baud rate	
Display range	0…3	
Bus interface	**SK CU4-CAO, SK TU4-CAO**	
Description	Display of the baud rate which is set with the DIP switches (🕮 Technical Information/Data Sheet).	
Display values	**Value**	**Meaning**
	0	125 kBaud
	1	250 kBaud
	2	500 kBaud
	3	1 MBaud

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	"6" = CANopen	"6" = CANopen	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", or "6"
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 or 38*	32, 34, 36 or 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 for communication with a bus interface via the system bus.

○[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 ready</td></tr><tr><td>1</td><td>Bus interface in status “Operational”</td></tr><tr><td>2</td><td>Initialisation active</td></tr><tr><td>3</td><td>Reserved</td></tr><tr><td>4</td><td>Bus interface error</td></tr><tr><td>5</td><td>Timeout error</td></tr><tr><td>6</td><td>Initialisation error</td></tr><tr><td>7</td><td>Reserved</td></tr><tr><td>8…15</td><td>Bus interface ID (0Ch)</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.

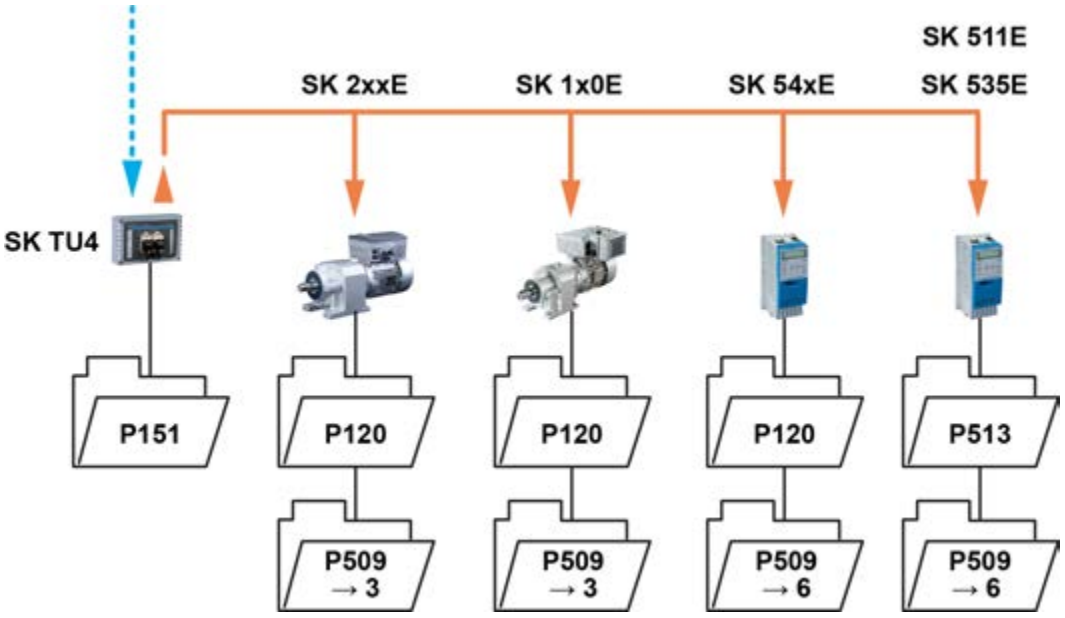


Figure 8: Examples of monitoring parameter settings – SK TU4 bus interface

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

3 = System bus

6 = CANopen

8.1.1 Additional CANopen monitoring functions

8.1.1.1 Node Guarding

The Node Guarding function (node monitoring) enables the bus master to monitor a CANopen bus participant (slave). An error message is triggered if no response is received from a bus participant after the elapse of a defined time after a query from the bus master.

The monitoring interval is set with parameter **P166 Timeout Control**, Array [-01] (🕮 Section 7.1.2 "CANopen standard parameters").

8.1.1.2 Life Guarding

The Life Guarding function (monitoring of readiness for operation) enables the bus master to be monitored by a bus participant (slave). An error message is triggered if after the receipt of a protocol the bus participant does not receive a further protocol from the bus master after a defined time has elapsed.

Setting of the monitoring interval is made with a combination of parameters **P166 Timeout Control**, Array [-01] and **P167 Life Time Factor** (🕮 Section 7.1.2 "CANopen standard parameters").

8.1.1.3 Heartbeat monitoring

The heartbeat function (heartbeat monitoring) enables the activation of a so-called "Producer Heartbeat Time (heartbeat cycle of the message transmitter). By setting an appropriate time in parameter **P166 Timeout Control**, Array [-02] (value ≠ "0"), the bus participant (slave) sends a corresponding protocol to the bus master within the set interval (🕮 Section 7.1.2 "CANopen standard parameters").

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 Handling of errors in the bus interface

If errors occur in frequency inverters which are connected to the NORD system bus, the bus interface sends an error message to the CANopen bus master via "Emergency Message". This message has the following structure:

COB ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
„80h“ + Node ID of the bus interface	Error code		Parameter 1001h	FI ID 0…3	Not used			

"FI ID" identifies the frequency inverter in which the error occurred.

8.3.1 Error Groups

The error groups listed below are defined in the CANopen communication profile DS-301.

Error code	Meaning
00xxh	No error
10xxh	Undefined error type
20xxh	Current error
30xxh	Voltage error
40xxh	Temperature error
50xxh	Hardware error
60xxh	Software error
70xxh	Additional module
80xxh	Communication
90xxh	External error
FF00h	Specific to device

8.3.2 Error codes – interruption of SDO communication

The error codes listed below can be generated on interruption of the SDO communication.

Error code	Meaning
0503 0000h	Toggle bit unchanged
0504 0000h	SDO message timeout
0504 0001h	Client/Server command invalid/unknown
0504 0005h	No memory
0601 0000h	Illegal access to an object
0601 0001h	Access to write-only parameter
0601 0002h	Access to read-only object
0602 0000h	Object does not exist in object dictionary
0604 0041h	Object cannot be mapped in PDO
0604 0042h	Object exceeds the PDO length
0604 0043h	Parameter incompatibility
0604 0047h	Module internally incompatible
0606 0000h	Access failure due to hardware error
0607 0010h	Data type or parameter length do not match
0607 0012h	Data type incorrect, parameter length too long
0607 0013h	Data type incorrect, parameter length too short
0609 0011h	Sub-index of parameter does not exist
0609 0030h	Parameter value range overflow
0609 0031h	
0609 0032h	Parameter value range undershot
0800 0020h	Data transfer or storage not possible
0800 0021h	Data transfer or storage not possible; reason: local controller

8.3.3 Status word from the frequency inverter.

Error messages which are generated by the frequency inverter are transferred from the bus interface to the field bus level. They do not result in an error of the bus interface.

Allocation of frequency inverter error codes:

CANopen error codes	Frequency inverter (P700)[1]	
	Error number	Meaning
1000h	—	The error number which has been sent from the frequency inverter is unknown to the bus interface and must be read out via parameter P700 or an actual value.
2200h	4.0/4.1	Module overcurrent / pulse switch-off due to overcurrent
2211h	3.2	IGBT overcurrent (125 %)
2212h	3.3	IGBT overcurrent fast (150 %)
2310h	3.0	Inverter overcurrent
2311h	3.2	IGBT overcurrent 125 %
2312h	3.3	IGBT overcurrent 150 %
3110h	5.1	Mains voltage too high
3120h	6.1	Mains voltage too low
3130h	7.0	Phase failure
3210h	5.0	Link circuit voltage too high
3230h	6.0	Link circuit voltage too low (charging error)
4210h	1.0	Overtemperature in frequency inverter
4310h	2.0/2.1	Motor overtemperature/ … I^2t
5000h	10.8	Bus interface communication error
5110h	11.0	External bus error
5300h	17.0	EMC fault
5510h	20.0	RAM data memory
5520h	20.8	EEPROM error
5530h	8.1/8.2	Invalid inverter type/copying error from external EEPROM
6000h	20.1…20.7	System error, device software
	20.9/21.0…21.3	
6310h	8.0	Parameter loss (maximum EEPROM value exceeded)
7112h	3.1	Brake chopper overcurrent
7120h	16.0/16.1	Phase error motor / motor current monitoring during brake operation
7300h	14.3	Sensor
7305h	13.0	Incremental encoder 1
7306h	14.4	Incremental encoder 2
7310h	14.5	Speed sensor
7320h	14.6…14.8	Position sensor
7330h	25.0	Hiper. abs./inc. error
7331h	25.1	Universal encoder communication
7332h	25.2	No corresp. univ. encoder
7333h	25.3	Universal encoder resolution
7334h	25.4	Universal encoder error
8100h	10.0…10.7	Telegram downtime, initialisation error, system error
8300h	13.2	Slip error switch-off monitoring
8400h	13.1	Speed slip error
8600h	14.0/14.1	Reserved
8612h	14.2	Reference limit
8710h	13.5	Flying saw acceleration too low
8711h	13.6	Flying saw value incorrect
9000h	12.0…12.2	External watchdog/switch-off limit reached
FF10h	18.0	Safety circuit
FF11h	19.0	Parameter identification error

1 For a detailed description of the error code 🕮 frequency inverter manual.

8.4 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
101.0	System bus 24 V missing	No 24 V voltage on bus, connections not correct
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
511.0	CANopen bus OFF	Bus subscriber not connected to bus
511.1	CANopen warning	Bus error
511.2	CANopen overrun	Message buffer of bus interface overwritten with new telegram before processing
511.3	Invalid CANopen address	Incorrect/duplicated bus address
512.0	CANopen timeout	Telegram transfer error

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
10.2	External bus interface telegram timeout	• Telegram transfer error. – Check the connections and links and the program sequence in the Bus Master.
10.3	Timeout by **P151**/**P513**	• System bus monitoring has triggered • Check time setting of parameter **P151/P513** • The enable bit is missing in the control word.
10.4	External bus interface initialisation error	• Unable to communicate with the bus interface. – Check the bus interface power supply.
10.8	External bus interface communication error	*SK TU3-CAO bus interface only:* • Connection between bus interface and frequency inverter interrupted.
10.9	Missing bus interface	*Only bus interfaces SK CU4-CAO and SK TU4-CAO:* • 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 275271001	Technical Information/Data Sheet for bus interface **SK CU4-CAO** (for IP55 devices)
TI 275281501	Technical Information/Data Sheet for bus interface **SK CU4-CAO-C** (for IP66 devices)
TI 275281101	Technical Information/Data Sheet for bus interface **SK TU4-CAO** (for IP55 devices)
TI 275281151	Technical Information/Data Sheet for bus interface **SK TU4-CAO-C** (for IP66 devices)
TI 275271201	Technical Information/Data Sheet for bus interface **SK TU4-CAO-M12** (for IP55 devices with M12 round plug connectors)
TI 275281251	Technical Information/Data Sheet for bus interface **SK TU4-CAO-M12-C** (for IP66 devices with M12 round plug connectors)
TI 275900075	Technical Information/Data Sheet for bus interface **SK TU3-PNT** (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 CANopen configuration software
NORDCON	Parametrisation and diagnostic software

Key word index

R

S

T

U

NORD DRIVESYSTEMS Group

Headquarters and Technology Centre
in Bargteheide, close to Hamburg

Innovative drive solutions
for more than 100 branches of industry

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

Electrical products
IE2/IE3/IE4 motors

Electronic products
centralised and decentralised frequency inverters,
motor starters and field distribution systems

7 state-of-the-art production plants
for all drive components

Subsidiaries and sales partners
in 98 countries on 5 continents
provide local stocks, assembly, production,
technical support and customer service

More than 4,000 employees throughout the world
create customer oriented solutions

www.nord.com/locator

Headquarters:

Getriebebau NORD GmbH & Co. KG
Getriebebau-Nord-Straße 1
22941 Bargteheide, Germany
T: +49 (0) 4532 / 289-0
F: +49 (0) 4532 / 289-22 53
info@nord.com, www.nord.com

Member of the NORD DRIVESYSTEMS Group

NORD® DRIVESYSTEMS

6082502 / 4319