Intelligent Drivesystems, Worldwide Services

GB

BU 0060

CANopen

Supplementary manual options for NORD - Frequency Inverters

NORD DRIVESYSTEMS

NORD frequency inverters

Safety and operating instructions for drive power converters

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

1. General

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

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

Further information can be found in this documentation.

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

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

2. Proper use in Europe

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

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

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

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

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

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

3. Transport, storage

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

4. Installation

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

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

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

5. Electrical connections

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

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

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

6. Operation

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

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

All covers must be kept closed during operation.

7. Maintenance and repairs

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

Further information can be found in this documentation.

These safety instructions must be kept in a safe place!

Documentation

Name:

Part No.: 607 06 01

Device series: **CANnord /CANopen** for
SK 300E, SK 5xxE, SK 700E, SK 750E

Version list

Name of previous issues	Software Version	Remarks
BU 0060 EN, May 2005 Part No. 607 06 02 / 1005	V. 1.1 R0	First issue
BU 0060 DE, November 2006 Part No. 607 06 02 / 4606	V. 1.2 R1	Modification of SK 500/520/530E parameters, correction of recommended M8/M12 connector and IW2/3 modification, inclusion of CANnord data
BU 0060 EN, May 2007 Part No. 607 06 02 / 1807	V. 1.2 R1	Combination of BU 0030 + BU 0060 = BU 0060. This now only contains CANnord (Nord-specific CAN bus) and CANopen.
BU 0060 EN, May 2010 Part No. 607 06 02 / 2010	V. 1.2 R1	Correction of errors (e.g. (P748): „CANopen NMT State“), RJ45 connection module supplemented
BU 0060 DE, October 2012 Part No. 607 06 02 / 4112	V. 1.2 R1	Supplementation of parameters for inverter variants: SK 54xE. Removal details of the vector mc series. Modification of the structure in the document and correction of small errors, revision of examples, supplementation of example for SDO communication, tables, control word and status word: Designations revised.

Table 1: Version list

Publisher

Getriebebau NORD GmbH & Co. KG
Rudolf-Diesel-Str. 1 · D-22941 Bargteheide · http://www.nord.com/
Tel.: +49 (0) 45 32 / 289-0 · Fax +49 (0) 45 32 / 289-2555

NOTICE **Supplementary operating manual**

This supplementary operating manual is only valid in conjunction with the operating manual supplied for the respective frequency inverter. This is an essential prerequisite for the availability of all the relevant information required for the safe commissioning of the frequency inverter.

Intended use of the frequency inverter

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

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

The described optional modules can only be used for the specifically defined frequency inverter series, use across series is only possible with the SK CU1-… module for SK 700E and SK 750E, or the SK TU2-... module with SK 300E and SK 750E. The use of these modules with other devices is not permitted and can lead to their destruction.

The described optional modules and the corresponding frequency inverters are, according to their type, devices for stationary installation in control cabinets or decentralised structures. All details regarding technical data and permissible conditions at the installation site must be complied with.

Commissioning (commencement of the intended use) is not permitted until it has been ensured that the machine complies with the EMC Directive 2004/108/EEC and that the conformity of the end product meets the Machinery Directive 2006/42/EEC (observe EN 60204).

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1. Introduction

1.1 General

This CANnord/ CANopen documentation is valid for the NORD series trio SK 300E, SK 500E, SK 700E, SK 750E. For discontinued device series (e.g. vector mc) which are no longer supplied, the technical documentation is available on request (older version of BU0060).

The respective basic devices are delivered with a blank cover for the technology unit slot. The basic models do not have any components for parameterisation and control.

In order to set up communication with CANnord/ CANopen, either a **CANnord/ CANopen customer unit** or a **Technologiebaugruppe CANnord/ CANopen technology module** (according to the device series) must be installed and connected.

The only exceptions to this from the SK 5xxE series are the types above SK 511E, in which the CANnord/CANopen function is integrated as standard and can be used via an RJ45 plug connector.

1.2 The bus system

1.2.1 CAN Bus

The CANbus enables powerful automation systems to be realised with distributed intelligence. The reason for the broad application of the CANbus protocol is mainly the availability of very reasonably priced protocol components.

CANbus is based on linear topology. Using repeaters, branch-like topologies are possible. Solutions based on fibre optic conductors as well as double wire lines can be used. The conflict recognition and resolution, as well as error recognition, integrated in the CAN bus protocol, enables high bus utilisation and data security.

Bus access rights are not issued by a higher-level control unit. Instead, each subscriber can start transmitting a message as soon as the bus is free (multi-master capability). With simultaneous access of several participants, the participant with the highest priority receives the access rights. The priority is assigned according to the identifier of the messenger in CANbus.

1.2.2 CANopen

CANopen is an open communications profile for various industrial automation systems. It is based on the CANbus system (Controller Area Network), developed by Bosch, and describes the layers 1 (physical layer) and 2 (data transmission) of the OSI reference model (ISO 11898). CANopen was specified by the international CAN-in-Automation (CiA) organisation and defines the communication mechanisms (process data, parameterisation, monitoring etc.) via the CANopen bus.

CANopen can be used for data exchange between devices from different manufacturers.

Alongside the communication profile, CANopen defines device profiles for the most important types of device used in industrial automation technology, e.g. digital and analog I/Os, drives, etc.

The CiA CANopen specification DS-301 and DS-402 is supported (does not apply for the integrated RJ45 interface of the SK 5xxE series (SK 511E and above)).

1.2.3 CANnord

CANnord is a specific bus system from Getriebebau NORD. Further details can be found in Section 4.2.

1.3 CAN for NORD frequency inverters

1.3.1 CAN Bus features, physics

- Electrically isolated bus interface
- Transfer rate from 10 kBit/s to 500 kBit/s (optionally up to 1 Mbit/s)
- Connection to frequency inverter via Sub-D9 connector, M12 system connector, RJ45 connector or screw/plug-in terminals (depending on option/device)
- CAN interface as per specifications 2.0A and 2.0B
- Up to 110 nodes (e.g. frequency inverters) on one bus
- Additional termination resistor (depending on option/device)
- Status display with 2 or 4 LEDs (not with SK 500E/520E/530E)
- External 24V supply required (~70mA for SK 300E/ SK 5xxE/ 700E/ 750E with technology unit CANopen, ~30mA for SK 5xxE (SK 511E and above) via internal RJ45 connection CANnord/ CANopen)
- TO supports 29 Bit + 11 Bit Identifier
- Internal interface (RJ45) for SK 5xxE (SK 511E and above) only 11 Bit Identifier

1.3.2 CANopen features

- Programming of all frequency inverter parameters using SDO
- Supports DS-301 communications profile and DS-402 drive profile (with technology units)
- Dynamic mapping (4 TPDOs und 4 RPDOs) with technology units
- Heartbeat/ Node Guarding

1.3.3 CANnord features

- Programming of all frequency inverter parameters using SDO
- Setpoint/actual values read/write
- Error messages
- Time out function

1.4 Delivery

Check the equipment **immediately** after delivery/unpacking for transport damage such as deformation or loose parts.

If there is any damage, contact the carrier immediately and carry out a thorough assessment.

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

1.5 Scope of delivery

Technology unit	SK TU1-CAN	for SK 700E	IP20	or
	SK TU1-CAO	for SK 700E	IP20	or
	SK TU2-CAO	for SK 300E / SK 750E	IP55	or
	SK TU2-CAO-C	for SK 300E / SK 750E	IP66	or
	SK TU3-CAO	for SK 5xxE	IP20	or
Customer interface	SK CU1-CAN	for SK 700E / SK 750E	IP00	or
	SK CU1-CAN-RJ	for SK 700E / SK 750E	IP00	

The operating instructions for the above bus modules or the relevant frequency inverters as well as the NORDCON parameterisation software are available for download free of charge under www.nord.com. In addition, a documentation CD is provided with every frequency inverter (designation: EPD), on which the above data is also provided.

Information — **Flat connecting sleeve for PE connection**

The technology units SK TU1 and SK TU3 are also supplied with a flat connecting sleeve. This sleeve must be used to produce a correct PE connection of the technology unit via an appropriate cable (cross-section 1.5mm²).

1.6 Certifications

1.6.1 European EMC Directive

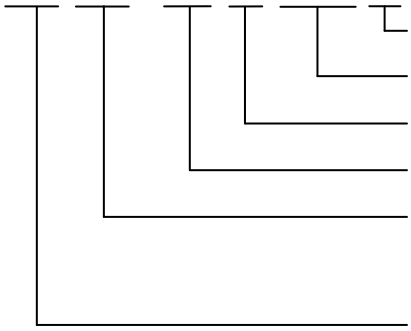
If the frequency inverter is installed according to the recommendations in this manual, it meets all EMC directive requirements, as per the EMC product standard for motor-operated systems EN 61800-3.

1.6.2 RoHS compliant

The frequency inverters and optional modules are designed to be RoHS compliant according to Directive 2002/95/EU.

1.7 Type code

SK TU2-PBR(-24V-KL-ATEX-C)



- Higher IP protection class (IP66)
- ATEX version
- Special version e.g.: KL= version with connection terminals
- Version with external 24V supply
- Device type: AS1 = AS-Interface, CAO = CANopen, DEV = DeviceNet, IBS = InterBus, ECT = EtherCAT, **PBR** = **Profibus**, PNT = ProfiNET
- Device series: SK TU1 / **SK TU2** / SK TU3 / SK CU1

2. Modules

2.1 Modular assemblies SK 5xxE

By the use of various modules for display, control and parameterisation, the SK 5xxE can be easily adapted to a wide range of requirements.

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

The **Technology Unit (Technology Unit, SK TU1-...)** is connected externally to the front of the frequency inverter and is therefore easy to access and replace at any time.

Fig. 1: Modular assemblies SK 5xxE

2.1.1 SK 5xxE CANnord / CANopen, overview

SK TU3-CAO	internal RJ45 connection
CANopen	CANnord or CANopen
SK 5xxE (entire series)	SK 511E and above
	
SUB D9 connector	Input/output via RJ45 sockets
Additional termination resistor	Additional termination resistor
External 24V +/- 25% voltage supply, approx. 80mA	External 24V +/- 25% voltage supply, approx. 30mA
Rotary coding switch for baud rate and address	Parameter P514 / P515 for baud rate and address
Drive profile DS 301 and DS 402	Drive profile DS 301

Figure 2: SK 5xxE -configuration CANnord / CANopen

Information **Strain relief**

By means of appropriate measures, ensure that no vibrations or tensile forces act on the cabling. In particular, the RJ45 connector cabling must be free of any tension.

2.1.2 CANnord / CANopen, internal RJ45 connection (SK 511E and above)

With SK 511E and above, a CANnord/CANopen interface is integrated and can be accessed via RJ45 connections.

To use the CANnord/CANopen, the bus must be provided with an external 24V voltage supply. The CAN participant can therefore be identified by the master system even without a voltage supply to the frequency inverter.

Information — **Control voltage**

There is no internal coupling between the control voltage level of the frequency inverter and the bus system.

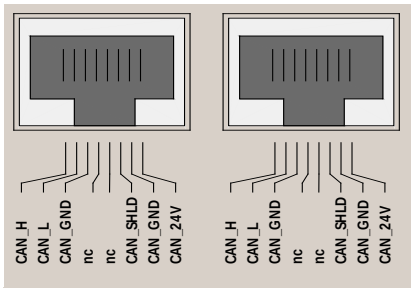
	CANnord (P509 = 3)	CANopen (P509 = 6)
Baud rate (P514)	The baud rate is set in the frequency inverter parameter P514. Transfer rates of up to 500 kbit/s can be used. (Optionally up to 1 Mbit/s)	
Supply voltage	The supply voltage is 24V DC ±25% (pin 8 = 24V, pin 7 = GND, approx. 30mA) and is connected via the RJ45 connector.	
Termination resistor	The termination resistor R=120W for the last bus participant is located next to the BUS connection. Switch No. 2 = ON.	
BUS address (P515)	The BUS address is set in the frequency inverter parameter P515.	
	0…255	**0…127**
BUS connection	2x RJ45 sockets are connected in parallel internally.	

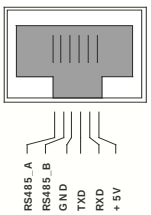
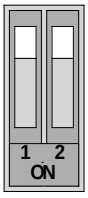
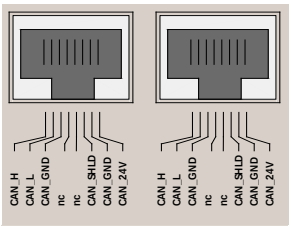
Table 2: Details of SK 5xxE – BUS -configuration via RJ45

Control block X9 and X10 – CAN / CANopen

Relevance	SK 500E	SK 505E	SK 510E	**SK 511E**	**SK 515E**	**SK 520E**	**SK 530E**	**SK 535E**
				√	√	√	√	√

Terminals X9: / X10:	1	2	3	4	5	6	7	8
Name	CAN_H	CAN_L	CAN_GND	nc	nc	CAN_SHD	CAN_GND	CAN_24V

Contact	Function [factory setting]	Data	Description / wiring suggestion	Parameter
1	CAN/CANopen signal	Baud rate …500kBaud RJ45 sockets are connected in parallel internally. Terminal resistance R=120W DIP 2 (see below) **NOTE:** To operate CANbus/CANopen the interface must be externally supplied with 24V (capacity at least 30 mA).	**X10** **X9**  2x RJ45: Pin No. 1 … 8 **NOTE:** For frequency inverters **SK 530E** and above, this CANopen interface can be used for the evaluation of an absolute encoder. Further details can be found in manual BU 0510. **Recommendation:** Provide strain relief (e.g. with EMC Kit)	P503 P509
2				
3	CAN GND			
4	No function			
5				
6	Cable shield			
7	GND/0V			
8	External 24VDC voltage supply			

DIP switch 1/2 (top side of frequency inverter)		
DIP-1	Termination resistor for RS485 interface (RJ12); ON = switched in [Default = "OFF"] For RS232 communication DIP1 to "**OFF**"	**X11**  RS232/485
DIP 2	Terminal resistor for CAN/CANopen interface (RJ12); ON = switched in [Default = "OFF"]	 DIP
		X10 **X9**  CAN/CANopen

2.1.3 RJ45 WAGO- Connection module

This adapter module can be used for the simple wiring of functions of the RJ45 connection (24V supply voltage, CANopen absolute encoder, CANbus) with normal cables.

Pre-assembled RJ45 patch cables are connected to the spring-loaded terminals (1-8 + S) with this adapter.

Contact	1	2	3	4	5	6	7	8	S
Meaning	CAN_H	CAN_L	CAN_GND	nc.	nc.	CAN_SHD	CAN_GND	CAN_24V	Shield

The shield clamp should be used in order to ensure the correct connection and relief of tension on the shield.

Supplier	Name	Article number
WAGO Kontakttechnik GmbH	Ethernet connection module with CAGE CLAMP connection RJ45 transfer module	289-175
WAGO Kontakttechnik GmbH	Accessories: WAGO shield clamp	790-108
Alternative, complete connection module and shield clamp		**Part No.**
Getriebebau NORD GmbH & Co.KG	Adapter module RJ45/terminal	278910300

Table 3: RJ45 WAGO connection module

2.1.4 CANopen module, SK TU3-CAO

This CANopen module can be used for all SK 500E devices. It occupies the technology slot which can then no longer be used for control and display modules. Alternatively, the SimpleBox SK CSX-0 can be plugged in to the CANopen module and connected to the frequency inverter via the RS232/485 interface.

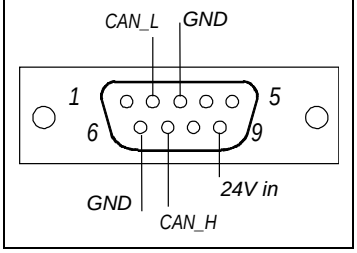
The CANopen module **must be provided with a 24 V external power supply** (via SUB – D9 connection). This CAN participant can therefore be identified by the master system even without a voltage supply to the frequency inverter. The data required for this purpose are set using a rotary coding switch. This Bus data is read in when the 24V is applied from the frequency inverter.

1	CANopen Status LEDs	
CR	(green)	CANopen RUN
CE	(red)	CANopen ERROR
DR	(green)	Module status
GB	(red)	Module error

2	Termination resistor	
	(ON)	Connected
	(OFF)	Not connected

3	Shielding terminal
⏚	Connection to PE of the frequency inverter to suppress interference in the Bus lines

4	SUB – D9



Baud rate *(BAUD)*

Transfer rates of up to 500 kbit/s can be used (optionally up to 1Mbit/s).

If *BAUD* is set to **PGM** the value from parameter P514 is used as the baud rate.

Supply voltage

The supply voltage is 24 V DC ±25% (Pin 9 = 24 V, Pin 3 = GND, approx. 80 mA). The connection is made via the SUB-D9 connector.

Termination resistor

The termination resistor for the last Bus participant is located on the CANopen Bus module.

CAN address, setting the ID *(IDx1 and ID10)*

The rotary switches **IDx1** and **IDx10** can be used to set the node identifier in decimal code in the range from 01...99_{dez}.

Example: Node ID = 64 à IDx10 = 6, IDx1 = 4

If *BAUD* is set to **PGM** the value from parameter P515 of the frequency inverter is used as the node identifier.

Information — **Rotary coding switches**

The settings made using the rotary coding switch are not transferred to the frequency inverter or saved. Changed settings are only adopted when the 24V supply is applied ("Power ON").

2.1.5 Installing

note

Installing the technology unit

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

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

The technology units must be **installed** as follows:

1. Switch off the mains voltage, observe the waiting period.
2. Push the control terminals cover down slightly or remove.
3. Remove the **blank cover**, by loosening the release on the lower edge and pulling off with an upward turning movement. If necessary, the attachment screw next to the release must be removed.
4. Hook the **technology unit** onto the upper edge slots and press in lightly until it engages. Ensure full contact with the connector strip and fasten with the screws if necessary (separate packet).
5. Close the control terminal cover again.

2.2 Modular units SK 700E (SK 750E)

By the use of various modules for display, control and parameterisation, the SK 700E can be easily adapted to various requirements.

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

The **Technology Unit (Technology Unit, SK TU1-...)** is connected externally to the front of the frequency inverter and is therefore easy to access and replace at any time.

In addition, further modules (customer interfaces and special extensions) can be used in the frequency inverter for the processing of digital and analogue signals and for speed control or positioning.

Fig. 3: Frequency inverter SK 700E and technology units

2.2.1 SK TU1- CANnord / CANopen module, overview

The communication modules SK TU1-CAN bor SK TU1-CAO are used to connect drive units of the SK 700E series to higher level automation systems via CANnord or CANopen.

Module	Description	Data
CANnord module **SK TU1-CAN**	This option enables control of the SK 700E via the CAN serial port.	1 CANnord interface Connector: Sub-D9 Part No. 278200070
CANopen module **SK TU1-CAO**	This option enables control of the SK 700E via the CANopen serial port.	1 CANopen interface Connector: Sub-D9 Part No. 278200075

Table 4: SK TU1-CAN / -CAO, overview of technology units

2.2.2 CANnord module, SK TU1-CAN

The CANnord interface on NORD frequency inverters enables parameterisation and control of devices as per the CAN specifications 2.0A and 2.0B. Up to 110 nodes can be addressed on a single Bus. Termination resistors are integrated and can be switched in.

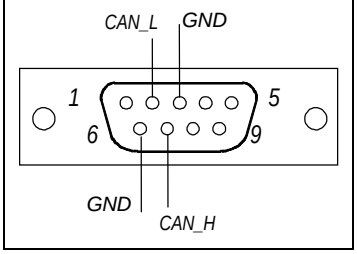
The transfer rate can be set to between 10 kBit and 500 Kbit/s.

The conflict and error recognition integrated in the CANnord protocol enables maximum Bus usage and data security.

1	CANnord Status LEDs	
TxD	(green)	Transmitting CAN data
RxD	(green)	Receiving CAN data

2	Termination resistor	
	(ON)	Connected
		
	(OFF)	Not connected

3	SUB – D9



2.2.3 CANopen module, SK TU1-CAO

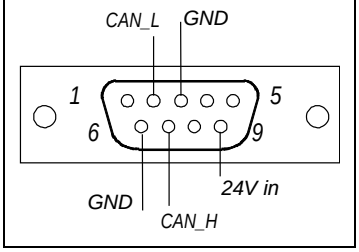
This CANopen module can be used for all SK 700E devices. It occupies the technology slot which can then no longer be used for control and display modules. The CANopen module **must be provided with a 24 V external power supply** (via SUB – D9 connection). This CAN participant can therefore be identified by the master system even without a voltage supply to the frequency inverter. The data required for this purpose are set using a rotary coding switch. This Bus data is read in when the 24 V is applied from the frequency inverter.

1	CANopen Status LEDs	
CR	(green)	CANopen RUN
CE	(red)	CANopen ERROR
DR	(green)	Module status
GB	(red)	Module error

2	Termination resistor	
	(ON)	Connected
	(OFF)	not connected

3	Shielding terminal
⏚	Connection to PE of the frequency inverter to suppress interference in the Bus lines

4	SUB – D9



Baud rate *(BAUD)*

Transfer rates of up to 500 kbit/s can be used (optionally up to 1Mbit/s).

If *BAUD* is set to **PGM** the value from parameter P514 is used as the baud rate.

Supply voltage

The supply voltage is 24 V DC ±25% (Pin 9 = 24 V, Pin 3 = GND, approx. 80 mA). The connection is made via the SUB-D9 connector.

Termination resistor

The termination resistor for the last Bus participant is located on the CANopen Bus module.

CAN address, setting the ID *(IDx1 and ID10)*

The rotary switches **IDx1** and **IDx10** can be used to set the node identifier in decimal code in the range from 01...99_{dez}.

Example: Node ID = 64 à IDx10 = 6, IDx1 = 4

If *BAUD* is set to **PGM** the value from parameter P515 of the frequency inverter is used as the node identifier.

Information — **Rotary coding switches**

The settings made using the rotary coding switch are not transferred to the frequency inverter or saved. Changed settings are only adopted when the 24V supply is applied ("Power ON").

2.2.4 Installation of the SK TU1 technology unit

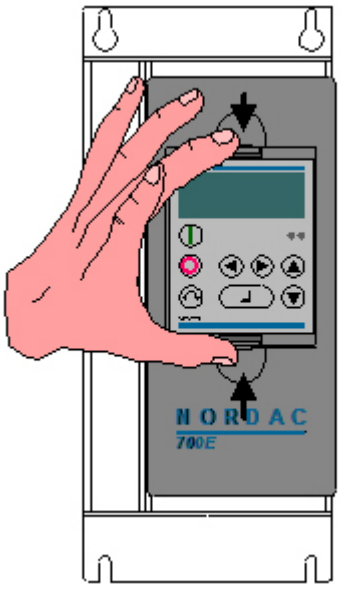
⚠ WARNING — **Electric shock**

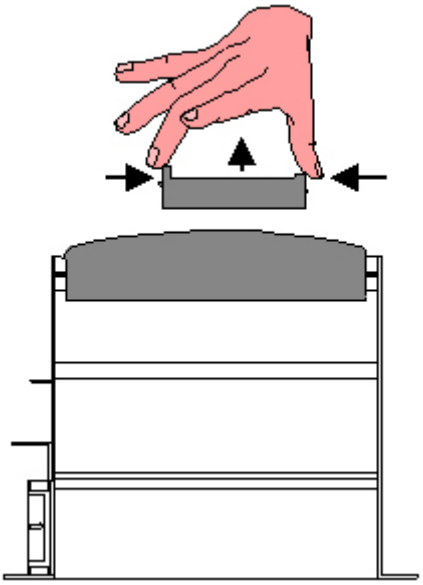
Modules must not be inserted or removed unless the device is **free of voltage**. The slots may only be used for the intended modules. Installation remote from the frequency inverter is not possible. It must be connected directly to the frequency inverter.

Failure to comply with this may result in an **electric shock**, which my cause serious injury and the destruction of the frequency inverter and the module.

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

1. Switch off the mains voltage, observe the waiting period.
2. Remove the dummy cover by actuating the unlocking device on the top and bottom edge.
3. Press the technology unit onto the mounting surface, until it audibly engages.





2.2.5 CANnord module, SK CU1-CAN

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

By means of a relay contact, brake control can be actuated or warnings can be sent to another system.

1	Connection terminals*	
X5.1	Relay	P434
X5.2	DigIN	P421
X5.3	CAN	P514 / P515
* max. 1.5mm²		

2	Termination resistor	
	(ON)	Connected
	(OFF)	not connected

The digital input has a 2.5V switching threshold for the evaluation of the temperature sensor. The input can, however, also be used for an emergency stop function.

Cabling can be implemented using Western connectors and commercial network cables (twisted pair, modular connector 8P8C, RJ45), networking of several devices is possible with T-connectors.

3	RJ45 contact assignment
1, 2, 7, 8	n. c.
3, 6	GND
4	CAN_L (-)
5	CAN_H (+)
Housing	PE (shield)

SK CU1-CAN terminal assignment

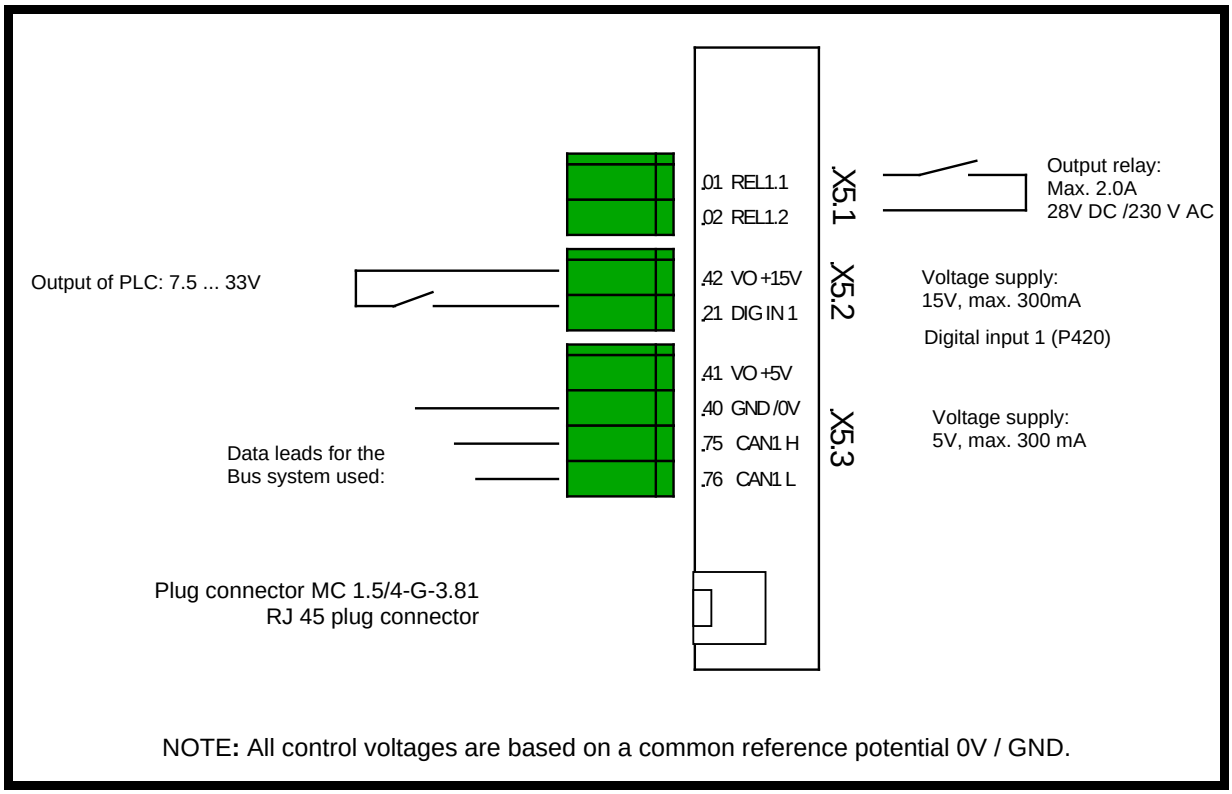


Figure 4: SK CU1-CAN terminal assignment

2.2.6 CANnord module, SK CU1-CAN-RJ

The customer interface (customer unit) CANnord with RJ45 connector offers high functionality of digital signal processing and 2 parallel switched data connections. 5 digital inputs are available to control the frequency inverter.

By means of a relay contact, brake control can be actuated or warnings can be sent to another system.

1	Connection terminals*	
X7.1	Relay	P434 … P436
X7.2	DigIN	P420 … P424
X7.3	CAN	P509 … P515
* X7.1: max. 1.5 mm² * X7.2: max. 1.0 mm² * X7.3: 2 x RJ45 sockets		

2	Termination resistor	
	(ON)	Connected
	(OFF)	not connected

The digital inputs of the CANnord module cannot process analog setpoints!

Cabling can be implemented using Western connectors and commercial network cables (twisted pair, modular connector 8P8C, RJ45), networking of several devices is possible with T-connectors.

3	RJ45 contact assignment
1, 2, 7, 8	n. c.
3, 6	GND
4	CAN_L (-)
5	CAN_H (+)
Housing	PE (shield)

SK CU1-CAN-RJ terminal assignment

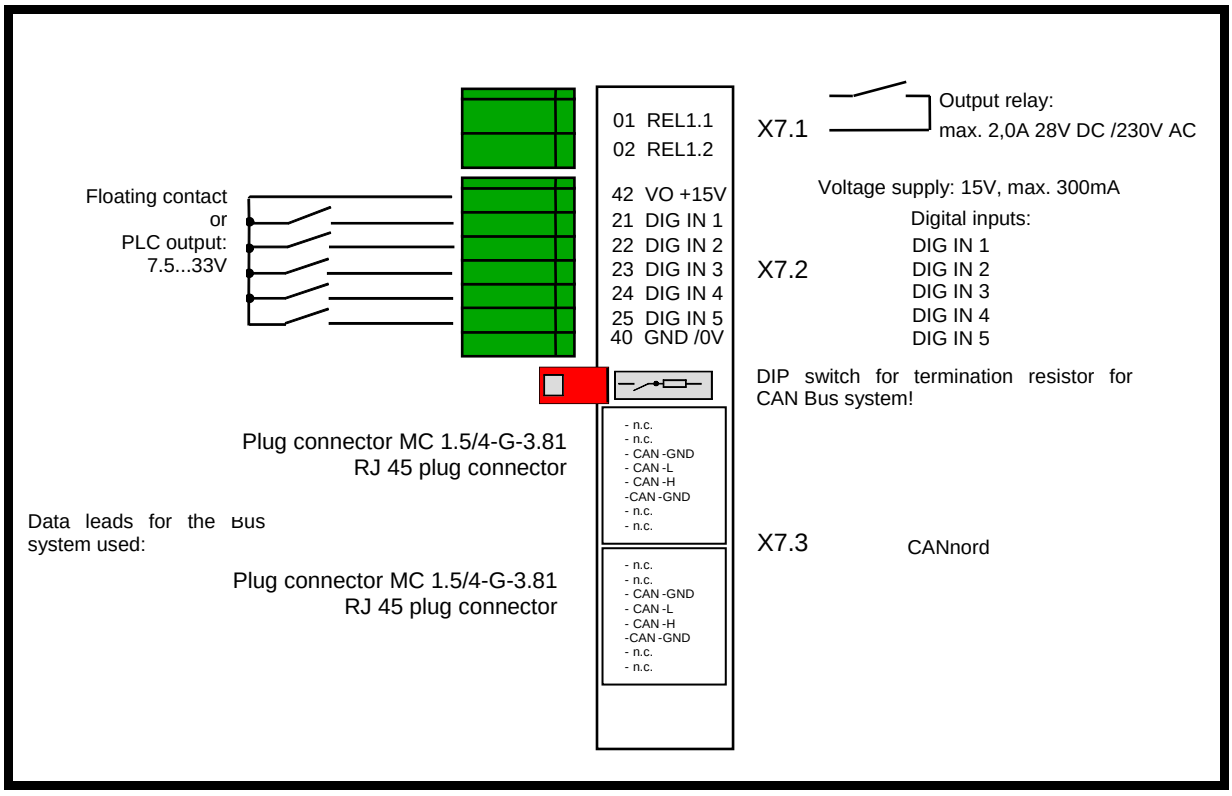


Figure 5: SK CU1-CAN-RJ terminal assignment

2.2.7 Installation of the SK CU1-xxx customer unit

WARNING — **electric shock**

Modules must not be inserted or removed unless the device is **free of voltage**. The slots may only be used for the intended modules. Installation remote from the frequency inverter is not possible. It must be connected directly to the frequency inverter.

Failure to comply with this may result in an **electric shock**, which my cause serious injury and the destruction of the frequency inverter and the module.

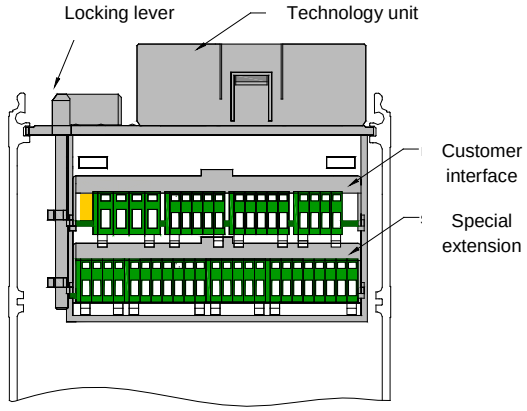
Note — **Error message E017**

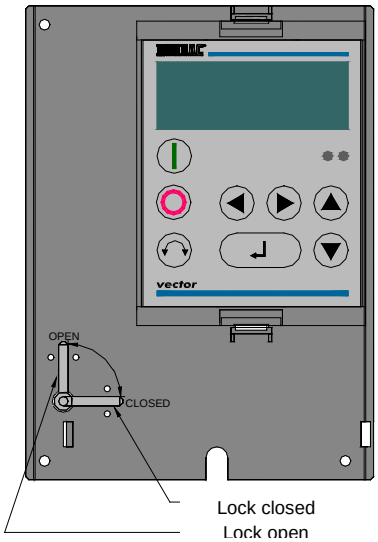
Following the insertion, replacement or removal of modules, and once the equipment has been switched on again, this procedure is indicated with the message E017 Customer unit changed.

This message can be directly reset by the usual measures.

Installing the customer unit

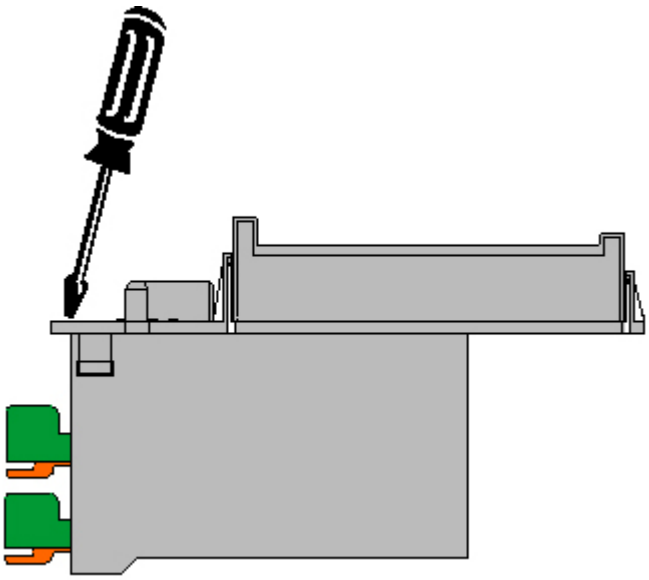
1. Switch off the mains voltage, observe the waiting period.
2. Remove the cover grille from the connection area by loosening the 2 screws and levering out the device cover (slot) or simply pull it out.
3. Locking lever in the "„**open**“ position.
4. Using light pressure push the customer unit into the upper guide rail until it engages.
5. Locking lever in the „**closed**“ position.
6. Remove the connector by pressing the releases then make the necessary connections. Then insert the connectors until they engage.
7. Replace all covers.

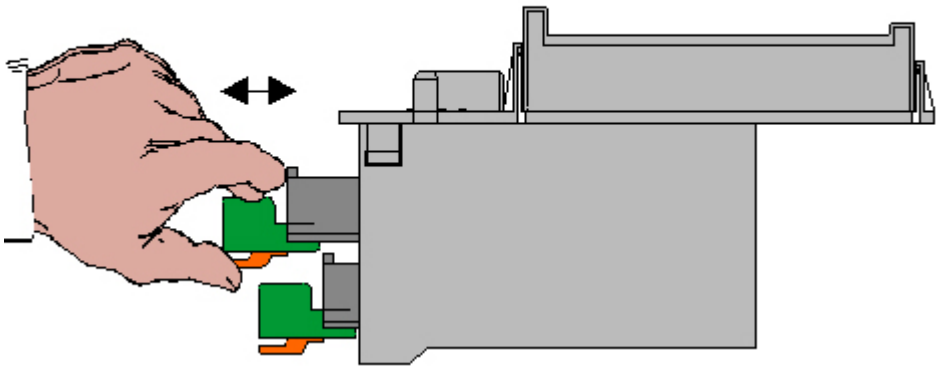




Removing the customer unit

1. Switch off the mains voltage, observe the waiting period.
2. Remove the cover grille from the connection area by loosening the 2 screws and levering out the device cover (slot) or simply pull it out.
3. Locking lever in the "„**open**“ position.
4. Using a screwdriver (as shown), lever the customer unit out of its engaged position and then remove it by hand.
5. Locking lever in the „**closed**“ position.
6. Replace all covers.

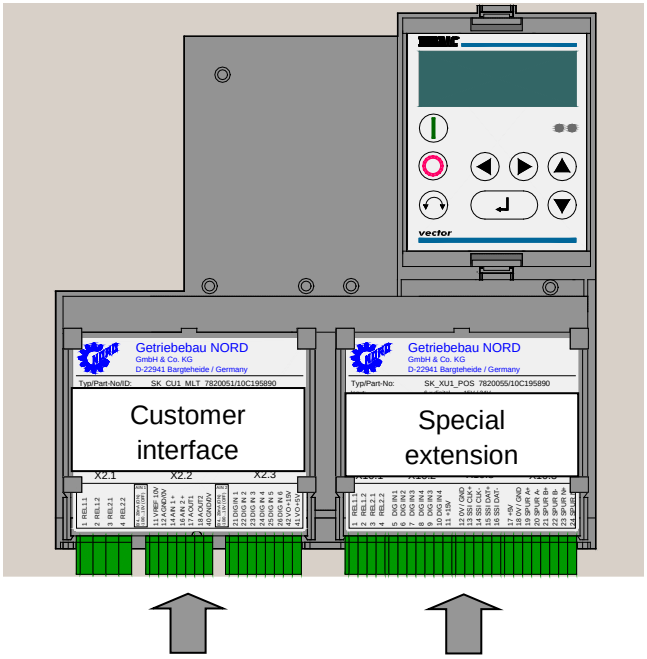




Deviating position of the customer unit for SK 700E above 30 kW and all SK 750E devices

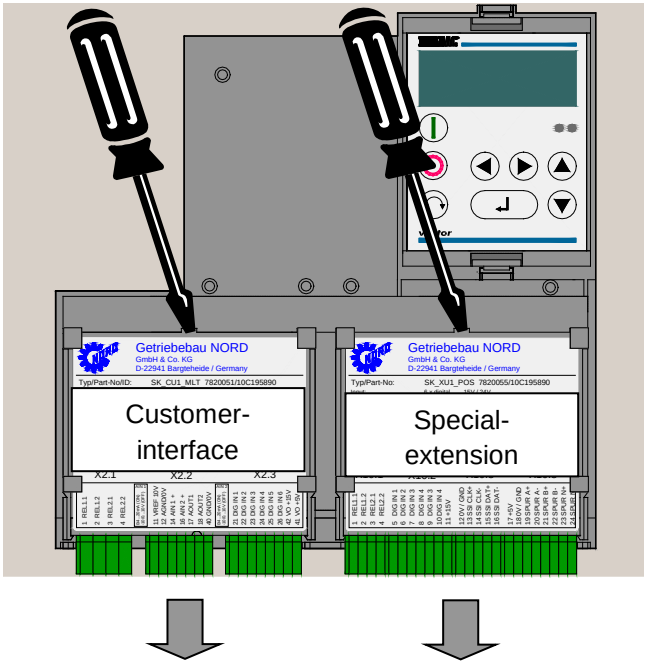
Installation

The procedure is as described above; however no locking lever is present. The modules engage on the front edge when they are inserted.



Dismantling

As shown, simply lever out from the upper edge. If this is difficult, simply unfasten the locking hook on the front edge.



2.3 Modular units *trio* SK 300E and SK 750E

Technology units are optional modules with which additional functions in the frequency inverter can be added depending on requirements. The high level of protection of the frequency inverter remains with all technology units.

Fig. 6: Frequency inverters SK 300E and SK 750E

2.3.1 SK TU2- CANopen module, overview

The communication module SK TU2-CAO, is used to connect drives from the trio SK 300E and 750E device series to higher level automation systems via CANopen. Both the SK 300E frequency inverters and the external technology units are available in the protection classes IP55 (standard) and IP66 (optional). The type designation of the SK 300E and the modules in the protection class IP66 is given an additional code "-C" (coated → coated board) to differentiate the IP55 and IP66 protection classes. For SK 750E frequency inverters, the protection class is specified by the type of cooling. IP54 for air-cooled devices and IP65 for water-cooled SK 750E frequency inverters.

Module	Protection class	Description	Data
CANopen module **SK TU2-CAO**	IP55	This option enables control of the SK 300E/750E via the serial CANopen port.	1 CANopen interface 2 x 5-pin M12 system plug connector Part No. 275130100 (IP55) Part No. 275170100 (IP66)
CANopen module **SK TU2-CAO-C**	IP66		

Table 5: SK TU3-CAO, Overview of Technology Units

Information — **IP66 version**

Modules of the IP66 version have an additional "C" in the type code and are modified with several **special measures** (see Manual SK 300E or SK 750E).

Information — **Firmware version**

The SK 300E must have at least software version 1.6 R1 (see P707) so that it is fully compatible with the CANopen protocol.

2.3.2 CANopen module, SK TU2-CAO

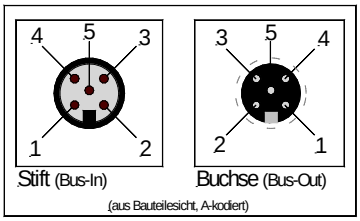
The CANopen module **must be provided with a 24 V external power supply** (via SUB - D9 connection). This CAN participant can therefore be identified by the master system even without a voltage supply to the frequency inverter. The data required for this purpose are set using a rotary coding switch. This Bus data is read in when the 24 V is applied from the frequency inverter.

1	CANopen Status LEDs	
CR	(green)	CANopen RUN
CE	(red)	CANopen ERROR
DR	(green)	Module status
GB	(red)	Module error

2	SK 300E status LEDs	
On	(green)	Mains voltage applied
Error	(red)	Inverter error*
* The flashing frequency corresponds to the error number (see BU0300)		

3	Rotary coding switches
ID-H	Addressing (ID x 10)
ID-L	Addressing (ID x 1)
Baud	Baud rate

4	M12 BUS-In / BUS-Out



4	Plug connector assignment:
1	PE (shield) *
2	+24V
3	GND
4	CAN-H
5	CAN-L
* Pin 1 and housing	

Baud rate *(BAUD)*

Transfer rates of up to 500 kbit/s can be used (optionally up to 1Mbit/s).

If *BAUD* is set to **PGM** the value from parameter P514 is used as the baud rate.

Supply voltage

The supply voltage is 24 V DC ±25% (Pin 9 = 24 V, Pin 3 = GND, approx. 80 mA). The connection is made via the SUB-D9 connector.

Termination resistor

The termination resistor for the last bus participant can be switched to the output (BUS-Out) of the final frequency inverter as the termination connector.

CAN address, setting the ID *(ID-L and ID-H)*

The rotary switches **ID-L** and **ID-H** can be used to set the node identifier in decimal code in the range from 01...99_{dez}.

Example: Node ID = 64 à ID-H = 6, ID-L = 4

If *BAUD* is set to **PGM** the value from parameter P515 of the frequency inverter is used as the node identifier.

Information — **Rotary coding switches**

The settings made using the rotary coding switch are not transferred to the frequency inverter or saved. Changed settings are only adopted when the 24V supply is applied ("Power ON").

2.3.3 Installation of the SK TU2 technology unit

WARNING — **Electric shock**

Modules must not be inserted or removed unless the device is **free of voltage**. The slots may only be used for the intended modules. Installation remote from the frequency inverter is not possible. It must be connected directly to the frequency inverter.

Failure to comply with this may result in an **electric shock**, which my cause serious injury and the destruction of the frequency inverter and the module.

Installing the technology unit

1. Switch off the mains voltage, observe the waiting period.
2. Unscrew the 6 fastening screws of the **blind plate** land remove the blind plate (Fig.1).
3. Attach the PE connection on the inside of the technology unit which is being installed (Fig. 2). Fit the seal together with the **technology unit** on the surface of the frequency inverter. Ensure that the connector strip makes full contact.
4. Lightly tighten all 6 fastening screws.
5. Now tighten the 6 fastening screws in the specified sequence from 1 to 6 (see Fig. 1) and with the torque stated in the table.

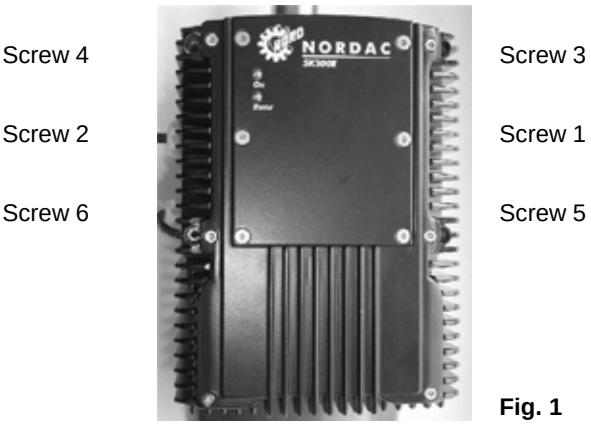


Fig. 1

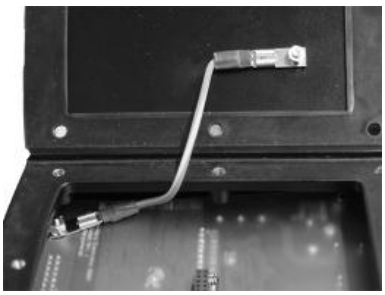


Fig. 2

Frequency inverter size	Screw size	Tightening torque
Size 1	M4 x 8	1.5Nm ± 20%
Size 2		

NOTICE — **Earthing / Grounding**

Note the earthing cable!

Make sure the earthing line is plugged into the plate of the standard device and each technology unit. This cable must be connected when installing the technology unit to ensure it is fully earthed. Operation is not permitted if there is no secure PE connection to the frequency inverter and to the technology unit, beacause frequency inverter and technology unit could be destroyed!

NOTICE

Entry of moisture

During installation, attention must be paid to **proper sealing** (do not forget the rubber seal!), to prevent the entry of moisture.

With IP66 versions, care must also be taken that the cables and cable glands at least comply with protection class IP66, so that compliance with protection class IP66 is ensured on the frequency inverter.

2.3.4 Recommended connector and accessory components

Note

Recommendations of products

The components listed below or in this section should only be regarded as recommendations. For further information please refer to the particular manufacturer's information and data sheets.

Please observe the manufacturer's information regarding installation and the corresponding installation guidelines.

M12 round plug CAN connector

Information

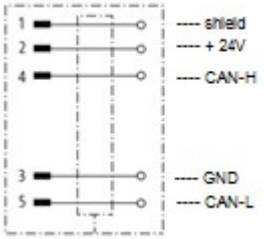
Connection components

For preference, pre-assembled CAN bus cables and connection components should be used.

For certain applications, vibration-proof round plug connectors should be used.

M12 connector

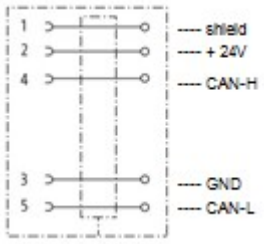
A coded



Supplier	Name	Part no.:	
		straight	angled
MURR Elektronik	M12 plug, 6...8mm, 5-pin, screwed, IP67, shielded	7000-13321-0000000	7000-13361-0000000
Franz Binder GmbH	M12 plug, 6...8mm, 5-pin, screwed, IP67,	99 1437 812 05	99 1437 822 05

M12 socket

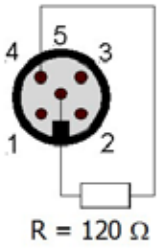
A coded



Supplier	Name	Part no.:	
		straight	angled
MURR Elektronik	M12 socket, 6..8mm, 5-pin, screwed, IP67, shielded	7000-13401-0000000	7000-13441-0000000
Franz Binder GmbH	M12 socket, 6…8mm, 5-pin, screwed, IP67,	99 1436 812 05	99 1436 822 05

M12 termination resistor

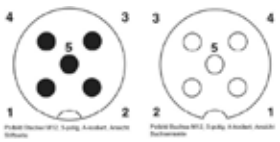
A coded

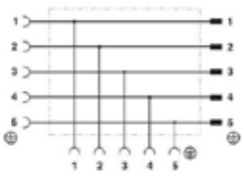


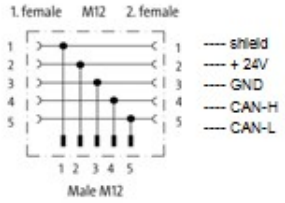
Supplier	Name	Part no.:
MURR Elektronik	Termination resistor, plug connector M12, 5-pin, straight, IP67	7000-13461-0000000
Lumberg	Bus terminating resistor, M12 plug connector	RST ST

M12- T connectors

A coded





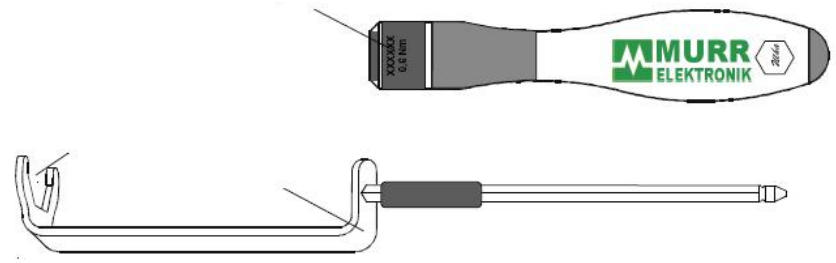


Supplier	Name	Part no.:
MURR Elektronik	M12 plug to 2x M12 socket, 5-pin, parallel distributor, IP67	7000-41141-0000000
Phoenix Contact GmbH & Co. KG	M12 socket to M12 plug and socket, 5-pin, parallel distributor, IP67	1541186

Installation tools for M12 round plug connectors

Torque wrench for assembly of M12 plug connectors

The M12 torque wrench set is used to check the optimum tightening torque of M12 round connectors. The torque wrench is calibrated to the optimum tightening torque is 0.6Nm.




Anwenderhinweise

MURR ELEKTRONIK

Mit Sicherheit dicht!

Der Montageschlüssel hilft ihnen bei der Überprüfung des optimalen Anzugsmomentes (0,6 Nm) bei Ihren M12 - Rundsteckverbindern.

Bitte beachten Sie:
Durch das Setzverhalten der Dichtung im Verteiler bzw. in der M12-Buchse kann der Rundsteckverbinder bereits nach kurzer Zeit nachgezogen werden.
Dies ist bereits in dem definierten Anzugsdrehmoment (0,6Nm) berücksichtigt!
Bei ordnungsgemäßem Einsatz ist der Schutzgrad IP 67 ohne Nachziehen gewährleistet.

Ein einmaliges Nachziehen ist möglich. Von einem regelmäßigen Nachziehen der Steckverbinder wird allerdings abgeraten, da dies Einfluss auf die elastischen Eigenschaften und die Funktionstüchtigkeit der Dichtung hat.

Supplier	Name	Article No. / Part No.
MURR Elektronik	M12 wrench set for M12 round connectors with calibrated torque of 0.6Nm	7000-99102-0000000
Franz Binder GmbH	M12 torque wrench for M12 round connectors with calibrated torque of 0.6Nm	07-0079-000

Note

Mounting connecting components

In order to ensure a secure, sealed and vibration-proof connection, connecting components with hexagonal fittings should be used.

By means of the corresponding installation tools, after completion of installation work, all M12 round connectors should be tightened to a torque of 0.6Nm with an M12 wrench.

3. Bus Configuration

A CAN network consists of a maximum of 128 participants (nodes) and is based on a linear topology. The number of subscribers is dependent on the driver modules (standard approx. 100 nodes). Repeaters must be used for a high number of nodes.

With NORD frequency inverters, a twisted two-wire line is used for data transfer.

3.1 Laying the bus cables

In an industrial environment the correct installation of the bus system is particularly important in order to reduce potential interference. The following points are designed to help prevent interference and problems right from the start. The installation guidelines are not complete and applicable safety and accident prevention guidelines must be complied with.

3.2 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 6: 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.

3.3 Cable layout and shielding (EMC measures)

If EMC measures are not in place, high-frequency interference which is mainly caused by switching processes or lightning often causes electronic components in the bus subscribers to be faulty and error-free operation can no longer be ensured.

Appropriate shielding of the bus cable reduces electrical interference which can arise in an industrial environment.

The best shielding qualities can be achieved with the following measures:

- Do not make cable connections shorter than 1 m between bus participants
- Avoid long connections between bus participants
- Shield the bus cable *at both ends* with large-area connection to the plug housing
- Avoid spur lines
- Avoid extensions to bus cables via plug connectors

Bus lines should be laid with a minimum spacing of 20 cm to other lines which carry a voltage higher than 60 V. This applies to lines laid inside and outside of control cabinets.

Special attention should be paid to bending radii:

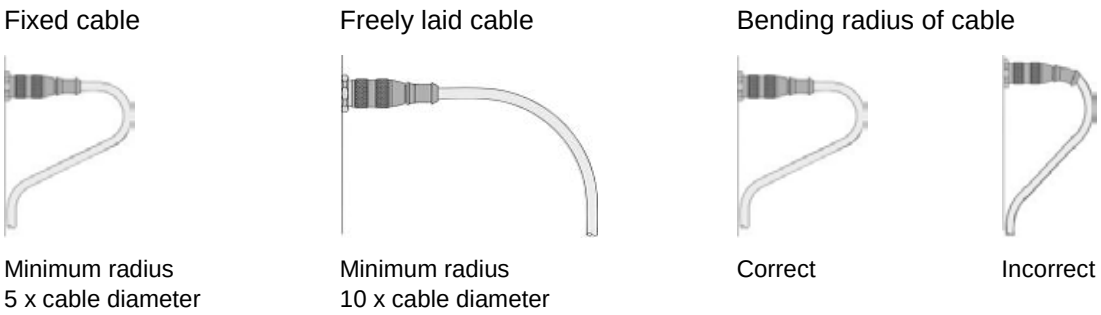


Fig. 7: Installation and cable laying information

NOTICE **Potential equalisation**

If earthing potential values are different, transient current may flow through shielding which is connected on both sides. This may be a danger to electronic components. Differences in potential must be reduced by means of adequate potential equalisation.

4. Communication and Protocol

Information — **Little Endian data format**

Data transfer is performed in *Little Endian* format. This means that in the data word, the High byte follows **after** the Low byte. Example: "047E" à *7E 04*.

4.1 Processing of Process Data in the Frequency Inverter

The following CAN profile specifications apply to process data transfer with all CANnord/CANopen interfaces in NORD frequency inverters. This protocol is used when P551 = 0 is set.

4.1.1 Process data - General (PZD)

In the process data area (PZD), control words and setpoints are transferred from the master to the frequency inverter and in return, status words and actual values are sent from the inverter to the master. The structure of the PZD area is always the same in terms of the sequence of its elements (words), however, dependent upon direction of data Master à Slave / Slave à Master, it is described differently.

The process data area of the reference data has the following structure:

STW	Control Word; length 16 bit, order telegram error acknowledgement)
ZSW	Status Word; length 16 bit, response telegram
SW 1 … 3	Setpoints; 3 x 16 bit or 1 x 32 bit and 1 x 16 bit, order telegram, e.g. frequency setpoint, position setpoint, torque setpoint.
IW 1 … 3	Actual values; 3 x 16 bit or 1 x 32 bit and 1 x 16 bit, response telegram, e.g. actual frequency, actual position, actual torque.

con

Information — **SK 54xE – CAN via RJ45**

If CANnord / CANopen is implemented via the internal RJ45 sockets, the setpoints and actual values 4 and 5 can also be communicated (SK 54xE and above).

4.1.2 Control word (STW)

The control word (STW) is the first word transferred to the frequency inverter in the process data area in an order telegram. For example, a control word "Ready for switch-on" corresponds to $047E_{(hex)}$. In general the command "Standby" should be the first command which is transferred to the inverter.

Bit	Value	Meaning	Remarks	
0	0	Not ready for operation	Reverse with the brake ramp, with disconnection from supply at f=0Hz **(OFF1)**	
	1	**Ready for operation**	Frequency inverter ready for operation	
1	0	**Disable voltage**	Cut off voltage; the inverter output voltage is switched off; the FI enters a state where switching on is disabled. **(OFF2)**	
	1	Do not disable voltage	Operating condition OFF 2 is cancelled	
2	0	**Emergency Stop** active	Quick stop with programmed quick stop time; with disconnection from supply at f=0Hz; the FI switches to starting disabled condition **(OFF3)**.	
	1	Emergency Stop not active	Operating condition OFF 3 is cancelled	
3	0	Disable operation	Cut off voltage; the inverter output voltage is switched off; the FI enters a state where switching on is enabled.	
	1	**Enable operation**	The output voltage is enabled; ramp to the existing setpoint	
4	0	Pulse not enabled	Ramp generator is set to zero; no disconnection from supply at f=0Hz; FI remains in the operation enabled state.	
	1	**Enable pulses**	Enable ramp generator	
5	0	Ramp not enabled	The setpoint currently provided by the ramp generator is "frozen" (frequency is maintained).	
	1	**Enable ramp**	Enable setpoint on ramp generator	
6	0	Setpoint not enabled	Selected setpoint value is set to zero on the ramp generator.	
	1	**Enable setpoint**	Selected ramp generator setpoint is activated.	
7	0	No acknowledgement	With the switch from 0 to 1, errors which are no longer active are acknowledged.	
	1	**Acknowledge error (0 à 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 (otherwise, flank evaluation would be prevented).	
8	0			
	1	**Start function 480, 11**	Bus bit 8 from the control word is set. Only for SK 2xxE and SK 5xxE. For further details of the function please refer to parameter P480.	
9	0			
	1	**Start function 480, 12**	Bus bit 9 from the control word is set. Only for SK 2xxE and SK 5xxE. For further details of the function please refer to parameter P480.	
10	0	Control data invalid	The transmitted process data is invalid.	
	1	**Control data valid**	Valid process data is transferred from the master. **Note:** In order for the transmitted setpoint to be valid, this bit must also be set (setting: interface), even if only setpoint values are transmitted via the bus.	
11	0			
	1	**Rotation right is on**	Rotational direction right (priority) ON*	
12	0			
	1	**Rotation left is on**	Rotational direction left ON*	
13	0/1	*Reserved*	Reserved	
14	0/1	**Parameter set Bit 0 ON**	00 = Parameter set 1 01 = Parameter set 2	10 = Parameter set 3 11 = Parameter set 4
15	0/1	**Parameter set Bit 1 ON**		

* If Bit 12=0, then "Direction of rotation right ON" applies

Table 7: Control word (STW)

4.1.3 Status word (ZSW)

In the inverter response telegram, in the area of the process data the status word (ZSW) is transferred as the first word. The meaning of the individual bits deviate for some types of devices.

Bit	Value	Meaning	Remarks	
0	0	Not ready to start		
	1	**Ready to start**	Initialisation completed, charging relay ON, output voltage disabled	
1	0	Not ready for operation	Causes: No command has been activated, fault is signaled, OFF2 or OFF3 activated, starting disabled state activated	
	1	**Ready for operation**	ON command activated, no faults present. The inverter can be started with the command ENABLE OPERATION	
2	0	Operation not enabled		
	1	**Operation enabled**	The output voltage is enabled; ramp to the existing setpoint	
3	0	No error		
	1	**Fault**	Drive fault resulting in stoppage; this state is changed to starting disabled after the fault has been successfully acknowledged	
4	0	Voltage not enabled	OFF2 command applied	
	1	**Voltage enabled**		
5	0	**Emergency stop**	OFF3 command applied	
	1	No emergency stop		
6	0	Starting not disabled		
	1	**Starting disabled**	Switches first to OFF1, then to ready-to-start status	
7	0	No warning		
	1	**Warning active**	Drive operation continues, no acknowledgement necessary	
8	0	Setpoint not reached	Actual value does not match the setpoint (with *posicon:* failure to reach setpoint position)	
	1	**Setpoint reached**	Actual value matches required setpoint (setpoint has been reached) (with *posicon:* setpoint has been reached)	
9	0	Bus control not active	Guidance on local device has been activated	
	1	**Bus controller active**	The master has been requested to assume guidance.	
10	0			
	1	**Start function 481.9**	Bus bit 10 from the status word is set. For further details of function, please refer to parameter P481.	
11	0			
	1	**Rotation right is on**	Inverter output voltage is turning right	
12	0			
	1	**Rotation left is on**	Inverter output voltage is turning left	
13	0			
	1	**Start function 481.10**	Bus bit 13 from the status word is set. For further details of function, please refer to parameter P481.	
14	0/1	**Parameter set Bit 0 ON**	00 = Parameter set 1 01 = Parameter set 2	10 = Parameter set 3 11 = Parameter set 4
15	0/1	**Parameter set Bit 1 ON**		

Table 8: Status word (ZSW)

4.1.4 Frequency inverter status machine

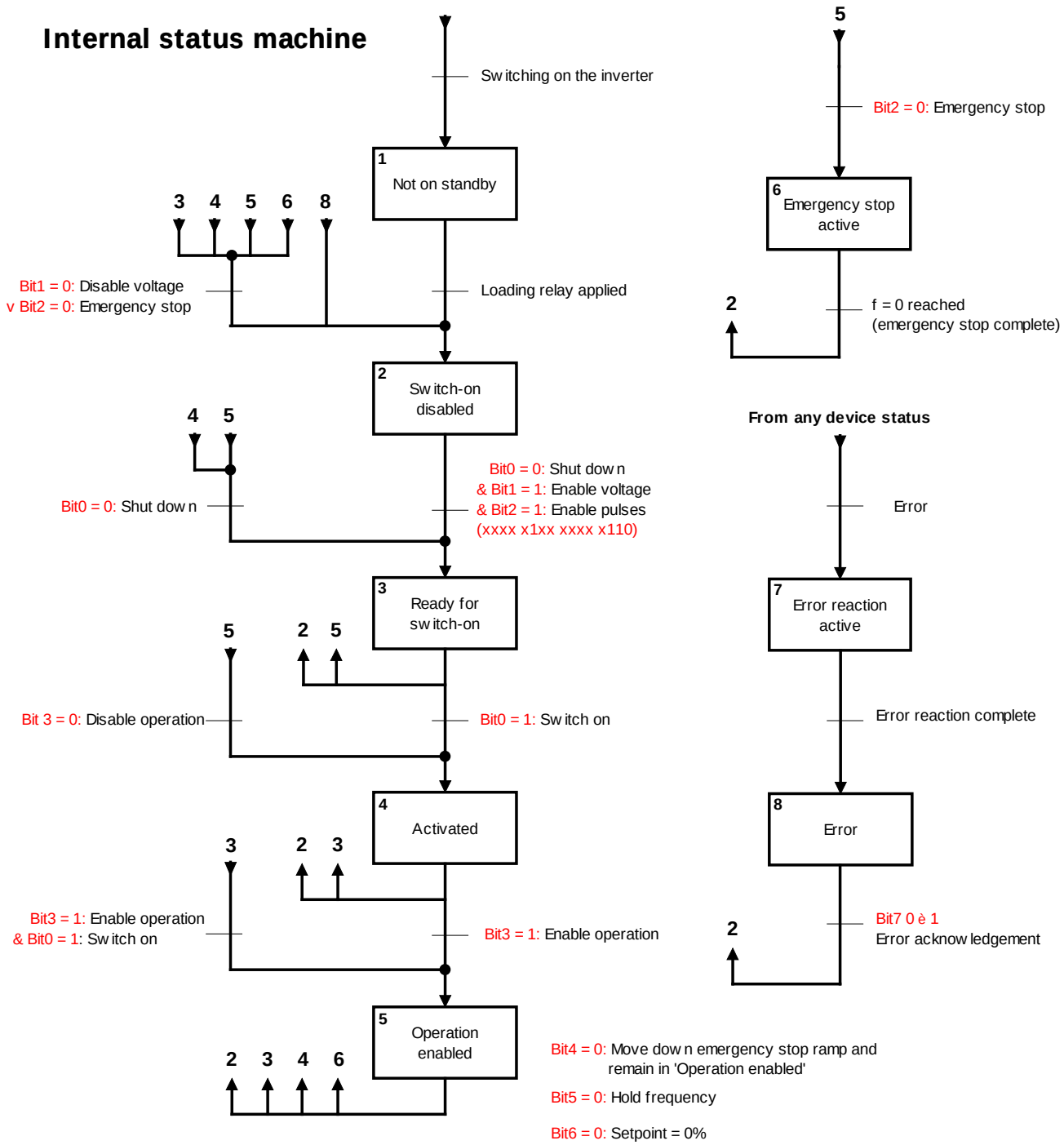
The frequency inverter passes through a status machine. The changes between various states are triggered by the respective control commands in the process data control word. The actual status is returned in the process data status word.

After switching on, the inverter is in **switch-on disabled** status. This status can only be ended by transmitting the “Shut down (Off 1)” command.

The answer to a master telegram normally does not yet contain a reaction to the control command. The controller must check the answers from the slaves as to whether the control command has been carried out.

The following bits indicate the status of the frequency inverter:

Status	**Bit 6** Switch-on disable	**Bit 5** Emergency stop	**Bit 4** Disable voltage	**Bit 3** Fault	**Bit 2** Operation enabled	**Bit 1** Standby	**Bit 0** Ready for switch-on
Not ready to start	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



Control bits
0. Standby / Shut down
1. Disable / enable voltage
2. Enable pulses / emergency stop
3. Disable / enable operation
4. Betriebsbedingung / HLG sperren
5. Enable / stop RUE
6. Enable / disable setpoint
7. Error acknowledgement (0 è 1)
10. Control data valid / invalid
11. Direction of rotation clockwise
12. Direction of rotation anticlockwise
14. Parameter set Bit 0
15. Parameter set Bit 1

Priority of control commands:
1. Disable / enable voltage
2. Emergency stop
3. Shut down
4. Enable operation
5. Switch on
6. Disable operation
7. Reset error

Coding of status:
1: Bit 0 = 0
2: Bit 6 = 1
3: Bit 0 = 1
4: Bit 1 = 1
5: Bit 2 = 1
6: Bit 5 = 0
7: Bit 2 & Bit 3 = 1
8: Bit 3 = 1

Fig. 8: Status Machine of the Frequency Inverter

4.1.5 Setpoint (SW)

The function of the 1st setpoint is set in parameter P546 (respectively P546 [-01]). The following options are available:

Setpoint frequency (16 bit)

The setpoint frequency in setpoint 1 is transferred as a 16 Bit value as standard. Setpoint 1 is transferred to the inverter as the second word in the process data area of the order telegram.

The setpoint is transferred as a whole number with a value range of -32768 to 32767 (8000 hex to 7FFF hex). The value 16384 (4000 hex) is equal to 100%. The value C000 HEX corresponds to -100%. A setpoint of 100% corresponds to the parameter **maximum frequency** (parameter P105) set in the same parameter set.

Setpoint position (16 or 32 Bit)

Using the posicon special extension **POSICON (SK XU1-POS) of the SK 700E** , the absolute setpoint position can be transferred in setpoint 1. It can be transferred as a 16 or 32 Bit value with a resolution of 1=0.001 revolutions. In addition, the control terminals (POSICON control bits setting) can be transferred in binary.

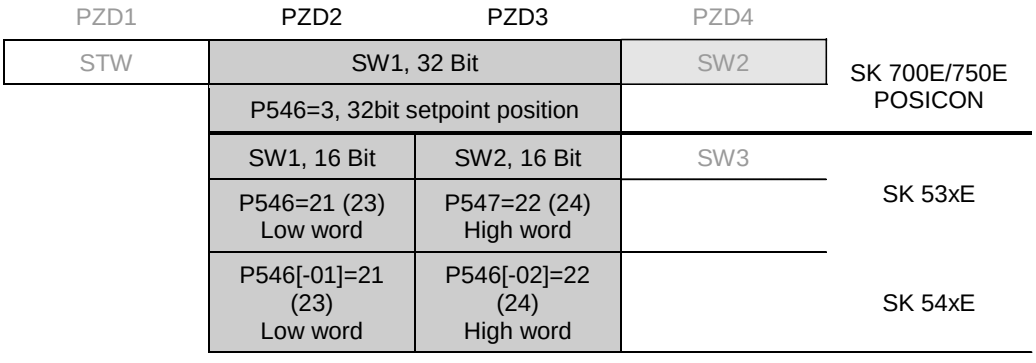
The **SK 53xE / SK54xE version** of the **SK 500E** series is also able to transfer positions, however here, the 32 Bit position is divided into two 16 Bit components (Low word and High word). The assignment of the two 16 Bit components is then carried out via appropriate parameterisation on 2 arbitrary setpoints (e.g.: SW1 and SW2).

16-Bit setpoint position setting:

As a **16 Bit** value, a range of +32767 (= 32,767 revolutions) to -32768 (= -32,768 revolutions) is possible. The 16 Bit setpoint position is transferred as the second word in the process data area (as with the setpoint, see above)

32-Bit setpoint position setting:

As a **32 Bit** value, the full position range of +/- 50000,000 revolutions is available. With the SK 700E/750E, the 32 Bit setpoint position is transferred in the area of the process data as the second and third word. With the SK 500E in any two of the three words PZD2, PZD3, PZD4.



Posicon control bits setting:

A 16 Bit value is transferred in which the control terminals of the posicon special extension unit are mapped. The setpoint position is based on the position array / position increment as per the P610 setpoint mode.

The transferred Bits have the following meaning (see Manual BU 0510 / BU 0710):

SK 7x0E + SK XU1-POS	
Bit	**Function**
Bits 0-5	Position array/position increment
Bit 6	Approach reference point
Bit 7	Reference point
Bit 8	Teach-in
Bit 9	Quit teach-in
Bit 10	Reset position

SK 53xE / SK 54xE	
Bit	**Function**
Bits 0-3	Position array/position increment
Bits 4-7	Vacant
Bits 8-15	no significance

Setpoints 2 and 3

In addition to setpoint 1, two further setpoints can be transferred. The division to the process data words PZD3 and PZD4 depends on the inverter series:

PZD1	PZD2	PZD3	PZD4	
STW	SW1	SW3	SW2	SK 300E, SK 7x0E
STW	SW1	SW2	SW3	SK 5xxE

SK 7x0E: third setpoint value can only be transferred if a 32 Bit setpoint value is not transferred in the first setpoint.

PZD1	PZD2	PZD3	PZD4
STW	SW1		SW2

The second and third setpoints are always 16 Bit. The function of the second and third setpoint can be set in the inverter under the parameter *'Fct. Bus Setpoint 2'* (P547 or P546 [-02]) as well as *'Fct. Bus Setpoint 3'* (P548 or P546 [-03]).

Both setpoints are transferred as whole numbers in the range (-32768 to 32767). The value 16384 (4000 HEX) corresponds to 100%. The value C000 HEX is equal to –100%, so that setpoints in the range –200% to +200% can be transferred. A setpoint of 100% corresponds to the respective nominal value (Section 4.1.7).

In addition, *posicon* control bits can also be transferred here.

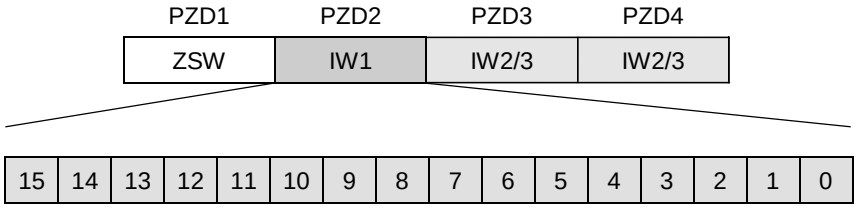
Setpoints 4 and 5

SK 540E and SK 545E frequency inverters can also process the 16 bit setpoints 4 and 5. The function of these setpoints can be set in the inverter under the parameter *'Fct. Bus Setpoint 4'* (P546 [-04]) as well as *'Fct. Bus Setpoint 5'* (P546 [-05]).

The value range and scaling corespond to setpoints 2 and 3.

4.1.6 Actual value (IW)

The actual value 1, i.e. the actual output frequency of the inverter, is transferred as a 16 Bit value as standard in the actual value 1. The actual value 1 is transferred to the master in the inverter response telegram as the second word in the process data area.



The actual value 1 is transferred as a whole number in the range -32768 to 32767. In addition to the actual frequency, other actual inverter values can be transferred. The setting is made in P543 (or P543 [-01]) *'Actual bus value 1'*.

The settings ‘Actual frequency’, ‘Actual speed’, ‘Current’ and ‘Torque current’ are transferred as percentages of the respective nominal values. The value 16384 (4000 HEX) corresponds to 100%. The value C000 HEX corresponds to -100%. Actual values in the range –200% to +200% can be transferred.

With the setting ‘Digital I/O status’, the states of the control terminals and the relay (MFR) /digital outputs can be transferred:

SK 300E/700E/750E	
Bit	**Status**
Bits 0-5	Digital input 1-6
Bit 6-11 for POSICON special extension unit	Digital input 7-12
Bit 6 for encoder special extension unit	Digital input 7
Bits 12-15	Multifunctional relay 1-4

SK 5xxE	
Bit	**Status**
Bits 0-4	Digital input 1-5
Bit 5-6 (above SK 520E)	Digital input 6-7
Bits 12-15	Relay and digital outputs 1 - 4

With the settings ‘Actual position’ and ‘Setpoint position’, the actual absolute position is transferred. The resolution is 1 = 0.001 revolutions.

If **with SK 700/750E** the value 'Setpoint position 32Bit' is set in parameter P546 *'Setpoint 1 function'*, the actual value of the setpoint position or actual position is also transferred as a 32Bit value in PZD2 and PZD3:

PZD1	PZD2	PZD3	PZD4
ZSW	IW1		IW2

Actual value 2 and 3

It is possible to forward two more actual values to the controller.

The assignment of the actual values 2 and 3 to the process data words PZD3 and PZD4 is carried out in the same way as the assignment of setpoints 2 and 3. These also differ in sequence between the SK 5xxE and other inverter series.

SK 300E/SK 700E/SK 750E

The actual value 2 (IW2) is transmitted in PZD4. The value to be transferred can be selected *"Actual bus value 2"* (P544). Actual value 3 (IW3) can be transmitted in PDZ3 if actual value 1 is not a 32 Bit value. The value to be transferred can be selected *"Actual bus value 3"* (P545).

SK 5xxE

The actual value 2 (IW2) is transmitted in PZD3. The value to be transferred can be selected *"Actual bus value 2"* (P544 or P543 [-02]). The actual value 3 (IW3) is transmitted in PZD4. The value to be transferred can be selected *"Actual bus value 3"* (P545 bzw. P543 [-03]).

Actual value 4 and 5

SK 540E and SK 545E frequency inverters can also process the 16 bit setpoints 4 and 5. The function of these actual values is set in the inverter under the parameters *'Actual bus value 4'* (P543 [-04]) and *'Actual bus value 5'* (P543 [-05])

The value range and the scalling correspond to thise of the other actual values.

4.1.7 Standardisation of setpoint / target values

The following table contains details for the standardisation of typical setpoint and actual values. These details relate to parameters (P400), (P418), (P543), (P546), (P740) or (P741).

Name	**Analog signal**		**Bus signal**						
Setpoint values {Function}	Value range	Standardisation	Value range	Max.value	Type	100% =	-100% =	Standardisation	Limitation absolute
Setpoint frequency {01}	0-10V (10V=100%)	P104 … P105 (min - max)	±100%	16384	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * $f_{setpoint}$[Hz]/P105	P105
Frequency addition {04}	0-10V (10V=100%)	P410 … P411 (min - max)	±200%	32767	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * $f_{setpoint}$[Hz]/P411	P105
Frequency subtraction { 05 }	0-10V (10V=100%)	P410 … P411 (min - max)	±200%	32767	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * $f_{setpoint}$[Hz]/P411	P105
Max. frequency {07}	0-10V (10V=100%)	P411	±200%	32767	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * f_{soll}[Hz]/P411	P105
Actual valueProcess controller {14}	0-10V (10V=100%)	P105* U_{AIN}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * $f_{setpoint}$[Hz]/P105	P105
Setpoint process controller { 15 }	0-10V (10V=100%)	P105* U_{AIN}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * $f_{setpoint}$[Hz]/P105	P105
Torque current limit {2}	0-10V (10V=100%)	P112* U_{AIN}(V)/10V	0-100%	16384	INT	4000_{hex} 16384_{dez}	/	4000_{hex} * I[A]/P112	P112
Current limit {6}	0-10V (10V=100%)	P536* U_{AIN}(V)/10V	0-100%	16384	INT	4000_{hex} 16384_{dez}	/	4000_{hex} * I[A]/P536	P536
Actual values {Function}									
Actual frequency {01}	0-10V (10V=100%)	P201* U_{AOut}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * f[Hz]/P201	
Actual speed {02}	0-10V (10V=100%)	P202* U_{AOut}(V)/10V	±200%	32767	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * n[rpm]/P202	
Current {03}	0-10V (10V=100%)	P203* U_{AOut}(V)/10V	±200%	32767	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * f[Hz]/P105	
Torque current {04}	0-10V (10V=100%)	P112* 100/ √((P203)²-(P209)²)* U_{AOut}(V)/10V	±200%	32767	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * I_q[A]/(P112)*100/ √((P203)²-(P209)²)	
Master value Setpoint frequency {19} … {24}	0-10V (10V=100%)	P105* U_{AOut}(V)/10V	±100%	16384	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * f[Hz]/P105	
Speed from rotary encoder {22}	/	/	±200%	32767	INT	4000_{hex} 16384_{dez}	$C000_{hex}$ 16385_{dez}	4000_{hex} * n[rpm]/ P201*60/Number of pairs of poles or 4000_{hex} *n[rpm]/P202	

Table 9: Scaling of setpoints and actual values (Selection)

4.2 The CANnord protocol

4.2.1 Message objects

The control and parameterisation of NORD frequency inverter is implemented via CANnord using four message objects. The message objects are identified by various identifiers. The following services are available for a logic master (client):

- Transmit process data (control word and target value) – confirmed or broadcast
- Receive process data (status word and actual value)
- Transmit parameter order (read or write)
- Receive parameter order response identifier / parameter value
- Transfer of setpoint positions with SK 700E with PosiCon option, SK 53xE / SK 54xE
- Transfer of the actual frequency inverter status during operation

Information — **Communication direction**

The data directions "transmit", "receive" are relative to the logic master or client.

The process objects (1. + 2.) can be 4 Bytes (transfer of setpoint) or 8 Bytes (transfer of several setpoints) long. Parameter objects are always 8 Bytes long.

Information — **SK 54xE – 2 additional setpoints and actual values**

In CAN mode SK 540E and SK 545E devices enable processing of up to 5 setpoints or actual values. However, this is only possible with a bus configuration via the integrated RJ45 interfaces. For the two additional values, 5 bytes must be transmitted, whereby the 5th byte is a dummy.

4.2.2 Identifier

The standard CAN (2.0A) permits maximum 2048 different identifiers. Each identifier represents the address for a message object, whereby a frequency inverter uses at least 4 different message objects. In addition, so-called broadcast identifiers can be assigned.

The identifier of the message object can be derived from the CANnord address (P515):

Serial No.	Message objects	Determination of the identifier
1*	Process data Master à Frequency inverter	(CAN address*2) + 0
2	Process data inverter à Master	(CAN address*2) + 1
3	Parameter order Master à Inverter	(CAN address*2) + 512
4	Parameter response inverter à Master	(CAN address*2) + 513
5	Broadcast process data Master à Inverter	1024 - 1032 (1)
* Only if broadcast is set in frequency inverter		

Table 10: CANnord - Determination of message object identifiers

The identifier also specifies the priority in the CANnord protocol (the higher the identifier, the lower the priority). Process data therefore always automatically have higher priority.

In *Extended Frame telegrams*, a constant part is added to the identifier. The Extended ID is generated by adding 18 null bits, so that the identifier for extended and standard formats can be the same. The identifier format is automatically recognised.

4.2.3 Identifier example

In the frequency inverter, the CANnord address (P515) is set to the value 100.

This results in the following identifier:

Message objects	Identifier
CAN bus address	**100_{dez}**
Process data Master à Frequency inverter	200_{dez}
Process data frequency inverter à Master	201_{dez}
Parameter order Master à Frequency inverter	712_{dez}
Parameter response frequency inverter à Master	713_{dez}
Broadcast identifier No. 4	1027_{dez}
Broadcast identifier No. 9 (all)	1032_{dez}

Table 11: Identifier example

Based on the above example, the master transmits its process data to the frequency inverter with the identifier 200. As a response, it receives the actual values with the identifier 201. A parameter is sent with the identifier 712 to the frequency inverter, the response of the frequency inverter is sent with the identifier 713.

If P509 is set to 11, the broadcast identifiers 1027 and 1032 are also valid.

4.2.4 Sequence of data transfer

If the user sends process data to the frequency inverter, it responds via the appropriate message channel. It acts in the same way with parameter orders.

The following delays occur between transmitting and receiving:

- Process data (t_{PZD}) approx 1 to 3 ms
- Parameter data (t_{PKW}) approx. 5 to 10 ms

If an error occurs in the frequency inverter, it immediately transmits its status word and actual value via the PZD channel. The error state is indicated by the error bit in the status word. The current error number can then be read out via the PKW channel.

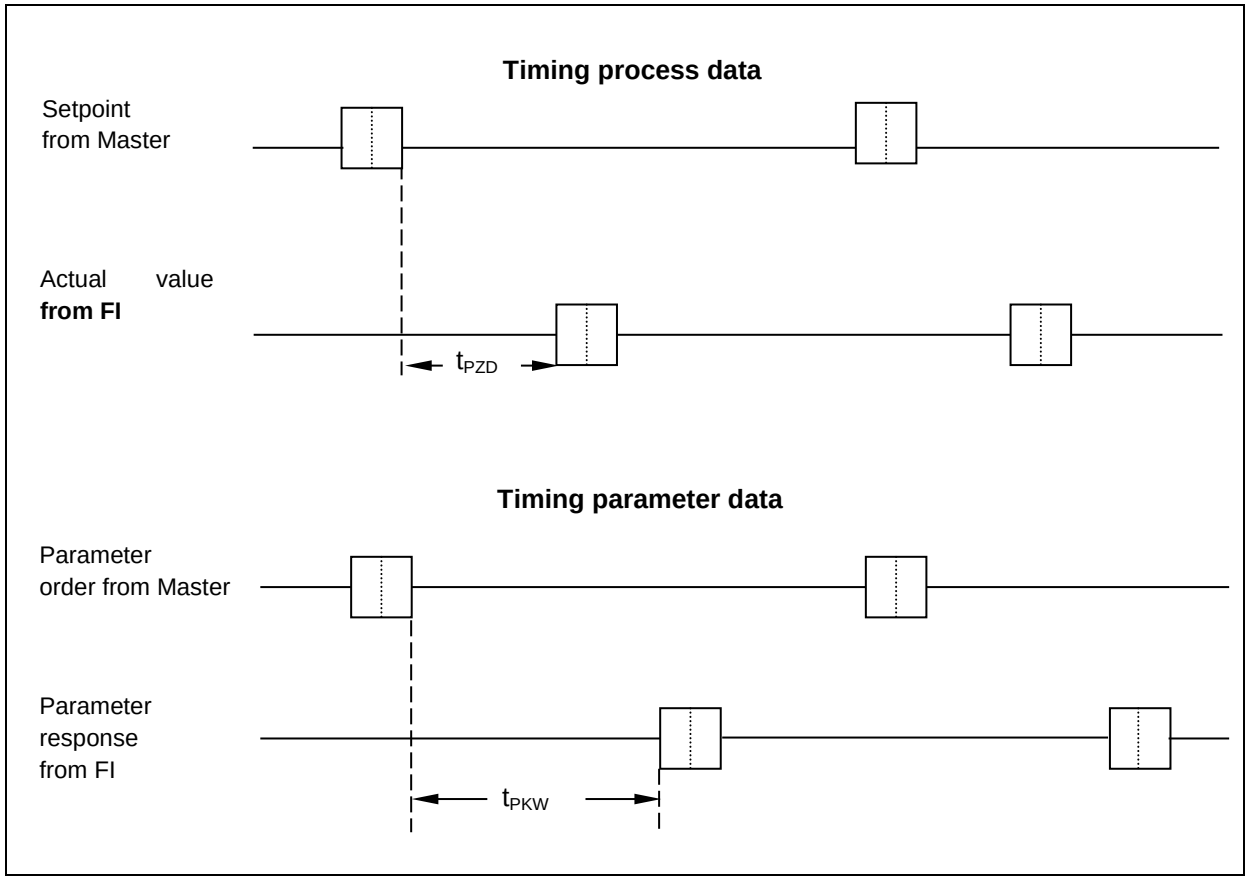


Figure 9: Sequence of data transfer

4.2.5 Broadcast telegrams

To control several frequency inverters simultaneously (e.g. same enable and same setpoint), it is possible to address frequency inverter groups or all frequency inverters using broadcast telegrams. This means that, in addition to the identifiers described above, additional broadcast identifiers for each frequency inverter are also valid. A range of 32 addresses is assigned to one broadcast identifier. All connected frequency inverters can be controlled using the broadcast identifier 1032.

CAN address (P515)	Broadcast identifier
00 - 31	1024 (400h)
32 - 63	1025 (401h)
64 - 95	1026 (402h)
96 - 127	1027 (403h)
128 - 159	1028 (404h)
160 - 191	1029 (405h)
192 - 223	1030 (406h)
224 - 255	1031 (407h)
0 - 255	1032 (408h)

Table 12: Assignment of CAN address (P515) to the broadcast identifier

The broadcast function is activated when the interface parameter (P509=11) is set to CAN broadcast.

This assumes that the control data and setpoint are specified via CANnord.

Only process data can be transferred with broadcast telegrams. Status data are not returned (unconfirmed service).

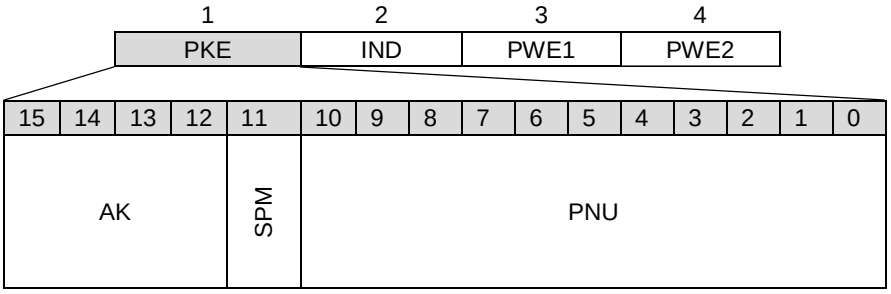
4.2.6 Parametrerisation in CAN mode

In order to process a parameter (read or write / change an inverter parameter) a unique order telegram is sent to the frequency inverter from the master. The FI responds with the corresponding response.

In principle, the area of the telegram which is relevant for processing the parameter consists of a **parameter identification**, in which the type of order (Write, Read etc.) and the relevant parameters are specified. Individual parameter sets or array elements can be addressed with the aid of the **Index**. The **parameter value** contains the value to be written or read.

Parameter label (PKE)

The order or response and the associated parameters are encrypted in the parameter label (PKE).



The parameter label **(PKE)** is always a 16 bit value.

PNU Bits 0 to 10 contain the number of the required parameter **(PNU)**, or the number of the current parameter in the response telegram of the frequency inverter.

Information — **Parameter number PNU**

For the inverter parameter numbers (PNU) of the particular inverter series please refer to the relevant operating instructions.

SPM Bit 11 is the toggle-bit for spontaneous messages. This function is **not** supported!

AK Bits 12 to 15 contain the order or response label.

Information — **Labelling: AK**

Both the order label and the response label are abbreviated as AK. Therefore, care must be taken when reading or interpreting the order processing description in this section.

Meanings of the values sent in the order label,:

The following table lists all the orders which can be transferred from the master to the inverter. The right-hand column contains the response, which is normally sent (response label positive). Only certain response labels are possible, depending on the order label. In case of error (AK negative) the inverter will always supply the value 7 in the response label (AK) to the master.

AK	Function	Response label positive
0	No order	0
1	Order parameter value	1 / 2
2	Change parameter value (word)	1
3	Change parameter value (double word)	2
4	Reserved	-
5	Reserved	-
6	Order parameter value (array)	4 / 5
7	Change parameter value (array word)	4
8	Change parameter value (array double word)	5
9	Order the number of array elements	6
10	Reserved	-
11	Change parameter value (array double word) to the EEPROM	5
12	Change parameter value (array word) EEPROM	4
13	Change parameter value (double word) EEPROM	2
14	Change parameter value (word) EEPROM	1

Meanings of the values sent in the response label,:

AK	Function
0	No response
1	Transfer parameter value (word)
2	Transfer parameter value (double word)*
4	Transfer parameter value (array word)
5	Transfer parameter value (array double word)*
7	Order cannot be executed (with error number in PWE2)

* Only for PPO Type 2

As long as an order has not yet been executed, the inverter provides the response to the last order. Therefore the master must always check whether the received response matches the order sent.

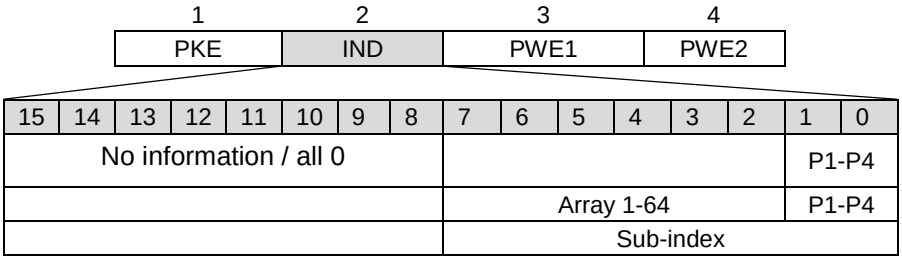
For the plausibility check, the value in the response label (AK), the received parameter number (PNU) with the corresponding Index (IND) as well as the current parameter value (PWE) can be used for the description of parameters.

Error messages if the order cannot be executed

In the response label "Order cannot be executed" (AK = 7), then an error message is added to the parameter value (PWE2) of the inverter response. For the meanings of the values transferred, please refer to the following table.

AK	Meaning
0	Invalid parameter number
1	Parameter value cannot be changed
2	Lower or upper value limit exceeded
3	Incorrect sub-index
4	No array
5	Invalid data type (at present only for SK 700E)
6	Only resettable (only 0 may be written)
7	Description element cannot be changed
9	Description data not present
201	Invalid order element in the last order received
202	Internal response label cannot be depicted

Sub-index (IND)



The structure and function of the parameter index (IND) depends on the type of parameter to be transferred. For values which depend on the parameter set, the parameter set can be selected via Bits 0 and 1 of the Index (IND) (0 = parameter set 1, 1 = parameter set 2,...).

If the parameter to be processed is also an array parameter (e.g. position array for the POSICON option), then the sub-index of the required parameter can additionally be accessed via Bit 2 to Bit 7 of the sub-index (0 = array element 1, 1 = array element 2,…):

Array element	Parameter set	Index
5 (000101_{BIN})	2 (01_{BIN})	15_{HEX} = $0001\ 0101_{BIN}$
21 (010101_{BIN})	4 (11_{BIN})	57_{HEX} = $0101\ 0111_{BIN}$

If a parameter is not dependent on the parameter set, then Bits 0 -7 are used for the sub-index.

Please refer to the operating instructions for details of the structure of the individual parameters and which values may be called up.

If the sub-index is used, nos. 6, 7, 8 or 11, 12 must be used as the order label, in order for the sub-index to be effective.

Parameter value (PWE)

According to the type of the PPO or parameter, transfer of the parameter value (PWE) is always as a word (16 Bit) or double word (32 Bit) Only one parameter value can be transferred in a telegram.

A 32 bit parameter value comprises PWE1 (High value word) and PWE2 (Low value word, 4th word). A 16 Bit parameter value is transferred in PWE2. For negative values the High word must be set to FFFF hex.

Information — **32 bit parameter values**

32 Bit parameter values are only used with the posicon option. All relevant parameters are described in the supplementary posicon instruction manual.

The parameter value is transferred as an integer value. For parameters with resolutions 0.1 or 0.01 the parameter value must be multiplied by the inverse of the resolution.

Example

A run-up time of 99.99 seconds is to be set.
99.99s à 99.99 * 1 / 0.01 = 99.99 * 100 = 9999
Therefore the value $9999_{dec} = 270F_{hex}$ must be transferred.

4.3 The CANopen protocol

Object Index (OI)

The OI contains all objects of the device. Objects depict the visible functionality. They contain data, parameters or functions. Access is gained via SDOs. An object is addressed via the Index (16 Bit) and the SubIndex (8Bit). The OI is divided into the following areas:
0000h...1FFFh: Communication specific objects
2000h...5FFFh: Manufacturer-specific objects
6000h...9FFFh: Standardised device profile objects
A000h...FFFFh: Reserved

Service data obj. (SDO)

SDOs are used for confirmed transfer of data of any length between two network subscribers: The SDO client is the initiating subscriber and has direct access to the OI inputs of the SDO server (read and write). The SDO transfer is normally used for parameterisation and service purposes.

Process data obj. (PDO)

PDOs are used for transferring process data. The process data can contain a maximum of 8 bytes. Transfer is made without confirmation. The significance of the data transferred is determined by the identifier and the set PDO mapping. A PDO always has a producer (transmitter). Several consumers (receivers) may exist.

PDO mapping

In objects 1600h-1603h / 1A00h..1A03h it is possible to set which objects (setpoint/actual values) are transferred into the PDO telegrams.

Identifier

Every CAN message has an 11 bit identifier. This identifier is used for addressing and priority assignment.
CANopen defines a preset identifier assignment which facilitates communication between a higher level device and up to 127 other devices. The 11 bit identifier is broken down as follows:

10	8	8	7	6	5	4	3	2	1	0
Function code				Node identifiers (1-127)						

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	1403h, 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

4.3.1 Network Management (NMT)

The individual states of the CANopen network can be activated with the following commands:

Status	Description	Commands for setting the operational state
Pre-Operational	The inverter enters this state after initialisation. This state is used for bus module configuration. Data traffic via SDO objects is possible. The PDO channel is blocked.	Identifier = 0x00 // Data byte 0 = 0x80 // Data byte 1 = 0x00
Operational	The bus is fully operational, SDO and PDO objects can be transmitted	Identifier = 0x00 // Data byte 0 = 0x01 // Data byte 1 = 0x00
Stopped	Transfer of SDO and PDO objects is blocked, only NMT messages can be transferred	Identifier = 0x00 // Data byte 0 = 0x02 // Data byte 1 = 0x00

Table 13: Network Management (NMT)

4.3.2 Drive profile DS 402

Together with the module SK TUx-CAO the frequency inverter supports the drive profile DS 402 Velocity Mode (speed profile).

The profile is only valid in parameter set 1 and is activated via parameter (P551).

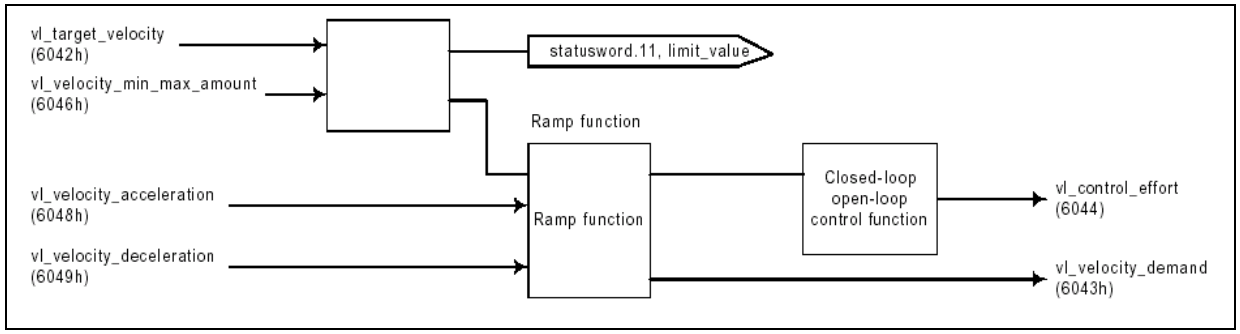


Figure 10: Velocity Mode CiA DSP 402 V1.1 page 178

Information **Drive profile DS 402**

When the drive profile is activated (P551 = On), objects 6040 - 6044 instead of 3000 - 3003 are relevant.

The drive profile is not supported if the CANbus is implemented via the integrated RJ 45 sockets for SK 5xxE inverters.

4.3.3 Process data transfer in CANopen mode (PDO communication)

PDOs (Process Data Objects) are used for transferring process data.

PDO mode	Data type	Frequency inverter ...
Receive PDO	control data	... receives data
Transmit PDO	Status data	.... transmits data

Table 14: PDO types

NORD frequency inverters have up to 4 transmit and 4 receive PDOs which are identified by different identifiers.

Transfer of PDOs is made without confirmation. The significance of the data transferred is determined by the CAN identifiers being used and the PDO mapping. A maximum of 8 bytes of data is transferred.

PDO operating modes (transmission type)

The “transmission type” determines when a transmit PDO is transmitted and when the data from a receive PDO is processed. These settings are set in objects 1400-1403 and 1800-1803. The following settings can be made with NORD frequency inverters:

Transmission type	Value
Transmit PDO (Tx)	
0	PDO is transmitted if a SYNC command has been received and the data (status) has changed since the last SYNC command.
1 - 240	PDO is transmitted if 1..240 SYNC commands have been received, whether the data (status) has changed or not.
252, 253	Reserved
254, 255	The PDO is transmitted immediately if the data (status) has changed (standard setting).
Receive PDO (Rx)	
0 - 240	Data from the Receive PDO is only processed after the next SYNC command has been received.
252, 253	Reserved
254, 255	Data from Receive PDO is processed immediately (standard setting).

Table 15: PDO modes

PDO mapping

The assignment of process data in the receive and transmit PDOs is set under PDO mapping (objects 1600-1603 and 1A00-1A03). Up to 8 bytes of data can be transferred in each PDO. Mapping determines where which pieces of data are placed in these 8 bytes, e.g.:

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

The control word, status word, the setpoint values and actual values can be set using the following object numbers:

Index	Sub-index	Control object		Index	Sub-index	Status object
3000		Control word (STW)		3001		Status word (ZSW)
3002	1	Setpoint 1 (SW1) 16 Bit		3003	1	Actual value 1 (IW1) 16 Bit
	2	Setpoint 2 (SW2) 16 Bit			2	Actual value 2 (IW2) 16 Bit
	3	Setpoint 3 (SW3) 16 Bit			3	Actual value 3 (IW3) 16 Bit
	4	Setpoint 4 (SW4) 16 Bit	*Only SK 54xE*		4	Actual value 4 (IW4) 16 Bit
	5	Setpoint 5 (SW5) 16 Bit	*Only SK 54xE*		5	Actual value 5 (IW5) 16 Bit
	4	Setpoint 1 (SW1) 32 Bit	*Only SK 7x0E*		4	Actual value 1 (IW1) 32 Bit

An entry in the object index determines the setting (objects 1600-1603 and 1A00-1A03). This specifies which object of the device is transferred to which point of the PDO.

Information

NORD frequency inverters support dynamic mapping and dummy mapping!

PDO mapping SK 300E, SK 5xxE (SK TU3-…), SK 700E, SK 750E

PDO type	Length	Identifier
PDO1 (Tx)	4 Byte	180h + NODE-ID
PDO1 (Rx)	4 Byte	200h + NODE-ID
PDO2 (Tx)	8 Byte	280h + NODE-ID
PDO2 (Rx)	8 Byte	300h + NODE-ID
PDO3 (Tx)	8 Byte	380h + NODE-ID
PDO3 (Rx)	8 Byte	400h + NODE-ID
PDO4 (Tx)	2 Byte	480h + NODE-ID
PDO4 (Rx)	2 Byte	500h + NODE-ID

1st word	2nd word	3rd word	4th word
ZSW	IW1		
STW	SW1		
ZSW	IW1	IW3 *	IW2 *
STW	SW1	SW3 *	SW2 *
ZSW	IW1 (32 Bit)		IW2
STW	SW1 (32Bit)		SW2
ZSW			
STW			

*) In the SK 5xxE devices, the IW/SW 3/2 are assigned inversely to the words.
3rd word = IW/SW2, 4th word = IW/SW3

In the default setting, all receive PDOs are active. A decision is made when sending messages to the applicable identifier whether one setpoint or up to three setpoints can be evaluated.

With transmit PDOs, only PDO 1 is active, while PDOs 2 to 4 are deactivated. If the application requires the sending of several actual values, the corresponding PDO must be switched on. In the following example, transmit PDO 2 is activated, the default setting transmits a status word and three actual values. For this, the following messages must be sent via the **SDO parameter channel** (see Section 4.3.4):

- Set the NMT status machine for the inverter to the state "Pre-Operational"
- Deactivate PDO 1 à SDO telegram (Index=0x1800 / Subindex=1 / Data=0xc0000181)
- Activate PDO 2 à SDO telegram (Index=0x1801 / Subindex=1 / Data=0x40000281)
- Set the NMT status machine for the inverter to the state "Operational"
- PDO 1 is deactivated to prevent the bus load from rising unnecessarily. The PDO is activated/deactivated via Bit 31 in the corresponding parameter.

PDO mapping, SK 511E up to SK 535E via internal RJ45 connection

PDO type	Length	Identifier
PDO1 (Tx)	8 Byte	180h + NODE-ID
PDO1 (Rx)	8 Byte	200h + NODE-ID
PDO2 (Rx)	4 Byte	300h + (NODE-ID +1)

1st word	2nd word	3rd word	4th word
ZSW	IW1	IW2	IW3
STW	SW1	SW2	SW3
IW1 (32 Bit) of an absolute encoder			

PDO mapping, SK 540E up to SK 545E via internal RJ45 connection

PDO type	Length	Identifier
PDO1 (Tx)	8 Byte	180h + NODE-ID
PDO1 (Rx)	8 Byte	200h + NODE-ID
PDO2 (Tx)	5 Byte	280h + NODE-ID
PDO2 (Rx)	5 Byte	300h + NODE-ID
PDO3 (Rx)	4 Byte	400h + (NODE-ID +1)

1st word	2nd word	3rd word	4th word
ZSW	IW1	IW2	IW3
STW	SW1	SW2	SW3
IW4	IW5		
SW4	SW5		
IW1 (32 Bit) of an absolute encoder			

Inhibit Time

Each transmit PDO has a parameter "Inhibit Time" (0x1800 – 0x1803 Sub-Index 3). This can be used to set a minimum send interval between two PDO messages. In networks with numerous subscribers, the bus load can be influenced with this value. The default setting is 10 ms (Value x 100µs).

Event Timer

The Parameter Event Time (0x1800 – 0x1803 Subindex 5) can be used for all transmit PDOs. Once this value is exceeded, the PDOs are transmitted cyclically. The default setting is 250 ms (Value x 1ms).

PDO settings

All settings for the PDOs are implemented via the SDO parameter channel (Section 4.3.4).

The settings made are not stored permanently in the device, i.e. a reset of the 24 V power supply will reset the changed parameters to the default values.

4.3.4 Parameterisation in CANopen mode (SDO communication)

Access to all parameters of the frequency inverter and the CANopen Box is implemented via so-called service data objects (SDO). Access is via handshake between client and server, i.e. after a message is transmitted, the response must be waited for before a new message can be sent.

Transmit and receive addresses for SDO access seen from the PLC

$$Sende\text{-}ID = 0x600 + Node\text{-}ID$$

$$Empfangs\text{-}ID = 0x580 + Node\text{-}ID$$

The Node ID of the frequency inverter is set via the "ID-H" and "ID-L" switches on the CANopen Box or in the PGM mode via parameter P515.

Transmitting parameter data via SDO

Transmission of parameter data = Writing a parameter value into the frequency inverter.

Example: Parameter P102 (acceleration time), 1.03s

Control byte	Index		Sub-index	Data			
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x2B	0x66	0x20	0x01	0x67	0x00	0x00	0x00

Data à user data (Parameter value):
The values of the selected parameter are transferred in this area.

16 Bit value: 67 00 00 00
(1.03s = 103_{dec} = 0067_{hex})
32 Bit value: 76 BC 2A 00
(2800,758rev = 2800758_{dec} = $002ABC76_{hex}$)

Sub-Index à Parameter index or array value:
The selected parameter set and the array element of the parameter are coded in this area.
For parameters which neither depend on parameter sets nor consist of array elements, the sub-index is **00_{hex}**
For all other cases, the following overview applies:

Column		1	2	3	4
Row		P-set 1	P-set 2	P-set 3	P-set 4
1	Array [-01]	0x01	0x02	0x03	0x04
2	Array [-02]	0x05	0x06	0x07	0x08
3	Array [-03]	0x09	0x0A	0x0B	0x0C
4	Array [-04]	0x0D	0x0E	0x0F	0x10
	…	…			

Index à Parameter number of the frequency inverter:
The parameters are mapped in the area above 2000_{hex}:
Parameter P102 = 102_{dec} =66_{hex} à 2000_{hex} + 66_{hex} = 2066_{hex} à 66 20

The **control byte** à specifies the data length and the order:
0x2B = Transmit 16 bit value
0x23 = Transmit 32 bit value

Response
0x60 = Error-free telegram received
Any other response corresponds to a termination of parameter communication.

Table 16: Transmitting parameter data via SDO

Loading parameter data via SDO

Loading of parameter data is carried out in a similar manner to the transmission of parameter data. For this, the master sends a read order (control byte 0x40) to the frequency inverter, which specifies which parameter and which array or which parameter set is to be read out. The data area remains empty (everything 0).

The response telegram corresponds to the order telegram, whereby the status byte specifies the length of the response data (response 16/32 bit) and the data area which contains the parameter value which has been read out.

Example: Read out parameter P102, Response: P102, 1.03s

Control byte/ Status byte	Index		Sub-index	Data			
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
Requirement							
0x40	0x20	0x66	0x01	0x00	0x00	0x00	0x00
Response							
0x4B	0x20	0x66	0x01	0x67	0x00	0x00	0x00
The **control byte** à states the order: 0x40 = Load value **Response** 0x4B = Deliver the 16 bit value which has been read out 0x43 = Deliver the 32 bit value which has been read out 0x80 = Response to an incorrect order							

Table 17: Loading parameter data via SDO

Cancelling of parameter communication (SDO)

If problems occur during parameter communication (e.g. value range overflow), a cancel telegram is sent. This can be recognised by the number 0x80 in byte 0. The cause of the cancellation is indicated in bytes 4 to 7.

Control byte	Last index used			Error code			
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x80	0x00	0x18	0x01	0x02	0x00	0x01	0x06

Table 18: Error message (0x06010002 = attempted writing access to a read-only object)

Error code	Description
0x0601 0001	Access to write-only parameter
0x0601 0002	Access to read-only object
0x0607 0010	Data type or parameter length do not match
0x0609 0030	Parameter value range overflow
0x0609 0031	Parameter value range overflow
0x0609 0032	Parameter value range undershot
0x0609 0011	Sub-Index of parameter does not exist

Table 19: Error codes – Parameter communication

Changing the COB-ID (address) of a PDO

Changes to the identifier of a PDO can only be made when the NMT status machine of the inverter is in the "Pre-Operational" state.

Each Transmit and Receive PDO has its own parameter for this setting.

PDO	Receive PDO	Send PDO
PDO 1	0x1400 Sub 1	0x1800 Sub 1
PDO 2	0x1401 Sub 1	0x1801 Sub 1
PDO 3	0x1402 Sub 1	0x1802 Sub 1
PDO 4	0x1403 Sub 1	0x1803 Sub 1

Table 20: Index table for transmit and receive PDOs of the inverter

The following parameter is a 32 bit value, which includes other information in addition to the identifier.

Bit number	Value	Meaning
31	0	PDO is active
	1	PDO is switched off
30	1	Values cannot be changed
29 to 11	0	
10 to 0	X	PDO identifier (COB – ID)

Table 21: Description of PDO COB-ID entry

The PDO identifier is stored in bits 0 to 10. The bit 31 must be set to null, otherwise the PDO will be deactivated. If, e.g. the identifier for a transmit PDO is changed to 0x201, the value 0x40000201 must be entered in the appropriate parameter.

The new identifier becomes valid by setting the NMT status machine to the "Operational" state.

4.3.5 Object Index

All available objects are contained in the NORD frequency inverter “Electronic data sheet” (eds file).

CANopen profile DS 301

Communication objects (1000_{hex} - 1200_{hex})

Index (hex)	Sub	Object	Description	Unit	Access	Type
1000	-	Device type	Device type and functionality		RO	U32
1001	-	Error register	Error register		RO	U8
1002	-	Status Register	Status of the module		RO	U32
1003	ARR	Pre-defined Error	Error signaled by an emergency object			U8
	0	Number of errors	Number of errors ; 0 deletes the error list		RW	U8
	1	Error code	Error number		RO	U32
1005	-	COB-ID SYNC	Identifier for SYNC messages (Default 80h)		RW	U32
1008	-	Device name	Device name		RO	STR
1009	-	Hardware version	Hardware configuration		RO	STR
100A	-	Software Version	Software version FI+CO		RO	STR
100C	-	Guard Time	Guard time (0=off)	ms	RW	U16
100D	-	Life Time Factor	Life time = life time factor * guard time		RW	U16
1014	-	COB-ID Emergency Object	Identifier Emergency Object (80h+Node-ID)		RW	U32
1015	-	Inhibit Time EMCY	Minimum repeat time	ms	RW	U16
1017	-	Producer Heartbeat Time	Cycle Time of Heartbeat	ms	RW	U16
1018	REC	Identity object	General device information			U32
	0	Largest sub-index	Number of elements		RO	U8
	1	Vendor ID	Manufacturer identification		RO	U32
	2	Product code	Device version (product number)		RO	U32
	3	Revision number	Software version and revision number		RO	U32
	4	Serial number	Serial number		RO	U32
1200	REC	Default Server SDO	SDO server			0x22
	0	Largest sub-index	Number of elements		RO	U8
	1	COB_ID Server>Client (rx)	Identifier receive SDO (600h +ID)		RO	U32
	2	COB_ID Server>Client (tx)	Identifier transmit SDO (580h +ID)		RO	U32

Table 22: Communication objects (DS 301)

PDO objects (1400_{hex} - $1A04_{hex}$)

Index (hex)	Sub	Object	Description	Unit	Access	Type
1400-1403	REC	Receive PDO Communication Parameter	Receive PDO characteristics		RW	0x21
	0	Largest sub-index	Number of elements		RO	U8
	1	COB-ID used by PDO	Identifier receive PDO		RW	U32
	2	Transmission type	Receive PDO type		RW	U8
	3	Not used	Not used		-	-
	4	Reserved	Reserved		-	-
	5	Not used	Not used		-	-
1600-1603	REC	Receive PDO Mapping Parameter	Receive PDO mapping		RW	0x21
	0	Largest sub-index	Number of elements		RW	U8
	1-4	PDO mapping	Mapped objects		RW	U32
1800-1803	REC	Transmit PDO Communication Parameter	Transmit PDO characteristics		RW	0x21
	0	Largest sub-index	Number of elements		RO	U8
	1	COB-ID used by PDO	Identifier receive PDO		RW	U32
	2	Transmission type	Send PDO type		RW	U8
	3	Inhibit Time	Minimum transmit time	100µs	RW	U16
	4	Reserved	Reserved		-	-
	5	Event Timer	Cyclic transmit timer	ms	RW	U16
1A00-1A03	REC	Transmit PDO Mapping Parameter	Send PDO mapping		RW	0x21
	0	Largest sub-index	Number of elements		RW	U8
	1-4	PDO mapping	Mapped objects		RW	U32

Table 23: PDO objects (DS 301)

CANopen drive profile DS402 - Objects ($603F_{hex}$ – 6049_{hex})

Index (hex)	Sub	Object	Description	Unit	Access	Type
603F	-	Error code	Error description	-	RO	U32
6040	-	Control word	Control word	-	RW	U16
6041	-	Status word	Status word	-	R0	U16
6042	-	Vl_target_velocity	Speed setpoint	rpm	RW	I16
6043	-	Vl_velocity_demand	Setpoint speed after ramp	rpm	RO	I16
6044	-	Vl_control_effort	Actual speed value	rpm	RO	I16
6046	ARR	Vl_velocity_min_max_amount	Speed min/max amount	-	RO	ARR
	1	Vl_velocity_min_amount	Min. speed value	rpm	RW	U32
	2	Vl_velocity_max_amount	Max. speed value	rpm	RW	U32
6048	REC	Vl_velocity_acceleration	Speed acceleration	-	RO	REC
	1	Delta_speed	Delta speed	rpm	RW	U32
	2	Delta_time	Delta time	s	RW	U16
6049	REC	Vl_velocity_deceleration	Speed deceleration	-	RO	REC
	1	Delta_speed	Delta speed	rpm	RW	U32
	2	Delta_time	Delta time	s	RW	U16

Table 24: Object drive profile DS 402

Frequency inverter objects (2000_{hex} - 3003_{hex})

Index (hex)	Sub	Object	Description	Unit	Access	Type
2000-23E7	-	Manufacturer Spec. Parameter	FI parameters manual)	-	-	-
3000		Control word	Control word (STW)			U16
3001		Status word	Status word (ZSW)			U16
3002	0	Largest sub-index	Number of elements			U8
	1	Setpoint 1	Setpoint 1 (SW1) 16 Bit			U16
	2	Setpoint 2	Setpoint 2 (SW2) 16 Bit			U16
	3	Setpoint 3	Setpoint 3 (SW3) 16 Bit			U16
	4*	Setpoint 4	Setpoint 4 (SW4) 16 Bit			U16
	5*	Setpoint 5	Setpoint 5 (SW5) 16 Bit			U16
	4**	Setpoint 1 (long)	Setpoint 1 (SW1) 32bit			U32
3003	0	Largest sub-index	Number of elements			U8
	1	Actual Value 1	Actual value 1 (IW1) 16 Bit			U16
	2	Actual Value 2	Actual value 2 (IW2) 16 Bit			U16
	3	Actual Value 3	Actual value 3 (IW3) 16 Bit			U16
	4*	Actual Value 4	Actual value 4 (IW4) 16 Bit			U16
	5*	Actual Value 5	Actual value 5 (IW5) 16 Bit			U16
	4**	Actual Value 1 (long)	Actual value 1 (IW1) 32bit			U32
* Only SK 54xE * Only SK 7x0E						

Table 25: Frequency inverter objects

5. Parameters

To operate the inverter with the CANnord/CANopen protocol, the bus must be connected to the master and some settings have to be made on the frequency inverter.

With CANopen protocol, the inverter parameters are mapped in the range 2000_{hex} to $23E7_{hex}$ = 8192_{dec} to 9191_{dec}, i.e. when parameterisation is carried out via the bus, the parameter numbers must be added to the value 2000_{hex} (e.g. P508 à obj . $21FC_{hex}$).

The frequency inverter can always be parameterised. The control source can be selected with parameter P509 (control word) and parameter P510 (setpoint source). The telegram down time P513 can be selected depending on the bus system.

Information — **Deviating Parameter Settings**

According to the type or equipment of the frequency inverter, individual parameters may be different or restricted.

Information — **Control terminal functions**

When activated, the functions **block voltage, quick stop, remote control and cancel error**, are available at the (local) control terminals. To operate the drive, a High signal must be present on the digital inputs being used before the drive can be enabled.

5.1 BUS parameter data for SK 300E/700E/750E

5.1.1 Control terminals

Parameter {factory setting}	Setting value / Description / Note		Supervisor	Parameter set

P480 **[-01] ... [-08]** **Function BusIO In Bits** *(Function Bus I/O In Bits)* | | **S** |

0 ... 62
{ all 0 }

The Bus I/O In Bits are perceived as digital inputs. They can be set to the same functions (P420...425).

In order to use this function, one of the bus setpoints (P546, P547, P548) must be set to >Bus I/O In Bits 0-7 <. The required function must then be assigned to the relevant bit.

[-01] = Bus I/O In Bit 0
[-02] = Bus I/O In Bit 1
[-03] = Bus I/O In Bit 2
[-04] = Bus I/O In Bit 3
[-05] = Bus I/O In Bit 4
[-06] = Bus I/O In Bit 5
[-07] = Bus I/O In Bit 6
[-08] = Bus I/O In Bit 7

The possible functions for the Bus In Bits can be found in the table of functions for the digital inputs P420...425.

Note **ControlBox at SK 300E**

SK 300E: Only the value of the first array can be accessed with the ControlBox. A ParameterBox or the NORDCON software is required to access the other arrays.

P481 **[-01] ... [-08]** **Function BusIO Out Bits** *(Function Bus I/O Out Bits)* | | **S** |

0 ... 38
{ all 0 }

The bus I/O Out bits are perceived as digital outputs. These can be set to the same functions as P434 … P443; P624 … P629 (only SK 7x0E with POSICON).

In order to use this function, one of the bus setpoints (P543, P544, P545) must be set to >Bus I/O In Bits 0-7 <. The required function must then be assigned to the relevant bit.

[-01] = Bus I/O Out Bit 0
[-02] = Bus I/O Out Bit 1
[-03] = Bus I/O Out Bit 2
[-04] = Bus I/O Out Bit 3
[-05] = Bus I/O Out Bit 4
[-06] = Bus I/O Out Bit 5
[-07] = Bus I/O Out Bit 6
[-08] = Bus I/O Out Bit 7

The possible functions for the Bus Out Bits can be found in the table of functions for the digital outputs or the relays P434.

Note **ControlBox at SK 300E**

SK 300E: Only the value of the first array can be accessed with the ControlBox. A ParameterBox or the NORDCON software is required to access the other arrays.

P482	[-01] ... [-08]	**Norm. BusIO Out Bits** *(Standardisation of bus I/O Out bits)*		S	

-400 … 400 %
{ all 100 }

Adjustment of the limit values of the relay functions/Bus Out Bits. For a negative value, the output function will be output negative.

When the limit value is reached and the setting values are positive, the relay contact closes, with negative setting values the relay contact opens.

The assignment of the arrays correspond to those of parameter (P481).

P483	[-01] ... [-08]	**Hyst. BusIO Out Bits** *(Hysteresis of bus I/O Out bits)*		S	

1 … 100 %
{ all 10 }

Difference between switch-on and switch-off point to prevent oscillation of the output signal.

The assignment of the arrays correspond to those of parameter (P481).

5.1.2 Additional parameters

Parameter {factory setting}	Setting value / Description / Note		Supervisor	Parameter set

P503	**Master function output** *(Master function output)*		S	

0 ... 5
{ 0 }

For master-slave applications this parameter specifies on which bus system the master transmits the control word and the master values for the slave. On the slave, parameters (P509), (P510), (P546)(… (P548)) define the source from which the slave obtains the control word and the master values from the master and how these are to be processed by the slave.

Only the **master frequency** (setpoint 1 and control word) is transferred with **Mode 1**, while the actual values selected in **P543, P544 and P545** are transferred in **Mode 2**.

In **Mode 3** a **32Bit actual position and** a **16 bit setpoint speed** (after ramp) is output. Mode 3 is required for synchronous control with the Posicon option.

Mode 4 can be used for curve control in torque-coupled vehicles. The **status word** (1st word), the actual **setpoint frequency** before the speed ramp (2nd word), the **actual torque current** standardised to the torque limit (3rd word) and the **actual frequency** without slip (4th word) are transmitted.

0 =	Off						
1 =	USS mode 1	3 =	USS mode 2	5 =	USS mode 3	7 =	USS mode 4
2 =	CAN Mode 1 up to 250kBaud	4 =	CAN Mode 2	6 =	CAN Mode 3	8 =	CAN Mode 4

Information **USS mode**

Each USS mode prevents communication with a PC and NORD CON.

P509	Interface *(Interface)*			

0 ... 21
{ 0 }

Selection of the interface via which the FI is controlled.

0 = **Control terminals or keyboard control** ** with the ControlBox (if P510=0), the ParameterBox (not ext. P-box) or via BUS I/O Bits.

1 = **Only control terminals** , the FI can only be controlled via the digital and analog inputs or via the bus I/O Bits.

5 = **CAN setpoint***, the frequency setpoint is transferred via CAN. Control via the digital inputs is still active.

6 = **CAN control word***, the control signals (enable, direction of rotation, ...) are transferred via UCAN, the setpoint via the analog input or the fixed frequencies.

7 = **CAN*,** all control data is transferred via CAN. The analog input and the digital inputs have no function (except safety functions)

11 = **CAN Broadcast***, the inverter receives all of the control data via CAN without responding to the master (e.g. for the synchronisation function). The analog input and the digital inputs have no function (except safety functions)

15 = **CANopen setpoint***, as for setting 5, but CANopen

16 = **CANopen control word***, as for setting 6, but CANopen

17 = **CANopen***, as for setting 7, but CANopen

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

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

P510	Bus interface auxiliary setpoint *(Bus interface auxiliary setpoints)*	SK 700E/ SK750E	S	

0 ... 8
{ all 0 }

Selection of the interface via which the FI is controlled.

0 = **Auto (=P509):** The source of the auxiliary setpoint is automatically derived from the setting in the parameter P509 >Interface<

1 = **USS**

2 = **CANbus**

3 = **Profibus**

4 = **InterBus**

5 = **CANopen**

6 = **DeviceNet**

7 = Reserved

8 = **CAN Broadcast**

P513	Telegram time-out *(Telegram time out)*		S	

-0.1 / 0.0 / 0.1 ... 1000 s
{ 0.0 }

Monitoring function of the active bus interface. Following receipt of a valid telegram, the next one must arrive within the set period. Otherwise the FI reports an error and switches off with the error message E010 >Bus Time Out<.

0.0 = Off: Monitoring is switched off.

-0.1 = No error: Even if communication between BusBox and FI is interrupted (e.g. 24V error, Box removed, etc.), the FI will continue to operate unchanged.

P514	CAN baud rate ***(CAN baud rate)***			

0 ... 7
{ 4 }

Used to set the transfer rate (transfer speed) via the CANbus interface. All bus participants must have the same baud rate setting. With the use of the CANopen technology unit, settings from this parameter are only valid if the *BAUD* rotary coding switch on the technology unit has been set to **PGM**.

0 =	10kBaud	**3 =**	100kBaud	**6 =**	500kBaud
1 =	20kBaud	**4 =**	125kBaud	**7 =**	1MBaud * (for test purposes only)
2 =	50kBaud	**5 =**	250kBaud		

*) Reliable operation cannot be guaranteed

Information **Data takeover**

The baud rate is only read after a Power On, a Reset Node message or a Power On of the 24V bus supply.

P515	CAN address *(CAN address)*			

0 ... 255
{ 50 }

Setting of the basic CANbus address for CAN and CANopen. With the use of the CANopen technology unit, settings from this parameter are only valid if the *BAUD* rotary coding switch on the technology unit has been set to **PGM**.

Information **Data takeover**

The baud rate is only read after a Power On, a Reset Node message or a Power On of the 24V bus supply.

P543	Bus actual value 1 *(Actual bus value 1)*	SK 300E / SK 7x0E	S	P

0 ... 12
{ 1 }

The return value 1 can be selected for bus actuation in this parameter.

Note **Settings**

For detailed informationen concerning the settings, please refer to the description of parameter P418 for the respective frequency inverter.

0 =	Off	**6 =**	Actual position *(only with POSICON, SK 7x0E)*
1 =	Actual frequency	**7 =**	Setpoint position *(only with POSICON, SK 7x0E)*
2 =	Actual speed	**8 =**	Setpoint frequency
3 =	Current	**9 =**	Error number
4 =	Torque current (100% = P112)	**10 =**	Actual position increment *(only with POSICON, SK 7x0E)*[1]
5 =	Digital IO status [2]	**11 =**	Setpoint position increment *(only with POSICON, SK 7x0E)*[1]
		12 =	BusIO Out Bits 0...7

P544	Actual bus value 2 *(Actual bus value 2)*	SK 300E / SK 7x0E	S	P

0 ... 12
{ 0 }

This parameter is identical to P543.

P545	Actual bus value 3 *(Actual bus value 3)*	SK 300E / SK 7x0E	S	P

0 ... 12
{ 0 }

This parameter is identical to P543.

[1] Setpoint/actual position corresponding to an 8192 increment encoder.

[2] The assignment of the digital inputs in P543/ 544/ 545 = 5 for SK 700E/ SK 750E

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

P546	Bus setpoint 1 *(Bus setpoint 1)*	SK 300E / SK 7x0E	S	P

0 ... 7
{ 1 }

In this parameter, a function is allocated to the output setpoint 1 during bus actuation. The settings 2 to 6 are only relevant for type SK 700E and SK 750E inverters in combination with the POSICON option.

- **0 =** Off
- **1 =** Setpoint frequency (16 bit)
- **2 =** 16 Bit setpoint position
- **3 =** 32 Bit Bit setpoint position *(PPO type 2 or 4)*
- **4 =** POSICON control terminals *(16 Bit)*[3]
- **5 =** Setpoint position (16 Bit)
- **6 =** Setpoint position (32 Bit) increment
- **7 =** Bus I/O In Bits 0-7

P547	Bus setpoint 2 *(Bus setpoint 2)*	SK 300E / SK 7x0E	S	P

0 ... 20
{ 0 }

In this parameter, a function is allocated to the setpoint 2 which is output during bus actuation.

- **0 =** Off
- **1 =** Setpoint frequency
- **2 =** Torque current limit *(P112)*
- **3 =** Actual frequency PID
- **4 =** Frequency addition
- **5 =** Frequency subtraction
- **6 =** Current limit *(only SK 7x0E) (P536)*
- **7 =** Maximum frequency *(only SK 7x0E) (P105)*
- **8 =** Actual PID frequency limited
- **9 =** Actual PID frequency monitored
- **10 =** Torque
- **11 =** Torque precontrol *(only SK 7x0E) (P214)*
- **12 =** POSICON control terminals *(only SK 7x0E)*
- **13 =** Multiplication *(only SK 7x0E)*
- **14 =** Process controller actual value
- **15 =** Process controller setpoint
- **16 =** Process controller lead
- **17 =** BusIO In Bits 0...7
- **18 =** Curve travel calculator *(only SK 7x0E)*
- **19 =** Set relays *(P541)*
- **20 =** Set analog output *(P542)*

P548	Bus setpoint 3 *(Bus setpoint 3)*	SK 300E / SK 7x0E	S	P

0 ... 20
{ 0 }

In this parameter, a function is assigned to the delivered setpoint 3 (SW3) for bus control. This is identical to parameter P547 and is only present if P546 ≠ 3 and 6.

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

Bit 0: Pos. array / Pos. increment	Bit 1: Pos. array / Pos. increment	Bit 2: Pos. array / Pos. increment		
Bit 3: Pos. array / Pos. increment	Bit 4: Pos. array / Pos. increment	Bit 5: Pos. array / Pos. increment		
Bit 6: Approach reference point	Bit 7: Ref. point	Bit 8: Teach- In	Bit 9: Quit Teach- In	Bit 10: Reset pos.

P551	Drive profile *(Drive profile)*		S	

0 … 1
{ 0 }

According to the option the relevant process data profiles can be activated with this parameter.

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

Note — **Activation of profiles**

This parameter is only **effective for pluggable** technology modules (SK TU3-…).

5.1.3 Information

Parameter	Setting value / Description / Note		Supervisor	Parameter set

P707 [-01] ... [-03]	Software-Version *(Software version/ revision)*			

0.0 ... 9999.9

This parameter shows the software and revision numbers in the FI. This can be significant when different FIs are assigned the same settings.

Array 03 provides information about any special versions of the hardware or software A zero stands for the standard version.

... [-01] = Version number (1.7)
... [-02] = Revision number (R0)
... [-03] = Special version of hard-/software (0.0)

P740 [-01] ... [-06]	Process data Bus In *(Process data bus in)*	SK 300E / SK 7x0E	S	

0000 ... FFFF (hex)

This parameter informs about the actual control word and the setpoints that are transferred via the bus systems.

For display, a BUS system must be selected in P509

Series SK 300E:

[-01] = Control word

[-02] = setpoint value 1
[-03] = setpoint value 2
[-04] = setpoint value 3

[-05] = Bus I/O In Bits (P480)

Series SK 7x0E:

[-01] = Control word

[-02] = setpoint value 1
[-03] = Setpoint val. 1 High byte
[-04] = setpoint value 2
[-05] = setpoint value 3

[-06] = Bus I/O In Bits (P480)

P741 [-01] ... [-06]	Process data Bus Out *(Process data bus out)*	SK 300E / SK 7x0E	S	

0000 ... FFFF (hex)

This parameter provides information about the actual status word and the actual values that are transferred via the bus systems.

Series SK 300E	Series SK 7x0E
[-01] = Status word	**[-01] =** Status word
[-02] = Actual value 1 **[-03] =** Actual value 2 **[-04] =** Actual value 3	**[-02] =** Actual value 1 **[-03] =** Actual val. 1 High byte **[-04] =** Actual value 2 **[-05] =** Actual value 3
[-05] = Bus I/O Out Bit (P481)	**[-06] =** Bus I/O Out Bit (P481)

P745	Module version *(Module version)*	SK 300E		

0.0 ... 3276.7

Version status (software version) of the technology unit (SK TU2-xxx), but only when own processor is present, i.e. not for SK TU2-CTR.

Have this data available if you have a technical query.

P745 [-01] ... [-03]	Module version *(Module version)*	SK 7x0E	S	

0000 ... FFFF (hex)

Version status (software version) of the installed option module(s) but only when own processor is present, i.e. not for SK TU1-CTR.

Have this data available if you have a technical query.

[-01] = Technology unit
[-02] = Customer unit
[-03] = Special extension unit

P746	Module status *(Module status)*	SK 300E	S	

0000 ... FFFF (hex)

Shows the actual status (readiness, error, communication) of the technology unit (SK TU2-xxx), but only when own processor is present, i.e. not for SK TU2-CTR.

Example:

0603_{hex}

High byte = 06_{hex} à Profibus

Low byte = 03_{hex} à Module ready + connection to master

Details of the codes specific to the bus can be found in the section "Error monitoring" of the relevant supplementary instructions.

P746	[-01] ... [-03]	Module status *(Module status)*	SK 7x0E	S	

0000 ... FFFF (hex)

Shows the actual status (readiness, error, communication) of the installed technology unit(s) (if active), but only when own processor is present, i.e. not for SK TU1-CTR.

Example:

0603_{hex}

High byte = 06_{hex} à Profibus

Low byte = 03_{hex} à Module ready + connection to master

Details of the codes specific to the bus can be found in the section "Error monitoring" of the relevant supplementary instructions.

[-01] = Technology unit
[-02] = Customer unit
[-03] = Special extension unit

5.2 SK 5xxE BUS Parameters

Information — **Number of bus setpoints and actual values**

The SK 54xE frequency inverter can administer 5 setpoint or actual values (each 16 bit). However, via the technology unit SK TU3-... the bus system only provides the possibility of processing setpoint or actual values 1 ... 3.

5.2.1 Control terminals

Parameter {factory setting}	Setting value / Description / Note		Supervisor	Parameter set
P480 **[-01] ... [-12]**	**Function BusIO In Bits** *(Bus I/O In Bits function)*		**S**	
0 ... 80 { all 0 }	The Bus I/O In Bits are perceived as digital inputs (P420). They can be set to the same functions. In order to use this function, one of the bus setpoints (P546) must be set to >Bus I/O In Bits 0-7 <. The required function must then be assigned to the relevant bit. With the SK 54xE in association with IO extension modules these I/O bits can also process their input signals. **[-01] = Bus I/O In Bit 0** (or SK54xE and above: + **DI1** of the **second IOE**) **[-02] = Bus I/O In Bit 1** (or SK54xE and above: + **DI2** of the **second IOE**) **[-03] = Bus I/O In Bit 2** (or SK54xE and above: + **DI3** of the **second IOE**) **[-04] = Bus I/O In Bit 3** (or SK54xE and above: + **DI4** of the **second IOE**) **[-05] = Bus I/O In Bit 4** (or SK54xE and above: + **DI1** of the **first IOE**) **[-06] = Bus I/O In Bit 5** (or SK54xE and above: + **DI2** of the **first IOE**) **[-07] = Bus I/O In Bit 6** (or SK54xE and above: + **DI3** of the **first IOE**) **[-08] = Bus I/O In Bit 7** (or SK54xE and above: + **DI4** of the **first IOE**) **[-09] = Flag 1** **[-10] = Flag 2** **[-11] = Bit 8 BUS control word** **[-12] = Bit 9 BUS control word** The possible functions for the Bus In Bits can be found in the table of functions for the digital inputs. Function {14} "Remote control" is not possible.			

P481	[-01] ... [-10]	Function BusIO Out Bits *(Function of Bus I/O Out Bits)*		S	

0 ... 39
{ all 0 }

The bus I/O Out bits are perceived as digital outputs (P434). They can be set to the same functions.

In order to use this function, one of the bus setpoints (P543) must be set to >Bus I/O In Bits 0-7 <. The required function must then be assigned to the relevant bit.

With the SK 54xE in association with IO extension modules these I/O bits can also process their input signals.

[-01] = Bus I/O Out Bit 0
[-02] = Bus I/O Out Bit 1
[-03] = Bus I/O Out Bit 2
[-04] = Bus I/O Out Bit 3
[-05] = Bus I/O Out Bit 4 (or SK54xE and above: + **DO1** of the **first IOE**)
[-06] = Bus I/O Out Bit 5 (or SK54xE and above: + **DO2** of the **first IOE**)
[-07] = Bus I/O Out Bit 6 / Flag 1 (or SK54xE and above: + **DO1** of the **second IOE**)
[-08] = Bus I/O Out Bit 7 / Flag 2 (or SK54xE and above: + **DO2** of the **second IOE**)
[-09] = Bit 10 BUS status word
[-10] = Bit 13 BUS status word

The possible functions for the Bus Out Bits can be found in the table of functions for the digital outputs or the relays.

For further details, please refer to the manual for the AS interface, BU 0090.

P482	[-01] ... [-10]	Norm. BusIO Out Bits *(Scaling of bus I/O Out bits)*		S	

-400…400 %
{ all 100 }

Adjustment of the limit values of the relay functions/Bus Out Bits. For a negative value, the output function will be output negative.

When the limit value is reached and the setting values are positive, the relay contact closes, with negative setting values the relay contact opens.

The assignment of the arrays correspond to those of parameter (P481).

P483	[-01] ... [-10]	Hyst. BusIO Out Bits *(Hysteresis of bus I/O Out bits)*		S	

1…100 %
{ all 10 }

Difference between switch-on and switch-off point to prevent oscillation of the output signal.

The assignment of the arrays correspond to those of parameter (P481).

5.2.2 Additional parameters

Parameter {factory setting}	Setting value / Description / Note		Supervisor	Parameter set
P502 **[-01] ... [-05]**	**Value Masterfunction** *(Value master function)*		**S**	**P**
0 ... 57 { all 0 }	Selection of the master value of a Master for output to a bus system (see P503) - (up to SK 535E: max. 3 master values, SK 540 and above: max. 5 master values). The assignment of these master values to the slave is carried out via (P546) (...(P548)): **[-01] =** Master value 1 **[-02] =** Master value 2 **[-03] =** Master value 3 *SK 540E and above:* **[-04] =** Master value 4 **[-05] =** Master value 5			
	Selection of possible setting values for master values:			
	00 = Off **01 =** Actual frequency **02 =** Actual speed **03 =** Electricity **04 =** Torque current **05 =** State of digital inputs and outputs **06 =** *Reserved* **07 =** *Reserved* **08 =** Setpoint frequency	**09 =** Error message **10 =** *Reserved* **11 =** *Reserved* **12 =** Digital Out Bit 0…7 **13 =** *Reserved* **14 =** *Reserved* **15 =** *Reserved* **16 =** *Reserved* **17 =** Value analog input 1 **18 =** Value analog input 2	**19 =** Setpoint frequency master value **20 =** Setpoint freq. after master val ramp **21 =** Actual freq. without master value slip **22 =** Speed encoder **23 =** Actual freq. with slip (SW V2.0 and above) **24 =** Master value, act. freq. with slip (SW V2.0 and above) **53 =** *... 57 Reserved*	
P503	**Master function output** *(Master function output)*		**S**	
0 ... 5 { 0 }	For master-slave applications this parameter specifies on which bus system the master transmits the control word and the master values (P502) for the slave. On the slave, parameters (P509), (P510), (P546 ...) define the source from which the slave obtains the control word and the master values from the master and how these are to be processed by the slave.			
	0 = Off: no output of control word and master values. **1 = USS:** output of control words and master values to USS. **2 = CAN:** output of control words and master values to CAN (up to 250 kBaud). **3 = CANopen:** output of control words and master values to CANopen. **4 = System bus active:** no output of control word and master values, however via the ParameterBox or NORD CON, all participants which are set to ***System bus active*** are visible. **5 = CANopen+Sys.bus active:** output of control word and master values on CAN open via the ParameterBox or NORD CON, all participants which are set to ***system bus active*** are visible.			

P509	Source Control Word *(Source control word)*			

0 ... 10
{ 0 }

Selection of the interface via which the FI is controlled.

- **0 =** **Control terminals or keyboard control** ** with the ControlBox (if P510=0), the ParameterBox (not ext. p-box) or via BUS I/O Bits.
- **1 =** **Only control terminals** , the FI can only be controlled via the digital and analog inputs or via the bus I/O Bits.
- **2 =** **USS** control word *, the control signals (enable, direction of rotation, ...) are transferred via the RS485 interface. The setpoint is transferred via the analog input or the fixed frequencies.
  Above SK 540E this setting should also be selected if communication via Modbus RTU is intended. The frequency inverter automatically detects whether this is a USS protocol or a Modbus protocol.
- **3 =** **CAN** control word *
- **4 =** **Profibus** control word *
- **5 =** **InterBus** control word *
- **6 =** **CANopen** control word *
- **7 =** **DeviceNet** control word *
- **8 =** **Ethernet TU*** ** control word*
- **9 =** **CAN Broadcast** *
- **10 =** **CANopen Broadcast ***

NOTE:
For details about the respective Bus systems please refer to the respective Options descriptions.
www.nord.com -

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

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

***) The **Ethernet TU** setting must be used for all NORD Ethernet-based bus systems (e.g.: EtherCAT: SK TU3-ECT, PROFINET: SK TU3-PNT).

Note: Parameterisation of a frequency inverter via a field bus connection requires parameter (P509) "Control Terminals" to be set to the appropriate bus system

P510	[-01] [-02]	Setpoint source *(Setpoint source)*		S	

0 ... 10
{ all 0 }

Selection of the setpoint source to be parameterised.

[-01] = Main **setpoint source** **[-02] =** Auxiliary **setpoint source**

Selection of the interface via which the FI receives the setpoint.

- **0 =** **Auto (=P509):** The source of the auxiliary setpoint is automatically derived from the setting in the parameter P509 >Interface<
- **1 =** **Control terminals**, digital and analog inputs control the frequency, including fixed frequencies
- **2 =** **USS (**or Modbus RTU SK 540E and above**)**
- **3 =** **CAN**
- **4 =** **Profibus**
- **5 =** **InterBus**
- **6 =** **CANopen**
- **7 =** **DeviceNet**
- **8 =** **Ethernet TU**
- **9 =** **CAN Broadcast**
- **10 =** **CANopen Broadcast**

P513	Telegram time-out *(Telegram time out)*		S	

-0.1 / 0.0 / 0.1 ... 1000 s
{ 0.0 }

Monitoring function of the active bus interface. Following receipt of a valid telegram, the next one must arrive within the set period. Otherwise the FI reports an error and switches off with the error message E010 >Bus Time Out<.

0.0 = Off: Monitoring is switched off.

-0.1 = No error: Even if communication between BusBox and FI is interrupted (e.g. 24V error, Box removed, etc.), the FI will continue to operate unchanged.

P514	CAN baud rate ***(CAN baud rate)***			

0 ... 7
{ 4 }

Used to set the transfer rate (transfer speed) via the CANbus interface. All bus participants must have the same baud rate setting. With the use of the CANopen technology unit, settings from this parameter are only valid if the *BAUD* rotary coding switch on the technology unit has been set to **PGM**.

0 =	10kBaud	**3 =**	100kBaud	**6 =**	500kBaud
1 =	20kBaud	**4 =**	125kBaud	**7 =**	1MBaud * (for test purposes only)
2 =	50kBaud	**5 =**	250kBaud		

*) Reliable operation cannot be guaranteed

Information **Data takeover**

The baud rate is only read after a Power On, a Reset Node message or a Power On of the 24V bus supply.

P515	[-01] ... [-03]	CAN address *(CAN address)*			

0 ... 255
{ all 50 }

Setting of the basic CANbus address for CAN and CANopen. With the use of the CANopen technology unit, settings from this parameter are only valid if the BAUD rotary coding switch on the technology unit has been set to PGM.

Information **Data takeover**

The baud rate is only read after a Power On, a Reset Node message or a Power On of the 24V bus supply.

From software version 1.6 and above, this can be set in three levels:

[-01] = Slave address, Receipt address for CAN and CANopen (as before)

[-02] = Broadcast slave address, Broadcast – receipt address for CANopen (Slave)

[-03] = Master address, Broadcast – Transmission address for CANopen (Master)

P543	Actual bus value 1 *(Actual bus value 3)*		S	P

0 ... 24
{ 1 }

The return value 1 can be selected for bus actuation in this parameter.

The possible analog functions can be found in the following table.

NOTE: For further details please refer to the manual for the frequency inverter (P418, P543), the relevant BUS operating instructions or BU 0510.

P543 [-01] ... [-05]	Bus actual value *(Bus – Actual value)*		S	P

0 ... 57
{ [-01] = 1 }
{ [-02] = 4 }
{ [-03] = 9 }
{ [-04] = 0 }
{ [-05] = 0 }

In this parameter the return value for bus actuation can be selected.

NOTE: The actual values 4 and 5 must be supported by the relevant bus module. For further details please refer to the manual for the frequency inverter (P418, P543), the relevant BUS operating instructions or the manuals BU 0510 / BU0550.

[-01] = Bus - Actual value 1 **[-02] =** Bus - Actual value 2 **[-03] =** Bus - Actual value 3

[-04] = Bus - Actual value 4 **[-05] =** Bus - Actual value 5

0 =	Off	**13 =**	... 16 Reserved
1 =	Actual frequency	**17 =**	Value analog input 1
2 =	Actual speed	**18 =**	Value analog input 2
3 =	Current	**19 =**	Setpoint frequency master value*(P503)*
4 =	Torque current (100% = P112)	**20 =**	Setpoint frequency master value after ramp *"Setpoint frequency master value after ramp"*
5 =	Digital IO status [4]	**21 =**	Act. freq. without slip master value *"Actual frequency without slip master value"*
6 =	... 7 Reserved	**22 =**	Speed encoder *(only possible with SK 520E and encoder feedback)*
8 =	Setpoint frequency	**23 =**	Actual frequency with slip, *"Actual frequency with slip"* *(SW V2.0 and above)*
9 =	Error number	**24 =**	Master value, actual freq. with slip, *"Master value, actual freq. with slip"* *(SW V2.0 and above)*
10 =	... 11 Reserved	**53 =**	*... 57 Reserved*
12 =	BusIO Out Bits 0...7		

P544	Actual bus value 2 *(Actual bus value 2)*		S	P

0 ... 24
{ 0 }

This parameter is identical to P543.

Condition is PPO 2 or PPO 4 type (P507).

[4] The assignment of the digital inputs in P543/ 544/ 545 = 5

Bit 0 = DigIn 1	Bit 1 = DigIn 2	Bit 2 = DigIn 3	Bit 3 = DigIn 4
Bit 4 = DigIn 5	Bit 5 = DigIn 6 (SK 520E and above)	Bit 6 = DigIn 7 (SK 520E and above)	Bit 7 = Dig. func. AIN1
Bit 8 = Dig. func. AIN1 AIN2	Bit 9 = DigIn 8 (SK 540E and above)	Bit 10 = DigIn 1, 1.IOE (SK 540E and above)	Bit 11 = DigIn 2, 1.IOE (SK 540E and above)
Bit 12 = Out 1/ MFR1	Bit 13 = Out 2/ MFR2	Bit 14 = Out 3/ DOUT1 (SK 520E and above)	Bit 15 = Out 4/ DOUT2 (SK 520E and above)

P545	Actual bus value 3 *(Actual bus value 3)*		S	P

0 ... 24
{ 0 }

This parameter is identical to P543.
Condition is PPO 2 or PPO 4 type (P507).

P546	Digital Bus setpoint 1 *(Function of bus setpoint 1)*		S	P

0 ... 55
{ 1 }

In this parameter, a function is allocated to the output setpoint 1 during bus actuation.
The possible analog functions can be found in the following table.

NOTE: For further details please refer to the manual for the frequency inverter (P400, P546), the relevant BUS operating instructions or the manuals BU 0510 / BU0550.

P546 [-01] ... [-05]	Digital Bus setpoint *(Function of bus setpoint)*		S	P

0 ... 57
{ [-01] = 1 }
all other { 0 }

In this parameter, during bus actuation a function is allocated to the setpoint provided.

NOTE: The setpoints 4 and 5 must be supported by the relevant bus module. For further details please refer to the manual for the frequency inverter (P400, P546), the relevant BUS operating instructions or the manuals BU 0510 / BU0550.

[-01] = Bus setpoint 1 **[-02] =** Bus setpoint 2 **[-03] =** Bus setpoint 3

[-04] = Bus setpoint 4 **[-05] =** Bus setpoint 5

0 =	Off	**16 =**	Process controller lead
1 =	Setpoint frequency	**17 =**	BusIO In Bits 0...7
2 =	Torque current limit *(P112)*	**18 =**	Curve travel calculator
3 =	Actual frequency PID	**19 =**	Set relays, "*Output status*" (P434/441/450/455=38)
4 =	Frequency addition	**20 =**	Set analog output (P418=31)
5 =	Frequency subtraction	**21 =**	*... 45 reserved from SK 530E and above à BU 0510*
6 =	Current limit *(P536)*	**46 =**	Setpoint Torque processreg., *"Setpoint torque process controller"*
7 =	Maximum frequency *(P105)*	**47 =**	*reserved from SK 530E and above à BU 0510*
8 =	Actual PID frequency limited	**48 =**	Motor temperature *(SK 540E and above)*
9 =	Actual PID frequency monitored	**49 =**	*reserved from SK 540E and above à BU 0510*
10 =	Torque servo mode *(P300)*	**53 =**	d-correction F process *(SK 540E and above)*
11 =	Torque precontrol *(P214)*	**54 =**	d-correction Torque *(SK 540E and above)*
12 =	*Reserved*	**55 =**	d-correction F+torque *(SK 540E and above)*
13 =	Multiplication	**56 =**	*reserved from SK 540E and above à BU 0510*
14 =	Process controller actual value	**57 =**	*reserved from SK 540E and above à BU 0510*
15 =	Process controller setpoint		

P547	Digital Bus setpoint 2 *(Function of bus setpoint 2)*		S	P

0 ... 55
{ 0 }

This parameter is identical to P546.

P548	Digital Bus setpoint 3 *(Function of bus setpoint 3)*		S	P

0 ... 55
{ 0 }

This parameter is identical to P546.

P551	Drive profile *(Drive profile)*		S	

0 … 1
{ 0 }

According to the option the relevant process data profiles can be activated with this parameter.

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

Note **Activation of profiles**

This parameter is only **effective for pluggable** technology modules (SK TU3-…).

P560	Parameter, Saving mode *(Saving mode parameter)*		S	

0 ... 2
{ 1 }

0 = **Only in RAM**, changes to the parameter settings are no longer saved on the EEPROM. All previously saved settings are retained, even if the FI is disconnected from the mains.

1 = **RAM and EEPROM**, all parameter changes are automatically written to the EEPROM and remain stored there even if the FI is disconnected from the mains supply.

2 = **OFF**, no saving in RAM and EEPROM possible (no parameter changes are accepted)

NOTE: If BUS communication is used to implement parameter changes, it must be ensured that the maximum number of write cycles (100,000 x) in the EEPROM is not exceeded.

5.2.3 Information

Parameter		Setting value / Description / Note		Supervisor	Parameter set
P707	**[-01] ... [-03]**	**Software-Version** *(Software version/ revision)*			
0.0 ... 9999.9		This parameter shows the software and revision numbers in the FI. This can be significant when different FIs are assigned the same settings. Array 03 provides information about any special versions of the hardware or software A zero stands for the standard version.	**... ... [-01] =** Version number (1.7) **... ... [-02] =** Revision number (R0) **... ... [-03]** = Special version of hardware/software (0.0)		
P740	**[-01] ... [-13]**	**Process Data Bus In** *(Process data Bus In)*		**S**	
0000 ... FFFF (hex)		This parameter informs about the actual control word and the setpoints that are transferred via the bus systems. For display, a BUS system must be selected in P509	**[-01] =** Control word **[-02] =** setpoint value 1 **[-03] =** setpoint value 2 **[-04] =** setpoint value 3 **[-05] =** Bus I/O In Bits (P480) **[-06]** = Parameter data In 1 **[-07]** = Parameter data In 2 **[-08]** = Parameter data In 3 **[-09]** = Parameter data In 4 **[-10]** = Parameter data In 5 **[-11] =** setpoint value 1 **[-12] =** setpoint value 2 **[-13] =** setpoint value 3	Control word, source from P509. Setpoint data from main setpoint (P510 [-01]). The displayed value depicts all Bus In Bit sources linked with "*OR*". Data during parameter transfer: Order label (AK),Parameter number (PNU), Index (IND), Parameter value (PWE 1/2) Setpoint data from the master function value (Broadcast), if P509 = 9/10 (P510 [-02])	

P740	[-01] ... [-23]	Process Data Bus In *(Process data Bus In)*		S	

0000 ... FFFF (hex)

This parameter informs about the actual control word and the setpoints that are transferred via the bus systems.

For display, a BUS system must be selected in P509

[-01] = Control word	Control word, source from P509.
[-02] = setpoint value 1 **[-03] =** setpoint value 2 **[-04] =** setpoint value 3 **[-05] =** setpoint value 4 **[-06] =** setpoint value 5	Setpoint data from main setpoint (P510 [-01]).
[-07] = Bus I/O In Bits (P480)	The displayed value depicts all Bus In Bit sources linked with "*OR*".
[-08] = Parameter data In 1 **[-09]** = Parameter data In 2 **[-10]** = Parameter data In 3 **[-11]** = Parameter data In 4 **[-12]** = Parameter data In 5	Data during parameter transfer: Order label (AK),Parameter number (PNU), Index (IND), Parameter value (PWE 1/2)
[-13] = setpoint value 1 **[-14] =** setpoint value 2 **[-15] =** setpoint value 3 **[-16] =** setpoint value 4 **[-17] =** setpoint value 5	Setpoint data from the master function value (Broadcast), if P509 = 9/10 (P510 [-02])
[-18] = PLC control word	Control word, source PLC
[-19] = setpoint value 1 **[-20] =** setpoint value 2 **[-21] =** setpoint value 3 **[-22] =** setpoint value 4 **[-23] =** setpoint value 5	Setpoint data from the PLC.

P741	[-01] ... [-13]	Process Data Bus Out *(Process data Bus Out)*		S	

0000 ... FFFF (hex)

This parameter provides information about the actual status word and the actual values that are transferred via the bus systems.

[-01] = Status word	Status word, source from P509.
[-02] = Actual value 1 (P543) **[-03]** = Actual value 2 (P544) **[-04]** = Actual value 3 (P545)	
[-05] = Bus I/O Out Bit (P481)	The displayed value depicts all Bus OUT Bit sources linked with "*OR*".
[-06] = Parameter data Out 1 **[-07]** = Parameter data Out 2 **[-08]** = Parameter data Out 3 **[-09]** = Parameter data Out 4 **[-10]** = Parameter data Out 5	Data during parameter transfer.
[-11] = Actual value 1 master function **[-12] =** Actual value 2 master function **[-13] =** Actual value 3 master function	Actual value of master function P502 / P503.

P741	[-01] ... [-23]	**Process Data Bus Out** *(Process data Bus Out)*		S	
0000 ... FFFF (hex)	This parameter provides information about the actual status word and the actual values that are transferred via the bus systems.	**[-01] =** Status word		Status word, source from P509.	
		[-02] = Actual value 1 (P543 [-01]) **[-03] =** Actual value 2 (P543 [-02]) **[-04] =** Actual value 3 (P543 [-03]) **[-05] =** Actual value 4 (P543 [-04]) **[-06] =** Actual value 5 (P543 [-05])			
		[-07] = Bus I/O Out Bit (P481)		The displayed value depicts all Bus OUT Bit sources linked with "*OR*".	
		[-08] = Parameter data Out 1 **[-09]** = Parameter data Out 2 **[-10]** = Parameter data Out 3 **[-11]** = Parameter data Out 4 **[-12]** = Parameter data Out 5		Data during parameter transfer.	
		[-13] = Actual value 1 master function **[-14] =** Actual value 2 master function **[-15] =** Actual value 3 master function **[-16] =** Actual value 4 master function **[-17] =** Actual value 5 master function		Actual value of master function P502 / P503.	
		[-18] = PLC status word		Status word via PLC	
		[-19] = Actual value 1 PLC **[-20]** = Actual value 2 PLC **[-21]** = Actual value 3 PLC **[-22]** = Actual value 4 PLC **[-23]** = Actual value 5 PLC		Actual value data via PLC	

P745	**Module version** *(Module version)*			
-3276.8 ... 3276.8	Version status (software version) of the technology unit (SK TU3-xxx), but only when own processor is present, i.e. not for SK TU3-CTR. Have this data available if you have a technical query.			

P746	**Module status** *(Module status)*		S	
0000 ... FFFF (hex)	Shows the actual status (readiness, error, communication) of the technology unit (SK TU3-xxx), but only when own processor is present, i.e. not for SK TU3-CTR. Example: 0603_{hex} High byte = 06_{hex} à Profibus Low byte = 03_{hex} à Module ready + connection to master Details of the codes specific to the bus can be found in the section "Error monitoring" of the relevant supplementary instructions.			

P748 [-01] ... [-03]	Status CANopen *(CANopen status)*	SK 520E or higher	S	

0000 ... FFFF (hex)

[01] = CANbus/CANopen status

Bit 0 = 24V bus voltage supply
Bit 1 = CANbus in "Bus Warning" status
Bit 2 = CANbus in "Bus Off" status
Bit 3 ... Bit 5 = free
Bit 6 = Protocol of the CAN module is 0 = CAN or 1 = CANopen
Bit 7 = free
Bit 8 = "Bootsup Message" sent
Bit 9 = CANopen NMT State
Bit 10 = CANopen NMT State
Bit 11 = free
Bit 12 ... 14 = reserved
Bit 15 = free

CANopen NMT State	Bit 10	Bit 9
Stopped =	0	0
Pre-Operational =	0	1
Operational =	1	0

[-02] = reserved

[-03] = reserved

6. Operating status messages

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

Frequency inverter start disabled

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

Display is only possible with the NORD CON software or the ParameterBox (SK PAR-3H).

Warning messages

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

Error messages

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

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

- Switching the mains off and on again,
- By an appropriately programmed digital input (P420 ... P425 / P470 = Function 12),
- By switching off the “enable” on the frequency inverter (if no digital input is programmed for acknowledgement),
- By Bus acknowledgement or
- By P506, automatic error acknowledgement.

Device LEDs:	As delivered (without the technology unit) 2 LEDs (green/red) are visible externally. These indicate the actual device status. The **green LED** indicates that the mains voltage is present and operational, while a flashing code that increases in speed shows the degree of overload at the frequency inverter output. The **red LED** signals actual error by flashing with a frequency which corresponds to the number code of the fault.

6.1 Error monitoring

Various methods of error monitoring are available for the field bus level. Depending on the technology which is used, this enables the status of modules and communication to be indicated with LED displays, inverter parameters and field bus telegrams.

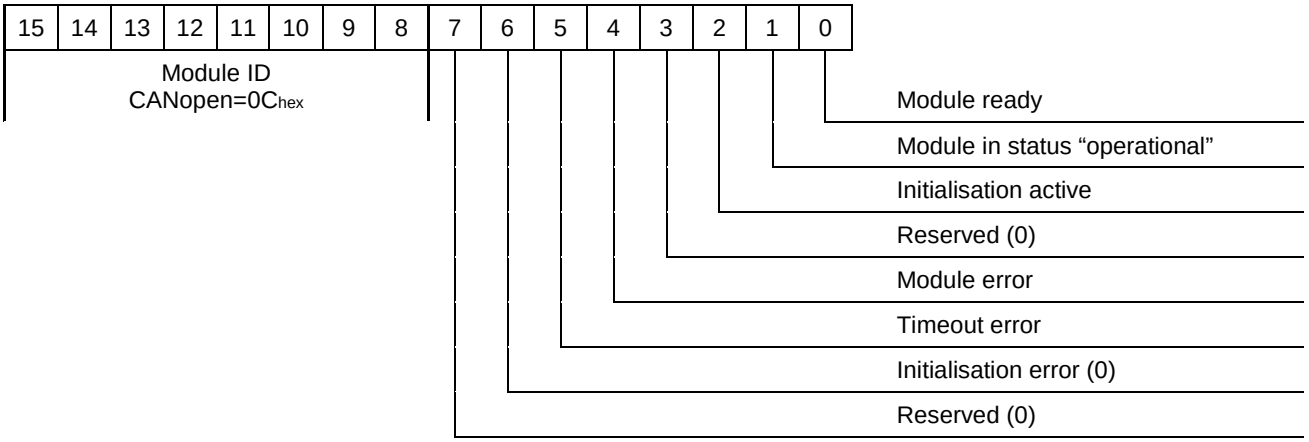
6.1.1 Status via parameter display

Module status of the technology unit

In parameter P746, the status of the CANopen technology unit can be read.

For the SK 700E, parameter P746 is a sub-index parameter. The status of the CANnord / CANopen technology unit (SK TU1-…) is shown in sub-index 0 (or Array -01), the status of the CANnord customer interface (SK CU1-…) is shown in sub-index 1 (or Array -02).

The parameter contains binary coded information which is displayed in hexadecimal:



Status of internal CANnord/CANopen, SK 511E and above

If the internal RJ45 CANnord/CANopen iterface (SK 511E and above) is used, parameter P748 array -01 can be used to display the status of the device.

The display is coded in hexadecimal, the individual bits are listed below:

<table>
<tr><th>Bit</th><th>Meaning</th></tr>
<tr><td>0</td><td>1 = 24V Bus supply voltage</td></tr>
<tr><td>1</td><td>1 = CAN Bus in "Bus Warning" status</td></tr>
<tr><td>2</td><td>1 = CAN Bus in "Bus Off" status</td></tr>
<tr><td>3 – 5</td><td>Vacant</td></tr>
<tr><td>6</td><td>The protocol of the CAN module is:
0 = CAN 1 = CANopen</td></tr>
<tr><td>7</td><td>Vacant</td></tr>
<tr><td>8</td><td>1 = "Bootsup Message" sent</td></tr>
<tr><td>9 – 10</td><td>CANopen NMT State
<table>
<tr><th>Status</th><th>Bit 10</th><th>Bit 9</th></tr>
<tr><td>Stopped</td><td>0</td><td>0</td></tr>
<tr><td>Pre-Operational</td><td>0</td><td>1</td></tr>
<tr><td>Operational</td><td>1</td><td>0</td></tr>
</table></td></tr>
<tr><td>11 – 15</td><td>Reserved</td></tr>
</table>

Table 26: CANnord/CANopen status, parameter P748

6.1.2 LED display with the technology unit:

The status of the technology unit is indicated by the integrated LEDs:

CANnord LED display

LED	Meaning
TxD (green)	Transmitting CAN data
RxD (green)	Receiving CAN data

Table 27: LED display, CANnord communication status

LED display CANopen

LED	Display	Meaning
CR (green)		
	Single flashing (1s)	CANopen status STOPPED
	Flashing (0.5s)	CANopen status PRE-OPERATIONAL
	Flashing (0.25s)	No other subscriber is in the bus or the wiring is faulty. (only possible when flashing with CE)
	To:	CANopen status OPERATIONAL
CE (red)		
	Off	No error
	Flashing	Bus warning, CAN controller error counter has reached or exceeded the warning limit. Check wiring / shielding / termination resistors No other subscribers available
	To:	Bus off, CAN controller has disconnected from the bus because a serious error has occurred, e.g.: Wiring error Incorrect baud rate set

Table 28: LED display, CANopen communication status

LED	Display	Meaning
DR (green)		
	Off	No voltage supply
	Flashing	Initialisation (init. phase)
	On	Module OK
DE (red)		
	Off	No error
	Flashing (0.2s)	Initialisation phase
	Flashing (0.5s)	Timeout error
	Single flashing (1s)	Inverter error (see frequency inverter instructions)
	To:	System error, e.g. plug contact not correct

Table 29: LED display, CANopen module status

6.1.3 Emergency Object telegram for inverter error messages

If an internal error occurs in the frequency inverter, an error message is sent automatically via the CANbus.

Error message		Error register	Not used				
Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7
0x00	0x81	0x01	0x00	0x00	0x00	0x00	0x00

Table 30: Structure of error message (Time-out through P513)

After the error is reset, the Emergency Object is sent with the error message null.

The Transmit ID for the error telegram is based on the following formula:

$$Sende\text{-}ID = 0x80 + Node\text{-}ID$$

The Node ID of the frequency inverter is set via the "ID-H" (or "IDx10")and "ID-L" (or "IDx1") switches on the CANopen unit or in the PGM mode via parameter P515.

6.1.4 Error lists,

CANopen error (hex)	FI error number	Meaning
1000	General error	The error number transmitted by FI is not known to the TO. It must be read out via P700 or another actual value.
4210	1.0	Inverter overtemperature
4310	2.0 / 2.1	Motor overtemperature / … I2t
2310	3.0	Inverter overcurrent
7112	3.1	Chopper overcurrent
2211	3.2	IGBT overcurrent (125%)
2212	3.3	IGBT overcurrent fast (150%)
2200	4.0 / 4.1	Module overcurrent / pulse switch-off overcurrent
3210	5.0	Link circuit overvoltage
3110	5.1	Mains overvoltage
3230	6.0	Link voltage undervoltage (charging error)
3120	6.1	Mains undervoltage
3130	7.0	Phase failure
6310	8.0	EEPROM parameter loss
5530	8.1 / 8.2	Invalid inverter type / copy error ext. EEPROM
8100	10.0 / 10.1 / 10.2 / 10.3 / 10.4 / 10.5 / 10.6 / 10.7	Telegram downtime, initialisation error, system error
5000	10.8	Communication error ext. Module
5110	11.0	ADU customer unit error
9000	12.0 / 12.1 / 12.2	Watchdog – customer/switch-off limit reached
7305	13.0	Incremental encoder 1

CANopen error (hex)	FI error number	Meaning
8400	13.1	Speed slip error
8300	13.2	Slip error switch-off monitoring
8710	13.5	Flying saw acceleration too low
8711	13.6	Flying saw value incorrect
8600	14.0 / 14.1	Reserved
8612	14.2	Reference limit
7300	14.3	Sensor
7306	14.4	Incremental encoder 2
7310	14.5	Speed sensor
7320	14.6 / 14.7 / 14.8	Position sensor
6000	15.0 / 15.1 / 15.2 / 15.3 / 15.4 / 15.5 / 15.6 / 15.7 / 15.8 / 20.1 / 20.2 / 20.3 / 20.4 / 20.5 / 20.6 / 20.7 / 20.9 / 21.0	System error, device software
7120	16.0 / 16.1	Phase error motor / motor current monitoring during brake operation
5300	17.0	Control panel
FF10	18.0	Safety circuit
FF11	19.0	Parameter identification error
5510	20.0	RAM data memory
5520	20.8	EPROM error
7330	25.0	Hiper. abs./inc. error
7331	25.1	Universal encoder communication
7332	25.2	No correspondence Universal Encoder
7333	25.3	Universal encoder resolution
7334	25.4	Universal encoder error

Table 31: Assignment of CAN open errors to inverter errors

7. Examples

Various examples are shown below to clarify the control and parameterisation of the frequency inverter with the bus system.

7.1 Mains switch-on

After the CAN participant has been switched on it logs into the system with the CAN ID: 700_{hex} + Node ID.

Example

Node ID: 50_{dec} à 32_{hex}

Mains On à if the participant was recognised 732_{hex} is transmitted.

As no valid telegram was sent at this time, the inverter switches to the status "Starting disabled" (à status word: 0B40).

7.2 Operational settting of the bus participant

Be sending **0001** to *ID000* all participants are set to "Operational".

7.3 Process data (PDO)

The exchange of process data is carried out via PDOs and is illustrated in the following example.

Example:

Communication via: Technology unit SK TU4-CAO

Scope of data: STW and SW1

Communication settings on the frequency inverter

Parameter number	Parameter name	Setting	Meaning
P509	Setpoint source	6 or 17	CANopen
P510	Setpoint source	0	Auto
P515 (or rotary coding switch on the bus module)	CAN address (Node ID)	50	($50_{dec} = 32_{hex}$)
P551	Drive profile	0	Off

Identifier:

CAN ID for Rx-PDO1: 200_{hex} + NODE-ID à $200_{hex} + 32_{hex} = 232_{hex}$ (control word + setpoint 1)

CAN ID for Tx-PDO1: 180_{hex} + NODE-ID à $180_{hex} + 32_{hex} = 1B2_{hex}$ (status word + actual value 1)

Mapping:

	Process data word 1		Process data word 2	
CAN-ID	Byte 0	Byte 1	Byte 2	Byte 3
for Rx-PDO1	Object 3000 (control word)		Object 3002 Sub 1 (setpoint 1)	

CAN-ID	Byte 0	Byte 1	Byte 2	Byte 3
for Tx-PDO1	Object 3001 (status word)		Object 3003 Sub 1 (actual value 1)	

Information — Objects 3002 and 3003

Objects 3002 and 3003 can be used to specify which setpoint or actual value is to be transferred. The significance of the setpoints or actual values is set using the parameters P543-P548 in the frequency inverter.

Information — Little Endian data format

Data transfer is performed in *Little Endian* format. This means that in the data word, the High byte follows **after** the Low byte. Example: "047E" à *7E 04*.

In order to be able to control the frequency inverter, the CANopen status must first be set to “Operational”

Setting the frequency inverter to "Ready for switch-on"

After switching on, the frequency inverter is in “Switch-on block” status. It has to be switched to "Standby" status using a control command. To do so, the control word “0x047E” must be transmitted. The PDO telegram therefore has the following structure:

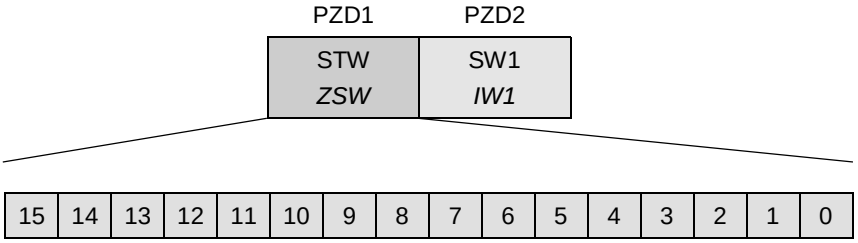
CAN-ID	Byte 0	Byte 1	Byte 2	Byte 3	
232_{hex}	$7E_{hex}$	04_{hex}	00_{hex}	00_{hex}	*Order*
$1B2_{hex}$	31_{hex}	$0B_{hex}$	00_{hex}	00_{hex}	*Response*

Enabling the frequency inverter with 50% of its maximum frequency

The drive unit is to operate at 50% of its maximum frequency. 100% corresponds to a setpoint of 4000_{hex}. Therefore "0x047F" must be sent as the control word and "0x2000" must be sent as the setpoint:

CAN-ID	Byte 0	Byte 1	Byte 2	Byte 3	
232_{hex}	$7F_{hex}$	04_{hex}	00_{hex}	20_{hex}	*Order*
$1B2_{hex}$	37_{hex}	$0B_{hex}$	00_{hex}	20_{hex}	*Response*

Structure of the control word / status word



Example: *"Ready to start"*

Control word			
Bit	**Value**	**Value HEX**	**Meaning**
15	0	0	Parameter set Bit 1 off
14	0		Parameter set Bit 0 off
13	0		Reserved
12	0		Rotation left is off
11	0	4	Rotational direction: right
10	1		Control data valid
9	0		Not function P481, 12
8	0		Not function P481, 11
7	0	7	No (error) acknowledgement
6	1		Enable setpoint
5	1		Enable ramp
4	1		Enable pulses
3	1	E	Operation enabled
2	1		Emergency Stop not active
1	1		Do not disable voltage
0	0		Not ready for operation

Status word			
Bit	**Value**	**Value HEX**	**Meaning**
15	0	0	Parameter set Bit 1 off
14	0		Parameter set Bit 0 off
13	0		Not function P481,10
12	0		Rotation left is off
11	1	B	Rotation right is on
10	0		Not function P481, 9
9	1		Bus controller active
8	1		Setpoint reached
7	0	3	No warning
6	0		Starting not disabled
5	1		No emergency stop
4	1		Voltage enabled
3	0	1	No error
2	0		Operation not enabled
1	0		Not ready for operation
0	1		Ready to start

7.4 Reading and writing parameter data (SDO)

Reading and writing of parameter data is performed via SDOs and is illustrated in the following examples.

Detailed information about the structure of an SDO (e.g: definition of the control bytes) can be found in Section 4.3.4.

Information — **Parameter objects**

Parameters are mapped in objects above 2000_{hex}!

Example

Node ID	$=50_{dec} = 32_{hex}$
Transmission address:	$= 632_{hex}$ ($600_{hex} + 32_{hex}$)
Receive address:	$= 5B2_{hex}$ ($580_{hex} + 32_{hex}$)
P102 „"Acceleration time":	$= 102_{dec} = 66_{hex}$ à $2000_{hex} + 66_{hex} = 2066_{hex}$
Parameter set 1	$= 01_{hex}$
Value **1.03s**:	= 1.03s à integer value: $=103_{dec} = 0067_{hex}$
Control byte:	
Send 16 bit value:	$= 2B_{hex}$
Load 16 bit value:	$= 40_{hex}$

Telegrams:

Writing parameter data

Sending a parameter setting to the FI:

ID 632 à 2B 6620 01 67 00

At the transmission address: 632_{hex} the control byte $2B_{hex}$ for a 16Bit value with the value 0067_{hex} (1,03s) is written in the parameter 2066_{hex} („P102 acceleration time“) in parameter set 1 Array 1 (01_{hex}).

Reading parameter data

Loading a parameter setting from the FI:

Query to the FI

ID 632 à 40 6620 01

At the transmission address: 632_{hex} the control byte 40_{hex} for the request is sent to the frequency inverter to read out the saved value from the parameter 2066_{hex} ("P102 acceleration time") iin parameter set 1 Array 1 (01_{hex}).

Response from the FI

ID 5B2 à 4B 6620 01 6700

At the receiving address: $5B2_{hex}$ the 16 bit value (status byte $4B_{hex}$) is delivered from the parameter 2066_{hex} ("P102 acceleration time") into parameter set 1 Array 1 (01_{hex}) with the value of 0067_{hex} (1.03s).

ATTENTION — **EEPROM writing cycles**

The maximum number or write cycles on the EEPROM of the frequency inverters is limited to 100,000 cycles. Continuous writing to the EEPROM therefore results in the destruction of the EEPROM.

Writing to the RAM of the frequency inverter should therefore be used for writing parameter data. The setting for this is made in parameter P560 of the frequency inverter.

8. Additional information

8.1 Electronic data sheet (eds file)

All available objects are contained in the (SK***E.eds) “Electronic data sheet” (eds file). This can be downloaded free of charge from www.nord.com.

http://www2.nord.com/cms/de/documentation/software/software_detail_14558.jsp#top

The selection of the correct file is made according to the name of the relevant bus module (e.g. SK TU3-CAO). The correct assignment can be found in the attached readme.txt file. If necessary, various versions of the eds file are available for selection. In this case, the correct version must be selected according to the firmware version of the frequency inverter (P707).

8.2 Further documents

Internet	www.can-cia.org
	www.drivecom.org
Literature	CIA draft Standard 301
	CIA draft Standard 402

8.3 Repair information

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

8.3.1 Repairs

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

NORD Electronic DRIVESYSTEMS GmbH

Tjüchkampstraße 37

26605 Aurich, Germany

For queries about repairs, please contact:

Getriebebau NORD GmbH & Co. KG

Tel.: 04532 / 289-2515

Fax: 04532 / 289-2555

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

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

Information **Reason for return**

If possible, the reason for returning the component/device should be stated. If necessary, at least one contact for queries should be stated.

This is important in order to keep repair times as short and efficient as possible.

On request you can also obtain a suitable return goods voucher from Getriebebau NORD.

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

ATTENTION **Possible Consequential Damage**

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

8.3.2 Internet information

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

8.4 Keyword Index

ASIC	Integrated circuit specific to the application
Baud rate	The transmission rate for serial interfaces in bits per second
Binary code	The designation for a code in which messages are communicated by "0" and "1" signals.
Bit / Byte	A bit (binary digit) is the smallest unit of information in the binary system. A byte consists of 8 bits.
Broadcast	In a network, all slave participants are addressed simultaneously by the master.
CAN	Controller Area Network is an asynchronous serial field bus system
CANopen	Designates a communications protocol based on CAN
COB - ID	Communication Object Identifier à Identifier of a CAN/CANopen message
EDS	Electronic Data Sheet
EMCY message	Emergency message (error telegram)
Little Endian	Describes the sequence in which the bytes are processed in a data word. In this case first the Low byte and then the High byte
Identifier	Unique definition of a message ("addressing") à Address of a CAN message box (i.e. addressing of a message and not the participant); a node may have several identifiers.
ISO	The International Standards Organisation is the international association of standardisation organisations and produces international standards in all fields, with the exception of electricity and electronics.
Node	Bus participant, e.g. an FI, I/O module, etc.
OSI layer model	The Open Systems Interconnection Reference Model (OSI) defines the elements, structures and tasks necessary for data communication and assigns these to the times for the communication process in seven consecutive layers.
Polling	Cyclical querying of individual components by a central component (NMT master / NMT slave)
Producer-consumer model	A participant (producer) places data on the bus, all other participants (consumers) receive this message and decide on the basis of the identifier, whether this message is relevant to them.

8.5 Abbreviations

AIN	Analog input
AOUT	Analogue output
DI (DIN)	Digital input
DO (DOUT)	Digital output
DP	Decentralized peripheral
EEPROM	Non-volatile memory
EMC	Electromagnetic compatibility
FI	Frequency inverter
GND	Earth
HW	Hardware
IND	Index
IO (I/O)	In / Out (Input / Output)
IW	Actual value
LED	Light-emitting diode
P	Parameter which depends on a parameter set
Pxxx	Parameter number
PDO	Prozess Data Object
PKE	Parameter identifier
PNO	PROFIBUS users´ organisation
PPO	Parameter Process data Object
PWE	Parameter value
PZD	Process data
SDO	Service Data Object
STW	Control word
SW	Software version, P707
ZSW	Status word

Key word index

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