Intelligent Drivesystems, Worldwide Services

SUPPLEMENTARY MANUAL BU 0280 GB

DEVICENET
FOR FREQUENCY INVERTER **NORDAC SK 200E**

Illustration of devices with options

BU 0280 GB

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NORDAC frequency inverter

Safety and operating instructions for drive power converters

(as per: Low voltage guideline 73/23/EEC)

1. General

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

Unauthorised removal of covers, improper use, incorrect installation or operation leads to the 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 erection, 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 being installed in machines, the drive power converter cannot be commissioned (i.e. implementation of the proper use) until it has been ensured that the machine meets the provisions of the EC directive 89/392/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 (89/336/EEC) is complied with.

The drive power converters meet the requirements of the low voltage directive 73/23/EEC. The harmonised standards in prEN 50178/DIN VDE 0160, together with EN 60439-1/VDE 0660 Part 500 and EN 60146/VDE 0558 were applied for the drive power converter.

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

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 that can be easily damaged by incorrect handling. Electrical components must not be mechanically damaged or destroyed (this may cause a health hazard!).

5. Electrical connection

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

The electrical installation must be implemented as per 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 limit values specified in the EMC regulations is the responsibility of the manufacturer of the system or machine.

6. Operation

Systems where drive power converters are installed must be equipped, where necessary, with additional monitoring and protective equipment as per the applicable safety requirements, e.g. legislation concerning technical equipment, accident prevention regulations, etc. Modifications to the drive power converter using the operating software are permitted.

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. Comply with the applicable information signs located on the drive power converter.

All covers must be kept closed during operation.

7. Maintenance and repairs

The manufacturer documentation must be complied with.

These safety instructions must be kept in a safe place!

Documentation

Designation: BU 0280 GB
Part. No.: 607 28 01
Device series: DeviceNet for SK 200E
Device types: **SK CU4-DEV**
SK TU4-DEV(-C) with SK TI4-TU-BUS
SK TU4-DEV-M12(-C) with SK TI4-TU-BUS

Version list

Designation of previous issues	Software version	Comments
BU 0280 GB, September 2009 Part. No. 607 2801 / 3709	V 1.1 R2	First issue

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NOTE

This supplementary operating manual is only valid in conjunction with the operating manual supplied for the respective frequency inverter.

Intended use of the frequency inverter

Compliance with the operating instructions **is the requirement for error-free operation** and the fulfilment of any warranty claims. **You must first read these operating instructions** before working with the device!

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

The field bus technology options described here are intended for use in combination with SK 200 E series frequency inverters. Use with other series is only possible with the SK TU4-DEV(-C)) and SK TU4-DEV-M12(-C) technology modules for the SK 500E. The use of these technology options with other devices is not permitted and can lead to their destruction.

The field bus technology options and the associated frequency inverters are devices for fixed installation on motors or in equipment close to the motor to be operated. All data regarding technical data and permissible conditions at the installation site must be complied with.

Commissioning (implementation of the intended use) is not permitted until it has been ensured that the machine complies with the EMC directive 89/336/EEC and that the conformity of the end product meets the machine directive 89/392/EEC (note EN 60204).

1 General information

Various technology options are available for Getriebebau Nord frequency inverters. General information regarding these can be found in the relevant main manual of the frequency inverter series (e.g. Manual BU0200 for the SK 200E frequency inverter series). Further information concerning special technology options (e.g. the field bus module) is included in the relevant supplementary operating instructions.

This DeviceNet documentation contains supplementary descriptions concerning the DeviceNet options for the SK 200E frequency inverter series.

The description of other optional modules (e.g. CANopen, Profibus DP) is dealt with in other supplementary documentation.

In order to set up communication with DeviceNet, either an internal **Customer Unit** or an external **DeviceNet Technology Unit** (according to the particular application) must be installed and connected.

The DeviceNet bus system

DeviceNet allows numerous different automation devices to exchange data with the frequency inverters. PLC's, PC's, operating and monitoring devices can all communicate via a uniform bus in serial bit mode. DeviceNet is primarily used for communication between sensor and actuator where system response needs to be very fast. DeviceNet is primarily used where time critical, fast and complex communication between the individual devices is essential. DeviceNet is a suitable alternative to expensive 24-volt parallel signal transmission and transmission of measured values. This type of DeviceNet, which is optimised to speed, is used for instance for operating frequency inverters on automation devices.

1.1 Overview

Features of DeviceNet modules

- Electrically isolated bus interface
- Transfer rate up to 500 kBaud
- Easy connection of the frequency inverter, optionally via M12 round plugs or screw terminals
- Looping of the DeviceNet via the modules is possible
- Integrated bus termination resistor
- DeviceNet-specific status display with 2 LEDs
- Module or FI-specific status display with 2 LEDs
- Up to four 24V inputs and two 24V outputs are integrated into the bus module
- Direct connection of up to 4 sensors and 2 activators via M12 round plug connectors on the SK TU4-DEV-M12(-C) version. Visualisation of signal status via LEDs
- DeviceNet gateway solution → up to 4 frequency inverters can be connected to a DeviceNet module
- Up to 64 DeviceNet modules can be connected to the bus, so that it is possible to operate up to 256 frequency inverters on a single bus.
- Interface (RS232/RS485) for parameter access by means of the SK CSX-3H or SK PAR-3H manual control unit or NordCon software via RJ12 connector (Except for SK CU4-DEV. Here parameter access via the SK 200E frequency inverter is possible)
- Available as versions for installation in the inverter (IP20) or in a separate housing (optionally IP55 / IP66)

1.2 Delivery

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

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

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

1.3 Scope of supply

Standard version:	**SK CU4-DEV**	IP20 or
	SK TU4-DEV(-M12)(-C)	IP55, **(optionally IP66)**

Operating instructions as PDF file on CD ROM including NORD CON, (Windows PC-based parameterisation software)

Available accessories: **SK TI4-TU-BUS(-C)** (bus connection unit, required for SK TU4…)

SK TIE4-WMK-TU, wall-mounting kit TU4

M12 round plug connector

Matching **RJ12 to SUB-D9** adapter cable to connection to a PC

ParameterBox: **SK CSX-3H**, SimpleBox, 4 digit 7 segment LED display

ParameterBox: **SK PAR-3H**, ParameterBox, plain text LCD display

1.4 Certifications

1.4.1 European EMC Directive

If the NORDAC SK 200E or its options are installed according to the recommendations in this instruction manual, it meets all EMC directive requirements, as per the EMC product standard for motor-operated systems EN 61800-3.

1.4.2 RoHS compliance

SK 200E series frequency inverters or their options are designed to be RoHS compliant according to Directive 2002/95/EEC

1.5 Type code / Optional BUS modules

BUS = Bus module or I/O extension

SK TU4-DEV (-C-M12-WMK-TU)

- Wall mounting kit: for external technology units TU4
- M12 system connectors: only TU4, alternative to terminals
- IP protection class: *Standard* = IP55, C = “coated” IP66
- Option type: CAO = CANopen, PBR = Profibus, DEV = DeviceNet, IOE = I/O-Erweiterung
- Option series: TU4 = external technology unit
  CU4 = internal customer unit

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

Optional external
technology unit, SK TU4-...

Optional internal
technology unit, SK CU4-...

1.6 Version with protection class IP55 / IP66

NORDAC SK 200E frequency inverters and the **external additional modules** are available in all sizes and powers in the protection classes IP55 (standard) or IP66 (optional).

The protection class IP66 must always be included in the order when ordering!

There are no restrictions or differences to the scope of functions in either protection class. In order to differentiate the protection classes, modules with protection class IP66 are given an extra " -**C**" (**c**oated → coated PCBs) in their type designation.

e.g. SK TU4-DEV-**C**

IP55 version:

The IP55 version of the external technology units is the **standard** version. Both versions (inverter-mounted – as an attachment to the frequency inverter or wall mounted on the wall bracket) are available.

IP66 design:

The IP66 design is a modified **option** compared to the IP55 design. With this design, both versions (inverter-mounted or wall-mounted) are also available. The modules available for the IP66 version have the same functionalities as the corresponding modules for the IP55 version.

NOTE

The modules for the IP66 design are identified by an additional "-**C**" and are modified according to the following **special measures**!

Special measures:

Impregnated PCBs, painted housing

Diaphragm valve for pressure compensation on temperature changes.

Low pressure test

→ A free M12 screwed connection is required for low pressure testing. After successful testing, a diaphragm valve is inserted here. This screw connection is therefore no longer available for a cable gland.

NOTE

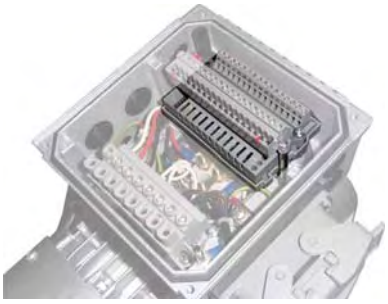
For all versions, care must be taken that the cable and the cable gland are carefully matched. This is essential to ensure that the required protection class is maintained.

2 Assembly and installation

2.1 Installation and assembly

Internal and external technology modules designed for NORDAC SK 200E series are available for DeviceNet. Except for the number of digital inputs and outputs, the functionalities of the various DeviceNet modules are identical.

These are used to connect SK 200E series speed regulated drive units to overriding automation systems via the DeviceNet field bus. Both the SK 200E 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**" (**c**oated → coated board) to differentiate the IP55 and IP66 protection classes.



SK TI4-… with integrated technology unit SK CU4-…

SK 200E with external technology unit SK TU4-… and BUS connection module SK TI4-TU-BUS

SK TIE4-WMK-TU with BUS connection module SK TI4-TU-BUS and external technology unit SK TU4-… or SK TU4-…-M12

The internal technology modules (**Customer Unit, SK CU4-**...) – designated as the **customer unit** – are integrated into the connection unit of the SK 200E. The electrical connection to the SK 200E is made via the internal system bus. The connection to external peripheral devices is made via screw terminals. The use of the optionally available 4 or 5 pin M12 round plug connector, installed in the connection unit of the SK 200E, provides a possible interface for connection to the field bus. A maximum of one customer interface (including any 24V module) can be installed in the SK 200E frequency inverter.

Optional internal
customer unit, SK CU4-...

The external technology modules **(Technology Unit, SK TU4-...)** – designated as the **technology unit** – are externally attached to the SK 200E connection unit and are therefore easy to access. Mounting of the SK TU4-... separate from the frequency inverter is possible by means of the optional wall mounting kit **SK TIE4-WMK-TU**. The electrical connection to the SK 200E is made via the internal system bus. 4 or 5 pin M12 round plug connectors (for installation in the BUS connection unit **SK TI4-TU-BUS**) are available as an option for connection of the field bus cable. The external modules are also available as a version with integrated M12 round plug connectors (SK TU4-xxx-**M12**). These enable the connection of up to 4 digital inputs and 2 digital outputs.

Optional external technology unit, SK TU4-...

NOTE

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

Mounting of the external technology unit **remote** from the frequency inverter is possible with the additional wall-mounting kit (SK TIE4-WMK-TU). However, a maximum cable length of **30m** should not be exceeded.

The external technology units (SK TU4-...(-M12) cannot be operated without the BUS connection unit (SK T14-TU-BUS)!

NOTE

Only one technology unit (SK CU4... or SK TU4...) can be connected to a system bus.

2.1.1 Features of DeviceNet modules

Bus Module	Description	Data
DeviceNet module **SK CU4-DEV** Part No. 275271002 (IP20)	 This option enables control of the NORDAC SK 200E via DeviceNet. This option is integrated into the connection unit of the frequency inverter.	Baud rate: up to 500 kBaud Connection: 16-terminal screw terminal bar 2x digital inputs: Low: 0-5V, High: 11-30V
DeviceNet module* **SK TU4-DEV(-C)** Part No. 275281102 (IP55) Part No. 275281152 (IP66)	 This option enables control of the NORDAC SK 200E via DeviceNet. This option is installed externally to the frequency inverter. According to the installation location, at least one "BUS connection unit"* is required.	Baud rate: up to 500 kBaud Connection: 36 pin spring terminal bar of the " BUS connection unit" * 4x digital inputs: Low: 0-5V, High: 11-30V 2x Digital outputs: 0/24V
DeviceNet module with M12*) **SK TU4-DEV-M12(-C)** Part No. 275281202 (IP55) Part No. 275281252 (IP66)	 This option enables control of the NORDAC SK 200E via DeviceNet. This option is installed externally to the frequency inverter. According to the installation location, at least one "BUS connection unit"* is required.	As for SK TU4-DEV(-C) but with additional: 6x M12 sockets for the connection of up to 4 sensors and 2 actuators via 5 pin M12 round plug connectors (B coded)
Connection unit for TU4 **SK TI4-TU-BUS** Part No. 275280000 (IP55) Part No. 275280500 (IP66)	 The connection unit is always required in order to use an external technology unit (SK TU4...). This implements the connection of the technology unit to the SK 200E or the wall-mounting kit.	Connection: 36 pin spring terminal bar 36x 2.5mm^2 AWG 26-14 spring terminals
TU4 wall-mounting kit **SK TIE4-WMK-TU** Part. No. 275274002	 With the wall mounting kit, a technology unit can be used/installed separately from the SK 200E.	
*) in order to use the TU4 modules, a suitable SK TI4-TU-BUS connection unit must always be available!		

2.1.2 Installation of the Customer Unit SK CU4-DEV

WARNING

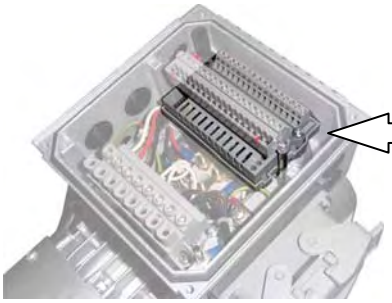
Installation must be carried out by qualified personnel only, paying particular attention to safety and warning instructions.

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

Installation of the SK CU4... customer unit **remote from the frequency inverter** is not permitted. This must be installed in the immediate vicinity of the SK 200E frequency inverter.

The installation of customer units is carried out in the connection unit SK T14… SK 200E underneath the control terminal bar. Fastening is by means of the terminal bar of the frequency inverter and two M4x20 screws (bag enclosed with the customer unit). Only one customer unit per FI is possible!

The pre-assembled cables for connection to the frequency inverter (SK 200E) are also included in the bag enclosed with the customer unit. Connections are made according to the following table:



SK TI4-… with integrated customer unit SK CU4-DEV

Internal customer unit SK CU4-DEV

Bag enclosed with internal customer unit

Function	Terminal label		Cable colour
Power supply (between frequency inverter and customer unit)	**44**	24V	brown
	40	GND	blue
System bus	**77**	SYS+	black
	78	SYS-	grey

NOTE

Set the termination resistors of the system bus!

See Section 2.2.3 “Configuration”

2.1.3 Installing the SK TU4-DEV-… Technology Unit

WARNING

Installation must be carried out by qualified personnel only, paying particular attention to safety and warning instructions.

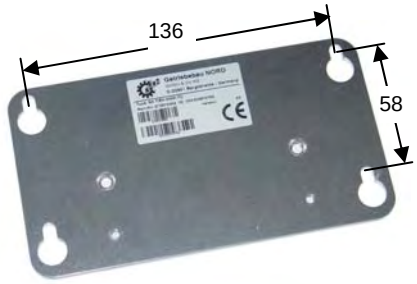
Modules must not be installed or removed unless the device is free of voltage. The slots may only be used for the applicable modules.

Mounting of the external technology unit **remote** from the frequency inverter is possible **with the additional wall-mounting kit** (SK TIE4-WMK-TU).

Together with the BUS connection unit SK TI4-TU-BUS(-C) the technology unit SK TU4-DEV-…(-C) forms a stand-alone functional unit. This can be attached to the SK 200E frequency inverter or installed separately by means of the optional SK TIE4-WMK-TU wall-mounting kit.

2.1.3.1 Dimensions of the SK TI4-WMK-TU wall-mounting kit

The optional wall-mounting kit has the following dimensions.



2.1.3.2 BUS connection unit SK TI4-TU-BUS(-C)

Various cable glands closed by caps are located on the sides of the BUS connection unit.

External BUS connection unit = SK TI4-TU-BUS

The following holes are available as cable inlets:

- 2 x 1 M20 x 1.5 (on sides)
- 4 M20 x 1.5 (underside)
- 2 M25 x 1.5 (rear side, without caps)

The transparent screw-on cover (M20 x 1.5) on the upper right serves as access to the diagnostic interface (RJ12 socket, interface RS232/RS485). The upper left screw-on cover is not used.

2.1.3.3 Mounting the SK T14-TU-BUS on the SK 200E

The screw fittings and seals required for installation are enclosed with the modules or are fitted to the intended locations.

Mounting of the technology unit on the SK 200E must be carried out as follows:

1. Switch off the mains.
2. Remove the two M25 caps on the required side of the frequency inverter (right / left).
3. Remove the printed circuit board (with terminal bar) from the BUS connection unit.
4. Install the SK TI4-TU-BUS (with adhered seal) on the SK 200E using the 4 enclosed bolts.
5. Replace the printed circuit board (See point 3) and carry out the electrical connections.
6. Fit and screw on the SK TU4 module.

Mounting the external technology unit on the SK 200E

Technology unit SK TU4-DEV (-M12)

BUS connection unit SK TI4-TU-BUS

SK TI4-WMK-TU wall-mounting kit

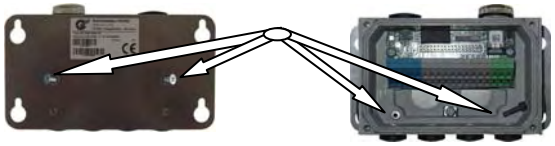
2.1.3.4 Wall mounting the SK TI4-TU-BUS

The screw fittings (except for anchoring screws) and seals required for installation are enclosed with the modules or are fitted to the intended locations.

The connecting cable between the technology unit and the SK 200E should not be longer than 30m.

1. Mount the SK TI4-TU-BUS connecting unit with adhered seal on the wall-mounting kit. To do this: Insert the 2 x cheese-head screws (enclosed with wall-mounting kit) into the (countersunk) holes from the outside and with the 2 x bolts (enclosed with the wall-mounting kit) securely screw both components together from the inside (BUS connection unit).

Wall-mounting kit SK TI4 WMK TU with field bus technology unit



2. Make a suitable cable connection between the technology unit and the frequency inverter. Take care that there is appropriate screw fitting and sealing of the modules. The cable sets enclosed with the BUS connection unit are not used.
3. Fit and screw on the SK TU4 module.

2.2 Electrical connection

WARNING THE DEVICES MUST BE EARTHED.

Safe operation of the devices presupposes that qualified personnel install and commission it in compliance with the instructions provided in these operating instructions.

In particular, the general and regional mounting and safety regulations for work on high voltage systems (e.g. VDE) must be complied with as must the regulations concerning professional use of tools and the use of personal protection equipment.

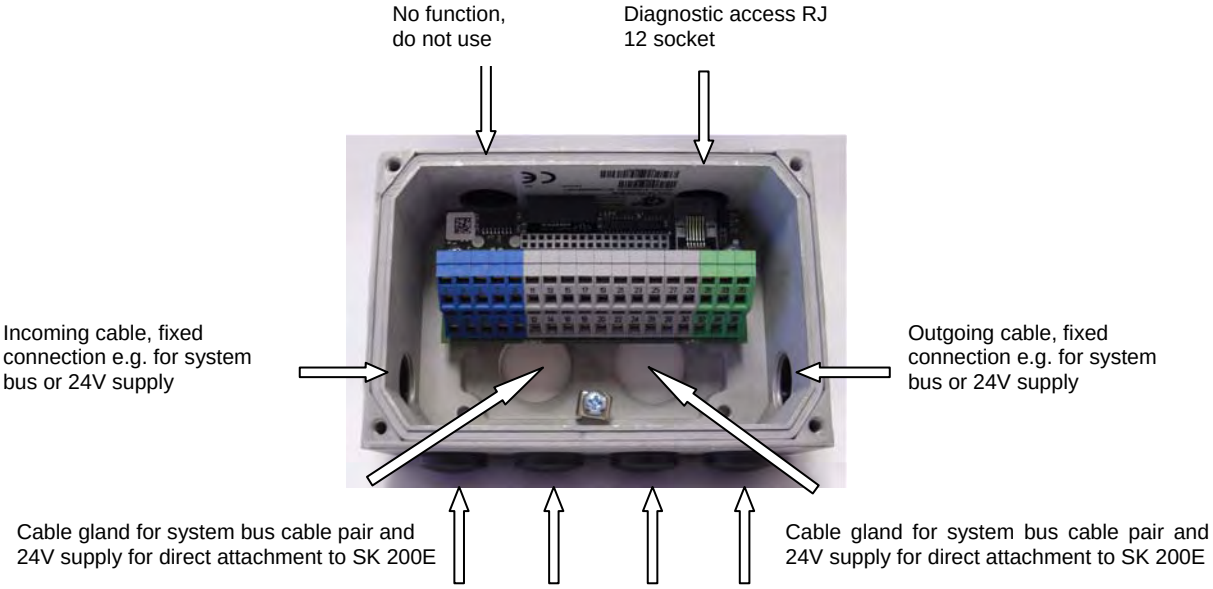
Dangerous voltages can be present at the motor connection terminals of the frequency inverter even when the inverter is switched off. Always use insulated screwdrivers on these terminal fields.

Ensure that the input voltage source is not live before setting up or changing connections to the unit.

Make sure that the inverter and motor are specified for the correct supply voltage.

2.2.1 Cable glands

Both the SK 200E connection unit and the bus module provide extensive facilities for the connection of all the required cables. The cables may enter the housing via cable glands and be connected to the terminal bar. However, appropriate round plug connections (e.g.: M12 round plug connectors in M16 cable glands) may be fitted in order to provide a plug-in solution.



M16 cable gland or installation of M12 round plug connection for:

- incoming and outgoing DeviceNet cables
- 24V and 24V (for DO) supply
- System bus
- I/O peripherals: Sensors and actuators

Example:
Cable glands for BUS connection unit SK TI4-TU-BUS

2.2.2 Control connections

The DeviceNet modules must be provided with one or two 24V DC (±20%, total current consumption 100mA) control voltages. Wire end sleeves must be used for flexible cables.

Designation	Data
Rigid cable cross-section	0.14 … 2.5mm²
Flexible cable cross-section	0.14 … 1.5mm²
AWG standard	AWG 26-14
Tightening torque (for screw terminals)	0.5…0.6Nm

Within the terminal box (unshielded cable section) the data cables (e.g. DeviceNet, system bus) must be installed as short as possible and of equal length. Associated data cables (e.g.: Sys+ and Sys-) must be twisted.

NOTE

In the customer unit, the DeviceNet is already installed with voltage isolation from the other signal connections.

In case of EMC problems, voltage separation of the field bus supply, the digital inputs and system bus interface and for the external technology unit also for the two additional digital outputs should be provided.

NOTE

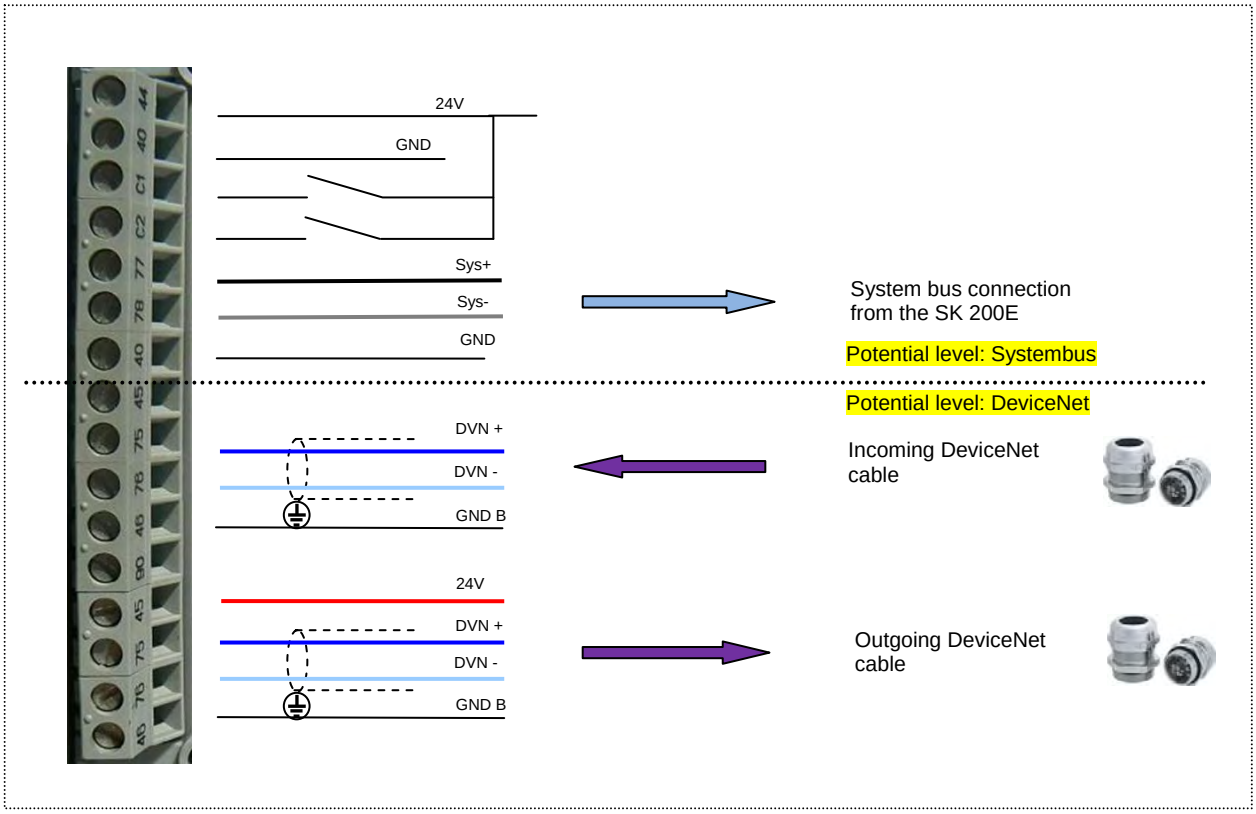
The cable shielding must be connected to the *functional earthing*[1] (usually the electrically conducting mounting plate) in order to prevent EMC interference in the device.

In order to achieve this, for DeviceNet connections it is mandatory that the metallic metric EMC screws are used for the connection of the DeviceNet shielding lead to the frequency inverter or the housing of the technology unit. This ensures a wide area connection of the *functional earthing*.

[1] In systems, electrical equipment is usually connected to a ***functional earth***. This serves as a means to dissipate leakage and interference currents in order to ensure EMC characteristics and must therefore be implemented according to high frequency technology aspects.

2.2.2.1 Control connections for SK CU4-DEV

The terminal bar of the customer unit SK CU4-DEV is divided into two potential levels.



Connection of up to 2 sensors is made on the terminal bar (terminals C1 and C2).

Control connection details

Terminal/ Designation	Function [factory setting]	Data	Description / wiring suggestion	Parameter
44 24V	External 24V supply	24VDC ±20% ≈ 50mA , reverse polarity protected	External supply voltage of the technology unit and supply of the digital inputs (DIN1 and DIN2)	-
40 GND	Reference potential for digital signals			-
C1 DIN1	Digital input 1 [I/O DeviceNet DIN1]	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1 ms Inputs as per EN 61131-2 Type 1	Each digital input has a reaction time of 1ms.	P174
C2 DIN2	Digital input 2 [I/O DeviceNet DIN2]			P174
77 Sys +	System bus data cable +		System bus interface	-
78 Sys -	System bus data cable -			-
40 GND	Reference potential for digital signals			-
Potential isolation				
45 24V	24V supply bus potential			-
75 DVN +	DeviceNet Bus +	DeviceNet	The use of twisted, shielded two-conductor cable is urgently recommended	-
76 DVN -	DeviceNet Bus -			-
46 GND Bus	Data ground		Bus reference potential	-
90 SHLD	Shield		Data cable shield	-
45 +24V Bus	Electrically isolated 24V bus supply	24VDC +/-20% ≤ 50mA reverse polarity protected	The external supply voltage of the technology unit is at the potential of the DeviceNet bus.	-
75 DVN +	DeviceNet Bus +	DeviceNet	The use of twisted, shielded two-conductor cable is urgently recommended	-
76 DVN -	DeviceNet Bus -			-
46 GND Bus	Data ground		Bus reference potential	-

2.2.2.2 Control connections for SK TU4-DEV(-…)

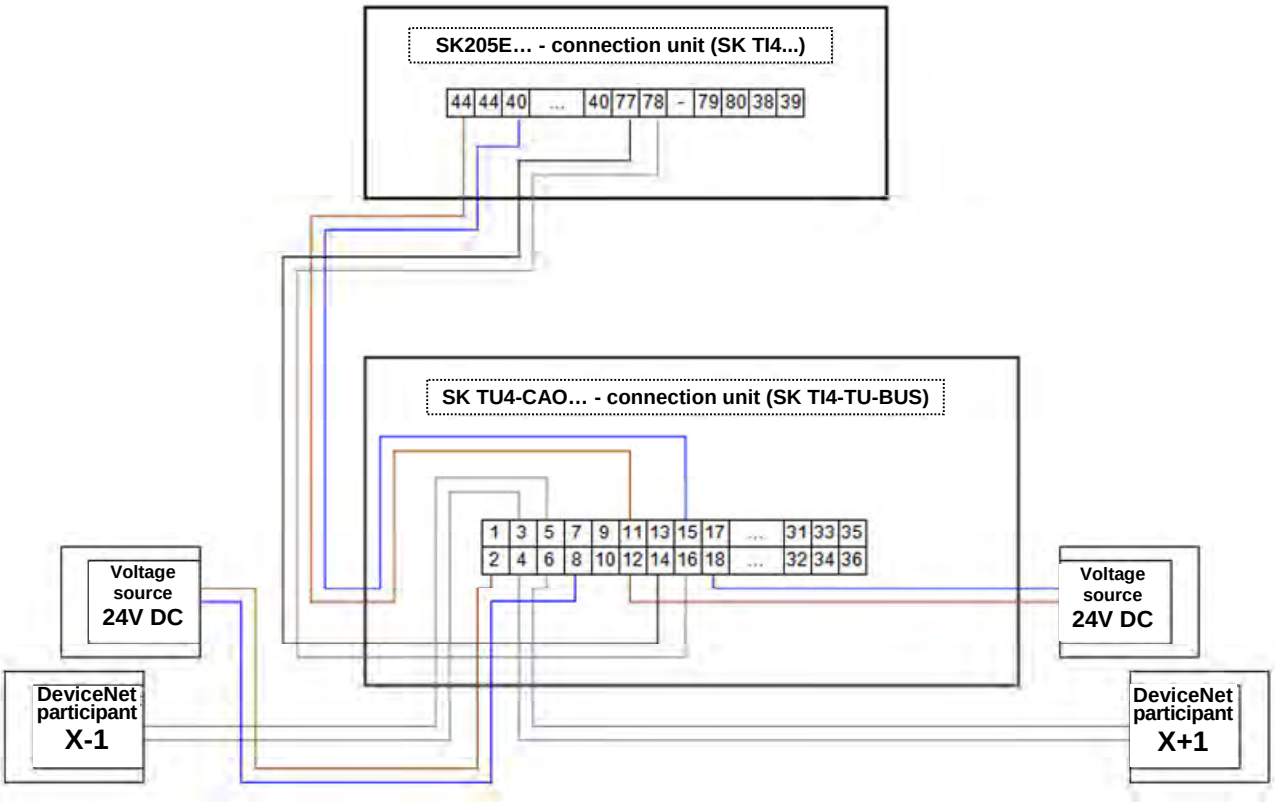
The double spring-loaded terminal bar of the technology unit is colour coded, and therefore indicates the three different potential levels.

A separate voltage source can be used to supply the DOs. However, by bridging the 24V o and GND o to one of the terminals of the system bus level 24V and GND it is possible to implement the supply of the DOs.

Connection of up to 4 sensors and 2 actuators is made via the terminal bar. Alternatively, the SK TU4-DEV-**M12** module enables the connection of these I/Os via the M12 round plug connector (5 pin socket, A-coded) mounted on the front.

Field bus level DeviceNet					System bus level and digital inputs										Digital outputs		
24V BUS	DVN + IN	DVN - IN	GND BUS	SHLD	24V	24V (as for 11)	GND	GND	DIN 1	GND	24V (as for 11)	DIN 2	DIN 4	24V (as for 11)	24V o DO	DO 1	GND o DO
1	**3**	**5**	**7**	**9**	**11**	**13**	**15**	**17**	**19**	**21**	**23**	**25**	**27**	**29**	**31**	**33**	**35**
2	**4**	**6**	**8**	**10**	**12**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**	**32**	**34**	**36**
24V BUS	DVN + OUT	DVN - OUT	GND BUS	PE	24V (as for 11)	Sys +	Sys -	GND	DIN 3	GND	24V (as for 11)	DIN 4	GND	24V (as for 11)	GND o DO	DO 2	GND o DO

Connection example: SK TU4-DEV to SK 200E



Control connection details

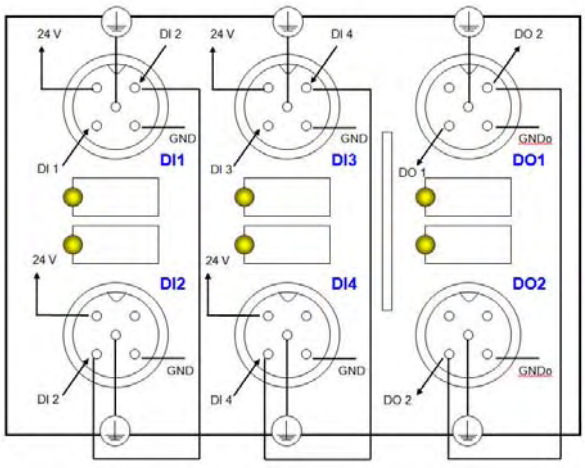
Terminal/ Designation	Function [factory setting]	Data	Description / wiring suggestion	Parameter
1 24V Bus 2	External 24V supply	24VDC -/+20% ≤ 50 mA , reverse polarity protected	Voltage supply at DeviceNet bus potential	-
3 DVN + 4	DeviceNet Bus +	DeviceNet	The use of twisted, shielded two-conductor cable is urgently recommended	-
5 DVN - 6	DeviceNet Bus -			-
7 GND BUS 8	Data ground bus		Voltage supply at DeviceNet bus potential	-
9 SHLD	Bus shield			-
10 PE	Earthing			-
Potential isolation				
11 24V 12 13	External 24V supply	24VDC -/+20% ≤ 50mA , reverse polarity protected	External supply voltage for system bus and digital inputs (DIN1 to DIN4)	-
14 Sys +	System bus data cable +		System bus interface	-
15 GND	Reference potential for digital signals		External supply voltage for system bus and digital inputs (DIN1 to DIN4)	-
16 Sys -	System bus data cable -		System bus interface	-
17 GND 18	Reference potential for digital signals		External supply voltage for system bus and digital inputs (DIN1 to DIN4)	-
19 DIN1	Digital input 1 [I/O DeviceNet DIN1]	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1 ms Inputs as per EN 61131-2 Type 1	Each digital input has a reaction time of 1ms.	P174
20 DIN3	Digital input 3 [I/O DeviceNet DIN3]			P174
21 GND 22	Reference potential for digital signals		External supply voltage for system bus and digital inputs (DIN1 to DIN4)	-
23 24V 24	External 24V supply	As for terminal 11		-

Terminal/ Designation	Function [factory setting]	Data	Description / wiring suggestion	Parameter
25 DIN2	Digital input 2 [I/O DeviceNet DIN2]	Low 0V ... 5V High 15V ... 30V R_i = 8.1kΩ Input capacitance 10nF Scan rate 1 ms Inputs as per EN 61131-2 Type 1	Each digital input has a reaction time of 1ms.	P174
26 DIN4	Digital input 4 [I/O DeviceNet DIN4]			P174
27 GND 28	Reference potential for digital signals		External supply voltage for system bus and digital inputs (DIN1 to DIN4)	-
29 24V 30	External 24V supply	As for terminal 11		-
Potential isolation				
31 24V o	External 24V supply for the DOs	24VDC -/+20% Up to 1A, according to load reverse polarity protected	External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to 24V terminal	-
32 GND o	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-
33 DO1	Digital output 1 [I/O DeviceNet DO1]	Low = 0V High: 24V Rated current: 500mA each	The digital outputs should be used with a separate 24V supply	P150 P175
34 DO2	Digital output 2 [I/O DeviceNet DO2]			P150 P175
35 GND o 36	Reference potential for digital signals		External supply voltage for digital outputs (DO1 and DO2) If necessary, bridge to GND terminal	-

Details of M12 connections of the SK TU4-DEV-M12

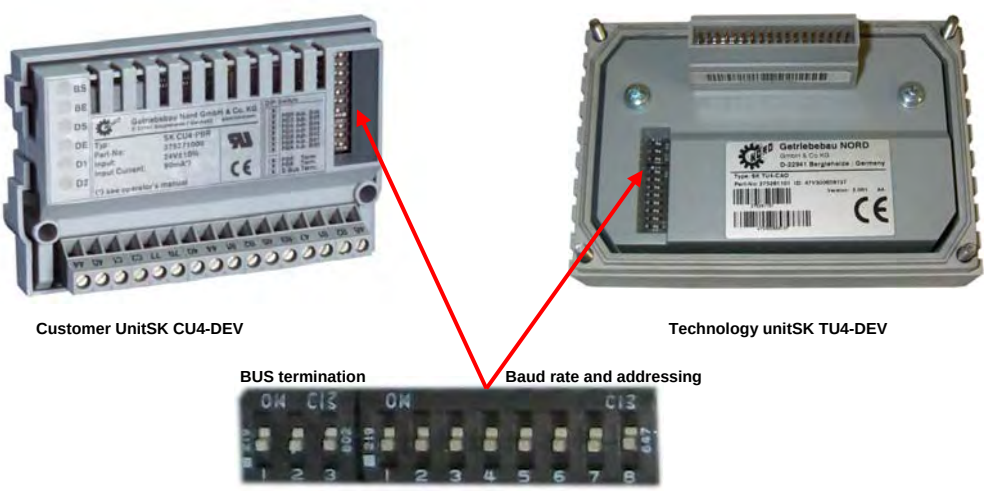
The special wiring of the M12 round plug connector enables the connection of both single and double sensors, which are equipped with normal M12 system connectors in the standard sensor/actuator configuration.

With the use of M12 round plug connectors, the terminal bar connectors for the digital inputs (Terminals 19, 20, 25, 26) must not be used.



2.2.3 Configuration

The configuration for all DeviceNet module versions is identical. All necessary settings are made using the hardware via a DIP switch element (3+8 part switching block).



DIP switch 3 + 8 part

Addressing

Note:

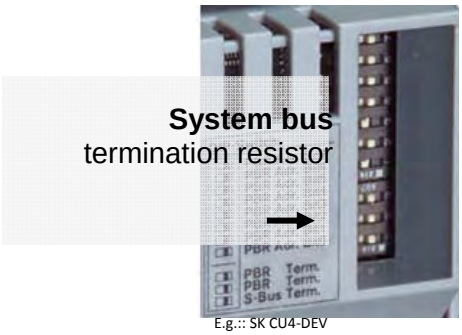
- DeviceNet address: setting only via DIP switch in binary code
- Permissible address range: 0 … 63
- Address changes: only become effective after switching the BUS module off and on again

Termination resistor

The termination of the system bus for the first and last subscribers carried out by connecting the relevant termination resistors (DIP switch).

According to the DeviceNet specification, termination resistors must be used at both physical ends of the bus cable.

DeviceNet module (View of DIP switch)



E.g.:: SK CU4-DEV

SK 200E (View from the inside)

E.g.: SK 200E

Configuration example

A DeviceNet subscriber SK TU4-DEV is connected to an SK 200E series frequency inverter via a BUS connection unit SK TI4-TU-BUS. The field bus address (DeviceNet address) should be “14” and a baud rate of 250kBaud should be selected. The system bus only includes the frequency inverter and the DeviceNet module. The termination resistor for the system bus is to be set at the frequency inverter. The DIP switches on the DeviceNet module must be set as follows:

Range	Significance		DIP-Switch ON - OFF	Configuration example
Addressing	Address-Bit 5	2^5		0
	Address-Bit 4	2^4		0
	Address-Bit 3	2^3		8
	Address-Bit 2	2^2		4
	Address-Bit 1	2^1		2
	Address-Bit 0	2^0		0
		Example address:		14
Baud rate	Baud rate Bit 1	2^1		0
	Baud rate Bit 0	2^0		1
		Baud rate		1 = 250kBaud
BUS termination	No significance			Always OFF
	No significance			Always OFF
	System bus	-		OFF

3 Displays and diagnosis

Various diagnosis possibilities are available, depending on the device. Operating conditions or errors are visualised by means of LEDs. PC-based communication or the connection of a parameterisation unit is possible via an RS232 interface (RJ12 diagnostic socket).

DeviceNet Module SK CU4-DEV
Status **LEDs**

DeviceNet Module unit SK TU4-DEV-M12 with SK TI4-TU-BUS and SK TIE4-WMK-TU

Status **LEDs** and viewing window (transparent screw-on cover) for **RJ12** diagnostic interface

Frequency inverter SK 200E
viewing window (transparent screw-on cover) for **RJ12** diagnostic interface**,** status **LEDs, Potentiometer**

3.1 LED displays

Both the SK 200E frequency inverter and the DeviceNet modules provide LED status and diagnostic displays to indicate the various statuses.

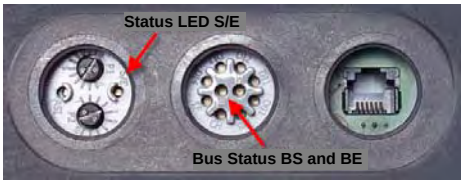
A differentiation into 3 categories is made

- **Module** or module-specific displays (S and E or DS and DE)
- **DeviceNet**-specific displays (MS and NS)
- Status displays for the additional digital **I/Os** of the module (D1/2 or DI1...4 and DO1/2)

The possible displays differ according to the device.

3.1.1 Device-specific display versions

3.1.1.1 SK 200E frequency inverter



LED **S/E**

The double **LED S/E** indicates the operating status of the frequency inverter by change of colour and different flashing frequencies. A device error is indicated by cyclic red flashing of the LED. The frequency of the flashing signals corresponds to the error number (Manual BU 0200).

LEDs **BS** and **BE**

The dual colour **LEDs BS** (**BUS State)** and **BE (BUS Error)** indicate the status of the system bus communication module. Various bus communication errors are indicated by means of different flashing frequencies.

A detailed description of the LED displays of the frequency inverter can be found in the main manual (BU0200).

3.1.1.2 Customer Unit SK CU4-DEV

LEDs **MS** and **NS**

The dual colour LEDs **MS (Module Status)** and **NS (Network Status)** indicate the status of the DeviceNet communication.

LEDs **DS** and **DE**

The dual colour LEDs **DS (Device State)** and **DE (Device Error)** indicate the status of the module and the status of the system bus.

LEDs **D1** and **D2**

The single colour LEDs **D1 (DIN 1** (digital input 1)**)** and **D2 (DIN 2** (digital input 2)**)** indicate the signal status of the digital inputs of the DeviceNet module. The corresponding LED lights up in case of a High signal.

A detailed description of the LED displays for this module can be found in Section 3.1.2 “Signal status LEDs”.

3.1.1.3 Technology unit SK TU4-DEV(-M12)

LEDs **MS** and **NS**

The dual colour LEDs **MS (Module Status)** and **NS (Network Status)** indicate the status of the DeviceNet communication.

LEDs **DS** and **DE**

The dual colour LEDs **DS (Device State)** and **DE (Device Error)** indicate the status of the module and the status of the system bus.

LEDs **DI1** to **DI4** and **DO1** and **DO2**

The single colour LEDs **DI1 (DIN 1** (digital input 1)**)** to **DI4 (DIN 4** (digital input 2)**)** and **DO1** (**DOUT 1** (digital output 1) and **DO2** (**DOUT 2** (digital output 2)) indicate the signal status of the digital inputs and outputs of the DeviceNet module. The corresponding LED lights up in case of a High signal.

These LEDs are only available in the DeviceNet module SK TU4-DEV-**M12**.

A detailed description of the LED displays for this module can be found in Section 3.1.2 “Signal status LEDs”.

3.1.2 Signal status LEDs

This manual only describes the LED signal statuses of the DeviceNet modules. Information for the frequency inverter LEDs (SK 200E) can be found in the relevant manual (BU0200).

3.1.2.1 Module-specific displays

The status of the technology unit or the system bus is indicated by the LEDs **DS** and **DE**.

LED (green) DS → **D**evice **S**tate	**LED (red)** DE → **D**evice **E**rror	**Significance** ... ... Slow flashing = 2Hz (0.5s cycle) … Rapid flashing= 4Hz (0.25s cycle)
OFF	OFF	Technology unit not ready, no control voltage
ON	OFF	Technology unit ready, no error, at least one frequency inverter is communicating via the system bus
ON	Flashing 0.25s	Technology unit ready, however → one or more of the connected frequency inverters has a fault status (see frequency inverter manual)
Flashing 0.5s	OFF	Technology unit ready and at least one further subscriber is connected to the system bus, but → No frequency inverter on the system bus (or connection interrupted) → Address error for one or more system bus subscribers
Flashing 0.5s	Flashing 0.25s Flash interval 1 x - 1s pause	System bus is in status "Bus Warning" → Communication on system bus interrupted or → No other subscriber present on the system bus
Flashing 0.5s	Flashing 0.25s Flash interval 2 x - 1s pause	→ System bus is in status "Bus off" or → The system bus 24V power supply was interrupted during operation
Flashing 0.5s	Flashing 0.25s Flash interval 3 x - 1s pause	→ No system bus 24V power supply (system bus is in status "Bus off")
Flashing 0.5s	Flashing 0.25s Flash interval 4 x - 1s pause	→ technology unit error present Details: under parameter P170 or P173
OFF	Flashing 0.25s Flash interval **1…7** - 1s pause	System error, internal program sequence interrupted → EMC interference (observe wiring guidelines!) → Module faulty

3.1.2.2 DeviceNet displays

The status of the DeviceNet module is indicated by the LEDs **MS** and **NS**.

LED (dual) MS → **M**odule **S**tatus	**Significance** ... Slow flashing = 2Hz (0.5s cycle)
OFF	No voltage supply
ON (green)	Normal operation, cyclic exchange of data via DeviceNet
Flashing 0.5s (green)	Module in standby mode, no connection to one or more FIs. (No parameters have yet been exchanged. Therefore setpoint specification via the DeviceNet AC profile is not possible) The baud rate setting for the DeviceNet bus is invalid.
ON (red):	Error which cannot be acknowledged. The module may need to be replaced.
Flashing 0.5s (red)	The module has an error which can be acknowledged

LED (dual) NS → **N**etwork **S**tatus	**Significance** ... Slow flashing = 2Hz (0.5s cycle)
OFF	No voltage supply The module has not carried out the “Dup_MAC_ID“ test
ON (green)	Normal operation, cyclic exchange of data via DeviceNet
Flashing 0.5s (green)	The module is online and has carried out the “Dup_MAC_ID” test, but has not set up communication to the other subscribers
ON (red):	Serious communication error, such as Bus Off, Duplicate MAC ID or invalid baud rate setting
Flashing 0.5s (red)	Timeout – The I/O connection or the P151 function has triggered a timeout error. The flashing code is displayed for at least 5 seconds.

3.1.2.3 I/O Displays

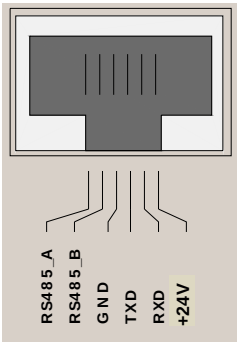
The status of additional digital inputs and outputs on the BUS module is indicated by corresponding LEDs (except for SK TU4-DEV(-C)).

I/O Channel	Status display	Significance
Customer Unit **SK CU4-DEV**		
	LED (green)	
Digital input 1 **D1**	**ON**	**High** potential on terminal ***C1***
	OFF	**Low** potential on terminal ***C1***
Digital input 2 **D2**	**ON**	**High** potential on terminal ***C2***
	OFF	**Low** potential on terminal ***C2***
Technology unit **SK TU4-DEV-M12(-C)**		
	LED (yellow)	
Digital input 1 **DI1**	**ON**	**High** potential on terminal ***19*** or on M12 socket ***DI1***
	OFF	**Low** potential on terminal ***19*** or on M12 socket ***DI1***
Digital input 2 **DI2**	**ON**	**High** potential on terminal ***25*** or on M12 socket ***DI2***
	OFF	**Low** potential on terminal ***25*** or on M12 socket ***DI2***
Digital input 3 **DI3**	**ON**	**High** potential on terminal ***20*** or on M12 socket ***DI3***
	OFF	**Low** potential on terminal ***20*** or on M12 socket ***DI3***
Digital input 4 **DI4**	**ON**	**High** potential on terminal ***26*** or on M12 socket ***DI4***
	OFF	**Low** potential on terminal ***26*** or on M12 socket ***DI4***
Digital output 1 **DO1**	**ON**	**High** potential on terminal ***33*** or on M12 socket ***DO1***
	OFF	**Low** potential on terminal ***33*** or on M12 socket ***DO1***
Digital output 2 **DO2**	**ON**	**High** potential on terminal ***34*** or on M12 socket ***DO2***
	OFF	**Low** potential on terminal ***34*** or on M12 socket ***DO2***

3.2 RJ12 Diagnostic socket

All participants which are coupled via a common system bus (field bus module / frequency inverter (up to 4 devices)) can be read out and edited/parameterised via an RJ12 diagnostic socket. Either the diagnostic socket of the frequency inverter or those of the bus connection units can be used. This provides users with a convenient facility to perform diagnosis and parameterisation from a central point, without having to access the particular frequency inverter at its location.

Although the customer unit SK CU4-DEV does not have an RJ12 connection, it can be accessed from any other subscriber (frequency inverter) on the same system bus.

<table>
<tr><th>Terminal/
Designation</th><th>Function</th><th>Data</th><th>Description / wiring suggestion</th><th>Parameter</th></tr>
<tr><td colspan="5">Diagnostic access / RJ12, RS485/RS232</td></tr>
<tr><td>1 RS485 A</td><td rowspan="2">Data cable RS485</td><td rowspan="2">Baud rate 9600…38400 baud
Termination resistor R=120Ω
must be set by the customer at the final subscriber.</td><td rowspan="4"> 

RJ12: Pin No. 1 … 6

1: RS485_A
2: RS485_B
3: GND
4: RS232_TxD
5: RS232_RxD
6: +24V</td><td rowspan="4">P502
…P513</td></tr>
<tr><td>2 RS485 B</td></tr>
<tr><td>3 GND</td><td>Reference potential for Bus signals</td><td>0V digital</td></tr>
<tr><td>4 232 TXD</td><td rowspan="2">Data cable RS232</td><td rowspan="2">Baud rate 9600…38400 baud</td></tr>
<tr><td>5 232 RXD</td><td></td></tr>
<tr><td>6 +24V</td><td>24V voltage supply from FI</td><td>24V ± 20%</td><td></td></tr>
</table>

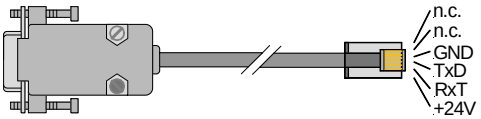
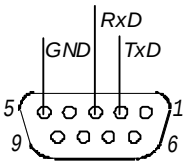
The bus speed of the diagnostic interface is 38400 baud. Communication is carried out according to the USS protocol.

ParameterBox SK PAR-3H

The ParameterBox **SK PAR3H** is available as a diagnostic tool.

The necessary connecting cables are included in the scope of delivery of the ParameterBox. For a detailed description of use, please refer to Manual BU0040.

Alternatively, diagnosis can be performed via a Windows PC with the aid of **NORD CON** software (available free of charge from www.nord.com). The necessary connection cable (**RJ12 - SUB D9**) is available from Getriebebau Nord GmbH as part number *278910240*. If necessary, an interface converter from SUB D9 to USB2.0 is commercially available.

Terminal/ Designation	Function [factory setting]	Data	Description / wiring suggestion	Parameter
Accessory cable (optional) for PC connection				
Adapter cable RJ12 to SUB-D9	... for direct connection to a PC with NORD CON software	Length 3m Assignment RS 232 (RxD, TxD, GND) Part. No. 278910240	 Assignment of SUBD9 connector: Pin2: RS232_TxD Pin3: RS232_RxD Pin5: GND 	

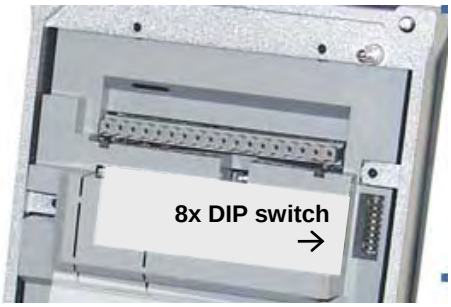
No special settings are required to set up communication with the individual diagnostic tools.

The allocation of addresses is defined via the system bus addressing. The display of the diagnostic tool is according to the following table, whereby the frequency inverter which is directly connected to the diagnostic tool is automatically assigned the address “ **0**” .

Device	External technology unit	Frequency inverter with address 32 (system bus)	Frequency inverter with address 34 (system bus)	Frequency inverter with address 36 (system bus)	Frequency inverter with address 38 (system bus)
USS address	30	1	2	3	4

Note:

Setting of the system bus address is carried out via two DIP switches (DIP 1 and 2) on the underside of the SK 200E-frequency inverter. For further details, please refer to the frequency inverter manual (BU 0220). The address of the BUS module is defined as “ 30” .



Underside of SK 200E

4 Commissioning

The DeviceNet module is a slave with “Group 2 Only Server” properties. Devices of this type can set up the following pre-defined connections:

- Explicit Request/Response Message (Parameter Transfer)
- Several static I/O messages (fragmented)
- Polled I/O connection
- Bit-Strobe I/O connection (gateway operation is only possible to a limited extent in this mode)

The transfer rate for parameter access (requested message body format) is 8/8 (8 Bit Class ID / 8 Bit Instance ID).

Clients which wish to use the gateway function of the DeviceNet must support fragmented transfer of the I/O messages.

4.1.1 Gateway function

Up to four FIs and the bus module can be controlled via the bus module.

With "explicit messages transfer", the differentiation of the FI is carried out via various classes (see Section "DeviceNet Communication”).

A single telegram is sent for the I/O messages (process data). This telegram contains the process data for all four FIs and the bus module. With several FIs on the system bus, the data length exceeds the available 8 bytes, i.e. in gateway operation the data must be fragmented.

The required data size and its allocation to the individual FI is made in the module parameters (P160) to (P165). These parameters are stored in an EEPROM in the module. The exact allocation is explained in the section "DeviceNet Communication".

4.1.2 Parameterisation via DeviceNet

All modules and FI parameters can be accessed via DeviceNet. This is carried out via Class 100 to 181.

If parameters are accessed for FIs which are not connected, the bus module responds with the error message “Resource unavailable”.

4.1.3 Timeout monitoring

Data traffic on the DeviceNet side is monitored via various timeouts defined by DeviceNet and/or P151.

P151 monitoring is triggered if the process data contact is interrupted or the process data in the USS profile are transferred with an invalid control word. Transfer of process data with a data length 0 (PLC in programming mode) also results in an error.

Sending of BitStrobe telegrams causes a reset of the P151 function, although no new process values have been sent.

Parameter P513 is not evaluated in the bus module. The error behaviour of the individual FI can be defined via this.

4.1.4 Input filtering

The four inputs are cyclically read every 250µs. This data is input into a filter routine. The minimum time for a change of flank is 1ms.

4.2 DeviceNet process data

4.2.1 I/O messages

The assembly object in the DeviceNet module is static. However, it is possible to set various data lengths and profiles in the assembly object via the parameters P160 to P165. The parameters are adopted by the bus modules when the I/O message connection is set up.

With this it is possible to set data lengths of between 2 and 33 bytes. Any data size (in steps of 8 bits) can be assigned to the individual FI. The lengths of the input and output data may be different.

The operating modes “Polled I/O” and “Change of state/Cyclic I/O” are fully supported by the module.

The operating mode “Bit Strobe” is subject to the restriction that the bus module may only return a maximum of 8 bytes. This must be noted for the setting of the parameters P160 and P161 – P165! Each MAC ID is assigned a bit in the “Bit Strobe” telegram. This bit must be zero in order for the process data to be forwarded to the FI. If the value is one, the last valid value is retained.

4.2.1.1 Transfer of 16 & 32 bit process data

The 16 and 32 bit process data must be sent in “Little Endian" format (see the following example).

Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
Control word		Setpoint 1		Setpoint 2		Setpoint 3	
16 bit		32 bit (e.g. position setpoint)				16 bit (e.g. speed)	
Low byte	High byte	Low Low byte	Low High byte	High Low byte	High High byte	Low byte	High byte

4.2.1.2 Structure of the process data

Data for up to 5 devices is sent in the fragmented telegram. The transmission sequence corresponds to the following illustration

Area 1	Area 2	Area 3	Area 4	Area 5
Bus module	FI 1	FI 2	FI 3	FI 4

The data for the bus module and then for FI 1 to 4 are sent in sequence. If one of the devices is not parameterised, the next area moves up. For example, if the bus module is not accessed, the first bytes are assigned to FI 1.

4.2.2 Interpretation of data in the Assembly Object

In the EDS file it is assumed that there is only one FI, or that all FIs have the same setting. This must also be represented by the ODVA. The following official table results from this. Otherwise, all possible or meaningful combinations must be recorded.

Instance	Profile	Length	Significance	Parameterisation (P160)
20	AC-Drive	4	STW + SW1 (only one FI)	1
70	AC-Drive	4	ZSW + IW1 (only one FI)	
21	AC-Drive	4	STW + SW1 (only one FI)	2
71	AC-Drive	4	ZSW + IW1 (only one FI)	
100	NORDAC	5	Bus module outputs + STW + SW1 (only one FI)	3
110	NORD-AC	5	Bus module inputs + ZSW + IW1 (only one FI)	
101	NORD-AC	8	STW + SW1 + SW2 + SW3 (only one FI)	4
111	NORD-AC	8	ZSW + IW1 + IW2 + IW3 (only one FI)	
102	NORD-AC	33	Bus module outputs + four FIs Structure for each FI: STW + SW1 + SW2 + SW3	5
112	NORD-AC	33	Bus module inputs + four FIs Structure for each FI: ZSW + IW1 + IW2 + IW3	
120	NORD-AC	1 to 33	Control values All combinations possible, parameterisation via P161 to P165	0
130	NORDAC	1 to 33	Status values All combinations possible, parameterisation via P161 to P165	

Explanation of abbreviations:

STW = FI control word
SW1 – 3 = FI setpoints 1 to 3
ZSW = FI status word
IW1 – 3 = FI actual value 1 to 3

4.2.3 Explanation of the I/O Assembly Data for the AC Drive Profile

Instance	Byte	Bit7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
20	0						Fault Reset		Run Fwd
	1								
	2	Speed setpoint (Low byte)							
	3	Speed setpoint (High byte)							
21	0		NetRef	NetCtrl			Fault Reset	Run Rev	Run Fwd
	1								
	2	Speed setpoint (Low byte)							
	3	Speed setpoint (High byte)							
70	0						Running1		Faulted
	1								
	2	Actual speed (Low byte)							
	3	Actual speed (High byte)							
71	0	At Ref	Ref From Net	Ctrl From Net	Ready	Running2 (Rev)	Running1 (Fwd)	Warning	Faulted
	1	Drive State (explanation in Class 41 Attribute 6)							
	2	Actual speed (Low byte)							
	3	Actual speed (High byte)							

4.2.3.1 Description of the bits in the control and status word

Run Forward
High level = The FI is switched on and the motor accelerates to its setpoint
Low level = The motor is braked on the set ramp to 0 rpm and the FI switched off

Run Reverse
As for “Run Forward” but with the opposite direction of rotation.

Fault Reset
A Low – High flank resets an error in the FI

NetCtrl
With a High level, the control words sent via the DeviceNet bus are valid The settings P509 and P510 in the FI are not affected

NetRef
With a High level, the setpoint words sent via the DeviceNet bus are valid The settings P509 and P510 in the FI are not affected

Fault
High level indicates an error in the FI

Warning
High level indicates a warning in the FI. See Bit 7 in the USS status word

Run 1
FI has a clockwise rotating field

Run 2
FI has an anticlockwise rotating field

Ready
FI is switched on, i.e. voltage is applied to the motor

Ctrl From Net
The FI is controlled via DeviceNet. Only the status of “NetCtrl” is imaged in the control word. The parameters P509 & P510 are not queried.

Ref From Net
The setpoint for the FI comes via DeviceNet. Only the status of “Netref” is imaged in the control word. The parameters P509 & P510 are not queried.

At Ref
The FI has attained the setpoint speed

4.2.4 Explanation of the I/O Assembly Data for the NORD-AC Profile

Instance	Byte	Bit7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
100	0							Out2	Out 1
	1	Control word (Low component)							
	2	Control word (High component)							
	3	Setpoint 1 (Low component) → P546							
	4	Setpoint 1 (High component) → P546							
110	0					Input 4	Input 3	Input 2	Input 1
	1	Status word (Low component)							
	2	Status word (High component)							
	3	Actual value 1 (Low component) → P543							
	4	Actual value 1 (High component) → P543							

Out 1 to 2
Enables the outputs of the bus module to be set, if present

Input 1 to 4
Here, up to four inputs of the bus module can be read out.

The structure of the NORD AC assemblies is shown on the basis of Instance 100/110.

If it is present in the instance, the bus module itself is always accessed in the first byte. The inputs and outputs can be set and read out. Further functionality is not possible.

After this, the structure is always the same: the control/status word and the setpoint/actual values follow. If several FIs are accessed in sequence, the control/status word of the next FI follows the last setpoint/actual value.

The structure of the control and status words can be obtained from the old documentation. Setting of the setpoint and actual values is made via the FI parameters P543 to P548.

4.2.5 Generation of variable data lengths in Instance 120/130

If parameter P160 is set to 0, the structure of the Instance can be freely defined via parameters P161 to P165. The length of the output and input data does not need to be identical.

	Para	Index [0]	Index [1]	Index [2]
Bus module	P161	Input length	Output length	- - -
FI 1	P162	Status data length	Control data length	Drive profile
FI 2	P163	Status data length	Control data length	Drive profile
FI 3	P164	Status data length	Control data length	Drive profile
FI 4	P165	Status data length	Control data length	Drive profile

Parameter	Value range	Significance	Explanation
P16x [0]	P162-P165 = 0 to 8 P161= 0 to 1	0 = Data length 0 byte 1 = Data length 1 byte 2 – 8 = etc.	Length of status data from FI x Data length = 0 → FI does not exist Structure: ZST | IW1 | IW2 | IW3
P16x [1]	P162-P165 = 0 to 8 P161=0 to 1	0 = Data length 0 byte 1 = Data length 1 byte 2 – 8 = etc.	Length of control data for FI x Data length = 0 → FI does not exist Structure: STW | SW1 | SW2 | SW3
P16x [2]	P162-P165 = 0 to 2	0 = AC-Drive profile 1 1 = AC-Drive profile 2 2 = NORDAC profile	Profile used by FI x on the DeviceNet bus

Example:

P161 = {1,1} → Inputs/Outputs of the bus module
P162 = {8,8,2} → Control/Status word and 3 Setpoint/Actual value in the NORD-AC profile for FI 1
P163 = {4,8,2} → Control/Status word and 1 setpoint and 3 actual value in the NORD-AC profile for FI 2
P164 = {4,4,0} → 1 Setpoint/Actual value in AC drive profile for FI 3
P165 = {0,0,0} → FI 4 is not accessed

Input data length for the bus module: 21 Byte

Output data length for the bus module bytes: 17 Byte

4.3 DeviceNet objects

4.3.1 Class 1 – Identity Object

Inst.	Attr.	Access	Name	Type	Description
1	1	Get	Vendor ID	UINT	Manufacturer identification number
1	2	Get	Device type	UINT	Product type
1	3	Get	Product code	UINT	Identification of device
1	4	Get	Revision	STRUCT	Software version
				USINT	Number of main version
				USINT	Number of ancillary version
1	5	Get	Status	UINT	Device status **Bit 0** Device is accessed via a master **Bit 2** Configuration loaded from the FI **Bit 8** One of the connected FIs has an error
1	6	Get	Serial number	UDINT	Serial number. Not supported at present
1	7	Get	Product Name	SHORTSTR	Name of device

4.3.2 Class 3 –DeviceNet Object

Inst.	Attr.	Access	Name	Type	Description
1	1	Get	MAC ID	USINT	Address of the bus module. Set via DIP switches
1	2	Get	Baud rate	USINT	Baud rate. Set via DIP switches
1	3	Get	BOI	BOOL	**FALSE** After a Bus Off, the CAN driver remains in this state. The module must be reset. **TRUE** After a Bus Off, the CAN chip resets automatically
1	4	Get/Set	Bus Off Counter	USINT	Number of Bus Off states for the bus module. Can only be written with 0 for reset.
1	5	Get	Allocation Information	Struct	
				Byte	Allocation of active communication Bit0 = Explicit Message Bit1 = Polled Bit2 = Bit Strobed Bit3 = Multicast Bit4 = Change of State Bit5 = Cyclic Bit6 = Acknowledge Suppression Bit7 = Reserve
				USINT	MAC ID of master
1	6	Get	MAC ID Switch Changed	BOOL	TRUE = If there has been a change to the ID switches since the last reset or power up.

1	7	Get	Baud Rate Switch Changed	BOOL	TRUE = If there has been a change to the baud rate switches since the last reset or power up.
1	8	Get	MAC ID Switch Value	USINT	Current ID setting on the DIP switch
1	9	Get	Baud Rate Switch Value	USINT	Current baud rate setting on the DIP switch

4.3.3 Class 4 – Assembly Object

Inst.	Attr.	Access	Type	Description
20	3	Get/Set	STRUCT 4 Byte	Write AC drive profile 1 to FI
21	3	Get/Set	STRUCT 4 Byte	Write AC drive profile 2 to FI
70	3	Get	STRUCT 4 Byte	Read AC drive profile 1 from FI
71	3	Get	STRUCT 4 Byte	Read AC drive profile 2 from FI
100	3	Get/Set	STRUCT 5 Byte	Describe NORD AC profile 1 to FI
101	3	Get/Set	STRUCT 8 Byte	Describe NORD AC profile 2 to FI
102	3	Get/Set	STRUCT 33 Byte	Describe NORD AC profile 3 to FI
110	3	Get	STRUCT 5 Byte	Read out NORD AC profile 1 from FI
111	3	Get	STRUCT 8 Byte	Read out NORD AC profile 2 from FI
112	3	Get	STRUCT 33 Byte	Read out NORD AC profile 3 from FI
120	3	Get/Set	STRUCT 1 to 33 Byte	Describe variables of NORD AC profile 1 to FI
130	3	Get	STRUCT 1 to 33 Byte	Read out variables of NORD AC profile 1 from FI

The instances 70, 71, 110, 111, 112 and 130 are only updated if I/O messages are received. Transmission to instances 20, 70, 100, 101, 102 & 120 is only meaningful if no I/O messages are sent, as otherwise these would overwrite the contents of the explicit response message. Reading and writing can only be carried out for the active instance.

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4.3.4 Class 5 – DeviceNet Connection Object

The settings of the current connection can be read out via this object. The following instances are supported:
Instance 1 = Explicit message
Instance 2 = Polling
Instance 3 = Bit Strobe
Instance 4 = COS/Cyclic

Attr.	Access	Name	Type	Description
1	Get	State	USINT	
2	Get	Instance_type	USINT	
3	Get	transportClass trigger	BYTE	
4	Get	Produced connection ID	UINT	
5	Get	Consumed connection ID	UINT	
6	Get	Initial comm. characteristics	BYTE	
7	Get	Produced connection size	UINT	
8	Get	Consumed connection size	UINT	
9	Get/Set	Expected packet rate	UINT	
12	Get	Watchdog timeout action	USINT	
13	Get	Produced connection path length	UINT	
14	Get	Produced connection path	EPATH	
15	Get	Consumed connection path length	UINT	
16	Get	Consumed connection path	EPATH	
17	Get	Production inhibit time	UINT	

4.3.5 Class 40 – Motor Data Object

Attr.	Access	Name	Type	Description
3	Get	Motor type	USINT	Motor type. Only type 7 = Asynchronous motors are supported
6	Get/Set	RatedCurrent	UINT	Rated current of motor Unit = 100mA
7	Get/Set	RatedVoltage	UINT	Nominal voltage Unit = V
8	Get/Set	RatedPower	UDINT	Nominal power Unit = W
9	Get/Set	RatedFreq	UINT	Nominal frequency Unit = Hz
12	Get	PoleCount	UINT	Number of poles of motor

In Class 40, Instances 1 to 4 are supported, whereby the value of the instance is addressed to the relevant FI on the system bus. E.g. FI 2 on the system bus is accessed via Instance 2.

4.3.6 Class 41 – Control Supervisor Object

Attr.	Access	Name	Type	Description
3	Set	Run Fwd	BOOL	Starts / stops the motor → clockwise direction
4	Set	Run Rev	BOOL	Starts / stops the motor → anticlockwise direction
5	Set	NetCtrl	BOOL	Determines the validity of Run1 & Run2 1 = Control via DeviceNet 0 = Control via DeviceNet invalid
6	Get	State	USINT	FI status 1 = Start 2 = Not Ready 3 = Ready 4 = Enabled 5 = Stopping 6 = Fault_Stop 7 = Faulted
7	Get	Running1	BOOL	If True, the FI is enabled via Run1 or it is in “Fault_Stop” mode and is braking in a clockwise direction.
8	Get	Running2	BOOL	If TRUE, the FI is enabled via Run1 or it is in “Fault_Stop” mode and is braking in an anticlockwise direction.
9	Get	Ready	BOOL	If TRUE, the FI is in status “Ready” or “Enabled”.
10	Get	Faulted	BOOL	If TRUE, the relevant FI is in a faulted condition.
11	Get	Warning	BOOL	TRUE indicates that there is a warning for the relevant FI.
12	Set	FaultRst	BOOL	An error present in the FI is deleted with a flank from FALSE to TRUE.
13	Get	FaultCode	UINT	Displays the current or last active error code.
15	Get	CtrFromNet	BOOL	Determines the validity of Run1 & Run2 1 = Control via DeviceNet 0 = Control via DeviceNet invalid

In Class 41, Instances 1 to 4 are supported, whereby the value of the instance is addressed to the relevant FI on the system bus. E.g. FI 2 on the system bus is accessed via Instance 2.

4.3.7 Class 42 – AC- Drive Object

Attr.	Access	Name	Type	Description
3	Get	AtReference	BOOL	Actual value corresponds to the setpoint
4	Get/Set	NetRef	BOOL	Setpoints sent via DeviceNet are enabled.
6	Get	DriveMode	USINT	This parameter is always 0 (specific to vendor). The drive mode can be obtained via FI parameter P509.
7	Get	SpeedActual	INT	Actual speed in rpm.
8	Get/Set	SpeedRef	INT	Setpoint speed in rpm.
9	Get	CurrentActual	INT	Actual current in the motor phases, resolution in 0.1A
15	Get	PowerActual	INT	Current power, 0.01kW
16	Get	InputVoltage	INT	Input voltage of the FI in V
17	Get	OutputVoltage	INT	Output voltage of the FI in V
18	Get/Set	AccelTime	UINT	Run-up time for the speed ramp in ms from 0 rpm to HighSpdLimit
19	Get/Set	DecelTime	UINT	Braking time for the speed ramp in ms from LowSpdLimit to 0 rpm.
20	Get/Set	LowSpdLimit	UINT	Minimum possible speed in rpm
21	Get/Set	HighSpdLimit	UINT	Maximum possible speed in rpm
29	Get	RefFromNet	BOOL	Status of setpoint enabling via DeviceNet 0 = Setpoint via DeviceNet disabled 1 = Setpoint via DeviceNet enabled

In Class 42, Instances 1 to 4 are supported, whereby the value of the instance is addressed to the relevant FI on the system bus. E.g. FI 2 on the system bus is accessed via Instance 2.

4.3.8 Class 43 – Acknowledge Handler Object

Inst.	Attr.	Access	Name	Type	Description
1	1	Get/Set	Acknowledge Timer	UINT	Time before the Acknowledge signal is sent Range from 1ms to 65535ms Resolution = 1ms
1	2	Get/Set	Retry Limit	USINT	Number of Acknowledge timeouts at which a RetryLimit_Reached event is executed
1	3	Get	COS Producing Connection instance	UINT	Connection Instance contains the path of the I/O application object which receives information from the Ack Handler.

4.3.9 Class 100 to 181 – Access to FI and bus module parameters

All parameters of the bus module and the FIs connected to the bus module can be accessed via the DeviceNet. The FIs connected to bus module can be accessed via various Class ranges. See following table.

DeviceNet Class	Accessed device	FI Offset
100 to 107	FI 1	0
110 to 117	FI 2	10
120 to 127	FI 3	20
130 to 137	FI 4	30
181	Bus module (Class 180 – 189 reserved)	

Coding of the FI parameters in DeviceNet format is carried out as follows:

Parameter number to DeviceNet:

Class = (100 + PNo. / 100) + FI Offset

Attribute = PNo. mod 100 (mod = modulus operation → Attribute = Remainder (PNo. / 100))

Instance = SubIndex + 1

DeviceNet to parameter number:

PNo. = ((Class – FI Offset) – 100) * 100 + Attribute

SubIndex = Instance – 1

Examples:

FU1, P103, SubIndex 0 → Class = 101, Attribute = 3, Instance = 1

FU4, P103, SubIndex 2 → Class = 131, Attribute = 3, Instance = 3

FU1, P546, SubIndex 0 → Class = 105, Attribute = 46, Instance = 1

FU3, P546, SubIndex 0 → Class = 125, Attribute = 46, Instance = 1

4.3.10 Class 199 - NORDAC Index Object

All FI parameters can be accessed via this object. Access to bus module parameters or the parameters of other modules on the system bus is not possible.

Access is obtained by setting the parameter number and the sub index. Then the parameter can be read or written via attribute 3 or 4 of the parameter. The relevant FI is selected via the instance, i.e. with Instance = 1, FI 1 is accessed, or with Instance = 4, FI 4 is accessed.

Inst.	Attr.	Description	Type	Access
1 to 4	1	Parameter number	UINT	Read/Write
1 to 4	2	Parameter Index	USINT	Read/Write
1 to 4	3	Read / write 16 bit parameter	INT	Read/Write
1 to 4	4	Read / write 32 bit parameter	DINT	Read/Write

Attribute 4 with 32 bit access is not contained in the EDS file, as otherwise the commissioning tools would access a parameter via attributes 3 and 4. This results in an error message for an incorrect parameter size (32Bit access to a 16Bit parameter).

In the EDS file and the bus module, attribute 1 is set to 0 as default. Parameter accesses with parameter 0 are ignored and always receive a positive response, even if the relevant FI is not online. This prevents unnecessary error messages.

5 Parameterisation

In order to enable communication via DeviceNet, the frequency inverter and the DeviceNet technology unit must be parameterised accordingly.

With the DeviceNet protocol, the inverter parameters are mapped in the range 100 to 109:

- Class = 100 + parameter number / 100
- Attribute = Parameter number % 100
- Instance = SubIndex + 1

or

- Parameter number = (Class -100) * 100 + Attribute
- SubIndex = Instance – 1

5.1 Parameterising the SK 200E frequency inverter

The following list of parameters for the frequency inverter series SK 200E are directly relevant for the operation of the frequency inverter via DeviceNet. A complete list of parameters for the frequency inverter (SK 200E) can be found in the relevant manual (BU0200).

5.1.1 Basic parameters (P100)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P120 … [-01] ... … [-04]	**Option monitoring**		S	
0 ... 2 { 1 }	**Array levels:** **… [-01] =** Extension 1 (BUS-TB) **… [-02] =** Extension 2 (IO-TB) **… [-03] =** Extension 3 (reserved) **… [-04] =** Extension 4 (reserved)			
	Setting value for each array: **0 = Monitoring OFF** **1 = Auto**, communication is only monitored if an existing communication is interrupted. If a module which was previously present is not found after switching on the mains, this does not result in an error Monitoring only becomes active when an extension starts communication with the FI. **2 = Monitoring active immediately**; the FI starts monitoring the corresponding module immediately after it is switched on. If the module is not detected on switch-on, the FI remains in the status "not ready for switch-on" for 5 seconds and then triggers an error message.			

5.1.2 Control terminal parameters (P400)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P420 **... [-01]** **...** **... [-04]**	Digital inputs 1 to 4			

0 ... 72

{ [-01] = 01 }

{ [-02] = 02 }

{ [-03] = 04 }

{ [-04] = 05 }

In the SK 200E, up to 4 freely programmable digital inputs are available. The only restriction is with the versions SK 215E and SK 235E. Here, the fourth digital input is always the input for the function "Safe Stop".

... [-01] = Digital input 1 (DIN1), **Enable right** as factory setting, control terminal 21

... [-02] = Digital input 2 (DIN1), **Enable left** as factory setting, control terminal 22

... [-03] = Digital input 3 (DIN3), **fixed frequency** 1 (P465 [-01]) as factory setting, control terminal 23

... [-04] = Digital input 4 (DIN4), **fixed frequency 2** (P465 [-02]) as factory setting, not with SK 215/235E → "Safe Stop", control terminal 24

Various functions can be programmed. For the complete list, please refer to the SK 200E frequency inverter manual (BU0200).

Excerpt…

Value	Function	Description	Signal
00	No function	Input switched off.	---
...			
14 [1]	Remote control	With bus system control, Low level switches the control to control via control terminals.	High
...			
[1] Also effective for bus control (RS232, RS485, CANbus, CANopen, DeviceNet, Profibus, InterBus, AS-Interface)			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P480 **... [-01]** **...** **... [-12]**	**Function bus I/O In Bits**			

0 ... 72

{ [-01] = 01 }

{ [-02] = 02 }

{ [-03] = 05 }

{ [-04] = 12 }

{ [-05...-12] = 00 }

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

These I/O bits can also be used in combination with the AS Interface (SK 225E or SK 235E) or the I/O extension (SK CU4-IOE or SK TU4-IOE).

... [-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

... [-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 in parameter P420.

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P481 ... [-01] ... ... [-10]	**Function Bus I/O Out bits**			
0 ... 39 { all 0 }	The bus I/O Out bits are perceived as multi-function relay outputs. They can be set to the same functions (P434). These I/O bits can also be used in combination with the AS Interface (SK 225E or SK 235E) or the I/O extension (SK CU4-IOE or SK TU4-IOE). **... [-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]** =Flag 1 **... [-08]** = Flag 2 **... [-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 relay P434.			
P482 ... [-01] ... ... [-08]	**Standardisation of bus I/O Out bits**			
-400 … 400 % { all 100 }	Adjustment of the limit values of the bus Out bits. For a negative value, the output function will be output negative. Once the limit value is reached and positive values are delivered, the output produces a High signal, for negative setting values a Low signal.			
P483 ... [-01] ... ... [-08]	**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.			

5.1.3 Supplementary parameter (P500)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P509	**Control word source**		S	
0 ... 4 { 0 }	Selection of the interface via which the FI is controlled. **0 = Control terminals or keyboard control**** with the SimpleBox (if (P510)=0), the ParameterBox or via BUS I/O Bits. **1 = Only control terminals** *, the FI can only be controlled via the digital and analog input signals or via the Bus I/O Bits. **2 = USS control word *,** the control signals (enable, rotation direction, etc.) are transferred via the RS485 interface, the setpoint via the analog input or the fixed frequencies. **3 = System bus** * (control via DeviceNet) **4 = System bus broadcast** *) Keyboard control (SimpleBox, ParameterBox, PotentiometerBox) is disabled, parameterisation is still possible. **) If the communication during keyboard control is interrupted (time out 0.5 sec), the FI will disable without an error message.			
	NOTE: As an alternative to setting the parameter, **System Bus Broadcast** can be selected with DIP switch 3.			
P510 **... [-01]** **... [-02]**	**Setpoint source**		S	
0 ... 4 { [-01] = 0 } { [-02] = 0 }	Selection of the setpoint source to be parameterised. **… [-01]** = Main setpoint source **… [-02**] = Subsidiary setpoint source Selection of the interface via which the FI receives the setpoint. **0 = Auto:** 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** **3 = System bus** **4 = System bus broadcast**			
P513	**Telegram downtime**		S	
-0.1 / 0.0 / 0.1 ... 100.0 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 (system bus)**		S	
0 ... 7 { 5 }	Setting of the transfer rate (transfer speed) via the system bus interface. All bus subscribers must have the same baud rate setting. **0 =** 10kBaud **3 =** 100kBaud **6 =** 500kBaud **1 =** 20kBaud **4 =** 125kBaud **7 =** 1Mbaud * **2 =** 50kBaud **5 =** 250kBaud *) Safe operation cannot be guaranteed			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P515 **... [-01]** **... ... [-03]**	**CAN address (system bus)**		S	
0 ... 255 dec { all 32 dec} or { all 20 hex}	Setting of the system bus address. **… [-01]** = Receive address for system bus **… [-02]** = Broadcast – Receive address for system bus (slave) **… [-02]** = Broadcast – Transmit address for system bus (master)			
	NOTE: If up to four SK 200E are to be linked via the system bus, the addresses must be set as follows → FI 1 = 32, FI 2 = 34, FI 3 = 36, FI 4 = 38. The system bus addresses should be set via the DIP switches 1/2 (Section 2.2.3).			
P543 **... [-01]** **... ... [-03]**	**Actual bus value 1… 3**		S	P
0 ... 22 { [-01] = 01 } { [-02] = 04 } { [-03] = 09 }	The return value can be selected for bus actuation in this parameter. **NOTE:** For further details, please refer to the description for P418. **… [-01] = Actual bus value 1** **… [-02] = Actual bus value 2** (only for PPO Type 2 or 4) **… [-03] = Actual bus value 3** (only for PPO Type 2 or 4) **Possible values which can be set:** **0 =** Off **1 =** Actual frequency **2 =** Actual speed **3 =** Current **4 =** Torque current (100% = P112) **5 =** State of digital inputs and outputs [2] **6 =** ... 7 Reserved **8 =** Setpoint frequency **9 =** Error number **10 =** ... 11 Reserved **12 =** Bus Out bits 0...7 **13 =** ... 16 Reserved **17 =** Value analog input 1 (P400) **18 =** Value analog input 2 (P405) **19 =** Setpoint frequency master value (P503) **20 =** Setpoint frequency after master value ramp **21 =** Actual frequency without master value slip **22 =** Speed from encoder			

[2] The assignment of the dig. inputs for P543 = 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	Bit 6 = DigIn 7	Bit 7 = Reserved
Bit 8 = Reserved	Bit 9 = Reserved	Bit 10 = Reserved	Bit 11 = Reserved
Bit 12 = Out 1	Bit 13 = Out 2	Bit 14 = Out 3	Bit 15 = Out 4

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P546 **... [-01]** **... ... [-03]**	**Function Bus setpoint 1 ... 3**		S	P

0 ... 24

{ [-01] = 01 }

{ [-02] = 00 }

{ [-03] = 00 }

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

NOTE: For further details, please refer to the description for P400.

... [-01] = Bus setpoint value 1

... [-02] = Bus setpoint value 2 (only for PPO Type 2 or 4)

... [-03] = Bus setpoint value 3 (only for PPO Type 2 or 4)

Possible values which can be set:

0 = Off
1 = Setpoint frequency (16 bit)
2 = Frequency addition
3 = Frequency subtraction
4 = Minimum frequency
5 = Maximum frequency
6 = PI process controller actual value
7 = PI process controller setpoint
8 = Actual frequency PID
9 = Actual PID frequency limited
10 = Actual PID frequency monitored
11 = Limiting torque current
12 = Torque current switch-off limit
13 = Limiting current
14 = Current switch-off limit
15 = Ramp time
16 = Lead torque (P214) multiplication
17 = Servo mode torque
18 = Curve travel calculator
19 = Digital In bits 0...7
20 = ...24 reserved for Posicon

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P552 **... [-01]** **... [-02]**	**System bus master cycle time**		S	

0 / 0.1 … 100.0 ms

{ 0 }

In this parameter, the cycle time for the system bus master mode and the CAN open encoder is set (see P503/514/515):

… [-01] = Cycle time for system bus master functions

… [02] = Cycle time for system bus absolute value encoder

With the setting **0 "Auto"** the default value (see table) is used.

According to the baud rate set, there are different minimum values for the actual cycle time:

Baud rate	Minimum value t_Z	System bus master default	System bus absolute default
10kBaud	10ms	50ms	20ms
20kBaud	10ms	25ms	20ms
50kBaud	5ms	10ms	10ms
100kBaud	2ms	5ms	5ms
125kBaud	2ms	5ms	5ms
250kBaud	1ms	5ms	2ms
500kBaud	1ms	5ms	2ms
1000kBaud	1ms	5ms	2ms

P560	**Save in EEPROM**		S	

0 ... 1

{ 1 }

0 = Changes to the parameter settings are no longer saved on the EEPROM. Previously saved settings remain stored, even if the FI is disconnected from the mains; however new changes are not saved after a mains failure.

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

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.

5.1.4 Information parameters (P700)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P700	**Current error**			
0.0 ... 21.4	Current error present. Further details are described in the frequency inverter manual (BU0200). **SimpleBox:** Descriptions of the individual error numbers can be found in the point Error messages. **ParameterBox:** Errors are displayed in plain text, further information can be found in the point Error messages.			
P701 ... [-01] ... ... [-05]	**Last fault 1...5**			
0.0 ... 21.4	This parameter stores the last 5 faults. Further details are described in the frequency inverter manual (BU0200). With the SimpleBox the corresponding memory location 1...5 (Array parameter), must be selected and confirmed with the ENTER key in order to read the stored error code.			
P740 ... [-01] ... ... [-13]	**Process data bus In**		S	
0000 ... FFFF (hex)	This parameter provides information about the actual control word (STW) and the setpoints (SW1-3) that are transferred via the bus systems. For values to be displayed, a bus system must be selected in P509.			
	... [-01] = Control word — Control word, source from P509.			
	... [-02] = Setpoint 1 (P546) **... [-03]** = Setpoint 2 (P547) **... [-04]** = Setpoint 3 (P548) — Setpoint data from main setpoint P510 - 01.			
	... [-05] = Bus I/O In Bits (P480) — The displayed value depicts all Bus In Bit sources linked with *or*.			
	... [-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 — Data during parameter transfer: Order label (AK), Parameter number (PNU), Index (IND), Parameter value (PWE 1/2)			
	... [-11] = Setpoint 1 **... [-12]** = Setpoint 2 **... [-13]** = Setpoint 3 — Setpoint data from master function value (Broadcast), if P509/510 = 4 (P502/P503)			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P741 **... [-01]** ... **... [-10]**	**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	Data during parameter transfer.
... [-09] = Parameter data Out 4	
... [-10] = Parameter data Out 5	

P748 System bus status

0000 ... FFFF (hex)
or
0 ... 65535 (dec)

Shows the status of the system bus.

Bit 0	24V Bus supply voltage
Bit 1	CANbus in "Bus Warning" status
Bit 2	CANbus in "Bus Off" status
Bit 3 ... 5:	Vacant
Bit 6	The protocol of the CAN module is 0 = CAN / 1 = CANopen
Bit 7	Vacant
Bit 8	"Bootsup Message" sent
Bit 9	CANopen NMT state
Bit 10	CANopen NMT state

CANopen NMT state	Bit 10	Bit 9
Stopped	0	0
Pre-Operational	0	1
Operational	1	0

P749 DIP switch status

0000 ... 00FF (hex)
or
0 ... 255 (dec)

This parameter shows the current setting of the FI DIP switch (Section 2.2.3).

Bit 0	DIP switch 1
Bit 1	DIP switch 2
Bit 2	DIP switch 3
Bit 3	DIP switch 4
Bit 4	DIP switch 5
Bit 5	DIP switch 6
Bit 6	DIP switch 7
Bit 7	DIP switch 8

5.2 Parameterisation of the bus module (SK CU4-… or SK TU4-…)

The following parameters relate to the bus modules.

5.2.1 BUS module standard parameters (P150)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P150	**Set relays**			
0 ... 4 { 0 }	**0 =** Outputs controlled via DeviceNet **1 =** Outputs OFF **2 =** Output 1 ON (DO1) **3 =** Output 2 ON (DO2) **4 =** Outputs 1 and 2 ON			
P151	**Timeout for external bus**			
0 ... 32767 ms { 0 }	Monitoring function of the relevant active bus technology unit. Following receipt of a valid telegram, the next one must arrive within the set period. Otherwise the inverter reports an error and switches off with the error message E010 / E10.2 >Bus Time Out< >Bus Time Out<. **0 = Off:** Monitoring is switched off.			
P152	**Factory setting**			
0 ... 1 { 0 }	By selecting the appropriate value and confirming it with the ENTER key, the selected parameter range is entered in the factory setting. Once the setting has been made, the value of the parameter returns automatically to 0. **0 = No change:** Does not change the parameterisation. **1 = Load factory settings:** The complete parameterisation of the FI is reset to the factory setting. All originally parameterised data are lost.			

5.2.2 DeviceNet Parameters

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P160	**Assembly selection**			
0 ... 5 { 3 }	Determination of the validity of SDO and PDO objects. (see Objects 1200 $_{(hex)}$… 1203 $_{(hex)}$, 1400 $_{(hex)}$ …1404 $_{(hex)}$ and 1800 $_{(hex)}$ …1804 $_{(hex)}$) **Possible values which can be set:** **0 =** Instance 120 & 130 **1 =** Instance 20 & 70 **2 =** Instance 21 & 71 **3 =** Instance 100 & 110 **4 =** Instance 101 & 111 **5 =** Instance 102 & 112			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P161 **... [-01] ... ... [-02]**	**Config. process data for the bus module**			
0 ... 1 { 0 }	**[-01] = Inputs** **[-02] = Outputs** **Possible values which can be set:** **0 =** Module does not transmit **1 =** Data length 1 Byte			
P162 **... [-01] [-02] ... [-03]**	**Configuration of FI process data**			
0 ... 8 { 0 }	**[-01] = Status values** **[-02] = Control values** **Possible values which can be set:** **0 =** FI does not exist **1 =** Data length in Bytes **...** **8 =** Data length in Bytes **[-03] = Profile** **0 =** AC drive profile 1 **1 =** AC drive profile 2 **2 =** NORDAC profile			
P163 **... [-01] [-02] ... [-03]**	**Configuration of FI 2 process data**			
0 ... 8 { 0 }	**[-01] = Status values** **[-02] = Control values** **Possible values which can be set:** **0 =** FI does not exist **1 =** Data length in Bytes **...** **9 =** Data length in Bytes **[-03] = Profile** **0 =** AC drive profile 1 **1 =** AC drive profile 2 **2 =** NORDAC profile			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P164 **... [-01]** **[-02]** **... [-03]**	**Configuration of FI 3 process data**			

0 ... 8

{ 0 }

[-01] = Status values

[-02] = Control values

Possible values which can be set:

0 = FI does not exist
1 = Data length in Bytes
...
10 = Data length in Bytes

[-03] = Profile

0 = AC drive profile 1
1 = AC drive profile 2
2 = NORDAC profile

P165 **... [-01]** **[-02]** **... [-03]**	**Configuration of FI process data**			

0 ... 8

{ 0 }

[-01] = Status values

[-02] = Control values

Possible values which can be set:

0 = FI does not exist
1 = Data length in Bytes
...
11 = Data length in Bytes

[-03] = Profile

0 = AC drive profile 1
1 = AC drive profile 2
2 = NORDAC profile

5.2.3 BUS module information parameters, general (P170)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P170 ... **... [-01]** **... [-02]**	**Current error**			
0 ... 9999	Current errror. Further details in Section 0 “Error Messages”. **… [-01]** = Current module error **… [-02]** = Last module error **Possible values:** **1000** = EEPROM error **1010** = System bus 24V missing **1020** = System bus timeout (see time in P151) **1030** = System bus OFF **Specific to DeviceNet** **5210 =** DeviceNet bus off **5211 =** Address already allocated **5212 =** illegal baud rate **5220 =** DeviceNet timeout			
P171 **... [-01]** **...** **... [-03]**	**Software version/ Revision**			
0,0 ... 9999.9 { 0.0 }	This parameter shows the software and revision numbers in the module. Array 03 provides information about any special versions of the hardware or software A zero stands for the standard version. **… [-01]** = Software version **… [-02]** = Software revision **… [-03]** = Special version			
P172	**Configuration**			
0 ... 2 { 0 }	The version can be queried in this parameter. **Possible values:** **0=** internal module **1=** external module **2 =** Bus TO via SPI			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P173	**Module status**			
0 ... FFFF (hex) { 0000 }	**Possible values:** Bit 0 = Bus status “Online / Not connected” Bit 1 = Bus status “Online / Connected” Bit 2 = Timeout (DeviceNet monitoring or time in P151) Bit 3 = Faulty DIP setting [X1] Bit 4 = DeviceNet “ BUS WARNING” Bit 5 = DeviceNet “ BUS OFF” Bit 6 = System bus “ BUS WARNING” Bit 7 = System bus “BUS OFF” Bit 8 = Status FI1 Bit 9 = Status FI 1 Bit 10= Status FI 2 Bit 11= Status FI 2 Bit 12= Status FI 3 Bit 13= Status FI 3 Bit 14= Status FI 4 Bit 15= Status FI 4			

Status for FI x:

Bit High	Bit Low	Status
0	0	FI is offline
0	1	Unknown FI
1	0	FI is online
1	1	FI lost or switched off

P174	**Digital inputs**			
0 ... 15 { 0 }	Instantaneous view of input level logic. **Possible values:** Bit 0= Input 1 (DIN1) Bit 1= Input 2 (DIN2) Bit 2= Input 3 (DIN3) Bit 3= Input 4 (DIN4)			
P175	**Digital outputs**			
0 ... 3 { 0 }	Instantaneous view of output level logic. **Possible values:** Bit 1= Output 1 (DO1) Bit 2= Output 2 (DO2)			

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P176 **... [-01]** **...** **... [-17]**	**Process data bus In**			
-32768 ... 32767 { 0 }	Bus data received from DeviceNet master **... [-01]** = Bus module outputs **... [-02]** = Control word FI 1 **... [-03]** = Setpoint 1 for FI 1 **... [-04]** = Setpoint 2 for FI 1 **... [-05]** = Setpoint 3 for FI 1 **... [-06]** = Control word FI 2 **... [-07]** = Setpoint 1 for FI 2 **... [-08]** = Setpoint 2 for FI 2 **... [-09]** = Setpoint 3 for FI 2 **... [-10]** = Control word FI 3 **... [-11]** = Setpoint 1 for FI 3 **... [-12]** = Setpoint 2 for FI 3 **... [-13]** = Setpoint 3 for FI 3 **... [-14]** = Control word FI 4 **... [-15]** = Setpoint 1 for FI 4 **... [-16]** = Setpoint 2 for FI 4 **... [-17]** = Setpoint 3 for FI 4			
P177 **... [-01]** **...** **... [-17]**	**Process data bus Out**			
-32768 ... 32767 { 0 }	Bus data sent to DeviceNet master **... [-01]** = Bus module inputs **... [-02]** = Status word FI 1 **... [-03]** = Actual value 1 for FI 1 **... [-04]** = Actual value 2 for FI 1 **... [-05]** = Actual value 3 for FI 1 **... [-06]** = Status word FI 2 **... [-07]** = Actual value 1 for FI 2 **... [-08]** = Actual value 2 for FI 2 **... [-09]** = Actual value 3 for FI 2 **... [-10]** = Status word FI 3 **... [-11]** = Actual value 1 for FI 3 **... [-12]** = Actual value 2 for FI 3 **... [-13]** = Actual value 3 for FI 3 **... [-14]** = Status word FI 4 **... [-15]** = Actual value 1 for FI 4 **... [-16]** = Actual value 2 for FI 4 **... [-17]** = Actual value 3 for FI 4			

Note X1 = This bit is active if the address of the bus module has been doubly assigned or the baud rate has not been set correctly.

5.2.4 Module information parameters specific to the bus (P180)

Parameter {Factory setting}	Setting value / Description / Note	Device	Supervisor	Parameter set
P180	**DeviceNet address:**			
0 ... 63 { 0 }	Each module transmitting on the bus must be allocated a unique address. After the new setting of addresses, all the devices on this bus must be restarted by switching the power supply off and on again.			
P181	**DeviceNet baud rate**			
0 ... 2 { 0 }	3 different baud rate settings are available: **0** = 125 kBaud **1** = 250 kBaud **2** = 500 kBaud			

6 Error monitoring and error messages

6.1 Error monitoring

The majority of bus module and frequency inverter functions and operating data are continuously monitored and simultaneously compared with limiting values. If a deviation is detected, the bus module or inverter reacts with a warning or an error message.
For detailed information, please refer to the relevant main manual of the frequency inverter.

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):

1. switching the mains off and on again,
2. by means of a correspondingly programmed digital input
   (SK 200E: (P420) [-…], function {12} or
   SK 500E: (P420 ... P425), function {12}),
3. By switching of the “enable” on the frequency inverter (if no digital input is programmed for acknowledgement),
4. by bus acknowledgement or
5. By P506, the automatic error acknowledgement.

Visualisation of the inverter error codes is made via the frequency inverter (see relevant manual).

Errors which are attributable to bus operation are visualised via the bus module. The precise error message is displayed in parameter P170.

NOTE

The display of a bus error is shown in the operating display of the SimpleBox **SK CSX3H** by means of the error group number **E1000**. In order to obtain the precise error number, the module information parameter P170 must be selected. The current error is shown in Array [01] of this parameter; the last error is stored in Array [02].

The DeviceNet module monitors the following functions:

- Cyclic connection to the bus master via the DeviceNet watchdog function (parameterisation is carried out in the bus master)
- Cyclic connection to the bus master and valid control data via the bus module parameter (P151)

6.2 Error messages

6.2.1 Table of possible error messages (caused by the bus) in the frequency inverter

The following error messages concern bus-related messages which are indicated on the frequency inverter. A complete list of error messages for the frequency inverter (SK 200E) can be found in the relevant manual (BU0200).

Display in the SimpleBox		Fault	Cause
Group	Details in P700 / P701	Text in the ParameterBox	Remedy
E010	**10.2**	**External bus module telegram timeout** (Timeout of DeviceNet Bus Watchdog)	Telegram transfer is faulty. Check external connection. Check bus protocol program process. Check Bus master.
	10.3	**Timeout via (P151)**	Telegram transfer is faulty. Check watchdog time (P151) Check external connection. Check bus protocol program process. Check Bus master. Control word is invalid (Bit 10 = 0)
	10.9	**Module not found**	The module entered in parameter (P120) is not available.

6.2.2 Table of possible error messages in the bus module

The following error messages concern bus-related messages, which are indicated on the DeviceNet module (SK CU4DEV or SK TU4DEV(-…)).

Display in the SimpleBox		Fault	Cause
Group	Details in P170	Text in the ParameterBox	Remedy
E1000	**1000**	**EEPROM error**	Module faulty
	1010	**System bus 24V missing**	Check connections and supply cables Ensure 24V voltage supply
	1020	**System bus timeout**	Check time set in parameter (P151). Telegram transfer is faulty. Check external connection. Check bus protocol program process. Check Bus master
	1030	**System bus OFF**	Check connections and supply cables Ensure 24V voltage supply Check Bus master
	5210	**DeviceNet Bus OFF**	
	5211	**Address already allocated**	Avoid double assignment of addresses Comply with address range 1 ... 63 Match master addressing to option addressing
	5212	**Illegal baud rate**	Invalid setting on DIP switch
	5220	**DeviceNet Timeout**	

7 DeviceNet data transmission

7.1 Structure of reference data

This section describes the cyclic data traffic between the bus master and the frequency inverter.

The reference data is divided into two sections:

- PKW section (Parameter Code Value (parameterisation level))
- PZD section (Process data (process data level))

Parameter values can be read and written via the PKW section of the reference data. All tasks which are carried out via the PKW interface are essentially tasks for configuration, monitoring or diagnosis.

The PZD section serves to control the frequency inverter. The control word or status word as well as the setpoint and actual values are transferred in the process data.

Access always consists of an order and a response telegram. In the order telegram, the reference data is transferred to the slave. In the response telegram, the reference data is transferred from the slave to the master. The structure of both telegrams is identical.

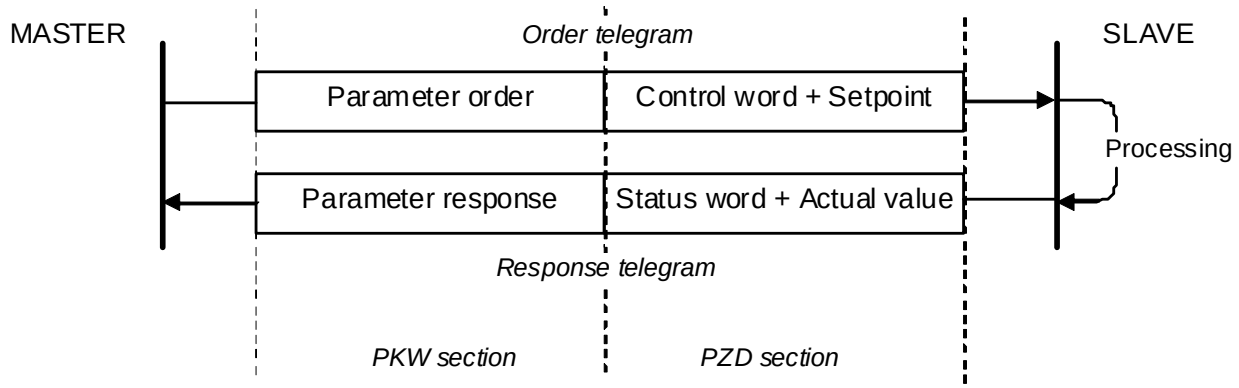


Fig.: Telegram traffic / structure of reference data area

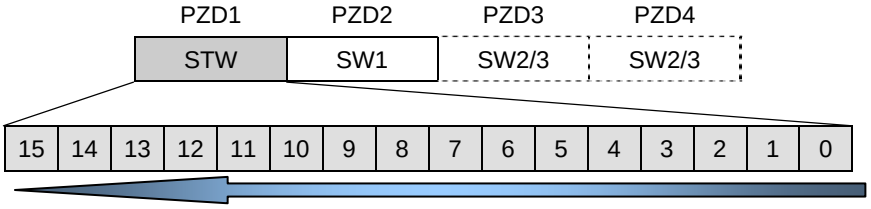
Processing of the process data is carried out immediately in the FI (high priority), in order to ensure a rapid reaction to control commands or a change in status can be transmitted to the master without delay.

On the other hand, the processing speed of the PKW data has a lower priority, so that processing may take considerably longer.

7.2 NORDAC profile

7.2.1 Control word (STW)

The control word (STW) is the first word transferred to the frequency inverter in the process data section in an order telegram.

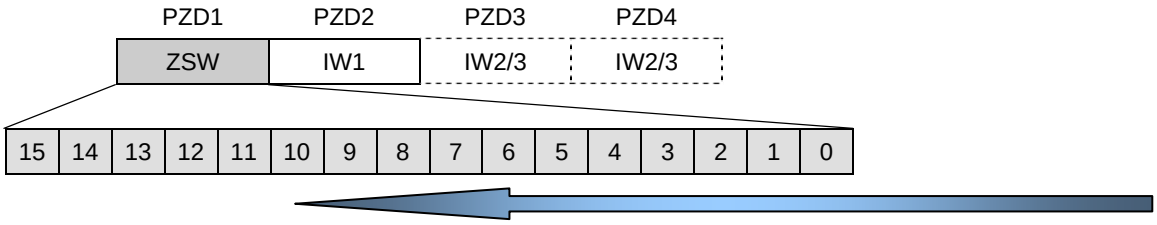


Meaning of the individual bits:

Bit	Value	Significance	Comments
0	0	OFF 1	Return with the brake ramp, at f=0Hz voltage activation
	1	ON	Standby
1	0	OFF 2	Disable voltage; the inverter output voltage is switched off; the FI goes into switch-on disabled status.
	1	Operating condition	OFF 2 is cancelled
2	0	OFF 3	Emergency stop with programmed emergency stop time; at f = 0Hz voltage enable; the FI goes into switch-on disabled status
	1	Operating condition	OFF 3 is cancelled
3	0	Disable operation	Disable voltage; the inverter output voltage is switched off; the FI goes into standby status.
	1	Enable operation	Output voltage enabled, run-up to present setpoint.
4	0	Disable run-up encoder	Run-up encoder is set to zero; at f = 0Hz no voltage enable; FI remains in operation enabled status.
	1	Operating condition	Run-up encoder is enabled
5	0	Stop run-up encoder	Freezing of actual setpoint from run-up encoder (hold frequency).
	1	Enable run-up encoder	Enable setpoint on run-up encoder
6	0	Disable setpoint	Selected setpoint is set to zero in the run-up encoder.
	1	Enable setpoint	Selected setpoint on run-up encoder is activated.
7	0	No acknowledgement	With the switch from 0 to 1, errors which are no longer active are acknowledged.
	1	Acknowledge	Note: If a digital input is programmed to the function "Error ack.", this bit must not be set permanently to 1 via the bus (otherwise this will prevent flank detection).
8	0		
	1	Bit 8 active	Bus bit 8 from the control word is set. (only for SK 200E and SK 500E) For further details of function, please refer to parameter (P481).
9	0		
	1	Bit 9 active	Bus bit 9 from the control word is set. (only for SK 200E and SK 500E) For further details of function, please refer to parameter (P481).
10	0	PZD invalid	The transmitted process data is invalid.
	1	PZD valid	Valid process data is transferred from the master. **Note:** If only setpoints are transferred via the bus, this bit must be set so that the transferred setpoint is valid.
11	0		
	1	Rotation right	Rotation right (priority) is on.
12	0		
	1	Rotation left	Rotation left is on.
13	0/1		Reserved
14	0/1	Parameter set switch Bit 0	00 = Parameter set 1 01 = Parameter set 2 10 = Parameter set 3 11 = Parameter set 4
15	0/1	Parameter set switch Bit 1	

7.2.2 Status word (ZSW)

The status word (ZSW) is the first word transferred to the frequency inverter in the process data section of a response telegram.



Meaning of the individual bits:

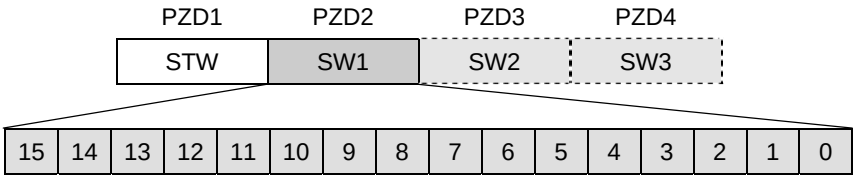
Bit	Value	Significance	Comments	
0	0	Not on standby		
	1	Ready for switch-on	Initialisation complete, load relay on, output voltage disabled	
1	0	Not operational	Causes: No ON command, an error has occurred, OFF 2 or OFF 3 active, switch-on disable status active.	
	1	Standby	ON command active, no errors. The inverter can be started with the ENABLE OPERATION command.	
2	0	Operation disabled		
	1	Operation enabled	Output voltage enabled, run-up to present setpoint.	
3	0	No errors		
	1	Fault	Drive malfunctioning therefore out of order, if acknowledgement is successful, will go to switch-on disabled status.	
4	0	OFF 2	OFF 2 disable voltage command active	
	1	No OFF 2		
5	0	OFF 3	OFF 3 rapid stop command active	
	1	No OFF 3		
6	0	No switch-on disable		
	1	Switch-on disabled	Goes to standby status through OUT 1 command	
7	0	No warning		
	1	Warning	Drive still in operation, no acknowledgement necessary	
8	0	Actual value not O.K.	Actual value does not match the setpoint (with *posicon*: Setpoint position not reached)	
	1	Actual value O.K.	Actual value matches the setpoint (setpoint reached) (with *posicon*: Setpoint position reached)	
9	0	Local guidance	Local guidance active on device	
	1	Guidance required	The master is called upon to take over the guidance.	
10	0			
	1	Bit 10 active	Bus bit 10 from the status word is set. For further details of function, please refer to parameter P481.	
11	0			
	1	Rotation right	Inverter output voltage has right-hand rotating field	
12	0			
	1	Rotation left	Inverter output voltage has left-hand rotating field	
13	0			
	1	Bit 13 active	Bus bit 13 from the status word is set. For further details of function, please refer to parameter P481.	
14	0/1	Actual active parameter set Bit 0	00 = Parameter set 1 01 = Parameter set 2	10 = Parameter set 3 11 = Parameter set 4
15	0/1	Actual active parameter set Bit 1		

7.2.3 Setpoint and actual values

7.2.3.1 Setpoint 1 (SW1)

The function of the first setpoint is set in the parameter "Function bus setpoint 1" (SK 200E: (P546[01]) or SK 500E: (P546)) (see relevant frequency inverter manual).

In the order telegram, setpoint 1 follows immediately after the control word. Setpoint 1 is pre-set to the transfer of a setpoint frequency (16 bit value).



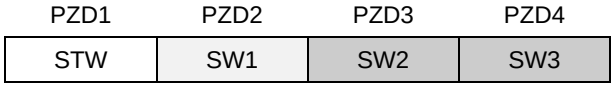
The setpoint is transferred as an integer in the range -32768 to 32767 (8000 hex to 7FFF hex), whereby 16384 (4000 hex) is exactly 100% and -16383 (C000 hex) corresponds to -100%. Due to this resolution, setpoints (depending on function) of up to ± 200% can be transferred.

A setpoint of 100% corresponds to the respective nominal value:

Setting	**100% is equal to**
Off	
Setpoint frequency, actual frequency PID, actual frequency PID limited, actual frequency PID monitored, frequency addition, frequency subtraction, maximum frequency	Maximum frequency
Torque current limit	Torque current limit (P112)
Current limit	Inverter nominal current
Servo mode torque	Nominal torque
Lead torque	Lead torque (P214)

7.2.3.2 Setpoints 2 and 3 (SW2/3)

If the PPO type 2 or 4 is used, in addition to setpoint 1, a second setpoint can be transferred in word PZD3 and a third setpoint in PZD4.



The definition of these two setpoints corresponds to that of setpoint 1.

However, the transfer of a third (maximum 16 Bit) setpoint is only possible if the other two setpoints are also 16 Bit values.

If the transfer of a 32 bit setpoint is necessary (Example: setpoint position), this must be divided into two 16 bit values, i.e. into two PZDs (**position High** and **Low word**).

STW	SW1	SW2

The definition in the frequency inverter can then, for example, be made via the parameters:

PZD3: **"Bus function setpoint 2"** (SK 200E: (P546[02]) or SK 500E (P547)) and

PZD4: **"Bus function setpoint 3"** (SK 200E: (P546[03]) or SK 500E (P548))

Example

If a position setpoint is to be transferred (Prerequisite: *posicon* inverter functionality) this can be performed either as a 16 bit or 32 bit value. The resolution is always 0.001 rotations/step.

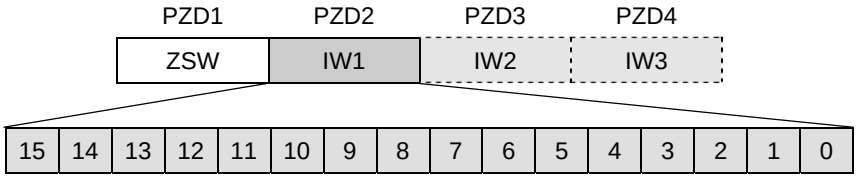
A value range of +32767 (= 32.767 revolutions) to -32768 (= -32.768 revolutions) is possible as a **16 Bit** value. Here, exactly one PZD word is required in order to transfer the position.

The full position range of +/- 50000.000 revolutions is available as a **32 Bit** value. Here, exactly two PZD words are required in order to transfer the position.

7.2.3.3 Actual value 1 (IW1)

The function of the actual value is set in the parameter "Function bus actual value 1" (SK 200E: (P543[01]) or SK 500E: (P543)) (see relevant frequency inverter manual).

In the order telegram, actual value 1 follows immediately after the control word. The actual value 1 is pre-set to the transfer of the current output frequency of the frequency inverter (16 bit value).



The actual value is transferred as an integer in the range -32768 to 32767 (8000 hex to 7FFF hex), whereby in the settings "actual frequency", "actual speed", "current" and "torque current", the values 16384 (4000 hex) exactly correspond to 100% and -16383 (C000 hex) correspond to exactly -100%. Due to this resolution, setpoints (depending on function) of up to ± 200% can be transferred.

7.2.3.4 Actual values 2 and 3 (IW2/3)

If the PPO type 2 or 4 is used, in addition to actual value 1, a second actual value can be transferred in word PZD3 and a third actual value in PZD4.

PZD1	PZD2	PZD3	PZD4
ZSW	IW1	IW2	IW3

The definition of these two actual values corresponds to that of actual value 1.

If the transfer of a 32 bit actual value is necessary (Example: actual position), this must be divided into two 16 bit values, i.e. into two PZDs (**position High** and **Low word**).

PZD1	PZD2	PZD3	PZD4
ZSW	IW1	IW2	

The definition in the frequency inverter can then, for example, be made via the parameters:

PZD3: **“Bus function Actual value 2"** (SK 200E: (P543[02]) or SK 500E (P544)) and

PZD4: **“Bus function Actual value 3"** (SK 200E: (P543[03]) or SK 500E (P545))

7.2.4 The status machine

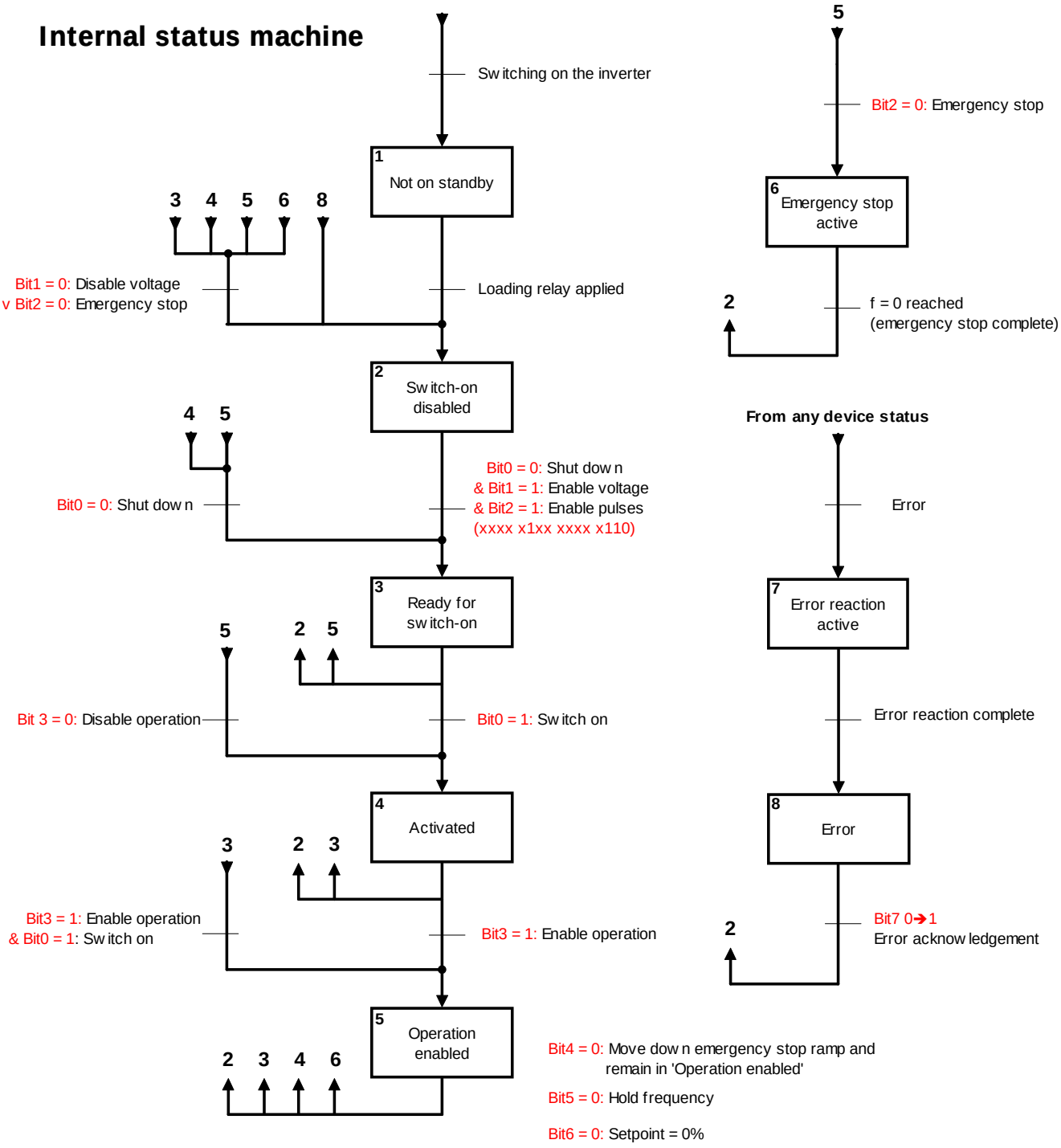
The frequency inverter passes through a status machine“. The changes between various states are triggered by the respective control commands in the process data control word. The actual status is returned in the process data status word.

After switching on, the frequency 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 has to 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 on standby	0	X	X	0	0	0	0
Switch-on disabled	1	X	X	0	0	0	0
Ready for switch-on	0	1	1	0	0	0	1
Activated	0	1	1	0	0	1	1
Operation enabled	0	1	1	0	1	1	1
Error	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➔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

8 Additional information

8.1 System bus

With NORDAC inverter technology, units or modules communicate via a dedicated system bus. With the launch of the SK 200E frequency inverter series and the associated components SK CU4-... and SK TU4-... functions and interfaces were implemented in this system bus, which enable the user to make appropriate adaptations.

A decisive advantage is provided by the fact that the system bus is no longer restricted to a single inverter and a directly connected module, but rather that up to 4 frequency inverters can jointly use a BUS interface (e.g.: DeviceNet). This increases the number of possible subscribers on a field bus system (by a factor of 4) with comparatively lower investment costs.

The system bus address of the bus modules (SK CU4-… and SK TU4-…) is set to "30". The system bus address of the up to 4 frequency inverters which can be connected are set by means of DIP switches (see manual BU0200) on the relevant frequency inverter, optionally between 32 / 34 / 36 and 38, whereby no address may be doubly assigned within a system bus system.

8.2 Electronic data sheet (eds file)

All available objects are contained in the “Electronic data sheet” (eds file). This can be found on the enclosed EPD CD or under www.nord.com.

8.3 Repairs

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

NORD Electronic DRIVESYSTEMS GmbH
Tjüchkampstr. 37
26605 Aurich, Germany

For queries about repairs, please contact:

Getriebebau NORD GmbH & Co. KG
Tel.: 04532 / 401-515
Fax: 04532 / 401-555

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

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

NOTE

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 obtain a suitable goods return voucher from Getriebebau NORD GmbH.

9 Index

Abbreviations used:

BE	Bus error (fault)
BG	Module
BR	Bus ready
BS	BUS state (status)
CU	Customer Unit (customer interface - internal technology unit)
D, DI, DIN	Digital IN
DE	DEVICE error (fault)
DO, DOUT	Digital OUT
DP	Decentralised peripheral
DS	DEVICE state (status)
DVN	DeviceNet
EDS	Electronic data sheet (eds file)
EMC	Electromagnetic compatibility
FI	Frequency inverter
GND	Earth
HW	Hardware
IND	Index
I/O	IN / OUT, input and output
IW	Actual value
I&M	Identification & Maintenance Functions
MS	Module status
NS	Network Status
P	Parameter which depends on a parameter set
PKE	Parameter identifier
PKW	Parameter identifier Value
PWE	Parameter Value
PZD	Process data
STW	Control word
SW	Software / Setpoint
Sys	NORD system bus
TU	Technology Unit (external technology unit)
ZSW	Status word

10 Keyword index

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