

## SK CU4-DEV

Part number: 275 271 002

### DeviceNet® – Internal Bus Interface

The bus interface may only be installed and commissioned by qualified electricians. An electrician is a person who, because of their technical training and experience, has sufficient knowledge with regard to

- Switching on, switching off, isolating, earthing and marking power circuits and devices,
- Proper maintenance and use of protective devices in accordance with defined safety standards.

### **DANGER**

### Danger of electric shock

The frequency inverter carries hazardous voltage for up to 5 minutes after being switched off.

- Work must not be carried out unless the frequency inverter has been disconnected from the voltage and at least 5 minutes has elapsed since the mains was switched off!

### NOTICE

### Validity of document

This document is only valid in conjunction with the operating instructions of the respective frequency inverter and the bus communication manual for this bus interface (📖 See overview at end of document). These documents contain all of the information that is required for safe commissioning of the bus interface module and the frequency inverter.

### Scope of delivery

|     |                      |                     |
|-----|----------------------|---------------------|
| 1 x | Bus interface        | SK CU4-DEV          |
| 1 x | System bus cable set | grey/black          |
| 1 x | 24 VDC cable set     | brown/blue          |
| 2 x | Connecting screws    | M4 x 20, cross-head |



### Usage area

Internal interface for connecting a decentralised frequency inverter (SK 2xxE) to a **DeviceNet** field bus. This is connected to the inverter via the system bus, and can directly access up to 4 frequency inverters. 2 digital inputs are available.

| Technical Information / Datasheet | SK CU4-DEV   |       |      |    |
|-----------------------------------|--------------|-------|------|----|
| DeviceNet Bus module              | TI 275271002 | V 1.0 | 4116 | EN |

**Technical Data**
*Bus interface*

|                   |                |                      |   |
|-------------------|----------------|----------------------|---|
| Temperature range | -25 °C...50 °C | Vibration resistance | 3M7   |
| Temperature class | Class 3K3      | Firmware version     | V1.5 R0   |
| Protection class  | IP20           | Supply voltage       | 24 V ± 20 %, ≈ 100 mA<br>Reverse polarity protected |

|                               |   |
|-------------------------------|---|
| Digital input - working range | Low: 0 V ... 5 V, High: 15 V ... 30 V   |
| Digital input - specific data | R <sub>i</sub> = 8.1 kΩ, input capacity: 10 nF, response time 1 ms, inputs as per EN 61131-2 type 1 |

*Bus specification*

| DeviceNet        | Max. 500 kBit/s<br>electrical isolation 500 V <sub>eff</sub>  |                  |               |             |            |             |            |             |            |
|------------------|---|------------------|---------------|-------------|------------|-------------|------------|-------------|------------|
| Bus connection   | Screw terminals   |                  |               |             |            |             |            |             |            |
| Bus termination  | via DIP switch on the bus interface   |                  |               |             |            |             |            |             |            |
| Status display   | 6 LEDs  |                  |               |             |            |             |            |             |            |
| Topology         | Linear bus  |                  |               |             |            |             |            |             |            |
| Cable            | twisted, shielded two-conductor cable   |                  |               |             |            |             |            |             |            |
| Cable length     | depending on transmission speed:<br><table border="1" data-bbox="454 1093 917 1220"> <thead> <tr> <th>Bus cable length</th> <th>Transfer rate</th> </tr> </thead> <tbody> <tr> <td>Up to 100 m</td> <td>500 KBit/s</td> </tr> <tr> <td>100...250 m</td> <td>250 KBit/s</td> </tr> <tr> <td>250...500 m</td> <td>125 KBit/s</td> </tr> </tbody> </table> | Bus cable length | Transfer rate | Up to 100 m | 500 KBit/s | 100...250 m | 250 KBit/s | 250...500 m | 125 KBit/s |
| Bus cable length | Transfer rate   |                  |               |             |            |             |            |             |            |
| Up to 100 m      | 500 KBit/s  |                  |               |             |            |             |            |             |            |
| 100...250 m      | 250 KBit/s  |                  |               |             |            |             |            |             |            |
| 250...500 m      | 125 KBit/s  |                  |               |             |            |             |            |             |            |
| Shield           | Direct to PE  |                  |               |             |            |             |            |             |            |
| PE connection    | via PE screw cap in terminal box  |                  |               |             |            |             |            |             |            |

*Power*

|   |         |
|---|---------|
| Update interval for process data between bus interface and frequency inverter | < 5 ms  |
| Parameter read access on the frequency inverter                               | < 12 ms |
| Parameter write access with storage in EEPROM                                 | ≈ 25 ms |

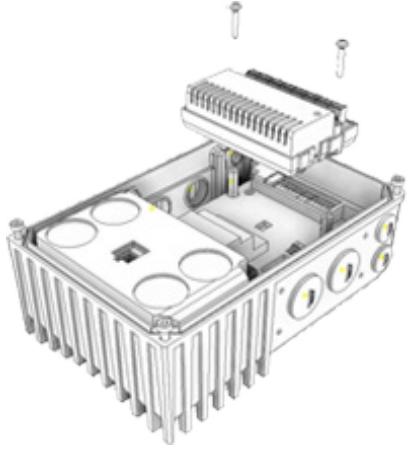
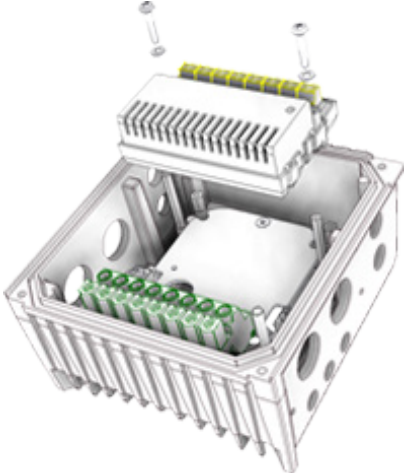
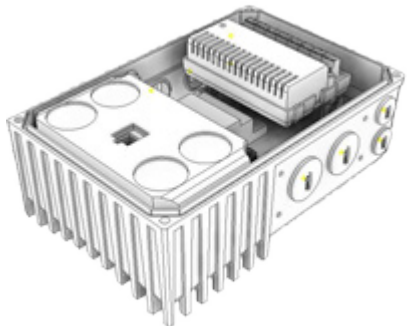
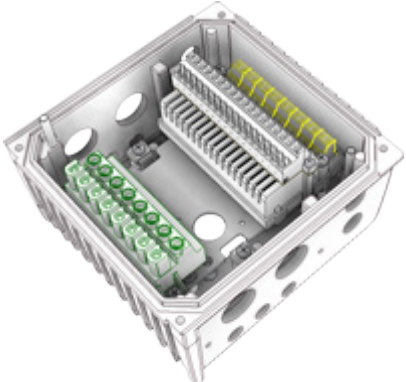
**Bus interface characteristics**

|                                      |  |                   |                   |                          |                |
|--------------------------------------|--|-------------------|-------------------|--------------------------|----------------|
| Parametrisation                      | DeviceNet via Explicit Messages  |                   |                   |                          |                |
| Addressing                           | <table border="1" data-bbox="790 1675 1241 1742"> <tr> <td><b>SK TU3-DEV</b></td> <td><b>SK xU4-DEV</b></td> </tr> <tr> <td>via Rotary coding switch</td> <td>via DIP switch</td> </tr> </table>         | <b>SK TU3-DEV</b> | <b>SK xU4-DEV</b> | via Rotary coding switch | via DIP switch |
| <b>SK TU3-DEV</b>                    | <b>SK xU4-DEV</b>  |                   |                   |                          |                |
| via Rotary coding switch             | via DIP switch   |                   |                   |                          |                |
| Setting the baud rate                | <table border="1" data-bbox="790 1742 1241 1809"> <tr> <td><b>SK TU3-DEV</b></td> <td><b>SK xU4-DEV</b></td> </tr> <tr> <td>via Rotary coding switch</td> <td>via DIP switch</td> </tr> </table>         | <b>SK TU3-DEV</b> | <b>SK xU4-DEV</b> | via Rotary coding switch | via DIP switch |
| <b>SK TU3-DEV</b>                    | <b>SK xU4-DEV</b>  |                   |                   |                          |                |
| via Rotary coding switch             | via DIP switch   |                   |                   |                          |                |
| Supported DeviceNet connection types | <ul style="list-style-type: none"> <li>• Explicit Messaging Connection</li> <li>• Polled I/O Connection</li> <li>• Bit Strobe I/O Connection</li> <li>• Change of State/Cyclic I/O Connection</li> </ul> |                   |                   |                          |                |
| Access for NORD diagnosis tool via   | diagnostics socket on the device (if available) and via frequency inverter   |                   |                   |                          |                |

### Installation

|                       |   |
|-----------------------|---|
| Installation location | Within the connection unit of a frequency inverter (SK 180E, SK 190E, 2xxE) |
| Fastening             | with screw fastenings   |

### Installation steps

|    | SK 1xxE  | SK 2xxE   |
|----|--|---|
| 1. |   |   |
| 2. |  |  |

### Connections

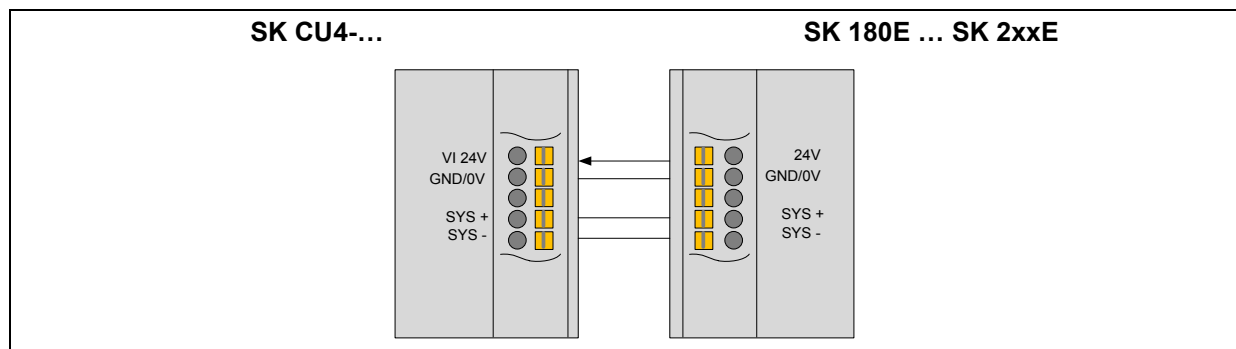
Connection is via the terminal strip of the bus interface.

| Potential | Contact                             | Designation             | Description |                                      |
|-----------|-------------------------------------|-------------------------|-------------|--------------------------------------|
| 1         | System bus level and digital inputs | 44                      | 24 V        | Supply potential (+24 V ±20%, 50 mA) |
|           |                                     | 40                      | GND         | Reference potential (0 V/GND)        |
|           |                                     | C1                      | DIN1        | Digital input 1 (I/O DeviceNet DIN1) |
|           |                                     | C2                      | DIN2        | Digital input 2 (I/O DeviceNet DIN2) |
|           |                                     | 77                      | Sys +       | System bus data line +               |
|           |                                     | 78                      | Sys -       | System bus data line -               |
|           |                                     | 40                      | GND         | Reference potential (0 V/GND)        |
| 2         | DeviceNet                           | 45                      | 24 V Bus    | 24 V supply voltage field bus        |
|           |                                     | 75                      | DeviceNet+  | Bus connection 1 Receive Data +      |
|           |                                     | 76                      | DeviceNet-  | Bus connection 1 Receive Data -      |
|           |                                     | 46                      | GND Bus     | Bus reference potential              |
|           |                                     | 90                      | SHLD        | Bus line shield                      |
|           |                                     | 45                      | 24 V Bus    | Supply potential (+24 V ±20%, 50 mA) |
|           |                                     | 75                      | DeviceNet+  | Bus connection 2 Transmit Data +     |
|           |                                     | 76                      | DeviceNet-  | Bus connection 2 Transmit Data -     |
| 46        | GND Bus                             | Bus reference potential |             |                                      |



### Schematic diagram - electrical connection

(Terminal designation for the example of NORD frequency inverters SK 180E ... SK 2xxE)



## Configuration

The bus address (MAC ID), the bus interface (1) and the baud rate (2) are set via the DIP switches. The DIP switch settings are read in after a “Power On” of the bus interface.

If the bus interface is the final subscriber on the DeviceNet field bus or the NORD system bus, the terminating resistor (3) must be activated.

| DIP switch | Meaning         | Department   | Meaning  |
|------------|-----------------|--------------|--|
| 8          | MAC ID Bit 5    | Addressing   | Bus address (MAC ID) of bus interface                            |
| 7          | MAC ID Bit 4    |              |  |
| 6          | MAC ID Bit 3    |              |  |
| 5          | MAC ID Bit 2    |              |  |
| 4          | MAC ID Bit 1    |              |  |
| 3          | MAC ID Bit 0    |              |  |
| 2          | Baud rate bit 1 | Baud rate    | Bus interface baud rate  |
| 1          | Baud rate bit 0 |              |  |
| E          | —               | Bus terminal | Not used   |
| 2          | —               |              | Not used   |
| 1          | S-Bus Term.     |              | Terminating resistor for DeviceNet field bus and NORD system bus |



### 1. Addressing (DIP 8 ... 3)

The setting of the bus address takes place with binary coding using DIP switches 8...3.

Address area "0"..."63".

### 2. Baud rate (DIP 2 ... 1)

The setting of the node ID takes place with binary coding using DIP switches 2...1.

| DIP switch 2 | DIP switch 1 | Baud rate |
|--------------|--------------|-----------|
| OFF          | OFF          | 125 kBaud |
| OFF          | ON           | 250 kBaud |
| ON           | OFF          | 500 kBaud |

### 3. Termination resistor (DIP E... 1)

Set DIP switch 1 to the “ON” position if the bus interface is the final subscriber on the bus.

## LED indicators

The operating statuses of the bus interface are visualised using LED indicators.

| No. | Name | Colour    | Meaning                  |
|-----|------|-----------|--------------------------|
| 1   | MS   | red/green | DeviceNet Module status  |
|     | NS   | red/green | DeviceNet Network status |
| 2   | DS   | green     | Device State             |
|     | EN   | red       | Device error             |
| 3   | D1   | green     | Digital input D1         |
|     | D2   | green     | Digital input D2         |



## DeviceNet-specific LED

| MS<br>(DeviceNet<br>Module status)  | Meaning   |
|-------------------------------------|---|
| <b>OFF</b>                          | No voltage supply   |
| <b>Steady illumination in green</b> | Bus interface ready   |
| <b>Flashing green (0.5 s)</b>       | <ul style="list-style-type: none"> <li>Bus interface in standby mode. No connection to one or more frequency inverters. No parameters exchanged, setpoint specifications via the AC profile not possible.</li> <li>Baud rate setting for DeviceNet field bus is invalid.</li> </ul> |
| <b>Steady illumination in red</b>   | A fault that cannot be acknowledged has occurred. The bus interface may be defective and must be replaced.  |
| <b>Flashing red (0.5 s)</b>         | A fault that can be acknowledged has occurred on the bus interface.   |

| NS<br>(DeviceNet<br>Network status) | Meaning  |
|-------------------------------------|--|
| <b>OFF</b>                          | <ul style="list-style-type: none"> <li>No voltage supply.</li> <li>The bus interface has not performed the "DUP_MAC_ID" test.</li> </ul> |
| <b>Steady illumination in green</b> | Normal operation, cyclic data exchange via DeviceNet field bus.  |
| <b>Flashing green (0.5 s)</b>       | Bus interface is "Online" and has performed the "Dup_Mac_ID" test but has not established a connection to field bus subscribers.         |
| <b>Steady illumination in red</b>   | A serious communication error has occurred (e.g. bus off, duplicated bus address or invalid baud rate setting).                          |
| <b>Flashing red (0.5 s)</b>         | The I/O connection or the function of parameter P151 has triggered a timeout error. The flash code is displayed for at least 5 seconds.  |

## NORD-specific LEDs

| DS<br>(Device State) | EN<br>(Device Error)                                       | Meaning<br>long flashing = 0.5 s on / 1 s off<br>short flashing = 0.25 s on / 1 s off  |
|----------------------|--|--|
| <b>OFF</b>           | <b>OFF</b>   | Bus interface not ready, no control voltage  |
| <b>ON</b>            | <b>OFF</b>   | Bus interface ready, no error, at least one frequency inverter is communicating via the system bus   |
| <b>ON</b>            | <b>Short flashing</b>                                      | Bus interface ready, but <ul style="list-style-type: none"> <li>One or more of the connected frequency inverters has fault status</li> </ul>   |
| <b>Long flashing</b> | <b>OFF</b>   | Bus interface ready and at least one other subscriber is connected to the system bus, but <ul style="list-style-type: none"> <li>No frequency inverter on the system bus (or connection interrupted)</li> <li>One or more system bus subscriber has an address error</li> <li>Software incompatible (bus interface software and FI software incompatible - update required)</li> </ul> |
| <b>Long flashing</b> | <b>Short flashing</b><br>Flash interval<br>1 x - 1 s pause | System bus is in status "Bus Warning" <ul style="list-style-type: none"> <li>Communication on system bus disrupted</li> <li>No other subscribers present on system bus</li> <li>Module not inserted correctly or no connection to system bus</li> <li>Frequency inverter has no supply voltage</li> </ul>  |
| <b>Long flashing</b> | <b>Short flashing</b><br>Flash interval<br>2 x - 1 s pause | System bus is in status "Bus Off" <ul style="list-style-type: none"> <li>The system bus 24 V power supply has been interrupted during operation</li> </ul>   |
| <b>Long flashing</b> | <b>Short flashing</b><br>Flash interval<br>3 x - 1 s pause | System bus is in status "Bus Off" <ul style="list-style-type: none"> <li>The 24 V voltage supply of the system bus is missing</li> </ul>   |
| <b>Long flashing</b> | <b>Short flashing</b><br>Flash interval<br>4 x - 1 s pause | Bus interface error <ul style="list-style-type: none"> <li>See parameter <b>P170</b></li> </ul>  |
| <b>OFF</b>           | <b>Short flashing</b><br>Flash interval<br>1 x - 1 s pause | System error, internal program sequence interrupted <ul style="list-style-type: none"> <li>EMC interference (observe the wiring guidelines!)</li> <li>Bus interface defective</li> </ul>   |

## Digital input LEDs

| LED<br>(green) | Display   |            | Meaning                                    |
|----------------|-----------|------------|--|
| <b>D1</b>      | <b>ON</b> |            | "High" potential present at terminal "C1". |
|                |           | <b>OFF</b> | "Low" potential present at terminal "C1".  |
| <b>D2</b>      | <b>ON</b> |            | "High" potential present at terminal "C2". |
|                |           | <b>OFF</b> | "Low" potential present at terminal "C2".  |

## Error messages

Error messages from the bus interface - current or archived message relating to the last fault - can be read out via module parameter **P170**. The error messages are lost if the bus interface is switched off.

| Error | Meaning                 | Remarks   |
|-------|-------------------------|---|
| 100.0 | EEPROM error            | EMC faults, bus interface defective   |
| 101.0 | System bus 24 V missing | No 24 V voltage on bus, connections not correct                                 |
| 102.0 | Bus timeout P151        | By means of timeout supervision parameter <b>P151/P513</b>                      |
| 103.0 | System bus BUS OFF      | No 24 V supply to the bus, connections not correct                              |
| 511.0 | CANopen BUS OFF         | Bus subscriber not connected to bus   |
| 511.1 | CANopen warning         | Bus error   |
| 511.2 | CANopen overrun         | Message buffer of bus interface overwritten with new telegram before processing |
| 511.3 | Invalid CANopen address | Incorrect/duplicated bus address  |
| 512.0 | CANopen timeout         | Telegram transfer error   |

Bus interface-related errors are depicted as follows in the error memory of the frequency inverter (**P700 / P701**).

| Error (E010) | Meaning                                     | Remarks   |
|--------------|---|---|
| 10.2         | External bus interface telegram timeout     | Telegram transfer error <ul style="list-style-type: none"> <li>Check the connections and links, program sequence and Bus Master.</li> </ul>   |
| 10.3         | Timeout by <b>P151/P513</b>                 | Telegram transfer error. <ul style="list-style-type: none"> <li>Check watchdog time (P151).</li> <li>Check the connections and links and the program sequence in the Bus Master.</li> </ul> The release bit is missing in the control word. |
| 10.4         | External bus interface initialisation error | Unable to address bus interface. <ul style="list-style-type: none"> <li>Check parameter P746 setting.</li> <li>Check power supply of bus interface.</li> <li>Check the connections and links.</li> </ul>                                    |
| 10.8         | External bus interface communication error  | Only SK TU3-CAO bus interface:<br>Connection between bus interface and frequency inverter interrupted.  |
| 10.9         | Missing bus interface                       | Bus interfaces SK CU4-DEV and SK TU4-DEV only:<br>Connection between bus interface and frequency inverter interrupted (see setting of parameter <b>P120</b> ).  |

## Parameters

*Frequency inverter:* The following frequency inverter parameters must be adapted for setting up communication between the frequency inverter and the bus interface (for details please refer to the frequency inverter manual).

| Parameter [-Array]  | Meaning                           | Remarks  |
|---|-----------------------------------|--|
| <b>P120</b> [-01]   | Option monitoring                 | <b>"Auto"</b> (default setting)<br>Only SK xU4   |
| <b>P509</b>   | Source Control Word               | SK TU3-... on SK 5xxE: <b>"Ethernet TU"</b><br>SK xU4-... on SK 180/SK 2xxE: <b>"System bus"</b> |
| <b>P510</b> [-01]...[-02]   | Setpoint source                   | <b>"Auto"</b> (default setting)  |
| <b>P513</b>   | Time-out                          | Monitoring of the SK TU3 bus interface<br>Only SK 5xxE   |
| <b>P543</b> [-01]...[-03] ([-05]) and <b>P543</b> ... <b>P545</b> | Bus actual value (1...3 (...5))   | Possible settings according to <b>P418</b>   |
| <b>P546</b> [-01]...[-03] ([-05]) and <b>P546</b> ... <b>P548</b> | Bus setpoint value (1...3 (...5)) | Possible settings according to <b>P400</b>   |
| <b>P700</b> [-01]/ <b>P701</b>                                    | Current/last faults               | Information parameter  |
| <b>P740</b> / <b>P741</b>   | Process data bus In / Out         | Information parameter  |
| <b>P745</b>   | Module version                    | Information parameter<br>Only SK TU3   |
| <b>P746</b>   | Module status                     | Information parameter<br>Only SK TU3   |
| <b>P748</b>   | CANopen/System bus status         | Information parameter  |

*Bus interface:* The bus interface provides a selection of appropriate parameters for setting or displaying special operating values. Parameters can be adapted using the NORDCON software or an






SK PAR-3H / -3E parameter box. All parameters can still be read and written by the bus master via DeviceNet.

| Parameter [-Array] | Meaning                   | Remarks   |
|--------------------|---------------------------|---|
| P150               | Set relays                | Set DOUT directly or control via BUS  |
| P151               | External bus time-out     | Monitoring of SK xU4 bus interface  |
| P152               | Factory setting           | Reset bus interface parameters  |
| P153 [-01]...[-02] | Minimum system bus cycle  | Reduction of bus load on the system bus caused by the bus interface                   |
| P154 [-01]...[-02] | Access to option card I/O | Administration of read and write rights to the IO of the module                       |
| P160               | Assembly selection        | Assignment if instances of the assembly object (frequency inverter and bus interface) |
| P161 [-01]...[-02] | Config PZD BusBG          | Determine length of process data for the bus interface                                |
| P162 [-01]...[-03] | Config PZD FU1            | Determine length of process data for frequency inverter FI1                           |
| P163 [-01]...[-03] | Config PZD FU2            | Determine length of process data for frequency inverter FI2                           |
| P164 [-01]...[-03] | Config PZD FU3            | Determine length of process data for frequency inverter FI3                           |
| P165 [-01]...[-03] | Config PZD FU4            | Determine length of process data for frequency inverter FI4                           |
| P170 [-01]...[-02] | Present errors            | Display bus interface errors  |
| P171 [-01]...[-03] | Software version          | Firmware version/Revision   |
| P172               | Configuration             | Bus interface type  |
| P173               | Module status             | Status of system bus or the connected FI  |
| P174               | Status of digital inputs  | Image of the switching status of DIN  |
| P175               | Digital output state      | Image of the switching status of DOUT   |
| P176 [-01]...[-17] | Process data bus In       | Information parameter   |
| P177 [-01]...[-17] | Process data bus Out      | Information parameter   |
| P180               | DeviceNet address         | Information parameter   |
| P181               | DeviceNet baud rate       | Information parameter   |

### Parameter access and diagnostics

The NORD CON software and optional control units such as the SK PAR-3H parameter box provide convenient access to the parameters of the bus interface and allow status information to be read out.

| SK TU3-   | SK TU4-  | SK CU4- / SK TU4-  |
|---|--|--|
| Access via RJ12 diagnostics socket of the SK 5xxE                                   | Access via RJ12 diagnostics socket of the bus connection unit <b>SK TI4-TU-BUS(-C)</b> | Access via RJ12 frequency inverter diagnostics socket, if connected to the bus interface via the system bus. |
|  |     |                         |

### Further documentation and software ([www.nord.com](http://www.nord.com))

| Software                 | Description                           |
|--------------------------|---------------------------------------|
| <a href="#">EDS-file</a> | Device characteristics and parameters |

| Software                 | Description                             |
|--------------------------|---|
| <a href="#">NORD CON</a> | Parametrisation and diagnostic software |

| Document                | Description                                |
|-------------------------|--|
| <a href="#">BU 0000</a> | Description of NORD CON software           |
| <a href="#">BU 0040</a> | Parameter box manual                       |
| <a href="#">BU 0180</a> | Frequency inverter manual SK 180E, SK 190E |
| <a href="#">BU 0200</a> | Frequency inverter manual SK 2xxE          |
| <a href="#">BU 2600</a> | DeviceNet bus communication description    |

| Document                     | Description   |
|------------------------------|---|
| <a href="#">TI 275274505</a> | SK TIE4-M12-SYSM System bus connection expansion exit     |
| <a href="#">TI 275274506</a> | SK TIE4-M12-SYSS System bus connection expansion entrance |
| <a href="#">TI 275274515</a> | SK TIE4-M12-CAO-OUT CANopen connection expansion output   |
| <a href="#">TI 275274501</a> | SK TIE4-M12-CAO CANopen connection expansion entrance     |