## SK CU4-PNT-C

**Part number: 275 271 515**

**PROFINET IO® – 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.

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| ⚠ **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!

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| *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.

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**Scope of delivery**

| 1 x | Bus interface | SK CU4-PNT-C |
|---|---|---|
| 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 the connection of a decentralised frequency inverter (SK 180E…SK 2xxE) to a **PROFINET IO** 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. The bus interface has a water-repellent coating. Reliable operation is retained even with condensation.

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## Technical Data

*Bus interface*

| | | | | |
|---|---|---|---|---|
| Temperature range | -25 °C … xx °C * | | Vibration resistance | 3M7 |
| Temperature class | Class 3K3 | | Firmware version | V1.4 R4 |
| Protection class | IP20 | | Supply voltage | 24 V ± 20 %, ≈ 100 mA reverse polarity protected |

* The upper temperature limit depends on the frequency inverter and the operating mode → see "Derating"

| | |
|---|---|
| Digital input - working range | Low: 0 V … 5 V, High: 15 V … 30 V |
| Digital input - specific data | $R_i$ = 10 kΩ, input capacity: 10 nF, response time 10 ms, inputs as per EN 61131-2 type 1 |

*Bus specification*

| | | | | |
|---|---|---|---|---|
| PROFINET IO | max. 100 MBaud | | Cable | Min. Ethernet CAT-5 |
| | electrical isolation 500 $V_{eff}$ | | Max. cable length | 100 m between two bus interfaces |
| Bus connection | Screw terminals | | Shield | Direct to PE |
| Bus termination | performed automatically | | PE connection | via PE screw cap in terminal box |
| Status display | 6 LEDs | | | |
| Topology | Star, tree, ring, line | | | |

*Power*

| | |
|---|---|
| Update interval for process data between bus interface and frequency inverter | ≈ 5 ms |
| Parameter read access on the frequency inverter | ≈ 25 ms |
| Parameter write access with storage in EEPROM | ≈ 70 ms |
| Cycle times | ≥ 1 ms |

## Derating

| **NOTICE** | **Derating** |
|---|---|

Depending on the installation location of the bis interface (SK 180E, SK 190E or SK 2xxE), the operating mode (S1, S3 ...) and the installation type (wall-mounting, motor-mounting) of the frequency inverter and the type of motor used (IE1 / IE2 / ...), restrictions to the permissible ambient temperature must be taken into consideration. If the permissible ambient temperature is exceeded, the bus interface can heat up to an impermissible extent and switch itself off with an error message (E104.0).

| | | Maximum ambient temperature * | |
|---|---|---|---|
| **Operating mode** | **Installation type** | **SK 180E/SK 190E** | **SK 2xxE** |
| S1 | Motor | 25 °C | 27 °C |
| S3 ED 50 %, 10 min | Motor | 40 °C | Not applicable |
| S3 ED 60 %, 10 min | Motor | Not applicable | 40 °C |
| S1 | Wall (unventilated) | 37 °C | 39 °C |
| S1 | Wall (ventilated) | 47 °C | 45 °C |

* The limits of the frequency inverter must not be exceeded (refer to the frequency inverter manual).
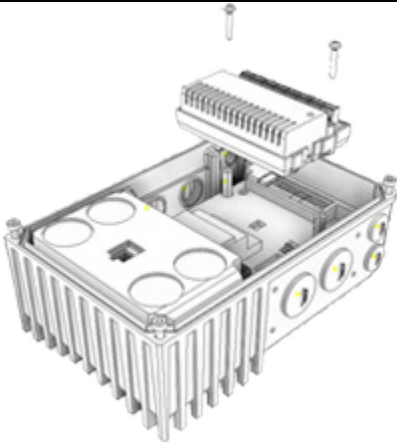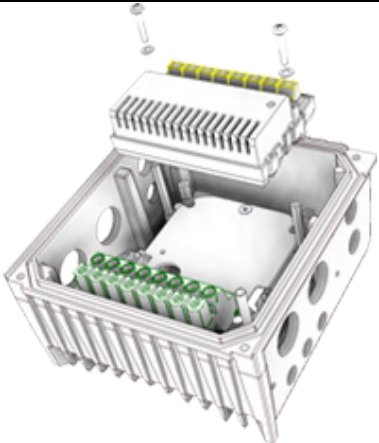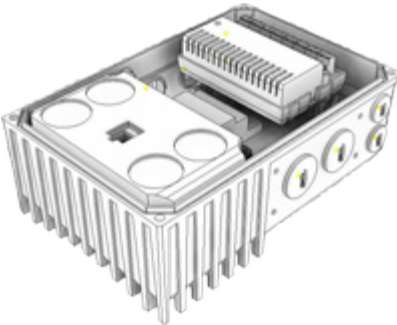
**Bus interface characteristics**

| Communication | RT (Real Time)<br>→ Real time communication of process data |
|---|---|
| | IRT (Isochronous Real Time)<br>→ Isochronous real time communication of synchronised process data |
| Addressing PROFINET IO | Automatic address assignment via IO controller using DCP (Discovery Configuration Protocol) |
| Data transfer | via Switched Ethernet |
| Autonegotiation | Negotiation of transfer parameters |
| Autocrossover | Transmission and receiver cables are automatically crossed in the switch as necessary |
| Conformity classes | CC-B and CC-C |
| Access for NORD diagnosis tool via | • Diagnostics socket on the device (if available) and via frequency inverter<br>• Ethernet protocols UDP or TCP/IP possible |

**Installation**

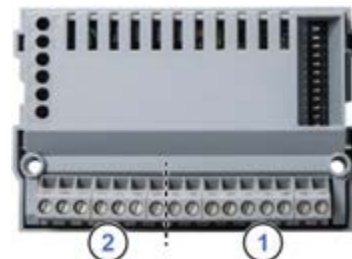| Installation location | Within the connection unit of a frequency inverter (SK 180E, SK 190E, 2xxE) |
|---|---|
| Fastening | with screw fastenings |

**Installation steps**

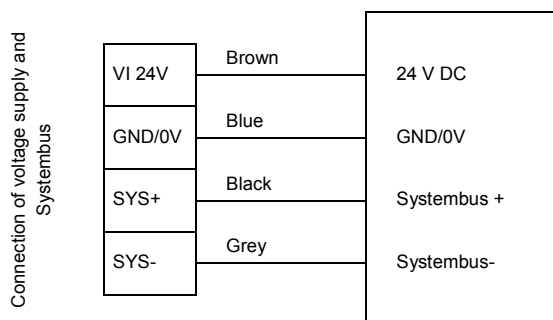| | SK 1xxE | SK 2xxE |
|---|---|---|
| 1. |  |  |
| 2. |  |  |

## Connections

Connection is via the terminal strip of the bus interface.

| Potential | | Contact | Designation | Description |
|---|---|---|---|---|
| **1** | Ethernet | E8 | PHY1 RX- | Ethernet connection 2 Receive Data - |
| | | E7 | PHY1 RX+ | Ethernet connection 2 Receive Data + |
| | | E6 | PHY1 TX- | Ethernet connection 2 Transmission Data - |
| | | E5 | PHY1 TX+ | Ethernet connection 2 Transmission Data + |
| | | E4 | PHY0 RX- | Ethernet connection 1 Receive Data - |
| | | E3 | PHY0 RX+ | Ethernet connection 1 Receive Data + |
| | | E2 | PHY0 TX- | Ethernet connection 1 Transmission Data - |
| | | E1 | PHY0 TX+ | Ethernet connection 1 Transmission Data + |
| **2** | System bus level and digital inputs | 78 | SYS - | System bus data line - |
| | | 77 | SYS + | System bus data line + |
| | | C1 | DIN1 | Digital input 1 |
| | | C2 | DIN2 | Digital input 2 |
| | | 40 | GND/0V | Reference potential (0 V/GND) |
| | | 44 | 24 V | Supply voltage (+24 V) |
| | | 40 | GND/0V | Reference potential (0 V/GND) |
| | | 44 | 24 V | Supply voltage (+24 V) |

*Connection examples*

Connection of voltage supply and Systembus

bus module

| VI 24V | Brown | 24 V DC |
| GND/0V | Blue | GND/0V |
| SYS+ | Black | Systembus + |
| SYS- | Grey | Systembus- |

## Configuration

Configuration of the bus interface module for remote maintenance or for the system bus is carried out via the DIP switches. The DIP switch settings are read after a "Power On" of the bus interface.

| DIP switch | | | | | | | | | | | | Meaning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 | |
| X | X | X | No function | | | | | | | | X | |
| | | | | | | | | | | | 0 | System bus terminating resistor not set. |
| | | | | | | | | | | | 1 | System bus terminating resistor set. |
| **Access rights for remote maintenance** | | | | | | | | | | | | |
| | | 0 | | | | | | | | | | Only read access to parameters possible. |
| | | 1 | | | | | | | | | | Read and write access to parameters possible. |
| | 0 | | | | | | | | | | | No control possible. |
| | 1 | | | | | | | | | | | Control is possible. |
| 0 | | | | | | | | | | | | TCP/IP open connection. |
| 1 | | | | | | | | | | | | Secure TCP/IP connection. |

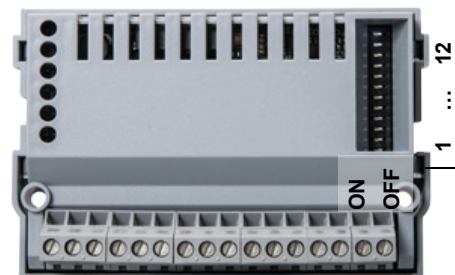1. System bus (DIP 1)

   The system bus must be terminated at both physical ends.

2. (DIP 2 ... 9)

   No function.

3. Access rights for remote maintenance (DIP 10 ... 12)

   The bus interface and the connected frequency inverter can be accessed using remote maintenance via the Ethernet TCP and UDP protocols. The type of access is defined via the DIP switch with inputs 10 to 12.
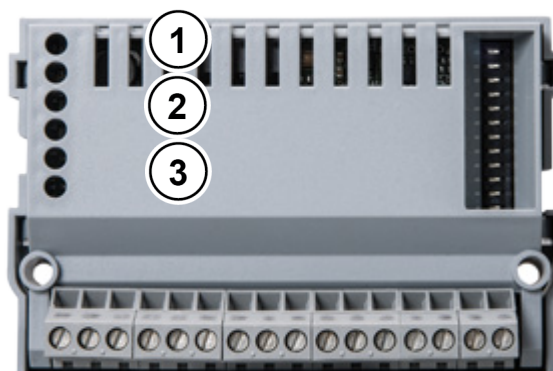


Factory settings DIP switches:   **OFF**

## LED indicators

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

| No. | Name | Colour | Meaning |
|---|---|---|---|
| 1 | RUN | green | Ethernet State |
| 1 | BF | red | Ethernet Error |
| 2 | L1 | green | Link 1 |
| 2 | A1 | yellow | Activity 1 |
| 3 | L2 | green | Link 2 |
| 3 | A2 | yellow | Activity 2 |



### *PROFINET-specific LED*

| RUN (Ethernet State) | Meaning |
|---|---|
| OFF | No operating voltage<br>Initialisation |
| Flashing green | No connection to PROFINET IO controller<br>No parameter communication<br>No process data communication |
| Green ON | Parameter communication active<br>Process data communication active |
| | |

| BF (Ethernet Error) | Meaning |
|---|---|
| OFF | No error |
| Flashing red | No process data communication<br>→ e.g. incorrect GSDML file |
| Red ON | Ethernet error → there is no physical connection to a further subscriber |
| Double-flashing red (2 x 0.25 s,+ 1sec pause) | PROFINET or FU timeout,<br>(see also P151, P513) |

| Link (Green LED) | Activity (Yellow LED) | Meaning |
|---|---|---|
| OFF | OFF | • Bus interface not ready, no control voltage,<br>• No bus connection (check cable connection) |
| ON | OFF | • Bus connection (cable connection) to another Ethernet device exists<br>• No bus activity present |
| ON | Flashing (Blinking) | • Bus connection (cable connection) to another Ethernet device exists<br>• Bus activity present |

*NORD-specific LEDs*

| DS<br>(**D**evice **S**tate) | EN<br>(**D**evice **E**rror) | **Meaning**<br>long flashing    = 0.5 s on / 1 s off<br>short flashing    = 0.25 s on / 1 s off |
|---|---|---|
| OFF | OFF | Bus interface not ready, no control voltage |
| ON | OFF | Bus interface ready, no error, at least one frequency inverter is communicating via the system bus |
| ON | Short flashing | Bus interface ready, but<br>   • One or more of the connected frequency inverters has fault status |
| Long flashing | OFF | Bus interface ready and at least one other subscriber is connected to the system bus, but<br>   • No frequency inverter on the system bus (or connection interrupted)<br>   • One or more system bus subscriber has an address error<br>   • Software incompatible (bus interface software and FI software incompatible - update required) |
| Long flashing | **Short flashing**<br>Flash interval<br>**1** x - 1s pause | System bus is in status "Bus Warning"<br>   • Communication on system bus disrupted<br>   • No other subscribers present on system bus<br>   • Module not inserted correctly or no connection to system bus<br>   • Frequency inverter has no supply voltage |
| Long flashing | **Short flashing**<br>Flash interval<br>**2** x - 1s pause | System bus is in status "Bus Off"<br>   • The system bus 24 V power supply has been interrupted during operation |
| Long flashing | **Short flashing**<br>Flash interval<br>**3** x - 1s pause | System bus is in status "Bus Off"<br>   • The 24V voltage supply of the system bus is missing |
| Long flashing | **Short flashing**<br>Flash interval<br>**4** x - 1s pause | Bus interface error<br>   • See parameter **P170** |
| OFF | **Short flashing**<br>Flash interval<br>**1…7** - 1s pause | System error, internal program sequence interrupted<br>   • EMC interference (observe the wiring guidelines!)<br>   • Bus interface defective |

## Error messages

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

| Error | Meaning | Remarks |
|---|---|---|
| 100.0 | EEPROM error | EMC fault, bus interface defective |
| 101.0 | System bus 24 V missing | No 24 V voltage on bus, connections not correct |
| 102.0 | Bus timeout **P151** | By means of timeout supervision parameter **P151/P513** |
| 103.0 | System bus Off | No 24 V voltage on bus, connections not correct |
| 104.0 | Overtemp. Module | Only SK CU4-PNT bus interface (see **E10.7**) |
| 550.0 | General configuration error | No Ethernet connection (see **E10.5**) |
| 550.1 | IO hardware error | Error on IO interfaces (see **E10.4**) |
| 550.2 | CAN hardware error | EMC fault (see **E10.6**) |
| 550.3 | SAFE hardware error | Error in the safety module |
| 550.4 | FI lost | Connection to system bus participant (FI) lost |
| 550.5 | AR lost | PROFINET telegram failure, connection to the IO controller lost (see **E10.2**) |
| 564.0 | MAC address error | MAC address defective |

Errors which occur in relation to the bus interface are depicted as follows in the error memory of the frequency inverter (P700 / P701).

| Error (E010) | Meaning | Remarks |
|---|---|---|
| 10.0 | Connection error | • Contact to bus interface lost |
| 10.2 | PROFINET telegram failure | • Check physical bus connections<br>• Check the status of the PROFINET IO controller |
| 10.3 | Timeout through **P151** | • System bus monitoring has triggered.<br>  – Check time setting parameter **P151**<br>• Telegram transfer is faulty.<br>  – Reception of cyclic telegrams<br>• Check physical bus connections |
| 10.4 | Hardware error, IOs | • An error has occurred in the IO hardware<br>  – Remedy EMC fault<br>  – Restart the bus interface |
| 10.5 | General PROFINET configuration error | • No Ethernet detected at the port<br>  This error only occurs if there had previously been a connection to another IO device or switch |
| 10.6 | System bus hardware error | • Remedy EMC fault |
| 10.7 | CU4 temperature too high | *Only SK CU4-PNT bus interface:*<br>• Excess bus interface temperature |
| 10.8 | Timeout connection error | • Connection between bus interface and frequency inverter interrupted due to timeout. |
| 10.9 | Module missing **P120** | *Bus interfaces SK CU4-PNT and SK TU4-PNT only:*<br>• The module entered in parameter **P120** is not available. |

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

| Parameter [-Array] | Meaning | Remarks | -TU3- | -TU4- | -CU4- |
|---|---|---|---|---|---|
| P150 | Set relays | Set DOUT directly or control via bus | | X | |
| P151 | External bus time-out | Monitoring of SK xU4 bus interface | | X | X |
| P152 | Factory setting | Reset bus interface parameters | X | X | X |
| P153 [-01 …] | Minimum system bus cycle | Reduction of bus load on the system bus caused by the bus interface | | X | X |
| P154 [-01 …] | Access to option card I/O | Administration of read and write permissions to the IOs of the bus interface | | X | X |
| P160 [-01…] | IP address | | X | X | X |
| P161 [-01…] | IP subnet mask | | X | X | X |
| P162 | Device name | Up to 240 characters (ASCII codes 45 … 122), save by entering "0" as the final character | X | X | X |
| P163 [-01 …] | Alarm test | Sets a diagnostic alarm | X | X | X |
| P164 [-01 …] | IP Gateway | IP-Address for Gateway functionality | X | X | X |
| P170 [-01 …] | Present errors | Indication of a bus interface error | X | X | X |
| P171 [-01 …] | Software version | Firmware version/Revision | X | X | X |
| P172 | Configuration | Bus interface type | X | X | X |
| P173 [-01 …] | Module status | Status of system bus or the connected FI | X | X | X |
| P174 | Status of digital inputs | Image of the switching status of DIN | | X | X |
| P175 | Digital output state | Image of the switching status of DOUT | | X | |
| P176 [-01…] | Process data bus In | Information parameter | X | X | X |
| P177 [-01…] | Process data bus Out | Information parameter | X | X | X |
| P178 | Internal temperature | Information parameter | | | X |
| P180 [-01 …] | PPO Type | Information parameter | X | X | X |
| P181 [-01 …] | MAC address | Information parameter | X | X | X |
| P185 [-01 …] | Present IP address | Information parameter | X | X | X |
| P186 [-01 …] | Current IP subnet mask | Information parameter | X | X | X |
| P187 [-01 …] | Actual IP Gateway | Information parameter | X | X | X |
| P190 | Status DIP-switches | Information parameter | X | X | X |

## 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 **SK TI4-TU-BUS(-C)** | Access via RJ12 frequency inverter diagnostics socket, if connected to the bus interface via the system bus. |

## Further documentation and software (**www.nord.com**)

| Software | Description | | Software | Description |
|---|---|---|---|---|
| GSDML-file | Device characteristics and parameters | | NORD CON | Parametrisation and diagnostic software |

| Document | Description | | Document | Description |
|---|---|---|---|---|
| BU 0000 | Description of NORD CON software | | BU 2400 | PROFINET IO bus communication manual |
| BU 0040 | Parameter box manual | | TI 275274505 | SK TIE4-M12-SYSM System bus connection expansion exit |
| BU 0180 | Frequency inverter manual SK 180E, SK 190E | | TI 275274506 | SK TIE4-M12-SYSS System bus connection expansion entrance |
| BU 0200 | Frequency inverter manual SK 2xxE | | TI 275274514 | SK TIE4-M12-SYSM Ethernet connection expansion entrance/exit |