SK TU3-CAO

Part number: 275 900 075

CANopen® – External 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 TU3-CAO

Usage area

Technology unit for connecting a frequency inverter (SK 5xxE) to a **CANopen** field bus. The bus interface must be directly plugged into the technology slot of the frequency inverter.

Technical Data

Bus interface

Temperature range	0 °C...40 °C		Vibration resistance	2M1
Temperature class	Class 3K3		Firmware version	V1.2 R1
Protection class	IP20		Hardware version	AA
Supply voltage	24 V ± 20 %, ≈ 100 mA Reverse polarity protected		Dimensions [mm]	H x W x D: 27 x 73 x 101

Bus specification

CANopen	Max. 1 MBit/s
	electrical isolation 500 V_{eff}
Bus connection	SUB-D9 connector to bus interface or 2 x RJ45 at frequency inverter (internal)
Bus termination	R = 120 Ω via bus interface switch
Status display	4 LEDs
Topology*	Linear bus
Cable	twisted, shielded two-conductor cable
Cable length	depending on transmission speed:

Bus cable length	Resistance	Cross-section	Transfer rate
Up to 25 m	70 mΩ/m	≥ 0.25 mm^2, AWG23	1 Mbit/s
25…50 m	70 mΩ/m	≥ 0.25 mm^2, AWG23	800 KBit/s
50…80 m	< 60 mΩ/m	≥ 0.34 mm^2, AWG22	500 KBit/s
80…230 m	< 40 mΩ/m	≥ 0.5 mm^2, AWG21	250 KBit/s
230…480 m	< 26 mΩ/m	≥ 0.75 mm^2, AWG18	125 KBit/s
480…1000 m	< 20 mΩ/m	≥ 1 mm^2, AWG…	50 KBit/s

Shield	Connection to PE of frequency inverter
PE connection	Via shielding terminal to bus interface, cable cross-section 1.5 mm^2 (flat connecting sleeve included in scope of delivery)

Power

Update interval for process data between bus interface and frequency inverter	≤ 8 ms[1]
Parameter read/write access on the frequency inverter	> 20 ms

[1] depending on bus utilisation

Bus interface characteristics

Parametrisation	CANopen via SDO
Addressing	via rotary coding switch
Setting the baud rate	via rotary coding switch
Supported CANopen profile	Communication profile DS -301
	Drive profile DS -402
Error Messages (Emergency Messages)	to CANopen communication profile DS-301
Access for NORD diagnosis tool via	diagnostics socket on the device (if available) and via frequency inverter

Installation

| ⓘ | **Information** | **Installing the SK TU3-... technology unit** |

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

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

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

1. Switch off the mains voltage, observe the waiting period.
2. Push the control terminal cover down slightly or remove.
3. Remove the **dummy cover** by activating the release mechanism at the lower edge and removing it with an upwards rotating movement.
4. Hook the **technology unit** onto the upper edge and press in lightly until it engages.

   Take care that the plug connection bar is properly contacted and if necessary fix it with a suitable screw (self-tapping screw 2.9 mm x 9.5 mm, included in the scope of delivery of the frequency inverter).

5. Close the control terminal cover again.

Connections

The bus interface is connected via the SUB-D9 socket attached to the front in accordance with ISO 11898. The 24 V voltage supply of the bus interface is also provided via this connection, meaning that it can also be detected in the field bus system without a frequency inverter voltage supply.

Detail SUB-D9 socket

SU-D9 Pin	Signal	Description
1	—	Not occupied
2	CAN_L	CAN-Low data transfer (dominant low)
3	GND	Earth
4	—	Not occupied
5	—	Not occupied
6	GND	Earth
7	CAN_H	CAN-High data transfer (dominant high)
8	—	Not occupied
9	24 V in	24 V supply
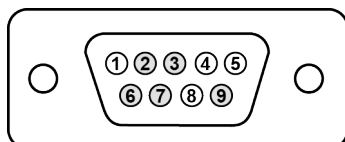
Configuration

The bus address (mode ID) of the bus interface is set via the rotary coding switch "**IDx10**" and "**IDx1**" (1) and the baud rate is set via the rotary coding switch "**BAUD**" (2). The rotary coding switch setting results in the node identifier, which is read in after a "Power On" of the bus interface.
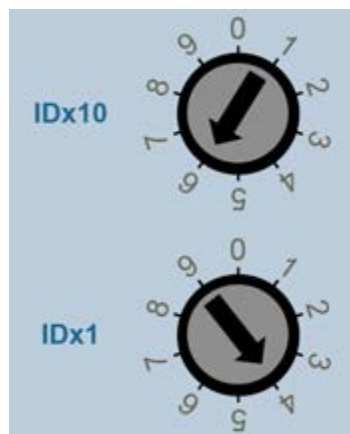
If the bus interface is the final subscriber on the CANopen field bus, the terminating resistor (3) must be activated.
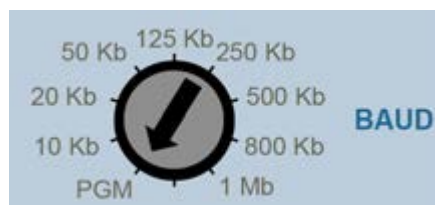
1. **IDx10** and **IDx1**

   The setting of the node ID takes place with decimal coding within the range of 01...99.

   Example: Node ID "**64**"

2. **BAUD**

   If the rotary coding switch is set to "**PGM**", the set value from the **P515 CAN address** parameter is read in as the node identifier.

3. Set terminating resistor to "ON" if the bus interface is the final subscriber on the field bus.

LED indicators

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

No.	Name	Colour	Meaning
1	CR	green	CANopen State
	CE	red	CANopen Error
2	DR	green	Device State
	EN	red	Device error

CANopen-specific LED

CR (CANopen State)	Meaning
OFF	No operating voltage, initialisation
Flashing green (1 s)	CANopen operating state "stopped"
Flashing green (0.5 s)	CANopen operating state "pre-operational"
Flashing green (0.25 s)	No other subscribers on the bus or wiring defective (only if the "CE" LED is flashing)
Green ON	CANopen operating state "operational"

CE (CANopen Error)	Meaning
OFF	No error
Flashing red	Bus warning, error counter of the CANopen controller has reached or exceeded the warning limit. → Check wiring / shielding / termination resistors.
	CANopen error → there is no physical connection to another subscriber
Red ON	CANopen controller disconnected from bus, since a serious error has occurred such as • Wiring error • Incorrect baud rate set

NORD-specific LEDs

DR (Device State)	EN (Device Error)	Meaning long flashing = 0.5 s on / 1 s off 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 • 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 • No frequency inverter on the system bus (or connection interrupted) • One or more system bus subscriber has an address error • Software incompatible (bus interface software and FI software incompatible - update required)
Long flashing	Short flashing Flash interval 1 x - 1s pause	System bus is in status "Bus Warning" • Communication on system bus disrupted • No other subscribers present on system bus • Module not inserted correctly or no connection to system bus • Frequency inverter has no supply voltage
Long flashing	Short flashing Flash interval 2 x - 1s pause	System bus is in status "Bus Off" • The system bus 24 V power supply has been interrupted during operation
Long flashing	Short flashing Flash interval 3 x - 1s pause	System bus is in status "Bus Off" • The 24V voltage supply of the system bus is missing
Long flashing	Short flashing Flash interval 4 x - 1s pause	Bus interface error • See parameter P170
OFF	Short flashing Flash interval 1…7 - 1s pause	System error, internal program sequence interrupted • EMC interference (observe the wiring guidelines!) • 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 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 **P151/P513**
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 • Check the connections and links, program sequence and Bus Master.	
10.3	Timeout by **P151/P513**	System bus supervision has triggered. • Check time setting of parameter P151/P513. The release bit is missing in the control word.	
10.4	External bus interface initialisation error	Unable to address bus interface. • Check power supply of bus interface.	
10.8	External bus interface communication error	SK TU3-CAO bus interface only: Connection between bus interface and frequency inverter interrupted.	
10.9	Bus interface missing (P120)	Only bus interfaces SK CU4-CAO and SK TU4-CAO: Connection between bus interface and frequency inverter interrupted (see setting of parameter **P120**).	

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

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
EDS-file	Device characteristics and parameters

Software	Description
NORD CON	Parametrisation and diagnostic software

Document	Description
BU 0000	Description of NORD CON software
BU 0040	Parameter box manual
BU 0500	Frequency inverter manual SK 500E…SK 535E

Document	Description
BU 0505	SK 54xE frequency inverter manual
BU 2500	Description of CANopen bus communication