SK CU4-IOE-C

Part Number 275 271 506

IO Extension

Only qualified electricians are allowed to install and commission the module described below. 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.

Validity of document

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

Scope of supply

1 x	Module	SK CU4-IOE-C
1 x	System bus cable kit	grey / black
1 x	24 VDC cable kit	brown / blue
2 x	Connection screws	M4 x 20 cross-head

Field of use

IO extension for installation in decentralized frequency inverters (NORDAC *BASE*, NORDAC *FLEX*, NORDAC *LINK*). This can be connected to the inverter via the system bus. Two digital inputs, 2 analog inputs (optionally as digital inputs) and 1 analog output are available. The assembly is water-resistant coating. Therefore, the reliability is maintained during condensation.

Technical Data

Temperature range	-25°C … 50 °C
Temperature class	Class 3K3
Protection class	IP20

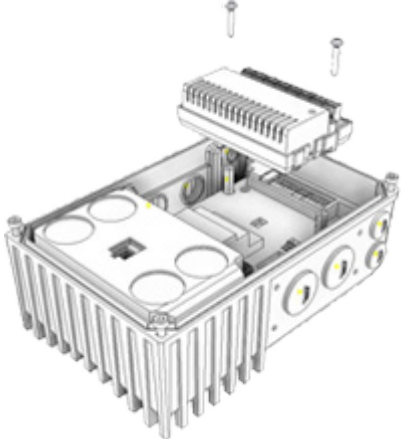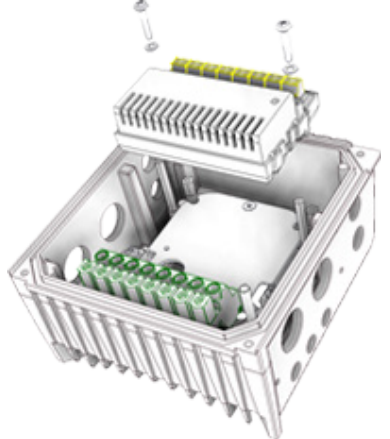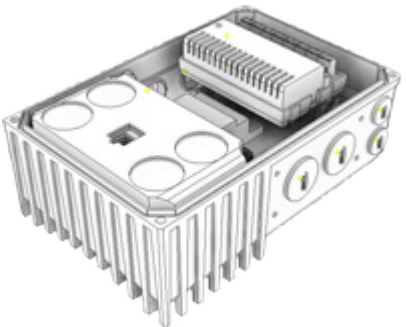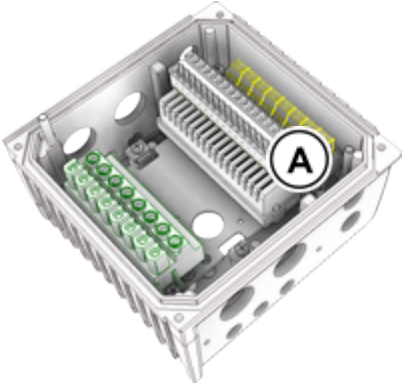| Vibration resistance	3M7
Firmware version	V1.3 R1

Name	Terminal	Data
Module power supply (load capacity)	40+44	24 VDC ± 20 %, reverse polarity protected (≤ 2 A)
Power consumption of module	40+44	≈ 110 mA
Digital input - operating range	C1/C2	PLC compatible in accordance with EN 61131-2 (digital inputs type 1), Low: 0 .. 5 V, High: 15 V .. 30 V, voltage-proof up to 50 V
Digital input - specific data	C1/C2	R_i = 8,1 kΩ, input capacitance: 10nF Scan rate 1 ms, reaction time 1 ms
Digital input - operating range	14/16	High: 7,5 V … 30 V
Analog input - reference voltage	11	10 VDC ±0,1 V, ≤ 20 mA (output)
Analog input - differential input version	13+14/15+16	Resolution: 12 Bit, accuracy: 0.1 V, Load resistance 250 Ω (Connection via DIP switch when configuration as a current input.)
Analogue input - load capacity	13+14/15+16	≤ 10 mA (mode: 0/2 … 10 V) ≤ 20 mA (mode: 0/4 … 20 mA)
Analog output - load capacity	17	≥ 1 kΩ (Mode: 0/2 … 10 V) ≤ 250 Ω (Mode: 0/4 … 20 mA)
Analog output - specific data	17	Resolution: 10 Bit, accuracy: 0.25 V

Installation

Installation location	In defined option slot inside the NORDAC device.
Fastening	with screw fastenings

1) With NORDAC *LINK*, this assembly must be selected when ordering. The installation is then carried out at the factory. Subsequent installation is not possible.

Installation steps

	NORDAC *BASE*	**NORDAC *FLEX* *)**
1.		
2.		

*) Before carrying out installation step 1 it may be necessary to remove the control terminal bar (A),
The control terminal bar (A) must be fitted after installation step 2.

Connections

Terminals	Screw terminals	1 terminal bar, with 16 connections, (5 mm spacing)
Cable cross section	0.14 … 2.5 mm	AWG 14-26
PE connection	Via inverter	Via screws if installed in inverter

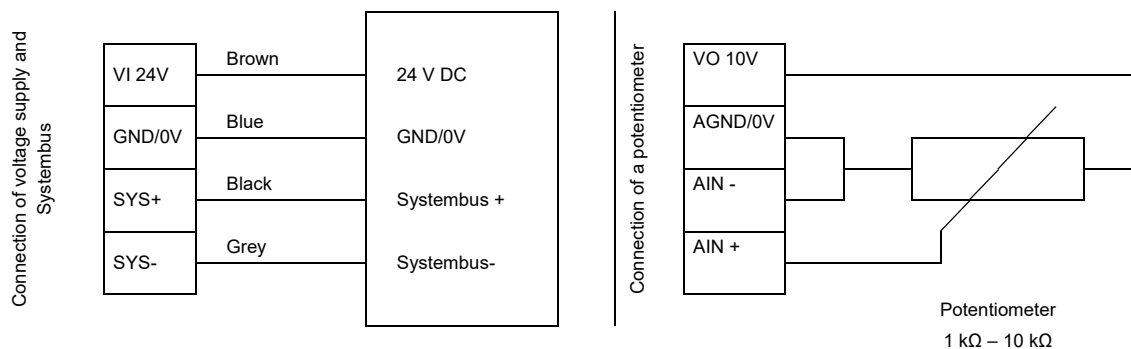| Level	Contact	Designation	Description
System bus level, digital signals	44	VI 24V	Supply voltage (+24 V - in)***
	40	GND/0V	Reference potential (0 V / GND)***
	C1	DIN1	Digital input 1
	C2	DIN2	Digital input 2
	77	SYS+	System bus data cable +**
	78	SYS-	System bus data cable -**
	40	GND/0V	Reference potential (0 V / GND)
Analog signals	11	VO 10V	10 V Reference voltage
	14	AIN1+/DIN3	Analog input 1, positive
	13	AIN1-	Analog input 1, negative
	12	AGND/0V	Analog Ground (internally connected to terminal 40)*
	17	AOUT	Analog output
	11	VO 10V	10 V Reference voltage
	16	AIN2+/DIN4	Analog input 2, positive
	15	AIN2-	Analog input 2, negative
	12	AGND/0V	Analog Ground (internally connected to terminal 40)*

*   AGND/0V is internally connected to the reference voltage of the module GND/0V via a special component. In order to prevent damage to the module or faults in the analog signals, the two contacts must not be bridged

**   Use system bus cable kit (included in scope of delivery), black = SYS +, grey = SYS –

***   Use 24VDC cable kit (included in scope of delivery), brown = 24V, blue = GND/0V

Connection examples

Configuration

Configuration of the module is mainly performed via the DIP switches. The DIP switches are read after a "power on" of the module. A change to the DIP switch during operation has no effect.

The system bus must be terminated at both of its physical ends (if necessary set the "System bus termination resistor" DIP switch).

ⓘ Information

Broadcast mode

In "Broadcast mode, which is activated via the parameter **(P162)**, the module can access up to 4 frequency inverters in parallel. Therefore the frequency inverters jointly access the I/Os and evaluate the input signals according to their own parameterisation. Output signals from the frequency inverters which are sent to the common IO module are linked by a logical "OR" within the module. i.e. a digital output is set as soon as one of the four frequency inverters addresses it. In addition, the highest analog value is provided via the analog output of the IO extension.

DIP switches

Function	DIP-Switch Meaning (DIP-No.)	DIP-Switch Combinations			Assignment Signal
		BIT2	BIT1	BIT0	
System bus termination resistor	S-Bus Term. (01)			0 1	not set setting
Addressing system bus	S-Bus Adr. Bit 0 (02) S-Bus Adr. Bit 1 (03)		0 0 1 1	0 1 0 1	Adr. 20 (for FI 0 Adr. 32)* Adr. 21 (for FI 1 Adr. 34)* Adr. 22 (for FI 2 Adr. 36)* Adr. 23 (for FI 3 Adr. 38)*
Analog input AIN1	Ain1 Mode Bit 0 (04) Ain1 Mode Bit 1 (05) Ain1 Mode Bit 2 (06)	0 0 0 1 1	0 0 1 0 0	0 1 0 0 1	0 … 10 V 2 … 10 V -10 … 10 V 0 … 20 mA 4 … 20 mA
Analog input AIN2	Ain2 Mode Bit 0 (07) Ain2 Mode Bit 1 (08) Ain2 Mode Bit 2 (09)	0 0 0 1 1	0 0 1 0 0	0 1 0 0 1	0 … 10 V 2 … 10 V -10 … 10 V 0 … 20 mA 4 … 20 mA
Analog output AOUT	Aout Mode Bit 0 (10) Aout Mode Bit 1 (11)		0 0 1 1	0 1 0 1	0 … 10 V 2 … 10 V 0 … 20 mA 4 … 20 mA
Mode Second - IOE	2nd IOE Mode (12)			0 1	First SK-…-IOE on FI Second SK-…-IOE on FI
* With DIP12 = ON: Address 10 … 13 instead of 20 … 23					

LED Displays

DS (Device State)	DE (Device Error)	Meaning Long flashing = 0.5 s on / 1 s off Short flashing = 0.25 s on / 1 s off
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	Short flashing	Technology unit ready, however • One or more of the connected frequency inverters is in fault status
Long flashing	OFF	Technology unit ready and at least one further participant 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 participants
Long flashing	Short flashing Flash interval **1** x - 1s pause	System bus is in status "Bus Warning" • Communication on system bus interrupted or • No other participant present on the system bus
Long flashing	Short flashing Flash interval **2** x - 1s pause	• System bus is in status "Bus off" or • The system bus 24V power supply was interrupted during operation
Long flashing	Short flashing Flash interval **3** x - 1s pause	• No system bus 24V power supply (system bus is in status "Bus off")
Long flashing	Short flashing Flash interval **4** x - 1s pause	Module error • EEPROM error
Long flashing	Short flashing Flash interval **5** x - 1s pause	Module error • AOUT error (analog output) • DIP switch configuration error
OFF	Short flashing Flash interval **1…7** - 1s pause	System error, internal program sequence interrupted • EMC interference (observe wiring guidelines!) • Module faulty

IO channel	Display	Meaning
DI 1	ON	High potential DIN1
DI 2	ON	High potential DIN2
DI 3	ON	High potential DIN3
DI 4	ON	High potential DIN4

IO channel	Display	Meaning
DO 1	ON	High potential DOUT1
DO 2	ON	High potential DOUT2

DI 3/4, DO 1/2   Available according to the type of IO module

Error messages

Error messages for the module - the present or archived messages for the last error - can be read out via the module parameter (P170).

Error	Meaning	Comments
1000	EEPROM error	EMC fault, module defective
1030	System bus OFF	No 24 V supply to bus, connections not correct
2000	DIP switch changed	DIP switch configuration changed during operation
2001	DIP switch configuration incorrect	Invalid DIP switch settings
2010	Error at analog output	Overload, reference voltage, short-circuit, calibration error
2020	Inverter does not support the module	Incorrect inverter type connected

Parameterisation

Inverter: In order to establish communication between the inverter and the IOE module, the following inverter parameters must be changed.

Parameter	Meaning	Comments
(P514)	Bus speed	5 (= 250 kBaud)
(P515 [-01])	Bus address	FI 1 = 32 FI 2 = 34 FI 3 = 36 FI 4 = 38
(P480 [-01 …])	DIN function of the device	Possible settings according to (P420)
(P481 [-05 …])	DOUT function of the device	Possible settings according to (P434)
(P400 [-03 …])	AIN function of the device	Possible settings according to (P400)
(P418 [-01 …])	AUT function of the device	Possible settings according to (P418)

IO extension: The module provides a selection of parameters for setting or displaying special operating values. The parameters can be changed with the aid of the NORDCON-software or with a ParameterBox. Communication is only possible via a frequency inverter which is connected to the module.

Parameter	Meaning	Comments
(P150)	Set relays	Set DOUT directly or control via BUS
(P152)	Factory setting	Reset the module parameters, calibrate AOUT
(P153 [-01 …])	Minimum system bus cycle	Reduction of bus load due to the module
(P160 [-01 …])	Set analog output	Set AOUT directly or control via BUS
(P161 [-01 …])	Filter time	Debounce or round input signals
(P162)	Send broadcast	Activate Broadcast mode (control of several inverters by this module)
(P163 [-01 …])	Invert analog output	Invert analog signal
(P170 [-01 …])	Present errors	Display of module errors
(P171 [-01 …])	Software version	Firmware version / Revision
(P172)	Configuration	Module type
(P173)	Module status	Status of system bus or connected FI
(P174)	Status of digital inputs	Display of DIN switching status
(P175)	Relay status	Display of DOUT switching status
(P176 [-01 …])	Actual voltage	Voltage level of analog signals

Further documentation and software (www.nord.com)

Software	Name
NORDCON	Parameterisation and diagnostic software

Software	Name

Document	Name
BU 0000	Description of NORDCON software
BU 0040	ParameterBox manual
BU 0180	Frequency inverter manual NORDAC *BASE*

Document	Name
BU 0200	Frequency inverter manual NORDAC *FLEX*
BU 0250	Frequency inverter manual NORDAC *LINK*

Description of parameters

P150	Set relays		
Setting range	0 … 4		Other applicable parameter(s) **P480**
Factory setting	{ 0 }		
Scope of Application	**SK CU4-IOE2, SK TU4-IOE, SK EBIOE-2**		
Description	Sets the switching states of the digital outputs		
Setting values	Value		Meaning

	Value		Meaning
	0	Via bus	Control of all digital outputs via the system bus; the functions are defined in the frequency inverter (**P480**).
	1	Outputs OFF	All digital outputs are Off (Low = 0 V).
	2	Output 1 ON (DO1)	The digital output DO1 is set to "High" (active); digital output DO2 remains switched off.
	3	Output 2 ON (DO2)	The digital output DO2 is set to "High" (active); digital output DO1 remains switched off.
	4	Outputs 1 and 2 ON	All digital outputs are on (High)

P152	Factory setting	
Setting range	0 … 2	
Factory setting	{ 0 }	
Description	Resets the module parameters to the factory settings.	
Note	On completion of this process the parameter display changes back to the value "0"	
Setting values	Value	Meaning

	Value		Meaning
	0	No change	This function is not implemented.
	1	Load factory setting	All parameters are reset to the factory settings.
	2	Calibration AOUT	The accuracy of the analog output can be improved with a correction line, however, this is not activated as standard. If factory settings (**P152**={ 1 }) are loaded, the correction values are retained. A calibration is carried out if (**P152**) is set to { 2 }, i.e. the line is re-recorded and stored in the EEPROM.

P153	Minimum system bus cycle		
Setting range	5 … 250 ms		
Arrays	[-01] = TxSDO Inhibit Time	[-02] = TxPDO Inhibit time	
Factory setting	{ [-01] = 10 }	{ [-02] = 5 }	
Description	Adjusts the cycle time for transmission of SDOs (Service Data Objects) and PDOs (Process Data Object) on the system bus.		
Note	Increasing the cycle time reduces the bus load		

P160	Set analog output			
Setting range	-0,1 … 10,0 V			
Arrays	[-01] = Analog output 1		[-02] = Analog output 2	
Factory setting	{ [-01] = -0.1 }		{ [-02] = -0.1 }	
Description	Sets the signal to a defined value, independent of the system bus.			
Note	If the analog output is configured as an output for current values, the factor 2 must be considered. The setting 0 V corresponds in this case to a current value of 0 mA (0 × 2 = 0). The setting 10 V corresponds in this case to a current value of 20 mA (10 × 2 = 20).			
	The arrays are only functional if the corresponding IOs are present in the module.			
Setting values	Value		Meaning	
	-0.1		The value is set via Bus	
	0.0	… 10.0	The value is set manually	

P161	Filter time			
Setting range	0 … 400 ms			
Arrays	[-01] = Analog input 1		[-02] = Analog input 2	
	[-03] = Analog output 1		[-04] = Digital input 1	
	[-05] = Digital input 2		[-06] = Digital input 3	
	[-07] = Digital input 4		[-08] = Digital output 1	
	[-09] = Digital output 2		[-10] = Analog output 2	
Factory setting	{ [-01], [-02] = 100 }	{ [-04] … [-07] = 2 }		{ [-03], [-08] … [-10] = 0 }
Description	The analog and digital inputs are read cyclically every 250 µs, which results in an input uncertainty of 0.25ms. In order to eliminate bounce and smooth the input signals, the information which is read in is passed through a filter routine. The filter time can be parametrised. For example, if a filter time of 1 ms is parametrised for a digital input, the input signal is delayed by approx. 1...1.25ms. The parameterisation of the filter time for the analog outputs is used to round off signal jumps.			
Note	The arrays are only functional if the corresponding IOs are present in the module.			

P162	Send broadcast			
Setting range	0 … 1			
Factory setting	{ 0 }			
Description	Activates the broadcast mode. In broadcast mode, up to four frequency inverters can access the module simultaneously.			
Note	In broadcast mode, the addressing of the module (DIP switches) is no longer taken into account.			
	The received data are linked in the I/O module using OR logic. If several frequency inverters are linked to the digital outputs of the module, the relevant output is set to "High" as soon as it is accessed by a frequency inverter. The analog outputs behave in a similar manner. Here, the highest value has priority.			
Setting values	0 = Off		1 = On (broadcast mode active)	

P163	AOut Inverse			
Setting range	0 … 1			
Arrays	[-01] = Analog output 1		[-02] = Analog output 2	
Factory setting	{ 0 }			
Description	Inverts the signal at the analog output. In other words, for values that come over the system bus (either from the frequency inverter (parameter **P542**) or from a PLC), the direction of action of the analog output is reversed. However, this does not apply if the analogue output is set by parameter **P160**. **Example** <table><tr><th>Value via system bus (from P542)</th><th>Value at AOUT if P163 = 1</th></tr><tr><td>10 V</td><td>0 V</td></tr><tr><td>2 V</td><td>8 V</td></tr><tr><td>0 V</td><td>10 V</td></tr></table>			
Note	The arrays are only functional if the corresponding IOs are present in the module.			
Setting values	0 = Off		1 = On (inversion active)	

P170	Actual error	
Display range	0 … 2020	
Arrays	[-01] = Actual error	Active error message (not acknowledged)
	[-02] = Last fault	Displays the last error message from the error memory
Description	Displays an error message.	
Note	SK CSX-3… The display is encoded	
	SK PAR-3… The display is in plain text	
Display values	📖 Section "Error messages"	

P171	Software version	
Display range	0.0 … 9999.0	
Arrays	[-01] = Software version	Version number (e.g.: V1.0)
	[-02] = Software revision	Revision number (e.g.: R1)
	[-03] = Special version	Special version of the hardware/software (e.g: 0.0). The value "0" stands for "Standard Version".
Description	Displays the software version (firmware version) of the module	

P172	Configuration	
Display range	0 … 8	
Description	Displays the configuration / version of the device	
Display values	Value	Meaning

Value		Meaning
0	CU4 (internal)	Module type: SK CU4-…
1	TU4 (external)	Module type: SK TU4-…
2	TU1-3 (Techn. Unit)	Module type: SK TU1- / TU2- / TU3- …
3	TU1-3 (Techn. Unit)+DIP	Module type: SK TU1- / TU2- / TU3- … with DIP-switches
4	EBIOE-2	Module type: SK EBIOE-2
5	TU4 Safe	Module type: SK TU4-… / "Safe" version
6	TU3 Safe	Module type: SK TU3-… / "Safe" version
7	CU4-IOE2	Module type: SK CU4-IOE2-…

P173	Option status				
Display range	0000 … FFFF (hex)				
Description	Displays the status of the connected devices and the system bus				
Note	SK CSX-3… The display is in hexadecimal format				
	SK PAR-3… The display is in binary format				
Display values	Value (Bit)		Meaning		

Value (Bit)		Meaning			
0	… 5	Not used			
6	BUS WARNING	System bus is in status "BUS WARNING"			
7	BUS OFF	System bus is in status "BUS OFF"			
8	FI 1 (Low – Bit)	FI 1 status (low Bit)	**Bit High**	**Bit Low**	**Meaning**
9	FI 1 (High – Bit)	FI 1 status (High Bit)	0	0	FI is offline
10	… 11	FI 2 status	0	1	FI is not recognised
12	… 13	FI 3 status	1	0	FI is online
14	… 15	FI 4 status	1	1	FI lost

* FI is switched off

P174	Status of digital in.		
Display range	0000 … 1111 (bin)		
Description	Actual image of the switching states of the digital inputs.		
Note	SK CSX-3… The display is in hexadecimal format		
	SK PAR-3… The display is in binary format		
Display values	Value (Bit)		Meaning

Value (Bit)		Meaning
0	Digital input 1	Digital input 1 of the module
1	Digital input 2	Digital input 2 of the module
2	Digital input 3	Digital input 3 of the module
3	Digital input 4	Digital input 4 of the module

P175	State of relays		
Display range	00 … 11 (bin)		
Description	Actual image of the switching states of the digital outputs.		
Note	SK CSX-3… The display is in hexadecimal format		
	SK PAR-3… The display is in binary format		
Display values	Value (Bit)		Meaning

Value (Bit)		Meaning
0	Relay 1	Digital output 1 of the module
1	Relay 2	Digital output 2 of the module

P176	Current voltage		
Display range	-100,0 … 100,0 %		
Arrays	[-01] = Analog input 1	[-02] =	Analog input 2
	[-03] = Analog output 1	[-04] =	Analog output 2
Description	Shows the measured voltage.		