Instructions for Use

COMBIVERT S6

Installation Control COMPACT

Translation of the original manual

Document 20087885 EN 08

Imprint

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ma_dr_s6-cu-k-inst-20087885_en
Version 08 • Edition 12/04/2023

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1 Introduction

The described devices, accessories, hardware and/or software are products of KEB Automation KG. The enclosed documents correspond to conditions valid at printing. Misprint, mistakes and technical changes reserved.

1.1 Markings

1.1.1 Warnings

Certain operations can cause hazards during the installation, operation or thereafter. There are safety informations in the documentation in front of these operations.

Warnings contain signal words for the severity of the hazard, the type and/or source of the hazard, the consequence of non-compliance and the measures to avoid or reduce the hazard.

⚠ DANGER

Type and/or source of the hazard.

Leads to death or serious bodily injury if not observed.

a) Measures to avoid the hazard.

b) Can be supplemented by an additional danger sign or pictogram.

⚠ WARNING

Type and/or source of the hazard.

May cause death or serious injury if not observed.

a) Measures to avoid the hazard.

b) Can be supplemented by an additional danger sign or pictogram.

⚠ CAUTION

Type and/or source of the hazard.

May cause bodily injury if not observed.

a) Measures to avoid the hazard.

b) Can be supplemented by an additional danger sign or pictogram.

NOTICE

Type and/or source of the hazard.

Can cause damage to property if not observed.

a) Measures to avoid the hazard.

b) Can be supplemented by an additional danger sign or pictogram.

1.1.2 Information notes

Indicates to the user a special condition, prerequisite, scope or simplification.

This is a reference to further documentation with barcode for smartphones and link for online users.

(🌐► https://www.keb.co.uk/nc/search)

Notes on conformity for use in the North American or Canadian market.

1.1.3 Symbols and markers

✓ Condition

a) Action step

⇨ Result or intermediate result

Cross-reference to a chapter, table or picture with page reference

ru21 parameter name or parameter index

(🌐► Hyperlink)

<Strg> Control code

COMBIVERT dictionary entry

1.2 Laws and guidelines

KEB Automation KG confirms with the CE mark and the EU declaration of conformity, that our device complies with the essential safety requirements.

The EU declaration of conformity can be downloaded on demand via our website.

1.3 Warranty and liability

The warranty and liability on design, material or workmanship for the acquired device is given in the general conditions of sale.

Here you will find our general sales conditions.

(🌐► https://www.keb.co.uk/terms-and-conditions)

Further agreements or specifications require a written confirmation.

1.4 Support

Through multiple applications not every imaginable case has been taken into account. If you require further information or if problems occur which are not treated detailed in the documentation, you can request the necessary information via the local KEB Automation KG agency.

The use of our units in the target products is beyond of our control and therefore exclusively the responsibility of the customer**.**

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the intended use. However, they are considered for information only without responsibility and changes are expressly reserved, in particular due to technical changes. This also applies to any violation of industrial property rights of a third-party.

Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be carried out within the scope of the intended end use of the product (Application**) by the** Customer**. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.**

1.5 Copyright

2 General Safety Instructions

The products are developed and built according to the state of the art and recognized safety rules. Nevertheless, their use may create dangers to life and limb of the user or third parties or damage to the machine and other material property.

The following safety instructions have been created by the manufacturer for the area of electric drive technology. They can be supplemented by local, country- or application-specific safety instructions. This list is not exhaustive. Non-observance of the safety instructions by the customer, user or other third party leads to the loss of all resulting claims against the manufacturer.

NOTICE

Hazards and risks through ignorance!

a) Read the instructions for use.

b) Observe the safety and warning instructions.

c) Ask if something is unclear.

3 Product description

3.1 Description of the control board COMPACT

The control board COMPACT provides the following functions:

- Digital and analog inputs and outputs
- Potential-free relay output
- CAN fieldbus interface
- Serial diagnostic interface for connection to a PC
- Hardware of the control circuit „safety separated“ according to EN 61800-5-1
- Brake control and supply
- Motor protection by I²t, KTY, PT1000 or PTC input
- Safety function STO (two channel torque off)
- External supply of the control board

3.2 Variants of the control board

The 11-digit type code indicates the variants of the control board. Not listed digits have no significance for this manual.

1. and 2. digit	**Device size**
07…14	For motor power from 0.75…7.5 kW
3. and 4. digit	**Series**
S6	COMBIVERT S6
5. digit	**Control type**
K	COMPACT
6. digit	**Variants**
1	Safety function STO (COMPACT)
4	reserved
7. digit	**Housing**
8. digit	**Connection, voltage, options**
9. digit	**Control board variant**
1	COMPACT | Multi encoder interface, CAN®, STO, EtherCAT®
2	COMPACT | Multi encoder interface, CAN®, STO, VARAN®
10. digit	**reserved**
11. digit	**reserved**

3.3 Safety functions

The safety function STO according to EN 61800-5-2 contains:

- Safe torque off (Safe Torque Off - STO)

The safety function meets the requirements in accordance with

- Performance-Level e (ISO 13849-1).
- SIL 3 (IEC 61508 and IEC 62061).

The safety function protects people against mechanical damage.

NOTICE

FS

The certification of drive controllers with safety technology is only valid under the following conditions:

a) The material number corresponds with the numerical code below.

b) The FS logo is printed on the type plate.

Numerical code for S6 COMPACT with safety technology (x=variable):

S6 with control EtherCAT®	**xxS6K1x-x1xx**
S6 with control VARAN	**xxS6K1x-x2xx**

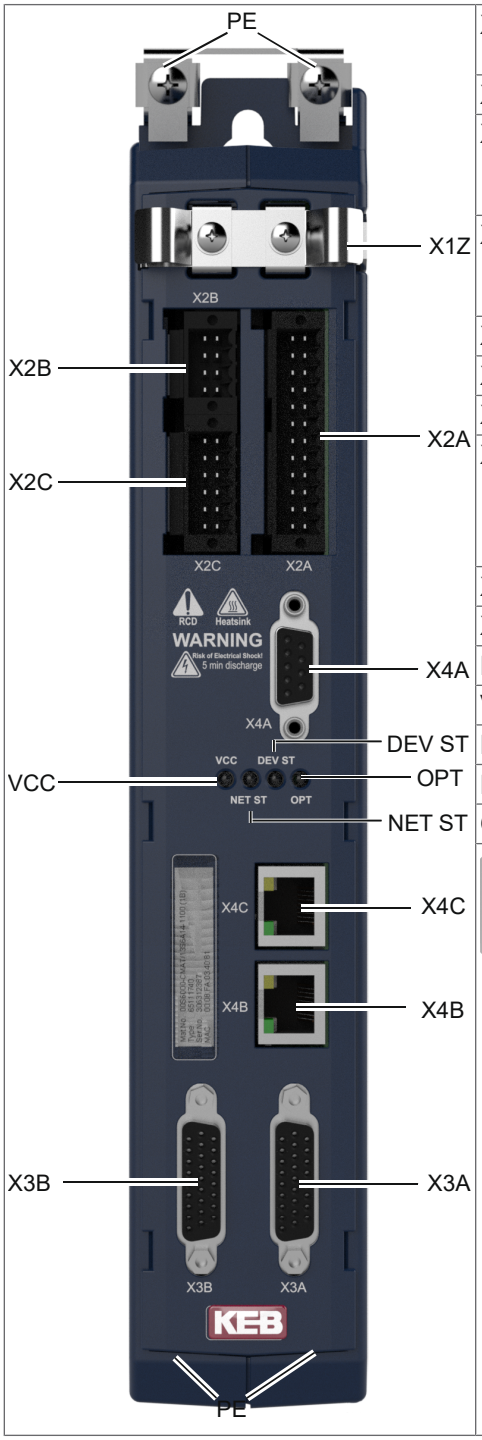
3.4 Accessories

To be able to use preassembled cables provided by the customer, the connectors of the control are optionally available. The following connector sets are available according to the used options:

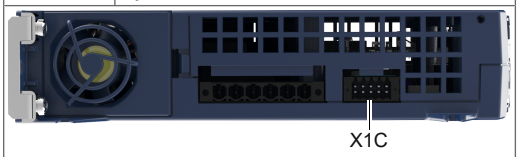
Housing/ phases/ control board	Set contains	Material number
02 / 1ph / COMPACT	terminal strip 24-pole terminal strip 12-pole terminal strip 8-pole terminal strip 6-pole Connector 3-pole Connector 6-pole shielding bracket 2 x shielding clamp 14 mm	00S6ZC0-0006
02 / 3ph / COMPACT		00S6ZC0-0000
04 / 3ph / COMPACT		00S6ZC0-0001

Tab. 1: Connector sets

3.5 Connection and control elements



X1C	Temperature monitoring, brake control
X1Z	Strain relief
X2A	Control terminal block for digital inputs/outputs; 24V output; relay output
X2B	Safety functions / +24V supply; 2 digital outputs
X2C	CAN bus / analog inputs
X3A	Encoder interface channel A
X3B	Encoder interface channel B
X4A	Diagnostic interface with RS232/485 interface according to DIN66019 protocol; operator slot
X4B	Fieldbus input / Port 0
X4C	Fieldbus output / Port 1
PE	Protection / functional earth
VCC	LED voltage supply (24V)
NET ST	LED network / fieldbus status
DEV ST	LED inverter/ device status
OPT	optional



Tab. 2: Overview Connection and operating elements

3.6 Motor monitoring X1C (temperature, brake)

Terminal strip X1C is a 6-pole, pluggable terminal strip with spring-cage connection. It contains:

- 1 output for control of 24V motor brakes
- 1 analog input for temperature detection

3.7 Control terminal strip X2A

Control terminal strip X2A is a 24-pole pluggable, double-row terminal strip with spring-cage connection. It contains:

- 8 digital inputs
- 2 digital outputs
- 1 Relay output
- 24V outputs to supply the inputs

3.8 Safety terminal block X2B

Terminal strip X2B is an 8-pole pluggable, double-row terminal strip with spring-cage connection. It contains:

- STO safety inputs
- 2 digital outputs
- Input for DC supply 24V

3.9 CAN bus and analog inputs and outputs X2C

Terminal strip X2C is a 12-pole pluggable, double-row terminal strip with spring-cage connection. It contains:

- CAN bus interface
- 2 analog inputs
- 1 analog output

3.10 Encoder interfaces X3A, X3B

The COMBIVERT contains two universal encoder interfaces. The interfaces can be adapted independently to different encoders.

3.11 Diagnostic interface X4A

The integrated RS232/485 interface serves for the connection of service tools (e.g. COMBIVIS) displays or the F6 operator. Telegram DIN 66019II is used as communication protocol.

3.12 Fieldbus interfaces X4B, X4C

Depending on the ordered (≡► Variants of the control board [▶ 11]) EtherCAT® or VARAN is available on the interfaces X4B and X4C.

see also

Variants of the control board [▶ 11]

3.13 Status LEDs

3.13.1 Boot display

Before the LEDs start their normal function, they signal the boot procedure after switching on:

LEDs	Status	Note
VCC ○ NET ○ ST DEV ○ ST OPT ○	off	Device off

LEDs	Status	Note
VCC ● NET ○ ST DEV ○ ST OPT ○	Initialization	Control is supplied with 24 V
VCC ● NET ◐ ST DEV ◐ ST OPT ○	FPGA booted	FPGA has been booted error-free (approx. 6 s)
VCC ● NET ● ST DEV ● ST OPT ○	ready for operation	Device is ready for operation and the LEDs start with their normal function (approx. 3 s)

Tab. 3: LEDs at power on

3.13.2 VCC - LED

VCC	LED colour	Description
off	-	Power supply of the control card switched off.
on	green	Control is supplied with 24 V.

Tab. 4: Function VCC LED

3.13.3 NET ST - LED

NET ST	LED colour	Description
off	-	Device off or booting.
on	yellow	During switching on, if FPGA is booted.
Blink code	various	depending on fieldbus => fieldbus interfaces.

Tab. 5: Function NET ST - LED

3.13.4 DEV ST - LED

DEV ST	LED colour	Description
off	-	Device off or booting.
on	red	Error
on	yellow	No error, DC link not loaded.
on	green	no error, ready for operation.
flashing	green	No error, is used for identification of the unit (fb32).

Tab. 6: Function DEV ST - LED

3.13.5 OPT - LED

OPT	LED colour	Description
-	-	reserved for options.

Tab. 7: Function OPT - LED

4 Connection of the control

Observe the following instructions to avoid malfunctions!

- Install control cables and power cables separately (approx. 10…20 cm distance); Lay crossings in a right angle.
- In case of inductive load on the relay outputs a protective wiring must be provided (e.g. free-wheeling diode).
- Electro magnetic interferences can be prevented by the following measures:
  - Always use twisted and shielded cables for analog control lines. Connect the shield at one side at the signal source.
  - Twist digital control cables. Up from 3 m a shield may be required. In this case connect the shield at both ends.
  - Connect the shield of the brake and temperature monitoring together with the motor shield. Leave the inner shields longer in order to avoid interference coupling or decoupling (the latter during temperature measurement) as far as possible.

The terminals of the control terminal block, enocder inputs and communication interface are securely isolated in accordance with EN 61800-5-1.

4.1 Assembly of wires

NOTICE

Loose and slack cable connections!

Malfunctions due to loose contacts.

a) Observe metal sleeve length and stripping length according to table.

b) Use a suitable pressing tool.

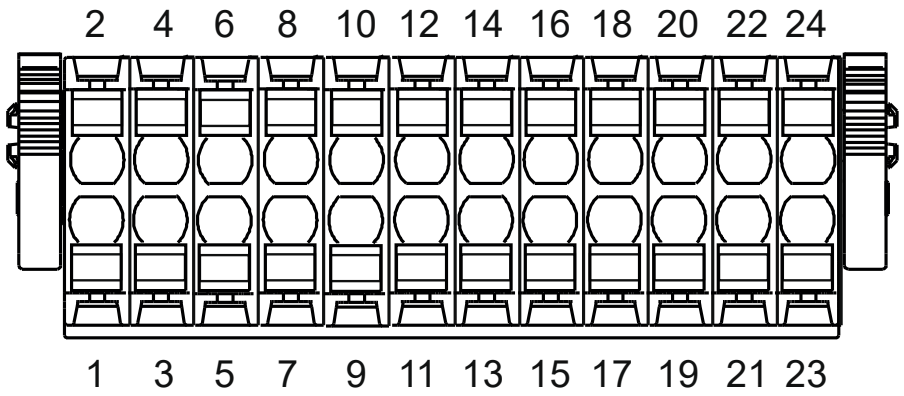
c) Make sure that all wires are inserted into the wire-end sleeve.

d) After inserting the cable into the terminal, check that it is firmly seated.

Cross-section	Wire-end ferrule	Metal sleeve length	Stripping length
0.5 mm²	with plastic collars	10 mm	12 mm
0.75 mm²		12 mm	14 mm
1.0 mm²		12 mm	15 mm
1.5 mm²	without plastic collars	10 mm	10 mm
0.2…1.5 mm² ein- oder feindrähtig	without wire-end ferrule	-	10…12 mm

Tab. 8: Wire-end ferrules and stripping length

4.2 Terminal strip X2A



PIN	Name	Description
1	DI1	Digital input 1
2	24Vout	Voltage output for control the inputs
3	DI 2	Digital input 2
24	24Vout	Voltage output for control the inputs
5	DI 3	Digital input 3
6	24Vout	Voltage output for control the inputs
7	DI 4	Digital input 4
8	24Vout	Voltage output for control the inputs
9	DI 5	Digital input 5
10	24Vout	Voltage output for control the inputs
1	DI 6	Digital input 6
12	24Vout	Voltage output for control the inputs
13	DI 7	Digital input 7
14	24Vout	Voltage output for control the inputs
15	DI 8	Digital input 8
16	24Vout	Voltage output for control the inputs
17	DO1	Digital output 1
18	0V	Reference potential for digital output
19	DO2	Digital output 2
20	0V	Reference potential for digital output
21	RLB	Relay output / NC contact
22	RLA	Relay output / NO contact
23	RLC	Relay output/ switching contact
24	24Vout	DC voltage output (SELV) for control the inputs.

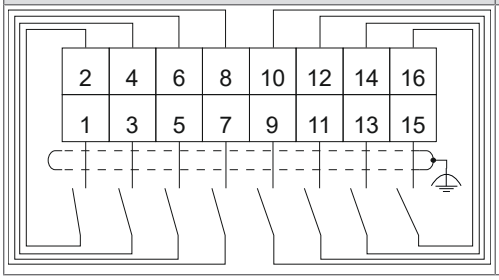
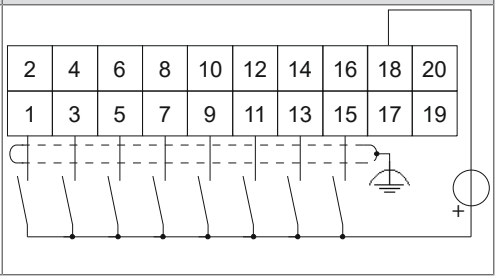
Tab. 9: Assignment of the terminal strip X2A

4.2.1 Digital Inputs

Specification

Number	8
Name	DI1…DI8
Terminals	X2A.1/ .3/ .5/ .7/ .9/ .11/ .13/ .15
Classification	Type 3 in accordance with DIN EN 61131-2
Low level (logical 0)	-3 … +5 V / 3 mA
High level (logical 1)	11 … 30 V / 2 … 6 mA

Connection

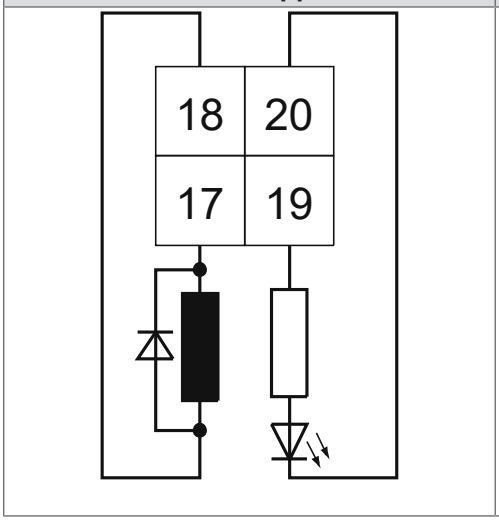
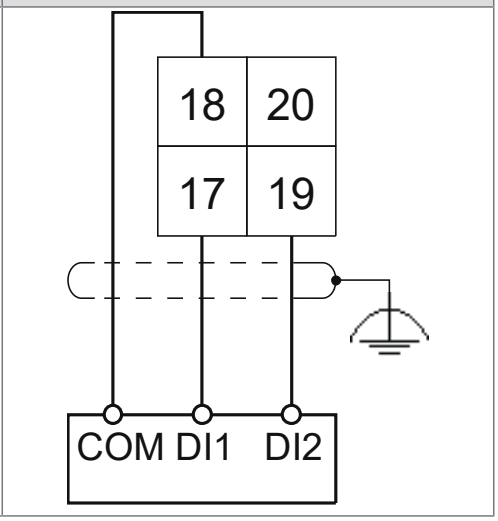
Internal voltage supply	External voltage supply
	

4.2.2 Digital Outputs

Specification

Number	2 (+2 more at X2B)
Name	DO1 … DO2
Terminals	X2A.17, X2A.19
Type	24 V high-side switch
Classification	DIN EN 61131-2
Output voltage	Minimum P24Vin – 3 V Maximum P24Vin Reference potential 0V (X2A.18 and X2A.20)
Output current	Maximum 100 mA per output (short-circuit proof)
Special features	Only ohmic load; no internal free-wheeling path

Connection

Connection appliance	Connection external control
	

4.2.3 Relay output;

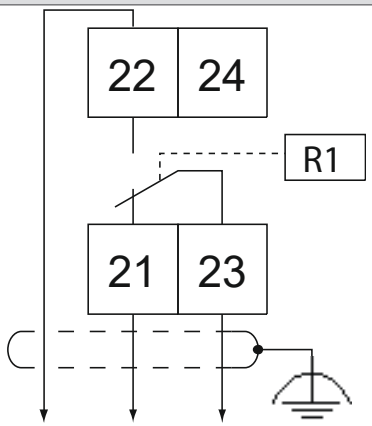
Specification

Number	1
Name	R1

Terminals	X2A.21…X2A.23
Type	Form C
Voltage	Maximum DC 30 V
Current	0.01…1 A
Switching cycles	10^8 mechanical
	500,000 at 30 V / 1 A
Special features	Resistive load only; no internal freewheeling branch

Connection

Relay output form C



4.2.4 Voltage supply

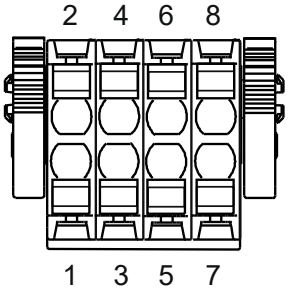
4.2.4.1 Voltage output to supply the inputs

Specification voltage output

Connection see (≡► Digital Inputs [▷ 18])

Name	24Vout
Terminals	X2A.2/ .4/ .6/ .8/ .10/ .12/ .14/.24 (24Vout)
Output current	max. 100 mA (short-circuit proof) for all 24Vout outputs together
Output voltage	minimum P24Vin - 3V maximum P24Vin
Notes	DC voltage output (SELV) to supply the digital inputs.

4.3 Terminal block X2B

X2B	PIN	Name	Function
	1	STO1-	Input STO channel 1
	2	STO1+	
	3	STO2-	Input STO channel 2
	4	STO2+	
	5	DO3	Digital output 3 Specification => DO1 and DO2
	6	DO4	Digital output 4 Specification => DO1 and DO2
	7	0V	Reference potential for P24Vin
	8	P24Vin	DC voltage input 24 V

Tab. 10: Assignment of the terminal strip X2B

4.3.1 Inputs STO

Specification

Number	2
Name	STO1; STO2
Terminals	X2B.1/2 and X2B.3/4
Low level (logical 0)	-3 … +5 V / 30 mA
High level (logical 1)	15 … 30 V / 5 … 30 mA
Others	Both channels potential-free, so that 24 V and 0 V can be connected. Inputs designed for safety switchgear with test pulses (OSSD). Signals are not evaluated, only filtered. OSSD test interval is limited to 10 ms.

STO with OSSD signals

The input voltage determines the maximum pulse width of the OSSD signals.

Input voltage	OSSD pulse width
15 V	0.1 ms
18 V	0.8 ms
20 V	1.1 ms
24 V	1.5 ms
30 V	1.8 ms

Tab. 11: OSSD pulse width depending on the input voltage

4.3.2 Digital outputs

Specification

Number	2 (+2 more at X2A)
Name	DO3 … DO4
Terminals	X2B.5, X2B.6
Type	24 V high-side switch
Classification	DIN EN 61131-2
Output voltage	Minimum P24Vin – 3 V maximum P24Vin reference potential 0V (X2B.7, X2A.18 and X2A.20)
Output current	Maximum 100 mA per output (short-circuit proof)
Special features	Only ohmic load; no internal free-wheeling path

Connection examples (≡► Digital Outputs [▸ 18])

4.3.3 Voltage input

The control board is supplied

- externally by a central 24V supply.

To select a suitable voltage source, the maximum current consumption must always be determined.

4.3.3.1 Determination of the current consumption

The input P24Vin (X2B.8) supplies following components:

- Control (control board with safety functions)
- Driver/power unit
- Brake
- Encoder

Consumer		Current consumption
Control		0.5 A

Consumer		Current consumption
Power unit		0,8 A
Consumer	Brake	Max. 2.0 A
	Encoder	Max. 0.5 A
	Digital output DO1	Max. 0.1 A
	Digital output DO2	Max. 0.1 A
	Voltage output 24Vout	Max. 0.1 A
	Sum DO safety module	Max. 0.2 A

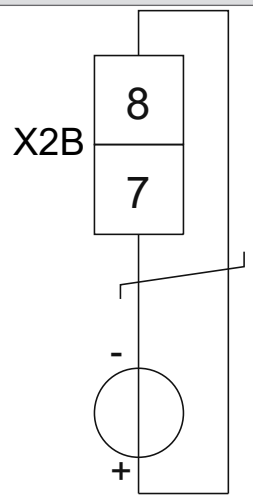
Tab. 12: Calculation the current consumption

In order to calculate the input current, the currents of the power unit, control and other loads must be added together. The actual current required can be used for the consumers. The maximum current must not be exceeded.

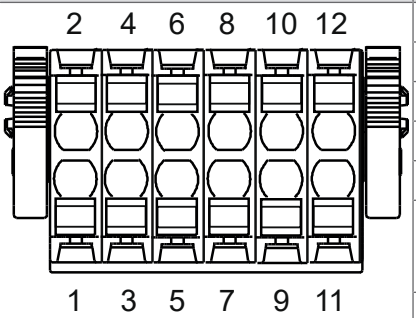
4.3.3.2 External supply

Specification external supply

Voltage	DC 24 V (±5 %)
Current consumption	Calculated value up to max. 4.6 A

Voltage supply of the control board


4.4 Terminal block X2C

X2C	PIN	Name	Notes
	1	CAN low	internally bridgedoperationally isolated
	2	CAN low	
	3	CAN high	internally bridgedoperationally isolated
	4	CAN high	
	5	CAN GND	CAN groundoperationally isolated (can be wired depending on the customer subscriber).
	6	CAN GND	
	7	AN1-	non-isolated difference input 1
	8	AN1+	
	9	AN2-	non-isolated difference input 2
	10	AN2+	
	11	0V	Reference potential

X2C	PIN	Name	Notes
	12	ANOUT	Analog output

Tab. 13: Assignment of the terminal block X2C

Description CAN bus (≡► CAN [▷ 26])

4.4.1 Analog input

NOTICE

No potential separation of the analog inputs to the control voltage!

Malfunction or defect caused by voltage differences.

a) A potential equalizing line between analog value source and analog input is required if the analog value is outside the common mode range.

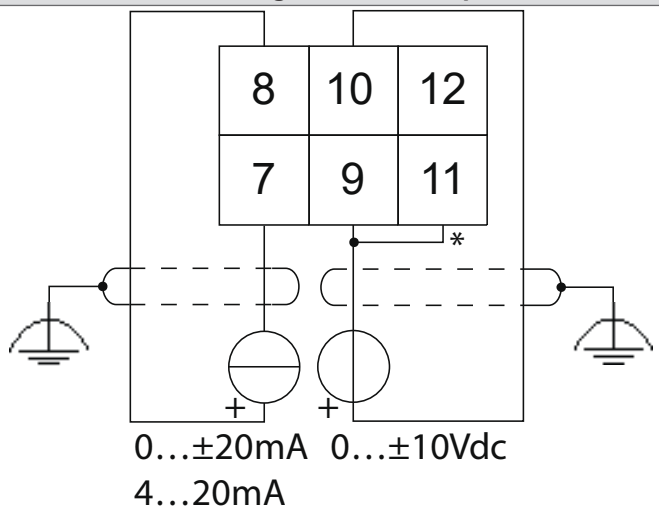
b) Connect potential equalizing line with 0V of the control terminal block.

Specification (differential inputs)

Number	2
Name	AN1, AN2
Terminals	X2C.7 (AN1-); X2C.8 (AN1+) X2A.9 (AN2-); X2C.10 (AN2+)
Classification	Non-isolated differential input
Input signals	Current/voltage switchable
Voltage input	DC 0…±10 V
Current input	DC 0…±20 mA; DC 4…20 mA
Common mode range	-12.5 V…17.5 V

Connection

Connection of the analog differential inputs AN1 and AN2



*) Equipotential bonding conductor

4.4.2 Analog output

Specification

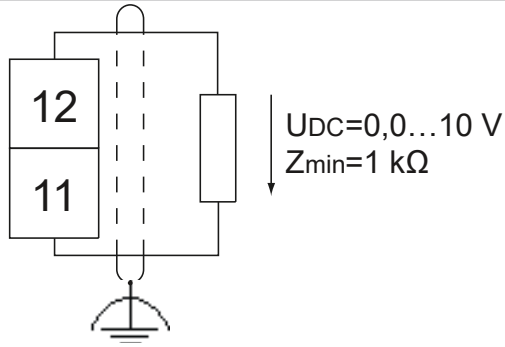
Number	1
Name	ANOUT
Terminals	X2A.12 analog output X2A.11 reference potential
Classification	DIN EN 61131-2
Voltage output	DC 0.0…10 V (corresponds to 0…100 % output value)
Minimum load impedance	1 kΩ

Notes

In the range up to 0.1 V the output value is not linear to the output voltage.

Connection

Connection of the analog output ANOUT



5 Diagnosis/visualisation X4A

The integrated serial interface provides the following functions:

- Parameterization of the device with the KEB software COMBIVIS.
- Connection of a control operator.
- DIN66019II as communication protocol.

Interface	Specification
RS485	Common-mode voltage range 0…12 V
RS232	ANSI TIA/EIA-232

Tab. 14: Serial interfaces

Name	Material number
RS232 PC inverter (SubD-9 coupling - SubD-9 plug)	0058025-001D
RS232/USB (USB serial converter inclusive cable)	0058060-0040

Tab. 15: Connecting cable

NOTICE

No potential separation of the diagnostic interface to the control voltage!

Malfunction or defect caused by voltage differences.

a) Install equipotential bonding conductor if voltage differences > common-mode signal.

XML file required for COMBIVIS 6.

a) A current XML file is required for the operation with COMBIVIS 6.

b) The download can be done directly from COMBIVIS 6 while an Internet connection is present.

5.1 Assignment of the terminal strip X4A

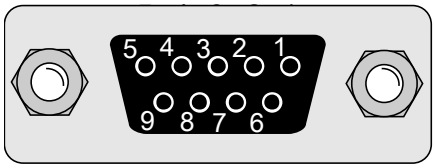


Fig. 1: Pin assignment socket D-Sub-9 (top view)

1	reserved	2	TxD (RS232)
3	RxD (RS232)	4	RxD-A (RS485)
5	RxD-B (RS485)	6	reserved
7	DGND (reference potential)	8	TxD-A (RS485)
9	TxD-B (RS485)		

5.2 Data cable RS232 PC-Drive Controller

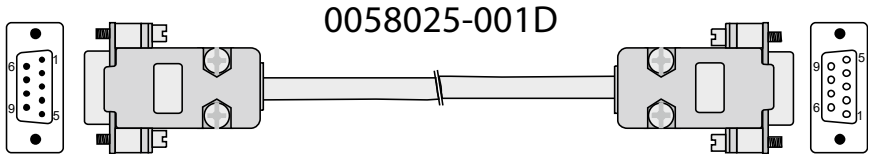


Fig. 2: Serial cable for the connection to a PC

5.3 USB-serial converter

The USB serial converter (material number 0058060-0040) is used to connect drive controllers, operators or IPC controllers with DIN 66019 interface or HSP5 interface to the USB port of personal computers. The USB-serial converter is internal electrically isolated.

5.4 Connection of the RS485 interface

The RS485 interface supports half-duplex and duplex operation. Wiring examples can be found in the following link:

Wiring examples can be found under the following link:

(🌐► https://www.keb.de/fileadmin/media/Techinfo/dr/tn/ti_dr_tn-rs485-connection-00002_en.pdf)

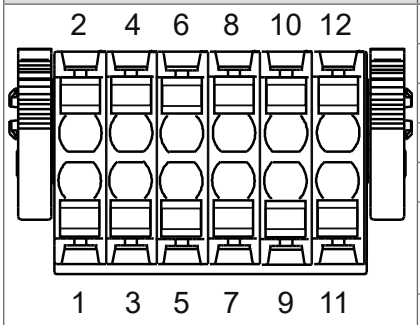
6 Fieldbus interfaces

6.1 Type code fieldbus

A CAN interface is integrated in the control unit as standard. Other fieldbus interfaces are identified by the 9th digit of the material number.

9. digit	Control board variant
1	COMPACT | Multi encoder interface, CAN®, STO, EtherCAT®
2	COMPACT | Multi encoder interface, CAN®, STO, VARAN®

6.2 CAN

X2C	PIN	Name	Notes
	1	CAN low	internally bridgedoperationally isolated
	2	CAN low	
	3	CAN high	internally bridgedoperationally isolated
	4	CAN high	
	5	CAN GND	CAN groundoperationally isolated (can be wired depending on the customer subscriber).
	6	CAN GND	
	7	AN1-	non-isolated difference input 1
	8	AN1+	
	9	AN2-	non-isolated difference input 2
	10	AN2+	
	11	0V	Reference potential
	12	ANOUT	Analog output

Tab. 16: Assignment of the terminal block X2C

Specification

Fieldbus type	CAN
Transmission level	According to DIN ISO 11898; ISO High Speed
Transmission speed	20, 25, 50, 100, 125, 250, 500, 1000 kbit/s; adjustable via (fb66)
Potential separation	Operationally isolated (functionally isolated) to the control potential.
Bus termination	Wire 120 Ω external between (CAN High and CAN Low) at both ends of the bus line.

Connection

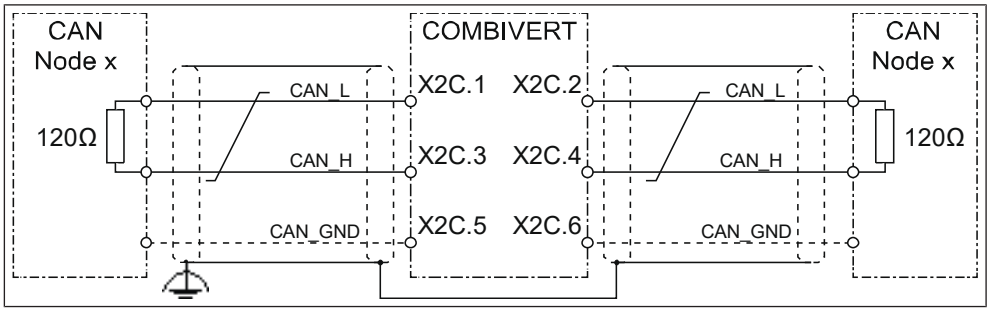


Fig. 3: Connection CAN bus

NET ST - LED in CAN mode

According to CiA 303-3, the NET ST LED is a combination of RUN and ERROR LED.

Light pattern NET ST LED (red/ green combination)

Status	Light pattern	Description
Pre-Op	g-0 (grid 200 ms)	Device in PRE-OPERATIONAL status
Stop	g-0-0-0-0-0 (grid 200 ms)	Device in STOPPED status
Op	g (permanent)	Device in OPERATIONAL status; no error
Bus off	r (permanent)	CAN bus switched off.
Invalid configuration	r-0 (grid 200 ms)	General configuration error.
Warning limit reached	r-0-0-0-0-0 (grid 200 ms)	An error counter has reached or exceeded the warning level.
Error control event	r-0-r-0-0-0-0-0 (grid 200 ms)	A Guard or Heartbeat event has occurred.
Sync error	r-0-r-0-r-0-r-0-0-0-0-0 (grid 200 ms)	SYNC message has not been received within the set time-out time.
Legend	r: Red g: Green 0: off	The red/green signals are shifted by 180°. In case of overlapping, red has priority.

6.3 EtherCAT

EtherCAT® is a registered trademark and patented technology licensed by the Beckhoff Automation GmbH, Germany.

Specification

Fieldbus type	EtherCAT
Transmission level	100Base-Tx according to IEEE802.3 with autonegotiation and auto-crossover
Connections	X4B: EtherCAT IN X4C: EtherCAT OUT
Device addressing	ECAT-Addr; is usually assigned by the master at start-up.
Device identification	StationAlias is supported. The cell in the ECAT-EEPROM(SII) can be written by the master and is stored non-volatile. Extension of the state machine is not supported (IdentificationReg 134 = False).
Hot Connect	Yes via StationAlias.
Number SyncManager	4 (Receive, Send-Mailbox, PDOUT, PDIN data).
Number FMMUs	3 (PDOUT, PDIN data, Send-Mailbox-Status).
Max. number PDOUT data	Max. 2 PDOs; Mapping freely selectable. 32 Byte + optional FSoE data. 64 Byte + optional FSoE data (from SW 2.8).
Max. number PDIN data	Max. 2 PDOs; Mapping freely selectable. 32 Byte + optional FSoE data. 64 Byte + optional FSoE data (from SW 2.8).
Acyclic data traffic:	Supported mailbox protocols CoE; SDO download; SDO-Upload (Complete Access is not supported); Emergency

Distributed Clocks (DC)	Yes, 32 Bit; minimum cycle time: 500 µs (is22=8 x tp) 250 µs (is22=4 x tp) from SW 2.8 => Synchronous communication mode

Connection

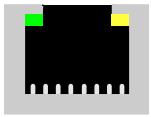


Fig. 4: RJ45 socket front view

PIN	RJ45 without supply voltage (Viewing with Auto-Cross Over)	
1	TX+	RX+
2	TX-	RX-
3	RX+	TX+
4	Reserved	
5	Reserved	
6	RX-	TX-
7	GND	
8	GND	

Tab. 17: PIN assignment RJ45 EtherCAT

LED / light pattern	Function
Yellow	**without function**
Green	**Link/Activity**
Off	Port closed
On	Port open; no data traffic
Flicker	Port open; with data traffic

Tab. 18: Function of the LEDs

According to ETG1300, the NET ST LED is a combination of RUN and ERROR LED.

Light pattern NET ST LED (red/green combination)

Status	Light pattern	Description
init	0	Device in INITIALISATION status; no error
Pre-Op	g-0 (grid 50 ms)	Device in PRE-OPERATIONAL status
Safe-Op	g-0-0-0-0-0 (grid 200 ms)	Device in SAFE-OPERATIONAL status
Op	g (permanent)	Device in OPERATIONAL status; no error
error	R (permanent)	Communication or device error.
LOAD ERROR	r-0 (grid 50 ms)	Loading error during initialisation
Invalid configuration	r-0 (grid 200 ms)	General configuration error.
Warning limit reached	r-0-0-0-0-0 (grid 200 ms)	An error counter has reached or exceeded the warning level.
Local Error	r-0-0-0-0-0 (grid 200 ms)	Local error; Device has independently changed status from OPERTIONAL to SAFE-OPERATIONAL. Error bit is set to "1".
Process Data or EtherCAT Watchdog	r-0-r-0-0-0-0-0 (grid 200 ms)	A watchdog error has occurred in the application.
Legend	r: Red g: Green 0: off	The red/green signals are shifted by 180°. In case of overlapping, red has priority.

Error status list

Error	Meaning	Example
Communication or device error	A communication or device error has occurred.	The device stops responding
Process data watchdog timeout	The watchdog application reports a timeout.	Sync-Manager timeout
Local error	The fieldbus status has changed due to an error.	Device changes its EtherCAT status from OP to SafeOPError due to a synchronisation error.
Invalid configuration	General configuration error	Change of status due to register or object settings that are not possible or invalid hardware configuration.
Loading error	Loading error during initialisation	Checksum error in the flash memory of the application controller.

Tab. 19: Error status list

6.4 VARAN

Specification

Fieldbus type	VARAN
Transmission level	100Base-Tx according to IEEE802.3 with autonegotiation and auto-crossover
Connections	X4B: VARAN IN X4C: VARAN OUT

Connection

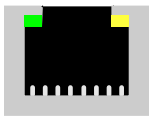


Fig. 5: RJ45 socket front view

PIN	RJ45 without supply voltage (Viewing with Auto-Cross Over)	
1	TX+	RX+
2	TX-	RX-
3	RX+	TX+
4	Reserved	
5	Reserved	
6	RX-	TX-
7	GND	
8	GND	

Tab. 20: PIN assignment RJ45 VARAN

LED / light pattern	Function
yellow	**Activity**
off	No data traffic or deactivated
ON	Lights up when receiving data via the VARAN bus
green	**Link**
off	No connection
On	Lights up when there is a connection between two PHYs.

Tab. 21: Function of the LEDs

Light pattern NET ST LED

At VARAN, the NET ST LED has no function.

7 Encoder interfaces

7.1 Multi-Encoder-Interface

The multi-encoder interface consists of two channels. Channel A supports the following encoder types:

- incremental encoder input (RS485) with or without zero signal
- Resolver
- EnDat (digital with 1V ss incremental signals)
- BiSS (digital)
- Hiperface
- SinCos with/without zero signal; with or without absolute position (SSI or analog 1 Vpp)

Channel B supports following encoder types:

- incremental encoder input (RS485) with or without zero signal
- incremental encoder input (HTL)
- incremental encoder output (RS485)
- SSI
- BiSS (digital)
- EnDat (digital)

NOTICE! When using a digital EnDat 2.2 encoder on channel B, the use of an analog EnDat encoder on channel A is not possible.

NOTICE

Undefined states by plugging of encoder cables during operation!

Malfunctions caused by incorrect speed or position values.

a) Never plug on/unplug the connector on the encoder interface during operation.

7.2 Input signals

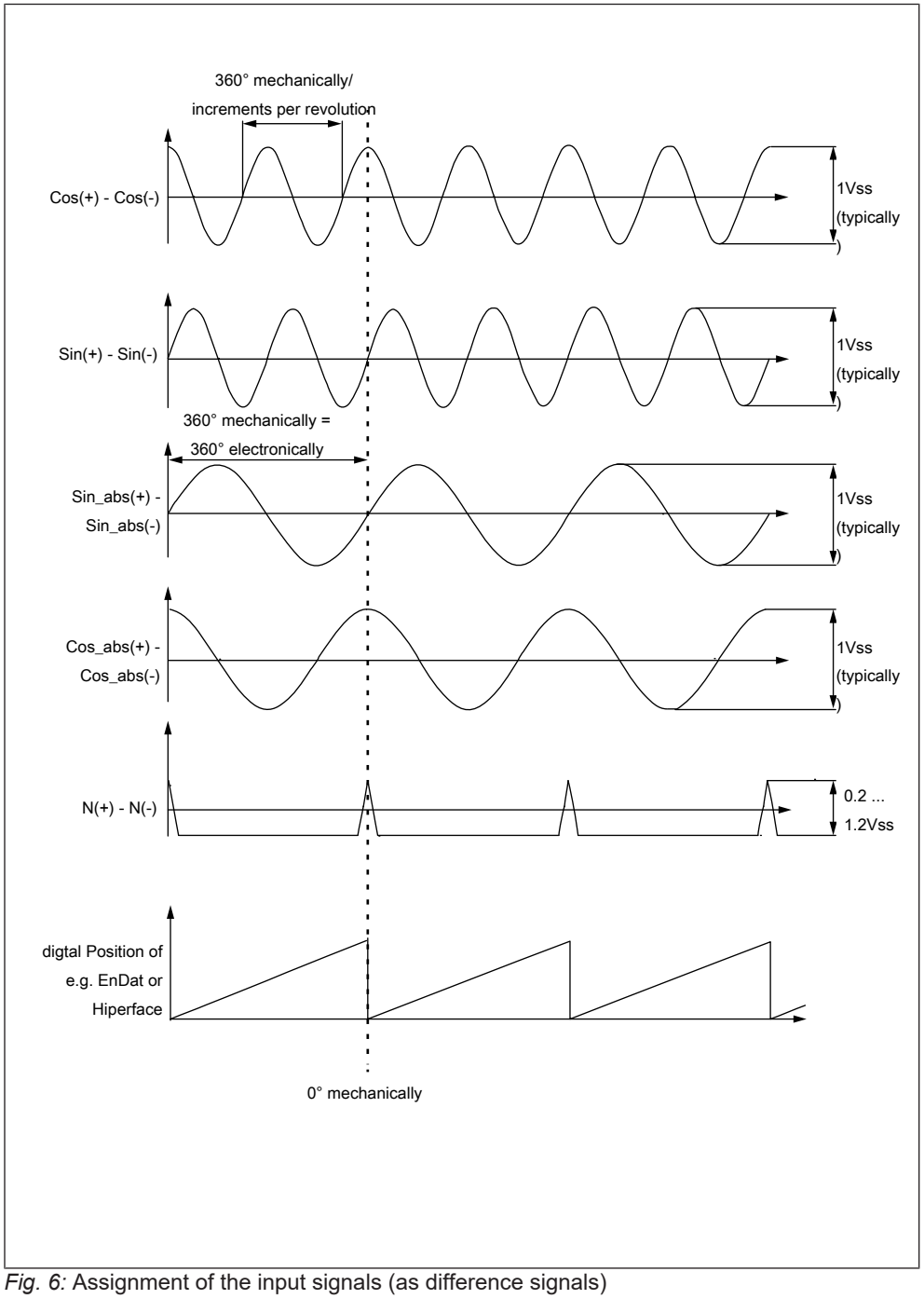
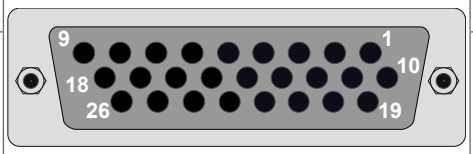


Fig. 6: Assignment of the input signals (as difference signals)

a) For rectangular incremental signals, the characteristic of the signal corresponds to A -> COS and B-> SIN.

b) The identification "C" and "D" for the absolute signals must be checked. Frequently signal C corresponds to -> SIN_abs and D to -> (inverted)COS_abs. Thus D+ is at COS_abs- and D- is at COS_abs+.

7.3 Encoder sockets X3A/X3B

X3A / X3B: Plug-in connector socket			(front view socket)			D-Sub DB-26 (HD), triple row		
Counterpart: Plug-in connector						D-Sub DB-26 (HD), triple row, with fixing screw		
Encoder	Incremental encoder RS485 and 1Vpp (channel 1 only)	Incremental encoder HTL	Resolver	Hiperface	SinCos (absolute)	SSI, EnDat (digital), BiSS (digital)	Sin/Cos-SSI, EnDat (1Vss), BiSS (digital)	Incremental encoder emulation
Channel	A / B	B	A	A	A	A / B	A	B
PIN								
1	A+			Cos+	Cos+		Cos+	A+ (out)
2	A-			Cos-	Cos-		Cos-	A- (out)
3	B+			Sin+	Sin+		Sin+	B+ (out)
4	B-			Sin-	Sin-		Sin-	B- (out)
5	N+			Data+	N+	Data+	Data+	N+ (out)
6	N-			Data-	N-	Data-	Data-	N- (out)
8, 9	5.25 V (is output, if an encoder type is set							
10			Cos+		Cos_abs+	Clock-	Clock-	
11			Cos-		Cos_abs-			
12			Sin+		Sin_abs+	Clock+	Clock+	
13			Sin-		Sin_abs-			
14			Exciter+					
15			Exciter-					
7, 16, 17	GND and internal shield							
18	24 V	24 V			24 V	24 V	24 V	
19		A_HTL+						
20		A_HTL-						
21		B_HTL+						
22		B_HTL-						
23		N_HTL+						
24		N_HTL-						
25, 26	8 V (depending on parameter ec14 if an encoder type is set							

Tab. 22: Assignment X3A and X3B

Notes for Pin 25 / 26

Supply voltage of U_{DC} = 8 V is issued if

- Parameter ec14 Bit 1 = "manual“ and ec14 Bit 0 = "8V“ is set.
- Parameter ec14 Bit 1 = "automatically“ and ec16 = "Hiperface“ or "Resolver“ is set.

All other voltages are not defined at this contacts and may not be used for supply of encoders!

7.4 Encoder cable length

The maximum encoder cable length is 50 m. In addition, the value is limited by the signal frequency, cable capacity and supply voltage.

The maximum encoder cable length due to the voltage drop on the supply line is calculated as follows:

$$\text{max. encoder cable length} = \frac{\text{voltage supply - min. encoder voltage}}{\text{max. encoder current} \cdot 2 \cdot \text{wire resistor per meter}}$$

Fig. 7: Encoder cable length

The supply voltage depends on the set encoder. The other values can be found in the data sheet of the encoder and the encoder cable.

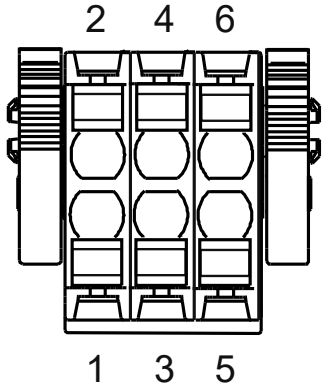
7.5 Description of the encoder interfaces

PIN	Signals	Description
1, 2, 3, 4	A+/- B+/- Cos+/- Sin+/-	**Only channel A:** Input for two sine-wave, shifted by 90° differential signals with 1 Vpp, maximum 200 kHz. Single-ended (e.g. Cos+ against GND): Constant component 2.5 V ±0.5 V Differential (e.g. Cos+ against Cos-): Constant component 0 V ±0.1 V signal level Uss=0.6 V…1.2 V **Channel A:** Input for square-wave incremental signals according to RS485 maximum 200 kHz. **Channel B:** Input for square-wave incremental signals according to RS485 maximum 500 kHz. Incremental encoder simulation: Position changes of channel A are output to channel B with two 90° shifted RS485 signals.Maximum output frequency 500 kHz.
5, 6	N+/- Data+/-	**Only channel A:** Input zero signal once per revolution. Differential signal level (N+ … N-): • higher 50 mV: zero signal is active • from 50 mV to -50 mV: undefined • lower -50 mV: zero signal is inactive Signal length 330°…360° of the signal length of the incremental signals. **Channel A and B:** Input zero signal or data RS485. Zero signal is 1-active, if signals A and B are also 1-active. **only channel B:** Output zero signal RS485. Zero signal is 1-active, if signals A and B are also 1-active. Is output, if the position on channel A is 0°.
10, 11, 12, 13	Sin+/- Cos+/- Sin_abs+/- Cos_abs+/-	**Only channel A:** Input for sinusoidal absolute signals Uss=1 V for SinCos encoder Uss=3.8 V maximum for resolver
10, 12	Clock+/-	Output for clock signal RS485
14, 15	Exciter+/-	**Only channel A:** Output field voltage for resolver: Ueff=2.54 V ≙ Uss=7.2 V ±5 %; max. Ieff=30 mA; 10 kHz Coupling factor for resolver: 0.5 ±10 % Phase shifting 0° ±5°

PIN	Signals	Description
25, 26	5.25 V / 8 V	Output supply voltage for encoder: ec14 = 0 => 5.25 V +5 %/ -10 % ec14 = 1 => 8 V +5 %/ -10 % ec14 = 2 => automatically, depending on the set encoder type (ec16) Max. 500 mA total (250 mA per channel)
8, 9	5.25 V	Output supply voltage for encoder: 5.25 V +5 %/ -10 % Max. 500 mA total (250 mA per channel)
18	24 V	Output supply voltage for encoder: Udc=24 V max. 500 mA total (250 mA per channel) • Minimum P24V_IN - 3 V • Maximum P24V_IN
19, 20, 21, 22, 23, 24	A_HTL+/- B_HTL+/- N_HTL+/-	**Only channel B:** Input HTL signals 10 V…30 V maximum 150 kHz

Tab. 23: Encoder specifications

8 Brake control and temperature detection

X1C	PIN	Name	Notes
	1	BR+	Brake control / output
	2	BR-	Brake control / output
	3	Reserved	
	4	Reserved	
	5	TA1	Temperature detection / input +
	6	TA2	Temperature detection / input -

Tab. 24: Assignment of the terminal block X1C

8.1 Brake control

⚠ CAUTION

Wrong dimensioning of the brake

Brake does not release or only with delay

a) Choose the input voltage tolerance of the brake corresponding to the tolerance of the output voltage.

b) Use auxiliary relays if necessary.

Specification brake/relay output

Name	BR+ (X1C.1); BR- (X1C.2)
Function	Output to supply a brake or relay.
Output voltage (DC)	minimum P24Vin – 2.4V maximum P24Vin
maximum output current	2 A
Others	Internal free-wheeling path; internal filter circuit; short-circuit proof

Connection

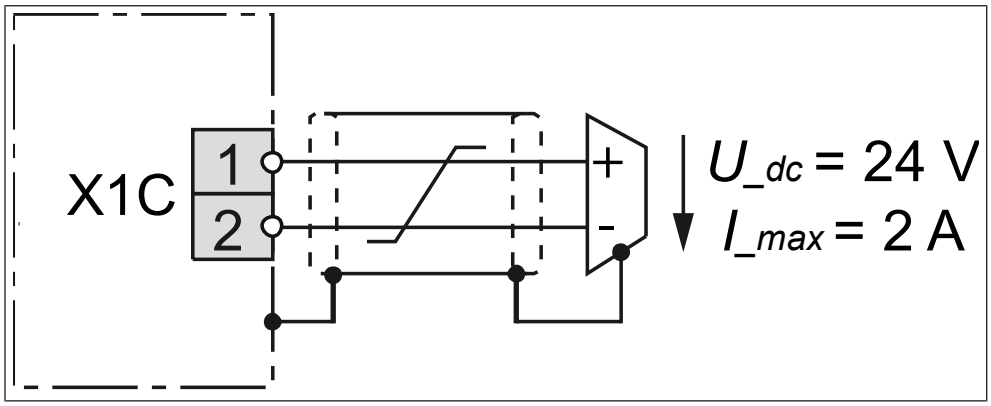


Fig. 8: Connection of a brake

8.2 Temperature detection

⚠ DANGER

Electric shock by sensors without protective separation!

a) Only use sensors with basic insulation.

b) Only sensors with double insulation (basic insulation plus additional insulation) are permitted up to the specified year/week of manufacturing (see specification).

NOTICE

Malfunctions due to wrong cables or laying!

Malfunctions of the control due to capacitive or inductive coupling

a) Do not lay the cables of the motor temperature sensor (also shielded) together with the control cables.

b) Cables of the motor temperature sensor within the motor cables are only permissible with double shielding.

Specification temperature input

Name	TA1; TA2
Terminals	X1C.5 (TA1) input + X1C.6 (TA2) input -
Function	Temperature sensor input (switchable)
Others	Basic insulation to the SELV voltage of the control card. A system voltage of 300 V is defined (Phase – PE).

A switchable temperature evaluation is implemented in COMBIVERT. The desired operating mode can be adjusted by software (dr33).

Operating mode (dr33)		Resistance	Temperature/state
0	KTY84/130	0.49 kΩ	0 °C
		1 kΩ	100 °C
		1.72 kΩ	200 °C
1	PTC in accordance with EN 60947-8 (standard)	<0.75 kΩ	TA1-TA2 closed
		0.75…1.5 kΩ	Reset resistance
		1.65…4 kΩ	Tripping resistance
		> 4 kΩ	TA1-TA2 open
2	by encoder	digital by the encoder channel	
3	KTY83/110	0.82 kΩ	0 °C
		1.67 kΩ	100 °C
		2.53 kΩ	175 °C
4	PT1000	1 kΩ	0 °C
		1.38 kΩ	100 °C
		1.75 kΩ	200 °C
-	Monitoring	<0.04 kΩ	Short circuit
		> 79.5 kΩ	No connection (sensor break)

8.2.1 Operation without temperature detection

Use of the COMBIVERT without evaluation of the temperature input:

Switch off evaluation (pn12 =7) or install bridge between terminal TA1 (X1C.5) and TA2 (X1C.6) (dr33=1).

8.2.2 Connection of a KTY sensor

NOTICE

No protection of the motor winding in case of wrong connection!

Non-observance leads to incorrect measurements and possibly to the destruction of the motor winding

a) Operate KTY sensors in forward direction.

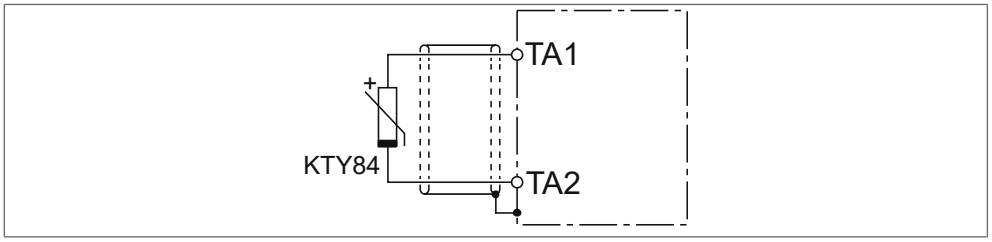
b) KTY sensors may not be combined with other detections.

Settings KTY input

Setting

dr33 = 0 => KTY84/130
dr33 = 3 => KTY83/110

Connection KTY sensor



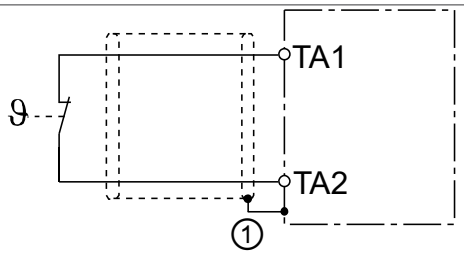
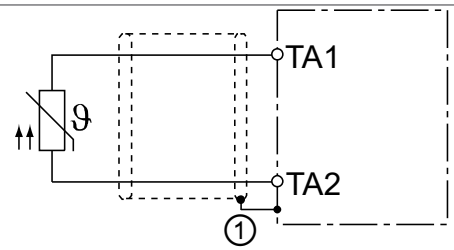
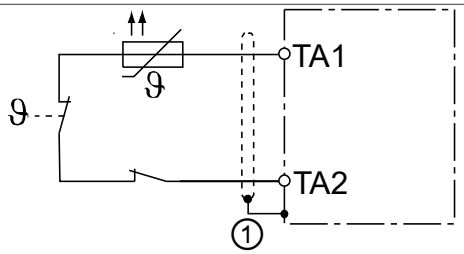
8.2.3 Connection of PTC, temperature switch or PT1000

Settings of PTC, temperature switch or PT1000

Stetting

dr33 = 1 => PTC or temperature switch
dr33 = 4 => PT1000

Connection

Thermal contact (NC contact)	
Temperature sensor (PTC) or PT1000	
Mixed sensor chain	
① Connection via shield bracket (if not available, place on mounting plate).	

Tab. 25: Connection examples

9 Safety function STO

⚠ DANGER

Improper installation of safety technology!

Death and serious bodily injuries.

a) Therefore the safety functions may only be installed and put into operation by qualified personnel which are trained in safety technology.

b) Check the safety functions and error responses and generate an acceptance report after installation.

Electronic protective devices are used to integrate safety functions into the drive control system in order to minimise or eliminate hazards caused by malfunctions in machines.

The integrated safety functions replace the time-consuming installation of external safety components. The safety functions can be requested or triggered by a fault.

Safety functions protect persons from mechanical damage when project planning, installation and operation are carried out properly.

⚠ WARNING

Failure of safety functions

No protection

✓ To ensure the safety permanently:

a) The safety functions must be checked in regular intervals.

b) The intervals result from the risk analysis.

c) The useful life is limited to 20 years. After this time the unit must be replaced.

9.1 Description of STO

STO **(Safe Torque Off) "Safe Torque Off"**

In hazardous areas, set-up or troubleshooting work may be necessary where protective devices such as mains or motor contactors should not be activated. The safety function STO can be used there.

Compared to disconnection by mains contactors or motor contactors, the integrated safety function enables the drives of a system to be easily combined into functional groups. The safely switched off torque can thus be limited to certain plant areas. Depending on the application, the use of mains or motor contactors can be omitted by using STO.

In error case or on demand, the power semiconductors of the drive module are switched off and no energy is supplied to the drive which would cause rotation or torque (or in the case of a linear drive, movement or force). If an error occurs, the system can still be switched off safely or remain switched off.

⚠ DANGER

Continue mains voltage with active STO function!

Electric Shock

a) Always switch off the power supply before working on the device.

b) Await discharge time.

Another advantage is that the charging and discharging time of the DC link must not be considered. This means that the system is ready for operation again more quickly after an operational interruption.

Regular electromechanical equipment is subject to wear and tear. Using the STO function eliminates the need for these items of equipment and reduces maintenance costs.

Characteristics for STO **:**

- Energy supply for the rotating field of the motor is interrupted (motor coasts down).
- Use when monitoring for standstill is not required.
- Unintentional start-up of the motor is prevented.
- No galvanic isolation of the motor from the drive controller DC link.

The safety functions meet the requirements of performance level e (ISO 13849-1) and SIL 3 (IEC 61508 and IEC 62061).

Safety functions protect persons from mechanical damage when project planning, installation and operation are carried out properly.

What can the STO function do in relation to EN 60204-1 ?

- Emergency stop can be realised by the STO function, because the mains voltage may still be applied.
- Emergency stop can only be realised in conjunction with a mains contactor that switches off the mains voltage!

9.2 Emergency stop according to EN 60204

By using suitable safety switchgear, the STO function can achieve stop categories 0 and 1 according to EN 60204-1 in the system ().

- **Stop category 0**
  "uncontrolled stop", i.e. stop by immediately switching off the energy to the drive elements.
- **Stop category 1**
  "controlled stop", i.e. the energy to the drive elements is maintained to achieve the stop. The energy is only interrupted when standstill is reached.

Emergency stop according to EN 60204-1 must be functional in all operating modes of the drive module. Resetting emergency stop must not lead to uncontrolled start-up of the drive.

NOTICE

Automatic restart when STO is no longer triggered.

Unpredictable consequences for personnel and machine.

✓ In order to comply with EN 60204-1, observe the following:

a) Ensured by external measures that the drive restarts only after confirmation.

⚠ DANGER

Motor coast in the event of a fault

Danger to persons

✓ If there is a danger to persons after the motor control has been switched off by STO:

a) Block access to the hazardous area.

b) Wait until the drive stops.

⚠ DANGER

Jerking of the drive in the event of a fault

Danger to persons

✓ In case of double malfunction it can lead to unwanted jerk. The rotation angle is depending on the number of poles of the selected drive and the gear ratio.

a) Switch off the supply voltage before carrying out any work on the machine.

b) Await capacitor discharge time (min. 5 minutes). Measure DC voltage at the terminals.

Calculation of the jerk:

Angle of rotation of the jerk Wr = 180°/ (number of pole pairs x gear reduction ratio)

The probability of a jerk is < $1.84\text{-}10^{-15}$ 1/h. This behaviour can be caused by a short circuit of the IGBTs. The error is only to be considered critical if the drive remains in the STO state.

9.3 Classification from STO to IEC 61508

PFH	$4.04 \cdot 10^{-12}$ 1/h
PFD	$3.54205 \cdot 10^{-7}$ per request
Proof test interval	20 years

For the SIL classification in connection with the applications, the failure rates of the external switching devices must be considered for the final assessment.

9.4 Classification from STO to EN ISO 13849

Control category	4
$MTTF_D$	>2500 years
DC value	high

For the classification within a performance level in connection with the applications, the failure rates of the external switching devices must be considered for the final assessment.

9.5 Functional description

The COMBIVERT with integrated safety technology fulfils the following function according to EN 61800-5-2:

The safety-oriented shutdown according to STO is achieved by a two-channel opto-coupler lock. The supply of the optocouplers, which are responsible for the commutation of the connected drive, is done by a transformer coupling of the input voltage. This ensures that the optocouplers cannot be supplied if the input voltage is lost. If the optocouplers are no longer supplied, no IGBT can be controlled and thus no energy can be supplied to the drive.

The dual-channel capability is achieved by using input STO1 to suppress the supply voltage (VTRO) of the upper optocouplers of the inverter bridge and input STO2 to suppress the supply voltage of the lower optocouplers (VTRU).

Maximum switch-on delay (UIN=15V)	7 ms
Maximum switch-off delay (UIN=30 V) at active modulation	10 ms
Maximum switch-off delay (UIN=30 V) at inactive modulation until safe state of the driver voltage is reached.	50 ms

Tab. 26: Technical data of the STO function

9.6 Wiring proposals

9.6.1 Direct switch-off with emergency stop switch

⚠ CAUTION

Emergency stop device in which both contacts are connected together against a positive supply signal!

In case of a short circuit, the system only works on one channel!

a) The wiring must be arranged by way, that no cross-connections occur.

b) Avoid short circuit between adjacent terminals (STO1+ & STO2+, STO1- & STO2- or STO2+ & Out3).

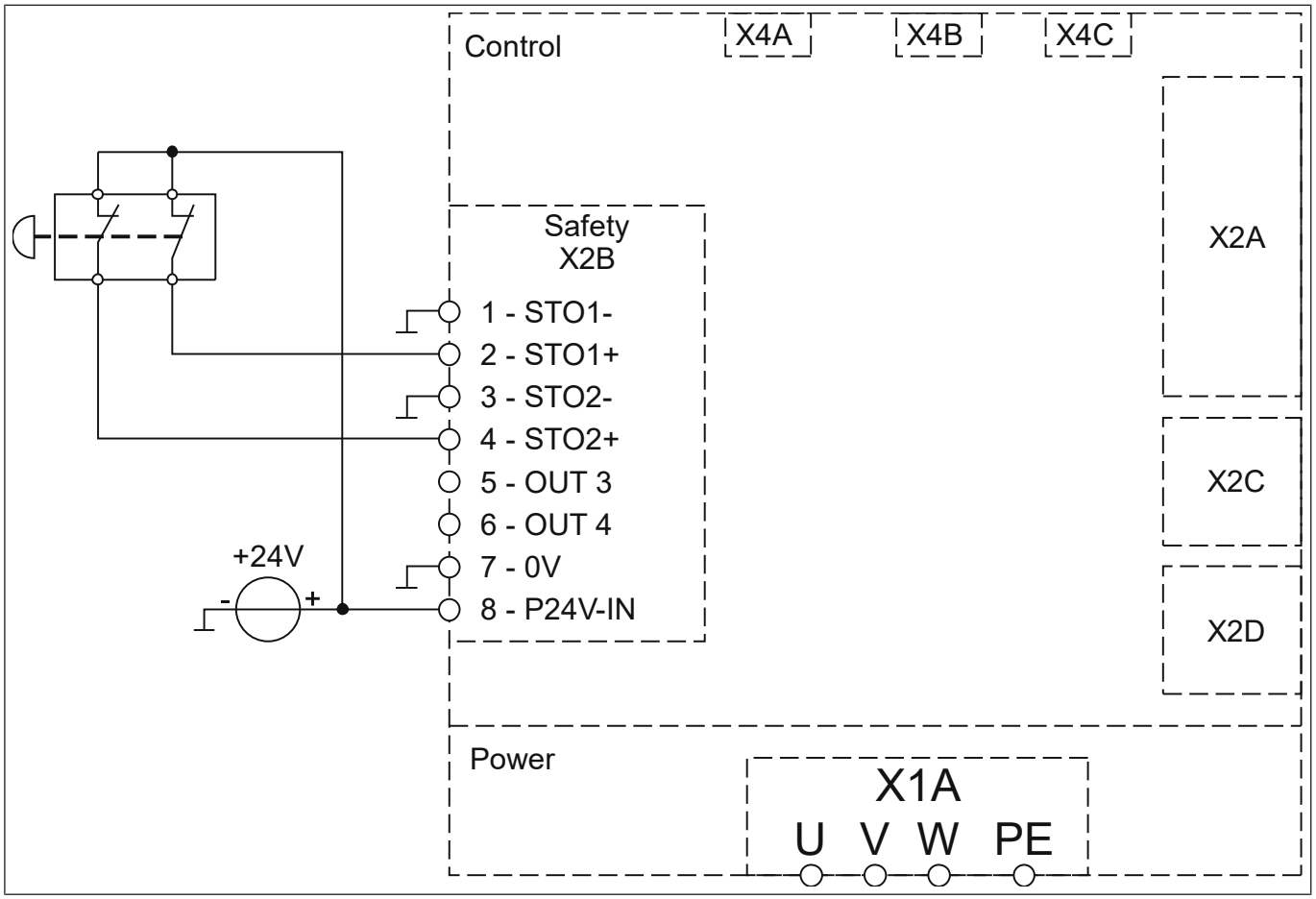


Fig. 9: Direct switch-off with emergency stop switch

9.6.2 Direct switch-off with emergency stop switch and monitoring of the wiring

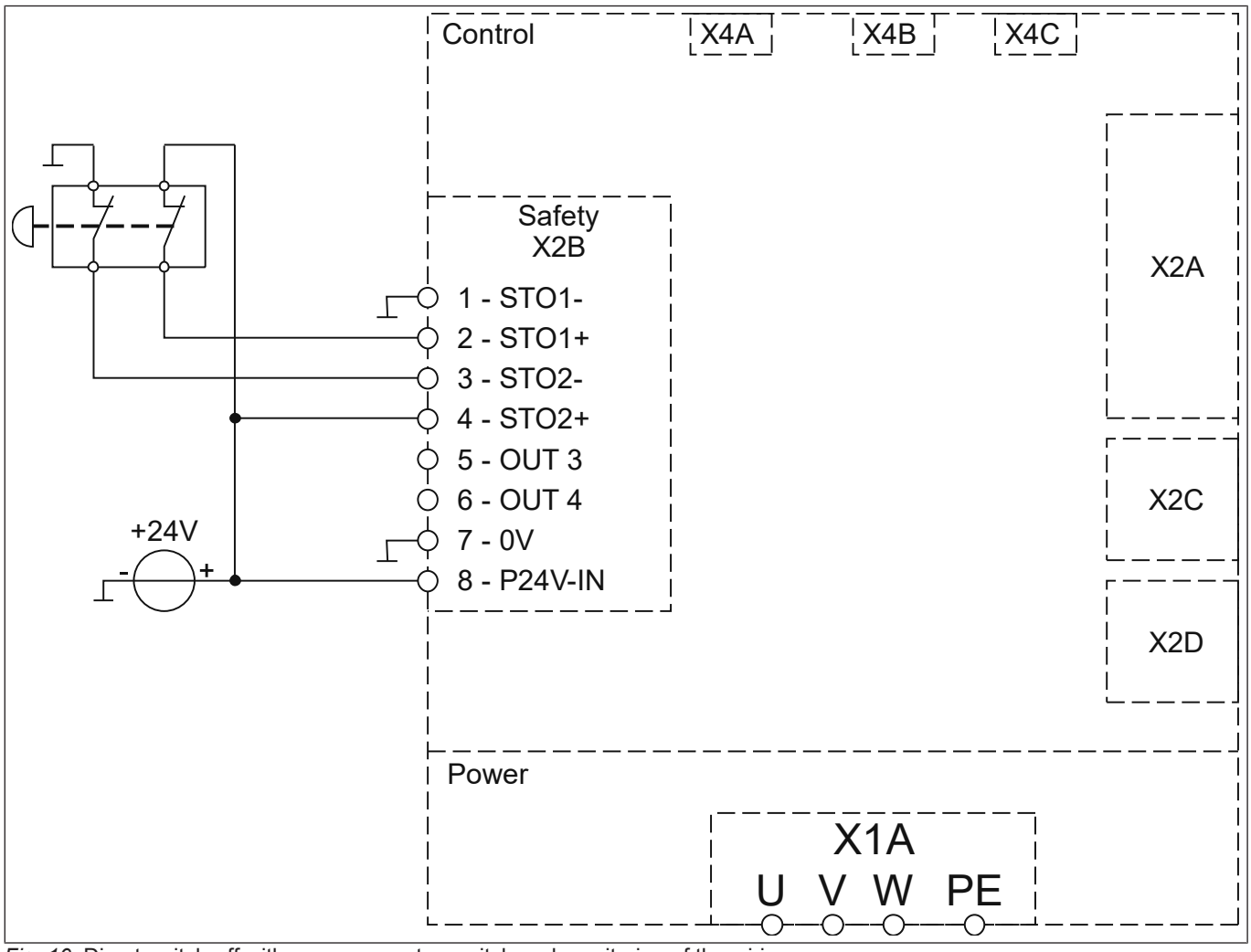


Fig. 10: Direct switch-off with emergency stop switch and monitoring of the wiring

The shown circuit detects wiring faults in the area of the emergency stop switchgear and the supply line. A possible short circuit on the primary side of the emergency stop switchgear (ground and DC +24 V) and a short circuit on the secondary side of the device or within the wiring leads either directly or with closed contacts to a short circuit of the supply, whereby an upstream 24 V fuse trips.

In addition to the two applications shown here with an emergency stop switching device, other sensors (such as door switches, etc.) can be used in the same way.

9.6.3 Direct switch-off by safety module with test pulses

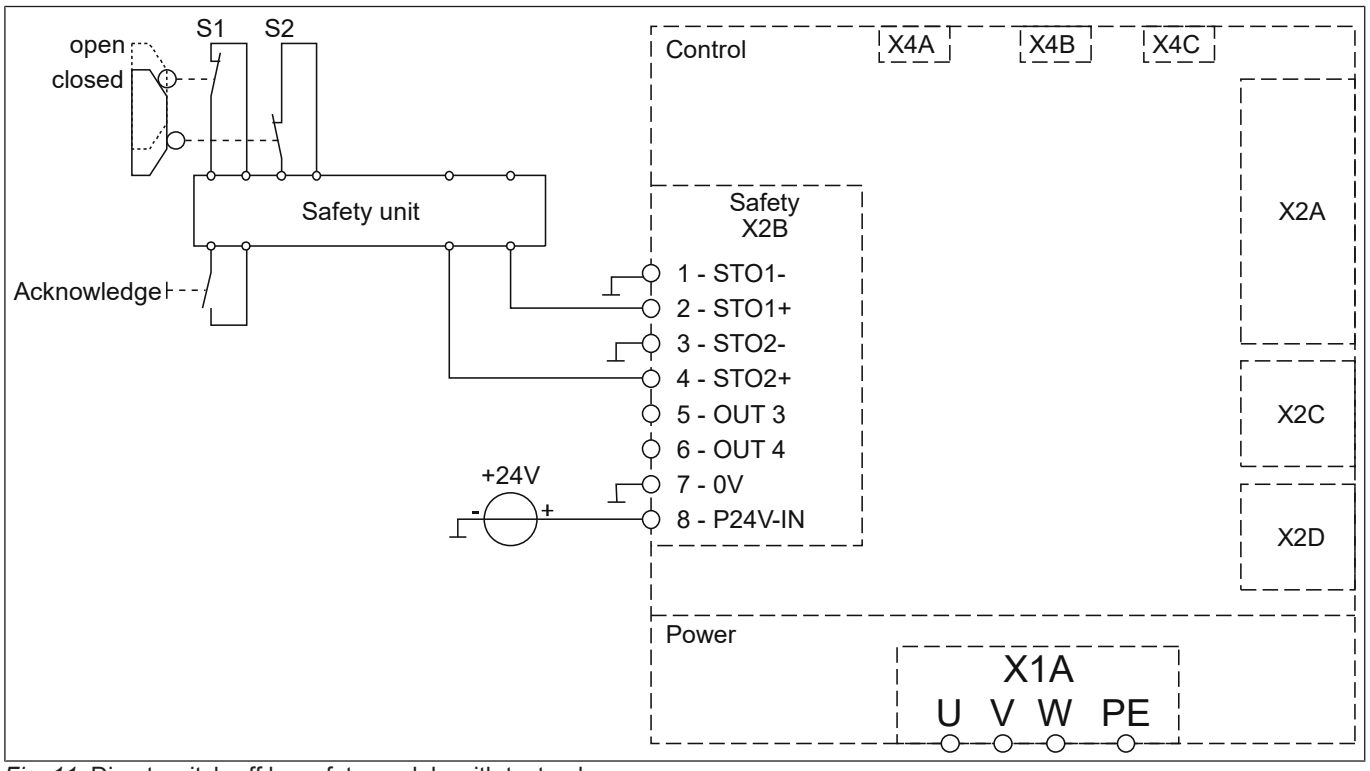


Fig. 11: Direct switch-off by safety module with test pulses

When the emergency stop device is actuated, e.g. by a safety door, the enable paths of the safety module are interrupted. This leads to the removal of the STO signals (X2B.2 and 4) and thus to the energy shutdown of the motor.

The safety module performs a consistency check of all signal paths via test signals (OSSD).

9.6.4 Wiring SS1

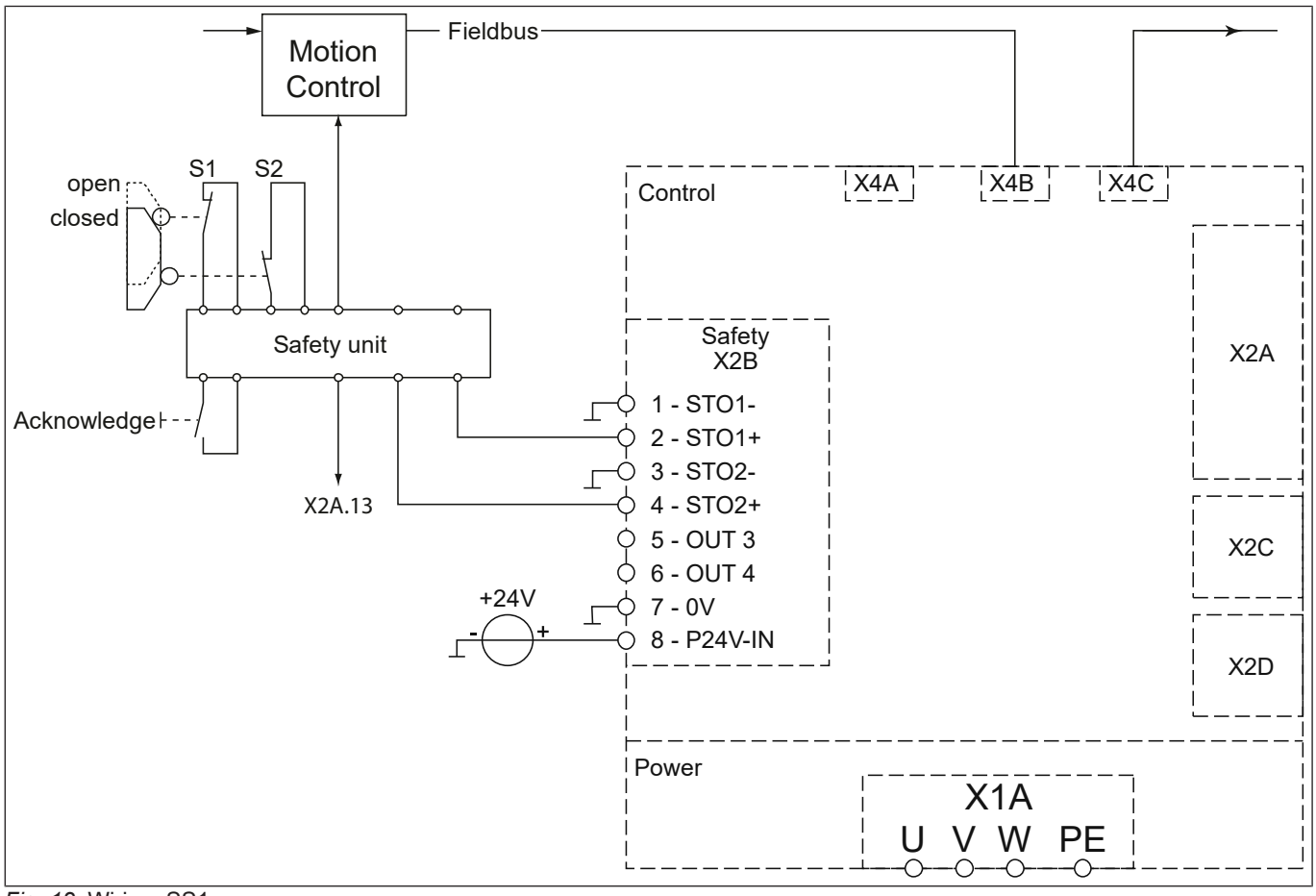


Fig. 12: Wiring_SS1

With triggering SS1 (Safe Stop 1), the motor is only switched torque-free when it has reached standstill [EN 61800-5-2]. The idle state is not queried directly, but the maximum time until the standstill is reached is estimated.

This time period is loaded into a safe time relay that finally switches the motor torque-free.

When the emergency stop device is actuated, the motor is brought to a standstill with a deceleration ramp via input X2A.13 (I7).

At the same time, the safe time expires in the safety module. After the safe time has elapsed, the control signals STO1+ and STO2+ (X2B.2 and X2B.4) are switched off and by way the energy supply of the motor is interrupted.

A suitable parameterisation of the control is necessary for the function "Stop drive".

10 Certification

10.1 EU type examination

see also

EU type examination S6-K with STO [▶ 46]

10.1.1 EU type examination S6-K with STO

EC Type-Examination Certificate

Reg.-Nr./No.: 01/205/5421.02/19

Prüfgegenstand **Product tested**	Sicherheitsfunktion STO in der Umrichter-Produktreihe KEB COMBIVERT S6-K Safety function STO within inverter series KEB COMBIVERT S6-K	**Zertifikats-inhaber** **Certificate holder**	KEB Automation KG Südstraße 38 32683 Barntrup Germany
Typbezeichnung **Type designation**	Steuerungsmodule 1K.S6.030-0002 und 1K.S6.030-0003 für Umrichter xxS6Kxx-xxxx Control boards 1K.S6.030-0002 and 1K.S6.030-0003 for Inverter xxS6Kxx-xxxx		
Prüfgrundlagen **Codes and standards**	EN 61800-5-2:2017 EN 61800-5-1:2007 + A1:2017 (in extracts) EN 61800-3:2018	EN 62061:2005 + AC:2010 + A1:2013 + A2:2015 EN ISO 13849-1:2015 IEC 61508 Parts 1-7:2010	
Bestimmungsgemäße Verwendung **Intended application**	Sicherer Halt an Maschinen. Die Sicherheitsfunktion "Safe Torque Off" (STO) erfüllt die Anforderungen der Prüfgrundlagen (Kat. 4 / PL e nach EN ISO 13849-1, SIL CL 3 / SIL 3 nach EN 62061 / EN 61800-5-2 / IEC 61508) und kann in Anwendungen bis PL e nach EN ISO 13849-1 und SIL 3 nach EN 62061 / IEC 61508 sowie für Stillsetzen nach Stopp-Kategorie 0 gemäß EN 60204-1 eingesetzt werden. Safe Stop at Machinery. The safety function "Safe Torque Off" (STO) complies with the requirements of the relevant standards (Cat. 4 / PL e acc. to EN ISO 13849-1, SIL CL 3 / SIL 3 acc. to EN 62061 / EN 61800-5-2 / IEC 61508) and can be used in applications up to PL e acc. to EN ISO 13849-1 and SIL 3 acc. to EN 62061 / IEC 61508 as well as stopping according to stop category 0 acc. to EN 60204-1.		
Besondere Bedingungen **Specific requirements**	Die Hinweise in der zugehörigen Installations- und Betriebsanleitung sind zu beachten. The instructions of the associated Installation and Operating Manual shall be considered.		

Es wird bestätigt, dass der Prüfgegenstand mit den Anforderungen nach Anhang I der Richtlinie 2006/42/EG über Maschinen übereinstimmt.
It is confirmed that the product under test complies with the requirements for machines defined in Annex I of the EC Directive 2006/42/EC.

Gültig bis / Valid until 2024-12-15

Der Ausstellung dieses Zertifikates liegt eine Prüfung zugrunde, deren Ergebnisse im Bericht Nr. 968/FSP 1056.02/19 vom 15.12.2019 dokumentiert sind.
Dieses Zertifikat ist nur gültig für Erzeugnisse, die mit dem Prüfgegenstand übereinstimmen.
The issue of this certificate is based upon an examination, whose results are documented in Report No. 968/FSP 1056.02/19 dated 2019-12-15.
This certificate is valid only for products which are identical with the product tested.

TÜV Rheinland 0035 Notified Body

Köln, 2019-12-15

Notified Body for Machinery, NB 0035

Dipl.-Ing. Eberhard Frejno

TÜV Rheinland Industrie Service GmbH, Am Grauen Stein, 51105 Köln / Germany
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11 Revision History

Edition	Version	Note
2014-11	01	Series version.
2015-06	02	Preface changed; type code adapted; function of LED3 and 4 changed; designation Out 3 and Out 4 changed; encoder specification extended.
2017-07	03	Changeover to new layout.
2017-09	04	Specification analog output changed.
2017-11	05	Alternative LED designation.
2021-08	06	Notes for encoder pin 25/26 extended; Function yellow LED EtherCAT changed; editorial revision due to conversion to editorial system.
2021-11	07	Changing the filter (S6K) in english version.
2023-04	08	Designation of the relay changed. Operation without temperature monitoring pn33 changed to pn12. CAN interface functionally isolated. Index corrected in english version.

Glossary

Application

The application is the intended use of the KEB product.

Autonegotiation

Procedure for determining the max. transmission speed.

Basic insulation

Protection against contact with electrical voltage.

BiSS

Open source real-time interface for sensors and actuators

CAN®

Serial bus system running protocols such as CANopen, Devicenet or J1939. CAN is a registered trademark of the CAN in AUTOMATION - International Users and Manufactures Group e.V.

COMBIVERT

Proper name for a KEB Drive Controller

COMBIVIS

KEB start-up and parameterizing software

Customer

The customer has purchased a product from KEB and integrates the KEB product into his product (customer product) or resells the KEB product (reseller).

DC-Value

Diagnostic coverage measures the quality of testing and monitoring measures.

DIN 66019

Information processing; control method with the 7-bit code during data transmission.

DIN EN 61131-2

Programmable controllers - Part 2: Equipment requirements and tests

Emergency off

Switching off the power supply in case of emergency.

Emergency stop

Shutting down a drive in case of emergency (not de-energised).

EN 60204-1

Safety of machinery - Electrical equipment of machines - Part 1: General requirements (VDE 0113-1, IEC 44/709/CDV).

EN 61800-5-1

Adjustable speed electrical power drive systems. Part 5-1: Safety requirements - Electrical, thermal and energy requirements (VDE 0160-105-1, IEC 61800-5-1)

EN 61800-5-2

Adjustable speed electrical power drive systems. Part 5-2: Safety requirements - Functional safety (VDE 0160-105-2, UL 61800-5-2, IEC 22G/264/CD)

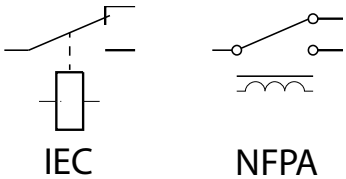
EnDat

Bidirectional encoder interface of the company Heidenhain

EtherCAT®

EtherCAT is a real-time Ethernet bus system. EtherCAT is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Form C



Form C describes a relay with three contacts (switching contact, break contact and make contact). Also referred to as SPDT (single pole, double throw).

Hiperface

Bidirectional encoder interface of the company Sick-Stegmann

HSP5

Fast, serial protocol

HTL

Incremental signal with an output voltage (up to 30V) -> TTL

IEC 61508

Functional safety of electrical/electronic/programmable electronic safety-related systems.

IEC 62061

Safety of machinery - Functional safety of safety-related control systems.

ISO 13849-1

Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design.

MTTF

Average life time to failure.

PFD

Term used in the safety technology (EN 61508-1...7) for the size of error probability.

PFH

Term used in the safety technology (EN 61508-1...7) for the size of error probability per hour.

RS485

RS-485 is an industry standard according to EIA-485 for a physical interface for asynchronous, serial data transmission.

SELV

Safe protective extra-low voltage (unearthed; <60V).

SIL

The security integrity level is a measure for quantifying the risk reduction. Term used in the safety technology (EN 61508 -1...7).

SinCos

Incremental encoder with sinusoidal signals.

SSI

Synchronous serial interface for encoder

STO

Safe torque off

VARAN

Real-time Ethernet bus system

Index

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