



Instructions for Use

COMBIVERT S6

Installation Control APPLICATION

Translation of the original manual

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Imprint

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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

The customer may use the instructions for use as well as further documents or parts from it for internal purposes. Copyrights are with KEB Automation KG and remain valid in its entirety.

Other wordmarks and/or logos are trademarks (™) or registered trademarks (®) of their respective owners.

1.6 Validity of this manual

This part of the instruction manual describes the implemented control card. It

- is only valid in conjunction with the instructions for use of the power part.
- contains only supplementary safety instructions.
- if certain functions or properties are version-dependent, this is indicated at the appropriate place. The version number of the COMBIVERT can be found in brackets after the material number.

1.7 Target group

The instructions for use is determined exclusively for electrical personnel. Electrical personnel for the purpose of this instruction manual must have the following qualifications:

- Knowledge and understanding of the safety instructions.
- Skills for installation and assembly.
- Start-up and operation of the product.
- Understanding of the function in the used machine.
- Detection of hazards and risks of the electrical drive technology.
- Knowledge of IEC 60364.
- Knowledge of national safety regulations (e. g. DGUV Regulation 3).

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.

2.1 Installation

DANGER



Electrical voltage at terminals and in the device!

Danger to life due to electric shock !

- ✓ For any work on the device
 - a) Switch off the supply voltage.
 - b) Secure it against switching on.
 - c) Wait until all drives has been stopped in order that no regenerative energy can be generated.
 - d) Await capacitor discharge time (min. 5 minutes). Measure DC voltage at the terminals.
 - e) Never bridge upstream protective devices. Also not for test purposes.

NOTICE



Use of unsuitable voltage sources!

Electric Shock!

- a) Use for the connection only suitable voltage sources with safe isolation (SELV/ PELV) in accordance with VDE 0100 with nominal voltage of DC 24 V ± 10 %.
- b) Pay attention on a sufficient overvoltage category of the voltage supply.
- c) With existing or newly wired circuits the person installing the units or machines must ensure that the PELV requirements are met.

For a trouble-free and safe operation, please pay attention to the following instructions:

- The electrical installation shall be carried out in accordance with the relevant requirements.
- Cable cross-sections and fuses must be dimensioned by the user according to the specified minimum/maximum values for the application.
- For drive converters that are not isolated from the supply circuit (in accordance with EN 61800-5-1) all control lines must be included in other protective measures (e.g. double insulation or shielded, earthed and insulated).
- When using components without isolated inputs/outputs, it is necessary that equipotential bonding exists between the components to be connected (e.g. by the equipotential line). Disregard can cause destruction of the components by equalizing currents.

2.2 Start-up and operation

The start-up (i.e. the starting of normal operation) is prohibited until the machinery has been proved to conform to the provisions Directive 2006/42/EG and Directive 2014/30/EU; EN 60204-1 must be observed.

WARNING



Wrong parameterization

Unintentional behaviour of the drive

- ✓ During initial start-up or replacement of the drive controller
 - a) Secure motors against automatic restart.
 - b) Check whether the appropriate parameter list for the application has been imported.

WARNING

Software protection functions as sole protection.

Protection function in case of software problems without function.

- ✓ Securing a unit solely with software-supported functions is not sufficient.
 - a) Install external protective measures (e.g. limit switch) that are independent of the drive controller.

2.3 Maintenance

DANGER

Unauthorized exchange, repair and modifications

Unpredictable malfunctions

- a) The function of the drive controller is dependent on its parameterization. Never replace without knowledge of the application.
- b) Modification or repair is permitted only by KEB Automation KG authorized personnel.
- c) Only use original manufacturer parts.
- d) Infringement will annul the liability for resulting consequences.

3 Product description

3.1 Description of the control board APPLIKATION

The control board APPLIKATION 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, supply and feedback
- Motor protection by I²t, KTY, PT1000 or PTC input
- 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
A	APPLIKATION
6. digit	Variants
1	Safety module type 1 (APPLICATION)
3	Safety module type 3
4	reserved
7. digit	Housing
8. digit	Connection, voltage, options
9. digit	Control board variant
1	APPLICATION Multi encoder interface, CAN®, Realtime Ethernet Module
B	APPLICATION Multi encoder interface, CAN®, Realtime ethernet module, alternative terminal strip
10. digit	reserved
11. digit	reserved

3.3 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/ control board	Safety module	Set contains	Material number
02 / APPLICATION	Type 1	terminal strip 28-pole terminal strip 10-pole terminal strip 8-pole connector 3-pole connector 6-pole shielding bracket 2 x shielding clamp	00S6ZC0-0002
04 / APPLICATION			00S6ZC0-0003
02 / APPLICATION	Type 3	terminal strip 32-pole terminal strip 28-pole terminal strip 6-pole connector 3-pole connector 6-pole shielding bracket 2 x shielding clamp	00S6ZC0-0004 ¹⁾
04 / APPLICATION			00S6ZC0-0005 ¹⁾
00S6ZC0-001x customized connector sets			

Tab. 1: Connector sets

3.4 Connection and control elements

X1C	Temperature monitoring, brake control/monitoring
X1Z	Strain relief
X2A	Control terminal block for digital inputs/outputs; 24V supply; relay output; analog inputs and outputs; CAN bus
X2B	Safety module (depending on variant)
X3A	Encoder interface channel A
X3B	Encoder interface channel B
X4A	Diagnostic interface with RS232/485 interface according to DIN66019 protocol; operator slot
X4B	Realtime-Ethernetmodul (variantenabhängig)
X4C	Realtime-Ethernet module (depending on variant)
S1	Realtime-Ethernet module (depending on variant); rotary coding switch 1 (low byte)
S2	Realtime-Ethernet module (depending on variant); rotary coding switch 2 (high byte)
FS ST	LED Safety state
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

3.5 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

3.6 Control terminal strip X2A

The control terminal strip X2A is a 28-pole pluggable, double-row terminal strip with spring-cage connection. It contains:

- 8 digital inputs
- 2 digital outputs
- 1 Relay output
- 2 analog inputs (plus 1 switchable analog input)
- 1 analog output
- CAN bus interface
- 24V input and output

3.7 Safety terminal block X2B

The design of the terminal strip X2B depends on the safety module. The description is given in a separate manual for the safety module.

3.8 Encoder interfaces X3A, X3B

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

3.9 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.

3.10 Realtime-Ethernet module

The Real-time Ethernet module contains more realtime fieldbus interfaces. The assignment of the fieldbus interfaces, the protocol and the function of the "NET ST" LED depends on the set protocol. The description is given in the Realtime Ethernet module's own manual.

3.11 Status LEDs

3.11.1 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
VCC ● NET ○ ST DEV ○ ST OPT ○	Initialization	Control is supplied with 24 V

LEDs	Status	Note
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

3.11.2 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

3.11.3 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

3.11.4 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

3.11.5 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, encoder 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!

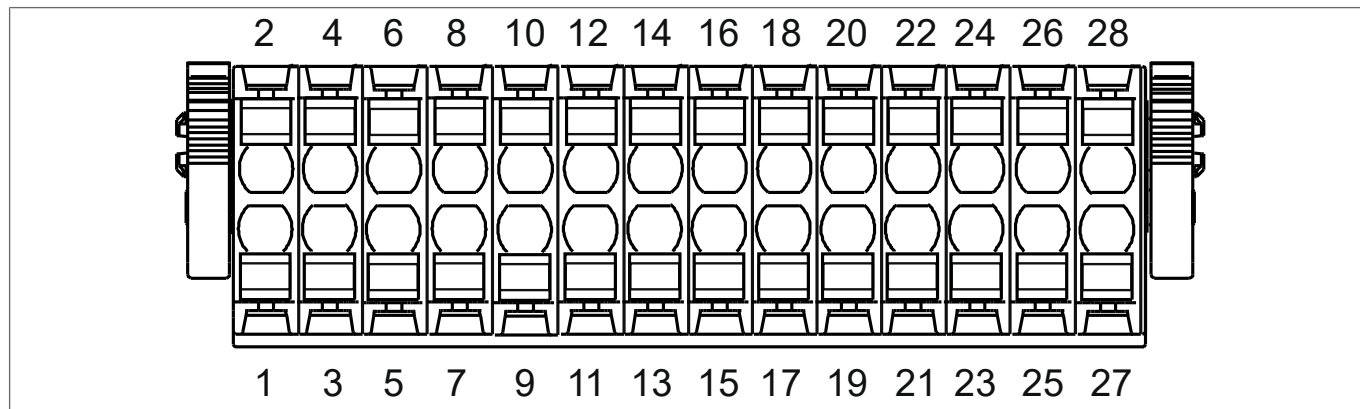
Malfunctions due to loose contacts.

- 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 mm ²	with plastic collars	10 mm	12 mm
0.75 mm ²		12 mm	14 mm
1.0 mm ²		12 mm	15 mm
1.5 mm ²	without plastic collars	10 mm	10 mm
0.2...1.5 mm ² ein- oder feindrähtig	without wire-end ferrule	-	10...12 mm

Tab. 8: Wire-end ferrules and stripping length

4.2 Terminal strip X2A



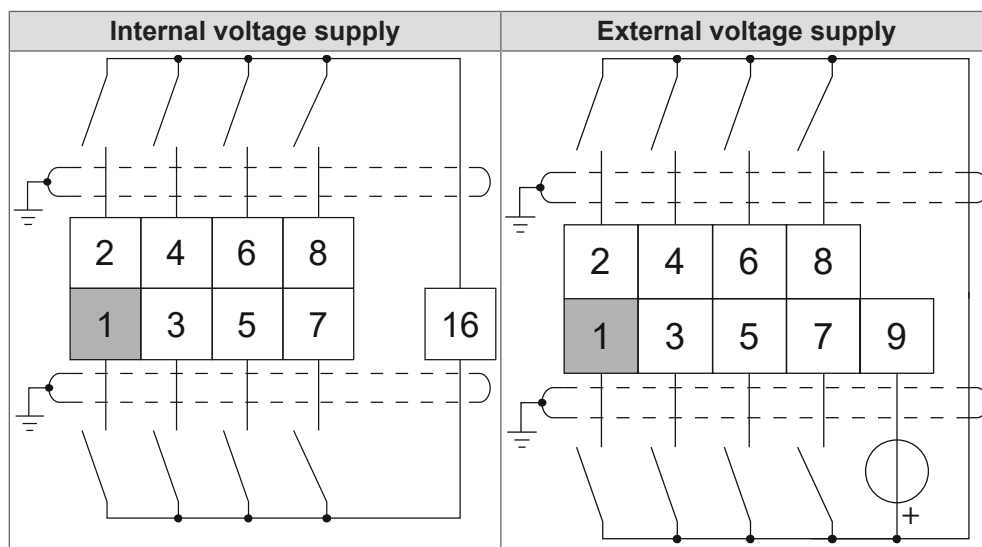
PIN	Name	Description
1	DI1 / AN3	Digital input 1 (standard) / analog input 3 (special software)
2	DI2	Digital input 2
3	DI3	Digital input 3
4	DI4	Digital input 4
5	DI5	Digital input 5
6	DI6	Digital input 6
7	DI7	Digital input 7
8	DI8	Digital input 8
9	0V	Reference potential for digital output
10	DO1	Digital output 1
11	0V	Reference potential for digital output
12	DO2	Digital output 2
13	RLB	Relay output / NC contact
14	RLA	Relay output / NO contact
15	RLC	Relay output/ switching contact
16	24Vout	DC voltage output 24V (max. 100 mA together with terminal 26) for control the inputs (SELV).
17	AN1-	non-isolated difference input 1
18	AN1+	Non-isolated difference input 1
19	AN2-	non-isolated difference input 2
20	AN2+	Non-isolated difference input 2
21	0V	Reference potential for analog inputs and outputs
22	ANOUT	Analog output DC 0...10 V
23	CAN low	CAN bus ISO High Speed according to ISO/DIN 11896 => fieldbus interfaces
24	CAN high	CAN bus ISO High Speed according to ISO/DIN 11896 => fieldbus interfaces
25	CAN GND	CAN Ground (=> Fieldbus interfaces [▶ 28])
26	24Vout	DC voltage output 24V (max. 100 mA together with terminal 16) for control the inputs (SELV).
27	0V	Reference potential for P24Vin at external supply
28	P24Vin	DC voltage input DC 24V to supply the control board

Tab. 9: Assignment of the terminal strip X2A

4.2.1 Digital Inputs

Specification	Number	8
	Name	DI1...DI8
	Terminals	X2A.1...X2A.8
	Classification	Type 3 according to DIN EN 61131-2
	Low level (logical 0)	-3 ... +5 V / 3 mA
	High level (logic 1)	11 ... 30 V / 2 ... 6 mA
	Special features	DI1 can be used as analog input AN3 depending on the firmware.

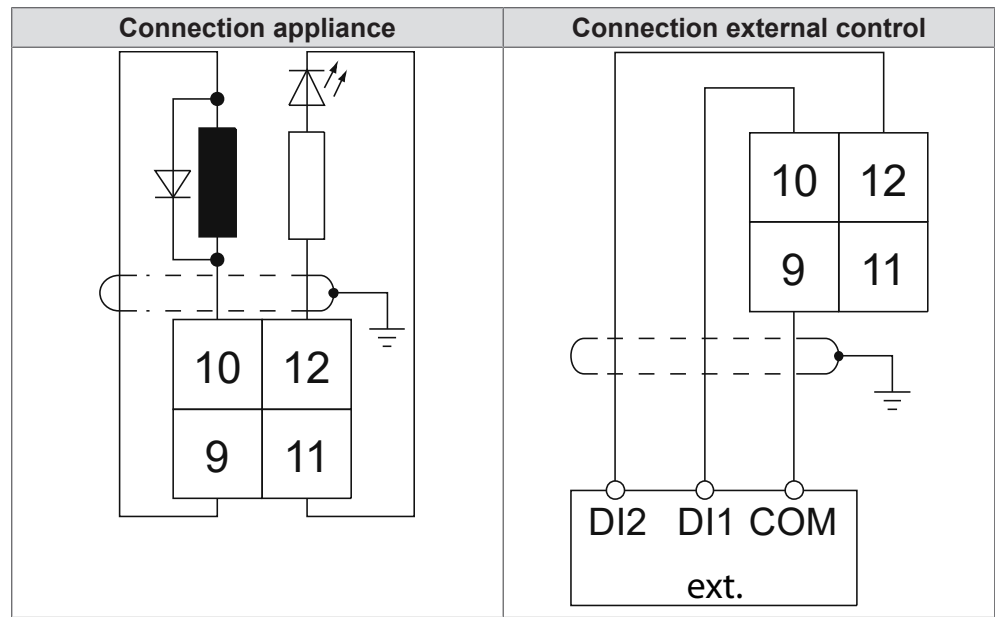
Connection



4.2.2 Digital Outputs

Specification	Number	2
	Name	DO1 ... DO2
	Terminals	X2A.10, X2A.12
	Type	24 V high-side switch
	Classification	DIN EN 61131-2
	Output voltage	Minimum P24Vin – 3 V maximum P24Vin
	Output current	Maximum 100 mA per output (short-circuit proof)
	Special features	Only ohmic load; no internal free-wheeling path

Connection



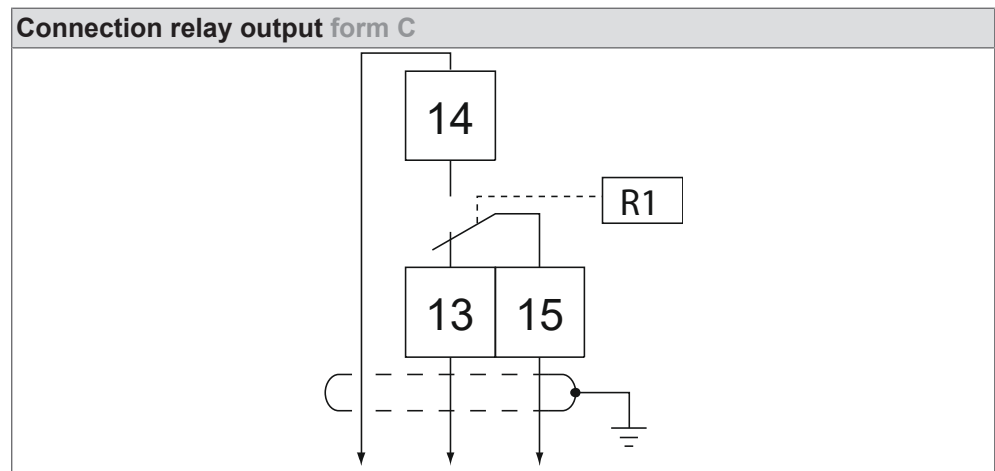
4.2.3 Relay output;

4.2.3.1 Relay output form C

Specification relay output Form C

Number	1
Name	R1
Terminals	X2A.13 (NC contact) X2A.14 (NO contact) X2A.15 (switching contact)
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 free-wheeling branch

Connection relay output form C



4.2.4 Analog input

4.2.4.1 Differential input

NOTICE

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

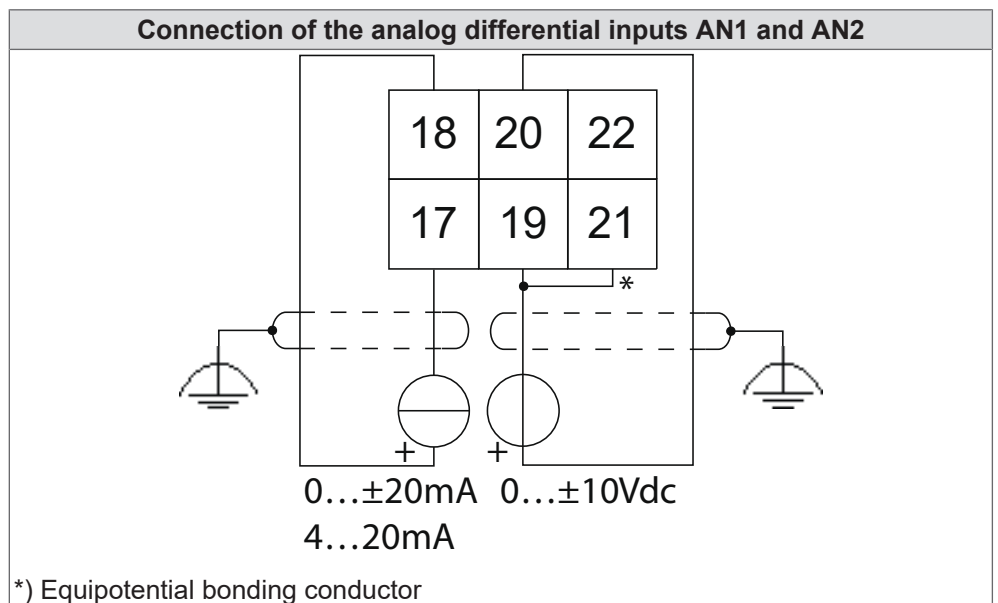
Malfunction or defect caused by voltage differences.

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	X2A.18 (AN1) X2A.20 (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

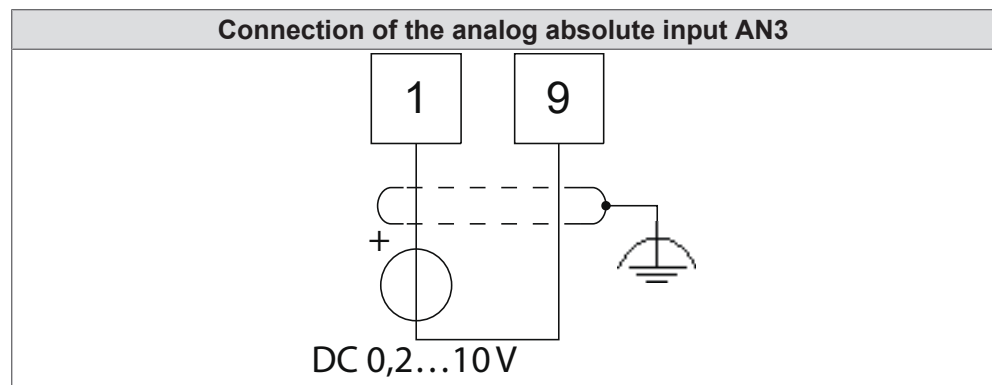
Connection



4.2.4.2 Absolute input

Specification (absolute input)	Number	1
	Name	AN3
	Terminals	X2A.1 (standard: digital input D11); can be used as analog input AN3 depending on the firmware.
	Classification	non-isolated absolute input
	Input signals	Voltage
	Voltage input	DC 0.2...10 V / max. 5 mA
	Others	Is not intended for control with potentiometer. The voltage source must be able to supply the input current.

Connection

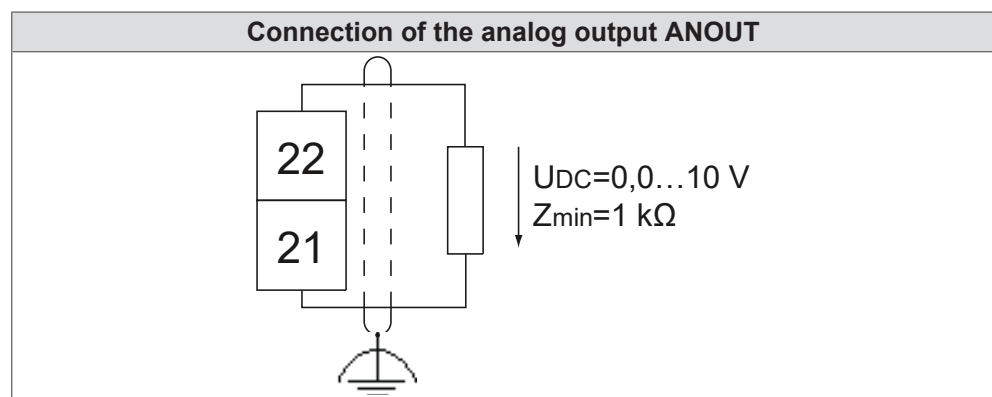


4.2.5 Analog output

Specification

Number	1
Name	ANOUT
Terminals	X2A.22 analog output X2A.21 reference potential
Classification	DIN EN 61131-2
Voltage output	DC 0.0...10 V (corresponds to 0...100 % output value)
Minimum load impedance	1 k Ω
Notes	In the range up to 0.1 V the output value is not linear to the output voltage.

Connection



4.2.6 Voltage supply

4.2.6.1 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.

4.2.6.1.1 Determination of the current consumption

The input P24Vin (X2A.28) supplies following components:

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

Consumer		Current consumption
Control		0.6 A
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. 0.4 A

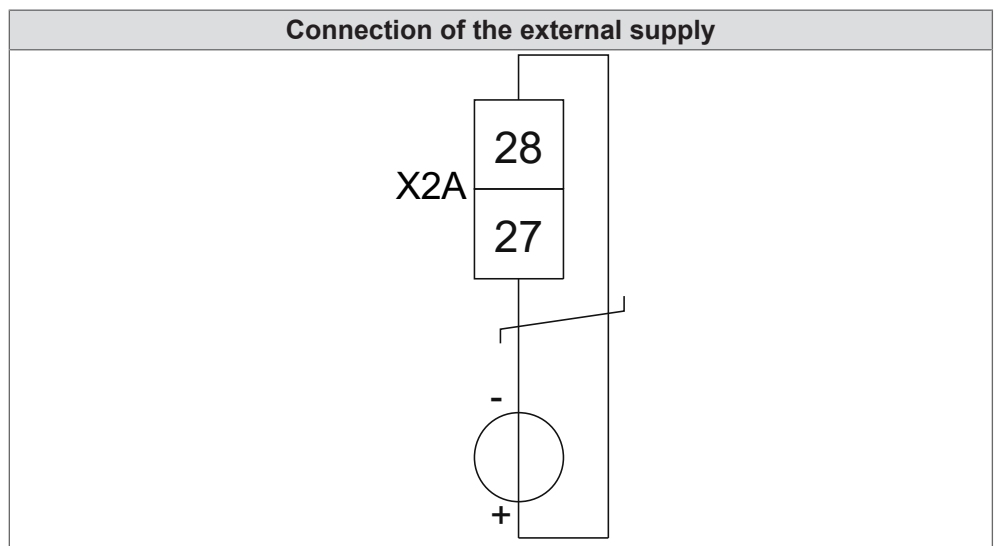
Tab. 10: Calculation the current consumption

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.

4.2.6.1.2 External supply

Specification external supply

Name	P24Vin, 0V
Terminals	X2A.28 (P24Vin) X2A.27 (0V)
Voltage	DC 24 V (±5 %)
Current consumption	Calculated value up to max. 4.6 A



NOTICE! The power-off function is not available if the controller is supplied externally.

4.2.6.2 Voltage output to supply the inputs

Specification voltage output

Name	24Vout 0V (reference potential)
Terminals	X2A.16, X2A.26 (24Vout) X2A.27 (0V)
Output current	max. 100 mA (short-circuit proof) total for both terminals
Output voltage	minimum P24Vin – 3V maximum P24Vin

Notes

DC voltage output (SELV) to control the digital inputs; Terminals are internally parallel connected.

Connection see (⇒ [Digital Inputs](#) [▶ 19])

5 Safety module X2B

The installed safety module is identified by the 6th digit of the material number.

6. digit	Variants
1	Safety module type 1 (APPLICATION)
3	Safety module type 3
4	reserved

5.1 Safety module type 1

The safety module type 1 includes the following functions:

STO and SBC.

The description is given in the safety manual at the following link:

	<p>Safety manual type 1</p> <p>(🌐 ► https://www.keb.de/fileadmin/media/Manuals/dr/ma_dr_safety-tp-1-shb-20109577_en.pdf)</p>	
---	--	---

5.2 Safety module type 3

The safety module type 3 includes the following functions:

STO, SBC, SS1, SS2, SEL, SLI, SLP, SOS, SLA, SDI, SLS, SSM, SMS, SAR, SSR and Safety over EtherCAT®

The description is given in the safety manual at the following link:

	<p>Safety manual type 3</p> <p>(🌐 ► https://www.keb.de/fileadmin/media/Manuals/dr/ma_dr_safety-tp3-20148769_en.pdf)</p>	
---	--	---

6 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. 11: 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. 12: 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.

6.1 Assignment of the terminal strip X4A

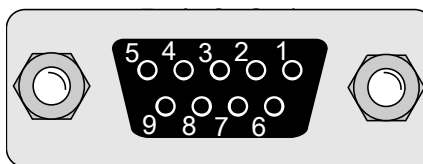


Fig. 1: Pin assignment socket D-Sub-9 (top view)

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)	

6.2 Data cable RS232 PC-Drive Controller

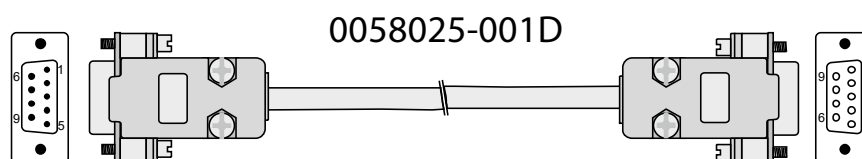


Fig. 2: Serial cable for the connection to a PC

6.3 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.

6.4 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)



7 Fieldbus interfaces

7.1 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	APPLICATION Multi encoder interface, CAN®, Realtime Ethernet Module
B	APPLICATION Multi encoder interface, CAN®, Realtime ethernet module, alternative terminal strip

7.2 CAN

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

Functional insulation between CAN terminals and to the control potential.

Bus termination

120 Ω external between (CAN High and CAN Low) at both ends of the bus line.

Connection

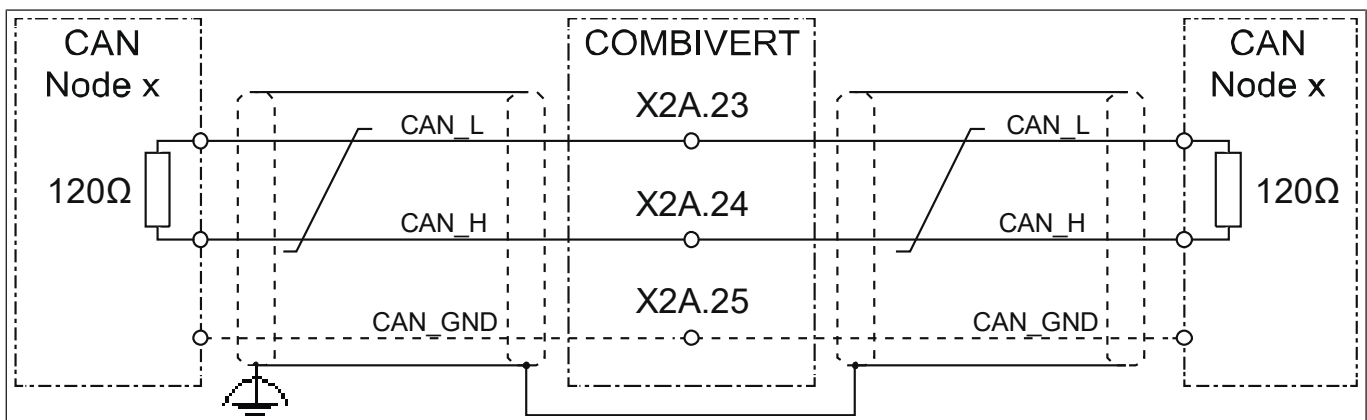


Fig. 3: Connection CAN bus

Clamp	Name	Note
X2A.23	CAN low	No internal bus termination
X2A.24	CAN high	
X2A.25	CAN GND	CAN ground (can be wired depending on the customer subscriber)

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

Status	Light pattern	Description
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 (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.

7.3 Realtime-Ethernet module

The real-time Ethernet module is depending on the ordered variant. It includes different fieldbus controls. The active fieldbus control is set with parameter fb68.

The description is given in a separate manual at the following link:

	Realtime-Ethernet module (🌐 ► https://www.keb.de/fileadmin/media/Manuals/dr/ma_dr_rte-inst-20148981_en.pdf)	
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8 Encoder interfaces

8.1 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.
-

8.2 Input signals

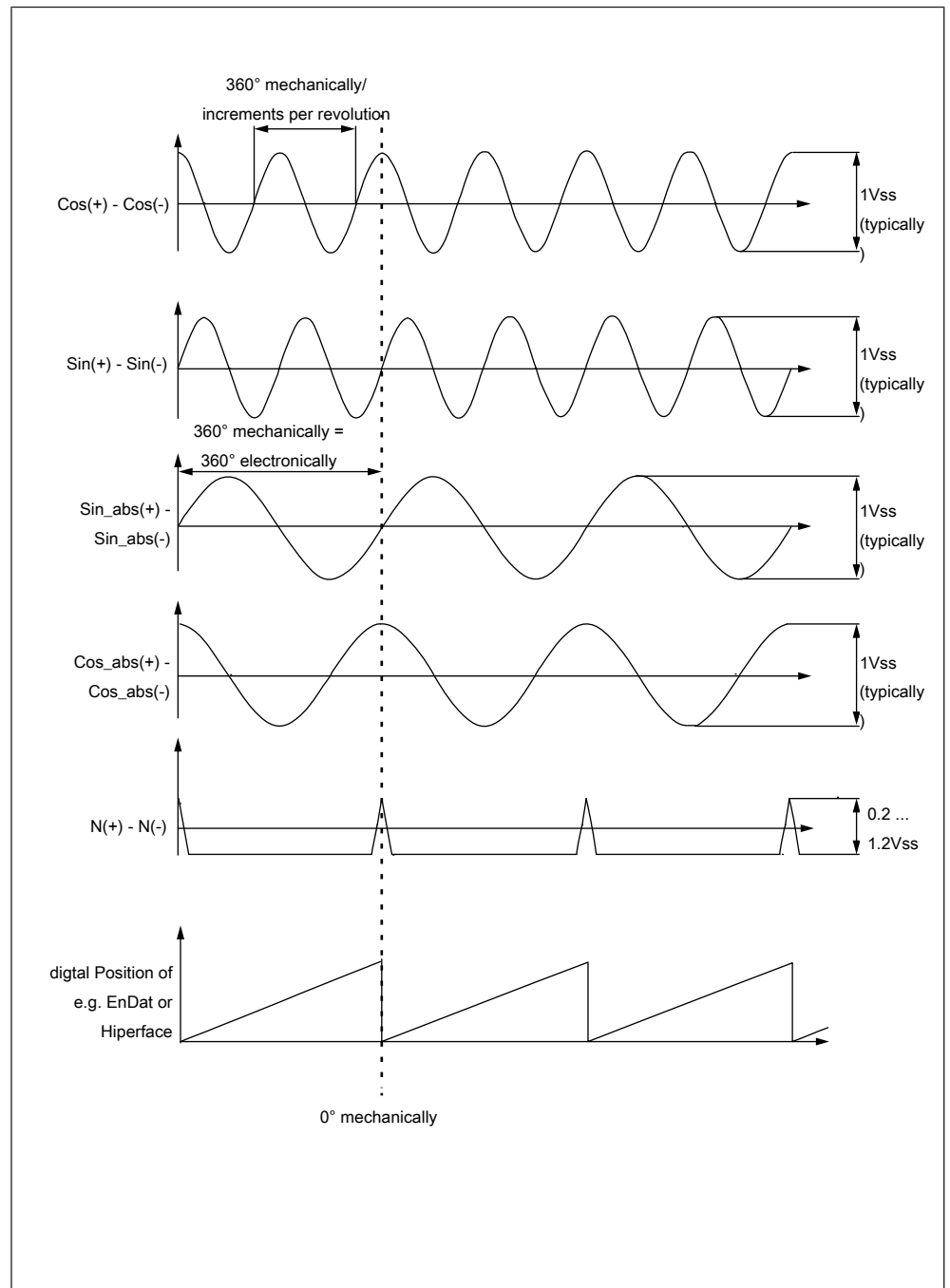
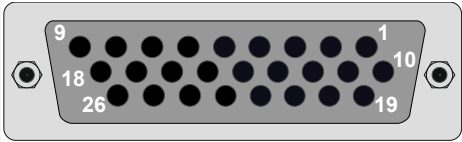


Fig. 4: Assignment of the input signals (as difference signals)

- 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+.

8.3 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. 13: Assignment X3A and X3B

Notes for Pin 25 / 26

Supply voltage of $U_{DC} = 8\text{ V}$ 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!

8.4 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:

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

Fig. 5: 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.

8.5 Description of the encoder interfaces

PIN	Signals	Description
1, 2, 3, 4	A+/- B+/- Cos+/- Sin+/-	<p>Only channel A:</p> <p>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</p> <p>Differential (e.g. Cos+ against Cos-): Constant component 0 V ±0.1 V signal level Uss=0.6 V...1.2 V</p> <p>Channel A:</p> <p>Input for square-wave incremental signals according to RS485 maximum 200 kHz.</p> <p>Channel B:</p> <p>Input for square-wave incremental signals according to RS485 maximum 500 kHz.</p> <p>Incremental encoder simulation: Position changes of channel A are output to channel B with two 90° shifted RS485 signals. Maximum output frequency 500 kHz.</p>
5, 6	N+/- Data+/-	<p>Only channel A:</p> <p>Input zero signal once per revolution. Differential signal level (N+ ... N-):</p> <ul style="list-style-type: none"> • higher 50 mV: zero signal is active • from 50 mV to -50 mV: undefined • lower -50 mV: zero signal is inactive <p>Signal length 330°...360° of the signal length of the incremental signals.</p> <p>Channel A and B:</p> <p>Input zero signal or data RS485. Zero signal is 1-active, if signals A and B are also 1-active.</p> <p>only channel B:</p> <p>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°.</p>
10, 11, 12, 13	Sin+/- Cos+/- Sin_abs+/- Cos_abs+/-	<p>Only channel A:</p> <p>Input for sinusoidal absolute signals Uss=1 V for SinCos encoder Uss=3.8 V maximum for resolver</p>
10, 12	Clock+/-	Output for clock signal RS485
14, 15	Exciter+/-	<p>Only channel A:</p> <p>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°</p>

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. 14: Encoder specifications

9 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. 15: Assignment of the terminal block X1C

9.1 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 $P24V_{in} - 2.4V$ maximum $P24V_{in}$
maximum output current	2 A
Others	Internal free-wheeling path; internal filter circuit; short-circuit proof

Connection

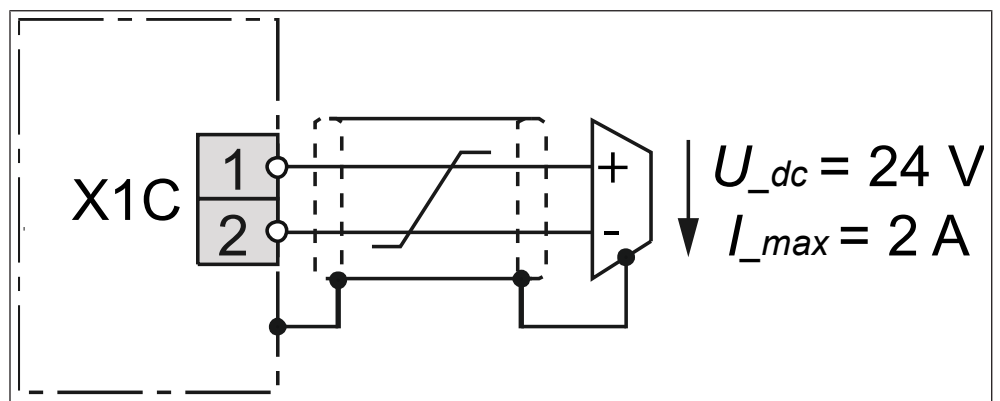


Fig. 6: Connection of a brake

9.2 Temperature detection

⚠ DANGER



Electric shock by sensors without protective separation!

- Only use sensors with basic insulation.
- 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

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

9.2.1 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).

9.2.2 Connection of a KTY sensor

NOTICE

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

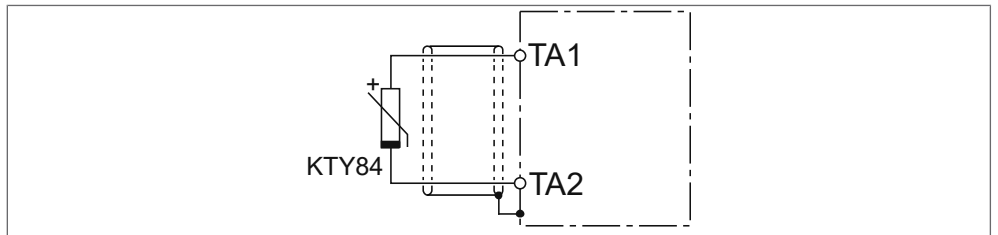
Non-observance leads to incorrect measurements and possibly to the destruction of the motor winding

- 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



9.2.3 Connection of PTC, temperature switch or PT1000

Settings of PTC, temperature switch or PT1000

Setting 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. 16: Connection examples

10 Revision History

Edition	Version	Note
2016-10	00	Completion pre-series version.
2017-03	01	Completion of series version
2017-09	02	Designation of the terminals in chapter 2.4.7 corrected. New specification of the analog input inserted.
2017-09	03	Input terminals adapted for universal use. editorial changes.
2022-10	04	Function yellow LED EtherCAT changed; editorial changes due to conversion to editorial system.
2022-11	05	Encoder interface pin 19 changed
2023-04	06	Relay designation changed. Operation without temperature monitoring pn33 changed to pn12. Description X2A PIN 25 changed. Chapter certification removed. English version only! Translation of control terminal X2A PIN 28 and index corrected.

Glossary

Application

The application is the intended use of the KEB product.

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 Manufacturers 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).

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

Directive 2006/42/EC

Machinery Directive

Directive 2014/30/EU

Electromagnetic Compatibility (EMC) Directive

EN 60204-1

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

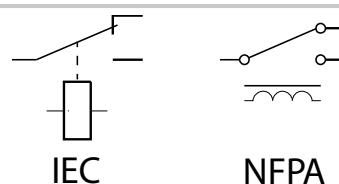
EN 61800-5-1

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

EnDat

Bidirectional encoder interface of the company Heidenhain

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

PELV

Safe protective extra-low voltage (earthed).

RS485

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

Safety over EtherCAT®

Safety over
EtherCAT®

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

SAR	SSI
Safe acceleration range; as SLA, but with upper and lower limit with the same sign.	Synchronous serial interface for encoder
SBC	SSM
Safe brake control	Safe speed monitor
SDI	SSR
Safe direction	Safe speed range; like SLS but with an upper and lower limit with the same sign.
SEL	STO
Safe Emergency Limit	Safe torque off
SELV	
Safe protective extra-low voltage (unearthed; <60V).	
SinCos	
Incremental encoder with sinusoidal signals.	
SLA	
Safely limited acceleration	
SLI	
Safely limited increment	
SLP	
Safely limited position	
SLS	
Safely limited speed	
SMS	
Safe maximum speed	
SOS	
Safe operating stop	
SS1	
Safe stop 1 emergency stop according to IEC 60204-1 Stop category 1	
SS2	
Safe stop 2; emergency stop according to IEC 60204-1 Stop category 2	

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