Instructions for use

COMBIVERT S6

Installation Control PRO

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 is safety information 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. The barcode is for smartphones, the following link is for online users or for typing.

(🌐► https://www.keb-automation.com/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
(≡► Refe [▷ 6])	Reference to a chapter, table or picture with page reference
ru21	Parameter name or parameter index
(🌐►)	Hyperlink
<Strg>	Control code
COMBIVERT	Glossary 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-automation.com/terms-conditions)

Further agreements or specifications require a written confirmation.

1.4 Support

Through multiple applications, not every possible 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 support provided verbally, written or through testing, is made to the best of our knowledge and information regarding intended use of KEB products. However, due to technical changes, any information provided is considered non-binding and is subject to change. This also applies to any violation of industrial property rights of a third-party.

Selection of KEB units in view of their suitability for the intended use must be done 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 and other documents accompanying the device or parts thereof for internal purposes. Copyrights are with KEB Automation KG and remain valid in its entirety.

Other word and/or figurative marks 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.

- The control card is only valid in conjunction with the instructions for use of the power part.
- The control card 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 suitable voltage sources!

Electric shock!

a) Only use voltage sources with protective separation (SELV/PELV) in accordance with VDE 0100 as per the stated specification.

b) Pay attention to a sufficient overvoltage category of the voltage supply.

c) With existing or newly-wired circuits the person installing the device or machine must ensure that the PELV requirements are met.

For a successful operation, please read 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 controllers 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 2006/42/EG and 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 parameterisation. 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 PRO

The control board PRO provides the following functions:

- Digital and analog inputs and outputs
- 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. Positions that are not listed are irrelevant 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**
P	PRO
6. digit	**Variants**
4	reserved
5	Safety module type 5
7. digit	**Housing**
8. digit	**Connection, voltage, options**
9. digit	**Control board variant**
2	PRO | Hiperface DSL® OCT, CAN®, Ethernet fieldbus interface, RS485 potential-free, standard relay (form C)
3	PRO | Multi-encoder interface, CAN®, RS485 potential-free, Ethernet TCP/IP (no EtherCAT), standard relay (form C)
4	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A
5	PRO | Multi-encoder interface, CAN®, Ethernet fieldbus interface, safe relay (form A)
E	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A, alternative terminal block
F	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A, alternative terminal block
10. digit	**reserved**
11. digit	**reserved**

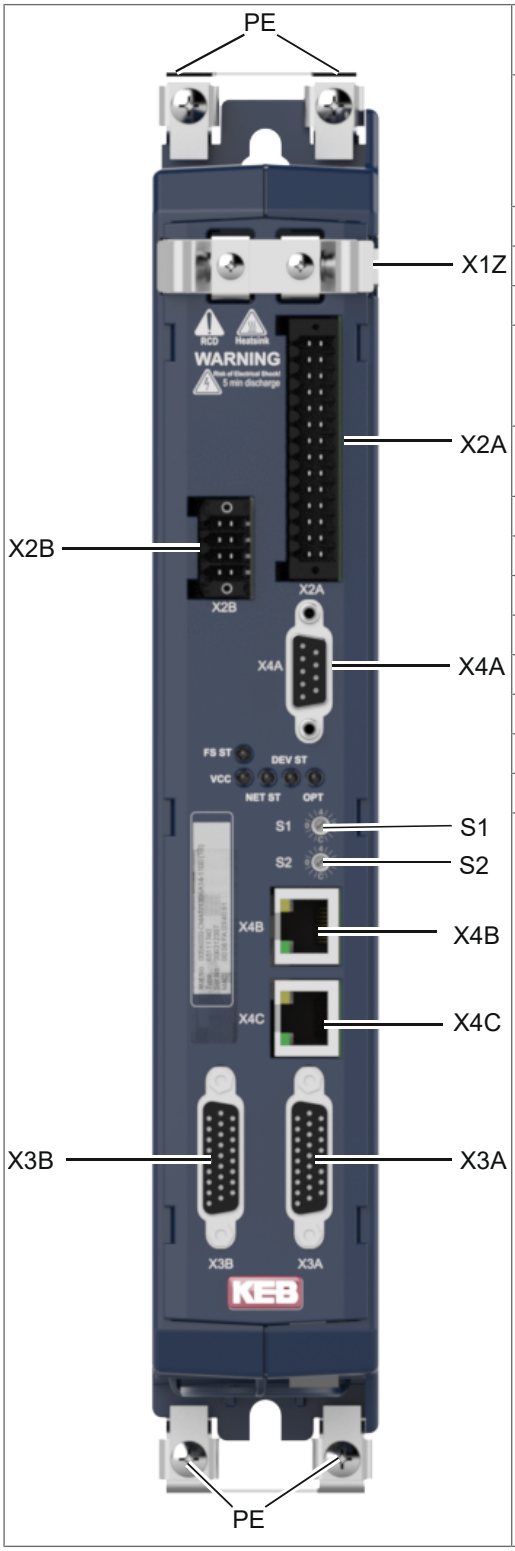
3.3 Accessories

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:

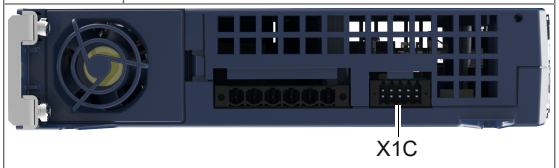
Housing/ phases/ control board	Set contains	Material number
02 / 1ph / PRO	terminal strip 28-pole terminal strip 10-pole terminal strip 8-pole connector 3-pole connector 6-pole shielding bracket 2 x shielding clamp	00S6ZC0-0011
02 / 3ph / PRO		00S6ZC0-0009
04 / 3ph / PRO		00S6ZC0-0010

Tab. 1: Connector sets

3.4 Connection and control elements



X1C	Temperature monitoring, brake control/monitoring
X2A	Control terminal block for digital inputs/outputs; 24V supply; relay output; analog inputs and outputs; CAN bus
X2B	Safety module
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 / RS485-Modbus potential-free
X4C	Fieldbus output / Port 1
S1	Rotary coding switch 1 (low byte)
S2	Rotary coding switch 2 (high byte)
FS ST	LED Safety state
VCC	LED voltage supply (24V)
NET ST	LED network / fieldbus state
DEV ST	LED inverter/ device state
OPT	Optional



Tab. 2: Overview Connection and operating elements

3.5 Motor monitoring X1C (temperature, brake)

The X1C terminal strip is a 10-pin, pluggable terminal strip with spring-loaded connection. It includes:

- 2 outputs for controlling 24V motor brakes
- 2 control inputs for brakes or relays
- 1 analogue input for temperature measurement (not for variant with Hiperface)
- Hiperface DSL OCT input (depending on variant)

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 is equipped with two universal encoder interfaces (depending on the variant). The interfaces can be adapted to different encoders independently of each other.

3.9 Diagnostic interface X4A

The integrated RS232/485 interface is used to connect service tools (e.g. USB or Bluetooth adapter). The interface also serves as a connection point for the F6 keyboard/ display operator. DIN 66019II is used as communication protocol.

3.10 Fieldbus interface X4B

The fieldbus interface X4B supports the following protocols depending on the variant:

- EtherCAT IN (Fieldbus)
- Ethernet (Fieldbus)
- RS485 potential-free

3.11 Fieldbus interface X4C

The fieldbus interface X4B supports the following protocols:

- EtherCAT OUT (field bus)
- Ethernet (fieldbus)

3.12 Rotary coding switch S1, S2

If the CAN protocol is active, the rotary coding switches S1 (low byte) and S2 (high byte) define the node ID. If both switches are set to "0" or a faulty node ID is set, the node ID from fb64 is active.

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
VCC ● NET ○ ST DEV ○ ST OPT ○	Initialization	Control is supplied with 24 V
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.
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 in boot process.
ON	Red	Error
ON	Yellow	No error, DC bus not charged.
ON	Green	No error, ready for operation.
Flashing	Green	No error, serves to identify the device (fb.32).

Tab. 6: Function DEV ST - LED

3.13.5 OPT - LED

OPT	LED colour	Description
-	-	reserved for options.

Tab. 7: Function OPT - LED

Tip

The DEV ST and OPT LEDs can be re-programmed for diagnostic purposes (i.e., the OPT LED could be programmed to represent the status of one of the digital inputs).

Refer to the Configuration Handling parameters in the programming manual.

4 Connection of the control board

Observe the following instructions to avoid malfunctions!

- Install control and power cable separately (approx. 10..20 cm (4"..8") distance).
- Cross high voltage conductors at a right angle.
- In case of inductive load on the relay outputs a protective wiring must be provided (e.g. free-wheeling diode).
- Electromagnetic interferences can be prevented by the following measures:
  - Always use twisted and shielded cables for analog control cables. Place the shield on one side of the source.
  - Twist digital control cables. For lengths longer than 3 m (10'), a shield may be required. In this case, place on both sides.
  - When the brake conductors or motor temperature sensor conductors are run together with the motor conductors, the brake and temperature conductors should be shielded. The shield of the brake and temperature sensor conductors should be connected to earth ground together with the motor conductor shield. The shields should be kept as long as possible to prevent cross coupling with the motor conductors.

The terminals of the control terminal blocks, encoder inputs and the communication interface are securely isolated in accordance with IEC 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.

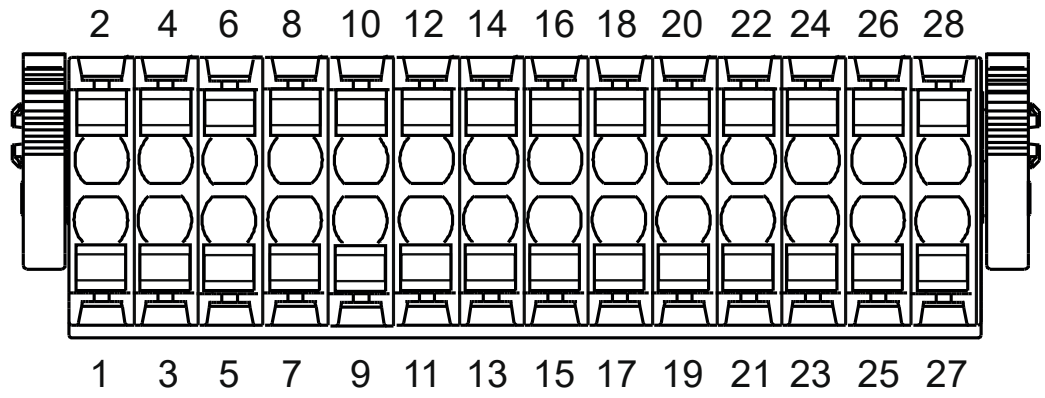
c) Make sure that all wires are inserted into the wire-end sleeve.

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…1 mm² (20…17 AWG)	With plastic collars	10 mm	12 mm
0.5…1.5 mm² (20…16 AWG)	Without plastic collars	10 mm	10 mm
0.2…1.5 mm² (24…16 AWG) Solid or fine strand	Without wire end ferrule	-	10 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 (fast input => see programming manual)
8	DI8	Digital input 8 (fast input => see programming manual)
9	0V	Reference potential for digital inputs
10	DO1	Digital output 1
11	0V	Reference potential for digital outputs
12	DO2	Digital output 2
13	RLB	reserved
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 controlling the inputs (SELV).
17	AN1-	Non-isolated differential input 1
18	AN1+	Non-isolated differential input 1
19	AN2-	Non-isolated differential input 2
20	AN2+	Non-isolated differential 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 controlling the inputs (SELV).
27	0V	Reference potential for P24Vin at external supply
28	P24Vin	Voltage input DC 24 V supplying the control board and the brake output

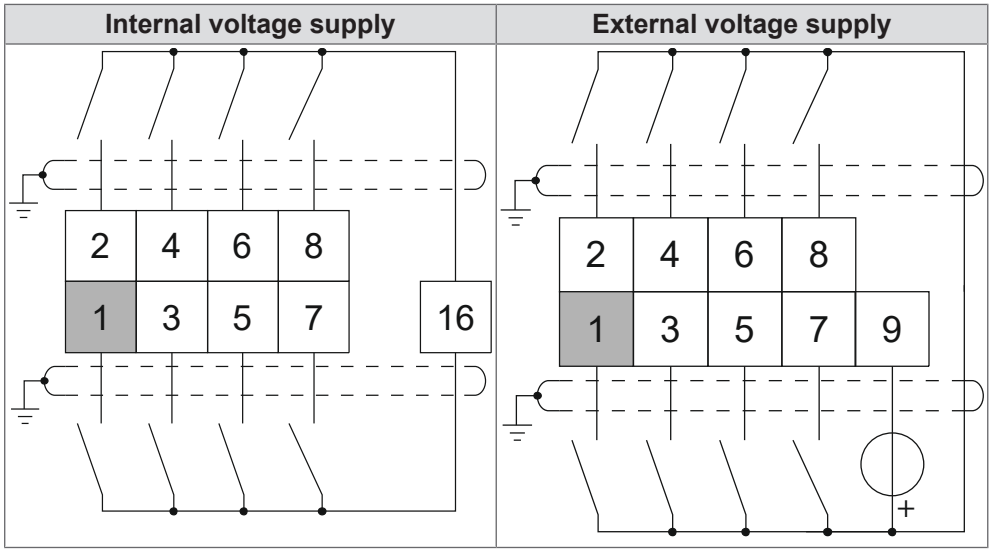
Tab. 9: Assignment of the terminal strip X2A

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
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

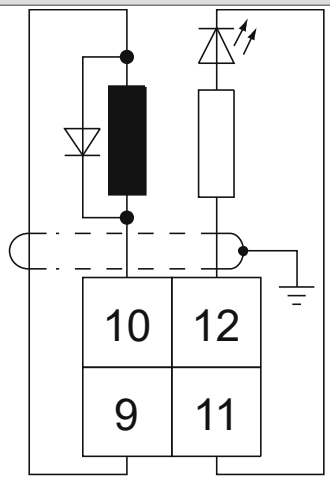
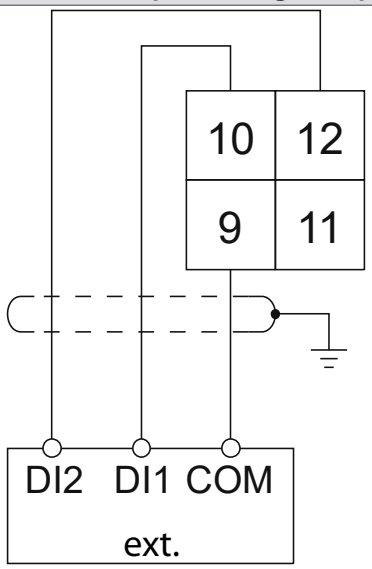


4.2.2 Digital outputs

Specification

Number	4 (2 at terminal strip X2A and 2 at terminal strip X2B)
Name	DO1 … DO4
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	No internal free-wheeling diode. External free-wheeling diode required for inductive load.

Connection

Connection external loads	Connection outputs to digital inputs
	

4.2.3 Relay output

4.2.3.1 Relay output form A

Specification Safe relay Form A with forcibly guided contacts

Number	1
Name	R1
Terminals	X2A.14; X2A.15
Type	Form A
Switching voltage (rated)	DC 24 V
Current	0.01…1 A
Switching frequency	0.1 Hz
Switching cycles	10,000,000 mechanical 500,000 at 30 V / 1 A
Delay time	Switch on (close) maximum 50 ms Switch off (open) maximum 50 ms
Special features	No internal free-wheeling diode. External free-wheeling diode required for inductive load. Control only via safety module.

⚠ WARNING

No internal fusing of the relay contacts!

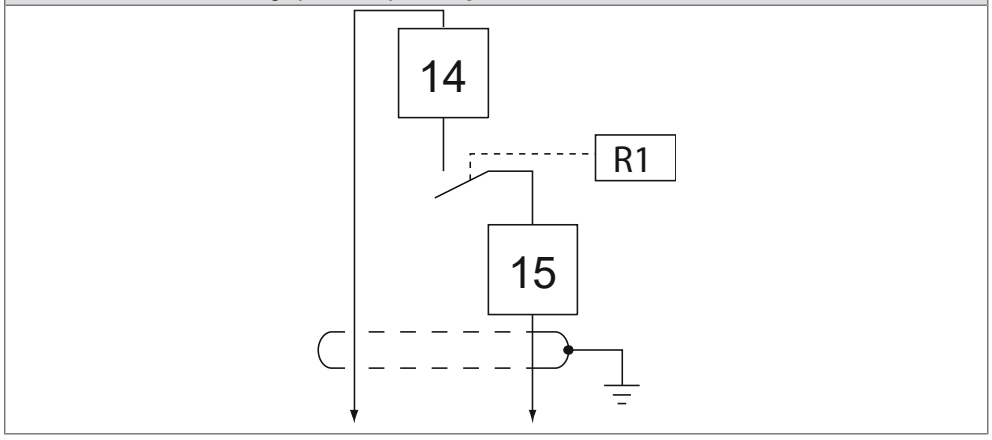
Welding of the relay contacts due to inadmissible overload!

a) Limit the current by the normally open contact to 2 A (e.g. by using a fuse type 2A gG).

b) Observe further instructions in the safety manual.

Connection safe relay (form A) with positive-driven contacts

Connection safe relay (form A) with positive-driven contacts



4.2.4 Analog input

4.2.4.1 Differential input

NOTICE

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

Malfunctions or defects due to voltage differences.

a) If the analog value is outside the common mode range, a potential equalisation cable is required between the analog source and the analog input. Connect the potential equalisation cable to 0V of the control terminal block.

⚠ WARNING

Common-related operation of an analog differential input!

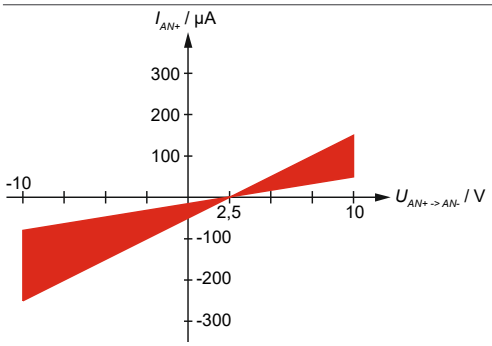
25 % setpoint with open conducter.

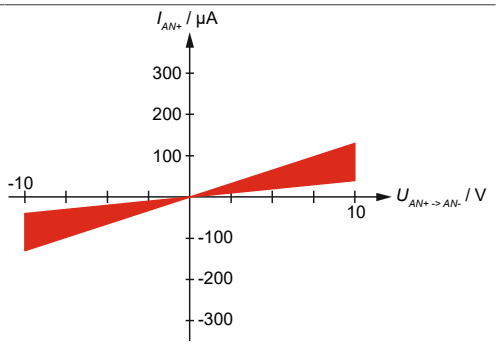
a) If pin AN- is connected to common, a voltage of 2.5 V appears from AN+ to AN- with open conductor (also in the event of a cable break). This corresponds to a setpoint of 25 % in the factory setting.

b) Depending on the control board (see programming manual), cable break detection is only possible in 4...20 mA mode.

The following characteristics show the internal resistance depending on the wiring.

Common-related voltage measurement (AN- to common)	Differential voltage measurement





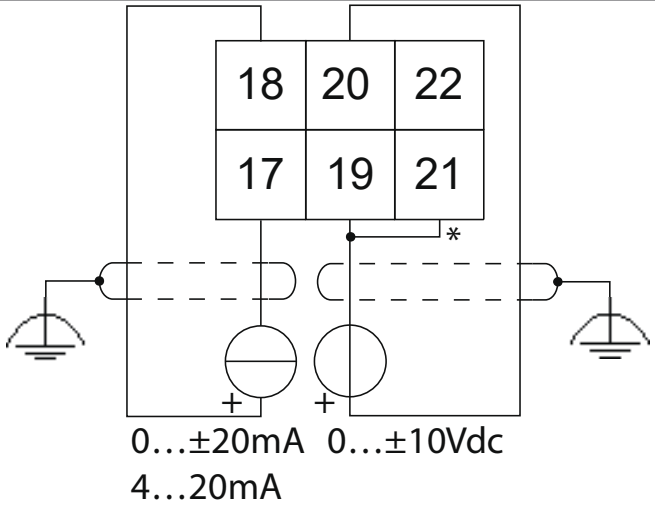
Specification (differential inputs)

Number	2
Name	AN1, AN2

Terminals	X2A.17 (AN1-) X2A.18 (AN1+) X2A.19 (AN2-) 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
Resolution	12 bit
Input impedance current input	235 Ω…240 Ω
Common mode range	-12.5 V…17.5 V

Connection

Connection of the analog differential inputs AN1 and AN2



*) Equipotential bonding conductor

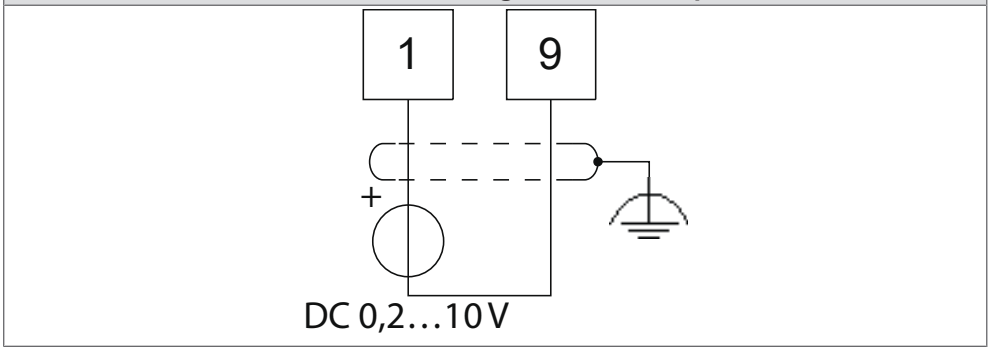
4.2.4.2 Absolute input

Specification (absolute input)

Number	1
Name	AN3
Terminals	X2A.1 (standard: digital input DI1); 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

Connection of the analogue absolute input AN3



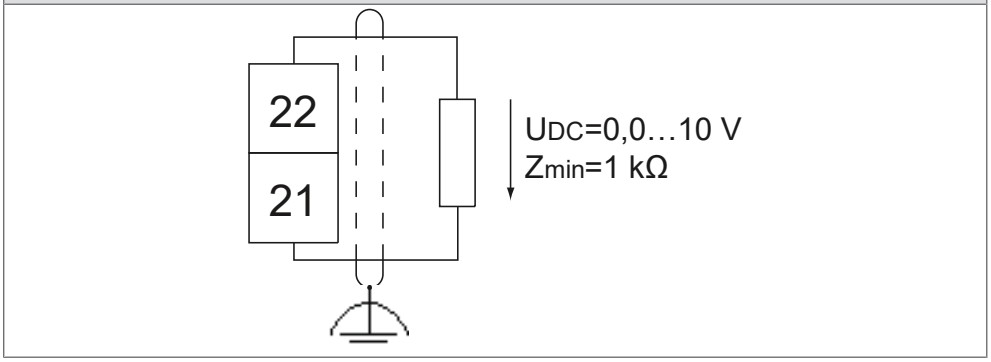
4.2.5 Analog output

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)
Resolution	11 bit
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 analogue output ANOUT



4.2.6 Voltage supply

4.2.6.1 Voltage input

The control board can be supplied:

- externally by a central 24 V supply.

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

4.2.6.1.1 Calculation 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

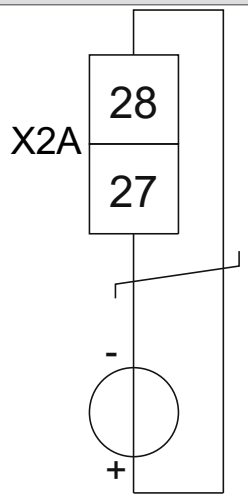
In order to calculate the input current, the currents of the power unit, control and other loads must be added together. The actual current required can be used for the consumers. The maximum current must not be exceeded.

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

Connection of the external supply



The control card is supplied by an external 24 V voltage. An internal supply via a voltage generated in the power section is not provided.

When using the Power-Off function, the external 24V supply must be maintained until the function has been completed. Further information in the programming manual under "Power-Off function".

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 [▸ 18])

5 Safety module X2B

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

6. digit	Variants
4	reserved
5	Safety module type 5

5.1 Safety manual type 5

The safety module type 5 includes the following functions:

STO, SBC, SS1-r, SS1-t, SLS, SSM, SMS, SLA, SDLC and Safety over EtherCAT®

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

Safety manual type 5

(🌐► https://www.keb-automation.com/0004)

Document: ma_dr_safety-typ5-20191137_en

6 Diagnosis/visualisation X4A

The integrated serial interface provides the following functions:

- Parameterization of the device with the KEB software COMBIVIS.
- Connection for operator keyboard/display.
- Connection for Bluetooth adapter.
- 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
Bluetooth adapter	0058060-0060

Tab. 12: Accessories

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

Tab. 13: Connecting cable

NOTICE

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

Malfunction or defect can be caused by voltage differences.

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

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

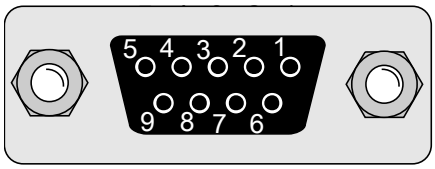


Fig. 1: Pin assignment socket D-Sub-9 (top view)

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

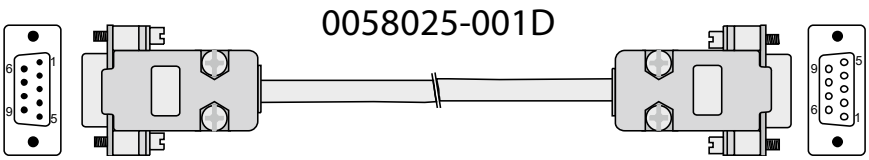


Fig. 2: Serial cable for the connection to a PC

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 internally 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:

	Technical information - RS485 connection: (► https://www.keb-automation.com/000C) Document: ti_dr_tn-rs485-connection-0002_en	

6.5 Remote control

The F6 operator with display/keypad can be operated up to 30 m away from the unit.

Recommended connection:

- Commercially available network cable 1:1 with RJ45 plugs (min. CAT5)
- Install to both ends an RJ45 socket on D-SUB DE-9 (1x female; 1x male)
- **Important!** The shielding from X4A to the operator must be connected via the CAT5 cable.

Signal	D-SUB DE-9 pin	RJ45 pin
RxD-A	4	1
RxD-B	5	2
TxD-A	8	4
TxD-B	9	5
reserved	6	3
DGND	7	6
Shielding	Housing	Housing

Tab. 14: Wiring of the DE-9 - RJ45 adapters

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
2	PRO | Hiperface DSL® OCT, CAN®, Ethernet fieldbus interface, RS485 potential-free, standard relay (form C)
3	PRO | Multi-encoder interface, CAN®, RS485 potential-free, Ethernet TCP/IP (no EtherCAT), standard relay (form C)
4	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A
5	PRO | Multi-encoder interface, CAN®, Ethernet fieldbus interface, safe relay (form A)
E	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A, alternative terminal block
F	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A, alternative terminal block

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

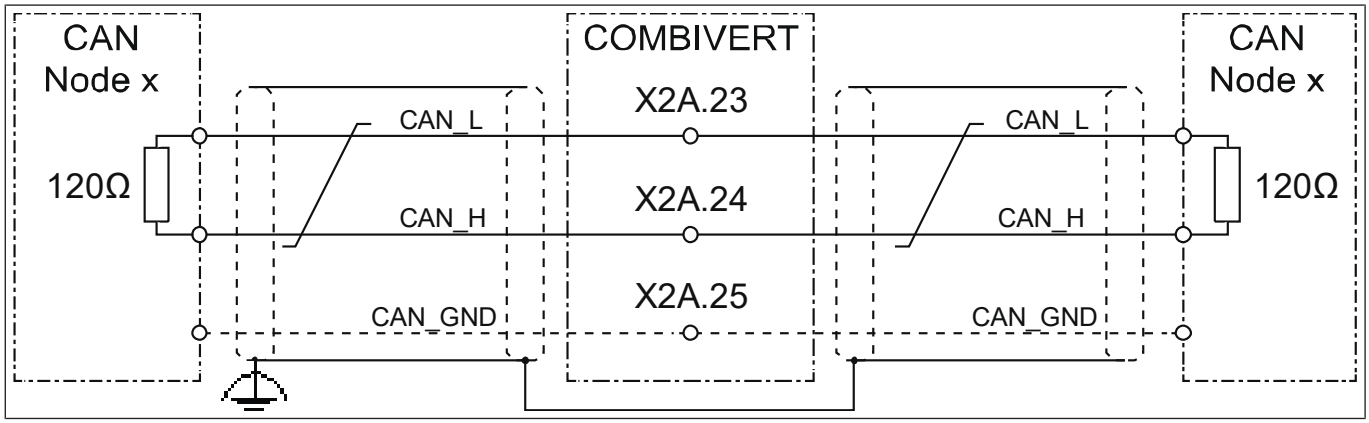


Fig. 3: Connection CAN bus

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 state PRE-OP-ERATIONAL
Stop	g-0-0-0-0-0 (grid 200 ms)	Device in state STOPPED
Op	g (continuously	Device in state OPERA-TIONAL no error
Bus off	r (continuously)	CAN bus off.
Invalid Configuration	r-0 (grid 200 ms)	General configuration er-ror.
Warning limit reached	r-0-0-0-0-0 (grid 200 ms)	The error counter has reached or exceeded a warning level.
Legend	r: Red g: Green 0: off	The signals from red/ green are shifted by 180°. Red has priority for super-imposition.

7.3 EtherCAT

EtherCAT® and Safety over EtherCAT® are registered trademarks and patented technologies, licensed by 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
Rotary coding switch S1, S2	No function with EtherCAT
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
Minimum FSoE watchdog time	35 ms (safety module type 5)

Connection

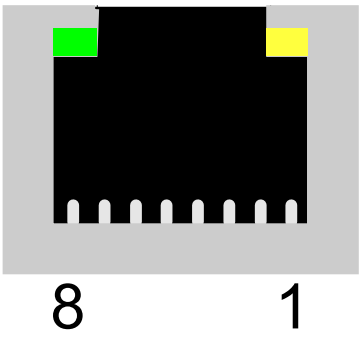


Fig. 4: RJ45 socket front view

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. 15: 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. 16: 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.

Status	Light pattern	Description
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. 17: Error status list

7.3.1 Synchronous communication mode

The COMBIVERT with control board PRO supports a so-called synchronous communication mode. This is titled differently for the different fieldbuses. In EtherCAT, this functionality is managed under the term Distributed Clocks (DC).

Ultimately, the synchronous operating mode means that the internal interrupt grid of the drive controller is synchronised to the synchronous signal generated by the fieldbus.

The COMBIVERT with control board PRO does not support any values for the synchronous cycle time. Which dependencies exist here and which parameters have an influence can be found in the chapters "Switching frequency and derating" in the programming manual.

7.4 RS485 potential-free with bus termination

7.4.1 Specification

Specification

Interface	RS485 potential-free with bus termination 4W
Transmission speed	9.6, 19.2, 38.4, 55.5, 57.6, 100, 115.2, 125, 250, 500 kBit/s
Bus nodes	2
Common-mode voltage range	0...12 V to the 'bus reference potential' BUS-COM
Potential separation	Potential-free to reference potential 0V/ COM (functional isolation)
Bus termination	120 Ω each (pin 1 and 2; 4 and 5); integrated (cannot be switched off)
Connection cable (minimum requirement)	S/UTP (twisted in pairs)

7.4.2 Connection

Connection X4B

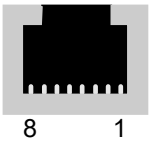


Fig. 5: RJ45 socket front view

PIN	Modbus name	EIA/TIA-485 name	Function
1	RxD0	(RxD-A) / A'	Receive signal inverted
2	RxD1	(RxD-B) / B'	Receive signal
3	n.c.	n.c.	reserved
4	TxD1	(TxD-B) / B	Transmission signal
5	TxD0	(TxD-A) / A	Transmission signal inverted
6	n.c.	n.c.	reserved
7	n.c.	n.c.	reserved
8	Common	(BUS-COM) / C/C'	Reference potential (does not have to be connected)
Housing	Shielding	Shielding	Functional earth (FE)

Tab. 18: PIN assignment RS485 potential-free to RJ45 plug

Schematic diagram 4W

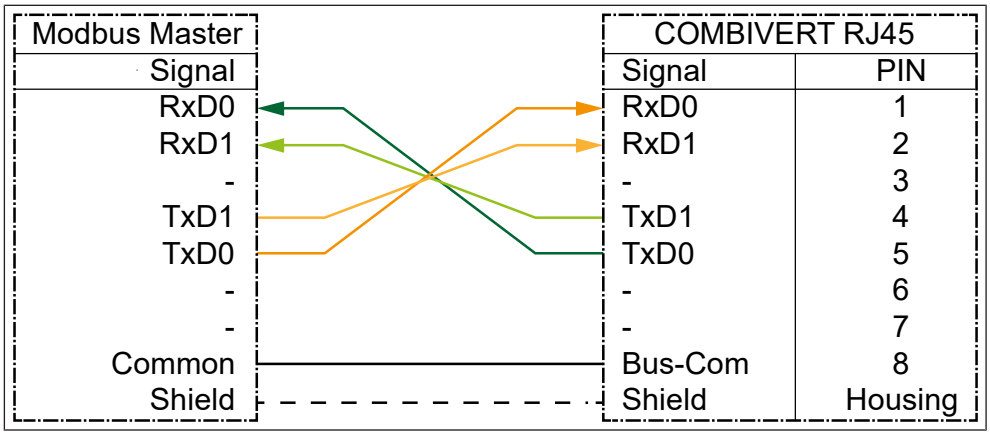


Fig. 6: Schematic diagram 4-Wire connection

7.4.3 Wiring example

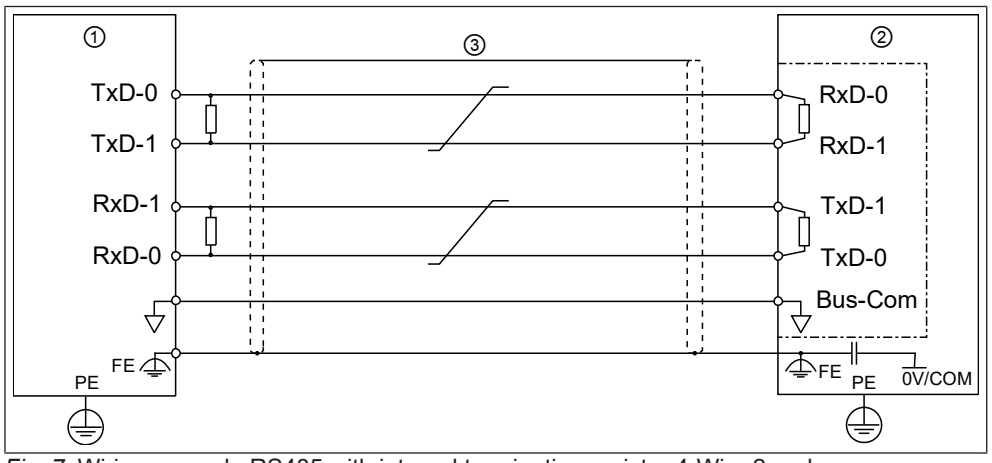


Fig. 7: Wiring example RS485 with internal terminating resistor 4-Wire 2 nodes

① Modbus master	② COMBIVERT as Modbus slave with internal bus termination
③ Connecting cable 4-Wire (twisted/ shielded)	

7.5 RS485 potential-free without bus termination

The interface RS485 potential-free without bus termination has no integrated bus termination resistors. This means that topologies with more than two participants can be realised. Optionally, external 2W or 4W wiring can be selected.

The interface RS485 potential-free without bus termination is a special variant. It cannot be retrofitted and must be taken into account when ordering. It can be recognised by the following marking on the fieldbus interface (F6) or on the nameplate (S6):

Fig. 8: No internal termination

7.5.1 Specification

Specification

Interface	RS485 without bus termination 2W/4W
Transmission speed	9.6, 19.2, 38.4, 55.5, 57.6, 100, 115.2, 125, 250, 500 kBit/s
Bus nodes	32 (up to 256 at min. 96 kΩ input resistance)
Common-mode voltage range	0...12 V to "bus reference potential" BUS-COM
Potential separation	Potential-free to reference potential 0V/ COM (functional isolation)
Bus termination	No integrated bus termination.
Stub cable length	1.5 m
Connection cable (minimum requirement)	S/UTP (twisted in pairs)

Stub cable

On (≡► Stub cables [▷ 35]) must not use terminating resistors. Therefore, only COMBIVERT with RS485 potential-free interface without bus termination 2W/4W may be used. If stub cables cannot be avoided, they must be kept as short as possible.

7.5.2 Connection

Connection X4B

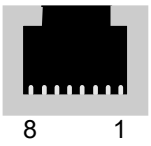


Fig. 9: RJ45 socket front view

PIN	Modbus name	EIA/TIA-485 name	Function
1	RxD0	(RxD-A) / A‘	Receive signal inverted
2	RxD1	(RxD-B) / B‘	Receive signal
3	n.c.	n.c.	reserved
4	TxD1	(TxD-B) / B	Transmission signal
5	TxD0	(TxD-A) / A	Transmission signal inverted
6	n.c.	n.c.	reserved
7	n.c.	n.c.	reserved
8	Common	(BUS-COM) / C/C‘	Reference potential (does not have to be connected)
Housing	Shielding	Shielding	Functional earth (FE)

Tab. 19: PIN assignment RS485 potential-free without bus termination to RJ45 plug

Schematic diagram 4W

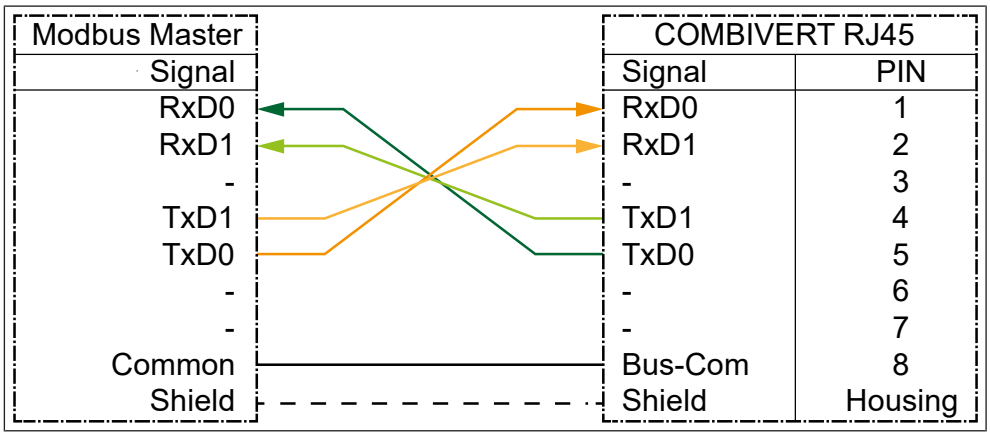


Fig. 10: Schematic diagram 4-Wire connection

Schematic diagram 2W

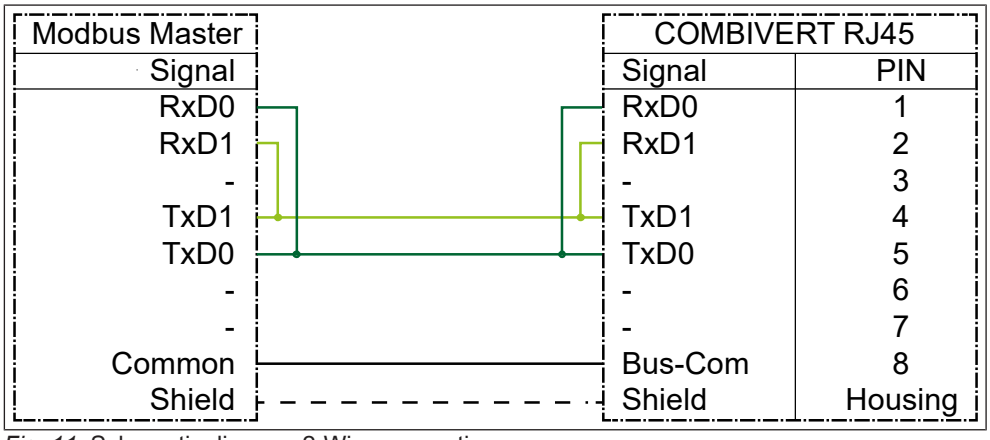


Fig. 11: Schematic diagram 2-Wire connection

7.5.3 Wiring example

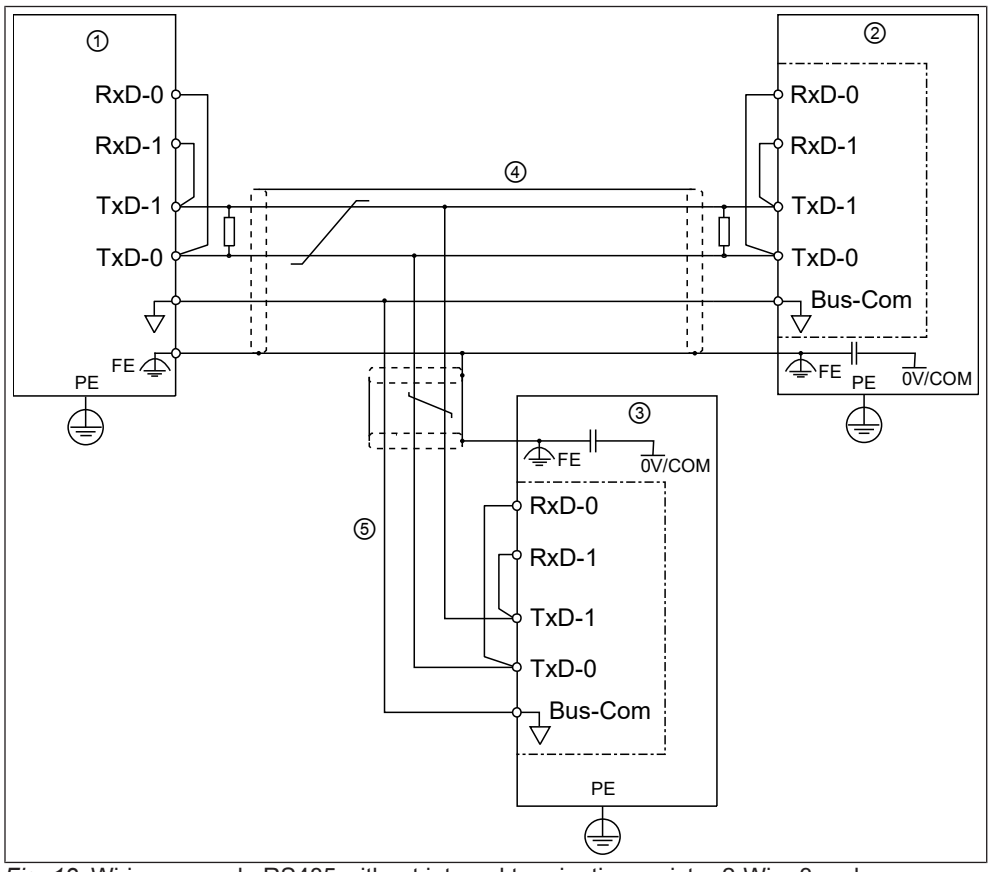


Fig. 12: Wiring example RS485 without internal terminating resistor 2-Wire 3 nodes

① Modbus master	② COMBIVERT as Modbus slave without bus termination
③ COMBIVERT as Modbus slave without bus termination	④ Connecting cable 2-Wire (twisted/ shielded)
⑤ Stub cable 2-Wire	

8 Encoder interfaces

8.1 Type code encoder interface

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
2	PRO | Hiperface DSL® OCT, CAN®, Ethernet fieldbus interface, RS485 potential-free, standard relay (form C)
3	PRO | Multi-encoder interface, CAN®, RS485 potential-free, Ethernet TCP/IP (no EtherCAT), standard relay (form C)
4	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A
5	PRO | Multi-encoder interface, CAN®, Ethernet fieldbus interface, safe relay (form A)
E	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A, alternative terminal block
F	PRO | No encoder interface, CAN®, Ethernet fieldbus interface, safe relay form A, alternative terminal block

8.2 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 1 Vpp incremental signals)
- BiSS (digital)
- Hiperface
- SinCos with/without zero signal; with/without absolute position (SSI or analogue 1 Vpp)

Channel B supports the 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

Connection of analog and digital EnDat encoders!

a) Analog EnDat encoders can only be operated on channel A.

b) Digital EnDat encoders can be operated on channel A and/or channel B.

c) Mixed operation of analog and digital EnDat encoders is not possible.

NOTICE

Undefined states by plugging of encoder cables during operation!

Malfunctions can be caused by incorrect speed or position values.

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

8.2.1 Input signals

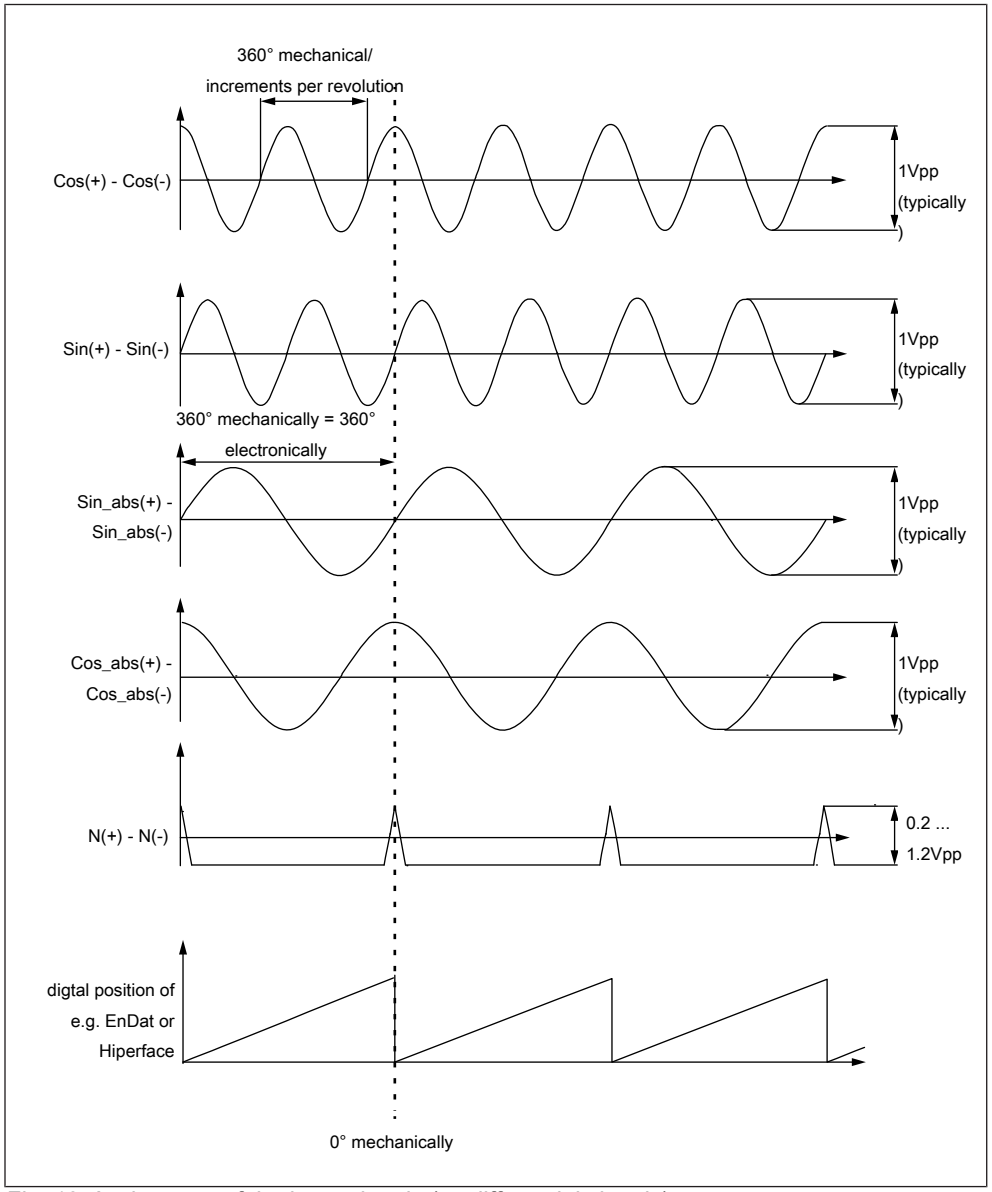


Fig. 13: Assignment of the input signals (as differential signals)

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

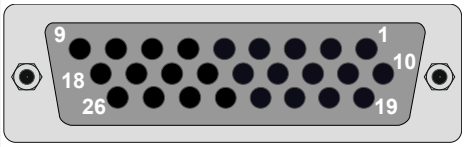
b) The identification "C" and "D" for the absolute signals must be checked. Frequently signal C corresponds to -> SIN_abs and D to -> (inverted) COS_abs.Thus D+ is at COS_abs- and D- is at COS_abs+.

Alternative designation of encoder signals (≡► Info)

Encoder signal	KEB signal input	Encoder signal	KEB signal input
A+	COS+	B+	SIN+
A-	COS-	B-	SIN-
R+	N+	R-	N-
C+	SIN_abs+	D+	COS_abs-
C-	SIN_abs-	D-	COS_abs+

Tab. 20: Alternative designation of encoder signals

8.2.2 Encoder sockets X3A/X3B

X3A / X3B: connector socket			(front view socket)			D-Sub DB-26 (HD), triple row		
Counterpart: connector						D-Sub DB-26 (HD), triple row, with fixing screws UNC 4.40		
Encoder	Incremental encoder RS485 and 1Vpp (only channel 1)	Incremental encoder HTL	Resolver	Hiperface	SinCos (absolute)	SSI, EnDat (digital 2.1/2.2), BiSS (digital)	Sin/Cos-SSI, EnDat (1Vpp + digital 2.1/2.2), BiSS (digital)	Incremental encoder emulation RS485
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 (available as soon as a sensor 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	0V/COM and internal shields							
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. 21: Assignment of encoder sockets X3A and X3B

Notes for PIN 25/26

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

- parameter ec14 bit 1 = "manual" and ec14 bit 0 = "8V" is set.
- parameter ec14 bit 1 = "automatic" and ec16 = "Hiperface" or "Resolver" is set.

All other voltages at these contacts are not defined and must not be used to supply encoders!

8.2.3 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:

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

Fig. 14: 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.

8.2.4 Encoder cable

Pre-assembled encoder cables:

- offer the best protection against interference.
- save installation time.
- are available in cable lengths of 5 m, 10 m, 15 m, 20 m, 25 m and 30 m.

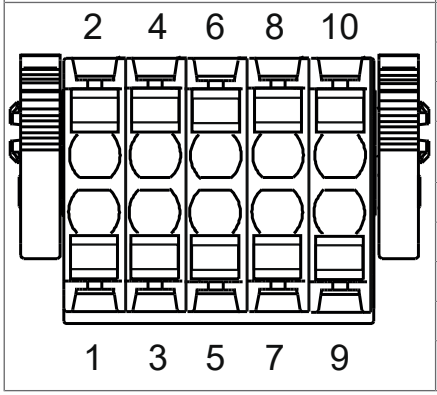
8.2.5 Description of the encoder interfaces

PIN	Signals	Description
1, 2, 3, 4	A+/- B+/- Cos+/- Sin+/-	**Channel A only:** Input for two sine-wave differential signals shifted by 90° with Upp=1V, maximum 200kHz. Ground-referenced (e.g. Cos+ against GND): DC component 2.5 V ±0.5 V Differential (e.g. Cos+ versus Cos-): DC 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 200kHz. **Channel B:** Input for square-wave incremental signals according to RS485, maximum 500kHz. Incremental encoder simulation: Position changes of channel A are output to channel B with two 90° shiftet RS485 signals. Maximum output frequency 500 kHz.
5, 6	N+/- Data+/-	**Channel A only:** Zero signal input once per revolution. Differential signal level (N+ … N-): • higher than 50 mV: Zero signal is active • from 50 mV to -50 mV: undefined • Lower than -50 mV: zero signal is inactive Signal length 330°…360° of the signal length of the incremental signals. **Channels A and B:** . Zero signal is 1-active, if signals A and B are also 1-active. **Channel B only:** 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°.

PIN	Signals	Description
10, 11, 12, 13	Sin+/- Cos+/- Sin_abs+/- Cos_abs+/-	**Channel A only:** Input for sinusoidal absolute signals Upp=1V for SinCos encoders Upp=3.8V maximum for resolvers
10, 12	Clock+/-	Output for RS485 clock signal
14, 15	Exiter+/-	**Channel A only:** Output of the variable excitation voltage for resolvers (default): Ueff=2.54 V ≙ Upp=7.2 V ±5% for a coupling factor of the resolver of 0.5 ±10%. Output frequency: 10 kHz Maximum output current: ieff = 30 mA Phase shift: 0° ± 5° **Only control board APPLICATION and PRO:** Further setting options for the excitation voltage can be found in the corresponding programming manual (from software version V3.3).
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 => automatic, depending on the set encoder type (ec16) Max. 500 mA in 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=24V max. 500mA total (250mA per channel) • Minimum P24V_IN - 3V • Maximum P24V_IN
19, 20, 21, 22, 23, 24	A_HTL+/- B_HTL+/- N_HTL+/-	**Channel B only:** HTL signal input 10 V…30 V maximum 150 kHz

Tab. 22: Encoder specifications

9 Brake control and temperature detection

X1C	PIN	Name	Notes
	1	BR+	Brake control / output
	2	BR-	Brake control / output
	3	0V	For supplying the feedback inputs P24Vin - 0.5V / max. 1A (BR+ and 24Vout in total 2A)
	4	24Vout	
	5	BCF1	Feedback input for brake control
	6	BCF2	Feedback input for brake control
	7/8	reserved	
	9	TA1	Temperature measurement / input+ [1)]
	10	TA2	Temperature measurement / input- [1)]

Tab. 23: Assignment of the terminal block X1C

1) Note special assignment for Hiperface DSL® OCT variant.

9.1 Brake control

⚠ CAUTION

Incorrect dimensioning of the brake may cause malfunctions

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 an auxiliary relay or contactor if necessary.

Specification brake /relay output

Name	BR+ (X1C.1); BR- (X1C.2)
Function	Output to control one/two brake(s) or relay(s).
Output voltage (DC)	minimum P24Vin – 1.2V maximum P24Vin
Maximum output current	One brake: 2 A two brakes: 2 x 1 A
Others	Internal free-wheeling path; internal filter circuit; not short-circuit proof

Features

- Safely control one brake/relay
- Control two single brakes/relays together (it must be the same brake/relay twice).
- Internal brake feedback without additional wiring or external via two brake control feedback inputs.
- ECO Mode by pulse width modulated control.
- Rapid demagnetization with a counter voltage of 27.5 V (maximum every 5 s).
- Current monitoring

The control, parameterization and reading of the feedback inputs of the brake is carried out via the integrated safety module. Corresponding wiring and parameterization suggestions are described in the safety manual type 5.

Connection

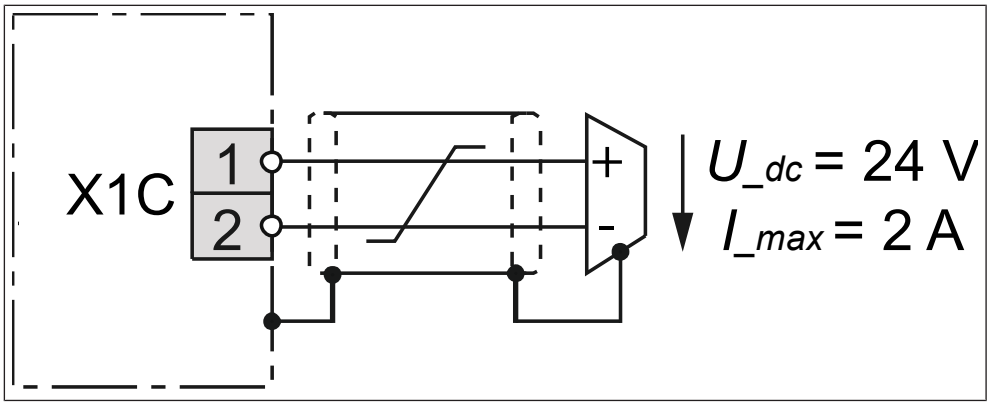


Fig. 15: Connection of a brake

9.2 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 incorrect placement!

Malfunctions of the control due to capacitive or inductive coupling.

a) Motor temperature sensor conductors must not be routed together with other low voltage control cables; even when shielded.

b) Motor temperature sensor conductors must be double shielded when inclosed in the same overall cable containing the U,V,W motor conductors.

Specification temperature input

Name	TA1; TA2
Terminals	X1C.9 (TA1) input + X1C.10 (TA2) input -
Function	Temperature sensor input (switchable)
Others	Terminals TA1 and TA2 have basic insulation to the SELV voltage (DC 24 V) 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

Operating mode (dr33)		Resistance	Temperature/state
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.9) and TA2 (X1C.10) (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.

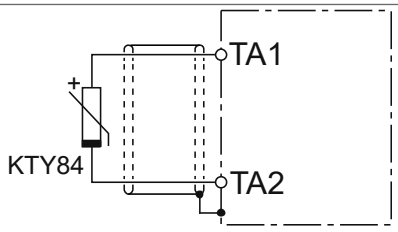
b) KTY sensors may not be combined with other sensors.

Settings KTY input

Setting

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

Connection KTY sensor



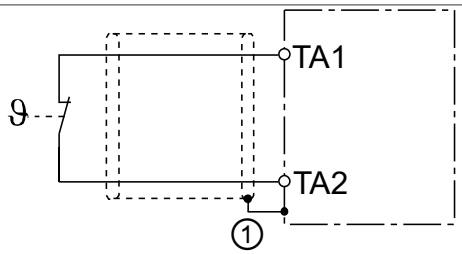
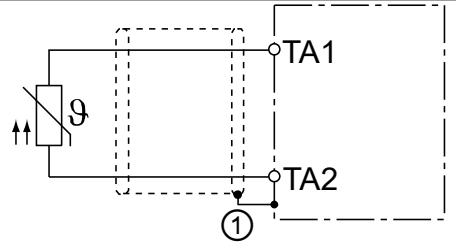
9.2.3 Connection of PTC, temperature switch or PT1000

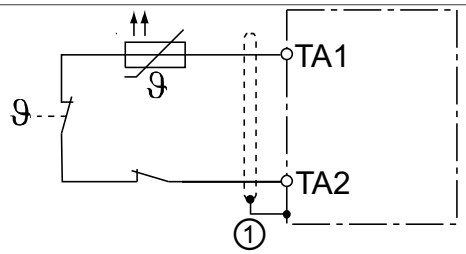
Settings of PTC, temperature switch or PT1000

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. 24: Connection examples

10 Certification

Current certificates, declarations and revision lists for your product can be viewed or downloaded from our website at the following link:

(🌐► keb-automation.com/search)

By entering the article number, you will receive a list of the corresponding documents in the "Certificates" drop-down menu.

If you need help or further documentation, please contact our customer service.

10.1 CE marking

Conformity with the EU directives and guidelines applicable on the production date is confirmed by the CE mark on the nameplate.

The current EU Declaration of Conformity for this product is available via the link above.

10.2 UL certification

UL (Underwriters Laboratories) approval ensures that a product fulfils the safety-related requirements for the North American market. UL is an independent organisation that tests and certifies products, components and systems for safety, quality and conformity with applicable standards.

Products that have received UL approval are marked with the UL logo on the nameplate. This symbol indicates that the product has been successfully tested in accordance with UL specifications and is approved for use in the USA or Canada. Depending on the type of approval, the logo with the UL file can also be marked with additional information (e.g. "cULus" for Canada and the USA).

The approval is linked to certain requirements. These are marked accordingly in this and/or further instructions. Only the assemblies/components described in the approval may be used.

A deviation from the tested specifications or the use of non-certified parts can lead to the loss of UL approval and thus jeopardise the operating permit in the target market.

10.3 Further markings

Other markings and approvals not listed here are identified by a corresponding logo on the rating plate or device, if applicable. The corresponding certificates are available on our website.

11 Revision history

Edition	Version	Note
2018-12	00	Pre-series version.
2019-07	01	Series version
2022-10	02	Function yellow LED EtherCAT changed; editorial changes due to conversion to editorial system.
2022-11	03	Encoder interface pin 19 changed
2023-12	04	Type code Digit 9 extended. Relay classified in Form A. RS485 potential-free assignment and description changed. Description X2A PIN 25 changed. Alternative designation for encoder signals inserted. English version only! Translation of control terminal X2A PIN 28 corrected. Values for (≡► Assembly of wires [▷ 16]) adapted. Light pattern (≡► CAN [▷ 29]) corrected. Editorial changes.
2024-07	05	Fieldbus interface (≡► RS485 without bus termination [▷ 33]) inserted. RS485 assignment changed. Designation GND in 0V/COM at (≡► encoder interfaces [▷ 38]) changed. Note for common-related operation of the analog differential inputs inserted. Warning notice inserted for protection for relay output form C. Internal supply for brake control removed.
2025-11	06	Hiperface DSL® OCT inserted. Variable excitation voltage for resolver inserted. Editorial changes.

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Glossary

2W

2-Wire; is used in the field of network technology for serial full duplex operation.

4W

4-Wire; is used in the field of network technology for serial full duplex operation.

Application

The application is the intended use of the KEB product.

Autonegotiation

Procedure for determining the max. transmission speed.

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).

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

DSL®

DSL® stands for Digital Servo Link. It is a digital, serial interface protocol between drive controllers and motor encoders.

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)

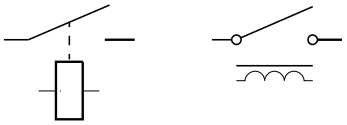
EnDat

Bidirectional encoder interface of the company Heidenhain.

EtherCAT®

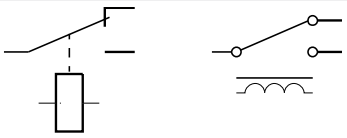
EtherCAT is a real-time Ethernet bus system. EtherCAT is a registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.

Form A



Form A describes a relay with two contacts (switching contact and NO contact). Also referred to as SPST NO (single pole, single throw; normally open).

Form C



Form C describes a relay with three contacts (switching contact, NC contact and NO contact). Also named as SPDT (single pole, double throw).

Functional earth

Functional earth is used exclusively to dissipate interferences. It offers no contact protection for persons.

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 61800-5-1

Electric power drive systems with adjustable speed. Part 5-1: Safety requirements - Electrical, thermal and energy requirements. German version EN 61800-5-1.

OCT

OCT stands for One Cable Technology. This means that the motor supply and encoder signals are transmitted via a common cable.

PELV

Safe protective extra-low voltage (earthed).

Power-off function

The power-off function (short: Power-Off) is used for a targeted reaction in the event of a mains voltage failure (e.g. stopping the drive). The energy stored in the drivetrain is utilised for this purpose.

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

SBC

Safe Brake Control.

SDLC

Safe Door Lock Control

SELV

Safe extra-low voltage (unearthed).

SinCos

Incremental encoder with sinusoidal signals.

SLA

Safely limited acceleration

SLS

Safely limited speed

SMS

Safe maximum speed

SS1-r

Safe Stop 1 ramp monitored (with deceleration ramp monitoring; STO (Safe torque off) is assumed after reaching the idle position.

SS1-t

Safe Stop 1 time controlledSTO (Safe torque off) is assumed after the deceleration time has elapsed.

SSI

Synchronous serial interface for encoder.

SSM

Safe speed monitor

STO

Safe torque off (STO).

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Notes

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