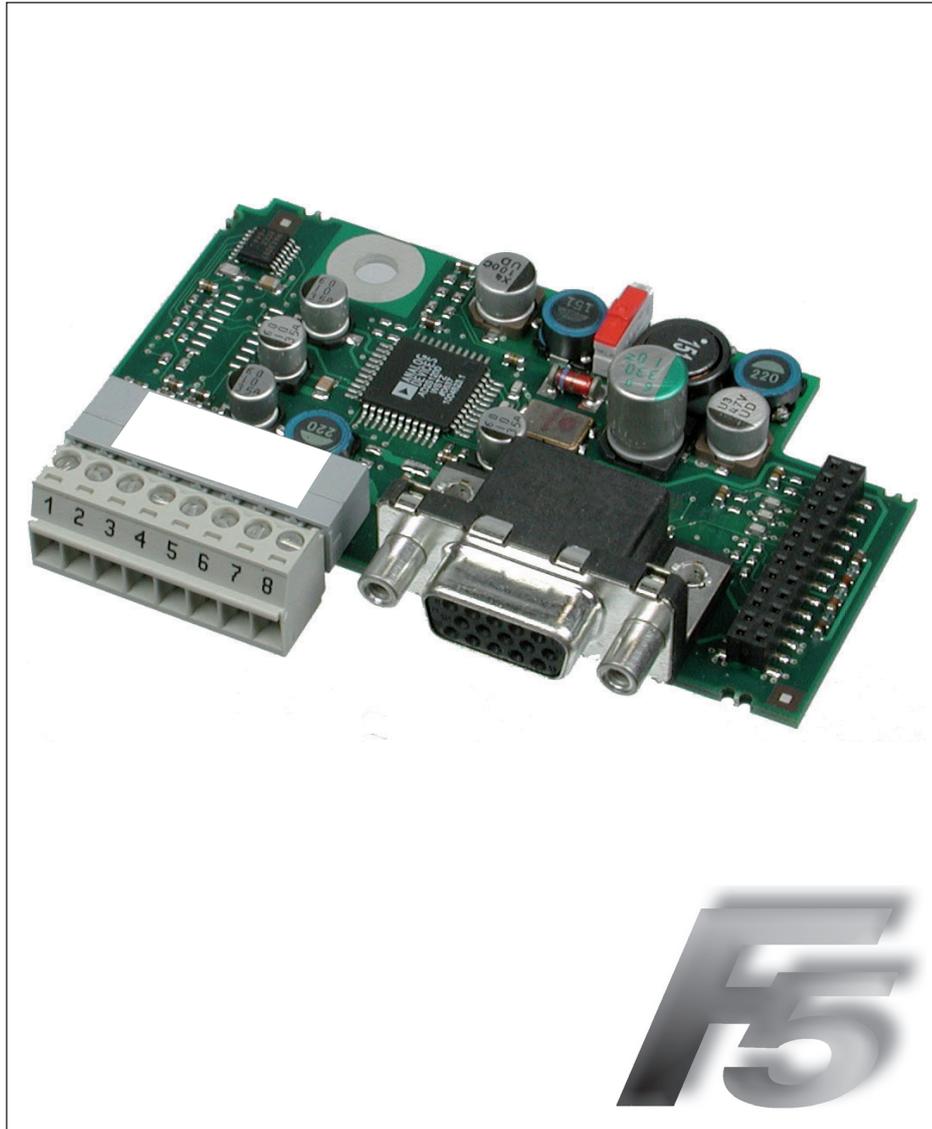


# COMBIVERT



**GB** INSTRUCTION MANUAL

Encoder Interface

Channel 1

Resolver

Channel 2

HTL input without inverse signals

Mat.No.	Rev.
DRF5ZEM-K010	1D

**KEB**



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## 1. Safety Instructions

Prior to performing any work on the unit the user must familiarize himself with the unit. This includes especially the knowledge and observance of the safety and warning directions. The pictographs used in this instruction manual have following meaning:

	Danger	Refers to danger of life by electric current.
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	Warning	Refers to possible danger of injury or life.
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	Note	Refers to tips and additional information.
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### 1.1 Validity

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 application. However, they are considered for information only without responsibility. This also applies to any violation of industrial property rights of a third-party.

Inspection of our units in view of their suitability for the intended use must be done generally by the user. Inspections are particularly necessary, if changes are executed, which serve for the further development or adaption of our products to the applications (hardware, software or download lists). Inspections must be repeated completely, even if only parts of hardware, software or download lists are modified.

	Controlling by the user	Application and use of our units in the target products is outside of our control and therefore lies exclusively in the area of responsibility of the user.
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	Use under special conditions	The used semiconductors and components of KEB are developed and dimensioned for the use in industrial products. If the KEB COMBIVERT is used in machines, which work under exceptional conditions or if essential functions, life-supporting measures or an extraordinary safety step must be fulfilled, the necessary reliability and security must be ensured by the machine builder.
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### 1.2 Qualification

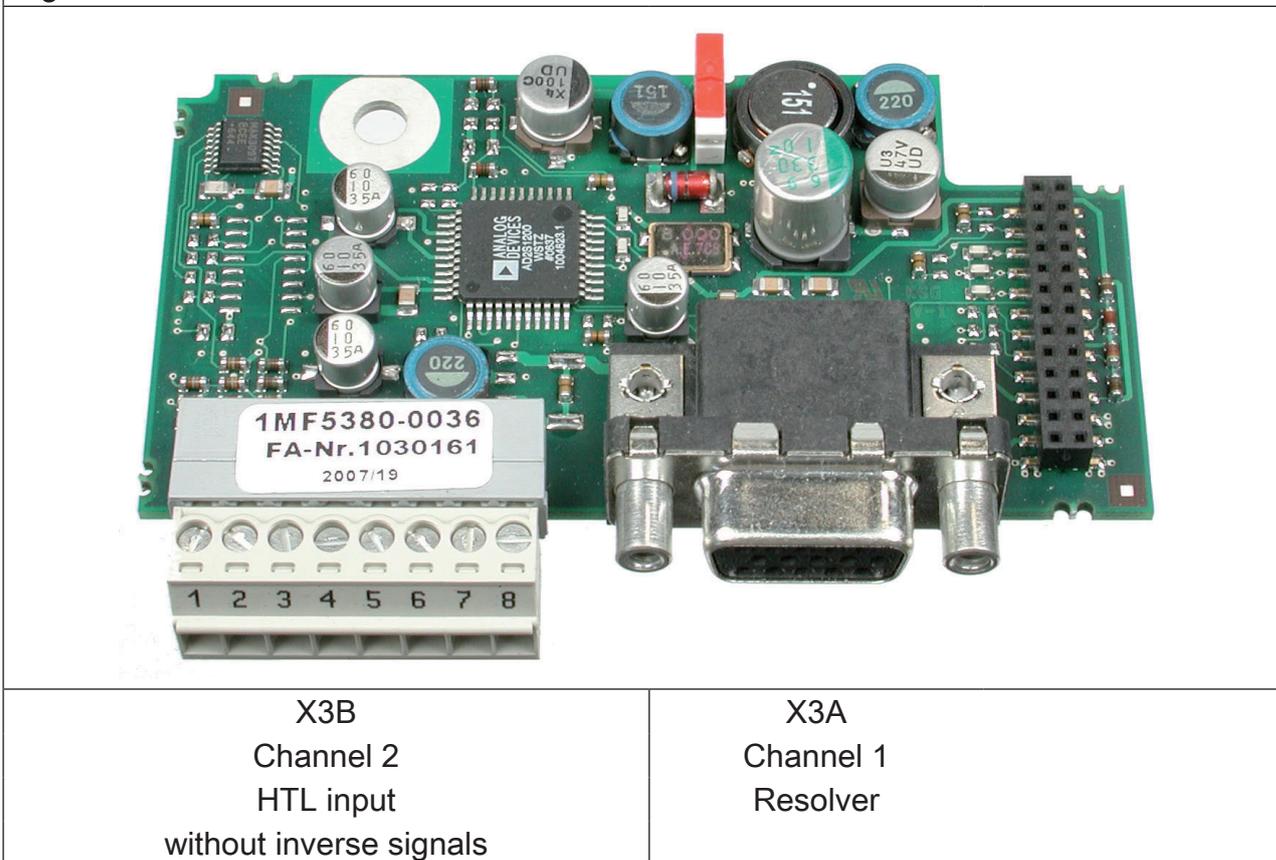
All operations serving transport, installation and commissioning as well as maintenance are to be carried out by skilled technical personnel (observe IEC 364 or CENELEC HD 384 or DIN VDE 0100 and national accident prevention rules!). According to this manual qualified staff means:

- those who are able to recognise and judge the possible dangers based on their technical training and experience
- those with knowledge of the relevant standards and who are familiar with the field of power transmission (VDE 0100, VDE 0160 (EN 50178), VDE 0113 (EN 60204) as well as the appropriate regulations for your area.

	Danger by high voltage	KEB electronics components contain dangerous voltages which can cause death or serious injury. In operation, drive converters, depending on their degree of protection, may have live, uninsulated, and possibly also moving and hot surfaces. In case of inadmissible removal of the required covers, of improper use, wrong installation or maloperation, there is the danger of serious personal injury and damage to property.
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## 2. Product Description

Figure 1: Encoder interface 1M.F5.380-0036



### 2.1 General

The available encoder interface includes an input for the connection of a resolver, as well as an input for the connection of incremental encoders with HTL level without inverse signals. The instruction covers the installation of the interface card, the connection as well as the start-up of a suitable encoder. Further information and the parameter adjustments are described in the application manual for the inverter/servo.

### 2.2 Material number

1M | F5 | K81 | H | 0 | 3 | 6

1M	F5	K81	H	0	3	6	0	installed	Z	Option, spare part	
1M	F5	K81	H	0	3	6	H	Resolver/HTL input without inverse signals			
1M	F5	K81	H	0	3	6	F5	Series			
1M	F5	K81	H	0	3	6	1M	Applicable for housing size D, E (PCB 1M.F5.380-0036)			

## 2.3 Mechanical installation

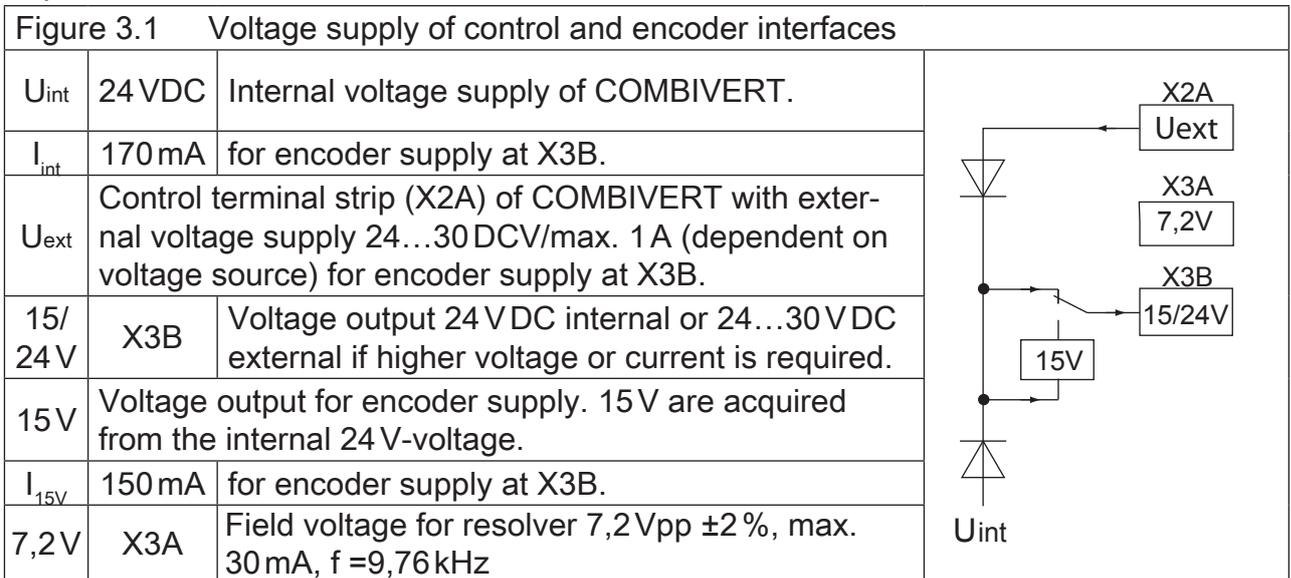
All kind of works on the inverter may be carried out by authorized personnel in accordance with the EMC and safety rules only.

- Switch inverter de-energized and await capacitor discharge time
- Pull off operator
- Remove plastic cover
- Remove fixing bolt
- Fix interface board beginning from the socket connector straightly
- Screw in fixing bolt
- Adjust desired supply voltage with DIL switch
- Attach plastic cover

## 3. Description of the Interface

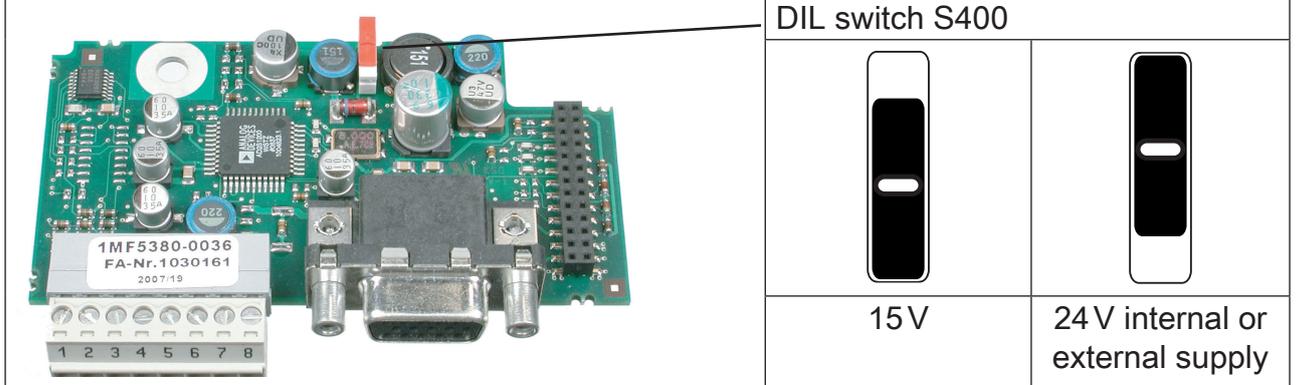
### 3.1 Voltage supply

Supply voltage for interface and encoders is made available by the frequency inverter. The voltage to HTL encoder supply is switchable between 24 V (standard) and 15 V. An external supply must be used if higher signal voltages or currents than mentioned below are required.



3.1.1 Adjustment of the Supply Voltage

Figure 3.1.1 Adjustment of the supply voltage for channel 2



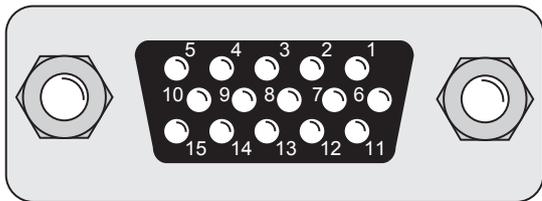
DIL switch S400	
	
15V	24 V internal or external supply

3.2 Channel 1

Slot	X3A
Interface type	Resolver
Field voltage Uout	7,2 Vpp ± 2 %; maximum 30 mA; f=9,76 kHz
Input voltage Uin	3,6 Vpp ± 10 %
Gear ratio resolver	0,5
Tolerance	≤ 3Bit; i.e. with 4 ms scan time and n=3000 rpm this can lead to speed fluctuations of ±20 rpm
Particularities	–
Resolution	12 Bit

3.2.1 Description of the socket X3A

Figure 3.2.1 Socket X3A



Attention! Plug connector only when COM-BIVERT and supply voltage are switched off!

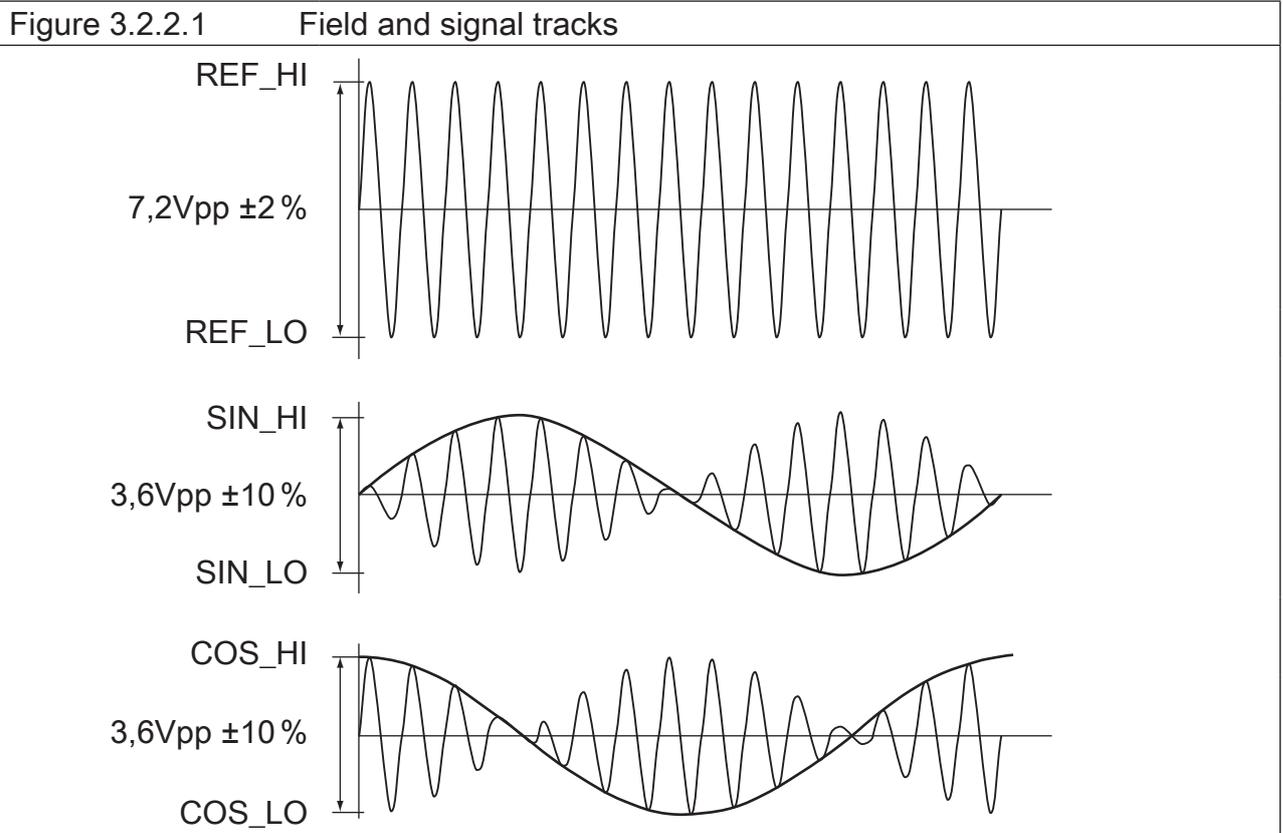
PIN	Name	Description
3	SIN_LO	Sine-signal cable low
4	COS_LO	Cosine-signal cable low
5	REF_LO	Field voltage output low
8	SIN_HI	Sine-signal cable high
9	COS_HI	Cosine-signal cable high
10	REF_HI	Field voltage output high
14	GND	Connection for shielding of the signal cables
–	Housing	Shielding of the total cable

## 3.2.2 Input signals channel 1

### 3.2.2.1 Signal tracks

A sine-wave voltage is output at terminals REF\_HI and REF\_LO at the resolver interface. This voltage supplies the field winding in the resolver. This signal is transmitted via a rotary transformer to the rotary part of the resolver.

The pulsating magnetic field induces electrical voltages in the two signal windings which are shifted about 90°. The voltages pulsate with the same frequency and phase position as the field signal. However their amplitudes are depending on the position of the rotor winding. The induced voltage has maximum value if rotor and measuring winding are parallel. No voltage is induced in signal winding in right angle to each other. Both signal voltages are directly transferred to the encoder interface.



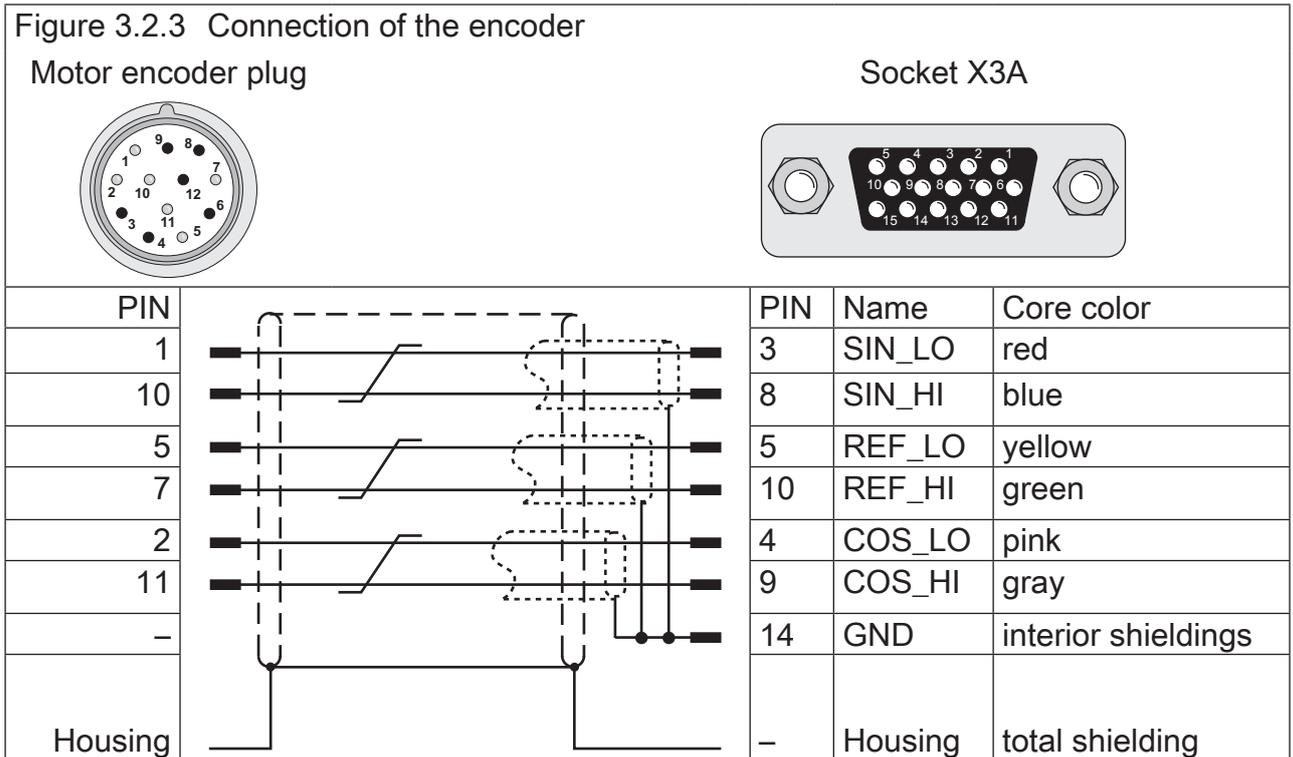
### 3.2.2.2 Encoder breakage recognition channel 1

Input signals SIN\_HI and COS\_HI are monitored for the monitoring of the resolver at channel 1. The monitoring for channel 1 will be switched on/off with parameter Ec.42 (in the past Ec.20).

The recognition of encoder breakage triggers an „error! encoder 1"(value 32), if the voltage at signal inputs SIN\_HI and COS\_HI is outside of the specification.

3.2.3 Connection of the encoder

- Encoder cable double-shielded and twisted in pairs
- Apply external shielding on both sides at the connector housing
- Connect interior shieldings at one side at the interface to GND
- Do not connect exterior and interior shielding



3.2.4 Encoder cable

KEB encoder cables are corresponding to the following specification:

Signal lines	3 x (2 x 0,14 mm <sup>2</sup> )
Supply lines	2 x 0,5 mm <sup>2</sup>
Particularities	trailing capable, oil resistant
Temperature range	constant up to 80 °C
Color	green RAL 6018

3.2.5 Encoder line length

The maximum line length of the encoder cable is 50 m. Please contact KEB if longer encoder cables are required.

## 3.2.6 Tested encoders

The following resolvers have been tested by KEB on it application:

- Tamagawa TS 2620 N21 E11 (default)
- Tamagawa TS 2641 N11 E64
- LTN RE-15-1-A14
- LTN RE-21-1-A05
- Harowe 10BRCX 401 k1C

However, this does not restrict the use of rotary encoder with same specifications of other manufacturers.

## 3.2.7 Special resolver

The use of 2-pole resolvers (pole-pair number 1) is provided as standard. If a resolver with another pole-pair number shall be used, the pole-pair number is to be used as gear factor.

$$\frac{\text{Gear factor denominator}}{\text{Gear factor numerator}} = \text{pole-pair number}$$

If synchronous motors shall be operated in this constellation, it must be guaranteed that the value pole-pair number x gear factor is integer (see example).

Example:

6-pole resolver (3 pole-pairs) at channel 1,  
pole-pair number of the synchronous motor = 3

$$\frac{\text{Ec.05 Gear factor channel 1 denominator } 3000}{\text{Ec.04 Gear factor channel 1 numerator } 1000} = \frac{\text{---}}{\text{---}} = \text{pole-pair number}$$

The operation of encoders which are not directly mounted at the motor or for operation of resolvers with a pole-pair number > 1, parameter Ec.39 must be set to „1: motor encoder“.

The gear factor is 1/3, the pole-pair number of the motor = 3

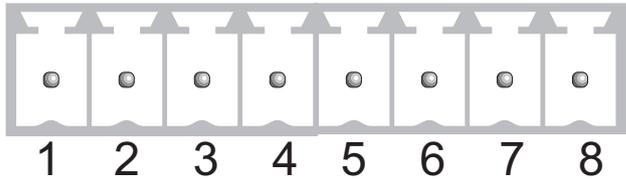
Gear factor x pole-pair number of the motor = 1

=> Synchronous motor can be operated in this constellation.

## 3.3 Channel 2

Terminal strip	X3B
Interface type	Incremental Encoder Input
Input signals	HTL 15...30 V without inverse signals
Inputs / tracks	A+, B+, N+
Output	Voltage output 15/24 V for encoder supply
Particularities	Encoder breakage recognition for all signals
Limiting frequency	100 kHz
Increments per revolution	1... 16383 inc (recommendation 2500 inc for speed upto 2400 rpm)
Input resistance	3,6 k $\Omega$ at 24 V input voltage

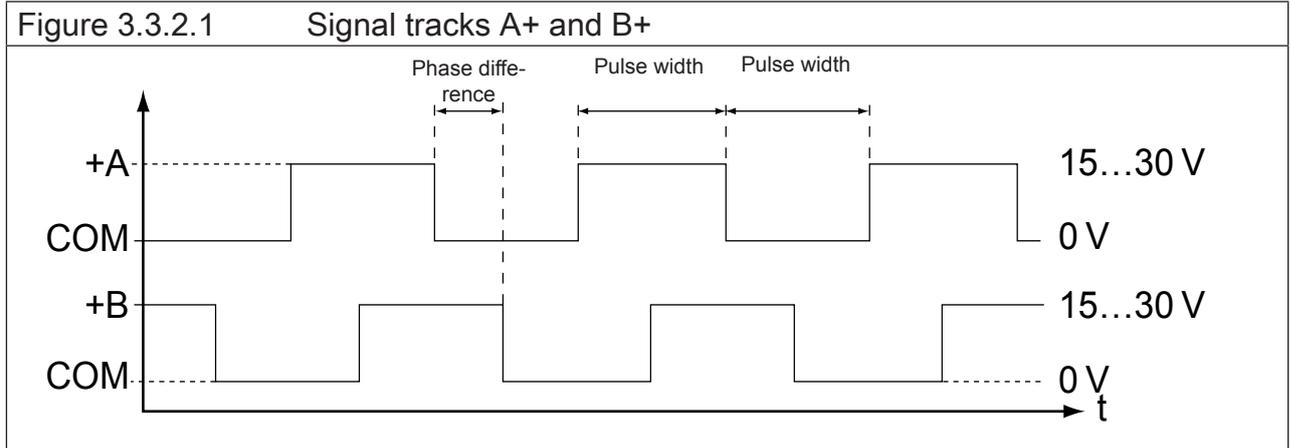
## 3.3.1 Description of terminal strip X3B

Figure 2.1.1 Terminal strip X3B			
	Stripping length	mm	7
	Tightening torque	Nm	0,22
		lb inch	2
	Conductor cross-section (min)	mm <sup>2</sup>	0,14
		AWG	28
Conductor cross-section (max)	mm <sup>2</sup>	1,5	
	AWG	16	
PIN	Name	Description	
1	A+	Encoder track A	
2	–	reserved	
3	B+	Encoder track B	
4	–	reserved	
5	N+	Zero track	
6	–	reserved	
7	15/24 V	Voltage output for encoder supply	
8	COM	Reference potential for encoder tracks and voltage supply	

## 3.3.2 Input signals channel 2

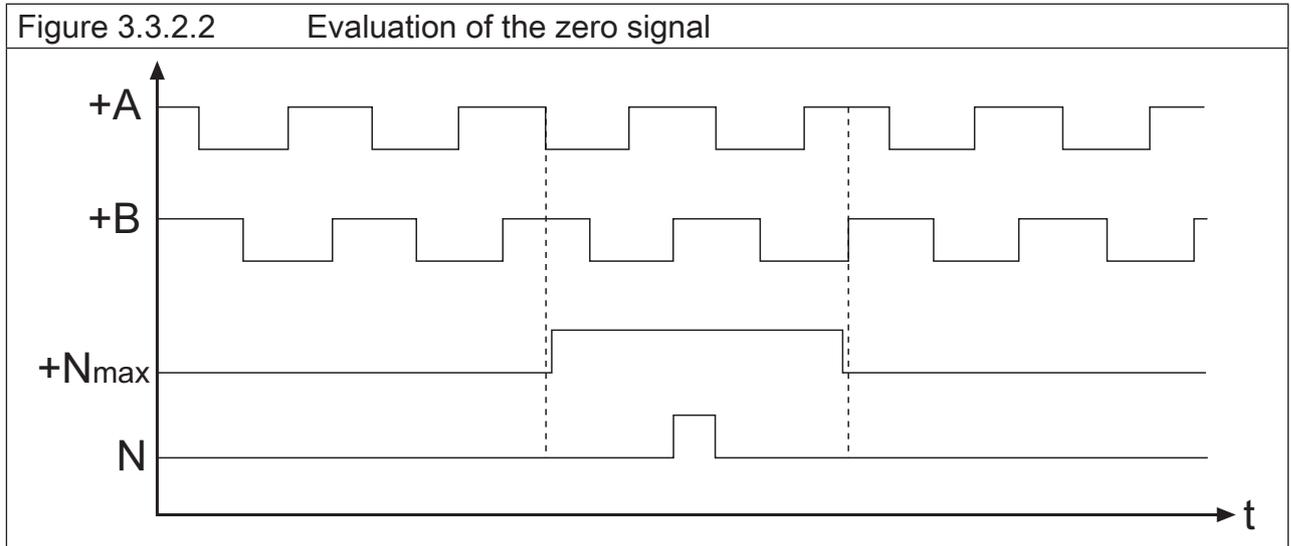
## 3.3.2.1 Signal tracks

In case of HTL encoder interface the signals A+ and B+ are rectangular signals with a phase-angle displacement by 90 degrees. The inverted signals will be generated internally and does not need to be provided by the encoder. The pulse width and the phase difference must be  $2\mu\text{s}$  at least.



## 3.3.2.2 Evaluation of the zero signal

The zero impulse is required to determine valid position points. In case of pure speed controls the signal does not need to be connected. In the following signal sequence the maximum permissible length of the zero impulse of the encoder is visible. The zero signal will be acquired if A+ ,B+ and N+ are at high level. By that there is only one valid position point which is independent from the travel direction. Input N+ must be connected with input 15/24 V if the encoder does not support a zero track.



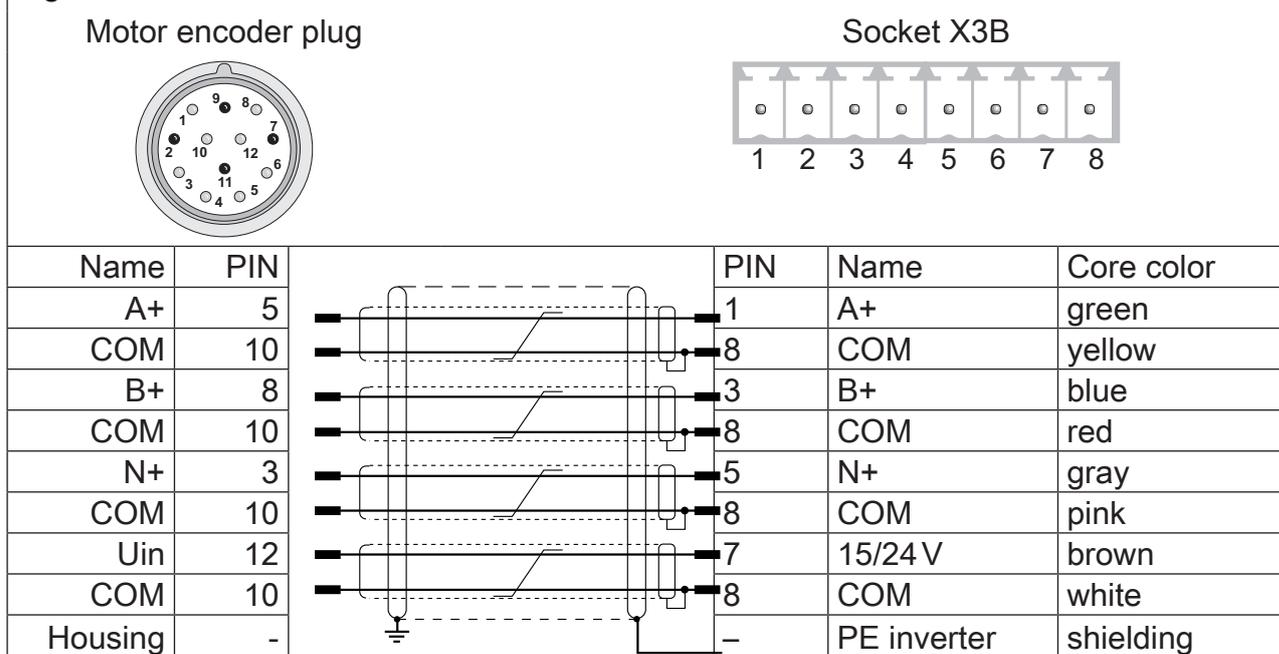
## 3.3.2.3 Encoder breakage recognition channel 2

For a monitoring of the encoder and the encoder cable the signal tracks and the zero track are monitored. Input N+ must be connected with input 15/24 V if the connected encoder should not have a zero track. The monitoring for channel 2 will be switched on/off with parameter Ec.42 (in the past Ec.20). The recognition of encoder breakage triggers an „error! encoder 1“ (value 32), if the voltage at the signal input is smaller than 6 V.

### 3.3.3 Connection of the encoder

- Encoder cable double-shielded and twisted in pairs
- Apply external shielding on both sides at the connector housing/inverter grounding
- Connect interior shieldings at one side to COM
- Do not connect exterior and interior shielding
- N+ is only required for posi function

Figure 3.3.3 Connection of the encoder



### 3.3.4 Encoder cable

KEB encoder cables are corresponding to the following specification:

Signal lines	3 x (2 x 0,14 mm <sup>2</sup> )
Supply lines	2 x 0,5 mm <sup>2</sup>
Particularities	trailing capable, oil resistant
Temperature range	constant up to 80 °C
Color	green RAL 6018

### 3.3.5 Encoder line length

The maximum line length of the encoder cable is 50 m. Please contact KEB if longer encoder cables are required.

### 3.3.6 Tested encoders

The following HTL-incremental encoder have been tested by KEB on it application:

- ROD436

However, this does not restrict the use of rotary encoder with same specifications of other manufacturers.

### 4. Start-up

After the installation or exchange of an encoder interface some adjustments of the inverter/servo software have to be done before operation:

- Switch on inverter
- Select application mode
- Select parameter Ec.00 and control whether value „7: resolver interface“ is entered. The displayed value has to be confirmed by „ENTER“ in any case.
- Select parameter Ec.10 and control whether value „15: inc. input with alarm 24V HTL is entered.
- Select parameter Ec.11 for channel 2 and adjust increments per revolution
- Select Ec.42 (in the past Ec.20) and adjust the encoder breakage recognition dependent on the case of operation.

### 5. Error Messages

Error messages and their meaning are described in the inverter documentation.



For safety reasons a power-on-reset must always be executed after error „E.EnC“.





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