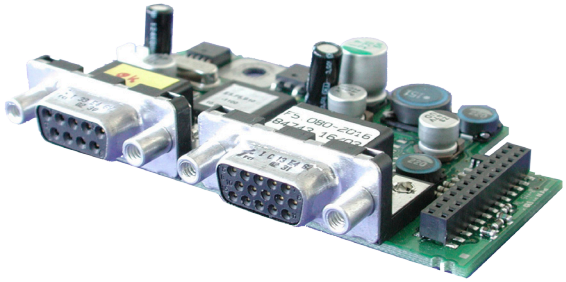
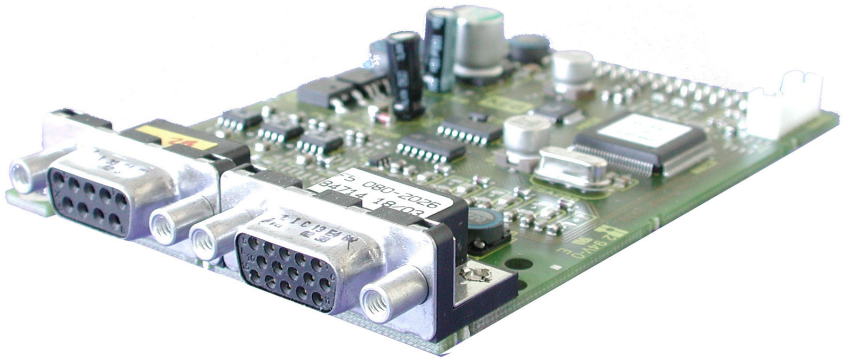
COMBIVERT





GB INSTRUCTION MANUAL — Encoder Interface

Channel 1 — SIN/COS

Channel 2 — variable

Mat.No.	Rev.
DCF5ZEM-K001	1F

KEB

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.

Warning — Refers to possible danger of injury or life.

Note — Refers to tips and additional information.

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 particulary 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.

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.

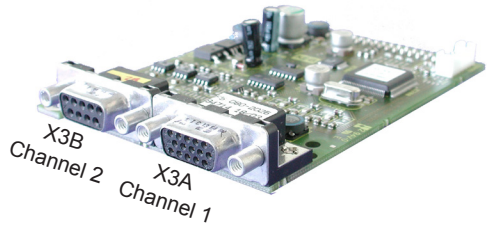
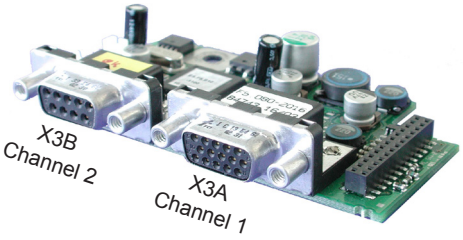
1.2 Qualification

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 approporiate 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.

2. Product description

Figure 1: SIN/COS at Channel 1

For housing size G…U	For housing size D and E
	
X3B Channel 2 see material number	X3A Channel 1 SIN/COS

2.1 General

Each of the interface cards delivered by KEB include two interfaces. As there are numerous different combinations available each interface will be described by means of separate instructions. The instruction comprises 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

xM	F5	K8G	X	X	X	X

Term of delivery	0	installed		Z	Option, spare part		
Interface X3A	M	TTL output	2036	N	TTL input	2035	
	1	SSI-input	2021				
	F5	Series					
applicable for housing size	1M	D, E (circuit board 1M.F5.280-xxxx see above)					
	2M	G…U (circuit board 2M.F5.280-xxxx see above)					

2.3 Scope of delivery (option or replacement delivery)

- Encoder interface
- two instruction manuals
- fixing bolt
- packing material

2.4 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.

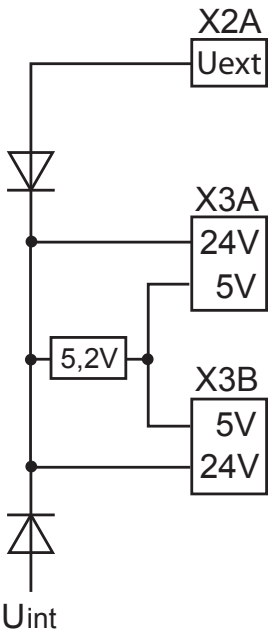
- Switch inverter de-energized and await capacitor discharge time
- Pull off operator
- Remove plastic cover
- Remove fixing bolt
- Fix interface board beginning from the socket connector straightly
- Screw in fixing bolt
- Attach plastic cover

3. Description of the Interface

3.1 Voltage supply

Figure 3.1 Voltage supply of control and encoder interfaces

U_{int}	24 VDC	Internal voltage supply of COMBIVERT.
I_{int}	120 mA	at Hiperface, Sin/Cos, EnDat, SSI-Sin/Cos and UVW.
	170 mA	at all other encoder interfaces.
U_{ext}	Control terminal strip (X2A) of the COMBIVERT with external voltage supply 24…30 DCV.	
24 V	Voltage output of encoder interfaces X3A and X3B for encoder supply.	
I_{24V}	Current I_{int} reduces itself by draw current to the 5 V output in accordance with the following formula: $I_{24V} = I_{int} - \frac{5.2_{V} \times I5V}{U_{int}}$	
5 V	Voltage output for encoder supply. 5.2 V are obtained from the 24 V voltage.	
I_{5V}	300 mA	at Hiperface, Sin/Cos, EnDat, SSI-Sin/Cos and UVW.
	500 mA	at all other encoder interfaces.
	1 A	at external supply (dependent on the voltage source)



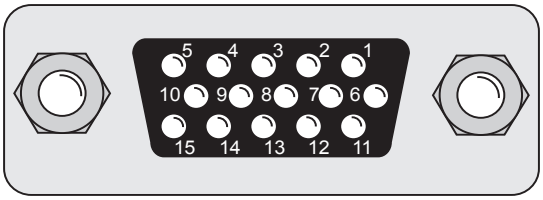
3.2 Channel 1

3.2.1 Specifications

X3A	Socket SUB-D15
Interface type	SIN/COS
Inputs / tracks	1 Vss typical (0.6…1.2)
Limiting frequency	200 kHz
Increments per revolution	1…2048 inc (recommendation 1024 inc for speed upto 4500 rpm
Input resistance	120 Ω
Max. line length	50 m, the value is additionally limited by the signal frequency, cable capacity and supply voltage (see chapter „encoder line length").

3.2.2 Description of X3A

Figure 3.2.2 Socket X3A



PIN	Name	Description
1	C-	Signal input C- (difference signal to C+)
2	D-	Signal input D- (difference signal to D+)
3	A-	Signal input A- (difference signal to A+)
4	B-	Signal input B- (difference signal to B+)
5	-	-
6	C+	Absolute track for initial position and angular calculation
7	D+	Absolute track for initial position and angular calculation
8	A+	Incremental encoder input track A for counter and direction detection
9	B+	Incremental encoder input B for counter and direction detection
10	-	-
11	24 V	Power supply for encoder
12	+5.25 V	Power supply for encoder
13	COM	Reference potential for voltage supply
14	-R	Signal input R- (difference signal to R+)
15	+R	Zero track
–	GND	Connection for shield at the connector housing (is directly connected with the inverter earth).

3.2.3 Input signals

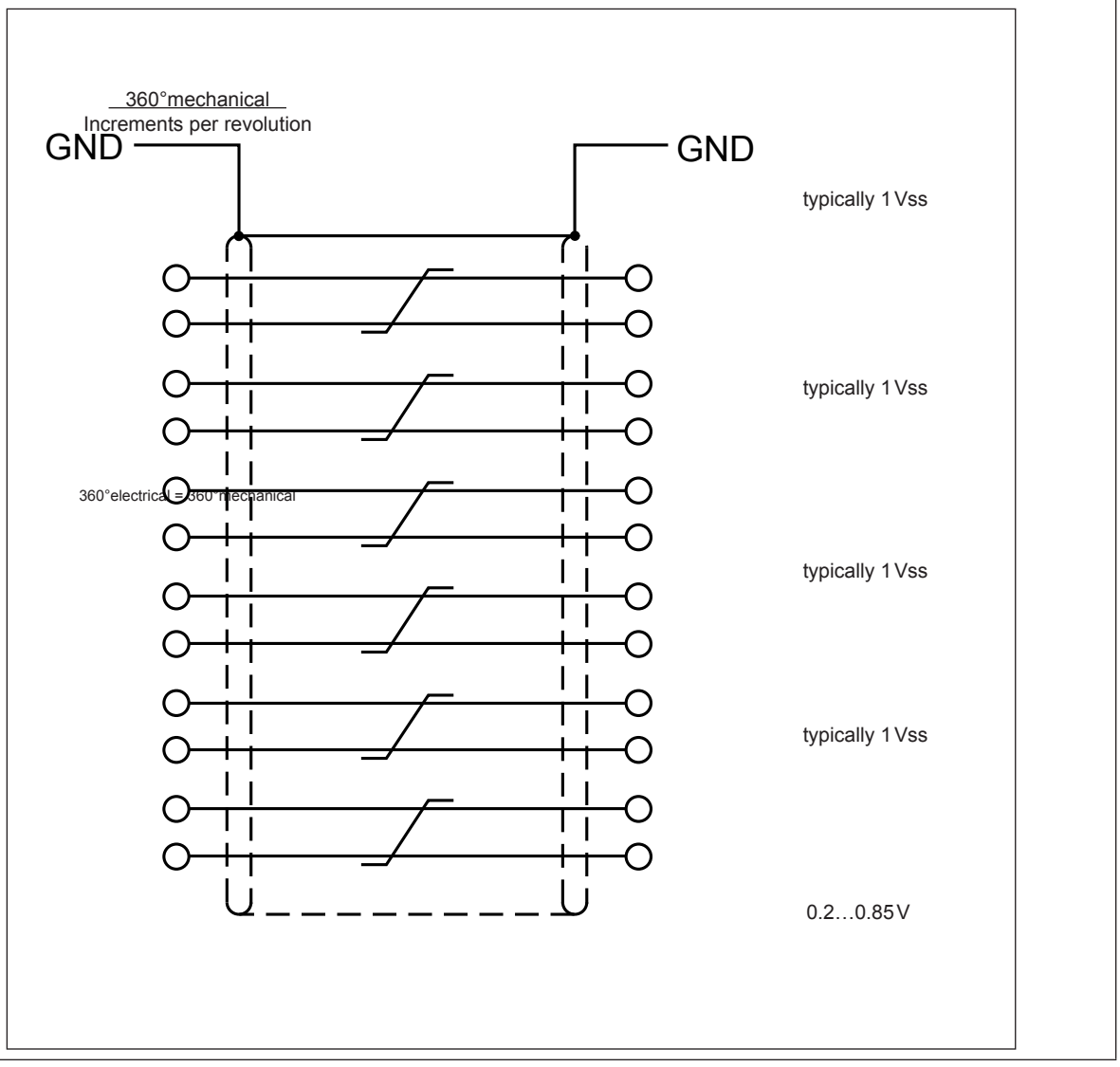
Tracks C and D are giving an absolute signal to the control unit. The period is correspond exactly to one mechanical revolution of the encoder. At starting the control unit will start with this relative inaccurate absolute value. With the first zero pulse the position will be corrected. Thus approach to reference point is not necessary.

The output signals of tracks A and B are dependent on the encoder line number. If the encoder line number, adjusted in parameter Ec.01, is not correspond with the actual encoder line number, an error will be triggered immediately after revolution of the rotor axis.
The zero track will permanently be compared with the position. In case a difference occurs the position will be corrected with a ramp time after a filter. In addition the position value of the absolute track (C and D) will be compared with the position any 30 ms. Since the absolute track is relatively inaccurate, corrections are only made until a valid zero signal is recognized. Then only an error is released, if the difference exceeds a maximum value.

	If no absolute and/or zero track is recognized during power-on, this functions are getting deactivate. Operation with exclusively utilization of the high resolution tracks A and B is possible.

3.2.3.1 Analog input signals

Figure 3.2.3.1 Signal tracks



3.2.3.2 Encoder monitoring

Parameter		r/w	Enter	prog.
Ec.42	Encoder alarm mode	yes	no	no

The encoder monitoring is a software function and dependent on the encoder type. The absolute track is monitored approx. all 30 ms and the incremental track is monitored approx. all 16 ms. If the permissible signal levels are fallen below „Error! Encoder 1“ (value 32) is triggered. Dependent on the encoder type the response time can be 100 ms and more.

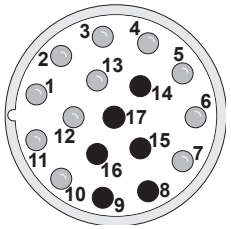
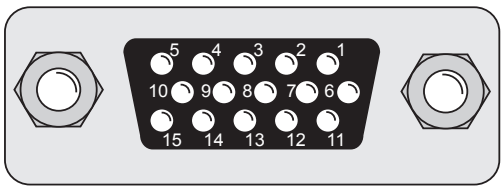
Setting range	Setting	Meaning
0	1	Encoder monitoring off
1		Encoder monitoring on
2		Encoder monitoring on (open-loop off)
3		Warning

3.2.4 Connection of the encoder

3.2.4.1 Encoder cabel at SUB-D15

- Encoder cable double-shielded and twisted in pairs
- Connect exterior shielding at both ends to PE/GND
- Connect interior shielding at one side to COM
- Do not connect exterior and interior shielding

Figure 3.3.4.1 Connection of the encoder

Motor encoder plug	Socket X3A
	

Name	PIN		PIN	Core color
GND	–		–	exterior shielding
A+	1		8	green
A-	2		3	yellow
B+	11		9	blue
B-	12		4	red
C+	5		6	white
C-	6		1	brown
D+	14		7	black
D-	4		2	purple
R+	3		15	gray
R-	13		14	pink
COM	7		13	white/green
+5.25 V	10		12	gray/pink

3.2.5 Encoder cable

KEB encoder cables are corresponding to the following specification:

Signal lines	4 x (2 x 0.14 mm²)
Supply lines	2 x (0.5 mm²)
Particularities	trailing capable, oil resistant
Temperature range	constant up to 80 °C
Color	green RAL 6018
Material number	00.S4.209-xxxx

3.2.6 Encoder line length

The maximum line length of the encoder cable is 50 m. It results from the voltage drop of the supply line. The value is calculated as follows:

Encoder line length =	$\frac{U - U_{min}}{I_{max} \cdot 2 \cdot R}$
max. encoder current I_{max}:	see encoder description
Supply voltage U:	5.2 V
minimum input voltage U_{min}:	see encoder description
KEB encoder cable resistance R:	0.036 Ω/m at 0.5 mm²

3.2.7 Tested encoders

The following encoder can be used dependent on the interface and the control:

Manufacturer	Type	Encoder type
Heidenhain	ERN1188	SIN/COS-encoder

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

3.3 Channel 2

The description of input X3B is depending on the used encoder interface. It is described in a separate manual.

4. Start-up

After 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
- When using synchronous motors set ud.2 to F5-S
- Select parameter Ec.00 and control whether „14: SIN/COS“ is displayed. The displayed value has to be confirmed by „ENTER“ in any case.
- Select parameter Ec.10 and carry out the same for the 2. encoder interface
- Depending on the encoder interface and control card (see 3.3.7) control/adjust the number of increments per rev. (Ec.1), the SSI data code (Ec.43) and the SSI data word length (Ec.44 and Ec.53).
- Select parameter Ec.01 and adjust increments per revolution

4.1 Parameter description

4.1.1 Encoder 1 status (Ec.37)

This parameter displays, by means of different status messages, the status of encoder and interface. Dependent on the encoder only special messages are possible. All errors are only set at control release, although they are already displayed in Ec.37.

Value	Description
The following value is displayed at correct operation:	
16	Position values are being transferred, encoder and interface are working
The following status messages triggers „Error Encoder Change“ (E.EncC) because the correct evaluation of the position is no longer guaranteed. Error E.EncC can only be reset via parameter Ec.0. Exception! An error due to wrong increments per revolution (value 70) is reset immediately, if the correct increments per revolution are adjusted (from software 2.7). Attention, the modulation is released, when the control release is still set!	
64	Encoder is unknown and will not be supported
67	The signals of the incremental track are not correct, e.g. no encoder is connected or the encoder cable is defective.
68	The signals of the absolute track are not correct. The absolute track at Endat, Hiperface and SSI-Sin/Cos is digital. The absolute track at Sin/Cos is analog.
69	Position deviation too high. The position determined by the incremental signals and the absolute position (of absolute track, zero signal or serial selected) does no longer correspond or cannot be corrected.
70	Increments per revolution adjusted in the inverter does not correspond with encoder increments per revolution.
71	Interface type is unknown: Interface has not been recognized.
75	Encoder temperature too high (message from encoder)
76	Rotary speed is too high (message from encoder)

further on next page

Value	Description
77	Encoder signals are outside the specification (message from encoder)
78	Encoder has internal defect (message from encoder)
92	Encoder will be formatted. When writing an encoder with memory structures different from the KEB-definition, their memories will be re-organized in such a manner that they can be written. This procedure can take some seconds, depending on the respective memory structure.
96	New value detected, because an another encoder is attached.
98	Interface is busy
The following status messages triggers „Error Encoder 1“ (E.Enc1), if encoder data is read:	
97	KEB-reference is undefined. Memory structure of the encoder does not correspond to the KEB-definition and therefore data cannot be read. The encoder is defined by writing data. At F5-S the error is reset as follow: • writing a position to Ec.2. • perform a system position trimming
Following status messages trigger error „Error Hybrid“ (E.HYb):	
0,255	No communication between interface and control card.

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