COMBIVERT

⚠ The general EMC and safety directions at www.keb.de have to be observed!

GB

Installation Manual **Housing A**

Mat.No.	Rev.
00F5SEM-KA03	1J

KEB

This manual describes the KEB COMBIVERT F5. Particular attention is paid to the installation, the connection as well as the basic operation. Due to the various application and programming possibilities, the application-specific connection and/or wiring diagram, the parameter adjustment as well as instructions to the start-up are to be taken from the documentation of the machine manufacturer.
A list of instruction manuals and documents giving assistance for the construction, documentation and service is provided at the end of this manual. The safety and warning notes listed in this instruction manual as well as in other documentation must be observed at any rate to ensure a safe operation. Non-observance of the safety instructions leads to the loss of any liability claims. The safety and warning instructions specified in this manual do not lay claim on completeness. KEB reserves the right to change/adapt specifications and technical data without prior notice. The used pictograms have following significance:

	Danger Warning Caution	Is used, if life or health of the user are endangered or substantial damage to property can occur.
	Attention observe at all costs	Is used, if a measure is necessary for safe and trouble-free operation.
	Information Aide Tip	Is used, if a measure simplifies the handling or operation of the unit.

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. Original spare parts and authorized accessories by the manufacturer serve as security. The use of other parts excludes liability for the damages which can result from it.
Application and use of our units in the target products is outside of our control and therefore exclusively in the area of responsibility of the user. Repairs may only be carried out by the manufacturer or an authorised repair agency. Unauthorised opening and tampering may lead to bodily injury and property damage and may entail the loss of warranty rights.

Table of Contents

1. Safety and Operating Instructions

Safety and Operating Instructions for drive converters

(in conformity with the Low-Voltage Directive 2006/95/EC)

1. General

In operation, drive converters, depending on their degree of protection, may have live, uninsulated, and possibly also moving or rotating parts, as well as 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.

For further information, see documentation.

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 IEC 664 or DIN/VDE 0110 and national accident prevention rules!).

For the purposes of these basic safety instructions, „skilled technical personnel" means persons who are familiar with the installation, mounting, commissioning and operation of the product and have the qualifications needed for the performance of their functions.

2. Intended use

Drive converters are components designed for inclusion in electrical installations or machinery.

In case of installation in machinery, commissioning of the drive converter (i.e. the starting of normal operation) is prohibited until the machinery has been proved to conform to the provisions of the directive 2006/42/EC (Machinery Directive). Account is to be taken of EN 60204.

The drive converters meet the requirements of the Low-Voltage directive 2006/95/EC. The harmonized standards of the series EN 61800-5-1 for the drive converters were used.

The technical data as well as information concerning the supply conditions shall be taken from the rating plate and from the documentation and shall be strictly observed.

3. Transport, storage

The instructions for transport, storage and proper use shall be complied with.

The climatic conditions shall be in conformity with EN 61800-5-1.

4. Installation

The installation and cooling of the appliances shall be in accordance with the specifications in the pertinent documentation.

The drive converters shall be protected against excessive strains. In particular, no components must be bent or isolating distances altered in the course of transportation or handling. No contact shall be made with electronic components and contacts.

Drive converters contain electrostatic sensitive components which are liable to damage through improper use. Electric components must not be mechanically damaged or destroyed (potential health risks).

5. Electrical connection

When working on live drive converters, the applicable national accident prevention rules (e.g. VBG 4) must be complied with.

The electrical installation shall be carried out in accordance with the relevant requirements (e.g. cross-sectional areas of conductors, fusing, PE connection). For further information, see documentation.

Instructions for the installation in accordance with EMC requirements, like screening, earthing, location of filters and wiring, are contained in the drive converter documentation. They must always be complied with, also for drive converters bearing a CE marking. Observance of the limit values required by EMC law is the responsibility of the manufacturer of the installation or machine.

6. Operation

Installations which include drive converters shall be equipped with additional control and protective devices in accordance with the relevant applicable safety requirements, e.g. act respecting technical equipment, accident prevention rules etc.. Changes to the drive converters by means of the operating software are admissible.

After disconnection of the drive converter from the voltage supply, live appliance parts and power terminals must not be touched immediately because of possibly energized capacitors. In this respect, the corresponding signs and markings on the drive converter must be respected.

During operation, all covers and doors shall be kept closed.

7. Maintenance and servicing

The manufacturer's documentation shall be followed.

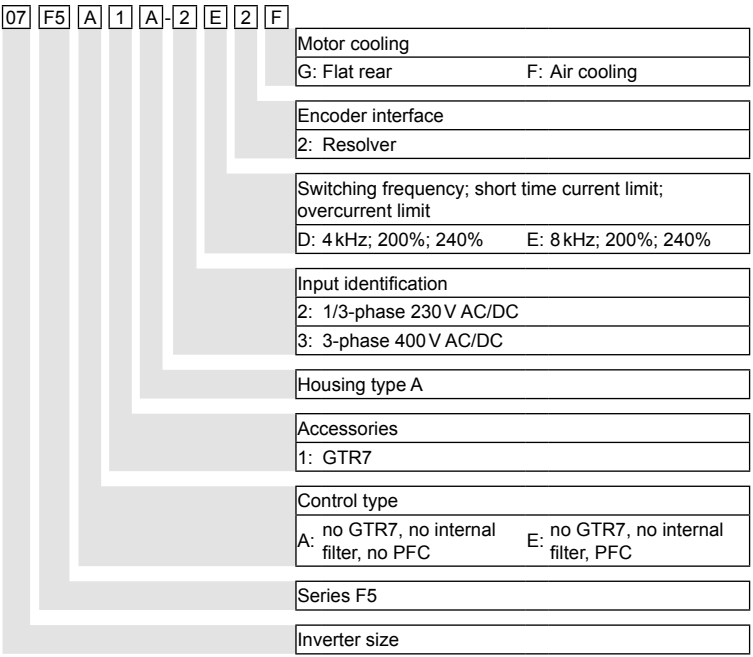
KEEP SAFETY INSTRUCTIONS IN A SAFE PLACE!

2. Product description

2.1 Intended use

The digital servo controller KEB COMBIVERT F5-SERVO serves exclusively for the control and regulation of synchronous servo motors. The operation of other electric consumers is prohibited and can lead to the destruction of the unit.
On delivery the controllers are tuned to the servo motors supplied by KEB. Servo controllers are components which are intended for the installation in electric systems or maschines.

2.2 Unit identification



2.3 Technical data

Inverter size			**05**		**07**	
Housing size			**A**			
Phases			**1**	**3**	**1**	**3**
Output rated power		[kVA]	0,9		1,6	
Output rated current		[A]	2,3		4	
Output rated current UL		[A]	2		4,1	
Stand still current		[A]	2,5		4,4	
Max. short time current	1)	[A]	4,6		8	
OC-tripping current		[A]	5,5		9,6	
Rated switching frequency		[kHz]	8		8	
Max. switching frequency		[kHz]	8		8	
Power loss at nominal operating		[W]	38	35	55	50
Power loss at DC operating		[W]	35	32	50	45
Heat sink power losses	2)	[W]	28	25	45	40
Heat sink power losses (DC)	2)	[W]	25	22	40	35
Minimum braking resistor		[Ω]	60		60	
Maximal braking current		[A]	7		7	
Rated input current		[A]	4,6	3,2	8	5,6
Rated input current UL		[A]	4	2,8	8	5,8
Rated input current DC		[A]	–	–	–	–
Rated input current UL DC		[A]	–	–	–	–
Rated input voltage		[VAC]	**230 (UL: 240)**			
Input voltage range U_{in}		[VAC]	180...260 ±0			
Rated input voltage DC		[VDC]	325 (UL:340)			
Input voltage range at DC operating		[VDC]	250…360			
Mains frequency		[Hz]	50…60 ±2			
Output voltage		[V]	3 x 0…U_{in}			
Output frequency	3)	[Hz]	0… max. 599			
Max. motor line length shielded	4)	[m]	30			
Max. motor line length shielded		[m]	50			
Associated submounted filter set			07U5B0A-1000			

1) This value initiates the response of the hardware current limit. The maximum torque limit should be always below this value, otherwise no more regulation is possible.

2) The heat sink power loss is based on the losses of the power module and the rectifier. There is no rectifier power loss at DC devices. The listed value must be dissipated via the mounting surface at flat rear devices.

3) The real output frequency is depending of the parameterisation. The output frequency is to be limited in such way that 1/10 of the switching frequency is not exceeded. Units with higher max. output frequency are subject to export restrictions and are only available on request.

4) With sub-mounted filter in compliance with class C1 in accordance with EN 61800-3.

Inverter size			**05**	**07**	**09**
Housing size				**A**	
Phases			**3**	**3**	**3**
Output rated power		[kVA]	0,9	1,8	2,8
Output rated current		[A]	1,3	2,6	4,1
Output rated current UL		[A]	1,0	1,8	3,4
Stand still current		[A]	1,4	2,9	4,5
Max. short time current	1)	[A]	2,6	5,2	8,2
OC-tripping current		[A]	3,1	6,2	9,8
Rated switching frequency		[kHz]	8	8	4
Max. switching frequency		[kHz]	8	8	8
Power loss at nominal operating		[W]	45	65	65
Power loss at DC operating		[W]	44	62	60
Heat sink power losses	2)	[W]	35	55	55
Heat sink power losses (DC)	2)	[W]	34	52	50
Minimum braking resistor		[Ω]	390	180	110
Maximal braking current		[A]	2,2	4,5	7,5
Rated input current		[A]	1,8	3,6	5,8
Rated input current UL		[A]	1,4	2,5	4,8
Rated input current DC		[A]	–	3,7	–
Rated input current UL DC		[A]	–	2,54	–
Rated input voltage	3)	[VAC]	**400 (UL: 480)**		
Input voltage range Uin		[VAC]	305...528 ±0		
Rated input voltage DC		[VDC]	565 (UL: 680)		
Input voltage range at DC operating		[VDC]	420…747		
Mains frequency		[Hz]	50…60 ±2		
Output voltage		[V]	3 x 0…Uin		
Output frequency	4)	[Hz]	0… max. 599		
Max. motor line length shielded	5)	[m]	30		
Max. motor line length shielded		[m]	50		
Associated submounted filter set			07U5B0A-1000		

1) This value initiates the response of the hardware current limit. The maximum torque limit should be always below this value, otherwise no more regulation is possible.

2) The heat sink power loss is based on the losses of the power module and the rectifier. There is no rectifier power loss at DC devices. The listed value must be dissipated via the mounting surface at flat rear devices.

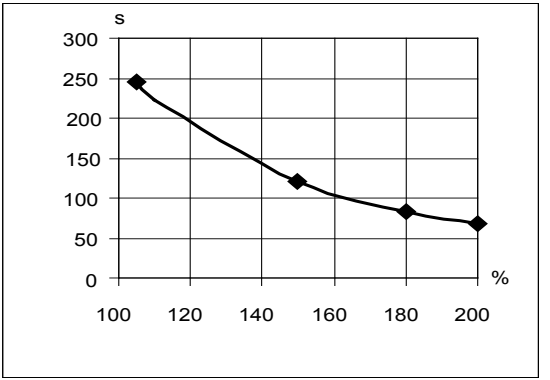
3) The operating threshold of the braking resistor (Pn.69) must be adjusted at least to 770 Vdc if the rated input voltage is 480 Vac (see annex).

4) The real output frequency is depending of the parameterisation. The output frequency is to be limited in such way that 1/10 of the switching frequency is not exceeded. Units with higher max. output frequency are subject to export restrictions and are only available on request.

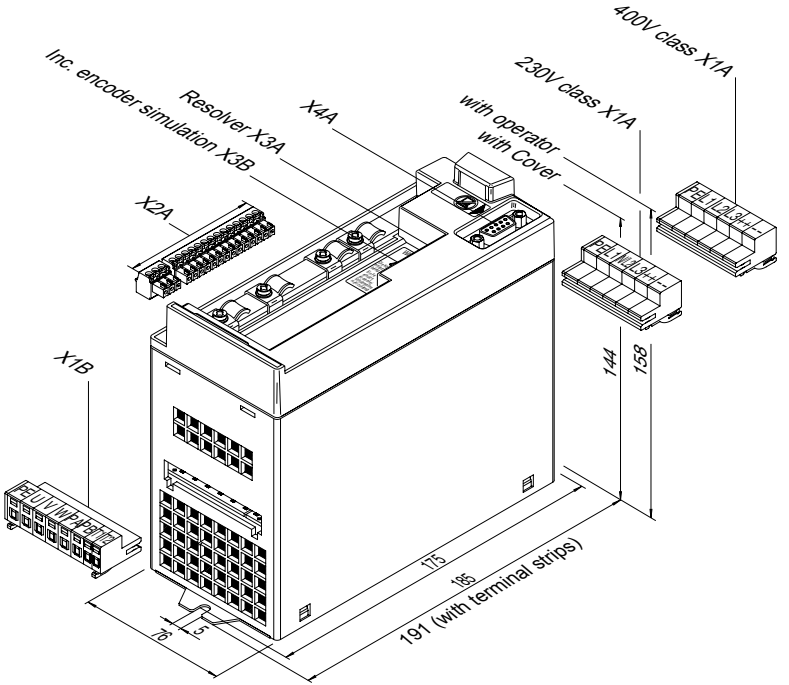
5) With sub-mounted filter in compliance with class C1 in accordance with EN 61800-3.

Site altitude maximal 2000 m above sea level. With site altitudes over 1000 m a derating of 1 % per 100 m must be taken into consideration.

Overload function



2.4 Dimensions and Terminals



U, V, W	Connection for servo motor
PA, PB	Connection for braking resistor
T1, T2	Connection for temperature sensor / switch
L1, N/L2, L3	1/3-phase mains connection (230V-class)
L1, L2, L3	3-phase mains connection (400V-class)
++, --	DC voltage supply in-/output for DC-supply networks 250...370 V DC (230V class) 420...747 V DC (400V class)
PE	Connection for shielding/earthing

Pay attention to the input voltage, since 230V and 400V class (3-phase) are possible!

3. Installation and Connection

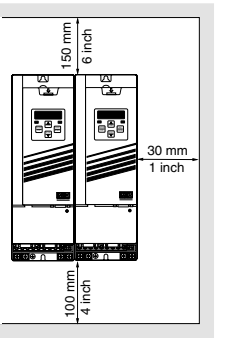
3.1 Control cabinet installation

Protective system (EN 60529):	IP20
Operation temperature:	-10…45 °C (14…113 °F)
Storage temperature:	-25…70 °C (-13…158 °F)
max. heat sink temperature:	
Size 05/230 V and 07-09/400 V	90 °C (194 °F)
Size 07/230 V	82 °C (180 °F)
Climatic category (EN 60721-3-3):	3K3
Environment (IEC 664-1):	Pollution degree 2
Vibration/Jolt according to:	German. Lloyd; EN50155

The flat-rear design requires cooling measures by the machine builder. This can be in the best case no further measure at all (e.g. at cyclic operation with down times) up to the dissipation of the entire, indicated heat loss at rated operation.

⚠ Protect the COMBIVERT against aggressive gases and aerosols !

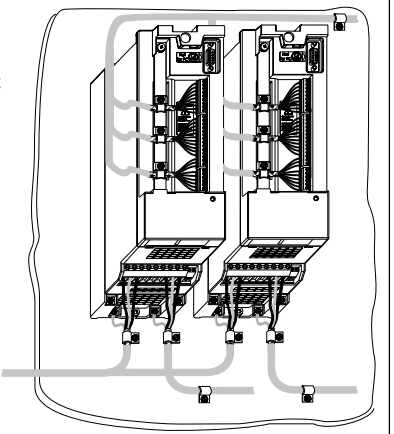
Installation position and min. distances



3.2 EMC-conform Installation

- Always apply the shielding of motor and control cables over a large contact surface on both sides.
- Distance between control and power cables at least 10…20 cm (4…8 inch).
- Lay motor and power cable separately.
- If it cannot be avoided, cross control and power cables in a right angle.
- Install all cables as close as possible to the mounting plate - ideal in a metal cable duct.
- Mount COMBIVERT well conducting with the mounting plate. Remove the paint beforehand.

You can find further instructions regarding the EMC-conform wiring in the Internet at KEB.

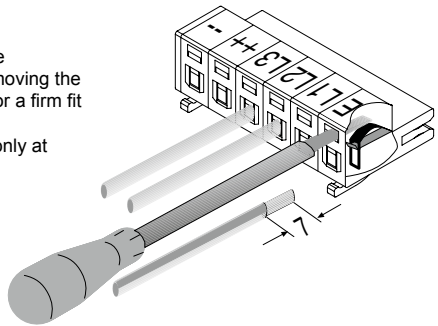


3.3 Connection of Power Circuit

3.3.1 Wiring instructions

- Core cross-section 1,5 mm²
- Strip 7 mm
- Optional use of wire-end ferrule
- After arresting the cable by removing the screwdriver absolutely check for a firm fit

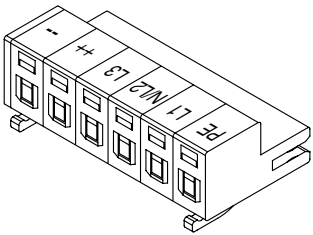
Attach / remove terminal strip only at tensionless state



3.3.2 Terminal Strip X1A

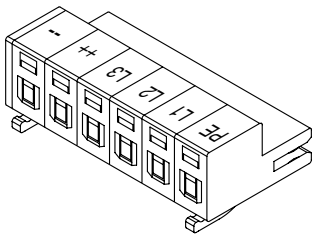
Terminal strip X1A / 230 V class

- 230 V AC / 1-phase (L1/N)
- 230 V AC / 3-phase (L1, L2, L3)
- DC-Supply 250…370 V DC (++, --)



Terminal strip X1A / 400 V class

- 400 V AC / 3-phase (L1, L2, L3)
- DC-Supply 420…747 V DC (++, --)



Absolutely observe the connecting voltage of the KEB COMBIVERT. A 230V-unit will be immediately destructed on a 400V-power supply.

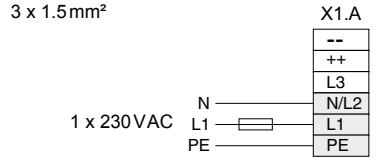
Never exchange the mains and motor cables.

Some countries demand that the PE-terminal is directly connected to the terminal box (not over the mounting plate).

3.3.3 Mains connection

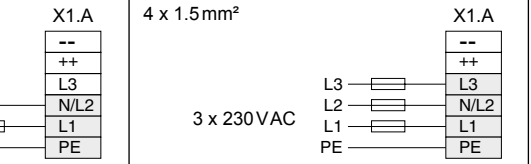
Mains connection 230 V 1-phase

3 x 1.5 mm²



Mains connection 230 V 3-phase

4 x 1.5 mm²

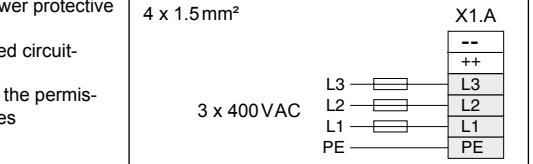


Protection

- Fuse 10 A slow-blowing or power protective switch
- RCD (residual current operated circuit-breaker) type A or type B
- at DC-supply pay attention to the permissible voltage range of the fuses

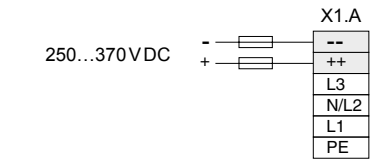
Mains connection 400 V 3-phase

4 x 1.5 mm²



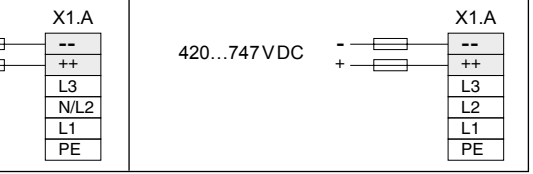
DC-connection 230 V-class

2 x 1.5 mm²

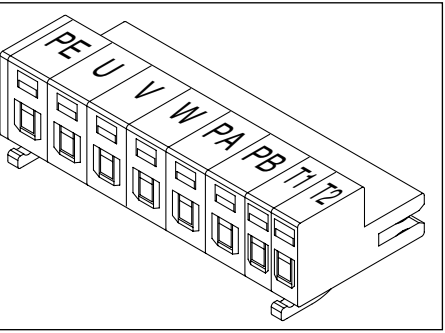


DC-connection 400 V-class

2 x 1.5 mm²

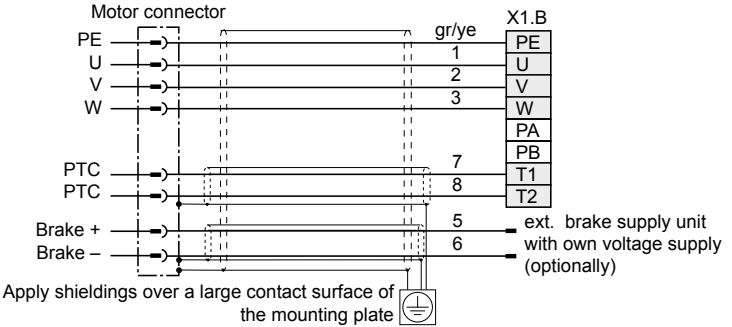


3.3.4 Motor connection with terminal strip X1B

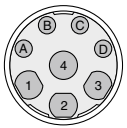


- PE Connection for earthing
- U, V, W Servo motor
- PA, PB Braking resistor
- T1, T2 Temperature sensor / switch

- Plug in all connectors only in off-circuit condition!
- Observe correct phase sequence of the motor!
- Shielded motor line



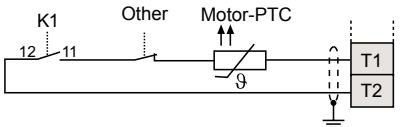
Motor
Power connector



Connector PIN No.	Name	Cable Core No.
1	U	1
4	V	2
3	W	3
2	green-yellow	4
A	5	5
B	6	6
C	7	7
D	8	8

3.3.5 Connection of the temperature monitoring

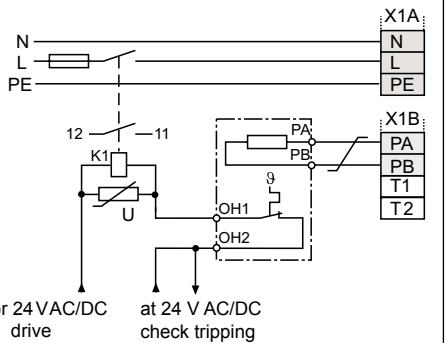
- Terminals T1, T2
- Tripping resistance 1.65…4 kΩ
- Reset resistance 0.75…1.65 kΩ
- Design in accordance with VDE 0660 Part 302
- This function can be activated by the machine builder by software
- Do not lay connecting cable together with control cable
- Permissible in the motor cable only with double shielding
- Connect relay K1 for fire prevention in regenerative operation (see 3.3.6)



3.3.6 Connection of a braking resistor with temperature monitoring in accordance with UL

- PA, PB Connection for braking resistor
- Technical data (see chapter 2.3)
- During clearing of the temperature monitoring the input voltage is switched off
- for additional protection in regenerative operation connect the auxiliary contacts 11 and 12 of the line contactor K1 (see 3.3.5)

The operating threshold of the braking resistor (Pn.69) must be adjusted at least to 770 Vdc if the rated input voltage is 480 Vac (see annex).



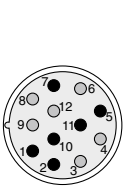
Braking resistors can develop very high surface temperatures, therefor install as safe-to-touch as possible!

3.4 Encoder interface connection

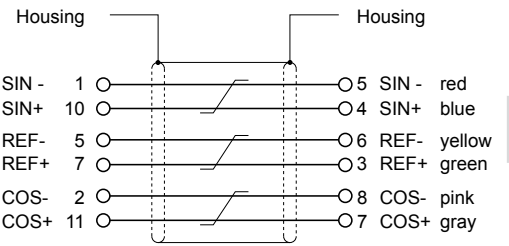
The plugs may only be connected / disconnected when the inverter and supply voltage are disconnected!

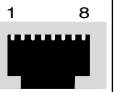
3.4.1 Resolver connection at KEB motors with connector X3A

- Maximum line length 50 m



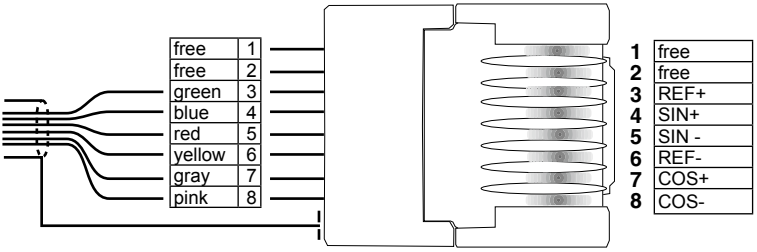
Motor
Resolver plug





Socket X3A

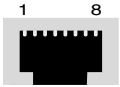
RJ45-Connector assignment



3.4.2 Incremental encoder input / -emulation X3B

The encoder interface X3 is switchable from an incremental encoder emulation to an incremental encoder input. The increments of the emulation are fixed to 1024 for units with resolver interface.

Max. input frequency:	< 300 kHz
Signals:	RS 422 / 2 track signals and zero signals
max. transmission link:	50 m
Approved encoder types:	Kübler RS 422 signals with 10…30 V voltage supply



Socket X3B

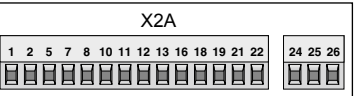
PIN	Signal
1	12 V
2	GND
3	A+
4	B+
5	B-
6	A-
7	N+
8	N-

The 12 V supply voltage at X3B is loadable with altogether 100 mA. If higher voltages / currents are needed for the supply of the incremental encoder, then the encoder must be supplied with an external voltage.

3.5 Control board Servo

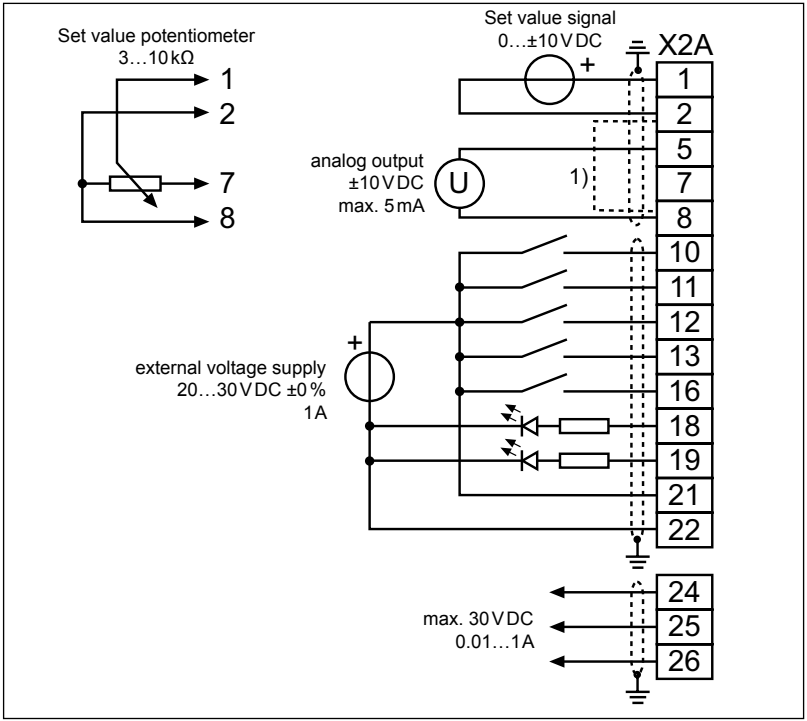
3.5.1 Control terminal strip X2A

- Tightening torque 0.22…0.25 Nm (2 lb inches)
- Use shielded/drilled cables
- Lay shield on one side of the inverter onto earth potential
- NPN control is not possible at the A servo!



PIN	Function	Name	Description
1	+ Set value input 1	AN1+	Difference voltage
2	- Set value input 1	AN1-	0…±10 V DC; 0…±maximum speed, Ri = 55 kΩ
5	Analog output	AN OUT1	Programmable analog output 0…±10 V DC/ 5 mA. Function is defined by the machine builder
7	+10V output	CRF	Reference voltage output for set value potentiometer (+10 V DC / max. 4 mA)
8	Analog Mass	COM	Mass for analog in- and outputs
10	Progr. input 1	I1	The function of the programmable inputs is defined by the machine builder. Switching voltage 13…30 V DC ±0 % smoothed Ri=2.1 kΩ
11	Progr. input 2	I2	
12	Progr. input 3	I3	
13	Progr. input 4	I4	
16	Voltage supply Driver stage	ST	Supply of the driver stage This input must be supplied with an external voltage of 20…30 V DC ±0 % / 0.2A (UBR max. 3.6 Vss). When switching off this voltage an error reset is executed.
18	Transistor output 1	O1	Programmable digital outputs Load capacity maximal 50 mA for both outputs. Function is defined by the machine builder
19	Transistor output 2	O2	
21	Voltage supply Control board	Uin	Supply of the control board This input must be supplied with an external voltage of 20…30 V DC ±0 % / 0.8A (UBR max. 3.6 Vss). Through the separate supply the control can also be operated at switched off driver/power section.
22	Digital Mass	0V	Potential for digital in- / outputs
	Relay 1		Programmable relay output (CP.33) Load capacity max. 30 V DC / 0.01…1 A Function is defined by the machine builder
24	NO contact	RLA	
25	NC contact	RLB	
26	Switching contact	RLC	

3.5.2 Connection of the control terminal strip



1) Connect potential equalizing line only if a potential difference of > 30 V exists between the controls. The internal resistance is reduced to 30 kΩ.

To avoid interferences a separate shielding must be provided for analog and digital control lines. Depending on the use of the relay outputs, an extra shielding is to be used, too.
In case of inductive load on the relay outputs a protective wiring must be provided (e.g. free-wheeling diode)!
The control board must always supply by an external voltage. This keeps the control in operation even if the power stage is switched off. To prevent undefined conditions at external power supply the basic procedure is to first switch on the power supply and after that the inverter.
The terminals of the control terminal strip and the transmitter inputs are securely isolated in accordance with EN 50178.

4. Operation of the Unit

4.1 Operation Accessories

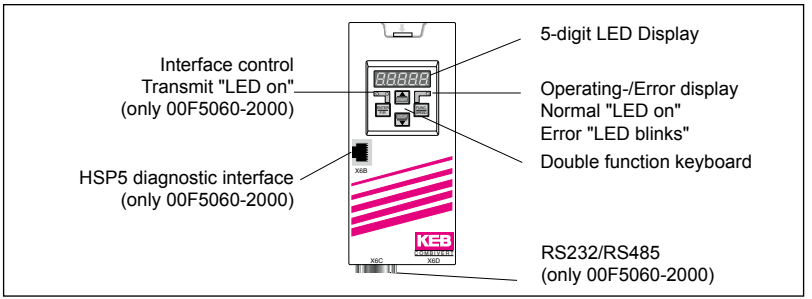
4.1.1 With HSP5 cable and without operator

A special cable (part number 00F50C0-0001) is necessary for the control of the KEB COMBIVERT without operator. It is connected between the HSP5-interface X4A and a serial RS232-PC-interface (COM1 or COM2). The operation takes place via the PC-program COMBIVIS.

The HSP5-cable has an integrated level converter. The connection of a serial standard cable would destroy the PC-interface.

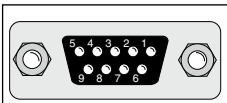
4.1.2 Digital operator (part number 00F5060-1000)

As an accessory for the local operation of the KEB COMBIVERT F5 an operator is available. To prevent malfunctions, the inverter must be brought into nOP status before connecting / disconnecting the operator (open control release). When starting the inverter, it is always started with the last stored values or the factory setting.



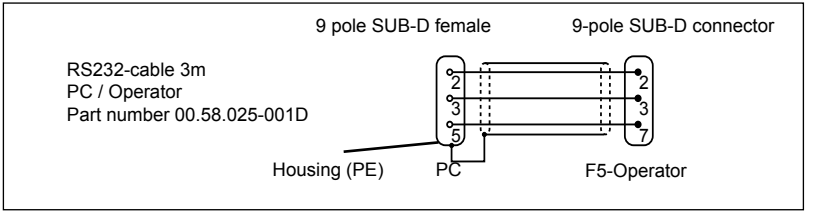
4.1.3 Interface operator (part number 00F5060-2000)

The interface operator corresponds to the functional range of the digital operator. However, it is enhanced by a serial RS232/485-interface.



PIN	RS485	Signal	Meaning
1	-	-	reserved
2	-	TxD	transmission signal RS232
3	-	RxD	receive signal RS232
4	A‘	RxD-A	receive signal A RS485
5	B‘	RxD-B	receive signal B RS485
6	-	VP	Voltage supply +5 V (Imax=50 mA)
7	C/C‘	DGND	Data reference potential
8	A	TxD-A	transmission signal A RS485
9	B	TxD-B	transmission signal B RS485

A RS232-cable is needed to connect the interface operator with the PC. The assignment is represented on the following page.



4.1.4 Remote control

For remote control of the KEB COMBIVERT F5 a special HSP5 operator is available.

Operator	Cable	
00F5060-9000	00F50C0-2xxx	The last three digits of the part number indicate the length of the cable in dm.
00F5060-9001	00F50C0-3xxx	

4.1.5 Other operators

In addition to the described operators the KEB COMBIVERT can be equipped with further operators for special applications (Profibus, Interbus, Sercos, CAN, DeviceNet). You find further information on that on our home page.

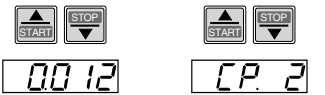
4.2 Keyboard Operation

4.2.1 Parameter numbers and values

When switching on KEB COMBIVERT F5 the value of parameter CP.1 appears.

The function key changes between the parameter value and parameter number.

With UP (▲) and DOWN (▼) the value of the parameter number is increased/decreased with changeable parameters.

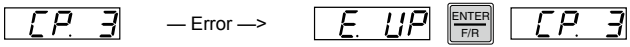


Principally during a change, parameter values are immediately accepted and stored non-volatile. However, with some parameters it is not useful that the adjusted value is accepted immediately. In these cases the adjusted value is accepted and stored non-volatile by pressing ENTER. When this type of parameter is changed a point appears behind the last digit.

By pressing „ENTER“ the adjusted value is accepted and non-volatile stored.

4.2.2 Resetting error messages

If a malfunction occurs during operation, then the actual display is overwritten by the alarm message. The alarm message in the display is reset by ENTER.



With ENTER only the error message in the display is reset. In order to reset the error itself, the cause must be removed or a power-on reset must be made.

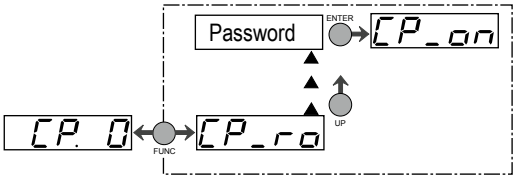
4.2.3 Password Input

The KEB COMBIVERT is outfitted with a comprehensive password protection. In dependence on the entered password the following modes are possible:

Display	Mode
CP_ro	End customer menu (CP-Parameter) read-only
CP_on	End customer menu (CP-Parameter) read/write
CP_SE	Service menu (like end customer menu, but with the original parameters)
APPL	Application menu (all parameter groups and parameters are visible)
–	Drive mode (COMBIVERT can be put into operation by the keyboard)

The menu admissible for the application is defined by the machine builder. The password input is generally made over the parameter CP.0. The adjusted password/menu is maintained even after switching off.

Example: Changing the CP-parameter from read-only to read/write



4.3 Parameter description for F5 servo

Display	Parameter	Setting Range	Resolution	Default	Unit	ENTER	Based on
CP.00	Password input	0...9999	1	-	-	-	ud.01
CP.01	Encoder 1 speed	±4000	0.125	0	rpm	-	ru.09
CP.02	Setpoint display	±4000	0.125	0	rpm	-	ru.01
CP.03	Inverter state	0...255	1	0	-	-	ru.00
CP.04	Apparent current	0...6553.5	0.1	0	A	-	ru.15
CP.05	Apparent current / peak value	0...6553.5	0.1	0	A	-	ru.16
CP.06	Actual torque display	±10000.00	0.01	0	Nm	-	ru.12
CP.07	DC-link voltage	0...1000	1	0	V	-	ru.18
CP.08	DC-link voltage / peak value	0...1000	1	0	V	-	ru.19
CP.09	Output voltage	0...778	1	0	V	-	ru.20
CP.10	Speed control configuration	4...6	1	4	-	-	cs.00
CP.11	DSM rated torque	0.1...6553.5	0.1	LTK	Nm	-	dr.27
CP.12	DSM rated speed	0...32000	1	LTK	rpm	-	dr.24
CP.13	DSM rated frequency	0.0...1600.0	0.1	LTK	Hz	-	dr.25
CP.14	DSM rated current	0.0...710.0	0.1	LTK	A	-	dr.23
CP.15	DSM EMK voltage constant	0...1000	1	LTK	V	-	dr.26
CP.16	DSM winding inductance	0.01...500.00	0.01	LTK	mH	-	dr.31
CP.17	DSM winding resistance	0.000...50.000	0.001	LTK	Ω	-	dr.30
CP.18	DSM current for zero speed	0.0...700.0	0.1	LTK	A	-	dr.28
CP.19	Load motor dependent parameter	0...3	1	1	-	E	fr.10
CP.20	Absolute position enc.1	0...65535	1	57057	-	-	ec.02
CP.21	Encoder 1 rotation	0...19	1	0	-	-	ec.06
CP.22	max. reference forward	0...4000	0.125	2100	rpm	-	op.10
CP.23	Step value 1	±4000	0.125	100	rpm	-	op.21
CP.24	Step value 2	±4000	0.125	-100	rpm	-	op.22
CP.25	Acceleration time	0.00...300.00	0.01	5	s	-	op.28
CP.26	Deceleration time	-0.01...300.00	0.01	5	s	-	op.30
CP.27	S-curve time	0.00...5.00	0.01	0	s	-	op.32
CP.28	Torque reference source	0...5	1	2	-	E	cs.15
CP.29	Abs. torque reference	±10000.00	0.01	LTK	Nm	-	cs.19
CP.30	KP speed	0...32767	1	50	-	-	cs.06
CP.31	KI speed	0...32767	1	500	-	-	cs.09
CP.32	Switching frequency	0...LTK	1	LTK	-	E	uf.11
CP.33	Relay output 1 / function	0...78	1	4	-	E	do.2
CP.34	Relay output 2 / function	0...78	1	2	-	E	do.3
CP.35	Limit switch / stopping mode	0...6	1	6	-	-	pn.7
CP.36	External Fault / stopping mode	0...6	1	0	-	-	pn.3

CP.3 Inverter state

In parameter „inverter status“ the actual operating condition of the frequency inverter is displayed. In the case of an error the current error message is displayed, even if the display has already been reset with ENTER (error-LED on the operator is still blinking). Status messages and information about the cause and removal are to be found in www.keb.de => Documentation => Operating Instructions => Other => Service informations => Error and status messages.doc.

CP.10 Speed control configuration

This parameter activates the speed or the torque control.

CP.10	Description
4	Speed control
5	Torque control
6	Speed / torque control

CP.19 Load motor dependent parameter

The factory settings of the servo correspond to the size of the unit and the respective motor. If the motor data in CP.11…18 are changed, then CP.19 must be activated once. This re-adjusts the current controller, torque curve and torque limit. The torque limit is set at the value, that is maximally possible in the basic speed range (depending on inverter rated current). Rated motor torque x 3 at maximum.

CP.19	Pre-adjustment of the motor-dependent control-parameters.
1	The voltage class of the inverter is taken as input voltage.
2	The measured DC-link voltage / √2 measured at switch on is taken as input voltage. Thus the frequency inverter can be adapted to the actually available mains voltage (e.g. USA with 460 V).

When control release is active the adjustment was not completed. „nco“ appears in the display!

CP.20 Absolute position enc. 1

The system position of the attached resolver system is adjusted at EC.07. With this parameter it is possible to adjust the controller to a not aligned motor. If the ystem position of the motor is unknown an automatic trimming can be done. Before starting with the adjustment, the direction of rotation must be checked. The speed display at CP.1 must be positive when the engine runs manual in clockwise direction. If that is not the case, the direction of rotation can be exchanged as described with CP.21. If the correct direction of rotation is displayed, it can be started with the adjustment.

- The connected motor must be able to rotate freely.
- Open control release (terminal X2A.16).
- Set CP.20 = 2206.
- Close control release (terminal X2A.16).

Now the motor is excited with its rated current and aligned to its zero position. The adjustment is finished when the displayed system position at CP.20 does not change for approx. 5 s. In this case open control release and switch off the unit.

If the error message E.EnC is displayed during trimming the direction of rotation must be checked (CP.21). In this case the position trimming must be repeated.

In case that motors with aligned encoder system are used, the value which has been established by the automatic trimming, can be entered under CP.20 as well. The adjustment values of known motors of the KEB COMBIVERT S4 series must be multiplied by the pole-pair number of the motor. The lower 16 bits of the result must be entered in CP.20.

CP.21 Encoder 1 rpotation

The speed display at CP.1 must be positive when the engine runs manual in clockwise direction. The signals SIN+ and SIN- of the resolver have to be changed, if the sign is wrong. Please ensure that the signals are not short-circuited with the internal shield.

The signals A(+) and A(-) must be changed for units with SIN/COS encoder. Should this involve too much effort then you can achieve a rotation reversal of encoder 1 by means of this parameter.

CP.21	Meaning
0	Tracks not exchanged
1	Track exchanged
2…3	Reserved for initiator input

CP.28 Torque reference source

With CP.28 the required setpoint source for torque control can be adjusted.

CP.28	Meaning	Setting Range
0	AN1+ / AN1-	0%…±100% = 0…±CP.29
1	AN2+ / AN2-	0%…±100% = 0…±CP.29
2	Digital absolute	0…±CP.29
3…5	Only application mode	

CP.33 Relay output 1 / function

CP.34 Relay output 2 / function

CP.33/34 determine the function of the two relay outputs (X2A.24-26, X2A.27-29).

Value	Function
0	No function (generally off)
1	Generally on
2	Run signal; also by DC-braking
3	Ready signal (no error)
4	Fault relay
5	Fault relay (without auto-reset)
6	Warning or error message after abnormal stopping
7	Overload pre-warning
8	Overtemperature alert signal power stage
9	Ex. overtemperature pre-warning motor
11	Overtemperature pre-warning OHI
20	Actual value = set value (CP.3 = Fcon, rcon, not at noP, LS, error, SSF)
21	Accelerate (CP.3=FAcc, rAcc, LAS)
22	Decelerate (CP.3 = FdEc, rdEc, LdS)
23	Real direction of rotation = set direction of rotation
24	Utilization > switching level [1)]
25	Active current > switching level [1)]
27	Real value (CP.1) > switching level [1)]
28	Setpoint (CP.2) > switching level [1)]
31	Absolute setpoint on AN1 > switching level [1)]
32	Absolute setpoint on AN2 > switching level [1)]
34	Setpoint at AN1 > switching level [1)]
35	Setpoint at AN2 > switching level [1)]
40	Hardware current limit activated
41	Modulation on-signal
47	Ramp output value>switching level [1)]
48	Apparent current (CP.4) > switching level [1)]
49	Forward running (not at nOP, LS, abnormal stopping or error)
50	Reverse running (not at nOP, LS, abnormal stopping or error)
51	Warning E.OL2
52	Current regulator limit reached
53	Speed regulator limit reached

Value	Function
63	Absolut value ANOUT1 > switching level [1]
64	Absolut value ANOUT2 > switching level [1]
65	ANOUT1 > switching level [1]
66	ANOUT2 > switching level [1]
70	Driver voltage activ (safety relay)
73	Absolut active power > switching level [1]
74	Active power > switching level [1]

Unlisted values are only for application mode
[1] Switching level of CP.33 = 100; switching level of CP.34 = 4

CP.35 Limit switch / stopping mode

This parameter determines the reaction of the drive to terminal X2A.14 (F) and/or X2A.15 (R), which are programmed as limit switches. The reaction of the drive is shown in the table below.

CP.35	Display	Response	Restart
0	E.PRx	Immediate disabling of modulation	Remove fault, reset
1	A.PRx	Quick stopping / disabling of modulation after reaching speed 0	
2	A.PRx	Quick stop / holding torque at speed 0	
3	A.PRx	Immediate disabling of modulation	Autoreset, if no fault is present
4	A.PRx	Quick stopping / disabling of modulation after reaching speed 0	
5	A.PRx	Quick stop / holding torque at speed 0	
6	None	No effect to the drive, **fault is ignored!**	Inapplicable

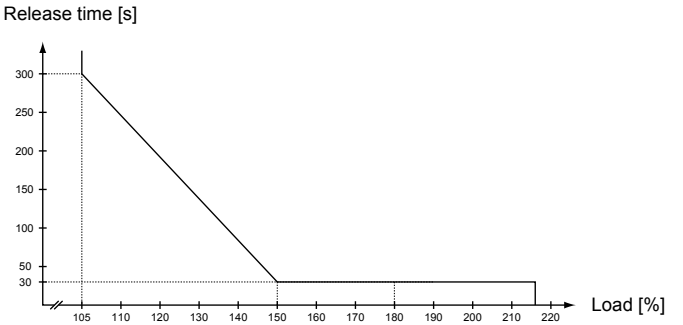
CP.36 External Fault / stopping mode

With the external error monitoring external units can take direct influence on the drive. This parameter determines the response of the drive to a signal at terminal X2A.12 (I3) according to following table.

CP.36	Display	Response	Restart
0	E.PRx	Immediate disabling of modulation	Remove fault, reset
1	A.PRx	Quick stopping / disabling of modulation after reaching speed 0	
2	A.PRx	Quick stop / holding torque at speed 0	
3	A.PRx	Immediate disabling of modulation	Autoreset, if no fault is present
4	A.PRx	Quick stopping / disabling of modulation after reaching speed 0	
5	A.PRx	Quick stop / holding torque at speed 0	
6	None	No effect to the drive, fault is ignored**!**	Inapplicable

A. Annex A

A.1 Overload characteristic



On exceeding a load of 105% the overload integrator starts. When falling below the integrator counts backwards. Error E.OL is triggered if the integrator achieves the overload characteristic.

A.2 Calculation of the motor voltage

The motor voltage for dimensioning of the drive is depending on the used components. The mains voltage reduces according to the following table:

Mains choke Uk	4 %	Example:
Inverter open loop	4 %	Closed loop inverter with mains- and motor choke at non-rigid supply system: 400 V mains voltage - 15 % = 340 V motor voltage
Inverter closed loop	8 %	
Motor choke Uk	1 %	
Non-rigid supply system	2 %	

A.3 Maintenance

All work may only be done by qualified personnel. The security must be ensured as follows:

- Disconnect power supply at MCCB
- Secure against restarting
- Await discharge time of capacitors (if necessary controlling by measurement at „+PA“ and „-“, respectively “++“ and „--“)
- Ensure loss of voltage by measurement

In order to avoid premature ageing and avoidable malfunctions, the measures mentioned below must be carried out in the appropriate cycle.

Cycle	Function
Constant	Pay attention to unusual noises of the motor (e.g. vibrations) as well as of the frequency inverter (e.g. fan).
	Pay attention to unusual smells of the motor or frequency inverter (e.g. evaporation of capacitor electrolyte, braise of the motor winding)
Monthly	Check unit for loose screws and plugs and if necessary tighten up.
	Clean frequency inverter from dirt and dust deposits. Pay attention especially to cooling fins and protective grid of the fans.
	Examine and clean extracted air filter and cooling air filter of the control cabinet.
	Examine function of the fans of the KEB COMBIVERT. The fans must be replaced in case of audible vibrations or squeak.

A.4 Storage

The DC link of the KEB COMBIVERT is equipped with electrolytic capacitors. If electrolytic capacitors are stored de-energized, the oxide film working as dielectric fluid reacts with the acidic electrolyte and destroy themselves slowly. This affects the dielectric strength and the capacity.

If the capacitor starts running with rated voltage, it is tried to build the oxide film abrupt again. This causes heat and gas and leads to the destruction of the capacitor.

In order to avoid defectives, the KEB COMBIVERT must be started up depending on the storage period in accordance with the following specification:

Storage period < 1 year			
•	Start-up without special measures		
Storage period 1…2 years			
•	Operate frequency inverter one hour without modulation		
Storage period 2…3 years			
•	Remove all cables from the power circuit; especially of braking resistor or module		
•	Open control release		
•	Connect variable transformer to inverter input		
•	Increase variable transformer slowly to indicated input voltage (>1 min) and remain at least on the specified time.		
	Voltage class	Input voltage	Residence time
	230 V	0…160 V	15 min
		160…220 V	15 min
		220…260 V	1 h
	400 V	0…280 V	15 min
		280…400 V	15 min
		400…540 V	1 h

further on next side

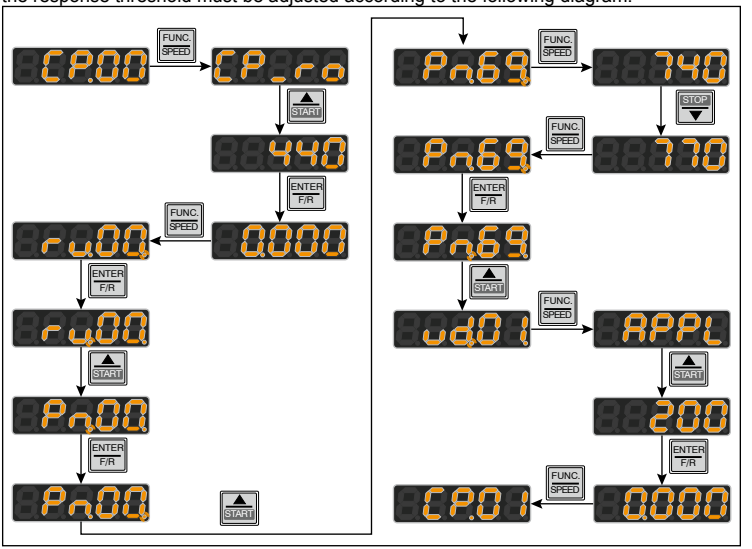
Storage period > 3 years	
•	Input voltages as before, however double the times per year. Eventually change capacitors. Eventually change capacitors.

After expiration of this start-up the KEB COMBIVERT can be operated on nominal rating conditions or delivered to a new storage.

A.5 Changing the response threshold of the braking transistor

(not valid for control type „BASIC“)

To prevent a premature switching of the brake transistor at input rated voltage of 480 Vac, the response threshold must be adjusted according to the following diagram.



B. Annex B

B.1 CE-Marking

CE marked frequency inverter and servo drives were developed and manufactured to comply with the regulations of the Low-Voltage Directive 2006/95/EC.
The inverter or servo drive must not be started until it is determined that the installation complies with the Machine directive (2006/42/EC) as well as the EMC-directive (2004/108/EC)(note EN 60204).
The frequency inverters and servo drives meet the requirements of the Low-Voltage Directive 2006/95/EC. The harmonized standards of the series EN 61800-2 were used.
This is a product of limited availability in accordance with IEC 61800-3. This product may cause radio interference in residential areas. In this case the operator may need to take corresponding measures.

B.2 UL Marking

c UL us	Acceptance according to UL is marked at KEB inverters with the adjacent logo on the type plate.

To be conform according to UL for use on the North American Market the following instructions must be observed (original text of the UL-File):

- For 240 V Models, stand-alone drive units:
  "Suitable For Use On A Circuit Capable Of Delivering Not More Than 10000 rms Symmetrical Amperes, 240 Volts Maximum, when Protected by Fuses, see Instruction Manual for specific fuse details and alternate Branch Circuit Protection details"
- For 480 V Models, stand-alone drive units:
  "Suitable For Use On A Circuit Capable Of Delivering Not More Than 10000 rms Symmetrical Amperes, 480 Volts Maximum, when Protected by Fuses, see Instruction Manual for specific fuse details and alternate Branch Circuit Protection Details"
- Maximum Surrounding Air Temperature 45 °C (113 °F)
- For control cabinet mounting as „Open Type"
- Use in a pollution degree 2 environment
- Use 60/75°C Copper Conductors Only
- Internal Overload Protection Operates prior to reaching the 130% of the inverter output rated current (see type plate). Motor protection by adjustment of current parameters. For adjustement see application manual parameters Pn.14 and Pn.15.
- Motor Overtemperature Protection:
  These drive models are not provided with load and speed sensitive overload protection and thermal memory retention up on shutdown or loss of power (for details see NEC, article 430.126(A)(2)".
- Only for use in WYE 480V/277V supply sources
- Operator and Control Board Rating of relays (30Vdc.:1A)

- Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the Manufacturer Instructions, National Electrical Code and any additional local codes, or the equivalent.

Table for input fusing of inverters F5 – A – housing, stand-alone drive units:

Inverter	Input Voltage	UL248 Fuse Class J or RK5 *)	UL248 Fuse Class CC *)
	[V]	[A]	[A]
05F5	240 1ph	10	10
05F5	240 3ph	6	5
05F5	400/480 3ph	5	5
07F5	240 1ph	15	20
07F5	240 3ph	10	10
07F5	400/480 3ph	6	6
09F5	400/480 3ph	10	10

*) The voltage rating of the Class rated fuses shall be at least equal to the voltage rating of the Drives.

Branch Circuit Protection: Type E Self Protected Manual Motor Controllers for inverters F5–A housing, stand-alone drive units::

Cat. No.	Drive Input rating	Self Protected Manual Motor Controller Type and manufacturer	Self Protected Manual Motor Controller rating
05F5	240V 1ph	PKZMO-10E, Eaton Industries	230V/1ph, 1.5 hp
05F5	240V 3ph	PKZMO-6.3E, Eaton Industries	230V/3ph, 1.5 hp
07F5	240V 1ph	PKZMO-16E, Eaton Industries	230V/1ph, 2 hp
07F5	240V 3ph	PKZMO-10E, Eaton Industries	240V/3ph, 3 hp

Cat. No.	Drive Input rating #	Self Protected Manual Motor Controller Type and manufacturer	Self Protected Manual Motor Controller rating
05F5	400/480V 3ph	PKZMO-10E, Eaton Industries	480Y/277V, 3 hp
07F5	400/480V 3ph	PKZMO-10E, Eaton Industries	480Y/277V, 7.5 hp
09F5	400/480V 3ph	PKZMO-10E, Eaton Industries	480Y/277V, 7.5 hp

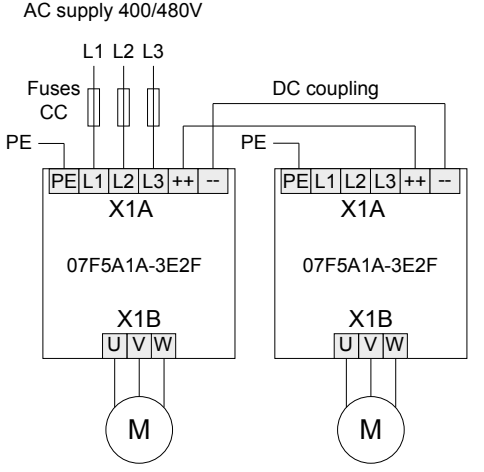
all Drives series which use a Self Protected Motor Controller rated 480Y/277V are suitable for 480Y/277V sources only.

Annex B

Use of Modular Drive System 07F5A1A-3E2F:

- For 480 V Models, F5-A, Modular Drive System, consisting of two drive units, Cat. No. 07F5A1A-3E2F:
  "Suitable For Use On A Circuit Capable Of Delivering Not More Than 10000 rms Symmetrical Amperes, 480 Volts Maximum, when Protected by Class CC Fuses only, rated max. 6A, 600V.
- "The maximum total motor load for the two Drive Units
  of the F5-A housing, Modular Drive System shall not exceed the specified motor load of one individual drive unit 07F5A1A-3E2F"
- "The Minimum wire size for the DC Bus Wring shall be at least 14 AWG. The minimum wire size for the 400/480V input/output wiring shall be at least AWG 14"
- Fuses Class CC with 600V / 6A is required for B.C.P.

Principle of DC coupling



B.3 Additional Manuals

You find supplementary manuals and instructions for the download under

www.keb.de > Service > Downloads

General instructions
- Part 1 EMC-and safety instructions

Unit-specific instructions
- Part 2 power circuits
- DPart 3 control circuit

Service notes
Download of parameter lists
- Error messages

Instruction and information for construction and development
- Application Manual
- Preparation of a user-defined parameter menu
- Programming of the digital inputs
- UL input fusing for COMBIVERT F5

Approvals and approbations
- Declaration of conformity CE
- UL-Yellow Card (http://www.ul.com)

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