COMBIVERT

US INSTRUCTION MANUAL
Type R6-S

Power Supply and Regeneration Unit
Size 15/19
Version 1.4

00.R6.SUB-K000 rev.2D

KEB

05/2017

Table of Contents

1. Introduction

1.1 Preface

First we would like to welcome you as a customer of KEB and congratulate you on the purchase of this product. You have decided on a product of the highest technical innovation.
The enclosed documents as well as the specified hardware and software are developments of KEB. KEB has created these documents, hardware, and software and they are, to the best of KEB's knowledge, error free. KEB reserves the right to change specifications without prior notice. This statement is not exclusive.

The icons used throughout this document have following significance:

Danger
Caution
Discharge Time

Pay Attention
Important
Warning

Information
Help
Tip

1.2 Product description

This instruction manual describes the power supply and recovery unit KEB COMBIVERT R6-S. The COMBIVERT R6-S has the following technical features.

As a supply unit
- converts a three-phase input voltage into DC voltage.
- supplies a single KEB frequency inverter or multiple units via DC interconnection.
- can be connected in parallel, if higher supply power is required.
- increases the stability of the DC Bus voltage in shared DC Bus applications.

As a regeneration unit
- returns the excess energy from generating operation (i.e. overhauling load) to the utility supply system.
- reduces the net energy demand.
- reduces the heat dissipation.
- is environmentally friendly.
- replaces braking resistor and braking transistor.
- is cost saving and space saving.

The COMBIVERT R6-S is generally protected against over current, ground fault and high temperature. Appropriately dimensioned DC fuses protect the DC Bus circuit against short-circuit. The following accessories are necessary for operation with the COMBIVERT R6-S:
- Commutation choke
- HF filter (for observance of European EMC standard)

1.3 Specified application

The COMBIVERT R6-S serves exclusively for the supply of frequency inverters with DC input and/or regeneration of excess energy into the line supply system. The operation of other electrical loads is prohibited and can lead to malfunctions or destruction of the unit.

1.3.1 Standard operation

If the DC Bus voltage increases to a value above the peak value of the line voltage (negative power), regeneration of the current to the line occurs automatically. The line voltage is measured by the R6 unit. Regeneration occurs in a square-wave format, whereby the current flow period corresponds to the line frequency and the normal conduction times of a standard 6 pulse bridge rectifier circuit. Regeneration stops if the DC bus voltage decreases below the line supply peak voltage (positive power).

1.3.2 Abnormal operation

When exceeding the permissible limit values for voltage, current, or temperature the current flow between DC link and the line is blocked during regeneration. An appropriate error message is also displayed. When acting as a supply, the unit must be disconnected from the supply system in case of over current, as current flow can not be limited by the unit itself when in this mode of operation.
With factory settings, the modulation is switched off in case of a line phase loss and/or a synchronization line failure. The error message E.nEt is displayed.
Special adjustments from KEB are necessary if the modulation and/or the standard operation should start again within a defined time in case of return of power supply.

1.4 Unit identification

19.R6.S3E-R00A

Type	A:	Heat sink (standard) B: Flat Heatsink	
Design	0:	default	
reserved	0:	default	
	K:	Kit (High speed Class J fuses, choke, fuse holder)	
Voltage	R:	3-ph.; 180…550 V; AC	
Housing	E		
Options	0:	without pre-charging	3: Pre-charging, DC-fuses
	1:	pre-charging	
Control	S:	1B.R6 (Block Commutation) 1N.R6 (NCM)	
Series	R6		
Unit size	15,19		

2. Safety Instructions

2.1 General instructions

 **CAUTION - Risk of Electrical Shock**	The COMBIVERT R6 power supply and recovery unit contains dangerous voltages which can cause death or serious injury. The COMBIVERT R6 can be adjusted such that energy is returned to the line supply system even in case of power failure during generator operation. Therefore dangerous high voltage can exist in the unit even after disconnection from the line supply system. **Before working with the unit always verify the voltage has dropped to a safe value by measuring both the DC bus voltage and the AC line voltage at the R6 unit.** Care should be taken to ensure correct and safe operation and to minimize risk to personnel and equipment.

 **Only Qualified Electrical Personnel**	All work from the transport, to installation and start-up as well as maintenance may only be done by qualified personnel (IEC 364 and/or CENELEC HD 384 and IEC-Report 664 and note national safety regulations). According to this manual, qualified personnel means those who are able to recognize and judge the possible dangers based on their technical training and experience as well as those with knowledge of the relevant standards and who are familiar with the field of power transmission or conversion.

 **Observe Standards**	The COMBIVERT R6 must not be started until it is determined that the installation complies with 89/392/EEC (machine directive) as well as the EMC-directive (89/336/EEC)(note EN60204), the US - NEC, and the OSHA machine safety code. The COMBIVERT R6 meets the requirements of the Low-Voltage Directive 73/231/EEC. The harmonized standard of the series EN 61800-5-1 (VDE 0160) is used. This is a product of limited interference susceptibility in accordance with IEC 61800-3. This product may cause radio interference in residential areas. In this case the installer/operator may need to take corresponding measures.

2.2 Transport, storage and installation

The storage and transport of the COMBIVERT must be done in the original packing. It is to be protected against humidity and excessive cooling and thermal effects. Long-distance transportation must be carried out in the original packing. It is to be secured against physical impact and shock during transport. Verify the packaging for signs of mishandling before removal from the packaging. Contact the shipper in case of damage. After removing the final packing, the COMBIVERT R6 must be mounted on a stable mounting base.

 **Protect Against Accidental Contact**	The COMBIVERT R6 must be protected against abnormal operation. Components and covers must not be bent or moved as this may affect insulation distances. The units contain electrostatically endangered components which can be destroyed by inappropriate handling. For that reason the contact of electronic components and circuit boards is to be avoided. The equipment must not be switched on if it is damaged as it may no longer comply with mandatory standards. Make sure during installation there is at least the minimum clearance and enough cooling. Climate conditions must be observed in accordance with this instruction manual.

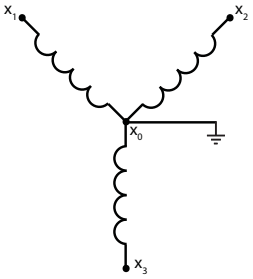
 **Hot Surface**	Heatsinks can reach high temperatures, which can cause burns when touched. A warning notice "hot surface" must be mounted on the machine control panel if direct physical contact with the heatsink can not be avoided.

2.3 Electrical connection

Note Capacitor Discharge Time	Before any installation and connection work, the system must be switched off and secured. After switch off, the intermediate circuit capacitors are still charged with high voltage for a short period of time. The unit can be worked on after it has been switched off for 5 minutes.

Secure Isolation	The terminals of the control terminal strip are securely isolated in accordance with EN 61800-5-1. With existing or newly wired circuits the person installing the units or machines must ensure the EN requirements are met. When used together with frequency inverters that are not isolated from the supply circuit, all control lines must be secured by other protective measures (e.g. double insulation or shielded, earthed and insulated).

Voltage With Respect To Ground	Connection of the COMBIVERT R6 is only permissible on symmetrical networks with a maximum line voltage (L1, L2, L3) with respect to ground (N/GND) of 317V. An isolating transformer must be used for networks which exceed this value! The unit may be damaged if this is not observed.

Grounded Delta Supply	Connection of the R6 series inverters to voltage systems configured as a corner grounded delta, center tap grounded delta, open delta, or ungrounded delta may defeat the internal noise suppression of the inverter. Increased high frequency disturbance in the controller and on the line may be experienced. **A balanced, neutral grounded wye connection is required**. The three phase voltage imbalance must be less than 2% phase-to-phase. Greater imbalance can lead to damage of the inverter's power circuit. It is acceptable to use a transformer with a WYE connection on the secondary. Example of a center grounded wye transformer: 

Only Fixed Connection	The COMBIVERT R6 is designed for fixed connection only as high frequency ground leakage currents of > 3.5 mA may occur especially when using EMI filters. It is therefore necessary to use a ground conductor with a section of at least a #4 AWG (16mm²) copper conductor or a second ground conductor in compliance with EN 61800-5-1. Ground point-to-point with the shortest connection possible to the main ground point in the system (avoid ground loops).

Insulation Measurement	When doing a high voltage insulation measurement in accordance with VDE 0100 / Part 620, the power semiconductor of the unit and existing radio interference filters must be disconnected because of the danger of destruction. This is permissible in compliance with the standard, since all units are given a high voltage test during the quality testing at KEB in accordance with EN 50178.

Different Ground Potentials	When using components without isolated inputs / outputs, it is necessary that equal potential bonding exist between the components to be connected (e.g. through the equalizer). Disregard can cause destruction of the components by the equalizing currents.

Fuse Sizing with Isolation Transformer	When the R6 unit is supplied through an isolation transformer, the maximum allowable fuse size is dictated by the size of the transformer as defined in the National Electric Code (NFPA-70 or CSA 22.1). As per Article 450-3(B) of NFPA-70 (similar statements can be found in CSA 22.1), the max fuse size is defined in table 450.3(B) with a rating not greater than 125% of the rated secondary current. In the case of multiple secondaries, it is the rated value of the winding which the unit is supplied from. In this case it is to be assumed that the end customer will fuse the transformer primary side with fuses exceeding 125% of transformer rated input current. The value of this secondary fuse may be less than the max fuse value listed in the technical data section 3.1 of this manual. The fusing of the transformer supercedes the fuse rating of the unit because the value required for the transformer is lower than the max value with which the unit was tested.

Prevent Disturbances	Trouble-free and safe operation of the COMBIVERT R6 is only guaranteed when the connection instructions below are strictly followed. Incorrect operation or damage may result from incorrect installation. • Pay attention to the line supply voltage. • **Supply connection must be a symmetrical, center-grounded wye.** • Install power cables and control cables separately (>6.0 inches (15 cm) separation). • Use shielded / twisted control lines. Connect the shield at one end to the COMBIVERT R6-S GND terminal! • Only use suitable circuit elements to control the logic and analog inputs, whose contacts are rated for extra-low voltages. • The heatsink of the COMBIVERT R6 must be well grounded. Shields of large power cables must be directly and securely attached to both the inverter GND terminal and the motor ground terminal. Remove paint finish where necessary. • Ground the cabinet or the system with the shortest connection to the main ground point (avoid ground loops) • **Use exclusively the commutation choke or harmonic filter specified by KEB.** • The average value of the supplied DC current may not exceed the maximum DC current. • If several frequency inverters are connected to the COMBIVERT R6, the maximum permissible DC bus capacities of all connected frequency inverters must be considered during supply operation (see technical data). • **A ferrite ring must be installed over both + and - DC bus connections to the COMBIVERT R6 unit to limit common mode noise on the DC bus.**

Automatic Restart	The COMBIVERT R6 can be adjusted in such a way that the unit will restart automatically after an error (e.g. single phase brown out or loss). System design must take this into account. If appropriate, additional monitoring or protective features should be added where necessary.

Not Short-Circuit Proof (Supply)	The COMBIVERT R6 is not short-circuit proof as a power supply input ! If the I2t - protection is adapted with a class gR fuse, a conditional protection at supply input is possible. If necessary the short-circuit protection at DC output is ensured by internal class aR fuse.

Conditionally Short-Circuit Proof (Regen)	The COMBIVERT R6 is conditionally short-circuit proof (EN 61800-5-1 / VDE 0160). After resetting the internal protection devices, the function as directed is guaranteed. Exception: • A ground fault or short-circuit frequently occurring at the output, can lead to damage to the unit.

Cyclic Turn On and Turn Off	With applications requiring the COMBIVERT R6 to be switched on and off cyclically, maintain an off-time of at least 5 min. If you require shorter cycle times please contact KEB.

GFI (Ground Fault Interrupt Circuit-Breaker)	If personnel protection of the system against ground fault is required, the COMBIVERT R6-S must be protected according to EN 61800-5-1: • 3-phase inverters (with B6 bridge-connected rectifier) by RCMA's with separation (use privileged) or RCD's type B (all-current sensitive GFI's) The tripping current should be 300mA or more, in order to avoid a premature triggering by leakage currents (about 200mA. Dependent on the load, the length of the motor cable and the use of a radio interference filter, substantially higher leakage current can occur). The connection instructions from the manufacturer and the valid local requirements must be observed. Dependent on the available supply type (TN, IT, TT) further protective measures are necessary in accordance with VDE Part 410 4(Part 4; Chapter 41). For example, with TN-mains this protection is made with over current protective devices, with IT-mains it is insulation monitoring with a pulse-code measuring method. A protective separation can be used with all mains forms as long as the required power and cable lengths permit this. The person setting up the unit must present proof of compatibility before installing the converter!

2.4 EMC instructions

The COMBIVERT R6-S represents electrical equipment designed for use in industrial and commercial installations. In accordance with the EMC directive 89/336/EEC, it is not mandatory to mark these devices as they represent components to be further handled by the respective machine and system manufacturer and are not operable independently according to the EMC directive. The person installing / operating the machine / system is obliged to prove the protective measures demanded by the EMC directive are complied with. The prescribed ratings can usually be complied with when using the radio interference voltage filters as specified by KEB, and when observing the following measures and installation guidelines.

2.5 EMC conforming installation

The COMBIVERT R6 is designed to be used in a second environment as defined in EN 61800-3 (unit with its own supply transformer). Take additional measures when using it in the first environment (residential and commercial area connected to public low-voltage line)!

- Install the control cabinet or system in an appropriate and correct manner (see chapter "control cabinet installation")
- To avoid coupled noise, separate during installation high voltage supply lines, motor lines, control and data lines (low-voltage level < 48V) and leave a space of at least 6.0 inches, 15 cm between them.
- In order to maintain low-resistance high frequency connections, grounding and shielding, as well as other metallic connections (e.g. mounting plate, installed units), must be made with bare metal to metal contact with the mounting plate, over as large a surface area as possible. Use ground conductors with a section as large as possible, minimum #4 AWG (16mm^2) or use thick ground straps.
- Only use shielded cable with copper or tin-plated braid, since steel braid is not suitable for high frequency ranges. The shield must always be connected to the ground bare on the unit or fastened with clamps to the bare metal of the sub mounting plate. Do not connect the shield using the drain wires alone, this reduces the effectiveness of the shield by 70%!
- If external interference suppression filters are used, then these must be installed as close as possible <12 inches (30 cm) to the interference source and must be in metal to metal contact with the sub mounting plate, over as large a surface area as possible.
- Always equip inductive control elements, (contactors, relays etc.), with suppressors such as varistors, RC-elements or diodes.

All connections must be kept as short as possible and as close as possible to the ground plane. Free floating cables act as active and passive antenna.

- Keep connection cables straight (do not loop). Tie all spare unassigned wires at one end to the ground.
- The twisted pair cables should be used when the conductors are not shielded in order to dampen common-mode noise.
- The cable for phase synchronization between the commutation choke and COMBIVERT R6-S may not exceed a line length of 39 inches (1 m) .
- Further information can be found on the internet, see "www.kebamerica.com".

2.6 Storage of the Unit

The DC bus of the KEB R6 is equipped with electrolytic capacitors. If the electrolytic capacitors are stored de-energized, the oxide film working as dielectric fluid reacts with the acidic electrolyte and destroys itself slowly. This affects the dielectric strength and capacity of the unit. If the capacitors start running with rated voltage again, the oxide film tries to build up quickly. This causes heat and gas and leads to the destruction of the capacitors.

In order to avoid failures, the KEB R6 must be started up according to the following specification based on duration of storage period (powered off):

Storage Period < 1 Year			
*	Start up normally, without any additional precautions		
Storage Period 1...2 Years			
*	Power on frequency inverter for one hour without modulation		
Storage Period 2...3 Years			
*	Remove all cables from power circuit		
*	Open control release		
*	Connect variable voltage supply to inverter input		
*	Increase voltage slowly to indicated input level and remain at for the specified time.		
	Voltage Class	**Input Voltage**	**Minimum Time**
	230V	0...160V	15 min
		160...220V	15 min
		220...260V	1 h
	460V	0...280V	15 min
		280...400V	15 min
		400...500V	1 h
Storage Period > 3 Years			
*	Input voltages same as above, however double the amount of time for each additional year. Eventually consider changing capacitors.		

3. Technical Data

3.1 Power data

Unit size			15	19
Housing size			E	
Phases			3	
Rated voltage	*)	[V]	208/230/480	
Supply voltage		[V]	180…528 ±0 %	
Line frequency		[Hz]	50 / 60 ±2	
Regenerative operation				
Output rated power	*)	[kVA]	18 (10.5)	45 (26)
Rated active power	*)	[kW]	17 (10)	42 (23)
Max. power output	*)	[kVA]	27 (15.5)	67.5 (39)
Max. active power	*)	[kW]	25.5 (15)	63 (34.5)
Regenerative rated current		[A_{AC}]	26	65
Regenerative DC current		[A_{DC}]	32	80
Over load current (E.OL) 60 s	1)	[A_{AC}]	39	97.5
Max. regenerative DC current 60 s		[A_{DC}]	48	120
Power supply operation				
Output rated power	*)	[kVA]	18 (10.5)	48.5 (28)
Rated active power	*)	[kW]	16 (10)	44.5 (25.5)
Max. power output	*)	[kVA]	27 (15.5)	72.5 (42)
Max. active power	*)	[kW]	24 (14.5)	67 (38)
Rated supply current	2)	[A_{AC}]	26	70
DC supply current		[A_{DC}]	32	87[3)]
Over load current (E.OL)		[A_{AC}]	39	105
Max. DC supply current		[A_{DC}]	48	130
OC-tripping current		[A_{AC}]	42	112
DC output voltage	*)	[V_{DC}]	180...680	
Max. permissible DC bus capacitance	*)	[µF]	5,000 (21500)	5,000 (21500)
Max. permissible line fuse UL 248 Class J [5)]		[A]	50	90
External DC Fuses: Siemens			Type Sitor 3NE8-717-1, rated 690Vac/700Vdc, 50A	Type Sitor 3NE8-722-1, rated 690Vac/700Vdc, 125A
Alternate external DC fuse: Bussmann			Type 170M1364-1	Type 170M1368-1
Short Circuit Current Rating (SCCR)		[kA]	10	10
I^2t Peak current ratings of the semiconductor		[A^2s]	1200	4500
Internal DC fuse class aR Siemens Sitor			3NC2240	3NC2200
Supply conductor cross section (min for terminal)		[AWG]	#18 (0.5mm²)	#14 (1.5mm²)
Supply conductor section (max)		[AWG]	#6 (10mm²)	#3 (25mm²)
DC conductor cross section (min for terminal)		[AWG]	#18 (0.5mm²)	#14 (1.5mm²)
DC conductor cross section (max)		[AWG]	#6 (10mm²)	#3 (25mm²)
Power loss at nominal operation		[W]	200	470
Max. heat sink temperature		[°C]	70	88

**) Use bracketed values for operation at 230 V.*

1) The over load time is specified for 1 minute. The overload period is 300 seconds. This corresponds to duty class 2 EN 60146-1-1.

2) The current ratings are based on a displacement power factor of g=0.95. The displacement power factor or the effective value of the input current is dependent on load and line supply conditions. With uncontrolled diode bridge rectifiers, the power factor can be set to 1.0, so the value of the fundamental frequency components is equal to the value of the displacement power factor.

3) For installations according to the UL 508C standard and DC supply currents > 85A, the DC bus connection must use both ++ and -- terminals with a second parallel conductor.

4) The wire gauge is based on the maximum fuse rating, copper wire with a 75°C insulation rating, THHW or equivalent. If branch circuit protection is selected based on the continuous current below the rated value, the wire size could be reduced.

5) For installations with isolation transformers, follow fuse sizing guidelines of NEC NFPA-70. Fuse size may be lower than the fuse rating of the unit. The fusing of the transformer supercedes the fuse rating of the unit. See page 8 for further details.

⚠ The units are not short circuit proof without correctly dimensioned fuses

⚠ Exceeding the maximum DC bus capacitance can lead to failure.

3.2 Operating Environment Specifications

		Standard	Classification	Specifications
Definition According To		EN 61800-2		Inverter Product Standard: Measurement specs.
		EN 61800-5-1		Inverter Product Standard: General Safety
Operating Altitude				2000m above sea level with 1% power derating per 100m above 1000m
Specifications During Operation				
Environment	Temperature	60721-3-3	3K3	Range -10C ...45 °C (from 45°C to max. 55°C a power derating of 5% per 1°C can be applied.)
	Humidity		3K3	5...85% (no condensation)
Mechanical	Vibration	Railroad	EN50155	Max. oscillation amplitude 1 mm (5…13 Hz) max. accel. amplitude 7 m/s² (13…200 Hz), sinewave
		Germ.Loyd	Part 7-3	
	Shock	EN60721-3-3	3M1	max. 50m/s²; 30msec; half sinewave
Contamination		Gas	3C2	
		Particle	3S2	
Specifications During Transport				
Environment	Temperature	60721-3-2	2K3	Range -25 ...70 °C
	Humidity		2K3	(no condensation)
Mechanical	Vibration	Railroad	EN50155	Max. oscillation amplitude 3.5 mm (2…9 Hz) max. acceleration amplitude 15 m/s² (9…200 Hz), sinewave
		Germ.Loyd	Part 7-3	
		EN60721-3-3	2M1	
	Shock	EN60721-3-3	2M1	max. 100m/s²; 11msec; half sinewave
Contamination		Gas	2C2	
		Particle	2S2	
Specifications During Storage				
Environment	Temperature	60721-3-2	1K4	Range -25 ...70 °C
	Humidity		1K3	(no condensation)
Mechanical	Vibration	Railroad	EN50155	Max. oscillation amplitude 1 mm (5…13 Hz) max. acceleration amplitude 7 m/s² (13…200 Hz), sinewave
		Germ.Loyd	Part 7-3	
		EN60721-3-3	1M1	
	Shock	EN60721-3-3	1M1	max. 100m/s²; 11msec; half sinewave
Contamination		Gas	1C2	
		Particle	1S2	
Construction / protection		EN60529	IP20	Chassis
Environment Class		IEC 664-1		Pollution degree 2
Definition According To		EN 61800-3		Inverter Product Standard: EMI
EMI disturbance creation (See instruction manual)				
Conducted disturbance		EN 55011	C3	Level A (Level B optional)
Radiated disturbance		EN55011	C3	Level A
EMI Susceptibility				
	ESD	EN 61000-4-2	8kV	AD (air charge) and CD (contact charge
	Burst - Control wires and bus com.	EN 61000-4-4	2kV	
	Burst - Line supply	EN 61000-4-4	4kV	
	Surge - Line supply	EN 61000-4-5	1 / 2kV	Phase to phase / Phase to ground
	EMF	EN6100-4-3	10 V/m	
Line supply fluctuations; collapse		EN 61000-2-1		+10 %, -15 %; 90 %
Line voltage symmetry / line frequency variation		EN 61000-2-4		3% / 2%

Installation altitude maximum 6,562 ft (2000 m). With installation altitudes over 3280 ft (1000 m) a de-rating of 1 % per 328 ft must be taken into consideration.

⚠ A load disconnection in the DC bus circuit may only occur after the operating status "Standby" is achieved.

3.3 Accessories

Unit size	15	19
Rated voltage	480 V (can also be used at 230V)	
Commutation choke	15.Z1.B05-1000	19.Z1.B05-1000

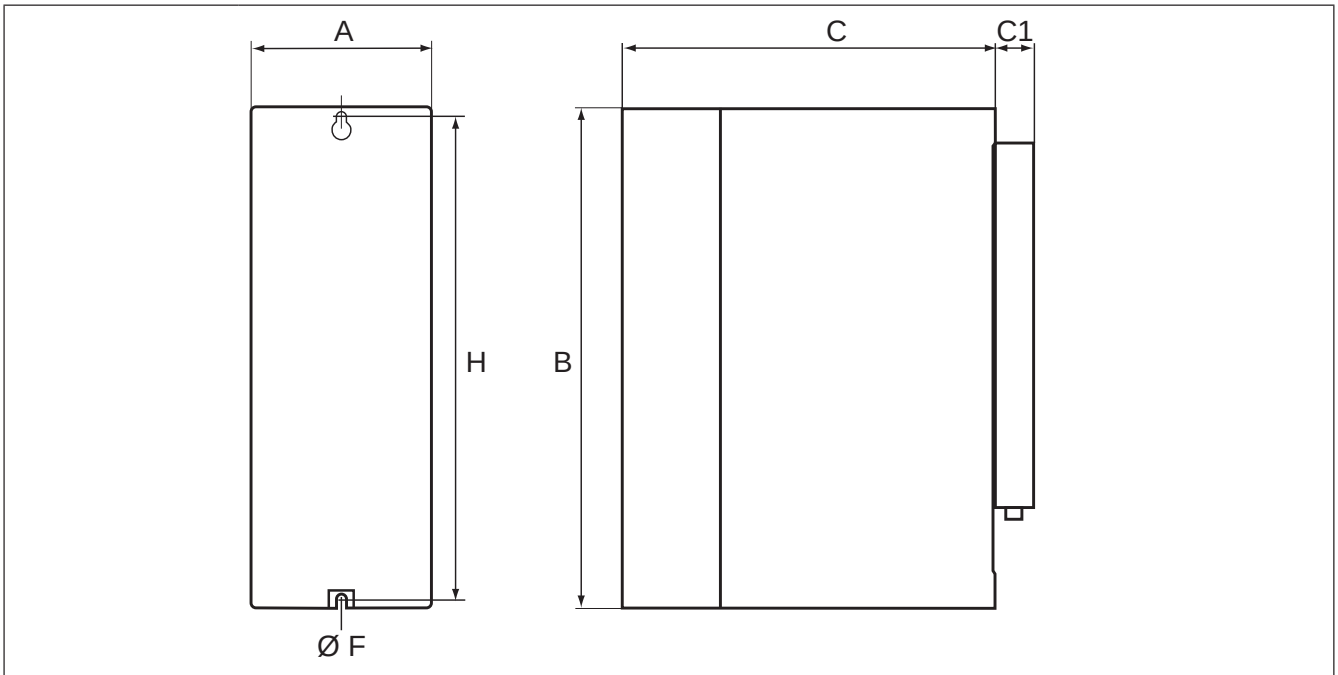
3.4 Options

Unit size	15	19
Line EMI filter	15.R6.T60-1001 according to EN 55011 class A	19.R6.T60-1001 according to EN 55011 class A
Ferrite Rings	See section 3.5.5	See section 3.5.5
Internal DC fuses	600 V / 50 A (part number 00.90.25H-3459)	600 V / 125 A (part number 00.90.25H-3559)
Operators	Digital operator, Serial Interface operator	
Bus operators	CAN, ProfiBus, InterBus, Ethercat, Ethernet, Sercos, ModBus, Devicenet, HSP5	

Harmonic Filter (Sizing Based on Input Current and Line Voltage)	230/208V On request	480V 17Z1C05-1002 19Z1C05-1002 21Z1C05-1002

3.5 Dimensions and weights

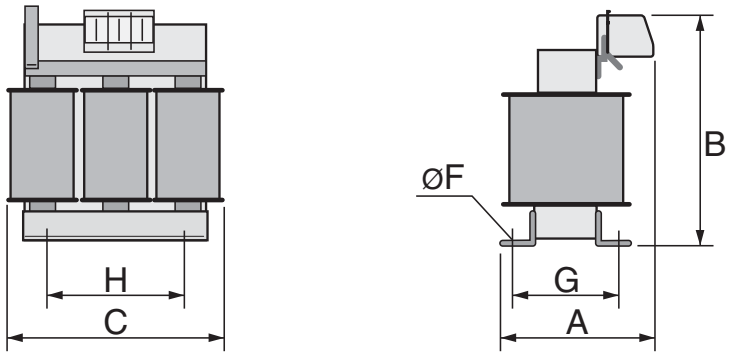
3.5.1 COMBIVERT R6-S



Housing	A	B	C	C1*	F	H	Weight
E	5.12	11.4	8.19	0.55	0.27	10.8	12.4 lb
	Values are in inches						

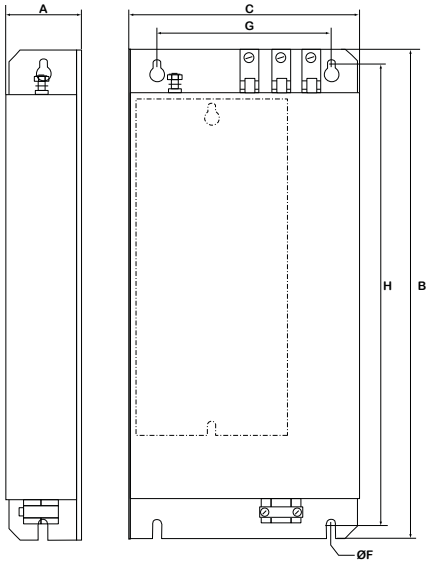
*C1 with operator

3.5.2 Commutation Choke



Part number	A	B	C	F	G	H	Weight
15.Z1.B05-1000	2.95	9.45	7.09	0.21	2.13	6.54	12.4 lb
19.Z1.B05-1000	4.53	11.4	9.57	0.28	3.35	8.86	30.2 lb
	Values are in inches						

3.5.3 HF sub-mount filter



Part number	A	B	C	F	G	H	Weight
15.E4.T60-1000	1.97	13.9	5.14	0.28	3.94	13.0	4.4 lb
19.R6.T60-1001	2.56	16.6	7.80	0.28	5.91	15.6	16.8 lb
	Values are in inches						

3.5.4 Synchronization Cable

Part number	00.F5.0C3-4010
Length	39.4 in (1m)

3.5.5 Ferrite Rings

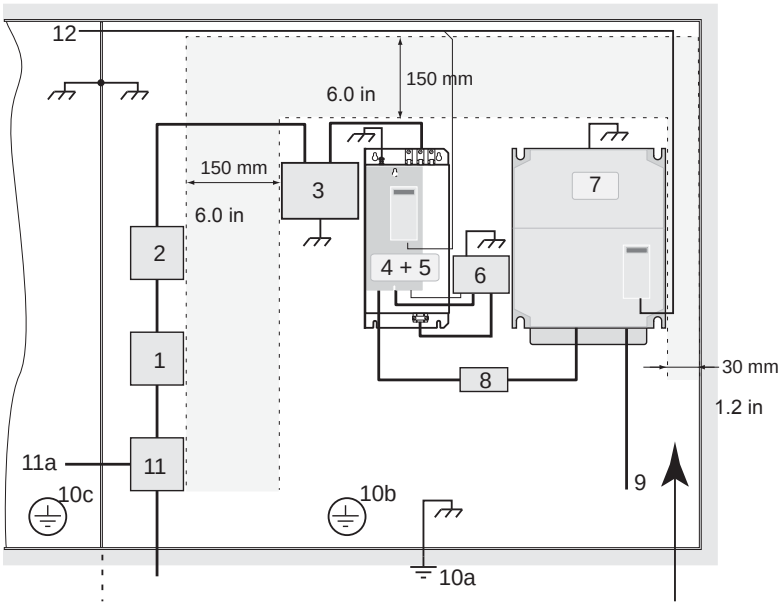
Ferrite rings are required to minimize electrical disturbances on the DC bus connections between the inverter(s) and the COMBIVERT R6 unit. The ferrite rings are to be installed over both the ++ and -- DC bus conductors. Do not use ferrite rings intended for the inverter(s)' motor leads on the DC bus as doing so negates the effect. Do not pass ground conductors through the ferrite rings. The ferrite rings are selected based on the size of the conductor and the inner diameter of the ring.

Part Number	Overall dimensions in mm	Opening cross section in mm
0090390-K000	R56/32/18	29.5

4. Installation

4.1 EMC-compatible control cabinet installation

1	Line fuse
2	Line contactor
3	Harmonic filter
4	COMBIVERT R6
5	HF sub-mounting filter
6	Commutation choke
7	Frequency inverter
8	If necessary, external DC fuses
9	Motor cables
10a	Protective ground on the sub mounting plate power circuit
10b	Protective ground on the mounting plate control circuit
10c	Equal potential bonding with the housing earth
11	Line connection power circuit
11 A	Line connection control circuit
12	Control circuit conductors
⏚	Large area contact on the sub mount plate



Control circuit Power circuit Direction of the cooling fins

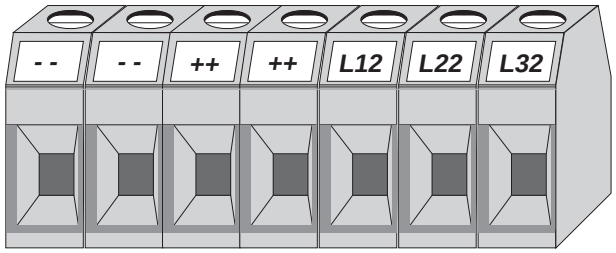
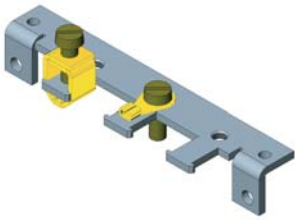
4.2 Installation instructions

- Install and ground the COMBIVERT R6 on a stationary system.
- Mist, water, or other liquids and vapors must not be allowed to permeate the device.
- Allow for sufficient heat dissipation if installed in a dust-proof housing.
- When operating the COMBIVERT in an explosion proof environment, install the unit in an appropriate enclosure in accordance with the local regulations and codes.
- Protect the COMBIVERT against conductive and aggressive gases and liquids.
- The conductors to the commutation choke must be limited to 39 inches (1 m).

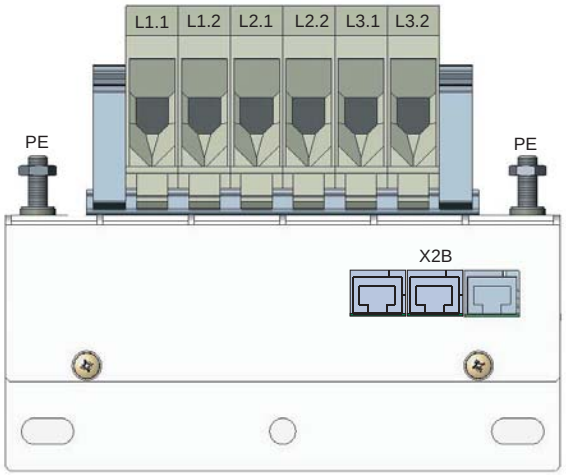
4.3 Connection of the COMBIVERT R6

4.3.1 Connection terminals of the power circuit

⚠	**Pay attention to the input voltage, since both 230 V and 480 V are possible!**

Housing Size E	Name	Function	Permissible line cross section [awg] Size 15	Tightening torque [Nm] Size 15	Tightening torque [Nm] Size 19
	**L12 L22 L32**	3-phase supply input from the commutation choke	#16 to #8	2 to 4	2 to 4
	++ – –	DC voltage input with in rush current limiting	Size 19 #14 to #4		
	**GND,** ⏚	Connections for shielding and grounding occur via the provided copper ground bar and clamps. It must be mounted to the heatsink with the four screws provided. The strain relief and the shielding must be done by the customer.	–	1.3 for philps. screws 6 for cable clamps	

4.3.2 Connection terminals of the commutation choke

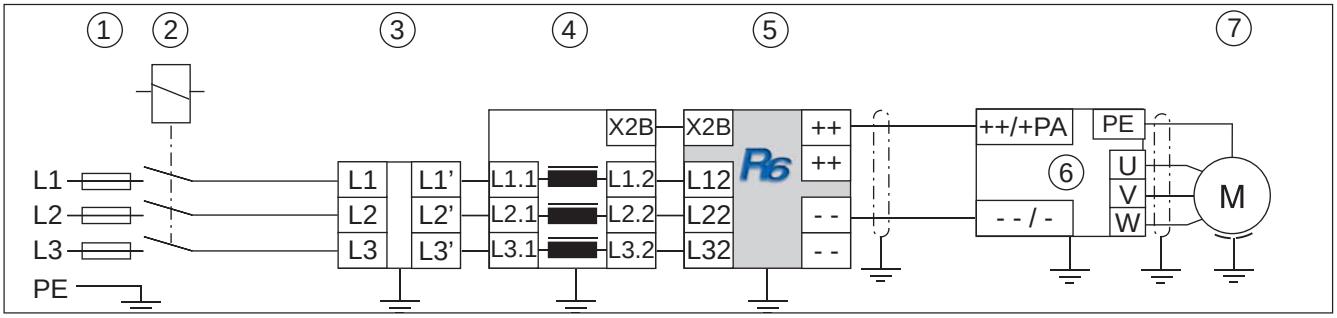
15/19.Z1.B05-1000	Name	Function	Permissible line cross section [awg] Size 15	Tightening torque [Nm] Size 15	Tightening torque [Nm] Size 19
	**L1.1 L2.1 L3.1**	3-phase line connections	#14 to #6	2 to 4	6 to 8
	L1.2 L2.2 L3.2	Output to COMBIVERT R6-S	Size 19 #12 to #2		
	X2B	see below	-	-	
	PE	Connection for shielding / ground	–	6	

4.4 Connection power circuit R6-S with internal fuses

4.4.1 Points for General Consideration

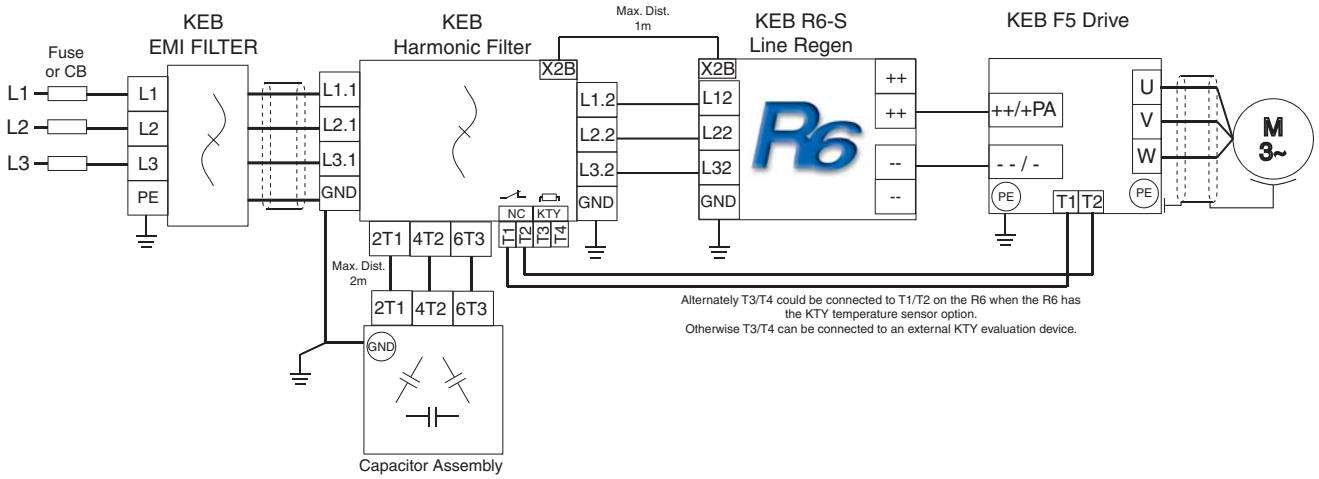
Always use UL listed and CSA approved wire. Use 60/75°C copper conductors only. Use minimum 300V rated wire with 230V systems and minimum 600V rated wire with 480V systems.
Suitable for use on a circuit capable of delivering not more than 10000 rms symmetrical amperes, 240 or 480 volts maximum when protected by fuses as listed in table 3.1.

4.4.2.1 Wiring Scheme 'A' with Single Regen Unit

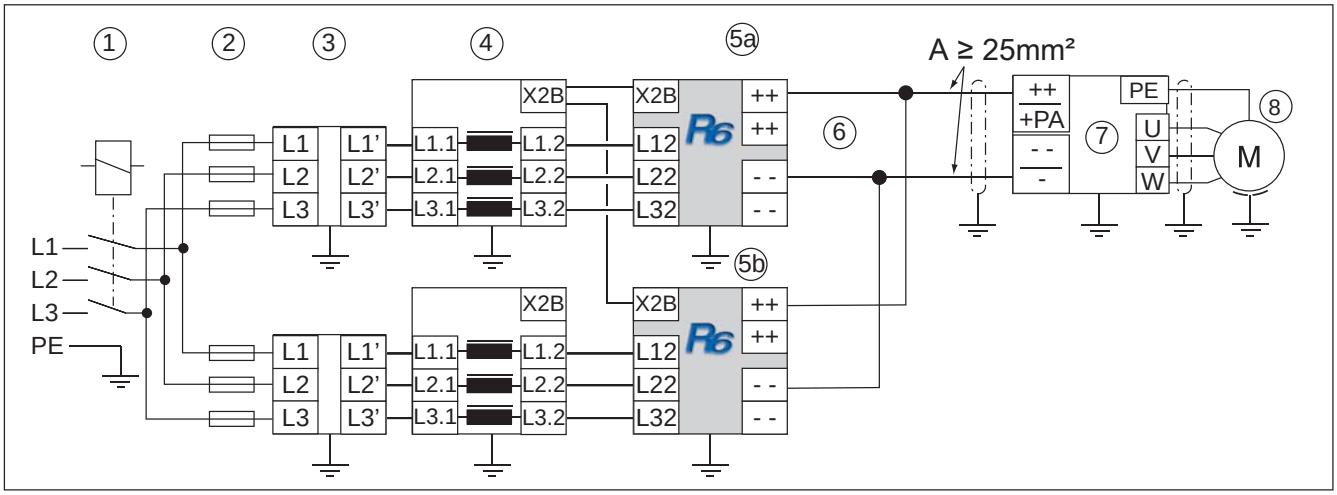


1	Line fuse UL Class J [1)]	5	COMBIVERT R6-S		
2	Main Line contactor	6	Frequency Inverter		
3	HF filter (optional)	7	Motor		
4	Commutation Choke or Harmonic Filter *(with synchronization connection)*				
1)	*KEB recommends using fast acting class J fuses only (ex. Bussman type JKS). For applications with KEB Harmonic Filters and an isolation transformer, a high speed class J fuse must be used (only Ferraz type HSJ is approved).*				

4.4.2.2 Wiring Scheme 'A' with Single Regen Unit and Harmonic Filter



4.4.3 Wiring Scheme 'A' with Parallel Regen Units



1	Main Line contactor	5	COMBIVERT R6-S		
2	Line fuse UL class J [1]	6	External terminal block [2]		
3	HF filter (optional)	7	Frequency inverter		
4	Commutation Choke or Harmonic Filter *(with synchronization connection)* [3] [4]	8	Motor		

1) KEB recommends using fast acting class J fuses only (ex. Bussman type JKS). For applications with KEB Harmonic Filters and an isolation transformer, a high speed class J fuse must be used (only Ferraz type HSJ is approved).

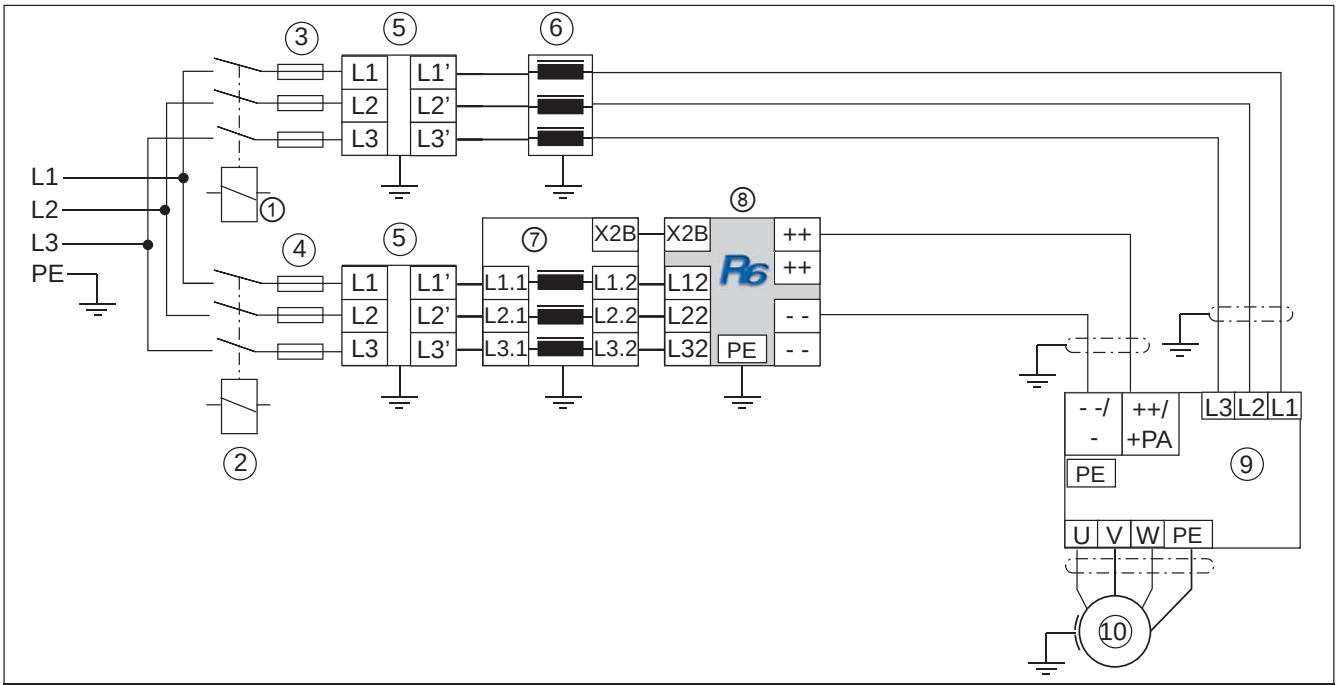
2) If the inverter current is greater than the current of one COMBIVERT R6, the DC bus conductors from the inverter must be connected to an external terminal block to split the current to multiple R6 units. In this case the conductors to each R6 unit must be at least 6 AWG (10 AWG for the size 15R6) or larger based on the DC bus current to each unit.

3) Due to tolerances in the inductance values of the commutation choke or harmonic filter, the actual available power of each R6 unit must be reduced by 15% to account for unequal load sharing. Therefore the total power available is reduced. With parallel connection of different sized R6 units, it is necessary to use the same commutation choke or harmonic filter in order to maintain the same short circuit voltage (uK) across the chokes.

4) The regen CAT5 synch cables must plug into the same synchronization module. It does not matter which X2B ports are used on the module.

Sizings with harmonic filters must utilize Wiring Scheme A (Sections 4.4.2 and 4.4.3) and should only be used in combination with harmonic filters from KEB.

4.4.4 Wiring Scheme 'B' with Single Regen Unit



1	Main line contactor	6	Inverter line choke [2) 4)]		
2	Regen contactor [3)]	7	Commutation choke [2) 4)]		
3	Inverter line fuse UL class J [1)]	8	COMBIVERT R6-S		
4	Regen line fuse UL class J [1)]	9	Frequency Inverter		
5	HF filter (optional)	10	Motor		

1) KEB recommends using fast acting class J fuses only (ex. Bussman type JKS). For applications with KEB Harmonic Filters and an isolation transformer, a high speed class J fuse must be used (only Ferraz type HSJ is approved).

2) Current sharing between the R6-S and the frequency inverter must be taken into consideration during motor (supply) operation. The current sharing is dependent on the uk value (voltage drop across the choke) and the nominal current of the line choke (see formula below). If too much current flows through the R6 unit, a second R6 unit should be used in parallel with the first.

3) The regenerative contactor may only be closed if the pre-charging of the DC bus circuit of the inverter is completed. A relay output on the R6 unit can provide the control for this contactor. See Section 4.5.1.

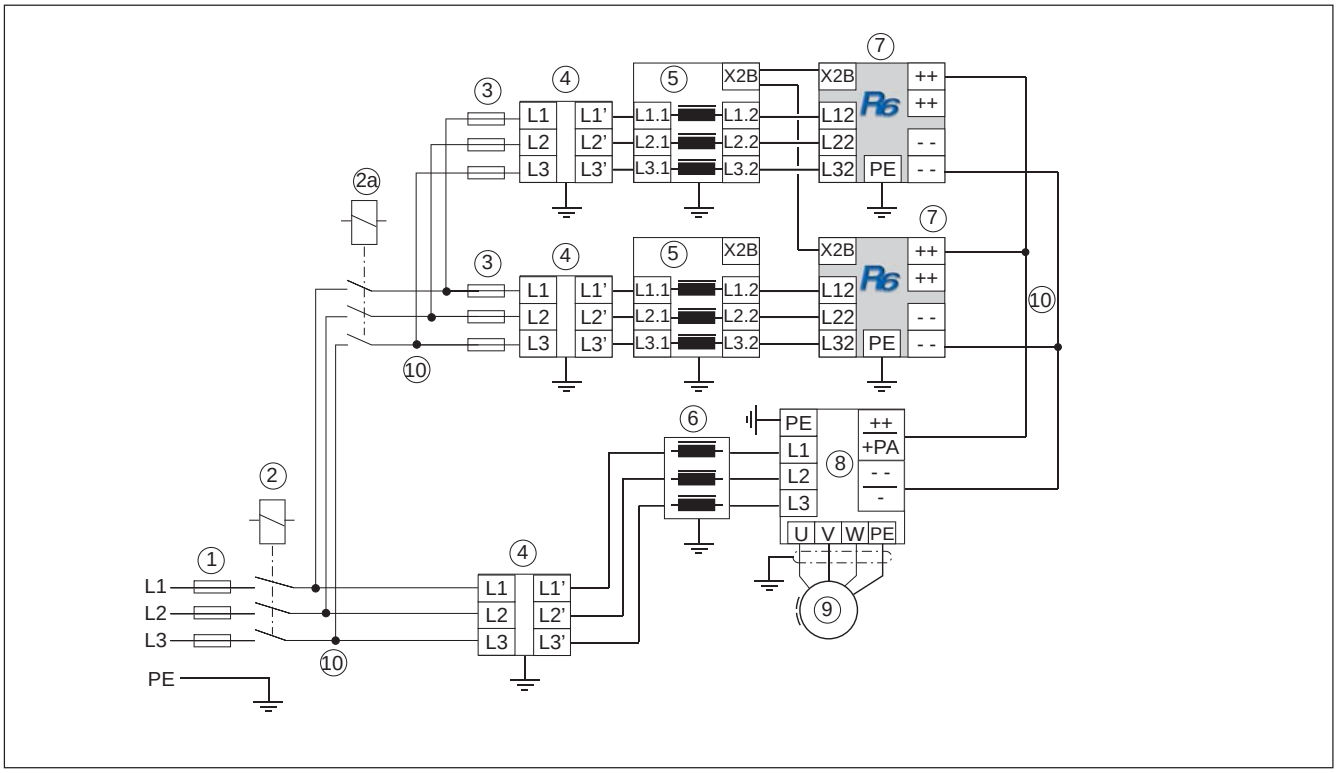
⚠

4) A line choke with minimum Uk=3 % is required for all inverters equal to or greater than size 23 for 480V units or size 20 for 230v units. Additionally a line choke is also recommended in general to minimize circle current which can flow between the R6 unit and the frequency inverter during regen operation. This circle current can reduce the available capacity of the R6 unit by 10-25% depending on the value of the choke connected to the inverter and the commutation choke.

Wiring Scheme B should only be utilized with R- and U-Housing F5 Elevator Drives. The drive housing is indicated in the part number's seventh digit (e.g. xx.F5.A1H-xxxx, xx.F5.A1R-xxxx, xx.F5.A1U-xxxx).

Sizings with harmonic filters must utilize Wiring Scheme A (Sections 4.4.2 and 4.4.3) and should only be used in combination with harmonic filters from KEB.

4.4.5 Wiring Scheme 'B' with Parallel Regen Units



1	Main line fuse UL class J [1]	5	Commutation choke [2] [4] [7]	9	Motor
2	Main line contactor	6	Inverter line choke [2] [4]	10	External terminal block [5]
2a	Regen contactor [2]	7	COMBIVERT R6-S [6]		
3	Regen line fuse UL class J [1]	8	Frequency Inverter		
4	HF filter (optional)				

1) KEB recommends using fast acting class J fuses only (ex. Bussman type JKS). For applications with KEB Harmonic Filters and an isolation transformer, a high speed class J fuse must be used (only Ferraz type HSJ is approved).

2) Current sharing between the R6-S and the frequency inverter must be taken into consideration during motor (supply) operation. The current sharing is dependent on the uk value (voltage drop across the choke) and the nominal current of the line choke. If too much current flows through the R6 unit, a second R6 unit should be used in parallel with the first.

3) The regenerative contactor may only be closed if the pre-charging of the DC bus circuit of the inverter is completed. A relay output on the R6 unit can provide the control for this contactor. See Section 4.5.1.

4) A line choke with minimum Uk=3% is required for all inverters equal to or greater than size 23. Additionally a line choke is also recommended in general to minimize circle current which can flow between the R6 unit and the frequency inverter during regen operation. This circle current can reduce the available capacity of the R6 unit by 10-25% depending on the value of the choke connected to the inverter and the commutation choke.

5) If the inverter current is greater than the current of one COMBIVERT R6, the DC bus conductors from the inverter must be connected to an external terminal block to split the current to multiple R6 units. In this case the conductors to each R6 unit must be at least 6 AWG (10 AWG for the size 15R6) or larger based on the DC bus current to each unit.

6) Due to tolerances in the inductance values of the regen choke, the actual available power of each R6 unit must be reduced by 15% to account for unequal load sharing. Therefore the total power available is reduced. With parallel connection of different sized R6 units, it is necessary to use the same choke in order to maintain the same short circuit voltage (uK) across the chokes.

7) The regen CAT5 synch cables must plug into the same synchronization module. It does not matter which X2B ports are used on the module.

Wiring Scheme B should only be utilized with R- and U-Housing F5 Elevator Drives. The drive housing is indicated in the part number's seventh digit (e.g. xx.F5.A1H-xxxx, xx.F5.A1R-xxxx, xx.F5.A1U-xxxx).

Sizings with harmonic filters must utilize Wiring Scheme A (Sections 4.4.2 and 4.4.3) and should only be used in combination with harmonic filters from KEB.

4.4.6 Sizing for Wiring Scheme A

Below is regen system sizing for Wiring Scheme A (Sections 4.4.2.1, 4.4.2.2, and 4.4.3) by horsepower according to line voltage, motor type, and whether a commutation choke or harmonic filter is used in conjunction with the R6 unit.

KEB R6 regen units may be used with third-party drives. When sizing a KEB R6 regen unit, it may be necessary to know the DC bus capacitance of the drive for proper regen sizing. The drive DC bus capacitance should not exceed the max. permissable DC bus capacitance of the R6 unit, according the Technical Data Section 3.1. The max. permissible DC bus capacitance for mulitple R6 regen units in parallel is added (e.g. the max. permissible DC bus capacitance of a drive for a single R6 unit is 5,000 uf for 480V operation or 21,500 uf for 230V operation, whereas the max. permissible DC bus capacitance of a drive when two R6 units in parallel is 10,000 uf for 480V operation or 43,000 uf for 230V operation).

The maximum suggested number of regen units in parallel is three. For larger sizings, it may be possible to utilize Wiring Scheme B (Sections 4.4.4 and 4.4.5) or a larger regen size. Contact KEB applications engineering.

Sizings with harmonic filters must utilize Wiring Scheme A (Sections 4.4.2 and 4.4.3) and should only be used in combination with harmonic filters from KEB.

Filter Type: Commutation Choke

Motor Type	Induction Geared	Permanent Magnet Gearless	
Line Voltage	Motor HP		R6 Size
208 / 230	0 - 7.5	0 - 6.5	15
	7.5 - 20	6.5 - 18	19
	20 - 30	18 - 36	2x19
	30 +	36 +	3x19
460 / 480	0 - 15	0 - 15	15
	15 - 40	15 - 40	19
	40 - 75	40 - 80	2x19
	75 +	80 +	3x19

Filter Type: Harmonic Filter

Motor Type	Induction Geared	Permanent Magnet Gearless	
Line Voltage	Motor HP		R6 Size
208 / 230	0 - 7.5	0 - 7	15
	7.5 - 20	7 - 20	19
	20 - 40	20 - 40	2x19
	40 +	40 +	3x19
460 / 480	0 - 15	0 - 16.5	15
	15 - 40	16.5 - 45	19
	40 - 75	45 - 90	2x19
	75 +	90 +	3x19

*Consult KEB applications engineering for Wiring Scheme B or larger sizing.

4.4.7 Sizing F5 DC Bus Capacitances

230 V units		480 V units	
Size	DC Bus Capacity (uF)	Size	DC Bus Capacity (uF)
13F5A1E-PLx2, B	3,280	13F5A1E-RLx2, B	705
14F5A1E-PLx2, B	4,100	14F5A1E-RLx2, B	820
14F5A1G-PLx2, B	3,280		
15F5A1G-PLx2, B	4,000	15F5A1E-RLx2, B	1,230
15F5A1G-PLx3, D	4,000	15F5A1G-RLx2, B	880
16F5A1H-PLx2, B	5,400	16F5A1G-RLx2, B	1,230
17F5A1H-PLx2, B	8,800	17F5A1G-RLx2, B	1,500
17F5A1H-PLx3, D	8,800	17F5A1H-RLx2, B	1,800
		18F5A1H-RLx2, B	1.800
19F5A1R-PLx2, B	15,600	19F5A1H-RLx2, B	2,700
19F5A1R-PLx3, D	15,600		
20F5A1R-PLx2, B	16,500	20F5A1H-RLx2, B	3,600
21F5A1R-PLx2, B	19,800		
23F5A1U-PLx2, B	33,600	22F5A1R-RLx2, B	4,950
		22F5A1R-RLx3, D	4,950
		23F5A1U-RLx2, B	8,250
		24F5A1U-RLx2, B	8,250
		26F5A1U-RLx2, B	14,100
		26F5A1U-RLx3, D	14,100
		28F5A1W-RLx2, B	19,800

4.5 Control connections

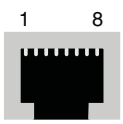
4.5.1 Assignment of the control terminal strip X2A

X2A

Tightening torque 0.5 Nm

PIN	Function	Name	Description	Specifications
10	24…30 V input	Vin	External supply of the control board	
11	Common	COM	Reference potential	
12	Enable	ST	Enables the unit for operation	R_{in}: 4.4 kΩ
13	Reset	I1	Resets at the falling edge of a pulse	
14	Programmable Input	I2	Prog. function for advanced use	
15	External Fault	I3	Prog. function for advanced use (E.EF)	
16	Digital in-/output	I/O	Active signal (connection for all R6 at parallel operation in master - slave applications)	
17	24 V-output	Vout	Voltage supply for in- and outputs	24 V +/-1 / max. 100 mA
18	Common	COM	Reference potential	
19	Digital output 1	O1	Transistor output	I_{max}: 25 mA
20	Ready (No fault)	O2	Transistor output	I_{max}: 25 mA
21	Analog output	ANOUT	-	0…±10 V / max. 5 mA
22	24 V-output	Vout	see terminal 17	
23	Mass	COM	Reference potential	
24	Relay 1 / NO contact	RLA	Relay output (RDY - Ready no Fault)	30 V DC 0.01…2 A 125VAC 0.01...2 A
25	Relay 1 / NC contact	RLB		
26	Relay 1 / switching contact	RLC		
27	Relay 2 / NO contact	FLA	Relay output (CCC - Charge Contactor Control)	
28	Relay 2 / NC contact	FLB		
29	Relay 2 / switching contact	FLC		

4.5.2 Assignment of socket X2B

RJ45 socket for phase synchronization and temperature sensor	No.	Name	Function
	1	t1	Connection for temperature sensor
	2	t2	
	3	U13_syn	Synchronization phase 1 / 3
	4	–	reserved
	5	U21_syn	Synchronization phase 2 / 1
	6	–	reserved
	7	U32_syn	Synchronization phase 3 / 2
	8	–	reserved

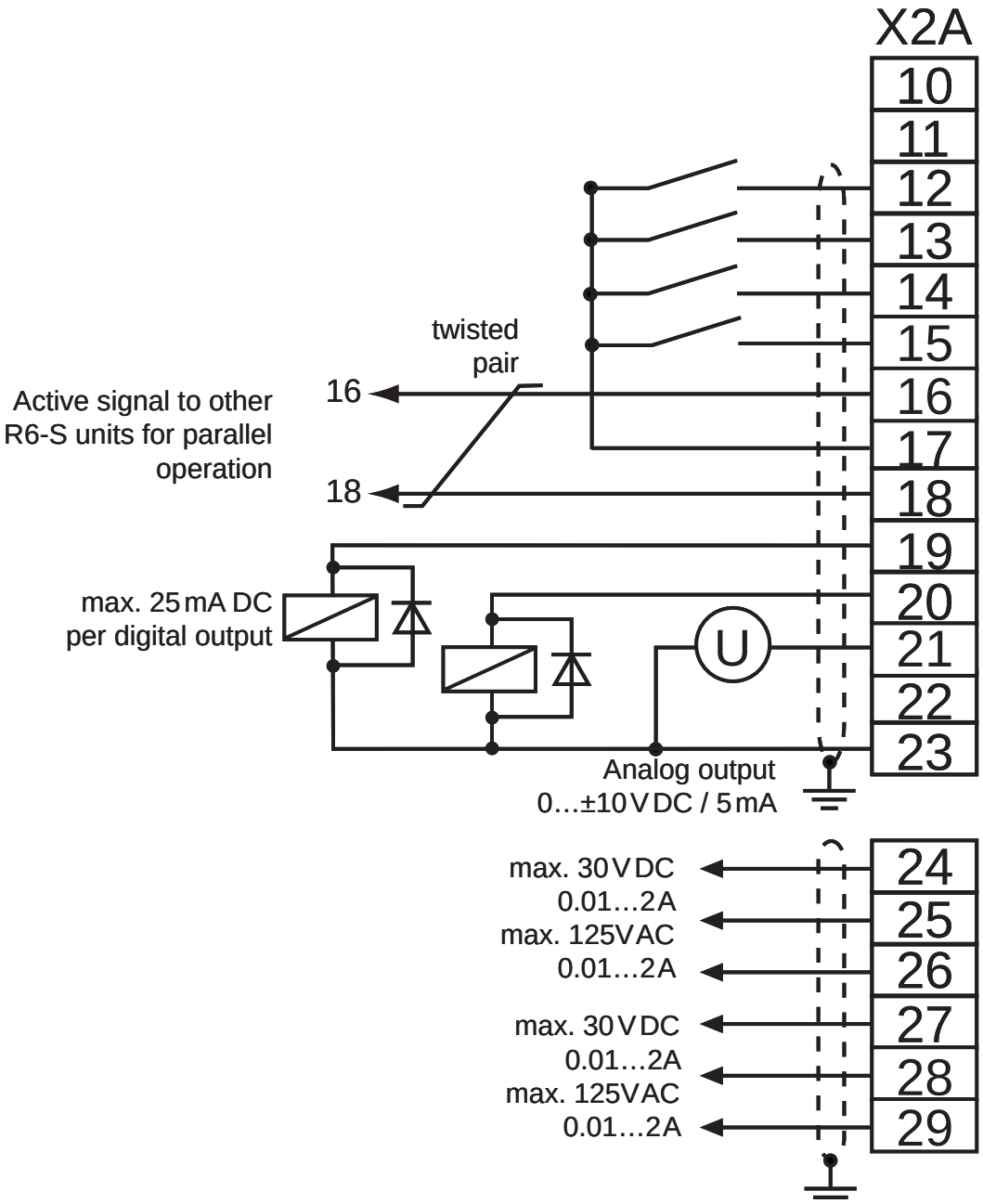
The connection is made with a shielded industrial ethernet patch cable 1:1 with the socket X2B on the commutation choke.

4.5.3 Wiring example

In order to prevent malfunctions caused by interference voltages on the control inputs, the following points should be observed:

EMC

- Use shielded / twisted control cables
- Connect the shield on the end connected to the inverter using the grounding bar
- Install control and power cable separately (about 6-8 inches (15...20 cm) apart) control conductors should cross high voltage power conductors at right angles

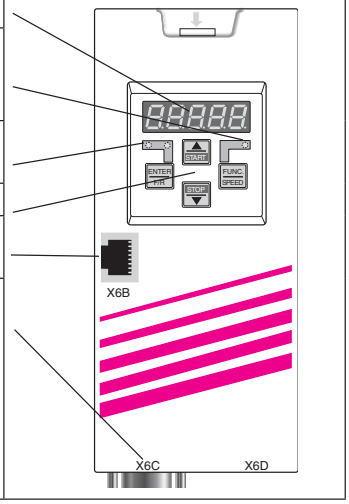


4.6 Operator

As an accessory, a keypad operator can be installed. A digital operator (00.F5.060-1000) is provided with every regen unit. To prevent malfunctions, the COMBIVERT must be brought into nOP status before connecting or disconnecting the operator (de-activate the enable input). When starting the COMBIVERT R6, it is started with the last stored values or factory settings regardless of whether the operator is installed or not.

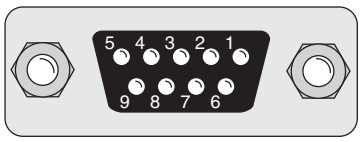
Do not place KEB F5 Elevator Drive Keypad on R6, it is not compatible and will display E.CArd.

Digital operator (part number 00.F5.060-1100)	Serial Interface operator (part number 00.F5.060-2000)	
x	x	5-digit LED Display
x	x	Operating-/Error display Normal "LED on" Error "LED blinks"
-	x	Interface control Transmit "LED on"
x	x	Double function keyboard
-	x	X6B HSP5 programming and diagnostic interface
-	x	X6C RS232/RS485



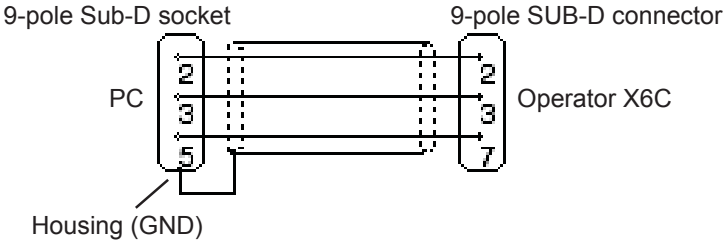
Do not connect a PC to the operator interface connector on the COMBIVERT R6 unit! Damage to the PC may result. Direct connection, PC to the COMBIVERT R6 is only possible with a special cable HSP5 cable (part number 00.F5.0C0-0010) or USB Converter Cable (part number 00.58.060-0020)

X6C



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=10 mA)
7	C/C‘	DGND	Data reference potential
8	A	TxD-A	Transmission signal A RS485
9	B	TxD-B	Transmission signal B RS485

RS 232 cable
Part number
00.58.025-001D
Length 3 m



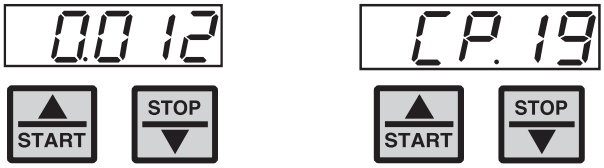
5. Operation of the Unit

5.1 Keyboard

When switching on the KEB COMBIVERT R6-S the value of parameter CP.1 appears.

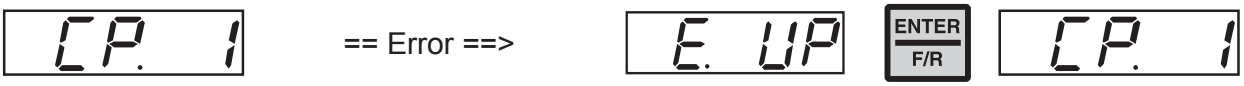
The function key (FUNC) changes between the parameter value and parameter number.

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



Generally, changes to parameter values are immediately accepted and stored non-volatile. However, with some parameters, due to their functionality, the adjusted value is not accepted immediately. With these parameters (see parameter overview) the adjusted value is accepted and stored non-volatile by pressing ENTER.

If an error occurs during operation, then the actual display is overwritten by the error message. The error message in the display is reset by ENTER.



With ENTER only the error message in the display is reset. The status display (CP.3) still displays the error. In order to reset the error itself, the cause must be corrected and a power-on reset must be made. Note: The R6 unit will attempt to reset errors on its own based on the auto reset parameter.

5.2 Operation with PC and programming software COMBIVIS

Instructions for the installation and operation of the programming software COMBIVIS are provided with the software.

5.3 Turn-on and operation procedure

The COMBIVERT R6-S is initialized after connection of the main line supply. The power circuit identification is checked first. If an invalid power circuit is recognized, error "E.PuCi" (power unit check) is triggered and displayed in the operator. This error cannot be reset, the power circuit must be checked.
If a valid power circuit is recognized, COMBIVERT R6-S changes into status "SYn". The following procedures take place one after another during this synchronization phase:

- Verification of correct synchronization to the line, (error "E.nEt" is triggered, if the synchronization signals are missing)
- Verification of the phasing of the synchronization signals to the main line phases. Error "E.SYn" is triggered if a phase signal is missing or in case the phasing is not correct.
- The actual line frequency is determined.

The unit is now ready for operation. If the enable (terminal X2A.12) is activated, the COMBIVERT R6-S is put into operation. Depending on the actual value of the DC bus voltage, the COMBIVERT R6-S is in status "rEgEn" or "Stb".

Status "Stb"

COMBIVERT R6-S detects the idle voltage level in the DC bus circuit of the connected frequency inverter (motor operation) and keeps the modulation signals of the regen unit deactivated.

Status "rEgEn"

If the DC bus voltage rises above 103% of the idle voltage (CP.9), the modulation signals are activated and the unit changes into regen operation. Alternately, if another R6 unit connected in parallel switches into "rEgEn" mode, the slave unit will immediately switch into regen mode simultaneously (master/slave operation of parallel units).

5.4 Parameter summary

The CP parameters serve as the base level parameters to adjust and monitor operation of the COMBIVERT R6 unit.

Display	Parameter	Setting range	Resolution	Factory
CP.0	Password input	0…9999	1	–
CP.1	Status display	–	–	Read Only
CP.2	Main Line Frequency	–	0.1 Hz	Read Only
CP.3	AC-Phase current L1	–	0.1 A	Read Only
CP.4	AC-Phase current L2	–	0.1 A	Read Only
CP.5	AC-Phase current L3	–	0.1 A	Read Only
CP.6	Actual Load	–	1 %	Read Only
CP.7	Actual Load / peak value	–	1 %	Read Only
CP.8	DC output current	–	0.1 A	Read Only
CP.9	Actual DC voltage	–	1 V	Read Only
CP.10	DC voltage / peak value	–	1 V	Read Only
CP.11	Heat sink temperature	–	1 °C	Read Only
CP.12	Over load counter	–	1 %	Read Only
CP.13	Active power	–	0.1 kW	Read Only
CP.17	Apparent power / Line input	–	0.1 kVA	Read Only
CP.18	Analog output 1 / amplification factor	-20.00…20.00	0.01	1.00
CP.19	DC bus switching level	+/-30000.00	0.01	580.00
CP.20	Auto error reset counter	0...10	1	3
CP.21	Last Error	-	-	Read Only
CP.22	Last Error 1	-	-	Read Only
CP.23	Last Error 2	-	-	Read Only
CP.24	Last Error 3	-	-	Read Only
CP.25	Last Error 4	-	-	Read Only
CP.26	Last Error 5	-	-	Read Only
CP.27	Last Error 6	-	-	Read Only
CP.28	Last Error 7	-	-	Read Only
CP.29	Software version	-	-	1.4
CP.30	Software date code	DDMM.Y	-	Read Only
CP.32	Pulse off level	-100kW...0.0kW	0.1kW	-0.8kW
CP.33	Operating mode	0...3	1	0
CP.34	Control angle	0.0...60.0	0.1	22.0 (20.0)
CP.35	Input Type	PNP or NPN	-	PNP

() Values in parenthesis correspond to size 15 R6.

5.5 Parameter description

The following parameters allow the user to monitor the functionality during operation.

CP.01 Status display

The status display shows the actual operating mode of the COMBIVERT R6. Refer to Section 6.0 for additional descriptions and troubleshooting faults.

CP.02 Actual line frequency

After switching on, the actual line frequency is determined during the initialization phase. Slowly, changes of the line frequency during operation are recognized and displayed in CP.02. CP.02 displays the actual regenerative frequency, if the COMBIVERT R6-S is in "netof" state, i.e. the main line is off. The rotating field of the mains frequency is displayed as follows: (+) right, (-) left

This value should be positive. If the value is negative the R6 unit will get an E.Sync error- swap L1.1 and L2.1 legs of the incoming line at the commutation choke to make the frequency positive.

CP.03 AC-Phase current L1

CP.03 displays the rms value of the current of phase L1 in amperes.

CP.04 AC-Phase current L2

CP.04 displays the rms value of the current of phase L2 in amperes.

CP.05 AC-Phase current L3

CP.05 displays the rms value of the current of phase L3 in amperes.

CP.06 Actual Load

Parameter CP.06 displays the actual load of the COMBIVERT R6-S in percent. 100 % represents an output current, which corresponds to the rated current of the COMBIVERT R6-S. The absolute value of the load is displayed. The sign indicates the energy direction: (+) = supply, (-) = feedback

CP.07 Actual Load / peak value

Parameter CP.07 stores the peak load value within an operating cycle. The highest value of CP.06 is stored in CP.07. The peak value can be cleared by pressing the UP and DOWN key or over bus by writing any value you like to the address of CP.07. Switching off COMBIVERT R6-S also clears the stored value.

CP.08 DC output current

Display of the actual DC current in amperes.

CP.09 Actual DC - voltage

Display of actual DC-Bus voltage in volts. The value is measured at the terminals "++" and "- -" of the COMBIVERT R6-S.

CP.10 Actual DC - voltage / peak value

Parameter CP.10 allows the user to recognize short-term peak values within an operating cycle. The highest value of CP.09 is stored in CP.10. The peak value can be cleared by pressing the UP and DOWN key or over bus by writing any value you like to the address of CP.10. Switching off COMBIVERT R6-S also clears the stored value.

CP.11 Heat sink temperature

Display of the actual heat sink temperature in °C. First a pre-warning can be given via digital output if the heat sink temperature is too high, so a controlled deceleration of the unit is possible. The modulation is shut off and the unit de-activated when reaching the max. heat sink temperature, if there is no reaction to the pre-warning.

CP.12 Over load counter

The average load of the COMBIVERT R6-S can be evaluated with this parameter in order to avoid an E.OL error (time based overload). When the actual load goes above 105%, the counter begins to increment. The Error E.OL is triggered, if the overload counter reaches 100 %.

CP.13 Active power

CP.13 displays the actual active power of the COMBIVERT R6-S. Motor power is displayed with positive values, generated power is displayed with negative values.

CP.17 Apparent power / Line input

Display of the actual apparent power at the mains input (kVA).

CP.18 Analog output 1 / amplification factor

This serves as a gain for the analog output 1. This output provides a signal in a range of 0...10 VDC = 0...150 % I_{DC} which corresponds to the DC-bus current. The gain can be adjusted with CP.18 in a range of 0...±20,00. With this parameter, the analog output signal can be adapted to individual requirements.

CP.19 DC Bus switching level

This sets a voltage threshold for the switching of the relay output R2, which is programmed to control the line contactor when Wiring Scheme B is utilized (Section 4.4.4 or 4.4.5). During power on, when the DC bus voltage rises above this value and the internal charging contactor of the R6 unit is closed, then the output is activated. This allows the drive and regen unit to precharge and power up together. If the line supply drops below this value during power off or during operation due to line sag and/or DC bus sag under (motoric) load, then the output controlling the line contactor would deactivate, causing the line contactor to open; if this occurs, the input line phases would not be detected by the commutation choke synchronization module, causing an E.net fault. Nominal and minimum settings based on line supply voltage are as follows:

Line Voltage - VAC	CP.19 VDC Bus Switching Level Nominal	CP.19 VDC Bus Switching Level Minimum
460	580	570
400-415	500	450
230	280	266
208	250	240

Setting this value too low when Wiring Scheme B is utilized (Section 4.4.4 or 4.4.5), or not utilizing the line contactor control for power up of the units may cause damage.

CP.20 Auto reset counter

This parameter can be used to activate an auto reset counter to reset errors. Attention, an auto restart could allow the system to resume operation at any time! Protective measures must be implemented for service personel and machine operation to prevent injury or damage.

A value of 0 means no automatic reset. Errors can only be reset via the terminal strip or power cycle. Values of 1…10 determine the maximum number of times per hour the unit will auto reset an error. If the number of errors exceeds this value, the unit will stop with the last error. Reset will then only be possible via the terminal strip.

CP.21...28 Last error(s)

The parameters CP.21...28 display the last eight triggered errors with the exception of "Under voltage" E.UP which is not stored. The oldest error is found in CP.28. When a new error occurs, the error message is stored in CP.21. All previous error messages are shifted by one to the next parameter. The oldest error in CP.28 is lost. The meaning of the error codes can be found in Section 6.1.2.

Same, subsequent errors are not uniquely logged. For example if the series of fault messages occurred was E.nEt, E.nEt, E.OC, then the fault log would read CP.21 = E.nEt, CP.22 = E.OC and NOT CP.21 = E.nEt, CP.22 = E.nEt, CP.23 = E.OC.

The error log cannot be cleared, although jumpering X2A.15 and X2A.17 (if CP.35 = PNP, else if NPN, then X2A.15 and X2A.18) will force an E.EF fault. This can be used to determine if any subsequent errors are the same as the fault prior to forcing E.EF or whether a new fault is occurring.

CP.29 Software version

This parameter displays the software version. Example: Version 1.4 = 1.40

CP.30 Software date code

This parameter displays the software compile date in the format DDMM.Y. Example: 0109.8

CP.32 Pulse off level

This determines the reverse power level required to switch out of regen mode and back into stand-by mode. The adjustment is in kW.

CP.33 Operating mode

Determines the operating mode of the unit. When more than one unit is connected in parallel it is necessary to set one unit as the master and the remaining unit(s) as slave(s).

0: Master with commutation choke
1: Master with harmonic filter
2: Slave with commutation choke
3: Slave with harmonic filter

CP.34 Control angle

This parameter adjusts the conduction angle during regen mode. By lowering this value, the audible sound from the commutation choke can be reduced.

For the Size 19 unit: The default value is 22.0 degrees if using a commutation choke or 29.0 degrees if using a harmonic filter. The typical adjustment range is 20.0-30.0 degrees with the choke and 28.0-33.0 degrees with the harmonic filter. Values lower than 20.0 degrees with the choke may begin to limit the available regen power. Values higher than 36.0 and lower than 27.0 with the filter can result in random E.OC errors.

For the Size 15 unit: This unit has a default value of 20.0 degrees with the commutation choke and 29.0 degrees with harmonic filter.

CP.35 Input Type

This parameter adjusts the inputs for the type of signals; PNP (sourcing) or NPN (sinking).

6. Diagnosis and Troubleshooting

6.1 Status Display: Status and Error Messages

6.1.1 Status Messages

The following are status messages for CP.1:

Status Messages	
rEgEn	Regen active (regeneration operation)
bbL	base-block time, Unit is blocked from operation for a short period - precedes all errors.
noP	"no Operation" the enable input is not activated, output modulation switched off
nEtoF	Line power failure; Regen operation mode is possible
Stb	The unit is enabled but in stand-by operation (motoric operation)
SYn	Phase synchronization mode, checks connection and phase angle of the line voltage

6.1.2 Error Messages

The following are error messages for CP.1:

Error Messages	
E.dOH	Error: Over temperature commutation choke; temperature sensing on the commutation choke is indicating the choke is too hot and the overheat delay timer has run out.
E. EF	Error: External Fault, error trigger by an external device through one of the digital inputs
E. FnEt	Error: Main Line Frequency out of tolerance.
E.LSF	Error: Load-shunt relay has not picked up, occurs for a short time during the switch-on phase, but will automatically reset immediately.
E.nEt	Error: Line, one or more phases are missing
E.nOH	Error: NO Over Heat, over-temperature condition not present (E.OH error can be reset)
E.nOL	Error: NO Over load, cooling period after E.OL is over, error can now be reset
E. OC	Error: Over current, output current too high or ground fault
E. OH	Error: Over temperature, overheating of the heat sink (see "technical data")
E.OHI	Error: R6 Unit interior temperature too high, temperature in the interior > 95 °C
E. OL	Error: Over Load, the actual load was greater than 105% and the overload timer timed out.
E. OP	Error: Over Voltage, DC bus voltage is too high, > 900VDC
E.PuCi	Power unit identification is invalid
E.Puch	Power unit change.
E.SYn	Error: Synchronization, connection of line phases at the commutation choke is not correct
E. UP	Error: Under voltage, DC bus voltage too low
E.PUIN	Error: Synchronization module
E.PFd	Error: Power Flicker Detection
E.PU	Error: General power circuit error

6.2 Troubleshooting

6.2.1 Troubleshooting Error Messages

Fault	Cause	Solution
E.Syn	**Line frequency calculated incorrectly**	Exchange two line input phases such that the main line frequency in CP.2 does not read negative. This can be done by swapping L1.1 and L2.1 at the commutation choke.
	Crossed synchronization connections	Ensure connection of the synchronization cable from commutation choke RJ45 connection to X2B on the R6.
	Bad synchronization cable connection	If the commutation choke has multiple RJ45 connection ports, try using a different port (any should work).
	Bad synchronization cable	Replace synchronization cable. A standard CAT5 can be used.
	Bad synchronization module	Replace commutation choke or harmonic filter.
	Synchronization cable too long	The synchronization cable between R6 and commutation choke should not exceed 1 meter.
E.net	Refer to Sections 4.4.2 ... 4.4.5 to determine the corresponding wiring of the regen unit.	
	Wiring Scheme B:	
	Line Contactor Open	Monitor the DC Bus voltage at CP.9. If the DC bus sags below the value set in CP.19, the line contactor will open causing the synchronization module of the commutation choke to recognize a line phase loss. The DC Bus level at which the line contactor opens/ closes can be reduced as needed. Refer to CP.19 for additional information.
	Noise/EMI	Refer to Noise/EMI in Section 6.2.2.
	Loss of a line phase	Verify three-phase supply.
	DC Bus voltage reaches 800VDC	Determine cause for excessive increase in DC bus voltage. Refer to Section 6.2.2 E.OP faults on (F5) Elevator Drive for additional troubleshooting.
	Wiring Scheme A	
	Noise/EMI	Refer to Noise/EMI in Section 6.2.2.
	Loss of a line phase	Verify three-phase supply.

Fault	Cause	Solution
E.OC	Ground fault or short	Check for any loose or missing power connections. Check for similar errors on the (F5) Elevator Drive indicating a ground fault, short, or excessive current. This may indicate the cause of the fault is occurring from the end of to the drive, motor contactor, or motor.
	Noise/EMI	Refer to Noise/EMI in Section 6.2.2.
	Supply or regenerative current too high	Check to see if the utilization in CP.6 is high. Refer to High Regenerative/Supply Current in Section 6.2.2. Verify sizing with controller manufacturer
E.Fnet	Line frequency out of range (57-60Hz, based on 60Hz nominal line).	
	Generator power operation causes voltage frequency swing.	Monitor Main Line Frequency at CP.2. Output frequency from generator may be too high/low and may change as various other loads come on/offline.
	Noise/EMI	Refer to Noise/EMI in Section 6.2.2.
E.PFd	The incoming voltage (as measured by the synchronization module and regen unit) is fluctuating and not stable during initialization sequence of the regen unit.	Power cycle unit. If fault persists, try connecting the CAT5 synch cable to a different X2B port on the commutation choke or harmonic filter. Replace synchronization cable. Replace commutation choke or harmonic filter.
E.LSF	If the error does not reset itself after power up and the fault remains, then the following causes may be applicable:	
	Load-shunt defective	Unit must be serviced.
	Input voltage wrong or too low	Verify line supply or transformer output supply and that there is not excessive sag or brown-out conditions.
	High losses in the supply cable	
E.PUIN	Excessive main line input voltage distortion detected.	
	Bad synchronization module	Replace commutation choke or harmonic filter. For parallel units, make sure CAT5 cable is plugged into the same synchronization module (choke or filter).
	Blown AC fuse	Check fuses.

Fault	Cause	Solution
E.UP	DC bus level is too low	Likely indicates poor power quality. Verify line input voltage. Sagging voltage or loss of phase could cause E.UP error. Check all grounding including X0 of transformer.
E.PU	Error on the power stage.	General error on the power stage. Check grounding of the transformer. If the error is always active, then the unit must be sent in for evaluation. If intermittent, it may indicate excessive line sag conditions.

6.2.2 Troubleshooting Operational Problems

Problem	Cause	Solution
E.OP faults on (F5) Elevator Drive	Regen unit unable to regen back to the line; CP.1 status not in 'regen' status during generating operation:	
	Enable input not present (CP.1 Status = nop)	Verify enable input at X2A.12. When active under normal operation, the CP.1 status should be either 'Stb' or 'rEgEn'.
	Input logic not set correctly to recognize enable input (i.e. CP.35 = PNP vs. NPN)	Verify CP.35 setting according to input type. PNP: inputs must be +24VDC to be active. NPN: inputs must be at 0VDC to be active.
	Regen unit in active fault;	CP.1 status displays fault message or if the fault message has been cleared from the screen by pressing ENTER on the operator keypad, a flashing red indicator LED on the keypad and R6 indicates an active fault remains. Reset (X2A.13) or resolve the cause of the fault. If the fault has been automatically reset, the last fault can be viewed in the fault log, CP.21. If it is unclear whether a fault actually occurred, refer to the note under CP.21...28 to force a specific fault in order to determine if a new fault is occurring.
	DC bus fuse(s) open.	The DC bus fuse(s), internal to the R6, can be checked visibly whether they are open and replaced as needed. Before checking, ensure all safety measures necessary including powering down the unit from the mains disconnect and locking it out and allowing the DC bus to fully dissipate and verifying 0VDC across the DC bus terminals ++, - -.
	Commutation Angle CP.34 set too low.	The default setting of 22.0 for size 19 unit or 20.0 for a size 15 unit should be sufficient to prevent E.OP faults. Refer to parameter CP.34 for further details.
Audible noise from commutation choke.		Reduce CP.34 Control Angle. Reducing this value will reduce the amount of audible noise from the commutation choke. Reducing this value too far may begin to reduce the amount of power that can be regenerated back to the line and may cause EOP overvoltage faults on the regen unit or elevator drive.

Problem	Cause	Solution
High regenerative or supply current	High nominal motor current	Check the current on the F5 Elevator Drive. Determine the cause of the high motor current, and troubleshoot accordingly.
	High peak motor current during acceleration/deceleration	Check the peak current on the F5 Elevator Drive. Determine the cause of the high peak motor current and troubleshoot accordingly. Potentially adjust acceleration/deceleration rates.
	Low input voltage/Excessive line sag	A decrease in input voltage causes a corresponding increase in supply current. Verify the incoming voltage, and insure that the line voltage is not sagging.
	Overutilization	Check CP.6 and CP.7. If CP.7=160%, then the regen unit is being overutilized.
Noise/EMI causing intermittent regen faults (E.OC, E.net, E.Fnet).	Imbalance line supply, Grounding	Line supply or transformer secondary MUST be a balanced, center-grounded wye connection. Check for actual connection of center-ground. Measure phase-ground voltage at R6; they should be balanced. Measure phase-phase voltage at R6; they should be balanced.
	Noise/EMI, Grounding	Add additional R6 ferrite ring to DC bus connections. Installing the incorrect type of ferrite ring will not have an affect mitigating noise. Verify correct grounding connections and techniques as well as panel wire layout. Any DC, AC, Motor leads or switching power (e.g. brake or contactor coil) wires must be physically separated from each other and not run together. Check for any loose or missing ground connections. Ground conductors must be minimum #4 AWG or thick ground strap. DC bus wires (++, - -) should be tied together. Add additional ferrite ring(s) around all motor lead connections at drive output (additional ferrites around individual motor leads is not necessary). A pipe may not be a sufficient earth ground.

A.1 Certification

A.1.1 CE Marking

CE	CE marked power supply-/regenerative units were developed and manufactured to comply with the regulations of the Low-Voltage Directive 2006/95/EC.

The described units 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 power supply-/regenerative units meet the requirements of the Low-Voltage Directive 2006/95/EC. The harmonized standards of the series EN 61800-5-1 in connection with EN 60439-1 and EN 60146 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.

A.1.2 UL Marking

c ® US	Acceptance according to UL is marked on KEB power supply and regenerative units with the adjacent logo on the name plate.

This device has been investigated by UL according to United States Standard UL508C, Third Edition (Power Conversion Equipment) and to the Canadian Standard CSA C22.2 No.14-2010, 11th Edition (Industrial Control Equipment).

A.1.3 CSA Marking

® C US	Acceptance according to CSA is marked on KEB power supply and regenerative units with the adjacent logo on the name plate.

This device has been investigated by CSA according to the Canadian Standard CSA C22.2 No.14-2010, 11th Edition (Industrial Control Equipment).

QUICK PARAMETER LIST

Display	Parameter
CP.0	Password input
CP.1	Status display
CP.2	Main Line Frequency
CP.3	AC-Phase current L1
CP.4	AC-Phase current L2
CP.5	AC-Phase current L3
CP.6	Actual Load
CP.7	Actual Load / peak value
CP.8	DC output current
CP.9	Actual DC voltage
CP.10	DC voltage / peak value
CP.11	Heat sink temperature
CP.12	Over load counter
CP.13	Active power
CP.17	Apparent power / Line input
CP.18	Analog output 1 / amplification factor
CP.19	DC bus switching level
CP.20	Auto error reset counter

Display	Parameter
CP.21	Last Error
CP.22	Last Error 1
CP.23	Last Error 2
CP.24	Last Error 3
CP.25	Last Error 4
CP.26	Last Error 5
CP.27	Last Error 6
CP.28	Last Error 7
CP.29	Software version
CP.30	Software date code
CP.31	Power part ID code
CP.32	Pulse off level
CP.33	Operating mode
CP.34	Control Angle
CP.35	Input Type

KEB Automation KG.
Försterweg 36-38 • D-32683 Barntrup
fon: +49 5263 401-0 • fax: +49 5263 401-116
net: www.keb.de • mail: info@keb.de

KEB worldwide…

KEB Antriebstechnik Austria GmbH
Ritzstraße 8 • A-4614 Marchtrenk
fon: +43 7243 53586-0 • fax: +43 7243 53586-21
net: www.keb.at • mail: info@keb.at

KEB Antriebstechnik
Herenveld 2 • B-9500 Geraadsbergen
fon: +32 5443 7860 • fax: +32 5443 7898
mail: vb.belgien@keb.de

KEB Power Transmission Technology (Shanghai) Co.,Ltd.
No. 435 Qianpu Road, Chedun Town, Songjiang District,
CHN-Shanghai 201611, P.R. China
fon: +86 21 37746688 • fax: +86 21 37746600
net: www.keb.de • mail: info@keb.cn

KEB Antriebstechnik Austria GmbH
Organizační složka
K. Weise 1675/5 • CZ-370 04 České Budějovice
fon: +420 387 699 111 • fax: +420 387 699 119
mail: info.keb@seznam.cz

KEB Antriebstechnik GmbH
Wildbacher Str. 5 • D–08289 Schneeberg
fon: +49 3772 67-0 • fax: +49 3772 67-281
mail: info@keb-drive.de

KEB España
C/ Mitjer, Nave 8 - Pol. Ind. LA MASIA
E-08798 Sant Cugat Sesgarrigues (Barcelona)
fon: +34 93 897 0268 • fax: +34 93 899 2035
mail: vb.espana@keb.de

Société Française KEB
Z.I. de la Croix St. Nicolas • 14, rue Gustave Eiffel
F-94510 LA QUEUE EN BRIE
fon: +33 1 49620101 • fax: +33 1 45767495
net: www.keb.fr • mail: info@keb.fr

KEB (UK) Ltd.
Morris Close, Park Farm Industrial Estate
GB-Wellingborough, NN8 6 XF
fon: +44 1933 402220 • fax: +44 1933 400724
net: www.keb.co.uk • mail: info@keb.co.uk

KEB Italia S.r.l.
Via Newton, 2 • I-20019 Settimo Milanese (Milano)
fon: +39 02 3353531 • fax: +39 02 33500790
net: www.keb.de • mail: kebitalia@keb.it

KEB Japan Ltd.
15–16, 2–Chome, Takanawa Minato-ku
J-Tokyo 108-0074
fon: +81 33 445-8515 • fax: +81 33 445-8215
mail: info@keb.jp

KEB Korea Seoul
Room 1709, 415 Missy 2000
725 Su Seo Dong, Gang Nam Gu
ROK-135-757 Seoul/South Korea
fon: +82 2 6253 6771 • fax: +82 2 6253 6770
mail: vb.korea@keb.de

KEB RUS Ltd.
Lesnaya Str. House 30, Dzerzhinsky (MO)
RUS-140091 Moscow region
fon: +7 495 632 0217 • fax: +7 495 632 0217
net: www.keb.ru • mail: info@keb.ru

KEB America, Inc.
5100 Valley Industrial Blvd. South
USA-Shakopee, MN 55379
fon: +1 952 224-1400 • fax: +1 952 224-1499
net: www.kebamerica.com • mail: info@kebamerica.com

More information can be found at www.kebamerica.com

© KEB		
Document	20153018	
Part/Version	USA	00
Date	2017-05-18	