COMBIVERT

Instruction Manual
Type R6-N

Power Supply and Regenerative Unit
Size 15/19

Translation of the original manual		
Document	Part	Version
20116581	ENG	03

KEB

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1. Preface

The described hardware and software are developments of the KEB Automation KG. The enclosed documents correspond to conditions valid at printing. Misprint, mistakes and technical changes reserved.

1.1 Information on special measures

The used pictograms have following significance:

Danger	Is used, when death or serious bodily injury may be the consequence of non-observance of the measure.
Warning	Is used, when bodily injury and/or substantial property damage may be the consequence of non-observance of the measure.
Caution	Is used, when property damage may be the consequence of non-observance of the measure.
Notice	Is used, when noise sensitive or unrequested operation may be the consequence of non-observance of the measure.
Info	Is used, when a better or simpler result can be the consequence of the measure.

For a special case the instructions can be supplemented by additional pictograms and text.

1.2 Documentation

Notice	**Documentation via www.keb.de**
	Prior to performing any work on the device, it is absolutely necessary to download and read the documentation, especially the safety precautions and instructions for use. Follow these steps to get the documentation:
Step 1	Read the material number (Mat.No.) from nameplate
Step 2	Input the material number at "www.keb.de => Service => Downloads" and click "search". **Downloads** **Suche nach Materialnummern** **Bitte geben Sie eine vollständige (11-stellige) Materialnummer ein.** **Suche nach:** XXXXXXX-XXXX suchen

continued on the next page

Step 3	The entire documentation associated with the device will be displayed, including the instruction manuals in German and English. If available, other translations are also indicated. Make sure that the user understands the provided language.
	**Should you be unable to read or understand the documentation, do not take any further steps. Please inform our support network for further assistance.**

Non-observance of the safety and operating instructions leads to the loss of any liability claims. The warnings and safety instructions in this manual work only supplementary. This list is not exhaustive.

1.3 Validity and liability

The use of our units in the target products is beyond of our control and therefore exclusively the responsibility of the machine manufacturer, system integrator or customer.

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.

Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be done within the application by the machine manufacturer. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.

Danger  **by tamper from unauthorized personnel**	
	Unauthorised opening and tampering may lead to death, bodily injury, property damage and malfunctions. Modification or repair is permitted only by KEB authorized personnel. Infringement will annul the liability for resulting consequences.

The suspension of liability is especially valid also for operation interruption loss, loss of profit, data loss or other damages. The disclaimer will void the warranty. This is also valid, if we referred first to the possibility of such damages.

If single regulations should be or become void, invalid or impracticable, the effectivity of all other regulations or agreements is not affected.

Through multitude applications not each possible case of installation, operation or maintenance can be considered. If you require further information or if special problems arise which are not treated in detail in the documentation, you can request the required information from the local agency of the company KEB Automation KG.

1.4 Copyright

The customer may use the instruction manual as well as further documents or parts from it for internal purposes. Copyrights are with KEB and remain valid in its entirety.

KEB®, COMBIVERT®, KEB COMBICONTROL® and COMBIVIS® are registered trademarks of the KEB Automation KG.

Other wordmarks or/and logos are trademarks (™) or registered trademarks (®) of their respective owners and are listed in the footnote on the first occurrence.

When creating our documents we pay attention with the utmost care to the rights of third parties. Should we have not marked a trademark or breach a copyright, please inform us in order to have the possibility of remedy.

1.5 Specified application

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

The used semiconductors and components of the KEB Automation KG are developed and dimensioned for the use in industrial products. If the KEB COMBIVERT F5 is used in machines, which work under exceptional conditions or if essential functions, life-supporting measures or an extraordinary safety step must be fulfilled, the necessary reliability and security must be ensured by the machine builder.

The operation of our products outside the indicated limit values of the technical data leads to the loss of any liability claims.

All output functions of the R6 are "one-channel according to ISO 13849, no diagnostic coverage and therefore not safe". If required, additional protective measures must be met by the user.

1.5.1 Standard operation

If the DC link voltage increases to a value above the peak value of the mains voltage (negative power), regeneration of the current into the mains occurs automatically. The regenerative level is defined with parameter CP.34 or cS.02. The mains voltage is analog measured. The regenerative current is equal to the feed-in, whereby the current flow periods correspond to the times of a B6 bridge circuit. Regeneration is completed if the regenerative and puls off level (CP.32 or cS.06) is fallen below.

1.5.2 Abnormal operation

When exceeding the permissible limit values for voltage, current or temperature the current flow between DC link and mains is blocked during regeneration. An appropriate error message is also displayed during supply. The device must be disconnected from the supply system or the load must be switched off in case of overcurrent or overload. This can be done by opening the control release of the inverter.

At factory setting the modulation is switched off in case of a net phase failure and 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.

1.6 Product description

This instruction manual describes the power supply and regenerative unit KEB COMBIVERT R6-N. The COMBIVERT R6-N has the following features.

The rectifier module

- converts a three-phase input voltage into DC voltage.
- supplies single KEB drive controller or via DC interconnection.
- can be parallel connected while maintaining a base load if higher power supply is required.
- increases the stability of the DC link voltage in the DC interconnection.

The regenerative unit

- feeds back the excess energy from generatoric operation into the supply system.
- reduces the energy demand.
- reduces the heat emission.
- is environmentally friendly and space-saving.
- replaces braking resistor and braking transistor.
- is cost-saving.
- **has the same current flow (harmonic components) such as feed-in and rarely noise level**

The COMBIVERT R6-N is generally protected against overcurrent, ground fault and temperature. Appropriate dimensioned DC fuses protects the DC link circuit against short-circuit. The following accessories are necessary for operation with the COMBIVERT R6-N:

- Mains choke / OSF
- EMC filter E6 (for observance of EMC standard)

1.7 Part code

1 9	R 6	N	3	E	-	9	0	0	A		
									Type	A: Standard	
										B: Flat rear	
										D: ext. fan power supply	
										E: Special fan	
								Design		0: Standard	
							reserved			0: Standard	
										1: modified standard (increased overload)	
						9	Voltage			9: 3-ph.; 180…550 V; AC	
					E	Housing				E	
				0	Options					0: without	3: Precharging, DC-fuses
				1						1: Precharging	
			N	Control						N 1N.R6	
		R6	Series							R6	
15 (13), 19 (16)	Device size										

2. Safety Instructions

2.1 General instructions

Danger	Electric Shock
	COMBIVERT R6 power supply and regenerative units contain dangerous voltages which can cause death or serious injury. COMBIVERT R6 can be adjusted by way that energy is regenerated into the supply system in case of power failure at regenerative operation. Therefore a dangerous high tension can exist in the unit after switching off the supply system. **Before working with the unit check the isolation from supply by measurements in the unit.** Care should be taken to ensure correct and safe operation to minimise risk to personnel and equipment.

Warning	Only qualified electro-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 staff means those who are able to recognise and judge the possible dangers based on their technical training and experience and those with knowledge of the relevant standards and who are familiar with the field of power transmission.

Notice	Observe standards
DIN DVE	The COMBIVERT 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 COMBIVERT meets the requirements of the Low-Voltage Directive 2006/95/EC. The harmonized standard of the series EN 61800-5-1 (VDE 0160) is 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 must take appropriate measures.

2.2 Transport, storage and installation

The storage of the COMBIVERT must be done in the original packing. It is to be protected against humidity and excessive cooling and thermal effect. A long-distance transport must be carried out in the original packing. It is to be secured against impact influence. Observe the marking on the final packing! After removing the final packing the COMBIVERT must be shut down on a stable base.

Warning **Protect against accidental contact**

The COMBIVERT R6 must be protected against invalid loading. Components and covers must not be bent or moved as this may affect insulation distances. The units contain electrostatic sensitive devices which can be destroyed by inappropriate handling. For that reason the contact of electronic devices and contacts 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 that during installation there is enough minimum clearance and enough cooling. Climatic conditions must be observed in accordance with the instruction manual.

Warning **Hot surface**

Heat sinks can reach temperatures, which can cause burns when touching. If in case of structural measures a direct contact cannot be avoided, a warning notice "hot surface" must be mounted at the machine.

2.3 Electrical connection

Danger **Observe capacitor discharge time**

Before any installation and connection work, the system must be switched off and secured.

After clearing the DC link capacitors are still charged with high voltage for a short period of time. The unit can be worked on again, after it has been switched off for 5 minutes.

Caution **Safe 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 that the EN requirements are met. With frequency inverters that are not isolated from the supply circuit all control lines must be included in other protective measures (e.g. double insulation or shielded, earthed and insulated).

Danger  **Voltage with respect to ground**

The connection of COMBIVERT R6 is allowed to:

a) symmetrical mains with a voltage phase (L1, L2, L3) with respect to neutral conductor/ ground (N/PE) of maximum 305 V.

b) phase conductor grounded supply networks:

- the control system is no longer regarded as “safe isolated circuit”, further protection measures are required therefore (see "Safe isolation").
- with this type of power system, the max. voltage phase / earth must not exceed 528 V absolute
- appropriate, external DC fuses at the DC connections are necessary for the 400 V class. Use the COMBIVERT R6-N without internal DC fuses.
- Contact KEB regarding EMC filter.

Notice  **Fixed connection**

The COMBIVERT R6 is designed for fixed connection, since discharge currents of > 3.5 mA occur especially when using together with EMI filters. Therefore, the requirements or instructions from EN 60204-1 (VDE 0113) and EN 61800-5-1 (IEC 0160-5-1) must be observed.

Caution  **Insulation measurement**

When doing an insulation or voltage measurement in accordance with in EN 60204-1 / VDE 0113-1, 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 inverters are given a high voltage test in the end control at KEB. In the case of special requirements please contact KEB.

Caution  **Different earth potentials**

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

Caution **Prevent malfunctions**

A 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 mains voltage.
- Install power cables and control cables separately (>15 cm separation).
- Use shielded / twisted control lines. Lay shield at one side to COMBIVERT R6-N to PE!
- Only use suitable circuit elements to control the logic and analog inputs, whose contacts are rated for extra-low voltages.
- Housing of the COMBIVERT R6 must be well earthed. Screens of larger power cable must be directly and securely attached to both the inverter PE terminal and the motor ground terminal (remove paint).
- Ground the cabinet or the system earth star point with the shortest connection to mains earth. (avoid earth loops)
- **Use exclusively the line commutation throttle 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-N the max. permissible DC link capacities of all connected frequency inverters must be considered during supply operation (see technical data).

Warning **Automatic restart**

The COMBIVERT R6 can be adjusted by such way that the inverter restarts automatically after an error case (e.g. broken phase line). System design must take this into account, if appropriate, and additional monitoring or protective features added where necessary.

Caution **Not short-circuit proof (supply)**

The COMBIVERT R6 is not short-circuit proof at the mains input! Conditional protection at the mains input is possible if the I^2t-protection was adapted with a gR fuse. The short-circuit protection at DC output is ensured by internal or external aR respectively gR fuses.

Caution **Conditionally short-circuit proof (regeneration)**

The COMBIVERT R6 is conditionally short-circuit proof (EN 61800-5-1 / VDE 0160). The intended function is guaranteed after resetting the internal protection devices.

Exception:

- If earth- or short circuits often occurs at the output, this can lead to a defect in the device.

Notice **Cyclic activation and deactivation**

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. Switching off during the initialization phase can cause undefined conditions.

Notice **RCD (residual current operated circuit-breaker)**

When using systems with RCD, the instructions or the requirements of VDE 0100-T 530 (IEC 60364-5) must be observed. The recommended tripping current of the RCD type "B“ is 300 mA.

2.4 EMC instructions

COMBIVERT R6-N represent electrical equipment designed for use in industrial and commercial units. In accordance with the EMC directive 2006/108/EC, it is not obligatory to mark these devices as they represent components to be further processed by the respective machine and unit manufacturer and are not operable independently according to the EMC directive. The person installing / operating the machine / unit 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 specified by KEB, and when observing the following measures and installation guidelines.

2.5 EMC conform installation

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

- Install the control cabinet or system in an appropriate and correctly way (see chapter "EMC conform control cabinet installation“)
- To avoid coupled-in noise, separate supply lines, motor lines, control and data lines (low-voltage level < 48 V) and leave a space of at least 15 cm between them when installing.
- In order to maintain low-resistance high frequency connections, earthing and shielding, as well as other metallic connections (e.g. mounting plate, installed units) must be in metal-to-metal contact with the mounting plate, over as large an area as possible. Make ground connections with a surface as large as possible (earthing strips).
- Only use shielded cable with copper or tin-plated braid, since steel braid is not suitable for high frequency ranges. The screen must always be installed on the compensating rail and fastened with clips or guided through the wall of the housing. Do not elongate the screen end (pigtails) with individual conductors!
- If external interference suppression filters are used, then these must be installed as close as possible to (<30 cm from) the interference source and in metal-to-metal contact with the mounting plate, over as large an area as possible.
- Always equip inductive control elements (contactors, relays etc.) with suppressors such as varistors, RC-elements or damping diodes.
- All connections must be kept as short as possible and as close as possible to the earth, as free floating lines work as active and passive aerials.
- Keep connection cables straight (do not bundle). Install a non-assigned wire at one sides to the protective earth conductor.
- The flow and return circuit must be twisted when the cables are not shielded, in order to dampen common-mode noise.
- Further information can be found in the internet, see "www.keb.de“.

3. Technical Data

3.1 Standard device size

Standard device size	*)		15 (13)	19 (16)
Housing size			E	
Phases			3	
Permitted mains forms			TN, TT [5]	
Rated voltage	*)	[V]	400 (230)	
Input voltage UL		[V]	240/400/480	
Mains voltage range		[V]	180…550 ±0 %	
Mains frequency		[Hz]	50 / 60 ±2	
DC voltage range	*)	[V_{DC}]	250…780 (UL: 340…680)	
Regenerative operation				
Rated apparent output power	Sn *)	[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)
Rated regenerative current		[A]	26	65
Regenerative DC current		[A_{DC}]	32	80
Overload current (E.OL) 60 s	1)	[A]	39	97.5
Max. regenerative DC current 60 s		[A_{DC}]	48	120
Power supply operation				
Rated input power	Sn *)	[kVA]	18 (10.5)	48.5 (28)
Rated active power	*)	[kW]	16 (10)	44.5 (25.5)
Max. input power	*)	[kVA]	27 (15.5)	72.5 (42)
Max. active power	*)	[kW]	24 (14.5)	67 (38)
Rated supply current	2)	[A]	26	70
DC supply current		[A_{DC}]	32	87 [3]
Overload current (E.OL) 60 s		[A]	39	105
Max. DC supply current 60 s		[A_{DC}]	48	130
Overload disconnection (E.OL)		[%]	160	160
Overvoltage switch-off (E.OP)		[V_{DC}]	900	
Rated output voltage		[V_{DC}]	540 (310)	
Max. permissible DC link capacity	4) *)	[µF]	10000 (42000)	10000 (42000)
I^2t Integral of the limiting load of the semiconductor		[A^2s]	1200	4500
Max. permissible mains fuse type gR / aR		[A]	40	100
Permissible aR fuse Siemens Sitor / Bussmann (no delta power system)			3NC2240 / FWP-40A22FA	3NC2240 / FWP-40A22FA
Mains fuse for UL type RK1 "fast acting" or "J fast acting"			50A / 480V (50A / 250V)	90A / 480V (90A / 250V)
Short-circuit factor at the connection point (S_{kn}" / S_n) or (S_{scp} / S_n)			20 < S_{kn}" / S_n < 350	
Power dissipation at rated operation		[W]	200	470
Max. heat sink temperature		[°C]	70	88

*) Bracket values obtain for operation at 230 V power supply. The device is automatically adjusted by the software when switching on.

1) The overload current is specified for 1 minute. The overload cycle is 300 seconds. This corresponds to duty class 2 EN 60146-1-1.

2) The current data are based on a fundamental frequency component of g=0.95. The fundamental frequency component or the effective value of the input current is dependent on load and line supply conditions. At uncontrolled B6 converters the phase angle cosφ1 can be set to one, so the value of the fundamental frequency components is equal to the value of the power factor.

3) If the DC infeed current > 85 ADC use two by two of the DC terminals (++ and --) to meet the requirements of the UL standard. The connection cables are parallel connected.

4) Please contact KEB for higher values.

5) After consultation KEB IT and delta power system

3.2 Special device Peak Power

Device size		*)		Special device Peak Power 19 (16)
Housing size				E
Phases				3
Approaved mains phases				TN, TT [3)]
Rated voltage		*)	[V]	400 (230)
Input voltage UL			[V]	240/400/480
Mains voltage range			[V]	180…550 ±0 %
Mains frequency			[Hz]	50 / 60 ±2
DC voltage range		*)	[VDC]	250…780 (UL: 340…680)
Regenerative operation				
Rated apparent output power	Sn	*)	[kVA]	45 (26)
Rated active power		*)	[kW]	42 (23)
Max. power output		*)	[kVA]	81 (46.6)
Max. active power		*)	[kW]	75 (42)
Rated regenerative current			[A]	65
Regenerative DC current			[ADC]	80
Overload current (E.OL) 10 s			[A]	117
Max. regenerative DC current 10 s			[ADC]	144
Power supply operation				
Rated input power	Sn	*)	[kVA]	48.5 (28)
Rated active power		*)	[kW]	44.5 (25.5)
Max. input power 10 s		*)	[kVA]	87 (50)
Max. active power 10 s		*)	[kW]	80 (46)
Rated supply current		1)	[A]	70
DC supply current		2)	[ADC]	87
Overload current (E.OL) 10 s			[A]	126
Max. DC supply current 10 s			[ADC]	156
Overload disconnection (E.OL)			[%]	200
Overvoltage switch-off (E.OP)			[VDC]	900
Rated output voltage			[VDC]	540 (310)
Max. permissible DC link capacity		*)	[µF]	10000 (42000)
I^2t Integral of the limiting load of the semiconductor			[A^2s]	3058
Max. permissible mains fuse type gR / aR			[A]	100
Permissible aR fuse Siemens Sitor / Bussmann (no delta power system)				3NC2240 / FWP-40A22FA
Line fuse for UL type RK1 "fast acting" or "J fast acting"				90A / 480V (90A / 250V)
Short-circuit factor at the connection point (S_{kn}" / S_n) or (S_{scp} / S_n)				20 < S_{kn}" / S_n < 350
Power dissipation at rated operation			[W]	430
Max. heat sink temperature			[°C]	88

*) Bracket values obtain for operation at 230 V power supply. The device is automatically adjusted by the software when switching on.

1) The current data are based on a fundamental frequency component of g=0.95. The fundamental frequency component or the effective value of the input current is dependent on load and line supply conditions. At uncontrolled B6 converters the phase angle cosφ1 can be set to one, so the value of the fundamental frequency components is equal to the value of the power factor.

2) If the DC infeed current > 85 ADC use two by two of the DC terminals (++ and --) to meet the requirements of the UL standard.
The connection cables are parallel connected.

3) After consultation KEB IT and delta power system (see also safety instructions, voltage with respect to ground)

Warning General instructions
• Voltage stabilization must be activated at the drive controller if a harmonic filter is used.
• The devices are not short-circuit proof without corresponding dimensioned fuses.
• Exceeding of the max. rechargeable DC link capacity can lead to a defect.
• A load removal in the DC circuit may be done only after the message "ready“.
• If the control release is set when switching off the mains, this can lead to an overcurrent error and the lifetime of the module can be reduced.
• The device must be disconnected from the supply system or the load must be switched off in case of over-current or overload.

3.3 Overload (OL) function

Standard:

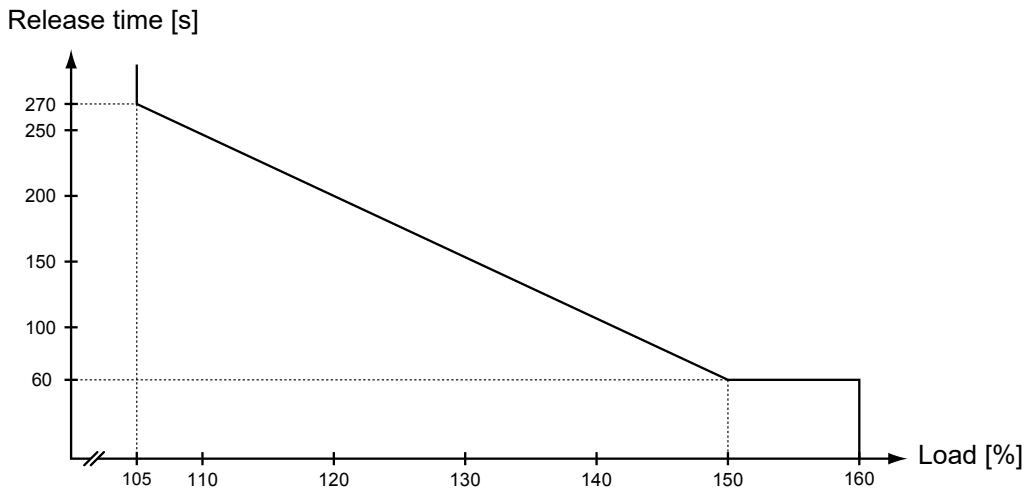
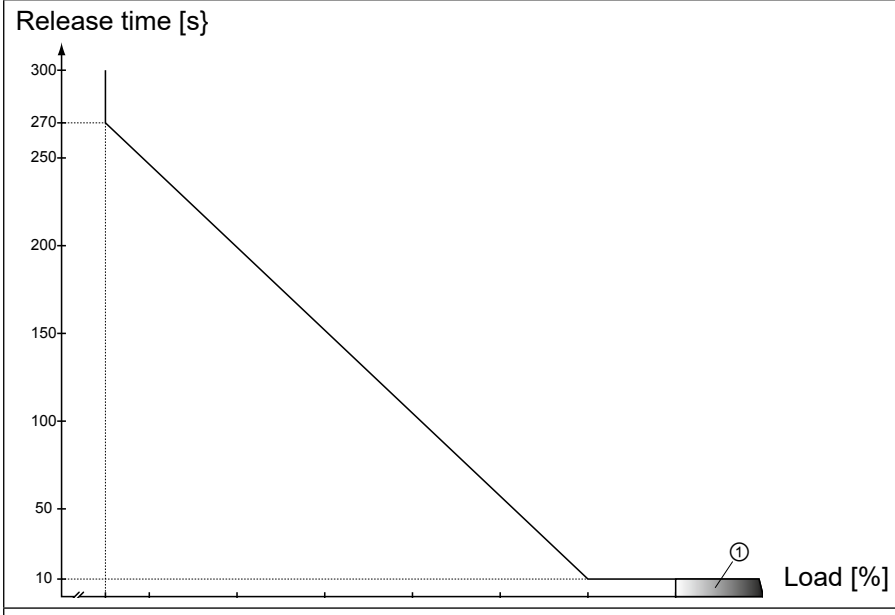


Figure 1: Overload (OL) function

Modified standard (increased overload):



1. Depending on the mains impedance

Figure 2: Overload (OL) function

3.4 Operating conditions

		Standard	Standard/ class	Instructions
Definition acc.		EN 61800-2		Inverter product standard: **Rated specifications**
		EN 61800-5-1		Inverter product standard: **General safety**
Site altitude				max. 2000 m above sea level With site altitudes over 1000 m a derating of 1 % per 100 m must be taken into consideration
Ambient conditions during operation				
Climate	Temperature	EN 60721-3-3	3K3	extended to -10…45 °C (with temperature over 45°C to max. 55°C a derating of 5 % per 1 K must be taken into consideration)
	Humidity		3K3	5…85 % (without condensation)
Mechanical	Vibration	Track	EN 50155	max. amplitude of a vibration 1 mm (5…13 Hz) max. acceleration amplitude 7 m/s² (13…200 Hz)
		Germ. Lloyd	Part 7-3	
		EN 60721-3-3	3M4	
Contamination		Gas	3C2	
		Solids	3S2	
Ambient conditions during transport				
Climate	Temperature	EN 60721-3-2	**2K3**	
	Humidity		**2K3**	(without condensation)
Mechanical	Vibration		**2M1**	max. vibration amplitude 3.5 mm (2…9 Hz) max. acceleration amplitude 15 m/s² (9…200 Hz)
	Surge		**2M1**	max. 100 m/s²; 11 ms
Contamination	Gas		**2C2**	
	Solids		**2S2**	
Ambient conditions for the storage				
Climate	Temperature	EN 60721-3-1	**1K4**	
	Humidity		**1K3**	(without condensation)
Mechanical	Vibration		**1M2**	max. vibration amplitude 1.5 mm (2…9 Hz) max. acceleration amplitude 5 m/s² (9…200 Hz)
	Surge		**1M2**	max. 40 m/s²; 22 ms
Contamination		Gas	**1C2**	
		Solids	**1S2**	
Type of protection		EN 60529	IP20	
Environment		IEC 664-1		Pollution degree 2
Overvoltage category		EN 618005-1	Class III	
Definition acc.		EN 61800-3		Inverter product standard: **EMC**
EMC emitted interference				
Conducted interference emission		–	C2	with EMC filter and ferrite rings and motor cable lengths < 100m

continued on the next page

	Standard	Standard/ class	Instructions
Radiated interferences	–	EN 61800-3	with EMC filter and ferrite rings
Interference immunity			
Static discharges	EN 61000-4-2	8 kV	AD (air discharge) and CD (contact discharge)
Burst - control lines + bus	EN 61000-4-4	2 kV	
Burst - mains supply	EN 61000-4-4	4 kV	
Surge - mains supply	EN 61000-4-5	1 / 2 kV	Phase-phase / phase-ground
Conducted immunity, induced by radio-frequency fields	EN 61000-4-6	10 V	0.15-80 MHz
Electromagnetic fields	EN 61000-4-3	10 V/m	
Voltage variation / voltage drop	EN 61000-2-1		+10 %, -15 %; 90 %
Voltage unsymmetries / frequency changes	EN 61000-2-4		3 %; 2 %

3.5 Accessories

Device size	15 (13)	19 (16) [1]
Rated voltage	400 V	
Commutation reactor	15Z1B04-1000 ED 100% [2]	19Z1B04-1000 ED 81% / 20Z1B04-1000 ED 100% [2]
Patch cable for parallel connection (length: 1 m)	00F50C3-1010	

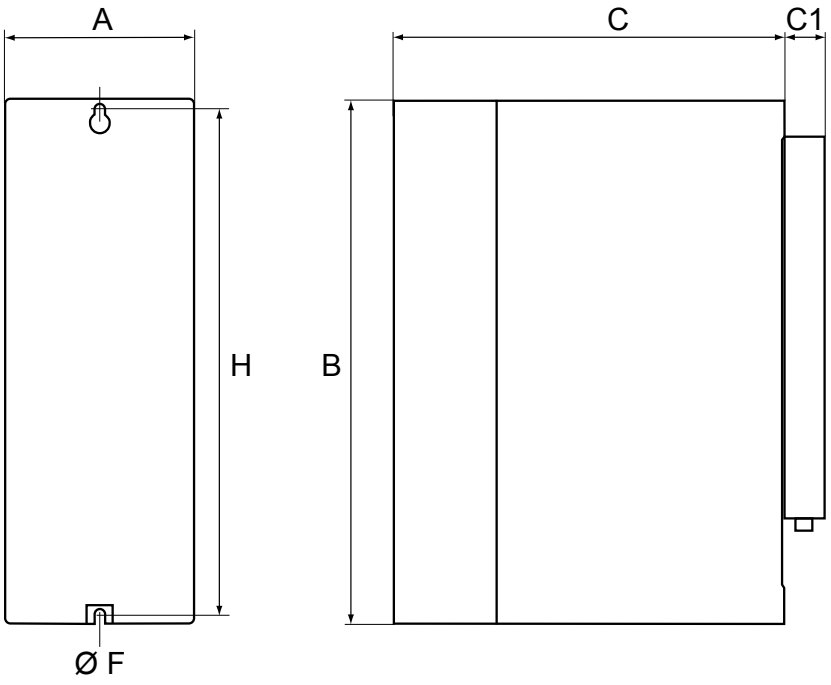
3.6 Options

Device size	15 (13)	19 (16)
Mains filter (see chapter connection power unit)	14E6T60-3000 ED 72% / 16E6T60-3000 ED 100% [2]	18E6T60-3000 ED 86% / 20E6T60-3000 ED 100% [2]
	Limit class in accordance with EN 61800-3	
	C2 (only with ferrite rings and motor cable lengths < 100m)	
	C1 on consultation with KEB	
Harmonic filter (no UL certification)	15Z1C04-1000 max. overload 125% regenerative / 150% motoric	19Z1C04-1000 max. overload 140% regenerative / 150% motoric [3]
	Please contact KEB for further sizes and data to the THD value at regenerative operation in accordance with EN 61000-2-12.	
Harmonic filter (with UL certification)	17Z1C05-1000 (480V) 14Z1C03-1000 (230V)	21Z1C05-1000 (480V) 18Z1C03-1000 (230V)
DC fuses (also see annex B.1.2)	690 V / 50 A (Part number 009025H-3459)	690 V / 125 A (Part number 009025H-3559)
Fuse holder for NH00 and NH000 fuses	0090574-0001	
Operators	Digital operator, interface operator	
Bus operators	CAN, ProfiBus, InterBus, EtherCAT, EtherNet, Sercos, ModBus, PROFINET, LCD-Operator, DeviceNet, HSP5 [4]	

1)	The same assignment of filter, commutation reactors and harmonic filter is done for the modified device (Peak Power).
2)	The ON time ED refers to R6-N.
3)	Depending on the load, the following harmonic filters are also possible with the technical data given therein: 15Z1C04-1000, 16Z1C04-1000, 17Z1C04-1000, 18Z1C04-1000, 20Z1C04-1000
4)	ProfiNet from operator firmware V3.4 of 30.01.2015

3.7 Dimensions and weights

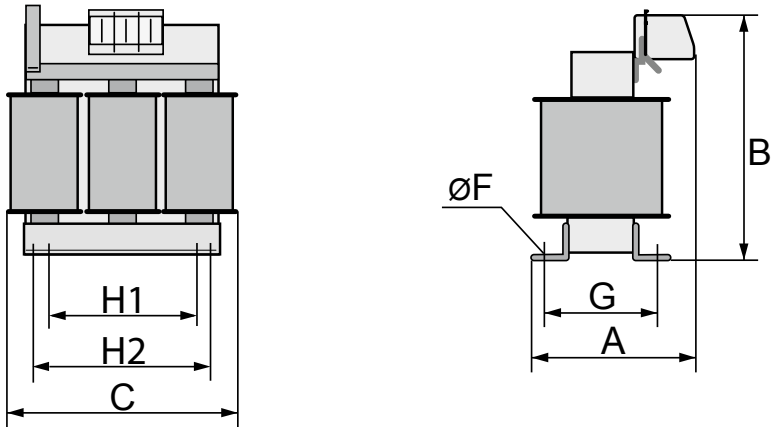
3.7.1 COMBIVERT R6-N



Housing	A	B	C	C1	F	H	Weight
E	130	290	208	14	7	275	5.6 kg
C1 with operator							

Figure 3: Dimensions and weights for the COMBIVERT R6-N

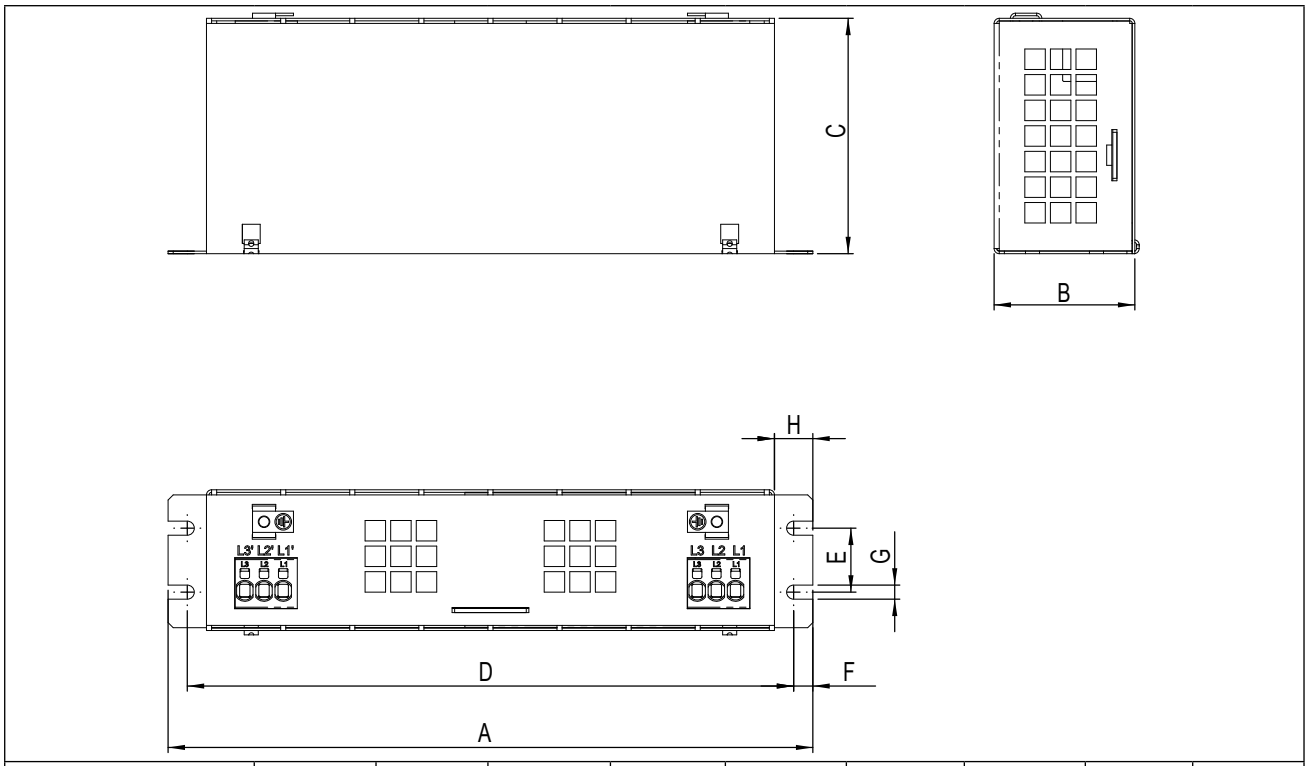
3.7.2 Commutation reactor



Part number	A	B	C	F	G	H1	H2	Weight
15Z1B04-1000	72.5	180	178	4.8	55	113	166	4.4 kg
19Z1B04-1000	135	220	219	7	91	136	201	12.0 kg
20Z1B04-1000	150	220	219	7	91	136	201	12.0kg

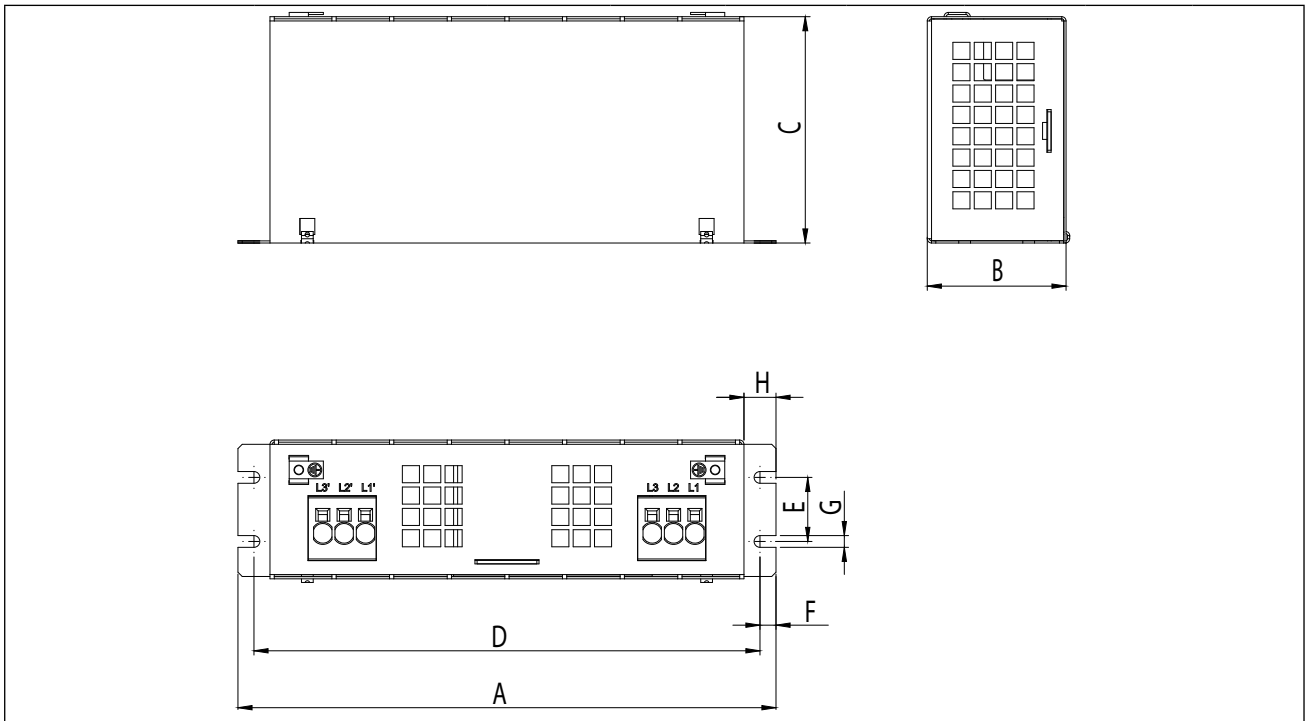
Figure 4: Commutation reactor

3.7.3 Radio interference filter



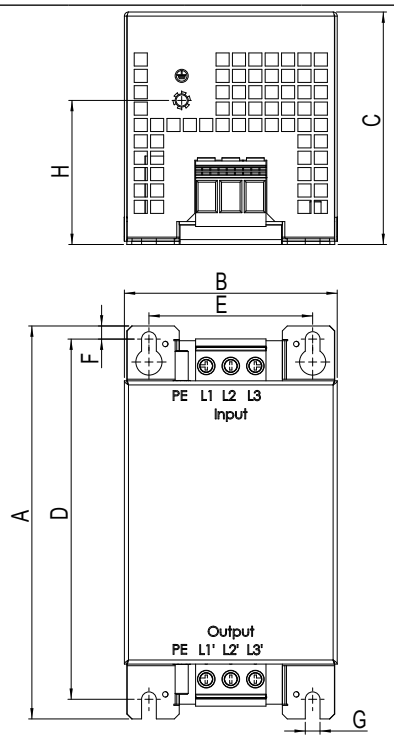
Part number	A	B	C	D	E	F	G	H	Weight
14E6T60-3000	252	55	92	237	25	7.5	5.5	15	1.25 kg

Figure 5: Radio interference filter 14E6T60-3000



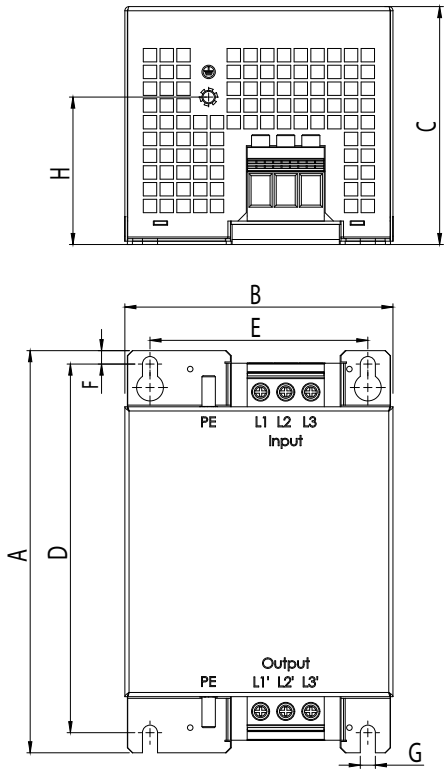
Part number	A	B	C	D	E	F	G	H	Weight
16E6T60-3000	252	65	106	237	30	7.5	5.5	15	1.8 kg

Figure 6: Radio interference filter 14E6T60-3000



Part number	A	B	C	D	E	F	G	H	Weight
18E6T60-3000	240	130	142	220	100	8	9	88	3.9 kg

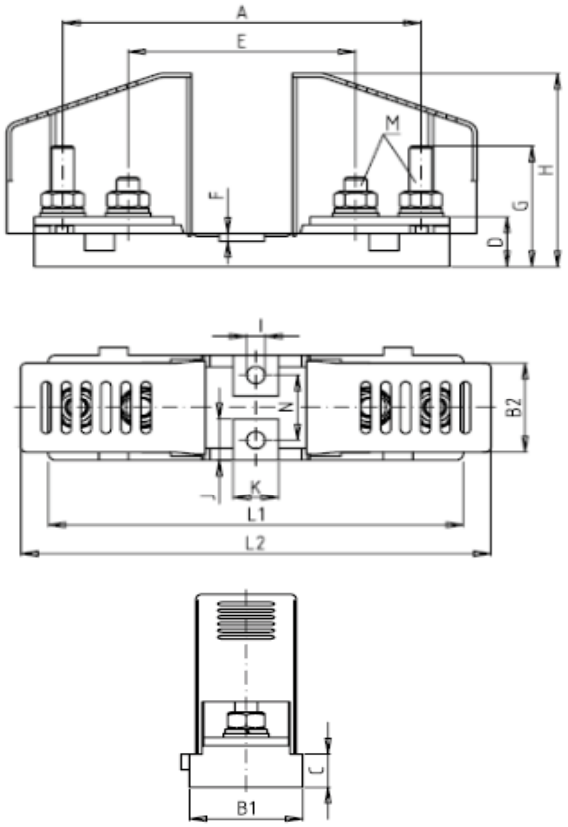
Figure 7: Radio interference filter 14E6T60-3000



Part number	A	B	C	D	E	F	G	H	Weight
20E6T60-3000	240	160	142	220	130	8	9	88	5.0 kg

Figure 8: Radio interference filter 14E6T60-3000

3.7.4 Fuse holder with cover



Dimensions:		
A	4,96"	126 mm
B1	1,57"	40 mm
B2	1,34"	34 mm
C	0,5"	13 mm
D	0,75"	19 mm
E	3,15"	80 mm
F	0,12"	3 mm
G	1,81 "	46 mm
H	2,91"	74 mm
I	0,26"	6,5 mm
J	0,6"	15,5 mm
K	0,63"	16 mm
L1	5,75"	146 mm
L2	6,5"	165 mm
M	M8	
N	0,98"	25 mm

Part number: 0090574-0001

Figure 9: Fuse holder

3.7.5 Ferrite rings

Ferrite rings are used to reduce the cable-fed and radiated disturbances. For a high damping they are placed as close as possible to the interference source, that means at the DC and motor output terminals of the inverter. The conductor are passed through the ferrite core for the use as current-compensated reactor. PE is passed outside the core. Further information is specified in the provided documentation. The ferrite ring to be used arises from the used cable cross-section.

Part number	Nominal size in mm	Inside diameter in mm
0090396-2621	R42/26/18	24.9
0090390-5241	R56/32/18	29.5
0090395-3820	R63/38/25	36.0
0090395-5222	R87/54/30	54.5
0090395-5520	R102/66/15	64.5

4. Installation

4.1 EMC-compatible control cabinet installation

1	Mains fuse
2	Main contactor
3	EMC side mount filter (>=size 25 R-S or R6-N) EMC back mount filter (<=size 19 R6-S)
4	Commutation reactor / harmonic filter
5	COMBIVERT R6
6	if necessary, external DC fuses
7	Drive controller
8a	DC lines with ferrite
8b	Motor line with ferrite
9a	Protective Earth (PE) on the mounting plate control circuit
9b	Protective Earth (PE) on the mounting plate power circuit
9c	Equipotential bonding with the housing earth
10	Mains connection power circuit
10a	Mains connection control circuit
11	Control lines
⏚	Large area contact at the mounting plate

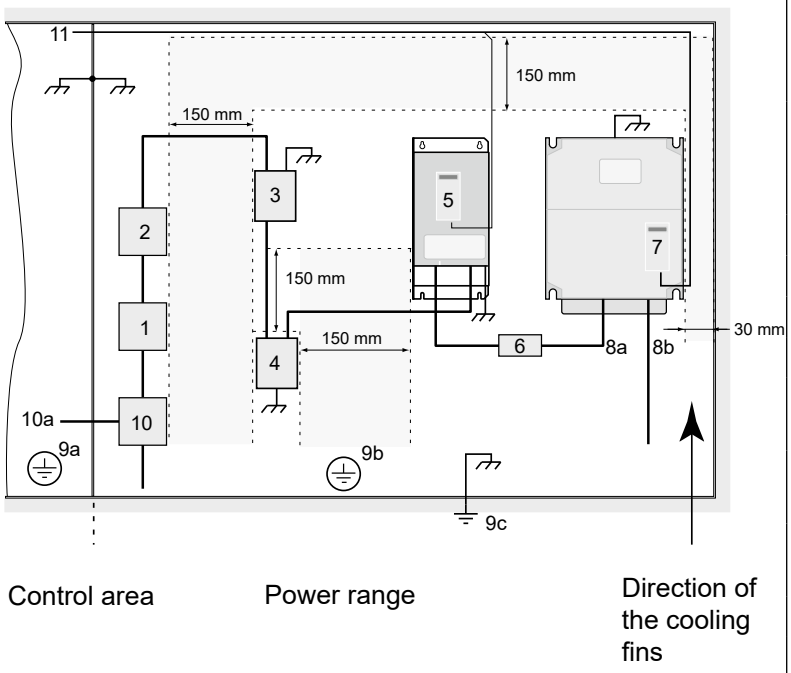


Figure 10: EMC-compatible control cabinet installation

4.2 Installation instructions

Warning ⚠ **General installation instructions**
• Stationary install and earth COMBIVERT.
• The device must not be permeated by mist or water.
• Allow for sufficient heat dissipation if installed in a dust-proof housing.
• Install the COMBIVERT in an appropriate housing in accordance with the local regulations when operating it in explosion-endangered spaces.
• Protect COMBIVERT against conductive and aggressive gases and liquids.
• The lines of the R6-N commutation reactor must be limiting to 1m.
• The inverter must be placed in the immediate environment of the R6-N.

4.3 Connection of the COMBIVERT R6-N

4.3.1 General description of inverter input terminals

Caution  **Starting current limiting**

When connecting inverters to a DC bus pay attention to the internal wiring of the DC voltage inputs!
Inverters that directly output the DC link bus to the DC terminals must be integrated into the DC bus by way that the supply unit(s) limit the starting current. The precharging must be completed within two seconds.

Caution  **Maximum DC link capacity**

The maximum DC link capacity can be calculated by adding the DC link capacities of all inverters in the DC bus. A table for this can be found in the appendix. The supply source (rectifier module or inverter with AC input) must be suitable for this value.

Terminals	Description of terminals at KEB inverters
++, – –	DC voltage input with starting current limiting; usable as output only if all units supplied by the DC bus have a starting current limiting at the DC voltage input.
+(PA), -	DC voltage output with starting current limiting; usable as input only if the starting current is limited by the supply source.
PA, PB	Connection for braking resistor; optionally only if a braking transistor is installed
L1, L2, L3	Mains input 3-phase

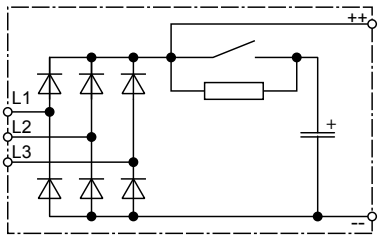
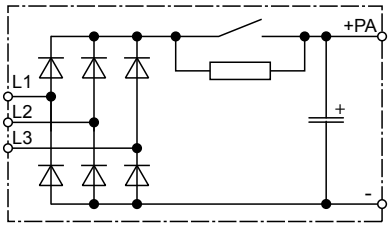
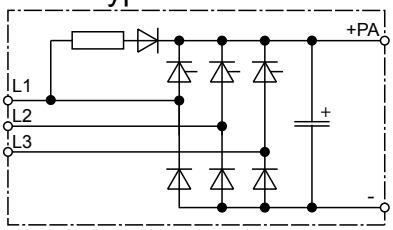
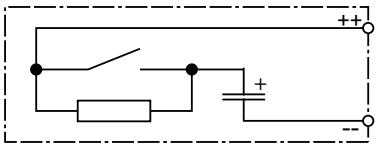
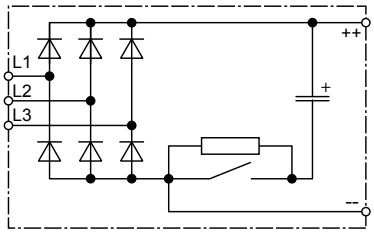
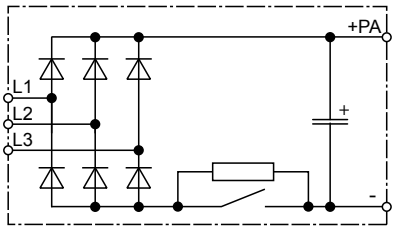
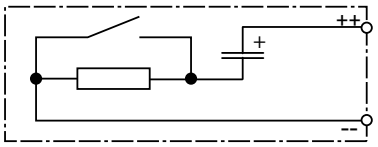
Type A1: AC/DC inverter	Type B1: AC inverter	Type C1: DC inverter
	 or also type D1 	
Type A2: AC/DC inverter	Type B2: AC inverter	Type C2: DC inverter
		
This type can be supplied by mains and by DC circuit. The starting current limitation is designed after the input terminals. When used as output parallel connected inverters must have an own starting current limiting at the DC voltage input. The maximum charging current is taken into account.	This type can be supplied by mains. The DC terminals can be used as output with regard to the maximum DC link capacity. When used as input ensure that the starting current is externally limited.	This type is only a DC inverter with starting current limiting. The DC inverter can be combined with all other types in consideration of the maximum DC link capacity.

Figure 11: General description of input terminals at KEB inverter

4.3.2 Connection terminals of the R6-N power circuit

Info **Input voltage**

The COMBIVERT R6-N in E-housing is suitable for rated voltages of 230 V and 400 V. The regenerative unit checks the mains at the first switching on and adjusts the parameters accordingly (see parameter CP.31 if mains supply is changed).

Notice **View of power supply and regenerative units**

The terminals of a power supply and regenerative unit can be input or output dependent on the actual operating status (power supply or regeneration). For the standardization of the view the line side is always regarded as input and the DC voltage side is always regarded as output.

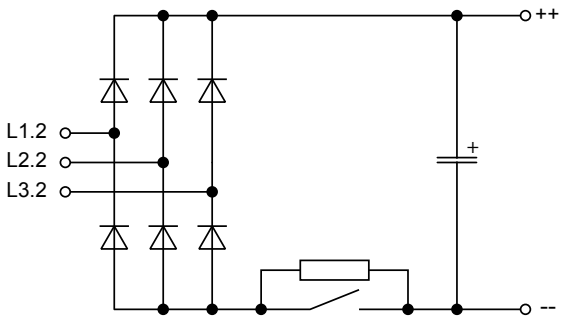
R6-N in E-housing	
	
Terminals	Description of terminals at KEB inverters
++, – –	DC voltage output with starting current limiting for loading the connected inverters; usable as input for regenerative operation. If inverters with mains supply of type A1 or A2 (see 4.3.1) are available in the DC bus, these may be switched to mains only after loading the DC bus. Note the maximum DC link capacity or decoupling diodes!
L1.2, L2.2, L3.2	Mains input 3-phase coming from the commutation reactor

Figure 12: Description of the input terminals of the COMBIVERT R6-N

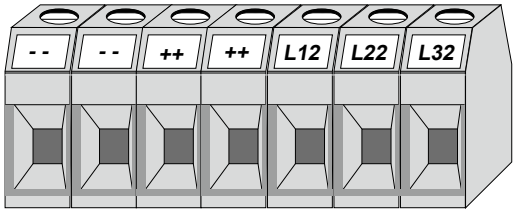
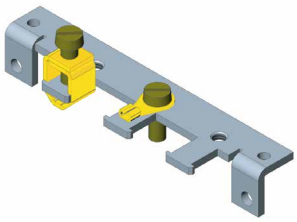
Housing Size E	Name	Function	Tightening torque [Nm] permissible cable cross-section	
	**L12** **L22** **L32**	3-phase supply input of the commutation reactor	1.5…25 mm² (AWG 16…4)	max. 4
	++ **--**	DC voltage output with starting current limiting		
	**PE,** ⏚	Connection for shielding/grounding occurs via provided copper bar by clamping yoke or ring cable lug. It must be mounted with four screws at the heat sink.	–	3
	Strain relief, shielding	The strain relief and the shielding must be done by the customer e.g. with two clips.	-	3

Figure 13: Terminals / earth handle

4.3.3 Terminals commutation reactor/ harmonic filter

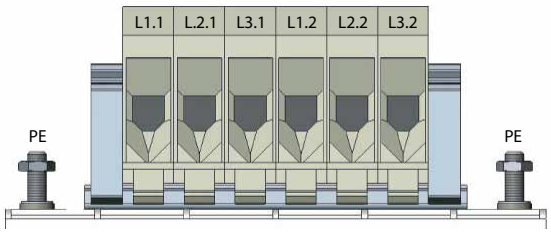
15/19Z1B04-1000 (commutation reactor) 15/19Z1C04-1000 (harmonic filter)	Name	Function	Tightening torque [Nm] permissible line cross section	
	**L1.1** **L2.1** **L3.1**	3-phase mains connection	Size 15 2.5...16 mm² (AWG 20…6)	Size 15 1.2…2
	L1.2 **L2.2** **L3.2**	Output to COMBIVERT R6-N	Size 19 2.5...35 mm² (AWG 12…2)	Size 19 2.5...5
	PE	Connection for shielding/earthing	–	6

Figure 14: Terminals for commutation reactor / harmonic filter

4.4 Connection Power Unit R6-N

4.4.1 Power supply and regeneration at inverter current ≤ current of one COMBIVERT R6-N

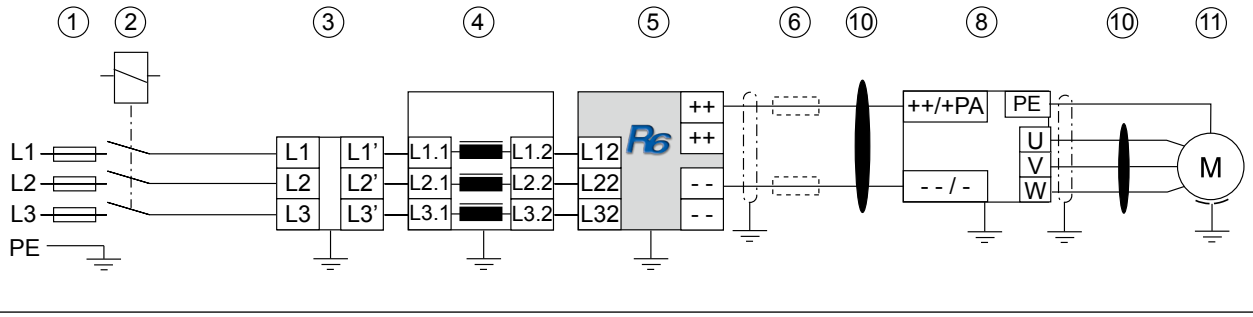
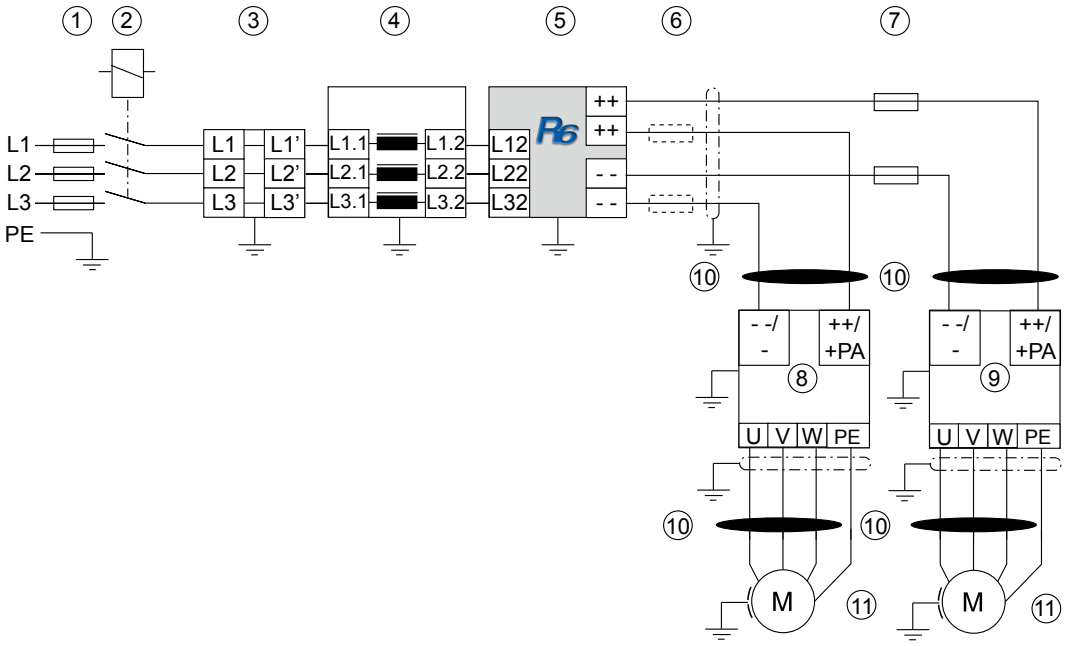


Figure 15: Power supply and regeneration at inverter current ≤ current of one COMBIVERT R6-N

4.4.2 Power supply and regenerative operation at inverter current ≤ current of one COMBIVERT R6-N



1	Mains fuse type gR	5	COMBIVERT R6-N with DC fuses [2]	9	Drive controller (FI type A1…C2 possible)
2	Mains contactor with protective circuit	6	DC fuses type aR/gR [1) 2)]		
3	Radio interference filter E6	7	DC fuses type aR/gR [2]	10	Ferrite (optional)
4	Commutation reactor / harmonic filter	8	Drive controller with $I_{N(8)} \geq I_{N(9)}$ (FI type A1…C2 possible)	11	Motor
1)	The cable cross-section may not be smaller than 10 mm². It must be dimensioned for the DC rated current of the load. Otherwise appropriate fuses in the DC bus (6) are required. The indicated maximum protection for the connected drive controllers must be observed!				
2)	If R6 devices without internal DC-fusing are used, fuses in accordance with annex B.1.2 must be used for compliance with UL. The specified fuses refer to a maximum fusing of the R6 devices. Lower fuse protection according to the connected inverter can be done with fuses of the same type.				
⚠	**Connection clockwise rotating field required!**				

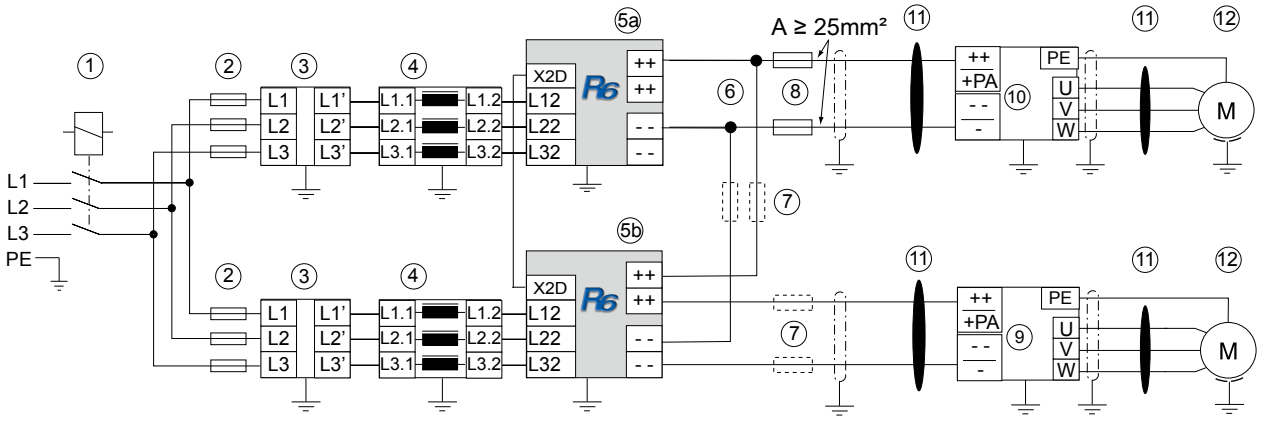
continued on the next page

⚠	**A load draw from the DC circuit may be done only if the ready signal is active**

Figure 16: Power supply and regeneration at inverter currents ≤ inverter current

4.4.3 Power supply and regeneraton at inverter currents ≤ current of one COMBIVERT R6-N

(Parallel operation of up to two units with an error at current sharing of the R6-N units of ≤10 %)



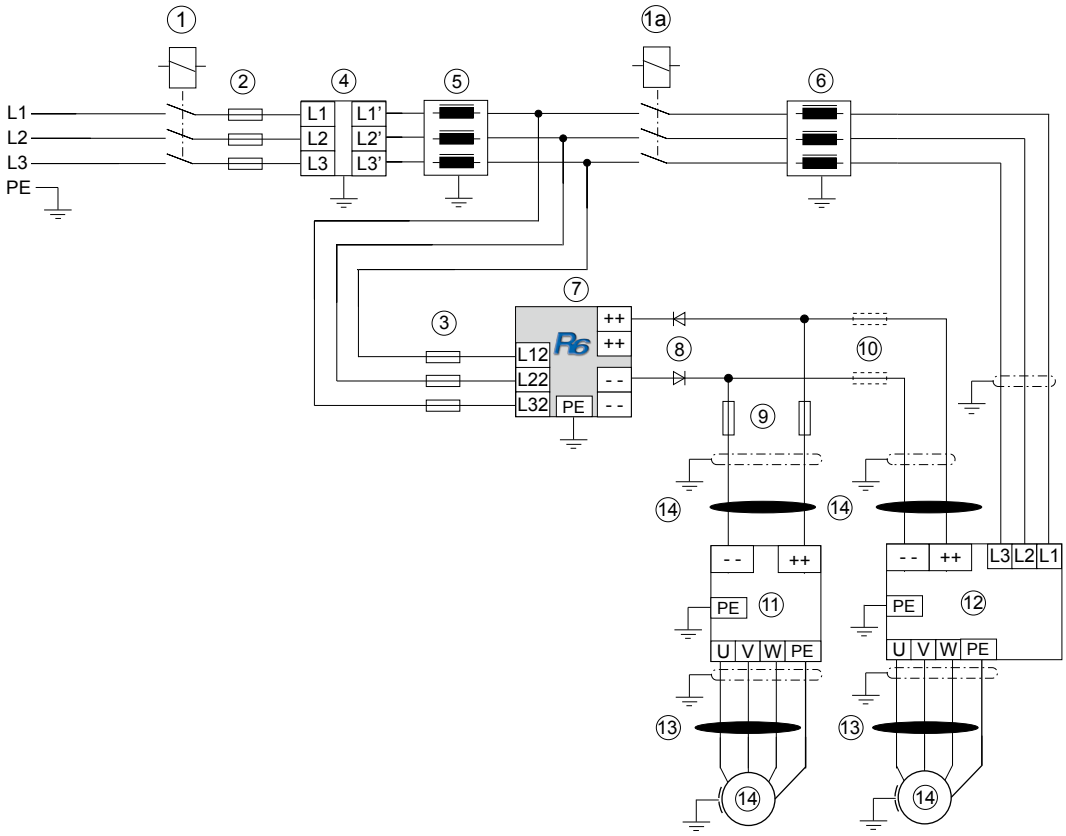
1	Mains contactor with protective wiring	5b	COMBIVERT R6-N slave with DC fuses [5]	10	Drive controller with $I_{N(10)} > I_{N(5)}$ [1] (FI type A1…C2 possible)
2	Mains fuses type gR [4]	6	External terminal [1]	11	Ferrite (optional)
3	Radio interference filter E6	7	DC fuses type aR/gR [2] [4] [5]	12	Motor
4	Commutation reactor/harmonic filter [3]	8	DC fuses type aR/gR [4] [5]		
5a	COMBIVERT R6-N master with DC fuses [5]	9	Drive controller with $I_{N(9)} < I_{N(5)}$ (FI type A1…C2 possible)		

1)	If the inverter current > inverter current of the COMBIVERT R6-N, it must be wired at an external terminal (6).
2)	The cable cross-section may not be smaller than 10 mm². It must be dimensioned for the DC rated current of the load. Otherwise appropriate fuses in the DC bus (7) are required. The indicated maximum protection for the connected drive controllers must be observed!
3)	In case of parallel connection of R6-N the total power can be lower up to 10 % caused by production tolerances of the commutation reactor.
4)	Mains and DC fuses must be monitored.
5)	If R6 devices without internal DC-fusing are used, fuses in accordance with annex B.1.2 must be used for compliance with UL. The specified fuses refer to a maximum fusing of the R6 devices. Lower fuse protection according to the connected inverter can be done with fuses of the same type.
⚠	**When connecting the devices absolutely pay attention to correct phasing!**
⚠	**Connection clockwise rotating field required!**
⚠	**A load draw from the DC circuit may be done only if the ready signal is active**
⚠	**For parallel connection, a base load per R6-N greater than 10% is required.**

Figure 17: Power supply and regeneration at inverter current ≥ inverter current

4.4.4 Regeneration with decoupling diodes

Regenerative inverter currents ≤ current of one COMBIVERT R6-N (with mains-operated inverter of type A1 or A2 and max. power ratio from inverter to regenerative unit 1.7:1)



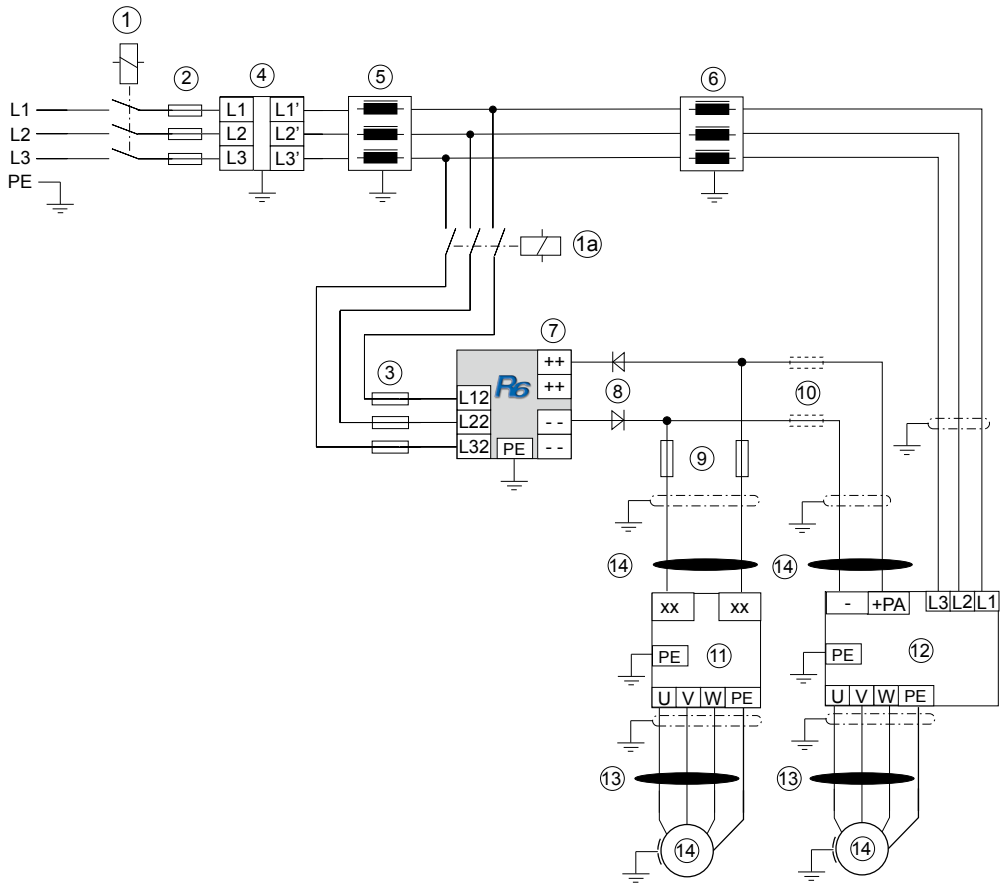
1	Line contactor with protective wiring	5	Mains choke / harmonic filter [4]	10	DC fuses type aR/gR [1] [3]
1a	Contactor with protective wiring [2]	6	Choke (xxZ1F04-1010) [4]	11	Drive controller (type A1, A2, C1, C2)
2	Mains fuses	7	COMBIVERT R6-N with DC fuses [3]	12	Drive controller (type A1, A2 -> 4.3.1)
3	Mains fuse type gR	8	Decoupling diodes (see annex)	13	Ferrite (optional)
4	Radio interference filter E6	9	DC fuses type aR/gR [3]	14	Motor
1)	The cable cross-section may not be smaller than 10 mm². It must be dimensioned for the DC rated current of the load. Otherwise appropriate fuses in the DC bus (10) are required. The indicated maximum protection for the connected drive controllers must be observed!				
2)	The contactor may only be connected if the precharging in the regenerative unit is completed. If there are several inverters, the max. permissible charging current of the inverter must be observed.				
3)	If R6 devices without internal DC-fusing are used, fuses in accordance with annex B.1.2 must be used for compliance with UL. The specified fuses refer to a maximum fusing of the R6 devices. Lower fuse protection according to the connected inverter can be done with fuses of the same type.				
4)	Mains choke xxZ1B04-1000 or harmonic filter xxZ1C04-1000 must be sized for the power supply.				
⚠	**Connection clockwise rotating field required!**				
⚠	**A load draw from the DC circuit may be done only if the ready signal is active (see page GB - 26).**				

continued on the next page

⚠	**In case of failure the contactors must disconnect the units from the supply system.**

Figure 18: Regenerative inverter currents ≤ inverter current (type A1/A2)

Regenerative inverter currents ≤ current of one COMBIVERT R6-N (with mains-operated inverter of type B1 or B2 and max. power ratio from inverter to regenerative unit 1,7:1)



1	Mains contactor with protective circuit	5	Mains choke / harmonic filter [4]	10	DC fuses type aR/gR [1] [3]
1a	Regenerative contactor with protective wiring [2]	6	Choke (xxZ1F04-1010) [4]	11	Drive controller (all types)
2	Mains fuses	7	COMBIVERT R6-N with DC fuses [3]	12	Drive controller (type B1, B2)
3	Mains fuse type gR	8	Decoupling diodes (see annex)	13	Ferrite (optional)
4	Radio interference filter E6	9	DC fuses type aR/gR [3]	14	Motor
1)	The cable cross-section may not be smaller than 10 mm². It must be dimensioned for the DC rated current of the load. Otherwise appropriate fuses in the DC bus (10) are required. The indicated maximum protection for the connected drive controllers must be observed!				
2)	The contactor may only be connected if the precharging in the regenerative unit is completed. Note the permissible DC link capacity of the charging circuit of the inverter!				

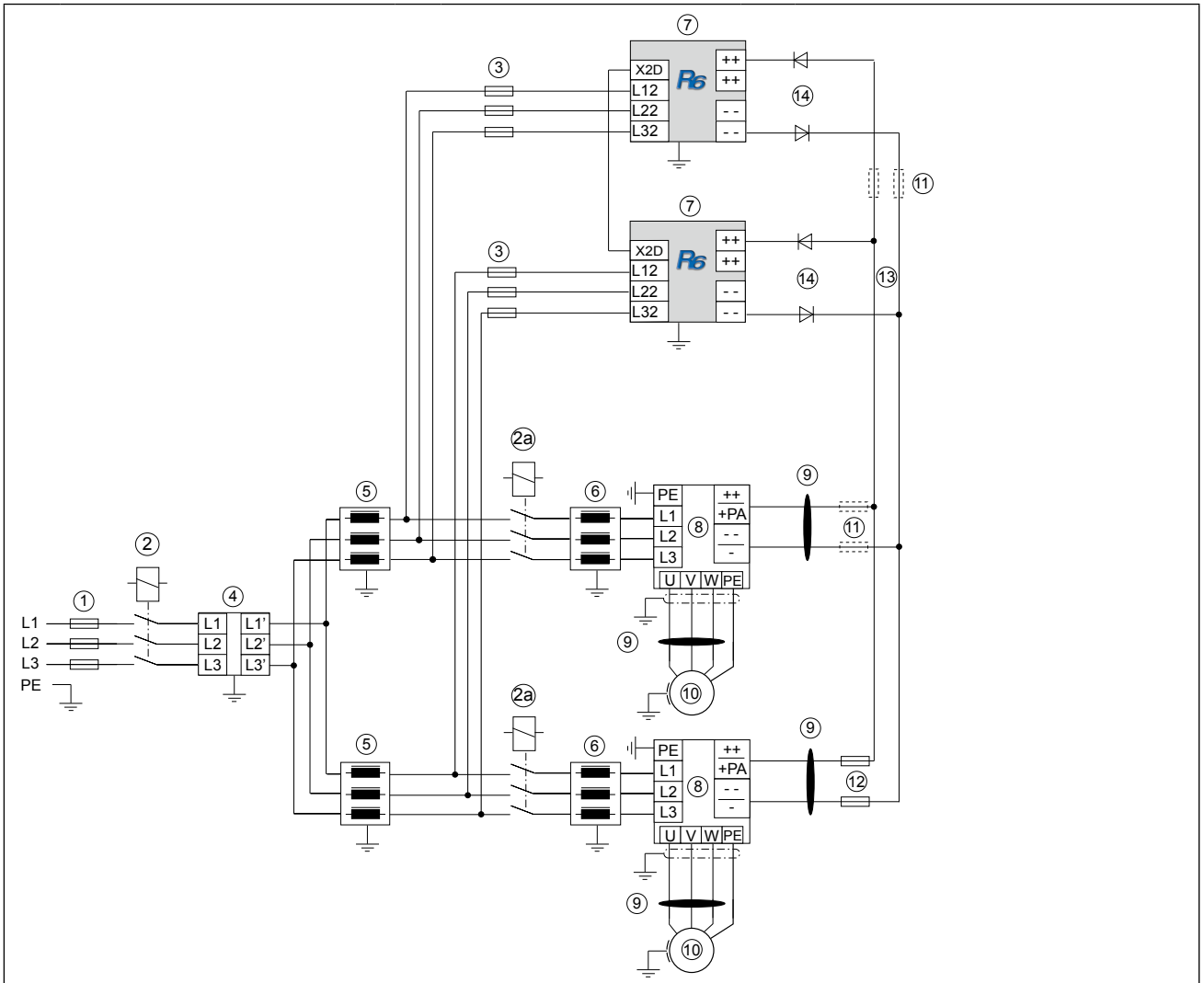
continued on the next page

3)	If R6 devices without internal DC-fusing are used, fuses in accordance with annex B.1.2 must be used for compliance with UL. The specified fuses refer to a maximum fusing of the R6 devices. Lower fuse protection according to the connected inverter can be done with fuses of the same type.
4)	Mains choke xxZ1B04-1000 or harmonic filter xxZ1C04-1000 must be sized for the power supply.
⚠	**Connection clockwise rotating field required!**
⚠	**A load draw from the DC circuit may be done only if the ready signal is active.**
⚠	**In case of failure the mains contactor must disconnect the devices from the supply system.**

Figure 19: Regenerative inverter currents ≤ inverter current (type B1/B2)

4.4.5 Regeneration at parallel operation of up to two R6-N with decoupling diodes

(Parallel operation with an error at current sharing of the R6-N units of ≤10 % and max. power ratio from inverter to regenerative units 1.7:1)



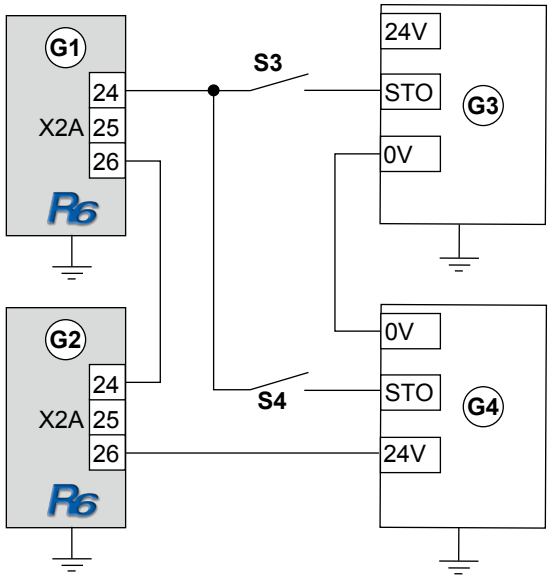
1	Mains fuses [5]	6	Choke (xxZ1F04-1010) [6]	10	Motor
2	Mains contactor with protective wiring	7	Combivert R6-N with DC fuses	11	DC fuses type aR/gR [1] [5]
2a	Contactor with protective circuit [3]	8	Drive controller (type A1/ A2 or B1/B2) same type and size	12	DC fuses type aR/gR [5]
3	Mains fuses type gR [5]	9	Ferrite (optional)	13	External terminal block [2]
4	Radio interference filter E6			14	Decoupling diodes (see annex)
5	Mains choke xxZ1B04-1000 harmonic filter xxZ1C04-1000 4 [6]				
1)	The cable cross-section may not be smaller than 10 mm². It must be dimensioned for the DC rated current of the load. Otherwise there are fuses in the DC circuit (10) necessary The indicated maximum protection for the connected drive controllers must be observed!				
2)	If the inverter current > inverter current of the COMBIVERT R6-N, it must be wired at an external terminal (13).				
3)	The contactor may only be connected if the precharging in the DC circuit of the regenerative unit has been completed.				

continued on the next page

4)	In case of parallel connection of R6-N the total power can be lower up to 10 % caused by production tolerances of the commutation reactor /harmonic filter.
5)	Mains and DC fuses must be monitored.
6)	Mains choke / harmonic filter must be sized for the power supply.
⚠	**When connecting the devices absolutely pay attention to correct phasing!**
⚠	**Connection clockwise rotating field required!**
⚠	**A load draw from the DC circuit may be done only if the ready signal is active (see page GB - 26).**
⚠	**In case of failure the contactors must disconnect the units from the supply system.**
⚠	**For parallel connection, a base load per R6-N greater than 10% is required.**

Figure 20: Regeneration operation at parallel operation

Connection of the control release of the connected inverters

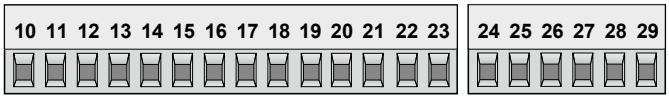


⚠	**A load draw in the DC circuit may be done only when the message "ready“ is set. This can be guaranteed by a series connection of relay R1 of the R6-N units with the control release of the connected inverters.**			
G1, G2	Regenerative unit COMBIVERT R6			
	X2A	Control terminal strip		
		24	Relay 1 / NO contact	Ready for operation relay
		25	Relay 1 / NC contact	
		26	Relay 1 / switching contact	
G3, G4	Drive controller			
	X2A	Control terminal strip		
		STO	Control release	General terminal assignment for drive controllers
		24V	24V output	
		0V	Mass	
S3, S4	Control release			

4.5 Connection of the control board version N

4.5.1 Assignment of the control terminal strip X2A

X2A

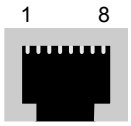


Core cross-section 0.14…1.5 mm², tightening torque 0.5 Nm

PIN	Function	Name	Default	Description	Specifications
10	24V input	Uin		External supply of the control board	21.6…26.4 V DC / 1 A
11	24V ground	COM		Reference potential: 24V input	
12	Digital input 1	ST		Control release / reset	Ri: 4.4 kΩ
13	Digital input 2	I1	Set selection	programmable	
14	Digital input 3	I2	Set selection	programmable	
15	Digital input 4	I3	Ext. error	programmable	
16	Mass	COM		Reference potential	
17	24 V output	Uout		Voltage supply for in and outputs	approx. 24 V / max. 100 mA
18	Mass	COM		Reference potential	
19	Digital output 1	O1	DC > 600V	Transistor output (DC > CP.19)	I_{max}: 25 mA
20	Digital output 2	O2	Error message	Transistor output (error message)	I_{max}: 25 mA
21	Analog output	ANOUT		Difference to mains frequency (CP.18)	0…±10 V / max. 5 mA
22	24 V output	Uout		see terminal 17	
23	Mass	COM		Reference potential	
24	Relay 1 / NO contact	RLA	Ready for operation (no error)	Relay output Ready signal ("Stb" or "rEGEn")	max. 30 V DC *) 0.01…2 A DC
25	Relay 1 / NC contact	RLB			
26	Relay 1 / switching contact	RLC			
27	Relay 2 / NO contact	FLA	DC > 600V	Relay output (DC > CP.19)	max. 30 V DC *) 0.01…2 A DC
28	Relay 2 / NC contact	FLB			
29	Relay 2 / switching contact	FLC			

*) max. 1Aac is permissible for 125Vac.

4.5.2 Assignment of the sockets X2D

RJ45 socket for parallel operation of regenerative units	No.	Name		
	1	IGBT off	→	High
	2	IGBT off	→	Low
	3	SLAVE active	→	High
	4	IGBT on	→	High
	5	IGBT on	→	Low
	6	SLAVE active	→	Low
	7	nc		
	8	nc		

Notice **at parallel connection**

At parallel connection the regenerative units are connected with the KEB catch cable (see Chapter Accessories) via the socket X2D.

4.5.3 Wiring example

Notice EMC
In order to prevent a malfunction caused by interference voltage supply on the control inputs, the following directions should be observed:
• Use shielded/drilled cables
• Lay shield on one side of the inverter onto earth potential
• Lay control and power cable separately (about 10...20 cm apart); lay crossings in a right angle

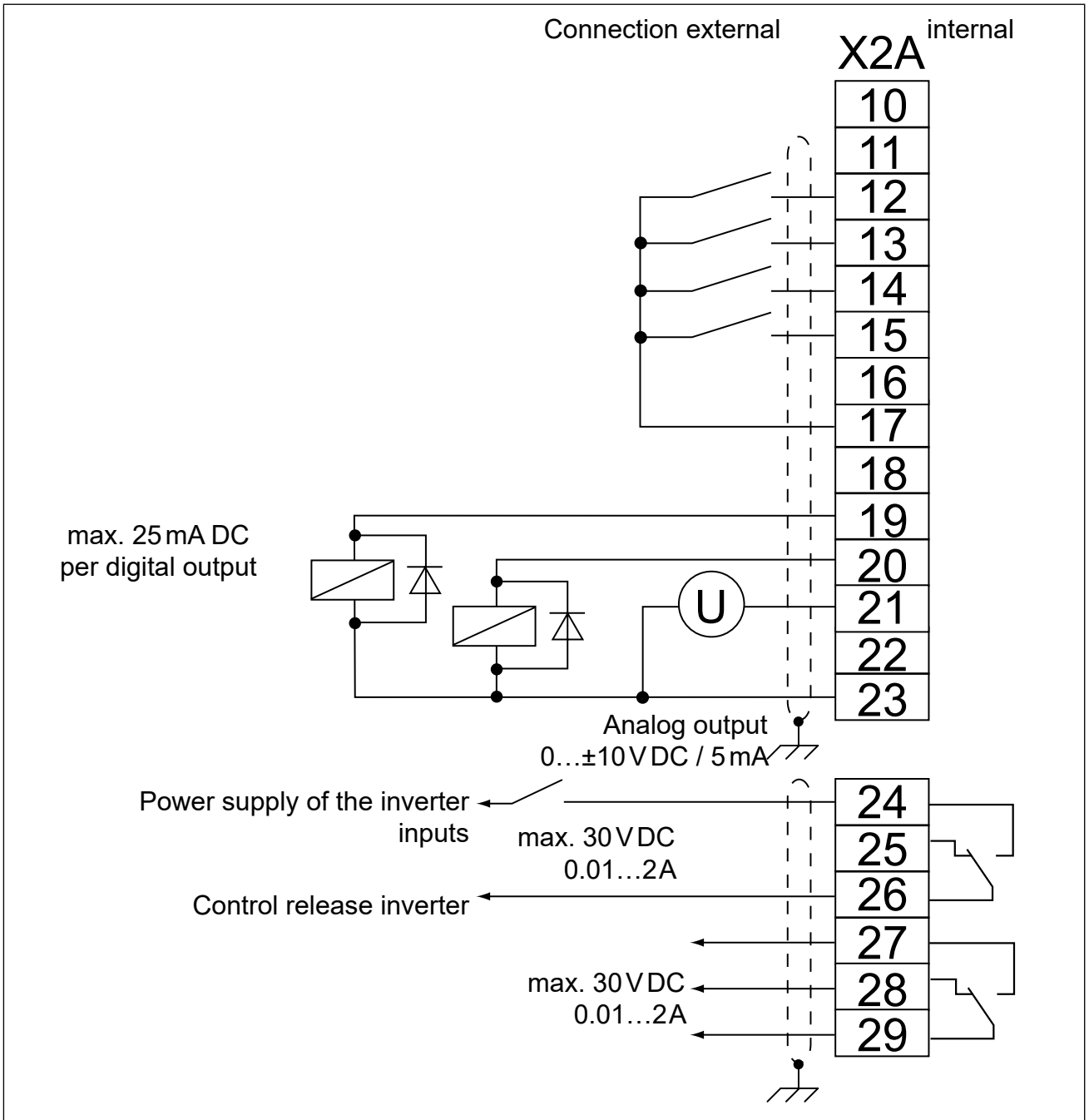


Figure 21: Wiring example R6-N

5. Operation of the Device

5.1 Operation with PC and system software COMBIVIS

Instructions for the installation and operation of the system software COMBIVIS can be taken from the appropriate software instruction.

5.2 Switch-on procedure

The COMBIVERT R6-N is initialized after connection of the power supply. The power circuit identification is checked first. Error "E.Puci” (Power unit code invalid) is released if an invalid power unit is recognized. This error cannot be reset, the power unit must be checked.

The COMBIVERT R6-N changes into synchronisation phase if a valid power unit is recognized.The following procedures occur one after another during this synchronisation phase:

- Testing the mains phases -> error "E.nEt” is triggered if a mains phase is missing.
- Testing the phase allocation -> error "E.SYn” is triggered if a phase allocation error occurs (reverse rotation).

The actual mains frequency is determined and the correct connection of the COMBIVERT R6-N is secured after successful synchronisation. If the control release (terminal ST) is set, the COMBIVERT R6-N starts independently with the specified operation. Depending whether regenerative requirement is available, the COMBIVERT R6-N is in status "rEGEn” or "Stb”.

Status "Stb“

COMBIVERT R6-N detects a typical voltage level in the DC link of the connected drive controller (motor operation) and keeps the modulation signals of the regenerative unit deactivated.

Status "rEGEn”

If the DC voltage in the DC link (CP.09 or ru.19) exceeds the value of the regeneration level (CP.34 or cs.02) referring to the reference value ru.18, the modulation signals are activated and the unit changes into regenerative operation. Further the regenerative unit is switched active, if regenerative operation is requested by an additional installed COMBIVERT R6-N in the system (master /slave operation).

5.3 Parameter summary

The CP-Parameters are one of the parameter selection defined by KEB. You need an application manual in order to get access to the entire parameters.

Display	Parameter	Setting range	Resolution	Factory setting	based on
CP.00	password	0…9999	1	–	Ud.01
CP.01	inverter state	–	–	–	ru.00
CP.02	actual line frequency	–	0.1 Hz	–	ru.03
CP.03	AC current L1	–	0.1 A	–	ru.08
CP.04	AC current L2	–	0.1 A	–	ru.09
CP.05	AC current L3	–	0.1 A	–	ru.10
CP.06	act. DC utilization	–	1 %	–	ru.13
CP.07	peak DC utilization	–	1 %	–	ru.14
CP.08	DC output current	–	0.1 A	–	ru.15
CP.09	DC voltage	–	1 V	–	ru.19
CP.10	peak DC voltage	–	1 V	–	ru.20
CP.11	power module temperature	–	1 °C	–	ru.38
CP.12	OL counter display	–	1 %	–	ru.39
CP.13	actual power	–	0.1 kW	–	ru.81
CP.14	total regen	–	0.1 kWh	–	ru.82
CP.15	total motor	–	0.1 kWh	–	ru.83
CP.16	total net	–	0.1 kWh	–	ru.84
CP.17	actual net	–	0.1 kVA	–	ru.85
CP.18	ANOUT1 gain	±20.00	0.01	1.00	An.33
CP.19	comparison level 0	±30000.00 V	0.01 V	600.00 V	LE.00
CP.20	general fault reset	0…10	1	3	Pn.15
CP.21	last error	–	–	–	In.21
CP.22	last error -1	–	–	–	In.21
CP.23	last error -2	–	–	–	In.21
CP.24	last error -3	–	–	–	In.21
CP.25	last error -4	–	–	–	In.21
CP.26	last error -5	–	–	–	In.21
CP.27	last error -6	–	–	–	In.21
CP.28	last error -7	–	–	–	In.21
CP.29	software version	1.11	–	1.11	In.06
CP.30	software date	0801.7	–	0801.7	In.07
CP.31	power unit code	250	–	–	Sy.03
CP.32	puls off level	0.0…-1000.0 kW	0.1 kW	-0.8 kW	cS.06
CP.33	operating mode	0…3	1	0	Pn.19
CP.34	regeneration level	100…120 %	1 %	103 %	cS.02

5.4 Password input

No.	Name	r/w	Enter	based on
CP.00	password	–	–	Ud.01
Ex works the COMBIVERT R6-N is supplied without password protection, i.e. all changeable parameters can be adjusted. After parameterizing the inverter can be secured against unauthorized access (locking: 100 and release: 200). The adjusted mode is stored.				

5.5 Monitoring and analysis parameters

The following parameters serve for the functional monitoring during operation.

No.	Name	r/w	Enter	based on
CP.01	inverter state	–	–	ru.00
The status display shows the actual working condition of the COMBIVERT.				
Status messages				
rEGEn	Regeneration active (regenerative operation)			
bbL	Count down of the base-block time, R6-N released			
noP	"no Operation“ control release not bridged, modulation switched off			
nEtoF	Mains power failure; regenerative operation is further possible, if the disconnecting time E.nEt (Pn.14) > 0 s			
rinit	Re-initialisation			
Stb	R6-N regenerative unit in stand-by operation (motor operation)			
Error Messages				
E.EF	External Fault, error message by an external unit			
E.FnEt	"Error! Mains frequency", the mains frequency deviates more than 5 %. The max. mains frequency deviation can be adjusted in the application mode with CS.03.			
E.Frlr	Error "Fault reset level reached" is triggered when the adjusted value in parameter Pn.15 is reached within one hour. The error can be reset.			
E.LSF	Error! Charging circuit, load-shunt defective or wrong or input voltage too low. This message is displayed for a short time during the power-on phase (no error message follows).			
E.nEt	"Error! net, one or more phases are missing			
E.nOH	No overheat, over-temperature error not present (E.OH), error can be reset.			
E.nOL	No overload, cooling time after E.OL is up , error can be reset.			
E.OC	"Error! Overcurrent“, output current too high or ground fault			
E.OH	"Error! Overtemperature“, overheating at heat sink (see "Technical data“)			
E.OHI	"Error! Interior temperature“, temperature in the interior > 95 °C			
E.OL	"Error! Overload“, overload monitoring of the regenerative unit has responded			
E.OP	"Error! Overvoltage“, DC link voltage too high			
continued on the next page				

No.	Name	r/w	Enter	based on
CP.01	inverter state	–	–	ru.00
E.Pfd	"Error! power flicker det.“, mains interruption (phase) during the initialisation phase			
E.Pu	"Error in power unit“, power unit code is missing, load shunt relay defective			
E.Puci	Power unit identification invalid			
E.Puch	"Error! Power unit changed“, a configured unit for 400 V was connected to a 230 V mains (or reverse). Load factory setting with CP.31, so the device can adapt itself to the changed supply system.			
E.SYn	"Error! Synchronisation“ with wrong phase allocation (reverse rotation).			
E.UP	"Error! Undervoltage“, DC link voltage too low			

No.	Name	r/w	Enter	based on
CP.02	actual line frequency	–	–	ru.03

After switching on, the actual mains frequency is determined during the initialization phase. Slowly changes of the line frequency during the operation are recognized and displayed in CP.02. CP.02 displays the actual regenerative frequency, if the COMBIVERT R6-N is in "netof" state.

Resolution	Meaning
0.01 Hz	positive values = forward rotating field
	negative values = reverse rotating field (not permissible -> error E.SYn)

No.	Name	r/w	Enter	based on
CP.03	AC current L1	–	–	ru.08
CP.04	AC current L2	–	–	ru.09
CP.05	AC current L3	–	–	ru.10

Resolution	Meaning
0.1 A	Display of the actual input current of the respective phase.

No.	Name	r/w	Enter	based on
CP.06	act. DC utilization	–	–	ru.13

Resolution	Meaning
1 %	Independent whether power supply or regenerative operation, the display indicates the actual utilization of the COMBIVERT R6-N. 100 % correspond to the rated current of the COMBIVERT R6-N.

No.	Name	r/w	Enter	based on
CP.07	peak DC utilization	–	–	ru.14

Resolution	Meaning
1 %	Parameter CP.07 enables to recognize short-term peak utilization within an operating cycle. For that the highest value of CP.06 is stored in CP.07. The peak value memory can be cleared by pressing the UP and DOWN key or via bus by writing any value you like to the address of CP.10. Switching off COMBIVERT R6-N also clears the memory.

No.	Name	r/w	Enter	based on
CP.08	DC current	–	–	ru.15

Resolution	Meaning
0.1 A	Display of the actual DC output current in ampere.

No.	Name	r/w	Enter	based on
CP.09	DC voltage	–	–	ru.19

Resolution	Meaning
1 V	Display of actual DC link voltage in volt. The value is measured at the DC output terminals of the COMBIVERT R6-N.

No.	Name	r/w	Enter	based on
CP.10	peak DC voltage	–	–	ru.20

Value range	Meaning
0…1000 V	Parameter CP.10 enables to recognize voltage peaks within an operating cycle. For that the highest value of CP.09 is stored in CP.10. The peak value memory can be cleared by pressing the UP and DOWN key or via bus by writing any value you like to the address of CP.10. Switching off COMBIVERT R6-N also clears the memory.

No.	Name	r/w	Enter	based on
CP.11	power module temperature	–	–	ru.38

Resolution	Meaning
1 °C	Display of the actual power module temperature. On exceeding the maximum power module temperature (see "Technical data") the modulation is switched off and error E.OH is displayed. Message E.nOH is displayed after the cooling period. The error can be reset now.

No.	Name	r/w	Enter	based on
CP.12	OL counter display	–	–	ru.39

Resolution	Meaning
1 %	The permanent load of the COMBIVERT R6-N can be evaluated with this parameter, in order to avoid an E.OL error (in-time load reduction). Error E.OL is released, if the overload counter reaches 100 %.

No.	Name	r/w	Enter	based on
CP.13	actual power	–	–	ru.81

Resolution	Meaning
0.1 kW	CP.13 displays the actual power of the COMBIVERT R6-N. Motor power is displayed with positive values, generatoric power is displayed with negative values.

No.	Name	r/w	Enter	based on
CP.14	total regen	–	–	ru.82

Resolution	Meaning
1 kW	Counter for the regeneratoric electric work to mains.

No.	Name	r/w	Enter	based on
CP.15	total motor	–	–	ru.83

Resolution	Meaning
1 kW	Counter for the supplied electrical work from mains in kWh.

No.	Name	r/w	Enter	based on
CP.16	total net	–	–	ru.84

Resolution	Meaning
1 kW	Display of the difference between supplied and regeneratoric work. The result is displayed by right sign.

No.	Name	r/w	Enter	based on
CP.17	Actual net	–	–	ru.85

Resolution	Meaning
0.01 kVA	Display of the current apparent power at the mains input.

5.6 Special adjustments

The power supply and regenerative unit can be adapted to the application with the following parameters.

No.	Name	r/w	Enter	based on
CP.18	ANOUT1 gain	yes	–	An.33
The analog output displays the difference between actual supply frequency and set supply frequency. At factory setting of CP.18 this corresponds to 1 V per 0.1 Hz difference. The display occurs with right sign. The reference value of 50 or 60 Hz is determined during power on.				
Setting range	Setting	Meaning		
0…±20.00	1.00	The amplification to the desired output voltage can be adapted with CP.18. Max. possible: ±10 V.		

No.	Name	r/w	Enter	based on
CP.19	DC switching level	yes	–	LE.00
This parameter determines the switching level for transistor output O1, as well as relay output 2.				
Setting range	Setting	Meaning		
0…3200.00 V	600.00 V	The switching condition is fulfilled and the transistor output is set if the DC voltage level exceeds the adjusted value in CP.19. Relay output 2 is set, if the load shunt relay is additionally tightened.		

No.	Name	r/w	Enter	based on
CP.20	general fault reset	yes	–	Pn.15
	**A general fault reset can be activated with this parameter. Attention, the machine manufacturer must observe appropriate protective measures for operating personnel and machine.**			
Setting range	Setting	Meaning		
0	3	No general fault reset.		
1…10		Maximum errors, which are reset within one hour. If the number of errors per hour exceeds the adjusted value in CP.20, only a manual reset via the terminal strip can be made.		

No.	Name	r/w	Enter	based on
CP.21	last error	–	–	In.24 set 0
CP.22	last error (t-1)	–	–	In.24 set 1
CP.23	last error (t-2)	–	–	In.24 set 2
CP.24	last error (t-3)	–	–	In.24 set 3
CP.25	last error (t-4)	–	–	In.24 set 4
CP.26	last error (t-5)	–	–	In.24 set 5
CP.27	last error (t-6)	–	–	In.24 set 6
CP.28	last error (t-7)	–	–	In.24 set 7

Parameters CP.21…CP.28 display the last eight errors. With exception error "undervoltage E.UP" is not stored. The oldest error is displayed in CP.28. A new error is stored in CP.21. All other errors are shifted to the next parameter. The oldest error (CP.28) is not applicable.

The meaning of the error messages is described in parameter CP.01.

No.	Name	r/w	Enter	based on
CP.29	software version	–	–	In.06

Value range	Meaning
0.00…9.99	Display of the inverter software version number (e.g. 1,11).

No.	Name	r/w	Enter	based on
CP.30	software date	–	–	In.07

Value range	Meaning
0…6553.5	Display of the inverter software date in the format "ddmm.y“.

No.	Name	r/w	Enter	based on
CP.31	power unit code	–	–	Sy.03

The COMBIVERT R6-N detects the connected supply system (230 V/400 V) at the first switching on. Depending on the supply system the COMBIVERT R6-S adjusts internally certain parameter values.

If the COMBIVERT R6-N is connected to another supply system, these stored parameter values are not valid any longer. Error message "power unit changed (E.Puch)" is displayed.

Value range	Meaning
0…32767	If the displayed value is written, only the power unit dependent parameters are re-initialised.

No.	Name	r/w	Enter	based on
CP.32	puls off level	yes	–	cS.06

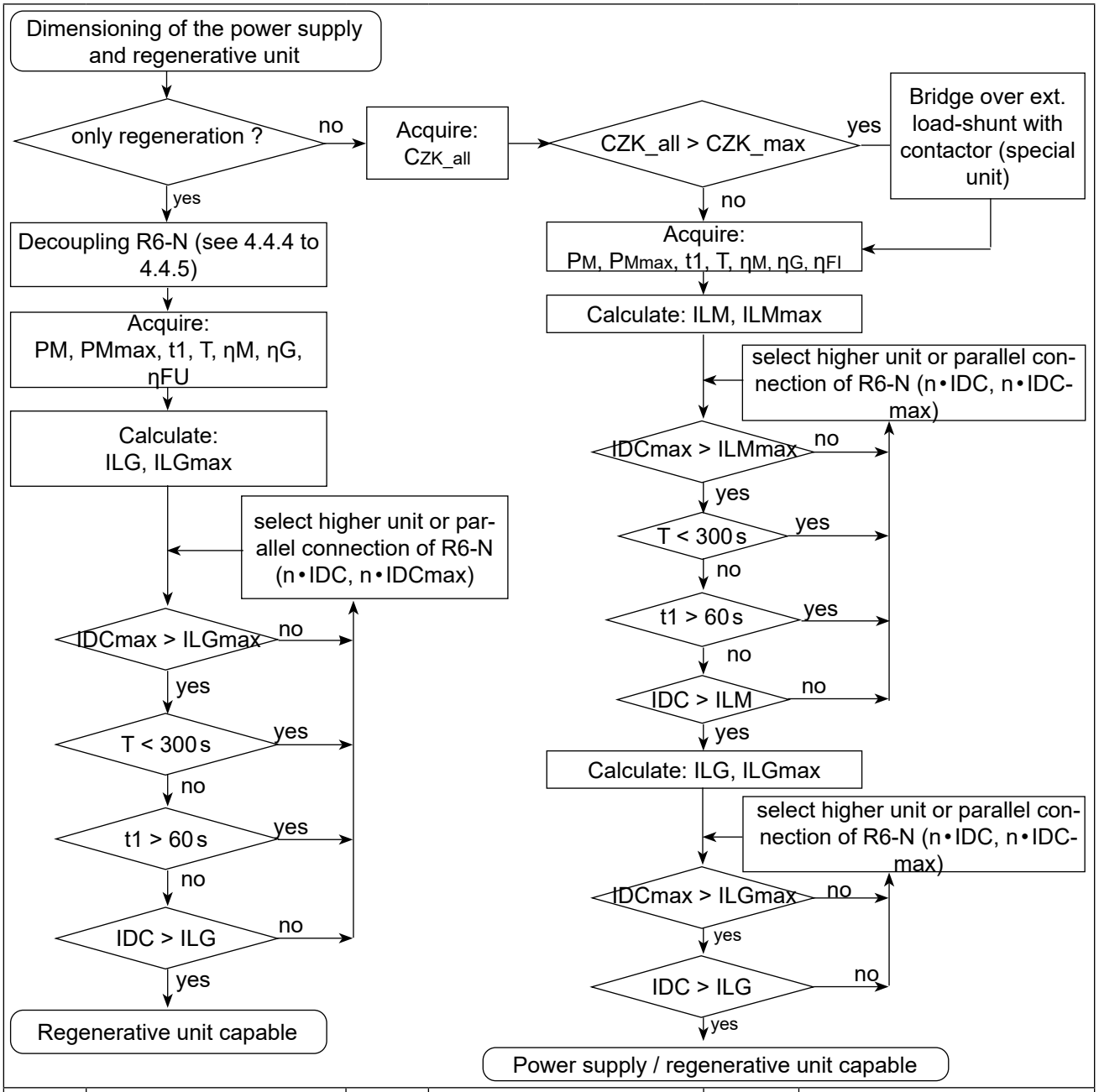
Value range	Standard	Meaning
0.0…-1000.0 kW	-0.8 kW	If the adjusted regenerative power is decreased, the COMBIVERT R6-N switches the modulation off after turn-off delay and changes into standby mode (display: „Stb“).

No.	Name	r/w	Enter	based on
CP.33	operating mode	yes	yes	Pn.19
This parameter determines the master or slave of regenerative units at parallel connection. Further it is adjusted whether a harmonic filter or a commutation choke is series-connected. Single units must be adjusted to master.				
Value range	Meaning			
0	Master with commutation reactor			
1	Master with harmonic filter			
2	Slave with commutation reactor			
3	Slave with harmonic filter			
4	Master-Slave with commutation reactor input selection			
5	Master-Slave with harmonic filter input selection			

No.	Name	r/w	Enter	based on
CP.34	regeneration level	yes	–	cS.02
Value range	Meaning			
100…120 %	The regeneration level determines the starting value to energy regeneration. The adjusted value refers to the reference value of the DC voltage in percentage. The status changes from Standby "Stb“ to regeneration "rEGEn“.			

A. Annex A

A.1 Dimension of power supply and regenerative units



PM	Mechanical power	ηM	Motor efficiency	IDC	DC output current R6-N
PM-max	Max. mechanical power	ηG	Gearbox efficiency	IDCmax	Max. DC output current R6-N
t1	Overload time	ηFU	Inverter efficiency	ILG	DC load regen. current
t	Load cycle	ILM	DC load mot. current	ILGmax	Max. DC load regen. current
n	Number R6-N	ILM-max	Max. DC load mot. current	CZK_all	DC link capacity of all drive controllers
				CZK_max	Max. connecting capacity R6-N

Figure 22: Dimension of power supply and regenerative units

A.2 DC link capacities of KEB drive controllers

Drive controller F5			
200 V devices		400 V devices	
Housing size	Capacity	Housing size	Capacity
05	780 µF	05	180 µF
07	880 µF (940 µF*)	07	180 µF (300 µF*)
09	1080 µF	09	300 µF
10	1080 µF	10	345 µF
12	2220 µF	12	470 µF
13	3280 µF	13	580 µF
14	4100 µF	14	650 µF
15	4100 µF	15	940 µF
16	5040 µF	16	1290 µF
17	9900 µF	17	1640 µF
18	13200 µF	18	1875 µF
19	15600 µF	19	2700 µF
20	16500 µF	20	3900 µF
21	19800 µF	21	4950 µF
		22	4950 µF
		23	6350 µF
		24	8400 µF
		25	9900 µF
		26	11700 µF
		27	14100 µF
		28(P)/28(W)	16200 / 19800 µF
		29(P)/(W)	19800 / 23400 µF
		30	28200 µF
		31	32900 µF
		32-35	39600 µF
		36	59400 µF

* Special device

Drive controller G6			
Housing	Device size	Capacity / µF	Precharging circuit
A	7	135	Type A1
	9	195	
	10	235	
B	12	470	Type A1
	13	560	
C	13	680	Type A1
	14		
	15	750	
D	13	680	Type A1
	14		
	15	840	
	16	1120	
E	16	1035	Type B1
	17	1400	
	18		
	19	1985	

Drive controller S6			
Housing	Device size	Capacity / µF	Precharging circuit
2	7	195	Type A1
	9	195	
	10	235	
4	12	470	Type A1
	13	560	

Notice Ferrites at the input and output are required in any case when using G6/S6.

A.3 Decoupling diodes

Use decoupling diodes when using the R6 as regenerative unit only, to avoid that the connected inverters cannot be supplied via the regenerative unit. Appropriate decoupling diodes are defined for the different sizes.

A.3.1 Assignment

R6-N	Material number	Type	Volume	Ta [°C]	Th [°C]	Rha [K/W]
15	0090147-3500	1600 V / 80 A	2	45	90	1.50
19	0090147-4101	1600 V / 120 A	2	45	90	0.84
25	0090147-6009	1600 V / 560 A	2	45	90	0.19
29	0090147-6009	1600 V / 560 A	2 x 2	45	90	0.09

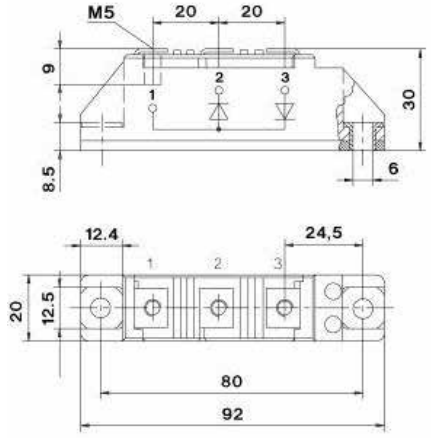
Legend

Ta: maximum ambient temperature

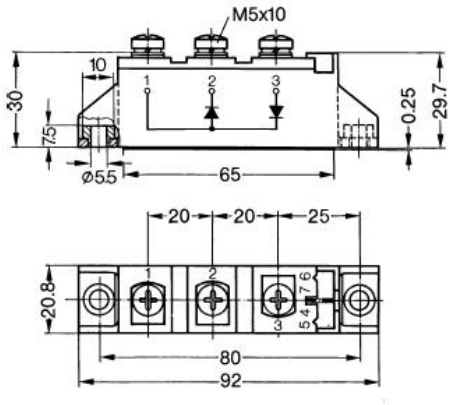
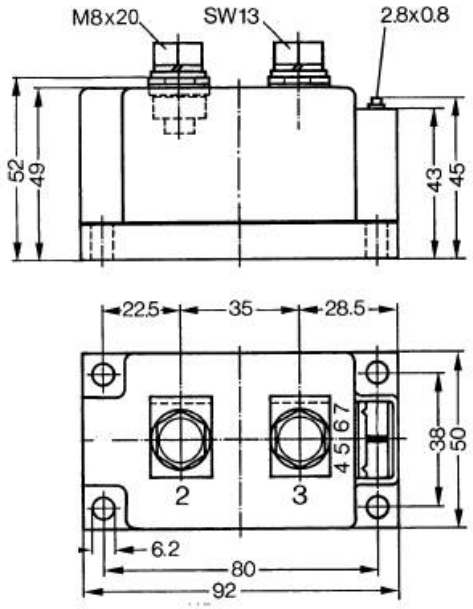
Th: maximum heat sink temperature

Rha: required thermal resistance of the heat sink at rated operation
(thermal value of the thermal compound ≥ 0.5 W/(m*K))

A.3.2 Dimensions of the decoupling diodes

Material number	Connection	Dimensions
0090147-3500	1 (anode) 2 (cathode) or 3 (anode) 1 (cathode)	

continued on the next page

Material number	Connection	Dimensions
0090147-4101	1 (anode) 2 (cathode) or 3 (anode) 1 (cathode)	
0090147-6009	3 (anode) 2 (cathode)	
Figure 23: Dimensions of the decoupling diodes		

B. Annex B

B.1 Certification

B.1.1 CE-Marking

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.

B.1.2 UL Certification

c UL us	Acceptance according to UL is marked at KEB power supply and regenerative units with the adjacent logo on the type plate.

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

- Maximum Surrounding Air Temperature 45°C
- When used without optional Line Filter or when used with optional Line Filter 15E4T60-1001 or 19R6T60-1001:

  Suitable For Use On A Circuit Capable Of Delivering Not More Than 10000rms Symmetrical Amperes, 240 or 480 Volts Maximum and When Protected by Fuses as listed below:

Feedback unit Cat. No.	Fuse
15R6 (240V)	1) RK1 fast acting or J fast acting, rated 50A, min. 250V 2) Special purpose, type 3NC2240, rated 40A/690Vac, mfr. by Siemens or type FWP-40A22FA, manufactured by Bussmann
19R6 (240V)	1) RK1 fast acting or J fast acting, rated 90A, min. 250V 2) Special purpose, type 3NC2200, rated 100A/690Vac, mfr. by Siemens or type FWP-40A22FA, manufactured by Bussmann
15R6 (400/480V)	1) RK1 fast acting or J fast acting, rated 50A, min. 480V 2) Special purpose, type 3NC2240, rated 40A/690Vac, mfr. by Siemens or type FWP-40A22FA, manufactured by Bussmann

19R6 (400/480V)	1) RK1 fast acting or J fast acting, rated 90A, min. 480V 2) Special purpose, type 3NC2200, rated 100A/690Vac, mfr. by Siemens or type FWP-40A22FA, manufactured by Bussmann

- When used with optional Line Filter 16E6T60-3000 or 20E6T60-3000:Suitable For Use On A Circuit Capable Of Delivering Not More Than 10000rms Symmetrical Amperes, 240 or 480 Volts Maximum and When Protected by Fuses as listed below:

Feedback unit Cat. No.	Optional Line Fi	Fuse
15R6 (240V)	16E6T60-3000	Class RK5 or J, rated 50A, min. 250V
19R6 (240V)	20E6T60-3000	Class RK5 or J, rated 90A, min. 250V
15R6 (400/480V)	16E6T60-3000	Class RK5 or J, rated 50A, min. 480V
19R6 (400/480V)	20E6T60-3000	Class RK5 or J, rated 90A, min. 480V

- Use 75°C Copper Conductors Only“
- Use in a Pollution Degree 2 environment“
- Following external DC fuses need to be installed in accordance with wiring diagrams in chapter 4.4 for following units without internal DC fuses:

15R6N1E-xxxx 15R6S1E-xxxx	Rated 690 Vac / 700 Vdc 50 A (KEB No.: 009025H-3459): R/C (JFHR2, JFHR8 or CSA Certified) - Type Sitor 3NE8-717-1, manufactured by Siemens or Type 170M1364-1, manufactured by Bussmann
19R6N1E-xxxx 19R6S1E-xxxx	Rated 690 Vac / 700 Vdc 125 A (KEB No.: 009025H-3559): R/C (JFHR2, JFHR8 or CSA Certified) - Type Sitor 3NE8-722-1, manufactured by Siemens or Type 170M1368-1, manufactured by Bussmann

- For Feedback units 15R6S1E-xxxx, 19R6S1E-xxxx, 15R6N1E-xxxx and 19R6N1E-xxxx: In case of Semiconductor Fuses as specified in item 4 and 12 above, the marking shall also state that the Feedback unit and overcurrent protection device must be integrated within the same overall assembly (effective date: May 9, 2013)
- Only for 15R6S1E-xxxx, 15R6S3E-xxxx, 15R6N1E-xxxx and 15R6N3E-xxxx:
  “Use max Wire Size: 8 AWG, strip wire insulation at 10 mm.” [1)]
  Wiring terminals are marked to show a range of values or a nominal value of tightening torque in pound-inches to be applied to the clamping screws as shown below:
  Mains Terminals of all 15.R6 AWG 8: 20.5 lb-in (2.3 Nm)
  Mains Terminals of all 19.R6 AWG 4: 18.0 lb-in (2.0 Nm)

[1)] For Mains Terminals of 19.R6 use max Wire Size: 4 AWG, strip wire insulation at 16 mm.

Info **Approved UL configurations**

For information on possible UL approved system configurations please contact KEB.

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Document	20116581	
Part/Version	ENG	02
Date	2018-12-04	