

COMBIVERT



R6

Instruction Manual
Type R6-S

Power Supply and Regenerative Unit
Size 15/19

Translation of the original manual		
Document	Part	Version
20311685	ENG	00





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1. Introduction

1.1 Preface

First we would like to welcome you as a customer of the KEB Automation KG and congratulation to the purchase of this product. You have decided for a product on highest technical niveau.

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

The manual must be made accessible for each user. Before working with the unit the user must become familiar with it. This especially applies to the knowledge and observance of the following safety and warning indications. The used pictograms have following significance:

	Danger	Is used, if life or health of the user is in danger or if substantial damage to property can occur.
	Warning	
	Caution	
	Notice	Is used, if a measure is necessary for the safe and trouble-free operation.
	Essential discharge time	
	Information	Is used, if a measure simplifies the handling or operation of the unit.
	Help	
	Tip	

Non-observance of the safety instructions leads to the loss of any liability claims. This list is not exhaustive.

1.2 Product description

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

The supply unit

- converts a three-phase input voltage into DC voltage.
- supplies single KEB frequency inverter or via DC interconnection.
- can be parallel connected 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.

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

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

1.3 Validity and liability

Application and use of our units in the target products is outside of our control and therefore exclusively in the area of responsibility of the machine manufacturer.

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.

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

Unauthorized opening and improper tampering can lead to bodily injuries or liability insurances and this cause loss of the warranty. Original spare parts and authorized accessories by the manufacturer serve as security. The use of other parts excludes liability for the consequences arising out of.

The suspension of liability is especially valid also for shutdown damages, lost profit, data loss or other consequential damages. This is also valid, if we have been referred to the possibility of such damages.

Should any part of this agreement be invalid for any reason, it is to be replaced with a corresponding text, which is valid and equivalent to the intended meaning. The rest of the agreement shall remain unaffected and valid.

1.4 Copyright

The customer may use the instruction manual as well as further enclosed documents or parts from it for internal purposes. KEB has the copyrights and they remain effective also to the full extent. All rights reserved. KEB®, COMBIVERT®, KEB COMBICONTROL® and COMBIVIS® are registered trademarks of the KEB Automation KG. Other wordmarks or/and logos are trademarks (TM) 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-S 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 devices.

The used semiconductors and components of KEB are developed and dimensioned for the use in industrial products. If the product 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. Regeneration is carried out in square-wave, whereby the current flow period is corresponding 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 Unit identification


19	R6	S	3	E	9	0	0	A	Type	A: Heat sink (standard)	B: Flat rear
									Design	0: Standard	
									reserved	0: Standard	
									Voltage	9: 3-ph.; 180...550V; AC	
									Housing	E	
									Options	0: without	3: Precharging, DC-fuses
										1: Precharging	
									Control	S: 1B.R6	
									Series	R6	
									Device size	15 (13), 19 (16)	

2. Safety Instructions

2.1 General instructions

 <p>Electric Shock</p>	<p>COMBIVERT R6 power supply and regenerative units contain dangerous voltages which can cause death or serious injury.</p> <p>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.</p> <p>Before working with the unit check the isolation from supply by measurements in the unit.</p> <p>Care should be taken to ensure correct and safe operation to minimise risk to personnel and equipment.</p>
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 <p>Only qualified electro-personnel</p>	<p>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.</p>
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 <p>Observe standards</p>	<p>The COMBIVERT R6 must not be started until it is determined that the installation complies with the Machine directive (2006/42/EC) (note EN 60204).</p> <p>The COMBIVERT R6 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.</p> <p>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.</p>
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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.


Safety Instructions


 <p>Protect against contact</p>	<p>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.</p> <p>Make sure that during installation there is enough minimum clearance and enough cooling. Climatic conditions must be observed in accordance with the instruction manual.</p>
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 <p>Hot surface</p>	<p>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.</p>
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2.3 Electrical connection

 <p>Observe capacitor discharge time</p>	<p>Before any installation and connection work, the system must be switched off and secured.</p> <p>After clearing the DC link capacitors are still charged with high voltage for a short period of time. The device can be worked on again, after it has been switched off for 5 minutes.</p>
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 <p>Safe isolation</p>	<p>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 requirements are met. For units without safe isolation from the supply circuit, all control lines must be included in further protective measures (e.g. double insulated or shielded, earthed and insulated).</p>
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 <p>Voltage with respect to ground</p>	<p>The connection of COMBIVERT R6 is allowed to:</p> <p>Symmetrical mains with a phase voltage (L1, L2, L3) to neutral conductor / earth (N/PE) of max. 305 V.</p>
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 <p>Fixed Connection</p>	<p>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.</p>
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 Insulation measurement	<p>When doing an insulation or voltage measurement in accordance with in EN60204-1 / VDE0113-1, 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.</p>
 Different earth potentials	<p>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.</p>

Safety Instructions

 <p>Prevent malfunctions</p>	<p>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:</p> <ul style="list-style-type: none">• 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-S 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 maximum DC current of the R6-S must not be exceeded.• If several drive controllers are connected to the COMBIVERT R6-S the max. permissible DC link capacities of all connected drive controllers must be considered during supply operation (see technical data).
 <p>Automatic restart of operation</p>	<p>The COMBIVERT R6 can be adjusted by such way that the inverter restarts automatically after an error case (e.g. phase failure). System design must take this into account, if appropriate, and additional monitoring or protective features added where necessary.</p>
 <p>Conditionally short-circuit proof</p>	<p>The COMBIVERT R6 is conditionally short-circuit proof (VDE 0160). The intended function is guaranteed after resetting the internal protection devices.</p> <p>Exception:</p> <ul style="list-style-type: none">• If earth or short circuits often occurs at the output during regenerative operation, this can lead to a defect in the device.• If earth or short circuits occur during supply operation, semiconductor protection is only limited.
 <p>Cyclic activation and deactivation</p>	<p>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.</p>



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-S represent electrical equipment designed for use in industrial and commercial units.

According to the EMC Directive 2014/30/EU, these devices are components for further processing within the meaning of the Directive that are operated by competent machine and system manufacturers and are not independently operable.

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, DC 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 (pigtailed) 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 lines are not shielded, in order to dampen common-mode noise.
- The cable for phase synchronisation between the mains choke and the COMBIVERT R6-S must not exceed a length of 1 m..
- Further information can be found in the internet, see "www.keb.de".

3. Technical Data

3.1 Standard device size

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)	
Regeneration			
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. DC regenerative 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	
Output rated voltage	[V _{DC}]	540 (310)	
Max. permissible DC link capacity	4) *) [µF]	5000 (21500)	5000 (21500)
I ² t Integral of the limiting load of the semiconductor	[A ² s]	1200	4500
Max. permissible mains fuse type gR / aR	[A]	40	100
Mains fuse type RK5 rated current/min. voltage	*)	50A / 480V (50A / 250V)	90A / 480V (90A / 250V)
Permissible aR fuse Siemens Sitor / Bussmann (no delta power system)		3NC2240 / FWP-40A22FA	3NC2240 / FWP-40A22FA
Mains fuse 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} " / Sn) 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 230V power supply.

1) The overload current is specified for 1 minute. The overload cycle is 300 seconds. This corresponds to duty class 2 EN60146-1-1.

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 > 85ADC 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) IT and delta power system after consultation KEB.







3.2 Special device Peak Power

Device size	*)		Special device Peak Power 19 (16)
Housing size			E
Phases			3
Approved 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)
Regeneration			
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) 10s		[A]	117
Max. DC regenerative current 10s		[ADC]	144
Power supply operation			
Rated input power	Sn	*) [kVA]	48.5 (28)
Rated active power	*)	[kW]	44.5 (25.5)
Max. input power 10s	*)	[kVA]	87 (50)
Max. active power 10s	*)	[kW]	80 (46)
Rated supply current	1)	[A]	70
DC supply current	2)	[ADC]	87
Overload current (E.OL) 10s		[A]	126
Max. DC supply current 10s		[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 ² t Integral of the limiting load of the semiconductor		[A ² s]	3058
Max. permissible mains fuse type gR / aR		[A]	100
Permissible aR fuse Siemens Sitor / Bussmann (no delta power system)			3NC2240 / FWP-40A22FA
Mains 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 > 85ADC 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.

continued on the next page

	Voltage stabilization must be activated at the inverter if a harmonic filter is used.
	The units are not short circuit proof without corresponding dimensioned fuses
	Exceeding of the max. rechargeable DC link capacity can lead to a defect.
	A load draw from the DC circuit may be done only when the message "ready" is set.
	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 overcurrent or overload.

3.3 Overload (OL) function

Standard:

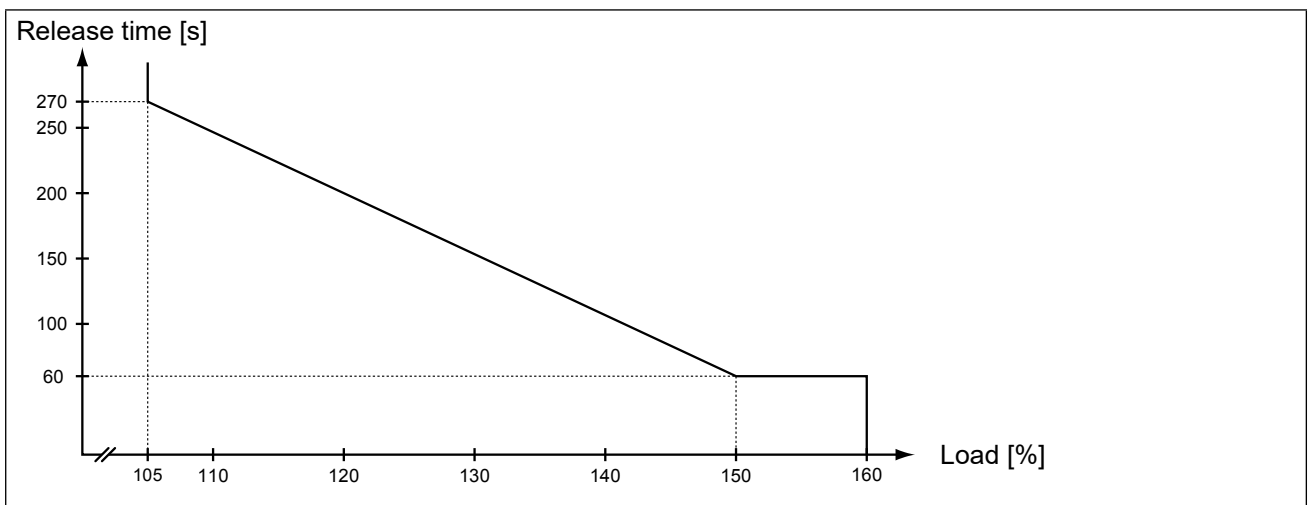
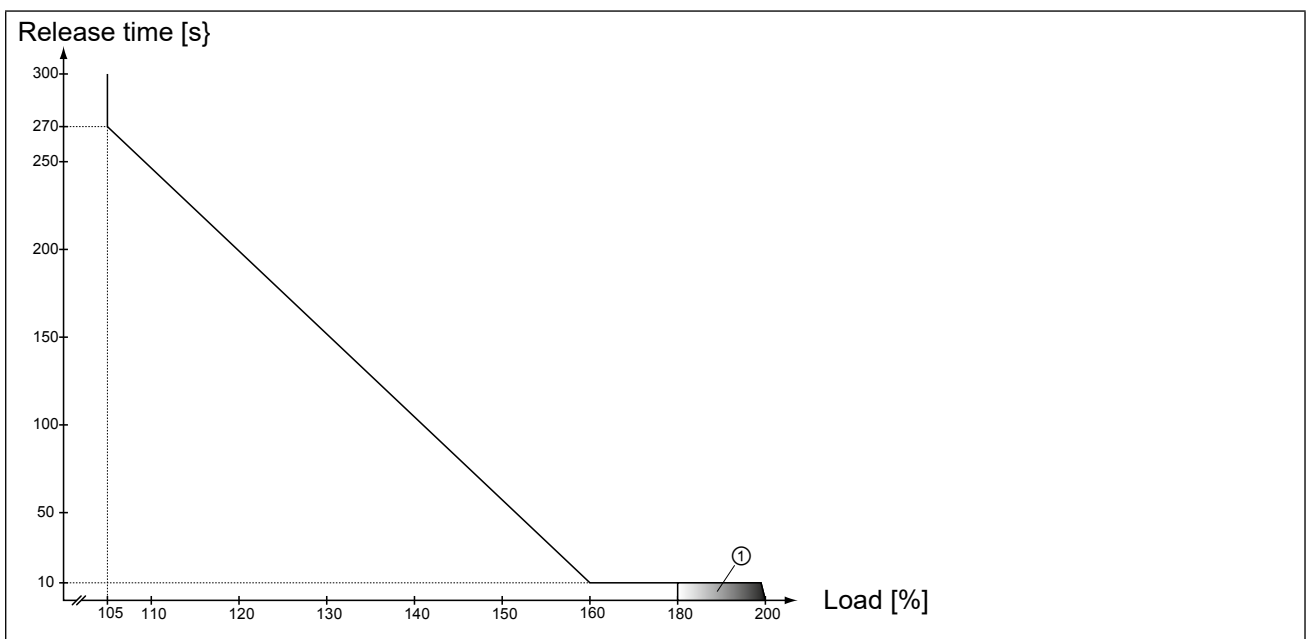


Table 1: Overload (OL) function

Modified standard (increased overload):



1. Depending on the line supply impedance

Table 2: Overload (OL) function

3.4 Operating conditions

		Standard	Standard/ class	Instructions
Definition according to		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	
Mechanical	Vibration	Track	EN 50155	max. amplitude of a vibration 1 mm (5...13 Hz) max. acceleration amplitude 7 m/s ² (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	(without condensation)
	Humidity		2K3	
Mechanical	Vibration		2M1	max. vibration amplitude 3.5 mm (2...9 Hz) max. acceleration amplitude 15 m/s ² (9...200 Hz)
	Surge		2M1	max. 100 m/s ² ; 11 ms
Contamination	Gas		2C2	
	Solids		2S2	
Ambient conditions for the storage				
Climate	Temperature	EN 60721-3-1	1K4	(without condensation)
	Humidity		1K3	
Mechanical	Vibration		1M2	max. vibration amplitude 1.5 mm (2...9 Hz) max. acceleration amplitude 5 m/s ² (9...200 Hz)
	Surge		1M2	max. 40 m/s ² ; 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 according to		EN 61800-3		Inverter product standard: EMC
EMC emitted interference				
Conducted interference emission		–	C2	with EMC filter and ferrite rings and motor cable length < 100m
Radiated interferences		–	C2	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 high-frequency fields	EN 61000-4-6		10 V	0.15...80 MHz

continued on the next page

	Standard	Standard/ class	Instructions
Electromagnetic fields	EN 61000-4-3	10 V/m	
Voltage fluctuations/ voltage drops	EN 61000-2-1		+10 %, -15 %; 90 %
Voltage unbalances/ frequency changes	EN 61000-2-4		3 %; 2 %

3.5 Accessories

Device size	15 (13)	19 (16)	
Rated voltage	400 V		
Commutation reactor	with synchronization	15Z1B05-1001	19Z1B05-1000
		15Z1B05-1010*	19Z1B05-1011**
	without synchronization	15Z1B05-1003	19Z1B05-1003
		15Z1B05-1013*	19Z1B05-1013*
max. short-term overload (regenerative mode)	150 %	150 % / 180%	
max. short-term overload (supply mode)	150 %	150 % / 180%	
Synchronization unit	00R6940-2407 Control cabinet installation; max. distance to the commutation choke or harmonic filter 1 m		
Patch cable (length: 1 m)	00F50C3-4010		
* Acceptance according cUR			
** Peak Power commutation reactor with acceptance according cUR			

3.6 Options

Device size	15 (13)	19 (16)	
Mains filter	15E4T60-1001	19R6T60-1001	
	Limit class in accordance with EN 61800-3 C2 (only with ferrite rings and motor cable lengths < 100m) C1 on consultation with KEB		
Ferrite rings	see chapter 3.5.4		
Harmonic filter (not for UL)	with synchronization	15Z1C04-1002 ^{1) 2)}	19Z1C04-1002 ^{1) 2)}
	without synchronization	15Z1C04-1000 ^{1) 2)}	19Z1C04-1000 ^{1) 2)}
	Please contact KEB for further sizes and data to the THD value at regenerative operation in accordance with EN 61000-2-12.		
DC fuses (also see annex B.1.2)	690 V / 50A (Part number 009025H-3459)	690 V / 125A (Part number 009025H-3559)	
Fuse holder for NH00 and NH000 fuses	0090574-0001		
Operators	Digital operator, interface operator		
Bus operators	CAN, ProfiBus, InterBus, EtherCAT, Ehternet, Sercos, ModBus, PROFINET, LCD-Operator, DeviceNet, HSP5		

¹⁾ Max. overload 125% regenerative / 150% motoric

²⁾ The ON time ED refers to the R6-S.

Dimensions and weights

3.7 Dimensions and weights

3.7.1 COMBIVERT R6-S

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

C1 with operator

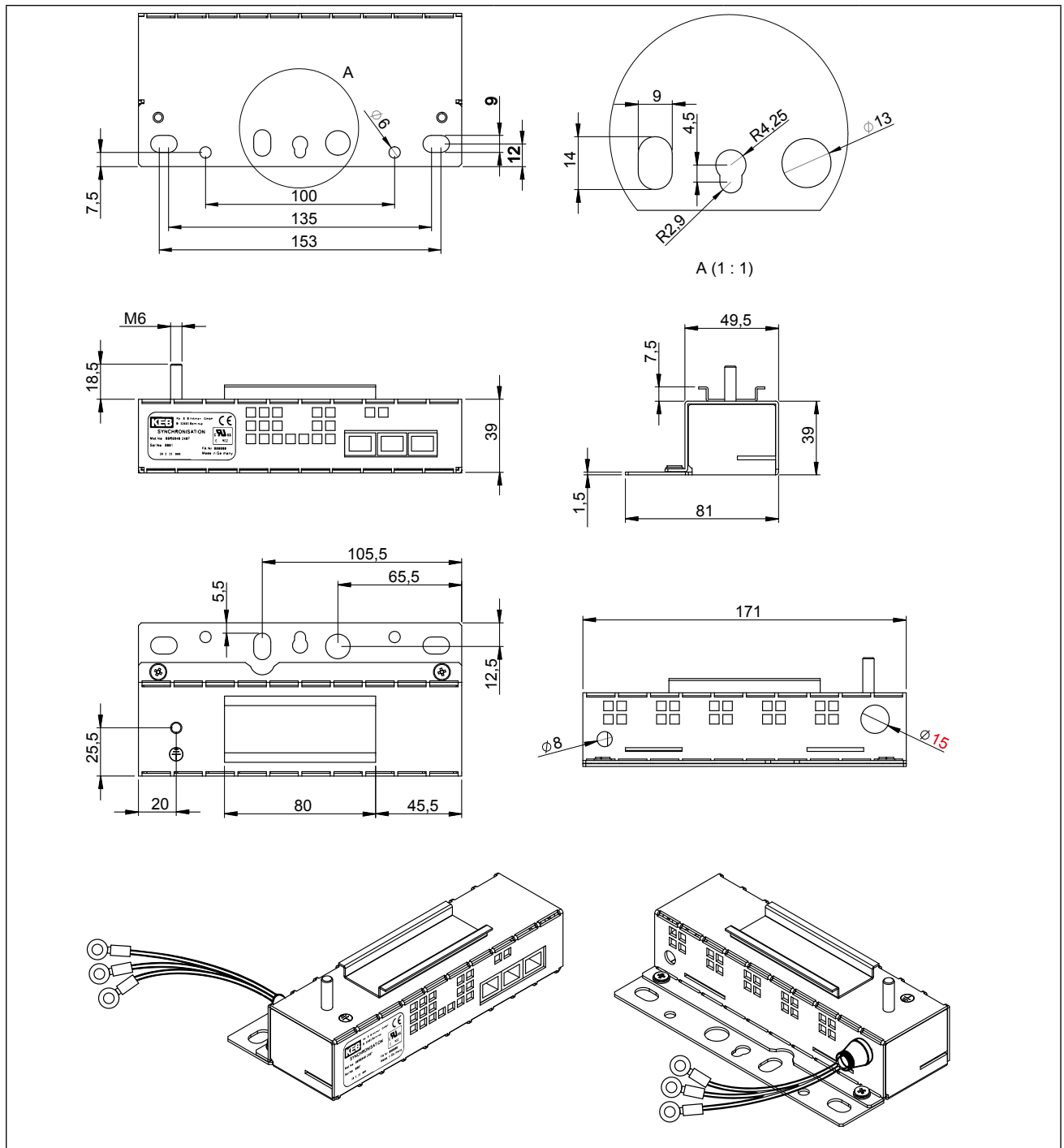
Table 3: Dimensions and weights for COMBIVERT R6-S in E housing

3.7.2 Commutation reactor

Part number	A	B	C	F	G	H	Weight
15Z1B05-1001	100	258	178	5	68	166	11.5 kg
15Z1B05-1003	95	178	178	4.8	79.4	166	8.5 kg
19Z1B05-1000	115	290	243	7	86	225	13.8 kg
19Z1B05-1003	115	233	243	7	85	225	11.3 kg

Table 4: Commutation reactor

3.7.3 Synchronisation unit

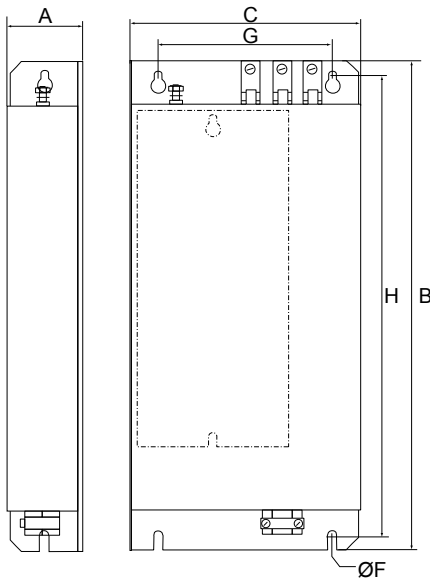


Part number	Weight	Terminal	Connection	Cable length	Max. tightening torque
00R6940-2407	0.65 kg	PE	M6 stud for ring crimp connector	-	4.5 Nm / 40 lb inch
		L1.1, L2.1, L3.1	M4 ring crimp connector (AWG 16)	240 mm	-

Table 5: Synchronisation unit

Dimensions and weights

3.7.4 Radio interference filter (sub-mounted)



The drawing shows two views of a radio interference filter. The left view is a front view with dimension A indicating the width of the top section. The right view is a side view with dimensions C and G indicating the width of the top section, H and B indicating the total height, and ØF indicating the diameter of a mounting hole at the bottom right.

Part number	A	B	C	F	G	H	Weight
15E4T60-1001	50	352	132	7	100	335	2 kg
19R6T60-1001	65	422	198	7	150	397	6 kg

Table 6: Radio interference filter (sub-mounted)

3.7.5 Ferrite rings

Ferrite rings are used for the reduction of the cable-based and radiated interferences. For a high damping, the ferrite rings are attached as close as possible to the interference source, i.e. at the DC and at the motor output terminals of the inverter. The conductors must pass through the ferrite core for the use as current-compensated choke. PE is passed outside the core. Further information can be taken from the provided documentation. Which ferrite ring shall be used is dependent on 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

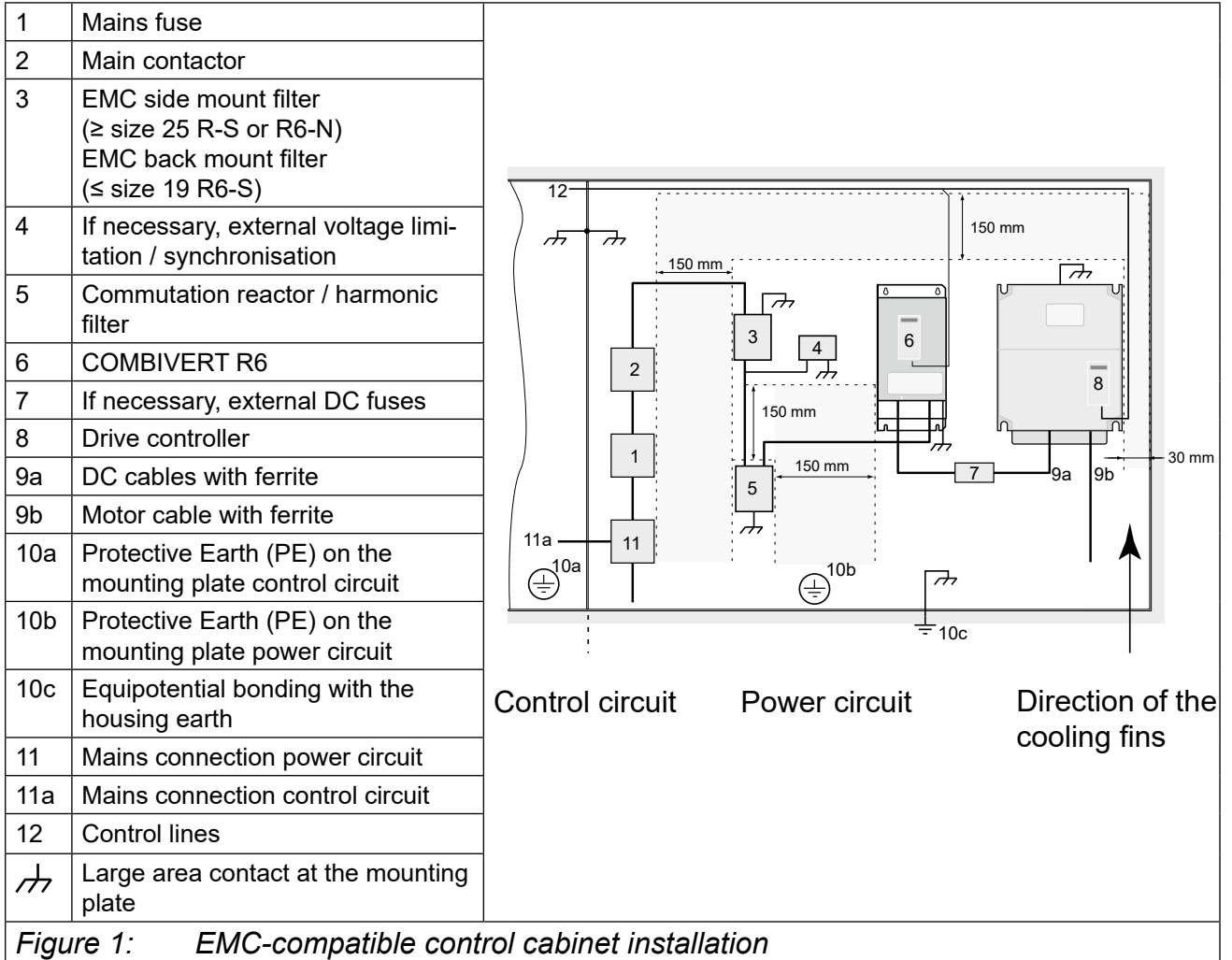



Figure 1: EMC-compatible control cabinet installation


4.2 Installation instructions

	<ul style="list-style-type: none"> • 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. • For EMC reasons, the cables between R6 and commutating reactor/harmonic filter must be limited to < 1m or shielding must be used.. • The inverters must be placed in the immediate vicinity of the R6-S.
--	--

4.3 Connection of the COMBIVERT R6

4.3.1 General description of inverter input terminals

	Starting current limiting
	<p>When connecting inverters to a DC bus pay attention to the internal wiring of the DC voltage inputs!</p> <p>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.</p>



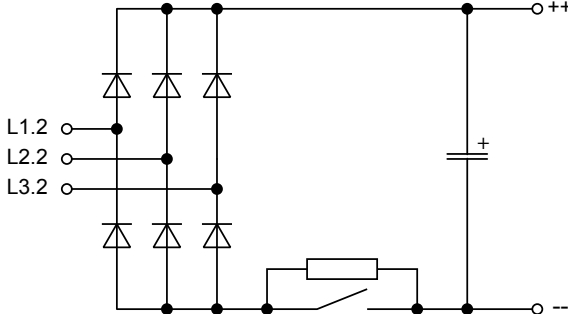
	Maximum DC link capacity
	<p>The maximum DC link capacity can be calculated by adding the DC link capacities of all inverters in the DC bus. A table for this can be found in the appendix. The supply source (rectifier module or inverter with AC input) must be suitable for this value.</p>

Terminals	Description of terminals at KEB inverters
++, --	DC voltage input with starting current limiting; usable as output only if all devices 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
<p>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. Observe the max. load current.</p>	<p>This type can be supplied by mains. In consideration of the DC link capacity the DC voltage terminals can be used as output. When used as input ensure that the starting current is externally limited.</p>	<p>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.</p>
<p>Table 7: General description of input terminals at KEB inverter</p>		

Connection of the COMBIVERT R6

4.3.2 Connection terminals of the R6 power circuit

	Input voltage
	The COMBIVERT R6 in E-housing is suitable for rated voltages of 230 V and 400 V.
	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-S 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
<i>Table 8: Description of the input terminals of the COMBIVERT R6</i>	

Housing size E		Tightening torque [Nm]		
		permissible cable cross-section		Size
		Function		
	Name	3-phase supply input of the commutation reactor	Size 15 0.5...10mm ² (AWG 20...8)	Size 15 max. 2.3
	L12			
	L22			
	L32	DC voltage output with starting current limiting	Size 19 1.5...25mm ² (AWG 16...4)	Size 19 2...4
++				
	--			
	PE, ⊕	Connection for shielding/grounding occurs via provided copper bar by clamping yoke or ring crimp connector. It must be mounted with four screws at the heat sink. The strain relief and the shielding must be done by the customer.		3

Table 9: Terminals / earth handle

Connection of the COMBIVERT R6

4.3.3 Terminals commutation reactor / harmonic filter

<p>15/19Z1B05-1000 (commutation reactor) 15/19Z1C05-1000 (harmonic filter)</p>		Tightening torque [Nm]			
	Name	permissible cable cross-section		Size	
		Function			
	L1.1 L2.1 L3.1	3-phase mains connection		Size 15 2.5...16mm ² (AWG 20...6)	1.2...2
	L1.2 L2.2 L3.2	Output to COMBIV-ERT R6-S		Size 19 2.5...35mm ² (AWG 12...2)	Size 19 2.5...5
	X2B,-C,-D	see below		–	–
	PE	Connection for shielding/earthing		–	6

Table 10: Commutation reactor / harmonic filter

X2B, X2C, X2D RJ45 socket for phase synchronization and temperature sensor	No.	Name	Function
	1	t1	Connection for temperature sensor (optional)
	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

Table 11: RJ45-socket

4.4 Connection Power Unit R6-S

4.4.1 Power supply and regeneration at inverter current \leq inverter current of one COMBIVERT R6-S

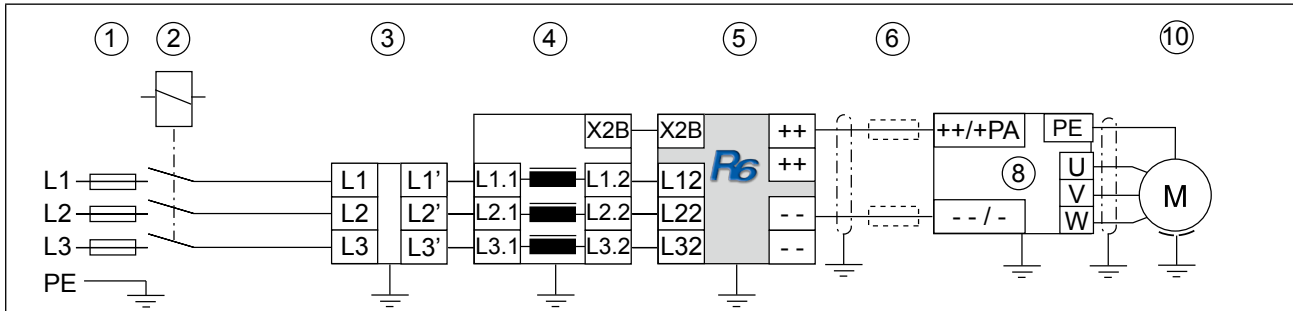
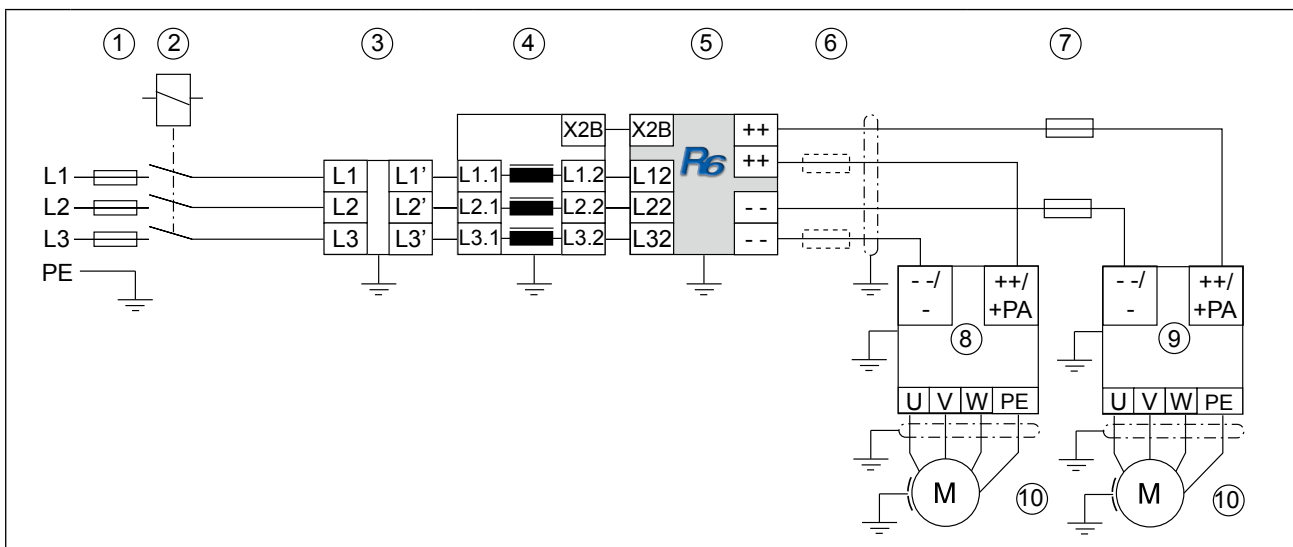


Table 12: Power supply and regeneration at inverter current \leq inverter current of one COMBIVERT R6-S

4.4.2 Power supply and regeneration at inverter current \leq inverter current of one COMBIVERT R6-S



1	Mains fuses type gR	5	COMBIVERT R6-S ²⁾	9	Drive controller (FI type A1...C2 possible)
2	Mains contactor	6	DC fuses type aR/gR ^{1) 2)}	10	Motor
3	Radio interference filter	7	DC fuses type aR/gR ²⁾		
4	Commutation reactor / harmonic filter	8	Drive controller with $I_N(8) \geq I_N(9)$ (FI type A1...C2 possible)		

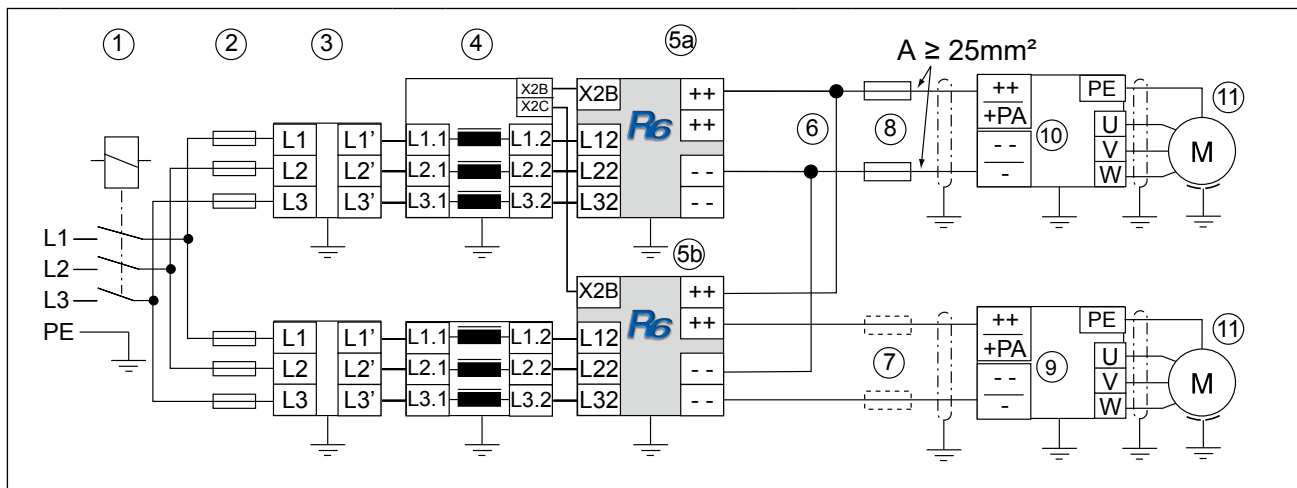
- 1) The cable cross-section may not be smaller than 10 mm². It must be dimensioned for the DC rated current of the load. Otherwise appropriate fuses in the DC bus (6) are required. The indicated maximum protection for the connected drive controllers must be observed!
- 2) If R6 devices without internal DC-fusing are used, fuses in accordance with annex B.1.2 must be used to be conform according to UL. The specified fuses there 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.

Table 13: Power supply and regeneration at inverter currents \leq inverter current of one COMBIVERT R6-S

Connection Power Unit R6-S

4.4.3 Power supply and regeneration at inverter currents \geq inverter current of one COMBIVERT R6-S

(Parallel operation of up to three units with an error at current sharing of the R6-S units of $\leq 10\%$)



1	Mains contactor	5a	COMBIVERT R6-S master ⁵⁾	8	DC fuses type aR/gR ⁵⁾
2	Mains fuses type gR ⁴⁾	5b	COMBIVERT R6-S Slave ⁵⁾	9	Drive controller with $I_N(9) < I_N(5)$ (FI type A1...C2 possible)
3	Radio interference filter	6	External terminal ¹⁾	10	Drive controller with $I_N(10) > I_N(5)$ ¹⁾ (FI type A1...C2 possible)
4	Commutation choke / harmonic filter ³⁾	7	DC fuses type aR/gR ^{2) 4) 5)}	11	Motor

1) If the inverter current $>$ inverter current of the COMBIVERT R6-S, 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-S the total power can be smaller up to 10% caused by production tolerances of the commutation reactor. The impedance voltages u_k of the commutation reactors must be the same in case of parallel connection of R6-S with different sizes.

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 to be conform according to UL. The specified fuses there 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!

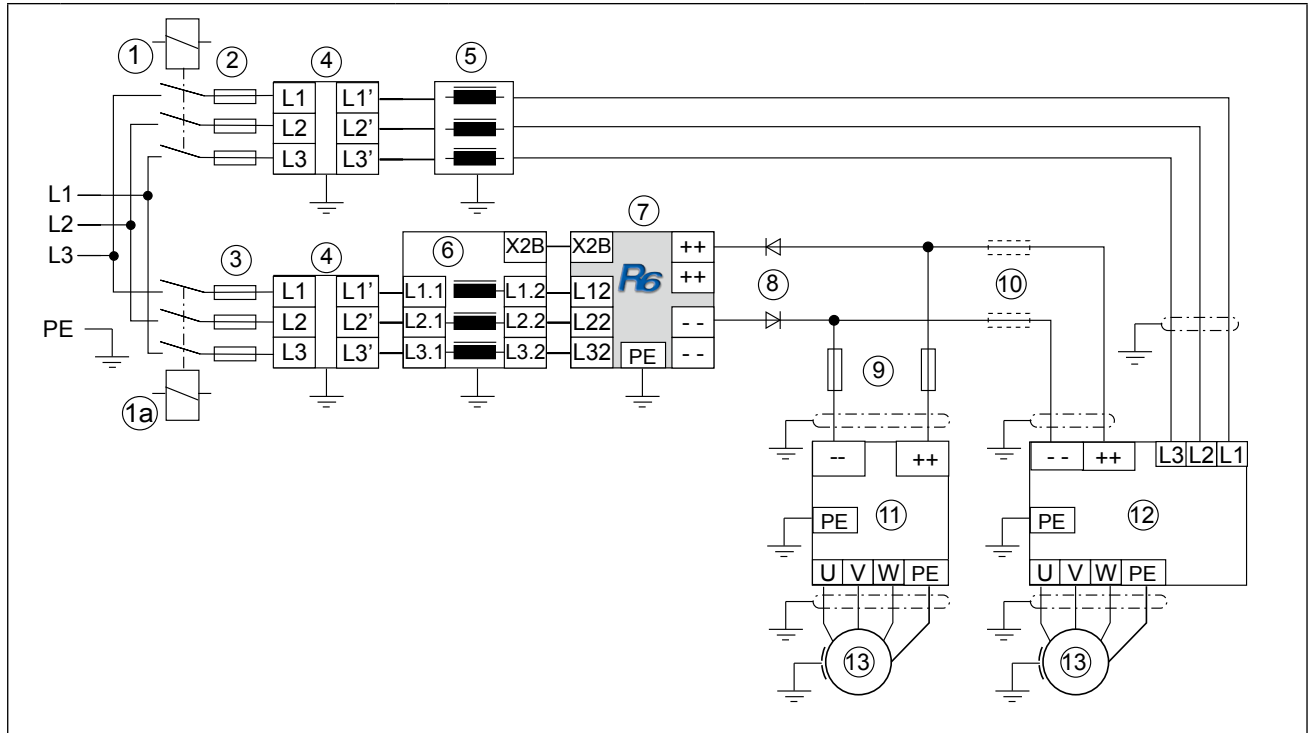
A load draw from the DC circuit may be done only if the ready signal is active.

Table 14: Power supply and regeneration at inverter currents \geq inverter current of one COMBIVERT R6-S

	Parallel operation
	When connecting in parallel operation, the parameter default set must be changed. See application instructions R6-S under "Special functions for parallel connection".

4.4.4 Regeneration with decoupling diodes

Regenerative inverter currents \leq inverter current of one R6-S
(with mains-operated inverter of type A1 or A2)



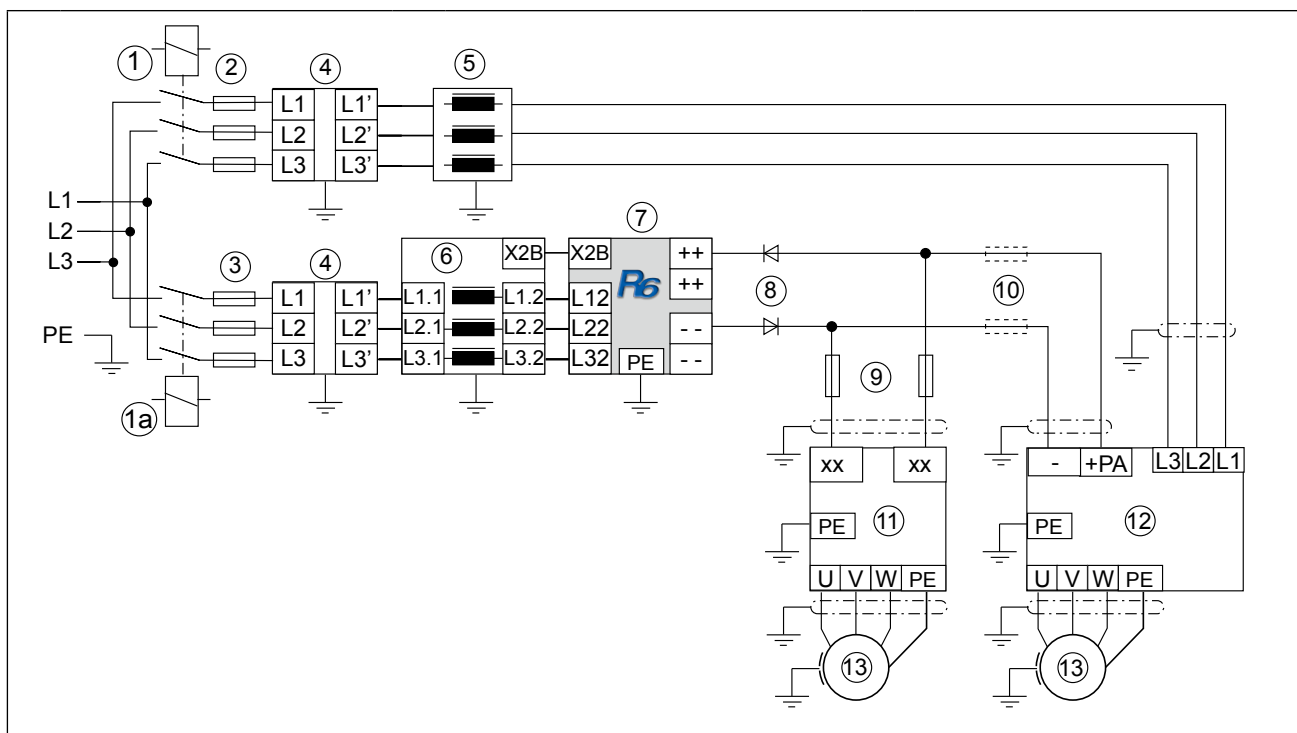
1	Mains contactor ⁶⁾	5	Mains choke ^{1) 4)}	10	DC fuses type aR/gR ^{3) 5)}
1a	Regenerative contactor	6	Commutation reactor ⁴⁾	11	Inverter (type A1, A2, C1, C2)
2	Mains fuses	7	COMBIVERT R6-S ⁵⁾	12	Inverter (type A1, A2 -> 4.3.1)
3	Mains fuses type gR	8	Decoupling diodes (see annex)	13	Motor
4	Radio interference filter	9	DC fuses type aR/gR ⁵⁾		

- 1) A mains choke with $uk=4\%$ is mandatory required for reduction of circulating currents.
- 3) The cable cross-section may not be smaller than 10 mm^2 . 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!
- 4) Parallel connection of the drive controller and R6-S causes a circulating current in regenerative operation. It is depending on the inductance of the mains choke/ commutation reactor. The total regenerative power is 75...90% of the R6-S regenerative power.
- 5) If R6 devices without internal DC-fusing are used, fuses in accordance with annex B.1.2 must be used to be conform according to UL. The specified fuses there 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.
- 6) The mains contactor may only be connected if the precharging in the DC bus of the regenerative unit is completed. If there are several inverters, the max. permissible charging current of the inverter must be observed.

Table 15: Regenerative inverter currents \leq inverter current of one R6-S (inverter type A1 or A2)

Connection Power Unit R6-S

Regenerative inverter currents \leq inverter current of one R6-S
(with mains-operated inverter of type B1 or B2)

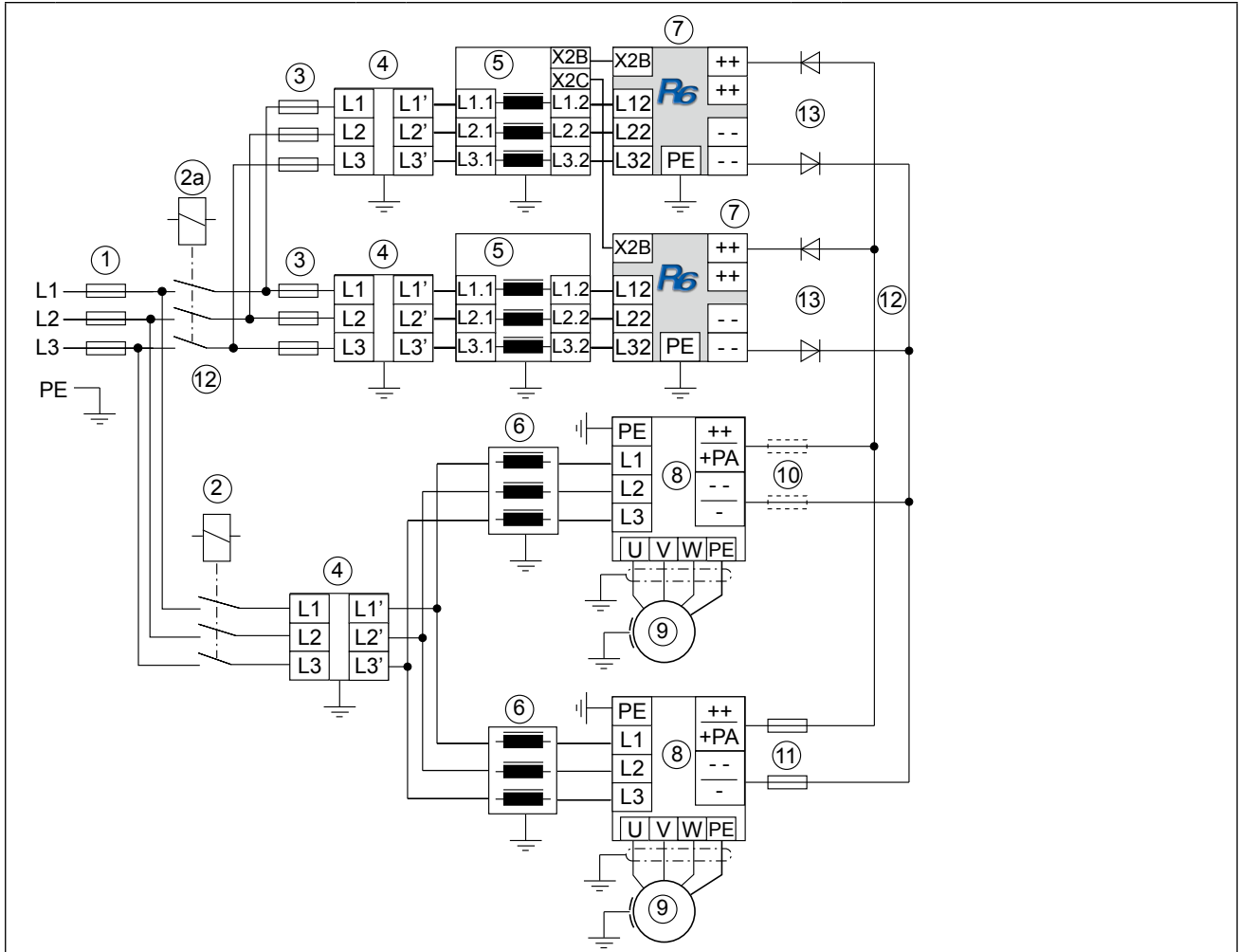


1	Mains contactor ²⁾	5	Mains choke ^{1) 4)}	10	DC fuses type aR/gR ^{3) 5)}
1a	Regenerative contactor ²⁾	6	Commutation reactor ⁴⁾	11	Inverter (all types)
2	Mains fuses	7	COMBIVERT R6-S ⁵⁾	12	Inverter (type B1, B2)
3	Mains fuses type gR	8	Decoupling diodes (see annex)	13	Motor
4	Radio interference filter	9	DC fuses type aR/gR ⁵⁾		

- 1) A mains choke with $uk=4\%$ is mandatory required for reduction of circulating currents.
- 2) Here alternatively the regenerative- or mains contactor can be switched first. The respective other contactor may be connected only if the precharging in the R6-S or DC bus of the drive controllers is completed. If the precharging of R6-S and drive controller is in the same DC branch (R6-S in E housing and inverter type B2), a regenerative contactor is eventually not necessary (depending on the charging resistors and the DC link capacity). Note the permissible DC link capacity of the charging circuit of the inverter!
- 3) The cable cross-section may not be smaller than 10 mm^2 . 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!
- 4) Parallel connection of the drive controller and R6-S causes a circulating current in regenerative operation. It is depending on the inductance of the mains choke/ commutation reactor. The total regenerative power is $75\% \dots 90\%$ of the R6-S regenerative power.
- 5) If R6 devices without internal DC-fusing are used, fuses in accordance with annex B.1.2 must be used to be conform according to UL. The specified fuses there 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.

Table 16: Regenerative inverter currents \leq inverter current of one R6-S (inverter type B1 or B2)

4.4.5 Regenerative operation at parallel operation of up to three R6-S with decoupling diodes
 (Parallel operation with an error at current sharing of the R6-S units of $\leq 10\%$)



1	Mains fuses	5	Commutation reactor ^{5) 6)}	9	Motor
2	Mains contactor ⁴⁾	6	Mains choke ^{1) 5)}	10	DC fuses type aR/gR ²⁾
2a	Regenerative contactor	7	COMBIVERT R6-S	11	DC fuses type aR/gR
3	Mains fuses type gR	8	Inverter (type A1/A2 or B1/B2) same type and size	12	External terminal ³⁾
4	Radio interference filter			13	Decoupling diodes (see annex)
1) A mains choke with $uk=4\%$ is mandatory required for reduction of circulating currents.					
2) The cable cross-section may not be smaller than 10mm^2 . 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!					
3) If the inverter current > inverter current of the COMBIVERT R6-S, it must be wired at an external terminal (12).					
4) The mains contactor may only be connected if the precharging in the DC bus of the regenerative unit is completed.					
5) Parallel connection of the drive controller and R6-S causes a circulating current in regenerative operation. It is depending on the inductance of the mains choke. The total regenerative power is 75...90% of the R6-S regenerative power.					
continued on the next page					

Connection Power Unit R6-S



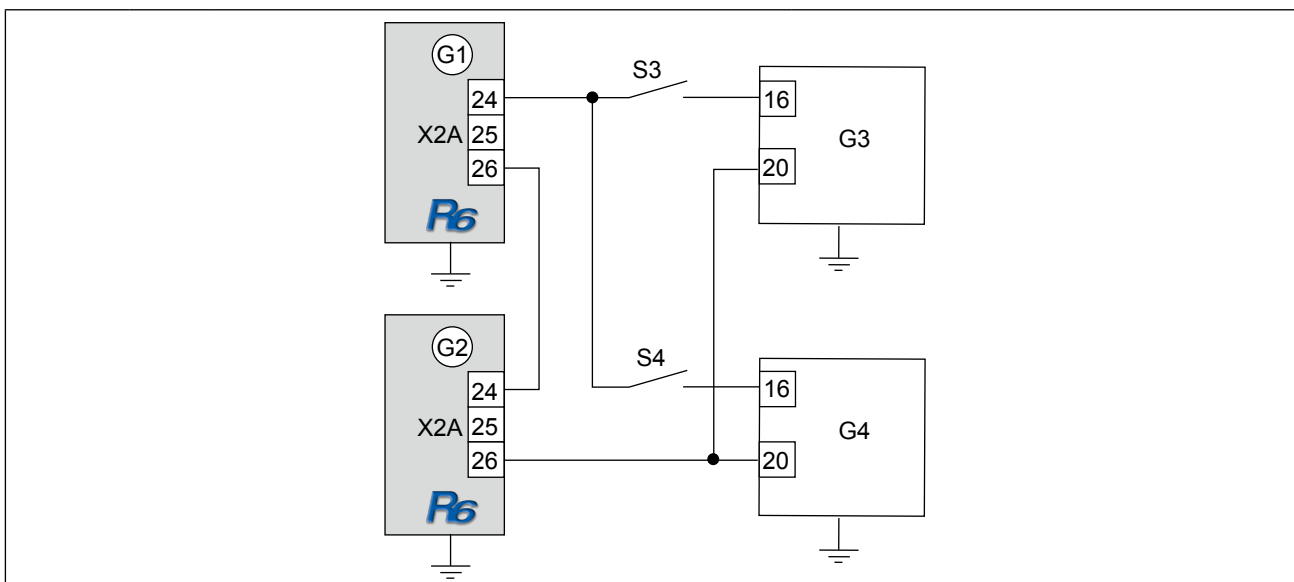
6)	In case of parallel connection of R6-S the total power can be smaller up to 10% caused by production tolerances of the commutation reactor. The impedance voltages u_k of the commutation reactors must be the same in case of parallel connection of R6-S with different sizes.
	When connecting the devices absolutely pay attention to correct phasing!

Table 17: Regenerative operation at parallel operation of up to three R6-S with decoupling diodes

	Parallel operation
	When connecting in parallel operation, the parameter default set must be changed. See application instructions R6-S under "Special functions for parallel connection".

Wiring of the control release of the connected inverters




	A load draw from the DC circuit may be done only when the message "ready for operation" is set. This can be guaranteed by a series connection of the relay R1 of the R6-S units with the control release of the connected inverters.		
G1, G2	Regenerative unit COMBIVERT R6-S		
	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 KEB COMBIVERT		
	X2A	Control terminal strip	
	16	Control release	This terminal assignment refers only to one KEB COMBIVERT
20	24V output		
S3, S4	Control release for one KEB COMBIVERT		

Table 18: Wiring of the control release of the connected inverters

4.5 Connection of the control board version S

4.5.1 Assignment of the control terminal strip X2A

X2A					
Conductor cross-section 0.14...1.5 mm ² , tightening torque 0.22...0.25 Nm					
PIN	Function	Name	Default	Description	Specifications
10	24V input	Uin		External supply of the control board	21.6...26.4 VDC / 1 A
11	Mass	COM		Reference potential	
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	Digital input or output	I/O (I4)		Active signal (connection of all R6 in parallel operation in master-slave mode)	
17	24V 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 >600 V	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	24V 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 (Status "Stb" or "rEGEn")	max. 30 VDC *) 0.01...2 ADC
25	Relay 1 / NC contact	RLB			
26	Relay 1 / switching contact	RLC			
27	Relay 2 / NO contact	FLA	DC > 600 V	Relay output (DC > CP.19)	max. 30 VDC *) 0.01...2 ADC
28	Relay 2 / NC contact	FLB			
29	Relay 2 / switching contact	FLC			

*) max. 1A_{ac} is permissible for 125Vac.

Connection of the control board version S

4.5.2 Assignment of the socket X2B

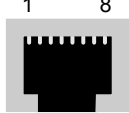
RJ45 socket for phase synchronization and temperature sensor	No.	Name	Function
	1	t1	Connection for temperature sensor (option)
	2	t2	
	3	U13_syn	Synchronization phase 1 / 3
	4	–	reserved
	5	U21_syn	Synchronization phase 2 / 1
	6	–	reserved
	7	U32_syn	Synchronization phase 3 / 2
	8	–	reserved

Table 19: RJ45 socket

The connection is made with a sync cable 1:1 with the socket X2B, X2C or X2D on the commutating choke or synchronisation unit.

4.5.3 Wiring example

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

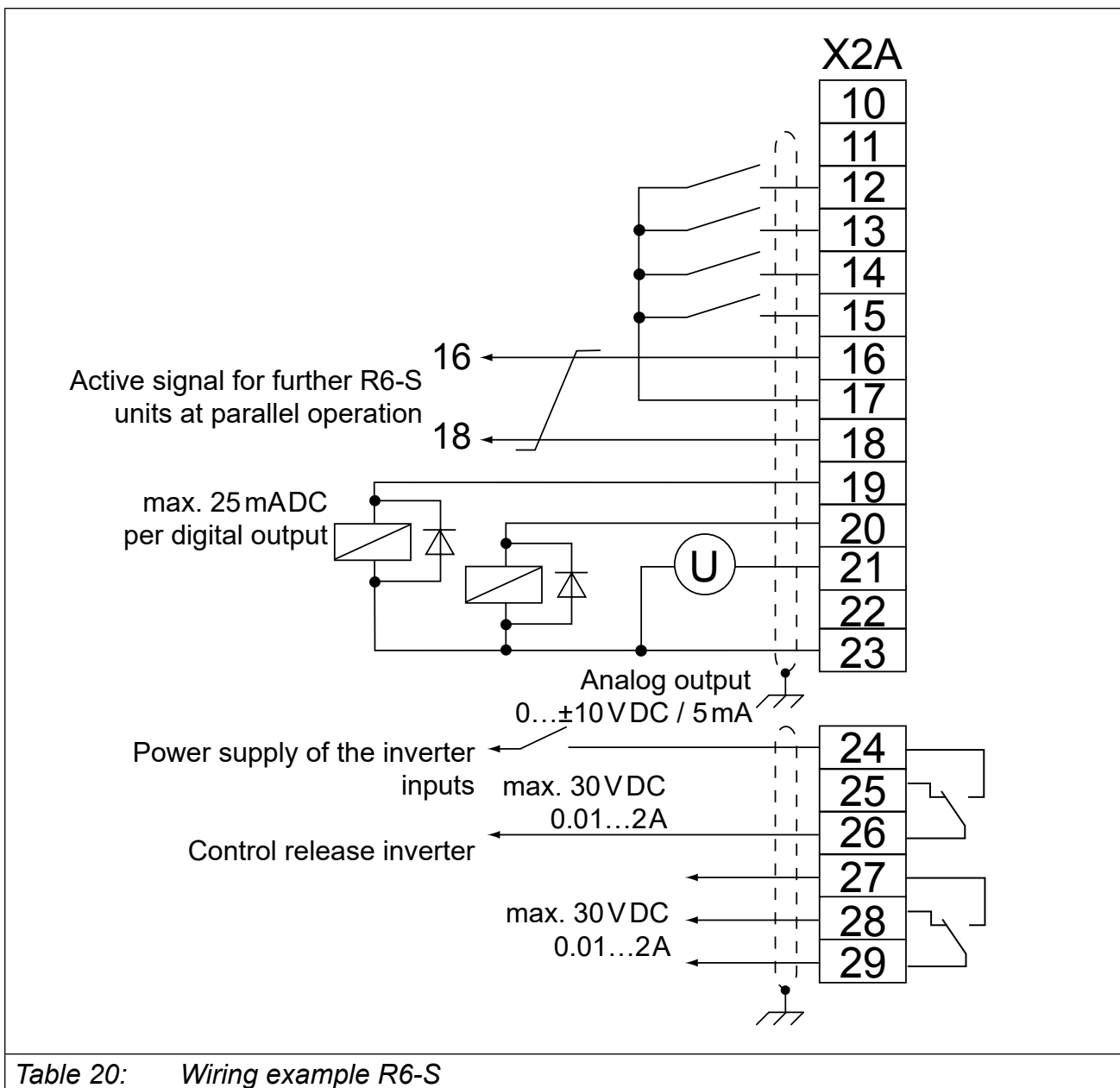
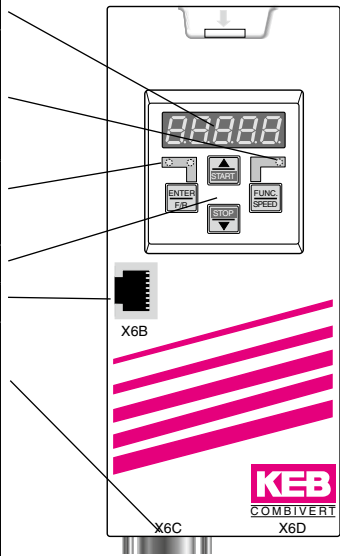



Table 20: Wiring example R6-S

4.6 Operator

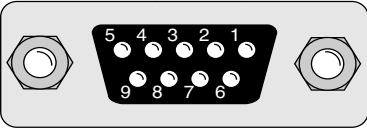
An operator is required as an accessory for local or external operation of the COMBIVERT R6-S. To avoid malfunctions, the COMBIVERT must be set to nOP status (open control release) before plugging/unplugging the operator. When the COMBIVERT is put into operation, it is started with the last saved values or the factory setting.

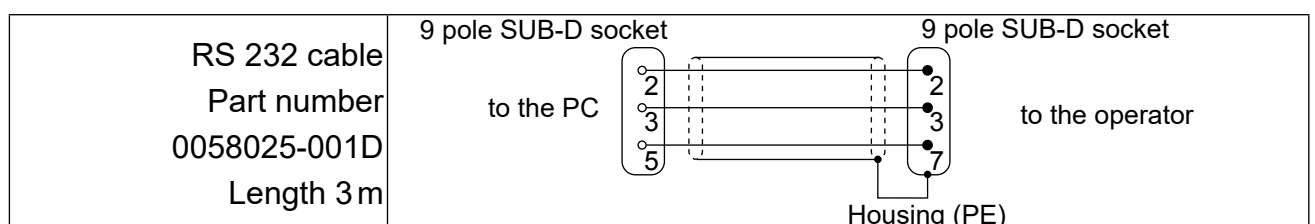
Digital operator (part number 00F5060-1000)		Interface operator (part number 00F5060-2000)	
x	x	5-digit LED display	
x	x	Operation/error display Normal "LED on" Error "LED flashes"	
-	x	Interface control BUS operation "LED on"	
x	x	Double function keyboard	
-	x	X6B HSP5 programming and diagnostic interface	
-	x	X6C RS232/RS485	





For serial data transmission to RS232 / 485 use only the operator interface. The direct connection of a PC to the COMBIVERT is only permitted via a special HSP5 cable (part number 00F50C0-0001) and would otherwise lead to the destruction of the PC interface!

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	Supply voltage +5 V (I _{max} =50 mA)
	7	C/C'	DGND	Data reference potential
	8	A	TxD-A	Transmission signal A RS485
	9	B	TxD-B	Transmission signal B RS485



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-S is initialized after connection of the supply voltage. The power unit code is checked first. When an invalid power unit is recognized, error "E.Puci" (Power unit code invalid) is released and displayed in the operator. This error cannot be reset, the power unit must be checked.

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

- Check for correct synchronisation connection (if a synchronisation signal is missing, error "E.nEt" is triggered)
- Checking the phase allocation of synchronous signals to the mains phases. If a phase is missing or a phase allocation error occurs, error "E.SYn" is triggered.

The current mains frequency and mains voltage are determined after successful synchronisation. The correct connection of the COMBIVERT R6-S is now ensured. If the control release (terminal ST) is set, the COMBIVERT R6-S now independently starts the intended operation. Depending whether regenerative requirement is available, the COMBIVERT R6-S is in status "rEGEn" or "Stb".

Status "Stb"

COMBIVERT R6-S detects a typical voltage level in the DC link circuit of the connected frequency inverter (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. The regenerative unit is switched active, if regenerative operation is requested by an additional installed COMBIVERT R6-S in the system (master /slave operation).

Parameter summary

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 peak value	–	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	Active 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	ANOUT 1 / 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.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

	View of the work meter
	The displayed values of the work meters only provide an estimated value due to measurement and calculation inaccuracies. These displayed values are not suitable for accounting purposes and cannot replace any measuring devices.

5.4 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-S released			
noP	"no Operation" control release not bridged, modulation switched off			
nEtToF	Net off; regenerative operation is further possible, if the disconnecting time E.nEt (Pn.14) > 0 s			
Stb	R6-S regenerative unit in stand-by operation (motor operation)			
Error Messages				
E.dOH	"ERROR! drive overheat", temperature monitoring of the commutation reactor has triggered and the waiting time has expired.			
E.EF	"ERROR! external fault", error message by an external unit			
E.FnEt	"ERROR! Line frequency", the line frequency deviates more than 5 %. The max. mains frequency deviation can be adjusted in the application mode with CS.03.			
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 E. overheat pow.mod. overheat pow.mod. temperature not present (E.OH), error can be reset.			
E.nOL	No Over Load, 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! Overheat pow.mod.", overheating at power module (see „Technical data“)			
E.OHI	"ERROR! Overheat internal", temperature in the interior > 70°C			
E.OL	"ERROR! Overload", overload monitoring of the regenerative unit has responded			
E.OP	"ERROR! Overpotential", DC link voltage too high			
E.Pfd	"ERROR! power flicker det.", mains interruption (phase) during the initialisation phase			
E.Pu	"ERROR! power unit", power unit code is missing, load shunt relay defective			

continued on the next page

Monitoring and analysis parameters

No.	Name	r/w	Enter	based on
CP.01	Inverter state	–	–	ru.00
E.Puci	"ERROR! Power unit code inv." power unit code is invalid			
E.Puch	"ERROR! Power unit code changed".			
E.Puln	"ERROR! Mains voltage", ripple of rectified mains voltage too high			
E.SYn	"ERROR! Synchronization", Phase allocation at commutating reactor not correct			
E.UP	"ERROR! Underpotential", DC link voltage too low			

No.	Name	r/w	Enter	based on
CP.02	Actual line frequency	–	–	ru.03
<p>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-S is in "netof" state.</p>				
Resolution		Meaning		
0.01 Hz		positive values = forward rotating field		
		negative values = reverse rotating field		

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-S. 100 % correspond to the rated current of the COMBIVERT R6-S.		

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.07. Switching off COMBIVERT R6-S also clears the memory.		

No.	Name	r/w	Enter	based on
CP.08	DC current	–	–	ru.15
Resolution		Meaning		
0.1A		Display of the calculated DC output current in amperes.		

No.	Name	r/w	Enter	based on
CP.09	DC voltage	–	–	ru.19
Resolution		Meaning		
1V		Display of actual DC link voltage in volt. The value is measured at the DC output terminals of the COMBIVERT R6-S.		

No.	Name	r/w	Enter	based on
CP.10	Peak DC voltage	–	–	ru.20
Value range		Meaning		
0...1000V		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-S 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-S 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%.		

Special adjustments

No.	Name	r/w	Enter	based on
CP.13	Active power	–	–	ru.81
Resolution		Meaning		
0.1 kW		CP.13 displays the actual power of the COMBIVERT R6-S. 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.		


5.5 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	ANOUT 1 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	

No.	Name	r/w	Enter	based on
CP.18	ANOUT 1 gain	yes	–	An.33
0...±20.00	1.00	The amplification to the desired output voltage can be adapted with CP.18. Max. possible: ±10V.		

No.	Name	r/w	Enter	based on
CP.19	Comparison level 0	yes	–	LE.00
This parameter determines the switching level for transistor output O1, as well as relay output 2.				
Setting range	Setting	Meaning		
0...3200.00V	600.00V	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 -1	–	–	In.24 set 1
CP.23	Last error -2	–	–	In.24 set 2
CP.24	Last error -3	–	–	In.24 set 3
CP.25	Last error -4	–	–	In.24 set 4
CP.26	Last error -5	–	–	In.24 set 5
CP.27	Last error -6	–	–	In.24 set 6
CP.28	Last error -7	–	–	In.24 set 7
Parameters CP.21...CP.28 display the last eight errors. With exception error "Underpotential 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.				

Special adjustments

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".		

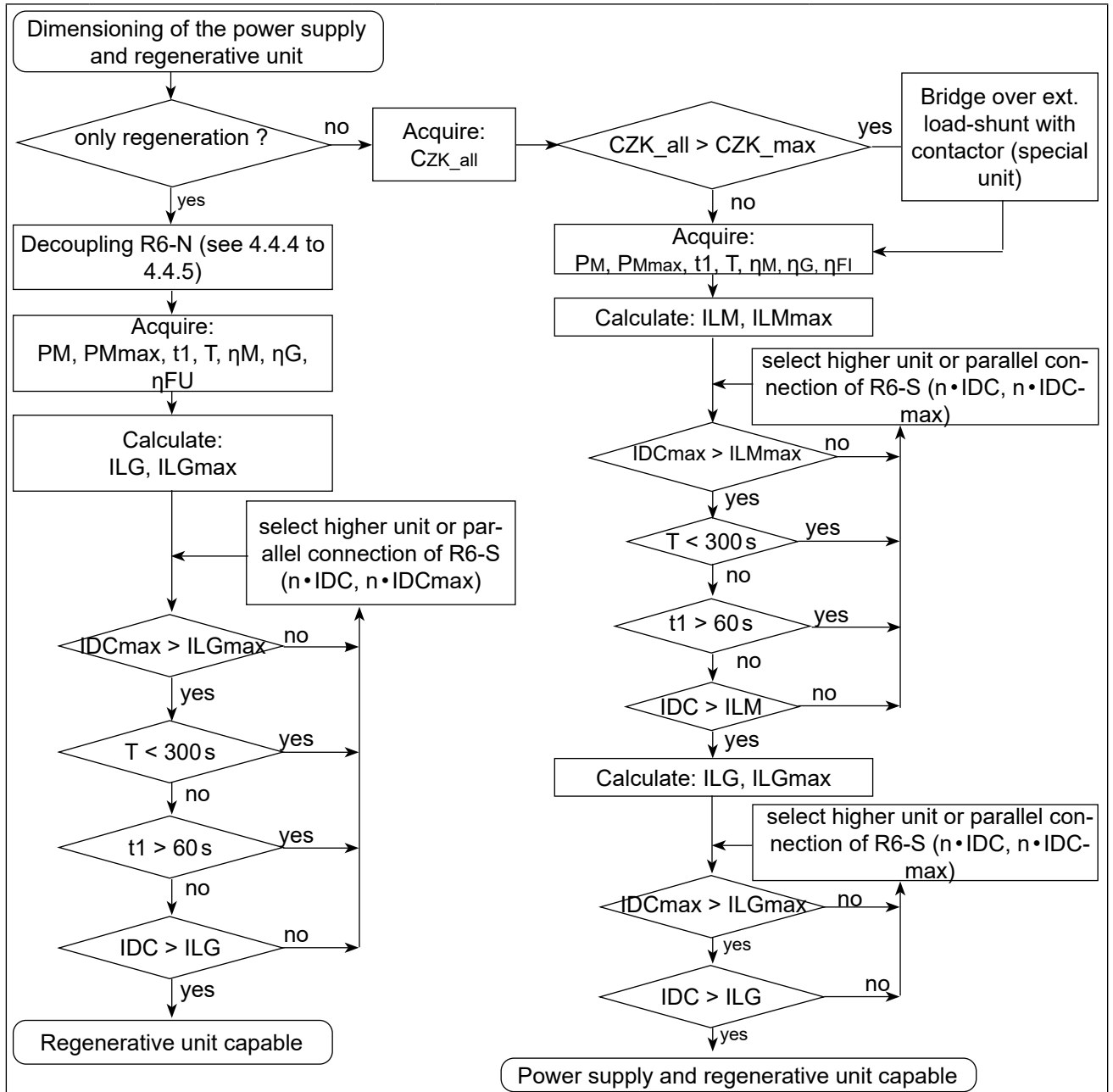
No.	Name	r/w	Enter	based on
CP.32	Puls off level	yes	–	cS.06
Value range		Standard	Meaning	
0.0...-1000.0 kW		-0.8 kW	If the adjusted regenerative power is decreased, the COM-BIVERT R6-N switches the modulation off after turn-off delay and changes into standby mode (display: "Stb").	

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 feedbacklevel 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	η_M	Motor efficiency	IDC	DC output current R6-S
PM-max	Max. mechanical power	η_G	Gearbox efficiency	IDCmax	max. DC output current R6-S
t1	Overload time	η_{FU}	Inverter efficiency	ILG	DC load regen. current
t	Load cycle	ILM	DC load mot. current	ILGmax	Max. DC load regen. current
n	Number R6-S	ILM-max	Max. DC load mot. current	CZK_all	DC link capacity of all drive controllers
				CZK_max	max. connection capacity R6-S

Table 21: Dimension of power supply and regenerative units

A.2 DC link capacities of KEB drive controllers

Drive controller COMBIVERT F5			
200 V devices		400 V devices	
Device size	Capacity	Device 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

	The precharging circuit for the COMBIVERT F5 inverters must be taken from the respective power section manual.
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Annex A

Drive controller COMBIVERT G6			
Housing size	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 COMBIVERT S6			
Housing size	Device size	Capacity / μF	Precharging circuit
2	7	195	Type A1
	9	195	
	10	235	
4	12	470	Type A1
	13	560	



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

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-S	Material number	Type	Volume	Ta [°C]	Th [°C]	Rha [K/W]
15	0090147-3500	1600 V / 80A	2	45	90	1.50
19	0090147-4101	1600 V / 120A	2	45	90	0.84
25	0090147-6009	1600 V / 560A	2	45	90	0.19
29	0090147-6009	1600 V / 560A	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 $\geq 0.5 \text{ W/(m}^2\text{K)}$)

Annex A

A.3.2 Dimensions of the decoupling diodes

Material number	Connection	Dimensions
0090147-3500	1 (anode) 2 (cathode) or 3 (anode) 1 (cathode)	<p>Technical drawing of decoupling diode 0090147-3500. The side view shows a height of 30 mm, a base width of 80 mm, and a mounting hole diameter of 6 mm. The front view shows a total width of 92 mm, with three diodes spaced 20 mm apart. The diodes are labeled 1, 2, and 3. The mounting holes are spaced 12.4 mm from the left edge and 24.5 mm from the right edge. A screw size of M5 is indicated.</p>
0090147-4101	1 (anode) 2 (cathode) or 3 (anode) 1 (cathode)	<p>Technical drawing of decoupling diode 0090147-4101. The side view shows a height of 30 mm, a base width of 65 mm, and a mounting hole diameter of 5.5 mm. The front view shows a total width of 92 mm, with three diodes spaced 20 mm apart. The diodes are labeled 1, 2, and 3. The mounting holes are spaced 20.8 mm from the left edge. A screw size of M5x10 is indicated.</p>
0090147-6009	3 (anode) 2 (cathode)	<p>Technical drawing of decoupling diode 0090147-6009. The side view shows a height of 52 mm, a base width of 49 mm, and a mounting hole diameter of 4.3 mm. The front view shows a total width of 92 mm, with three diodes spaced 22.5 mm apart. The diodes are labeled 2 and 3. The mounting holes are spaced 6.2 mm from the left edge. A screw size of M8x20 and a SW13 wrench size are indicated.</p>

Table 22: 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 EN61800-5-1 in connection with EN60439-1 and EN60146 were used.

This is a product of limited availability in accordance with IEC61800-3. 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

	Acceptance according to UL is marked at KEB power supply and regenerative units with the adjacent logo on the type plate.
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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-100A22FA, 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-100A22FA, manufactured by Bussmann

Annex B

- 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 50A (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 125A (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)

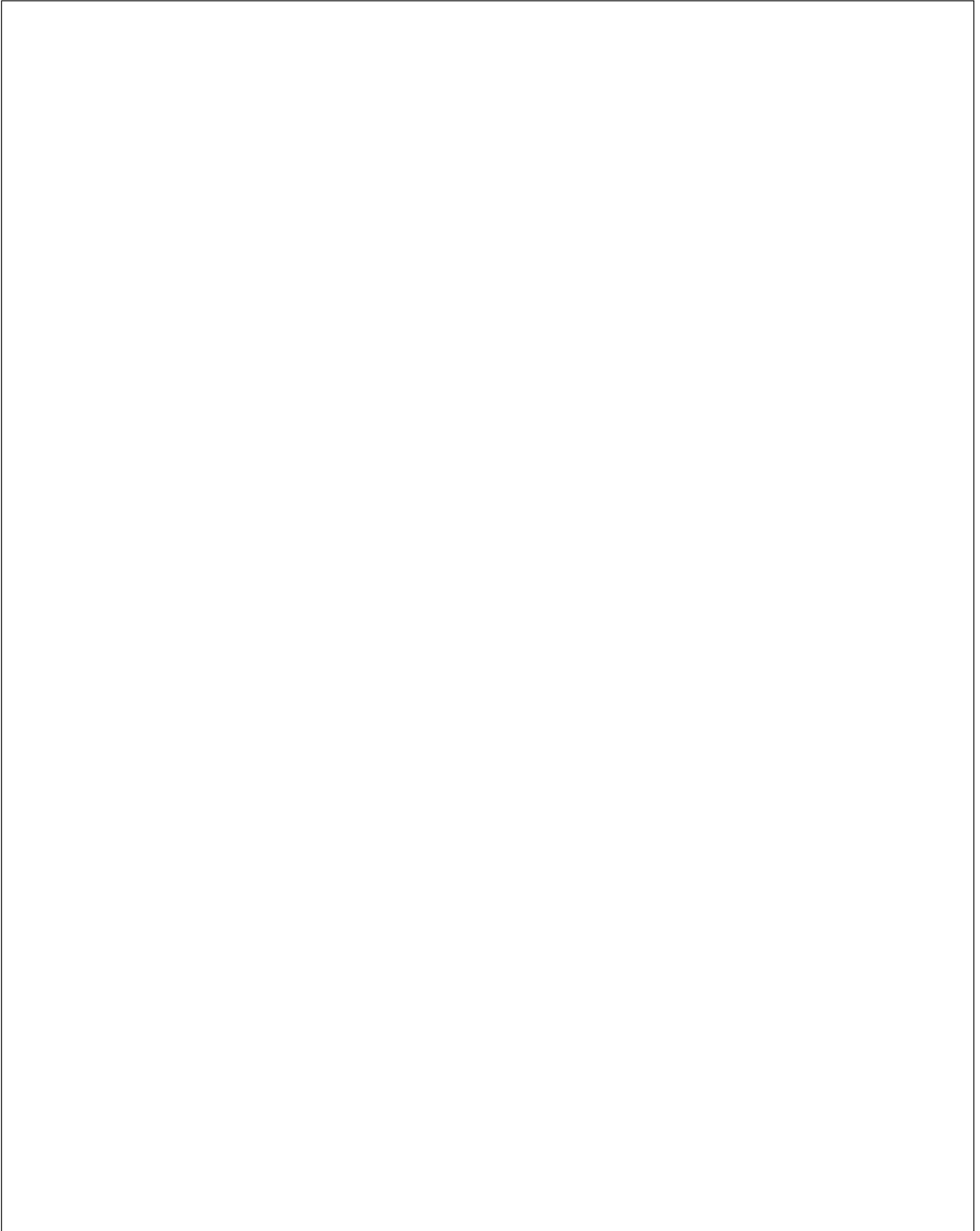
¹⁾ For Mains Terminals of 19.R6 use max Wire Size: 4 AWG, strip wire insulation at 16 mm.

Info



Approved UL configurations

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





KEB Automation KG

Südstraße 38 • 32683 Barntrup
fon: +49 5263 401-0 • fax: +49 5263 401-116
net: www.keb.de • mail: info@keb.de

KEB worldwide...

KEB Automation GmbH

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

KEB Automation KG

Herenveld 2 • 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,
Shanghai 201611, P.R. China
fon: +86 21 37746688 • fax: +86 21 37746600
net: www.keb.de • mail: info@keb.cn

KEB Automation GmbH

Organizační složka
Suchovrbenske nam. 2724/4 • 370 06 České Budějovice
fon: +420 387 699 111 • fax: +420 387 699 119
mail: info@keb.cz

KEB Antriebstechnik GmbH

Wildbacher Str. 5 • 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
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
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
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 • 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
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
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)
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
Shakopee, MN 55379
fon: +1 952 224-1400 • fax: +1 952 224-1499
net: www.kebamerica.com • mail: info@kebamerica.com

More and latest addresses at <http://www.keb.de>

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Document	20311685
Part/Version	ENG 00
Date	2022-07-12