

COMBIVERT



R6

Instruction Manual
Type R6-S

Power Supply and Regenerative Unit
Type 25R6S3R-xxxx

Translation of the original manual		
Document	Part	Version
20311834	ENG	01



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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 enclosed documents as well as the indicated hardware and software are developments of the KEB Automation KG. Errors excepted. KEB Automation KG has created these documents and the hardware and software to the best of knowledge, but they assume no liability that the specifications will provide the benefits sought by the user. KEB Automation KG reserves the right to change specifications without prior notice or to inform third parties. This list is not exhaustive.

The used pictograms have following significance:

	Danger
	Warning
	Caution
	Notice
	absolutely observe
	Information
	Help
	Tip

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.

In power supply operation

- 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.

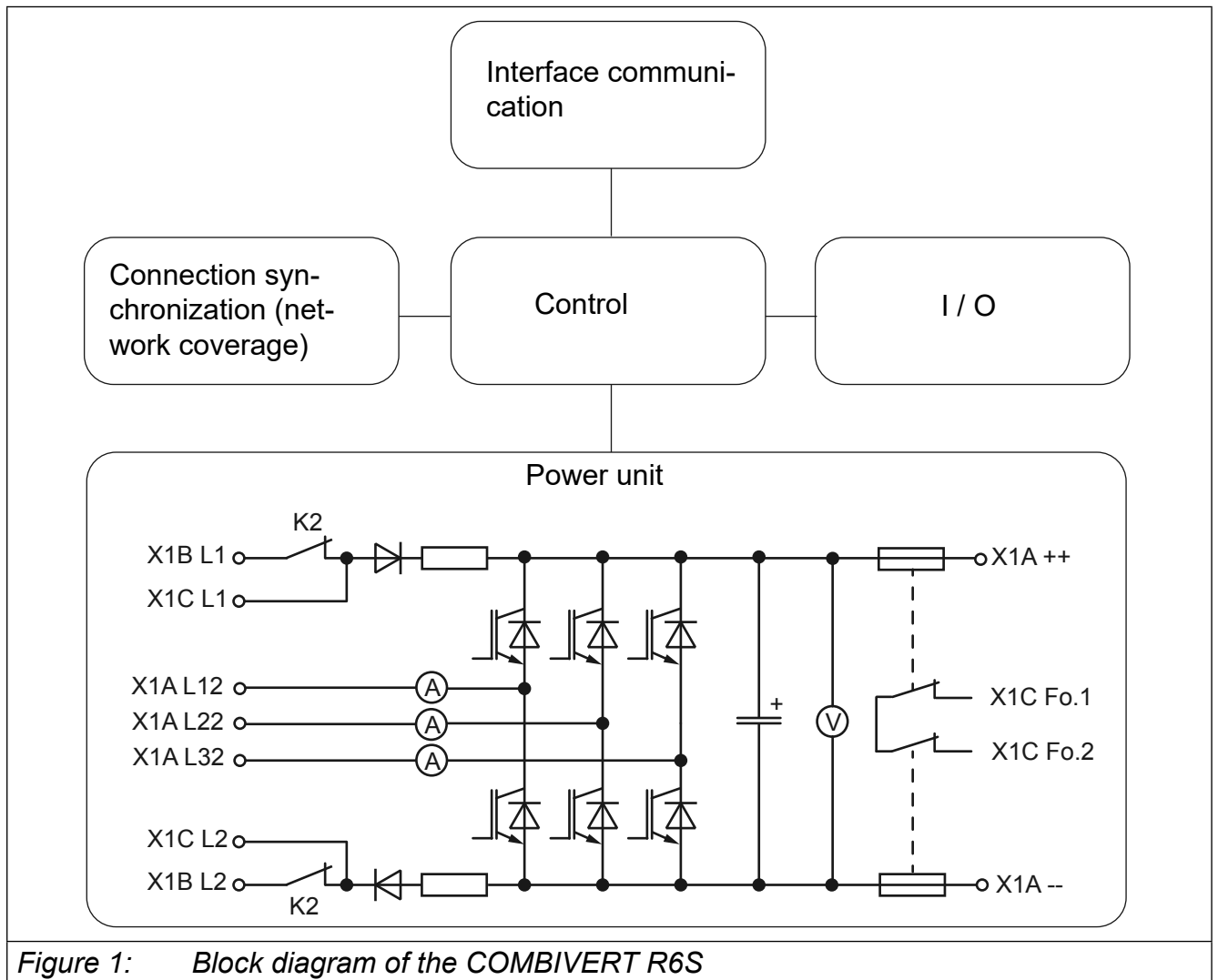
In regenerative operation

- refeeds excess energy from regenerative operation into the supply system.
- replaces braking resistor and braking transistor.
- reduces the heat loss dissipation compared to the braking resistor
- improves the energy balance
- is environmentally friendly and space-saving.
- is economical.

Introduction

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

- Mains choke
- HF filter (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 be 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 control card outputs of the R6 are "one-channel, no diagnostic coverage and therefore not safe" according to ISO 13849. If required, additional protective measures must be met by the user.

1.5.1 Standard operation

Generally the power supply and regenerative unit is a DC supply. If the DC voltage increases to a value above the peak value of the mains voltage, regeneration of the current into the mains occurs automatically. The regenerative level can be defined with parameter CP.34 or cS.02. The mains voltage is analog measured. Regeneration occurs by square-wave current curve which corresponds in phase position to the current flow period 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 Device identification


25	R6	S	3	R	9	0	0	A	
									Type
									A: Standard
									D. ext. fan power supply
									H: Water cooling
									Design
									0: Standard
									reserved
									0: Standard
									1: modified standard
									Voltage
									9: 3-ph.; 400V; AC
									Housing
									R
									Options
									3: Precharging, DC fuses
									Control
									S: 2B.R6
									Series
									R6
									Device size
									25


Safety Instructions

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.


 <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>Note 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 devices 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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Safety Instructions

 <p>Insulation measurement</p>	<p>When doing an insulation or voltage measurement in accordance with in EN60204-1 / 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.</p>
 <p>Different earth potentials</p>	<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>
 <p>Prevent interferences</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 COMVIBERT R6-S, the max. permissible DC link capacities of all connected drive controllers must be considered (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>Conditional-ly 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 fault or short circuits occur in during supply operation, semi-conductor 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>
 <p>RCD (residual current operated circuit-breaker)</p>	<p>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.</p>

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

Device size		25
Housing size		R
Phases		3
Permitted mains forms	5)	TN, TT
Rated voltage	[V]	400
Mains voltage range	[V]	305...528
Mains frequency	[Hz]	50 / 60 ±2
DC voltage range	[V _{DC}]	420...747
Regenerative operation		
Rated apparent output power	Sn [kVA]	153
Rated active power	[kW]	140
Max. power output	[kVA]	230
Max. active power	[kW]	210
Rated regenerative current	*) [A]	221 (184)
Regenerative DC current	1) [A _{DC}]	270
Overload current (E.OL) 60s	2) [A]	331
Max. DC regenerative current 60 s	[A _{DC}]	405
Power supply operation		
Rated input power	Sn [kVA]	153
Rated active power	[kW]	140
Max. input power	[kVA]	230
Max. active power	[kW]	210
Rated supply current	*), 3) [A]	221 (184)
DC supply current	1) [A _{DC}]	270
Overload current (E.OL) 60s	[A]	331
Max. DC supply current 60s	[A _{DC}]	405
Overload disconnection (E.OL)	[%]	160
Overvoltage switch-off (E.OP)	[V _{DC}]	840
Rated output voltage	[V _{DC}]	540
Max. permissible DC link capacity	4) [mF]	50 (400 V class) 35 (480 V class)
Max. permissible total load current at precharging (I _{LSF})	[A _{AC}]	≤4
I ² t Integral of the limiting load of the semiconductor	[A ² s]	39000
Max. permissible mains fuse type gR / aR	[A]	315
Permissible mains fuse (no delta power system)		Siemens 3NE8731 / Eaton Bussmann 170M1372 or 170M1422
Permissible mains fuse (no delta power system) for UL		Ferraz Shawmut HSJ300, rated 300A / 600Vac
Max. permissible DC fuse Bussmann Type aR		see options
Short-circuit factor at the connection point (S _{kn} /S _n) or (S _{scp} /S _n)		15 < S _{kn} "/S _n < 350
Power dissipation at rated operation	[W]	1300
Max. heat sink temperature	[°C]	88

*) The values in brackets must be observed when UL approval is required!

1) Lay two connection cables parallel at supply and regenerative current > 230 A DC.







2) The overload current is specified for 1 minute. The overload cycle is 300 seconds. This corresponds to duty class 2 EN2-60146-1.

3) 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.

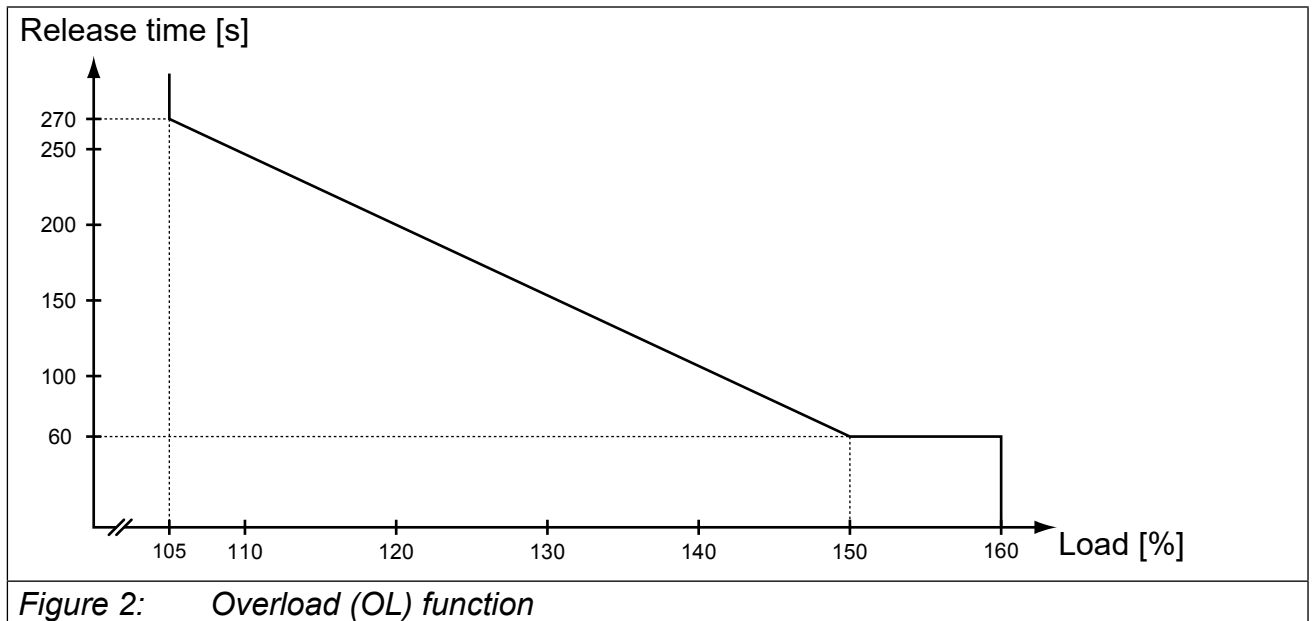
4) Please contact KEB for higher values.

Technical Data

5) IT and delta power systems after consultation KEB.

	Voltage stabilization must be activated at the inverter connected to the DC circuit if a harmonic filter (OSF) is used.
	Exceeding of the max. rechargeable DC link capacity can lead to a defect.
	A load draw from 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 load must be disconnected in case of overcurrent or overload.
	The device must be disconnected from the mains supply if a mains fuse has triggered.

3.1 Overload (OL) function



3.2 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. 2000m above sea level (with site altitudes over 1000m a derating of 1% per 100m 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 1K must be taken into consideration)
	Humidity		3K3	5...85% (without condensation)
Mechanical	Vibration		3M4	max. amplitude of a vibration 1 mm (5...13Hz) max. acceleration amplitude 7 m/s ² (13...200Hz)
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...9Hz) 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	
	Humidity		1K3	(without condensation)
Mechanical	Vibration		1M2	max. vibration amplitude 1.5 mm (2...9Hz) max. acceleration amplitude 5 m/s ² (9...200Hz)
	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		EN 55011	C2	with EMC filter and ferrit upto 100 m line length
Radiated interferences		EN 55011	C2	with EMC filter and ferrit
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	10V	0.15-80 MHz
Electromagnetic fields		EN 61000-4-3	10V/m	

continued on the next page

Technical Data

	Standard	Standard/ class	Instructions
Voltage variation/ voltage drops	EN 61000-2-1		+10 %, -15 %; 90 %
Voltage unsymmetries / frequency changes	EN 61000-2-4		3 %; 2 %

3.3 Accessories

Device size	25
Rated voltage	400 V
Commutation reactor	25Z1B04-1000
Synchronisation unit	00R6940-2407 Control cabinet installation; max. distance to the power supply and regenerative unit 1m
Sync cable	00F50C3-4010 Length 1 m for connection of the synchronization unit with R6 regenerative unit

3.4 Options

Device size	25
HF radio interference filter (EMC)	For an ED of max. 82 % -> 24E6T60-3000 For an ED of 100 % -> 25E4T60-1001 in accordance with EN 61800-3 C2 (only with ferrite rings and motor cable lengths < 100m) C1 (after consultation with KEB)
DC fuses	690V/400A Mat.No. 009025H-4651
Micro switch for fuse 009025H-4651	0090278-0001
Fuse holder for NH00 and NH000 fuses	0090574-0001
Harmonic filter (no UL certification)	25Z1C04-1000 ²⁾ Please contact KEB for data to the THD value at regenerative operation in accordance with EN 61800-2-12.
Harmonic filter (with UL certification)	Compliance with the IEEE519 requirements at a 480V / 60Hz mains is possible with the following harmonic filter: 22Z1C05-1000, 23Z1C05-1000, 24Z1C05-1000, 25Z1C05-1000
Operators	Digital operator, interface operator
Bus operators	CAN®, ProfiBus®, INTERBUS®, EtherCAT®, Ethernet®, Sercos, ModBus, PROFINET® ³⁾ , LCD, Devicenet, HSP5
¹⁾	The ON time ED refers to the regenerative unit R6-S
²⁾	Depending on the load, the following harmonic filters are also possible with the technical data given therein: 20Z1C04-1000, 21Z1C04-1000, 22Z1C04-1000, 23Z1C04-1000, 24Z1C04-1000
³⁾	ProfiNet from operator firmware V3.4 of 30.01.2015

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EtherCAT® is a registered trademark and patented technology licensed by Beckhoff Automation GmbH, Germany

Industrial Ethernet® is a registered trademark of Siemens AG

PROFBUS® is a registered trademark of Siemens AG

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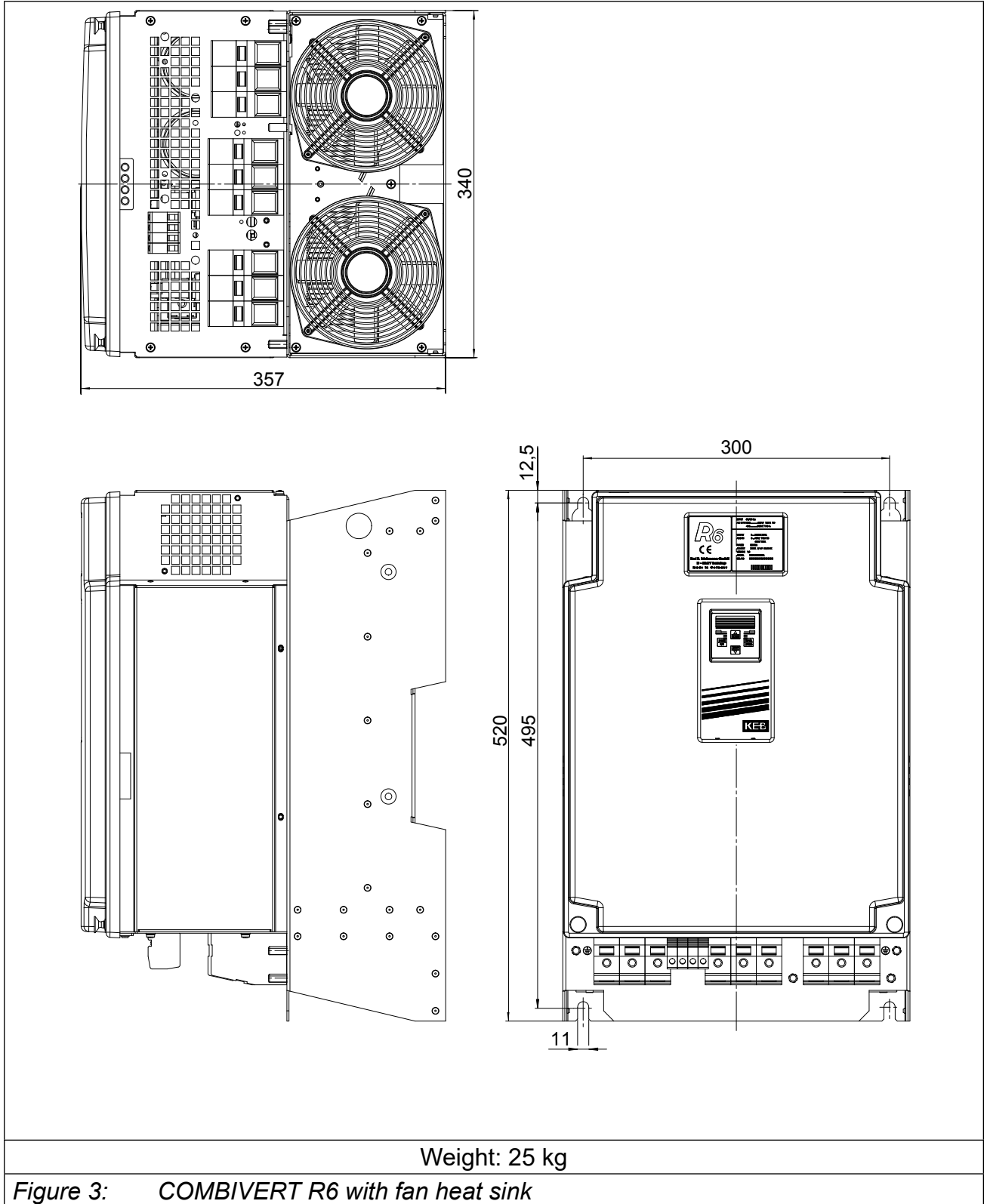
3.4.1 Ferrite rings

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 be passed 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

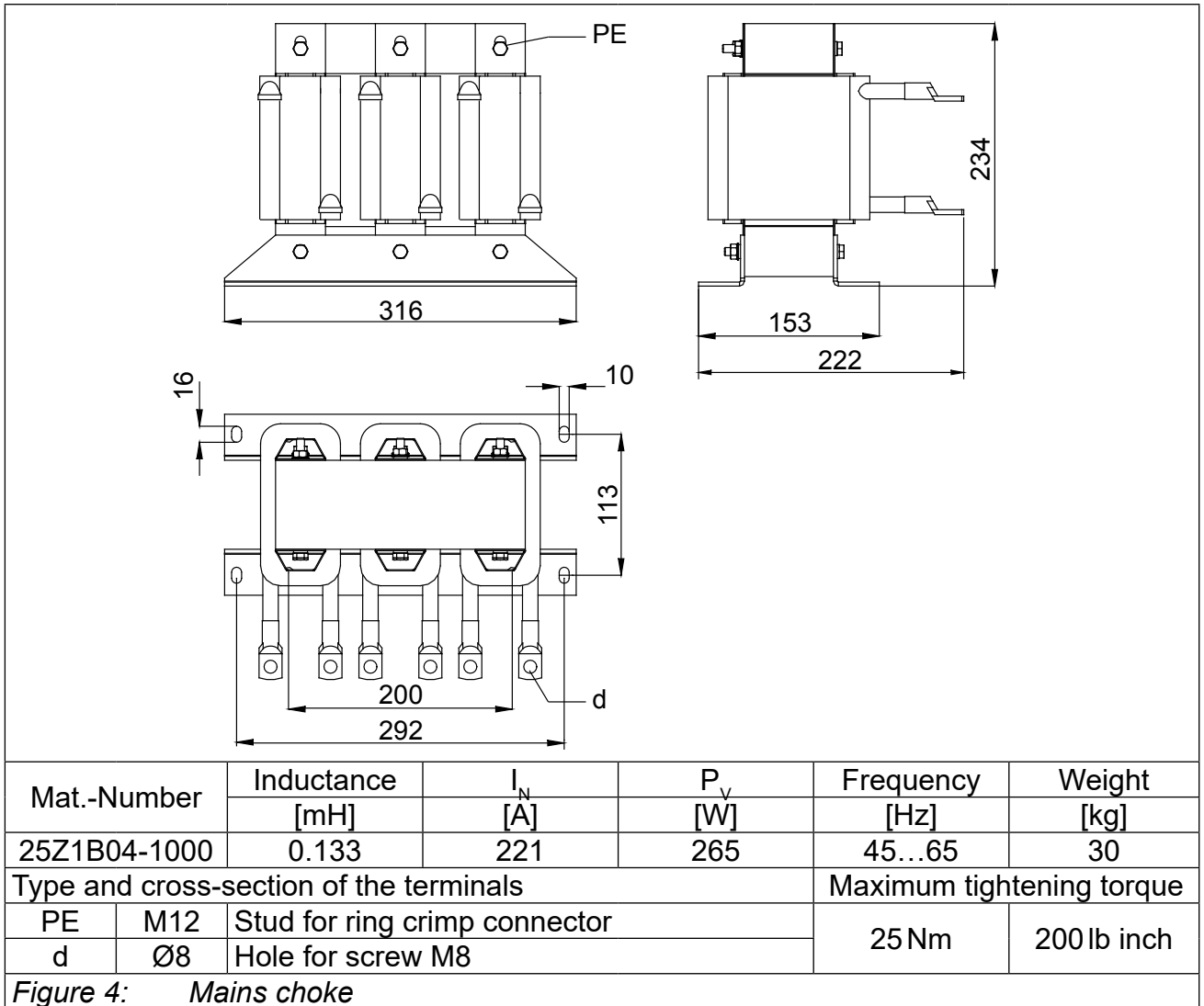
3.5 Dimensions and weights

3.5.1 Dimensions air cooler built-in version

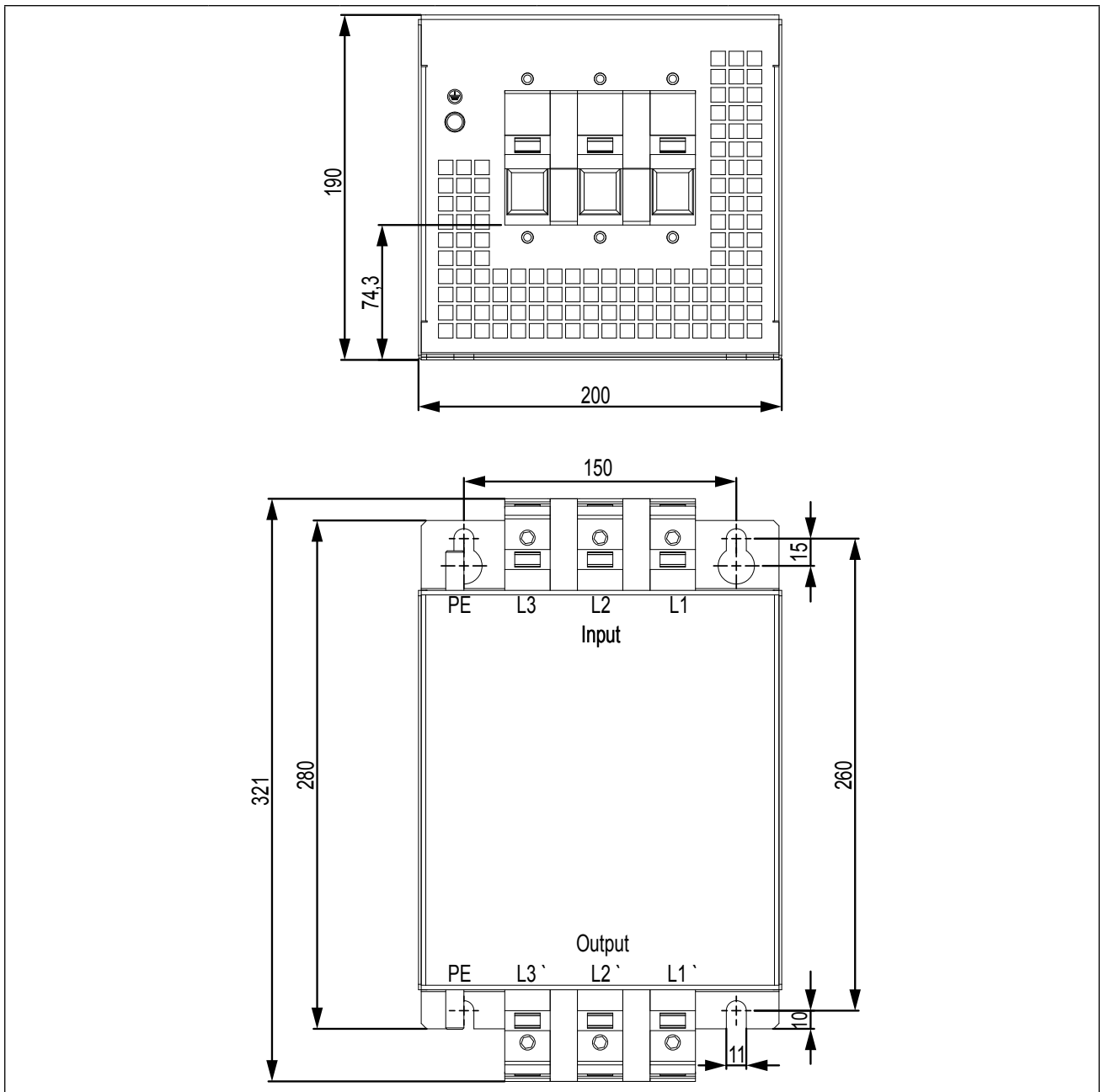


Dimensions and weights

3.5.2 Commutation reactor / mains choke



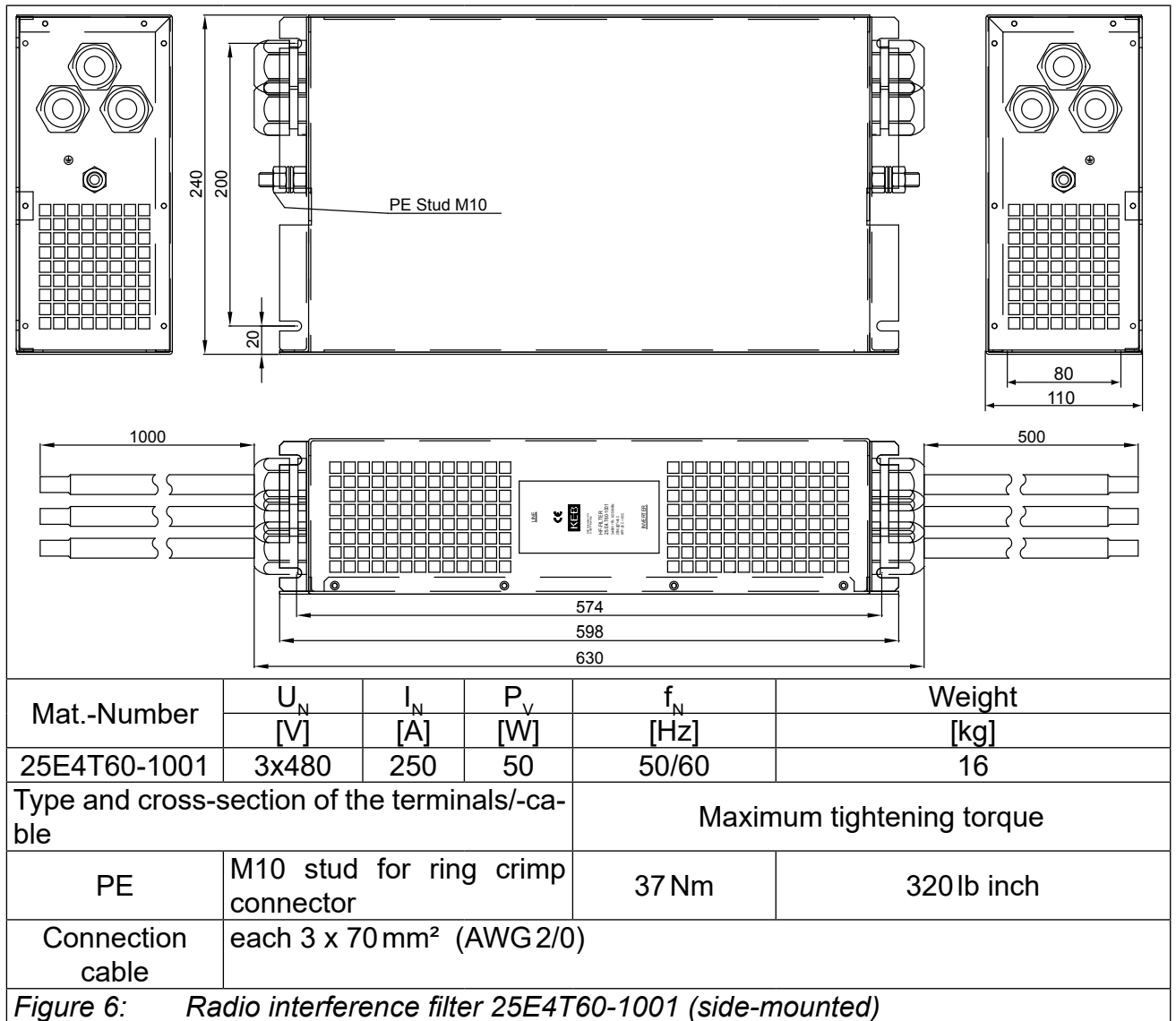
3.5.3 Radio interference filter (side-mounted)



Mat.-Number	U_N	I_N	P_V	f_N	Weight
	[V]	[A]	[W]	[Hz]	[kg]
24E6T60-3000	3x480	200	100	50 / 60 ± 2	9.2
Type and cross-section of the terminals/-cable				Maximum tightening torque	
PE	M10 stud for ring crimp connector			35 Nm / 310 lb inch	
Terminals L1, L2, L3, L1', L2', L3'	35...95 mm ² / AWG 4...AWG 4/0			15 Nm / 133 lb inch	

Figure 5: Radio interference filter 24E6T60-3000 (side-mounted)

Dimensions and weights



3.5.4 Synchronisation unit

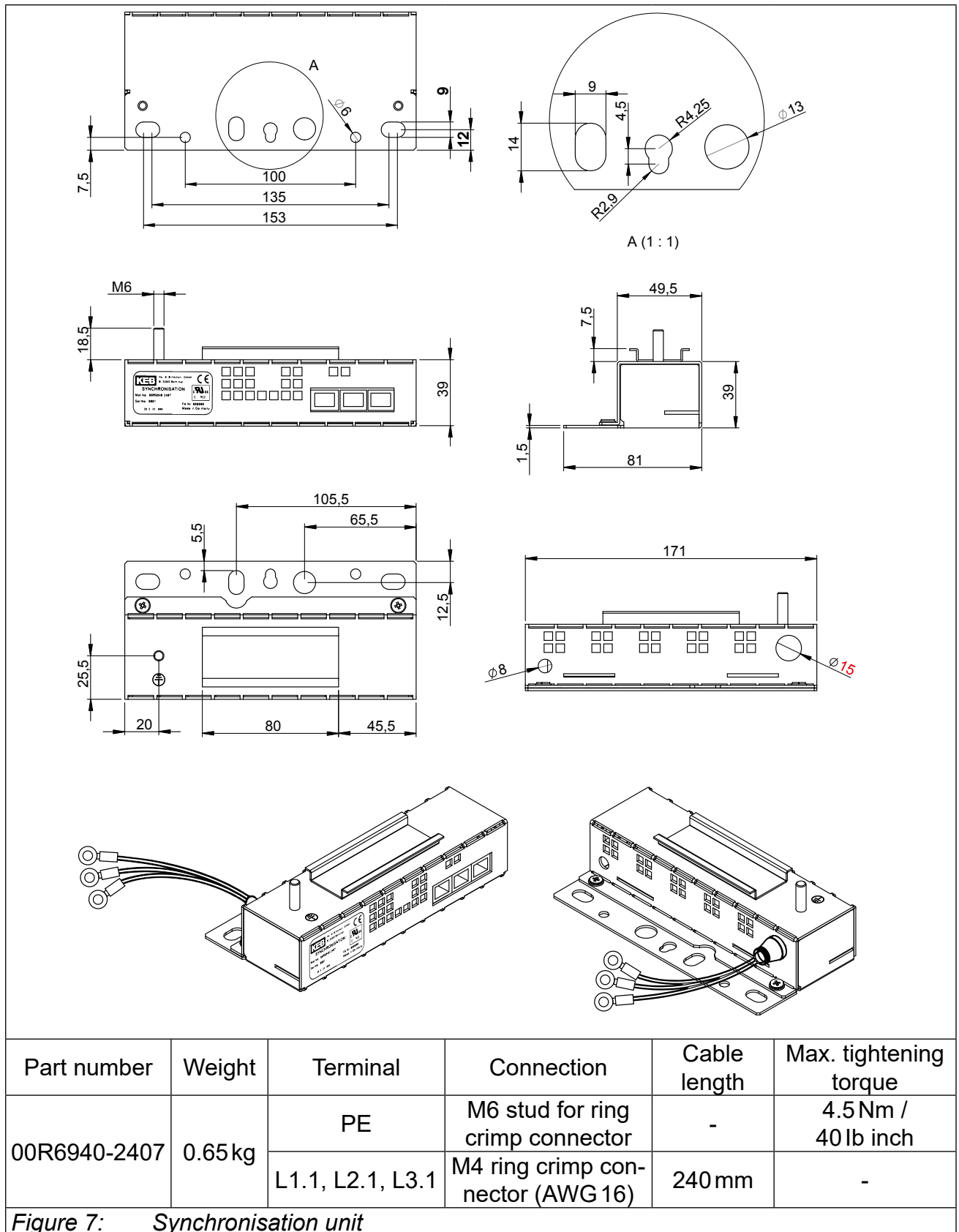
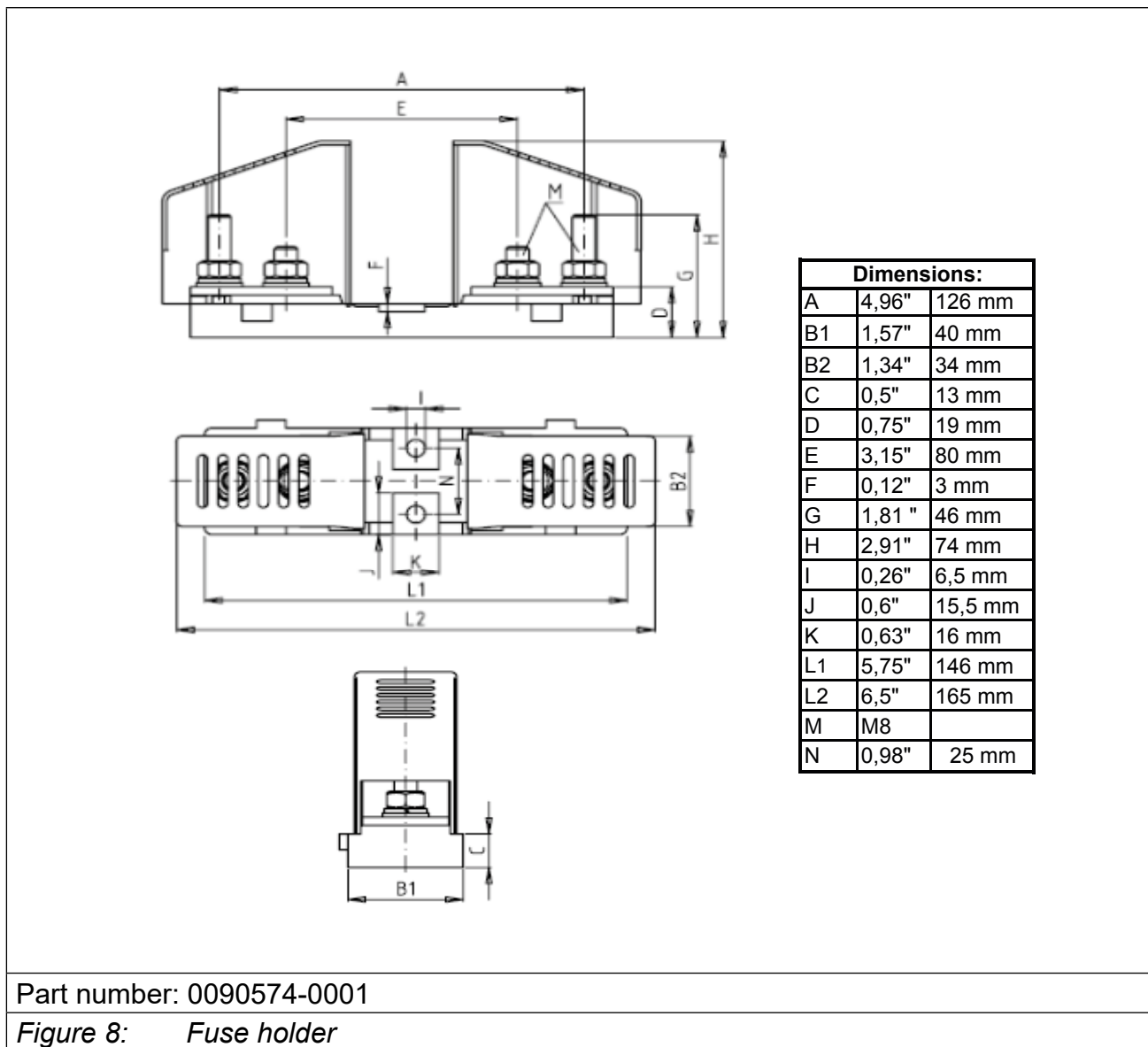


Figure 7: Synchronisation unit

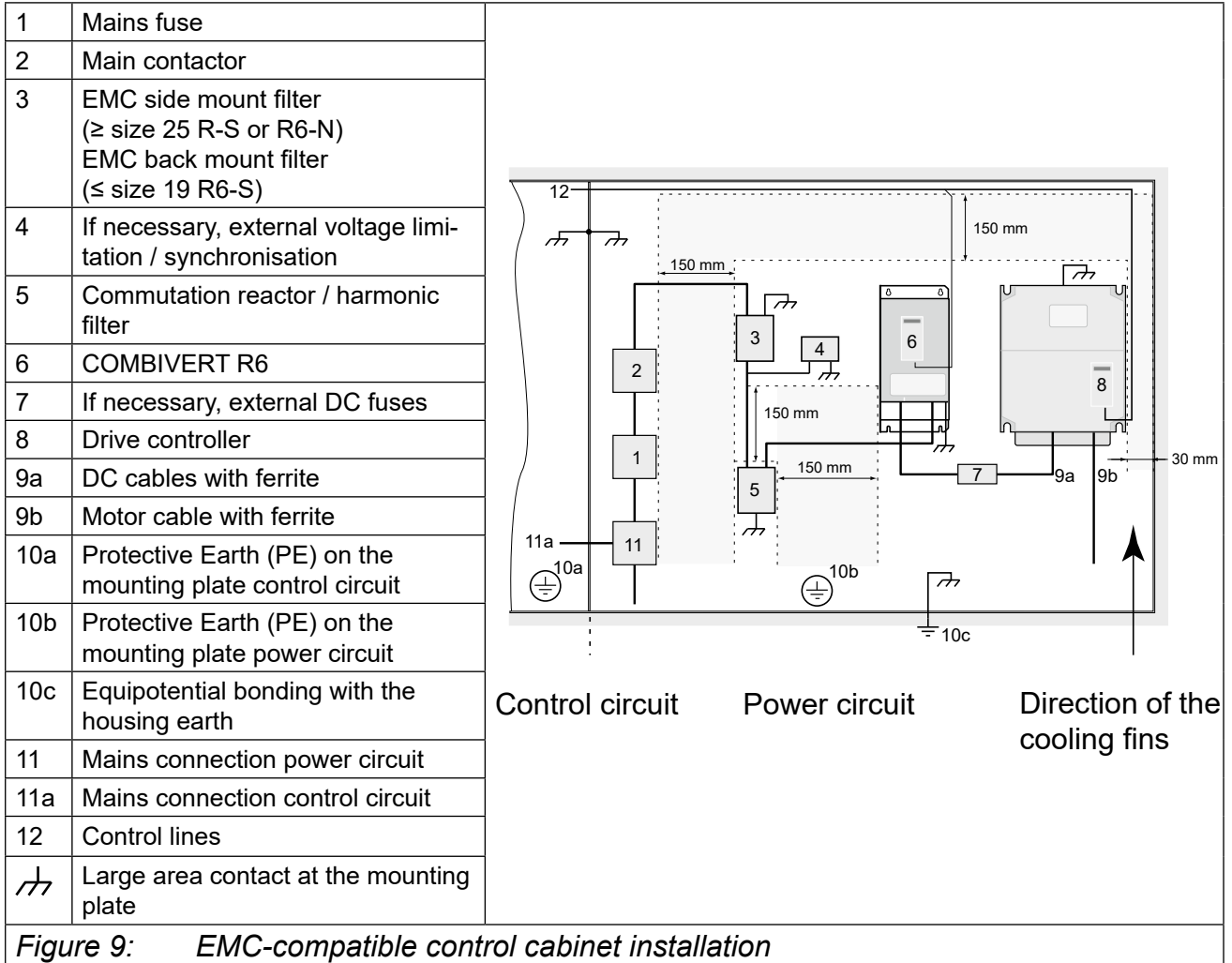
Dimensions and weights

3.5.5 Fuse holder with cover




4. Installation

4.1 EMC-compatible control cabinet installation





4.2 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.
	• 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! 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 ten seconds.¹⁰</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>



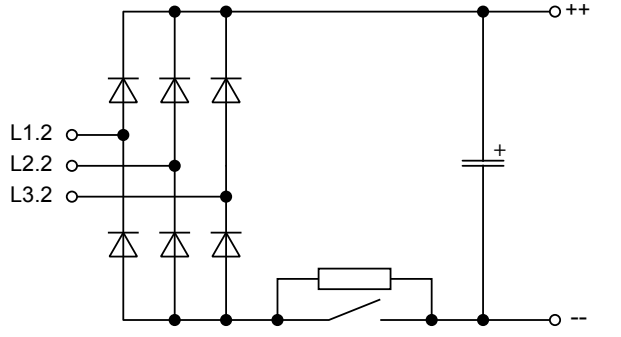
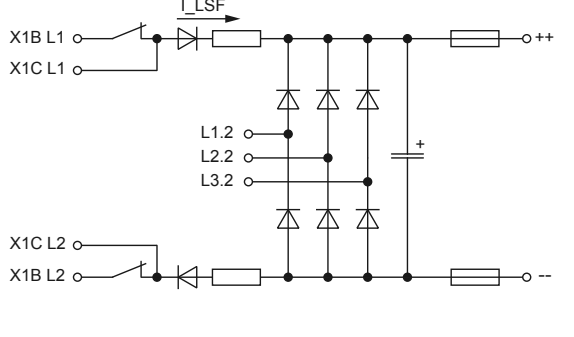
Terminals	Description of terminals at KEB inverters
++, --	DC voltage input with starting current limiting; usable as output only if all devices supplied by the DC bus have a starting current limiting at the DC voltage input.
+(PA), -	DC voltage output with starting current limiting; usable as input 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

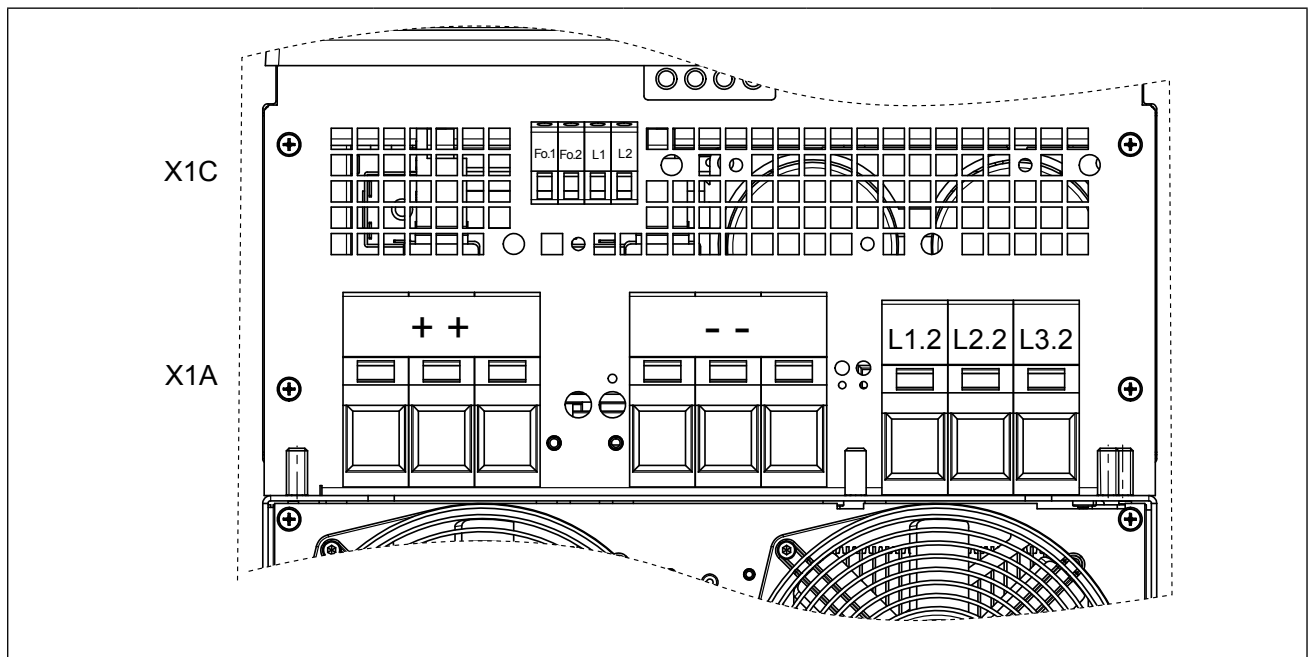
Type A1: AC/DC inverter	Type B1: AC inverter	Type C1: DC inverter
	<p style="text-align: center;">or also type D1</p>	
<p>This type can be supplied by mains and by DC circuit. The starting current limitation is designed after the input terminals. When used as output parallel connected inverters must 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>

Figure 10: General description of input terminals at KEB inverter

Connection of the COMBIVERT R6

4.3.2 Connection terminals of the power circuit

	<p>All terminal strips meet the requirements on EN 60947-7-1 (IEC 60947-7-1)</p>
	<p>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.</p>
<p>Equivalent circuit diagram for R6-S in E housing</p>	<p>Equivalent circuit diagram for R6-S in R housing with internal DC-fuse</p>
	
<p>Terminals</p>	<p>Description of terminals at KEB inverters</p>
<p>++, --</p>	<p>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!</p>
<p>L1.2, L2.2, L3.2</p>	<p>Mains input 3-phase coming from the commutation reactor</p>
<p><i>Figure 11: Description of the input terminals of the COMBIVERT R6</i></p>	



Terminal	Name	Function
X1A	L1.2, L2.2, L3.2	3-phase mains connection to the commutation throttle
	+, --	DC voltage output with starting current limiting; Connection for the inverter, the connection terminals are each internally connected in parallel.
X1C	Fo.1, Fo.2	NC contact for safety monitoring (250Vac /2A, 24Vdc / 0.4A ¹⁾)
	L1, L2	Precharging
PE		Connection for shielding /earthing

¹⁾ Min. 20V / 30mA

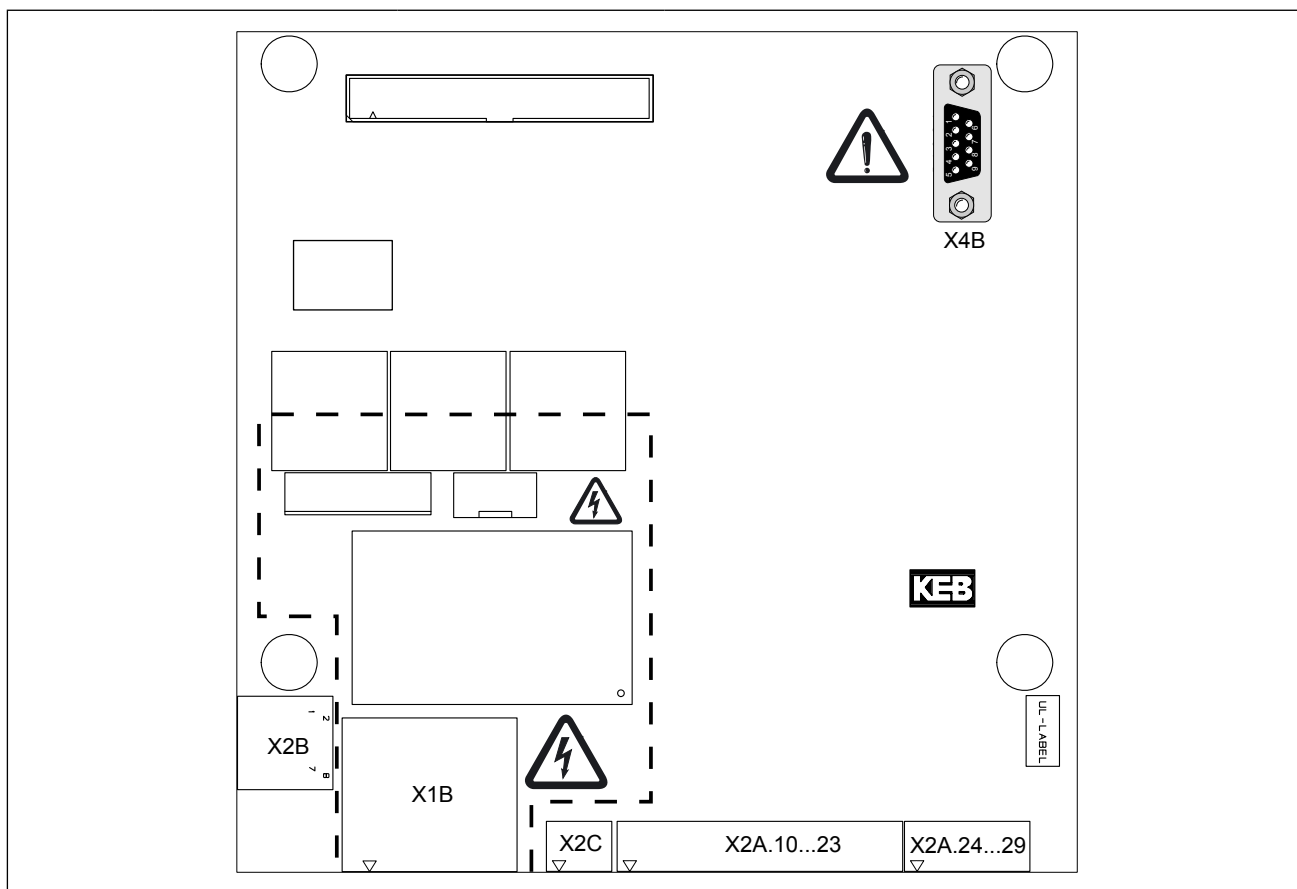
Type and cross-section of the terminals	Conductor cross-section [mm ²]		Tightening torque	
	min	max	Nm	lb inch
Screw terminals (6mm internal hexagon)	35	95	15...20	175
Screw terminals Fo.1, Fo.2, L1, L2 (slit)	0.5	16	1.5...1.8	11...20
Stud M10	Stud for ring crimp connector 10 mm		15...25	133...220

Figure 12: Connection terminals of the power circuit

- Unused terminals must be tightened with the preset torque!
- Mains potential may be at terminals X1A, X1B or X1C (see the following chapter)!

Connection of the COMBIVERT R6

4.3.3 Connections of the control board



Terminal	Function	
X1B	Connection mains contactor (AC15: 6A 230V AC / DC13: 6A 24V DC) and precharging	Mains voltage potential!
X2B	Connection for synchronization line	
X2C	Activation of the mains contactor self-holding	
X4B	HSP5 operator interface	No direct PC connection
X2A	Control terminal strip	Install control and mains cable separately!

Terminal	Conductor cross-section [mm ²]		Tightening torque	
	min	max	Nm	lb inch
X1B	0.2	6	0.7...0.8	7
X2A	0.14	1.5	0.22...0.25	1.9...2.2
X2C	0.14	1.5	0.22...0.25	1.9...2.2

Figure 13: Connection terminals of the control board



Unused terminals must be tightened with the preset torque!



For UL approval the following values should be observed for X1B:

X1B: 230 Vac 2A

X2A: 23...30 Vdc 0.01...2A

Precharging must be carried out via the terminal X1C!

4.3.4 Connection of the synchronization unit

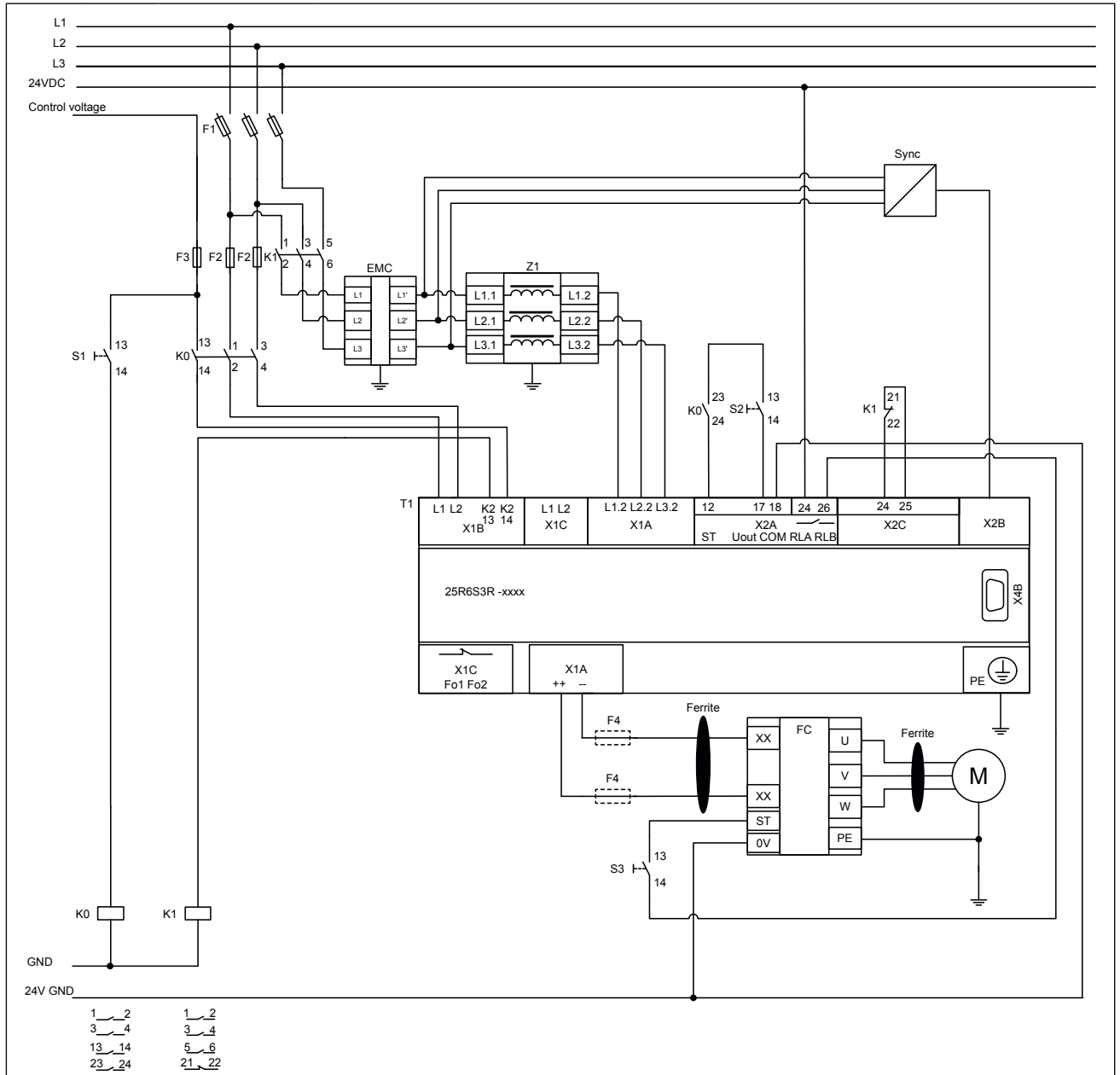
RJ45 socket for phase synchronization and temperature sensor	No.	Name	Function
	X2B.1	t1	Connection for temperature sensor (option)
	X2B.2	t2	
	X2B.3	U13_syn	Synchronization phase 1 / 3
	X2B.4	–	reserved
	X2B.5	U21_syn	Synchronization phase 2 / 1
	X2B.6	–	reserved
	X2B.7	U32_syn	Synchronization phase 3 / 2
	X2B.8	–	reserved

Figure 14: RJ45 socket for phase synchronization and temperature sensor

Connection power unit R6-S without UL

4.4 Connection power unit R6-S without UL

4.4.1 Power supply and regenerative operation at inverter current \leq inverter current of one COMBIVERT R6-S without UL



F1	Mains fuses type aR/gR	
F2	10A fuse gG/gL or automat characteristic K	
F3	10A fuse gG/gL	
F4	DC fuses type aR/gR (optional)	The cable cross section as well as the DC fuses must be dimensioned to the DC rated current of the load (see technical data of the inverter).
S1/K0	Power on/off	
S2/S3	External control release	
K1	Line contactor with auxiliary contacts	

continued on the next page

Sync	Synchronization unit (max. length of the phase lines 1 m)	
Z1	Commutation reactor / harmonic filter	
t1	Regenerative unit COMBIVERT R6-S	
	X1A	Power circuit terminals
	X1B	Connection for line contactor and precharging
	X1C	Connection for DC fuse monitoring
	X2A	Control terminal strip (X2A.12: control release; X2A.17: voltage output)
	X2B	Connection for synchronization line
	X2C	Activation of the self-holding of the load shunt relay
EMC	EMC filter	
M	Motor	
FC	Drive controller	
K0	Switch on relay (400V / 12A AC3)	
	Ferrite (optional)	

Figure 15: Power supply and regenerative operation at inverter current \leq inverter current of one COMBIVERT R6-S

NOTICE

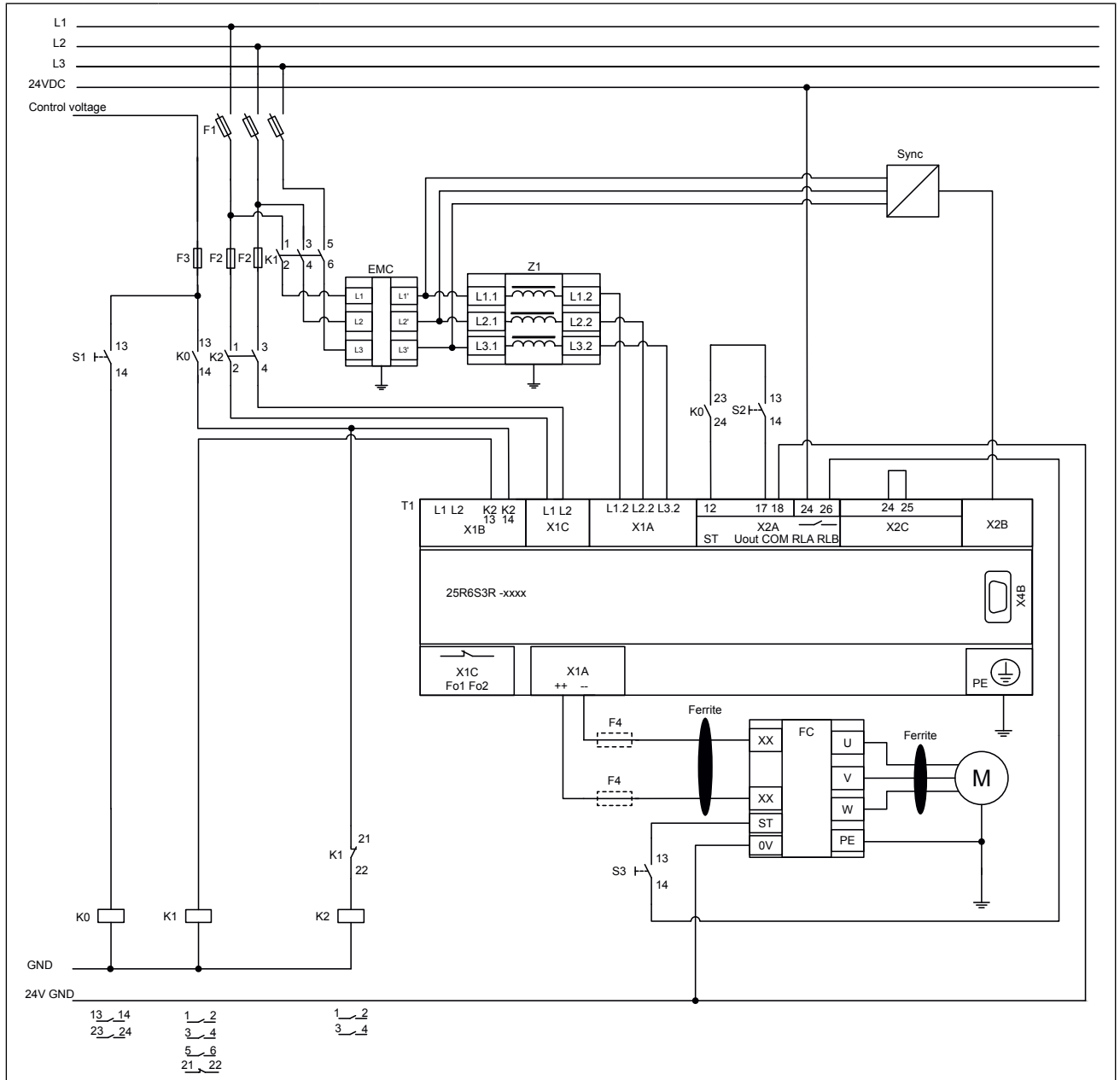
Destruction of the regenerative unit!

- ▶ A load draw may be done only if relay 1 is active.
- ▶ In case of failure disconnect the line contactor with S1/K1 from the supply system.

Connection power unit R6-S with UL

4.5 Connection power unit R6-S with UL

4.5.1 Power supply and regenerative operation at inverter current ≤ inverter current of one COMBIVERT R6-S with UL



F1	Mains fuses type aR/gR	
F2	10A fuse gG/gL or automat characteristic K	
F3	10A fuse gG/gL	
F4	DC fuses type aR/gR (optional)	The conductor cross-section as well as the DC fuses must be dimensioned to the DC rated current of the load (see technical data of the inverter).
S1/K0	Power on/off	
S2/S3	External control release	
K1	Mains contactor with auxiliary contacts	

continued on the next page

K2	Pre-charging contactor (400 V / 12 AAC3)	
Sync	Synchronization unit (max. length of the phase lines 1 m)	
Z1	Commutation reactor / harmonic filter	
t1	Regenerative unit COMBIVERT R6-S	
	X1A	Power circuit terminals
	X1B	Connection for mains contactor
	X1C	Connection for precharging and DC fuse monitoring
	X2A	Control terminal strip (X2A.12: control release; X2A.17: voltage output)
	X2B	Connection for synchronization line
	X2C	Activation of the self-holding of the load shunt relay
EMC	EMC filter	
M	Motor	
FC	Drive controller	
K0	Switch on relay	
	Ferrite (optional)	

Figure 16: Power supply and regenerative operation at inverter current \leq inverter current of one COMBIVERT R6-S

NOTICE

Destruction of the regenerative unit!

- ▶ A load draw may be done only if relay 1 is active.
- ▶ In case of failure disconnect the line contactor with S1/K1 from the supply system.

4.5.2 Regenerative power supply in parallel operation with a drive controller

	<p>More information and a detailed wiring diagram can be found under the following link:</p> <p>https://www.keb.de/fileadmin/media/Techinfo/dr/tn/01_inverter_servo/ti_wiring_r6s_diode_fu_0501_0001_deu.pdf</p>	
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4.5.3 Power supply and regenerative operation at parallel operation with a further regenerative unit

	<p>More information and a detailed wiring diagram can be found under the following link:</p> <p>https://www.keb.de/fileadmin/media/Techinfo/dr/tn/01_inverter_servo/ti_wiring_r6s_para_r6s_0501_0002_deu.pdf</p>	
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	<p>Parallel operation</p> <p>When connecting in parallel operation, the parameter default set must be changed. See application instructions R6-S under "Special functions for parallel connection".</p>
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Connection of the control board version S

4.6 Connection of the control board version S

4.6.1 Assignment of the control terminal strip X2A

X2A																																													
<table border="1" style="margin: auto;"> <tr> <td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>			10	11	12	13	14	15	16	17	18	19	20	21	22	23															<table border="1" style="margin: auto;"> <tr> <td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>			24	25	26	27	28	29						
10	11	12	13	14	15	16	17	18	19	20	21	22	23																																
24	25	26	27	28	29																																								
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...±10V / 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. 1Aac is permissible for 125Vac.

4.6.2 Assignment of the socket X2B

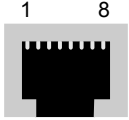
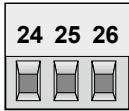
RJ45 socket for phase synchronization and temperature sensor	No.	Name	Function
	1	t1	Connection for temperature sensor (option)
	2	t2	
	3	U13_syn	Synchronization phase 1 / 3
	4	–	reserved
	5	U21_syn	Synchronization phase 2 / 1
	6	–	reserved
	7	U32_syn	Synchronization phase 3 / 2
	8	–	reserved

Figure 17: 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.


4.6.3 Assignment of the terminal block X2C

		
Conductor cross-section 0.14...1.5 mm ² , tightening torque 0.22...0.25 Nm		
PIN	Function	Description
24	Bridge between pin 24 and pin 25	Activation of the self-holding of the mains contactor
25		
26	not assigned	-

Connection of the control board version S

4.6.4 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

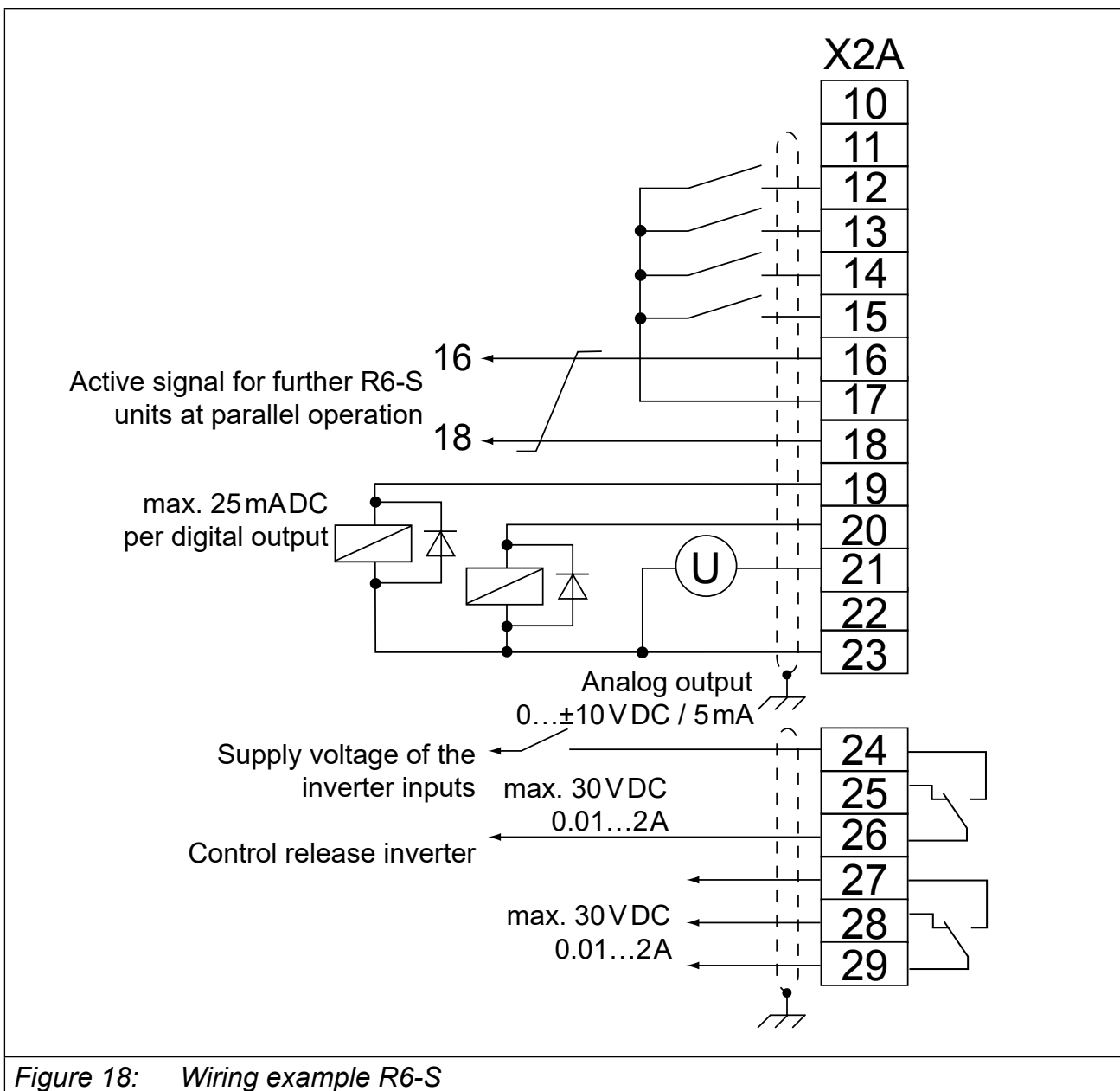


Figure 18: Wiring example R6-S

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			
nEtoF	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.PuIn	"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. Appendix A

A.1 Dimensioning power supply and regenerative units

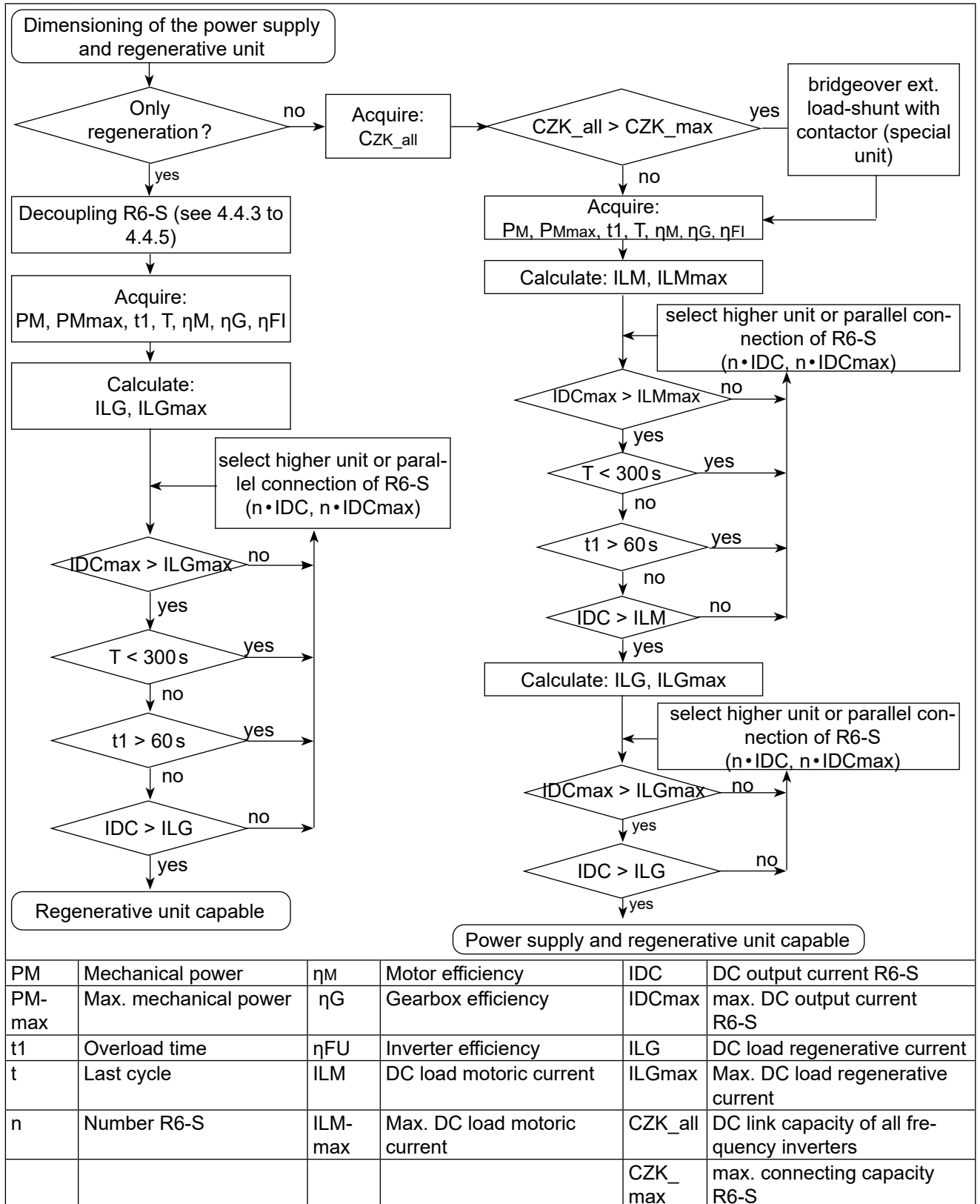


Figure 19: Dimensioning power supply and regenerative units

A.2 DC link capacitors of KEB frequency inverters

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

* Special unit



The precharge circuit must be taken for COMBIVERT F5 inverters from the respective power circuit manual.

Appendix A

Frequency inverter COMBIVERT G6			
Housing size	Unit 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	

Frequency inverter COMBIVERT S6			
Housing size	Unit size	Capacity / μF	Precharging circuit
2	7	195	Type A1
	9	1955	
	10	235	
4	12	470	Type A1
	13	560	



When using G6 / S6 inverters ferrites must be used in each case at the input and output.

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 $\geq 0.5 \text{ W/(m}^2\text{K)}$)

Appendix 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 component with a total height of 30 mm and a base width of 80 mm. It features three diodes labeled 1, 2, and 3. Diode 1 is an anode and diode 2 is a cathode. The distance between diodes 1 and 2 is 20 mm, and between 2 and 3 is 20 mm. The component has a base thickness of 6 mm and a mounting hole diameter of 8.5 mm. The top view shows a total width of 92 mm and a height of 20 mm. The distance between the centers of the diodes is 12.4 mm (between 1 and 2) and 24.5 mm (between 2 and 3). An M5 screw is used for mounting.</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 component with a total height of 30 mm and a base width of 65 mm. It features three diodes labeled 1, 2, and 3. Diode 1 is an anode and diode 2 is a cathode. The distance between diodes 1 and 2 is 20 mm, and between 2 and 3 is 25 mm. The component has a base thickness of 0.25 mm and a mounting hole diameter of 7.5 mm. The top view shows a total width of 92 mm and a height of 20.8 mm. The distance between the centers of the diodes is 20 mm (between 1 and 2) and 25 mm (between 2 and 3). An M5x10 screw is used for mounting.</p>
0090147-6009	3 (anode) 2 (cathode)	<p>Technical drawing of decoupling diode 0090147-6009. The side view shows a component with a total height of 52 mm and a base width of 92 mm. It features three diodes labeled 1, 2, and 3. Diodes 1 and 2 are anodes, and diode 3 is a cathode. The distance between diodes 1 and 2 is 22.5 mm, and between 2 and 3 is 35 mm. The component has a base thickness of 4.3 mm and a mounting hole diameter of 4.5 mm. The top view shows a total width of 92 mm and a height of 50 mm. The distance between the centers of the diodes is 22.5 mm (between 1 and 2) and 35 mm (between 2 and 3). An M8x20 screw and an SW13 wrench are used for mounting. A 2.8x0.8 mm component is also shown.</p>

Figure 20: Dimensions of the decoupling diodes

B. Appendix B

B.1 Certification

B.1.1 CE Marking


CE marked power supply and regenerative units were developed and manufactured to comply with the regulations of the Low-Voltage Directive 2014/3/5EU.

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 (2014/30/EU)(note EN 60204).

The power supply and regenerative units meet the requirements of the Low-Voltage Directive 2014/35/EU. 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

	<p>Acceptance according to UL is marked at KEB power supply and regenerative units with the adjacent logo on the type plate.</p>
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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):

- Control Board Rating(21 to 30 V DC/ 0.01 to 1 A)
- „Maximum Surrounding Air Temperature 45°C“
- Degree of Overload Protection provided internally by the Drive, in percent of full load current, and instructions for adjustment.
- Power Conversion Equipment, Open Types, R housing - Series Combivert, Cat. Nos. 25., followed by R6 followed by S or N , followed by 3, followed by R-, followed by four digits of numbers or letters.
- Motor Overtemperature Protection:
above drive models are not provided with load and speed sensitive overload protection and thermal memory retention up on shutdown or loss of power.
- Short Circuit rating and fuse type/circuit breaker and size: See page 10 for detailed marking requirements.
- Wiring Terminals marked to indicate proper connections for the power supply, load and control circuit.
- Intended for use in pollution degree 2 environment.
- High Voltage, Umax 528 V AC ~ 800 V DC
- Terminals - Torque Value for Field Wiring Terminals, the value to be according to the R/C or Unlisted Terminal Block used.

Appendix B

- "Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the manufacturer instructions, National Electrical Code and any additional local codes, or the equivalent."
- Short Circuit rating and Branch Circuit Protection when used with F5-series drive:

Following marking shall be provided:

All Models:

„Suitable for use on A circuit capable Of delivering not More than 100 kA rms symmetrical amperes, 480 volts maximum when protected by class J fuses, rated 300 am peres as specified in table below”:

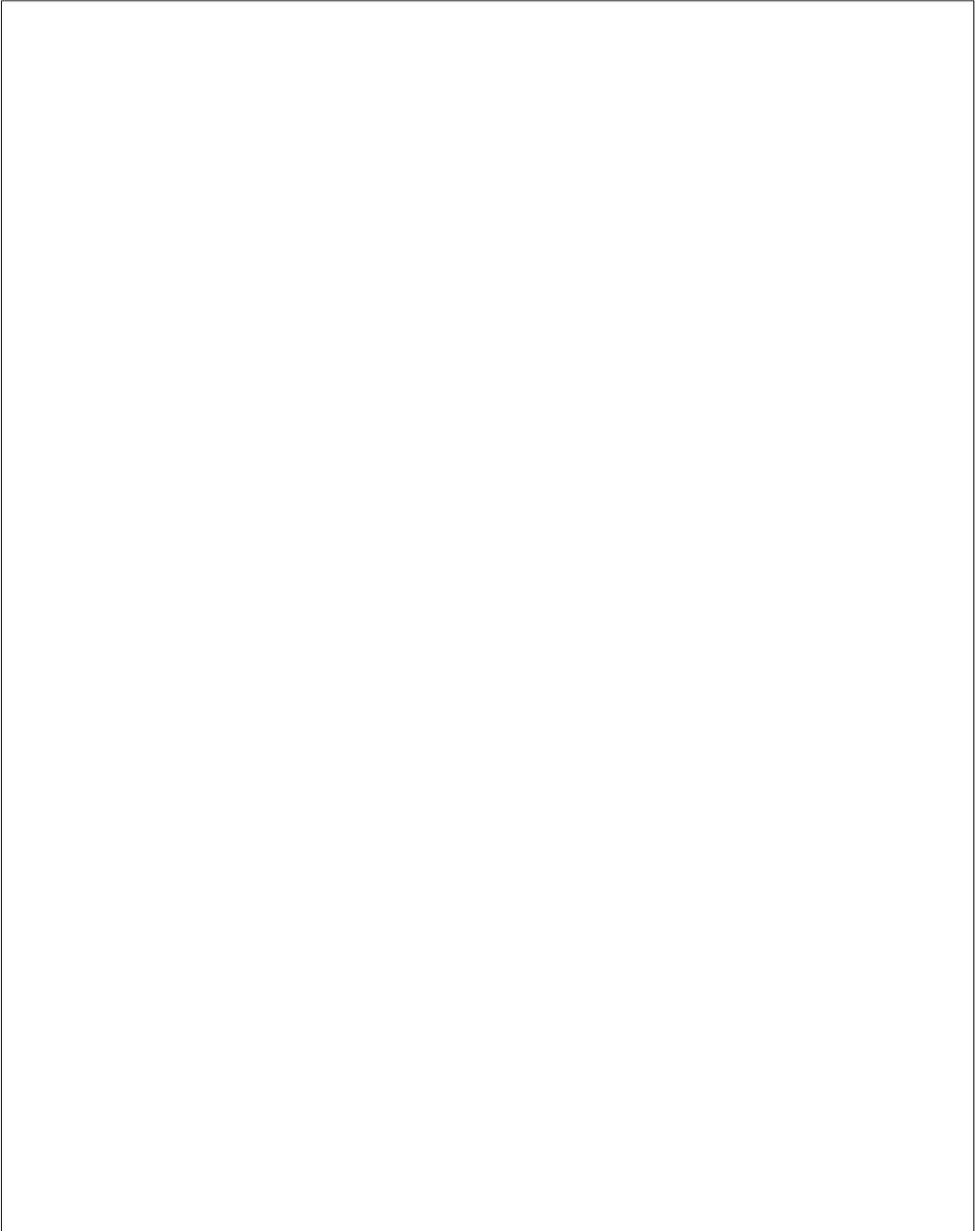
Table I Branch Circuit Protection for KEB Converter / converter R6–R housing:

a) UL 248 Fuses; Class J as specified below:

300 A, 100 KA SCCR

Main line AC:

Converter	Input Voltage [V]	UL 248 Fuse type J max [A]	Manufacturer and rating	Part #
25R6	480 / 3ph	300 A	Ferraz Shawmut, 300 A , 600 v AC	HSJ300, High Speed UL listed Fuse NDB6-26





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