

COMBIVERT



R6

GB Instruction Manual
Type R6-S

**Power Supply and Regenerative
Unit
Size 25**

Mat.No.	Rev.
00R6SEB-KR00	1N



Table of Contents

1.	Introduction.....	5
1.1	Preface.....	5
1.2	Product description.....	5
1.3	Validity and liability	6
1.4	Copyright.....	6
1.5	Specified application.....	7
1.5.1	Standard operation	7
1.5.2	Abnormal operation	7
1.6	Unit identification	8
2.	Safety Instructions	9
2.1	General instructions.....	9
2.2	Transport, storage and installation.....	9
2.3	Electrical connection.....	10
2.4	EMC instructions	14
2.5	EMC conform installation	14
3.	Technical Data	15
3.1	Overload (OL) function.....	16
3.2	Operating conditions.....	16
3.3	Accessories.....	17
3.4	Options	18
3.4.1	Ferrite rings.....	18
3.5	Dimensions and weights.....	19
3.5.1	Dimensions air cooling system mounted version.....	19
3.5.2	Commutation reactor/mains choke	20
3.5.3	Radio interference filter (side-mounted)	21
3.5.4	Synchronization unit	21
4.	Installation.....	22
4.1	EMC-compatible control cabinet installation.....	22
4.2	Installation instructions	22
4.3	Connection of the COMBIVERT R6	23
4.3.1	General description of inverter input terminals	23
4.3.2	Connection terminals of the power circuit.....	25
4.3.3	Connections of the control board.....	27
4.3.4	Connection of the synchronization unit.....	27
4.4	Connection Power Unit R6-S	28
4.4.1	Power supply and regenerative operation at inverter current \leq current of one COMBIVERT R6-S	28
4.4.2	Power supply and regenerative operation at inverter currents \leq current of one COMBIVERT R6-S	29
4.4.3	Power supply and regenerative operation at parallel operation of up to three R6-S	30
4.4.4	Regenerative operation at parallel operation of up to three R6-S with decoupling diodes ..	33

Table of Contents

4.5	Connection of the control board version S	35
4.5.1	Assignment of the control terminal strip X2A.....	35
4.5.2	Assignment of the socket X2B.....	36
4.5.3	Assignment of the terminal block X2C.....	36
4.5.4	Wiring example	37
4.6	Operator	38
5.	Operation of the Unit	39
5.1	Operation with PC und system software COMBIVIS	39
5.2	Switch-on procedure	39
5.3	Parameter summary	40
5.4	Monitoring and analysis parameters	41
5.5	Special adjustments	45
A.	Appendix A	48
A.1	Dimensioning power supply and regenerative units	48
A.2	DC link capacitors of KEB frequency inverters	49
A.3	Decoupling diodes.....	51
A.3.1	Assignment.....	51
A.3.2	Dimensions of the decoupling diodes	52
B.	Appendix B	53
B.1	Certification	53
B.1.1	CE Marking.....	53




1. Introduction

1.1 Preface

First we would like to welcome you as a customer of KEB 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 hard- and software are developments of the KEB Automation KG. Errors excepted. KEB Automation KG has created these documents and the hard- 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
	Attention
	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.

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

- refeds excess energy from regenerative 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
- 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 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 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 units.

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 unit 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 frequency 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


25	R6	S	1	R	9	0	0	A	Type	A: Heat sink (standard)	
									Design	0: default	
									reserved	0: default	1: modified standard
									Voltage	9: 3-ph.; 400V; AC	
									Housing	R	
									Options	1: Precharging intern	
									Control	S: 2BR6	
									Series	R6	
									Unit size	25	

2. Safety Instructions

2.1 General instructions

 <p>Electric shock</p>	<p>COMBIVERT R6 power supply und 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 be 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>Standards discharge time</p>	<p>The COMBIVERT R6 must not be started until it is determined that the installation complies with 2006/42/EC (machine directive) (note EN60204).</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 accidental 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 unit can be worked on again, after it has been switched off for 5 minutes.</p>
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 <p>Secure 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 EN requirements are met. With frequency inverters that are not isolated from the supply circuit all control lines must be included in other protective measures (e.g. double insulation or shielded, earthed and insulated).</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 voltage phase (L1, L2, L3) with respect to neutral conductor/ ground (N/PE) of maximum 305 V.</p>
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 <p>Stationary connection</p>	<p>The COMBIVERT R6 is designed for fixed connection, since discharge currents of > 3.5 mA occur especially when using together with EMC 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 EN 60204-1 / VDE 0113-1, the power semiconductor of the unit and existing radio interference filters must be disconnected because of the danger of destruction. This is permissible in compliance with the standard, since all inverters are given a high voltage test in the end control at KEB. In the case of special requirements please contact KEB.</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 disturbances</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 average value of the supplied DC current may not exceed the maximum DC current.• If several frequency inverters are connected to the COMBIVERT R6-S the max. permissible DC link capacities of all connected frequency inverters must be considered during supply operation (see technical data).
 <p>Automatic restart</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>Not short-circuit proof (supply)</p>	<p>The COMBIVERT R6 is not short-circuit proof at the power supply input! A conditional protection at the supply input is possible if the I²t-protection is adapted with a gR fuse. Short-circuit protection at the DC output is ensured by internal or external aR or gR fuses.</p>

 <p>Conditionally short-circuit proof (regeneration)</p>	<p>The COMBIVERT R6 is conditionally short-circuit proof (EN61800-5-1 / VDE0160). 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, this can lead to a defect in the unit.
 <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 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.

In accordance with the EMC directive 2014/30/EU, these devices are with the meaning of the directive components to be further processed by the respective machine and unit manufacturer and are not operable independently.

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 noises, separate supply lines, DC lines, motor lines, control and data lines (low-voltage level < 48V) 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 (pigtailes) 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 aeriels.
- 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 synchronization between mains choke and COMBIVERT R6-S may not exceed a cable length of 1 m.
- Further information can be found in the internet, see „www.keb.de“.

3. Technical Data

Unit size		25
Housing size		R
Phases		3
Mains forms		TN, TT ⁵⁾
Rated voltage	[V]	400
Mains voltage range	[V]	305...528 ±0 %
Mains frequency	[Hz]	50 / 60 ±2
DC voltage range	[V _{DC}]	420...747 ±0 %
Regenerative operation		
Output rated power	Sn [kVA]	153
Rated active power	[kW]	140
Max. power output	[kVA]	230
Max. active power	[kW]	210
Regenerative rated current	[A]	221
Regenerative DC current	1) [A _{DC}]	270
Over load current (E.OL) 60s	2) [A]	331
Max. regenerative DC current 60s	[A _{DC}]	405
Power supply operation		
Input rated 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
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}]	800
Output rated 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
perm. mains fuse (no delta power system) Siemens Sitor / Bussmann		3NE8731-1 / 170M1372
Max. permissible DC fuse Siemens Sitor / Bussmann Type aR		see options
Short-circuit factor at the connection point (S _{kn} /S _n) or (S _{scp} /S _n)		30 < S _{kn} "/S _n < 350
Power loss at nominal operating	[W]	1300
Max. heat sink temperature	[°C]	88

- 1) Lay two connection cables parallel at supply-/regenerative current > 230 A DC.
- 2) The overload current is specified for 1 minute. The overload cycle is 300 seconds. This corresponds to load class 2 according to EN60146-01-1.
- 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.
- 5) IT and delta power system after consultation KEB (see also safety instructions, voltage with respect to ground)

Technical Data

	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 removal in the DC link circle 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 unit must be disconnected from the supply system or the load must be switched off in case of overcurrent or overload.

3.1 Overload (OL) function

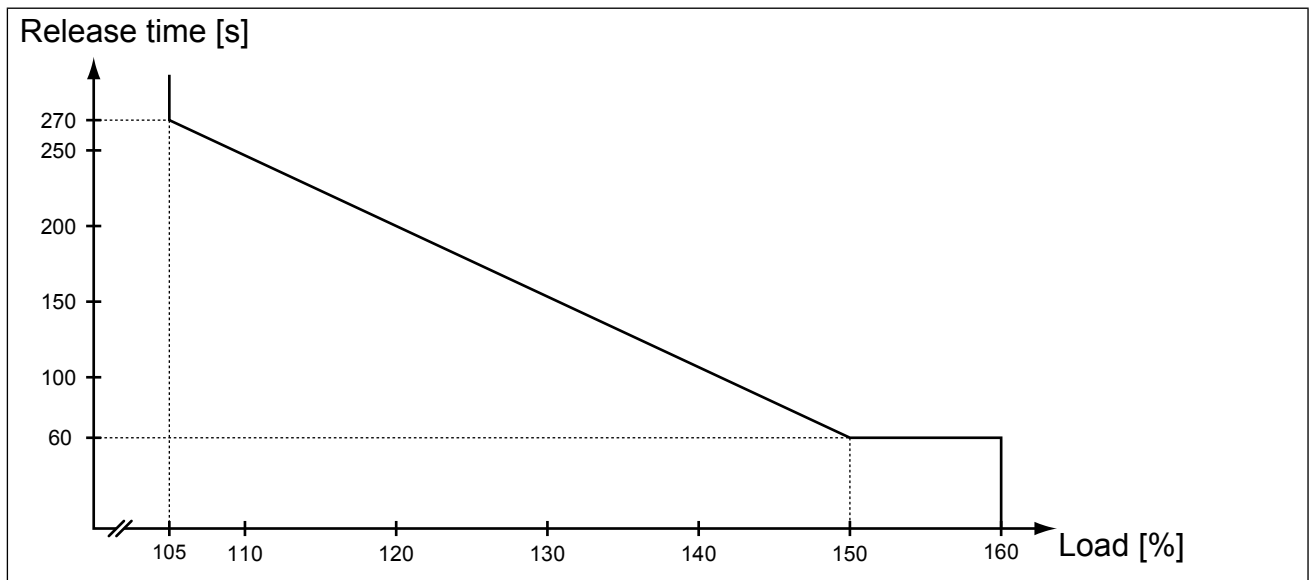


Figure 1: Overload (OL) function

3.2 Operating conditions

	Standard	Standard/ class	Instructions
Definition according to	EN61800-2		Inverter product standard: rated specifications
	EN61800-5-1		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			further on next side

		Standard	Standard/ class	Instructions	
Climate	Temperature	EN 60721-3-3	3K3	extended to -10...45 °C (with temperature over 45 °C to max. 55 °C a derating of 5 % per 1 K must be taken into consideration)	
	Humidity		3K3	5...85 % (without condensation)	
Mechanical	Vibration				max. amplitude of a vibration 1 mm (5...13 Hz) max. acceleration amplitude 7 m/s ² (13...200 Hz)
				3M1	
Contamination	Gas			3C2	
	Solids			3S2	
Ambient conditions during transport					
Climate	Temperature	EN 60721-3-2	2K3		
	Humidity		2K3	(without condensation)	
Mechanical	Vibration		2M1	max. vibration amplitude 3.5 mm (2...9 Hz) max. acceleration amplitude 15 m/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		1M1	max. amplitude of a vibration 1 mm (5...13 Hz) max. acceleration amplitude 7 m/s ² (13...200 Hz)	
	Surge		1M1	max. 100 m/s ² ; 11 ms	
Contamination	Gas			1C2	
	Solids			1S2	
Type of protection		EN 60529	IP20		
Environment		IEC 664-1		Pollution degree 2	
Definition according to		EN 61800-3		Inverter product standard: EMC	
EMC emitted interference					
Cable-based interferences		EN 55011	C2	with filter (only with filter)	
Radiated interferences		EN 55011	C2	with filter (only with filter)	
Interference immunity					
Electro-static discharge		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	
Immunity to conducted disturbances, induced by radio-frequency fields		EN 61000-4-6	10 V	0.15-80 MHz	
Electromagnetic fields		EN 61000-4-3	10 V/m		
Voltage variation/ voltage drop		EN 61000-2-1		+10 %, -15 %; 90 %	
Voltage unsymmetries/ frequency changes		EN 61000-2-4		3 %; 2 %	

3.3 Accessories

Unit size	25
Rated voltage	400 V
Commutation reactor	25Z1B04-1000 150 % max. short-term overload (regenerative mode) 150 % max. short-term overload (supply mode)

Technical Data

Synchronization unit	00R6940-2408 Control cabinet installation; max. distance to the commutation choke or harmonic filter 1 m
Patch cable	00F50C3-4010 Length 1 m for connection of the synchronization unit with R6 regenerative unit

3.4 Options

Unit size	25
Mains filter	25E4T60-1001 in accordance with EN 61800-3 Limit class C2 (only with ferrite rings) Limit class C1 (on consultation with KEB)
DC fuses	1000V/500A Mat.no. 009025H-3679 or 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	25Z1C04-1000 The overload current reduces at certain mains conditions! Please contact KEB for data to the THD value at regenerative operation in accordance with EN 61800-2-12.
Operators	Digital operator, interface operator
Bus operators	CAN, ProfiBus, InterBus, EtherCAT, Ethernet, Sercos, ModBus, PROFINET, LCD-Operator, DeviceNet, HSP5

3.4.1 Ferrite rings

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

Part number	Nominal size in mm	Inside diameter in mm
0090396-2621	R 42/26/18	24.9
0090390-5241	R 56/32/18	29.5
0090395-3820	R 63/38/25	36.0
0090395-5222	R 87/54/30	54.5
0090395-5520	R 102/66/15	64.5

3.5 Dimensions and weights

3.5.1 Dimensions air cooling system mounted version

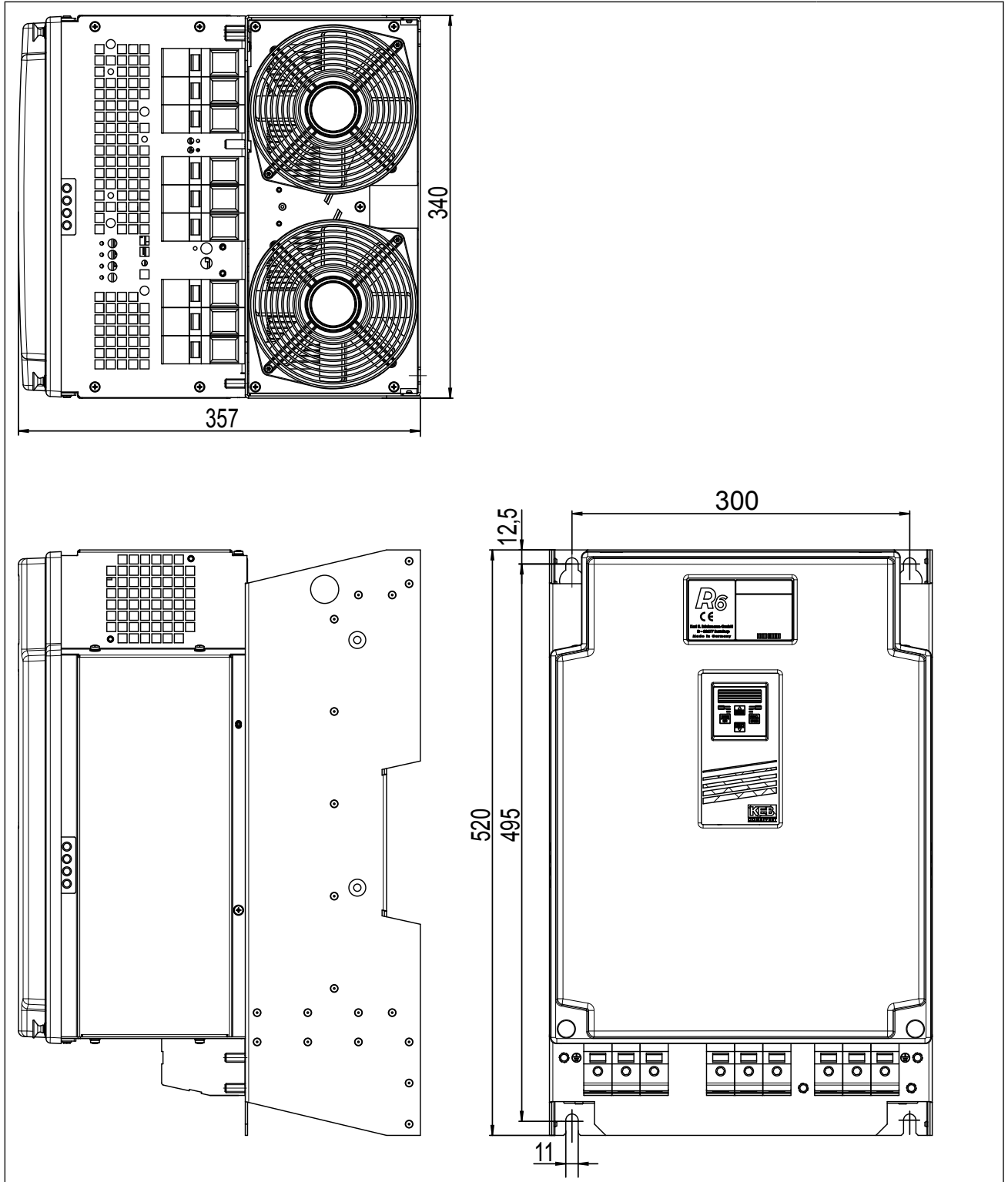
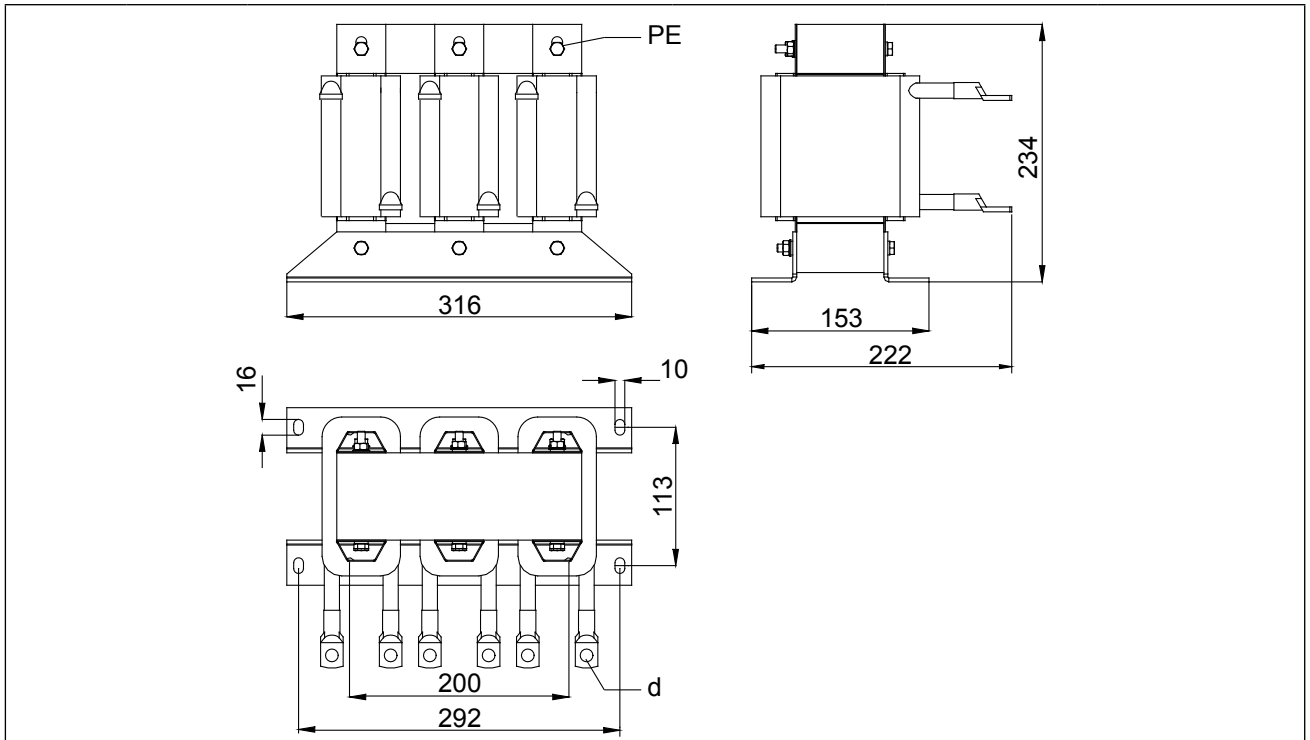


Figure 2: COMBIVERT R6 with fan heat sink

Weight
25 kg

Dimensions and weights

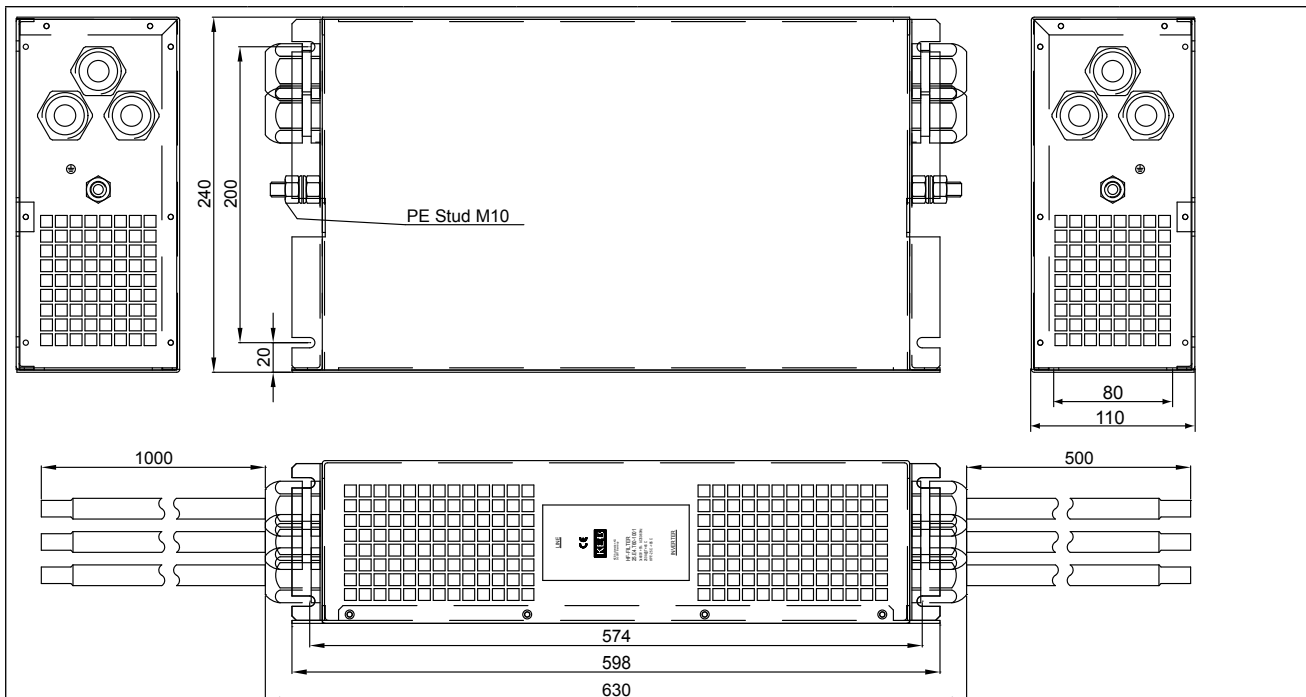
3.5.2 Commutation reactor/mains choke



Mat.-Number	Inductance [mH]	I _{rated} [A]	PV [W]	Frequency [Hz]	Weight [kg]
25Z1B04-1000	0,133	221	265	45...65	30
Technical data of the connection terminals				Maximum tightening torque	
PE	M12	Stay bolt for ring thimble		25 Nm	200 lb inch
GB	Ø8	Hole for screw M8			

Figure 3: Mains choke

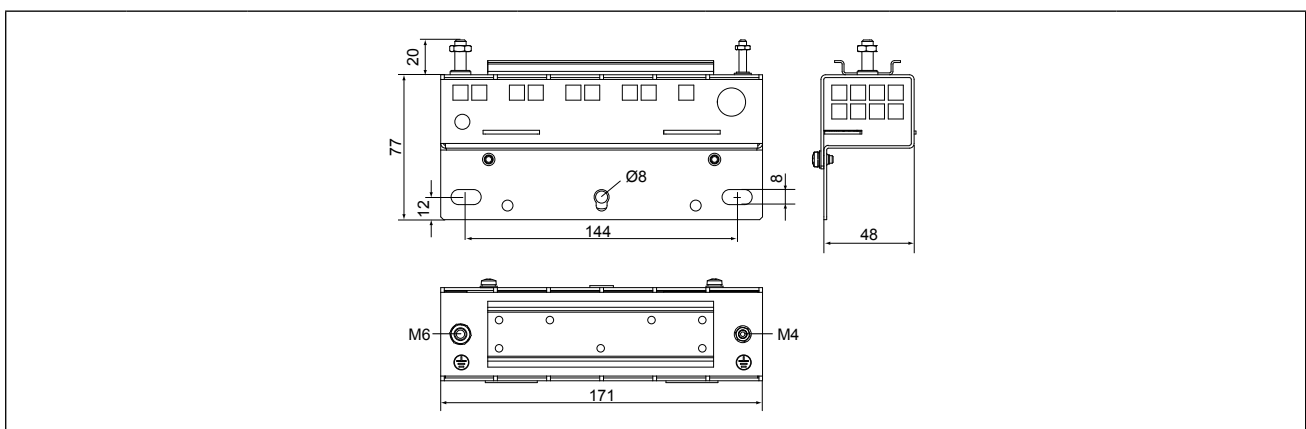
3.5.3 Radio interference filter (side-mounted)



Mat.-Number	U_{rated}	I_{rated}	P_V	Interference level/	f_{rated}	Weight
	[V]	[A]	[W]	Line length	[Hz]	[kg]
25E4T60-1001	3x480	250	50	C2 / 30 m	50/60	16
Technical data of the terminals / cables					Maximum tightening torque	
PE	M10 stay bolt for ring thimble				37 Nm	320 lb inch
Connection cable	each 3 x 70 mm ² (AWG 2/0)					

Figure 4: Radio interference filter (side-mounted)

3.5.4 Synchronization unit

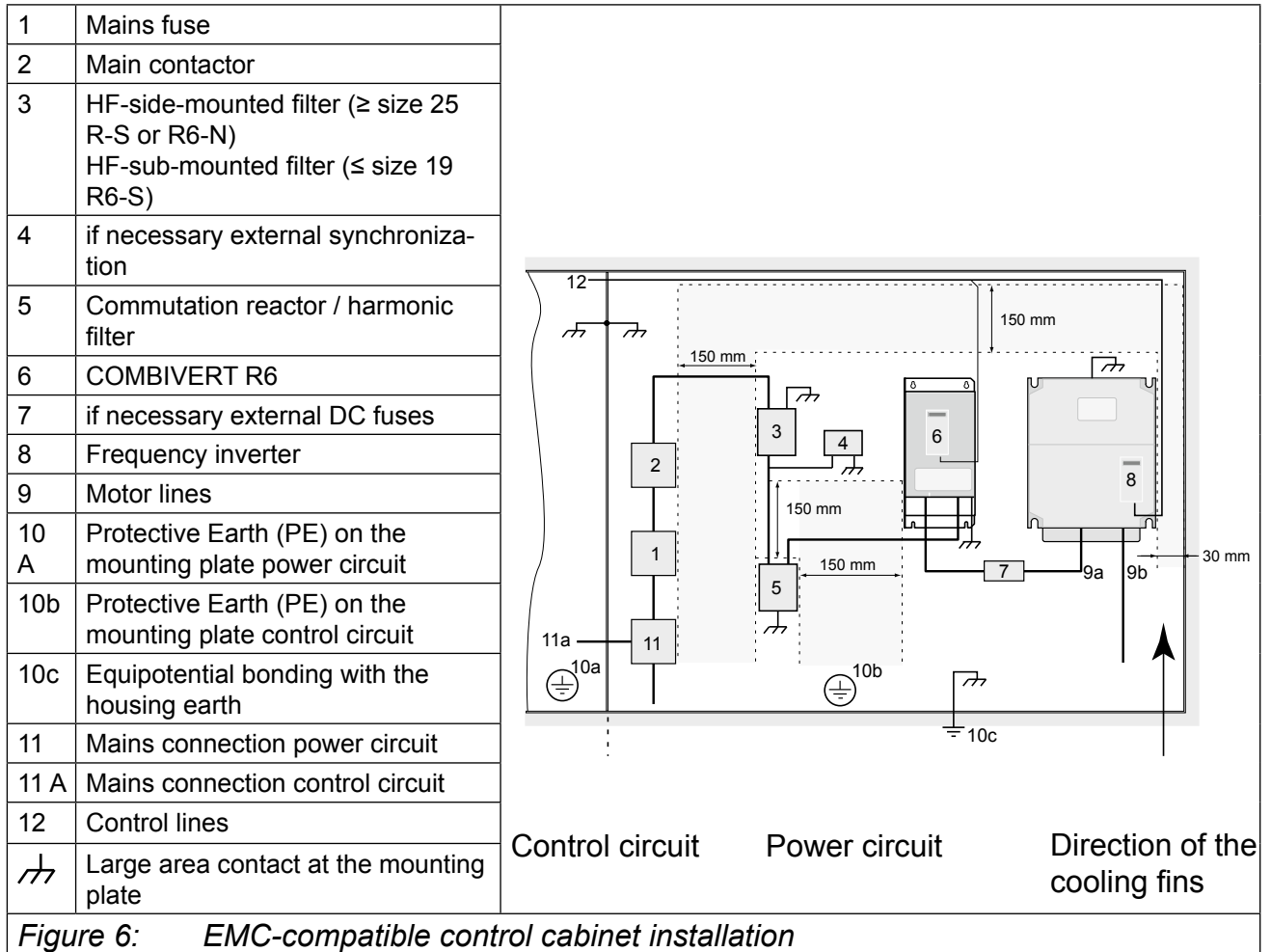


Mat.-Number	00R6940-2408	Weight	0.65 kg
Technical data of the connection terminals			Maximum tightening torque
PE	M12	Stay bolt for ring thimble	1.3 Nm / 12 lb inch
PE	M12		4.5 Nm / 40 lb inch


Figure 5: Synchronization unit

4. Installation

4.1 EMC-compatible control cabinet installation





4.2 Installation instructions

	• Stationarily install and earth COMBIVERT.
	• The device must not be permeated by mist or water.
	• Allow for sufficient heat dissipation if installed in a dust-proof housing.
	• Install the COMBIVERT in an appropriate housing in accordance with the local regulations when operating it in explosion-endangered spaces.
	• Protect COMBIVERT against conductive and aggressive gases and liquids.
	• The lines of the R6-S commutation reactor must be limiting to 50 cm.
	• The frequency 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

	<p>Starting current limiting</p> <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.</p>
	<p>Maximum DC link capacity</p> <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 (supply unit 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 units supplied by the DC bus have a starting current limiting at the DC voltage input.
+(PA), -	DC voltage output with starting current limiting; usable as input only if the starting current is limited by the supply source.
PA, PB	Connection for braking resistor; optionally only if a braking transistor is installed
L1, L2, L3	Mains input 3-phase

Connection of the COMBIVERT R6

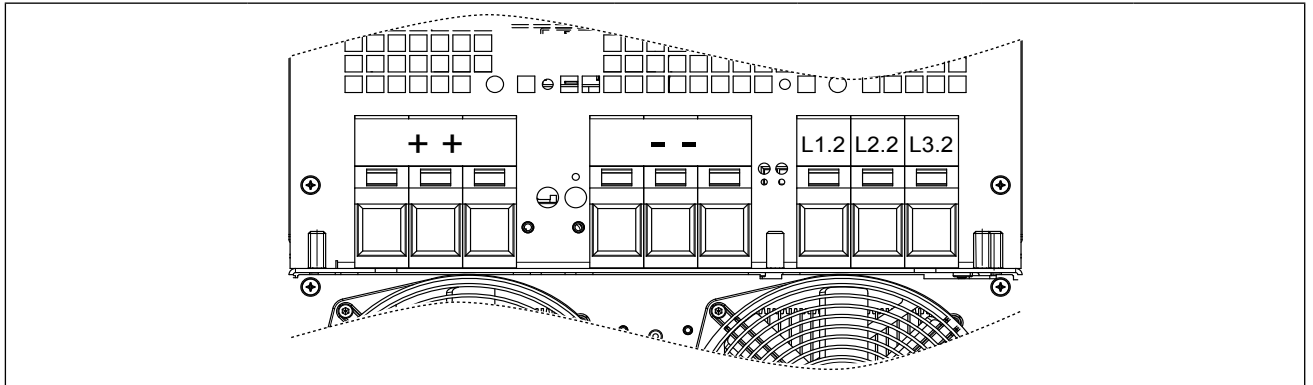
Type A1: AC/DC inverter	Type B1: AC inverter	Type C1: DC inverter
<p>This type can be supplied by mains and by DC circuit. The starting current limitation is designed after the input terminals. When used as output parallel connected inverters must have an own starting current limiting at the DC voltage 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>Figure 7: General description of input terminals at KEB inverter</p>		


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>R6-S in E housing</p>	<p>R6-S in R and P housing without 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>

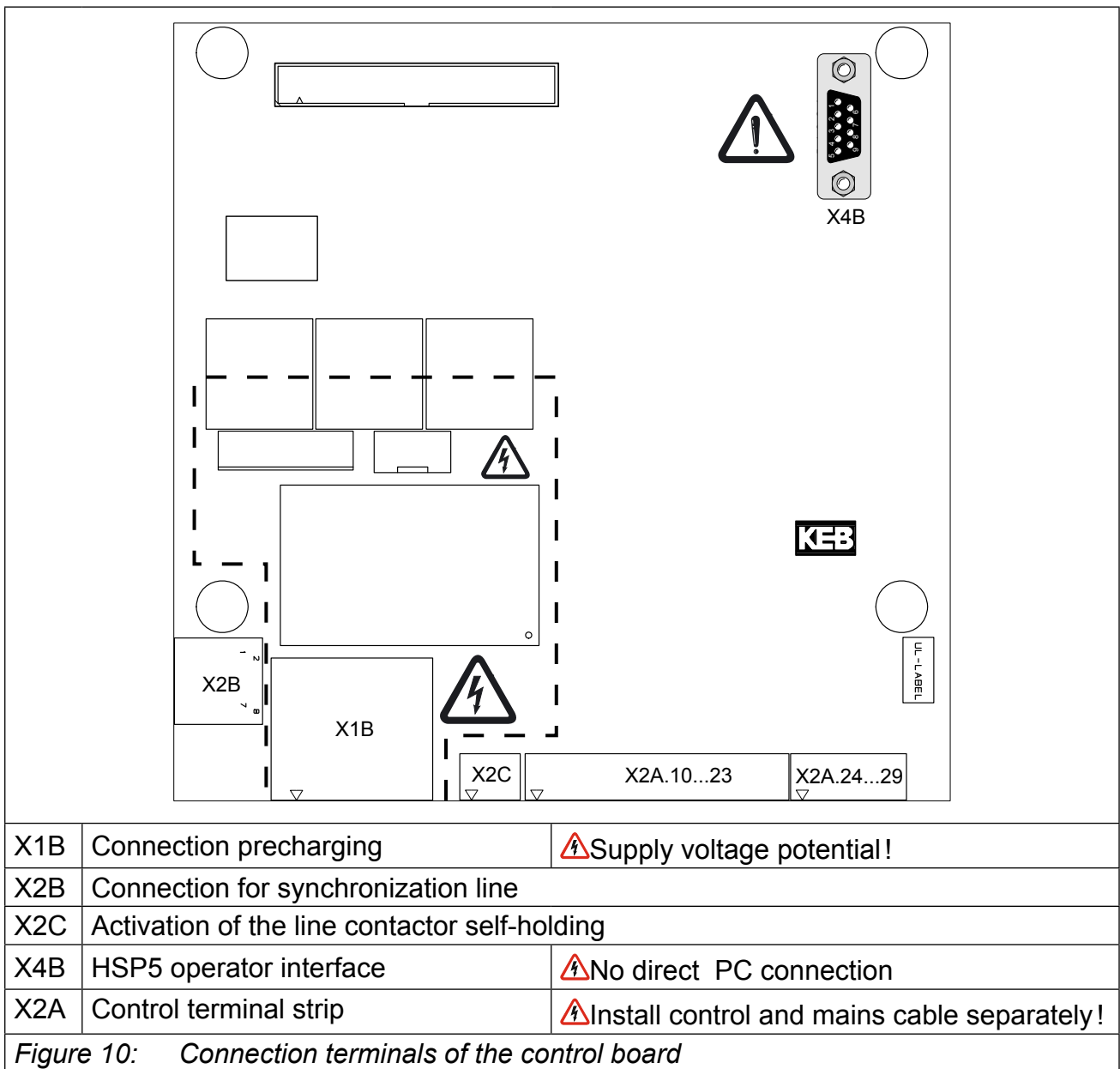
Figure 8: Description of the input terminals of the COMBIVERT R6

Connection of the COMBIVERT R6



Name	Function			
L1.2, L2.2, L3.2	3-phase mains connection to the commutation reactor			
++, --	DC voltage output with starting current limiting; Connection for the inverter, the connection terminals are each internally connected in parallel.			
	Connection for shielding /earthing			
Technical data of the connection terminals	Core cross-section [mm ²]		max. tightening torque	
	min	max	Nm	lbinch
Screw terminals (8mm internal hexagon)	35	95	20	170
Stay bolt M10	Stay bolt for ring thimble 10 mm		25	220
<i>Figure 9: Connection terminals of the power circuit</i>				

4.3.3 Connections of the control board



4.3.4 Connection of the synchronization unit

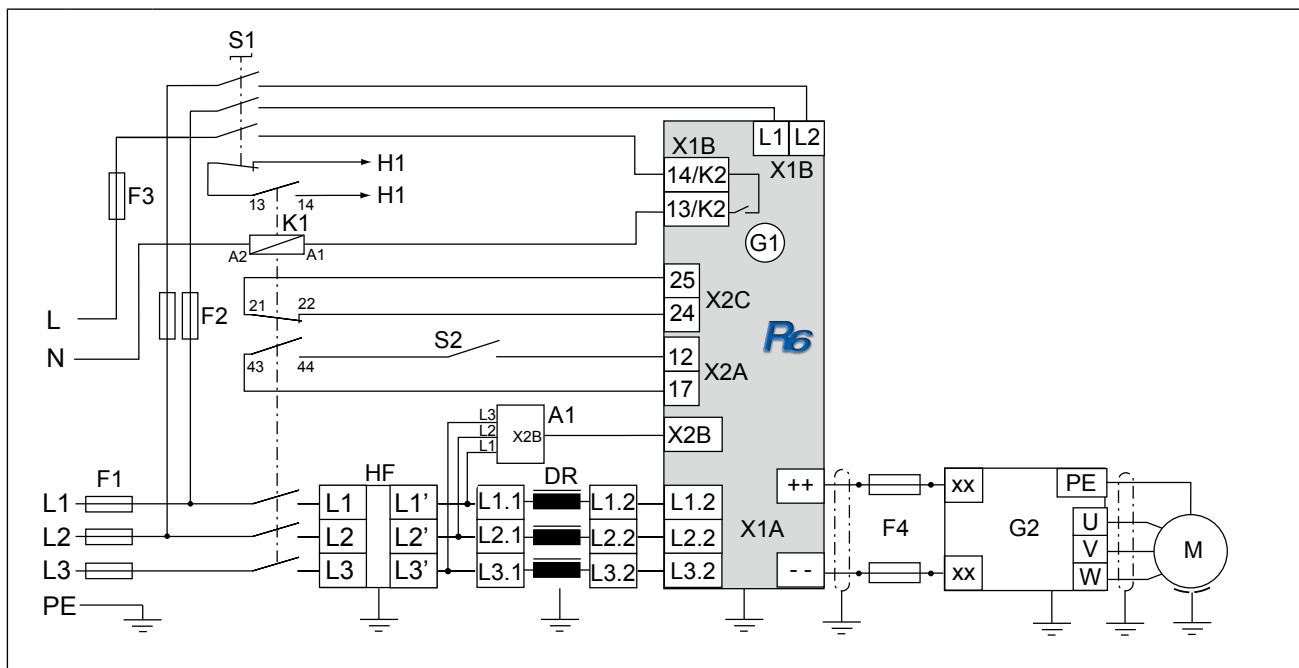
RJ45 socket for phase synchronization and temperature sensor	No.	Name	Function
	X2B.1	T1	Connection for temperature sensor (option)
	X2B.2	T2	
	X2B.3	U13_syn	Synchronization phase 1 / 3
	X2B.4	–	reserved
	X2B.5	U21_syn	Synchronization phase 2 / 1
	X2B.6	–	reserved
	X2B.7	U32_syn	Synchronization phase 3 / 2
	X2B.8	–	reserved

Figure 11: RJ45 socket for phase synchronization and temperature sensor

Connection Power Unit R6-S

4.4 Connection Power Unit R6-S

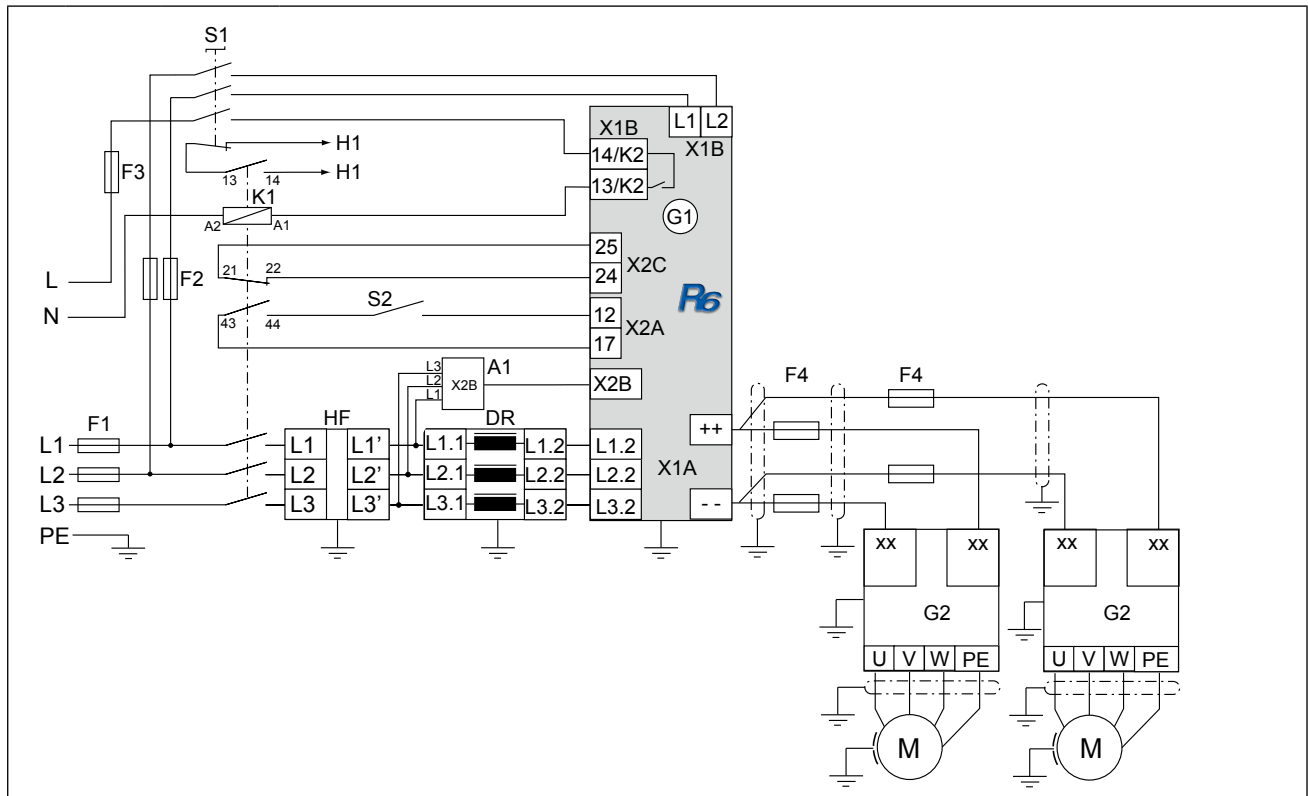
4.4.1 Power supply and regenerative operation at inverter current \leq current of one COMBIVERT R6-S



A1	Synchronization unit (max. length of the phase lines 1 m)	
DR	Commutation reactor / harmonic filter	
F1	Mains fuse type gR	
F2	10A fuse gG/gL or automat characteristic K	
F3	10A fuse gG/gL	
F4	DC fuses type aR/gR	The cable cross section as well as the DC fuses (see chapter 2.1) must be dimensioned to the DC rated current of the load (see technical data of the inverter).
G1	Regenerative unit COMBIVERT R6-S	
	X1A	Power circuit terminals
	X1B	Connection for precharging and switching-on of line contactor K1
	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 (K2 internal)	
G2	Frequency inverter all types (see 4.3.1)	
H1	Error message contactor K1 not dropped	
HF	HF filter	
K1	Line contactor with auxiliary contacts	
M	Motor	
S1	Switch (400V/16A AC3)	
S2	Realize control release with PLC or pre-charging contactor /-switch	

Figure 12: Power supply and regenerative operation at inverter current \leq current of one COMBIVERT R6-S

4.4.2 Power supply and regenerative operation at inverter currents \leq current of one COMBIVERT R6-S

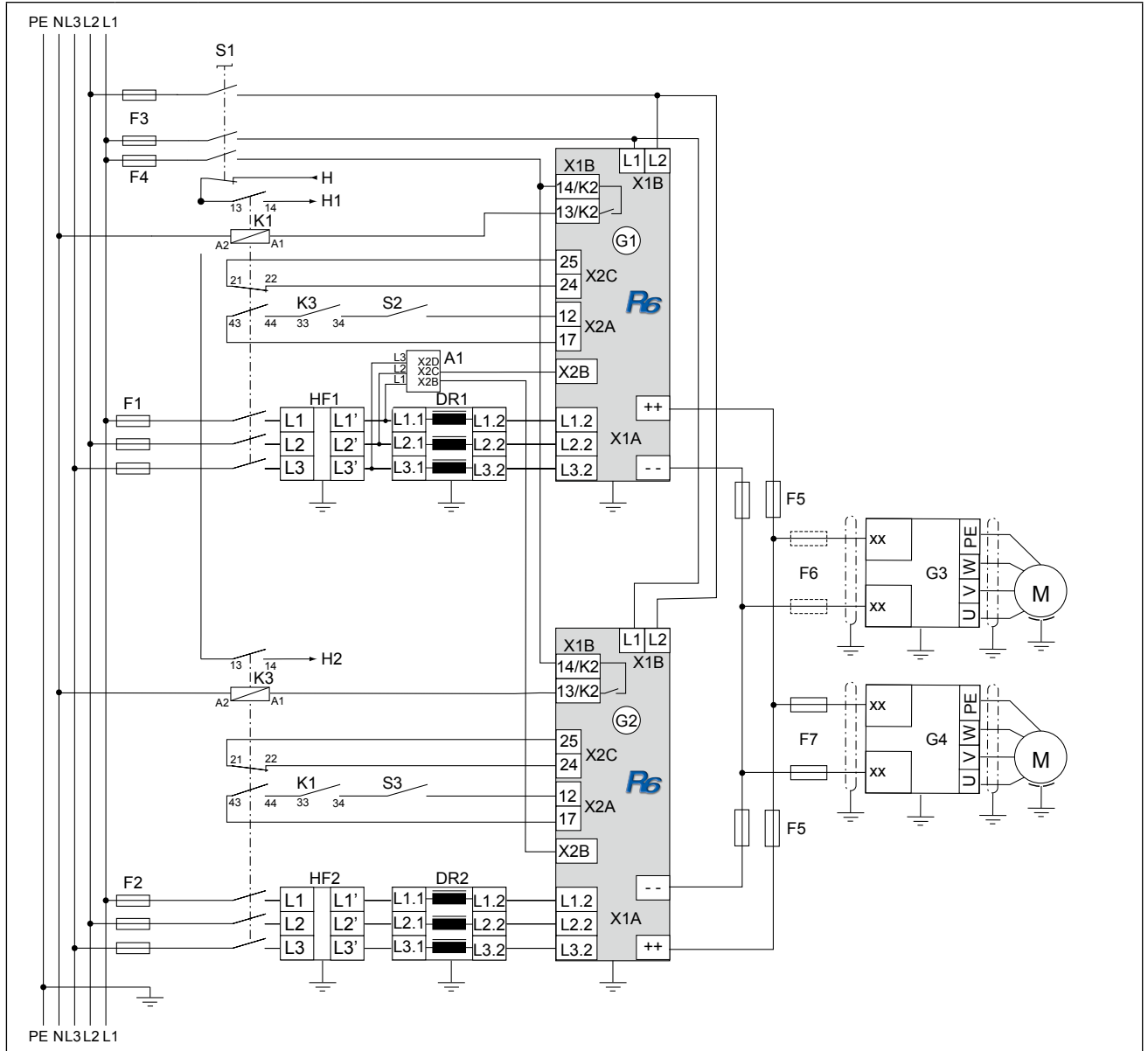


A1	Synchronization unit (max. length of the phase lines 1 m)	
DR	Commutation reactor / harmonic filter	
F1	Mains fuse type gR	
F2	10A fuse gG/gL or automat characteristic K	
F3	10A fuse gG/gL	
F4	DC fuses type aR/gR	The cable cross section as well as the DC fuses (see chapter 2.1) must be dimensioned to the DC rated current of the load (see technical data of the inverter).
G1	Regenerative unit COMBIVERT R6-S	
	X1A	Power circuit terminals
	X1B	Connection for precharging and switching-on of line contactor K1
	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 (K2 internal)	
G2	Frequency inverter all types (see 4.3.1)	
H1	Error message contactor K1 not dropped	
HF	HF filter	
K1	Line contactor with auxiliary contacts	
M	Motor	
S1	Switch (400V/16AAC3)	
S2	Realize control release with PLC or pre-charging contactor / -switch	

Figure 13: Power supply and regenerative operation at inverter currents \leq current of one COMBIVERT R6-S

Connection Power Unit R6-S

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

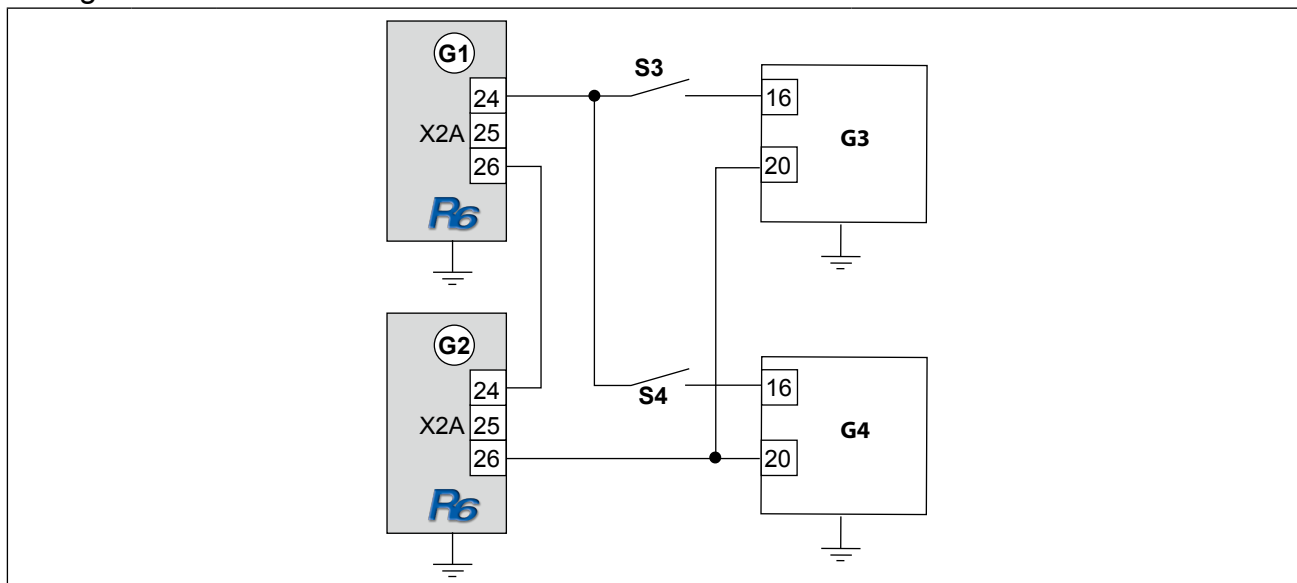


	When connecting the units absolutely pay attention to correct phasing!
	A load draw from the DC circuit may be done only if relay 1 is active (ready signal). This can be guaranteed by a series connection of the relay of the R6 units with the control release of the connected inverters (see next side).
A1	Synchronization units (maximum length of the phase lines 1 m)
DR1, DR2 ¹⁾	Commutation reactor / harmonic filter
F1, F2 ²⁾	Mains fuse type gR
F3	Precharging fuse gG/gL or automatic circuit breaker with characteristic K dimensioned for the sum of the precharging currents (here 20 A)
F4	10A fuse gG/gL
F5 ²⁾	DC fuses type aR
further on next side	

F1, F2 ²⁾	DC fuses type aR/gR	The cable cross section as well as the DC fuses (see chapter 2.1) must be dimensioned to the DC rated current of the load (see technical data of the inverter).
G1, G2	Regenerative unit COMBIVERT R6-S	
	X1A	Power circuit terminals
	X1B	Connection for precharging and switching-on of line contactor K1, K3
	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 (K2 internal)	
G3, G4	Frequency inverter all types (see 4.3.1)	
H	Supply of the signalling device	
H1	Error message contactor K1 not dropped	
H2	Error message contactor K2 not dropped	
HF1, HF2	HF filter	
K1, K3	Line contactor with auxiliary contacts	
M	Motor	
S1	Switch (400V/32A AC3) dimensioned for the sum of the precharging currents	
S2, S3	Realize control release with PLC or pre-charging contactor / -switch	
1)	<i>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 reactor must be the same in case of parallel connection of R6-S with different sizes.</i>	
2)	<i>Main- and DC fuses must be monitored.</i>	
Figure 14: Power supply and regenerative operation at parallel operation of up to three R6-S		

Connection Power Unit R6-S

Wiring of the control release of the connected inverters



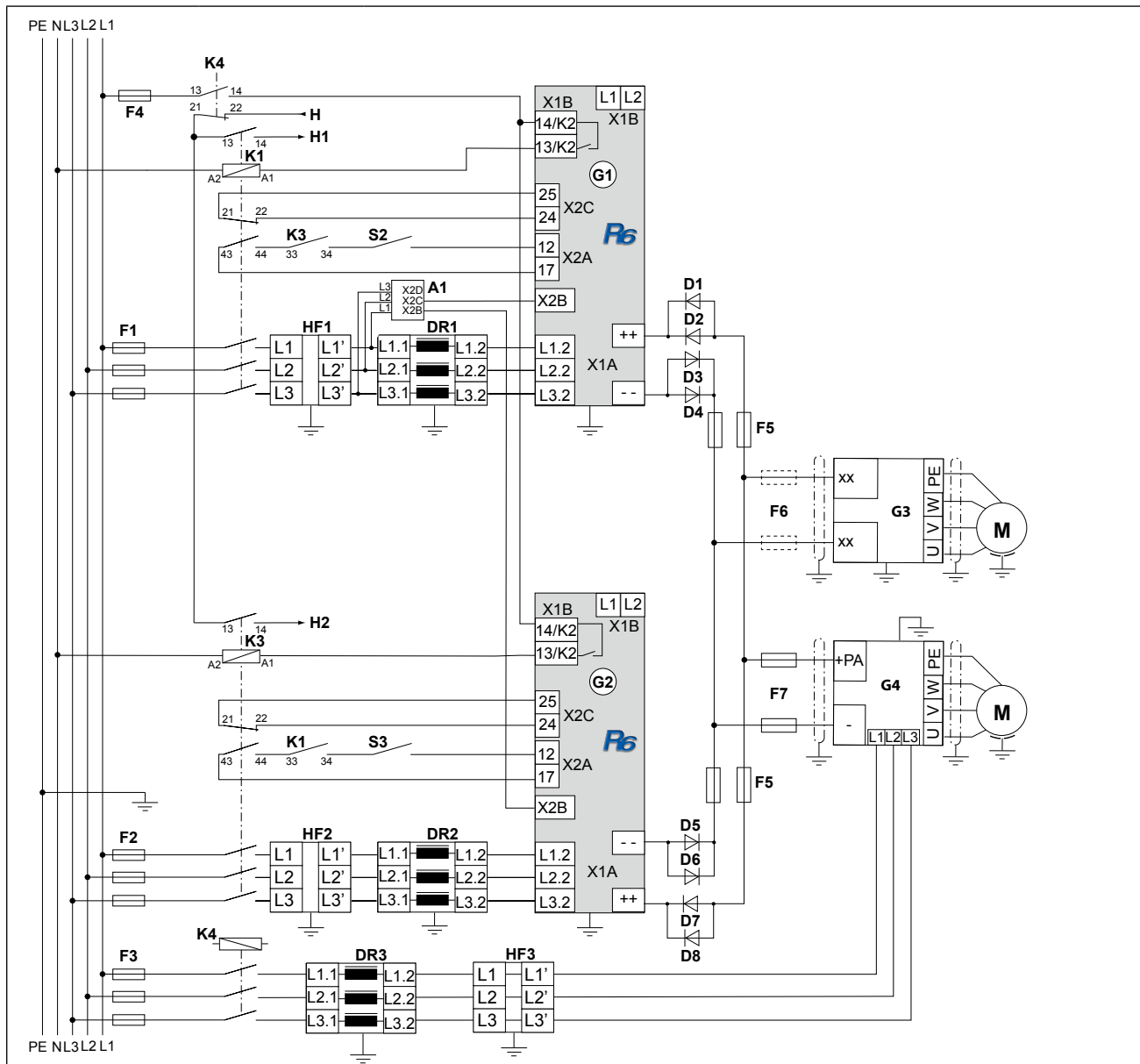
A load draw in the DC circuit may be done only when the message „ready“ is set. This can be guaranteed by a series connection of the relay R1 of the R6-S units with the control release of the connected inverters.

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	Frequency inverter COMBIVERT		
	X2A	Control terminal strip	
	12	Control release	This terminal assignment refers only to one COMBIVERT
17	24V output		
S3, S4	Control release for COMBIVERT		

Figure 15: Wiring of the control release of the connected inverter

4.4.4 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 $\leq 10\%$)



	When connecting the units absolutely pay attention to correct phasing! The external precharging is to be made within 10 s!
	A load draw from the DC circuit may be done only if relay 1 is active (ready signal). This can be guaranteed by a series connection of the relay of the R6 units with the control release of the connected inverters (see next side GB-24).
	In case of failure the contactors must disconnect the units from the supply system.
A1	Synchronization unit (max. length of the phase lines 1 m)
D1...D8	Decoupling diodes (see annex)
DR1, ¹⁾²⁾ DR2	Commutation reactor / harmonic filter

further on next side

Connection Power Unit R6-S

DR3 ²⁾	Mains choke	
F1...F3	Mains fuses type gR must be monitored (see technical data)	
F4	10A fuse gG/gL	
F5	DC fuses type aR must be monitored (see technical data)	
F6, F7	DC fuses type aR/gR	The cable cross section as well as the DC fuses (see chapter 2.1) must be dimensioned to the DC rated current of the load (see technical data of the inverter).
G1, G2	Regenerative unit COMBIVERT R6-S	
	X1A	Power circuit terminals
	X1B	Connection for precharging and switching-on of line contactor K1, K3
	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 (K2 internal)
G3	Frequency inverter all types (see 4.3.1)	
G4	Frequency inverter of type B1/B2 (see 4.3.1)	
H	Supply of the signalling device	
H1	Error message contactor K1 not dropped	
H2	Error message contactor K2 not dropped	
HF1, HF2, HF3	HF filter	
K1, K3	Regenerative contactor with auxiliary contact	
K4	Line contactor with auxiliary contacts	
M	Motor	
S2, S3	Realize control release with PLC or pre-charging contactor /-switch	
1)	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 chokes must be the same in case of parallel connection of R6-S with different sizes.	
2)	Parallel connection of the frequency inverter 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.	
<i>Figure 16: Regenerative operation at parallel operation of up to three R6-S with decoupling diodes</i>		



Parallel operation

When connecting in parallel operation, the parameter defaults record must be changed. See application instructions R6-S under „Special Functions for the parallel connection“.

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 / 1A
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 at parallel operation in master-slave mode)	
17	24 V output	Uout		Voltage supply for in- and outputs	approx. 24 V / max. 100 mA
18	Mass	COM		Reference potential	
19	Digital output 1	O1	DC >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	AN-OUT		Difference to mains frequency (CP.18)	0...±10 V / max. 5 mA
22	24 V output	Uout		see terminal 17	
23	Mass	COM		Reference potential	
24	Relay 1 / NO contact	RLA	Ready for operation (no error)	Relay output Ready signal (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 > 600V	Relay output (DC > CP.19)	max. 30 VDC *) 0.01...2 ADC
28	Relay 2 / NC contact	FLB			
29	Relay 2 / switching contact	FLC			

*) The relay outputs must be operated with max. 48VDC protective separation voltage to guarantee the CE standard. After consultation KEB a current of max. 2ADC is permissible for 120VAC (depending on the switching capacity etc.).

Connection of the control board version S

4.5.2 Assignment of the socket X2B

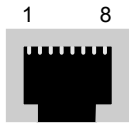
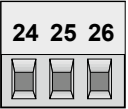
RJ45 socket for phase synchronization and temperature sensor	No.	Name	Function
	1	T1	Connection for temperature sensor (option)
	2	T2	
	3	U13_syn	Synchronization phase 1 / 3
	4	–	reserved
	5	U21_syn	Synchronization phase 2 / 1
	6	–	reserved
	7	U32_syn	Synchronization phase 3 / 2
	8	–	reserved

Figure 17: RJ45 socket

The connection is made with a sync cable 1:1 with the socket X2B, X2C or X2D at the commutation reactor or synchronisation unit.

4.5.3 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 line contactor
25		
26	not assigned	-

4.5.4 Wiring example

In order to prevent a malfunction caused by interference voltage supply on the control inputs, the following directions should be observed:

 EMC	• 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

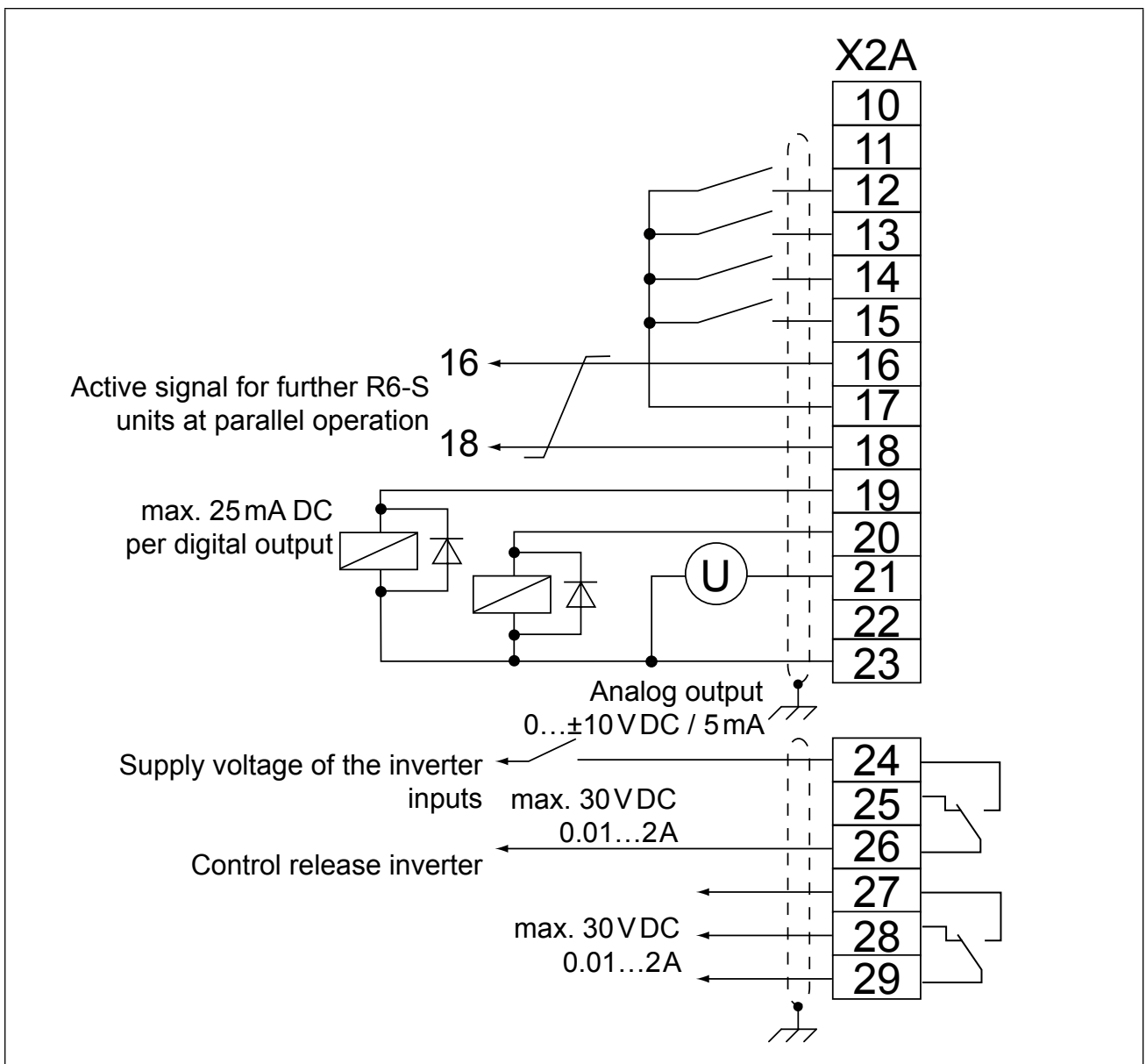


Figure 18: Wiring example R6-S

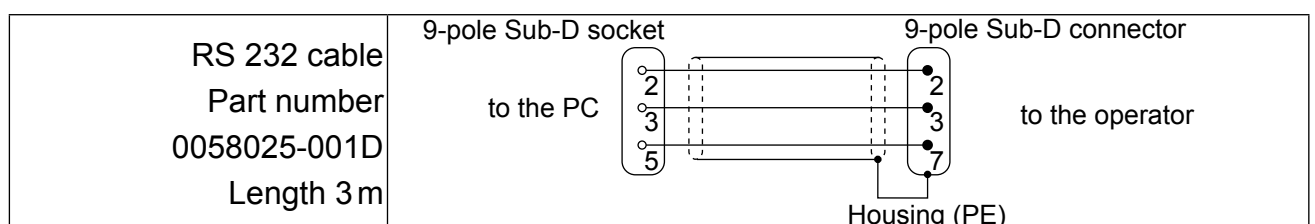
4.6 Operator

An operator is necessary as accessories for local or external operation of the COMBIVERT R6-S. To prevent malfunctions, the COMBIVERT must be brought into nOP status before connecting/ disconnecting the operator (open control release). When starting the COMBIVERT, it is started with the last stored values or factory setting.

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

	<p>Only use the operator interface for the serial data transfer to RS232/485. The direct connection, PC to the COMBIVERT is only permissible with a HSP5-special cable (part number 00F50C0-0001) otherwise it would lead to the destruction of the PC-interface!</p>
--	---

X6C	PIN	RS485	Signal	Meaning
	1	-	-	reserved
	2	-	TxD	Transmission signal RS232
	3	-	RxD	Receive signal RS232
	4	A'	RxD-A	Receive signal A RS485
	5	B'	RxD-B	Receive signal B RS485
	6	-	VP	Voltage supply +5V (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 Unit

5.1 Operation with PC und 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 power supply. The power circuit identification is checked first. If 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 circuit must be checked.

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

- Inspection of correct synchronisation connection (error "E.nEt" is released, if the synchronous signal is missing)
- Inspection of the phase allocation of synchronous signals to the mains phases. Error "E.SYn" is released if a phase is missing or in case of phase allocation failure.

The actual line frequency and the mains voltage is 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 starts independently with the normal 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. Furthermore 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	Origin
CP.00	password input	0...9999	1	–	ud.01
CP.01	status display	–	–	–	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 current	–	0.1 A	–	ru.15
CP.09	DC voltage	–	1V	–	ru.19
CP.10	peak DC voltage	–	1V	–	ru.20
CP.11	power module temperature	–	1°C	–	ru.38
CP.12	OL counter display	–	1%	–	ru.39
CP.13	actual power	–	0.1 kW	–	ru.81
CP.14	total regen	–	0.1 kWh	–	ru.82
CP.15	total motor	–	0.1 kWh	–	ru.83
CP.16	total net	–	0.1 kWh	–	ru.84
CP.17	actual net	–	0.1 kVA	–	ru.85
CP.18	ANOUT 1 / gain	±20.00	0.01	1.00	An.33
CP.19	comparison level	±30000.00V	0.01V	600.00V	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...-1000.0kW	0.1 kW	-0.8kW	cS.06
CP.33	operating mode	0...3	1	0	Pn.19
CP.34	regeneration level	100...120%	1%	103%	cS.02

	Approach of the working meters
	The displayed values of the working meters offer only an estimate value because of measurement and calculation inaccuracies. These displayed values are unsuitable for tariff applications 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	Origin
CP.01	status display	–	–	ru.00
The status display shows the actual working conditions 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	Mains power failure; regenerative operation is further possible, if the disconnecting time E.nEt (Pn.14) > 0 s			
Stb	R6-S regenerative unit in stand-by operation (motoric operation)			
Error Messages				
E.dOH	„ERROR! overheat choke“, temperature monitoring of the commutation choke has triggered and the coolong-off period is up.			
E. EF	„ERROR! external fault“, error message by an external unit			
E.FnEt	„ERROR! mains frequency“, the mains frequency deviates more than 5 %. The max. mains frequency deviation can be adjusted in the application mode with CS.03.			
E.LSF	ERROR! load-shunt defective or wrong respectively 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 ERROR overheat pow.mod. (E.OH) not any longer present, 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 heat sink (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 initialisation“, power failure (phase) during the initialisation phase			
E. Pu	„ERROR power unit“, power unit code is missing, load shunt relay defective			
E.Puci	„ERROR pow.unit code inv.“ power unit code is invalid			
E.Puch	„ERROR power unit changed“.			
continued on the next page				

Monitoring and analysis parameters

No.	Name	r/w	Enter	Origin
CP.01	status display	–	–	ru.00
E.PUIN	„ERROR net“, ripple of the rectified mains voltage too high			
E.SYn	„ERROR synchronisation, phase allocation at commutation throttle not correct			
E. UP	„ERROR underpotential, DC link voltage too low			

No.	Name	r/w	Enter	Origin
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" status.</p>				
Resolution		Meaning		
0.01 Hz		positive values = clockwise rotating field		
		negative values = counterclockwise rotating field		

No.	Name	r/w	Enter	Origin
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	Origin
CP.06	actual 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	Origin
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 over 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	Origin
CP.08	DC current	–	–	ru.15
Resolution		Meaning		
0.1 A		Display of the calculated DC output current in ampere.		

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

No.	Name	r/w	Enter	Origin
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 over 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	Origin
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	Origin
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 %.		

Monitoring and analysis parameters

No.	Name	r/w	Enter	Origin
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	Origin
CP.14	total regen	–	–	ru.82
	Resolution	Meaning		
	1 kW	Counter for the regeneratoric electric work to the mains.		

No.	Name	r/w	Enter	Origin
CP.15	total motor	–	–	ru.83
	Resolution	Meaning		
	1 kW	Counter for the supplied electrical work from the mains in kWh.		

No.	Name	r/w	Enter	Origin
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	Origin
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	Origin
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	
0...±20.00		1.00	The amplification to the desired output voltage can be adapted with CP.18. Max. possible: ±10 V.	

No.	Name	r/w	Enter	Origin
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...3200.00 V		600.00 V	The switching condition is fulfilled and the transistor output is set if the DC voltage level exceeds the adjusted value in CP.19. Relay output 2 is set, if the load shunt relay is additionally tightened.	

No.	Name	r/w	Enter	Origin
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 operators staff 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 terminal strip can be made.	

Special adjustments

No.	Name	r/w	Enter	Origin
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.

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

No.	Name	r/w	Enter	Origin
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 choke		
	1	Master with harmonic filter		
	2	Slave with commutation choke		
	3	Slave with harmonic filter		

No.	Name	r/w	Enter	Origin
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		
4		Master-Slave with commutation reactor input selection		
5		Master-Slave with harmonic filter input selection		
No.	Name	r/w	Enter	Origin
CP.34	regeneration level	yes	–	cS.02
Value range		Meaning		
100...120 %		The regeneration level determines the starting value to energy regeneration. The adjusted value refers to the reference value of the DC voltage in percentage. The status changes from Standby „Stb“ to regeneration „rEGEn“.		

A. Appendix A

A.1 Dimensioning power supply and regenerative units

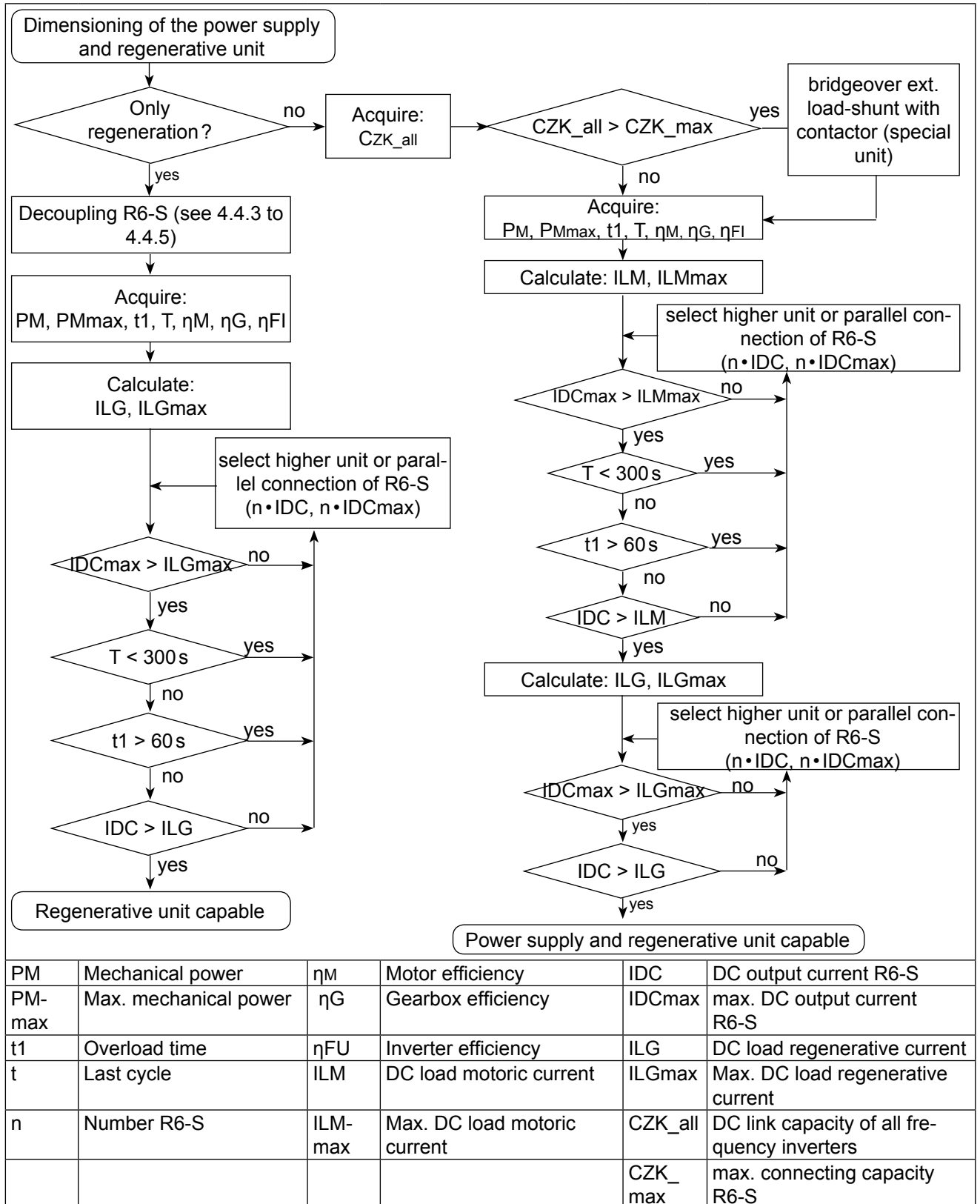



Figure 19: Dimensioning power supply and regenerative units

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 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 unit

	The precharge circuit must be taken for COMBIVERT F5 inverters from the respective power circuit manual.
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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 height of 30 mm, a base width of 80 mm, and a total length of 92 mm. The top has an M5 screw. The front view shows a width of 20 mm and a total length of 92 mm. The diode is labeled with 1, 2, and 3.</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 total length of 92 mm. The top has an M5x10 screw. The front view shows a width of 20.8 mm and a total length of 92 mm. The diode is labeled with 1, 2, and 3.</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 total length of 92 mm. The top has an M8x20 screw and a SW13 screw. The front view shows a width of 6.2 mm and a total length of 92 mm. The diode is labeled with 2 and 3.</p>

Figure 20: Dimensions of the decoupling diodes

B. Appendix 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.



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