



COMBIVERT G6

INSTRUCTIONS FOR USE | INSTALLATION G6 HOUSING C

Translation of the original manual
Document 20086993 EN 10

Preface

The hardware and software described in this document are products of KEB. The information contained in this document is valid at the time of publishing. KEB reserves the right to update this document in response to misprints, mistakes or technical changes.

Signal words and symbols

Certain procedures within this document can cause safety hazards during the installation or operation of the device. Refer to the safety warnings in this document when performing these procedures. Safety signs are also located on the device where applicable. A safety warning is marked by one of the following warning signs:

 DANGER	Dangerous situation, which will cause death or serious injury if this safety warning is ignored.
 WARNING	Dangerous situation, which may cause death or serious injury if this safety warning is ignored.
 CAUTION	Dangerous situation, which may cause minor injury if this safety warning is ignored.
NOTICE	Situation, which can cause damage to property if this safety warning is ignored.

RESTRICTION

Used when the following statements depend on certain conditions or are only valid for certain ranges of values.



Used for informational messages or recommended procedures.

More symbols

- This arrow starts an action step.
- / - Enumerations are marked with dots or indents.
- => Cross reference to another chapter or another page.



Note to further documentation.
<https://www.keb-automation.com/search>



Laws and guidelines

KEB Automation KG confirms with the EC declaration of conformity and the CE mark on the device nameplate that it complies with the essential safety requirements.

The EC declaration of conformity can be downloaded on demand via our website.

Warranty and liability

The warranty and liability on design, material or workmanship for the acquired device is given in the general sales conditions.



Here you will find our general sales conditions.

<https://www.keb-automation.com/terms-conditions>



Further agreements or specifications require a written confirmation.

Support

Although multiple applications are referenced, not every case has been taking into account. If you require further information or if problems occur which are not referenced in the documentation, you can request the necessary information via the local KEB agency.

The use of our units in the target products is outside of our control and therefore lies exclusively in the area of responsibility of the customer.

The information contained in the technical documentation, as well as any user-specific advice in spoken and written and through tests, are made to best of our knowledge and information about the intended use. However, they are regarded as being only informal and changes are expressly reserved, in particular due to technical changes. This also applies to any violation of industrial property rights of a third-party. Selection of our units in view of their suitability for the intended use must be done generally by the user.

Tests can only be done within the intended end use of the product (application) by the customer. They must be repeated, even if only parts of hardware, software or the unit adjustment are modified.

Copyright

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

This KEB product or parts thereof may contain third-party software, including free and/or open source software. If applicable, the license terms of this software are contained in the instructions for use. The instructions for use are already available to you, can be downloaded free of charge from the KEB website or can be requested from the respective KEB contact person.

Other wordmarks or/and logos are trademarks (™) or registered trademarks (®) of their respective owners.

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1 Basic safety instructions

The products are developed and manufactured in accordance with the state of the art and recognised safety regulations. Nevertheless, depending on the application, there may be risks to the life and limb of the user or third parties, or damage to the machine and other property.

The following safety instructions have been compiled by the manufacturer for the field of electrical drive technology. They may be supplemented by local, national or application-specific safety regulations. This list is not exhaustive. Failure to observe the safety instructions by the customer, user or other third parties will result in the loss of all claims against the manufacturer caused by this.

NOTICE



Dangers and risks due to lack of knowledge.

- ▶ Read the instructions for use!
- ▶ Observe the safety and warning instructions!
- ▶ If anything is unclear, please ask!

1.1 Target group

These operating instructions are intended exclusively for qualified electricians. Electrical specialists within the meaning of these instructions must have the following qualifications:

- Knowledge and understanding of safety instructions.
- Skills for installation and assembly.
- Commissioning and operation of the product.
- Understanding of the function in the machine used.
- Recognising hazards and risks associated with electric drive technology.
- Knowledge of [VDE 0100](#).
- Knowledge of national accident prevention regulations (e.g. [DGUV Regulation 3](#)).

1.2 Transport, storage and proper handling

Transport must be carried out by appropriately trained persons in compliance with the environmental conditions specified in these instructions. Drive converter shall be protected against excessive strains.



Transport of drive controller with an edge length >75 cm

Transporting the heat sink using a forklift truck without suitable aids may cause it to bend. This leads to premature ageing or destruction of internal components.

- ▶ Transport drive converters on suitable pallets.
- ▶ Do not stack drive converters or place other heavy objects on top of them.

NOTICE

Damage to the coolant connections

Bending of the pipes!

- ▶ Never place the device on the coolant connections!



Product contains components that are susceptible to electrostatic discharge.

- ▶ Prevent contact .
- ▶ Wear ESD protective clothing.

Do not store the product

- in the vicinity of aggressive and/or conductive liquids or gases.
- in areas exposed to direct sunlight.
- outside the specified environmental conditions.

1.3 Installation and setup

⚠ DANGER



Do not operate in potentially explosive atmospheres!

- ▶ The product is not intended for use in potentially explosive atmospheres.

⚠ CAUTION



Design-related edges and heavy weight!

Bruises and contusions!

- ▶ Never step under suspended loads.
- ▶ Wear safety shoes.
- ▶ Secure the product appropriately when using lifting equipment.

To prevent damage to and inside the product:

- Ensure that no components are bent and/or insulation distances are altered.
- The product must not be put into operation if it has any mechanical defects. Compliance with applicable standards is no longer guaranteed.
- No moisture or mist should be allowed to enter the product.
- The ingress of dust must be prevented. When installing in a dust-proof enclosure, ensure adequate heat dissipation.
- Observe the installation position and minimum distances to surrounding elements. Do not cover ventilation openings.
- Install the product in accordance with the specified protection class.
- Ensure that no small parts (drill chips, screws, etc.) fall into the product during assembly and wiring. This also applies to mechanical components that may lose small parts during operation.
- Check that device connections are secure to prevent contact resistance and sparking.
- Do not commit to the product.
- The safety instructions must be kept in a safe place!

1.4 Electrical connection

⚠ DANGER**Electrical voltage at terminals and inside the device!****Danger to life due to electric shock!**

- ▶ Never work on an open device or touch exposed parts.
- ▶ Before carrying out any work on the device, switch off the supply voltage, secure it against being switched back on and check that the input terminals are free of voltage by measuring them.
- ▶ Wait until all drives have come to a standstill so that no generator energy can be produced.
- ▶ Wait for the capacitor discharge time (5 minutes). Check that there is no voltage at the DC terminals by measuring.
- ▶ If personal protection is required, install protective devices suitable for drive converters.
- ▶ Never bypass upstream protective devices, not even for testing purposes.
- ▶ Always connect the protective conductor to the drive controller and motor.
- ▶ Fit all necessary covers and protective devices for operation.
- ▶ Keep the control cabinet closed during operation.
- ▶ Residual current: This product may cause a direct current in the protective earth conductor. Where a residual current device (RCD) or residual current monitoring device (RCM) is used to provide protection in the event of direct or indirect contact, only a type B RCD or RCM is permitted on the power supply side of this product.
- ▶ Drive converters with a leakage current > 3.5 mA alternating current (10 mA direct current) are intended for fixed connection. Protective conductors are installed in accordance with local regulations for equipment with high leakage currents in accordance with [EN 61800-5-1](#), [EN 60204-1](#) or [DIN IEC 60364-5-54](#).



If personal protection is required when installing systems, suitable protective devices must be used for drive controller.

www.keb.de/fileadmin/media/Techinfo/dr/tn/ti_dr_tn-rcd-00008_de.pdf



Installations which include drive converter shall be equipped with additional control and protective devices in accordance with the relevant applicable safety requirements, e.g. act respecting technical equipment, accident prevention rules etc.. They must always be complied with, also for drive converter bearing a CE marking.

For trouble-free and safe operation, please observe the following instructions:

- The electrical installation must be carried out in accordance with the relevant regulations.
- Cable cross-sections and fuses must be dimensioned by the user in accordance with the specified minimum/maximum values for the application.
- The wiring must be carried out using flexible copper cable for temperatures $> 75^{\circ}\text{C}$.
- The drive controller may only be connected to symmetrical networks with a maximum voltage of 300 V between phase (L1, L2, L3) and neutral conductor/earth (N/PE), USA UL: 480 / 277 V.. For supply networks with higher voltages, an appropriate isolating transformer must be connected upstream. If this is not observed, the control system is no longer considered a PELV circuit.
- The installer of equipment or machinery must ensure that the requirements are met for existing or newly wired circuits with PELV.
- For drive converters without safe isolation from the supply circuit (in accordance with
- When using components that do not use potential-separated inputs/outputs, it is necessary to ensure that there is potential equality between the components to be connected (e.g. by means of an equalisation cable). Failure to comply may result in the components being destroyed by equalising currents.

1.4.1 EMC-compliant installation

Compliance with the limits required by EMC legislation is the responsibility of the customer.



Information on EMC-compliant installation can be found here.

www.keb.de/fileadmin/media/Manuals/dr/emv/0000ndb0000.pdf



1.4.2 voltage test

A test with AC voltage (in accordance with [EN 60204-1](#) Chapter 18.4) must not be performed, as this poses a risk to the power semiconductors in the drive controller.



Due to the interference suppression capacitors, the test generator will immediately switch off with a current fault.



According to [EN 60204-1](#), it is permissible to disconnect components that have already been tested. KEB drive controller KEB Automation KG are delivered ex works voltage tested to 100% according to product standard.

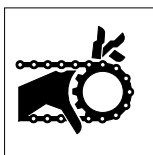
1.4.3 insulation measurement

An insulation measurement (in accordance with [EN 60204-1](#) Chapter 18.3) with DC 500 V is permitted if all connections in the power section (mains potential) and all control connections are bridged with PE. The insulation resistance of each product can be found in the technical data.

1.5 Commissioning and operation

Commissioning (i.e. the start of intended operation) is prohibited until it has been established that the machine complies with the provisions of the Machinery Directive. [EN 60204-1](#) must be observed.

⚠ WARNING



Software protection and programming!

Danger due to unintended behaviour of the drive!

- ▶ Particularly when commissioning for the first time or replacing the drive controller, check whether the parameterisation is suitable for the application.
- ▶ Securing a system solely with software protection functions is not sufficient. Be sure to install protective measures (e.g. limit switches) that are independent of the drive power controller.
- ▶ Secure motors against automatic start-up.

⚠ CAUTION



High temperatures on heat sinks and coolant!

Burns to the skin!

- ▶ Cover hot surfaces so that they are safe to touch.
- ▶ If necessary, affix warning signs to the equipment.
- ▶ Check the surface and coolant lines for contact.
- ▶ Allow the appliance to cool down before carrying out any work.

- During operation, all covers and doors shall be kept closed.
- Only use accessories approved for the device.
- Never touch connection contacts, busbars or cable ends.

NOTICE

Continuous operation (S1) with utilisation > 60% or Motor rated power from 55 kW!

Premature ageing of electrolytic capacitors!

- ▶ Mains choke with $U_k = 4\%$.

Switching at the output

With single drives, switching between the motor and drive controller during operation should be avoided, as this can cause the protective devices to activate. If gear changes cannot be avoided, the "speed search" function must be activated. This may only be initiated after the motor starter has been closed (e.g. by switching the controller enable). In the case of multi-engine drives, switching on and off is permitted if at least one engine is switched on during the switching process. The drive controller must be dimensioned for the starting currents that occur.

If the motor is still running when the drive controller is restarted (mains on) (e.g. due to large flywheel masses), the "speed search" function must be activated.

Switching at the input

For applications that require the drive controller to be switched off and on cyclically, a period of at least 5 minutes must elapse after the last switch-on. If shorter cycle times are required, please contact KEB Automation KG.

short-circuit resistance

The drive controller are conditionally short-circuit-proof. After resetting the internal protective devices, proper functioning is guaranteed.

Exceptions:

- If repeated earth faults or short circuits occur at the output, this may lead to a defect in the device.
- If a short circuit occurs during generator operation (second or fourth quadrant, feed-back into the intermediate circuit), this may result in a defect in the device.

1.6 Maintenance

The following maintenance work must be carried out as required, but at least once a year, by authorised and trained personnel.

- ▶ Check unit for loose screws and plugs and if necessary tighten up.
- ▶ Clean drive converter from dirt and dust deposits. Pay attention especially to cooling fins and protective grid of the fans.
- ▶ Examine and clean extracted air filter and cooling air filter of the control cabinet.
- ▶ Check the function of the fans of the drive controller. The fan must be replaced in case of audible vibrations or squeak.
- ▶ For liquid-cooled drive controller, a visual inspection of the cooling circuit must be carried out to check for leaks and corrosion. If a system is to be shut down for a longer period of time, the cooling circuit must be completely drained. At temperatures below 0°C, the cooling circuit must also be blown out with compressed air.

1.7 Maintenance

In the event of operational malfunctions, unusual noises or odours, inform the person responsible!

DANGER



Unauthorised replacement, repair and modifications!

Unpredictable malfunctions!

- ▶ The function of the drive controller depends on its parameterisation. Never replace without knowledge of the application.
- ▶ Modification or repair is permitted only by KEB Automation KG authorized personnel.
- ▶ Only use original manufacturer parts.
- ▶ Infringement will annul the liability for resulting consequences.

In the event of a fault, please contact the machine manufacturer. Only this person knows the parameters of the drive converter used and can supply a suitable replacement device or arrange for maintenance.

1.8 Disposal

Electronic devices from KEB Automation KG are intended for professional, commercial processing (so-called B2B devices).

Manufacturers of B2B equipment are obliged to take back and recycle equipment manufactured after 14 August 2018. These devices must not be disposed of at municipal collection points.



Unless otherwise agreed between the customer and KEB or unless there is a different mandatory legal provision, KEB products marked as such may be returned. The company name and keyword for the return location can be found in the list below. Shipping costs shall be borne by the customer. The devices will then be professionally recycled and disposed of.

The following table lists the entry numbers for each country. You can find KEB addresses on our website.

Return by	WEEE registration no.	Keyword:
Germany		
KEB Automation KG	EAR: DE12653519	Keyword "WEEE take-back"
France		
RÉCYLUM - Recycle point	ADEME: FR021806	Mots clés „KEB DEEE“
Italien		
COBAT	AEE: (IT) 19030000011216	Parola chiave „Ritiro RAEE“
Österreich		
KEB Automation GmbH	ERA: 51976	Keyword "WEEE take-back"
Spanien		
KEB Automation KG	RII-AEE: 7427	Palabra clave "Retirada RAEE"
Tschechische Republik		
KEB Automation KG	RETELA: 09281/20-ECZ	Klíčové slovo "Zpětný odběr OEEZ"
Slowakei		
KEB Automation KG	ASEKOL: RV22EEZ0000421	Klíčové slovo: "Spätný odber OEEZ"

The packaging should be recycled with paper and cardboard.

2 Product Description

The device series COMBIVERT G6 concerns to drive controllers, which are developed for the universal operation at open-loop three-phase drives. The COMBIVERT is optimized for the operation at synchronous and asynchronous motors and is equipped with an integrated EMC filter.

The COMBIVERT meets the requirements of the Low-Voltage Directive. The harmonised standards of [EN 61800-5-1](#) series for drive power controller are applied.

The COMBIVERT is a product of limited availability in accordance with [EN 61800-3](#). This product may cause radio interference in residential areas. In this case the operator may need to take corresponding measures.

The machine directive, EMC directive, Low Voltage Directive and other guidelines and regulations must be observed depending on the version.

2.1 Specified application

The COMBIVERT serves exclusively for the control and regulation of three-phase motors. It is intended for the installation into electrical systems or machines.

Technical data and information for connection conditions shall be taken from the type plate and from the instruction manual and must be strictly observed.

The used semiconductors and components of the KEB Automation KG are developed and dimensioned for the use in industrial products.

Restriction

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.

2.1.1 Residual risks

Despite intended use, the drive controller can reach unexpected operating conditions in case of error, with wrong parameterization, by faulty connection or unprofessional interventions and repairs. This can be:

- Wrong direction of rotation
- Motor speed too high
- Motor is running into limitation
- Motor can be under voltage even in standstill
- Automatic start

2.2 Unintended use

The operation of other electric consumers is prohibited and can lead to the destruction of the unit. The operation of our products outside the indicated limit values of the technical data leads to the loss of any liability claims.

2.3 Product features

This instruction manual describes the power circuits of the following devices:

Device type:	Drive controller
Series:	COMBIVERT G6
Power range:	5.5...11 kW / 400 V
Housing:	C

The COMBIVERT G6 is characterized by the following features:

- Operation of three-phase asynchronous motors and three-phase synchronous motors, in operating modes open-loop or closed-loop without speed feedback
- Following fieldbus systems are supported: EtherCAT, VARAN, IO-Link or CAN-Open
- Comprehensive operating concept
- Wide operating temperature range
- Low switching losses by IGBT power unit
- Low noise development due to high switching frequencies
- Different heat sink concepts:
 - Air cooler as built-in version
 - Flat rear version
- Temperature-controlled fan, replaceable
- Depending on the operating mode, the torque limits and s-curves are adjustable (to protect the gearbox)
- General protection functions of the COMBIVERT series against overcurrent, over-voltage, ground fault and overtemperature
- Analog inputs and outputs, digital inputs and outputs, brake control and supply, motor protection by I²t, KTY or PTC input, diagnostic interface, fieldbus interface (depending on the control board)
- Potential-free relay output

2.4 Type code

xx	G6	x	x	x	x	x	x	x	
									Heat sink version ⁴⁾
									0: Air-cooling
									1: Flat rear
									Control, Keyboard, Display ⁴⁾
									0: U/f controlled without display
									1: U/f controlled with display
									A: U/f controlled without display LT externally supplyable
									B: U/f controlled with display LT externally supplyable
									2: SCL ⁵⁾ regulated SSM without display; LT externally supplyable
									3: SCL ⁵⁾ Regulated SSM with display; LT externally supplyable
									4: ASCL ⁶⁾ regulated ASM without display; LT externally supplyable
									5: ASCL ⁶⁾ regulated ASM with display; LT externally supplyable
									Switching frequency; Short time current limit; Overcurrent cut-off ⁴⁾
									5: 4 kHz / 150% / 180%
									9: 4 kHz / 180% / 216%
									A: 8 kHz / 180% / 216%
									Voltage / Connection type ⁴⁾
									0: 1ph 230 V AC/DC
									3: 3ph 400 V AC/DC
									5: 400 V DC
									A-Z: Customer / special version (firmware, hardware, download)
									Housing
									A, B, C, E
									Variants
									0: without filter, without braking transistor, without safety function STO
									1: without filter, with braking transistor, without safety function STO
									3: internal filter, with braking transistor, without safety function STO
									A: like 0 with STO
									H: like A with f=0Hz
									B: like 1 with STO
									I: like B with f=0Hz
									D: like 3 with STO
									L: like D with f=0Hz
									Control type
									C: Analog / digital (standard)
									D: CAN ^{® 2)}
									E: IO-Link ^{® 3)}
									F: EtherCAT ^{® 1)}
									I: VARAN
									Series
									COMBIVERT G6
									Device size
									07...19

Table 1: Type code

- ¹⁾  *EtherCAT® is registered trademark and patented technology, licensed by Beckhoff Automation GmbH, Germany.*
- ²⁾  *CANopen® is registered trademark of CAN in AUTOMATION - International Users and Manufacturers Group e.V.*
- ³⁾  *IO-LINK® is registered trademark of PROFIBUS user organisation e.V.*
- ⁴⁾ *Not valid at customer/special versions.*
- ⁵⁾ *SCL = Sensorless Closed Loop*
- ⁶⁾ *ASCL = Asynchronous Sensorless Closed Loop*



The type code is not used as an order code, but only for identification!

3 Technical Data

Unless otherwise indicated, all electrical data in the following chapter refer to a 3-phase AC voltage supply.

3.1 Operating conditions

3.1.1 Climatic environmental conditions

Storage		Standard	Class	Notes
Ambient temperature		EN 60721-3-1	1K4	-25...55 °C
Relative humidity		EN 60721-3-1	1K3	5...95 % (without condensation)
Storage height		—	—	Max. 3000 m above sea level
Transport		Standard	Class	Notes
Ambient temperature		EN 60721-3-2	2K3	-25...70 °C
Relative humidity		EN 60721-3-2	2K3	95 % at 40 °C (without condensation)
Operation		Standard	Class	Notes
Ambient temperature		EN 60721-3-3	3K3	5...40 °C (extended to -10...45 °C)
Coolant inlet temperature	Air	—	—	5...40 °C (-10...45 °C)
	Liquid	—	—	5...40 °C
Relative humidity		EN 60721-3-3	3K3	5...85 % (without condensation)
Version and degree of protection		EN 60529	IP20	Protection against foreign material > ø12.5 mm No protection against water Non-conductive pollution, occasional condensation when PDS is out of service.
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. - With site altitudes over 2000 m, the control board to the mains has only basic isolation. Additional measures must be carried out when wiring the control system.

Table 2: Climatic environmental conditions

3.1.2 Mechanical environmental conditions

Storage	Standard	Class	Notes
Vibration limits	EN 60721-3-1	1M2	Vibration amplitude 1.5 mm (2...9 Hz) Acceleration amplitude 5 m/s ² (9...200 Hz)
Shock limit values	EN 60721-3-1	1M2	40 m/s ² ; 22 ms
Transport	Standard	Class	Notes
Vibration limits	EN 60721-3-2	2M1	Vibration amplitude 3.5 mm (2...9 Hz) Acceleration amplitude 10 m/s ² (9...200 Hz) (Acceleration amplitude 15 m/s ² (200...500 Hz)) ¹⁾
Shock limit values	EN 60721-3-2	2M1	100 m/s ² ; 11 ms
Operation	Standard	Class	Notes
Vibration limits	EN 60721-3-3	3M4	Vibration amplitude 3.5 mm (2...9 Hz) Acceleration amplitude 10 m/s ² (9...200 Hz)
	EN 61800-5-1	–	Vibration amplitude 0.075 mm (10...57 Hz) Acceleration amplitude 10 m/s ² (57...150 Hz)
Shock limit values	EN 60721-3-3	3M4	100 m/s ² ; 11 ms

Table 3: Mechanical environmental conditions

¹⁾ Not tested.

3.1.3 Chemical / mechanical active substances

Storage	Standard	Class	Notes
Contamination	EN 60721-3-1	1C2	–
		1S2	–
Transport	Standard	Class	Notes
Contamination	EN 60721-3-2	2C2	–
		2S2	–
Operation	Standard	Class	Notes
Contamination	EN 60721-3-3	3C2	–
		3S2	–

Table 4: Chemical / mechanical active substances

3.1.4 Electrical operating conditions

3.1.4.1 Device classification

Requirement	Standard	Class	Notes
Overvoltage category	EN 61800-5-1	III	–
	EN 60664-1		–
Pollution degree	EN 60664-1	2	Non-conductive pollution, occasional condensation when PDS is out of service

Table 5: Device classification

3.1.4.2 Electromagnetic compatibility

For devices without an internal filter, an external filter is required to comply with the following limit values.

EMC emitted interference	Standard	Class	Notes
Cable-conducted interferences	EN 61800-3	C2	–
Radiated interferences	EN 61800-3	C2	–
Interference immunity	Standard	Level	Notes
Static discharges	EN 61000-4-2	8 kV 4 kV	AD (air discharge) CD (contact discharge)
Burst - Ports for process measurement control lines and signal interfaces	EN 61000-4-4	2 kV	–
Burst - Power ports	EN 61000-4-4	4 kV	–
Surge - Power ports	EN 61000-4-5	1 kV 2 kV	Phase-phase Phase-ground
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 3 V/m 1 V/m	80 MHz...1 GHz 1.4...2 GHz 2...2.7 GHz
Voltage fluctuations/ voltage dips	EN 61000-2-1 EN 61000-4-34	–	-15 %...+10 % 90 %
Frequency changes	EN 61000-2-4	–	≤ 2 %
Voltage deviations	EN 61000-2-4	–	±10 %
Voltage unbalance	EN 61000-2-4	–	≤ 3 %

Table 6: Electromagnetic compatibility

3.2 Technical data 400V devices

Device size		13	14	15
Housing		C		
Mains phases		3		
Rated apparent output power	S_{out} / kVA	8,3	11	17
Max. rated motor power	P_{mot} / kW	5,5	7,5	11
Rated output current	I_N / A	12	16,5	24
Rated output current UL	I_{N_UL} / A	11	14	21
Max. short time current	¹⁾ $I_{HSR} / \%$	180	180	150
Overcurrent	¹⁾ $I_{OC} / \%$	216	216	180
Max. current 0Hz/corner frequency f_d at $f_s = 4 \text{ kHz}$	¹⁾ $I_{f0/fd} / \%$	100/180	100/180	100/180
Max. current 0Hz/corner frequency f_d at $f_s = 8 \text{ kHz}$	¹⁾ $I_{f0/fd} / \%$	100/180	70/160	70/150
Corner frequency	f_d / Hz	6		
Rated input current	I_{in} / A	17	23	31
Rated input current UL	I_{in_UL} / A	15,4	19,6	27
Rated input current DC	²⁾ I_{in_dc} / A	12,6	16,8	24,1
Rated input current UL DC	²⁾ $I_{in_UL_dc} / \text{A}$	10,4	13,8	19,8
Max. permissible mains fuse type gG	I_{max} / A	25	25	35
Rated switching frequency	³⁾ f_{SN} / kHz	8	4	4
Max. switching frequency	³⁾ f_{S_max} / kHz	8	8	8
Power dissipation at nominal operating	⁴⁾ P_D / W	128	161	230
Power dissipation standby (no control release)	⁴⁾ P_{D_nop} / W	20		
Max. heat sink temperature	$T_{HS} / ^\circ\text{C}$	82		
Temperature for derating the switching frequency	⁵⁾ $T_{dr} / ^\circ\text{C}$	75		
Temperature for uprating the switching frequency	⁵⁾ $T_{ur} / ^\circ\text{C}$	70		
Min. braking resistor	R_{B_min} / Ω	39		
Max. braking current	I_{B_max} / A	21,5		
Rated input voltage	U_N / V	400 (UL: 480)		
Input voltage range	U_{in} / V	340...528 ± 0		
Mains frequency	f_N / Hz	50 / 60 ± 2		
Rated input voltage DC	U_{N_dc} / V	565 (UL: 680)		
Input voltage range DC	U_{in_dc} / V	480...746 ± 0		
DC switch-off level "Error! Underpotential" DC	U_{UP_dc} / V	240		
Switching level braking transistor DC	U_{B_dc} / V	780		
Switch-off level "Error! Overpotential" DC	U_{OP_dc} / V	840		
Output voltage	⁶⁾ U_{out} / V	3 x 0... U_{in}		
Output voltage at DC devices	⁶⁾ U_{out_dc} / V	3 x 0... $U_{in_dc} / \sqrt{2}$		
Output frequency	³⁾ f_{out} / Hz	0...400 ($f_s = 4 \text{ kHz}$) 0...599 ($f_s = 8 \text{ kHz}$)		
Insulation resistance @ $U_{dc} = 500 \text{ V}$	$R_{iso} / \text{M}\Omega$	2		
Min. waiting period between two switch-on procedures	t / min	5		

Table 7: Technical data 400V devices

¹⁾ The values refer percentage to the rated output current I_N .

²⁾ The values resulting from rated operation with B6 rectifier circuit and mains choke 4 % UK.

³⁾ The output frequency is to be limited in such a way that it does not exceed 1/10 of the switching frequency. Devices with higher max. output frequency are subject to export restrictions and are only available on request.

⁴⁾ Rated operation corresponds to $U_N = 400 \text{ V}$; f_{SN} ; $f_{out} = 50 \text{ Hz}$ (typically value).

⁵⁾ On reaching the temperature T_{dr} the switching frequency is step down. The switching frequency is increased again on cooling down to temperature T_{ur} .

⁶⁾ The voltage at the motor is dependent on the series-connected units and on the control method, => „4.3 Calculation of the motor voltage“.



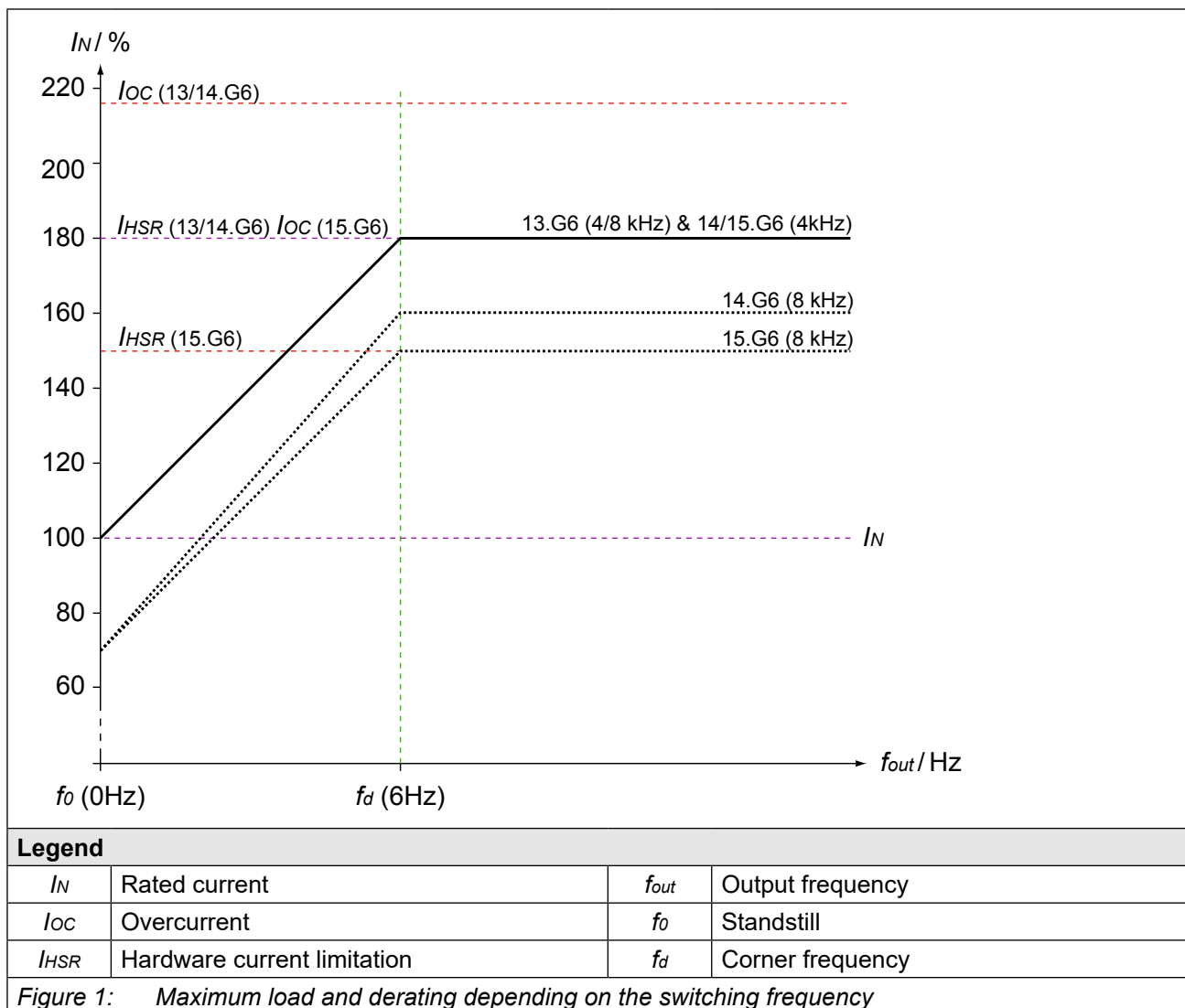
The technical data are for 2/4-pole standard motors. With other pole numbers the drive controller must be dimensioned onto the rated motor current. Contact KEB for special or medium frequency motors.

The service life of the drive controller with voltage DC link depends on the current load of the electrolytic capacitors in the DC link. The use of mains chokes can increase the service life of the condensators to a considerable extent, especially when connecting to „hard“ power systems or when under permanent drive load (continuous duty).

The term "hard" power system means that the nodal point power (S_{net}) of the mains is very high ($>> 200$) compared to the output rated power of the drive controller (S_{out}).

$k = \frac{S_{net}}{S_{out}} \gg 200$	e.g.	$k = \frac{2 \text{ MVA (supply transformer)}}{6.6 \text{ kVA (12G6)}} = 303 \rightarrow \text{Choke required}$
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3.2.1 Overload and derating



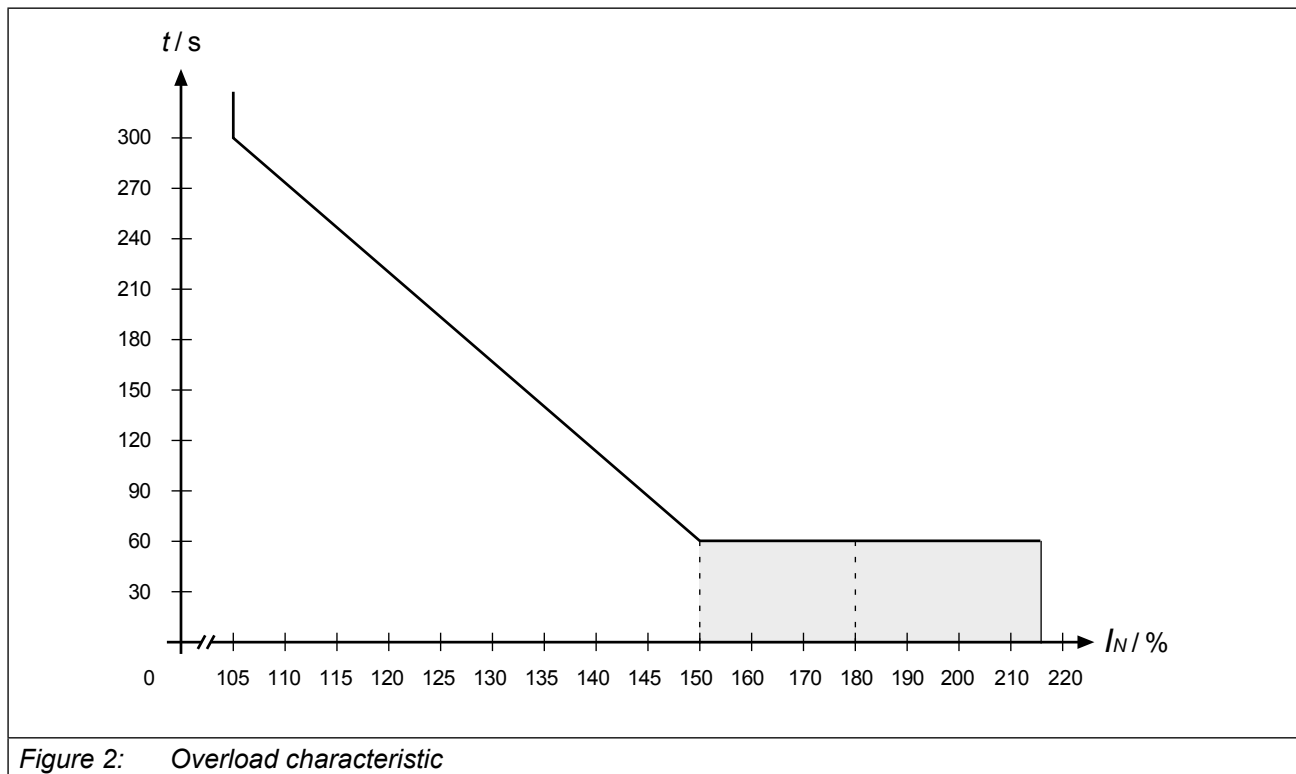


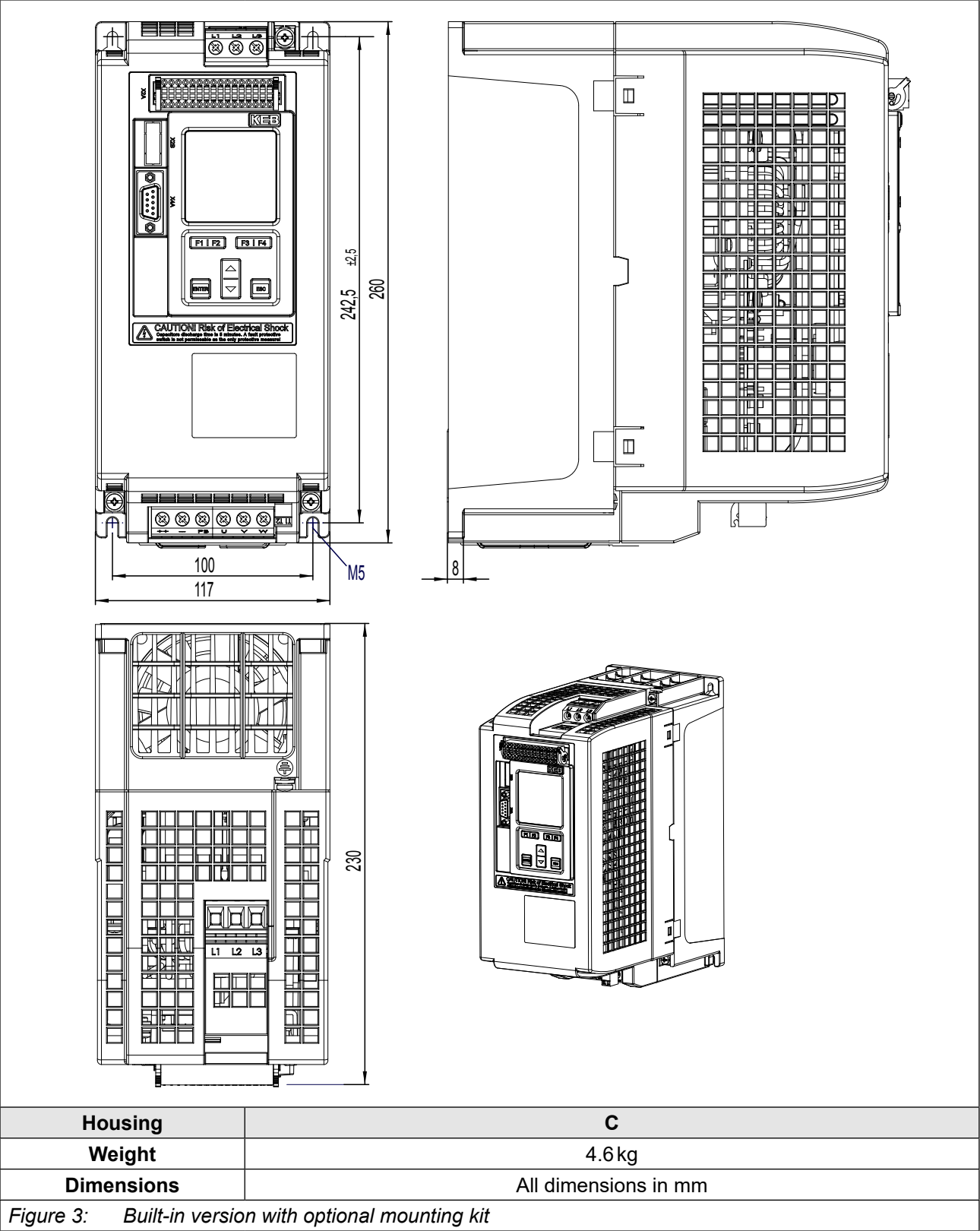
Figure 2: Overload characteristic

On exceeding a load of 105% the overload integrator starts. When falling below the integrator counts backwards. If the integrator achieves the overload characteristic that corresponds to the drive converter, „ERROR overload“ is triggered

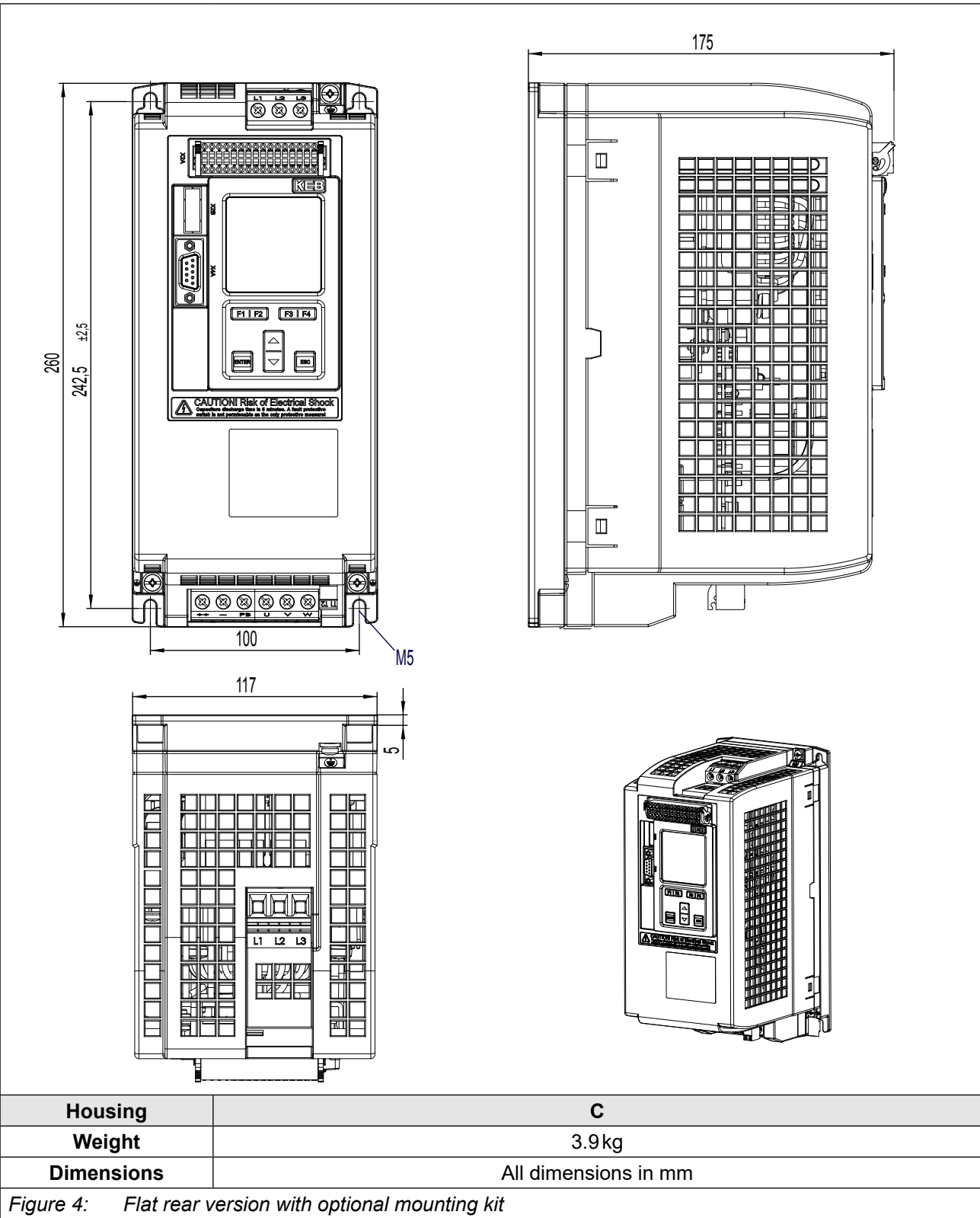
After a cooling period the message „no ERROR overload“ is displayed. The error can be reset now. The drive converter must remain switched on during the cooling period.

3.3 Dimensions and weights

3.3.1 Built-in version



3.3.2 Flat rear version



Heat-conducting paste

For information on the correct application of the heat-conducting paste visit www.keb.de under the search term "Heat-conducting paste".

3.3.3 Control cabinet installation

The power dissipation for the control cabinet dimension is to be taken from the technical data. => „3.3 Technical data G6 400V devices“.

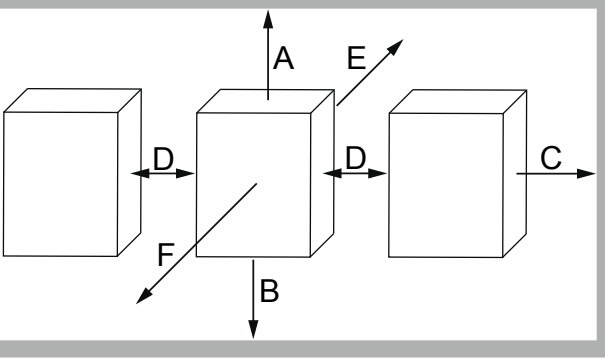
Mounting distances	Dimension	Distance in mm	Distance in inch
	A	150	6
	B	100	4
	C	30	1.2
	D	0	0
	E	0	0
	F ¹⁾	50	2
	1) Distance to preceding elements in the control cabinet door.		

Figure 5: Mounting distances

3.3.3.1 Ventilation in the control cabinet

If construction-conditioned the control cabinet cannot be without indoor ventilation, appropriate filters must avoid suction of foreign objects.



Installation of the drive converter

For reliable operation, the drive converter must be mounted without clearance on a smooth, closed, bare metal mounting plate.

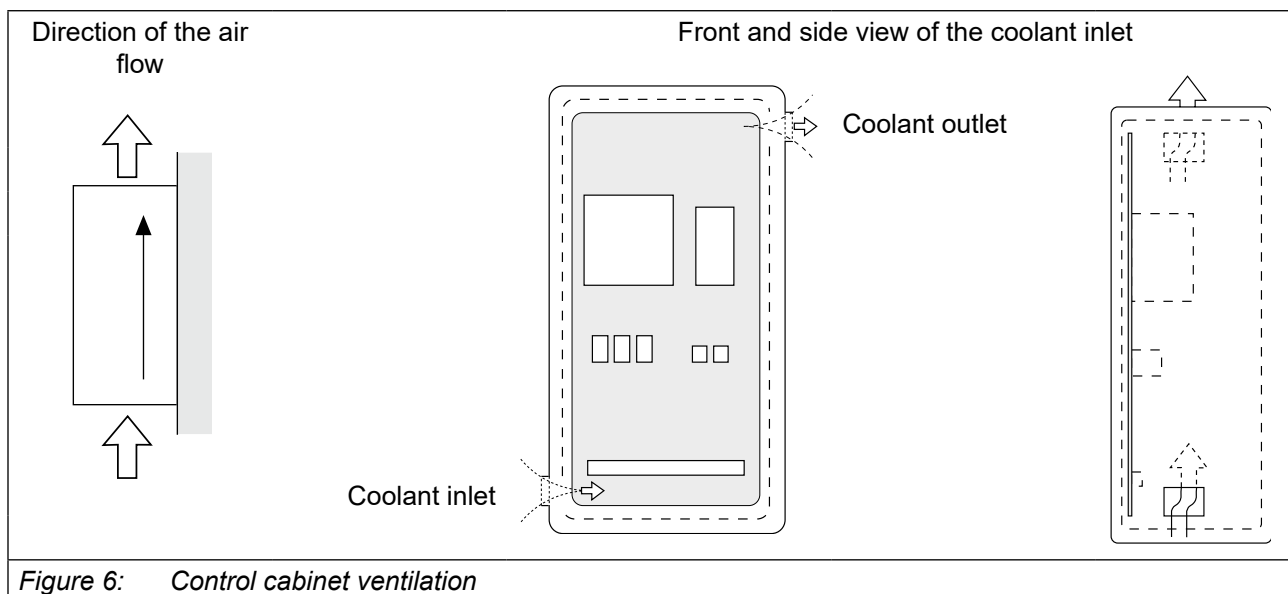


Figure 6: Control cabinet ventilation

4 Installation and Connection

4.1 Overview of the COMBIVERT G6

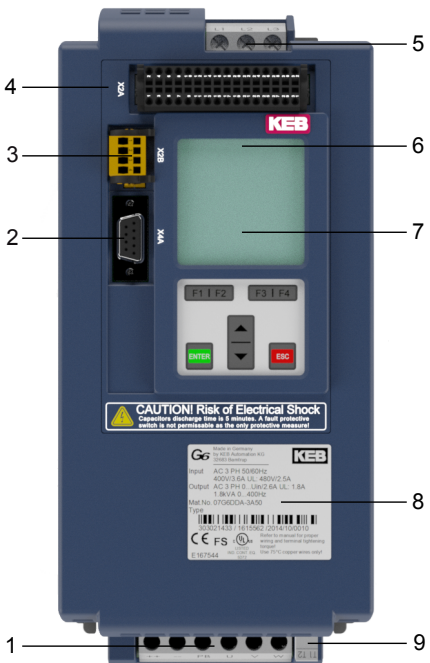
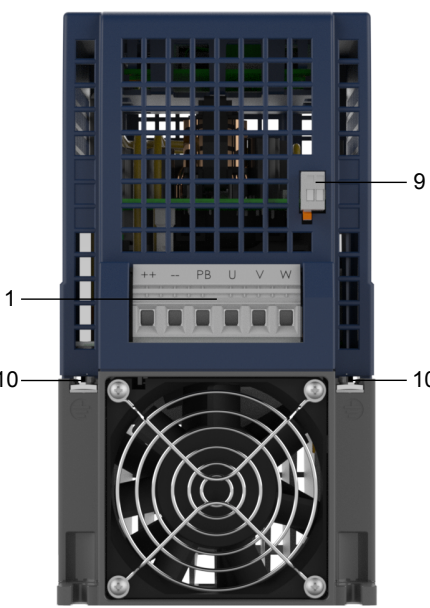
Housing C	No.	Name	Description
	1	X1B	Terminal block for three-phase motor, braking resistor and DC supply
	2	X4A	Diagnostic interface RS232/485 interface with DIN66019-II
	3	X2B	Safety function STO (optional)
	4	X2A	Control terminal strip 32-pole
	5	X1A	Mains input 3-pole
	6	LED1	Drive controller state (if no operator is available)
	7	–	Operator with display and keyboard
	8	–	Nameplate
	9	X1C	Temperature monitoring; Connection for external PTC or temperature switch
	10	PE, 	Protective earth; at connection to protective earth each terminal may be assigned only once. The shielding e.g. from the motor cable is laid on the mounting plate in the control cabinet or on the mounting kit (optionally available). => „5.1 Mounting kit shield connection bracket“
			

Figure 7: Overview of the COMBIVERT G6

NOTICE

Ferrite rings required!

To comply with the limit values it is absolutely necessary to use the supplied ferrite rings. => „5.2 Ferrite rings“

4.2 Connection of the power unit

4.2.1 Connection of the voltage supply

The COMBIVERT G6-C corresponds to the drive controller type A1. This type can be supplied both by mains and via DC terminals. The starting current limiting is arranged before the DC link. When using as DC output parallel connected drive controllers must have their own starting current limiting at the DC voltage input.

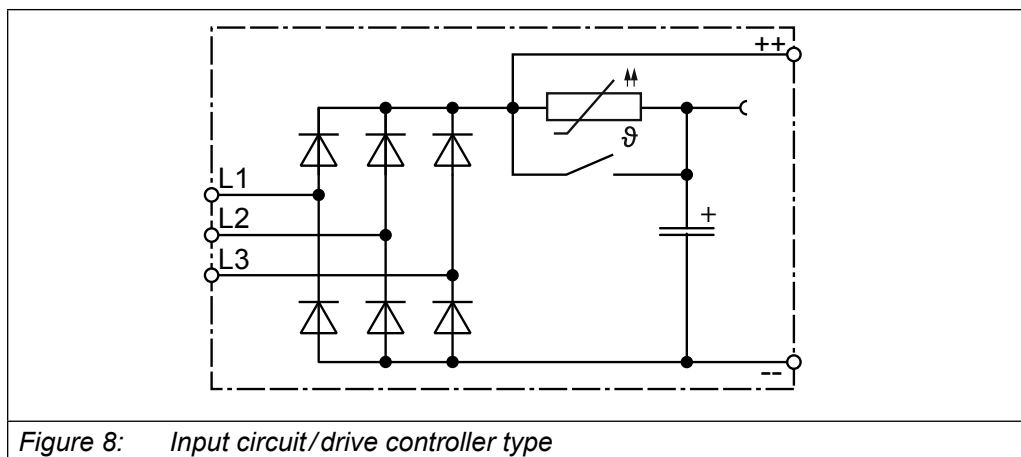


Figure 8: Input circuit/drive controller type

NOTICE

Device switches off!

Cyclic switching on and off of the unit leads to temporary high resistance of the resistor (PTC) in the input. The device displays in this state "ERROR load shunt fault". When switching the control release during this error, the device would switch off. A restart without limitation is possible after cooling. Waiting time => „3.2 Technical data 400V devices“.

4.2.1.1 Wiring instructions

NOTICE

Ensure the correct connection!

Never exchange the mains and motor cables.



Some countries demand that the PE-terminal is directly connected to the terminal box (not over the mounting plate).

4.2.1.2 Line terminal strip X1A

X1A	Name	Function	Cross-section		Tightening torque
	L1, L2, L3	Mains con- nection 3-phase	AWG without wire-end ferrule	mm² with wire-end ferrule	1.2...1.5 Nm 12 lb-inch
			20...8	2,5...10	
			stranded wire		
	PE, 	Connection for protective earth	Screw M4 for ring crimp connector		1.3 Nm 11 lb inch

Figure 9: Line terminal strip X1A

4.2.2 Leakage currents

Calculated maximum leakage currents depending on voltage and frequency.

Rated input voltage / V	Frequency / Hz	Leakage current / mA
400	50 / 60	< 5

Table 8: Leakage currents

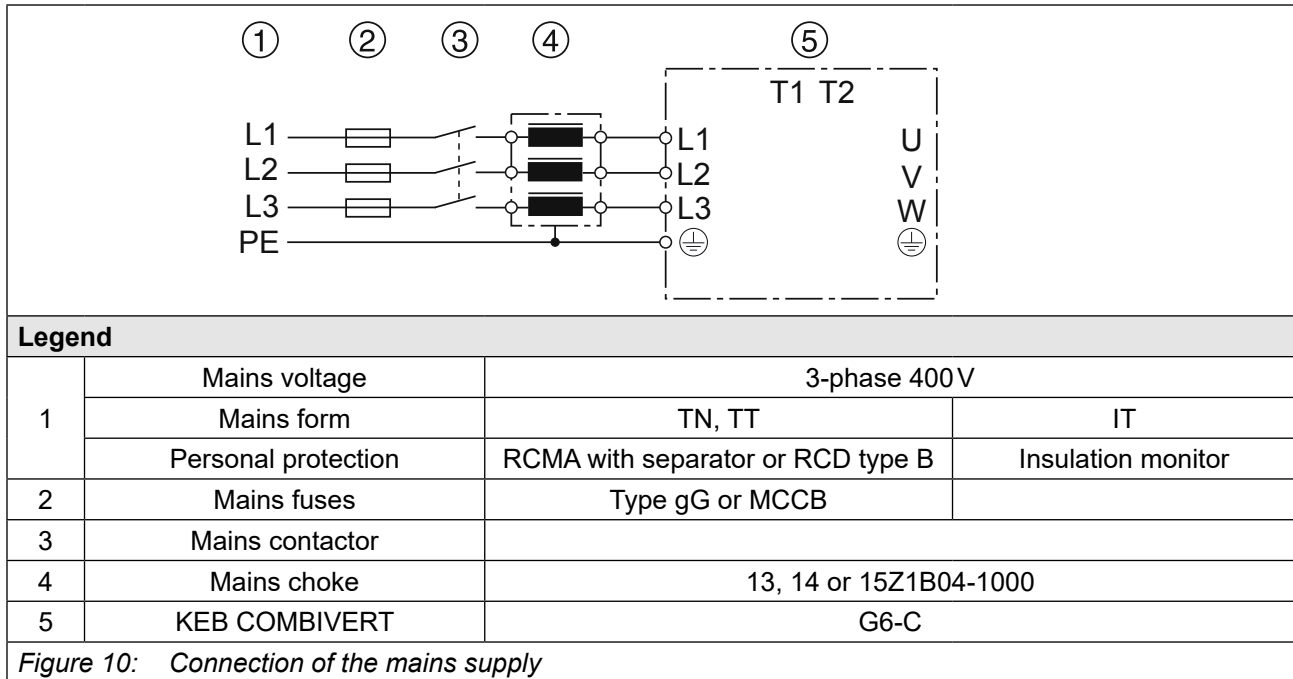


The specified leakage currents are calculated values according to [DIN EN 60939-1](#). The real leakage currents may deviate from the calculated values depending on the network conditions.

CONNECTION OF THE POWER UNIT

4.2.3 AC connection

4.2.3.1 AC supply 400V / 3-phase

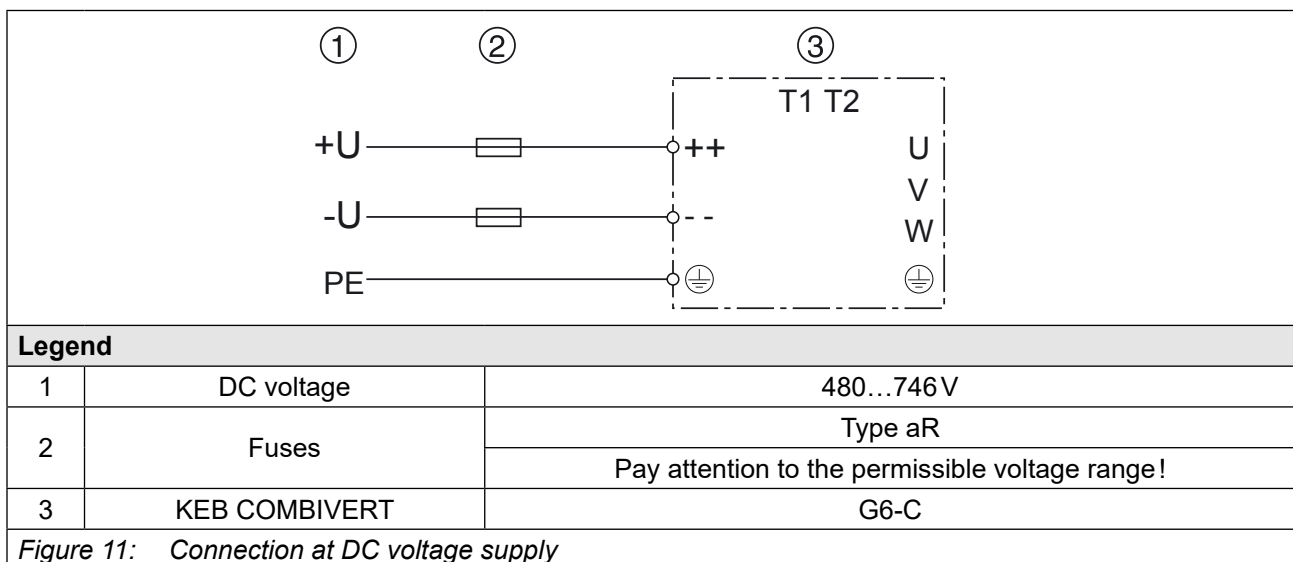


4.2.3.2 Supply cable

The conductor cross-section of the supply cable is dependent on the input current, the cable according to manufacturer's data, as well as the VDE regulations.

4.2.4 DC connection

4.2.4.1 Connection at DC voltage supply



4.2.4.2 Terminal block X1B DC connection

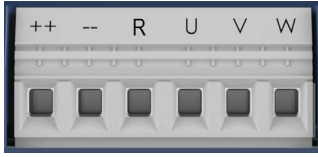
X1B	Name	Function	Cross-section		Tightening torque
	++, --	DC input	AWG without wire-end ferrule	mm² with wire-end ferrule	1.2...1.5Nm 12lb-inch
			20...8	2,5...10	
			stranded wire		
	PE, 	Connection for protective earth	Screw M4 for ring crimp connector		1.3 Nm 11lb inch

Figure 12: Terminal block X1B DC connection

4.2.5 Connection of the motor

4.2.5.1 Selection of the motor cable

The correct cabling as well as the motor cable play an important part in case of low power in connection with long motor line lengths. Ferrite cores and low-capacitance cable (phase/phase < 65 pF/m, phase/screen < 120 pF/m) at the output have the following effects:

- Longer motor cable lengths
- Less abrasion of the motor gearbox by leakage currents
- Better EMC properties

4.2.5.2 Cable-fed disturbances depending on the motor cable length at AC supply

The maximum motor cable length is depending on the capacity of the cable as well as on the EMC emitted interference. The following data apply for operation under rated conditions.

Size	Voltage / V	Max. motor cable length shielded in accordance with EN 61800-3			
		Category C1		Category C2	
		Motor cable / m (standard)	Motor cable / m (low-capacitance)	Motor cable / m (standard)	Motor cable / m (low-capacitance)
13	400	25	50	50	100
14					
15					

Table 9: Cable-fed disturbances depending on the motor cable length at AC supply



The cable length can be significantly extended by using motor chokes or filters. KEB recommends the use of motor chokes or filters for a line length upto 50 m. Motor chokes or filters are absolutely necessary upto 100 m.

4.2.5.3 Motor cable length at operation with DC voltage

The maximum motor cable length at DC operation is basically dependent on the capacity of the motor cable. The internal filter is not active at DC operation. External measures must be taken here, if necessary. The following data apply for operation under rated conditions.

Size	Motor cable / m (standard)	Motor cable / m (low-capacitance)
13	25	50
14		
15		
Table 10: Motor cable length at operation with DC voltage		

4.2.5.4 Motor cable length for parallel operation of motors

The resulting motor cable length for parallel operation of motors, or parallel installation with multiple cables arises from the following formula:

$$\text{Resulting motor cable length} = \sum \text{single cable lengths} \times \sqrt{\text{Number of motor cables}}$$

4.2.5.5 Motor cable cross-section

The motor cable cross-section is dependent

- on the kind of the output current (e.g. not sinusoidal).
- on the real effective value of the motor current.
- on the cable length.
- on the type of the used cable.
- on environmental conditions such as bundling and temperature.

4.2.5.6 Interconnection of the motor

NOTICE

Faulty behaviour of the motor!

The connecting-up instructions of the motor manufacturer are always generally valid!

NOTICE

Protect motor against voltage peaks!

Drive controllers switch at the output with $dV/dt \leq 5\text{ kV}/\mu\text{s}$. Voltage peaks that endanger the insulation system at the motor can occur especially in case of long motor cables ($> 15\text{ m}$).

A motor choke, a dv/dt -filter or sine-wave filter can be used for protection of the motor.

4.2.5.7 Terminal block X1B motor connection

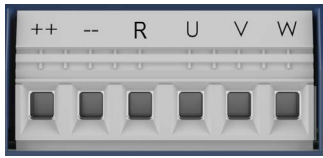
X1B	Name	Function	Cross-section		Tightening torque
	U, V, W	Motor connection	AWG without wire-end ferrule	mm² with wire-end ferrule	1.2...1.5 Nm 12 lb-inch
			20...8	2,5...10	
			stranded wire		
	PE, 	Connection for protective earth	Screw M4 for ring crimp connector		1.3 Nm 11 lb inch

Figure 13: Terminal block X1B motor connection

Figure 13: Terminal block X1B motor connection

4.2.5.8 Wiring of the motor

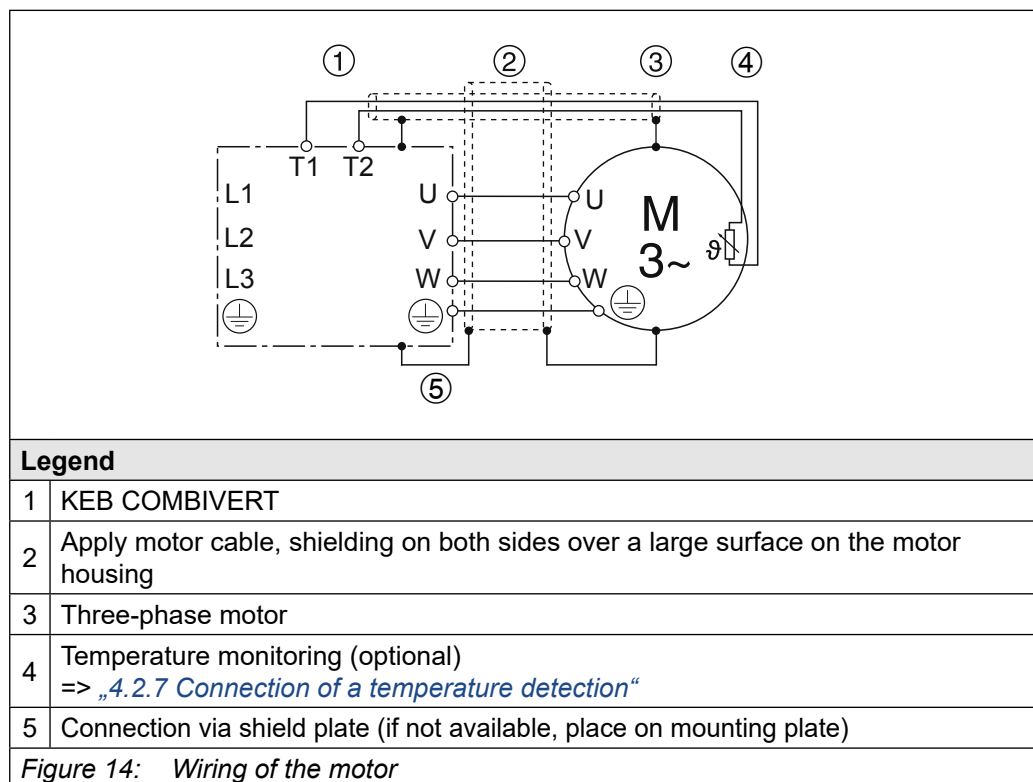


Figure 14: Wiring of the motor

NOTICE

Ensure correct laying of the PTC cables!

- Do not lay PTC cable of the motor (also shielded) together with control cable!
- PTC cable inside the motor cable only permissible with an additionally shielding (double shielding)!

4.2.6 Connection of a braking resistor

4.2.6.1 Terminal block X1B connection braking resistor

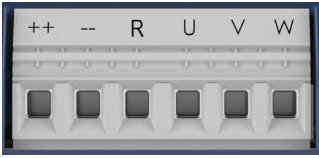
X1B	Name	Function	Cross-section		Tightening torque
	++, R	Connection for braking resistor	AWG without wire-end ferrule	mm² with wire-end ferrule	1.2...1.5Nm 12lb-inch
			20...8	2,5...10	
			stranded wire		

Figure 15: Terminal block X1B connection of a braking resistor



Terminal R can alternatively be labeled with PB.

4.2.6.2 Wiring of an intrinsically safe braking resistor

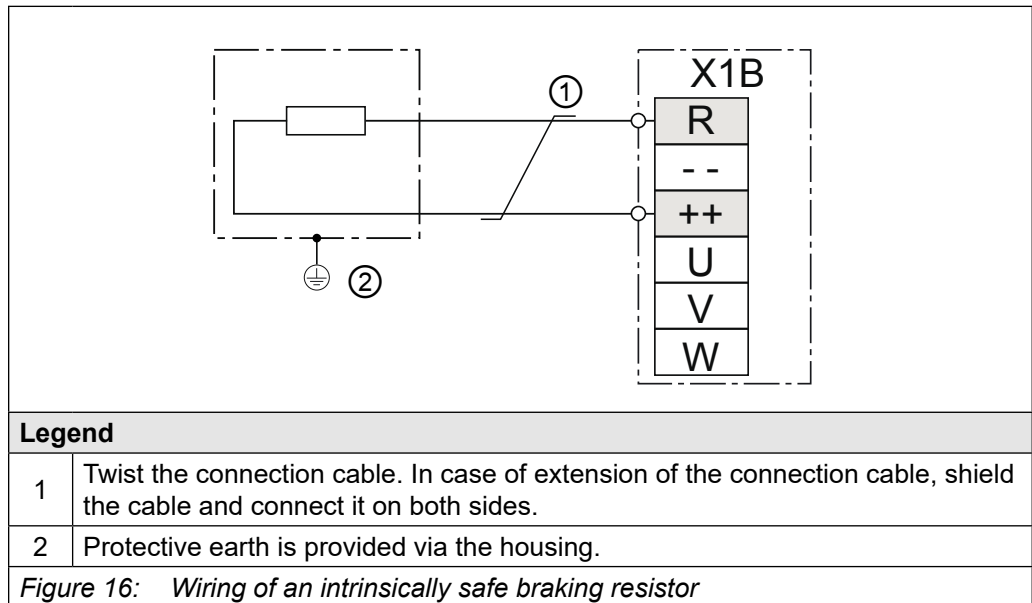


Figure 16: Wiring of an intrinsically safe braking resistor

NOTICE

Only intrinsically safe braking resistors permitted!

Only "intrinsically safe" braking resistors are permissible for this operation, since these resistors interrupt themselves at fault such as safety fuse without fire risk.



Technical data and design for intrinsically safe braking resistors.

www.keb.de/fileadmin/media/Manuals/dr/ma_dr_safe-braking-resistors-20106652_en.pdf



4.2.6.3 Use of non-intrinsically safe braking resistors

⚠ WARNING**Use of non-intrinsically safe braking resistors****Fire or smoke development in case of overload or fault!**

- ▶ Only use braking resistors with temperature sensor.
- ▶ Evaluate temperature sensor.
- ▶ Trigger fault on the drive controller (e.g. external input).
- ▶ Switch off input voltage (e.g. input contactor).
- ▶ Connection examples for non-intrinsically safe braking resistors
=> *Instructions for use „Installation Braking Resistors“.*



Instructions for use „Installation Braking Resistors“

www.keb.de/fileadmin/media/Manuals/dr/ma_dr_braking-resistors-20116737_en.pdf

4.2.7 Connection of a temperature detection

4.2.7.1 Temperature detection terminals T1, T2

The COMBIVERT G6 is delivered with a PTC evaluation. The function corresponds to [EN 60947-8](#) and works in accordance with the following table:

Function of T1, T2	Resistance	Display ru46	Error/warning
PTC or temperature switch	< 750 Ω	T1-T2 closed	–
	0.75...1.65 k Ω (reset resistance)	undefined	
	1.65...4 k Ω (tripping resistance)		
	> 4 k Ω	T1-T2 open	✓

Figure 17: Temperature detection terminals T1, T2



The behaviour of the drive controller in case of error/warning is defined with parameter CP37 (Pn12). At factory setting the switching condition "9: dOH warning" is set when terminals T1, T2 are open.

4.2.7.2 Terminal block X1C temperature detection

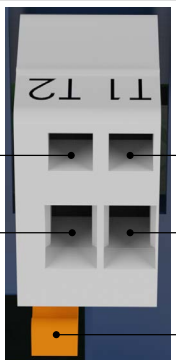
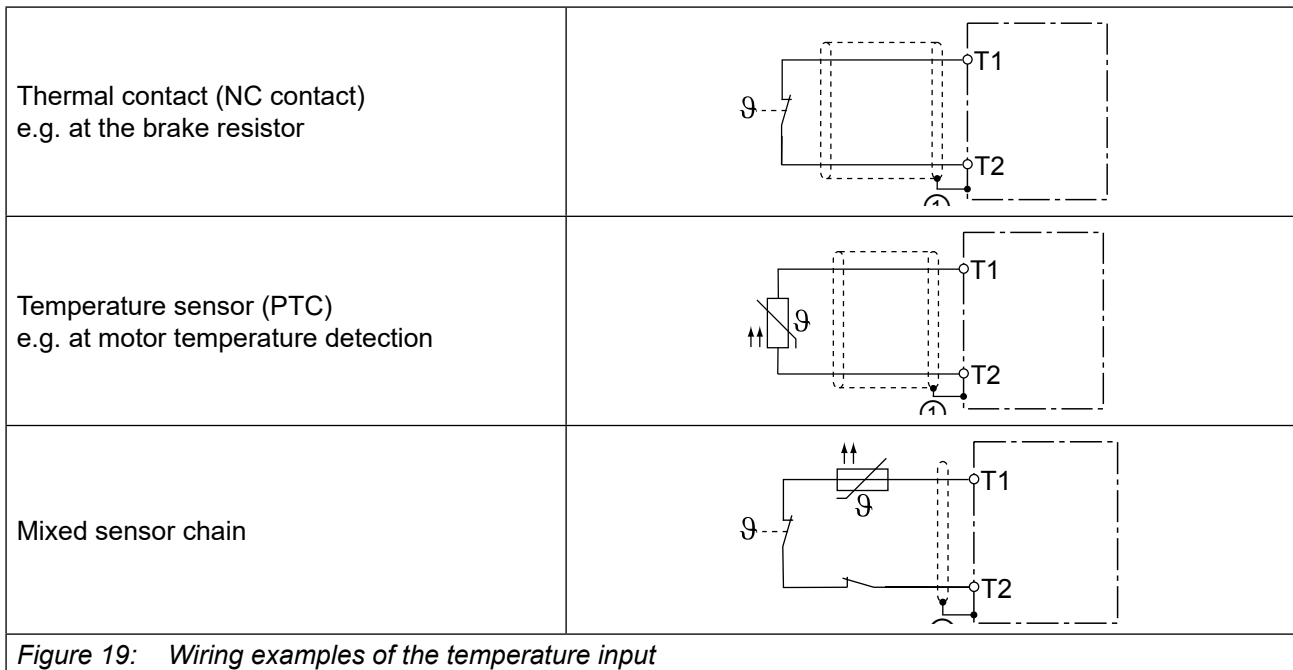
X1C	No.	Name	Function	Cross-section	
	1, 4	T1, T2	Connection for temperature sensor	AWG with-out wire-end ferrule	mm ² with wire-end ferrule
				24...16	0,25...1
				stranded wire	
	2, 3	–	Insertion slots to release the cage clamp terminal with screw driver SD 0, 4x2.5 (DIN 5264)	–	
	5	–	Unlocking the terminal block	–	

Figure 18: Terminal block X1C temperature detection

4.2.7.3 Use of the temperature detection

The temperature detection provides the user all possibilities within the resistance range specified in „4.2.7 Connection of a temperature detection“. This can be:



4.2.8 Final test information

Final test information of the machines/systems which are provided with drive converters according to [EN 60204-1](#) of 2007.

4.3 Calculation of the motor voltage

The motor voltage for dimensioning of the drive is depending on the used components. The mains voltage reduces according to the following table:

Components	%	Example
Mains choke Uk	4	Closed loop drive converter with mains and motor choke at non-rigid supply system: 400 V mains voltage - 15 % = 340 V motor voltage
Drive converter open-loop	4	
Drive converter closed-loop	8	
Motor choke Uk	1	
Non-rigid supply system	2	

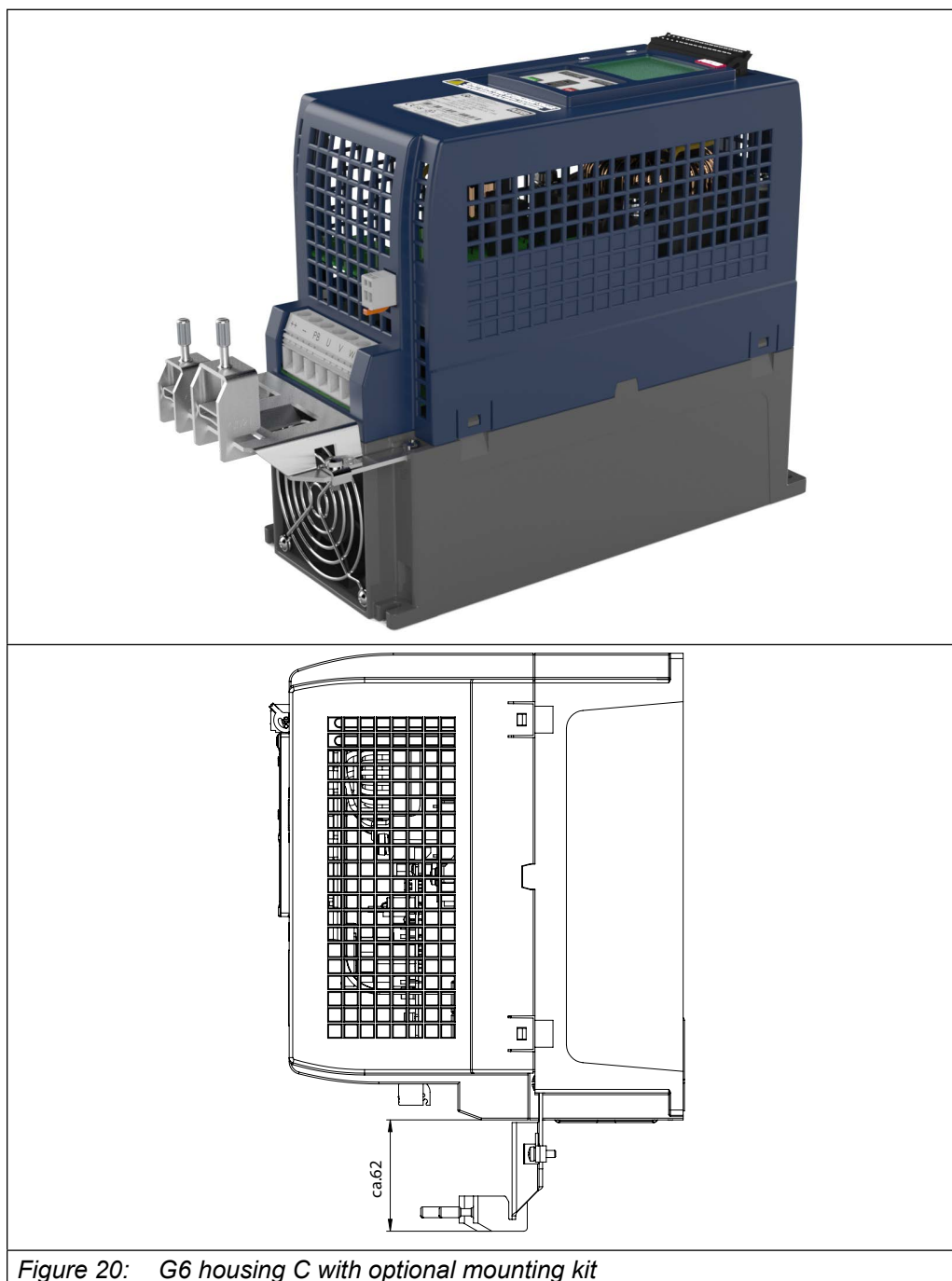
Table 11: Calculation of the motor voltage

5 Accessories

5.1 Mounting kit shield connection braket

A mounting kit is available for large surface of the shieldings of the connecting cables:

Material number	Name
C0G6T88-0001	Mounting kit shield connection braket
Table 12: Mounting kit shield connection braket for G6 housing C	



5.2 Ferrite rings

To comply with the EMC limit values it is absolutely necessary to use the supplied ferrite rings.



Use of the supplied ferrite rings.

www.keb.de/fileadmin/media/Manuals/dr/ma_dr_g6-zub-inst-ferrite-rings-20176092_en.pdf

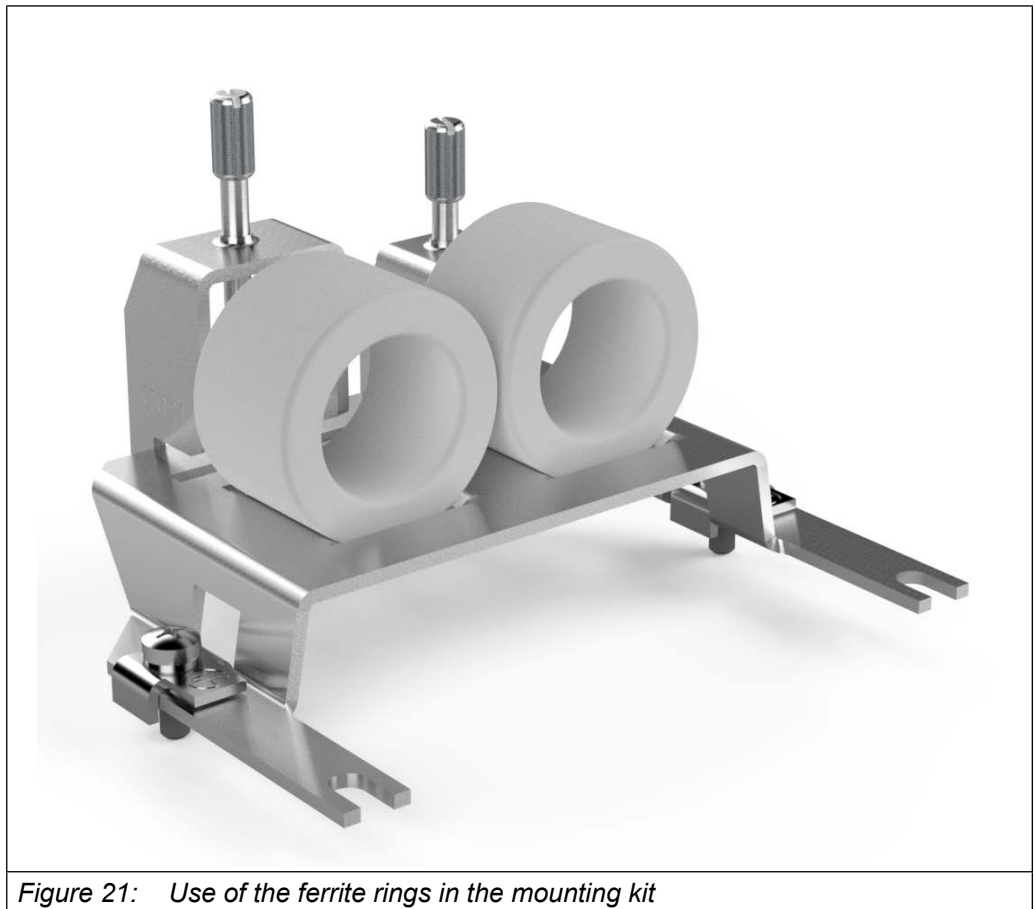


Figure 21: Use of the ferrite rings in the mounting kit

6 Certification

6.1 CE-Marking

CE marked drive controllers are developed and manufactured to comply with the regulations of the Low-Voltage Directive 2006/95/EC and EMC directive (2004/108/EC). The harmonized standards of the series [EN 61800-5-1](#) and [EN 61800-3](#) were used.

6.2 Functional safety

Drive controllers with functional safety are marked with the FS logo on the nameplate. These units are designed and manufactured in accordance with the Machine Directive (2006/42/EC). The harmonized standard of the series [EN 61800-5-2](#) is used.

6.3 UL Marking



Acceptance according to UL is marked at KEB drive controllers with the adjacent logo on the nameplate.

To be conform according to UL for use on the North American and Canadian Market the following additionally instructions must be observed (original text of the UL-File):

“During the UL evaluation, only Risk of Electrical Shock and Risk of Fire aspects were investigated. Functional Safety aspects were not evaluated”

•	“Only for use in WYE 480V/277V supply sources (or similar wording)”
•	Operator and Control Board Rating of relays (30Vdc.:1A)
•	“Maximum Surrounding Air Temperature 45°C”
•	“Internal Overload Protection Operates prior to reaching the 180% of the Motor Full Load Current”
•	“Suitable For Use On A Circuit Capable Of Delivering Not More Than 5000 rms Symmetrical Amperes, 480 Volts Maximum, see instruction manual for Branch Circuit Protection details” and “Suitable For Use On A Circuit Capable Of Delivering Not More Than 18000 rms Symmetrical Amperes, 480 Volts Maximum when protected by CC, J or RK5 Class Fuses”, see instruction manual for maximum fuse sizes”.
•	“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”.
•	Wiring Terminals marked to indicate proper connections for the power supply, load and control circuit.
•	Wiring terminals are marked to show a range of values or a nominal value of tightening torque in pound-inches to be applied to the clamping screws as shown below: 480V In/output terminals: 20.5lb-in (2.3Nm)
•	„Use in a Pollution Degree 2 environment“
<i>continued on the next page</i>	

480V In/output terminals: „Use 60/75 °C Copper Conductors Only,max Wire Size: 8 AWG, strip wire insulation at 10 mm.
“During the UL evaluation, only Risk of Electrical Shock and Risk of Fire aspects were investigated. Functional Safety aspects were not evaluated”
In order to comply with CSA C22.2 No. 274-13 (cUL) UL/cUL certified (NMTR/7, NMTR2/8, NMMS/7, or NMMS2/8) external Input Chokes with uk 4% need to be installed. The chokes must comply with rated values in the table below:

Table 1: Mains input chokes for CSA applications:

Cat. No.	Housing	Input Voltage [V]	Min. FLA	Inductance [mH]	uk [%]
13G6	C	480 / 3ph	3 x 15.4A	1.70	4
14G6	C	480 / 3ph	3 x 19.6A	1.16	4
15G6	C	480 / 3ph	3 x 27.0A	0.85	4

Branch Circuit Protection for G6 - C Drive series

I) Fuses:

Cat. No.	Housing	Input Voltage [V]	Class CC, J or RK5 UL248 Fuse rating [A]
13G6	C	480 / 3ph	20
14G6	C	480 / 3ph	25
15G6	C	480 / 3ph	40

The voltage rating of the external fuses shall be at least equal to the input voltage of the drives.

II) Listed (DIVQ, DIVQ7/CSA Certified) Circuit Breakers, Type, manufacturer and electrical ratings as specified below:

Cat. No.	Housing	Type	Manufacturer	Ratings
13G6	C	5SJ4 320-8HG42 S203UP-K 20 FAZ D20/3-NA 1489 A3D 200	Siemens ABB Eaton Allen Bradley	480Y/277V, 20A
14G6	C	5SJ4 325-8HG42 S203UP-K 25 FAZ D25/3-NA 1489 A3D 250	Siemens ABB Eaton Allen Bradley	480Y/277V, 25A
15G6	C	N/A	N/A	N/A

III) Listed (NKHJ, NKHJ7/CSA Certified) Type E Self Protected Manual Motor Controllers, Type and manufacturer and electrical ratings as specified below:

Cat. No.	Housing	Self Protected Manual Motor Controller, Type	Manufacturer	Self Protected Manual Motor Controller, ratings
13G6	C	PKZM0(1) 25-E	Eaton	480Y/277V, 15.0 Hp
14G6	C	PKZM0(1) 25-E	Eaton	480Y/277V, 15.0 Hp
15G6	C	PKZM0(1) 32-E	Eaton	480Y/277V, 20.0 Hp

WARNING – The opening of the branch circuit protective device may be an indication that a fault current has been interrupted. To reduce the risk of fire or electrical shock, current-carrying parts and other components of the controller should be examined and replaced if damaged. If burnout of the current element of an overload relay occurs, the complete overload relay must be replaced.

CSA: For Canada:

“ATTENTION - LE DÉCLENCHEMENT DU DISPOSITIF DE PROTECTION DU CIRCUIT DE DÉRIVATION PEUT ÊTRE DÙ À UNE COUPURE QUI RÉSULTE D'UN COURANT DE DÉFAUT. POUR LIMITER LE RISQUE D'INCENDIE OU DE CHOC ÉLECTRIQUE, EXAMINER LES PIÈCES PORTEUSES DE COURANT ET LES AUTRES ÉLÉMENTS DU CONTRÔLEUR ET LES REMPLACER S'ILS SONT ENDOMMAGÉS. EN CAS DE GRILLAGE DE L'ÉLÉMENT TRAVERSÉ PAR LE COURANT DANS UN RELAIS DE SURCHARGE, LE RELAIS TOUT ENTIER DOIT ÊTRE REMPLACÉ.”

6.4 Further informations and documentation

You find supplementary manuals and instructions for the download under www.keb-automation.com/search

General instructions

- EMC and safety instructions
- Manuals for additional control boards, safety modules, fieldbus modules, etc.

Instruction and information for construction and development

- Input fuses in accordance with UL
- Programming manual for control and power unit
- Motor configurator to select the appropriate drive controller and to create downloads for parameterizing the drive controller

Approvals and approbations

- Declaration of conformity CE
- TÜV certificate
- FS certification

Other markings and approvals not listed here are identified by a corresponding logo on the rating plate or device, if applicable. The corresponding certificates are available on our website.

Others

- COMBIVIS, the software for comfortable parameterization of drive controllers via PC (available per download)
- EPLAN drawings

7 Revision History

Revision	Date	Description
1B	2011-03	First published version
1C	2011-09	„Original manual“ inserted; Type code extended; Technical data changed; Connection braking resistor changed
1D	2012-02	Recommended supply and motor cable cross section removed; Drawings mains and motor connection changed; UL certification; Addresses on the back
1E	2012-07	Addition to terminal description
1F	2013-05	For all other languages the table of contents corrected
1G	2014-04	Type code extended to VARAN: Technical data have been adjusted; Voltages for DC operation; UL certification adjusted
Version	Date	Description
00	2014-04	Converted to document number. Revision 1G is identical with version 00
01	2015-12	Added note on use of ferrite rings
02	2018-03	Insertion of dimensions; Conversion to new KEB corporate identity optics
03	2018-10	Editorial changes, warning symbol inserted
04	2019-05	Dimensions for mounting kit inserted
05	2019-05	Revised mounting kit added
06	2020-03	Adjustments type code; Editorial changes
07	2020-09	Editorial changes
08	2021-05	Insertion of the chapter "Leakage currents", editorial changes
09	2022-11	Correction of type code
10	2025-12	Adaptation of UL texts, editorial changes

Glossary

0V	Earth-potential-free common point	Encoder emulation	Software-generated encoder output
1ph	1-phase mains	End customer	The end customer is the user of the customer product
3ph	3-phase mains	Endat	Bidirectional encoder interface of the company Heidenhain
AC	AC current or voltage	EtherCAT	Real-time Ethernet bus system of the company Beckhoff
AFE	From 07/2019 AIC replaces the previous name AFE	Ethernet	Real-time bus system - defines protocols, plugs, types of cables
AFE filter	From 07/2019 AIC filter replaces the previous name AFE filter	FE	Functional earth
AIC	Active Infeed Converter	FSoE	Functional Safety over Ethernet
AIC filter	Filter for Active Infeed Converter	FU	Drive controller
Application	The application is the intended use of the KEB product	GND	Reference potential, ground
ASCL	Asynchronous sensorless closed loop	GTR7	Braking transistor
Auto motor ident.	Automatically motor identification; calibration of resistance and inductance	HF filter	KEB specific term for an EMC filter (for description see EMC filter).
AWG	American wire gauge	Hiperface	Bidirectional encoder interface of the company Sick-Stegmann
B2B	Business-to-business	HMI	Human machine interface (touch screen)
BiSS	Open source real-time interface for sensors and actuators (DIN 5008)	HSP5	Fast, serial protocol
CAN	Fieldbus system	HTL	Incremental signal with an output voltage (up to 30V) -> TTL
c.d.f.	Cyclic duration factor	IEC	IEC xxxxx stands for an international standard of the International Electrotechnical Commission
CDM	Complete drive module including auxiliary equipment (control cabinet)	IPxx	Protection class (xx for class)
COMBIVERT	KEB drive controller	KEB product	The KEB product is subject of this manual
COMBIVIS	KEB start-up and parameterizing software	KTY	Silicium temperature sensor (polarized)
Customer	The customer has purchased a KEB product from KEB and integrates the KEB product into his product (customer product) or resells the KEB product (dealer)	Manufacturer	The manufacturer is KEB, unless otherwise specified (e.g. as manufacturer of machines, engines, vehicles or adhesives)
DC	DC current or voltage	MCM	American unit for large wire cross sections
DI	Demineralized water, also referred to as deionized (DI) water	Modulation	Means in drive technology that the power semiconductors are controlled
DIN	German Institut for standardization	MTTF	Mean service life to failure
DS 402	CiA DS 402 - CAN device profile for drives	NHN	Standard elevation zero; based on the specified height definition in Germany (DHHN2016). The international data generally deviate from this by only a few cm to dm, so that the specified value can be applied to the regionally applicable definition.
ELV	Extra-low voltage	OC	Overcurrent
EMC filter	EMC filters are used to suppress conducted interferences in both directions between the drive controller and the mains	OH	Overheat
Emergency stop	Shutdown of a drive in emergency case (not de-energized)	OL	Overload
Emergency switching off	Switching off the voltage supply in emergency case		
EMS	Energy Management System		
EN	European standard		

OSSD	Output signal swithching device; - an output signal that is checked in regular intervals on its shutdown. (safety technology)
PDS	Power drive system incl. motor and measuring probe
PE	Protective earth
PELV	Protective Extra Low Voltage
PFD	Term used in the safety technology (EN 61508-1...7) for the size of error probability
PFH	Term used in the safety technology (EN 61508-1...7) for the size of error probability per hour
PLC	Programmable logic controller
Pt100	Temperature sensor with R0=100Ω
Pt1000	Temperature sensor with R0=1000Ω
PTC	PTC-resistor for temperature detection
PWM	Pulse width modulation
RJ45	Modular connector with 8 lines
SCL	Synchronous sensorless closed loop
SELV	Safe extra-low voltage, unearthed
SIL	The safety integrity level is a measure for quantifying the risk reduction. Term used in the safety technology (EN 61508 -1...7)
SS1	Safety function „Safe stop 1“ in accordance with IEC 61800-5-2
SSI	Synchronous serial interface for encoder
STO	Safety function „Safe Torque Off“ in accordance with IEC 61800-5-2
TTL	Logic with 5 V operating voltage
USB	Universal serial bus
VARAN	Real-time Ethernet bus system

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KEB Automation KG Suedstrasse 38 D-32683 Barntrop Tel. +49 5263 401-0 E-Mail: info@keb.de