Technical Info | Technic Note

Branch Circuit Protection

for KEB drive controllers

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1 Preface

The Technic Notes contain additional information about the units and accessories. They are helping constructors and developers to use KEB products in their applications. However, they are considered for information only without responsibility. The selection with regard to their suitability for the intended use can only be made by the user. If you have any questions, please contact KEB Automation KG or your area representative.

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

This document is not legally part of the certified device documentation. The functions described in the current KEB documentation must always be given priority. The enclosed documents correspond to conditions valid at printing. Misprint, mistakes and technical changes reserved.

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2 Structure of the document

This document is intended to assist in selecting suitable protective devices for KEB Dive Controllers. We recommend the following procedure:

- Selecting the area of validity (IEC, UL/CSA)
  Note! Fuses for the IEC area, including those with UL approval, are not permitted for use in the UL/CSA area.
- Selection of the Drive Controller Series
- Selecting the fuse type.
  Fuses, circuit breakers and motor protection switches (for motor circuits) are available here.
- Selection of voltage class
  The rated voltage of the protective device must be at least equal to the rated voltage of the supply circuit.
- Selection of the rated output power

The table thus created lists the protective devices from various manufacturers that we tested according to their maximum rated current. Protective devices of the same series with a lower rated current are permissible if they are suitable for the application.

The table also shows the SCCR value that our drive controllers achieve in conjunction with the fuse used. The SCCR value must be higher than or equal to the maximum possible short-circuit current at the installation site. This means that in the event of a fault, only the affected branch circuit is switched off without the main supply breaking down. This should largely prevent fires, damage to equipment and, to a certain extent, personal injury.

KEB drive controllers have integrated motor overload protection. The settings for this can be found in the respective device documentation. The output of the KEB drive controller is conditionally protected against short circuits.

The use of unlisted protective equipment with comparable properties is possible, but is the responsibility of the user.

3 Scope of application IEC

3.1 Validity

The protective devices described in this section are intended for use in accordance with the IEC 60364 (HD 60364, VDE 0100) series of standards. Other local or national standards and regulations must be checked for use.

3.2 COMBIVERT F6

3.2.1 Protection for 230V devices

Fuse type Type gG

Housing	Drive controller	Power	Maximum fuse	SCCR
2	10F6xx2-xxxx	2.2 kW	20 A	30 kA
2	12F6xx2-xxxx	4.0 kW	32 A	30 kA
2	13F6xx2-xxxx	5.5 kW	35 A	30 kA
2	14F6xx2-xxxx	7.5 kW	50 A	30 kA
3	15F6xx3-xxxx	11 kW	80 A	30 kA
4	18F6xx4-xxxx	22 kW	125 A	30 kA
6	18F6xx6-xxxx	22 kW	125 A	30 kA
6	19F6xx4-xxxx	30 kW	160 A	30 kA

Tab. 1: Protection according to IEC 230V class (single-phase)

3.2.2 Protection for 400V devices

Fuse type Type gG

Housing	Drive controller	Power	Maximum fuse	SCCR
2	12F6xx2-xxxx	4.0 kW	20 A	30 kA
2	13F6xx2-xxxx	5.5 kW	25 A	30 kA
2	14F6xx2-xxxx	7.5 kW	25 A	30 kA
2	15F6xx2-xxxx	11 kW	35 A	30 kA
2	16F6xx2-xxxx	15 kW	50 A	30 kA
4	17F6xx4-xxxx	18.5 kW	63 A	30 kA
4	18F6xx4-xxxx	22 kW	80 A	30 kA
4	19F6xx4-xxxx	30 kW	80 A	30 kA
4	20F6xx4-xxxx	37 kW	100 A	30 kA
4	21F6xx4-xxxx	45 kW	125 A	30 kA
4	22F6xx4-xxxx	55 kW	160 A	30 kA
6	21F6xx6-xxxx	45 kW	125 A	100 kA
6	22F6xx6-xxxx	55 kW	160 A	100 kA
7	25F6xx7-xxxx	110 kW	250 A	30 kA
7	26F6xx7-xxxx	132 kW	315 A	30 kA
7	27F6xx7-xxxx	160 kW	355 A	30 kA
7	28F6xx7-xxxx	200 kW	400 A	30 kA
8	27F6xx8-xxxx	160 kW	500 A	100 kA
8	28F6xx8-xxxx	200 kW	500 A	100 kA

Housing	Drive controller	Power	Maximum fuse	SCCR
8	29F6xx8-xxxx	250 kW	630 A	100 kA
8	30F6xx8-xxxx	315 kW	630 A	100 kA
9	29F6xx9-xxxx	250 kW	630 A	100 kA
9	30F6xx9-xxxx	315 kW	630 A	100 kA
9	31F6xx9-xxxx	355 kW	700 A (2x350)	100 kA
9	32F6xx9-xxxx	400 kW	800 A (2x400)	100 kA
9	33F6xx9-xxxx	450 kW	900 A (2x450)	100 kA

Tab. 2: Protection according to IEC 400V class

3.2.3 Protection of DC operation

Fusing of frequency inverters in DC link connection

Semiconductor protection fuses (fuses of type *aR* or *gR*) are generally used to protect frequency converters in DC link connections. These fuses are specially designed to protect power electronic components such as diodes, thyristors or IGBTs.

In a DC link connection, several frequency converters are operated at a common DC link voltage. This can result in energy flows between the individual drives (e.g. regeneration of braking energy into the drive of another motor). At the same time, operation requires reliable protection against faults such as short circuits or earth faults in the DC circuit.

Function of the fuses

- **Protection of semiconductor devices**: The switching transistors (IGBTs) in the frequency converter are very sensitive to high short-circuit currents. Standard line protection fuses or gG fuses are too slow to provide adequate protection for these components.
- **Quick shutdown**: aR fuses have a particularly fast tripping response in the event of a short circuit, thereby limiting the fault current and the energy impact on the semiconductors.
- **Selectivity in the DC link**: Each frequency converter is individually protected so that a fault does not take the entire DC link network out of operation.

Special features of type a (aR)

- **"a" = "connection protection"**: These fuses only trip in the event of a short circuit (no overload protection!).
- **"R" = "Rectifier" (semiconductor protection)**: They are optimised for the special requirements of semiconductors.
- They **must therefore always be used in combination with other protective measures**, e.g. motor protection switches or electronic overcurrent monitoring, as they do not provide thermal protection in the overload range.

Conclusion

Type aR fuses are a key protective element in the DC link connection of frequency converters. They ensure that sensitive power semiconductors are reliably protected in the event of a short circuit and that consequential damage is minimised. However, to fully protect the drive system, a coordinated combination of aR fuses and other protective devices is required.

NOTICE

Observe the rated voltage of the fuse!

a) The rated voltage of the fuse must be at least equal to the maximum DC supply voltage of the drive controller.

General properties

Max. DC supply voltage of the drive controller	Fuse
DC 622 V (565 V + 10 %)	Type

Tab. 3: General characteristics of fuses

Housing	Drive controller	Power	recommen-ded fuse	SCCR
2	12F6xx2-xxxx	4.0 kW	25 A	30 kA
2	13F6xx2-xxxx	5.5 kW	32 A	30 kA
2	14F6xx2-xxxx	7.5 kW	40 A	30 kA
2	15F6xx2-xxxx	11 kW	63 A	30 kA
2	16F6xx2-xxxx	15 kW	80 A	30 kA
4	17F6xx4-xxxx	18.5 kW		
4	18F6xx4-xxxx	22 kW		
4	19F6xx4-xxxx	30 kW		
4	20F6xx4-xxxx	37 kW		
4	21F6xx4-xxxx	45 kW		
4	22F6xx4-xxxx	55 kW		
6	21F6xx6-xxxx	45 kW		
6	22F6xx6-xxxx	55 kW		
7	25F6xx7-xxxx	110 kW		
7	26F6xx7-xxxx	132 kW		
7	27F6xx7-xxxx	160 kW		
7	28F6xx7-xxxx	200 kW		
8	27F6xx8-xxxx	160 kW		
8	28F6xx8-xxxx	200 kW		
8	29F6xx8-xxxx	250 kW		
8	30F6xx8-xxxx	315 kW		
9	29F6xx9-xxxx	250 kW		
9	30F6xx9-xxxx	315 kW		
9	31F6xx9-xxxx	355 kW		
9	32F6xx9-xxxx	400 kW		
9	33F6xx9-xxxx	450 kW		

Tab. 4: Protection according to IEC 400V class

3.3 COMBIVERT S6

3.3.1 Protection for 230V devices

Fuse type Type gG

Housing	Drive controller	Power	Maximum fuse	SCCR
2	07S6xx2-(3|4)xxx	0.75 kW	15 A	30 kA

Housing	Drive controller	Power	Maximum fuse	SCCR
2	09S6xx2-(3|4)xxx	1.5 kW	20 A	30 kA

Tab. 5: Protection according to IEC 230V class (single-phase)

Housing	Drive controller	Power	Maximum fuse	SCCR
2	07S6xx2-(1|2)xxx	0.75 kW	6 A	30 kA
2	09S6xx2-(1|2)xxx	1.5 kW	10	30 kA
2	10S6xx2-(1|2)xxx	2.2 kW	10 A	30 kA
4	12S6xx4-xxxx	4.0 kW	16 A	30 kA
4	13S6xx4-xxxx	5.5 kW	20 A	30 kA
4	14S6xx4-xxxx	7.5 kW	25 A	30 kA

Tab. 6: Protection according to IEC 230V operation (3-phase)

3.3.2 Protection for 400V devices

Fuse type Type gG

Housing	Drive controller	Power	Maximum fuse	SCCR
2	07S6xx2-xxxx	0.75 kW	6 A	30 kA
2	09S6xx2-xxxx	1.5 kW	10 A	30 kA
2	10S6xx2-xxxx	2.2 kW	10 A	30 kA
4	12S6xx4-xxxx	4.0 kW	16 A	30 kA
4	13S6xx4-xxxx	5.5 kW	20 A	30 kA
4	14S6xx4-xxxx	7.5 kW	25 A	30 kA

Tab. 7: Protection according to IEC 400V class

4 Scope of application UL/CSA

4.1 Validity

The protective devices described in this section are intended for use in branch circuits in accordance with the National Electrical Code (NEC) for the United States and the Canadian Electrical Code (CEC) Part 1 for Canada. Other local or national standards and regulations must be checked for use.

Automation **with Drive** **www.keb-automation.com**

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