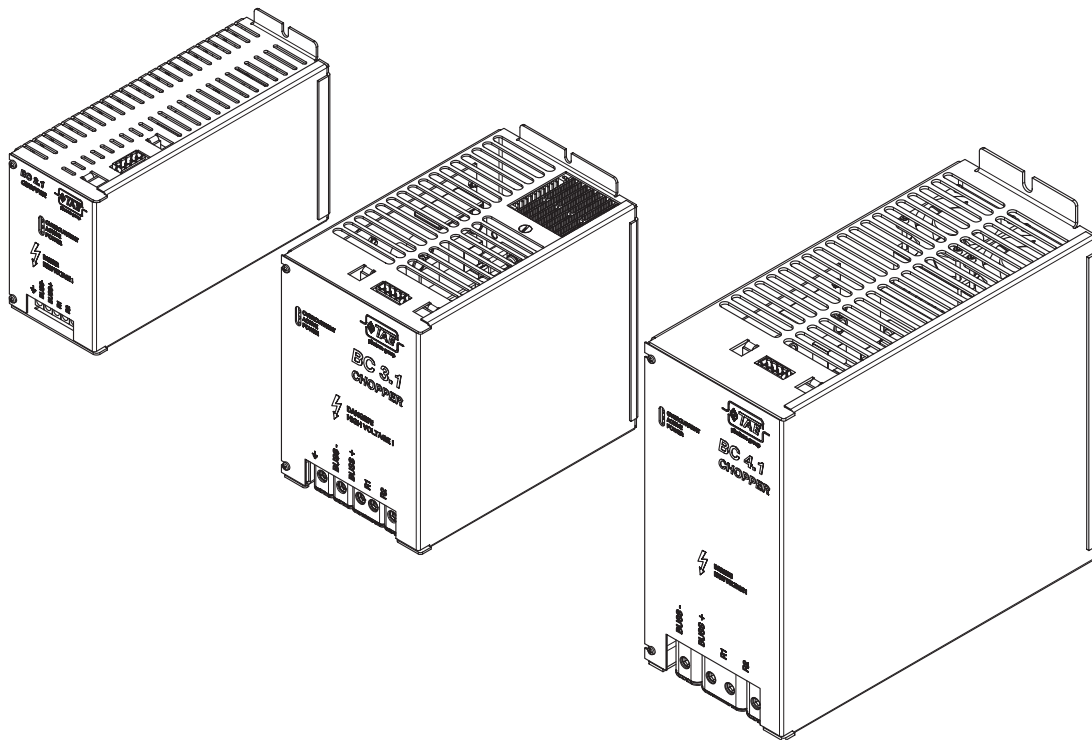


Brake Chopper

BC 2.1 - BC 4.1

Instruction and Operation Manual



Caution:

There is always a risk involved in the handling of electrical machinery!
Therefore mounting and maintenance should only be done by authorized personnel.

Chopper BC 2.1 - BC 4.1

About This Instruction Manual

If you look for some definite topic you can use the table of contents at the beginning of these instruction and operation manual.

In these instructions is a row of symbols which shall provide you with a fast orientation and show the importants.

This symbol stands for notes and useful informations which shall make the operation easier for you.



Note, disregard can damage or destruct the chopper.



Note, disregard means a danger for the operator.



1. Instruction of Safety



Before you put the chopper into operation, please read this instruction and operation manual completly. The operation should only be done by qualified personnel. The precautions and warnings below must be observed at the operation of the chopper. The braking chopper instruction and operation manual do not replace the manual of initial operation of the inverter.

1.1 Instructions and Rules

During installation, general installation regulations such as following should be observed.

DIN VDE 0100	General requirements for the installation of power with mains
VDE 0113	General requirements for the installation of electrical equipment for production and tooling machines
VDE 0160	Requirements for electronic equipment for use in electrical power installations.
VDE 0470 part 1	International protection

Chopper BC 2.1 - BC 4.1

1.2 Safety



Caution Danger !

Disconnect unit from mains and wait until the capacitors have discharged before making any repairs. After the installation make sure that the unit and motor is properly grounded in order to avoid electrical hazards.



As with any form of electrical equipment, there is always a risk involved in the handling of electrical machinery. The greatest care must always be exercised during installation and maintenance. It is recommended that service is performed by authorized personnel only.



Caution !

1. Do not connect or disconnect the chopper when it has power.
2. Please take care of the correct polarity.
3. If you exchange the connections BUSS + and BUSS- the inverter or the chopper can be destroyed.
4. An ultra rapid fuse for the protection of the IGBT is not installed.

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Chopper BC 2.1 - BC 4.1

2. Function

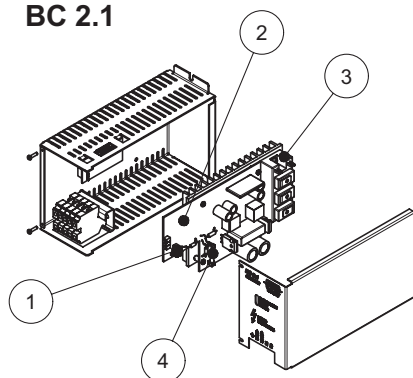
If the speed of the motor is reduced the motor behaves like a generator. Since the kinetic energy is not sent back with the Inverter to mains the intermediate circuit (BUSS) capacitors store the energy. The voltage of the intermediate circuit increases. If the intermediate circuit voltage the inverter protects itself by turning off.

To avoid the interruption of braking, a Braking Choppers is used. It is activated if the voltage of the intermediate circuit is higher than the tolerable intermediate circuit voltage. The braking resistor is connected with the intermediate circuit and the additional energy is transformed to heat.

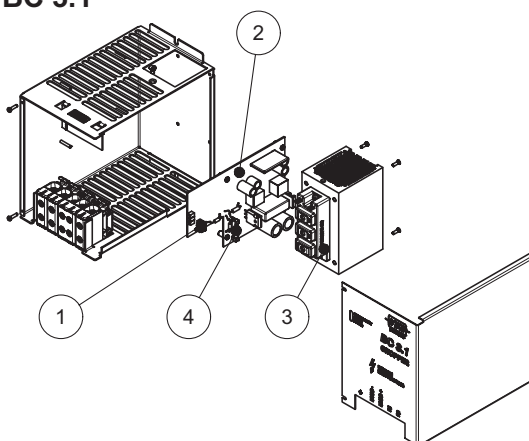
If big masses have to be decelerated the braking resistor must have enough power related to the kinetical energy.

3. Mounting and Location

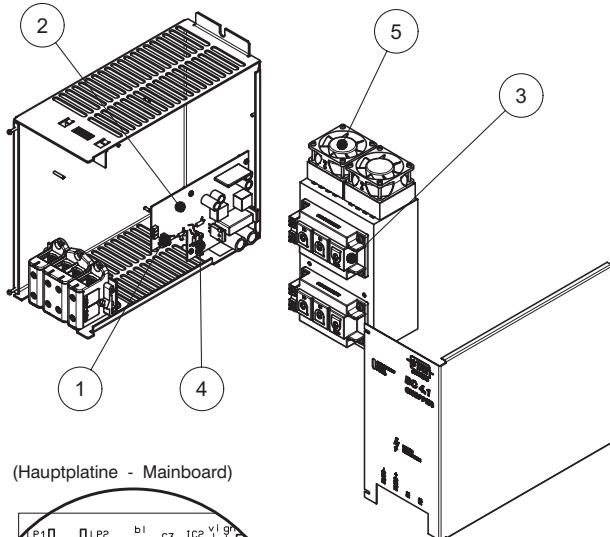
BC 2.1



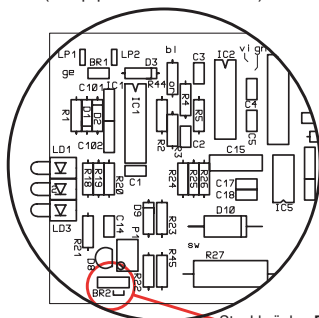
BC 3.1



BC 4.1



(Hauptplatine - Mainboard)



Steckbrücke BR2 - Jumper

type	Position				
	1	2	3	4	5
BC 2.1-16/5,5	Jumper BR2 & Potentiometer P1 Chopper voltage	PC- Board	1x IGBT 2MBI	Fuse F1 (only Electronic not IGBT)	-
BC 2.1-24/6					-
BC 2.1-33/11					-
BC 2.1-51/13					-
BC 3.1-32/13					-
BC 3.1-32/22					1x Fan
BC 3.1-47/25					-
BC 3.1-65/27					-
BC 3.1-67/26					-
BC 3.1-67/45					-
BC 3.1-97/52			1x Fan		
BC 3.1-135/56			-		
BC 4.1-90/33			-		
BC 4.1-120/36			-		
BC 4.1-180/67	-				
BC 4.1-185/41	-				
BC 4.1-250/75	-	2x IGBT 2MBI	-	-	
BC 4.1-375/82	-	2x IGBT 2MBI	-	-	

		Connection Voltage	
		BR2	200 - 440V 450 - 800V
Chopper Voltage at potentiometer P1 at factory adjustment	⊖ ⊕	375V	750V
	⊕ ⊖	340V	680V

Chopper BC 2.1 - BC 4.1

4. Technical Data

4.1 Chopper voltage 375V

Connection voltage		200 - 440 VDC <i>BUSS +/-</i>					
Chopper voltage		Factory adjustment Jumper BR2 right:375V, BR2 left: 340V Control range potentiometer P1: 240 to 440, cw:10V/turn lower					
Type	Article-No.	Brake power in kVA at		Permanent current	Peak current	Superfast fuse F2	Brake resistor
		Permanent load	Peak load	in A	in A	in A	$>R_{min.}$
BC 2.1-16/5,5	12262-0F01	5,5	16	15	45	50	8Ω
BC 2.1-24/6	12262-1F01	6	24	17	68	63	5,3Ω
BC 3.1-32/13	12263-AF01	13	32	35	90	100	4Ω
BC 3.1-32/22	12263-0F01	22	32	60	90	100	4Ω
BC 3.1-47/25	12263-1F01	25	47	70	130	125	2,8Ω
BC 3.1-65/27	12263-2F01	27	65	75	180	200	2Ω
BC 4.1-90/33	12264-0F01	33	90	90	240	250	1,6Ω
BC 4.1-120/36	12264-1F01	36	120	100	330	355	1,1Ω
BC 4.1-185/41	12264-2F01	41	185	110	500	500	0,75Ω
Ambient temperature		0-40°C					
Dimensions		refer to Chapter 8.					

4.2 Chopper voltage 750V

Connection voltage		450 - 800 VDC <i>BUSS +/-</i>					
Chopper voltage		Factory adjustment Jumper BR2 right:750V, BR2 left: 680V Control range potentiometer P1: 540 to 800, cw:25V/turn lower					
Type	Article-No.	Brake power in kVA at		Permanent current	Peak current	Superfast fuse F2	Brake resistor
		Permanent load	Peak load	in A	in A	in A	$>R_{min.}$
BC 2.1-33/11	12262-0F00	11	33	15	45	50	16Ω
BC 2.1-51/13	12262-1F00	13	51	17	68	63	11Ω
BC 3.1-67/26	12263-AF00	26	67	35	90	100	8,5Ω
BC 3.1-67/45	12263-0F00	45	67	60	90	100	8,5Ω
BC 3.1-97/52	12263-1F00	52	97	70	130	125	5,5Ω
BC 3.1-135/56	12263-2F00	56	135	75	180	200	4,2Ω
BC 4.1-180/67	12264-0F00	67	180	90	240	250	3,2Ω
BC 4.1-250/75	12264-1F00	75	250	100	330	355	2,3Ω
BC 4.1-375/82	12264-2F00	82	375	110	500	500	1,5Ω
Ambient temperature		0-40°C					
Dimensions		refer to Chapter 8.					

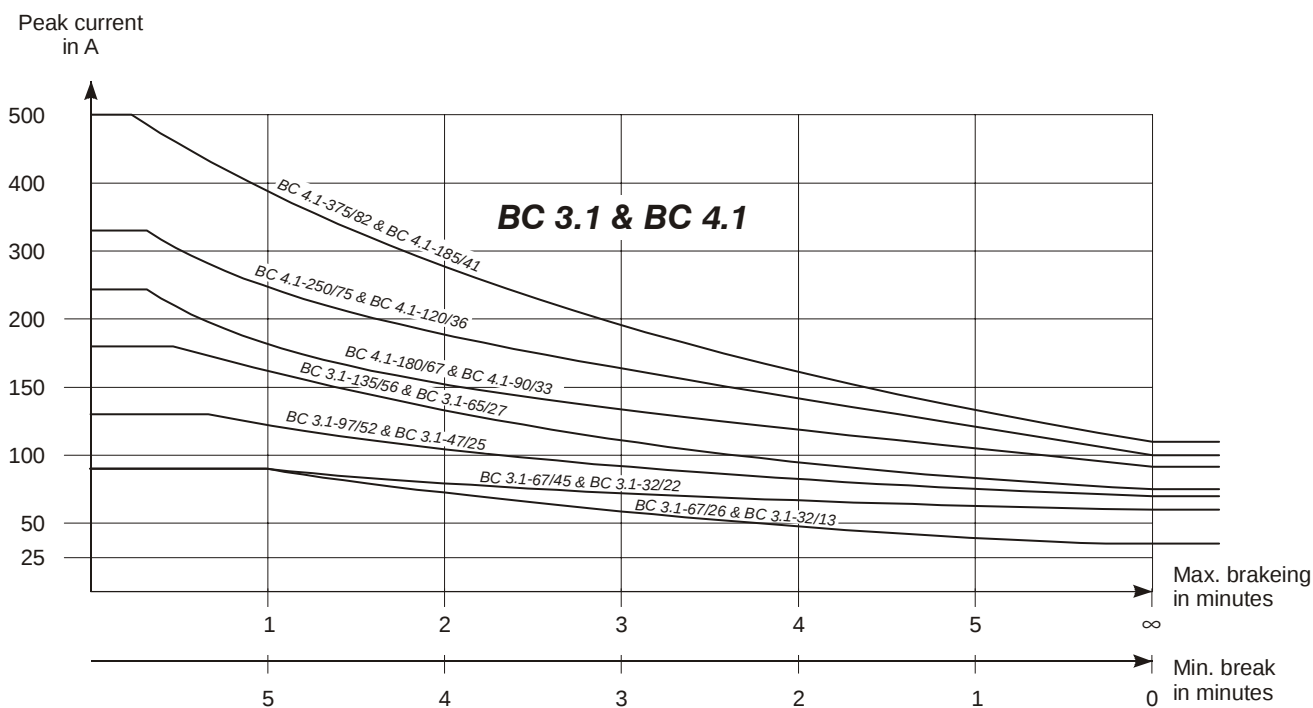
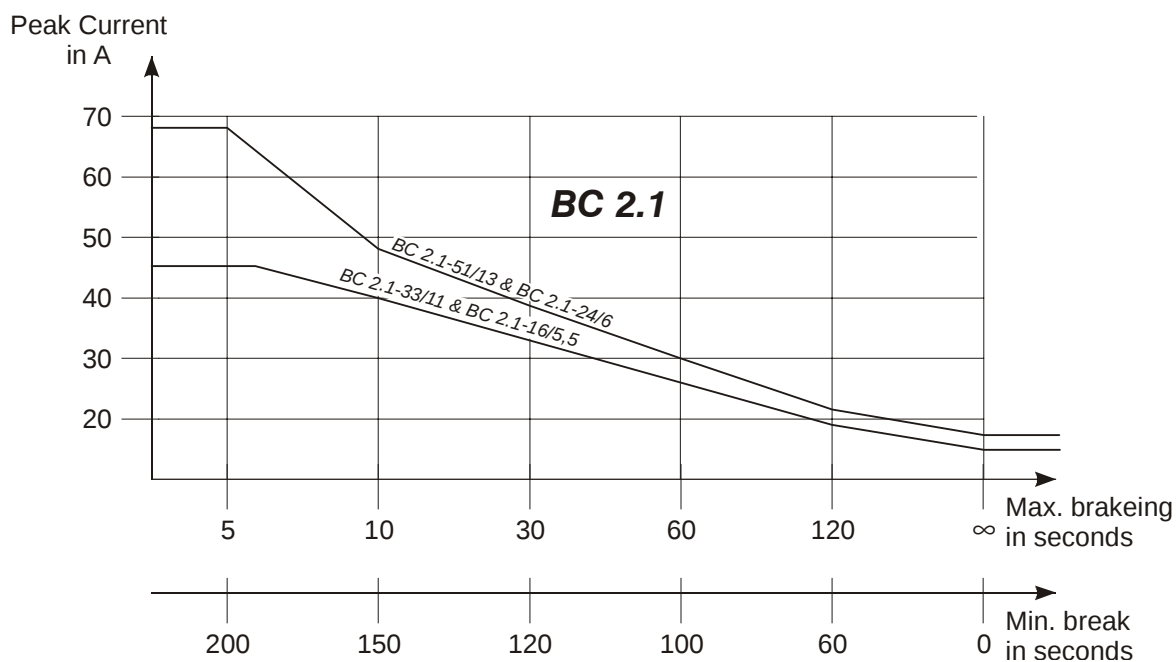


The value of the brake resistor has to be equal or higher than $R_{min.}$ and depends on the required output. If the brake resistor is lower than $R_{min.}$, the IGBT (Insulated Gate Bipolar Transistor) can be destroyed. The output is protected against short circuit but not against permanent overload.

Chopper BC 2.1 - BC 4.1

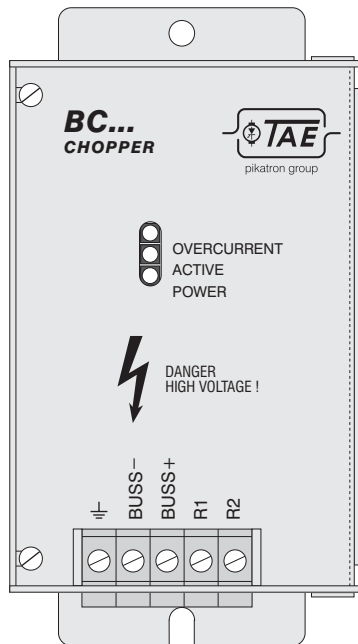
5. Load Curve

at 40°C ambient temperature



Chopper BC 2.1 - BC 4.1

6. Connections and Indications



Indications:

Overcurrent	red	Overcurrent/Short circuit
Active	clear	Chopper is active
Power	green	Chopper is ready

Connections of the terminal blocks:

$\perp$ Connection for earth ($\perp$)
Earth the cover large surfaced, e.g. mounting on a galvanized assembly plate.

BUSS- -connection BUSS-voltage inverter

BUSS+ + connection BUSS-voltage inverter

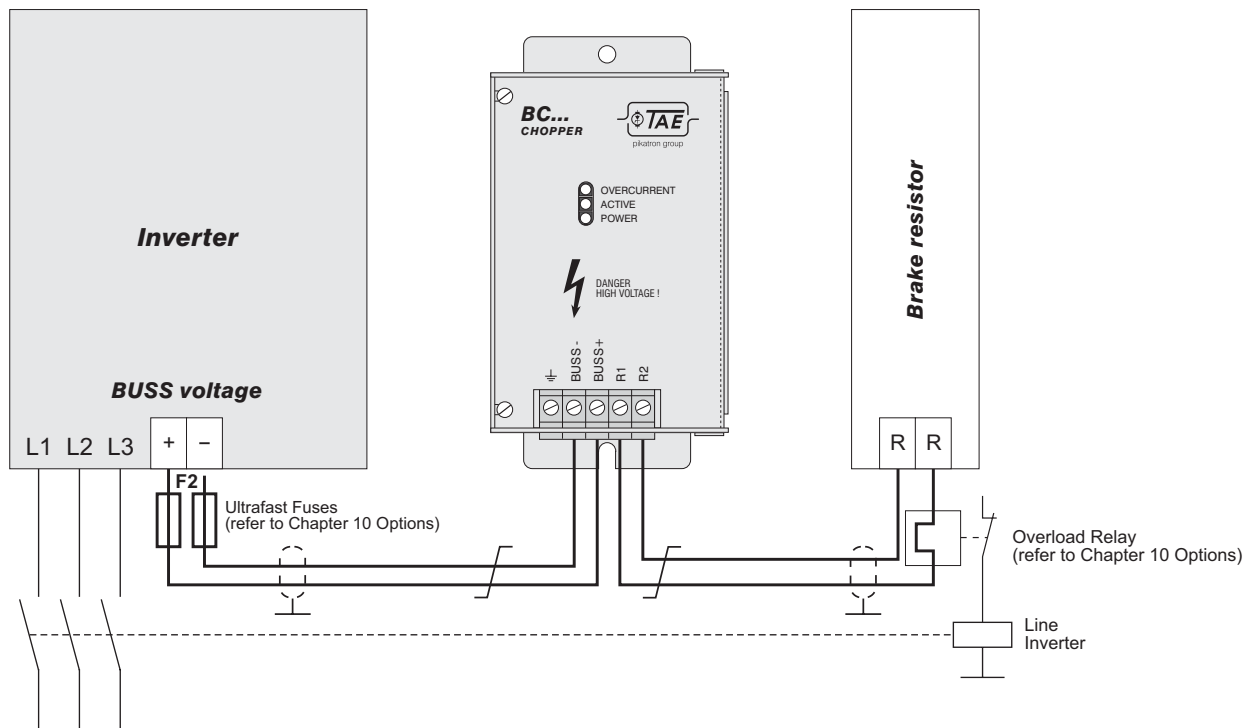
R1 - R2 a thermo protection has to be connected in row to the brake resistor. This thermo protection has to be adjusted to the nominal current of the brake resistor.
(see Chapter 7 Example of Connection)



Caution !

1. Do not connect or disconnect the chopper when it has power.
2. Please take care of the correct polarity.
3. If you exchange the connections BUSS + and BUSS- the inverter or the chopper can be destroyed.
4. An ultra rapid fuse for the protection of the IGBT is not installed.

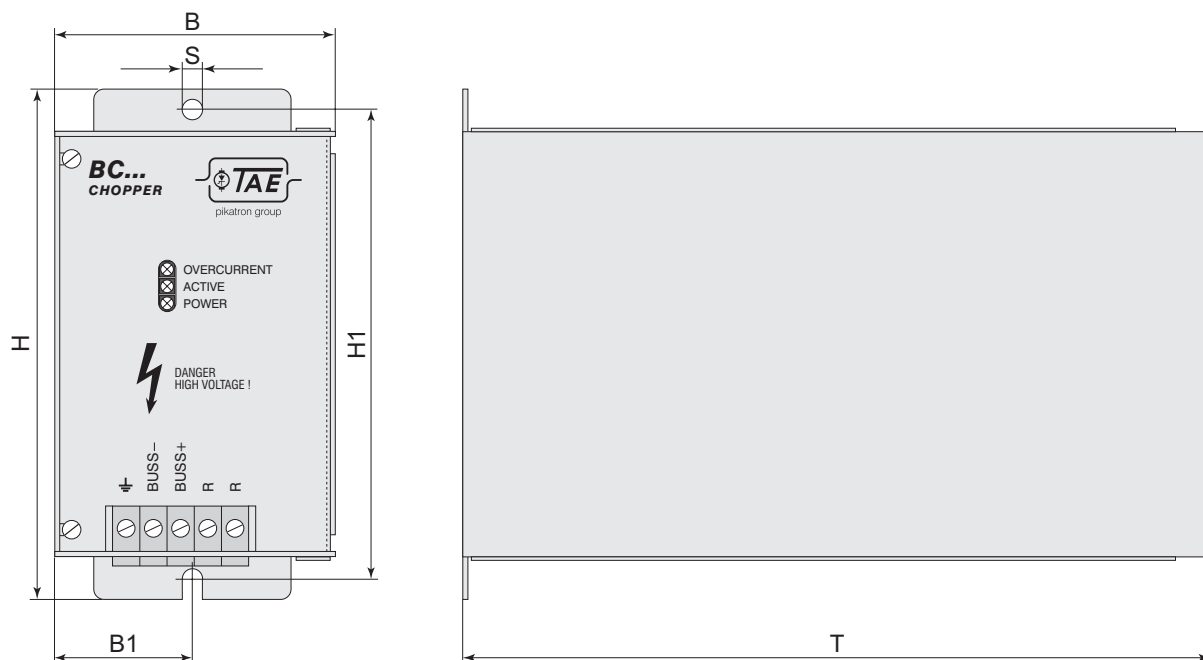
7. Example of Connection



If cables between inverter and chopper resp. chopper and brake resistor are less than 25 cm, they have to be twisted and if they are longer than 25 cm they have to be shielded.

Chopper BC 2.1 - BC 4.1

8. Dimensions



Device size	B	B1	H	H1	T	S
BC 2.1	82,5	40,5	150	138	220	6
BC 3.1	130	64,5	205	193	208	6
BC 4.1	131	64,5	298	280	300	9

9. Spare Parts

Device type		BC 2.1		BC 3.1				BC 4.1		
Art.-No.	Description	12262-0F..	12262-1F..	12263-AF..	12263-0F..	12263-1F..	12263-2F..	12264-0F..	12264-1F..	12264-2F..
34292-42	IGBT 2MBI 50N-120 50A	•								
34292-47	IGBT 2MBI 75N-120 75A		•							
34292-52	IGBT 2MBI 100N-120 100A			•	•					
34292-55	IGBT 2MBI 150N-120 150A					•				
34292-62	IGBT 2MBI 200N-120 200A						•		•	
34292-67	IGBT 2MBI 300N-120 300A							•		•
34472-00	F1 Fuse for electronic 30x5 medium blow 3,15A	•	•	•	•	•	•	•	•	•
68053-00	Fan 24V				•	•	•	•	•	•
78303-0F	PC-Board	•	•	•	•	•	•	•	•	•

Chopper BC 2.1 - BC 4.1

10. Options

- Brake resistors up to 60kW permanent load enclosure IP 20 and different types according to customer wishes. Please consult TAE Antriebstechnik.
- Overcurrent relays for protection of the brake resistor against thermal overstressing.
Overcurrent relays with higher rated current of enquiry.

10.1 Overcurrent relay

Rated current in A:	Art.-No:	Rated current in A:	Art.-No:
0,1 - 0,16	36770-A0	1,6 - 2,4	36770-G0
0,16 - 0,24	36770-B0	2,4 - 4	36770-H0
0,24 - 0,4	36770-C0	4 - 6	36770-I0
0,4 - 0,6	36770-D0	6 - 10	36770-K0
0,6 - 1	36770-E0	10 - 16	36770-L0
1 - 1,6	36770-F0	16 - 24	36770-M0

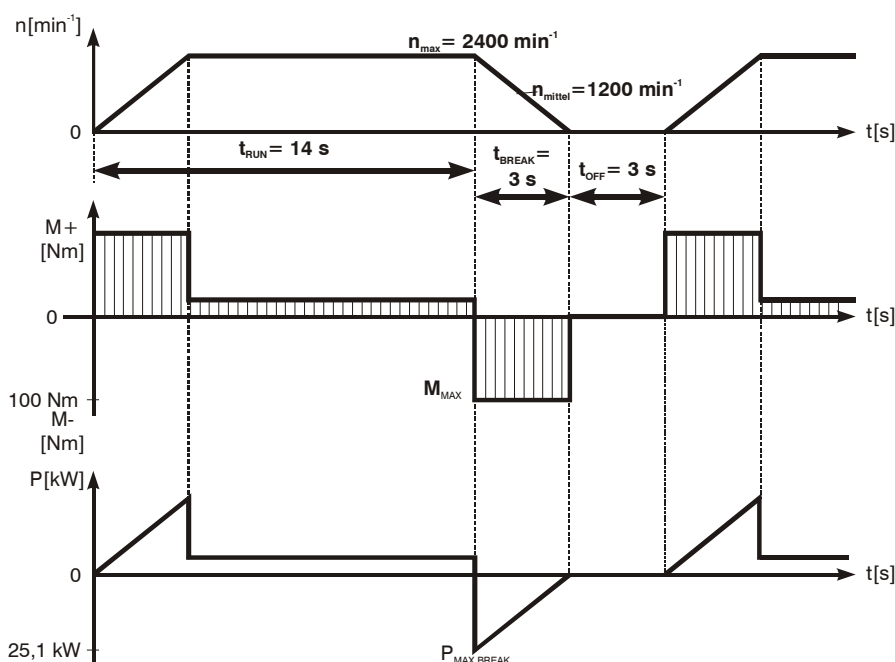
10.2 Ultrafast semiconductor fuses

Use with Braking chopper:	Fuse value in A	Art.-No. Fuse	Art.-No. Fuse Breaker 3pol
12262-0F...	50	34606-00	34529-00
12262-1F...	63	34607-00	34529-00
12263-AF...	100	34609-00	34529-00
12263-0F...	100	34609-00	34529-00
12263-1F...	125	34610-00	34529-00
12263-2F...	200	34621-00	34529-01
12264-0F...	250	34622-00	34529-01
12264-1F...	355	34633-00	34529-02
12264-2F...	500	on request	34529-03

11. Calculation Braking Chopper and Resistor

Basis of calculation:

Constant Brake torque and linear speed reduction.



Example:

Brake torque 100 Nm
Max Speed 2400 min⁻¹
Motor operation time 14 sec.
Brake time 3 sec.
Stop 3 sec.
Chopper voltage 750 V

Chopper BC 2.1 - BC 4.1

Calculation Peak Load $P_{\text{MAX BREAK}}$

$$P_{\text{MAX BREAK}} = \frac{n_{\text{MAX}} \times M_{\text{MAX}}}{9550} = \frac{2400 \times 100}{9550} = 25,1 \text{ kW}$$

$P_{\text{MAX BREAK}}$	in kW	peak load brake chopper
n_{MAX}	in min^{-1}	max speed
M_{MAX}	in Nm	max brake torque

Calculation RMS Brake load $P_{\text{BREAK RMS}}$

$$P_{\text{BREAK RMS}} = P_{\text{MAX BREAK}} \times \sqrt{\frac{t_{\text{BREAK}}}{3 \times (t_{\text{RUN}} + t_{\text{BREAK}} + t_{\text{OFF}})}} = 25,1 \times \sqrt{\frac{3}{3 \times (14 + 3 + 3)}} = 5,6 \text{ kW}$$

$P_{\text{BREAK RMS}}$	in kW	RMS brake load
$P_{\text{MAX BREAK}}$	in kW	peak load brake chopper
t_{BREAK}	in seconds	brake time
t_{RUN}	in seconds	motoring operation
t_{BREAK}	in seconds	regen operation
t_{OFF}	in seconds	stop

Calculation Brake Resistor

$$R = \frac{U^2}{P_{\text{MAX BREAK}}} = \frac{750^2}{25100} = 22,4 \Omega$$

R	in Ω	brake resistor
U	in V	(turn-on) voltage
$P_{\text{MAX BREAK}}$	in W	peak load brake chopper

Brake Chopper selected from table 4.2 (refer to technical data)

Brake chopper BC2.1-33/11 Art.-No. 12262-0F00

Chopper voltage 750V

Permanent Load:

$$P_{\text{BREAK RMS}} = 5,6 < 11 \text{ kW} \quad \text{OK}$$

Peak Load:

$$P_{\text{MAX BREAK}} = 25,1 < 33 \text{ kW} \quad \text{OK}$$

Brake Resistor:

$$R = 22,4 > 16 \Omega \quad \text{OK}$$

Chopper BC 2.1 - BC 4.1

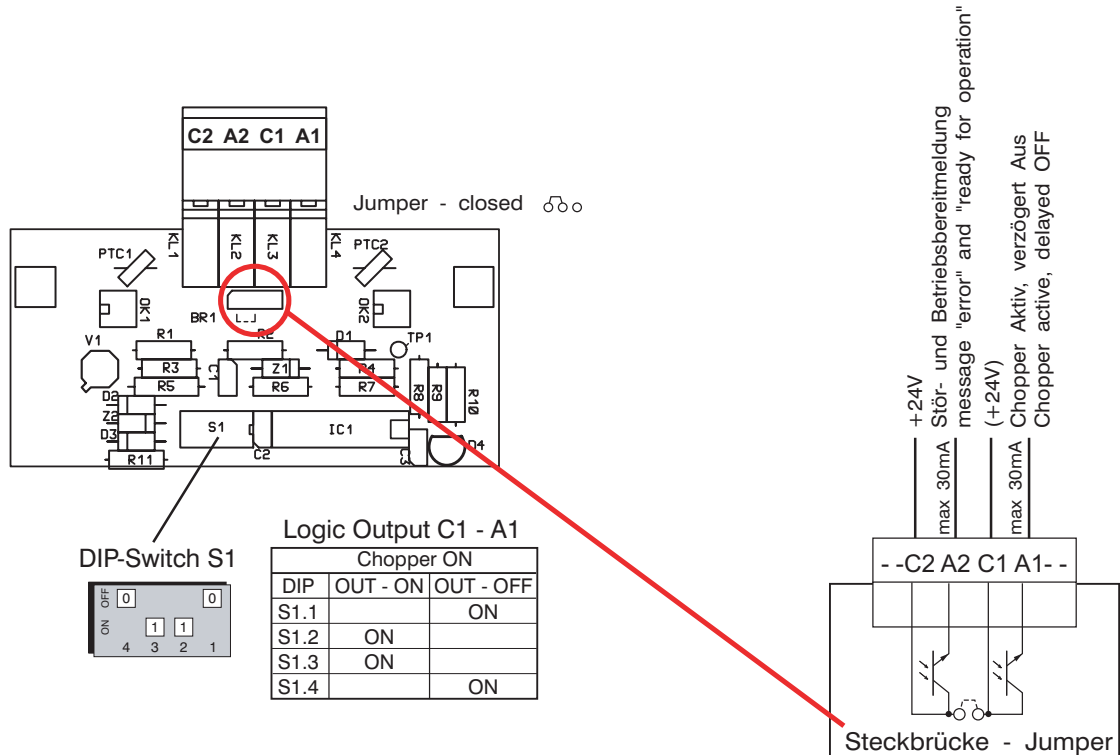
12. Connection diagram option, ready for operation and chopper active

C2/A2 Stör- und Betriebsbereitmeldung

C1/A1 Chopper Aktiv, verzögert Aus

C2/A2 message "error" and "ready for operation"

C1/A1 Chopper active, delayed OFF



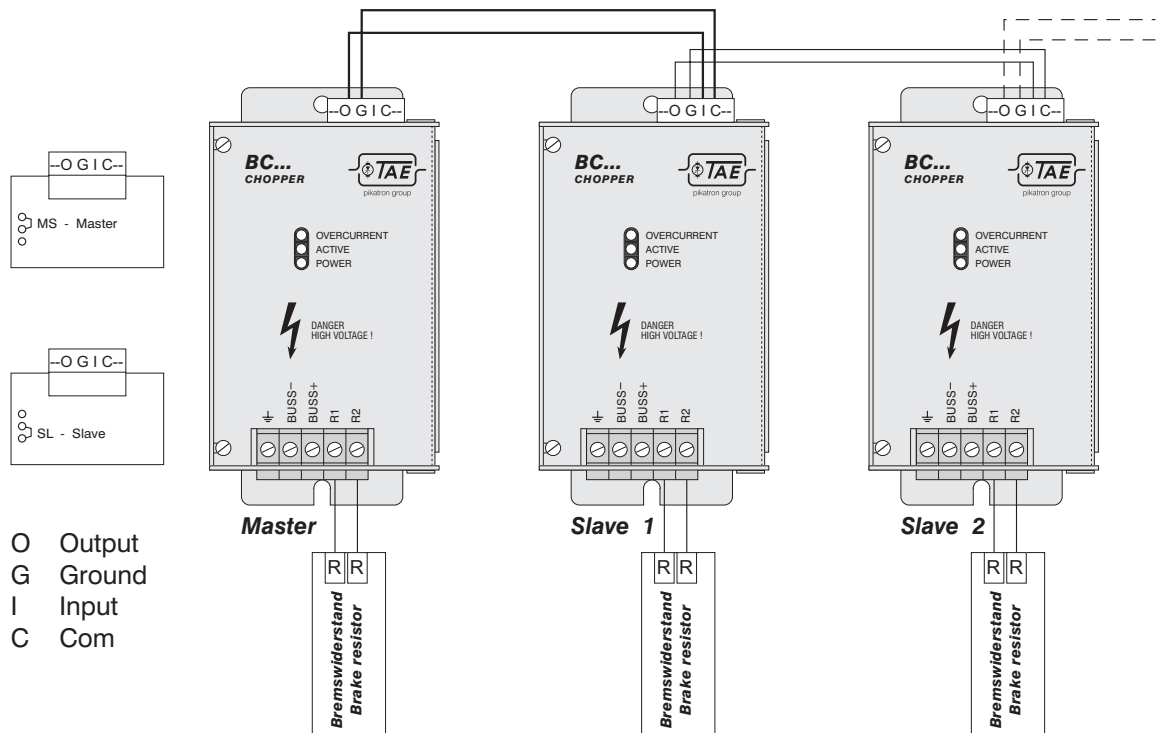
Chopper BC 2.1 - BC 4.1

13. Connection diagram option Master - Slave



Achtung !!! Anschlüsse O,G,I,C führen 400VDC nach Erde!
Caution !!! Connection O,G,I,C lead 400VDC to ground!

Anschluss Variante 1: Master - Slave (in Reihe) - Connection version 1: Master - Slave (in series)



Anschluss Variante 2: Master - Slave (Parallel) - Connection version 2: Master - Slave (parallel)
(max 5 Slaves Parallel)

