COMBITRON PROGRAM SCHEDULE

COMBITRON are supply and actuator modules for the electromagnet clutches and brakes. As power supply for DC- or AC-side switching different single-wave and bridge rectifiers as well as rapid switchgear of the series COMBITRON are available.

The rectifiers correspond to the low voltage regulation 73/231/EWG of the European Union.

COMBITRON	**RECTIFIERS AND SWITCHES**		
Half-wave and bridge rectifiers from	0 ... 720 V AC	page 44	**COMBITRON 91**
Electronic rapid switch up to	50 W	page 46	**COMBITRON 94**
Rapid-switching rectifier (for COMBISTOP)		page 47	**COMBITRON 98**

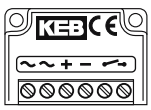
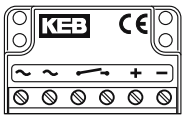
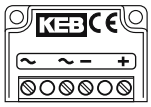
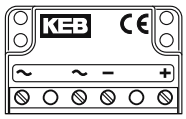
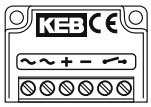
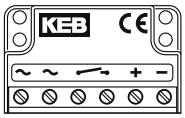
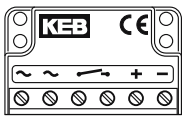
TECHNICAL DATA

Switching mode (AC- / DC-side switching)	Seite 48

COMBITRON 91 are rectifiers for power supply of brakes and clutches. AC voltage supply max 720 V AC for AC or DC side switching conform to the low voltage regulation 72/231 EWG of the European Union.

Harmful electromagnetic interferences arise at the switching of electromagnetic clutches and brakes and other inductive DC consumers.
The half-wave rectifier 0291010-CEMV limits these interferences to class A according to EN 55011.

All other rectifiers are not equipped with measurements to suppress radio interference. This has to be taken into consideration for the planning of the interference suppression of the plant or the machine. The user is responsible for meeting the EU machine directive.

U_{in} / Switching / U_{vmax}	275 V AC +0% AC/DC 450 V	500 V AC +0% AC/DC 900 V	600 V AC +0% AC 1000 V	720 V AC +0% AC 1600 V
Half wave [4] $U_{out} = 0,45*U_{in}$ I_N (45 °C) = 1,0A I_N (80 °C) = 0,5A	0291010-CE07 [2] 	0491010-CE07 [3] 	0591010-CE09 [2] 	0691010-CE09 [3] 
Fullwave [4] $U_{out} = 0,9*U_{in}$ I_N (45 °C) = 2,0A I_N (80 °C) = 1,0A	0291020-CE07 [2] 	0491020-CE07 [3] 		
Half wave with EMC protection [1] $U_{out} = 0,45*U_{in}$ I_N (45 °C) = 1,0A I_N (80 °C) = 0,5A	0291010-CEMV [3] 			

[1] *with internal interference suppression according to EN 55011/ class A*
[2] *picture 1* [3] *picture 2*
[4] *different values (U, A) when used under UL conditions*

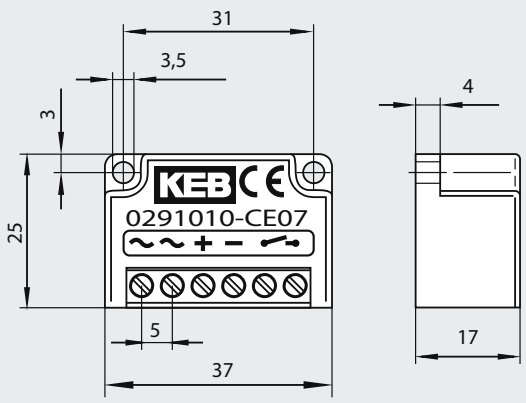
U_{in}	maximum input voltage
U_{vmax}	maximum cut-off voltage
U_{out}	Output DC voltage
AC	AC switching
DC	DC-side switching
I_N (45 °C)	Rated output current at the temperature

CHARACTERISTICS

- UL - certification (No.: E.308765)
- compact design in a plastic housing
- possible installation into the motor terminal box
- protection against voltage peaks of the switching contacts
- maximal ambient temperature 80 °C

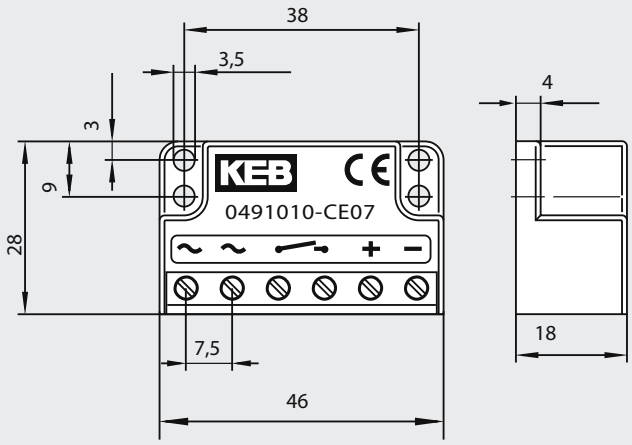
Nominal voltage magnet	Coil voltage tolerance U_2 (U_{out})	AC voltage supply U_1 (U_{in})	Type of rectifier	
24 V DC				
105 V DC	93 - 118	230 V AC	half wave rectifier	(0291010-CE07)
205 V DC	182 - 230	230 V AC	full wave rectifier	(0291020-CE07)
180 V DC	162 - 198	400 V AC	half wave rectifier	(0491010-CE07)

picture 1



Terminal cross section 1,5 mm²

picture 2



Terminal cross section 2,5 mm²

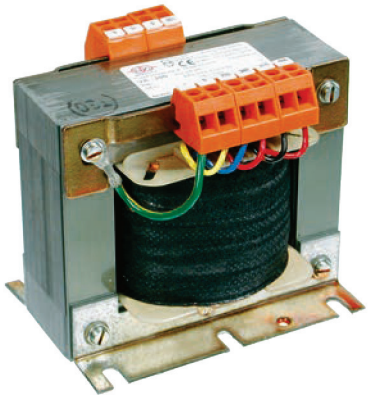
COMBITRON 94

COMBITRON 94 for the power supply / actuator of two consumers. The output current control ensures a constant magnetic flux and permits short-time overexcitations for shorter switching processes, i.e. improved repeat accuracy.

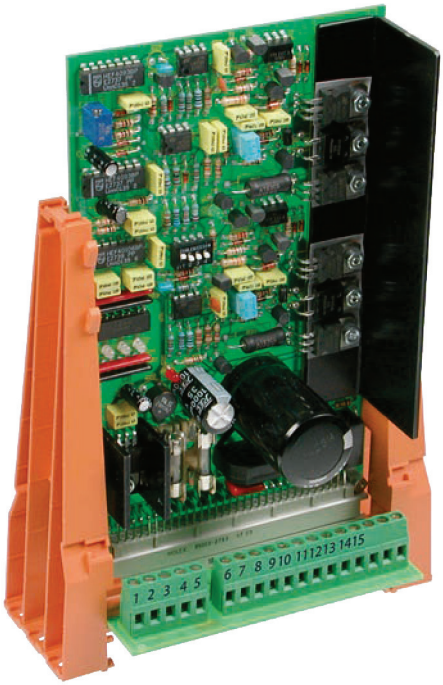
The main field of application is the interconnection of clutch-brake-combinations COMBIBOX and is used whenever high switching frequencies and positioning accuracy are demanded. The primary feature is the current regulation of 24 V DC supply of electromagnets.

FEATURES

- circuit board is supplied inclusive holder and slide-in device
- connection according to DIN 41612
- Vadjustment of the deceleration time by potentiometer from 0 . . . 1 second
- power supply of the circuit board via separate transformer
  input voltage: 230/400/460 V AC
- power range 15 . . . 50 W
- digital inputs
- relay output

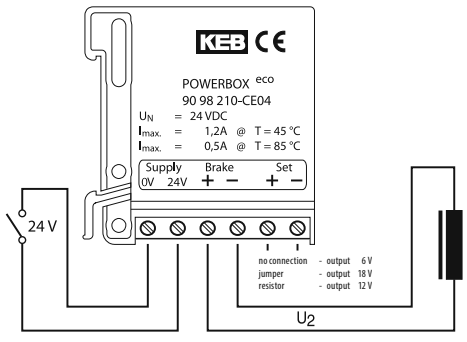
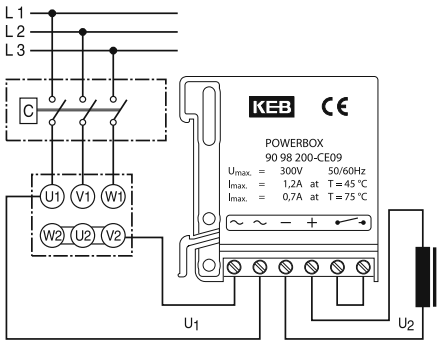


Transformer 0094006-0100

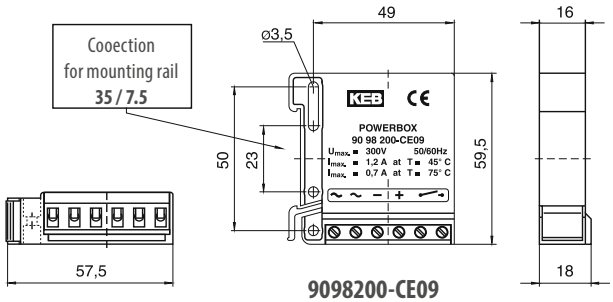


Switcher 0094006-0004

COMBITRON 98 rapid-switching rectifiers with overexcitation for optimal turn-on and turn-off times of spring-applied brakes and electromagnets. Two Powerbox versions with similiar rigit housing to fit on DIN rail or bolt on version.
COMBITRON 9098200-CE09 UL - certification (No.: E.308765)

	9098210-CE04	9098200-CE09 [1]
Input voltage	24 V DC ±20 %	180-300 V AC ±0 %
Overexcitation time	800 ms ±15 %	350 ms ±10 %
Cable length	max. 10 m to brake coil	max. 100 m to brake coil
Current I_N 45 °C	1,2 A continous 7 A for 800 ms	1,2 A continous 2,4 A for 350 ms
Current I_N 75 °C	0,6 A continous 3,5 A for 800 ms	0,7 A continous 1,4 A for 350 ms
Temperature	CCV -40° ... 75°	CCV -40° ... 75°
Switching rate	max. 6 per minute at max current	max 1 per minute at max current
Side altitude above sea level	> 1.000 m - 1 % current reduction/100 m	> 1.000 m - 1 % current reduction/100 m
Wiring diagrams		

[1] *different values (U, A) when used under conditions of UL*



9098200-CE09
9098210-CE04

All dimensions in mm

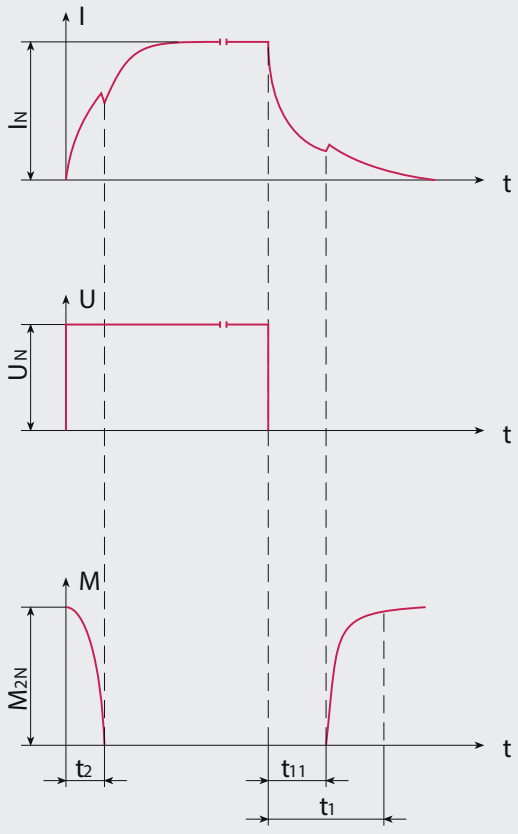
AC-SIDE SWITCHING

When switching before the rectifier on the AC-side the magnetic field decays slowly. At this mode of switching the tripping delay is quite long. The AC-side switching requires no protective measurements for the coil and the switching contacts. On disconnection the rectifier diodes act as free-wheeling diodes.

The switching times t_{11} for AC-side switching increase when the rectifier is connected directly in the motor terminal box **(2)**. When the motor slows down a generatoric voltage is applied to the motor terminals. The wiring **(2 and 3)** is not permitted for frequency inverter operation.

For line lenghts of more than 10 m between rectifier and brake at AC-side switching the regulations prescribe the use of a separate switch (1). In this case the supply voltage may not be tapped behind the motor contactor **(2)**. If it is not possible to install an additional switch the use of special rectifiers becomes necessary.

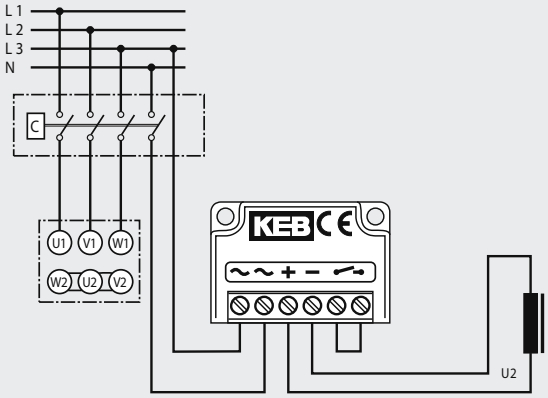
CURRENT-TIME-/VOLTAGE-TIME-/ TORQUE-TIME-DIAGRAM



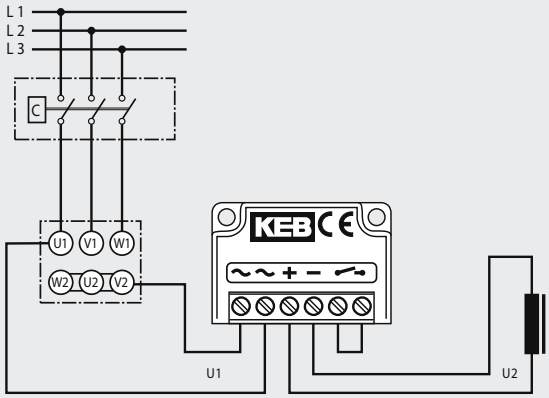
t1 = Engagement time
t11 = Engagement delay time
t2 = Release time

WIRING DIAGRAM

(1)



(2)



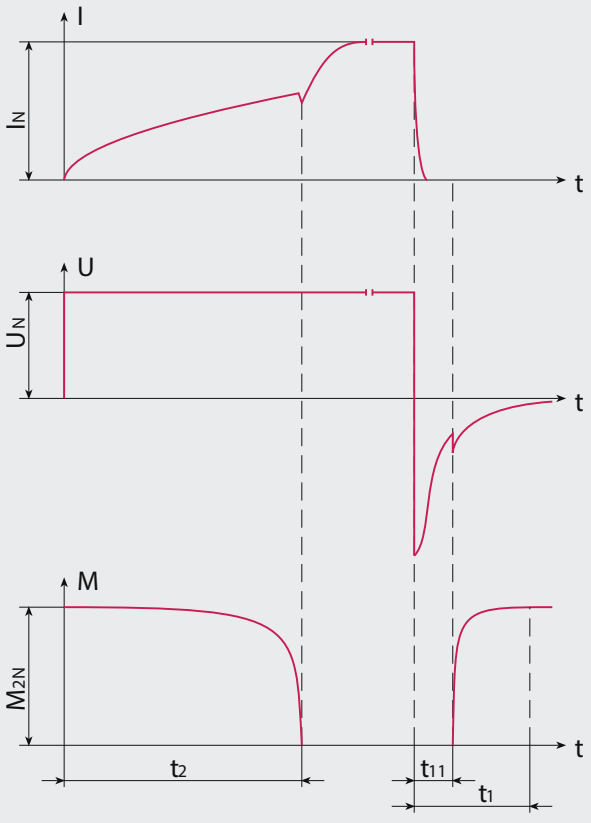
DC-SIDE SWITCHING

The switching is done between the rectifier and the magnet. At his mode of switching the tripping delay is short, since the energy of the magnetic field is absorbed by the rectifier. The voltage peaks that occur at switching are limited to a harmless level for the rectifier.

The maximal permissible switching frequency for the DC-side switching of rectifiers depends on the energy content of the magnet for COMBISTOP. Higher switching frequencies are achieved by the external connection of a varistor in parallel to the brake or to the terminals + and - DC of the rectifier.

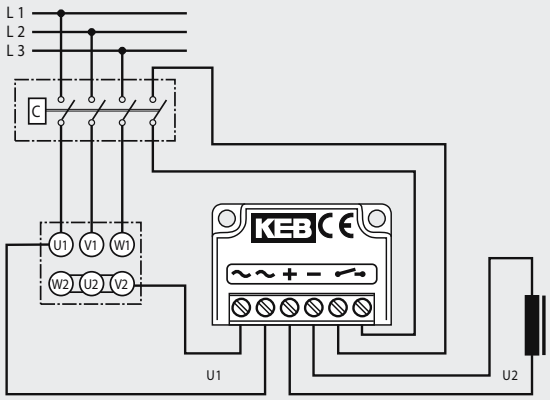
Rectifier	KEB-article	varistor
0291	0090045-2753	S20K275
0491	0090045-6251	S20K625
0591	0090045-6251	S20K625

CURRENT-TIME-/VOLTAGE-TIME-/ TORQUE-TIME- DIAGRAM

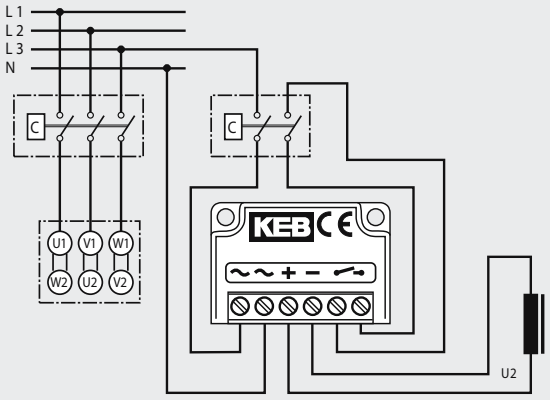


WIRING DIAGRAM

(3)



(4)



The simultaneous AC and DC-side switching, shown in example 4 guarantees short disconnecting times and reduces the contact erosion.

DIMENSIONING / CALCULATIONS

Decisive for the dimensioning of the clutches and brakes are the required torque, thermal load, braking time and service life.

RATED TORQUE T_{2N}

To ensure that brakes and clutches work safely even under extreme conditions, the required torque must be multiplied by a safety factor. The selection of the safety factor depends essentially on the application.
The dynamic torque of a single-disc brake may be substantially lower than the rated torque.

$$T_{2N} = T_{erf} \cdot K \qquad K \geq 2 \qquad T_{erf} = \text{required torque [Nm]}$$

REQUIRED TORQUE T_{erf}

The required torque very often is a mixture of dynamic and static load. When choosing the sign take into account whether the load torque supports or counteracts the deceleration.

$$T_{erf} = T_A \pm T_L$$
$$T_A = J \cdot \alpha$$

ROUGH DEFINITION OF THE REQUIRED BRAKING TORQUE

If the mass moment of inertia is unknown and the driving power is fixed then the required braking torque is calculated as follows:

$$T_{erf} = 9550 \cdot \frac{P}{n}$$

THERMAL LOAD

The dimensioning solely on the basis of the required braking torque is permissible only in very few cases. When decelerating the load and the mass moment of inertia is reduced to the brake shaft, the kinetic energy is converted into heat (friction work of the brake). The permissible friction work in dependence on the switching frequency may not be exceeded.
Please note that the maximal permissible friction work is valid only up to the corresponding speed. In case of emergency stop from maximum speed the maximal permissible friction work lies considerably below the values specified in the graphic.

$$W_R = \frac{J \cdot n^2}{182{,}5} \cdot \frac{T_{2N}}{T_{2N} \pm T_L} \qquad WR \leq WR_{max}$$

SLIP TIME t_3 [MS]

The time from the beginning of the torque rise until attaining the moment of synchronization.

$$t_3 = 104{,}6 \cdot \frac{J \cdot \Delta n}{T_{2N} \pm T_L} + t_{11}$$

SERVICE LIFE

The service life depends to a large extent on the peak temperature at braking, which is dependent on the speed, the deceleration time and the current brake torque.
For that reason it is not possible to make universally valid statements with regard to the service life that apply to all operating conditions. Statements to the individual case can be made only when all operating conditions are known. At no time should the friction lining thickness (COMBISTOP) be less than g_{min}.

$$L_N = \frac{(X_n - X) \cdot W_{R0,1}}{0{,}1 \cdot W_R}$$

ACCELARATION- / DECELERATION TIME

$$t = \frac{J \cdot \omega}{T_{2N} \pm T_L} + t_1$$

LEGEND

J	= moment of inertia [1]	[kgm²]
K	= safety factor (K ≥2)	[-]
L_n	= service life untill readjustment [2]	[-]
T_a	= dynamic braking torque	[Nm]
T_{erf}	= required torque	[Nm]
T_L	= load torque [3]	[Nm]
T_{2N}	= static rated torque [4]	[Nm]
P_R	= friction work	[J/s]
P_{20}	= power input at 20 °C	[W]
t	= acceleration / deceleration time	
t_1	= switch on time	[ms]
W_R	= friction	[J]
$W_{R0,1}$	= friction work up to 0,1 mm wear	[J]
S	= cycles per second	[s^{-1}]
ω	= angular frequency	[s^{-1}]
X	= rated air gap	[mm]
X_n	= clearance at which an adjustment is recommended	[mm]

DEVIATIONS COMBIBOX

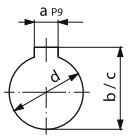
1) Sum of the moment of inertia reduced to the speed of the COMBIBOX plus the moment of inertia of the COMBIBOX parts to be accelerated or decelerated.

2) Number of switchings until readjustment. For type 06 and 10 the friction T_R of the clutch as well as the friction T_R of the brake are to be considered.

3) For the selection of the sign take notice of whether the load torque supports or counteracts the acceleration or deceleration.

4) The rated torques listed in the tables are safely attained after a run-in phase at 100 rpm. In new condition and for substantially higher speeds the torques are possibly lower.

SIZE					ROTOR																				ARMATURE										
					12	11	10	09	08	07	06	05	03	02	01	with bearing 01	02	03	05	06	07	08	09	10	11	12	12	11	10	09	08	07	06	05	03	02	01
d		a^{P9}	b	c	Minimum bore (without keyway)											Minimum bore without keyway											Minimum bore without keyway										
					29	24	16	14	11	9	7	6	-	-	-	-	-	-	-	7	9	11	14	16	24	29	29	24	16	14	11	9	7	7	-	-	-
5																																					⑤
6			7												⑥	⑥	⑥																			⑥
7	H8	2	8																																		
8			9										⑧	⑧				⑧	⑧																⑧	⑧	
9		3	10,4																																		
10			11,4								⑩	⑩	⑩					⑩	⑩														⑩	⑩	10		
11		4	12,8																																		
12			13,8								⑫	⑫							⑫	⑫													⑫	⑫			
14			16,3	15,2																	⑭										⑭	⑭				
15		5	17,3	16,2						⑮	⑮	⑮							⑮	⑮	⑮										⑮	⑮	⑮			
17			19,3	18,2						⑰	⑰									⑰	⑰											⑰				
18			20,8	19,6																																	
19		6	21,8	20,6																	⑲	⑲															
20			22,8	21,6					⑳	⑳	⑳										⑳	⑳	⑳							⑳	⑳	⑳					
22			24,8	23,6																																	
24			27,3	26,0																		㉔															
25		8	28,3	27,0				㉕	㉕	㉕												㉕	㉕	㉕						㉕	㉕						
28			31,3	30,0																			㉘							㉘							
30			33,3	32,0			㉚	㉚	㉚													㉚	㉚	㉚				㉚	㉚	㉚							
32			35,3	34,4																																	
35	H7	10	38,3	37,4		㉟	㉟	㉟															㉟	㉟	㉟			㉟	㉟								
38			41,3	40,4		㊳																															
40		12	43,3	42,2		㊵	㊵																㊵	㊵			㊵	㊵								
42			45,3	44,2																																	
45			48,8	47,1		㊺	㊺																㊺	㊺			㊺	㊺								
48		14	51,8	50,1																																	
50			53,8	52,1	㊿	㊿	㊿																㊿	㊿	㊿	㊿	㊿	㊿								
55		16	59,3	57,4		㊺																	㊺	㊺	㊺											
60		18	64,4	62,3	㊿	㊿																	㊿	㊿	㊿	㊿	㊿	㊿								
65			69,4	67,3	㊺	㊺																	㊺			㊺										
70		20	74,9	72,7	70																					70										
75			79,9	77,7																																	
80		22	85,4	83,1	㊽																																
85			90,4	88,1																																	
90		25	95,4	92,9																																	



d Bore
a^{P9} Keyway with DIN 6885
b Depth over standard keyway DIN 6885/1
c Depth over reduced keyway DIN 6885/3

available bore „d“ with standard keyway DIN 6885/1

available bore „d“ with reduced keyway DIN 6885/3

○ Preferred bore sizes / standard

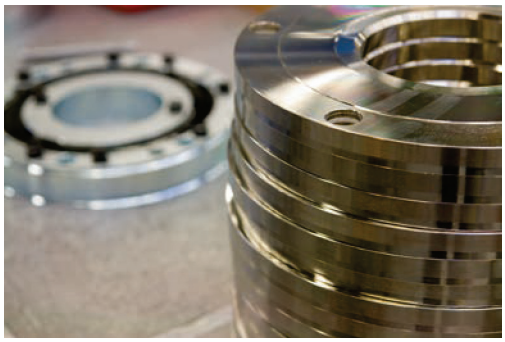
All dimensions in mm

KEB SERVICE

PERFORMANCE AND COMPETENCE

AFTER-SALES CUSTOMER SUPPORT

- start-up support
- EMC service
- mains analysis
- Insulation, heat or vibration measurements
- conversion of old product series



MAINTENANCE AND REPAIRS

- rush or standard service

COMPONENT AND SPACE PART SUPPLY

- used and new parts for the exchange

PREVENTIVE MAINTENANCE

- forming and cleaning, inspection, functional analysis

CUSTOMER SPECIFIC SERVICE

- individual service support
- system optimisation

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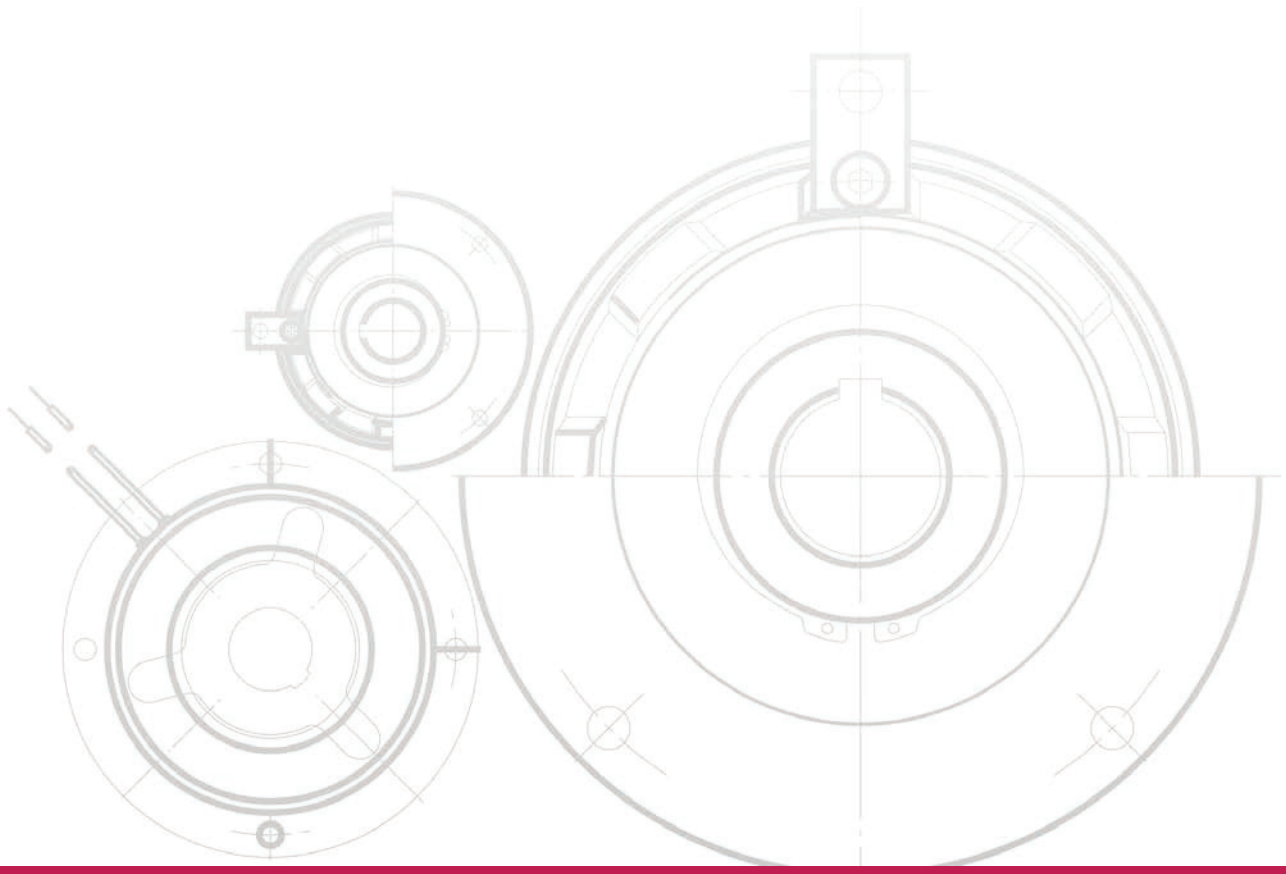

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