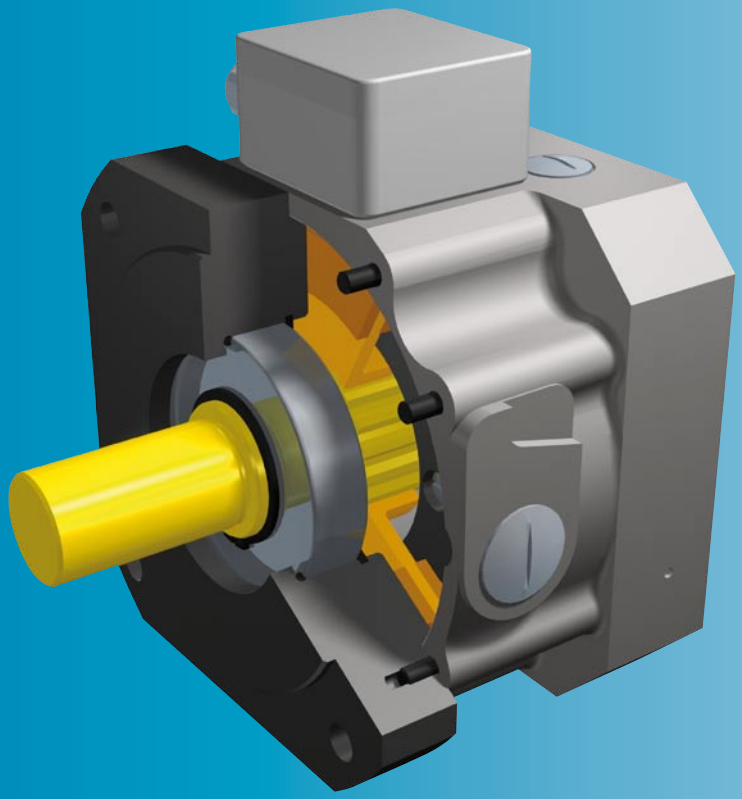
ROBA®-topstop®

Brake systems for gravity loaded axes



ROBA-stop®
The best choice for safe brakes

- ***Reliable protection in all operating modes***
- ***Maximum safety due to redundant systems and integrated function monitoring***
- ***Easy way to retrofit existing axes***

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mayr®
your reliable partner

Safe brake systems for gravity loaded axes

mayr® ROBA-stop® brakes prevent unintentional vertical axes drops or crashes!

- ❒ **Reliable safety protecting people in all operating modes**
- ❒ **Maximum safety via redundancy and diversity is achieved when using two different brake systems**
- ❒ **Controlled operational safety due to an integrated brake function monitoring system**
- ❒ **Minimal braking distances due to short reaction times and high brake performance density**
- ❒ **Optimum adaptation for individual axes construction due to different brake concepts**
- ❒ **Economic and problem-free to retrofit pre-existing axes**

Additional measures are required to minimise the potential risk of a falling load on vertical axes in areas where personnel might be endangered. These measures have been demanded by the Technical Committee for Mechanical Engineering, Production Systems and Steel Construction in their Information sheet "gravity loaded axes". *mayr*® power transmission has developed various new brake systems which guard against all critical danger situations which can occur during operation of vertical axes.

The operation of vertical axes represents a particular problem. Switching off the drive energy due to an error in the machine control or a power failure can lead to an axis crash. Unpredictable mechanical wear as a result of the design, due for example to EMERGENCY STOP brakings or to contamination of the friction linings caused by oil, drastically reduce the braking torque. Often, motor-integrated brakes are equipped with insufficient braking torque reserves.

The possibility of brake failure can therefore not be excluded. On linear motors, braking in EMERGENCY STOP situations or in the event of power failure is not possible, as no brake is integrated. In order to avoid critical situations, further measures must be taken to minimise any risks.

Dependent on the risk analysis with the risk parameters "Severity of injury", "Frequency and/or time duration of exposure to danger" and "Possibility of danger prevention or damage limitation", different demands result on the selection of the safety components for protecting the machine operator during dangerous movement of the machine.

In DIN EN ISO 13849 "Machine safety" the respective solution approaches are specified via descriptions of the system structure (category) and the additional demands on reliability parameters (DC, CCF...) . The safety-related quality of the SPR/CS (safety-related control components) is indicated as the Performance Level (PL).

For this reason, *mayr*® power transmission has developed different new brake systems, which increase the safety-related quality as part of the SPR/CS.

The safety brake product range
ROBA®-topstop®,
ROBA®-alphastop®,
ROBA®-pinionstop,
ROBA®-linearstop and
ROBA-stop®-M fulfils the requirements for a safe holding and braking system and minimises the endangerment of people and machines. These brakes are used both as secure single brakes and in combination with a second brake as two-channel or redundant systems for protection against high risks.
Maximum safety via redundancy and diversity is achieved when using two different brake systems.

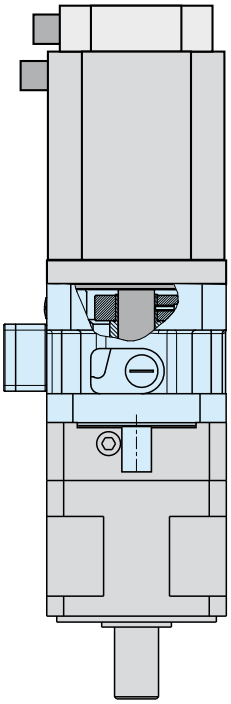
Please Observe:

According to German notation, decimal points in this catalogue are represented with a comma (e.g. 0,5 instead of 0.5).

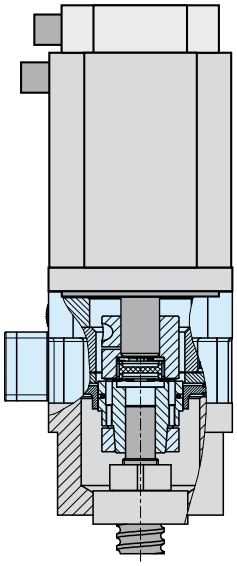
ROBA®-topstop®
Modular safety brake system for a mounted servo motor on the A-bearing side

Characteristics and advantages

- ❒ The leading system on the market for vertical axes with rotatory drives
- ❒ The axis is held safely in any position, even with a dismantled servomotor, e.g. during machine maintenance
- ❒ Safe braking on EMERGENCY STOP and power failure
- ❒ Long lifetime even after frequent EMERGENCY STOP brakings
- ❒ Highest reliability due to decades of experience and a *mayr*® construction which has been tried and tested millions of times
- ❒ Indication of the operating condition (released/ braked) via an integrated switch
- ❒ Short, compact design
- ❒ Low weight
- ❒ Low self-induced heat production even at 100 % duty cycle



ROBA®-topstop® with output shaft for direct mounting onto a gearbox with a hollow shaft.



Brake system with integrated, plug-in shaft coupling. Separate coupling and coupling housing are no longer necessary. Very short design.

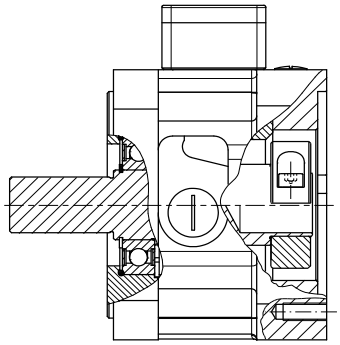
Brake designs:

- ❒ Single circuit brake with a bearing-supported output shaft: i.e. suitable for toothed belt drives
- ❒ Single circuit brake with an integrated plug-in shaft coupling
- ❒ Single circuit brake with a shaft coupling and an installed EAS®-smartic® safety clutch
- ❒ Redundant dual circuit brake system with a bearing-supported output shaft
- ❒ Basic brake module for special brake configurations

Due to their adaptable flange dimensions, ROBA®-topstop® safety brakes can easily be integrated into pre-existing constructions between the servomotor and the counterflange. If necessary, the design can be easily adapted to any installation situation by changing the standard flange.
Three standard sizes for braking torques of 12 to 400 Nm are available for delivery at short notice.

Structural Shapes

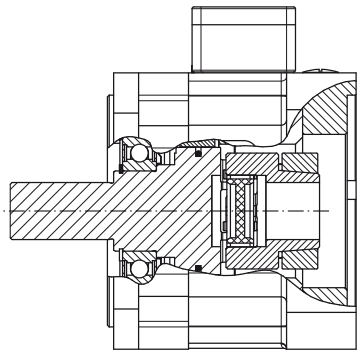
ROBA®-topstop® with shaft design



Type 899.000.0_
Single circuit brake with bearing-supported clamping hub shaft

Type 899.000.0_

This brake type can be integrated into existing drives without any additional constructive work, or can be retrofitted. The output-side brake flange connection dimensions and the shaft dimensions equal the servomotor connection dimensions.
A bore positioned above the terminal box allows access to the clamping screw on the motor-side clamping hub construction. Radial forces can be absorbed by the ball bearing brake shaft, so that mounting belt pulleys and therefore operation in belt pulley drive systems is easily possible.



Type 899.002._ _
Single circuit brake with integrated shaft coupling

Type 899.002._ _

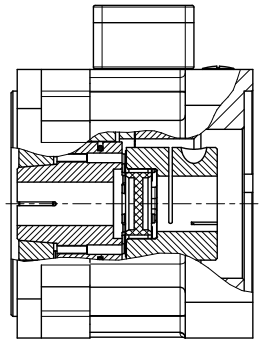
On the ROBA®-topstop® single circuit brake with bearing-supported output shaft and integrated, plug-in ROBA®-ES shaft coupling, the servomotor can be mounted or dismantled in any shaft position. The shaft coupling compensates for shaft misalignment. To install this Type, a second bearing machine-side is necessary.

Application Example

Due to its adapted flange dimensions, it was possible to integrate the ROBA®-topstop® with a minimum of effort into the pre-existing Z-axis of a handling system (see photo) between the servomotor and gearbox, thereby ensuring increased safety.
Often, the integrated permanent magnet brakes integrated into servomotors are unable to provide sufficient safety. Wear or lubrication can mean that the nominal holding torque on the brakes falls below the permitted level. In EMERGENCY STOP situations, the brakes must take on very high friction work. High operating temperatures – not unusual in servomotors – can also lead to brake malfunctions or can reduce the braking torque.
ROBA®-topstop® safety brakes protect against all critical danger situations which can occur during operation of vertical axes. They guarantee full security, even when the servomotor is dismantled e.g. during maintenance work.

Structural Shapes

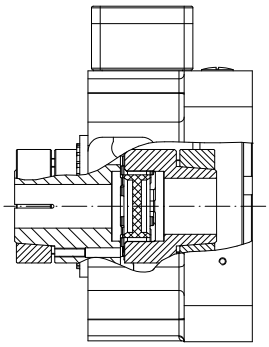
ROBA®-topstop® with plug-in coupling for mounting directly onto ball screw spindles



Type 899.01_._ _
Single circuit brake (with standard output flange)

Types 899.011._ _ and 899.012._ _

The brake Types 899.01_._ _ are specially conceived for direct mounting onto ball screw spindles. A backlash-free, plug-in ROBA®-ES Type series shaft coupling is integrated into the brake housing to compensate for axial, radial and angular shaft misalignment. This makes separate coupling housing and shaft couplings unnecessary.
The coupling hub to be mounted motor-side is offered in standard design as a ROBA®-ES clamping hub and as a ROBA®-ES shrink disk hub. The output-side coupling hub is connected securely to the spindle shaft via a shrink disk-clamping connection.
The short brake construction length requires very little more space than the usual clutch housing designs (see Fig. below). For safety reasons, the braking torque is transferred directly via the shrink disk-clamping connection onto the spindle instead of via the coupling.

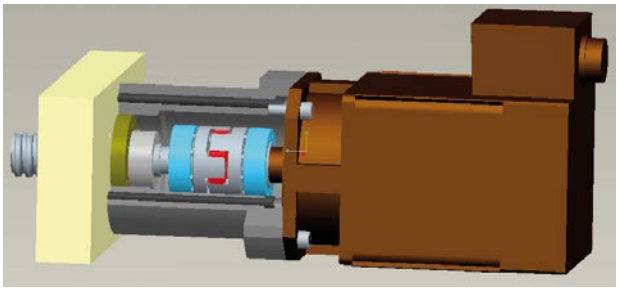


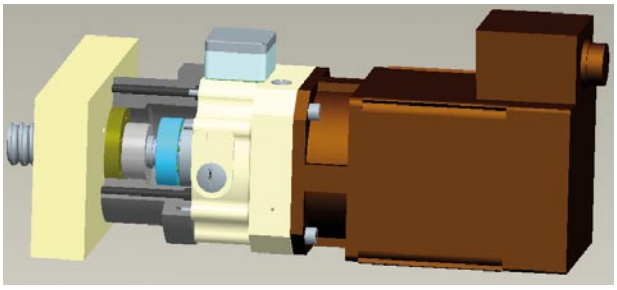
Type 899.1_ _._ _
Single circuit brake module (without output flange)

Type 899.3_ _._ _
Single circuit module (with special output flange)
Example on page 13

Types 899.11_._ _ and 899.31_._ _

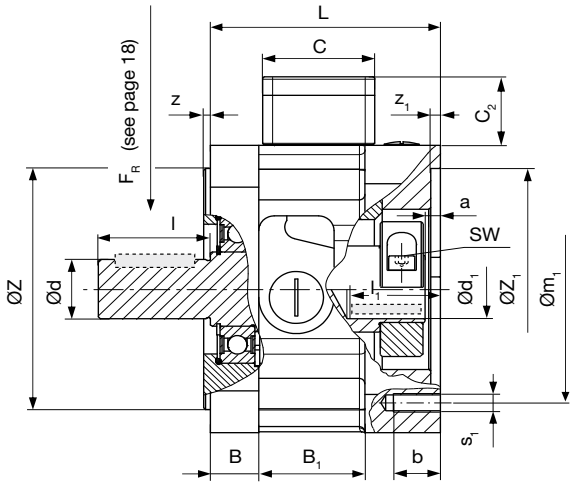
The brake module Type series 899.1_ _._ _ and the brake Type 899.3_ _._ _ were conceived for specific customer-tailored mounting situations.
Depending on the individual mounting conditions, these brakes can be mounted directly onto a pre-existing friction flange (Type 899.11_._ _) or can be delivered with a mounting flange specially adapted for the application (Type 899.31_._ _). On Type 899.11_._ _, the friction flange is not included in standard delivery.
On Type 899.31_._ _, the special mounting flange is included in delivery. The brake module can be equipped with the standard clamping hub shaft and ROBA®-ES shaft couplings or with special coupling constructions which can be optimally adapted for individual mounting conditions.





Upper Illustration: a typical servomotor attachment with a shaft coupling on an axis with a ball screw drive. The coupling housing ensures the necessary distance between machine and servomotor.

Lower Illustration: the same design; but this time with an additional brake. The ROBA®-topstop® single circuit brake with integrated ROBA®-ES shaft coupling is especially conceived for mounting on a ball screw spindle. The coupling housing is much shorter, meaning that the total construction increases only minimally in length. The shaft coupling becomes a brake component.
The brake function also maintains its effect if the servo-motor is dismantled. The axis dynamic remains, because the total mass moments of inertia increase minimally on this integrated construction. The coupling housing can be ordered as part of the delivery Type 899.31_._ _ and produced according to the customer's request, or just the brake module can be delivered Type 899.11_._ _.



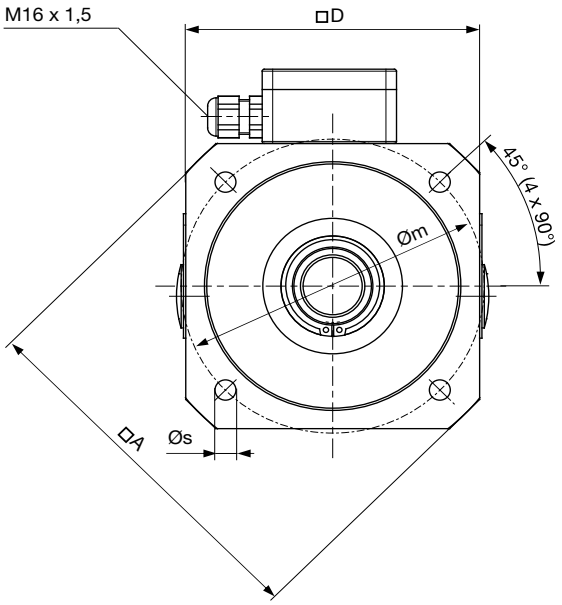


Fig. 1 Type 899.000.0_
Single circuit brake with bearing-supported clamping hub shaft
Optional keyway design possible.

Technical Data				Size				
				120	150	175	200	260
Braking torque [1]	Type 899.000.01	M_{nom} [1]	[Nm]	12	45	70	100	200
		Braking torque tolerance -20 % / +40 %	[Nm]	-2,4 / +4,8	-9 / +18	-14 / +28	-20 / +40	-40 / +80
	Type 899.000.02 [4]	M_{max} [1]	[Nm]	30	90	120	160	400
		Braking torque tolerance -20 % / +40 %	[Nm]	-6 / +12	-18 / +36	-24 / +48	-32 / +64	-80 / +160
Input power	Type 899.000.01	P_{20}	[W]	31,5	44	50	60	86
	Type 899.000.02	A [2]	[W]	102	128	128	148	200
		B [3]	[W]	26	32	32	38	50
Max. speed	Type 899.000.0_	n_{max}	[rpm]	5000	4000	4000	3000	3000
Mass	Type 899.000.0_	m	[kg]	7,5	13	20	24	60
Mass moment of inertia Rotor + Hub with d_{max}	Type 899.000.0_	J_{R+N}	[10^{-4} kgm²]	6,5	16	43	52	250

Dimensions	Size				
	120	150	175	200	260
A	160	190	232	246	345
a	5	6,5	10	10	10
B	20	25	20	20	25
B_1	52	55	90	71	92
b	20	24	25	28	30
C	58	58	58	58	75
C_2	37	37	37	37	56
D	126	155	176	194	264
L	104	119	138,5	138,5	185
Shaft Ø d_{k6} x l	19 x 40	24 x 50	35 x 79	32 x 58	48 x 82
	24 x 50	32 x 58	-	38 x 80	42 x 110
	-	-	-	-	48 x 110
(Shaft) bore [5] Ø d_1 F7 x l_1	19 x 55	24 x 68	35 x 90	32 x 90	42 x 110
	24 x 55	32 x 68	-	38 x 90	48 x 110
m	130	165	200	215	300
m_1	130 (115*)	165	200	215	300
s	9	11	13,5	13,5	18
s_1	4 x M8	4 x M10	4 x M12	4 x M12	4 x M16
SW	5	6	8	8	10
Z_{j6}	110	130	114,3	180	250
	95	110	-	130	-
Z_1 F8	110	130	114,3	180	250
	95	110	-	130	-
z	3	3,5	3,5	4	5
z_1	5	5	10	6	10

Correlation of bore diameter d_1, dependent on respective transmittable torques (without key)

		Preferred bore	Size				
		d_1	120	150	175	200	260
Frictionally-locking transmittable torques (**Clamping hub** motor-side)	T_R [Nm]	Ø 19	64	-	-	-	-
		Ø 24	81	150	-	-	-
		Ø 32	-	199	-	199	-
		Ø 35	-	-	215	-	-
		Ø 38	-	-	-	237	-
		Ø 42	-	-	-	-	680
Suitable for F7 / k6		Ø 48	-	-	-	-	840

Table 1

The transmittable torques for the clamping connection allow for the max. tolerance backlash on a solid shaft: tolerance k6 / bore (d_1): tolerance F7. If the tolerance backlash is larger, the torque decreases.

1) Braking torque tolerance: -20 % / +40 %
2) Coil capacity on overexcitation
3) Coil capacity for holding voltage
4) Max. braking torque only with overexcitation (see pages 19, 22, 23 and 24)
5) The transmittable torques in bore d_1 are dependent on the diameter, see Table 1, page 6.
*) Optionally available with pitch circle m_1 = 115

We reserve the right to make dimensional and constructional alterations.

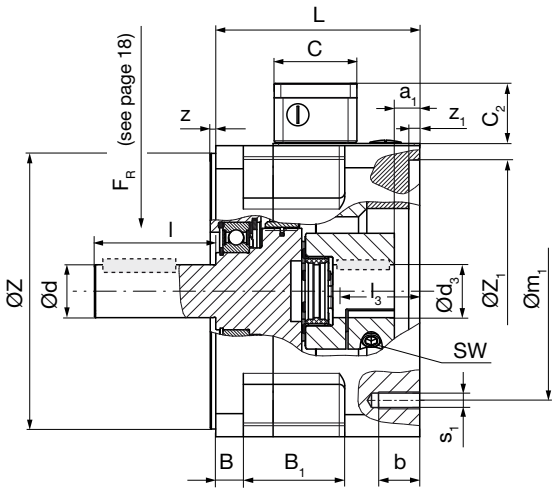


Fig. 2 Type 899.001._ _
Single circuit brake with bearing-supported output shaft and with plug-in shaft coupling (clamping hub motor-side)
Optional keyway design possible.

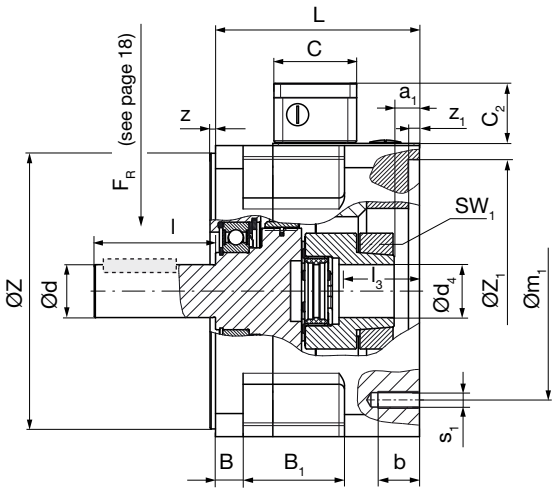


Fig. 3 Type 899.002._ _
Single circuit brake with bearing-supported output shaft and with plug-in shaft coupling (shrink disk hub motor-side)
Optional keyway design possible.

Technical Data				Size				
				120	150	175	200	260
Braking torque [1]	Type 899.00_._1	M_{nom} [1]	[Nm]	12	45	70	100	200
		Braking torque tolerance -20 % / +40 %	[Nm]	-2,4 / +4,8	-9 / +18	-14 / +28	-20 / +40	-40 / +80
	Type 899.00_._2 [4]	M_{max} [1]	[Nm]	30	90	120	160	400
		Braking torque tolerance -20 % / +40 %	[Nm]	-6 / +12	-18 / +36	-24 / +48	-32 / +64	-80 / +160
Input power	Type 899.00_._1	P_{20}	[W]	31,5	44	50	60	86
	Type 899.00_._2	A [2]	[W]	102	125	128	148	200
		B [3]	[W]	26	32	32	38	50
Max. speed	Type 899.00_._ _	n_{max}	[rpm]	5000	4000	4000	3000	3000
Size of flexible coupling [5] (ROBA®-ES)			[-]	24	28	38	38	48
Nominal and maximum torques, flexible coupling [5]	Type 899.00_.3_ ***92 Sh A***	T_{KN} / T_{Kmax}	[Nm]	35 / 70	95 / 190	190 / 380	190 / 380	310 / 620
	Type 899.00_.2_ ***98 Sh A***	T_{KN} / T_{Kmax}	[Nm]	60 / 120	160 / 320	325 / 650	325 / 650	525 / 1050
	Type 899.00_.1_ ***64 Sh D***	T_{KN} / T_{Kmax}	[Nm]	75 / 150	200 / 400	405 / 810	405 / 810	655 / 1310
Mass	Type 899.00_._ _	m	[kg]	8,5	15	23	28	60
Mass moment of inertia Rotor + Hub with d_{max}	Type 899.001._ _	J_{R+N}	[10^{-4} kgm²]	7,5	18,5	60	67	235
	Type 899.002._ _	J_{R+N}		8,5	21,5	70	77	250

Dimensions		Size				
		120	150	175	200	260
A [7]		160	190	232	246	345
a_1		18,5	20,5	16	16	23
B		12	14	20	20	25
B_1		76	83	92	92	92
b		20	24	25	28	30
C		58	58	58	58	75
C_2		37	37	37	37	56
D [7]		126	155	176	194	264
L		120	136	160	160	185
Shaft	Ø d_{k6} x l	19 x 40	24 x 50	35 x 79	32 x 58	48 x 82
		24 x 50	32 x 58	-	38 x 80	42 x 110
		-	-	-	-	48 x 110
Bores [6]	Ø d_3 F7	15 - 28	19 - 35	20 - 45 *	20 - 45 *	35-55 *
	Ø d_4 H7	15 - 28	19 - 38	20 - 45 *	20 - 45 *	35-60 *
Required shaft length	l_3	40 - 50	50 - 58	58 - 80 *	58 - 80 *	80-110*
m [7]		130	165	200	215	300
m_1		130 (115**)	165	200	215	300
s [7]		9	11	13,5	13,5	18
s_1		4 x M8	4 x M10	4 x M12	4 x M12	4 x M16
SW		5	6	6	6	10

Dimensions	Size				
	120	150	175	200	260
SW_1	4	4	5	5	6
Z_{j6}	110	130	114,3	180	250
	95	110	-	130	-
Z_1 F8	110	130	114,3	180	250
	95	110	-	130	-
z	3	3,5	3,5	4	5
z_1	5	5	10	6	10

1) Braking torque tolerance: -20 % / +40 %
2) Coil capacity on overexcitation
3) Coil capacity for holding voltage
4) Max. braking torque only with overexcitation (see pages 19, 22, 23, 24)
5) For further information on flexible coupling e.g. angle misalignments, spring stiffness or temperature resistance please see ROBA®-ES Catalogue K.940.V__._
6) The transmittable torques in bores d_3 and d_4 are dependent on the diameter, see Tables 2 and 3, page 9.
7) See fig. 1, page 6.
*) - Sizes 175 and 200: Over a shaft length of 60 mm, only possible with a bored elastomeric element (max. through hole Ø38 mm)
- Size 260: Over a shaft length of 85 mm, only possible with a bored elastomeric element (max. through hole Ø48 mm)
**) Optionally available with pitch circle m_1 = 115

We reserve the right to make dimensional and constructional alterations.

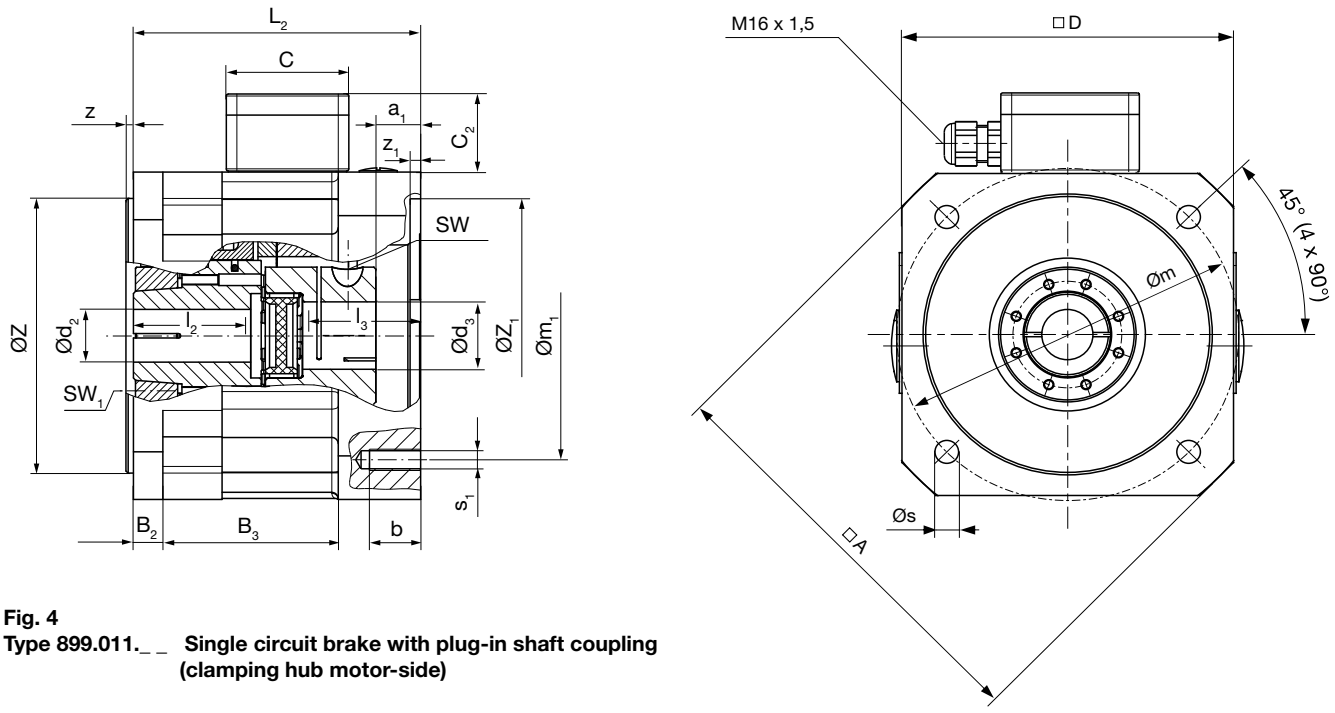


Fig. 4
Type 899.011._ _ Single circuit brake with plug-in shaft coupling (clamping hub motor-side)

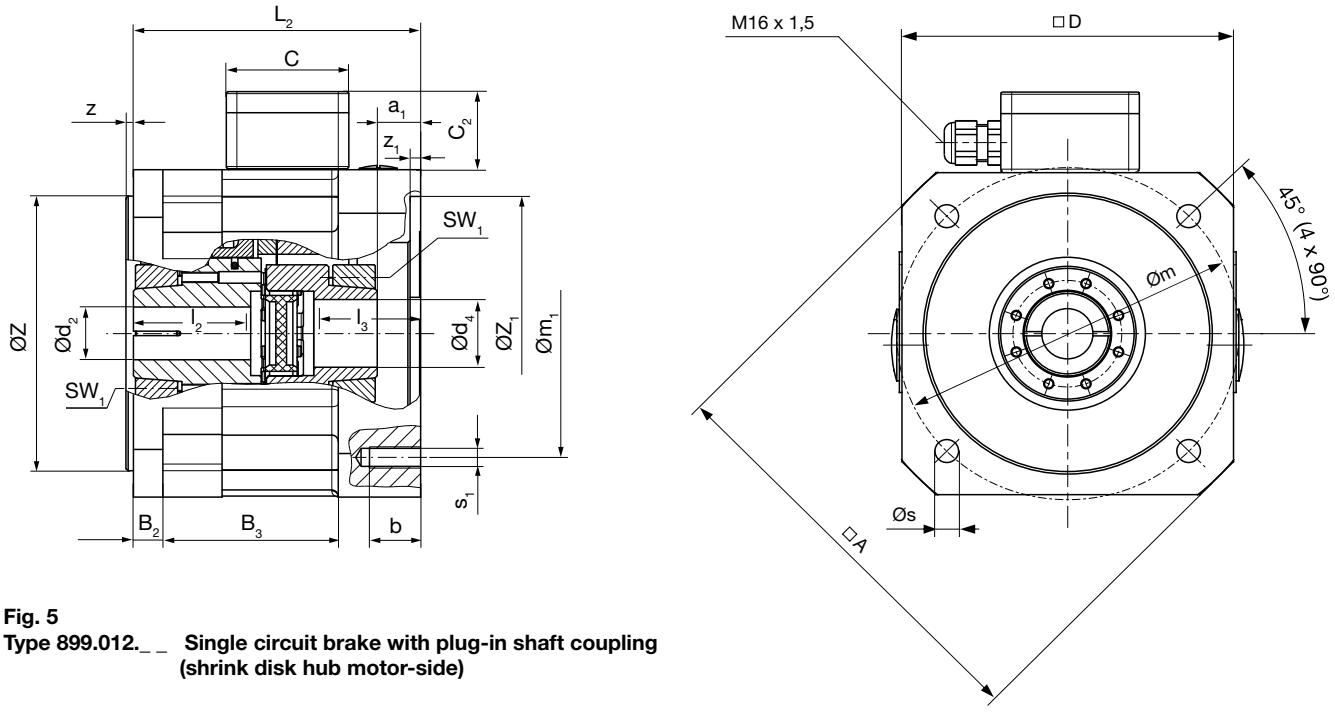


Fig. 5
Type 899.012._ _ Single circuit brake with plug-in shaft coupling (shrink disk hub motor-side)

Technical Data				Size 120	150	175	200	260
Braking torque [1]	Type 899.01_._1	M_{nom} [1]	[Nm]	12	45	70	100	200
		Braking torque tolerance -20 % / +40 %	[Nm]	-2,4 / +4,8	-9 / +18	-14 / +28	-20 / +40	-40 / +80
	Type 899.01_._2 [4]	M_{max} [1]	[Nm]	30	90	120	160	400
		Braking torque tolerance -20 % / +40 %	[Nm]	-6 / +12	-18 / +36	-24 / +48	-32 / +64	-80 / +160
Input power	Type 899.01_._1	P_{20}	[W]	31,5	44	50	60	86
	Type 899.01_._2	A [2]	[W]	102	125	128	148	200
		B [3]	[W]	26	32	32	38	50
Max. speed	Type 899.01_._1	n_{max}	[rpm]	5000	4000	4000	3000	3000
Size of flexible coupling [5] (ROBA®-ES)			[-]	24	28	38	38	48
Nominal and maximum torques, flexible coupling [5]	Type 899.01_.3_ *92 Sh A*	T_{KN} / T_{Kmax}	[Nm]	35 / 70	95 / 190	190 / 380	190 / 380	310 / 620
	Type 899.01_.2_ *98 Sh A*	T_{KN} / T_{Kmax}	[Nm]	60 / 120	160 / 320	325 / 650	325 / 650	525 / 1050
	Type 899.01_.1_ *64 Sh D*	T_{KN} / T_{Kmax}	[Nm]	75 / 150	200 / 400	405 / 810	405 / 810	655 / 1310
Mass	Type 899.01_._ _	m	[kg]	7,5	14	23	27	60
Mass moment of inertia Rotor + Hub with d_{max}	Type 899.011._ _	J_{R+N}	[10^{-4} kgm²]	7,5	18,5	60	67	235
	Type 899.012._ _	J_{R+N}	[10^{-4} kgm²]	8,5	21,5	70	77	250

Dimensions		Size 120	150	175	200	260
A		160	190	232	246	345
a_1		20	20,5	16	16	23
B_2		12	14	20	20	25
B_3		76	83	90	92	92
b		20	24	25	28	30
C		58	58	58	58	75
C_2		37	37	37	37	56
D		126	155	176	194	264
L_2		120	136	160	160	185
Bores [6]	Ø d_2 H6	15 - 28	19 - 38	20 - 45	20 - 45	35 - 60
	Ø d_3 F7	15 - 28	19 - 35	20 - 45 *	20 - 45 *	35 - 55 *
	Ø d_4 H7	15 - 28	19 - 38	20 - 45 *	20 - 45 *	35 - 60 *
Required shaft length	l_2	25 - 52	30 - 60	35 - 75	35 - 75	40 - 80
	l_3	40 - 50	50 - 58	58 - 80 *	58 - 80 *	80-110 *
m		130	165	200	215	300
m_1		130 (115**)	165	200	215	300
s		9	11	13,5	13,5	18
s_1		4 x M8	4 x M10	4 x M12	4 x M12	4 X M16
SW		5	6	6	6	10
SW_1		4	4	5	5	6
Z_{j6}		110	130	114,3	180	250
		95	110	-	130	-
Z_1 F8		110	130	114,3	180	250
		95	110	-	130	-
z		3	3,5	3,5	4	5
z_1		5	5	10	6	10

1) Braking torque tolerance: -20 % / +40 %
2) Coil capacity on overexcitation
3) Coil capacity for holding voltage
4) Max. braking torque only with overexcitation (see pages 19, 22, 23 and 24)
5) For further information on flexible coupling e.g. angle misalignments, spring stiffness or temperature resistance please see ROBA®-ES Catalogue K.940.V__._
6) The transmittable torques in bores d_2, d_3 and d_4 are dependent on the diameter, see Tables 2 and 3.
*) - Sizes 175 and 200: Over a shaft length of 60 mm, only possible with a bored elastomeric element (max. through hole Ø38 mm)
- Size 260: Over a shaft length of 85 mm, only possible with a bored elastomeric element (max. through hole Ø48 mm)
**) Optionally available with pitch circle m_1 = 115

We reserve the right to make dimensional and constructional alterations.

Correlation of bore diameters d_2 / d_3 / d_4, dependent on respective transmittable torques (without key)

	Preferred bore d_2 / d_4	Size 120	150	175	200	260
Frictionally-locking transmittable torques **shrink disk hub** / Suitable for H6 / k6 — T_R [Nm]	Ø 15	56	-	-	-	-
	Ø 16	62	-	-	-	-
	Ø 19	81	141	-	-	-
	Ø 20	87	153	197	197	-
	Ø 22	100	177	228	228	-
	Ø 24	120	203	261	261	-
	Ø 25	125	216	279	279	-
	Ø 28	135	256	332	332	-
	Ø 30	-	282	368	368	-
	Ø 32	-	308	405	405	-
	Ø 35	-	343	460	460	450
	Ø 38	-	373	513	513	500
	Ø 40	-	-	547	547	600
	Ø 42	-	-	577	577	720
	Ø 45	-	-	617	617	850
	Ø 48	-	-	-	-	1000
	Ø 50	-	-	-	-	1180
	Ø 52	-	-	-	-	1270
	Ø 55	-	-	-	-	1353
	Ø 58	-	-	-	-	1428
	Ø 60	-	-	-	-	1471

Table 2

The transmittable torques for the clamping connection allow for the max. tolerance backlash on a:
- solid shaft: tolerance k6 / bores Ø d_2 and Ø d_4: tolerance H6 (Table 2),
- solid shaft: tolerance k6 / bore Ø d_3: tolerance F7 (Table 3).

If the tolerance backlash is larger, the torque decreases.

	Preferred bore d_3	Size 120	150	175	200	260
Frictionally-locking transmittable torques **clamping hub** / Suitable for F7 / k6 — T_R [Nm]	Ø 15	34	-	-	-	-
	Ø 16	36	-	-	-	-
	Ø 19	43	79	-	-	-
	Ø 20	45	83	83	83	-
	Ø 22	50	91	91	91	-
	Ø 24	54	100	100	100	-
	Ø 25	57	104	104	104	-
	Ø 28	63	116	116	116	-
	Ø 30	-	124	124	124	-
	Ø 32	-	133	133	133	-
	Ø 35	-	145	145	145	350
	Ø 38	-	-	158	158	390
	Ø 40	-	-	166	166	420
	Ø 42	-	-	174	174	455
	Ø 45	-	-	187	187	505
	Ø 48	-	-	-	-	560
	Ø 50	-	-	-	-	600
	Ø 52	-	-	-	-	640
	Ø 55	-	-	-	-	705

Table 3

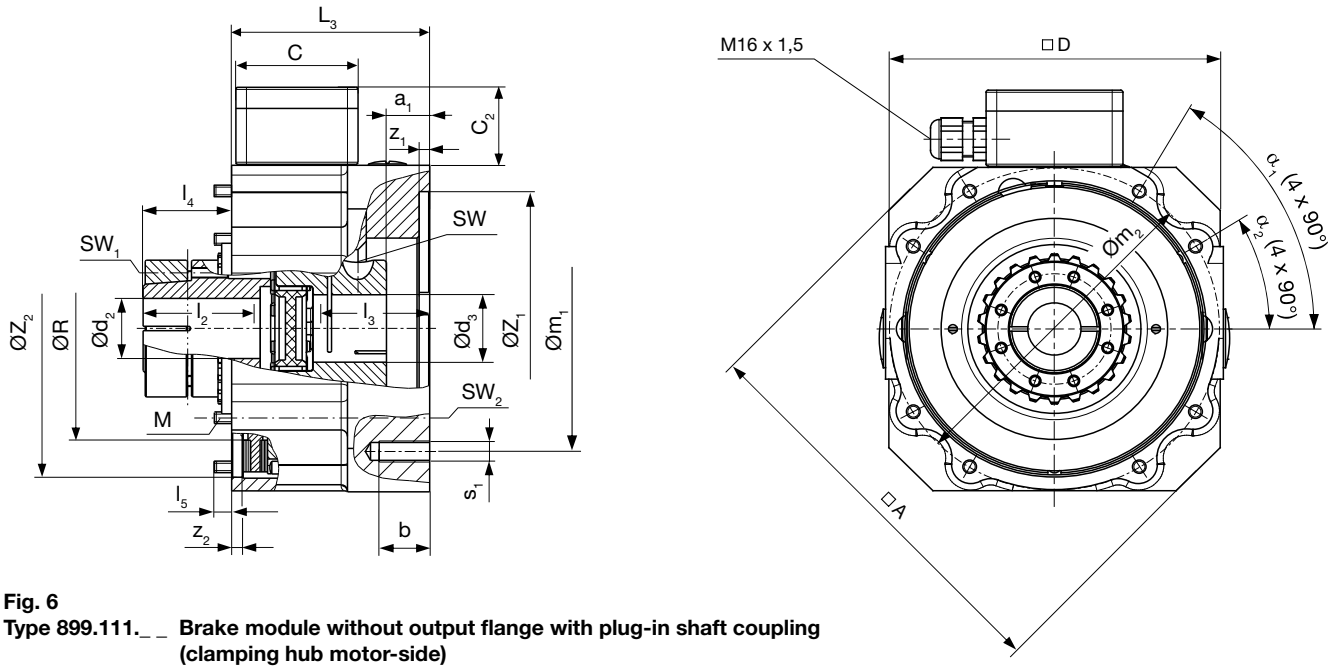


Fig. 6
Type 899.111._ _ Brake module without output flange with plug-in shaft coupling (clamping hub motor-side)

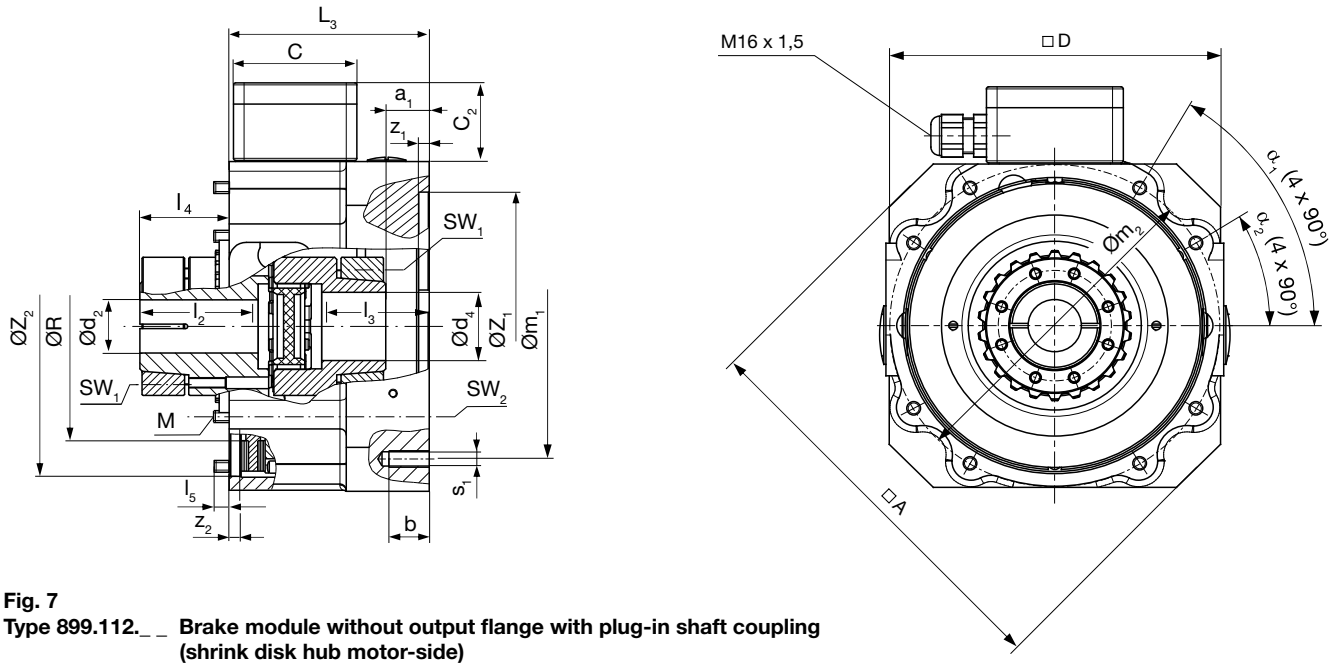


Fig. 7
Type 899.112._ _ Brake module without output flange with plug-in shaft coupling (shrink disk hub motor-side)

Technical Data				Size 120	150	175	200	260
Bremsmoment [1]	Type 899.11_._1	M_{nom} [1]	[Nm]	12	45	70	100	200
		Braking torque tolerance -20 % / +40 %	[Nm]	-2,4 / +4,8	-9 / +18	-14 / +28	-20 / +40	-40 / +80
	Type 899.11_._2 [4]	M_{max} [1]	[Nm]	30	90	120	160	400
		Braking torque tolerance -20 % / +40 %	[Nm]	-6 / +12	-18 / +36	-24 / +48	-32 / +64	-80 / +160
Input power	Type 899.11_._1	P_{20}	[W]	31,5	44	50	60	86
	Type 899.11_._2	A [2]	[W]	102	125	128	148	200
		B [3]	[W]	26	32	32	38	50
Max. speed	Type 899.11_._1	n_{max}	[rpm]	5000	4000	4000	3000	3000
Size of flexible coupling [5] (ROBA®-ES)			[-]	24	28	38	38	48
Nominal and maximum torques, flexible coupling [5]	Type 899.11_.3_ *92 Sh A*	T_{KN} / T_{Kmax}	[Nm]	35 / 70	95 / 190	190 / 380	190 / 380	310 / 620
	Type 899.11_.2_ *98 Sh A*	T_{KN} / T_{Kmax}	[Nm]	60 / 120	160 / 320	325 / 650	325 / 650	525 / 1050
	Type 899.11_.1_ *64 Sh D*	T_{KN} / T_{Kmax}	[Nm]	75 / 150	200 / 400	405 / 810	405 / 810	655 / 1310
Mass	Type 899.11_._ _	m	[kg]	4,5	8,5	14	16	35
Mass moment of inertia Rotor + Hub with d_{max}	Type 899.111._ _	J_{R+N}	[10^{-4} kgm²]	7,5	18,5	60	67	235
	Type 899.112._ _	J_{R+N}		8,5	21,5	70	77	250

Dimensions		Size 120	150	175	200	260
A		160	190	232	246	345
a_1		20	20,5	16	16	23
b		20	24	25	28	30
C		58	58	58	58	75
C_2		37	37	37	37	56
D		126	155	176	194	264
L_3		84	94	107,5	107,5	133
Bores [6]	Ø d_2 H6	15 - 28	19 - 38	20 - 45	20 - 45	35 - 60
	Ø d_3 F7	15 - 28	19 - 35	20 - 45 *	20 - 45 *	35 - 55 *
	Ø d_4 H7	15 - 28	19 - 38	20 - 45 *	20 - 45 *	35 - 60 *
Required shaft length	l_2	25 - 52	30 - 60	35 - 75	35 - 75	40 - 80
	l_3	40 - 50	50 - 58	58 - 80 *	58 - 80 *	80-110 *
l_4		36	42	52,5	52,5	52
l_5		7	10	12	12	16
M		8 x M5	8 x M6	8 x M6	8 x M8	8 x M10
m_1		130 (115**)	165	200	215	300
m_2		122	154	185	200	280
R		75	95	130	130	190
s_1		4 x M8	4 x M10	4 x M12	4 x M12	4 x M16
SW		5	6	6	6	10
SW_1		4	4	5	5	6
SW_2		4	5	5	6	8
Z_1 F8		110	130	114,3	180	250
		95	110	-	130	-
Z_2 H7		111	141	170	186	256
z_1		5	5	10	6	10
$z_{2\ -0,03}$		5,5	5,5	6	6	8
α_1		30°	31°	30°	30°	30°
α_2		60°	59°	60°	60°	60°

1) Braking torque tolerance: -20 % / +40 %
2) Coil capacity on overexcitation
3) Coil capacity for holding voltage
4) Max. braking torque only with overexcitation (see pages 19, 22, 23 and 24)
5) For further information on flexible coupling e.g. angle misalignments, spring stiffness or temperature resistance please see ROBA®-ES Catalogue K.940.V__._
6) The transmittable torques in bores d_2, d_3 and d_4 are dependent on the diameter, see Tables 4 and 5.
*) - Sizes 175 and 200: Over a shaft length of 60 mm, only possible with a bored elastomeric element (max. through hole Ø38 mm)
- Size 260: Over a shaft length of 85 mm, only possible with a bored elastomeric element (max. through hole Ø48 mm)
**) Optionally available with pitch circle m_1 = 115

We reserve the right to make dimensional and constructional alterations.

Correlation of bore diameters d_2 / d_3 / d_4, dependent on respective transmittable torques (without key)

		Preferred bore d_2 / d_4	Size 120	150	175	200	260
Frictionally-locking transmittable torques **shrink disk hub**	T_R [Nm]	Ø 15	56	-	-	-	-
		Ø 16	62	-	-	-	-
		Ø 19	81	141	-	-	-
		Ø 20	87	153	197	197	-
		Ø 22	100	177	228	228	-
		Ø 24	120	203	261	261	-
		Ø 25	125	216	279	279	-
		Ø 28	135	256	332	332	-
		Ø 30	-	282	368	368	-
		Ø 32	-	308	405	405	-
		Ø 35	-	343	460	460	450
		Ø 38	-	373	513	513	500
Suitable for H6 / k6		Ø 40	-	-	547	547	600
		Ø 42	-	-	577	577	720
		Ø 45	-	-	617	617	850
		Ø 48	-	-	-	-	1000
		Ø 50	-	-	-	-	1180
		Ø 52	-	-	-	-	1270
		Ø 55	-	-	-	-	1353
		Ø 58	-	-	-	-	1428
Table 4		Ø 60	-	-	-	-	1471

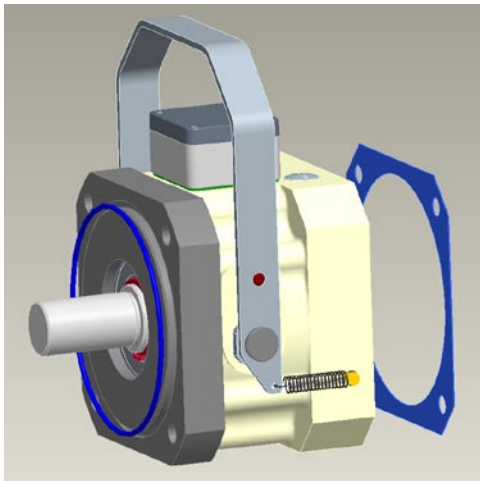
The transmittable torques for the clamping connection allow for the max. tolerance backlash on a:
- solid shaft: tolerance k6 / bores Ø d_2 and Ø d_4: tolerance H6 (Table 4),
- solid shaft: tolerance k6 / bore Ø d_3: tolerance F7 (Table 5).

If the tolerance backlash is larger, the torque decreases.

		Preferred bore d_3	Size 120	150	175	200	260
Frictionally-locking transmittable torques **clamping hub**	T_R [Nm]	Ø 15	34	-	-	-	-
		Ø 16	36	-	-	-	-
		Ø 19	43	79	-	-	-
		Ø 20	45	83	83	83	-
		Ø 22	50	91	91	91	-
		Ø 24	54	100	100	100	-
		Ø 25	57	104	104	104	-
		Ø 28	63	116	116	116	-
		Ø 30	-	124	124	124	-
		Ø 32	-	133	133	133	-
		Ø 35	-	145	145	145	350
Suitable for F7 / k6		Ø 38	-	-	158	158	390
		Ø 40	-	-	166	166	420
		Ø 42	-	-	174	174	455
		Ø 45	-	-	187	187	505
		Ø 48	-	-	-	-	560
		Ø 50	-	-	-	-	600
		Ø 52	-	-	-	-	640
Table 5		Ø 55	-	-	-	-	705

Examples: Further Options

ROBA®-topstop® single circuit brake with a bearing-supported output shaft, a hand release lever and Protection IP65

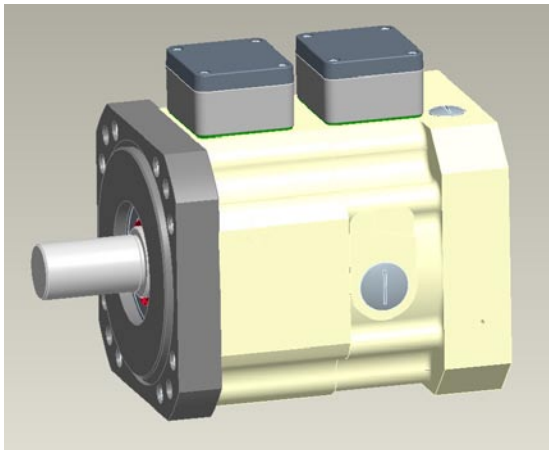


A hand release lever is available for the ROBA®-topstop® single circuit brake standard design as an accessory. Please note that the hand release prevents the safety brake from functioning during operation.
A further option is the extended Protection IP65:
=> Protection motor-side: NBR flat seal with high oil resistance
=> Protection output-side: NBR O-ring in the brake flange
=> Protection IP65 is only valid from the outside. Entry via the shaft (from the front) is not part of this protection!

Voltage: 104 V
Output-side: Ød = 24 / ØZ = 130
Motor-side: $Ød_1$ = 24 / $ØZ_1$ = 130
Electrical connection: standard configuration
(see Order Extensions on page 14: Electrical connection **2**)
Hand release lever
Protection IP65

Fig. 8: 899.000.01 / 104 V / Ø Z = 130 / $ØZ_1$ = 130 / Ød = 24 / $Ød_1$ =130 / 2 / 1 / 1

ROBA®-topstop® double circuit brake with a bearing-supported output shaft

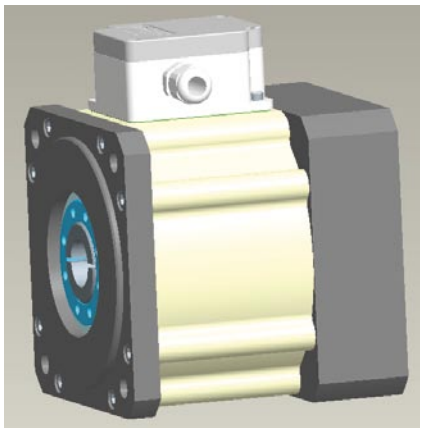


This dual circuit brake with bearing-supported clamping hub shaft is equipped with two independent brake circuits. Each braking circuit is individually electrically controllable. In accordance with the single brake circuit system, the operating condition of each brake circuit is scanned and signalled. Using this redundant brake system and the respective control, an even higher Performance Level acc. DIN EN ISO 13849 is possible.
(Dimensions Sheet available on request)

Voltage: 104 V
Output-side: Ød = 24 / ØZ = 130
Motor-side: $Ød_4$ = 24 / $ØZ_1$ = 130
Electrical connection: standard configuration
(see Order Extensions on page 14: Electrical connection **2**)

Fig. 9: 899.200.01 / 104 V / Ø Z = 130 / $ØZ_1$ = 130 / Ød = 24 / $Ød_4$ =24 / 2 / 0 / 0

ROBA®-topstop® single circuit brake with integrated ROBA®-ES shaft coupling and EAS®-smartic® safety clutch

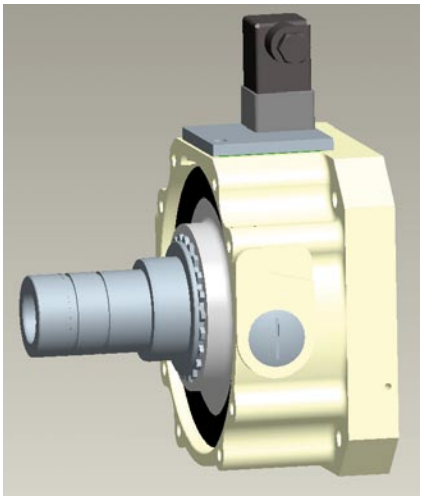


This ROBA®-topstop® single circuit brake has an integrated ROBA®-ES shaft coupling and additionally an EAS®-smartic® safety clutch. If the set limit torque is exceeded, the EAS®-smartic® clutch disengages and the drive torque drops immediately.
The overload must be recognised machine-side, so that the brake can be switched and the axis can be held safely. Reliable overload protection and a securely-held axis offer maximum protection for people and machines.

Voltage: 104 V
Output-side: $Ød_2$ = 15 / ØZ = 130
Motor-side: $Ød_5$ = 24 / $ØZ_1$ = 130
Electrical connection: standard configuration
(see Order Extensions on page 14: Electrical connection **2**)

Fig. 10: Special Type 899.013.21 SO / 104 V / Ø Z = 130 / $ØZ_1$ = 130 / $Ød_2$ = 15 / $Ød_5$ =24

ROBA®-topstop® single circuit brake with integrated ROBA®-ES shaft coupling and shaft connection



This ROBA®-topstop® single circuit brake module is mounted directly onto a gearbox. The gearbox input side is adapted to the brake module interface. The special shaft bearing is located in the gearbox and carries the input pinion. The ROBA®-ES shaft coupling is integrated into the brake module. The respective centering diameter and screw-on pitch circles for the servomotor are mounted in the housing flange.

Voltage: 24 V

Output-side: Ød = 20

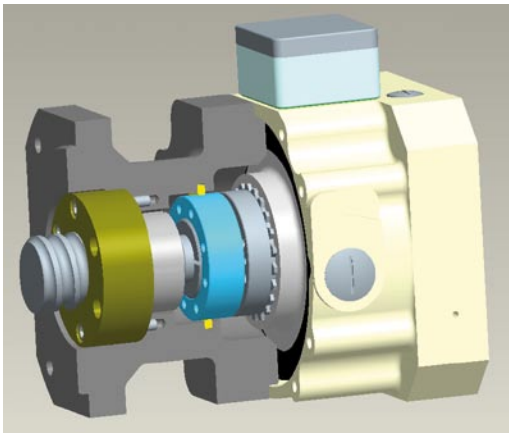
Motor-side: $Ød_4$ = 24 / $ØZ_1$ =110

Electrical connection:

- special configuration without terminal box
- without release monitoring
- with mounted plug

Fig. 11: Special Type 899.102.21 SO / 24 V / Ø Z_1 = 110 / Ød = 20 / Ød$_4$ =24

ROBA®-topstop® single circuit brake with integrated ROBA®-ES shaft coupling and special friction flange



The ROBA®-topstop® single circuit brake with integrated ROBA®-ES shaft coupling is conceived for mounting onto a ball screw spindle. The special friction flange is adapted to the machine tool. The ball screw spindle bearing is integrated into this special flange, and at the same time serves as the friction surface for the brake. This compact construction is only minimally longer than a construction without the brake. The friction flange can be included in the delivery on request and is produced according to customer specifications. The brake can however also be delivered without a friction flange (Type 899.112.22 SO).

Voltage: 104 V

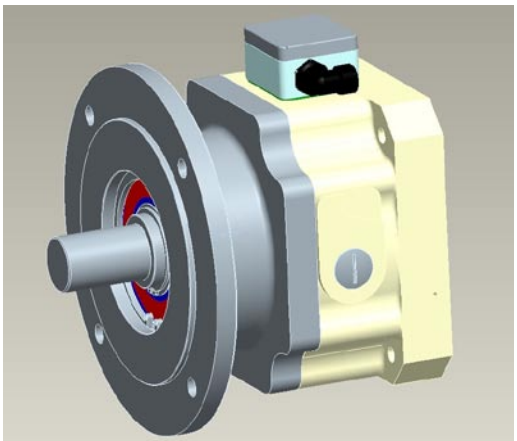
Output-side: $Ød_2$ = 15 / ØZ = 130

Motor-side: $Ød_4$ = 24 / $ØZ_1$ = 130

Electrical connection: standard configuration
(see Order Extensions on page 14: Electrical connection **2**)

Fig. 12: Special Type 899.312.22 SO / 104 V / ØZ = 130 / ØZ$_1$ = 130 / Ød$_2$ = 15 / Ød$_4$ =24

ROBA®-topstop® single circuit brake with a bearing-supported output shaft and special friction flange



The ROBA®-topstop® single circuit brake with special friction flange is tailored for application with a bearing-supported output shaft and deep groove ball bearing in two rows for the absorption of high axial forces, e.g. in case of pulley or attachment of a pinion with spur toothing.

Voltage: 24 V

Output-side: Ød = 40 / ØZ = 200

Motor-side: $Ød_1$ = 38 / $ØZ_1$ = 180

Electrical connection:

- special configuration with rectangular cable outlet on the left side
- with release monitoring

Fig. 13: Special Type 899.300.01 SO / 24 V / ØZ = 200 / ØZ$_1$ = 180 / Ød = 40 / Ød$_1$ =38

Order Number

Size	Output-side		Motor-side		Coil voltage [1]	Centering-bore	Output-side	Motor-side
120	Shaft design	0	0	Shaft bore with clamping	[VDC]	ØZ	Ød	$Ød_1$
150	Shrink disk hub	1	1	ROBA®-ES clamping hub	12	$ØZ_1$	$Ød_2$	$Ød_3$
175			2	ROBA®-ES shrink disk hub	24			$Ød_4$
200					104			
260					180			
					207			

According to catalogue, special dimensions available on request.

__ / 8 9 9 . __ __ __ . __ __ / __ / __ / __ / __

Single circuit brake (with standard output flange)	0	Without elastomeric element	0	1	**Nominal torque**
Single circuit brake module (without output flange)	1	Elastomeric element hardness 64 Sh D (green)	1	2	**Maximum torque**, only possible with overexcitation (see pages 20/23/24/25)
Dual circuit brake	2	Elastomeric element hardness 98 Sh A (red)	2		
*- only with nominal torque 899.2_ _._**1** and only for Sizes 120/150/200*		Elastomeric element hardness 92 Sh A (yellow)	3		
- see Fig. 9 on page 12, 'Further Options'					
- Dimensions Sheet available on request					
Single circuit brake module [2] (with special output flange)	3				

Only for coil voltages **12 V** and **104 V**:
- Coil voltage 12 VDC
  => Overexcitation voltage 24 VDC
  => Supply voltage 24 VDC
  (ROBA®-switch 24V Type 018.100.2)
- Coil voltage 104 VDC
  => Overexcitation voltage 207 VDC
  => Supply voltage 230 VAC
  (ROBA®-switch Type 017.000.2)

Further coil voltages for overexcitation on demand.

Order Extensions

Electrical connection		Hand release		Protection	
1	Terminal box Terminal (without release monitoring) Cable outlet, right side	without	0	Basic Protection IP54	0
2	**Standard configuration** (Terminal box Terminal Release monitoring with proximity sensor Cable outlet, right side)	with	1	Extended Protection IP65 [3]	1

Protection IP65 is only valid from the outside – Entry via a shaft (from the front) is not part of this protection!

=> Protection motor-side:
NBR flat seal with high oil resistance

=> Protection output-side:
NBR O-ring in the brake flange

___ / __ / ___

Examples

- ROBA®-topstop® single circuit brake with shaft design – Nominal torque – Electrical connection: Standard configuration – without hand release – Protection IP54
  Order Number: 120 / 899.000.01 / 24 V / ØZ = 110 / $ØZ_1$ = 110 / Ød = 24 / $Ød_1$ = 24 / 2 / 0 / 0
- ROBA®-topstop® single circuit brake module with shrink disk hub – Max. braking torque – Electrical connection: Standard configuration – without hand release – Protection IP54
  Order Number: 150 / 899.112.22 / 104 V / $ØZ_1$ = 130 / $Ød_2$ = 25 / $Ød_4$ = 32 / 2 / 0 / 0

The Order extensions do not apply to all Types. *Please contact our field service.*

c UL us E189728 **On request ROBA®-topstop® brakes can also be delivered with UL approval.**

1) Permitted voltage tolerance according to DIN IEC 60038: ± 10 %
2) Type 899.3_ _._ _ is the basic Type 899.1_ _._ _ with special output flange according to the customer's request. This special output flange is included in delivery.
3) See Fig. 8 on page 12, 'Further Options'. Dimensions Sheet available on request.

Switching Times

The switching times are only valid for the braking torques stated in the catalogue.
According to directive VDI 2241, the switching times are measured with a sliding speed of 1 m/s with reference to a mean friction radius.
The brake switching times are influenced by the temperature, by the air gap between the armature disk and the coil carrier, which depends on the wear status of the linings, and by the type of quenching circuit.

The values stated in the Table are mean values which refer to the nominal air gap and the nominal torque on a warm brake.
Typical switching time tolerances are ± 20 %.

Please Observe: DC-side switching
When measuring the DC-side switching times (t_{11} – time), the inductive switch-off peaks are according to VDE 0580 limited to values smaller than 1200 volts. If other quenching circuits and constructional elements are installed, this switching time t_{11} and therefore also switching time t_1 increase**.**

Switching times Type 899. _ _ _ . _1				**Size**				
				120	**150**	**175**	**200**	**260**
Nominal torque	Type 899._ _ _._1	M_{nom}	[Nm]	12	45	70	100	200
Connection time	DC-switching	t_1	[ms]	55	80	85	90	200
	AC-switching	t_1	[ms]	300	400	450	600	800
Response delay on connection	DC-switching	t_{11}	[ms]	40	50	50	55	75
	AC-switching	t_{11}	[ms]	250	350	400	500	800
Separation time		t_2	[ms]	80	120	150	200	250

Table 6: Switching times Type 899. _ _ _ . _1, brake operation with **nominal torque (without overexcitation)**

Switching times Type 899._ _ _ ._ 2				**Size**				
				120	**150**	**175**	**200**	**260**
Maximum torque	Type 899._ _ _._2	M_{max}	[Nm]	30	90	120	160	400
Connection time	DC-switching	t_1	[ms]	40	50	55	60	120
	AC-switching	t_1	[ms]	160	250	270	300	400
Response delay on connection	DC-switching	t_{11}	[ms]	20	25	25	30	35
	AC-switching	t_{11}	[ms]	125	200	200	250	300
Separation time (with overexcitation)		t_2	[ms]	60	90	100	150	200

Table 7: Switching times Type 899. _ _ _ . _2, brake operation with **maximum torque and overexcitation**

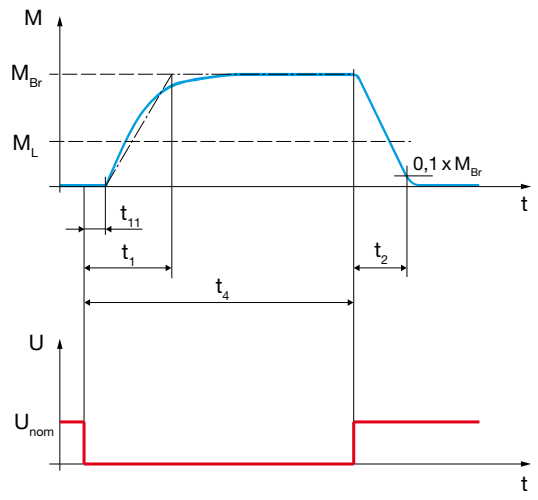


Diagram 1:
Switching times Type 899. _ _ _ . _1
Brake operation with **nominal voltage**

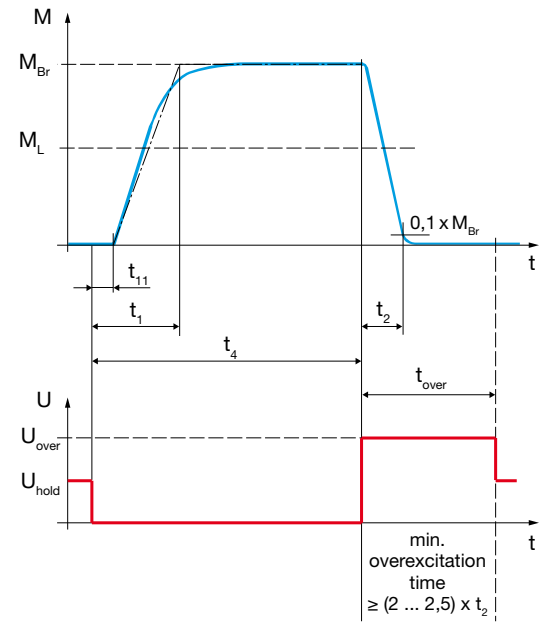


Diagram 2:
Switching times Type 899. _ _ _ . _2
Brake operation with **overexcitation voltage**

Keys

M_{Br} = Braking torque
M_L = Load torque
t_1 = Connection time
t_{11} = Response delay on connection
t_2 = Separation time
t_4 = Slip time + t_{11}
t_{over} = Overexcitation time
U_{hold} = Holding voltage
U_{nom} = Coil nominal voltage
U_{over} = Overexcitation voltage

It is possible to reduce the connection times (t_1 / t_{11}) by another 20 – 50 % via suitable wiring.
For brake operation with overexcitation voltage, select at least double the brake separation time t_2 as overexcitation time t_{over}:
t_{over} ≥ (2 ... 2,5) x t_2

Brake Dimensioning

1. Dimensioning the brake static holding torque according to the system load torque
(The carriage is held safety in the holding position via the brake)

$$M_{nom\ -20\%} > M_L \times S$$

$M_{nom\ -20\%}$	[Nm]	Brake minimum braking torque (= braking torque – 20% x braking torque) see Technical Data, pages 6 – 11
M_L	[Nm]	Load torque on system
S	[-]	Recommended safety factor min. 1,5 – 2 depending on the application

2. Checking the braking distance (stopping distance) by taking the following into account:
(Guaranteeing the required minimum braking distance for the protection of people or from collisions)

- All rotatory mass inertias (motor, brake, drive elements, etc.)
- All translationally moved masses and loads
- Inclination of the gravity-loaded axis
- Transmissions via gear, spur gear and toothed belt levels as well as via spindle pitches
- Path feed and direction from which the axis is braked
- All system times such as sensor response time, controls processing time and brake connection time t_1 / t_{11} times
- Total efficiency of the input axis

The following applies:
Total braking distance < required braking distance x safety factor

Please observe:
During the system running times, the input speed might increase depending on the total efficiency and load.

3. Taking the inspection and test torques into account

$$M_{Test} < M_{nom\ -20\%} \times (0{,}8 \text{ to } 0{,}9)$$

$M_{nom\ -20\%}$	[Nm]	Brake minimum braking torque (= braking torque - 20% x braking torque) see Technical Data, pages 6 – 11
M_{Test}	[Nm]	Test torque as e.g. cyclic brake test

4. Inspection of thermic load Q_r

$$Q_r = \frac{J \times n^2}{182{,}4} \times \frac{M_{nom}}{M_v}$$

$$M_v = M_{nom} - M_L$$ (-) is valid if load is braked during downward

Q_r	[J/braking]	Friction work present per braking
J	[kgm²]	Total mass moment of inertia referring to the brake
M_{nom}	[Nm]	Nominal torque (see Technical Data, pages 6 – 11)
M_V	[Nm]	Delaying torque
M_L	[Nm]	Load torque on system

The permitted friction work (switching work) $Q_{r\ perm.}$ per braking for the specified switching frequency can be found in Table 8 (page 17).
If the friction work per braking is known, the max. switching frequency can also be found in Table 8 (page 17).

Guaranteeing the necessary brake distances with all control and braking times in case of danger due to gravity-loaded axes must be checked via a test.
A cyclic braking torque and toothing backlash inspection of the brake rotor during operation provides additional safety.
Please observe the respective Guidelines and Directives applicable to the danger situation.

Friction-Power

The ROBA®-topstop® safety brake is only suitable for application as a **holding brake** with a possible number of dynamic EMERGENCY STOP braking actions and is **not** suitable for cyclic STOP braking actions in cycle operation.

When using the ROBA®-topstop® safety brake in gravity-loaded axes, the number of dynamic EMERGENCY STOP braking actions should not exceed approx. 2000 dynamic braking actions within the total application timeframe.

For dynamic EMERGENCY STOP braking actions, the following maximum switching work values are possible:

a) The friction work values stated in Table 8 are valid for a **max. switching frequency of 1-3 switchings (= individual events) per hour.**

Permitted switching work $Q_{r\ perm.}$ per braking				Speed			
	Size	Type		1500 rpm	3000 rpm	4000 rpm	5000 rpm
$Q_{r\ perm.}$	120	899._ _ _._1 Nominal torque	[J/braking]	9000	4500	1500	1000
		899._ _ _._2 Maximum torque	[J/braking]	6000	2500	700	400
	150	899._ _ _._1 Nominal torque	[J/braking]	11000	6000	2000	-
		899._ _ _._2 Maximum torque	[J/braking]	7500	3500	1000	-
	175	899._ _ _._1 Nominal torque	[J/braking]	15000	7500	4500	-
		899._ _ _._2 Maximum torque	[J/braking]	9000	4500	2400	-
	200	899._ _ _._1 Nominal torque	[J/braking]	22000	9000	-	-
		899._ _ _._2 Maximum torque	[J/braking]	15000	6000	-	-
	260	899._ _ _._1 Nominal torque	[J/braking]	32000	14000	-	-
		899._ _ _._2 Maximum torque	[J/braking]	18000	6500	-	-

Table 8: Permitted switching work $Q_{r\ perm.}$ at a max. switching frequency of 1-3 switchings (= individual events) per hour

b) For a **switching frequency of up to 10 switchings per hour** a factor of 0,5 for the stated switching work values must be taken into account (Example: Size 120 / Type 899._ _ _._2 / Speed =1500 rpm => permitted switching work $Q_{r\ perm.}$ = 3000 J/braking).

c) For higher speed values, special dimensioning is necessary.

Friction Work up to Rotor Replacement / Brake Inspection

Friction work $Q_{r\ tot.}$ up to rotor replacement / Brake inspection		Size				
		120	150	175	200	260
$Q_{r\ tot.}$	[10^6 J]	28	65	100	180	300

Table 9: Possible friction work $Q_{r\ tot.}$ up to rotor replacement / Brake inspection

Due to operating parameters such as slipping speed, pressing or temperature the **wear values** can only be considered **guideline values**.

Permitted Motor Attachments/Max. Permitted Breakdown Torque

The permitted components of the motor screwed onto the brake module include the static and dynamic loads "F" of motor weight, mass acceleration and vibrations, multiplied by the motor centre of gravity clearance "l_s".

$M_k = F \times l_s \leq M_{k\ perm.}$

Permitted breakdown torque		Size				
		120	150	175	200	260
$M_{k\ perm.}$	[Nm]	65	150	275	400	650

Table 10

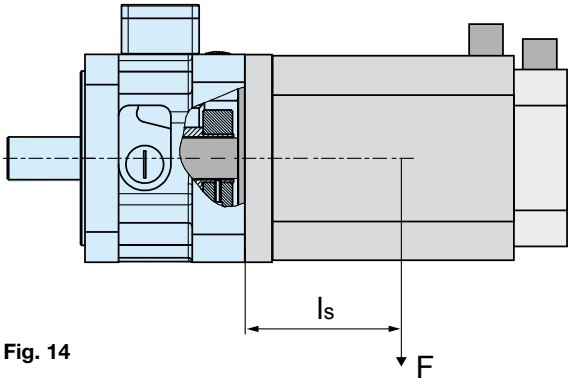


Fig. 14

Permitted Outer Acceleration and Deceleration Torques on the Brake

		Types			Size				
					120	150	175	200	260
1	Max. permitted acceleration and deceleration torque by the servomotor on the brake	all Types	M_{accel}	[Nm]	45	120	160	280	560
2	*I) Max. dynamic braking torque by the motor on the brake (servomotor with holding brake)	all Types except 899.200.01 899.___._2	$M_{braking}$	[Nm]	22	60	80	140	280
3	Max. dynamic braking torque by the motor on the brake (servomotor with holding brake)	899.200.01 899.___._2	$M_{braking}$	[Nm]	*II) No other braking torque permitted				

Table 11

*I) This restriction applies when the ROBA®-topstop® brake and all further braking torques, such as for as example the motor during brake operation (eddy current operation) and/or the motor brake engage at the same time. The brake times overlap and the braking torque adds up.
If it is certain that the brake times do not overlap, a braking torque via the holding brake in the servomotor (see Point 1 in the Table) can be permitted.

*II) No other braking torque is permitted.
If it is certain that the brake times do not overlap, a braking torque via the holding brake in the servomotor (see Point 1 in the Table) can be permitted.

Shaft Load Capacity

Max. radial forces on the bearing applicable for:

Type **899.000.0**_ and Type **899.200.01**

ROBA®-topstop® brake		Size				
		120	150	175	200	260
Distance „l_R" (Fig. 15)	[mm]	22,5	30	40	40	55
Max. permitted radial force "F_R" on system l_R	[N]	600	1000	1750	1750	3000
The permitted forces refer to a max. speed of	[rpm]	5000	4000	4000	3000	3000
Nominal service lifetime	[h]	30000	25000	25000	15000	15000

Table 12

The values refer to purely radial forces.
The permitted forces are applicable for shaft dimensions according to the catalogue, with a force of application for radial forces in the centre of the output shaft.

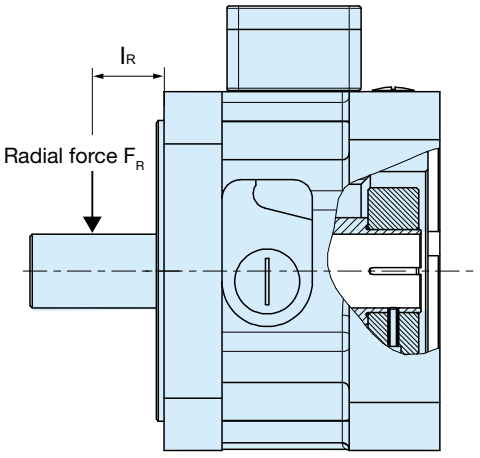


Fig. 15

Electrical Connection and Wiring

DC current is necessary for the operation of the brake. The coil voltage is indicated on the Type tag as well as on the brake body and is designed according to the DIN IEC 60038 (± 10 % tolerance). Operation is possible both via alternating voltage in connection with a rectifier or with another suitable DC supply. Dependent on the brake equipment, the connection possibilities can vary. Please follow the exact connections according to the Wiring Diagram. The manufacturer and the user must observe the applicable directives and standards (e.g. DIN EN 60204-1 and DIN VDE 0580). Their observance must be guaranteed and double-checked.

Earthing Connection

The brake is designed for Protection Class I. This protection covers not only the basic insulation but also the connection of all conductive parts to the PE conductor on the fixed installation. If the basic insulation fails, no contact voltage will remain. Please carry out a standardized inspection of the PE conductor connections to all contactable metal parts.

Device Fuses

To protect against damage from short circuits, please add suitable device fuses to the mains cable.

Switching Behaviour

The operational behaviour of a brake is to a large extent dependent on the switching mode used. Furthermore, the switching times are influenced by the temperature and the air gap between the armature disk and the coil carrier (dependent on the wear condition of the linings).

Magnetic Field Build-up

When the voltage is switched on, a magnetic field is built up in the brake coil, which attracts the armature disk to the coil carrier and releases the brake.

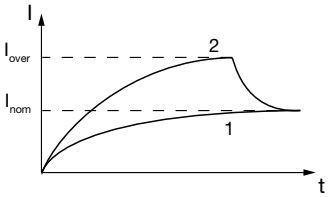
Field Build-up with Normal Excitation

If we energise the magnetic coil with nominal voltage the coil voltage does not immediately reach its nominal value. The coil inductivity causes the current to rise slowly as an exponential function. Accordingly, the build-up of the magnetic field happens more slowly and the braking torque drop (curve 1, below) is also delayed.

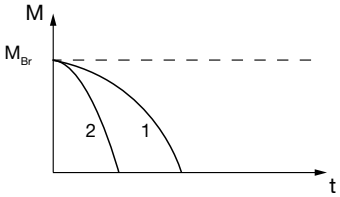
Field Build-up with Overexcitation

A quicker drop in braking torque is achieved if the coil is temporarily placed under a higher voltage than the nominal voltage, as the current then increases more quickly. Once the brake is released, switch to the nominal voltage (curve 2, below). The relationship between overexcitation and separation time t_2 is approximately indirectly proportional. This means that, using doubled nominal voltage (overexcitation voltage U_{over}), it is possible to halve the separation time t_2 in order to release the brake. The ROBA®-(multi)switch fast acting rectifier and phase demodulator work on this principle.

Current path



Braking torque path



Keys:

I_{nom} = Nominal current
I_{over} = Overexcitation current
M_{Br} = Braking torque

Operation with overexcitation requires testing of:
- the necessary overexcitation time *
- as well as of the RMS coil capacity ** for a cycle frequency higher than 1 cycle per minute.

*** Overexcitation time t_{over}**

Increased wear and therefore an enlarged air gap as well as coil heat-up lengthen the separation time t_2 of the brake. Therefore, as overexcitation time t_{over}, please select at least double the separation time t_2 with nominal power on each brake size.

**** Coil Capacity P_{RMS}**

$P_{RMS} \leq P_{nom}$

The coil capacity P_{RMS} may not be larger than P_{nom}. Otherwise, the coil may fail due to thermic overload.

Calculations:

P_{RMS} [W] RMS coil capacity, dependent on switching frequency, overexcitation, power reduction and switch-on time duration

$$P_{RMS} = \frac{P_{over} \times t_{over} + P_{hold} \times t_{hold}}{t_{tot}}$$

P_{nom} [W] Coil nominal capacity (Catalogue value, Type tag)

P_{over} [W] Coil capacity on overexcitation

$$P_{over} = \left(\frac{U_{over}}{U_{nom}}\right)^2 \times P_{nom}$$

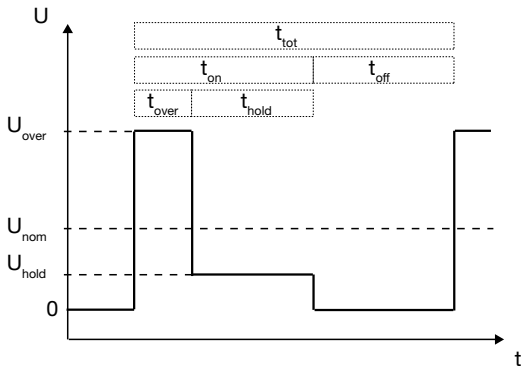
P_{hold} [W] Coil capacity on power reduction

$$P_{hold} = \left(\frac{U_{hold}}{U_{nom}}\right)^2 \times P_{nom}$$

Keys:

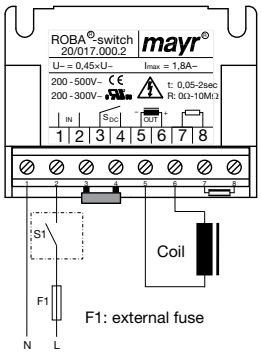
t_{over}	[s]	Overexcitation time
t_{hold}	[s]	Time of operation with power reduction
t_{off}	[s]	Time without voltage
t_{on}	[s]	Time with voltage
t_{tot}	[s]	Total time ($t_{over} + t_{hold} + t_{off}$)
U_{over}	[V]	Overexcitation voltage (bridge voltage)
U_{hold}	[V]	Holding voltage (half-wave voltage)
U_{nom}	[V]	Coil nominal voltage

Time Diagram:



Magnetic Field Removal

AC-side Switching

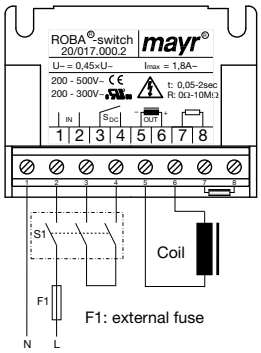


The power circuit is interrupted before the rectifier. The magnetic field slowly reduces. This delays the rise in braking torque.

When switching times are not important, please switch AC-side, as no protective measures are necessary for coil and switching contacts.

AC-side switching means **low-noise switching**; however, the brake engagement time is longer (c. 6 – 10 times longer than with DC-side switch-off). Use for non-critical braking times.

DC-side Switching



The power circuit is interrupted between the rectifier and the coil as well as mains-side. The magnetic field is removed very quickly, resulting in a rapid rise in braking torque.

When switching DC-side, high voltage peaks are produced in the coil, which lead to wear on the contacts from sparks and to destruction of the insulation.

DC-side switching means **short brake engagement time (e.g. for EMERGENCY STOP operation)**. However, this produces louder switching noises.

Protective Circuit

When using DC-side switching, the coil must be protected by a suitable protective circuit according to VDE 0580, which is integrated in *mayr*® rectifiers. To protect the switching contact from consumption when using DC-side switching, additional protective measures may be necessary (e.g. series connection of switching contacts). The switching contacts used should have a minimum contact opening of 3 mm and should be suitable for inductive load switching. Please make sure on selection that the rated voltage and the rated operation current are sufficient. Depending on the application, the switching contact can also be protected by other protective circuits (e.g. *mayr*® spark quencher, half-wave rectifier and bridge rectifier), although this may of course then alter the switching time.

Half-wave Rectifiers and Bridge Rectifiers Type 02_.000.6

Application

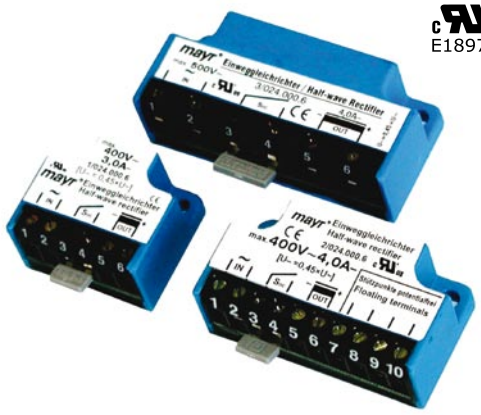
Rectifiers are used to connect DC units to alternating voltage supplies, for example electromagnetic brakes and clutches (ROBA-stop®, ROBA-quick®, ROBATIC®), electromagnets, electrovalves, contactors, switch-on safe DC motors, etc.

Function

The AC input voltage (VAC) is rectified (VDC) in order to operate DC voltage units. Also, voltage peaks, which occur when switching off inductive loads and which may cause damage to insulation and contacts, are limited and the contact load reduced.

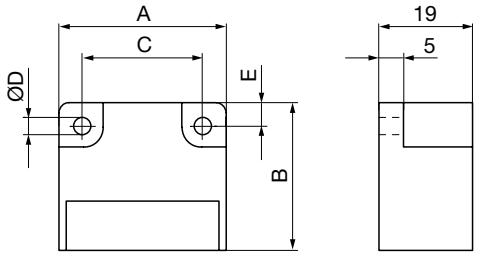
Electrical Connection (Terminals)

1 + 2 Input voltage
3 + 4 Connection for an external switch for DC-side switching
5 + 6 Coil
7 - 10 Free nc terminals (only for size 2)



E189728

Dimensions (mm)



Size	A	B	C	ØD	E
1	34	30	25	3,5	4,5
2	54	30	44	4,5	5,0
3/4	64	30	54	4,5	5,0

Accessories: Mounting bracket set for 35 mm rail acc. EN 60715: Article-No. 1803201

Order Number

__ / 0 2 __ . 0 0 0 . 6

Size	
1	
up to	
4	
4	Half-wave rectifier
5	Bridge rectifier

Technical Data

	Bridge rectifier		Half-wave rectifier			
Calculation output voltage	VDC = VAC x 0,9		VDC = VAC x 0,45			
Type	**1/025**	**2/025**	**1/024**	**2/024**	**3/024**	**4/024**
Max. input voltage	230 VAC	230 VAC	400 VAC	400 VAC	500 VAC	600 VAC
Max. output voltage	207 VDC	207 VDC	180 VDC	180 VDC	225 VDC	270 VDC
Output current at ≤ 50°C	2,5 A	2,5 A	3,0 A	4,0 A	4,0 A	4,0 A
Output current at max. 85 °C	1,7 A	1,7 A	1,8 A	2,4 A	2,4 A	2,4 A
Max. coil capacity at 115 VAC ≤ 50 °C	260 W	260 W	-	-	-	-
Max. coil capacity at 115 VAC up to 85 °C	177 W	177 W	-	-	-	-
Max. coil capacity at 230 VAC ≤ 50 °C	517 W	517 W	312 W	416 W	416 W	416 W
Max. coil capacity at 230 VAC up to 85 °C	352 W	352 W	187 W	250 W	250 W	250 W
Max. coil capacity at 400 VAC ≤ 50 °C	-	-	540 W	720 W	720 W	720 W
Max. coil capacity at 400 VAC up to 85 °C	-	-	324 W	432 W	432 W	432 W
Max. coil capacity at 500 VAC ≤ 50 °C	-	-	-	-	900 W	900 W
Max. coil capacity at 500 VAC up to 85 °C	-	-	-	-	540 W	540 W
Max. coil capacity at 600 VAC ≤ 50 °C	-	-	-	-	-	1080 W
Max. coil capacity at 600 VAC up to 85 °C	-	-	-	-	-	648 W
Peak reverse voltage	1600 V	1600 V	2000 V	1600 V	2000 V	2000 V
Rated insulation voltage	320 V_{RMS}	320 V_{RMS}	500 V_{RMS}	500 V_{RMS}	630 V_{RMS}	630 V_{RMS}
Pollution degree (insulation coordination)	1	1	1	1	1	1
Protection fuse	To be included in the input voltage line.					
Recommended microfuse switching capacity H The microfuse corresponds to the max. possible connection capacity. If fuses are used corresponding to the actual capacities, the permitted limit integral I^2t must be observed on selection.	FF 3,15A	FF 3,15A	FF 4A	FF 5A	FF 5A	FF 5A
Permitted limit integral I^2t	40 A^2s	40 A^2s	50 A^2s	100 A^2s	50 A^2s	50 A^2s
Protection	IP65 components, encapsulated / IP20 terminals					
Terminals	Cross-section 0,14 - 1,5 mm^2 (AWG 26-14)					
Ambient temperature	- 25 °C up to + 85 °C					
Storage temperature	- 25 °C up to + 105 °C					
Conformity markings	UL, CE	UL, CE	UL, CE	UL, CE	UL, CE	CE
Installation conditions	The installation position can be user-defined. Please ensure sufficient heat dissipation and air convection! Do not install near to sources of intense heat!					

Application

ROBA®-switch fast acting rectifiers are used to connect DC consumers to alternating voltage supplies, for example electromagnetic brakes and couplings (ROBA-stop®, ROBA®-quick, ROBATIC®) as well as electromagnets and electrovalves etc.

Fast acting rectifier ROBA®-switch 017._00.2

- Consumer operation with overexcitation or power reduction
- Input voltage: 100 - 500 VAC
- Maximum output current I_{RMS}: 3 A at 250 VAC
- UL-approved

Function

The ROBA®-switch units are used for operation at an input voltage of between 100 and 500 VAC, dependent on size. They can switch internally from bridge rectification output voltage to half-wave rectification output voltage. The bridge rectification time can be modified from 0,05 to 2 seconds by exchanging the external resistor (R_{ext}).

Electrical Connection (Terminals)

1 + 2	Input voltage (fitted protective varistor)
3 + 4	Connection for external contact for DC-side switch-off
5 + 6	Output voltage (fitted protective varistor)
7 + 8	R_{ext} for bridge rectifier timing adjustment

Technical Data

Input voltage	see Table 1
Output voltage	see Table 1
Protection	IP65 components, IP20 terminals, IP10 R_{ext}
Terminal nom. cross-section	1,5 mm², (AWG 22-14)
Ambient temperature	-25 °C up to +70 °C
Storage temperature	-40 °C up to +105 °C

ROBA®-switch Sizes, Table 1

	Size			
	Type 017.000.2		Type 017.100.2	
	10	20	10	20
Input voltage VAC ± 10 %	100 - 250	200 - 500	100 - 250	200 - 500
Output voltage VDC, U_{bridge}	90 - 225	180 - 450	90 - 225	180 - 450
Output voltage VDC, $U_{half\text{-}wave}$	45 - 113	90 - 225	45 - 113	90 - 225
Output current I_{RMS} at ≤ 45 °C, (A)	2,0	1,8	3,0	2,0
Output current I_{RMS} at max. 70 °C, (A)	1,0	0,9	1,5	1,0
Comformity markings	cULus CE	cULus up to 300 V CE	cULus CE	cULus CE

Order Number

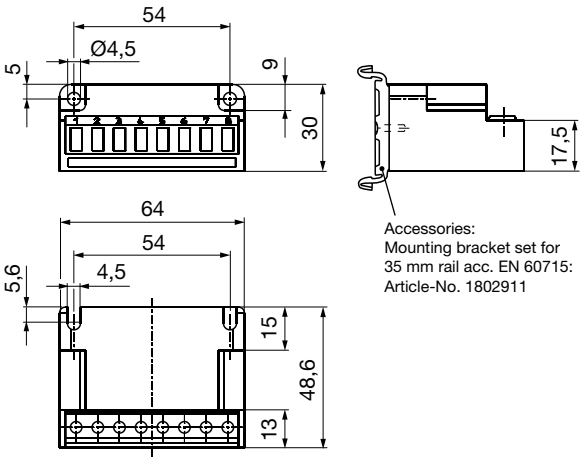
__ / 0 1 7 . __ 0 0 . 2

Size		UL-approved	
10		0	to 300 V
20		1	to 500 V

cULus E189728 CE

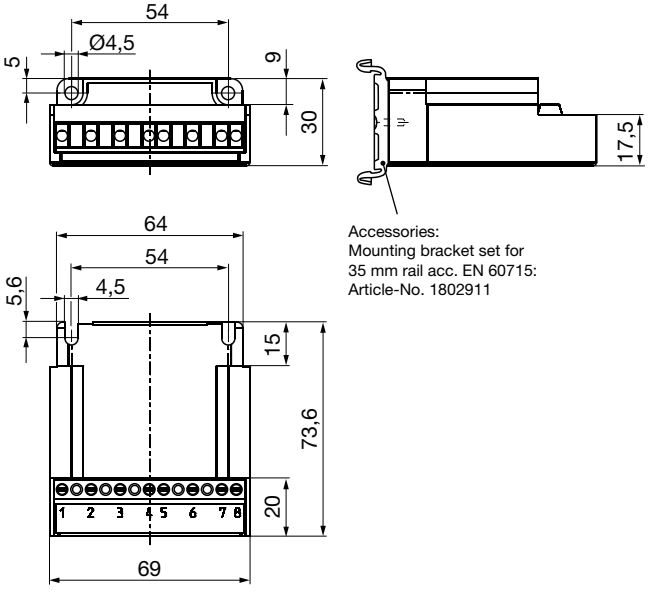
Dimensions (mm)

Type 017.000.2



Accessories:
Mounting bracket set for 35 mm rail acc. EN 60715:
Article-No. 1802911

Type 017.100.2



Accessories:
Mounting bracket set for 35 mm rail acc. EN 60715:
Article-No. 1802911

ROBA®-switch 24V Type 018.100.2

Application

ROBA®-switch 24V fast switching modules are used to operate DC consumer units with overexcitation or power reduction, for example electromagnetic brakes and clutches (ROBA-stop®, ROBA®-quick, ROBATIC®), electromagnets, electrovalves etc.

Fast acting rectifier ROBA®-switch 24V 018.100.2

- consumer operation with overexcitation or power reduction
- integrated automatic DC-side switch-off (shorter connection time t_1)
- input voltage: 24 VDC
- max. output current I_{RMS}: 5 A

The ROBA®-switch 24V integrated automatic DC-side switch-off is not suitable for being the only safety switch-off in applications!

Function

The ROBA®-switch 24V units are used for an input voltage of 24 VDC. They can switch internally automatically, meaning that the output voltage switches to holding voltage from the input voltage (=overexcitation voltage). The overexcitation time can be adjusted via a DIP switch to 150 ms, 450 ms, 1 s, 1,5 s and 2,15 s. The holding voltage can be adjusted via a further DIP switch to ¼, ⅓, ½ and ⅔ of the input voltage (equals 6 V, 8 V, 12 V and 16 V at an input voltage of 24 V).

Apart from this, the ROBA®-switch 24V has an integrated automatic DC-side switch-off. In contrast to the usual DC-side switch-off, no further protective measures or external components are required. The DC-side switch-off is activated in standard mode and causes short switching times on the electromagnetic consumer. This can, however, be deactivated by installing a bridge between terminals 7 and 8 in order to produce soft brakings and quieter switching noises. However, this substantially lengthens the switching times (c. 6 – 10x).

Electrical Connection (Terminals)

2 + 3	Input voltage, ground
4	Control input
5 – 7	Input voltage +24 VDC
8 + 9	Output voltage +
10	Output voltage -

Technical Data

Input voltage U_I	24 VDC +20 % / -10 % SELV/PELV
Output voltage U_{over}	Input voltage U_I
Output voltage U_{hold}	¼, ⅓, ½, ⅔ x U_I ± 20 %
Output current I_{RMS} at ≤ 45 °C	5,0 A
Output current I_{RMS} at max 70 °C	2,5 A
Protection	IP00
Terminal nominal cross-section	1,5 mm² (AWG 22-14)
Ambient temperature	-25 °C up to +70 °C
Storage temperature	-40 °C up to +105 °C

Order Number

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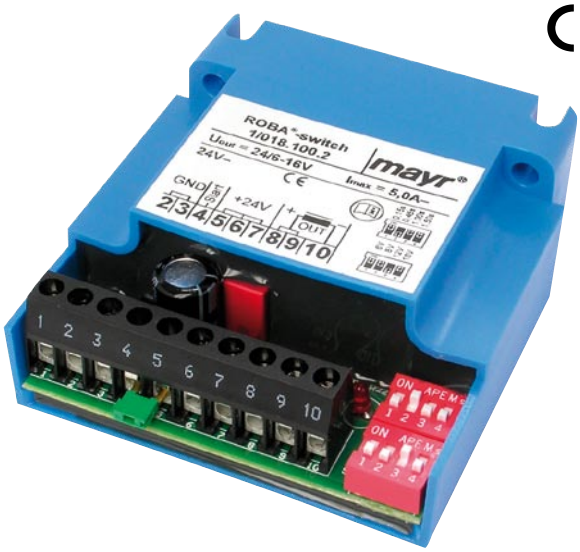
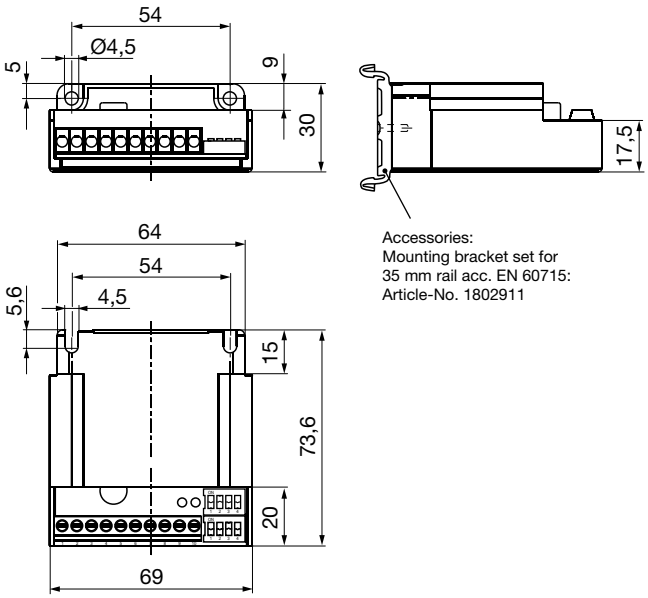
△

Size
1



Dimensions (mm)



Accessories:
Mounting bracket set for 35 mm rail acc. EN 60715:
Article-No. 1802911

c UL us in preparation

Application

ROBA®-multiswitch fast acting rectifiers are used to connect DC units to alternating voltage supplies, for example electromagnetic brakes and clutches (ROBA-stop®, ROBA®-quick, ROBATIC®), electromagnets, electrovalves etc.

Fast acting rectifier ROBA®-multiswitch 019.100.2

- Consistently controlled output voltage in the entire input voltage range.
- Consumer operation with overexcitation or power reduction
- Input voltage: 100 - 500 VAC
- Max. output current I_{RMS}: 2 A

ROBA®-multiswitch units are not suitable for all applications, e.g. use of the ROBA®-multiswitch when operating noise-damped brakes is not possible without taking additional measures. The product's suitability should be checked before use.

Function

The ROBA®-multiswitch units are (dependent on size) used for an input voltage of between 100 and 500. After switch-on, they emit the rectified bridge voltage for 50 ms and then control the 90 or 180 VDC overexcitation voltages. After the overexcitation period, they control the 52 or 104 VDC holding voltages. The overexcitation period can be adjusted via a DIP-switch to 150 ms, 450 ms, 1 s, 1,5 s and 2 s.

Electrical Connection (Terminals)

1 + 2	Input voltage (fitted protective varistor)
3 + 4	Connection for external contact for DC-side switch-off
5 + 6	Output voltage (fitted protective varistor)

Technical Data

Input voltage	see Table 1
Output voltage	see Table 1
Protection	IP65 components, IP20 terminals
Terminal nom. cross-section	1,5 mm², (AWG 22-14)
Ambient temperature	-25 °C up to +70 °C
Storage temperature	-40 °C up to +105 °C

Order Number

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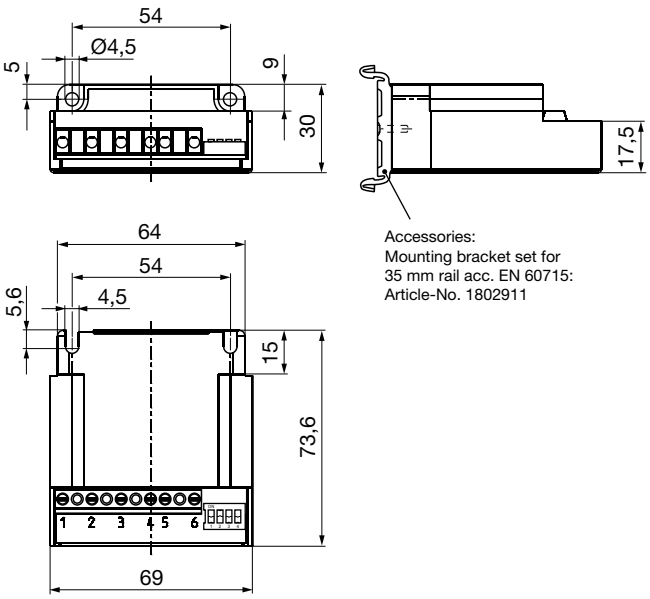
△

Size
10
20

Dimensions (mm)



Accessories:
Mounting bracket set for 35 mm rail acc. EN 60715:
Article-No. 1802911

ROBA®-multiswitch Sizes, Table 1

	Size 10	Size 20
Input voltage VAC ± 10 % acc. to EN 50160	100 - 275	200 - 500
Frequency input voltage Hz	50 - 60	50 - 60
Output voltage U_{over} VDC ± 10 %	90	180
Output voltage U_{hold} VDC ± 10 %	52	104
Output current I_{RMS} at ≤ 45 °C ADC	2,0	2,0
Output current I_{RMS} at max. 70 °C ADC	1,0	1,0
Conformity markings	CE *	CE *

* c UL us in preparation

Spark Quenching Unit Type 070.000.6

Application

Reduces spark production on the switching contacts occurring during VDC inductive load switching.

- Voltage limitation according to VDE0580 2000-07, Item 4.6.
- Reduction of EMC-disturbance by voltage rise limitation, suppression of switching sparks.
- Reduction of brake engagement times by a factor of 2-4 compared to free-wheeling diodes.

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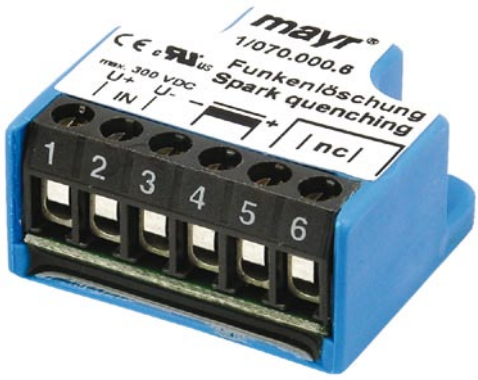


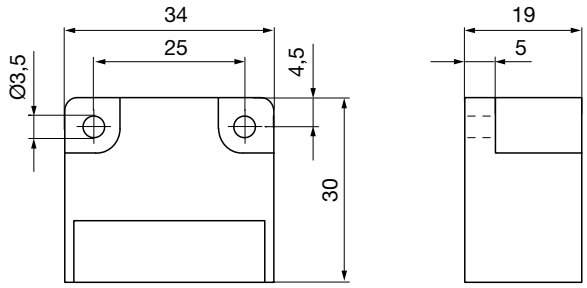
Function

The spark quenching unit will absorb voltage peaks resulting from inductive load switching, which can cause damage to insulation and contacts. It limits these to 70 V and reduces the contact load. Switching products with a contact opening distance of > 3 mm are suitable for this purpose.

Electrical Connection (Terminals)

1 (+) Input voltage
2 (–) Input voltage
3 (–) Coil
4 (+) Coil
5 Free nc terminal
6 Free nc terminal

Dimensions (mm)



Technical Data

Input voltage	max. 300 VDC, max. 615 V_{peak} (rectified voltage 400 VAC, 50/60 Hz)
Switch-off energy	max. 9 J/2 ms
Power dissipation	max. 0,1 Watt
Max. voltage nc terminals	250 V
Protection	IP65 / IP20 terminals
Ambient temperature	-25 °C up to +85 °C
Storage temperature	-25 °C up to +105 °C
Max. conductor connection diameter	2,5 mm^2 / AWG 26-12
Max. terminal tightening torque	0,5 Nm

Accessories

Mounting bracket set for 35 mm rail acc. EN 60715
Article-No. 1803201

Order Number

__ / 0 7 0 . 0 0 0 . 6
△
Size
1

Guidelines on the Declaration of Conformity: A conformity evaluation has been carried out for the product (electromagnetic safety brake) according to the EC Low Voltage Directive 2006/95/EC. The conformity evaluation is set out in writing in a separate document and can be requested if required.

Guidelines on the EMC Directive (2004/108/EC): The product cannot be operated independently according to the EMC Directive. Due to their passive state, brakes are also non-critical equipment according to the EMC. Only after integration of the product into an overall system can this be evaluated in terms of the EMC. For electronic equipment, the evaluation has been verified for the individual product in laboratory conditions but not in the overall system.

Guidelines on the Machinery Directive (2006/42/EC): The product is a component for installation into machines according to the Machinery Directive 2006/42/EC. The brakes can fulfil the specifications for safety-related applications in coordination with other elements. The type and scope of the required measures result from the machine risk analysis. The brake then becomes a machine component and the machine manufacturer assesses the conformity of the safety unit to the directive. It is forbidden to put the product into initial operation until it has been ensured that the machine accords with the stipulations in the directive.

Guidelines on the ATEX Directive: Without a conformity evaluation, this product is not suitable for use in areas where there is a high danger of explosion. In order to use this product in areas where there is a danger of explosion, classification and marking according to the directive 94/9/EC must be carried out.

Safety Guidelines

Brakes may generate, among other things, the following risks:

During the required risk assessment when designing the machine or system, the dangers involved must be evaluated and removed by taking appropriate protective measures. **To prevent injury or damage, only professionals and specialists should work on the devices.** They must be familiar with the dimensioning, transport, installation, initial operation, maintenance and disposal according to the relevant standards and regulations.

Application Conditions

The catalogue values are guideline values which have been determined in test facilities. It may be necessary to carry out your own tests for the intended application.

When dimensioning the brakes, please remember that installation situations, braking torque fluctuations, permitted friction work, run-in behaviour and wear as well as general ambient conditions can all affect the given values. These factors should therefore be carefully assessed, and alignments made accordingly.

- ❒ Mounting dimensions and connecting dimensions must be adjusted according to the size of the brake at the place of installation.
- ❒ The magnetic coils are designed for a relative duty cycle of 100 %, if no other values are stated.
- ❒ The braking torque is dependent on the present run-in condition of the brakes
- ❒ The brakes are only designed for dry running. The torque is lost if the friction surfaces come into contact with oil, grease, water or similar substances, such as other foreign substances.
- ❒ Manufacturer-side corrosion protection of the metallic surfaces.
- ❒ The rotors may rust up and block in corrosive ambient conditions and/or after long periods of storage.

Appointed Use

mayr® brakes have been developed, manufactured and tested in compliance with the VDE 0580 standard, in accordance with the EU Low Voltage Directive. During installation, operation and maintenance of the product, the standard requirements must be observed. *mayr*® brakes are for use in machines and systems and must only be used in the situations for which they are ordered and confirmed. Using them for any other purpose is not allowed!

Ambient Temperature – 20 °C up to + 40 °C

Earthing Connection

The brake is designed for Protection Class I. This protection covers not only the basic insulation, but also the connection of all conductive parts to the PE conductor on the fixed installation. If the basic insulation fails, no contact voltage will remain. Please carry out a standardized inspection of the PE conductor connections to all contactable metal parts!

Protection

(mecanical) IP54: When installed, protected against dust, contact and splashing water form all directions (dependent on the customer-side provided friction flange)
(electrical) IP54: Dust-proof and protected against contact as well as against splashing water from all directions.

Guidelines for Electromagnetic Compatibility (EMC)

In accordance with the EMC Directives 2004/108/EC, the individual components produce no emissions. However, functional components e.g. mains-side energisation of the brakes with rectifiers, phase demodulators, ROBA®-switch devices or similar controls can produce disturbance which lies above the allowed limit values. For this reason it is important to read the Installation and Operational Instructions very carefully and to keep to the EMC Directives.

Regulations, Standards and Directives Used

VDE 0580	Electromagnetic devices and components, general directives
2006/95/EC	Low voltage directive
CSA C22.2 No. 14-2010	Industrial Control Equipment
UL 508 (Edition 17)	Industrial Control Equipment
EN ISO 12100	Machine safety - General principles for design - Risk assessment and risk reduction
EN 61000-6-4	Noise emission
EN 61000-6-2	Interference resistance
EN 60204-1	Electrical machine equipment

Liability

- The information, guidelines and technical data in these documents were up to date at the time of printing.
  Demands on previously delivered brakes are not valid.
- Liability for damage and operational malfunction will not be taken when
  - the Installation and Operational Instructions are ignored or neglected.
  - the brakes are used inappropriately.
  - the brakes are modified.
  - the brakes are worked on unprofessionally.
  - the brakes are handled or operated incorrectly.

Guarantee

- The guarantee conditions correspond with the Chr. Mayr GmbH + Co. KG sales and delivery conditions.
- Mistakes or deficiencies are to be reported to mayr® at once!

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You can find the complete address for the representative responsible for your area under www.mayr.com in the internet.

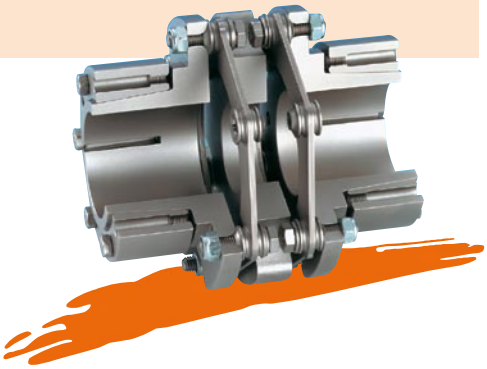
mayr®
your reliable partner

Product Summary

Safety Clutches/Overload Clutches

- **EAS®-Compact®/EAS®-NC**
  Positive locking and completely backlash-free torque limiting clutches
- **EAS®-smartic®**
  Cost-effective torque limiting clutches, quick installation
- **EAS®-element clutch/EAS®-elements**
  Load-disconnecting protection against high torques
- **EAS®-axial**
  Exact limitation of tensile and compressive forces
- **EAS®-Sp/EAS®-Sm/EAS®-Zr**
  Load-disconnecting torque limiting clutches with switching function
- **ROBA®-slip hub**
  Load-holding, frictionally locked torque limiting clutches
- **ROBA®-contitorque**
  Magnetic continuous slip clutches

Shaft Couplings

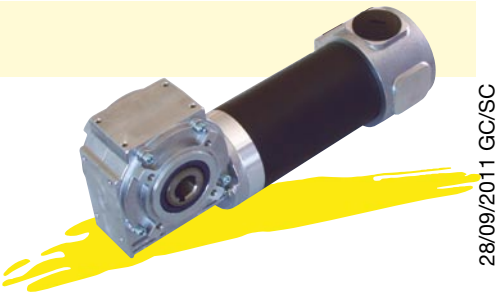


- **smartflex®**
  Perfect precision couplings for servo and stepping motors
- **ROBA®-ES**
  Backlash-free and damping for vibration-sensitive drives
- **ROBA®-DS/ROBA®-D**
  Backlash-free, torsionally rigid all-steel couplings
- **EAS®-control-DS**
  Cost-effective torque-measuring couplings

Electromagnetic Brakes/Clutches

- **ROBA-stop® standard**
  Multifunctional all-round safety brakes
- **ROBA-stop®-M motor brakes**
  Robust, cost-effective motor brakes
- **ROBA-stop®-S**
  Water-proof, robust monoblock brakes
- **ROBA-stop®-Z/ROBA-stop®-silenzio®**
  Doubly safe elevator brakes
- **ROBA®-diskstop®**
  Compact, very quiet disk brakes
- **ROBA®-topstop®**
  Brake systems for gravity loaded axes
- **ROBA®-linearstop**
  Backlash-free brake systems for linear motor axes
- **ROBATIC®/ROBA®-quick/ROBA®-takt**
  Electromagnetic clutches and brakes, clutch brake units

DC Drives



- **tendo®-PM**
  Permanent magnet-excited DC motors
- **tendo®-SC**
  1 quadrant and 4 quadrant transistor controllers

28/09/2011 GC/SC