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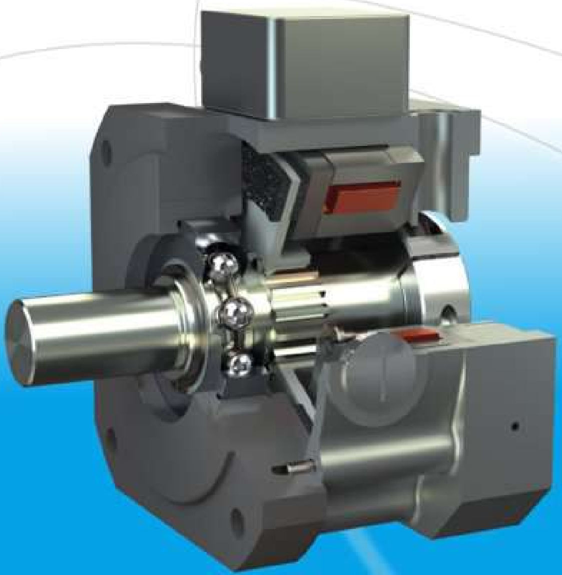

ROBA®-topstop®

K.899.V14.EN

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Safety brake systems for gravity-loaded axes

ROBA-stop® brakes by mayr® prevent inadvertent dropping or crashing of vertical axes.

- ❒ **Reliable safety protecting people in all operating modes**
- ❒ **Controlled operational safety due to an integrated 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 dropping 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 assessment 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 "Safety of Machinery – Safety-related Parts of Controls", the respective solution approaches are specified via additional parameters, such as the system structure (category) and the $MTTF_d$, B_{10d}, DC, CCF values. The safety-related quality of the SPR/CS (safety-related control components) is indicated as the Performance Level (PL).

> ℹ Please contact ***mayr*®** for information on the safety parameters of the brake according to ISO 13849-1.

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.

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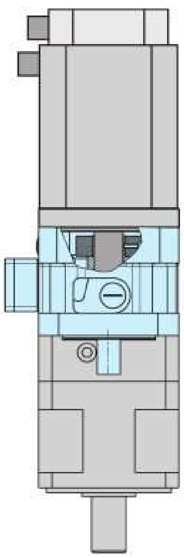
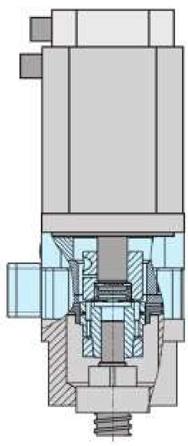
ROBA®-topstop®
Modular safety brake system for a A-bearing-side servomotor attachment

Highlights and Advantages

- **DGUV (German Social Accident Insurance) test certificate: Braking device as "tried and tested component" in terms of the Category 1 acc. DIN EN ISO 13849-1**
- 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 (open/closed) via an integrated condition monitoring
- Short, compact design
- Low rotational moments of inertia
  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.

Tested Safety

DGUV Test
MF 13001
Sicherheit geprüft
tested safety

Type 200/899.012.22

A voluntary prototype inspection has been carried out on the ROBA®-topstop® single circuit brake Type 899.012.22, Size 200. The "DGUV Test Prüf- und Zertifizierungsstelle Maschinen und Fertigungsautomation" (translation: "DGUV Testing and Certification Body, Machines and Manufacturing Automation") confirms that this braking equipment can be considered a "tried and tested component" in terms of category 1 acc. DIN EN ISO 13849-1.

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 flanges.
Seven standard sizes for braking torques of 6 to 400 Nm are available for delivery at short notice.

Brake designs:

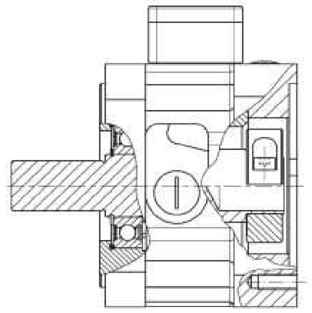
- Single circuit brake with a bearing-supported output shaft: i.e. suitable for toothed belt drives
- Single circuit brake with an integrated plug-in shaft coupling
- Single circuit brake with a shaft coupling and an installed EAS®-smartic® torque limiter
- Redundant dual circuit brake system with a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

Content

The catalogue contains basic information on pre-selection and dimensioning (see page 15).

ROBA®-topstop® – Designs

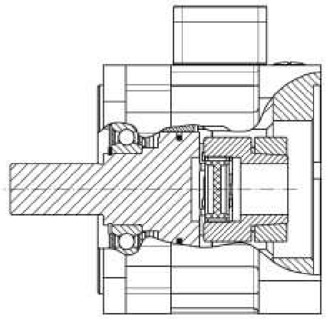
ROBA®-topstop® with shaft design



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

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 screw plug 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._ _

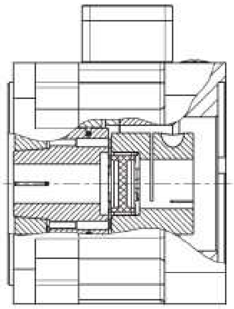
On the ROBA®-topstop® single circuit brake with bearing-supported output shaft and integrated, plug-in ROBA®-ES shaft coupling, the servomotor can be mounted or dismantled in any shaft position. The shaft coupling compensates for shaft misalignment. To install this Type, a second bearing machine-side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

ROBA®-topstop® – Designs

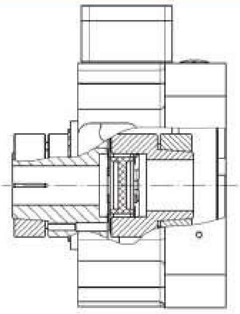
ROBA®-topstop® with plug-in coupling for mounting directly onto ball screw spindles



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 installation 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 nearly no additional space in comparison to 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.

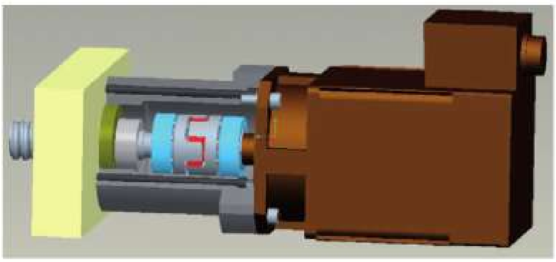


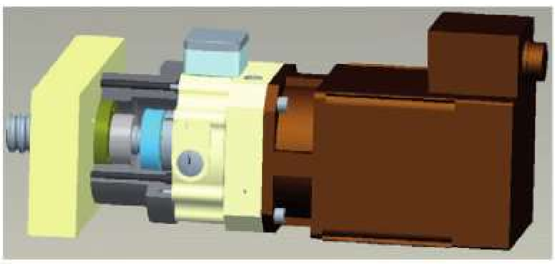
Type 899.1_ _._ _
Single circuit brake module without output flange

Type 899.3_ _._ _
Single circuit brake 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 Types 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 servomotor 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_._ _.

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ROBA®-topstop® single circuit brake

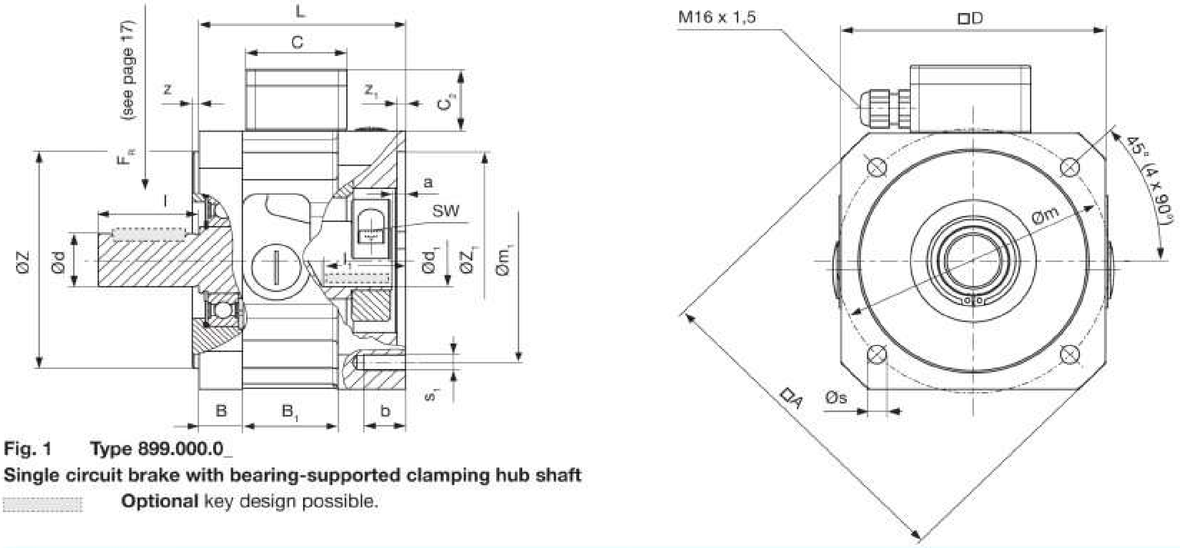

Fig. 1 Type 899.000.0_
Single circuit brake with bearing-supported clamping hub shaft
Optional key design possible.

Technical Data				Size 100	120	150	175	200	230	260
Braking torque [1] M_N	Type 899.000.01	**Standard**	[Nm]	6	12	45	70	100	150	200
		Braking torque tolerance -20% / +40%	[Nm]	4.8 / 8.4	9.6 / 16.8	36 / 63	56 / 98	80 / 140	120 / 210	160 / 280
	Type 899.000.02 [4]	**Increased**	[Nm]	12	30	90	120	160	300	400
		Braking torque tolerance -20% / +40%	[Nm]	9.6 / 16.8	24 / 42	72 / 126	96 / 168	128 / 224	240 / 420	320 / 560
Electrical power	Type 899.000.01	P_N	[W]	21	31.5	44	50	60	86	86
	Type 899.000.02	P_O [2]	[W]	66	102	128	128	148	200	200
		P_H [3]	[W]	16	26	32	32	38	50	50
Maximum speed	Type 899.000.0_	n_{max}	[rpm]	6000	5000	4000	4000	3000	3000	3000
Weight	Type 899.000.0_	m	[kg]	4.75	7.5	13	20	24	45	60
Mass moment of inertia Rotor + Hub with d_{max}	Type 899.000.0_	J_{R+H}	[10^{-4} kgm²]	0.9	6.5	16	43	52	131	250

Dimensions	Size 100	120	150	175	200	230	260
A	130	160	190	232	246	305	345
a	4	5	6.5	10	10	10	10
B	15	20	25	20	20	25	25
B_1	42	52	55	90	71	92	92
b	12	20	24	25	28	30	30
C	58	58	58	58	58	75	75
C_2	37	37	37	37	37	56	56
D	100	126	155	176	194	235	264
L	80	104	119	138.5	138.5	185	185
Shaft Ø d_{k6} x l	14 x 30	19 x 40	24 x 50	35 x 79	32 x 58	38 x 80	48 x 82
	19 x 40	24 x 50	32 x 58	-	38 x 80	42 x 110	42 x 110
	-	-	-	-	-	48 x 110	48 x 110
						-	55 x 110
(Shaft) bore [5] Ø d_1 F7 x l_1	14 x 45	19 x 55	24 x 68	35 x 90	32 x 90	-	42 x 110
	19 x 45	24 x 55	32 x 68	-	38 x 90	-	48 x 110
						-	55 x 110
m	100 (115)	130	165	200	215	265	300
m_1	100 (115)	130 (115*)	165	200	215	265	300
s	7/9	9	11	13.5	13.5	14.5	18
s_1	4 x M6/8	4 x M8	4 x M10	4 x M12	4 x M12	4 x M12	4 x M16
SW	4	5	6	8	8	8	10
Z_{j6} [6]	80	110	130	114.3	180	230	250
	95	95	110	-	130	-	-
Z_1 F8	80	110	130	114.3	180	230	250
	95	95	110	-	130	-	-
z	3	3	3.5	3.5	4	5	5
z_1	4	5	5	10	6	10	10

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

Preferred Bore	d_1	Sizes 100	120	150	175	200	230	260
Frictionally-locking transmittable torques (**Clamping hub** motor-side) T_R [Nm]	Ø 14	30	-	-	-	-	-	-
	Ø 19	40	64	-	-	-	-	-
	Ø 24	-	81	150	-	-	-	-
	Ø 32	-	-	199	-	199	-	-
	Ø 35	-	-	-	215	-	-	-
	Ø 38	-	-	-	-	237	380	-
	Ø 42	-	-	-	-	-	440	545
Suitable for F7 / k6	Ø 48	-	-	-	-	-	530	670
	Ø 55	-	-	-	-	-	-	845

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 at holding voltage
4) Braking torque increased only with overexcitation (see operational instructions)
5) The transmittable torques in bore d_1 are dependent on the diameter, see tables 1, page 6.
6) On sizes 175: Tolerance field h7
*) Optionally available with pitch circle m_1 = 115
We reserve the right to make dimensional and constructional alterations.

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ROBA®-topstop® with output shaft and shaft coupling

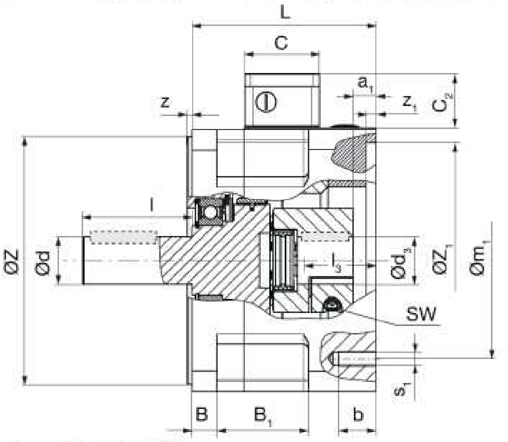

Fig. 2 **Type 899.001._ _**
Single circuit brake with bearing-supported output shaft and with plug-in shaft coupling (clamping hub motor-side)
Optional key design possible.

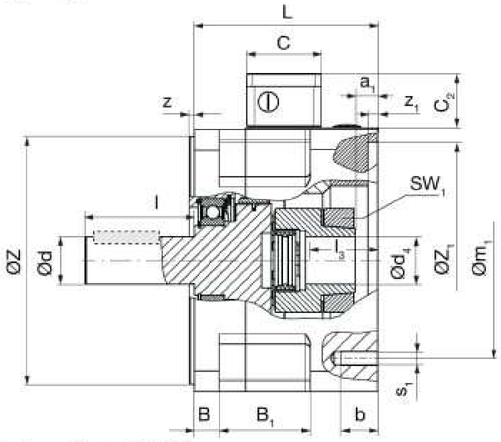

Fig. 3 **Type 899.002._ _**
Single circuit brake with bearing-supported output shaft and with plug-in shaft coupling (shrink disk hub motor-side)
Optional key design possible.

Technical Data					Size					
					120	150	175	200	230	260
Braking torque 1) M_N	Type 899.00_._1	Standard		[Nm]	12	45	70	100	150	200
		Braking torque tolerance -20% / +40%		[Nm]	9.6 / 16.8	36 / 63	56 / 98	80 / 140	120 / 210	160 / 280
	Type 899.00_._2 4)	Increased		[Nm]	30	90	120	160	300	400
		Braking torque tolerance -20% / +40%		[Nm]	24 / 42	72 / 126	96 / 168	128 / 224	240 / 420	320 / 560
Electrical power	Type 899.00_._1		P_N	[W]	31.5	44	50	60	86	86
	Type 899.00_._2		P_O 2)	[W]	102	125	128	148	200	200
			P_H 3)	[W]	26	32	32	38	50	50
Maximum speed	Type 899.00_._ _		n_{max}	[rpm]	5000	4000	4000	3000	3000	3000
Size of Flexible Coupling 5) (ROBA®-ES)				[-]	24	28	38	38	42	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	265/530	310 / 620
	Type 899.00_.2_	*98 Sh A*	T_{KN} / T_{Kmax}	[Nm]	60 / 120	160 / 320	325 / 650	325 / 650	450/900	525 / 1050
	Type 899.00_.1_	*64 Sh D*	T_{KN} / T_{Kmax}	[Nm]	75 / 150	200 / 400	405 / 810	405 / 810	560/1120	655 / 1310
Weight	Type 899.00_._ _		m	[kg]	8.5	15	23	28	45	60
Mass moment of inertia Rotor + Hub with d_{max}	Type 899.001._ _		J_{R+H}	[10^{-4} kgm²]	7.5	18.5	60	67	137	235
	Type 899.002._ _		J_{R+H}		8.5	21.5	70	77	151	250

Dimensions		Size					
		120	150	175	200	230	260
A 7)		160	190	232	246	305	345
a_1		20	20.5	16	16	32	23
B		12	14	20	20	25	25
B_1		76	83	92	92	92	92
b		20	24	25	28	30	30
C		58	58	58	58	75	75
C_2		37	37	37	37	56	56
D 7)		126	155	176	194	235	264
L		120	136	160	160	185	185
Shaft	Ø d_{k6} x l	19 x 40	24 x 50	35 x 79	32 x 58	38 x 80	48 x 82
		24 x 50	32 x 58	-	38 x 80	42 x 110	42 x 110
		-	-	-	-	48 x 110	48 x 110
		-	-	-	-	-	55x 110
Bores 6)	Ø d_3 F7	15 - 28	19 - 35	20 - 45*	20 - 45*	28 - 50	35-55*
	Ø d_4 H7	15 - 28	19 - 38	20 - 45*	20 - 45*	28 - 50	35-60*
Required shaft length	l_3	40 - 50	50 - 58	58 - 80*	58 - 80*	80-110	80-110*
m 7)		130	165	200	215	265	300
m_1		130 (115**)	165	200	215	265	300
s 7)		9	11	13.5	13.5	13.5	18
s_1		4 x M8	4 x M10	4 x M12	4 x M12	4 x M12	4 x M16
SW		5	6	6	6	8	10

Dimensions	Size					
	120	150	175	200	230	260
SW_1	4	4	5	5	6	6
Z_{j6} 8)	110	130	114.3	180	230	250
	95	110	-	130	-	-
Z_1 F8	110	130	114.3	180	230	250
	95	110	-	130	-	-
z	3	3.5	3.5	4	5	5
z_1	5	5	10	6	10	10

1) Braking torque tolerance: -20 % / +40 %,
2) Coil capacity on overexcitation
3) Coil capacity at holding voltage
4) Braking torque increased only with overexcitation (see operational instructions)
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 dimensions Fig. on the right on page 6.
8) On sizes 175: Tolerance field h7

*) - 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

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ROBA®-topstop® with integrated shaft coupling

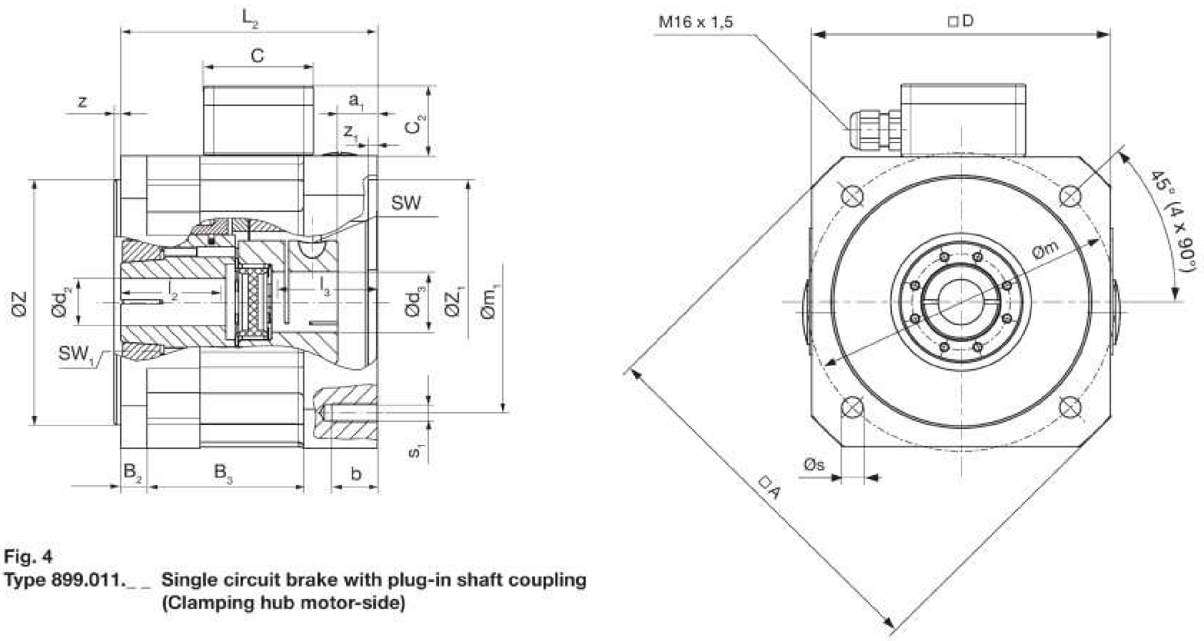

Fig. 4
Type 899.011._ _ Single circuit brake with plug-in shaft coupling (Clamping hub motor-side)

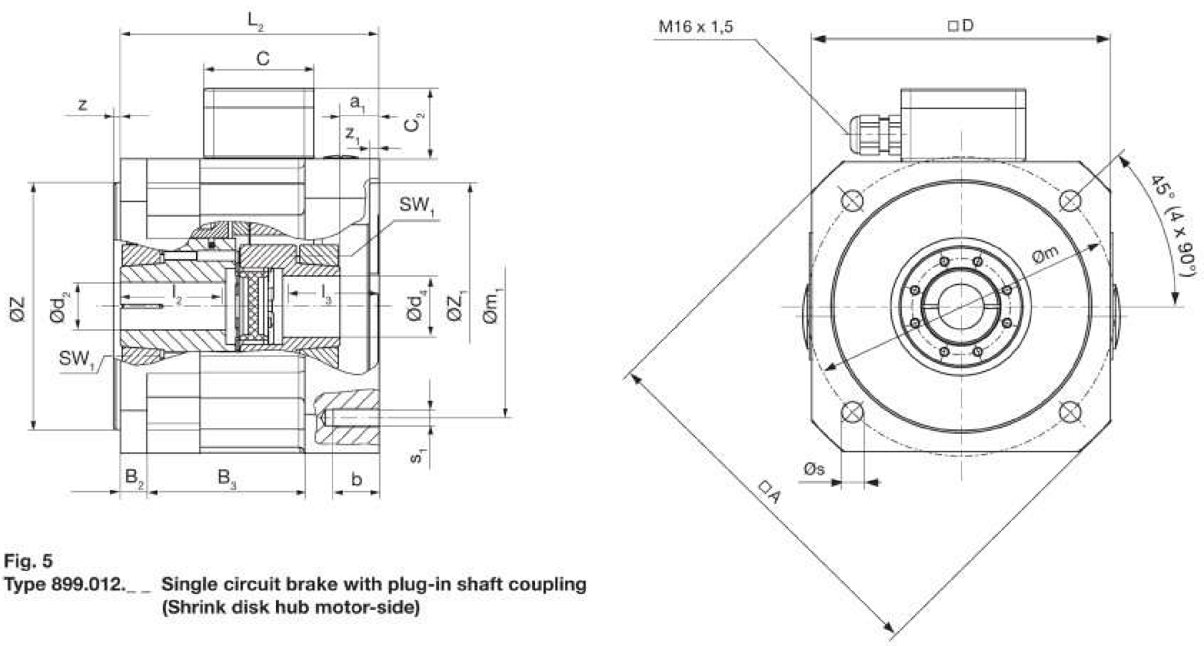

Fig. 5
Type 899.012._ _ Single circuit brake with plug-in shaft coupling (Shrink disk hub motor-side)

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Technical Data

Technical Data				Size 120	150	175	200	230	260
Braking torque [1)] M_N	Type 899.01_._1	Standard	[Nm]	12	45	70	100	150	200
		Braking torque tolerance - 20% / + 40%	[Nm]	9.6 / 16.8	36 / 63	56 / 98	80 / 140	120 / 210	160 / 280
	Type 899.01_._2 [4)]	Increased	[Nm]	30	90	120	160	300	400
		Braking torque tolerance -20% / +40%	[Nm]	24 / 42	72 / 126	96 / 168	128 / 224	240/ 420	320 / 560
Electrical power	Type 899.01_._1	P_N	[W]	31.5	44	50	60	86	86
	Type 899.01_._2	P_O [2)]	[W]	102	125	128	148	200	200
		P_H [3)]	[W]	26	32	32	38	50	50
Maximum speed	Type 899.01_._1	n_{max}	[rpm]	5000	4000	4000	3000	3000	3000
Size of Flexible Coupling [5)] (ROBA®-ES)			[-]	24	28	38	38	42	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	265 / 530	310 / 620
	Type 899.01_.2_ *98 Sh A*	T_{KN} / T_{Kmax}	[Nm]	60 / 120	160 / 320	325 / 650	325 / 650	450 / 900	525 / 1050
	Type 899.01_.1_ *64 Sh D*	T_{KN} / T_{Kmax}	[Nm]	75 / 150	200 / 400	405 / 810	405 / 810	560 / 1120	655 / 1310
Weight	Type 899.01_._ _	m	[kg]	7.5	14	23	27	45	60
Mass moment of inertia Rotor + Hub with d_{max}	Type 899.011._ _	J_{R+H}	[10^{-4} kgm²]	7.5	18.5	60	67	137	235
	Type 899.012._ _	J_{R+H}		8.5	21.5	70	77	151	250

Dimensions

Dimensions		Size 120	150	175	200	230	260
A		160	190	232	246	305	345
a_1		20	20.5	16	16	32	23
B_2		12	14	20	20	25	25
B_3		76	83	90	92	92	92
b		20	24	25	28	30	30
C		58	58	58	58	75	75
C_2		37	37	37	37	56	56
D		126	155	176	194	235	264
L_2		120	136	160	160	185	185
Bores [6)]	Ø d_2 H6	15 - 28	19 - 38	20 - 45	20 - 45	28 - 50	35 - 60
	Ø d_3 F7	15 - 28	19 - 35	20 - 45 *	20 - 45 *	28 - 50	35 - 55 *
	Ø d_4 H7	15 - 28	19 - 38	20 - 45 *	20 - 45 *	28 - 50	35 - 60 *
Required shaft length	l_2	25 - 52	30 - 60	35 - 75	35 - 75	40 - 80	40 - 80
	l_3	40 - 50	50 - 58	58 - 80 *	58 - 80 *	80-110 *	80-110 *
m		130	165	200	215	265	300
m_1		130 (115**)	165	200	215	265	300
s		9	11	13.5	13.5	13.5	18
s_1		4 x M8	4 x M10	4 x M12	4 x M12	4 x M12	4 X M16
SW		5	6	6	6	8	10
SW_1		4	4	5	5	6	6
Z_{j6} [7)]		110	130	114.3	180	230	250
		95	110	-	130	-	-
Z_1 F8		110	130	114.3	180	230	250
		95	110	-	130	-	-
z		3	3.5	3.5	4	5	5
z_1		5	5	10	6	10	10

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

		Preferred Bore	Sizes 120	150	175	200	230	260
		d_2 / d_4	120	150	175	200	230	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	300	-
		Ø 30	-	282	368	368	350	-
		Ø 32	-	308	405	405	400	-
		Ø 35	-	343	460	460	500	450
		Ø 38	-	373	513	513	600	500
		Ø 40	-	-	547	547	680	600
		Ø 42	-	-	577	577	730	720
		Ø 45	-	-	617	617	790	850
		Ø 48	-	-	-	-	850	1000
		Ø 50	-	-	-	-	880	1180
		Ø 52	-	-	-	-	-	1270
		Ø 55	-	-	-	-	-	1353
		Ø 58	-	-	-	-	-	1428
Table 2		Ø 60	-	-	-	-	-	1471

The transmittable torques for the shrink disk connection allow for the max. tolerance backlash on a:
- solid shaft: tolerance k6 / bores Ø d_2 and Ø d_4: Tolerance k6 (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	Sizes 120	150	175	200	230	260
		d_3	120	150	175	200	230	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	208	-
		Ø 30	-	124	124	124	228	-
		Ø 32	-	133	133	133	248	-
		Ø 35	-	145	145	145	280	350
		Ø 38	-	-	158	158	315	390
		Ø 40	-	-	166	166	340	420
		Ø 42	-	-	174	174	365	455
		Ø 45	-	-	187	187	404	505
		Ø 48	-	-	-	-	442	560
		Ø 50	-	-	-	-	470	600
		Ø 52	-	-	-	-	-	640
Table 3		Ø 55	-	-	-	-	-	705

1) Braking torque tolerance -20 % / +40 %
2) Coil capacity on overexcitation
3) Coil capacity at holding voltage
4) Braking torque increased only with overexcitation (see operational instructions)
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 und d_4 are dependent on the diameter, see tables 2 and 3.
7) On sizes 175: Tolerance field h7
*) - 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

ROBA®-topstop® with integrated shaft coupling

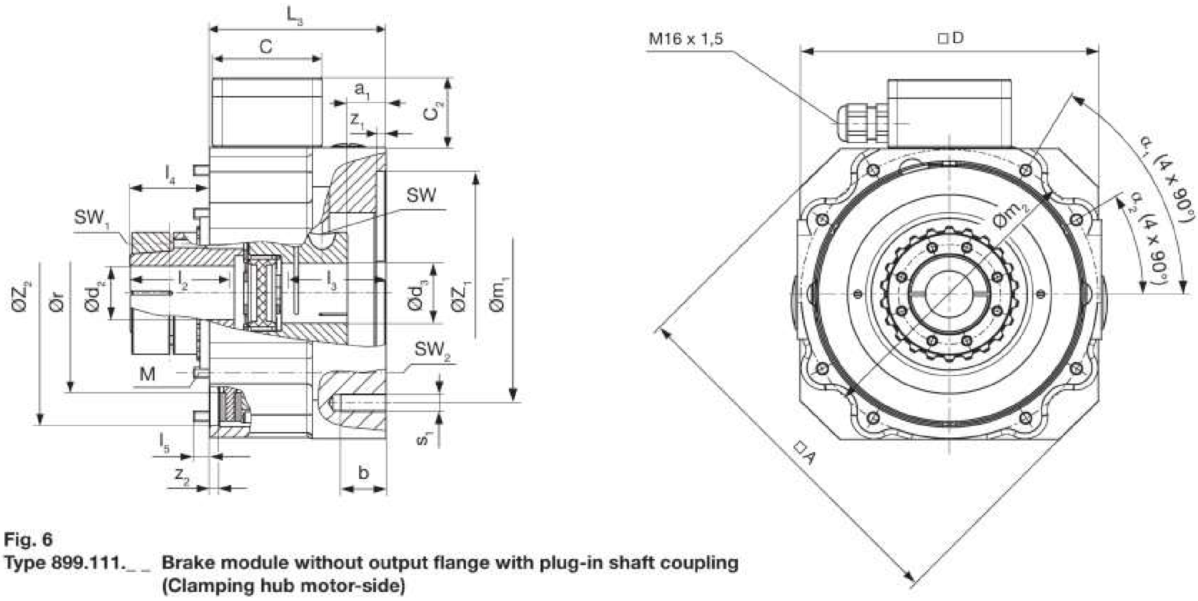

Fig. 6
Type 899.111._ _ Brake module without output flange with plug-in shaft coupling (Clamping hub motor-side)

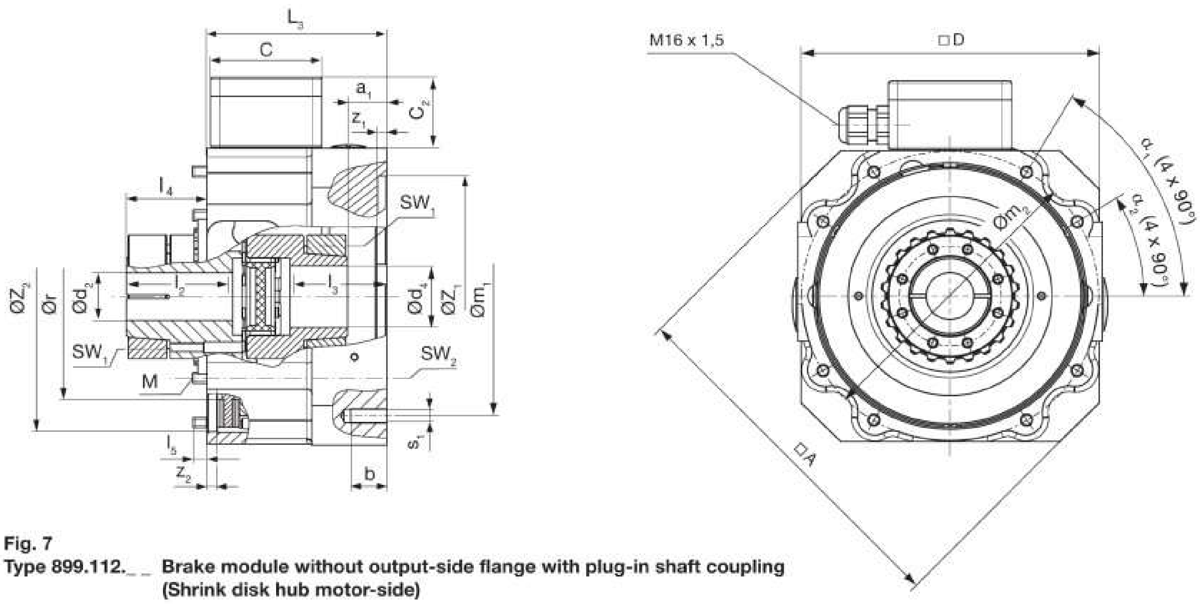

Fig. 7
Type 899.112._ _ Brake module without output-side flange with plug-in shaft coupling (Shrink disk hub motor-side)

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Technical Data				Size					
				120	150	175	200	230	260
Braking torque [1] M_N	Type 899.11_._1	Standard	[Nm]	12	45	70	100	150	200
		Braking torque tolerance - 20% / + 40%	[Nm]	9.6 / 16.8	36 / 63	56 / 98	80 / 140	120 / 210	160 / 280
	Type 899.11_._2 [4]	Increased	[Nm]	30	90	120	160	300	400
		Braking torque tolerance -20% / +40%	[Nm]	24 / 42	72 / 126	96 / 168	128 / 224	240/ 420	320 / 560
Electrical power	Type 899.11_._1	P_N	[W]	31.5	44	50	60	86	86
	Type 899.11_._2	P_O [2]	[W]	102	125	128	148	200	200
		P_H [3]	[W]	26	32	32	38	50	50
Maximum speed	Type 899.11_._1	n_{max}	[rpm]	5000	4000	4000	3000	3000	3000
Size of Flexible Coupling [5] (ROBA®-ES)			[-]	24	28	38	38	42	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	265 / 530	310 / 620
	Type 899.11_.2_ *98 Sh A*	T_{KN} / T_{Kmax}	[Nm]	60 / 120	160 / 320	325 / 650	325 / 650	450 / 900	525 / 1050
	Type 899.11_.1_ *64 Sh D*	T_{KN} / T_{Kmax}	[Nm]	75 / 150	200 / 400	405 / 810	405 / 810	560 / 1120	655 / 1310
Weight	Type 899.11_._ _	m	[kg]	4.5	8.5	14	16	27	35
Mass moment of inertia	Type 899.111._ _	J_{R+H}	$[10^{-4}$ kgm$^2]$	7.5	18.5	60	67	137	235
Rotor + Hub with d_{max}	Type 899.112._ _	J_{R+H}		8.5	21.5	70	77	151	250

Dimensions		Size					
		120	150	175	200	230	260
A		160	190	232	246	305	345
a_1		20	20.5	16	16	32	23
b		20	24	25	28	30	30
C		58	58	58	58	75	75
C_2		37	37	37	37	56	56
D		126	155	176	194	235	264
L_3		84	94	107.5	107.5	133	133
Bores [6]	Ø d_2 H6	15 - 28	19 - 38	20 - 45	20 - 45	28 - 50	35 - 60
	Ø d_3 F7	15 - 28	19 - 35	20 - 45*	20 - 45*	28 - 50	35 - 55*
	Ø d_4 H7	15 - 28	19 - 38	20 - 45*	20 - 45*	28 - 50	35 - 60*
Required shaft length	l_2	25 - 52	30 - 60	35 - 75	35 - 75	40 - 80	40 - 80
	l_3	40 - 50	50 - 58	58 - 80*	58 - 80*	80 - 110*	80 - 110*
l_4		36	42	52.5	52.5	52	52
l_5		7	10	12	12	16	16
M		8 x M5	8 x M6	8 x M6	8 x M8	8 x M8	8 x M10
m_1		130 (115**)	165	200	215	265	300
m_2		122	154	185	200	248	280
r [7]		83	106	135	140	165	195
s_1		4 x M8	4 x M10	4 x M12	4 x M12	4 x M12	4 x M16
SW		5	6	6	6	8	10
SW_1		4	4	5	5	6	6
SW_2		4	5	5	6	6	8
Z_1 F8		110	130	114.3	180	230	250
		95	110	-	130	-	-
Z_2 H7		111	141	170	186	229	256
z_1		5	5	10	6	10	10
$z_{2\,-0.03}$		5.5	5.5	6	6	8	8
α_1		30 °	31 °	30 °	30 °	30 °	30 °
α_2		60 °	59 °	60 °	60 °	60 °	60 °

1) Braking torque tolerance: -20 % / +40 %,
2) Coil capacity on overexcitation
3) Coil capacity at holding voltage
4) Braking torque increased only with overexcitation (see operational instructions)
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 und d_4 are dependent on the diameter, see tables 4 and 5.
7) Maximum bore in flange (customer-side) at least 4 mm smaller than Ør.
*) - 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

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

	Preferred Bore		Sizes					
		d_2 / d_4	120	150	175	200	230	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	300	-
		Ø 30	-	282	368	368	350	-
		Ø 32	-	308	405	405	400	-
		Ø 35	-	343	460	460	500	450
		Ø 38	-	373	513	513	600	500
		Ø 40	-	-	547	547	680	600
		Ø 42	-	-	577	577	730	720
		Ø 45	-	-	617	617	790	850
		Ø 48	-	-	-	-	850	1000
		Ø 50	-	-	-	-	880	1180
		Ø 52	-	-	-	-	-	1270
		Ø 55	-	-	-	-	-	1353
		Ø 58	-	-	-	-	-	1428
Table 4		Ø 60	-	-	-	-	-	1471

The transmittable torques for the shrink disk 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		Sizes					
		d_3	120	150	175	200	230	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	208	-
		Ø 30	-	124	124	124	228	-
		Ø 32	-	133	133	133	248	-
		Ø 35	-	145	145	145	280	350
		Ø 38	-	-	158	158	315	390
		Ø 40	-	-	166	166	340	420
		Ø 42	-	-	174	174	365	455
		Ø 45	-	-	187	187	404	505
		Ø 48	-	-	-	-	442	560
		Ø 50	-	-	-	-	470	600
		Ø 52	-	-	-	-	-	640
Table 5		Ø 55	-	-	-	-	-	705

We reserve the right to make dimensional and constructional alterations.

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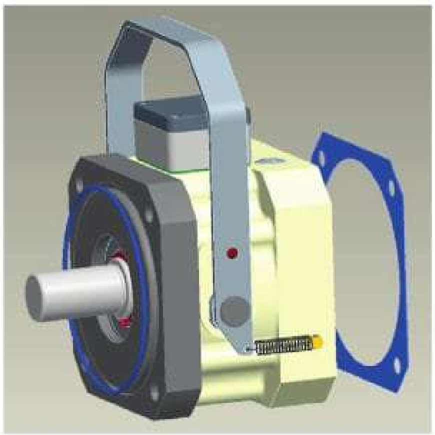
ROBA®-topstop® – Examples: Further options as special designs

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 a special accessory. Please note that the hand release prevents the safety brake from functioning during operation. With hand release lever, only Protection IP54 possible. Size 200 (Type 899.___._2) hand release not possible.

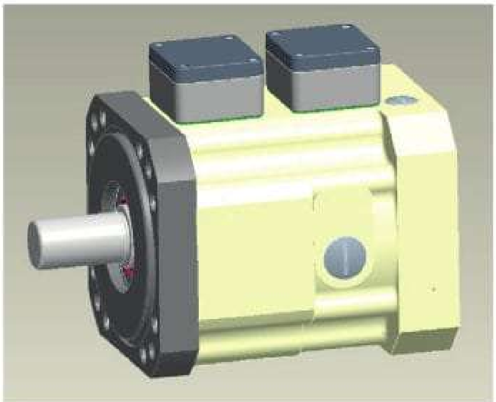
Another option is the extended **Protection IP65**:

=> 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**)

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

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

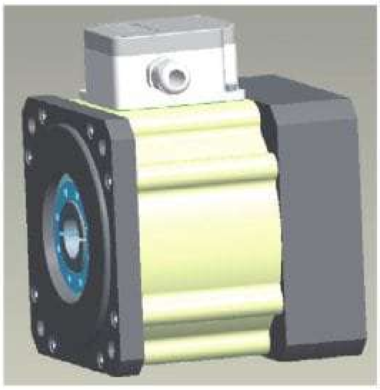


This dual circuit brake with bearing-supported clamping hub shaft is equipped with two independent brake circuits. Every brake circuit can be controlled separately electrically and the data are requested separately.
Using this homogenous redundant brake system, in connection with the respective diagnosis and testing measures, a Performance Level acc. DIN EN ISO 13849 is possible.

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® torque limiter



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

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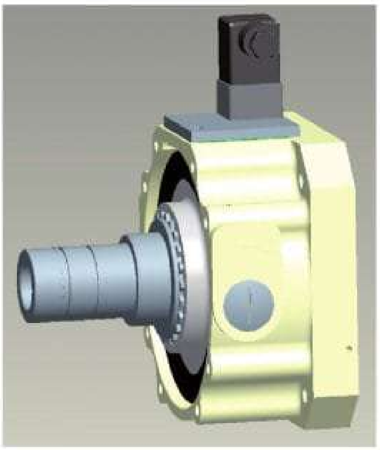
ROBA®-topstop® – Examples

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



This ROBA®-topstop® single circuit brake 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. It 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

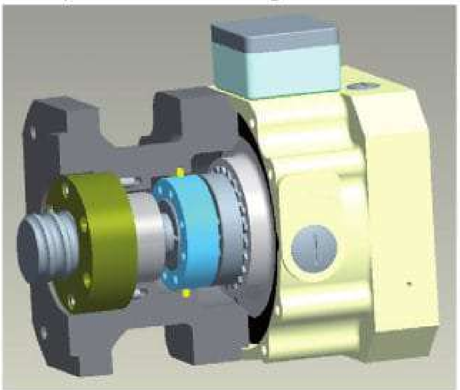
Output side: Ød = 20

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

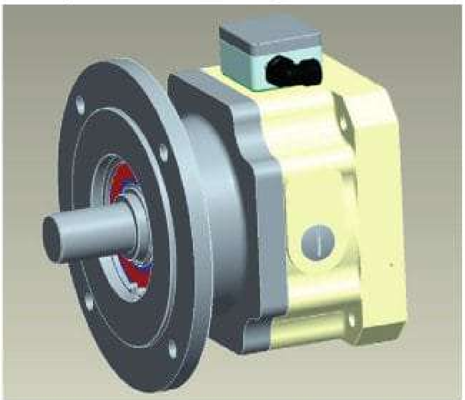
ROBA®-topstop® single circuit brake with integrated ROBA®-ES shaft coupling and special friction flange



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
- release monitoring

Fig. 13: Special Type 899.300.01 SO / 24 V / ØZ = 200 / $ØZ_1$ = 180 / Ød = 40 / $Ød_1$ =38

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ROBA®-topstop® – Order Example

Order Number

Sizes
100 [4]
120
150
175
200
230
260

Output side

Shaft design	0
Shrink disk hub	1

Motor side

0	Shaft bore with clamping
1	ROBA®-ES Clamping hub
2	ROBA®-ES Shrink disk hub

Coil voltage [1]
[VDC]
12
24
104
180
207

Centering bore	Output side	Motor side
ØZ	Ød	Ød$_1$
ØZ$_1$	Ød$_2$	Ød$_3$
		Ød$_4$

according to catalogue, special dimensions available on request.

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

Single circuit brake (with standard output flange) — **0**
Single circuit brake module (without output flange) — **1**
Dual circuit brake — **2**
- *only with nominal torque 899.200.01 and only for Sizes 120/150/200*
- *see Fig. 9 on page 12, 'Further Options'*
- *Dimension sheet available on request*

Single circuit brake module [2] (with special output flange) — **3**

without elastomeric element	0
Elastomeric element hardness 64 Sh D (green)	1
Elastomeric element hardness 98 Sh A (red)	2
Elastomeric element hardness 92 Sh A (yellow)	3

1 Braking torque Standard
2 Braking torque Increased
only with overexcitation (see operational instructions)

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 request.

Order Extensions

Electrical Connection

1 Terminal box
Terminal
(without release monitoring)
Cable outlet, right side

2 **Standard configuration**
(Terminal box
Terminal
Release monitoring with proximity switch
Cable outlet, right side)

Hand release

without	0
with	1

- with hand release, only Protection IP54 possible
- Size 200 (Type 899.___.2) hand release not possible

Protection

Basic protection IP54	0
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

__ / __ / __

Order Example

- 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 mayr® power transmission.**

(LR 108927-1) Certified for the American and Canadian market

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. Special output flange is included in delivery.
3) See Fig. 8 on page 12, 'Further Options'. Dimension sheet available on request
4) Size 100 only on Type 899.000.0_

ROBA®-topstop® - General

The catalogue contains basic information on pre-selection and dimensioning.

For detailed information on selection, brake dimensioning, electrical connection, installation and initial operation, please see the Installation and Operational Instructions B.8.8.

If you have any questions regarding the selection and dimensioning, please contact our headquarters.

Intended Use

General Guidelines

mayr®-brakes have been developed, manufactured and tested in compliance with the DIN VDE 0580 standard and in accordance with the EU Low Voltage Directive as electromagnetic components. During installation, operation and maintenance of the product, the requirements for the standard must be observed.

ROBA®-topstop® brakes by *mayr* ® prevent inadvertent dropping or crashing of gravity-loaded axes.

- ROBA®-topstop® brakes are intended for use in industrial machines and systems with electrical drives.
- For applications in, for example, defence technology or medical products, please contact *mayr*®.
- Not suitable for operation in areas where there is a danger of explosion
- Not suitable for applications with combustion engines

The brakes must only be used in the situations for which they are ordered and confirmed. Using them for any other purpose is not allowed.

Guidelines on ROBA®-topstop®

- Only for use as holding brake with a limited number of EMERGENCY STOP braking actions. Not suitable for cyclic STOP braking actions in cycle operation. With designs featuring a microswitch, please observe the switching frequency.
- Please observe the correct dimensioning of speed, braking torque, friction work and switching frequency in case of EMERGENCY STOP for safe holding of the load torque and safe compliance of the required braking distance and overtravel time.
- The switching times stated in the catalogue can only be achieved using the respective correct electrical wiring. This also refers to the protection circuit for brake control and the response delay times of all control components.
- Temperatures over 80 °C on the brake housing when the machine is in use may influence the switching times and braking torque levels. The brake and the achieved braking torque must be tested in the application.
- Application in clean environments (penetration of coarse dust and liquids such as oils can have a negative effect on the braking function).
- Application in enclosed buildings (In tropical regions, in high humidity with long downtimes and sea climates only after taking special measures).
- Intended for motor-side mounting onto synchronous and asynchronous servomotors.

Electrical control

For safe function of the system, an aligned control system and the correct electrical wiring are necessary. Please find detailed informations in the**Installation and Operational Instruction B.8.8**.

The design of the control unit depends on the application and is determined by the possible hazard risk.

Secure Control acc. EN ISO 13849-1

In order to safeguard against hazardous situations, which can occur for example during operation of vertical axes, the ROBA®-topstop® must be combined with a safe control.

The combination of "safe brake" and "safe control" can contribute towards fulfilling the harmonized standard EN ISO 13849-1 on the Machinery Directive 2006/42/EC.

For safe control, a brake control module specially developed for such applications, is available. According to SIL 3 Level, two brake circuits can be supplied. **For detailed information please see pages 20 and 21**.

Additional Supply and Control Modules

For controlling the ROBA®-topstop®, additional suitable supply and control modules are available.

For overview and functions, please see page 22.

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ROBA®-topstop® – 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)

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

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 speed and direction from which the axis is braked
- All system times such as proximity switch 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

During the system running times, the input speed might increase depending on the total efficiency and load. Please take this into account when calculating the friction power.

3. Taking the inspection and test torques into account

$M_{Test} < M_{N\ -20\%} \times 0.9$

4. Inspection of thermic load Q_r

$$Q_r = \frac{J \times n^2}{182.4} \times \frac{M_N}{M_v}$$

$M_v = M_N - M_L$ (-) is valid if load is braked during downward movement

$M_{N\ -20\%}$	[Nm]	Brake minimum braking torque (= braking torque -20 % x braking torque) see tables Technical Data, pages 6 – 11
Q_r	[J/braking]	Friction work present per braking
S	[-]	Recommended safety factor min. 1.5 – 2 depending on the application
J	[kgm²]	Total mass moment of inertia referring to the brake
M_N	[Nm]	Brake nominal torque (see tables Technical Data, pages 6 – 11)
M_{Test}	[Nm]	Test torque as e.g. cyclic brake test (see operational instructions)
M_V	[Nm]	Delaying torque
M_L	[Nm]	Load torque on system

The permitted friction work $Q_{r\,zul.}$ per braking action with 1 – 3 switchings (reduction of the friction work after several switchings), see table 11 (page 19).

Guaranteeing the necessary braking 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 test of the brake rotor during operation provides additional safety.
Depending on the danger, please observe the respective regulations / standards.

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ROBA®-topstop® – Technical Explanations / Parameters

Permitted Motor Attachments / Breakdown Torques

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

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

Permitted Breakdown Torque		Size						
		100	120	150	175	200	230	260
$M_{k\ zul.}$	[Nm]	25	45	90	135	200	300	450

Table 6

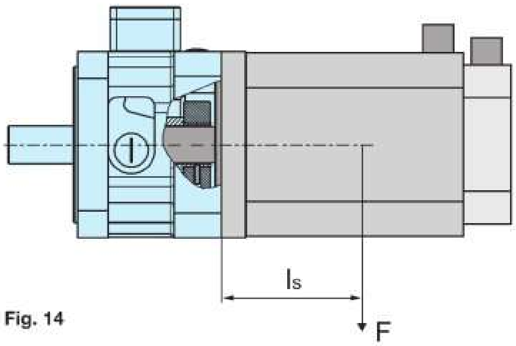

Fig. 14

Permitted Outer Acceleration and Deceleration Torques on the Brake

		Types			Size						
					100	120	150	175	200	230	260
1	Max. permitted acceleration and deceleration torque on the servomotor on the brake	all Types	M_{Beschl}	[Nm]	15	40	100	150	200	300	500
2	*I) Max. dynamic braking torque by the motor on the brake (servomotor with holding brake)	all Types except 899.___._2	M_{Brems}	[Nm]	7.5	15	35	60	80	120	200
3	Max. dynamic braking torque by the motor on the brake (servomotor with holding brake)	899.200.01 899.___._2	M_{Brems}	[Nm]	*II) No further braking torque permitted through motor brake						

Table 7

*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.

Permitted Shaft Loads

Max. radial forces on the bearing applicable for:
Type **899.000.0_** and Type **899.200.01**

ROBA®-topstop® brake		Size						
		100	120	150	175	200	230	260
Distance "l_R" (Fig. 15)	[mm]	20	22.5	30	40	40	55	55
Max. perm. radial force „F_R" with a distance l_R	[N]	250	600	1000	1500	1500	2000	3000
The permitted forces refer to a max. speed of	[rpm]	6000	5000	4000	4000	3000	3000	3000
Nominal service lifetime	[h]	30000	30000	25000	25000	15000	15000	15000

Table 8

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.

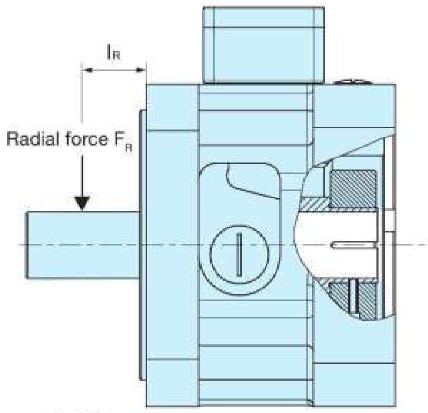

Fig. 15

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ROBA®-topstop® – Switching Times

The switching times are only valid for the braking torques stated in the catalogue and can only be achieved using the respective correct electrical wiring. This also refers to the protection circuit for brake control and the response delay times of all control components.

According to directive VDI 2241, the switching times are measured at 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 voltage-limiting components.

These 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 voltage peaks are according to VDE 0580 limited to values smaller than 1200 volts. If other voltage-limiting components are installed, this switching time t_{11} and therefore also switching time t_1 increase.

Switching times Type 899. _ _ _ . _1				Size						
				100	120	150	175	200	230	260
Braking torque Standard			[Nm]	6	12	45	70	100	150	200
Connection time	DC-side switching	t_1	[ms]	65	55	80	85	90	160	200
	AC-side switching	t_1	[ms]	350	300	400	450	600	700	800
Response delay on connection	DC-side switching	t_{11}	[ms]	50	40	50	50	55	70	75
	AC-side switching	t_{11}	[ms]	300	250	350	400	500	600	650
Separation time (release)		t_2	[ms]	70	80	150	150	200	230	250

Table 9: Switching times Type 899. _ _ _ . _1, brake operation with **braking torque Standard (without overexcitation)**

Switching times Type 899. _ _ _ . _2				Size						
				100	120	150	175	200	230	260
Braking torque Increased			[Nm]	12	30	90	120	160	300	400
Connection time	DC-side switching	t_1	[ms]	40	40	50	55	60	100	120
	AC-side switching	t_1	[ms]	200	160	250	270	300	360	400
Response delay on connection	DC-side switching	t_{11}	[ms]	25	20	25	25	30	35	35
	AC-side switching	t_{11}	[ms]	175	125	200	200	250	280	300
Separation time (release)		t_2	[ms]	60	60	100	100	150	200	200

Table 10: Switching times Type 899. _ _ _ . _2, brake operation with **braking torque Increased (with overexcitation)**

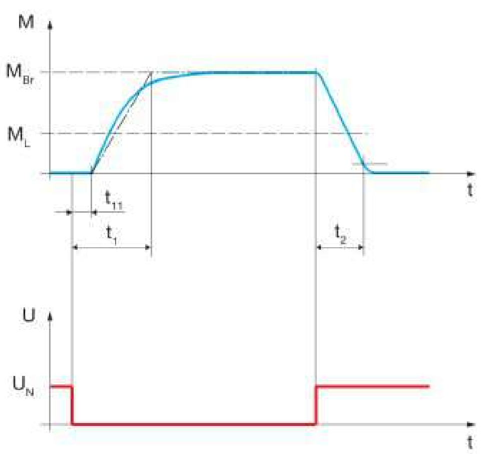

Diagram 1:
Switching times Type 899. _ _ _ . _1, brake operation with **coil nominal voltage**

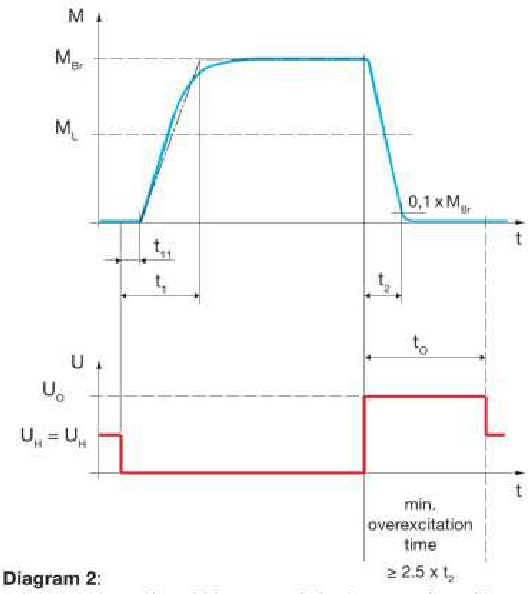

Diagram 2:
Switching times Type 899. _ _ _ . _2, brake operation with **overexcitation voltage**

Keys

- M_{Br} = Braking torque
- M_L = Load torque
- t_1 = Connection time
- t_{11} = Response delay on connection
- t_2 = Separation time
- t_O = Overexcitation time
- U_H = Holding voltage
- U_N = Coil nominal voltage
- U_O = Overexcitation voltage

On brake operation with overexcitation voltage, at least 2.5 times the brake separation time t_2 must be selected as overexcitation time t_O: **$t_O \geq 2.5 \times t_2$**

It is possible to reduce the connection times (t_1 / t_{11}) by 20 – 50 % using suitable wiring.

Please contact *mayr*® power transmission.

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ROBA®-topstop® – Friction Power / Friction Work

For safety reasons, the ROBA®-topstop® safety brake is only to be used as a holding brake with a possible number of dynamic EMERGENCY STOP braking actions.

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 times within the total application timeframe.

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

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

Permitted Switching Work $Q_{r\,zul.}$ per Braking				Speed				
	Size	Type		1500 1/min	3000 1/min	4000 1/min	5000 1/min	6000 1/min
$Q_{r\,zul.}$	100	899._ _ _.1 Standard	[J/braking]	7000	5500	4000	3000	2000
		899._ _ _.2 Increased		4500	3000	2000	1000	800
	120	899._ _ _.1 Standard		9000	4500	1500	1000	-
		899._ _ _.2 Increased		6000	2500	700	400	-
	150	899._ _ _.1 Standard		11000	6000	2000	-	-
		899._ _ _.2 Increased		7500	3500	1000	-	-
	175	899._ _ _.1 Standard		15000	7500	4500	-	-
		899._ _ _.2 Increased		9000	4500	2400	-	-
	200	899._ _ _.1 Standard		22000	9000	-	-	-
		899._ _ _.2 Increased		15000	6000	-	-	-
	230	899._ _ _.1 Standard		27000	11000	-	-	-
		899._ _ _.2 Increased		16000	6500	-	-	-
	260	899._ _ _.1 Standard		32000	14000	-	-	-
		899._ _ _.2 Increased		18000	6500	-	-	-

Table 11: Permitted switching work $Q_{r\,zul.}$ 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 $Q_{r\,zul.}$ = 3000 J/braking action).

c) Special dimensioning is necessary for higher speeds. Please contact *mayr*® power transmission.

Friction Work up to Rotor Replacement

Permitted friction work $Q_{r\,ges.}$ up to rotor replacement		Size						
		100	120	150	175	200	230	260
$Q_{r\,ges.}$	[10^6 J]	17	28	65	100	180	240	300

Table 12: Friction work $Q_{r\,ges.}$ up to rotor replacement

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

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ROBA®-SBCplus

The safe brake control - for use up to PLe and SIL CL3

Application

The safe brake control ROBA®-SBCplus is used to control and monitor two ROBA®stop safety brakes, especially in applications, which have to fulfill requirements regarding personal protection according to the standards for functional reliability, such as for example ISO 13849 and IEC 62061.

Characteristics:

- Safe electronic switching of two brakes
- Input voltage power circuit 24/48 VDC
- Connection for up to 2 brakes up to 4.5 A/24 VDC or 2.25 A/48 VDC (108 W)
- Output voltage (holding voltage) can be selected as 6,8,12,24,48 VDC
  → Power reduction, temperature reduction, electricity costs reduction
- Overexcitation time configurable
- Feedback inputs release monitoring for proximity switch or microswitch
- Monitoring for plausibility of the feedback
  → Error diagnostics of the brake
- Status and error outputs for feedback to the control
- No mechanic contacts for controlling and monitoring
  → High reliability, no wear, independent of cycle frequency and cycle rate
- Fast ("DC-side") or slow ("AC-side") switch-off possible
- Galvanic separation between the control part and the power part
  → Prevention of EMC issues
- Four integrated functions:
  Contactor, 24 VDC fast-acting rectifier, safety relay, spark quenching
- Safe holding voltage and overexcitation time
- Safety functions are programmed into the ROBA®-SBCplus and only have to be parameterised
  → Plausibility check integrated and must not be programmed and validated
- Applicable up to PLe and SIL CL3, Type examination TÜV Süd (German Technical Inspectorate)

Maximum switching reliability

The brake control must safely interrupt the current in the magnetic coil on switching off the brake. The ROBA®-SBCplus module works with wear-free electronic semiconductors and thus achieves almost unlimited switching frequencies and switching reliability.

Safe inner configuration

Amongst other things, the internal diagnostics inspections for short circuits, earth short-circuits and line breaks as well as safe overexcitation for releasing the brake and switching to reduced holding voltage when the brake is opened are the components required for "fail-safe" inner configuration.

Numerous safety functions

Numerous safety functions permit comprehensive error diagnostics. The brake voltage is monitored. An excessively high voltage could dangerously extend the drop-out time on switch-off, if, for example, this were to cause a vertical axis to drop to an unpermittedly low level. The monitoring of the switching times, which influence the braking distance, is therefore another component of error diagnostics.

Safe switching condition monitoring

The signal evaluation of the release monitoring with plausibility check permits a switching condition monitoring of the brake. The plausibility is controlled as follows: If voltage is applied, the brake must be opened after a defined time and vice versa. The switching condition monitoring can be used to reliably prevent the drive starting up against a closed brake. In this way, creeping errors, such as gradually increasing wear, which affects the switching times, can be detected.

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ROBA®-SBCplus

Type 021.100.2

Technical Data

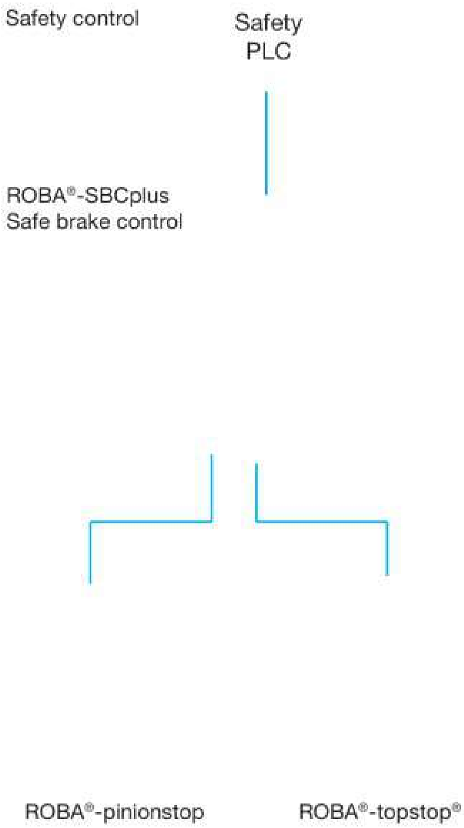
Electrical connection	
Supply voltage logic	24 VDC -15 % / +20 %
Supply voltage power	24 VDC or 48 VDC ±10 %
Inputs:	
Safe inputs	4 (Y10 – Y23)
Standard inputs	4 (S35, S36, Y1, Y2)
Monitoring times	30 ms ... 4000 ms
Outputs:	
Supply voltage S11	24VDC, 0.1 A
Acknowledgement outputs	24VDC, 0.1 A O3 fault message O4 Status circuit 1 O5 Status circuit 2
Test pulse outputs	T0, T1, 24 VDC, 0.1 A
Power outputs	O1, O2
Continuous operation	24 VDC/2 x 4.5 A max.
Continuous operation	48 VDC/2 x 2.25 A max.
Overexcitation	24 VDC/2 x 6.5 A max.
Overexcitation	48 VDC/2 x 3.25 A max.

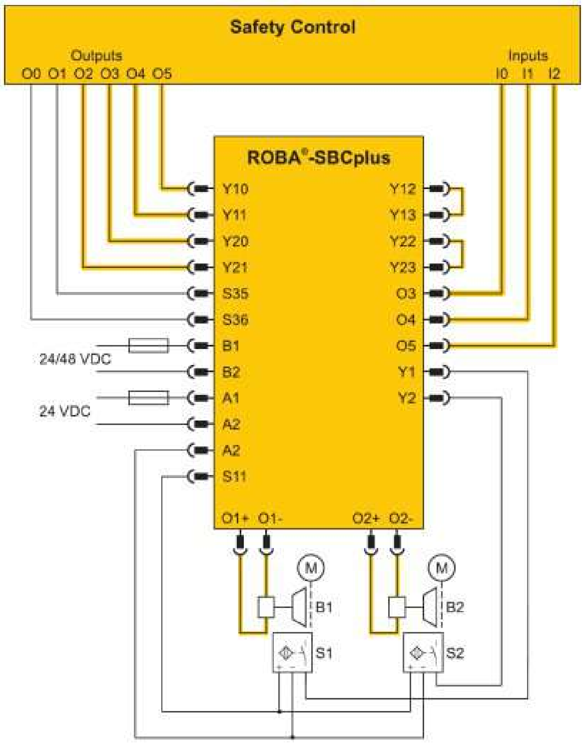
Reduced voltages	6/8/12/16/24 VDC ±10 %
Overexcitation times	100 ms ... 2500 ms
Cycle frequency	4/min max.
Ambient temperature	0 – 45 °C
Protection	IP20
Installation into control cab.	IP54
Dimension	45×100×120 mm
Connection terminal	0.20 – 2.5 mm², 24 – 12 AWG
Clamping terminals per connection	2

Certification:
Type examination tested by TÜV (German Technical Inspectorate), CE

Parameterisation:
- On delivery, the device is completely parameterised for the respective ROBA-stop® brake
- Only due to the correct parameterisation, a diagnostic coverage DC of 60% can be assumed for the brake without additional measures via the feedback of the release monitoring signal.

Application Example





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If the brake control ROBA®-SBCplus is not used, safe disconnection must be guaranteed customer-side. For generation of the DC voltage required for the magnetic coils, the following *mayr*®-DC modules are available.

DC voltage module	Mains/input voltage	Mains/output voltages ratio	Output voltages	Certification
Half-wave rectifier Type 024.000.6	**Up to 600 VAC**	VDC = 0.45 x VAC	**Up to 270 VDC** Level dependent on the mains voltage	**UL**
Bridge rectifier Type 025.000.6	**Up to 230 VAC**	VDC = 0.9 x VAC	**Up to 207 VDC** Level dependent on the mains voltage	**UL**
ROBA®-switch Type 017._00.2	**100 to 500 VAC**	Excitation voltage VDC = 0.9 x VAC	**90 to 450 VDC** Level dependent on the mains voltage	**UL**
		Selectable switching time		
		Holding voltage VDC = 0.45 x VAC	**45 to 225 VDC** Level dependent on the mains voltage	
ROBA®-switch Type 017.110.2 (with integrated DC-side switch-off)	**100 to 500 VAC**	Excitation voltage VDC = 0.9 x VAC	**90 to 450 VDC** Level dependent on the mains voltage	**UL**
		Selectable switching time		
		Holding voltage VDC = 0.45 x VAC	**45 to 225 VDC** Level dependent on the mains voltage	
ROBA®-switch 24 V Type 018.100.2 (with integrated DC-side switch-off)	**24 VDC**	Excitation voltage Mains = output	**24 VDC**	**UL**
		Selectable switching time		
		Selectable holding voltage	**6 VDC, 8 VDC, 12 VDC,16 VDC**	
ROBA®-multiswitch Type 019.100.2 Size 10	**100 to 275 VAC**	Excitation voltage constant/independentof the mains voltage	**90 VDC**	**UL**
		Selectable switching time		
		Holding voltage constant/independentof the mains voltage	**52 VDC**	
ROBA®-multiswitch Type 019.100.2 Size 20	**200 to 500 VAC**	Excitation voltage constant/independentof the mains voltage	**180 VDC**	**UL**
		Selectable switching time		
		Holding voltage constant/independentof the mains voltage	**104 VDC**	

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Product Summary

Torque Limiters/Overload Clutches

- **EAS®-Compact®/EAS®-NC/EAS®-smartic®**
  Positive locking and completely backlash-free torque limiting clutches
- **EAS®-reverse**
  Reversing, re-engaging torque limiter
- **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
- **EAS®-HSC/EAS®-HSE**
  High-speed safety clutches for high-speed applications

Shaft Couplings

- **smartflex®/primeflex®**
  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
- **ROBA®-DSM**
  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®-duplostop®/ROBA®-twinstop®/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
- **ROBA®-guidestop**
  Backlash-free holding brake for profield rail guides
- **ROBATIC®/ROBA®-quick/ROBA®-takt**
  Electromagnetic clutches and brakes, clutch brake units

DC Drives

- **tendo®-PM**
  Permanent magnet-excited DC motors

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