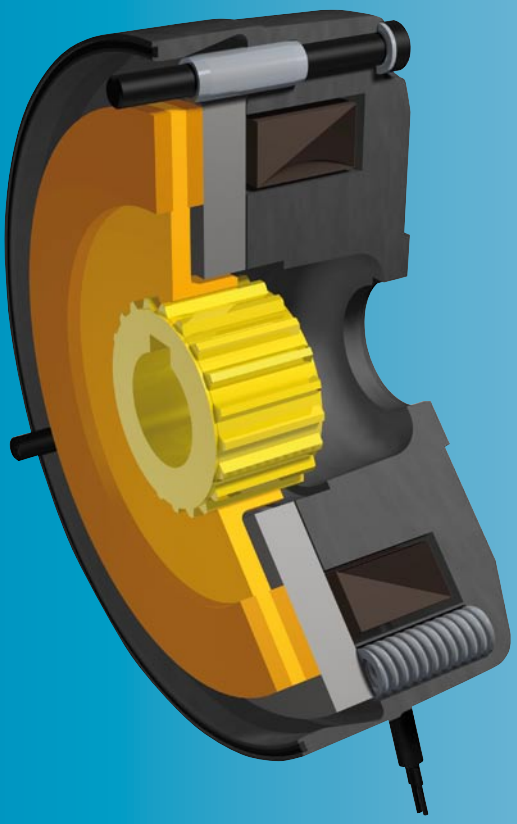
ROBA-stop®-M

Electromagnetic safety brakes



ROBA-stop®
Always the safest choice for brakes

- *Fast and cost-effective installation*
- *High Protection IP54 / IP65*
- *Maintenance-free for the rotor lifetime*

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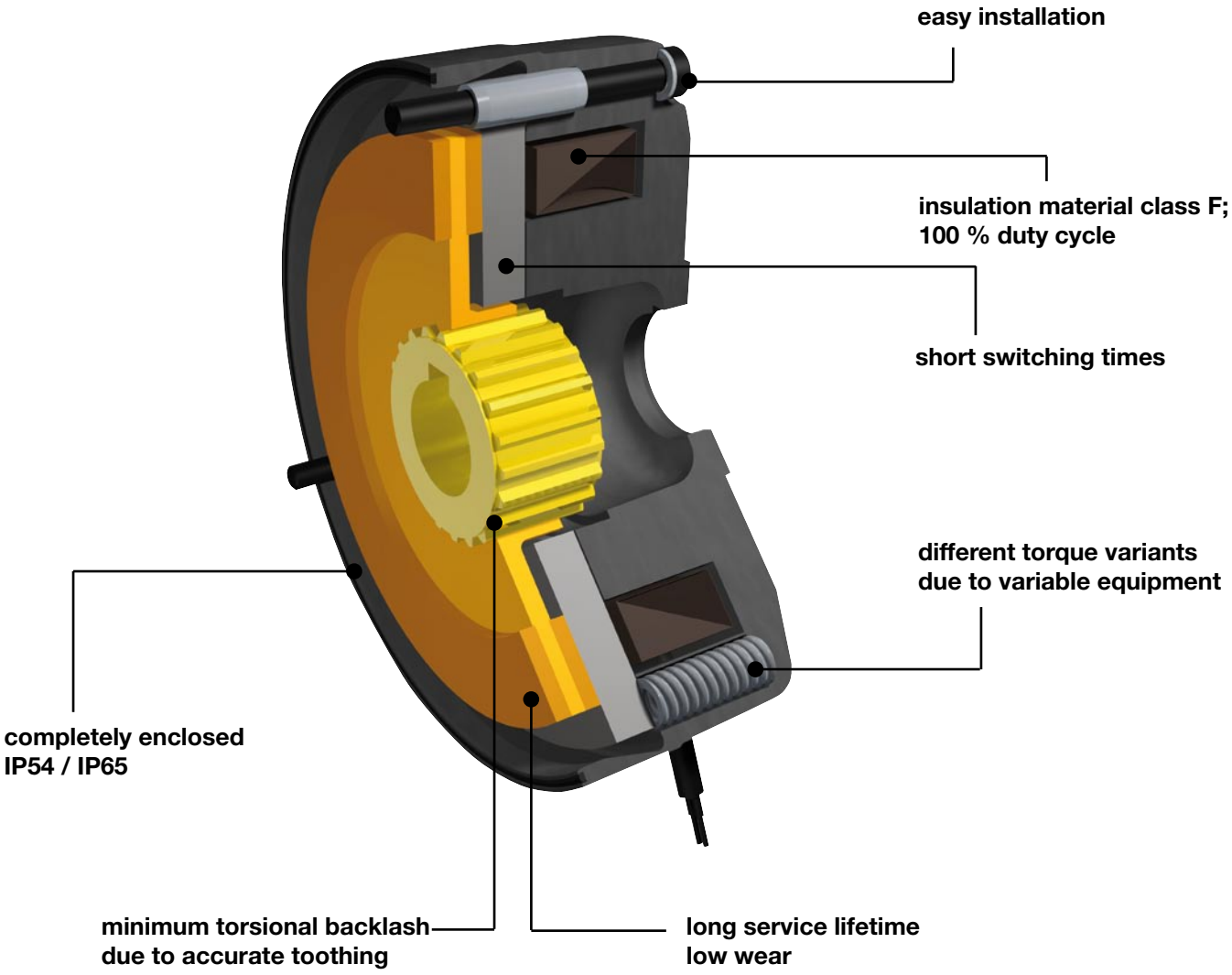
your reliable partner

Your Reliable Brake



Advantages for Your Applications

- ❑ Easy installation
- ❑ Brake outer diameter completely enclosed (higher protection can easily be realised)
- ❑ Magnetic coil is designed for a relative duty cycle of 100 %
- ❑ Magnetic coil and casting compound correspond to insulation material class F
- ❑ The nominal air gap is constructionally specified and inspected
- ❑ Short switching times
- ❑ Maintenance-free for rotor lifetime

Designs and Variants

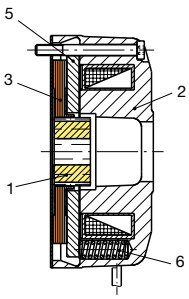
See Type key on page 3, Dimensions Figs., Technical Data and Dimensions Sheets on pages 4 and 5 and Further Options on page 10.

Function

ROBA-stop®-M brakes are spring applied, electromagnetic safety brakes.

Spring applied:

In a de-energised condition, helical springs (6) press against the armature disk (5). The rotor (3) is held between the armature disk (5) and the corresponding mounting surface of the machine. The shaft is braked via the gear hub (1).



Electromagnetic:

When the power is switched on, a magnetic field is built up. The armature disk (5) is attracted to the coil carrier (2) against the spring pressure. The brake is released and the shaft is able to rotate freely.

Safety brakes:

The brake brakes reliably and safely in the event of power switch-off, a power failure or an EMERGENCY STOP.

Order Number

Nominal torque holding brake	**0**
Nominal torque standard	**1**
84 % nominal torque [6]	**2**
68 % nominal torque [6]	**3**
50 % nominal torque [6]	**4**
34 % nominal torque [6]	**5**
Nominal torque adjustable [2] [6]	**6**
112 % nominal torque [6]	**7**
125 % nominal torque [6]	**8**

0	Without supplementary parts
1	Hand release [1]
2	Friction disk [7]
3	Hand release/Friction disk [1] [7]
4	Flange plate [8]
5	Hand release/Flange plate [1] [8]

__ / 8 9 1 . __ __ __ . __ / __ / __ / __

Sizes 2 up to 1000	Standard brake metal rotor[3] Holding brake metal rotor Standard brake Friction lining rotor [4]	**0** **1** **2**	Standard [11] Enclosed design IP65 [5] Tacho design [5] Central torque adjustment [2]	**0** **1** **2** **3**	Coil voltage [9] [VDC] 24 [10] 104 180 207	Bore Hub Ø d (please observe dimensions pages 4-5, Table 2, page 7)	Keyway acc. DIN 6885/1 or DIN 6885/3

Example: 16 / 891.211.0 / 24 / 16 / 6885/1

For Further Options, see page 10.

1) Hand release not installed on sizes 2 – 500. Size 1000: hand release only available as emergency hand release. Hand release for IP65 design only ex works.
2) On request
3) From size 60
4) Up to size 32 (for brake operation in hoisting device drives, please contact the manufacturer)
5) Not in combination with friction disk
6) See Technical Explanations pages 6 – 7
7) Sizes 2 – 60
8) Standard tacho brake flange plate
9) Brake operation only with overexcitation on size 500 from 700 Nm onwards and on size 1000.
10) Not possible on size 1000.
11) Standard and tacho design are identical on size 1000.

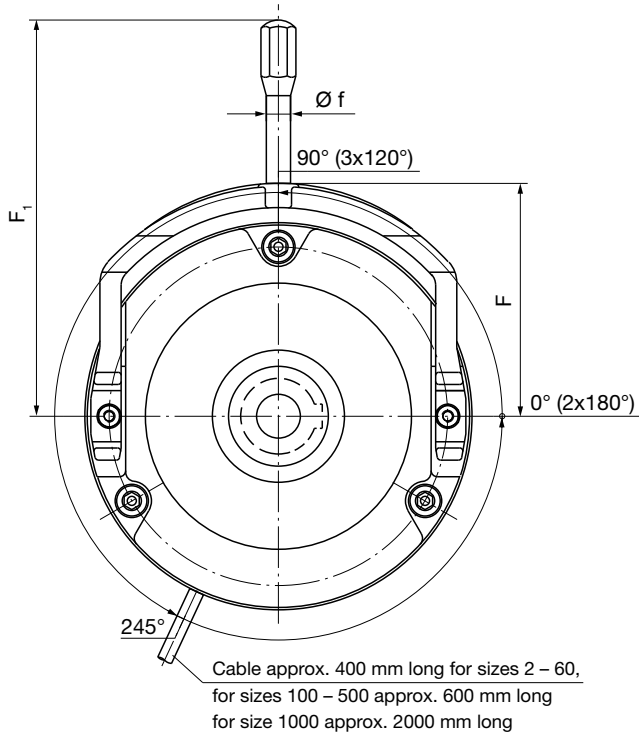
Please Observe:

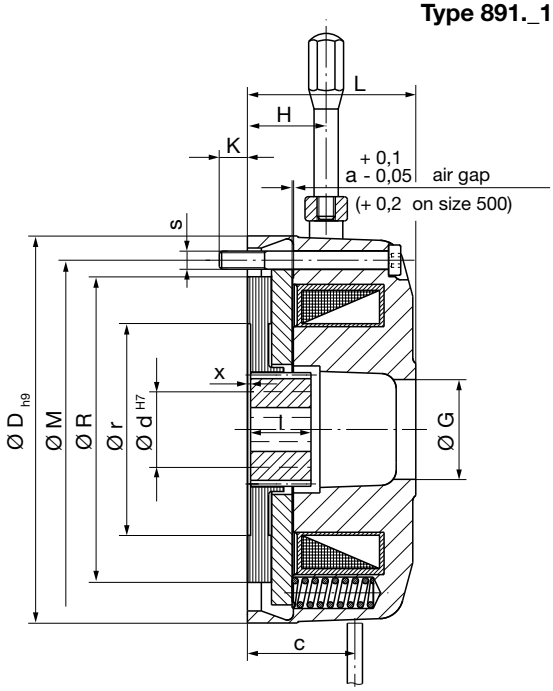
According to German notation, decimal points in this document are represented with a comma (e.g. 0,5 instead of 0.5).

We reserve the right to make dimensional and constructional alterations.

ROBA-stop®-M brakes are also available in ATEX-design according to the directive 94/9 EC (ATEX 95)
(Please contact the manufacturer separately for this).

Type 891._11.0



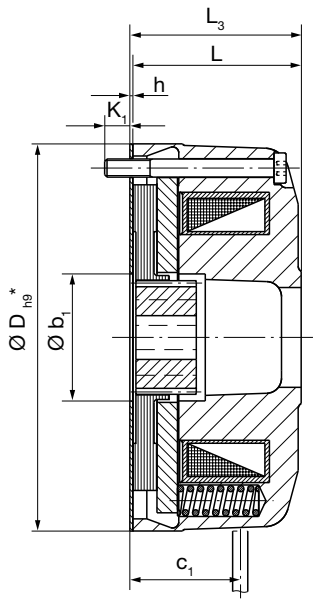


Technical Data				Size									
				2	4	8	16	32	60	100	150	250	500	1000
Braking torque	Standard brake [1] Type 891.0/2 _ _._	M_{nom}	[Nm]	2	4	8	16	32	60	100	150	250	500 [1.2]	1000 [5]
	Holding brake [1.2] Type 891.1_ _._	M_{nom}	[Nm]	4	8	16	32	64	100	180	250	450	800 [3]	1600 [5]
Input power		P_{nom}	[W]	19	25	29	38	46	69	88	98	120	152	186
Maximum speed		$n_{max.}$	[rpm]	6000	5000	4000	3500	3000	3000	3000	1500	1500	1500	1500
Weight	Standard brake Type 891.0/2 _ _._	m	[kg]	0,76	1,1	1,8	3,4	4,5	7,4	13,6	19,2	33,3	38	79
	Holding brake Type 891.1_ _._	m	[kg]	0,76	1,1	1,8	3,4	4,5	7,4	13,6	19,2	33,3	38	79

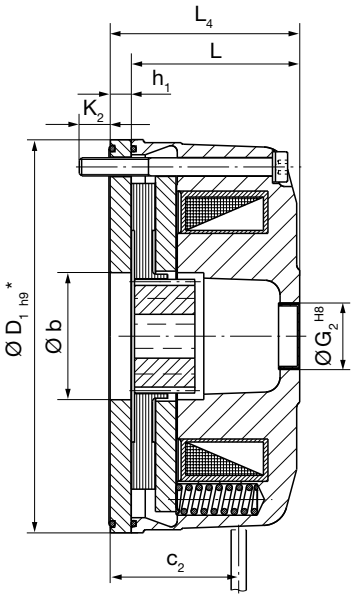
Bores				Size										
				2	4	8	16	32	60	100	150	250	500	1000
Bore Ø d^{H7} [2]	Standard brake Type 891.0/2 _ _._	min.	[mm]	8	10	11	14	19	22	24	30	40 [1.1]	50 [1.1]	75
		max.	[mm]	15	15	20	25	30	35	45	50	60	80	90
				Please observe Table 2, page 7										
	Holding brake Type 891.1_ _._	min.	[mm]	8	10	11	14	19	22	24	30	40	50	75
		max.	[mm]	15	15	20	25	30	35	45	50	55	75	90
				Please observe Table 2, page 7										

Dimensions [mm]	Size										
	2	4	8	16	32	60	100	150	250	500	1000
a	0,15	0,15	0,2	0,2	0,2	0,25	0,3	0,3	0,35	0,4	0,5
b	30	30	36	42	52	60	78	84	96	130	180
b_1	30	30	36	42	52	62	-	-	-	-	-
c	24	26,5	28,7	35,5	39,2	50,5	54	59	69	70	85
c_1	25	27,5	29,7	36,8	40,5	51,8	-	-	-	-	-
c_2	29	32,5	34,7	42,5	47,2	58,5	64	71	83	89	106
D	76	87	103	128	148	168	200	221	258	310	382
D_1	81	92	108	130	148	168	200	221	258	310	382
D_2	81	92	108	134	154	174	206	227	266	318	392
F	48,5	54	63,5	77	88	100,5	123	133	153	179	-
F_1	102,5	108	117,5	131	169	228,5	267	347	494	521	-
f	8	8	8	8	10	14	14	19	23	23	-

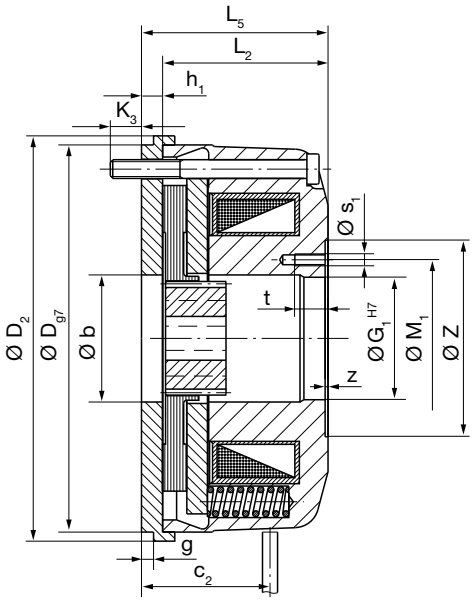
Type 891._12.0
Standard with friction disk



Type 891._14.1
Enclosed design (IP 65)
with flange plate



Type 891._14.2
Tacho attachment design
with flange plate



* Outer diameter friction disk: free size; outer diameter flange plate: -0,2

Missing dimensions are identical with Type 891.011.0 see page 4.

Dimensions [mm]	Size										
	2	4	8	16	32	60	100	150	250	500	1000
G	16,5	18	22	33	36	38	48	55	65	85	100
G_1	23,5	28,5	32,5	40,5	52,5	60	75,5	82,5	92	131	100
G_2 H8	-	-	22	22	28	32	42	48	52	62	100
g	4	4	4	4	4	4	5	6	7	7	7
H	16	14,5	17,5	26	27	26	34	41	46	54,5	-
h	1	1	1	1,25	1,25	1,25	-	-	-	-	-
h_1	5	6	6	7	8	8	10	12	14	19	21
K	10	10,8	12,5	12,3	8,3	12	12	20	20	22	18,5
K_1	9	9,8	11,5	11,1	7,1	10,8	-	-	-	-	-
K_2	10	8,8	11,5	10,3	10,3	14	12	18	25,5	21,5	17,5
K_3	10	9,8	11,5	10,3	10,3	14	12	18	26	23	19
L	39	41,5	45,2	55,7	61,7	72,5	84	97	116	114	135 [6) 7)]
L_2	38	40,5	44,2	54,7	60,7	71,5	83	96	115	113	135 [7)]
L_3	40	42,5	46,2	57	63	73,8	-	-	-	-	-
L_4	44	47,5	51,2	62,7	69,7	80,5	94	109	130	133	170 [6)]
L_5	43	46,5	50,2	61,7	68,7	79,5	93	108	129	132	156 [7)]
l	18	18	20	20	25	30	30	35	40	50 [4)]	70
	supporting length of the key										
M	66	72	90	112	132	145	170	196	230	278	325
M_1	29	35	41	52	61	75	88	100	112	145	115,5
R	57	65	81	101	121	130,5	154	178	206	253	300
r	45	45	53	70	83	94	106	122	140	161	190
s	3 x M4	3 x M4	3 x M5	3 x M6	3 x M6	3 x M8	3 x M8	3 x M8	3 x M10	6 x M10	6 x M12 [8)]
s_1	3 x M3	3 x M4	3 x M4	3 x M4	3 x M5	3 x M5	3 x M5	3 x M6	3 x M6	6 x M8	6 x M6
t	6	10	10	10	10	10	10	10	10	13	12
x	0	0	0	0 - 0,5	0 - 0,5	0 - 2	0 - 3	0 - 3	0 - 3	3 - 4	0 – 1,5
Z	36	45	55	65	75	90	100	115	130	175	-
z	1	1	1	1	1	1	1	1	1	1	-

Standard voltages 24; 104; 180; 207 V.
Permitted voltage tolerance acc. DIN IEC 60038 (±10 %).

We reserve the right to make dimensional and constructional alterations.

1) Braking torque tolerance = +30 %/-10 %, for other adjustments see Table 3, page 7 and Type key page 3.
1.1) Minimum bore not permitted for braking torque adjustment = 125 %.
1.2) Braking torque tolerance = +40 %/-20 % (slight grinding necessary).
2) The respective maximum bores are to be seen in relation to the corresponding keyways and their tolerances acc. Table 2 page 7.
3) Brake operation from 700 Nm on only possible with overexcitation.
4) Hub facing side (both sides) 3 mm deep, Ø 97 recessed.
5) Brake operation only possible with overexcitation.
6) The IP65 design is equipped with a sealing cover on size 1000: L = 149 mm, L_4 = 170 mm.
7) Projection screw plugs (emergency hand release): 8,5 mm
8) For flange plate securement: additional 2 x M12 screws (dimensions available on request).

Installation Conditions

- ❑ The eccentricity of the shaft end against the mounting pitch circle may not exceed 0,2 mm.
- ❑ The position tolerance of the threaded holes for the cap screws (8, Fig. 2) may not exceed 0,2 mm.
- ❑ The axial run-out deviation of the screw-on surface to the shaft may not exceed the permitted axial run-out tolerance according to DIN 42955. Larger deviations can lead to a drop in torque, to continuous slipping on the rotors and to overheating.

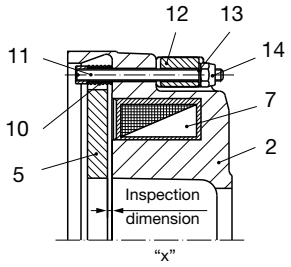


Fig. 1

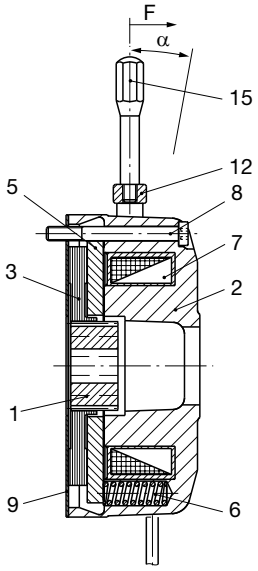


Fig. 2

Installation

ROBA-stop®-M brakes are very easy to install:

1. Mount the hub (1) onto the shaft and secure it axially (e.g. using a locking ring).
   – Recommended tolerance of hub-shaft connection = H7/k6.
   – Avoid too tight hub-shaft connections (especially on max. bores). They lead to the rotor (3) jamming on the hub (1) and therefore to brake malfunctions.
   – Keep the friction surfaces free of oil and grease.
   Warning!
   Please observe supporting length of the key acc. Dimensions on page 5.
2. If necessary (dependent on Type), move the friction disk or the flange plate over the shaft and attach it to the machine wall (or screw on for size 1000).
   – If there are no suitable counter-friction surfaces made of grey cast or steel available, please use brake Types 891._ _2/3._ (with friction disk (9)) or 891._ _.4/5._ (with flange plate).
   When using a brake with a friction disk (Type 891._ _2/3._), please observe the stamp "friction side" on the friction disk.
3. Push the rotor (3) onto the hub (1) by hand.
4. If necessary, install the hand release (only on sizes 2 - 500/the emergency hand release is partly assembled on size 1000).
5. If necessary (dependent on Type, Type 891._ _ _.1), insert the O-ring into the axial recess of the coil carrier (2).
6. Push the rest of the brake over the hub (1) and the rotor collar (3).
7. Attach the brake to the motor bearing shield or onto the machine wall evenly all around by using the cap screws (8) incl. the manufacturer-side mounted flat sealing ring (dependent on Type, Type 891._ _ _.1), torque wrench and tightening torque (acc. Table 1, page 7).
   Warning!
   Only use *mayr*® original screws (Table 1, page 7).

Braking Torque Adjustment

It is possible to achieve different torque settings or torque reductions by using different spring configurations (6) in the coil carrier (2) (see Table 3, page 7).

Design with continuous setting available on request.

Hand Release Installation (Sizes 2 – 500)

On Type 891._ _ _.1 installation of the hand release is only possible if a request for a hand release is stated on the brake order form (completely enclosed coil carrier (2)).

The brake must be dismantled and de-energised for the hand release installation.

Installation Procedure (Figs. 1 and 2):

1. Unscrew brake from the motor bearing shield or from the machine wall.
2. Remove the sealing plugs from the hand release bores in the coil carrier (2).
3. Put the thrust springs (10) onto the threaded bolts (11). The threaded bolts (11) are manufacturer-side produced with a key as a tension element and are secured with glue up to size M60. This connection must not be loosened.
4. Push the threaded bolts (11) with thrust springs (10) from the inside (facing the magnetic coil (7)) into the hand release bores in the coil carrier (2).
5. Push the O-rings (only with sealed hand release, Type 891._ _ _.1) over the threaded bolts (11) and insert them into the recesses of the coil carrier (2).
6. Push intermediate plates (only with sealed hand release, Type 891._ _ _.1) over the threaded bolts (11).
7. Put the switch bracket (12) in place, put washers (13) onto it and lightly screw on the self-locking hexagon nuts (14).
8. Tighten both hexagon nuts (14) until the armature disk (5) lies evenly on the coil carrier (2).
9. Loosen both hexagon nuts (14) by "Y" turns (see Table 1, page 7), thereby creating an air gap between the armature disk (5) and the coil carrier (2) or the inspection dimension "x" (Fig. 1).
   Warning!
   An unequal alignment dimension on the hand release can cause the brake to malfunction.
10. After installing the release cover, screw the hand release bar (15) into the switch bracket (12) and tighten it. The hand release bar (15) must be protected against loosening with a screw-securing product, e.g. Loctite 243.

Maintenance

ROBA-stop®-M brakes are mainly maintenance-free.
However, the rotor (3) is subject to functional wear. The friction linings are robust and wear-resistant. This ensures a particularly long service lifetime.
However, if the rotor (3) does become worn due to high total friction work, the brake can be brought back into its original functional condition by replacing the rotor. For this, the brake must be cleaned thoroughly.
The wear condition of the rotor (3) is determined by measuring the release voltage (this must not exceed max. 90 % of the nominal voltage on a warm brake), or by measuring the rotor thickness on a dismantled brake ("minimum rotor thickness" acc. Table in the currently valid Installation and Operational Instructions). On sizes 500 and 1000 there is an air gap inspection opening. This means that the brake does not have to be dismantled.

Warning!
The brake function cannot be guaranteed on brakes with a reduced braking torque and/or operation with a fast-acting rectifier if the friction linings are heavily worn.
Unpermittedly high wear cannot be recognized via the switching behaviour of the brake, as in this constellation the magnetic coil (7) is able to manage a very high tension path of the armature disk (5). Unpermittedly high wear causes the thrust springs (6) to relax, which results in a decrease in torque.

Technical Data for Installation				Size										
				2	4	8	16	32	60	100	150	250	500	1000
Inspection dimension		x	[mm]	0,9 +0,1	0,9 +0,1	1,1 +0,1	1,6 +0,1	1,8 +0,1	2,2 +0,1	2,2 +0,1	2,2 +0,1	2,4 +0,1	2,4 +0,1	-
Number of rotations		Y	[-]	1,7	1,7	1,5	2,0	2,0	2,0	1,6	1,6	1,5	1,5	-
Release force	Standard brake Type 891.$^{0}_{2}$_ _._	F	[N]	20	35	70	100	130	220	260	290	350	310	-
	Holding brake Type 891.10 _._	F	[N]	26	45	90	125	170	300	340	350	430	470	-
Release angle		α	[°]	6	7	7	7	8	10	12	13	10	10	-
Fixing screws (8)	Type 891._ _0._		[-]	3 x M4 x 45	3 x M4 x 45	3 x M5 x 50	3 x M6 x 60	3 x M6 x 60	3 x M8 x 75	3 x M8 x 80	3 x M8 x 100	3 x M10 x 110	6 x M10 x 110	6 x M12 x 130
			DIN	6912	6912	6912	6912	6912	6912	EN ISO 4762	EN ISO 4762	EN ISO 4762	EN ISO 4762	EN ISO 4762
	Type 891._ _4._		[-]	3 x M4 x 50	3 x M4 x 50	3 x M5 x 55	3 x M6 x 65	3 x M6 x 70	3 x M8 x 85	3 x M8 x 90	3 x M8 x 110	3 x M10 x 130	6 x M10 x 130	6 x M12 x 150
			DIN	EN ISO 4762	EN ISO 4762	6912	6912	EN ISO 4762	EN ISO 4762	EN ISO 4762	EN ISO 4762	EN ISO 4762	EN ISO 4762	EN ISO 4762
Tightening torque for screws (8)		T_A	[Nm]	2,5	2,5	5,0	9,0	9,0	22	22	22	45	45	83
Rotor thickness “new condition“			[mm]	6,05	6,05	6,9	8	10,4	11,15	14	15,5	17	18,5	18,5

Table 1

Permitted Bores Ø d_{max}				Size										
				2	4	8	16	32	60	100	150	250	500	1000
Ø d_{max}	Type 891.$^{0}_{2}$_ _._	Keyway JS9	6885/1	13	13	18	22	30	32	42	45	55	75	90
			6885/3	15	15	20	25	-	35	45	50	60	80	-
		Keyway P9	6885/1	13	13	18	20	28	32	42	45	50	75	90
			6885/3	15	15	20	22	30	-	45	50	55	80	-
	Type 891.1_ _._	Keyway JS9	6885/1	13	13	18	22	30	32	42	45	55	75	90
			6885/3	15	15	20	25	-	35	45	50	-	-	-
		Keyway P9	6885/1	13	13	18	20	28	32	42	45	50	75	90
			6885/3	15	15	20	22	30	-	45	50	55	-	-

Table 2

Braking Torque Adjustments				Size										
				2	4	8	16	32	60	100	150	250	500	1000 [3]
Holding brake			[Nm]	4	8	16	32	64	100	180	250	450	800 [2]	1600
Standard brake	Braking torque [4] in %	125 %	[Nm]	2,5	5	10	20	40	75	125	185	312	700 [1]	1400
		112 %	[Nm]	2,2	4,5	9	18	36	68	110	165	280	560	1200
		100 %	[Nm]	2	4	8	16	32	60	100	150	250	500	1000
		84 %	[Nm]	1,7	3,4	6,8	13,5	27	51	85	125	215	400	800
		68 %	[Nm]	1,4	2,8	5,5	11	22	42	70	100	180	350	700
		50 %	[Nm]	1	2	4	8	16	30	50	75	125	250	500
		34 %	[Nm]	0,7	1,4	2,8	5,5	11	21	35	50	90	200	400

Table 3

1) Brake operation only as holding brake.
2) Brake operation from 700 Nm only possible with overexcitation.
3) Brake operation only possible with overexcitation.
4) The braking torque (switching torque) is the torque effective in the shaft train of a slipping brake with a sliding speed of 1 m/s in relation to the mean friction radius (acc. VDE 0580/07.2000).

Brake Dimensioning

Brake Size Selection

1. Brake selection

$$M_{req.} = \frac{9550 \times P}{n} \times K \leq M_2 \quad [Nm]$$

$$t_v = \frac{J \times n}{9{,}55 \times M_v} \quad [sec]$$

$$t_4 = t_v + t_1 \quad [sec]$$

$$M_v = M_2 + (-)^* M_L \quad [Nm]$$

2. Inspection of thermic load

$$Q_r = \frac{J \times n^2}{182{,}4} \times \frac{M_2}{M_v} \quad [J/braking]$$

The permitted friction work (switching work) $Q_{r\ perm.}$ per braking for the specified switching frequency can be taken from the friction-power diagrams (page 9).

If the friction work (switching work) per braking is known, the max. switching frequency can also be taken from the friction-power diagrams (page 9).

Key:

J	[kgm²]	Mass moment of inertia
K	[-]	Safety factor (1 – 3 x acc. to conditions)
$M_{req.}$	[Nm]	Required braking torque
M_v	[Nm]	Delaying torque
M_L	[Nm]	Load torque * sign in brackets is valid if load is braked during downward movement
M_2	[Nm]	Nominal torque (Technical Data page 4)
n	[rpm]	Speed
P	[kW]	Input power
t_v	[s]	Braking action
t_1	[s]	Connection time (Table 6 page 10)
t_4	[s]	Total switch-on time
Q_r	[J/braking]	Friction work present per braking
$Q_{r\ 0,1}$	[J/0,1]	Friction work per 0,1 wear (Table 4)
$Q_{r\ tot.}$	[J]	Friction work up to rotor replacement (Table 4)

Please Observe!

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

When using a brake with a friction disk (Type 891._ _2._), the max. friction work and friction power must be reduced by 30 % for sizes 2 to 16 and by 50 % for sizes 32 – 60.
The wear values $Q_{r\ 0,1}$ and $Q_{r\ tot.}$ are therefore not valid.

Friction Work				Size										
				2	4	8	16	32	60	100	150	250	500	1000
Per 0,1 mm wear	Standard brake Type 891.0 2 _ _._	$Q_{r\ 0,1}$	[10^6 J/0,1]	35	40	65	100	130	130	140	150	160	170	180
	Holding brake Type 891.1_ _._	$Q_{r\ 0,1}$	[10^6 J/0,1]	7	8	13	20	30	65	70	75	80	85	90
Up to rotor replacement	Standard brake Type 891.0 2 _ _._	$Q_{r\ tot.}$	[10^6 J]	95	100	162	500	600	700	840	950	1000	1700	2000
	Holding brake Type 891.1_ _._	$Q_{r\ tot.}$	[10^6 J]	7	8	13	20	45	130	170	300	350	425	540

Table 4

Mass Moment of Inertia Rotor + hub at d_{max}			Size									
			2	4	8	16	32	60	100	150	250	500	1000
Type 891.0 1 _ _._ (Metal rotor)	J_{R+H}	[10^{-4} kgm²]	0,12	0,21	0,67	1,74	4,48	6,74	16,54	31,68	61,82	222,6	424
Type 891.2_ _._ (Friction lining rotor)	J_{R+H}	[10^{-4} kgm²]	0,1	0,17	0,58	1,53	4,1	-	-	-	-	-	-

Table 5

Friction-Power Diagrams

Type 891.01_._
and
Type 891.21_._
(Standard brake)
for 50 %
of the maximum speed n_{max}

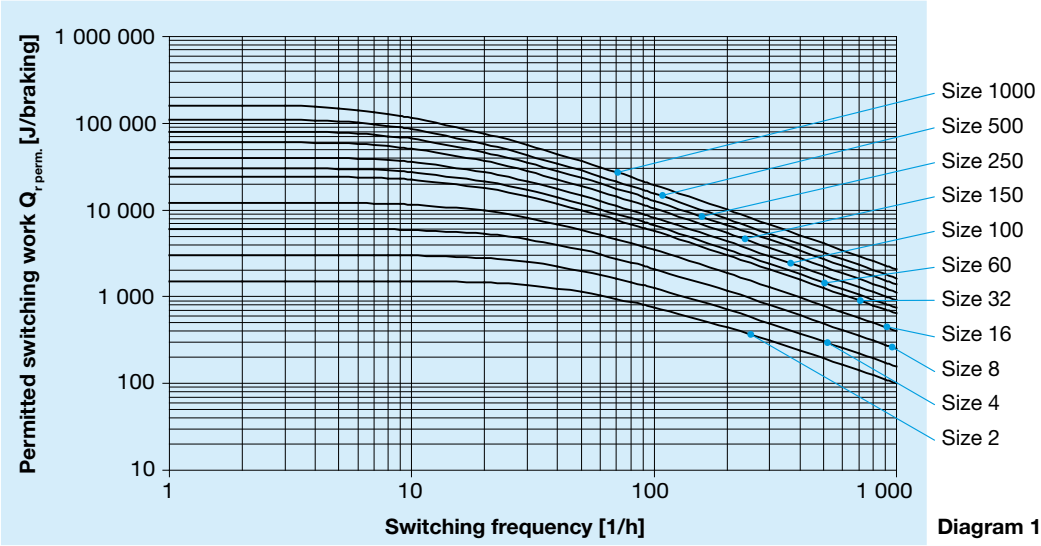


Diagram 1

Type 891.01_._
and
Type 891.21_._
(Standard brake)
for the
maximum speed n_{max}

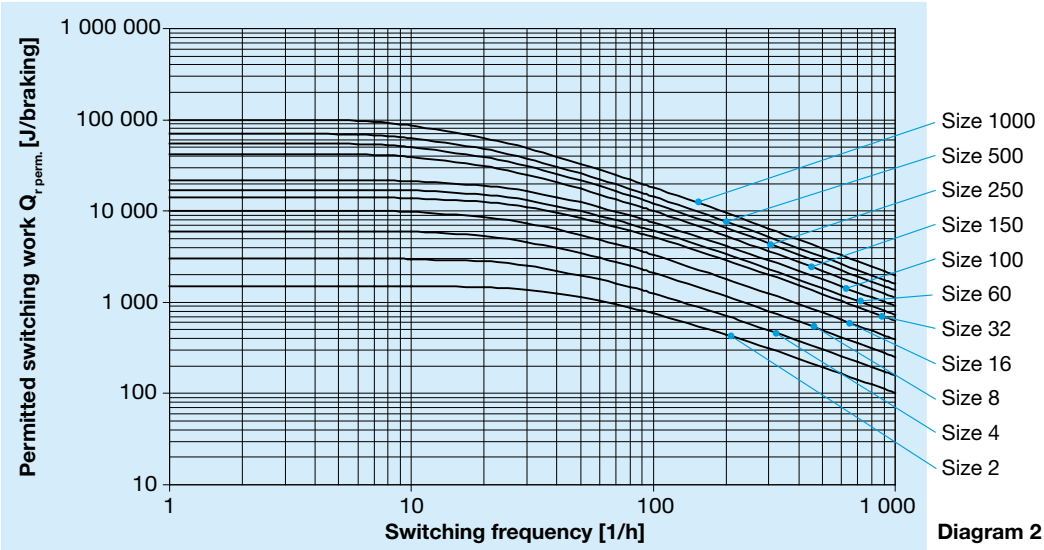


Diagram 2

Type 891.10_._ (Holding brake)
for 50 % of the maximum speed n_{max}

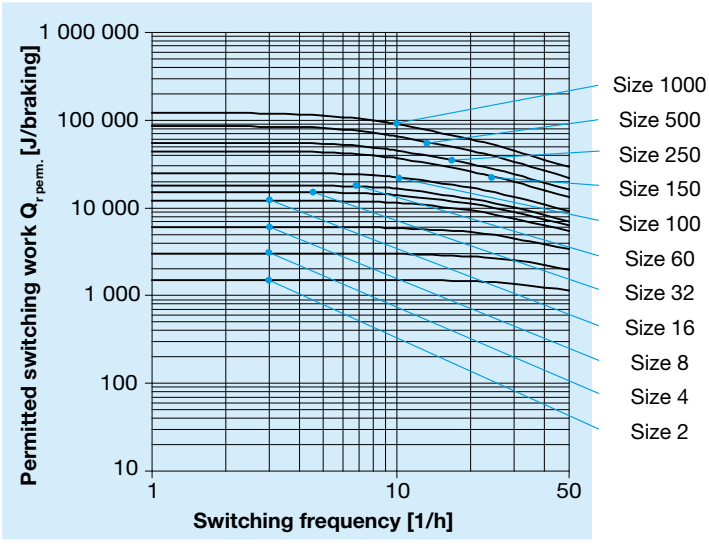


Diagram 3

Type 891.10_._ (Holding brake)
for the maximum speed n_{max}

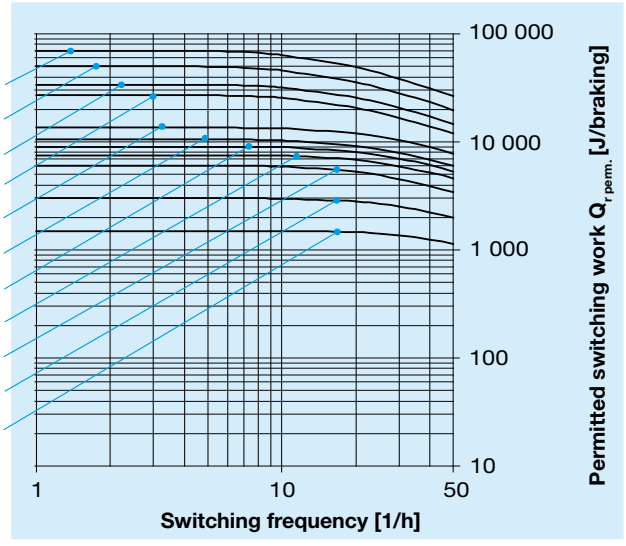


Diagram 4

Further Options

In addition to the standard brakes, *mayr*® power transmission provides a multitude of further designs, which cannot be described in detail in this catalogue.

Some of the most frequently requested options are:

- Microswitch for switching condition indication (release inspection)
- Microswitch for wear indication (wear inspection)
- Special coil voltages
- Lockable hand release
- IP65 design for continuous shafts
- Noise damping (O-ring damping between the gear hub and the rotor)
- Anti-condensation heating
- Customer-specific flange plate
- Special lubricating material
- ATEX design

Please contact *mayr*® for further information.

Release inspection

When the magnetic coil in the coil carrier (Item 2) is energised, the armature disk (Item 3) is pulled towards the coil carrier (Item 2). The microswitch (Item 1) emits a signal and the brake is released.

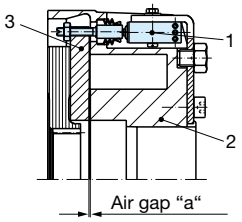


Fig. 1

Wear inspection

Due to wear on the rotor (Item 5), the nominal air gap “a” between the coil carrier (Item 2) and the armature disk (Item 3) increases. If the limit air gap (see Table in the Installation and Operational Instructions) is reached, the microswitch contact (Item 1) switches over and emits a signal. The rotor (Item 5) must be replaced.

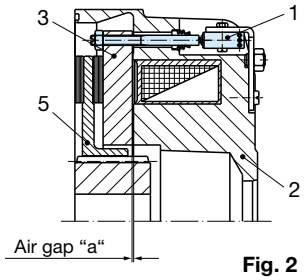


Fig. 2

Lockable hand release

In de-energised condition, the brake with lockable hand release can be released manually. By moving the hand release rod (Item 1), the armature disk (Item 3) is pushed against the thrust springs (Item 4) onto the coil carrier (Item 2) and the braking torque is removed.

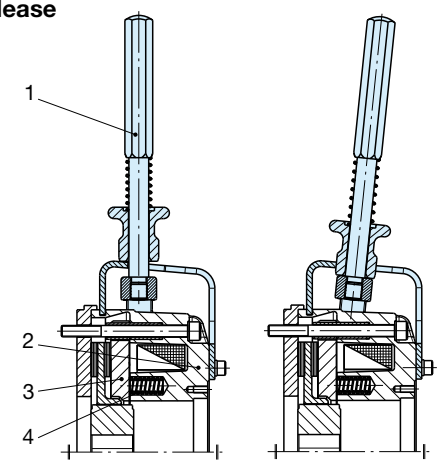


Fig. 3

		Hand release in starting position	Hand release in engaged position
Coil	energised	Shaft braked	Shaft runs free
	de-energised	Shaft runs free	Shaft runs free

Continuous shaft with IP65

The enclosed design (IP65) is equipped with a screw plug (sizes 8 to 500) or with a sealing cover (size 1000) (see Type 891._14.1, page 5) as part of the standard delivery.

A radial shaft sealing ring (Item 1) is installed in the coil carrier (Item 2) on continuous shafts.

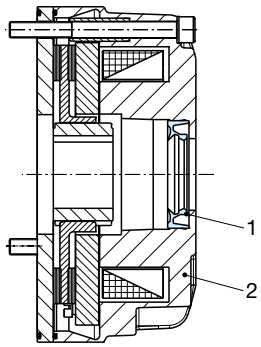


Fig. 4

Damping rotor/gear hub

If vibrations in the drive line cannot be avoided, an O-ring (Item 1) is used to damp backlash between the gear hub (Item 6) and the rotor (Item 5).

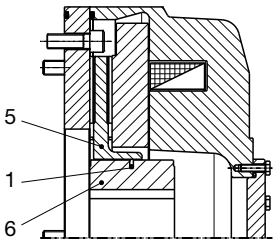


Fig. 5

Anti-condensation heating

The anti-condensation heating (Item 1) is used to prevent condensation formation inside the brake.

This product is particularly useful at temperatures of under zero degrees Celsius or in high humidity.

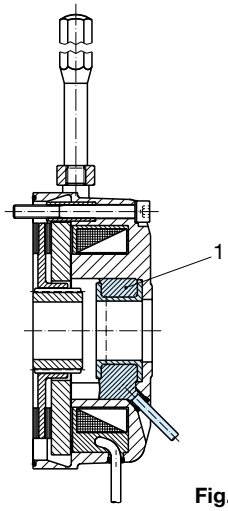


Fig. 6

Special flange plate

We offer a range of flange plates for customer-specific solutions, such as for example the special flange plate shown in Fig. 7 (Item 1) with customer-tailored centring (Item 8) and sealing (Item 7).

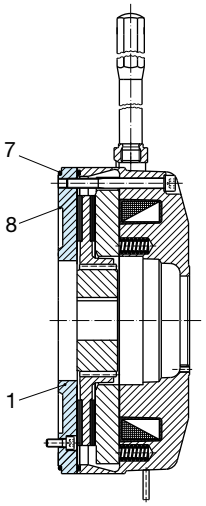


Fig. 7

Switching Times

The values are mean values which refer to the nominal air gap and the nominal torque (100 %) for a warm brake.
For other braking torque adjustments, see Diagram: “Brake separation time t_2 dependent on spring configuration“ on page 12.

Switching Times				Size										
				2	4	8	16	32	60	100	150	250	500	1000
Nominal torque (100 %)		M_2	[Nm]	2	4	8	16	32	60	100	150	250	500	1000
Connection time	DC-side switching	t_1	[ms]	10	18	20	30	50	55	68	80	100	100	180
	AC-side switching	t_1	[ms]	100	160	220	320	400	500	640	730	1100	1100	1200
Response delay on connection	DC-side switching	t_{11}	[ms]	6	12	16	25	35	35	38	40	50	30	70
	AC-side switching	t_{11}	[ms]	80	130	175	240	300	350	400	450	700	700	750
Separation time		t_2	[ms]	28	30	45	70	100	150	180	220	290	400	270 *

Table 6

* Value in operation with overexcitation

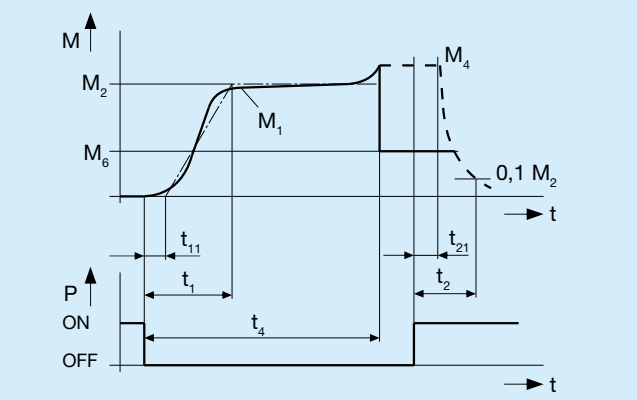


Diagram 5: Torque-Time

Key:

M_1 = Switching torque
M_2 = Nominal torque (characteristic torque)
M_4 = Transmittable torque
M_6 = Load torque
P = Input power
t_1 = Connection time
t_{11} = Response delay on connection
t_2 = Separation time
t_{21} = Response delay on separation
t_4 = Total switch-on time + t_{11}

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.

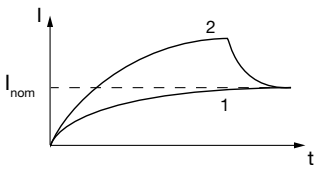
• Field Build-up with Normal Excitation

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.

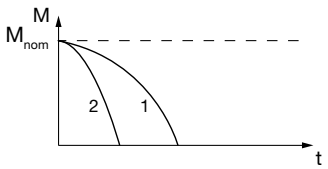
• Field Build-up with Overexcitation

A quicker and safer 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, it is possible to switch to the nominal voltage (curve 2, below). The relationship between the overexcitation and the separation time t_2 is roughly proportional indirectly; this means that at doubled nominal voltage, the separation time t_2 for brake release is halved. The ROBA®-switch fast-acting rectifier works on this principle.

Current path



Braking torque path



Operation with overexcitation requires testing of:
- the necessary overexcitation time * (page 12)
- as well as of the RMS coil capacity ** for a cycle frequency higher than 1 cycle per minute (page 12).

* **Overexcitation time t_{over}**

Increased wear and therefore an enlarged air gap as well as coil heat 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.

The spring forces also influence the brake separation time t_2: Higher spring forces increase the separation time t_2 and lower spring forces reduce the separation time t_2. The separation time t_2 alterations due to the spring configuration can be seen in the adjoining diagram.

- Spring force (braking torque adjustment) < 100 %:

The overexcitation time t_{over} is less than double the separation time t_2 on each brake size.

Example: braking torque adjustment = 34 %
--> separation time t_2 = 50 %
--> overexcitation time t_{over} = 200 % x 50 % = 100 % t_2

- Spring force (braking torque adjustment) = 100 %:

The overexcitation time t_{over} is double the separation time t_2 on each brake size.

- Spring force (braking torque adjustment) > 100 %:

The overexcitation time t_{over} is higher than double the separation time t_2 on each brake size.

Example: braking torque adjustment = 125 %
--> separation time t_2 = 120 %
--> overexcitation time t_{over} = 200 % x 120 % = 240 % t_2

**** RMS coil capacity P_{RMS}**

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

The coil capacity P_{RMS} must 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 values or 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 $P_{hold} = \left(\frac{U_{hold}}{U_{nom}}\right)^2 \times P_{nom}$
t_{over}	[s]	Overexcitation time
t_{hold}	[s]	Time of operation with power reduction
t_{off}	[s]	Time without 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:

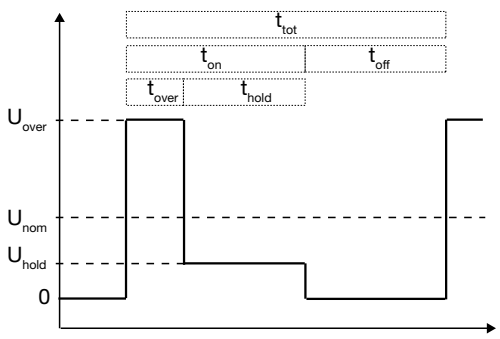
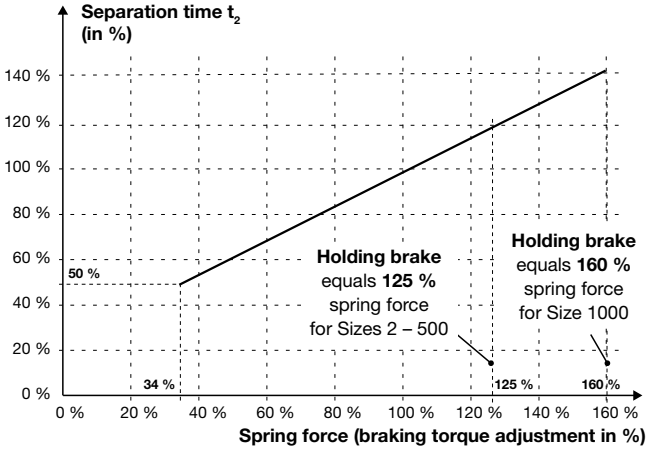
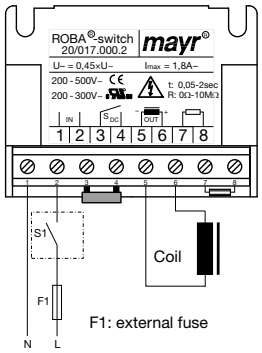


Diagram: Brake separation time t_2 dependent on spring configuration



Magnetic Field Removal

• AC-side switching

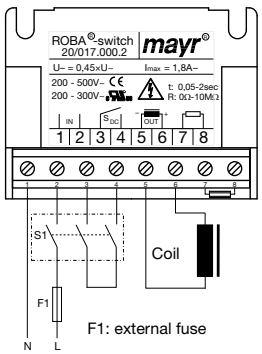


The power circuit is interrupted before the rectifier. The magnetic field slowly reduces. This delays the rise in braking torque.

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



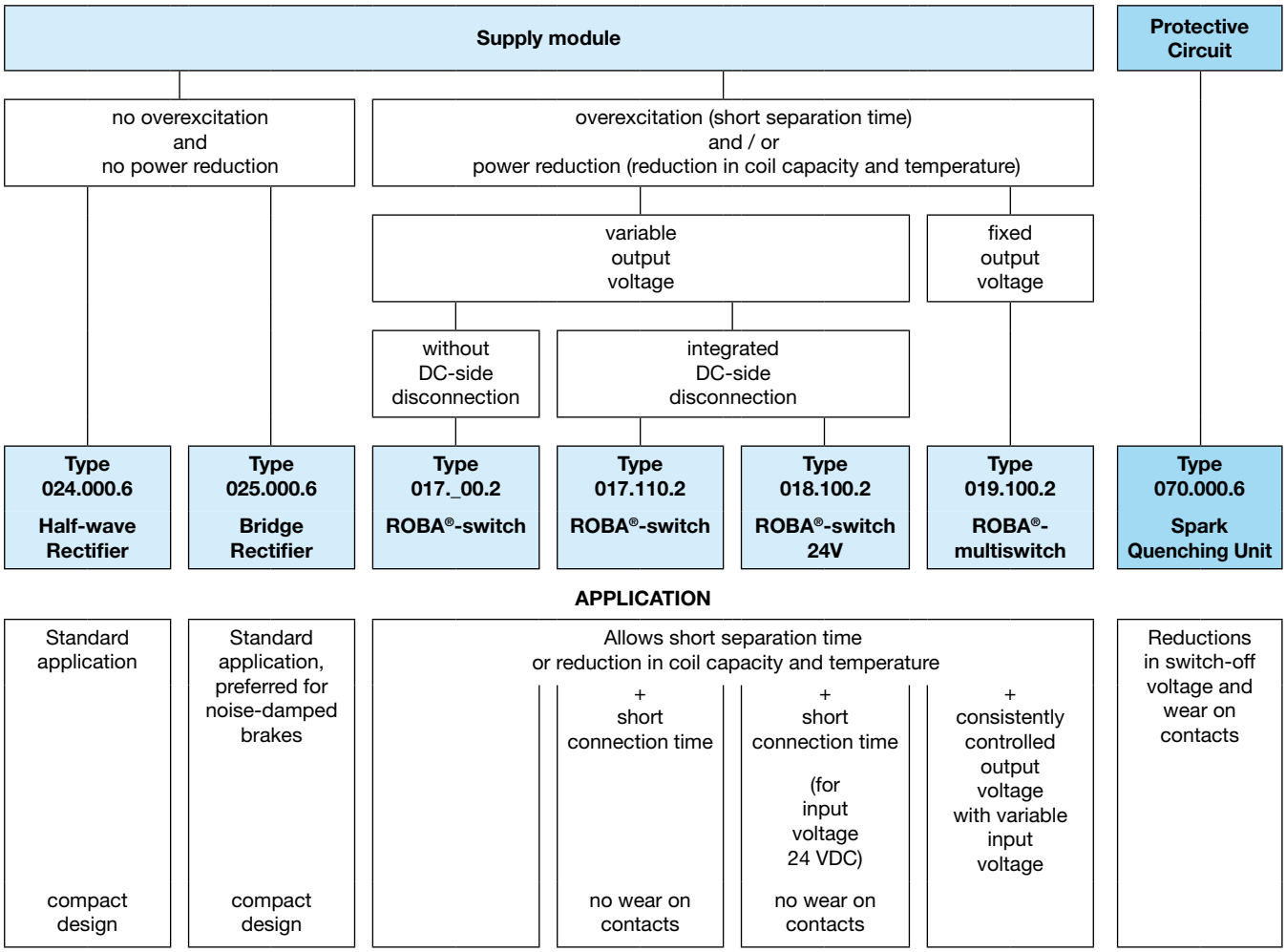
The power circuit is interrupted between the rectifier and the coil as well as mains-side. The magnetic field is removed very quickly, resulting in a rapid rise in braking torque.

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 times (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 quenching units), although this may of course then alter the switching times.



Example 1

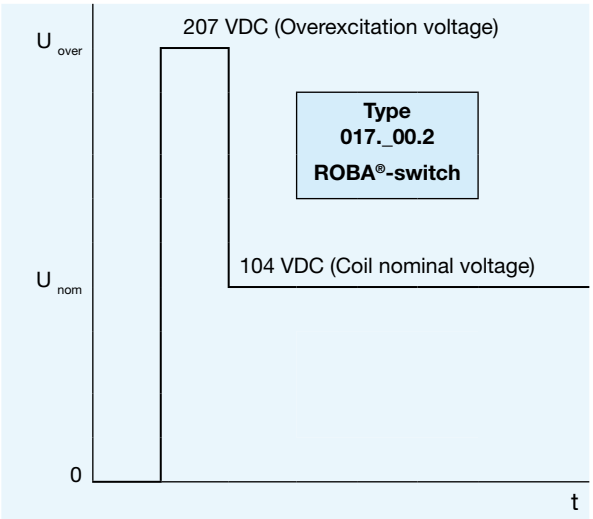
Available: network voltage 230 VAC

Wanted: short separation time (overexcitation)

Required: supply module / coil nominal voltage

Solution:

- Supply modules available for selection: Type 017._00.2 (in Example below), Type 017.110.2 or Type 019.100.2
- Coil nominal voltage: 104 VDC



Example 2

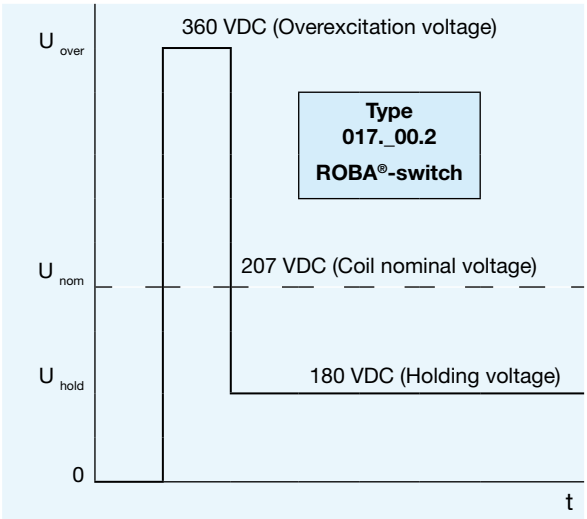
Available: network voltage 400 VAC

Wanted: short separation time (overexcitation) and and low coil temperature (power reduction)

Required: supply module / coil nominal voltage

Solution:

- Supply modules available for selection: Type 017._00.2 (in Example below), Type 017.110.2 or Type 019.100.2
- Coil nominal voltage: 207 VDC



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

Application

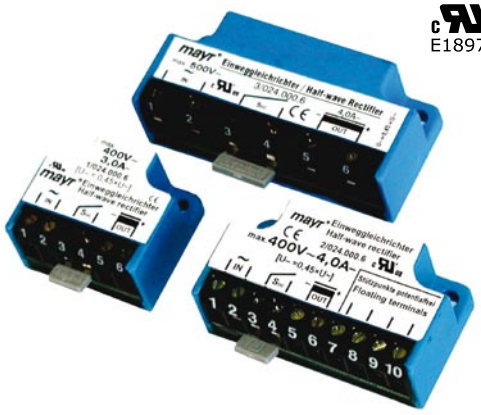
Rectifiers are used to connect DC units to alternating voltage supplies, for example electromagnetic brakes and clutches (ROBA-stop®, ROBA-quick®, ROBATIC®), electromagnets, electrovalves, contactors, switch-on safe DC motors, etc.

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.

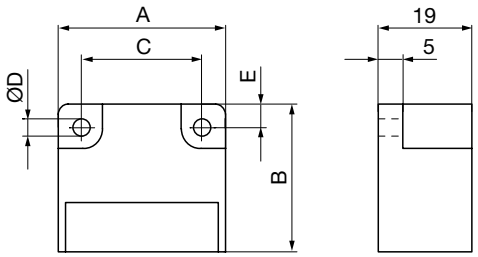
Electrical Connection (Terminals)

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. to EN 50022: 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	250 V_{RMS}	320 V_{RMS}	500 V_{RMS}	500 V_{RMS}	630 V_{RMS}	630 V_{RMS}
Pollution degree (insulation coordination)	2	2	2	1	2	2
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 according to the actual capacities, please observe the permitted limit integral I²t on selection.	FF 3,15A	FF 3,15A	FF 4A	FF 5A	FF 5A	FF 5A
Permitted limit integral I²t	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

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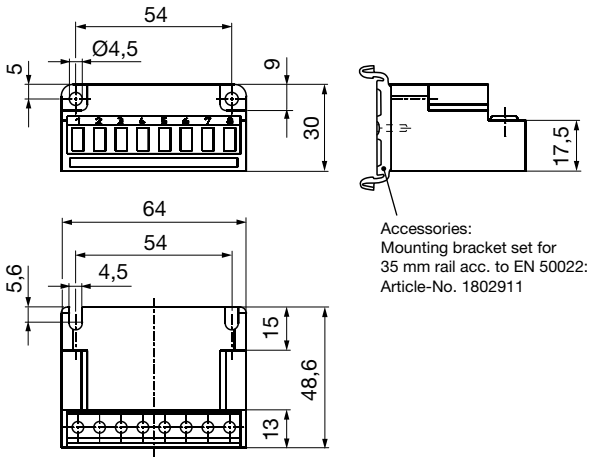
Size		UL-approved	
10		0	to 300 V
20		1	to 500 V

cULus E189728 CE

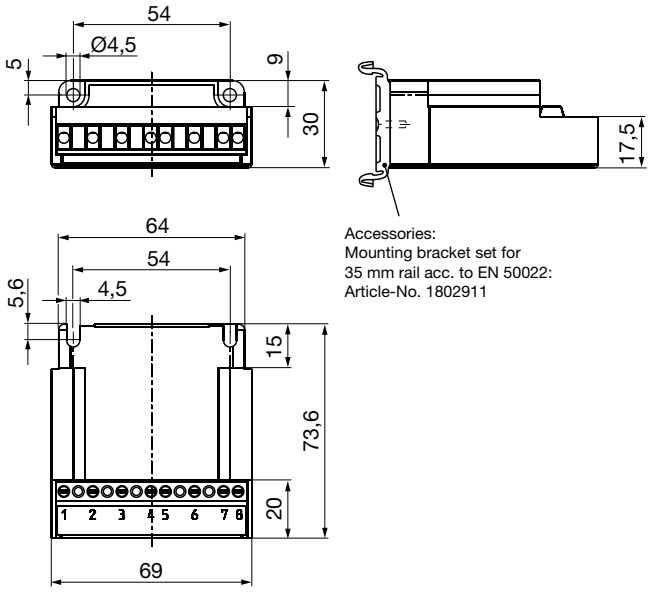
Dimensions (mm)

Type 017.000.2



Accessories:
Mounting bracket set for
35 mm rail acc. to EN 50022:
Article-No. 1802911

Type 017.100.2



Accessories:
Mounting bracket set for
35 mm rail acc. to EN 50022:
Article-No. 1802911

Application

ROBA®-switch fast acting rectifier units 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®-switch 017.110.2

- Consumer operation with overexcitation or power reduction
- Integrated automatic DC-side disconnection (shorter connection time)
- Input voltage: 100 - 500 VAC
- Max. output current I_{RMS}: 1,5 A
- UL-approved

The ROBA®-switch units with integrated automatic DC-side disconnection are not suitable for use as safety disconnections!

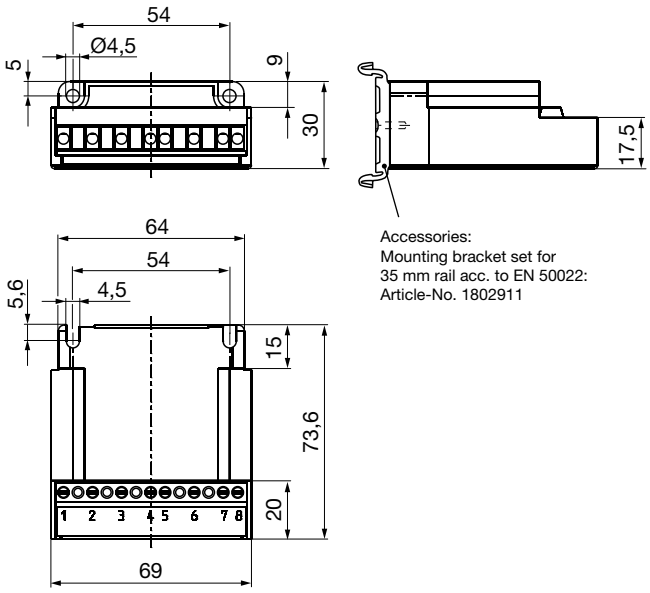
Function

The ROBA®-switch units are used for operation at an input voltage of between 100 and 500 VAC, depending on the size. They can switch automatically 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}).

The ROBA®-switch units also have an integrated automatic DC-side disconnection. In contrast to the conventional DC-side disconnection, no further protective measures or external components are necessary. The DC-side disconnection is standard-activated (terminals 3 and 4 are not wired), resulting in short electromagnetic consumer switching times.

The integrated automatic DC-side disconnection is deactivated by fitting a bridge between the terminals 3 and 4. The coil is deenergised via the free wheeling diode. This has the advantages of softer braking and a lower switching noise. However, the switching times increase (taking approx. 6 - 10 times longer).

Dimensions (mm)



Accessories:
Mounting bracket set for 35 mm rail acc. to EN 50022:
Article-No. 1802911

Electrical Connection (Terminals)

1 + 2	Input voltage (fitted protective varistor)
3 + 4	Switching between DC- and AC-side disconnection
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 10	Size 20
Input voltage VAC ± 10 %	100.. ..250	200.. ..500
Output voltage VDC, U_{bridge}	90.. ..225	180.. ..450
Output voltage VDC, $U_{half\text{-}wave}$	45.. ..113	90.. ..225
Output current I_{RMS} at ≤ 45 °C, (A)	1,5	1,5
Output current I_{RMS} at max. 70 °C, (A)	0,75	0,75
Conformity markings	cULus CE	cULus CE

Order Number

__	/	0	1	7	.	1	1	0	.	2

△

Size
10
20

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: 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.

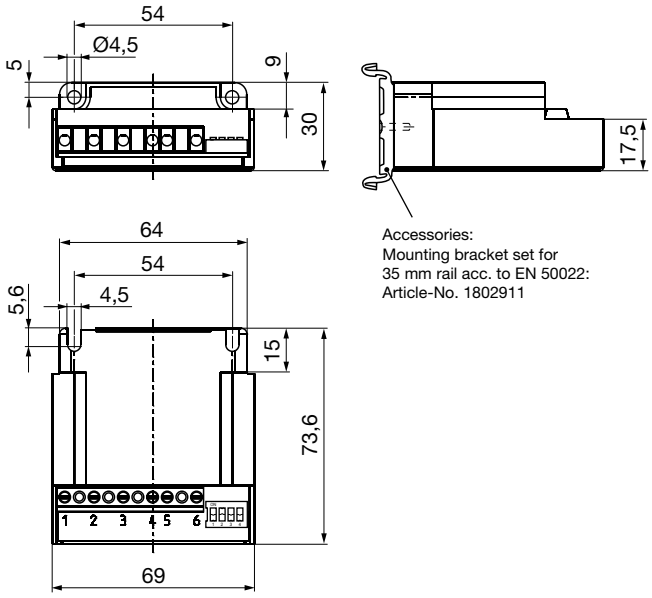
Electrical Connection (Terminals)

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

Dimensions (mm)



Accessories:
Mounting bracket set for 35 mm rail acc. to EN 50022:
Article-No. 1802911

ROBA®-multiswitch Sizes, Table 1

	Size	
	10	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

Order Number

__	/	0	1	9	.	1	0	0	.	2

△

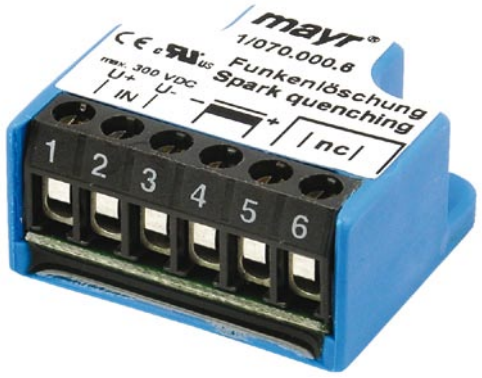
Size
10
20

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.

c UL us E189728 CE



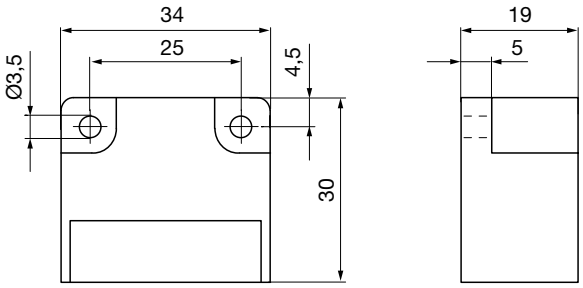
Function

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 70V 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. 9J/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. to EN50022
Article-No. 1803201

Order Number

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△
Size
1

Declaration of Conformity

A conformity evaluation for the applicable EU directives has been carried out for this product. The conformity evaluation is set out in writing in a separate document and can be requested if required. It is forbidden to start use of the product until the machine or system into which it should be built is operating in accordance with all applicable EU directives.

Without a conformity evaluation, this product is not suitable for use in areas where there is a high danger of explosion. This statement is based on the ATEX directive.

Guidelines for Electromagnetic Compatibility (EMC)

In accordance with the EMC directives 89/336/EEC, the individual components produce no emissions. However, functional components e.g. rectifiers, phase demodulators, ROBA®-switch devices or similar controls for mains-side energisation of the brakes 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.

Device Conditions

The catalogue values are standards which can, in certain cases, vary. 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.

Please Observe!

- Mounting dimensions and connecting dimensions must be adjusted according to the size of the brake at the place of installation.
- The brakes are designed for a relative duty cycle of 100 %.
- The brakes are only designed for dry running. The braking torque is lost if the friction surfaces come into contact with oil, grease, water or similar substances.
- The braking torque is dependent on the present run-in condition of the brakes.
- Manufacturer-side corrosion protection of the metallic surface is provided.
- Without a conformity inspection, this product is not suitable for use in areas where there is a high danger of explosion. This statement is based on the directive 94/9/EC (ATEX directive). Please contact the manufacturer separately for brakes in ATEX-design!

Protection Class I

This protection can only be guaranteed if the basic insulation is intact and if all conductive parts are connected to the PE conductor. Should the basic insulation fail, the contact voltage cannot function (VDE 0580).

Protection (mechanical) IP54

When installed, protected against dust, contact and splashing water from all directions (dependent on customer-side mounting arrangements).

Protection (electrical) IP54

Dust-proof and protected against contact as well as against splashing water from all directions.

Protection IP65 (Type 891._ _ _.1)

Dust-proof and protected against contact as well as against jet water from all directions.

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

At temperatures of around or under freezing point, condensation can strongly reduce the torque, or the rotors can freeze up. The user is responsible for taking appropriate countermeasures.

Insulation Material Class F (+155 °C)

The magnetic coil and the casting compound are suitable for use up to a max. operating temperature of +155 °C.

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27/10/2008 SC