your reliable partner

Safety brake for servomotors

ROBA®-servostop Lean
Type 8982.00_01
Sizes 40 – 100

Issue status 2023-11

Original operating instructions
B.8982.EN

Contents

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Please read these Operational Instructions carefully and follow them accordingly!

Ignoring these Instructions may lead to malfunctions or to brake failure, resulting in damage to other parts. These Operational Instructions are part of the brake delivery.
Please keep them handy and near to the brake at all times.

1 General Guidelines

1.1 Definition of Terms

Term	Meaning
ROBA®-servostop	Electromagnetically-actuated safety brakes as a component for holding and deceleration of moved machine parts.
Nominal braking torque M_N	The theoretical nominal braking torque assigned to the designation. The braking torque lies within the stated braking torque tolerances. The braking torque tolerance is stated in % of the braking torque Standard.
Load torque	Holding torque which is required to hold a vertical axis (load) suspended, referring to the brake.
Release (separate)	Release designates the procedure through which the magnetic coil is energised, the rotor is released in the brake, and therefore no braking torque is applied.
Close (connect)	Closing or armature disk drop-out designates the process through which the magnetic coil is de-energised, the voltage is switched off, the rotor in the brake is clamped and the braking torque is applied.
Overexcitation	Overexcitation designates when the brake requires a higher supply voltage (= overexcitation voltage) than the coil nominal voltage to release for a short period of time (overexcitation time). Here a ratio of 2:1 or 3:1 is usual.
Overexcitation time	The overexcitation voltage must only be available for a short time for release of the brake.
Response delay on connection t_{11} (close)	The time from power switch-off to the start of the braking torque increase (10 % of the stated braking torque).
Connection time t_1 (drop-out time)	The time from power switch-off to achieving 90 % of the stated braking torque.
Separation time t_2 (attraction time) (release)	The time from power switch-on to achieving 10 % of the stated braking torque. At this point, the brake is almost free.

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2 Safety

2.1 Safety and Guideline Signs

Symbol	Signal word	Meaning
	**DANGER**	Designates a directly pending danger. If not avoided, death or severe injuries will be the consequence.
	**WARNING**	Designates a possibly hazardous situation. If not avoided, death or severe injuries will be the consequence.
	**CAUTION**	Designates a hazardous situation. If not avoided, slight or minor injuries can be the consequence.
	ATTENTION	Possible property damage can be the consequence.
	**Please Observe**	Designates tips for application and other particularly useful information. Not a signal word for dangerous or damaging situations.

2.2 General Guidelines

DANGER

Danger of death! Do not touch voltage-carrying lines and components.

Brakes may generate further risks, among other things:

Hand injuries

Danger of seizure

Contact with hot surfaces

Magnetic fields

Severe injury to people and damage to objects may result if:

- ❒ the electromagnetic brake is used incorrectly.
- ❒ the electromagnetic brake is modified.
- ❒ the relevant standards for safety and / or installation conditions are ignored.

2.2.1 Personnel Requirements

To prevent injury or damage, only professionals and specialists are allowed to work on the components. They must be familiar with the dimensioning, transport, installation, initial operation, maintenance and disposal according to the relevant standards and regulations.

Before product installation and initial operation, please read the Installation and Operational Instructions carefully and observe the Safety Regulations. Incorrect operation can cause injury or damage.

- ❒ Technical data and specifications (Type tags and documentation) must be followed.
- ❒ The correct connection voltage must be connected according to the Type tag and wiring guidelines.
- ❒ Check electrical components for signs of damage before putting them into operation. Never bring them into contact with water or other fluids.
- ❒ Please observe the EN 60204-1 requirements for electrical connection when using in machines.

Only carry out installation, maintenance and repairs when the brake is in a de-energised, disengaged condition and secure the system against inadvertent switch-on (acc. EN 50110).

General Guideline:

During the risk assessment required when designing the machine or system, the dangers involved must be evaluated and removed by taking appropriate protective measures in accordance with the Machinery Directive 2006/42/EC.

Brakes for safety-related applications are to be installed singly or as redundant devices in accordance with the required category, in order to fulfil the required Performance Level (PL_r) acc. EN ISO 13849. This is in principle the task of the system manufacturer.

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2.3 Intended Use

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.
mayr®-brakes are for use in machines and systems and must only be used in the situations for which they are ordered and confirmed. Using them for any other purpose is not allowed.

2.4 Handling

Before installation, the brake must be inspected and found to be in proper condition (visual inspection). The following are not considered as being representative of a proper condition:

- ❑ External damage
- ❑ External oiling
- ❑ External contamination

The brake function must be inspected both **once attachment has taken place** as well as **after longer system downtimes**, in order to prevent the drive starting up against possibly seized linings.

2.5 User-implemented Protective Measures

- ❒ Brakes with a nominal voltage ≤ 50 V (VDE 0580) must only be connected to a current source in accordance with IEC 60364-4-41 Extra-Low Voltage SELV / PELV.
- ❒ Please cover moving parts to protect **against injury through seizure**.
- ❒ Place a cover on the magnetic part to protect **against injury through high temperatures**.
- ❒ **Protection circuit:** When using DC-side switching, the coil must be protected by a suitable protection 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 are 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 operating current are sufficient. Depending on the application, the switching contact can also be protected by other protection circuits (e.g. *mayr*®-spark quenching unit, half-wave and bridge rectifiers), although this may of course then alter the switching times.
- ❑ Take precautions **against freeze-up of the friction surfaces** in high humidity and at low temperatures.

2.6 Dimensioning Other Machine Elements

The effects of the maximum and minimum braking torque on the other machine components must be observed in order to provide sufficient dimensioning. If other brakes are positioned in the drive line, and if the braking times of the different brakes overlap, the loads will add up.

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3 Legal Provisions

3.1 Directives, Standards and Regulations Used

DIN VDE 0580	Electromagnetic devices and components, general specifications
DIN EN 61140	Protection against electric shock - Common aspects for installation and equipment
DIN EN IEC 63000	Technical documentation for the assessment of electrical and electronic equipment regarding the restriction of hazardous substances
DIN EN IEC 60529	Degrees of protection provided by enclosures (IP Code)
2014/35/EU	Low voltage directive
2011/65/EU	RoHS II - Directive
2015/863/EU	RoHS III - Directive
UL 508 (Edition 17)	Industrial Control Equipment
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
DIN EN 61000-6-4	Interference emission
DIN EN 61000-6-2	Interference immunity
IEC 60364-4-41	Extra-Low Voltage SELV / PELV
EN ISO 13849-2	Safety of machinery Safety related parts of control systems - Validation

3.2 Liability

The information, guidelines and technical data in these documents were up to date at the time of printing. Demands on previously delivered brakes are not valid. Liability for damage and operational malfunctions will not be taken if:

- ❑ the Installation and Operational Instructions are ignored or neglected.
- ❑ the brakes are used inappropriately.
- ❑ the brakes are modified.
- ❑ the brakes are worked on unprofessionally.
- ❑ the brakes are handled or operated incorrectly.

3.3 Guarantee

- ❑ The guarantee conditions correspond with the Chr. Mayr GmbH + Co. KG sales and delivery conditions (www.mayr.com → Service → General Terms and Conditions)
- ❑ Mistakes or deficiencies are to be reported to *mayr*® power transmission at once!

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3.4 Guidelines on CE Identification

Guidelines on the Declaration of Conformity
A conformity evaluation has been carried out for the product (electromagnetic safety brake) in terms of the EU Low Voltage Directive 2014/35/EU and the RoHS 2011/65/EU with 2015/863/EU. The Declaration of Conformity is laid out in writing in a separate document and can be requested if required.

Guidelines on the EMC Directive 2014/30/EU
The product cannot be operated independently according to the EMC Directive.
Due to their passive state, brakes are also non-critical equipment according to the EMC.
Only after integration of the product into an overall system can this be evaluated in terms of the EMC.
For electronic equipment, the evaluation has been verified for the individual product in laboratory conditions, but not in the overall system.

Guidelines on the Machinery Directive 2006/42/EC
The product is a component for installation into machines according to the Machinery Directive 2006/42/EC.
The brakes can fulfil the specifications for safety-related applications in coordination with other elements.
The type and scope of the required measures result from the machine risk analysis. The brake then becomes a machine component and the machine manufacturer assesses the conformity of the safety device to the directive.
It is forbidden to start use of the product until you have ensured that the machine accords with the regulations stated in the directive.

Guidelines on the EU Directive 2011/65/EU (RoHS II) with 2015/863/EU (RoHS III – from 22 July 2019)
These restrict the use of certain hazardous substances in electrical and electronic devices as well as in products / components (category 11), the proper operation of which is dependent on electric currents and electromagnetic fields. **Our electromagnetic products / components fulfill the requirements laid down in the RoHS Directive(s), taking into account the valid exceptions (according to Appendix III and IV RoHS (2011/65/EU) with delegated Directives (EU) 2018/739-741 from 01.03.2018 for Category 11 – until 21 July 2024) and comply with the RoHS.**

Guidelines on the ATEX Directive
Without a conformity evaluation, this product is not suitable for use in areas where there is a high danger of explosion.
For application of this product in areas where there is a high danger of explosion, it must be classified and marked according to Directive 2014/34/EU.

Guidelines on the REACH Regulation (EC) No. 1907/2006
of the European Parliament and of the Council concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH). This regulation governs the manufacture, placing on the market and use of chemical substances in preparations and, under certain conditions, also of substances in finished products.
mayr® power transmission exclusively manufactures products (articles: overload clutches, shaft couplings, electromagnetic brakes / clutches, permanent magnet motors and the appropriate control modules / rectifiers) in accordance with the definition in Article 3 of the REACH Regulation.
mayr® power transmission is aware of its responsibility towards the environment and society. As a matter of precaution, we pay attention to particularly critical substances in the supply chain and strive to avoid using any such substances completely or to replace them in the near future.
In compliance with Article 33 of the REACH Regulation, we would like to inform you that in our overload clutches and shaft couplings, electromagnetic brakes / clutches as well as permanent magnet motors, subcomponents with a lead content of > 0.1% are or may be used. These are manufactured from raw materials such as machining steel / copper alloys (e.g. brass, bronze) or aluminum alloys.
Besides high-melting-point (HMP) solders (electronics), this also affects integrated machine elements as well as standard parts (screws / nuts / set screws / pins / etc.) among others, provided that the relevant standards allow this.
For example, lead can occur as an alloying element with more than 0.1 mass percent, based on the respective total mass, in screws and set screws of the following property classes: 4.6, 4.8, 5.8, 6.8, 04, 4, 5, 6, 14H, 17H, 22H, 33H, 45H.
Products made from copper and copper alloys do not fall within the area of applicability of Regulation (EC) No. 1272/2008 of the European Parliament and Council on the Classification, Labeling and Packaging of Substances and Mixtures (CLP Regulation) and are therefore not subject to the classification and labeling obligations.
To our knowledge, when used for their intended purpose and disposed of correctly (recycling), the contained substances pose no threat to health or environment.
We would like to point out that the proportion of lead used here is not prohibited according to the REACH Regulation. It is merely necessary to declare the use of this substance.

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3.5 Guidelines on UK Directives / Conformity

Products / components from *mayr*® power transmission fulfill the requirements for the British economic area due to currently identical UK and EU directives.
In addition to the CE identification, the UKCA identification is attached to the product.
The UK Declaration of Conformity is available in a separate document.

Directives under EU Law	Directives under UK Law
Machinery Directive 2006/42/EC	Supply of Machinery (Safety) Regulations UK 2008 No. 1597
EMC Directive 2014/30/EU	Electromagnetic Compatibility Regulations UK 2016 No. 1091
EU Low Voltage Directive 2014/35/EU	Electrical Equipment (Safety) Regulations UK 2016 No. 1101
RoHS II 2011/65/EU	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations UK 2012 No. 3032

3.6 Guidelines on EU and UK REACH

According to the European Union (Withdrawal) Act 2018, the EU REACH Regulation was transposed into UK law on January 1, 2021, and is known as UK REACH.
REACH and related legislation have been replicated in the UK with the necessary changes to make it workable in a domestic context.
The fundamental principles of the EU REACH Regulation have been retained in UK REACH.
The remarks on the information obligation according to UK-REACH correspond in content to the REACH Regulation (EC) No. 1907/2006.

3.7 CE Identification

CE

according to the Low Voltage Directive 2014/35/EU (only for voltage > 75 V) and/or RoHS Directive 2011/65/EU with 2015/863/EU.

3.8 UKCA Identification

UK CA

according to Low Voltage Directive UK 2016 No. 1101 (only for voltage >75 V DC) and / or RoHS Directive UK 2012 No. 3032

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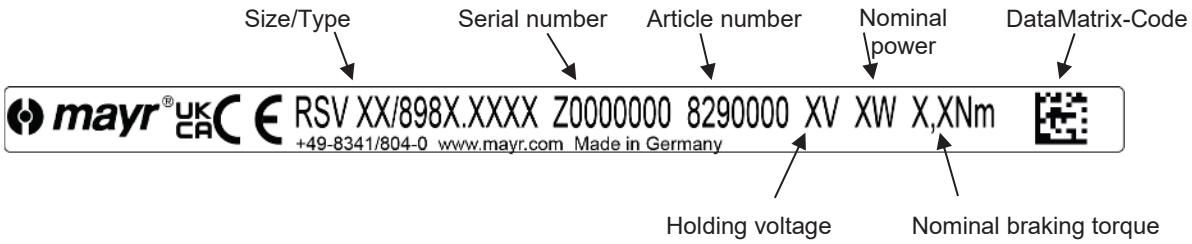
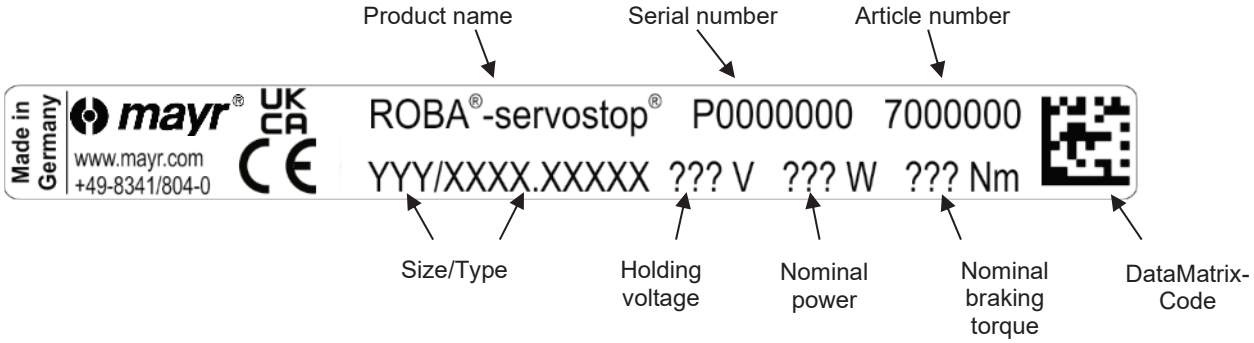
3.9 Identification/ Type Tag

mayr® components are clearly marked and described on the Type tag:



Type tag for size 100



Serial number

Year	Code
2000	A
2001	B
2002	C
2003	D
2004	E
2005	F
2006	H
2007	J
2008	K
2009	L
2010	M
2011	N

Year	Code
2012	P
2013	R
2014	S
2015	T
2016	U
2017	V
2018	W
2019	X
2020	Y
2021	Z
2022	G
2023	Q

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4 Product Description

4.1 Scope of Delivery / State of Delivery

- ❑ The brakes are manufacturer-assembled ready for installation.
- ❑ Please observe the Type tag.
- ❑ Please check the scope of delivery as well as the state of delivery immediately after receiving the goods. *mayr*® power transmission will take no responsibility for belated complaints. Please report transport damage immediately to the supplier. Please report incomplete delivery and obvious defects immediately to the manufacturer.
- ❑ The hub (6) is included loose in delivery.

4.2 Function

4.2.1 Quiescent Current Principle

The functional principle applied here is the energy-separation principle according to EN ISO 13849-2 Appendix A.2 “List of basic safety principles”. The reliable condition is achieved through separation of the energy source, and thus accords with the required safety aspects, for example during power failure or EMERGENCY STOP.

ROBA®-servostop® brakes are spring applied, electromagnetic safety brakes.

Spring applied function (brake):
In de-energized condition, thrust springs (3) press against the armature disk (2). The rotor (4) is held between the armature disk (2) and the flange plate (5) via frictional locking.
The brake is released electromagnetically.

Electromagnetic function (release):
Due to the magnetic force of the coil in the coil carrier (1), the armature disk (2) is attracted against the spring pressure to the coil carrier (1).
The brake is released and the rotor (4) can rotate freely.

Safety brake function:
The ROBA®-servostop® applies the brakes reliably and safely in the event of a power switch-off, a power failure, or an EMERGENCY STOP.

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4.3 Views

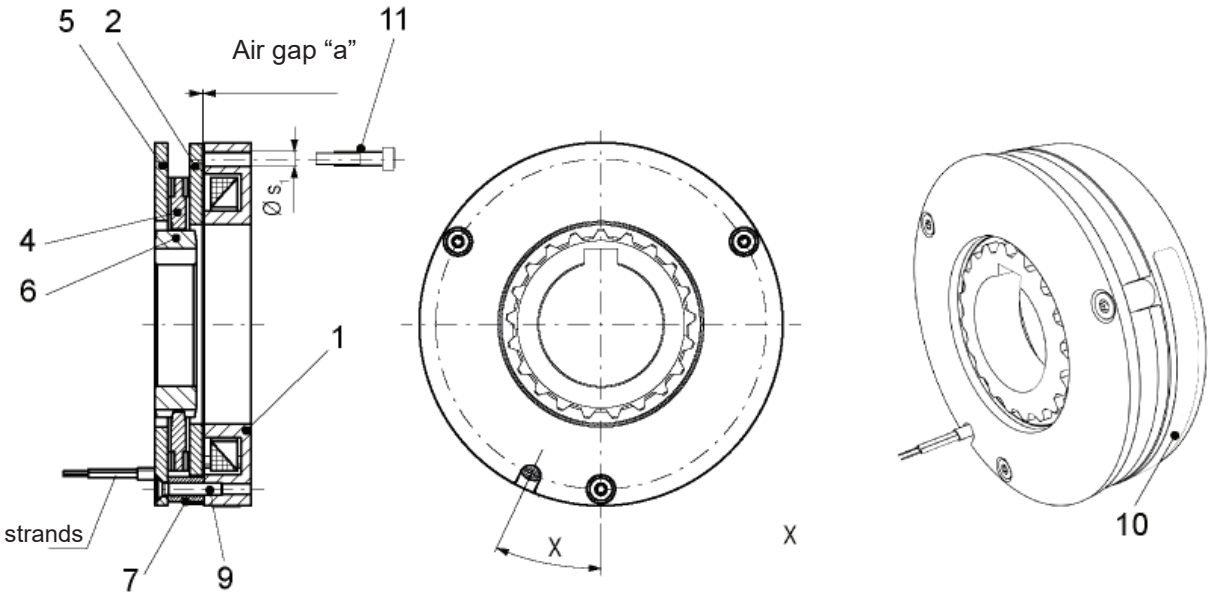

Fig. 1: Type 8982.00001

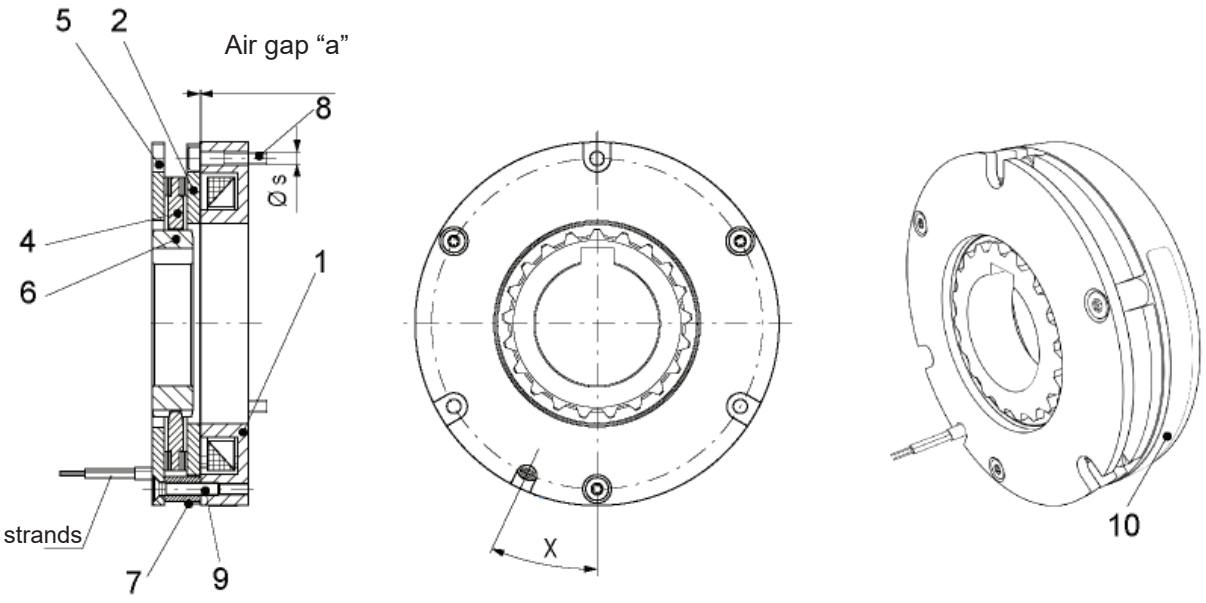

Fig. 2: Type 8982.00101

Information regarding the strand:
2x SPEC 44
Conductor cross-section: AWG 24 or 0.25 mm²
Strand diameter: Ø 1.02 mm
min. Bending radius 6 x Ø
Length: approx. 480+30 mm
Deviations from the standard strand are possible for special designs. If necessary, take into account the information on the drawing.

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4.4 Parts List
(Only use *mayr*® original parts)

Item	Name
1	Coil carrier (assembly with coil)
2	Armature disk
3	Thrust spring (not depicted)
4	Rotor
5	Flange plate
6	Hub
7	Distance bushing
8	Cap screw (customer-side) DIN EN ISO 4762 – 8.8
9	Countersunk screw
10	Type tag
11	Fixing screw (provided by the customer), property class 8.8

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5 Technical Data

5.1 Guidelines

5.1.1 Application Conditions

The catalogue values are guideline values which have been determined in test facilities. It may be necessary to carry out your own tests for the intended application. When dimensioning the brakes, please remember that installation situations, braking torque fluctuations, permitted friction work, bedding-in condition / conditioning of the brake linings and wear as well as general ambient conditions can all affect the given values. These factors should therefore be carefully assessed, and alignments made accordingly.

- ❑ Mounting dimensions and connection dimensions must be adjusted according to the size of the brake at the place of installation.
- ❑ Use of the brake in extreme environmental conditions or outdoors, directly exposed to the weather, is not permitted.
- ❑ The brakes are designed for a relative duty cycle of 100 %.
- ❑ The braking torque is dependent on the following factors:
  - Bedding-in condition of the rotor (4)
  - Ambient temperature
  - Age of the rotor's friction lining (4)
- ❑ The brakes are only designed for dry running. The torque is lost if the friction surfaces come into contact with oil, grease, water or similar substances or any other foreign bodies.
- ❑ The outer components have been provided with a phosphated or a gas-nitrated surface manufacturer-side to form a basic corrosion protection.

CAUTION

The rotors (4) may rust up and seize up in corrosive ambient conditions and / or after longer downtimes.
The user is responsible for taking appropriate countermeasures.

5.1.2 Ambient temperature/Climate Conditions

The electromagnetic brake is suitable for applications with an ambient temperature of between -20 °C and +120 °C.

CAUTION

Reduction in braking torque possible
Condensation can form on the brake and cause a loss in braking torque:

- ❒ due to fast changes in temperature
- ❒ at temperatures of around or under freezing point

The user is responsible for taking appropriate countermeasures (e.g. forced convection, heating, drain screw).

CAUTION

Brake malfunction possible
Condensation can form on the brake and cause malfunctions:

- ❒ at temperatures around or under freezing point, the brake can freeze over and not release any more.

The user is responsible for taking appropriate countermeasures (e.g. forced convection, heating, drain screw).

The system function must be checked by the user after longer downtimes.

At high temperatures and in high humidity or with occurring dampness, the rotor (4) can seize up to the armature disk or the bearing shield / the flange plate after longer downtimes.

5.1.3 Class of Insulation F (+155 °C)

The insulation components on the magnetic coils are manufactured at least to class of insulation F (+155 °C).

5.1.4 Protection

(mechanical) IP20: Protection against fingers or similar-sized objects, against medium-sized foreign bodies > 12 mm in diameter. No protection against water.

(electrical) IP54: Dust-proof and protected against contact as well as against water spray from any direction.

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5.1.5 Noise Emissions

The brake is not noise-reduced. When the armature disk is switched, the impact pulse from the armature disk onto the coil carrier or the armature disk onto the rotor (4) generates a switching noise which can reach approx. 90 dB(A). The brake is not suitable for use in noise-sensitive applications.

5.1.6 Installation Position

The brake can be operated in any installation position.

5.1.7 Pre-requisites for Product Application

Compare the limit values stated in these Installation and Operational Instructions with the actual application, e.g.

- ❑ Braking torque
- ❑ Braking distance
- ❑ Masses
- ❑ Temperatures etc.

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5.2 Technical Data

5.2.1 General

Technical Data			Size						
			40	50	60	70	80	90	100
Nominal braking torque [1) 2) 3) 4)]	M_N	[Nm]	0.31	0.7	1.9	3.7	5.5	7.9	11.5
Overexcitation voltage	U_O DC	[V]	24	24	24	24	24	24	24
Holding voltage	U_H DC	[V]	8	8	8	8	8	8	8
Power at overexcitation voltage	P_O	[W]	20.7	28.6	42.6	53.4	60.6	71.6	83.4
Power at holding voltage	P_H	[W]	2.3	3.2	4.7	5.9	6.7	8.0	9.3
Nominal power	P_N								
Maximum speed	n_{max}	[rpm]	10500	8500	7000	6500	5500	5000	4500
Max. idle speed		[rpm]	21000	16500	14000	12500	10500	10000	9000
Weight		[kg]	0.12	0.19	0.29	0.47	0.57	0.76	0.94
Total mass moment of inertia at $d_{1\ max}$	J	[10-6 kgm²]	1.98	7.58	16.02	21.46	44.09	83.46	135.89
Recommended min. radial distance of magnetically conductive materials in the area of the coil carrier (1) and the armature disk (2)		[mm]	1.25	1.25	1.25	1.25	1.5	1.5	1.75

5.2.1.1 Explanations

1) Braking torque tolerance: + 75 %
2) Suitable for a temperature of 0 up to 60 °C: For higher temperatures, please consider the following braking torque reductions:
   >60 °C to 80 °C: 10 % reduction
   >80 °C to 100 °C: 20 % reduction
   >100 °C to 120 °C: 30 % reduction

   For temperatures of -20 to 0 °C:
   Observe the “Ambient temperature/Climate conditions” section **5.1.2** in the operational instructions!

3) The braking torque values are based on friction values determined in tests at *mayr*® power transmission. As a friction system is influenced by many parameters, such as mounting situation, temperature, ambient conditions, run-in condition, wear, switching work, sliding speed, aging, contamination, etc., deviating braking torques are possible. The specified nominal braking torque is a lower limit which is very likely to be reached, but cannot be guaranteed due to the many possible influences. The fluctuations in braking torques must be taken into account during dimensioning by providing appropriate safety measures. Specially for critical applications, it is important to consult *mayr*® power transmission and carry out an appropriate application check.

4) Remarks and recommendations regarding the dimensioning and selection of brakes (e.g., based on load torque and test torque):

See the document “Hinweise und Empfehlungen zum statischen Bremsentest” (Remarks and recommendations for the static brake test) on our website under ROBA®-servostop “Downloads”.

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5.2.2 Tightening torques

		Size						
		40	50	60	70	80	90	100
Screw thread Item 8		M2	M2	M2.5	M3	M3	M4	M4
Screw tightening torque Item 8	[Nm]	0.32	0.32	0.65	1.1	1.1	2.6	2.6
Screw thread Item 11		M2.5	M2.5	M3	M4	M4	M5	M5
Screw tightening torque Item 11	[Nm]	0.65	0.65	1.1	2.6	2.6	5.1	5.1

All tightening torques are recommendations only. These data do not relieve the user from checking the data regarding the actual installation situation.

5.2.3 Friction work

Friction work Lean			40	50	60	70	80	90	100
max. friction work on individual switching (1…10 switchings in a succession)		[J]	150	200	230	550	650	850	1000
Dynamic braking torque ($M_{dyn-min}$) in the speed range									
$M_{dyn-min} = M_N$	n	[rpm]	0 - 5000	0 - 4000	0 - 3500	0 - 3000	0 - 2500	0 - 2500	0 - 2000
$M_{dyn-min} = M_N$ -15 %	n	[rpm]	5000 - 8000	4000 - 6000	3500 - 5000	3000 - 4500	2500 - 4000	2500 - 3500	2000 - 3500
$M_{dyn-min} = M_N$ -30 %	n	[rpm]	8000 - 10500	6000 - 8500	5000 - 7000	4500 - 6500	4000 - 5500	3500 - 5000	3500 - 4500
Wear (max. number of individual braking actions at max. friction work in the speed range)									
2000	n	[rpm]	0 - 5000	0 - 4000	0 - 3500	0 - 3000	0 - 2500	0 - 2500	0 - 2000
1400	n	[rpm]	5000 - 8000	4000 - 6000	3500 - 5000	3000 - 4500	2500 - 4000	2500 - 3500	2000 - 3500
1000	n	[rpm]	8000 - 10500	6000 - 8500	5000 - 7000	4500 - 6500	4000 - 5500	3500 - 5000	3500 - 4500

5.2.4 Permitted hub bore

Permitted hub bore Ø $d_{1\ max}$				Size						
				40	50	60	70	80	90	100
Type 8982.00_01	Keyway JS9	6885/1	[mm]	11	18	22	22	30	32	37
		6885/2	[mm]	12	-	-	-	-	-	-
		6885/3	[mm]	-	20	25	25	-	35	-

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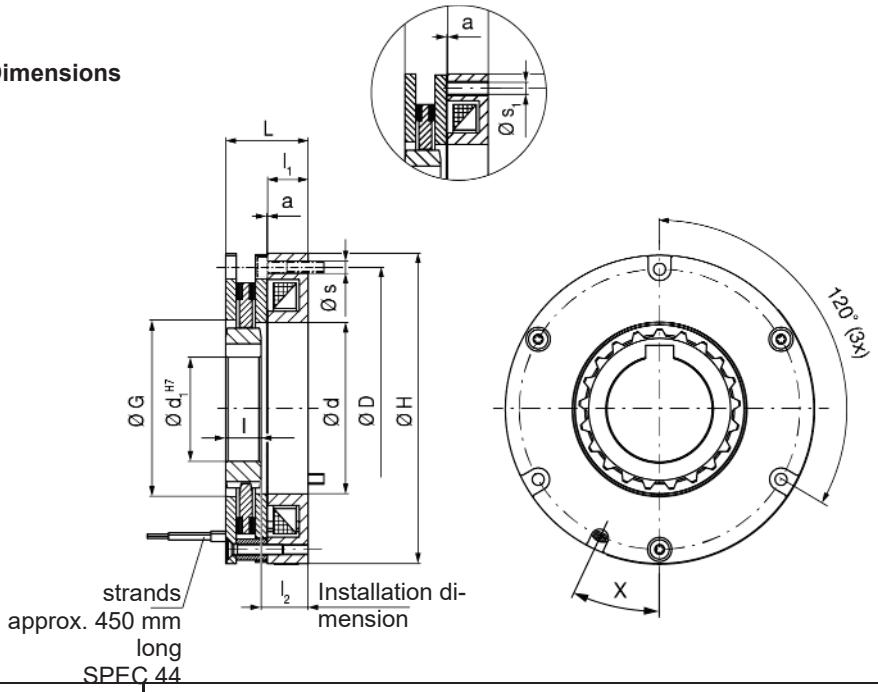
5.2.5 Dimensions



Dimensions	Size						
	40	50	60	70	80	90	100
$a^{+0.06}_{-0.03}$	0.15	0.15	0.15	0.2	0.2	0.2	0.2
d	22.5	33.5	40.5	40.5	48.5	56	63
$d_{1\ min}$	8	10	12	12	15	23	20
$d_{1\ max}$ 5)	12	20	25	25	30	35	37
D	43	53	62	70	80	90	100
G	22.5	33.5	40.5	40.5	50	57	67
H	48	58	68	78	88	98	108
L	16.35	19.15	21.15	23.3	23.3	25.4	25.9
$l^{-0.2}$	7.4	9.2	9.5	9.5	10	13.5	12
l_1	8.5	10	11	11.5	11.5	11.5	12
l_2 ±0.5	8.95	9.95	11.65	13.8	13.3	11.9	13.9
s	2.4	2.4	2.9	3.4	3.4	4.5	4.5
s_1	M2.5	M2.5	M3	M4	M4	M5	M5
Max. Screw-in depth for thread s_1 (Item 11)	7.5	7.5	9	8	8	10	10
X	25°	25°	25°	25°	25°	25°	25°

5) The respective maximum bores can be found in the table “Permitted hub bores” **5.2.4** according to the corresponding keyways and their tolerances.

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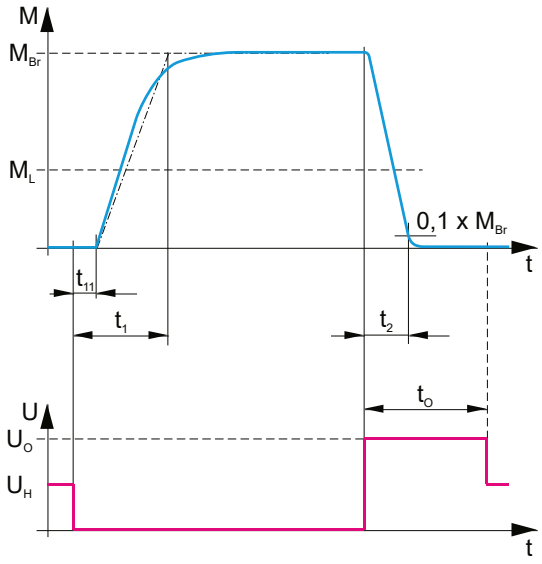
5.2.6 Switching times



The switching times are only valid for the stated braking torque values 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.
The values stated in the table are mean values which refer to the nominal air gap and the nominal torque on a warm brake.
Typical switching time tolerances are ±20 %.

Please Observe:
Wear on the rotor increases the air gap. The separation time t_2 (release) increases by a factor of 2 at the end of the pull-in distance (max. possible air gap).

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.

Diagram 1
Switching times for brake operation with overexcitation voltage

Key

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_N	=	Coil nominal voltage/coil voltage
U_H	=	Holding voltage	U_O	=	Overexcitation voltage

(These values are mean values referring to a nominal air gap „a“ on a cold brake)

Switching Times		Size		40	50	60	70	80	90	100
Connection time	DC-side switching	t_1	[ms]	15	15	15	20	20	30	30
	AC-side switching	t_1	[ms]	65	65	65	80	90	150	150
Response delay on connection	DC-side switching	t_{11}	[ms]	10	10	10	15	15	20	20
	AC-side switching	t_{11}	[ms]	50	50	50	60	60	100	100
Separation time (release)		t_2	[ms]	25	25	35	50	70	70	70
Overexcitation time t_O (guideline value)		t_o	[ms]	50	50	70	100	140	140	140

Limit value for overexcitation time t_O: $2 \times t_2 \leq t_O \leq 3 \times t_2$

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6 Intended Use

See also section **2.3**

6.1 Guidelines for Application

- ❑ 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.
- ❑ 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 stated switching times 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.
- ❑ The brake is designed for 120 °C. Temperatures above 120 °C in machine use can reduce the magnetic force. Brake does not release properly.
- ❑ Application in clean environments (penetration of coarse-grained 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).

Please contact *mayr*® power transmission.

Brakes which are to be used in safety-related applications must be selected, dimensioned and positioned according to the risk assessment DIN EN 12100 and other standards and regulations applicable to the special application. This is in principle the task of the system manufacturer/user.

6.2 Limits

- ❑ The brake is not suitable for use in oily or severely contaminated environments

6.3 Reasonably Foreseeable Misuse

The following uses are prohibited and may generate hazards.

- ❑ Any opening of the screws on the housing.
- ❑ The maximum switching frequency is exceeded
- ❑ Brake is used in oily or heavily contaminated surroundings
- ❑ The overexcitation time, see Chapter 5.2.6, is exceeded or undercut.
- ❑ No overexcitation

6.4 Duration of Use

20 years or on reaching the T10d (for definition, see EN ISO 13849-1) duration of use.

6.5 Dimensioning

Attention!
When dimensioning the brake, please take into consideration whether a load torque is present when selecting the protection.

- ❒ Load torques reduce the deceleration torque available.
- ❒ Load torques may increase the output speed:
  - ➔ during a possible processing time in the controls
  - ➔ during the brake downtime

When calculating the friction work, please observe that the brake nominal torque is subject to a tolerance.

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7 Electrical Connection and Wiring

DC current is necessary for operation of the brake. The coil nominal 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 can take place with a suitable DC power supply The connection possibilities can vary dependent on the brake equipment. Please follow the exact connections according to the section **9.4**. The manufacturer and the user must observe the applicable regulations and standards (e.g. DIN EN 60204-1 and DIN VDE 0580). Their observance must be guaranteed and double-checked!

7.1 Grounding Connection

Depending on the nominal voltage and/or identification in the technical documents, the brake is designed for Protection Class I or Protection Class III. In accordance with VDE 0580 Item 4.6, the grounding connection can be made directly or indirectly on the magnetic coil body.

Protection Class I:
This protection covers not only the basic insulation, but also the connection of all conductive parts to the protective conductor (PE) on the fixed installation. If the basic insulation fails, no contact voltage will remain. Please carry out a standardised inspection of the protective conductor connections to all contactable metal parts!
The grounding contact acts as a protective ground.

Protection class III:
The brake's supply and thus protection against electric shock takes place via the Safety Extra Low Voltage PELV/SELV (see EN61140 Items 6.7-6.8 and 7.5) The requirements of the machine and device standards (for example, IEC 60204-1 or similar) must be observed.
The grounding contact acts as the functional ground and serves to prevent electromagnetic disturbance or potential equalization, for example.

7.2 Fuse Element

To protect against damage from short circuits, please add suitable fuse elements to the mains cable/supply line.

7.3 Switching Behavior

The reliable operational behavior 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).

7.4 Switching Modes

The separation time (t_2) and the connection time (t_1) of the brake are substantially influenced by the electrical wiring of the magnetic coil (see **5.2.6**)

7.4.1.1 Field build-up with normal excitation

Determination of the separation time (t_2).
If the magnetic coil is energised with coil nominal voltage, the coil current does not immediately reach its nominal value. The coil inductivity causes the current to increase slowly as an exponential function. Accordingly, the build-up of the magnetic field takes place more slowly and the braking torque drop (see Diagram 3/curve 1) is also delayed.
For this type of wiring, no electrical construction elements are required as long as the DC supply voltage equals the coil nominal voltage on the magnetic coil.

7.4.1.2 Field Build-up with Overexcitation

Quicker Release

Determination of the separation time (t_2)
A quicker drop in braking torque is achieved if the coil is temporarily placed under a higher voltage than the coil nominal voltage, as the current then increases more quickly. Once the brake is released, it needs to be switched over to the coil nominal voltage U_N (see Diagram 3/curve 2). The relationship between overexcitation and separation time t_2 is roughly indirectly proportional, meaning that at doubled coil nominal voltage the separation time t_2 for release of the brake is halved. For this, further wiring modules are required. The ROBA®-switch 24V and ROBA®-brake-checker work on this principle.

Increased spring force

Generally, overexcitation of the magnetic coil is also required if the brake has an increased braking torque, and an increased magnetic force is required to attract the armature disk against the increased spring forces.

Current path | Braking torque path

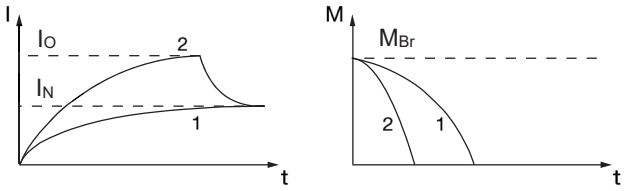

Diagram 3:

Operation with overexcitation requires an inspection of:
- ❑ the required overexcitation time
- ❑ the **RMS coil capacity** with a cycle frequency higher than 1 cycle per minute.

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7.4.1.3 Calculation during Field Build-up with Overexcitation

Required overexcitation time

Increased wear, and therefore an increasing air gap as well as coil heating lengthen the separation times t_2 for the brake. For this reason, at least 2 to 2.5 times the separation time t_2 at nominal current I_N must be selected as overexcitation time t_O.

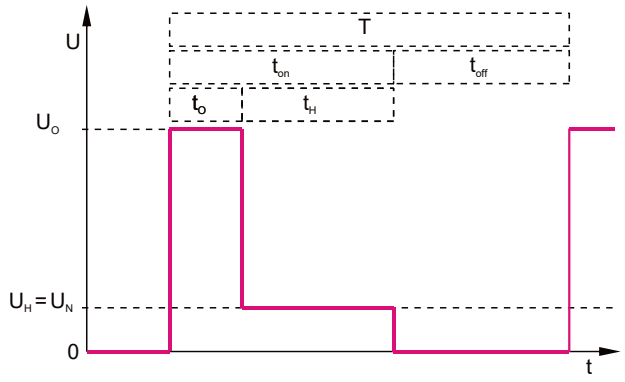
RMS coil capacity P

$P \leq P_N$
The coil capacity P must not be larger than P_N. Otherwise the coil may fail due to thermal overload.

Key and Calculations:

P	[W]	RMS coil capacity dependent on switching frequency, overexcitation, reduction in capacity and duty cycle $P = \frac{P_O \times t_O + P_H \times t_H}{T}$
P_N	[W]	Nominal power (Technical Data, type tag)
P_O	[W]	Power on overexcitation (Technical Data)
P_H	[W]	Power on holding voltage (Technical Data, type tag)
t_O	[s]	Overexcitation time
t_H	[s]	Holding time
t_{on}	[s]	Time with voltage
t_{off}	[s]	Time without voltage
T	[s]	Total time ($t_O + t_H + t_{off}$)
U_O	[V]	Overexcitation voltage (bridge voltage)
U_H	[V]	Holding voltage (half-wave voltage)
U_N	[V]	Nominal voltage
I_O	[A]	Overexcitation current
I_N	[A]	Nominal current
M_{Br}	[Nm]	Braking torque

7.4.1.4 Time Diagram:

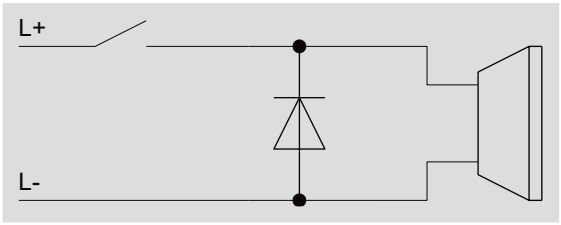


7.4.2 Magnetic Field Removal

Determination of the connection time (t_1)

7.4.2.1 Switching with Freewheeling Diode

Supply with DC voltage



Schematic wiring diagram 1

The power circuit is interrupted in front of the freewheeling diode. The magnetic field slowly reduces. This delays the rise in braking torque and generates a slow connection time t_1. The freewheeling diode is to be dimensioned in accordance with the nominal current of the brake and the maximum occurring supply voltage with the appropriate safety factor.

Recommendation!
Connection time t_1 is of no consequence:

- ❑ switch with the freewheeling diode. No protective measures for the coil and switching contacts required.

Switching with freewheeling diode means a longer brake engagement time (approx. 6 – 10 times longer than with DC-side switch-off), use for non-critical braking times.

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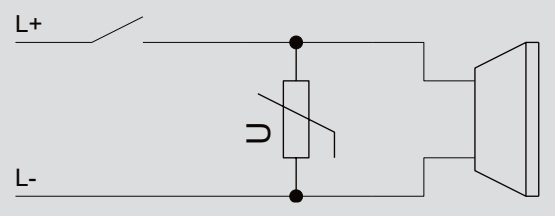
7.4.2.2 DC-side switching

Supply with DC voltage



Schematic wiring diagram 2

The power circuit is interrupted between the power supply and the coil. The magnetic field is quickly reduced via the protective element. This causes a quick rise in braking torque and a quick connection time t_1. The varistor is to be dimensioned in accordance with the maximum occurring DC or AC voltage. The recommended disk diameters are 14 – 20 mm.

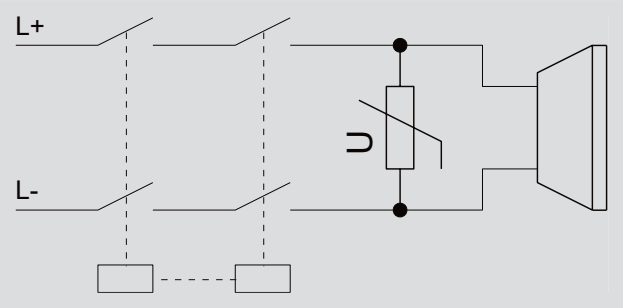
When switching DC-side, high voltage peaks are produced in the coil. This can lead to wear on the switching contacts from sparks and to destruction of the insulation. For this reason, the voltage peaks must be limited (see section **7.5**).

DC-side switching causes the **shortest connection times on the brake (e.g. for EMERGENCY STOP operation or for safety switch-offs)** so that the braking torque is made available as quickly as possible for short braking distances or for fast take-over of loads.

Please Observe!

Safety switch-off

In applications with a necessarily short switching time for short braking distances and fast take-over of loads, reliable DC-side switch-off is required e.g. through redundant, monitored contactors.
(see schematic wiring diagram 3)



Schematic wiring diagram 3

7.5 Protection Circuit

When using DC-side switching, the coil must be protected by a suitable protection circuit according to VDE 0580, which is integrated in *mayr*®-supply and monitoring modules. To protect the switching contact from consumption when using DC-side switching, additional protective measures are 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 operating current are sufficient.
Depending on the application, the switching contact can also be protected by other protection circuits (e.g. *mayr*®-spark quenching unit), although this may of course then alter the switching times.

The following parameters can be changed through suitable adaptations of the protection circuit.

- ❑ Contact lifetime
- ❑ Switching times on drop-out
- ❑ Voltage peaks or level of switch-off voltage

Please contact mayr® power transmission.

Please Observe!

For accessories, please go to
www.mayr.com

8 Storage

8.1.1 Brake Storage

- ❑ Store the brakes in a horizontal position, in dry rooms and dust and vibration-free.
- ❑ Relative air humidity < 50 %.
- ❑ Temperature without major fluctuations within a range from 20 °C up to +40 °C.
- ❑ Do not store in direct sunlight or UV light.
- ❑ Do not store aggressive, corrosive substances (solvents / acids / lyes / salts etc.) near to the brakes.

For longer storage lasting more than 2 years, special measures are required.

► **Please contact *mayr*® power transmission.**

Storage acc. DIN EN 60721-3-1 (including the limitations / additions described above): 1K3; 1Z1; 1B1; 1C2; 1S3; 1M1

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9 Installation

9.1 Installation Conditions

Please observe before installation!

- ❑ The eccentricity of the shaft end in relation to the mounting pitch circle must not exceed 0.2 mm.
- ❑ The positional tolerance of the threads for the customer-side fixing screws must not exceed 0.2 mm.
- ❑ The axial run-out deviation of the screw-on surface to the shaft must not exceed the permitted axial run-out tolerance of **0.08 mm** acc. DIN 42955. The reference diameter is the pitch circle diameter for securement of the brakes.
  Larger deviations can lead to a drop in torque, to continuous grinding of the rotor (4) and to overheating.
- ❑ The rotor (4) and brake surfaces must be oil and grease-free.
- ❑ The shaft tolerance must be selected so that the hub toothing (6) is not widened. Widening of the toothing leads to the rotor (4) jamming on the hub (6) and therefore to brake malfunctions.
  Recommended shaft tolerance: k6.
  The max. permitted joining temperature of 150 °C must not be exceeded.
- ❑ The hub toothing (6) and the rotor (4) must not be oiled or greased.
- ❑ Select the screw length so that the max. screw-in depth for thread s_1 (see **5.2.5**) is not exceeded. Due to the long screws (see Item 11 in **4.4** parts list), the armature disk's stroke can be impaired. It may not or only partially be possible to release the brake. This can lead to continuous grinding or an unintended drop-out of the armature disk (2).
- ❑ The tensile strength R_m of the attachment wall must be at least 300 N/mm². Lower strength values must be approved by *mayr*® power transmission.
- ❑ Observe the installation dimension l_2 as per Chapter **5.2.5** in the design to minimize the installation effort.

Recommendation

Observe the suggested min. radial distance of magnetic conductive material around the coil carrier (1) and the armature disk (2), see **5.2.1**, for the outer and inner dimension (for example, housing and/or shaft)!

Possible consequences of non-observance:
Too little distance can affect the magnetic functionality of the brake.

Recommendation

Axial undercut is recommended:

At the transition of the end face of a shaft shoulder (if available) and the shaft section that receives the hub (6).

This ensures a flat and defined contact of the hub (6).

9.2 Installation

9.2.1 Pre-requisites

- ❑ Unpack the brake
- ❑ Check for completeness
- ❑ Check the data on the Type tag
- ❑ Visual inspection (e.g. after longer storage period)

9.2.2 Preparation

- ❑ Have the necessary tools ready
  - Spanners or hexagon socket wrench etc.
  - Torque wrenches
- ❑ Provide fixing screws (not included in the standard scope of delivery)
- ❑ Check installation dimension l_2 as per Chapter **5.2.5** and Figure 3.

9.2.3 Protection against electric shock

If the brake is opened electrically for installation onto the motor, protective measures against electric shock must be taken in accordance with DIN EN 61140 and EN 50191.

- ❑ See also DGUV Regulation 3 and DGUV Information 203-034.

All tightening torques are recommendations only. These data do not relieve the user from checking the data regarding the actual installation situation.

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9.3 Installation Procedure

Rotor with friction linings (4) and brake surface must be oil and grease-free.

9.3.1 Type 8982.00101 screw connection on the coil carrier front

1. Mount the hub (6) onto the shaft with inserted key, bring it into the correct position as per installation dimension l_2 in Chapter **5.2.5** (Figure 3) and secure it axially.
2. Establish the electrical connection of the brake.
3. Position the brake with the coil carrier side (1) first onto the motor flange. Please observe the correct position of the tapped holes and strands.

If necessary, release (energize) the brake if the centerings cannot be inserted easily.

Observe the information on protective measures **9.2.3** against electric shock.

Do not use force when joining the rotor toothing onto the hub toothing.

4. Screw the brake together with the bearing flange using the three bores “s” in the coil carrier (1) (see Fig. 2).
   The user is responsible for providing the cap screws (8). Sizes and tightening torques see **5.2.2**

9.3.2 Type 8982.00001 screw connection on the coil carrier back side

1. Mount the hub (6) onto the shaft with inserted key, bring it into the correct position as per installation dimension l_2 in Chapter **5.2.5** (Figure 3) and secure it axially.
1. Establish the electrical connection of the brake.
2. Position the brake with the coil carrier side (1) first onto the motor flange. Please observe the correct position of the tapped holes and strands.

If necessary, release (energize) the brake if the centerings cannot be inserted easily.

Observe the information on protective measures **9.2.3** against electric shock.

Do not use force when joining the rotor toothing onto the hub toothing.

3. Screw the brake together with the bearing flange using the 3 threads „s_1“ in the coil carrier (1) (see Fig. 1).
   → Here, please observe the max. screw-in depth, see **5.2.5**.
   The user is responsible for providing the fixing screws (11). Sizes and tightening torques see **5.2.2**

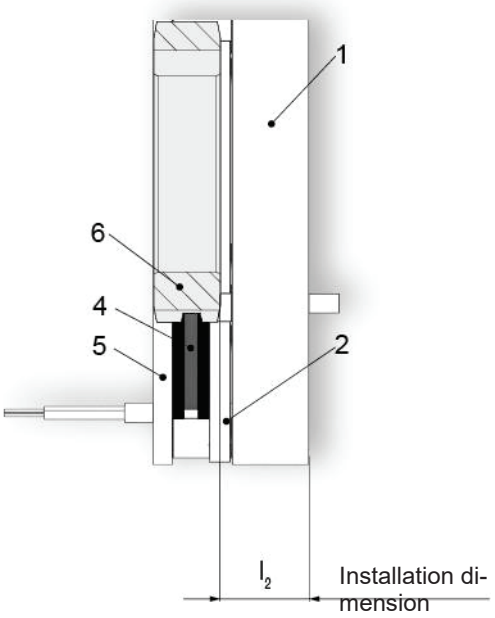

Fig. 3

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9.4 Electrical Connection

DANGER

Carry out electrical connection only in de-energised condition.

Electrical shock possible.

Only trained personnel should carry out the connection.

Cable	
Black	0 V
Red	+V

10 Initial Operation

10.1 Definition of the Braking Torques

10.1.1 Static braking torque

Effectively averaged, fully developed torque for slipping brake with smallest speed values.
Guideline value: n = 3 [rpm]

10.1.2 Dynamic braking torque

Effectively averaged, fully developed torque in a braking procedure from the output speed up to standstill.

For correct evaluation, a sufficient slip time is required (sliding speed between 1 m/s and 10 m/s).
The permitted friction work and speed values must not be exceeded.

10.2 Run-in Procedure

The stated brake nominal torque (see 5.2.1.1 for details) is valid for the friction lining pairings in new condition in standard climate conditions.

- ❑ If the friction lining pairing requires conditioning, the brakes may have to be run in during operation.
- ❑ In case of longer storage or downtime, the brakes may have to be run in to achieve the specified braking torque.

10.3 Brake Inspection (Before Initial Operation)

➔ **Braking torque inspection:**
Please compare the requested braking torque with the torque stated on the type tag (10) (see also braking torque **5.2.1.1** Explanations).

➔ **Release function inspection:**
by energizing the brake.

10.4 Brake Test (initial operation)

CAUTION

During the Brake Test danger to personnel and damage to machines cannot be ruled out in case of malfunctions (incorrect installation, control errors etc.). Risks to personnel and machine damage cannot be ruled out.

Do not enter the danger zone.

Possibly take measures for catching or damping the load

The brake test is used to inspect the braking torque, and must be carried out cyclically depending on the application. This is to be defined by the customer.
To avoid wear on the brake, the brake test must be conducted so that the motor builds up torque slowly against the closed brake up to the lower tolerance limit of the braking torque.

See the document “Hinweise und Empfehlungen zum statischen Bremsentest” (Remarks and recommendations for the static brake test) on our website under ROBA®-servostop “Downloads”.

If the rotor (4) is pulled through at this torque, regeneration of the friction linings is necessary.
The regeneration of the friction linings is an independent procedure.

Please contact *mayr®* power transmission.

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11 Maintenance / Inspection

ROBA®-servostop® brakes are mainly maintenance-free. However, the friction linings of the rotor (4) are subject to operational wear. The friction lining pairing is robust and wear-resistant. This ensures a long service lifetime of the brake.
If the rotor (4) does become worn due to the high total friction work, and the function of the brake can no longer be guaranteed, the brake must be replaced.

12 Wear

The wear condition of the rotor (4) is determined by measuring the release voltage. The release voltage may be up to max. 90 % of the overexcitation voltage on a warm brake (= maximum temperature in case of application).
The amount of wear on the rotor (4) must be examined during the regular inspection intervals:

Wear times are influenced by many factors and can vary substantially. The required inspection and maintenance intervals must be calculated individually according to the system manufacturer's planning documentation.

12.1 Cleaning:

Do not clean the brake using compressed air, brushes or similar devices!

- ❒ Wear safety gloves / safety goggles.
- ❒ Use a suction system or wet towels to clean off the brake dust.
- ❒ Do not inhale brake dust.
- ❒ In case of dust formation, a dust mask FFP 2 is recommended.

13 De-installation

WARNING **Load crash possible**

The brake must be load-free.
Please check that it is load-free before de-installation.

- ❑ Provide security in the danger zone.
- ❑ Support the load

De-installation takes place by following the "Installation Procedure" section 9.3 backwards.

14 Information on the Components

The **friction material** contains different inorganic and organic compounds, which are integrated into a system of hardened binding agents and fibers.

Possible hazards:
No potential dangers have been recognized so far when the brake is used according to its intended purpose.
When grinding in the brake linings (new condition) and also in case of EMERGENCY STOP braking actions, functional wear can occur (wear on the friction linings); on open brake designs, fine dust can be emitted.

Classification: Hazardous property
Attention: H-classification: H372

Protective measures and rules of behavior:
Do not inhale dusts.
Vacuum the dusts at the point of origin (tested suction devices, tested filters acc. DIN EN 60335-2-69 for dust classes H; maintenance of the suction devices and filter replacement at regular intervals).
If local dust suction is not possible or is insufficient, the entire work area must be ventilated using appropriate technology.

Additional information:
This friction lining (asbestos free) is not a dangerous product in terms of the EU Directive.

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15 Disposal

Our electromagnetic brake components must be disposed of separately as they consist of different materials. Please also observe the relevant authority regulations. Code numbers may vary according to the disassembling process (metal, plastic and cables).

Electronic components
(Rectifier / Switch):

Products which have not been disassembled can be disposed of under Code No. 160214 (mixed materials) or components under Code No. 160216, or can be disposed of by a certified disposal firm.

Brake bodies made of steel with coil/cable and all other steel components:
Steel scrap (Code No. 160117)

Brake rotor (steel or aluminum pads with friction linings):
Brake linings (Code No. 160112)

Guidelines on the WEEE Directive 2012/19/EU
Avoidance of waste from electrical and electronic devices and the reduction of such waste through recycling.

Our electromagnetic products (brakes, clutches) as well as the components required to control them (rectifiers) are frequently used in electrical and electronic devices within the appropriate area of application of WEEE, independent of the applicable product categories.
The stated products do not fall within the area of application of this Directive. They have been classified as electromagnetic / electronic components (VDE 0580) or as electronic equipment (DIN EN 50178), and have been determined for installation in devices for "use in accordance with the intended purpose". Only products which are to be viewed as devices in terms of the Directive and not as parts or components are subject to registration obligations.

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16 Malfunctions / Breakdowns

Malfunction	Possible Causes	Solutions
Brake does not release	❑ Incorrect voltage on rectifier ❑ No power ❑ Air gap too large (worn rotor) ❑ Coil interrupted ❑ Screws in thread s_1 too long	❑ Apply correct voltage ❑ Replace the power supply ❑ Replace the brake ❑ Select the correct screw length

Mayr® power transmission will take no responsibility or guarantee for replacement parts and accessories which have not been delivered by *mayr*® power transmission, or for damage resulting from the use of these products.

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