your reliable partner

Piston rod brake

ROBA®-linearstop electrical
Type 382.0_ _.0 _
Sizes 10 – 80

Issue status 2019-07

Translation of the Original Operational Instructions
B.382.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®-linearstop	Electromagnetically-actuated piston rod brake as a component for holding and deceleration of moved machine parts.
Nominal holding force F_{Nenn}	The theoretical nominal holding force assigned to the designation.
Load mass	Designation of the weight, which must be held by the brake.
Release	Release designates the procedure through which the magnetic coil is energised and therefore no nominal holding force is applied to the brake any more.
Closing	Closing or armature disk drop-out designates the process through which the magnetic coil is de-energised, the voltage is switched off and the nominal holding force 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).
Overexcitation time	The overexcitation voltage must only be available for a short time for release of the brake (0.5 s).
Holding voltage	The voltage at which the brake remains permanently released.

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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

Use according to the intended use is prohibited until it has been determined that the machine / system accords with the EC Directive 2006/42/EC (machinery directive).

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

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

- ❑ For applications in, for example, defence technology or medical products, **please contact *mayr*® power transmission.**
- ❑ Not suitable for operation in areas where there is a danger of explosion

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

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

- ❑ Attach a cover to protect **against injury through high temperatures** on the housing in case high temperatures are generated through incorrect wiring, for example increased switching frequency or excessive overexcitation
- ❑ Protection circuit: see section 7.4
- ❑ Install additional protective measures **against corrosion** if the brake is subject to extreme ambient conditions or is installed in open air conditions, unprotected from the weather.
- ❑ Please cover moving parts to protect **against injury through seizure.**

2.6 Dimensioning Other Machine Elements

The effects of the maximum and minimum braking force on the other machine components must be observed in order to provide sufficient dimensioning. The ROBA®-linearstop has (at room temperature) a maximum braking force of 2.5 x brake nominal holding force and a minimum braking force of 1 x brake nominal holding force.

If other brakes are positioned behind the ROBA®-linearstop, 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

(also to be observed during installation and operation)

2014/35/EU	Low voltage directive
2014/30/EU	EMC Directive
DIN VDE 0580	Electromagnetic devices and components, general specifications
EN ISO 12100	Safety of machinery - General principles for design - Risk assessment and risk reduction
EN ISO 13849-2	Safety of machinery Safety related parts of control systems - Validation
DIN EN 61000-6-4	Interference emission
DIN EN 61000-6-2	Interference immunity

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. 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 on the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment
The electromagnetic brake as well as the DC voltage modules / microswitches / proximity switches required for control / self-monitoring fulfil the requirements laid down in the EU Directive 2011/65/EC (RoHS).
(Restrictions on the use of certain hazardous substances, such as lead (0.1 %), mercury (0.1 %), cadmium (0.01 %), hexavelent chromium (0.1 %), polybrominated biphenyls (PBB) (0.1 %), polybrominated diphenylethers (PBDE) (0.1 %))

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.

3.5 Certification Symbols

C SA US

The installation components used are UL-listed or are applied in conformance with the approval.
The CSA conformity marking with the addition of "C" and "US" means that the product has been certified both for the US American market as well as for the Canadian market, and accords with the applicable US American and Canadian standards.

3.6 CE Identification

CE

Identification according to the low voltage directive 2014/35/EU

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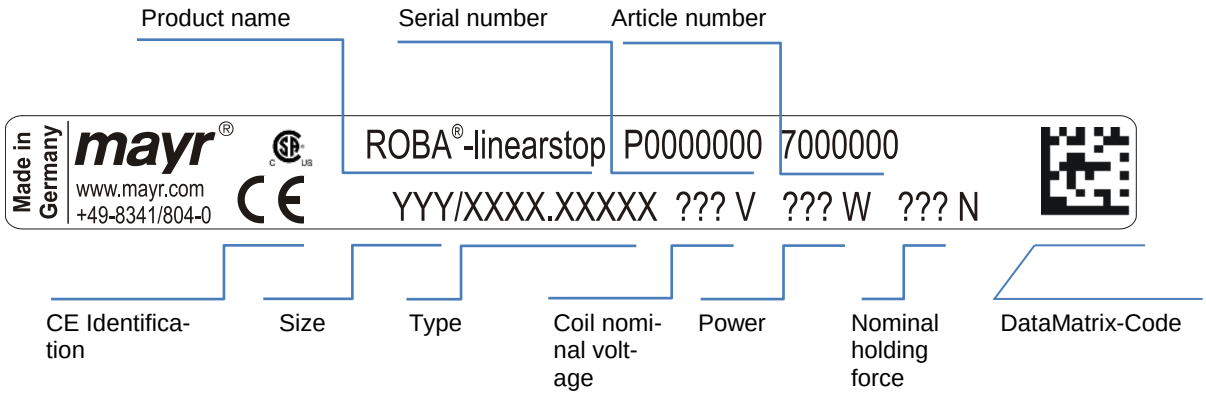
3.7 Identification/ Type tag

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



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	A

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4 Product Description

4.1 Scope of Delivery / State of Delivery

- ❑ ROBA®-linearstop brakes are manufacturer-assembled and 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 ROBA®-linearstop is delivered without piston rod. Cap screws serve as transportation lock (10) (3 x red head).

ATTENTION **The brake could be damaged**

Removal of the transportation lock (10) in de-energised condition of the brake can lead to damage

Transportation lock (10) (3 x red head) must be removed after the brake is fitted on the piston rod and energised.

CAUTION **Please observe the own weight of the brake**

The brake may drop during lifting / transport.

This might lead to crushing or bruising, e.g. of the foot.

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.

The spring-loaded, enclosed **ROBA®-linearstop,** which can be opened electrically, clamps a piston rod steplessly and backlash-free.

Due to the spring-loaded system, the fail-safe principle can be guaranteed, the **ROBA®-linearstop** works as a **safety brake.**

- ❑ The brake clamping element is pulled against the spring though application of the voltage. The piston rod can be moved (Fig. 1).
- ❑ The spring has an effect on the clamping element of the brake though switch-off the voltage. The piston rod is clamped (Fig. 2).

The max. permitted sliding speed is 2 m/s.

Higher speeds on request!

Please Observe!
Before brake closure, the collet must enclose the piston rod completely.

If the piston rod ends in the collet, the clamping element might get damaged when actuating the brake!

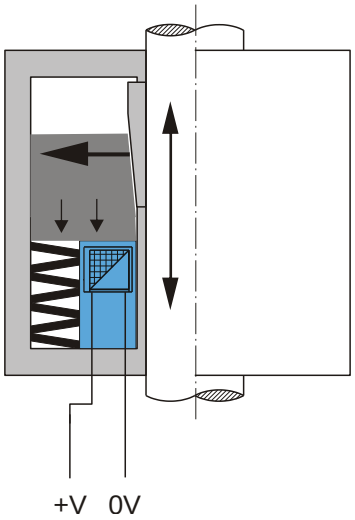

Illustration 1 Movable piston rod on application of the coil nominal voltage

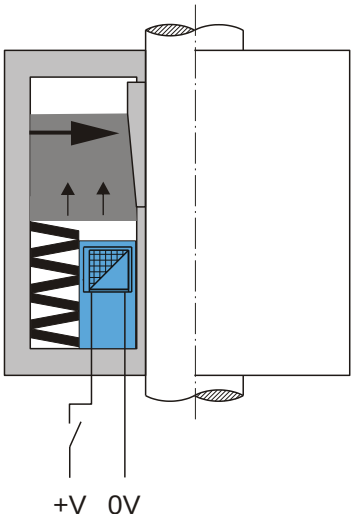

Illustration 2 Clamped piston rod on disconnection of the coil nominal voltage

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4.3 Views

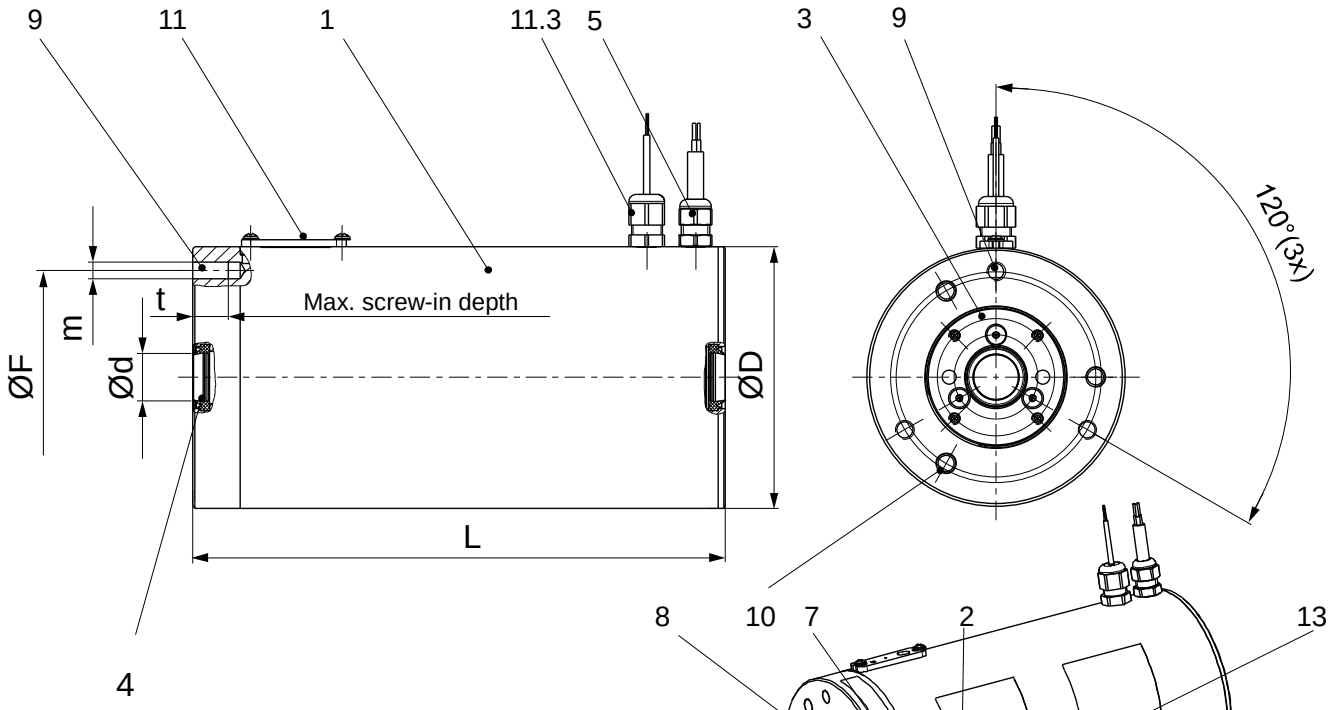
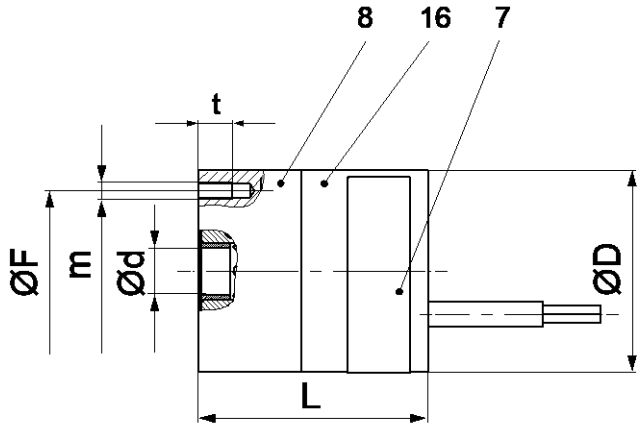


Fig. 1



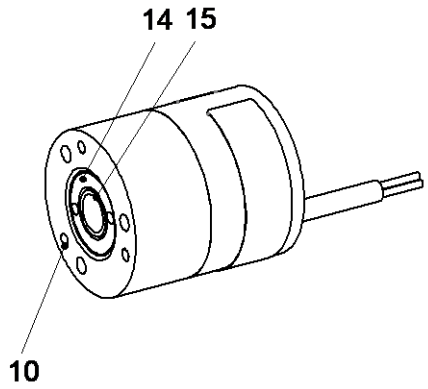


Fig. 2 (Size 10)

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4.4 Parts List

(Only use *mayr*® original parts)

Item	Name
1	Housing
2	Guideline sign, transportation lock
3	Adjustment ring
4	Double dirt wiper (not on size 10, 20)
5	Cable gland
6	Sealing plug (not shown)
7	Type tag
8	Adaptor
9	Threaded holes for fixing screws (m)
10	Transportation lock (red head)
11	Switching condition monitoring (option dependent on Type)
11.1	Proximity switch
11.2	PT raised head screw
11.3	Cable gland proximity switch
13	Guideline sign overexcitation/ power reduction
14	Collet
15	Plain bearing
16	Coil carrier

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5 Technical Data

5.1 Guidelines

5.1.1 Application Conditions

The stated 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, permitted friction work and braking distances as well as general ambient conditions can all affect the given values.

- ❑ Mounting dimensions and connection dimensions must be adjusted according to the size of the brake at the place of installation.
- ❑ The magnetic coils are designed for a relative duty cycle of 100% on holding voltage.
- ❑ Temperatures of up to 60 °C can occur on the brake housing at an ambient temperature of 20 °C.
  In higher ambient temperatures the brake housing temperature will also increase. Protective measures must be undertaken customer-side against contact burns.
- ❑ If the maximum switching frequency (see section **5.2**) is exceeded, the brake may overheat. The required magnetic force can no longer be reached. The brake first has to cool down
- ❑ The surfaces of the outer components have been phosphated manufacturer-side to form a basic corrosion protection. For brake applications outdoors where the device is subject to weather influences or extreme environmental conditions, additional protective measures, such as for example protective paint, must be provided.

5.1.2 Ambient temperature

–20 °C up to +40 °C, non-condensing

The Technical Data refers to the stated temperature range.

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) IP54: When installed, dust-proof and protected against contact as well as against water spray from any direction (dependent on customer-side mounting method).

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

5.1.5 Noise Emissions

The ROBA®-linearstop 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 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 ROBA®-linearstop 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.

- ❑ Clamping / braking forces
- ❑ Braking distance
- ❑ Masses
- ❑ Temperatures etc.

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5.2 Technical Data

				Size				
				10	**20**	**40**	**60**	**80**
Nominal holding force [1] (minimum holding force)	Type 382.00 _ .0	F_{Nenn}	[kN]	0.07	0.180	0.6	1.8	4.5
	Type 382.01 _ .0			-	0.36	1.3	4	10.5
	Type 382.02 _ .0			-	0.55	2.1	6.5	17
Electrical Power	Type 382.00 _ .0	P_N [2]	[W]	5.9	7.9	12.1	19.8	42
		P_O [3]		94	126	191	314	665
		P_H [4]		2.6	3.5	4	6.6	14
	Type 382.01 _ .0	P_N		-	15.8	24	40	84
		P_O [3]		-	253	382	628	1329
		P_H [4]		-	7.0	8	13.2	28
	Type 382.02 _ .0	P_N		-	23.7	36	59	126
		P_O [3]		-	379	573	941	1994
		P_H [4]		-	10.5	12	19.8	42
Electrical voltage	Coil nominal voltage	U_N	[VDC]	6		52		
	Overexcitation voltage	U_O		24		207		
	Holding voltage	U_H		4		30		
Weight	Type 382.00 _ .0		[kg]	0.23	0.9	2.4	3.4	14
	Type 382.01 _ .0			-	1.3	3.2	6.8	20
	Type 382.02 _ .0			-	1.7	4	10.3	26.3
Ambient temperature			[°C]	-20 to +40				
Max. switching frequency		1/min		3				
Brake switching time (DC-side)		t50	[s]	0.020	0.030	0.030	0.035	0.045
Transportation lock Item 10	Max. Tightening torque		[Nm]	2				

[1] Type 382.0 Minimum holding force when the brake is de-energised, and with the piston rod dry or moistened with mineral oil.
[2] Coil nominal capacity
[3] Coil capacity on overexcitation (0.5 s) $U_O = 4 \times U_N$.(see section **7**).
[4] Coil capacity at holding voltage $U_H = 0.5 \times U_N$

5.3 Dimension Sheet

[mm]		Size				
		10	**20**	**40**	**60**	**80**
D		35	50	75	110	160
d		8	10	12	20	25
F		30.5	42	56	90	140
L	Type 382.00 _ .0	83.5	95	107	132	155
	Type 382.01 _ .0	-	132	148	178	213
	Type 382.02 _ .0	-	169	189	224	270
m		3xM3	3xM5	3xM6	3xM8	3xM10
t		6	8	10	15	14

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6 Intended Use

See also section **2.3**

6.1 Guidelines for Application

- ❑ Please observe the correct dimensioning of clamping or braking force, friction work and switching frequency at an EMERGENCY STOP for safe holding of the mass and safe compliance of the required braking distance.
- ❑ Static application
  - Holding and clamping in case of power failure
  - on cable breakage
  - EMERGENCY STOP
- ❑ 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.
- ❑ Temperatures over 80 °C on the brake housing when the machine is in use may 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
- ❑ The brake is not suitable for application in high ambient temperatures >40 °C

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
- ❑ Transportation locks will not be removed
- ❑ Brake is used in oily or heavily contaminated surroundings
- ❑ The overexcitation time of 0.5s is exceeded
- ❑ No overexcitation

6.4 Duration of Use

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

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6.5 Brake Dimensioning

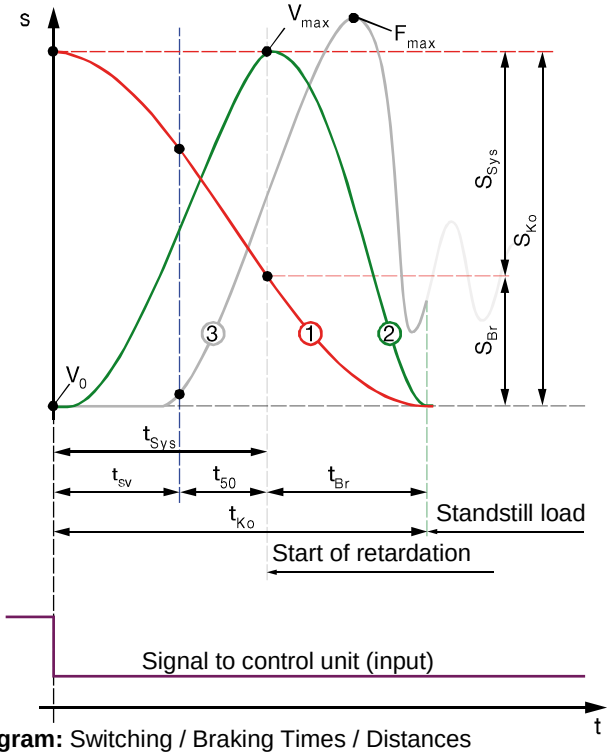

Diagram: Switching / Braking Times / Distances

Name

1		Distance
2		Speed
3		Axial force
β	[°]	Angular position 0° (horizontal) to 90° (vertical)
a	[m/s2]	**Acceleration** of the downward-moving load, dependent on the angular position
a_V	[m/s2]	Retardation
g	[m/s2]	Gravitational acceleration (9.81 m/s²)
F_{Br}	[N]	Braking force for dynamic calculation
$F_{erf.}$	[N]	Required holding force
F_{Nenn}	[N]	Nominal holding force (minimum holding force)
F_{NGes}	[N]	Total nominal holding force (one or more brakes)
F_{max}	[N]	Maximum holding force
m	[kg]	Load mass
S_{Br}	[m]	**Braking distance:** Distance from the beginning of the retardation up to the standstill of the load
S_{Sys}	[m]	**System distance:** Distance travelled by the load until the retardation begins.
S_{Ko}	[m]	**Stopping distance:** Distance from the signal interruption up to standstill of the load
t50	[s]	Brake switching time
t_{SV}	[s]	Switching time control unit (signal processing time)
t_{Sys}	[s]	System switching time
t_{Br}	[s]	Brake braking time

General

When selecting the brake, the nominal holding force must be greater or equal to the required holding force.

$F_{Nenn} \geq F_{erf.}$ [N]

Dimensioning for dynamic braking (EMERGENCY STOP)

For safety reasons, at least the weight load of the masses to be held +100 % reserve must be provided.

The larger the ratio of the nominal holding force to the required holding force, the shorter the stopping distance (for the same technical conditions)

The minimum required holding force can be calculated with the following formula:

$$F_{erf.} = \frac{m \times g}{0.5}$$ [N]

Dimensioning for static holding (clamping)

For safety reasons, at least the minimum weight load of the masses to be held +20 % reserve must be provided.

The minimum required holding force can be calculated with the following formula:

$$F_{erf.} = \frac{m \times g}{0.8}$$ [N]

The stopping distance / stopping time of the load to be braked is strongly dependent on the following influences:

- ❑ Switching time control unit (signal processing)
- ❑ Switching time of the control valve [1)]
- ❑ Switching time of the brake
- ❑ Cross-section and length of the lines

The larger the sum of the switching times, the later the retardation of the load occurs (due to longer periods of acceleration). The stopping distance / the stopping time becomes longer (with constant holding force).

Name

t_{Ko}	[s]	**Stopping time:** Time from the signal interruption up to standstill of the load
V0	[m/s]	Initial speed
V_{max}	[m/s]	Maximum speed

If you have any questions, please contact *mayr*® power transmission.

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6.5.1 Calculation example (dynamic braking)

Data		
Angular position piston rod	β	= 90° (vertical axis)
Mass	m	= 320 kg
Initial speed	V0	= 0.5 m/s
Switching time control system	t_{SV}	= 0.020 s

1. Pre-selection of braking force

$$F_{erf.} = \frac{m \times g}{0.5} \quad [N]$$

$$F_{erf.} = \frac{320 \times 9.81}{0.5} = 6278 \quad [N]$$

Selected: ROBA®-linearstop Size 60, Type 382.02_.0,
Nominal holding force F_{Nenn} = 6500 N
(from section **5.2** Table "Technical Data")

2. Calculation of the stopping distance/stopping time

Checking the selected brake size

Acceleration of the load

$$a_B = g \times \sin(\beta) = \mathbf{9.81 \times \sin(90°)} = 9.81 \quad [m/s2]$$

System distance

$$\mathbf{S_{Sys} = V_0 \times t_{Sys} + a_B \times t_{Sys}^2 \times 0.5} \quad [m]$$

$$S_{Sys} = 0.5 \times 0.055 + 9.81 \times 0.0552 \times 0.5 \quad [m]$$

$$S_{Sys} = 0.057 \quad [m]$$

$$t_{Sys} = t_{50} + t_{SV} = 0.035 + 0.02$$

$$t_{Sys} = 0.055 \quad [s]$$

Braking distance

$$\mathbf{S_{Br} = \frac{Vmax2}{2 \times \left(\frac{F_{NGes}}{m} - a_B\right)}} \quad [m]$$

$$S_{Br} = \frac{1.042}{2 \times 10,5} = 0.052 \quad [m]$$

$$V_{max} = V_0 + a_B \times t_{Sys} \quad [m/s]$$

$$V_{max} = 0.5 + 9.81 \times 0.055 = 1.04 \quad [m/s]$$

Stopping distance

$$\mathbf{S_{Ko} = S_{Br} + S_{Sys}} \quad [m]$$

$$S_{Ko} = 0.052 + 0.057 = 0.109 \quad [m]$$

Stopping time

$$\mathbf{t_{Ko} = t_{Br} + t_{Sys}} \quad [s]$$

$$t_{Ko} = 0.099 + 0.055 = 0.154 \quad [s]$$

$$t_{Br} = \frac{V_{max}}{\frac{F_{NGes}}{m} - a_B} = \frac{1.04}{10.5} = 0.099 \quad [s]$$

Retardation (for system dimensioning)

$$a_V = \frac{F_{Nges} \times 2.5}{m} - g = \frac{6500 \times 2.5}{320} - 9.81 = 40.97 \quad [m/s2]$$

$$\text{Load} = \frac{a_V}{g} = \frac{40.97}{9.81} = 4.18 \quad [g]$$

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7 Electrical Connection and Wiring

The brake must only be operated with overexcitation and holding voltage. The required overexcitation time is 0.5 s.

Recommendation:
Use the following *mayr*® DC voltage modules for the respective brake size:

Size	DC voltage module	Art. No.
10	ROBA®-brake-checker	8262586
20		
40	ROBA®-multiswitch	8225580
60		
80	ROBA®-multiswitch	8237887

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).
Please follow the exact connections according to the section **9.3**. 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 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 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!

7.2 Fuse Element

Short-circuits or earth short-circuits can lead to DC voltage module failures. After fuse elements have reacted to a malfunction, the DC voltage module must be checked for functional and operational safety (overexcitation voltage, switch-off voltage, response delay time and holding voltage). The same procedure is to be carried out after brake failure.

Recommendation:
In case of failure of the DC voltage module, please protect the brake from permanent overexcitation:
Measure:
Installation of a circuit breaker (characteristic C) into the power supply cable of the DC voltage module.
The measure fulfills the device fuse requirements for the DC voltage module.

7.2.1 Rated current of the circuit breaker:

The specifications only apply when using the recommended *mayr*®-DC voltage modules (see section **7**).

Rated current [A]	Size ROBA®-linearstop				
	10	20	40	60	80
Type 382.000	0.75	1	0.25	0.5	1
Type 382.001	-	2	0.5	0.75	2
Type 382.002	-	3	0.75	1.5	2.5

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7.3 Switching Behaviour

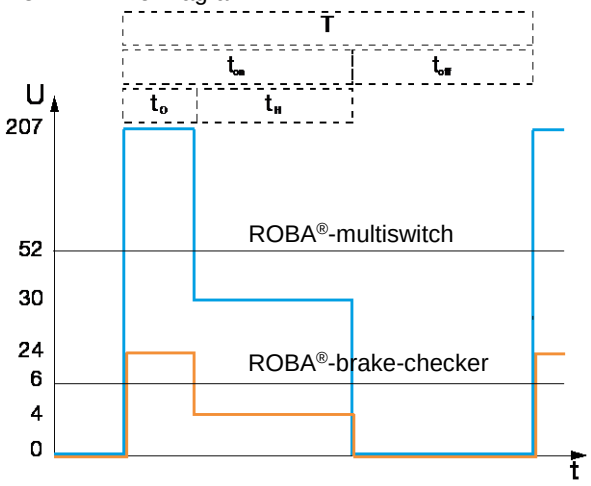
The reliable operational behaviour of a brake is to a large extent dependent on the correct wiring and the temperature.

Key and Calculations:

P	[W]	RMS coil capacity dependent on switching frequency [1], overexcitation, reduction in capacity and duty cycle $P = \frac{P_O \times t_O + P_H \times t_H}{T}$
P_N	[W]	Coil nominal capacity (Technical Data, type tag)
P_O	[W]	Coil power on overexcitation (Technical Data) $P_O = \left(\frac{U_O}{U_N}\right)^2 \times P_N$
P_H	[W]	Coil power on power reduction (Technical Data, type tag) $P_H = \left(\frac{U_H}{U_N}\right)^2 \times P_N$
t_O	[s]	Overexcitation time (0.5 s)
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 ($\triangleq 4 \times U_N$)
U_H	[V]	Holding voltage ($\triangleq 0.5 \times U_N$)
U_N	[V]	Coil nominal voltage
I_O	[A]	Overexcitation current
I_N	[A]	Nominal current

1) See section **5.2**

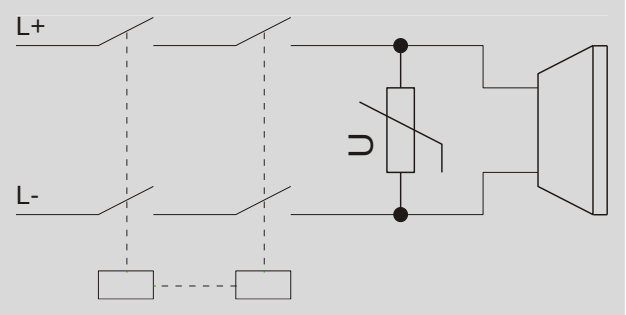
7.3.1.1 Time Diagram:



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).



Schematic wiring diagram

7.4 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*®-DC voltage 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
- ❑ Voltage peaks or level of switch-off voltage

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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 10 °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.**

9 Installation

9.1 Installation Conditions

Please observe before installation!

9.1.1 General

Please Observe!
The piston rod must only be loaded in the direction of motion.

- ❑ The brake is delivered manufacturer-assembled ready for installation

Please Observe!
Leave the brake in its installed condition!

9.1.2 Piston Rod

Requirements on the piston rod

- ❑ For brake installation, we recommend an insertion chamfer on the piston rod of min. 3 x 20°.
- ❑ The piston rod should be installed at one end as a floating bearing.
- ❑ We recommend to stress the piston rod with tension.

Please Observe!
Please pay attention to the buckling safety on pressure-loaded piston rods!

Please observe the stroke length, the load and cylinder mounting to prevent bending or buckling of the piston rod in any stroke position.

$F_{max} = 2.5 \times F_{Nenn}$

Please Observe!
The **ROBA®-linearstop** function can only be guaranteed on a proper rod surface.

Rod quality

Steel, hard chromium-plated	
Layer thickness	at least 20 µm
Diameter tolerance	f7
Surface quality	Ra < 0.4 µm
Yield point	min. 400 N/mm² (e.g. C45)

or

Steel, hardened	
Hardness testing	at least HRC 60
Tolerance field	f7
Surface quality	Ra < 0.4 µm
Yield point	min. 400 N/mm² (e.g. C45)

CAUTION
The clamping effect might get influenced by friction value-reducing materials, such as tough greasy lubricants, greases or separating agents - please clean, if necessary; see section **12.4**

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9.2 Installation (Figs. 1 and 2)

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)

CAUTION **Please observe the own weight of the brake**

The brake may drop during lifting / disassembly. The consequences may be crush injuries and impact injuries.

9.2.2 Preparation

- ❑ Have the necessary tools ready
  - Spanners etc.
  - Torque wrenches
- ❑ Provide fixing screws (not included in the standard scope of delivery)

Fixing screw sizes and tightening torques				
Size	**Thread**	**Tightening torque**	**Property class**	**Screw-in depth t**
10	3 x M3	1.3 Nm	8.8	6 mm
20	3 x M5	5.1 Nm	8.8	8 mm
40	3 x M6	9 Nm	8.8	10 mm
60	3 x M8	21 Nm	8.8	15 mm
80	3 x M10	43 Nm	8.8	14 mm

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

9.2.3 Installation Procedure

The piston rod support (Fig. 1 Item 5) and the piston rod (Fig. 1 Item 3) (customer-side) must be exactly aligned with one another. Max. Deviation to 0.3 m = 0.1 mm

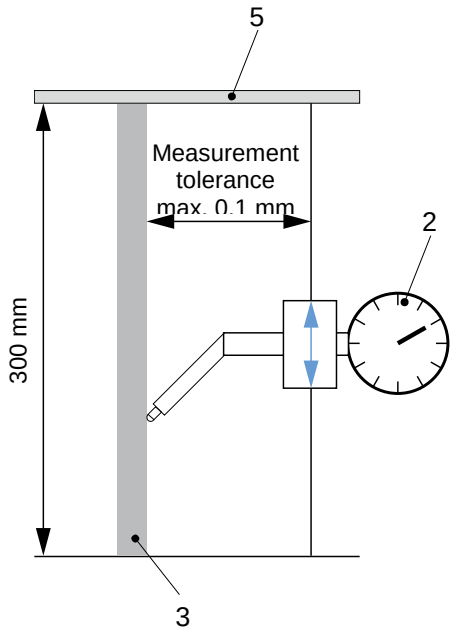

Fig. 1: Alignment piston rod

1. Position the mounting flange (Fig. 2 Item 1) (customer-side) at the fixed bearing of the piston rod.
2. Connect the brake acc. the Wiring Diagram **9.3**
3. Energise the brake

The brake only opens on overexcitation (se section 7).

The brake is opened at the factory through the transportation lock (10), and can be pushed onto the piston rod without being energised.

4. Push the brake onto the piston rod.

Please Observe!
Tilted insertion of the piston rod might cause damage to the double wiper and seals (not on size 10, 20).

Push the brake onto the piston rod carefully.

5. Unscrew and remove the transportation lock (10)

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ATTEN-TION **The brake could be damaged**

Removal of the transportation lock (10) in de-energised condition of the brake can lead to damage

Transportation lock (10) (3 x red head) must be removed after the brake is fitted on the piston rod and energised.

6. Bring the brake up to contact to the mounting flange (customer-side).
7. Screw in the fixing screws (without torque).
8. Screw securing medium with Loctite 243

Please Observe!
Before brake closure, the collet must enclose the piston rod completely.

If the piston rod ends in the collet, the clamping element might get damaged when actuating the brake!

Please Observe!
To check the angular misalignment of the mounting flange (Fig. 2 Item 1) to the brake (Fig. 2 Item 4), the distance of the brake to the mounting flange at the circumference of the brake is measured. Maximum gap B = 0.05 mm

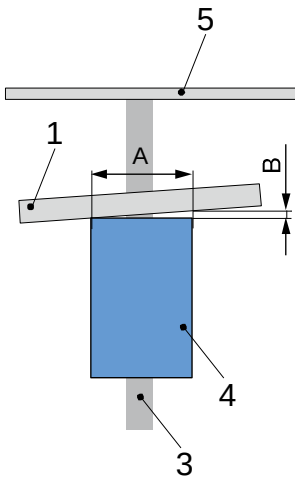

Fig. 2: Alignment of brake to the flange

9. Switch the brake in de-energised state, thereby placing it under tension (centring).
10. Tighten the fixing screws using the tightening torque.

CAUTION **Load crash possible**

The brake will not work with the transportation lock (10) screwed in.

The transportation locks (10) must be removed.

Position	
1	Mounting flange
2	Dial gauge
3	Piston Rod
4	Brake
5	Piston rod support

Please Observe!
The following signs of use/conditions may indicate an incorrectly installed brake:

- ❑ Abraded particles on the piston rod
- ❑ Pulled out double dirt wiper

9.3 Electrical Connection

DANGER **Carry out electrical connection only in de-energised condition.**

Electrical shock possible.

Only trained personnel should carry out the connection.

9.3.1 Wiring diagram brake

Cable	
Black	+V
Blue	0 V
Yellow/green	Earthing

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10 Options (not on size 10, 20)

10.1 Switching condition monitoring (NO contact)

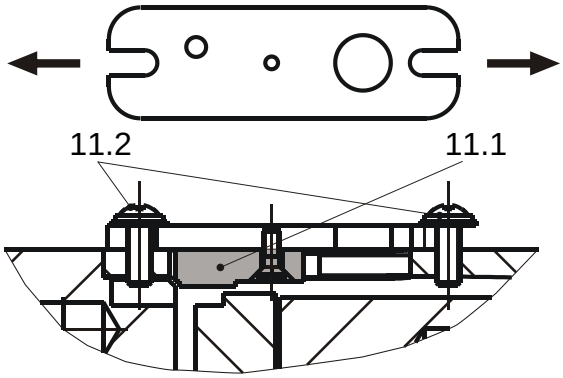


Fig. 6

Please Observe!
The switching condition monitoring unit is installed and adjusted manufacturer-side.

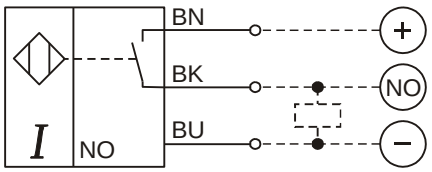
A proximity switch (11.1) emits a signal for every brake condition change.

Plausibility check

Brake opened	Brake energised	**Signal "OFF"**
Brake closed	Brake de-energised	**Signal "ON"**

The customer is responsible for a signal evaluation of both conditions.

Wiring Diagram:



Technical Data	
PNP/NO contact	
Rated operating voltage:	U_e= 24 VDC
Operating voltage:	U_B= 10...30 VDC
Rated operating current	Ie= 100 mA
Cable length:	2000 mm

Replacement of the proximity switch

Please Observe!
Proximity switches cannot be guaranteed fail-safe. Therefore, please ensure appropriate access for replacement or adjustment.

Pre-requisites

❑ Load must be secured (e.g. on vertical axes).

WARNING **Load crash possible**
Gravity-loaded axes must be secured before beginning the work: this secures them against dropping.

❑ Brake is without power (enclosed) on the piston rod.

De-installation

1. Disconnect the connection cable
2. Unscrew the screws (11.2)
3. Remove the proximity switch (11.1)

Installation and adjustment (only for replacement)
Initial position: Proximity switch is connected → **Signal "OFF"**

Activity		Result
1.	Apply the proximity switch (11.1) lightly using two cap screws (11.2) so that the proximity switch (11.1) can still be moved.	
2.	Energise the brake	
3.	Change the proximity switch (11.1) position axially	**Signal "OFF"**
4.	Secure the proximity switch (11.1) using cap screws (11.2).	
5.	Carry out a functional inspection	
5.1	Close brake (switch off current)	**Signal "ON"**
5.2	Open brake (switch on current)	**Signal "OFF"**

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10.2 Switching condition monitoring (NC contact)

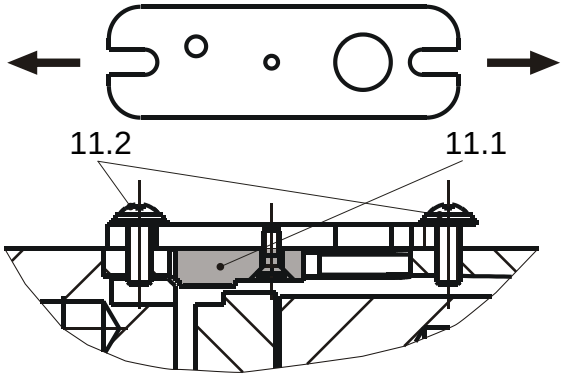


Fig. 7

Please Observe!
The switching condition monitoring is installed and set manufacturer-side.

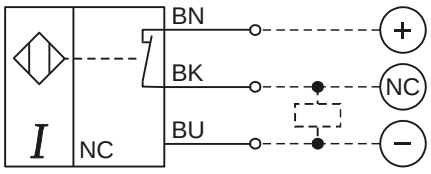
A proximity switch (11.1) emits a signal for every brake condition change.

Plausibility check

Brake opened	Brake energised	**Signal "ON"**
Brake closed	Brake de-energised	**Signal "OFF"**

The customer is responsible for a signal evaluation of both conditions.

Wiring Diagram:



Technical Data	
PNP/NC contact	
Rated operating voltage:	U_e= 24 VDC
Operating voltage:	U_B= 10...30 VDC
Rated operating current	Ie= 100 mA
Cable length:	5000 mm

Replacement of the proximity switch

Please Observe!
Proximity switches cannot be guaranteed fail-safe. Therefore, please ensure appropriate access for replacement or adjustment.

Pre-requisites

❑ Load must be secured (e.g. on vertical axes).

WARNING **Load crash possible**
Gravity-loaded axes must be secured before beginning the work: this secures them against dropping.

❑ Brake is without power (enclosed) on the piston rod.

De-installation

1. Disconnect the connection cable
2. Unscrew the screws (11.2)
3. Remove the proximity switch (11.1)

Installation and adjustment (only for replacement)
Initial position: Proximity switch is connected → **Signal "ON"**

Activity		Result
1.	Apply the proximity switch (11.1) lightly using two cap screws (11.2) so that the proximity switch (11.1) can still be moved.	**Signal "OFF"**
2.	Energise the brake	
3.	Change the proximity switch (11.1) position axially	**Signal "ON"**
4.	Secure the proximity switch (11.1) using cap screws (11.2).	
5.	Carry out a functional inspection	
5.1	Close brake (switch off current)	**Signal "OFF"**
5.2	Open brake (switch on current)	**Signal "ON"**

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11 Initial Operation

11.1 Brake Inspection (before initial operation)

- ❑ Check all fixing screws for the required tightening torque.
- ❑ Function test after completed assembly and electrical connection of the brake

11.2 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.

Check dimensioning!

11.2.1 (Static) Brake Inspection

- ❑ On vertical axes, a brake inspection is carried out via load assumption or via the drive.

Recommendation!
Test the brake using the nominal holding force or the maximum load mass.

11.2.2 Regular Function Inspection (static)

- ❑ Depending on the application requirements, we recommend carrying out regular braking force inspections (depending on the application), e.g. check the static holding force 1 x per shift with nominal holding force or with maximum load mass.
- ❑ In addition to the regular inspection of the holding force, we recommend the application of a switching condition monitoring device (option), in order to request the brake switching condition or to prevent a possible load crash on vertical installation.

Recommendation!
The holding force may be reduced by friction value-reducing materials. If the brake during the functional inspection does not achieve the nominal holding force, repeat using 90 % of the nominal holding force and clean the piston rod at the next opportunity (see section **12.4**).

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12 Maintenance / Inspection / Number of switchings

12.1 Number of Switchings

The **ROBA®-linearstop** is designed for a switching frequency of up to 200.000 switching actions.

At a switching frequency > 200.000 please contact ***mayr*®** power transmission.

12.2 Inspection

Check the condition

Measure	Condition		Interval	Implementation
Visual inspection	Double wiper	The wiper must not show any signs of wear, as otherwise there might be a risk of dirt penetration	To be determined by machine operator depending on the installation situation If you have any questions, please contact *mayr*® transmission.	Qualified personnel
	Piston Rod	Check the piston rod for wear.	After every EMERGENCY STOP occurrence.	
	Wear indicators	Nominal holding force is not reached (slipping). Replace brake	To be determined by machine operator depending on the installation situation If you have any questions, please contact *mayr*® transmission.	***mayr*® power transmission**

12.3 Maintenance

The **ROBA®-linearstop** is mainly maintenance-free.

Measure	Note/comment	Interval	Implementation
Functional Inspection	Carry out a regular functional inspection	see section **11.2.2**.	Qualified personnel
Check the piston rod	The piston rod must be checked regularly for contamination with friction value-reducing materials; it must be cleaned, if necessary (see section **12.4**). Special measures may be necessary if the device is subject to large amounts of dirt or dust or is operating in extreme ambient conditions. **Please contact *mayr*® power transmission.**	at least every 6 months	

Should the **ROBA®-linearstop** no longer meet the required characteristics or should the necessary safety for work on the machine or system no longer be given, the brake must be checked at ***mayr*® power transmission** and, if necessary, professionally repaired and approved.

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12.4 Cleaning:

Clean the piston rod using ethyl alcohol.

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

CAUTION **Please observe the own weight of the brake**

The brake may drop during lifting / disassembly.

The consequences may be crush injuries and impact injuries.

De-installation takes place by following the "Installation Procedure" section **9.2.3** backwards.

Please Observe!
Prior to the brake being pushed from the piston rod, the transportation lock (10) must be screwed in.

- ❑ Completely screw in the transportation lock (10) (3 screws) by hand up to its limit.

14 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

(DC voltage modules / ROBA®-switch / proximity 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 pads with coil /cable and all other steel components:
Steel scrap (Code No. 160117)

All aluminium components:
Non-ferrous metals (Code No. 160118)

Seals, O-rings, V-seals, elastomers:
Plastic (Code No. 160119)

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15 Malfunctions / Breakdowns

Malfunction	Possible Causes	Solutions	Implementation
Brake does not release	Incorrect voltage, no DC voltage	Check voltage, observe the wiring guidelines	Qualified personnel
	Defective electrical wiring	Check electrical wiring	
	Defective coil, coil is thermally overloaded	Check coil capacity, check insulation resistance	
	Wear too big	Send the device	***mayr*® power transmission**
Brake does not brake	Transportation lock (10) is not removed	Remove the transportation lock (10)	Qualified personnel
	Piston rod too small	Check dimensioning, check technical data	
	Defective electrical wiring	Check electrical wiring	
Braking distance too long	Friction value-reducing materials on the piston rod	Clean the piston rod	
	Incorrect dimensioning	Check dimensioning, check technical data	

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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