



Guidelines on the Declaration of Conformity

A conformity evaluation has been carried out for the product in terms of the EC Low Voltage Directive 2006/95/EC and EMC Directive 2004/108/EC. The Declaration of Conformity is laid out in writing in a separate document and can be requested if required.

Guidelines on the EMC Directive (2004/108/EC)

The product cannot be operated independently according to the EMC directive. 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 product 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 product 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 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 94/9/EC.

Safety and Guideline Signs

Danger



Immediate and impending danger, which can lead to severe physical injuries or to death.

CAUTION



Danger of injury to personnel and damage to machines.



Guidelines on important points.

General Safety Guidelines

DANGER



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

Danger



Danger of burns when touching hot surfaces

CAUTION



- Danger from devices caused by short-circuits and earth short-circuits at the terminals
- Electronic devices cannot be guaranteed

Standards

EMC inspections

EN 61000-6-2:2006-03

Interference immunity

EN 61000-6-4:2007-09

Interference emission

Insulation coordination

acc. VDE 0110 / EN 60664:2008-01

Pollution degree 2

Rated insulation voltage 63 VDC

Intended use

acc. EN 50178:1998-04

During the risk assessment required when designing the machine or system, the dangers involved must be evaluated and removed by taking appropriate protective measures.

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



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.

Installation and Operating Instructions for ROBA®-brake-checker Typ 028.100.2

(B.028102.EN)

Application

ROBA®-brake-checker monitoring modules are used to operate DC consumers.
Motion monitoring of the armature disk for released ROBA-stop® safety brakes is possible.

- Consumer operation with overexcitation and/or power reduction
- Controlled output voltage (on reduction)
- Simple adjustment of holding voltage and overexcitation time via a DIP switch
- Fast or slow switch off
- Armature disk condition recognition (release and drop-out recognition)
- Wear recognition and error recognition
- Wide input voltage range
- Maximum output current $I_{RMS} = 10\text{ A} / 5\text{ A}$
- Maximum overexcitation current $I_O = 20\text{ A} / 10\text{ A}$
- Automatic reduction of the holding voltage U_H
- Electrical isolation of performance terminal and control terminal



CAUTION



The ROBA®-brake-checker with integrated DC-side disconnection is not suitable for being the only safety disconnection in applications!

Function

The ROBA®-brake-checker monitoring module is intended for use with an input voltage of 24 or 48 VDC. The module monitors the movement of the armature disk and emits the determined switching condition via control terminal 3 (signal output).

Critical conditions (line breakages, wear) can be recognised and the respective signal can be emitted via control terminal 7 (error output).

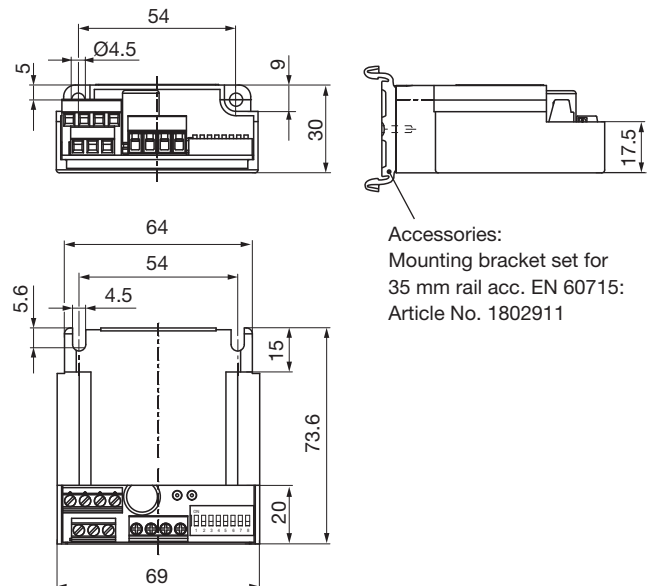
After a brake-specific overexcitation time period, the integrated automatic voltage mechanism mode adjusts to the pre-set reduction voltage. The automatic voltage mechanism mode can be switched off using a DIP switch.

In case of switched-off automatic voltage mechanism mode, the overexcitation time can be adjusted manually to 150 ms, 450 ms, 1 s, 1.5 s, and 2 s using the DIP switch.

It is possible to select between fast and slow switch-off via the input S/L on the control terminal.

Louder switching noises are generated on the brakes in case of fast switch-off than in case of slow switch-off.

Dimensions (mm)



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

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(B.018102.EN)

Technical Data				24 VDC Type 2/028.100.2	48 VDC Type 4/028.100.2
Input voltage Power Terminal	SELV/PELV,	U_i	[VDC]	18 - 30	42 - 54
Input voltage Control terminal		U_i	[VDC]	24 (19 - 28)	
Output voltage	± 5 %	U_o	[VDC]	Input voltage U_i	
		U_H	[VDC]	6, 8, 12, 16	12, 16, 24, 32
Output current	at ≤ 45 °C	I	[A]	10	5.0
	at max. 70 °C	I	[A]	5	2.5
Device fuses				1.2 × I_o , fast acting	
Protection				Protection IP65 components, IP20 terminals	
Power Terminal				Power terminals 4 mm ² (AWG 20-12) max. tightening torque for screws: 0.5 Nm	
Control terminals				Nominal cross-section 1.5 mm ² (AWG 30 -14), max. tightening torque for screws: 0.5 Nm	
Ambient temperature			[°C]	-30 to +70	
Storage temperature			[°C]	-40 to +105	
Conformity markings				CE	
Installation conditions				The installation position can be user-defined. Please ensure sufficient heat dissipation and air convection! Do not install near to sources of intense heat!	



Only for variant 24 VDC (Type 2/028.100.2)

The tolerances from the signal terminals and power terminals differ in their upper voltage limit values. Whilst the supply voltage on the power terminal and therefore on the load can have a maximum voltage of 30 VDC, only a maximum supply voltage of 28 VDC may be applied to the signal terminal. Under these prerequisites, both terminals can be operated with one supply voltage (see connection example).

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Electrical Connection

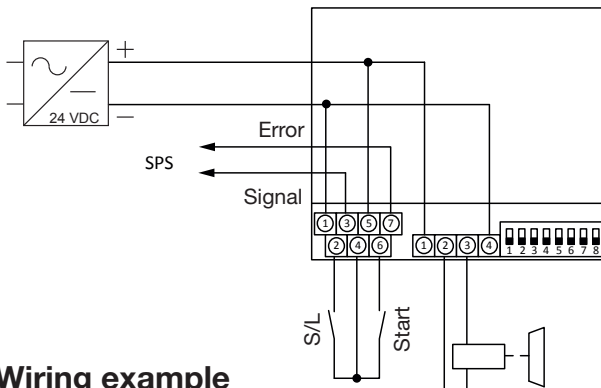
Power Terminal

1	Supply voltage +24 VDC / +48 VDC
2	Output voltage +
3	Output voltage -
4	Supply voltage 0 VDC

Electrical Connection

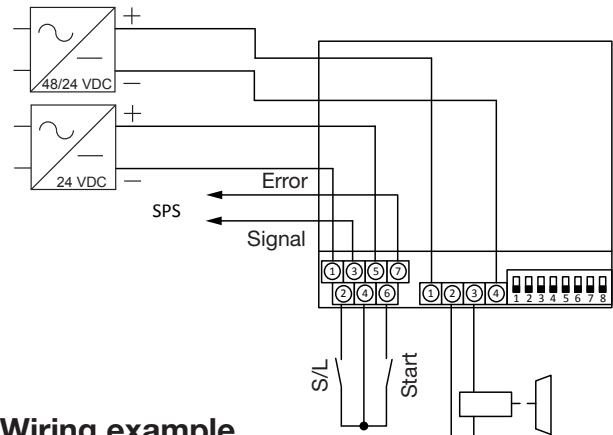
Control terminal (electrically insulated)

1	Supply voltage 0 VDC
2	Switch-off fast/slow (input)
3	Signal (output)
4	24 VDC (auxiliary voltage for bridging)
5	Supply voltage +24 VDC
6	Start (input)
7	Error (output) max. 300 mA



Wiring example

(without electrical isolation)




Wiring example

(with electrical isolation)

Inputs

Input	Terminal	Signal	Description
S/L	2	0 VDC (low)	slow switch off
		24 VDC (high) ¹⁾	fast switch off
Start	6	0 VDC (low)	Brake is not energised
		24 VDC (high)	Brake is energised

Outputs

Output	Terminal	Signal	Description
Signal	3	0 VDC (low)	Brake is not energised, movement of the armature disk for closing the brake.
		24 VDC (high)	Brake energised, movement of the armature disk for opening the brake.
Error	7	24 VDC (high)	no errors
		0 VDC (low)	- line breaks - Brake is not opened - Incorrect detection
Warning		 ²⁾	Wear limit reached or brake too hot

1) 24 VDC control signal or control terminal 4 (auxiliary voltage for bridging)

2) Rectangular signal 10 Hz / 24 Vpp

Operation

For the operation of the ROBA®-brake-checker monitoring module, the overexcitation time and the switch-off mode must be adjusted after connection of the brake and the supply lines.

These settings should be implemented in a de-energised state at the DIP switch. An adjustment change in energised state is not adopted until the end of the subsequent brake cycle (switch-off).



Always observe the valid settings on the DIP switch of the ROBA®-brake-checker monitoring module. In case of an invalid or incorrect setting, the ROBA®-brake-checker monitoring module does not function.

Switch-ON

Brake switch-on occurs with a connected supply voltage (control and power terminal) by closing of start (Input) on the signal side using the voltage 24 VDC (auxiliary voltage for bridging) or a 24 VDC control signal applied there. A green light-emitting diode emits a signal when the device is switched on. After the changeover from overexcitation voltage to holding voltage, the diode continues to illuminate at reduced brightness.

Switch-OFF



If short switching times are required, please switch DC-side and via the control input (bridge between control terminal 2 and 4) Here, the ROBA®-brake-checker monitoring module limits the switch-off voltage to approx. 60V. DC-side disconnection is signaled by the red light-emitting diode flashing at the moment of switch-off.

If a longer brake engagement time or a quieter switching noise is required, please switch freewheeling (manufacturer-side setting).

Holding voltage U_H

The holding voltage can be adjusted via the DIP switch. The switches may only be switched in de-energised state and may only be adjusted as depicted.

The set holding voltage value U_H should equal 3 times the drop-out voltage of the safety brake .

DIP switch	Holding voltage U_H [VDC]	
	24	48
	6	12
	8	16
	12	24
	16	32
	no power reduction	

Manufacturer-side setting

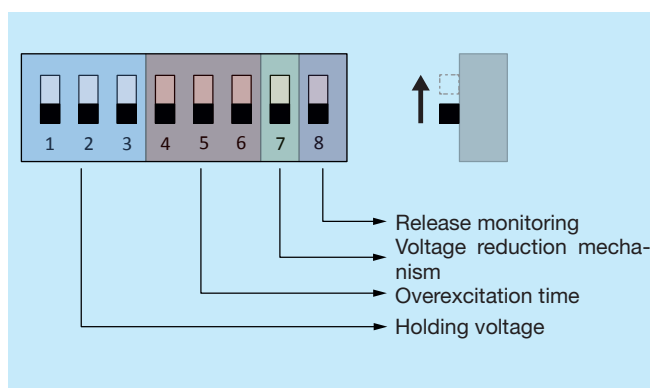
Device Fuses

Installation of a device protection fuse into the mains fuse of the ROBA®-brake-checker monitoring module.

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

Adjustments DIP switch

The 8 positions DIP switch mounted onto the device is split up into several different functional areas:



If the brakes are operated in power reduction mode, then additional times must be observed in order to ensure reduction of the current.

Design 24 VDC					
Minimum recommended reduction times prior to switch-off [ms]					
Reduced voltage [VDC]	16	12	8	6	
Current range	< 5 A	100	120	140	150
	> 5 A	200	250	300	350

Design 48 VDC					
Minimum recommended reduction times prior to switch-off [ms]					
Reduced voltage [VDC]	32	24	16	12	
Current range	< 5 A	150	170	200	250
	> 5 A	300	340	400	500

Overexcitation



Increased wear and therefore an enlarged air gap as well as coil heat-up lengthen the separation time t_2 of the brake. Therefore, when dimensioning the overexcitation time t_0 , please select at least double the separation time t_2 on each brake size (catalogue values).

The overexcitation time t_0 can be adjusted via the DIP switch to 150 ms, 450 ms, 1 s, 1.5 s and 2 s \pm 1 %. The DIP switches may only be switched in de-energised state and may only be adjusted as depicted. The voltage reduction mechanism (DIP switch 7) must be de-activated.

DIP switch	Overexcitation time t_0 [s]
	0.15
	0.45
	1.00
	1.50
	2.00

Manufacturer-side setting

Voltage reduction mechanism

After a brake-specific overexcitation time period, the intelligent automatic voltage mechanism mode adjusts to the preset holding voltage. Manual adjustment of the overexcitation time is not necessary.

DIP switch	Overexcitation time t_0 [s]
	ON (automatically)
	OFF (manual)

Manufacturer-side setting

Release monitoring

The intelligent release monitoring can be deactivated for certain applications in order to prevent errors.

Possible applications:

- Parallel operation of several brakes
- Damped brakes
- Unspecific brakes

The release monitoring recognises the movement of the armature disk for opening the brake after switch-on as well as the movement of the armature disk for closing the brake after switch-off.

DIP switch	Release monitoring
	ON
	OFF

Manufacturer-side setting



In order to ensure correct monitoring, brakes <50 W may not be reduced below 12 VDC.

Time delays

During detection and processing of different brake conditions, input and output signal delays can occur .

Switch-on delay	Normal operation	≤ 4 ms
	Malfunction	≤ 4 ms
Delay time		≤ 4 ms
Signal delay		≤ 20 ms

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Coil Capacity

The values for the **maximum coil nominal capacity** stated in the Table are guideline values for a switching frequency of maximum 1 cycle per minute and for keeping to the permitted current I.

Design 24 VDC

Holding Voltage U_H [VDC]	Coil voltage U_N [VDC]	Coil capacity P_N		Operation with	
		Type 2/028.100.2		overexcitation	power reduction
		$\leq 45\text{ °C}$	$\leq 75\text{ °C}$		
		[W]			
6	6	30	15	x	
	8	53	27	x	x
	12	120	60	x	x
	16	213	107	x	x
	24	480	240		x
8	8	53	27	x	
	12	120	60	x	x
	16	213	107	x	x
	24	480	240		x
12	12	120	60	x	
	16	213	107	x	x
	24	480	240		x
16	16	160	80	x	
	24	360	180		x

Design 48 VDC

Holding Voltage U_H [VDC]	Coil voltage U_N [VDC]	Coil capacity P_N		Operation with	
		Type 4/028.100.2		overexcitation	power reduction
		$\leq 45\text{ °C}$	$\leq 75\text{ °C}$		
		[W]			
12	12	30	15	x	
	16	53	27	x	x
	24	120	60	x	x
	36	270	135	x	x
	48	480	240		x
16	16	53	27	x	
	24	120	60	x	x
	36	270	135	x	x
	48	480	240		x
24	24	120	60	x	
	36	270	135	x	x
	48	480	240		x
36	36	180	90	x	
	48	320	160		x



If the switching frequency is larger than 1 cycle per minute or if the overexcitation time t_o is longer than double the separation time t_2 , please observe the following:

$$P \leq P_N$$

The coil capacity P_{eff} must not be larger than P_N or the rated current I which flows through the ROBA®-brake-checker Type 2/028.100.2 monitoring module must not be exceeded, otherwise the coil and the ROBA®-brake-checker Type 2/028.100.2 monitoring module may fail due to thermal overload.

Calculations:

P [W] RMS coil capacity dependent on switching frequency, overexcitation and duty cycle

$$P = \frac{P_o \times t_o + P_N \times t_N}{T}$$

P_N [W] Coil nominal capacity (catalogue values, Type tag)

P_o [W] Coil capacity on overexcitation

$$P_o = \left(\frac{U_o}{U_N} \right)^2 \times P_N$$

P_o [W] Coil capacity on reduction in capacity

$$P_H = \left(\frac{U_H}{U_N} \right)^2 \times P_N$$

t_o [s] Overexcitation time

t_H [s] Time of operation with reduction in capacity

t_N [s] Time of operation with coil nominal voltage

t_{off} [s] Time without voltage

t_{on} [s] Time with voltage

T [s] Total time ($t_o + t_N + t_{off}$)

U_o [V] Overexcitation voltage

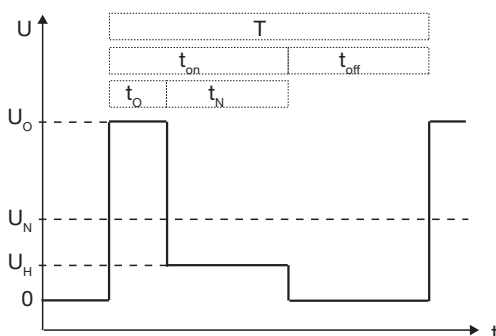
U_H [V] Holding voltage

U_N [V] Coil nominal voltage

I [V] RMS current dependent on switching frequency, overexcitation time and duty cycle

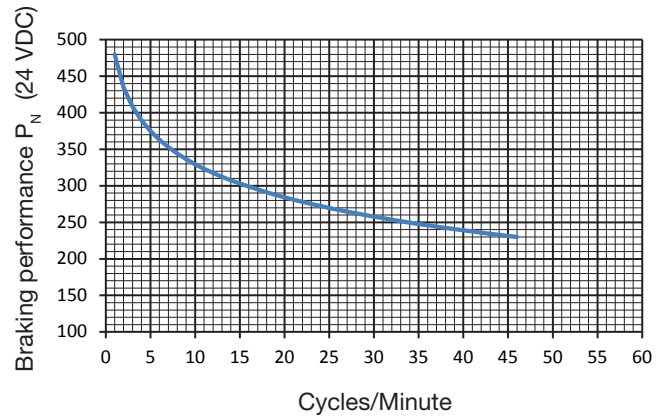
$$I = \sqrt{\frac{P \times P_N}{U_N^2}}$$

Time Diagram:



Cycle frequency

In order to prevent thermal overload, an upper cycle limit must be observed for especially high-performance brakes in operation with fast switch-off.



For brakes, which do not require overexcitation, the holding voltage may be lower than the nominal voltage, e.g. on power reduction to reduce the coil temperature.

EMC-compatible Installation



- Avoid antennae effect: Keep the supply cables as short as possible; Do not form ring or bow shapes with the cables.
- Mount good earth connections onto the metal body of the brake.
- Lay control cables separately from power cables or from strongly pulsating cables.
- A voltage drop can occur when operating using long lines.
 - ▶ Check the holding voltage on the respective brake.
- In case of operation of the ROBA®-brake-checker monitoring module in living and small business areas, special precautions must be taken in order to keep to the correct limit values for these areas in line with the complete system, (for example by installing a Würth ferrite WE74271221). The device has been inspected individually only for industrial areas.

Malfunctions / Breakdowns

Malfunction	Possible Causes	Solutions
Brake does not release	No supply voltage available	Check voltage at the supply and signal terminals
	Brake line interrupted	Inspect the brake feed line (check feed-through)
	Unpermitted setting on the DIP switch	Check the DIP setting (valid settings)
	Line voltage drop on long line	Deactivate release detection (DIP), apply supply voltage, Check output voltage at the brake output (power terminals 2 + 3) (Multimeter)
	Start signal missing	Check the voltage at the start (input)
No signal output release monitoring (brake has audibly released)	Release monitoring deactivated	Activate release monitoring (DIP setting)
	Non-specified brake, brake worn, brake does not release, movement of the armature disk too low	Check brake and replace if necessary, check error output
Error (Continuous signal)	Brake is not opened, brake will not be recognised	Check the supply/output voltage (power terminal) to the brake
	Brake does not close, brake is not recognised	Check the supply/output voltage (power terminal) to the brake
	Brake feed line interrupted	Inspect the brake feed line (check feed-through)
Warning (Rectangular signal)	Wear limit reached	Check the brake and replace if necessary.
	Supply voltage too low	Check or increase supply/output voltage (power terminal) to the brake
	Coil temperature of the brake too high	Check or increase supply/output voltage (power terminal) to the brake
Overexcitation time not reached	DIP switch for the voltage reduction mechanism is activated	Deactivate the DIP switch for voltage reduction mechanism

Functional sequence diagram

