Installation and Operational Instructions for ROBA®-brake-checker plus AC Type 029.700.2

(B.0297002.EN)

Guidelines on the Declaration of Conformity

A conformity evaluation has been carried out for the product in terms of the EU Low Voltage Directive 2014/35/EU and the Electromagnetic Compatibility (EMC) Directive 2014/30/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.
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 2014/34/EU.

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 of device failures caused by short-circuits and earth short-circuits at the terminals
- Electronic devices cannot be guaranteed fail-safe.

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.

General Safety Guidelines

Only carry out installation, maintenance and repairs in a de-energised, disengaged state and secure the system against inadvertent switch-on.

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.

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Application

ROBA®-brake-checker plus AC monitoring modules are used to connect permitted ROBA®-stop safety brakes to AC voltage.
Motion monitoring of the armature disk for released ROBA-stop® safety brakes is possible.

Monitoring module ROBA®-brake-checker plus AC

- Consistently controlled output voltage in the entire input voltage range
- Consumer operation with overexcitation or power reduction
- Input voltage: 200 – 480 VAC
- Supply voltage with 50 or 60 Hz
- Max. output current I_{RMS}: 2 A
- Sensorless and contactless detection of switching statuses
- Brake motion recognition (release and drop-out recognition of the armature disk)
- Preventative function monitoring (wear recognition and error recognition, functional reserve)
- Continuous drop-out recognition
- Simple installation or retrofitting
- Electrical isolation on the output channels

CAUTION

The ROBA®-brake-checker cannot be used in all applications (e.g. when operating noise-damped brakes, it cannot be used without additional measures). The product's suitability should be checked before use.

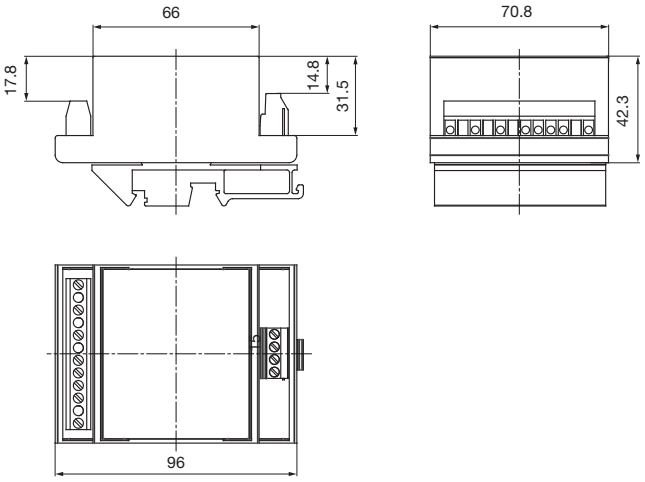
Function

The ROBA®-brake-checker monitoring module plus AC is intended for use with an input voltage from 200 up to 480 VAC. And then regulates to the permanently programmed overexcitation voltage. After the overexcitation time ends, it regulates to the permanently programmed holding voltage.

The overexcitation time is set automatically.
The monitoring module monitors the movement of the armature disk and emits the determined switching condition via control terminal 2 (signal output).
Critical conditions (line breakages, wear) can be recognised and the respective signal can be emitted via control terminal 3 (error output).

The movement detection feature of the armature disk is based on the detection of electromagnetic changes in the brake. If, due to unfavourable external influences, the secured detection cannot be ensured, it is possible that the signal and error outputs do not correspond to the expected state (plausibility).

Dimensions (mm)



The use of the ROBA®-brake-checker in combination with brakes of other manufacturers is not intended and expressly not approved by mayr® power transmission.

In these cases, operation is at your own risk, the guarantee and service and support provided by *mayr®* power transmission no longer apply.

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Technical Data				104 VDC	180/ 207 VDC
Input voltage, power terminal acc. DIN 50160		U_I	[VAC]	200 – 480	
Supply voltage control terminal	SELV/PELV ripple content ≤ 5%	U_I	[VDC]	24 (19 - 28)	
Output voltage	Power terminal	U_{OUT}	[VDC]	Input voltage (control terminal)	
Output voltage Reduction		U_O	[VDC]	104	207 *
		U_H	[VDC]	52	104
Output voltage overexcitation		U_O	[VDC]	185	360 *
		U_H	[VDC]	104	185 *
Output current	at ≤ 45 °C	I_{RMS}	[A]	2	
	at max. 70 °C	I_{RMS}	[A]	1	
Terminals	Control terminal			Nominal cross-section 0.14 – 1.5 mm² (26 – 16 AWG) tightening torque screws: 0.5 – 0.6 Nm	
	Power terminal			Nominal cross-section 0.2 – 2.5 mm² (22 – 14 AWG) tightening torque screws: 0.4 Nm	
Device Fuses				Brake supply: 1.2 * I_O, slow acting Input Signal +24 VDC: 500 mA, medium	
Ambient temperature			[°C]	-25 to +70	
Storage temperature			[°C]	-40 to +105	
Conformity markings				CE	
Protection				IP20	
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!	

* At least 0.9 × U_I (input voltage, power terminal) required

Size	Type	Input voltage ±10 % acc. EN50160 [VAC]	Output voltage ± 10% U_O [VDC]	U_H [VDC]	Article number
20	029.700.2	200 - 275	104	52	8269426
		230 - 480	207	104	8269424
		200 - 480	185	104	8264926
		400 - 480	360	185	8269425

Preventative function monitoring

Through the monitoring of different parameters, the ROBA®-brake-checker recognises safety critical operating conditions of the brake in advance, as well as acute faults (e.g. line breakage). Safety critical operating conditions are determined as they occur and are notified to the user as a warning before the brake can no longer be operated.

Possible causes for the warning:

- Increasing wear
- Rising coil temperature
- Falling supply voltage
- Line voltage drop on feed lines to the brake

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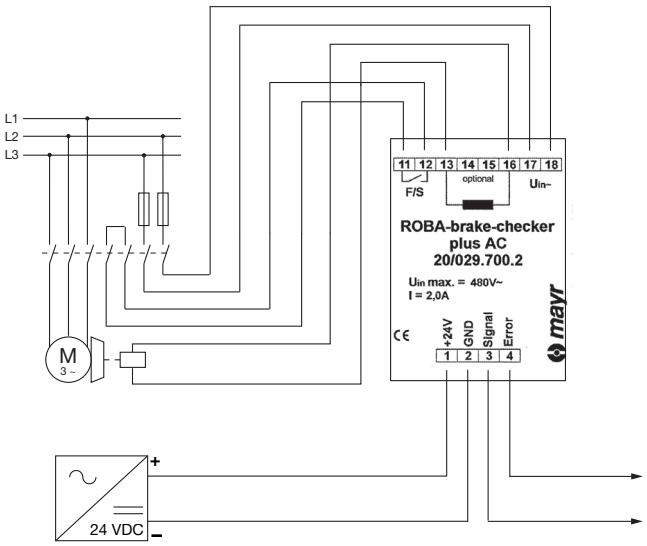
(B.0297002.EN)

Electrical Connection	
Power terminal	
11	F/S (see wiring examples)
12	F/S (see wiring examples)
13	Output voltage -
14	**Do not assign!**
15	**Do not assign!**
16	Output voltage +
17	Supply voltage VAC
18	Supply voltage VAC

Electrical Connection	
Control terminal	
1	Input voltage +24 VDC
2	Input voltage 0 VDC
3	Signal (output) max. 100 mA
4	Error (output) max. 100 mA

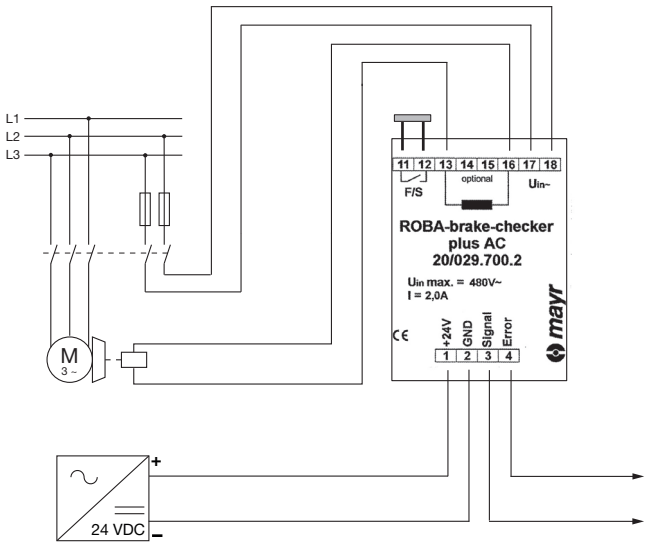
Wiring Example

(400 VAC,
DC-side, fast switching)



Wiring Example

(400 VAC,
AC-side, slow switching)



Outputs			
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	4	24 VDC (high)	No errors
		0 VDC (low)	Brake does not open or close, line interruption, false detection
Warning [1)]			Preventative function monitoring (wear recognition and error recognition, functional reserve)

1) Rectangular signal 10 Hz / 24 Vpp

DANGER

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

No mains separation!
Voltage control through phase angle control system

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Functional Guidelines

Start process

During each individual start process, all outputs (signal, error, warning) are reset.
The outputs must be assessed for the plausibility of signal conditions, signal changes and their correct temporal sequence.

Switch-ON

Switch-on always takes place AC-side, as only then is the overexcitation activated.

Inching Mode

During inching mode (fast sequence of switching on and off), no reliable detection is possible.
After the end of inching mode, restart the monitoring function:

- De-energise the brake
- Switch on (energise) the brake again

Repeated switch-on (energisation) before the brake is closed generates a fault when the maximum current is reached.

Reset

Interruption of voltage at control terminal 1 Supply voltage +24 VDC: All outputs (signal, error, warning) are reset.

- Signal (output) is set to 0 VDC (low)
- Error (output) is set to 24 VDC (high)

Switch-OFF

If short switching times are required, please switch DC-side. The AC-side should always be switched as well, in order to activate the overexcitation.

If a longer brake engagement time or a quieter switching noise is required, please switch AC-side. For this, a bridge must be installed between terminals 11 and 12.

Frequency Change (50/60 Hz)

After a frequency change in the input voltage, the switching-on process (energisation) is not detected, or an error is indicated.

- Switch on (energise) the brake again
- After this “initialisation switching“, the ROBA®-brake-checker can be operated as normal.

Operation on Transformers

During operation on a transformer, please ensure sufficient rigidity on transformers (min. 3x P_N of the brake).
A filter or external varistor must be installed.
Please ensure that the standard EN 50160 is kept to and that this is re-checked after installation of the ROBA®-brake-checker.

Overexcitation

On overexcitation, the brake is initially energised with a voltage higher than the nominal voltage. This decreases the separation time t_2.

Reliability Nominal Values

MTTF	140 years at 60 °C
	200 years at 40 °C
Duration of use	20 years

The basis of the MTTF calculation forms (if available) the information of the component manufacturer supplemented by the information from the Siemens standard SN 29500. The simplified Parts Count procedure ISO 13849-1 has been used for the calculation.

Time Delays

Recovery Time	20 ms
Reset	>20 ms
Signal delay	approx. 40 ms
overexcitation	2 × t_2 + 200 ms

Switching Times

The switching times of the brake can increase by 20 - 60 ms compared to the specifications in Katalog.

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EMC-compatible Installation

The measure described for compliance with the EMC directive is examined under laboratory conditions, and cannot necessarily be bindingly transferred onto the condition of a machine or equipment in case of deviations.

Scope of the inspection:
- Monitoring module ROBA®-brake-checker
- released ROBA®-stop safety brake
- Input voltage up to 500 VAC

Measure

Installation of a line filter in the AC-supply line
(e.g. Schaffner FN 2415-10-29)

- Avoid antennae effects:
  Keep the supply cables as short as possible;
  do not form rings or loops 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 supply cables!
- During operation with a frequency converter, please ensure EMC-compatible installation of the frequency converter!
- Please always check the holding voltage during operation of all components in the system!
- For the operation in living and small business areas, special precautions must be taken in order to keep to the correct limit values for this area with the complete system, e.g. by installing a capacitor.

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Intended Use

ROBA®-brake-checker products have been developed, manufactured and tested as electronic equipment in compliance with the DIN EN 50178 standard and in accordance with the EU Low Voltage Directive. During installation, operation and maintenance of the product, the requirements for the standard must be observed. ROBA®-brake-checker products are for use in machines, systems and devices and must only be used in the situations for which they are ordered and confirmed. The products are designed for installation into electrical control cabinets and terminal boxes. Using them for any other purpose is not allowed.

Basically:
Apply supply voltage 24 VDC (control terminal) before switching input voltage VAC (power terminal). Otherwise an error can occur.

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*® monitoring modules. Nevertheless, the high switch-off voltage produces switching sparks, which lead to contact consumption.
Therefore, only use the main contacts of a contactor suitable for inductive loads with a minimum contact opening of 3 mm for switching the DC-side contact S_{DC}. Connecting the main contacts in series reduces wear.

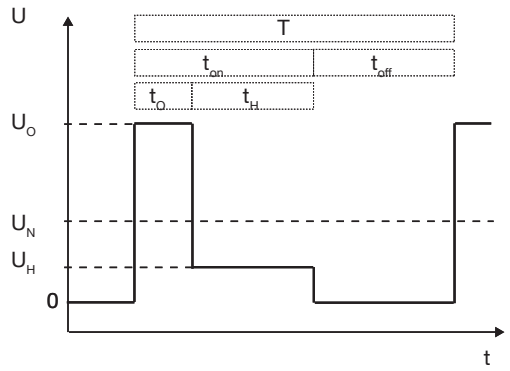
Coil Capacity

If the switching frequency is higher 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 must not be larger than P_N or the nominal current I_{RMS} which flows through the ROBA®-brake-checker must not be exceeded, as otherwise the coil and the ROBA®-brake-checker can fail due to thermal overload.
At high input voltage and low brake performance, the initial bridge rectification of 50 ms can lead to thermic overload.

Time Diagram:



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] 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_H [W] Coil capacity at reduced 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_{off} [s] Time without voltage
t_{on} [s] Time with 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] Coil nominal voltage
I_{RMS} [A] RMS current dependent on switching frequency, overexcitation time and duty cycle

$$I_{RMS} = \frac{P \times P_N}{U_N^2}$$

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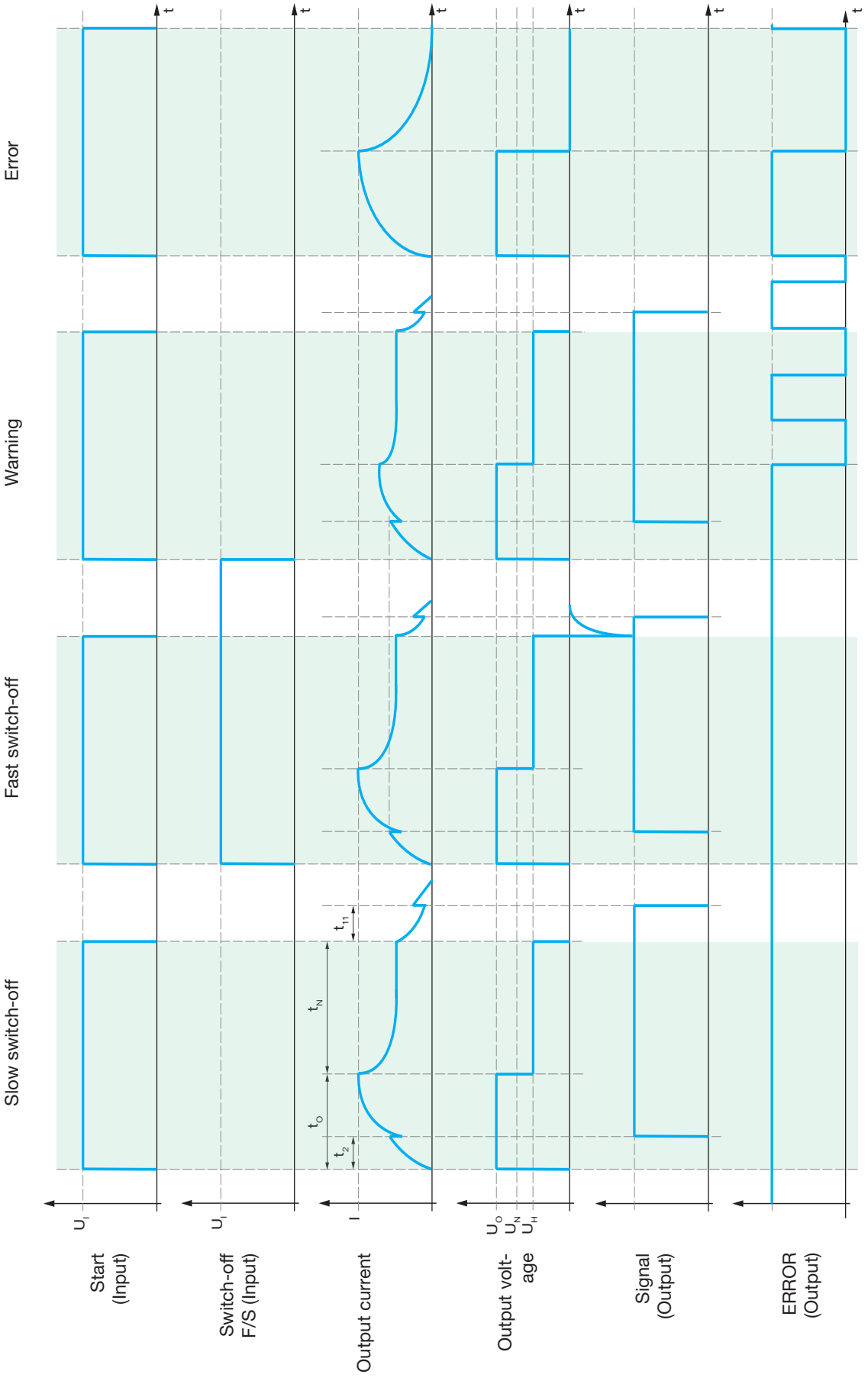
Functional sequence diagram



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Standards

Product standard
VDE 0160/DIN EN 50178:1998-04
Electronic equipment for use in power installations

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
Degree of pollution 2
Rated insulation voltage voltage inputs 480 V_{RMS}
Rated insulation voltage Grounding/Protective extra low voltage 300 V_{RMS}

Reliability nominal values
SN 29500, T = 60 °C / failure rates, components
EN ISO 13849-1

Disposal

Electronic Components
Products which have not been disassembled can be disposed of under Code No. 160214 (mixed materials) or components under Code No. 160216 (Code No. acc. 200/532/EC), or can be disposed of by a certified disposal firm.

Malfunctions / Breakdowns

Malfunction	Possible Causes	Measure
Brake does not release	No supply voltage available	Check voltage on input terminal
	Brake line interrupted	Check brake supply line (check passage)
No signal	Brake is not permitted	Use released brake
	Brake is worn	Open and clean the brake, check the air gap; Replace the brake if necessary
Error (continuous signal)	Brake release is not recognised	Brake is not permitted Incorrect RBC-module (brake nominal voltage)
	Brake drop-out is not detected	Brake is not permitted Check the supply module function
	Break voltage drop (supply voltage)	Check network stability and reinstate it
Warning	Wear limit reached	Check the brake and replace if necessary
	Supply voltage too low	Check or increase supply/output voltage on the supply module
	Coil temperature of the brake too high	Check effective coil power, ext. Temperature, friction power

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