

ROBA[®]-brake-checker plus AC monitoring module

ROBA[®]-brake-checker
Type 029.700.2
Size 20

Issue status 2023-03



Original Operational Instructions
B.0297002.EN

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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, the Electromagnetic Compatibility (EMC) Directive 2014/30/EU and 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.

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 EU Directive 2011 / 65 / EU (RoHS II) with 2015 / 863 EU (RoHS III - from 22 July 2019), which 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 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.

Guidelines on the REACH Regulation (EC No. 1907/2006)

of the European Parliament and of the Council Concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals. This regulates the manufacture, placing on the market and use of chemical substances in preparations, under certain conditions also pertaining to substances in 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. To our knowledge, when used for their intended purpose and disposed of correctly (recycling), the contained substances pose no threat to health or environment.

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

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

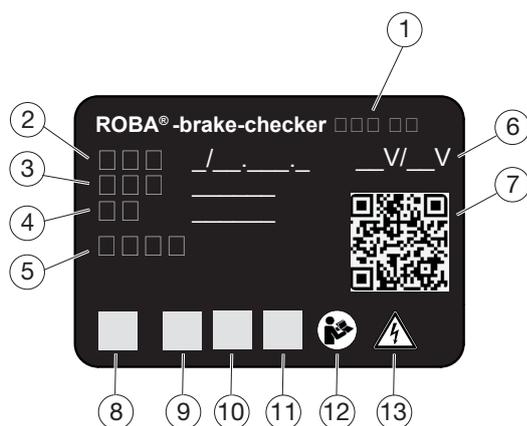


Only carry out installation, maintenance and repairs in a de-energised, disengaged state and secure the system against inadvertent switch-on.



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.

Typenschild



Type tag		
1		Type name
2		Size/Type number
3		Article number
4		Serial number
5		Additional text
6		Overexcitation voltage/Holding voltage
7		QR code
8		No specification (internal use)
9	CE	CE Identification
10	cULus	UL Identification
11	UKCA	UKCA Identification
12		Symbol for "Observe instructions"
13		High voltage

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

(B.0297002.EN)

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
- Consumer operation with overexcitation or power reduction
- Supply voltage AC: 200 – 480 V
- Supply voltage with 50 or 60 Hz
- Max. output current I_{RMS} : 2 A
- Sensorless and contactless detection of switching statuses
- Motion recognition of the brake (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



The UL information applies only when the UL mark is printed onto the product label.

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 plus AC monitoring module is intended for use with an supply voltage AC of 200 to 480 V. The monitoring module supplies the connected brakes and regulates to a permanently programmed overexcitation voltage. After the overexcitation time ends, it regulates to the permanently programmed holding voltage.

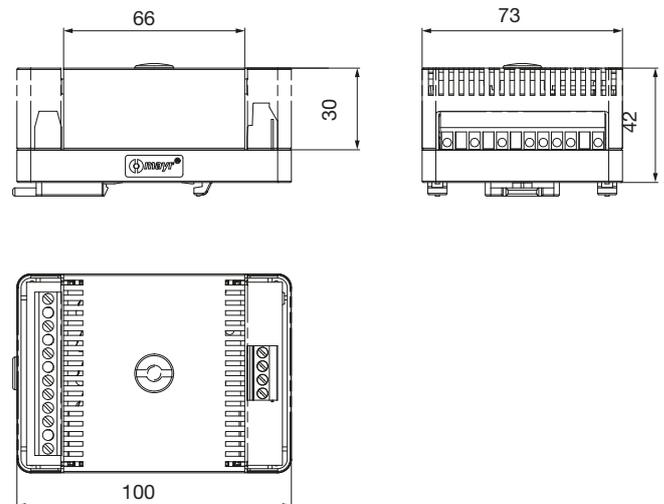
The overexcitation time is set automatically.

The monitoring module monitors the movement of the armature disk and emits the determined switching condition via control terminal 3 (signal output).

Critical conditions (line breakages, wear) can be recognized and the respective signal can be emitted via control terminal 4 (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.

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

(B.0297002.EN)

Technical Data			
Brake nominal voltage DC			104 V 180/207 V
Supply voltage AC, power terminal acc. DIN 50160	$U_{I-Power}$	[V]	200 – 480 / 320 ¹⁾
Supply voltage DC control terminal SELV/PELV ripple content ≤5 %	$U_{I-Signal}$	[V]	24 (7 - 30)
Output voltage DC Reduction	U_O	[V]	104 207 ²⁾
	U_H	[V]	52 104
Output voltage DC Overexcitation	U_O	[V]	185 360 ²⁾
	U_H	[V]	104 185 ²⁾
Output current	at ≤45 °C	I_{RMS}	2   _{US}
	at ≤60 °C	I_{RMS}	1
Terminals	Control terminal		Nominal cross-section 0.34 – 2.5 mm ² (22 – 14 AWG) tightening torque screws: 0.29 Nm/3.5 lb-in
	Power terminal		Nominal cross-section 0.2 – 2.5 mm ² (22 – 14 AWG) tightening torque screws: 0.5 Nm/7 lb-in
Device fuses	Control terminal		Fuse 315 mA, slow acting
	Power terminal		Max. 2 A circuit breaker, characteristic K/Z (rated brake current)
Surrounding air temperature		[°C]	-25 to +60
Storage temperature		[°C]	-40 to +105   _{US}
Conformity markings			/
Protection			IP20   _{US}
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!

Size	Type	Supply voltage	Output voltage		Brake voltage	Operation mode	Article number
		±10 % acc. EN50160 [V] ⁴⁾	U_O [V] ³⁾	U_H [V] ³⁾			
20	029.700.2	200 - 275	104	52	104	power reduction	8269426
		230 - 480/320 ¹⁾	207 ²⁾	104	180/207	power reduction	8269424
		200 - 480/320 ¹⁾	185 ²⁾	104	104	overexcitation	8264926
		400 - 480/320 ¹⁾	360 ²⁾	185	180/207	Overexcitation	8269425

1) CSA-C22.2 No. 14-18

2) Max. $0.9 \times U$ (supply voltage, power terminal)

3) DC = DC voltage

4) AC = AC voltage

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). These are determined as they occur and are notified to the user as a warning before the brake can no longer be operated.

Only the mechanical switching function is checked. Conclusions on the braking torque are not possible (e.g. reduced friction value due to oiling of the brake lining)

Possible causes for the warning:

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

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 AC
18	Supply voltage AC

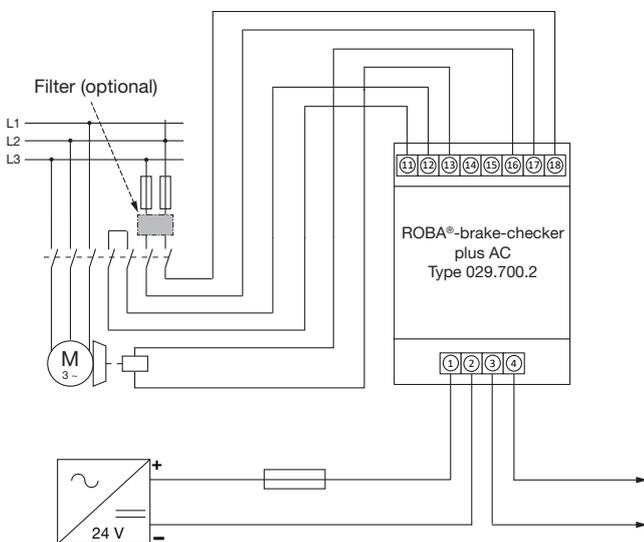
Electrical Connection

Control terminal

1	Supply voltage DC +24 V
2	Supply voltage DC 0 V
3	Signal (output) max. 100 mA
4	Error (output) max. 100 mA

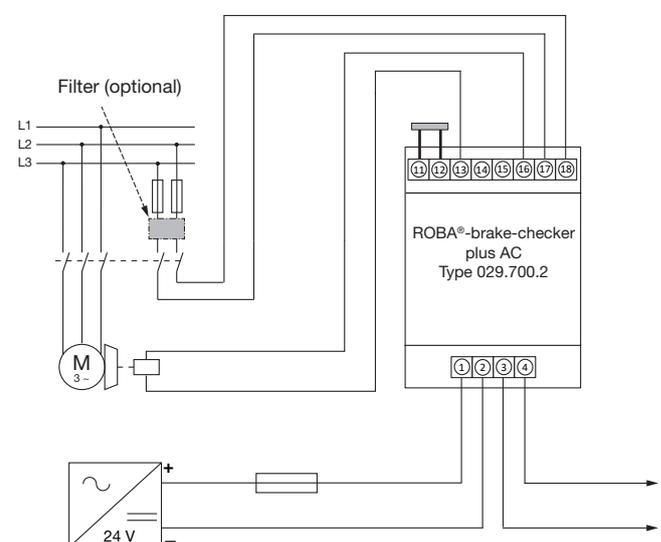
Wiring Example

(400 V,
DC-side, fast switching (Fast))



Wiring Example

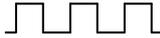
(400 V,
AC-side, slow switching (Slow))



Guidelines on installation:

The cover flaps of the connection terminals are only intended to be opened.

- Just a design element:
The cover flap is no contact protection.
The function of the device is not influenced.

Outputs				
Signal	3	0 V ⁵⁾ (low)	LED blue ³⁾	Brake is not energised, movement of the armature disk for closing the brake.
		24 V ⁵⁾ (high) ²⁾	LED green ³⁾	Brake energised, movement of the armature disk for opening the brake.
Error	4	24 V ⁵⁾ (high) ²⁾		no errors
		0 V ⁵⁾ (low)	LED red ³⁾	Brake does not open or close, line interruption, false detection Attention! Output voltage -
Warning ¹⁾			LED blue + green ⁴⁾	Preventative function monitoring (wear recognition and error recognition, functional reserve)

- 1) Rectangular signal 10 Hz / 24 Vpp
- 2) Voltage corresponds to supply voltage of control terminal
- 3) Status LED: Permanent light
- 4) Status LED: Flashing
- 5) DC = DC voltage

DANGER



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

No mains separation!

Voltage control through phase angle control system

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.

Recommendation: Use a contactor to switch on (other electronic control elements can cause problems (e.g. leakage current))

Jog Mode

During jog mode (fast sequence of switching on and off), no reliable detection is possible.

After the end of the jog 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



Prerequisites

- To make a **reset**, the supply voltage AC must be interrupted at the power terminals
- The brake must be closed

Start the reset:

- Interruption of the voltage at control terminal 1 Supply voltage DC +24 V:

All outputs are re-set:

- Signal (output) DC is set to 0 V (low)
- Error (output) DC is set to 24 V (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 supply 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. $3 \times P_N$ 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	$2 \times t_2 + 200$ ms

Switching Times

The switching time t_2 of the brake can increase by 20 - 60 ms.

Guidelines for EMC-compatible Installation

General:

For electronic equipment that supplies inductive loads (such as electromagnetic safety brakes or clutches/couplings), the prescribed measures regarding interference emission as per the EMC directive can only be considered in combination with the respective load and not only for the equipment itself. The EMC directive can only be adhered to by the complete device or machine.

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

Scope of the inspection:

- Monitoring module ROBA®-brake-checker
- released ROBA®-stop safety brake
- Supply voltage AC bis 500 V

Interference immunity:

The interference immunity as per the stated standards is achieved without additional measures.

Interference emission:

The line filter must be installed before the control element on the mains side (see wiring example on Page 5)

Installation of a line filter in the AC-supply line

(e.g. Schaffner FN 2415-10-29 or Epcos BS4143-AS-R105 (500 V))



- Mains, power, measurement, signal and control lines laid separately
- Possibly use shielded, separate line per brake
- Line shielding must be EMC compliant and have the greatest possible surface area
- Ensure good earth connections on the metal body of the brake
- Avoid antennae effects: Keep lines as short as possible; do not form rings or loops
- Signal lines over 30 m are considered long lines and may require special measures
- According to IEC 618003, IT networks are "second environment" category C4 and require special measures
- Equipment with interference emission levels for industrial usage (environment/class A, second environment) may require additional measures when used for domestic purposes (environment/class B, first environment)



- Observation of the requirements of the standard IEC 60364-4-44/VDE0100-444
- Observation of the remarks/guidelines/instructions of the control cabinet, line filter and frequency converter manufacturer regarding EMC-compliant setup
- Observation of the EMC guidelines from ZVEI and DEMVT
- Observation of the recommendations of the IEC TR 61000-5-2

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 European directives. 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 DC 24 V (control terminal) before switching supply voltage AC (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} . Series connection of main contacts 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 supply voltage and low brake performance, the initial bridge rectification of 50 ms can lead to thermic overload.

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)

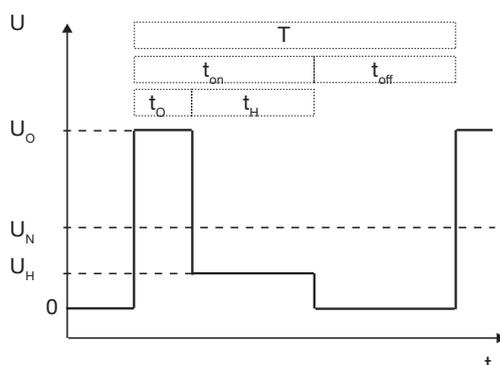
U_H [V] Holding voltage (half-wave voltage)

U_N [V] Coil nominal voltage

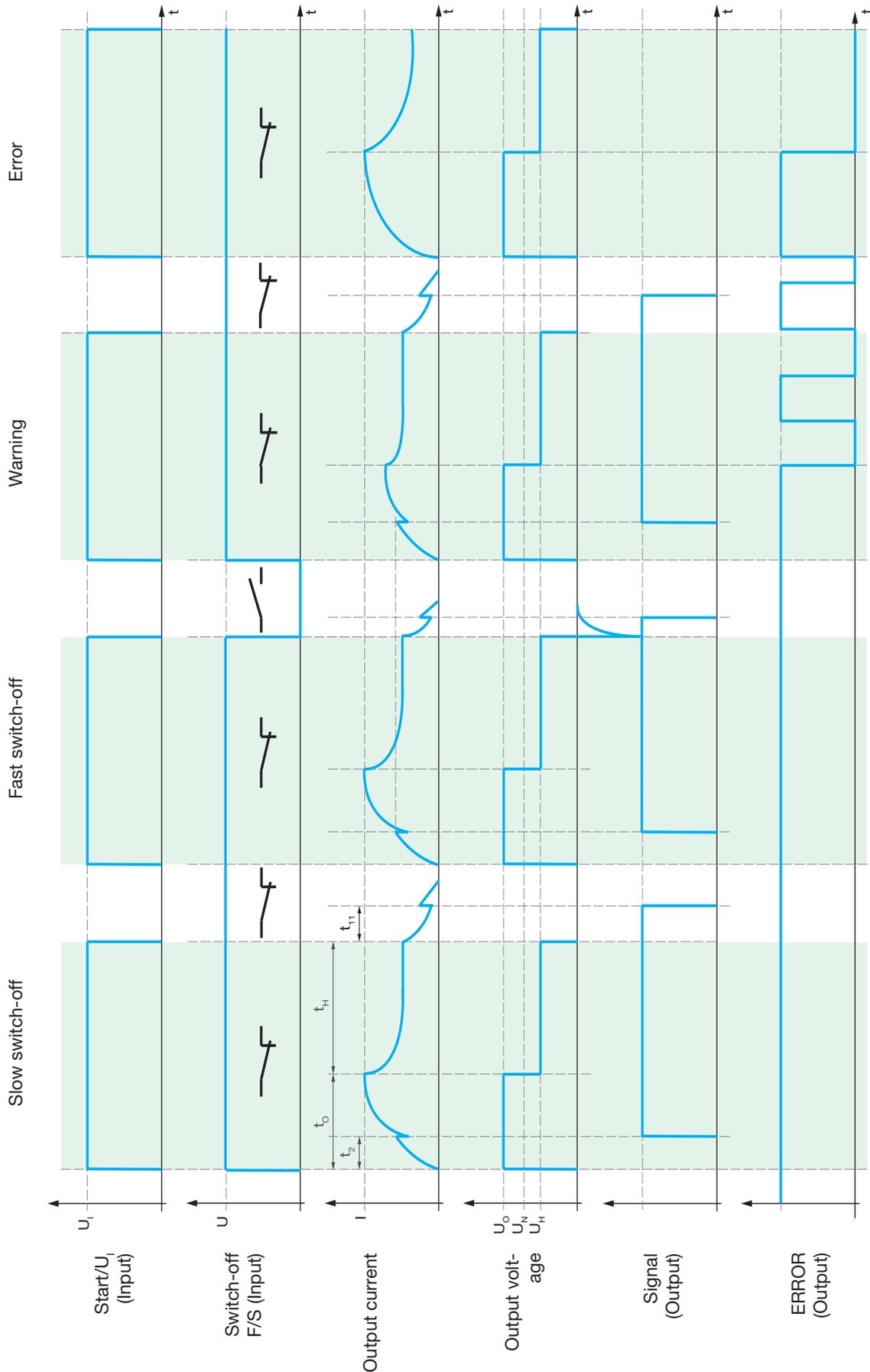
I_{RMS} [A] RMS current dependent on switching frequency, overexcitation time and duty cycle

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

Time Diagram:



Functional sequence diagram



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

(B.0297002.EN)

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

Installation space (e. g. control cabinet) IP54

Rated insulation voltage inputs 480 V_{RMS}

Rated insulation voltage Grounding/Safety Extra Low voltage 300 V_{RMS}

Reliability nominal values

SN 29500, T = 60 °C / failure rates, components

EN ISO 13849-1

Guidelines on the WEEE Directive 2012 / 96 / EU

Avoidance of waste from electrical and electronic devices and the reduction of such waste through recycling.

Our electromagnetic products (ROBA-stop® / ROBA-quick® / ROBATIC®-clutches) as well as the components required for control and monitoring (rectifier / brake-checker) and the DC motors (tendo®-PM) 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 (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.

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

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.

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	Measures
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