Installation and Operational Instructions for ROBA®-switch Type 017.110.2

(B.0171102.EN)

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 the 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 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.

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

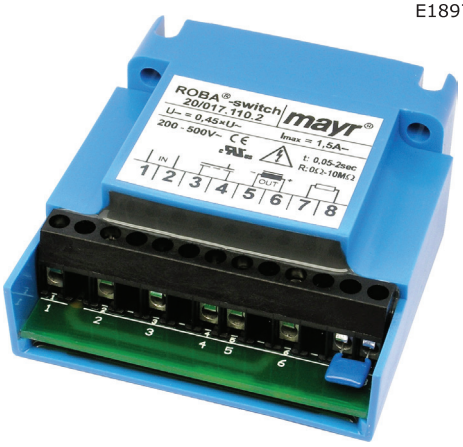
ROBA®-switch fast acting rectifiers are used to connect DC consumers to alternating voltage supplies, for example electromagnetic brakes and clutches (ROBA-stop®, ROBA®-quick, ROBATIC®) as well as electromagnets, electrovalves, etc.

Fast acting rectifier ROBA®-switch 017.110.2

- Consumer operation with overexcitation or power reduction
- Integrated DC-side disconnection (shorter connection time t_1)
- Input voltage: 100 – 500 VAC
- Maximum output current I_{RMS}: 1.5 A
- UL-approved

CAUTION

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



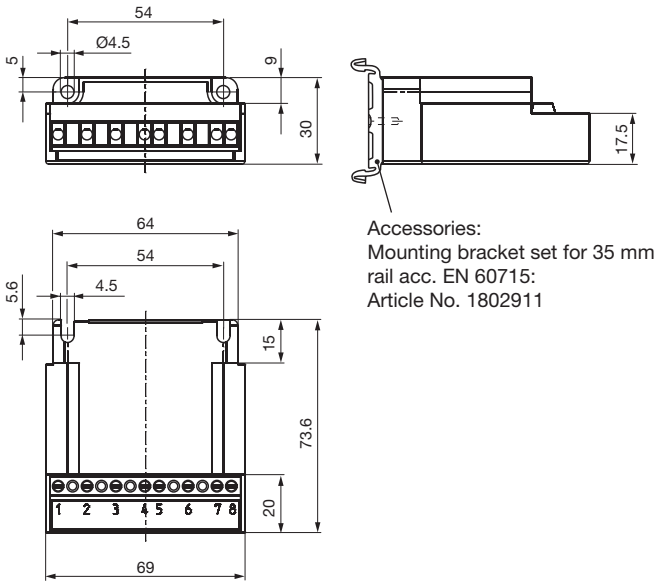
Function

The ROBA®-switch is used for operation at an input voltage of between 100 and 500 VAC, depending on the size. It can switch internally from bridge rectification output voltage to half-wave rectification output voltage. The bridge rectification time can be modified from 0.05 to 2 seconds by exchanging the external resistor (R_{ext}).

In addition, the ROBA®-switch features integrated DC-side disconnection. In contrast to the usual DC-side disconnection, no further protective measures or external components are required; however, switch off takes approximately 20 – 30 ms longer. The DC-side disconnection is activated as a standard measure (terminals 3 and 4 are not wired) and causes short switching times on the electromagnetic consumer.

The integrated DC-side disconnection is deactivated by fitting a bridge between the terminals 3 and 4, and the coil is deenergised via the freewheeling diode. This has the advantages of gentler braking actions and quieter switching noise. However, this substantially lengthens the switching times (approx. 6 – 10x).

Dimensions (mm)



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

Electrical Connection (Terminals)

1 + 2 Input voltage (fitted protective varistor)
3 + 4 Switching between DC and AC-side disconnection
5 + 6 Output voltage (fitted protective varistor)
7 + 8 R_{ext} for bridge rectification time adjustment

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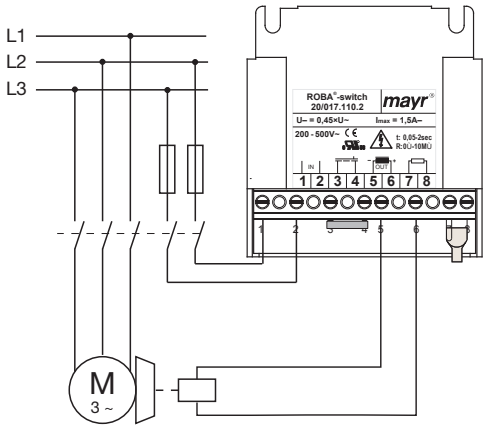
Technical Data				Type 017.110.2	
				Size 10	Size 20
Input voltage	± 10 % 50 / 60 Hz	U_{AC}	[VAC]	100 – 250	200 – 500
Output voltage	(= 0.9 x U_{AC})	U_{bridge}	[VDC]	90 – 225	180 – 450
	(= 0.45 x U_{AC})	$U_{half\text{-}wave}$	[VDC]	45 – 113	90 – 225
Output current	at ≤ 45 °C	I_{RMS}	[A]	1.5	1.5
	at max. 70 °C	I_{RMS}	[A]	0.75	0.75
Fitted protective varistors		U_{RMS}	[V]	275 on AC connection 385 on DC connection	550 on AC connection 385 on DC connection
Device fuses				FF 4 A (H) 5 x 20 mm	FF 4 A (H) 6.3 x 32 mm
Protection				IP65 components IP20 terminals IP10 R_{ext}	
Terminals				Nominal cross-section 1.5 mm² (AWG 22-14), screws M3, max. tightening torque 0.5 Nm	
Ambient temperature			[°C]	-25 to +70	
Storage temperature			[°C]	-40 to +70	
Conformity markings				c UL us CE	c UL us 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!	

Wiring example

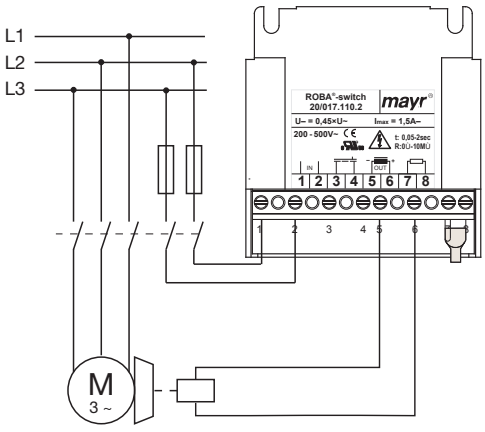
(400 VAC, AC-side switching)



AC-side switching means **low-noise switching**; however, the brake engagement time is longer (approx. 6 – 10 times longer than with DC-side switching), use for non-critical braking times.

Wiring Example

(400 VAC, DC-side switching)



DC-side switching means **short brake engagement times (e.g. for EMERGENCY STOP operation)**; but louder switching noises will occur.

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Switch-ON

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

Switch-OFF

If short switching times are required, please switch DC-side.

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 3 and 4.

Device Fuses

To protect against damage from short-circuits or earth short-circuits, please add suitable device fuses to the mains cable. As an alternative, a motor protection switch can be used. This must be adjusted to the holding current of the brake; at the same time it serves as overload protection for the brake.

Short-circuits or earth short-circuits occuring during the overexcitation time period can lead to ROBA®-switch failures. After fuse elements have reacted to a malfunction, the ROBA®-switch 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.

Overexcitation

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

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

Different external resistors between terminals 7 and 8 allow the adjustment of different overexcitation times. The overexcitation time has a standard adjustment of 0.45 s ± 20 %.

Overexcitation Times

Overexcitation time t_O	External resistors on terminals 7 and 8 R_{ext}
[s]	[Ω]
0.05	0 (bridge)
0.10	22 K
0.20	82 K
0.45	**221 K (standard)**
0.69	390 K
0.76	470 K
0.95	680 K
1.15	1 M
1.25	1.30 M
1.53	**2.20 M (included)**
2.00	10 M
2.15	**open**

The times printed in bold can be adjusted for delivery.
For the other times, please select the respective resistors.

Recovery Time 100 ms

The recovery time is the amount of time the ROBA®-switch requires in order to reach its starting position after switch-off. Therefore, the input voltage may be switched on again at the earliest after 100 ms.
During cycle operation, please take suitable measures to ensure that the recovery time of 100 ms is maintained.

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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 maintenance of the permitted current I_{RMS}.

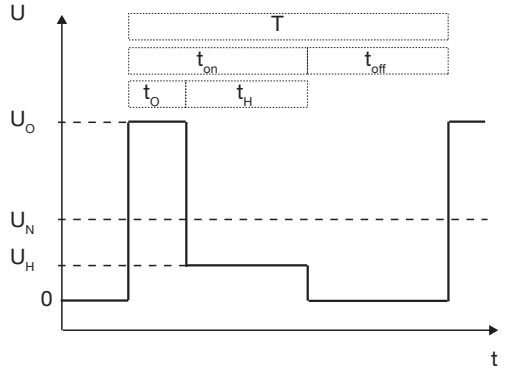
Sizes	Input voltage U_{AC}	Coil nominal voltage U_N	Coil nominal capacity P_N		Operation with	
			Type 017.110.2		overexcitation	power reduction
			≤ 45 °C	70 °C		
	[VAC]	[VDC]	[W]			
10	115	104	312	156		x
	230	104	156	78	x	
		180	467	234	x	x
		207	618	309		x
20	230	104	156	78	x	
		180	467	234	x	x
		207	618	309		x
	400	180	270	135	x	
		207	357	179	x	x
		225	422	211	x	x
	500	225	338	179	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 must not be larger than P_N or the nominal current I_{RMS} which flows through the ROBA®-switch must not be exceeded, as otherwise the coil and the ROBA®-switch can fail due to thermal 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_{eff} [A] RMS current dependent on switching frequency, overexcitation time and duty cycle

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

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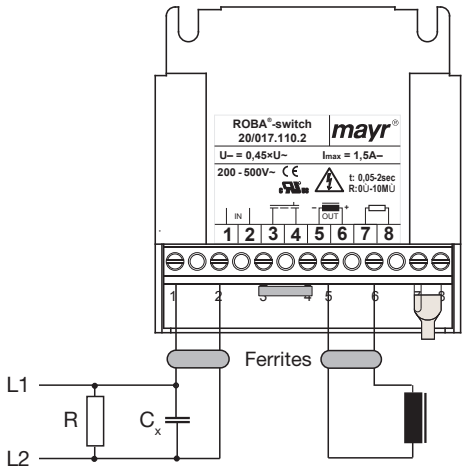
EMC-compatible Installation

The ROBA®-switch does not produce any interference. However, if the device is used in connection with other components (e.g. electromagnetic brakes), the resulting interference can exceed the permitted limit values. Please therefore install the rectifier in accordance with the EMC directives!

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. The inspection tests the individual components *mayr*®-ROBA®-switch and the *mayr*®-brake and is applicable for an input voltage of up to 500 VAC.



Measures against interference may prove unnecessary if suitable measures are already present in the system (shielded lines, shielding housing, appropriate wiring, etc.).

Measure

Installation of a C_x-capacitor into the AC connection:

C_x = 330 nF / 660 V	The voltage resistance of the capacitor must be at least that of the U_{AC} mains voltage!
R = 0.5 MΩ	Discharge resistor

Please mount the C_x-capacitor and ferrites directly onto the ROBA®-switch (connection terminal)!

- Avoid an antennae effect: 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!

Standards

EMC inspections

EN 61000-6-2:2006-03	Interference immunity
EN 61000-6-4:2007-09	Interference emission
VDE 0160/EN 50178:1998-04	Electronic equipment for use in power installations

In order to fulfil the interference immunity standards for individual components according to EN 61000-4-3:2011-04 (high-frequency, electromagnetic field immunity test), snap ferrites (e.g. Würth 7427113) must be mounted on the connection and the brake cables.

Insulation coordination
acc. VDE 0110 / EN 60664:2008-01
Overvoltage category III
Pollution degree 3
Rated insulation voltage 500 V_{RMS}

Intended use
acc. EN 50178:1998-04

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