

Electromechanical magnetic switches

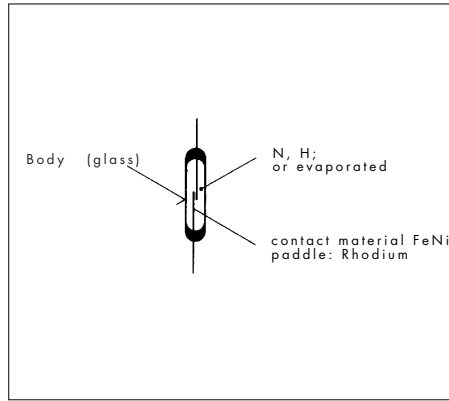
Bernstein magnetic switches – the advantages

- reliability even under extreme ambient conditions. They are unaffected by dirt, humidity, gases, dust, etc. and operate completely free from wear and tear
- IP 67 protection
- repeatable switching point precision of approx. 0.1 mm
- may be operated from several directions
- can be mounted in any position
- electromechanical magnetic switches normally contain only a single component, thus ensuring high reliability
- easy to mount
- long electrical life (> 10⁸ switching cycle lifetime if contacts are suitably protected)
- special types available for extreme temperature ranges (- 40° C to + 150° C)
- AC/DC switching

Design, function and effect of an electromechanical magnetic switch

The basic elements of this type of switch are the components which change their behaviour when approaching a magnet. The contact paddles invert their polarity (north and south pole) under the influence of a magnetic field. The approach can be made by either permanent magnets or electromagnets; the sensitivity of the switch and the field strength of the magnet determine the sensing distance. Correspondingly the approach or moving away of the magnet controls the opening and closing of the reed contacts. Normally-closed, normally-open and changeover contacts are available in our range of products.

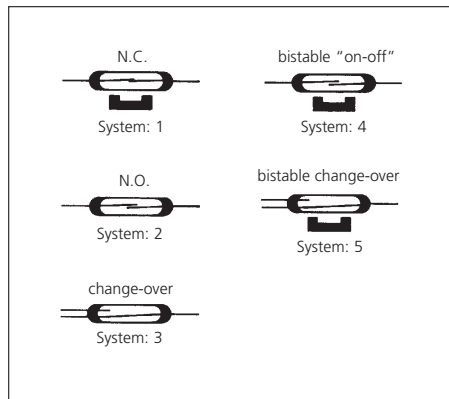
The magnetic switches and their auxiliary components (resistors, diodes, triacs, output stages etc.) are cast in high-quality isolating material or casting compound to increase their resistance to vibration and to guarantee the protection class up to IP 67. For use under extreme ambient conditions such as wider temperature ranges, metal versions (non-corrosive steel, aluminium and brass) as well as standard plastic versions are available.



Construction of a reed contact

Biasing

Bias magnets energise or hold the bistable or normally-closed contact closed, until a stronger magnet with opposite polarity neutralises the biasing.



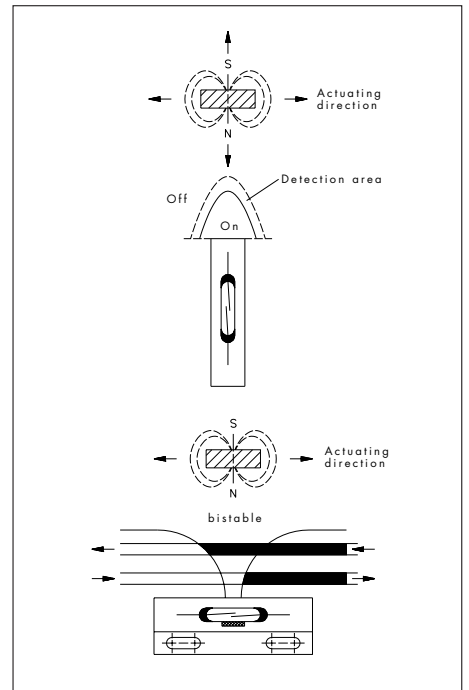
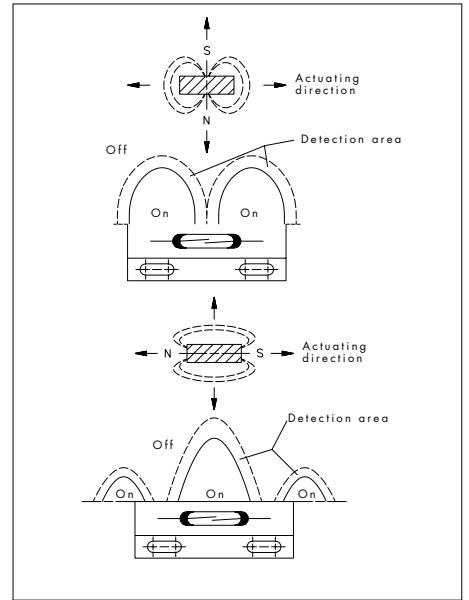
Types of reed contacts

Actuation and switching behavior

Switching behavior is principally determined by the movement and polarity of the magnet. The following drawings show typical characteristics. Body material and external dimensions are specified in the product overview. The magnetic switches with reed-contact output are identified by an „A” in the second position of the type code (MA...).

Switching frequency

Up to 200 Hz, depending on the size of load to be switched (i. e. considerably faster than relays, contactors, etc.).



Switching distances

Refer to tables of this catalogue to identify which switching magnet may be used and therefore which minimum switching distance will be realised.

Temperature ranges

The standard version may be used in environments from -5°C to $+70^{\circ}\text{C}$. Special types are also available offering an extended operating temperature range of -40°C to $+150^{\circ}\text{C}$.

Electrical life

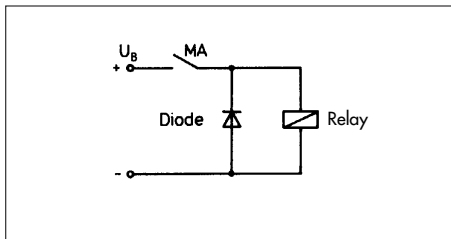
To maintain the long operational life of the electrical contacts, it is important to ensure the maximum supply voltage and maximum switching current are not exceeded. The following graphs show the load values for different contacts.

Guidelines for reed contact protection

The values for current, performance and voltage specified in the catalogue are valid only for resistive loads. Very often however, these loads will be used in conjunction with inductive or capacitive components when it is advisable to protect the reed contacts against voltage and current spikes. Whilst it is not possible to recommend a safe contact protection that applies to all load ranges (each individual case will require its own evaluation) we would like to present a general introduction to how reed contacts may be connected to different loads for improved operation.

1. Inductive loads

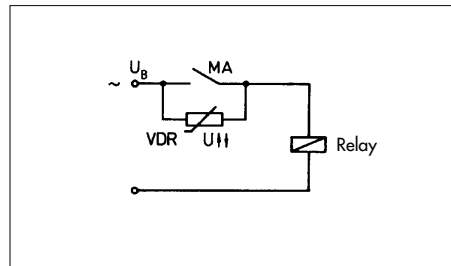
In DC voltage applications, contact protection is realised relatively easily with the help of a reverse polarity diode connected in parallel to the load. The diode polarity is selected so that it will block the normal operating voltage applied but will short-circuit any reverse voltage resulting from the switch being opened. (Note: these reverse voltage peaks can significantly exceed the normal operating voltage.)



Suppression of reverse voltage peaks with a reverse polarity diode

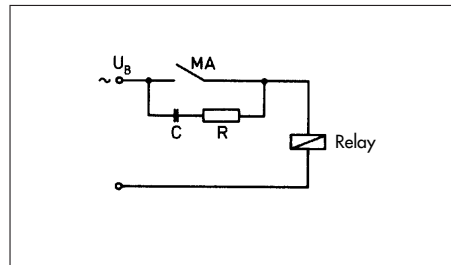
In AC voltage applications, two solutions may be applied.

1) Voltage peaks induced by switching off inductive loads are suppressed by connecting a Voltage Dependent Resistor (VDR) in parallel to the reed contact.



Suppression of reverse voltage peaks with a VDR

2) A Resistive/Capacitive (RC) element is connected in parallel to the contact, thus being in series with the load (vice versa is also possible).

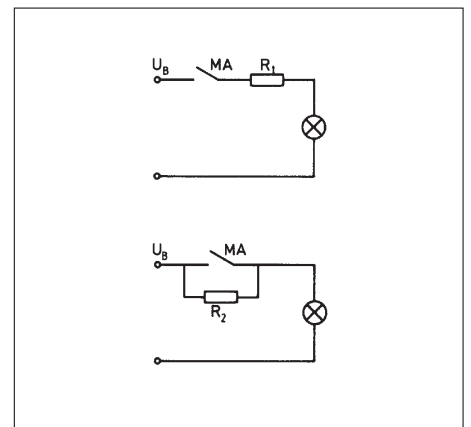
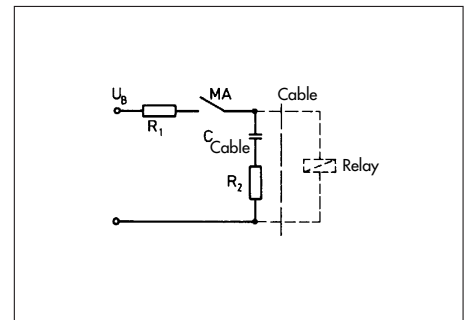


Suppression of reverse voltage peaks with RC network

2. Capacitive loads

In contrast to inductive loads, increased making currents can occur in connection with capacitive loads and lamp loads. If charged capacitors are switched (including inherent cable capacities), a sudden discharge occurs that can damage and even weld contacts closed. The intensity of this discharge depends on the capacity and length of the cable leading to the switch but may be decreased by inserting a series resistor. The size of the resistor is determined by the characteristics of the corresponding switching circuit.

It should however be as large as possible to reduce the discharge current to a permissible value to ensure reliable contact protection. These considerations are also valid for charging capacitors.



Contact protection with resistors



Using the selection matrix

To assist the user in selecting the right sensor for their application, Bernstein developed the following selection matrix. The individual fields match those in the product index to allow rapid selection of the most suitable sensor starting with the model description. By not using detailed technical descriptions the selection is considerably simplified. The corresponding output diagrams are shown on page 223.




Selection guide electromechanical magnetic switches in threaded and smooth barrels




Model	Switching capacity $S/I_{max.}$	Switching voltage $U_{max.}$	Switching distance S_{an}	Output	Housing material	Connection
MA-30 ø 6 x 28 mm	10 VA/0.5 A	250 V	19 mm	N.O.	plastic PA 6.6	cable
	5 VA/0.25 A	100 V	19 mm	change over		
MA-46 ø 6.5 x 40 mm	20 VA/0.5 A	250 V	18 mm	N.O.	plastic PA 6	cable
	20 VA/1 A	150 V	on request	change over		
MA-06 ø 12 x 86 mm	100 VA/3 A	250 V	7 mm	N.O.	aluminium	cable
	60 VA/1 A		10 mm	change over		
	250 VA/5 A		18 mm	bistable		
MA-16 ø 12 x 86 mm	100 VA/3 A	250 V	7 mm	N.O.	stainless steel	cable
	60 VA/1 A		12 mm	change over		
MA-26 ø 12 x 92 mm	100 VA/3 A	250 V	7 mm	N.O.	plastic PA 6	cable
	60 VA/1 A		12 mm	change over		
MA-36 ø 13 x 108 mm	250 VA/5 A	250 V	13 mm	bistable	plastic PA 6.6	cable
MA-04 ø 15.5 x 145 mm	80 VA/1 A	250 V	6 mm	change over	plastic PC	plug
MA-08 M 8 x 1 x 32 mm (Cable) M 8 x 1 x 40 mm (Plug)	10 VA/3 A	250 V	18 mm	N.O.	stainless steel	cable
	20 VA/1 A	100 V	13 mm	change over		
		30 V		plug		
MA-18 M 12 x 1 x 60 mm	10 VA/0.5 A	250 V	18 mm	N.O.	brass, nickel-plated	cable
	60 VA/1 A		12 mm	change over		
MA-28 M 12 x 1 x 60 mm	60 VA/1 A	250 V	15 mm	N.O.	plastic PA	cable
MA-23 M 12 x 1 x 80 mm	100 VA/3 A	250 V	6 mm	N.O.	brass, nickel-plated	cable
MA-33 M 12 x 1 x 80 mm	100 VA/3 A	250 V	7 mm	N.O.	plastic PA 6	cable
	60 VA/1 A		10 mm	change over		
	250 VA/5 A		22 mm	bistable		
MA-17 Pg 9 x 60 mm	30 VA/0.5 A	250 V	12 mm	change over	plastic PA 6	cable
MA-43 Pg 9 x 80 mm	60 VA/1 A	250 V	17 mm	change over	brass, nickel-plated	cable



Overview electromechanical magnetic switches in smooth barrels

Smooth barrels	MA-30, Ø 6 x 28 mm PA 6.6		MA-46, Ø 6.5 x 39 mm PA 6		MA-06, Ø 12 x 86 mm Al		
							
Switching distance (S_{an})	19 mm	19 mm	18 mm	on request	7 mm	10 mm	18 mm
Referring magnet (page)	T-62N/S (212)	T-62N/S (212)	T-62N/S (212)		T-62N/S (212)	T-62N/S (212)	T-62N/S (212)
Switching capacity (diagr.-no.)	10 VA (4)	5 VA (2)	20 VA (7)	20 VA (6)	100 VA (11)	60 VA (9)	250 VA (12)
Max. switching voltage	250 V	100 V	250 V	150 V	250 V	250 V	250 V
Switching function	N.O.	change over	N.O.	change over	N.O.	change over	bistable
Special features	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Designation	MAK-3012-B-1	MAK-3013-X-1	MAK-4612-A-2	MAK-4613-3	MAA-0612-F-1	MAA-0613-L-1	MAA-0614-P-1
Part number	631.1230.571	631.0330.572	631.0246.500	641.0346.336	631.4206.246	631.6306.248	631.0406.554
Smooth barrels	MA-06, Ø 12 x 86 mm Al		MA-16, Ø 12 x 86 mm Stainless steel 1.4305		MA-16, Ø 12 x 86 mm Stainless steel 1.4305		
							
Switching distance (S_{an})	16 mm	10 mm	7 mm	12 mm	7 mm		
Referring magnet (page)	T-62N/S (212)	T-62N/S (212)	T-62N/S (212)	T-62N/S (212)	T-62N/S (212)		
Switching capacity (diagr.-no.)	60 VA (9)	60 VA (9)	100 VA (11)	60 VA (9)	100 VA (11)		
Max. switching voltage	250 V	250 V	250 V	250 V	250 V		
Switching function	N.O.	change over	N.O.	change over	N.O.		
Special features	Temp. range -40°C...+150°C	Temp. range -40°C...+150°C	Standard	Standard	Temp. range -40°C...+150°C		
Designation	MAA-0612-NT-4	MAA-0613-LT-1	MAN-1612-F-3	MAN-1613-L-1	MAN-1612-FT-8		
Part number	641.0206.399	631.6306.004	631.4216.476	631.6316.259	631.4216.585		
Smooth barrels	MA-26, Ø 12 x 92 mm PA 6		MA-36, Ø 13 x 108 mm PA 6.6		MA-04, Ø 15.5 x 145 mm PC		
							
Switching distance (S_{an})	7 mm	12 mm	13 mm		6 mm		
Referring magnet (page)	T-62N/S (212)	T-62N/S (212)	T-62N/S (212)		T-62N/S (212)		
Switching capacity (diagr.-no.)	100 VA (11)	60 VA (9)	250 VA (12)		80 VA (10)		
Max. switching voltage	250 V	250 V	250 V		250 V		
Switching function	N.O.	change over	bistable		change over		
Special features	Standard	Standard	Standard		plug Amphenol		
Designation	MAK-2612-F-1	MAK-2613-L-1	MAK-3614-P-2		MAK-0413-M-5		
Part number	631.4226.423	631.6326.426	631.0436.553		631.7304.313		

Overview electromechanical magnetic switches in threaded barrels

Threaded barrels	MA-08, M8 x 1 x 32 mm Stainless steel 1.4305		MA-08, M8 x 1 x 39 mm Stainless steel 1.4305		MA-18, M12 x 1 x 60 mm CuZn39Pb3	
						
Switching distance (S_{an})	18 mm	13 mm	13 mm		18 mm	12 mm
Referring magnet (page)	T-62N/S (212)	T-62N/S (212)	T-62N/S (212)		T-62N/S (212)	T-62N/S (212)
Switching capacity (diagr.-no.)	10 VA (4)	10 VA (3)	20 VA (5)		10 VA (4)	60 VA (9)
Max switching voltage	250 V	100 V	30 V		250 V	250 V
Switching function	N.O.	change over	change over		N.O.	change over
Special features	Standard	Standard	plug Ø 6.5		Standard	Standard
Designation	MAN-0812-B-1	MAN-0813-Y-1	MAN-0813-STK		MAM-1812-B-1	MAM-1813-L-1
Part number	631.1208.596	631.0308.597	631.0308.595		631.1218.294	631.6318.002









Threaded barrels	MA-28, M12 x 1 x 60 mm PA		MA-23, M12 x 1 x 80 mm CuZn39Pb3		MA-33, M12 x 1 x 80 mm PA 6		
							
Switching distance (S_{an})	15 mm		7 mm		7 mm	10 mm	22 mm
Referring magnet (page)	T-62N/S (212)		T-62N/S (212)		T-62N/S (212)	T-62N/S (212)	T-62N/S (212)
Switching capacity (diagr.-no.)	60 VA (9)		100 VA (11)		100 VA (11)	60 VA (9)	250 VA (12)
Max switching voltage	250 V		250 V		250 V	250 V	250 V
Switching function	N.O.		N.O.		N.O.	change over	bistable
Special features	Standard		Standard		Standard	Standard	Standard
Designation	MAK-2812-L-3		MAM-2312-F-1		MAK-3312-F-2	MAK-3313-L-1	MAK-3314-P-2
Part number	641.6228.260		631.4223.268		631.4233.002	631.6333.005	641.0433.350

Threaded barrels	MA-17, Pg 9 x 60 mm PA 6		MA-43, Pg 9 x 80 mm CuZn39Pb3	
				
Switching distance (S_{an})	12 mm		17 mm	
Referring magnet (page)	T-62N/S (212)		T-62N/S (212)	
Switching capacity (diagr.-no.)	30 VA (8)		60 VA (9)	
Max switching voltage	250 V		250 V	
Switching function	N.O.		change over	
Special features	Standard		Standard	
Designation	MAK-1713-K-1		MAM-4313-L-2	
Part number	631.5317.001		631.6343.544	




Selection guide electromechanical magnetic switches in rectangular housings

Model	Switching capacity $S/I_{max.}$	Switching voltage $U_{max.}$	Switching distance S_{an}	Output	Housing material	Connection
MA-11 28.6 x 6.4 x 18 mm	10 VA/0.5 A	250 V	10 mm	N.O.	plastic PA 6.6	cable
	3 VA/0.25 A	130 V	8 mm	change over		
	10 VA/0.5 A	250 V	25 mm	bistable		
MA-01 45 x 9 x 13 mm	10 VA/0.5 A	250 V	10 mm	N.O.	plastic PA 6.6	cable
MA-45 45 x 9 x 25.5 mm	10 VA/0.5 A	250 V	10 mm	N.O.	plastic PA 6.6	cable
	60 VA/1 A		5 mm	change over		
MA-13 68 x 30 x 15 mm	10 VA/0.5 A	250 V	18 mm	N.O.	plastic PC	cable
	60 VA/1 A		12 mm	change over		
MA-02 80 x 15 x 20 mm	100 VA/3 A	250 V	21 mm	N.O.	plastic PA 6	cable
	30 VA/0.5 A		18 mm	change over		
	250 VA/5 A		20 mm	bistable		
MA-12 80 x 15 x 20 mm	100 VA/3 A	250 V	21 mm	N.O.	plastic PA 6.6	cable
	60 VA/1 A		24 mm	change over		
			25 mm	bistable		
MA-44 80 x 15 x 30 mm	100 VA/3 A	250 V	19 mm	N.O.	plastic PA 6.6	plug
	80 VA/1 A		22 mm	change over		
	250 VA/5 A		20 mm	bistable		
MA-32 85 x 24 x 26 mm	250 VA/5 A	250 V	16 mm	bistable	plastic PBT	cable plug
MA-42 88 x 13 x 25 mm	100 VA/3 A	250 V	25 mm	N.O.	plastic PA 6.6	cable
	80 VA/1 A		28 mm	change over		
	250 VA/5 A		20 mm	bistable		
MA-03 105 x 25.5 x 58 mm	100 VA/3 A	250 V	10 mm	N.O.	aluminium die casting	screw termination
	80 VA/1 A		10 mm	change over		
	250 VA/5 A		15 mm	bistable		

Overview electromechanical magnetic switches in rectangular housings

Rectangular housings	MA-11, 28.6 x 6.4 x 18 mm PA 6.6			MA-01, 45 x 9 x 13 mm PA 6.6			MA-45, 45 x 9 x 25.5 mm PA 6.6	
								
Switching distance (S_{an})	10 mm	8 mm	25 mm	10 mm			10 mm	5 mm
Referring magnet (page)	TK-11-11 (229)	TK-11-11 (229)	T-67N/S	TK-11-01 (229)			TK-45 (229)	TK-45 (229)
Switching capacity (diagr.-no.)	10 VA (4)	3 VA (1)	10 VA (4)	10 VA (4)			10 VA (4)	60 VA (9)
Max. switching voltage	250 V	130 V	250 V	250 V			250 V	250 V
Switching function	N.O.	change over	bistable	N.O.			N.O.	change over
Special features	Standard	Standard	Standard	Standard			Standard	Standard
Designation	MAK-1112-B-1	MAK-1113-1.5	MAK-1114-B-5	MAK-0112-B-1			MAK-4512-B-1	MAK-4513-L-1
Part number	631.1211.541	641.0311.368	631.1411.603	631.1201.288			631.1245.539	631.6345.540
Rectangular housings	MA-13, 68 x 30 x 15 mm PC			MA-02, 80 x 15 x 20 mm PA 6.6			MA-02, 80 x 15 x 20 mm GDAISi 12	
								
Switching distance (S_{an})	8 mm			21 mm	18 mm	20 mm	10 mm	30 mm
Referring magnet (page)	T-62N/S (212)			TK-21-02 (229)	TK-21-02 (229)	T-62N/S	T-62N/S (212)	T-62N/S (212)
Switching capacity (diagr.-no.)	60 VA (9)			100 VA (11)	30 VA (8)	250 VA (12)	100 VA (11)	60 VA (9)
Max. switching voltage	250 V			250 V	250 V	250 V	250 V	250 V
Switching function	N.O.			N.O.	change over	bistable	N.O.	change over
Special features	Standard			Standard	Standard	Standard	Temp. range -40°C...+150°C	Temp. range -40°C...+150°C
Designation	MAK-1313-L-1			MAK-0212-F-1	MAK-0213-K-1	MAK-0214-P-3	MAA-0212-FT-5	MAA-0213-LT-1
Part number	631.6313.004			631.4202.204	631.5302.309	641.9402.397	631.4202.522	631.6302.389
Rectangular housings	MA-12, 80 x 15 x 20 mm PA 6.6			MA-44, 80 x 15 x 30 mm PA 6.6			MA-32, 85 x 24 x 26 mm PBT	
								
Switching distance (S_{an})	21 mm	24 mm	25 mm	19 mm	22 mm	20 mm	15 mm	16 mm
Referring magnet (page)	TK-21-12 (229)	TK-21-12 (229)	T-62N/S (212)	TK-44 (229)	TK-44 (229)	T-62N/S (212)	T-67N/S	T-62N/S (212)
Switching capacity (diagr.-no.)	100 VA (11)	60 VA (9)	60 VA (9)	100 VA (11)	80 VA (10)	250 VA (12)	100 VA (11)	250 VA (12)
Max. switching voltage	250 V	250 V	250 V	250 V	250 V	250 V	250 V	250 V
Switching function	N.O.	change over	bistable	N.O.	change over	bistable	bistable	bistable
Special features	Standard	Standard	Standard	Standard	Standard	Standard	Standard	Standard
Designation	MAK-1212-F-1	MAK-1213-L-1	MAK-1214-L-2	MAK-4412-F-1	MAK-4413-M-1	MAK-4414-P-2	MAK-3214-F-3	MAK-3214-P-1
Part number	631.4212.217	631.6312.220	641.0412.143	631.4244.536	631.7344.538	631.0444.562	631.4432.609	631.0432.598

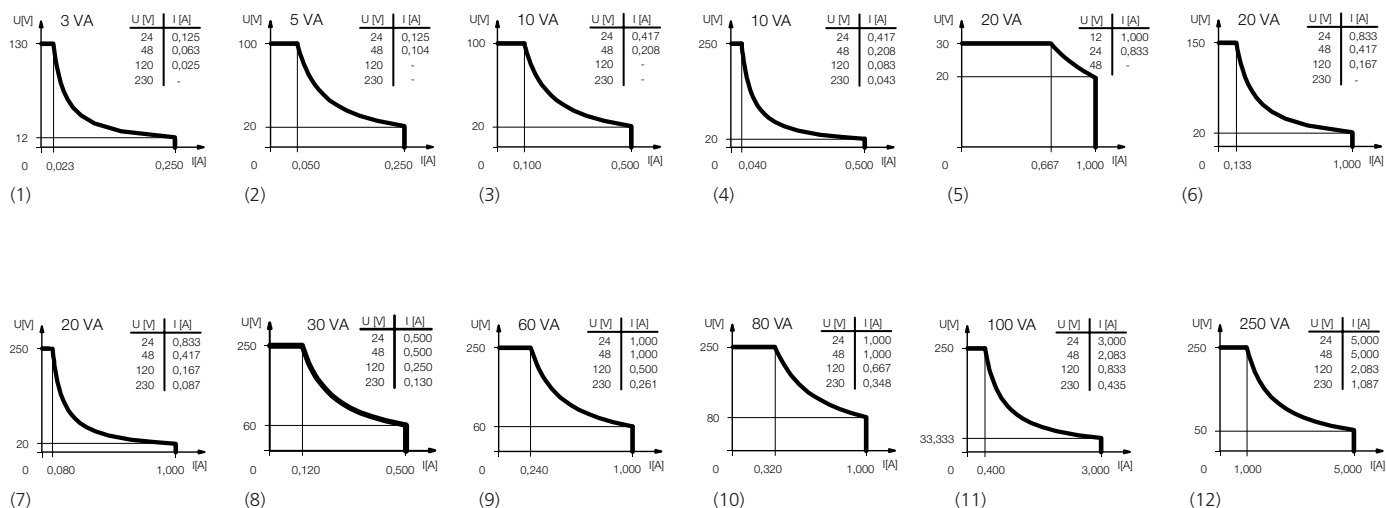
Overview electromechanical magnetic switches in rectangular housings

Rectangular housings	MA-32, 85 x 24 x 26 mm PBT		MA-42, 88 x 13 x 25 mm PA 6.6			MA-03, 100 x 29.5 x 58 mm GK-AlSi 12		
								
Switching distance (S_{an})	15 mm	16 mm	25 mm	22 mm	20 mm	10 mm	10 mm	15 mm
Referring magnet (page)	T-62N/S	T-62N/S (212)	TK-42 (213)	TK-42 (213)	T-62N/S (212)	TA-31 (214)	TA-31 (214)	T-62N/S (212)
Switching capacity (diagr.-no.)	100 VA (11)	250 VA (12)	100 VA (11)	80 VA (10)	250 VA (12)	100 VA (11)	80 VA (10)	250 VA (12)
Max. switching voltage	250 V	250 V	250 V	250 V	250 V	250 V	250 V	250 V
Switching function	bistable	bistable	N.O.	change over	bistable	N.O.	change over	bistable
Special features	plug flat plug 6.3	plug flat plug 4.8	Standard	Standard	Standard	Standard	Standard	Standard
Designation	MAK-3214-F-STK 6.3	MAK-3214-P-STK 4.8	MAK-4212-F-1	MAK-4213-M-1	MAK-4214-P-1	MAA-0312-F	MAA-0313-M	MAA-0314-P
Part number	631.4432.612	631.0432.590	631.4242.533	631.7342.535	631.0442.534	631.4203.232	631.7303.312	631.9403.532

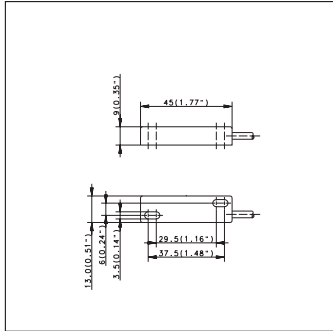
Technical data standard versions electromechanical magnetic switches

Switching current	see output diagram
Temperature range	-5 °C...+70 °C
Protection class (IEC 529, EN 60 529)	IP 67
Repeatable accuracy	≈ ± 0.1 mm
Mech. operational life	> 3 x 10 ⁸ switching cycles

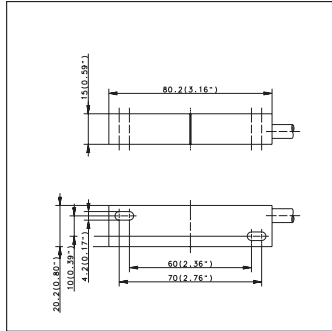
Output diagrams electromechanical magnetic switches



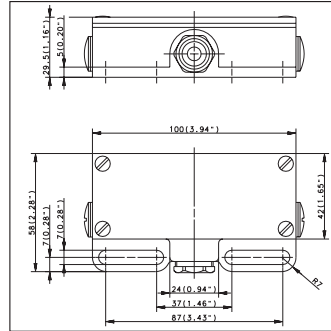
Dimension diagrams magnetic switches



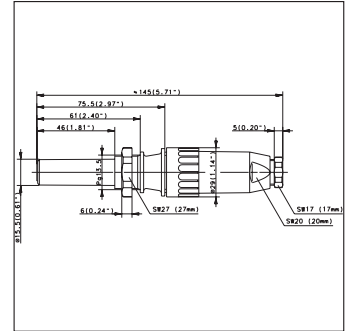
MA-01 Page 202



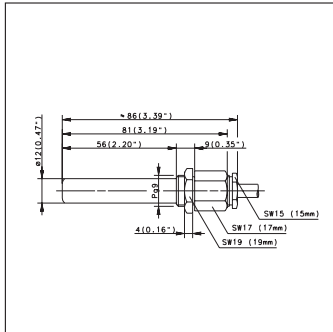
MA-02 Page 202



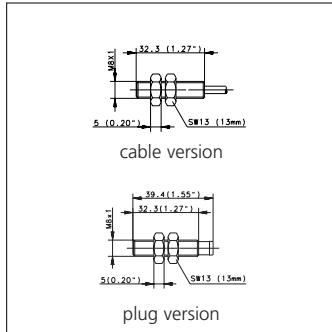
MA-03 Page 203



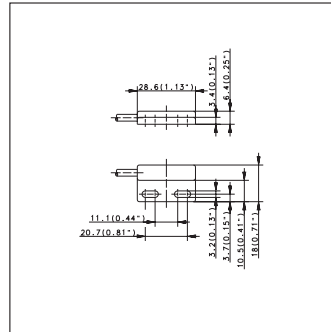
MA-04 Page 199



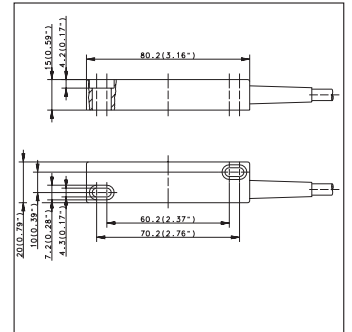
MA-06 Page 199



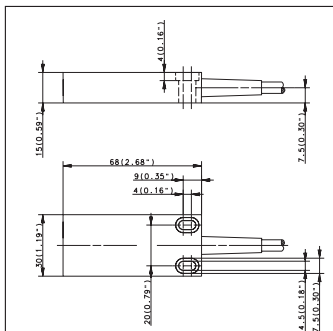
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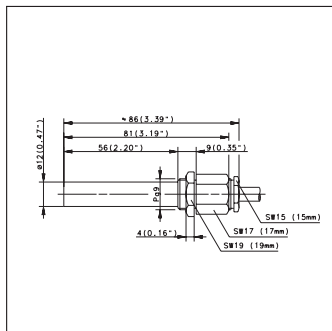
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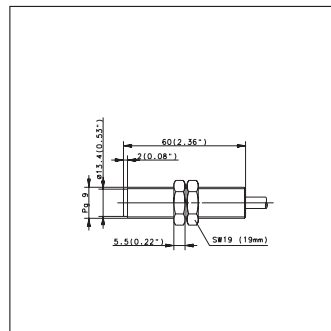
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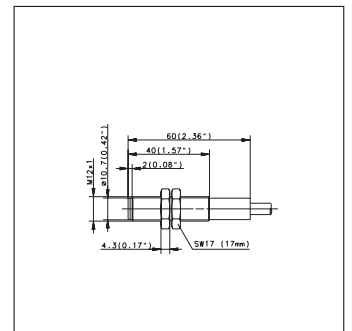
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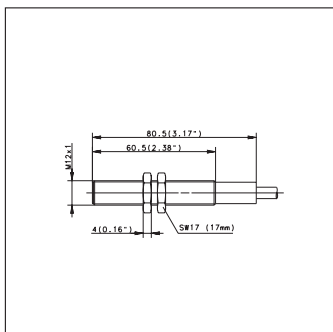
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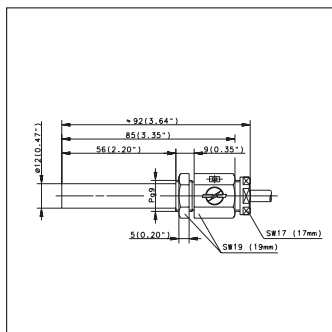
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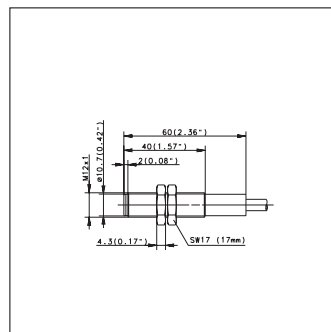
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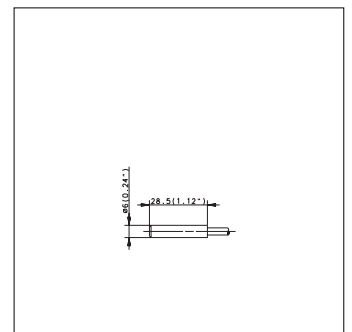
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