

# Electronic magnetic switches

## Electronic magnetic switches

The electronic magnetic switches from Bernstein are based on two different physical operating principles: the Hall effect and magneto-resistive (MR) effect. The sensors are characterised by their high sensing range and the absolute non-sensitivity to mechanical influences.

### MR sensor technology

The prime elements of MR sensors are magnetic field dependent, ferromagnetic thin-film resistors. The base material of such a unit is made from silicon to which the ferromagnetic film is applied using electron gun vaporisation.

### Fields of use for MR sensors

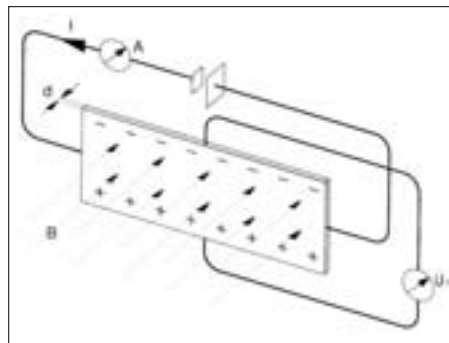
The main application areas for MR sensors are in the detection of current, angles, speed of rotation, position and magnetic fields. Detecting very low magnetic fields is possible with such sensors. An output voltage proportional to the magnetic field can be electrically conditioned. The ability to set the sensitivity or hysteresis allows these sensors to be used in a wide range of applications.



### Hall element technology

The Hall effect is defined as the generation of a voltage difference on the opposing sides of a thin gold wafer through which a current is flowing. This effect also occurs in some semiconductors when certain geometrical conditions are fulfilled. The thickness of the wafer must be very small in relation to the length and width.

Signal Hall elements are used in all types of controllers as contact-free signal sensors. Since the signal voltage is independent of the speed of motion, and in contrast to inductive systems, targets with a very low speed, almost stopped, can be detected.



Schematic description of the Hall effect

### Fields of use for Hall sensors

Since, when the sensor is suitably installed, only the polarity of the Hall voltage or the zero crossing is evaluated, InSb is used as the sensitive material for these Hall elements as its high sensitivity to temperature is not a problem for this application. Having designed the Hall elements for various application areas, they can be used for:

- measuring induction
- measuring tangential and axial components of magnetic induction
- measurements at low temperatures
- contact-free signal generation
- replacing inductive sensors (large sensing distance)

## Selection guide electronic magnetic switches in smooth and threaded barrels and rectangular housings




| Designation               | Switching current<br>$I_{max}$ | Operating voltage<br>$U_b$ | Switching distance<br>$S_n^*$ | Activity:<br>N = North Pole<br>S = South Pole<br>O = Omnipolar | Output- and switching function:<br>N.O.<br>N.C.<br>bi = bistable | Housing material                          | Connection |
|---------------------------|--------------------------------|----------------------------|-------------------------------|--|--|---|------------|
| MA-70<br>ø 6.5 x 25 mm    | 200 mA                         | 10...30 V                  | 45 mm                         | O  | PNP N.O.   | stainless steel 1.4401                    | cable      |
| MA-61<br>M 10 x 1 x 40 mm | 200 mA                         | 10...30 V                  | 17 mm                         | N<br>N   | PNP N.O.<br>PNP N.C.   | plastic PPE, red<br>brass, nickel-plated  | cable      |
| MA-62<br>M 12 x 1 x 46 mm | 400 mA                         | 10...30 V                  | 17 mm<br>35 mm                | N<br>N<br>N/S***   | PNP N.O.<br>PNP N.C.<br>PNP bi                                   | plastic PA 6, red<br>brass, nickel-plated | cable**    |
| MA-63<br>M 18 x 1 x 35 mm | 400 mA                         | 10...30 V                  | 17 mm<br>35 mm                | N<br>N<br>N/S***   | PNP N.O., NPN N.O.<br>PNP N.C., NPN N.C.<br>PNP bi               | plastic PA 6, red<br>brass, nickel-plated | cable**    |
| MA-80<br>8 x 8 x 40 mm    | 200 mA                         | 10...30 V                  | 45 mm                         | O  | PNP N.O.   | brass, nickel-plated                      | cable      |
| MA-55<br>12 x 12 x 55 mm  | 400 mA                         | 10...30 V                  | 17 mm<br>35 mm                | N<br>N<br>N/S***   | PNP N.O.<br>PNP N.C.<br>PNP bi                                   | brass, nickel-plated                      | cable**    |
| MA-52<br>26 x 13 x 43 mm  | 200 mA                         | 10...30 V                  | 60 mm                         | O<br>O   | PNP N.O. PNP N.O.<br>PNP N.C. PNP N.C.                           | plastic PA 12,<br>black                   | cable**    |



\* Switching distance referring to magnet T-62N/S  
for magnet T-67N/S approx. 10 % lower switching distance  
for magnet T-69N/S approx. 30 % higher switching distance



\*\* Plug on request

\*\*\* Activity:  
south-pole – switches on  
north-pole – switches off



## Overview electronic magnetic switches in smooth and threaded barrels

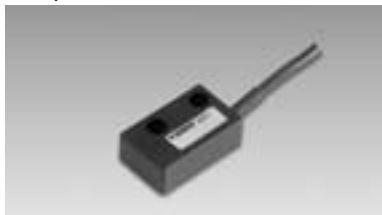
| Smooth and threaded barrels     |                    | MA-70, Ø 6.5 x 25 mm<br>Stainless steel 1.4401                                    |  | MA-61, M 10 x 1 x 40 mm<br>PPE, red  |  | MA-61, M 10 x 1 x 40 mm<br>CuZn39Pb3, nickel-plated                                 |  |
|---------------------------------|--------------------|---|--|--|--|---|--|
|                                 |                    |  |  |  |  |  |  |
| Switching distance ( $S_{an}$ ) |                    | 45 mm   |  | 17 mm  |  | 17 mm   |  |
| Mag. sensitivity                |                    | 0.5 mT  |  | 10 mT  |  | 10 mT   |  |
| Referring magnet (page)         |                    | T-62N/S (212)   |  | T-62N/S (212)  |  | T-62N/S (212)   |  |
| Switching function              |                    | N.O.  |  | N.C.   |  | N.C.  |  |
| PNP                             | Designation        | MEN-70OP2-01.2-2/K  |  | MEK-61NP1-10.2-2/KL  |  | MEK-61NP2-10.2-2/KL   |  |
|                                 | <b>Part number</b> | <b>637.3270.067</b>   |  | <b>637.1161.040</b>  |  | <b>637.1261.041</b>   |  |
|                                 | Designation        | MEM-61NP1-10.2-2/KL   |  | MEM-61NP2-10.2-2/KL  |  |   |  |
|                                 | <b>Part number</b> |   |  |  |  | <b>637.1161.043</b>   |  |
|                                 | <b>Part number</b> |   |  |  |  | <b>637.1261.042</b>   |  |

| Smooth and threaded barrels     |                    | MA-62, M 12 x 1 x 46 mm<br>PA 6, red  |  |                     | MA-62, M 12 x 1 x 46 mm<br>CuZn39Pb3, nickel-plated                                  |                     |  |
|---------------------------------|--------------------|---|--|---------------------|--|---------------------|--|
|                                 |                    |  |  |                     |  |                     |  |
| Switching distance ( $S_{an}$ ) |                    | 17 mm   |  | 17 mm               |  | 35 mm               |  |
| Mag. sensitivity                |                    | 10 mT   |  | 10 mT               |  | 2.5 mT              |  |
| Referring magnet (page)         |                    | T-62N/S (212)   |  | T-62N/S (212)       |  | T-62N/S (212)       |  |
| Switching function              |                    | N.C.  |  | N.O.                |  | bistable            |  |
| PNP                             | Designation        | MEK-62NP1-10.4-2/KL   |  | MEK-62NP2-10.4-2/KL |  | MEK-62SP4-03.4-2/KL |  |
|                                 | <b>Part number</b> | <b>637.1162.047</b>   |  | <b>637.1262.048</b> |  | <b>637.3462.049</b> |  |
|                                 | Designation        | MEM-62NP1-10.4-2/KL   |  | MEM-62NP2-10.4-2/KL |  | MEM-62SP4-03.4-2/KL |  |
|                                 | <b>Part number</b> |   |  |                     |  | <b>637.1162.044</b> |  |
|                                 | <b>Part number</b> |   |  |                     |  | <b>637.1262.045</b> |  |
|                                 | <b>Part number</b> |   |  |                     |  | <b>637.3462.046</b> |  |

| Smooth and threaded barrels     |                    | MA-63, M 18 x 1 x 35 mm<br>PA 6, red  |  |                     | MA-63, M 18 x 1 x 35 mm<br>CuZn39Pb3, nickel-plated                                  |                     |  |
|---------------------------------|--------------------|---|--|---------------------|--|---------------------|--|
|                                 |                    |  |  |                     |  |                     |  |
| Switching distance ( $S_{an}$ ) |                    | 17 mm   |  | 17 mm               |  | 35 mm               |  |
| Mag. sensitivity                |                    | 10 mT   |  | 10 mT               |  | 2.5 mT              |  |
| Referring magnet (page)         |                    | T-62N/S (212)   |  | T-62N/S (212)       |  | T-62N/S (212)       |  |
| Switching function              |                    | N.C.  |  | N.O.                |  | bistable            |  |
| PNP                             | Designation        | MEK-63NP1-10.4-2/KL   |  | MEK-63NP2-10.4-2/KL |  | MEK-63SP4-03.4-2/KL |  |
|                                 | <b>Part number</b> | <b>637.1163.053</b>   |  | <b>637.1263.054</b> |  | <b>637.3463.055</b> |  |
|                                 | Designation        | MEM-63NP1-10.4-2/KL   |  | MEM-63NP2-10.4-2/KL |  | MEM-63SP4-10.4-2/KL |  |
|                                 | <b>Part number</b> |   |  |                     |  | <b>637.1163.050</b> |  |
|                                 | <b>Part number</b> |   |  |                     |  | <b>637.1263.051</b> |  |
|                                 | <b>Part number</b> |   |  |                     |  | <b>637.3463.052</b> |  |
| NPN                             | Designation        | MEK-63NN1-10.4-2/KL   |  | MEK-63NN2-10.4-2/KL |  | MEM-63NN1-10.4-2/KL |  |
|                                 | <b>Part number</b> | <b>637.1563.069</b>   |  | <b>637.1663.070</b> |  | <b>637.1563.071</b> |  |
|                                 | Designation        | MEM-63NN2-10.4-2/KL   |  |                     |  | MEM-63NN2-10.4-2/KL |  |
|                                 | <b>Part number</b> |   |  |                     |  | <b>637.1663.072</b> |  |

## Overview electronic magnetic switches in rectangular housings

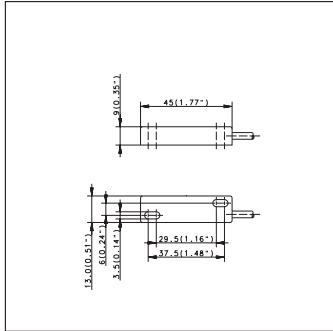
| Rectangular housings            |                    | MA-80, 8 x 8 x 40 mm<br>CuZn39Pb3, nickel-plated                                  |  | MA-55, 12 x 12 x 55 mm<br>CuZn39Pb3, nickelé                                       |                     |                     |
|---------------------------------|--------------------|---|--|--|---------------------|---------------------|
|                                 |                    |  |  |  |                     |                     |
| Switching distance ( $S_{an}$ ) |                    | 45 mm   |  | 17 mm  | 17 mm               | 35 mm               |
| Mag. sensivity                  |                    | 0.5 mT  |  | 10 mT  | 10 mT               | 2.5 mT              |
| Referring magnet (page)         |                    | T-62N/S (212)   |  | T-62N/S (212)  | T-62N/S (212)       | T-62N/S (212)       |
| Switching function              |                    | N.O.  |  | N.C.   | N.O.                | bistable            |
| PNP                             | Designation        | MEM-80OP2-01.2-2/K  |  | MEM-55NP1-10.4-2/KL  | MEM-55NP2-10.4-2/KL | MEM-55SP4-03.4-2/KL |
|                                 | <b>Part number</b> | <b>637.3280.057</b>   |  | <b>637.1155.058</b>  | <b>637.1255.059</b> | <b>637.3455.060</b> |

| Rectangular housings            |                    | MA-52, 43 x 26 x 13 mm<br>PA 12, noir   |                     |
|---------------------------------|--------------------|---|---------------------|
|                                 |                    |  |                     |
| Switching distance ( $S_{an}$ ) |                    | 60 mm   | 60 mm               |
| Mag. sensivity                  |                    | 0.1 mT  | 0.1 mT              |
| Referring magnet (page)         |                    | T-62N/S (212)   | T-62N/S (212)       |
| Switching function              |                    | N.C.  | N.O.                |
| PNP                             | Designation        | MEK-52OP1-00.4-2/KL   | MEK-52OP2-00.4-2/KL |
|                                 | <b>Part number</b> | <b>637.3152.075</b>   | <b>637.3252.068</b> |
| NPN                             | Designation        | MEK-52ON1-00.4-2/KL   | MEK-52ON2-00.4-2/KL |
|                                 | <b>Part number</b> | <b>637.3552.073</b>   | <b>637.3652.074</b> |

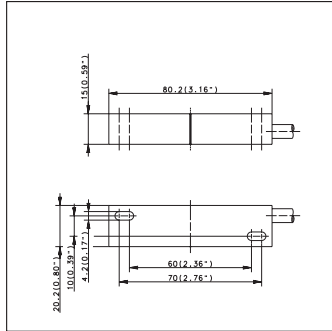
## Technical data standard versions electronic magnetic switches

|                             |       | MA-70                                 | MA-61       | MA-62       | MA-63       | MA-80       | MA-55       | MA-52       |
|-----------------------------|-------|---------------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Operating voltage           | $U_B$ | 10 V...30 V                           | 10 V...30 V | 10 V...30 V | 10 V...30 V | 10 V...30 V | 10 V...30 V | 10 V...30 V |
| Rated operating current     | $I_B$ | ≤ 200mA                               | ≤ 200mA     | ≤ 400mA     | ≤ 400mA     | ≤ 200mA     | ≤ 200mA     | ≤ 200mA     |
| Switching frequency         |       | ≥ 5000 Hz                             |             |             |             |             |             |             |
| Output                      |       | short-circuit and overload protection |             |             |             |             |             |             |
| Reverse polarity protection |       | yes                                   |             |             |             |             |             |             |
| LED for output function     |       | •                                     | •           | •           | •           | •           | •           | •           |
| Temperature range           |       | -20 °C/+70 °C                         |             |             |             |             |             |             |
| Protection class            |       | IP 65/IP 67                           |             |             |             |             |             |             |
| Cable (2 m)                 |       | •                                     | •           | •           | •           | •           | •           | •           |
| Plug on request             |       |                                       |             | •           | •           | •           | •           | •           |

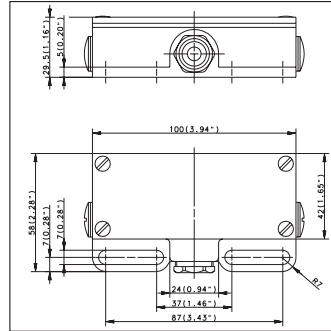
# Dimension diagrams magnetic switches



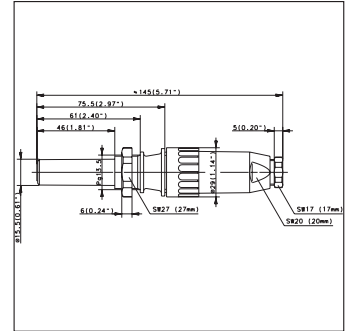
MA-01 Page 202



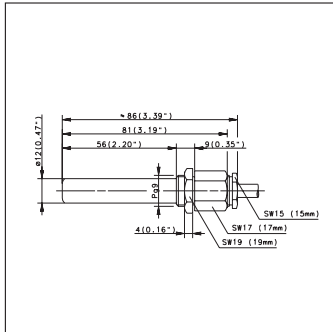
MA-02 Page 202



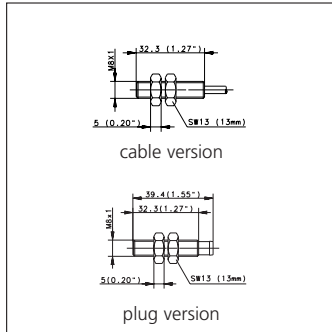
MA-03 Page 203



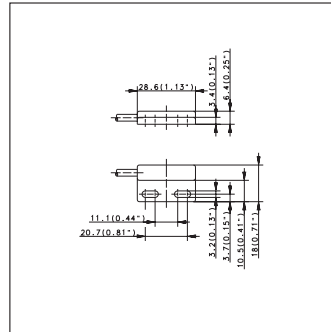
MA-04 Page 199



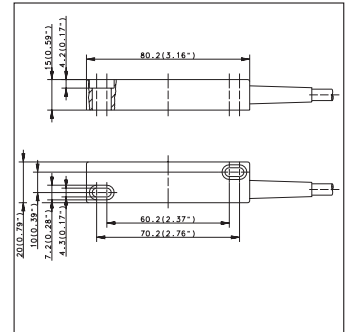
MA-06 Page 199



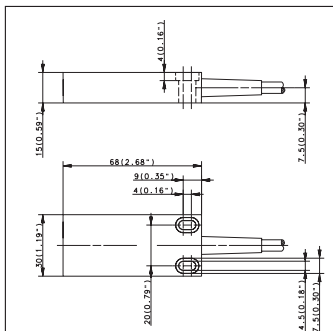
MA-08 Page 200



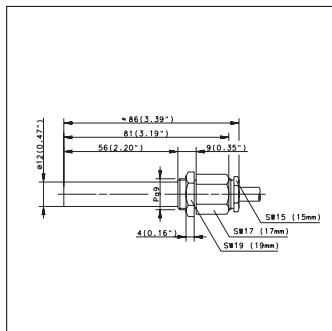
MA-11 Page 202



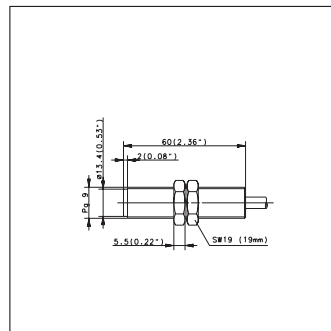
MA-12 Page 202



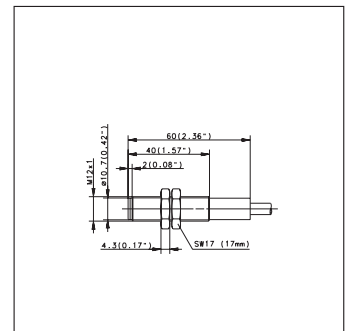
MA-13 Page 202



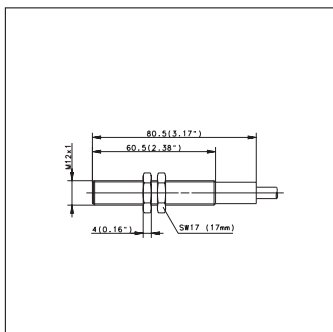
MA-16 Page 199



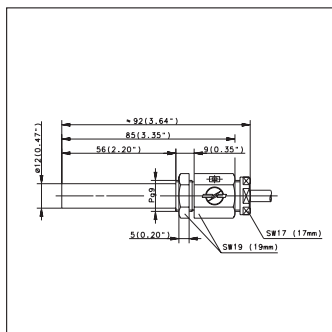
MA-17 Page 200



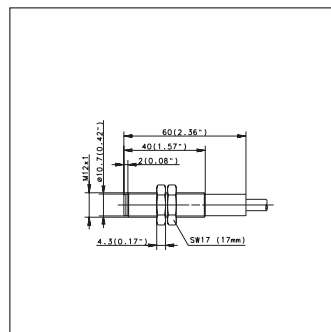
MA-18 Page 200



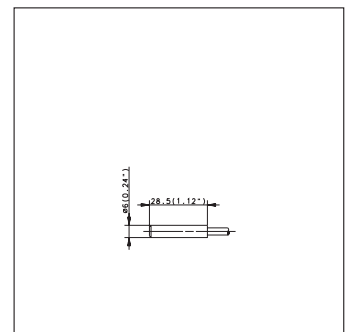
MA-23 Page 200



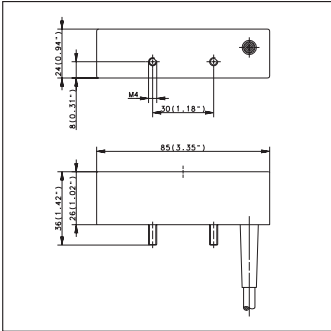
MA-26 Page 199



MA-28 Page 200

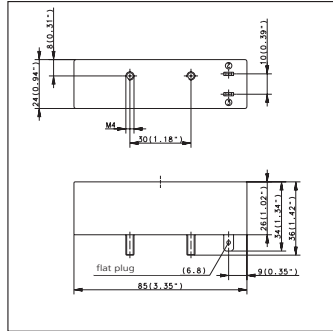


MA-30 Page 199



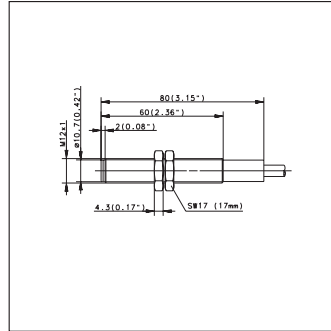
MA-32 (cable)

Page 202



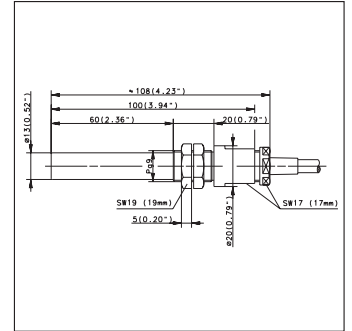
MA-32 (plug)

Page 203



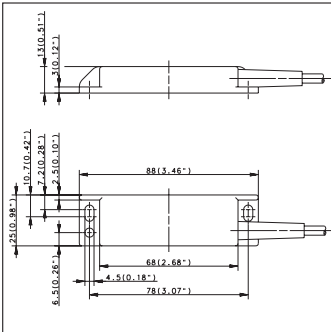
MA-33

Page 200



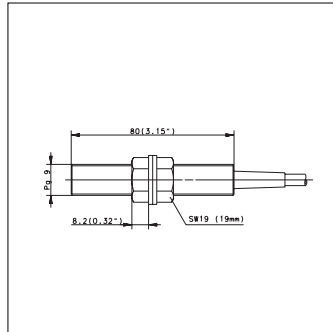
MA-36

Page 199



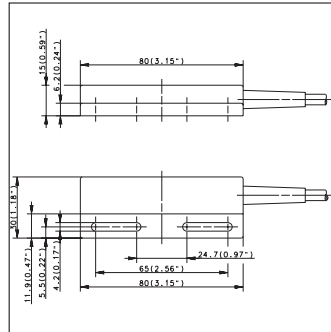
MA-42

Page 203



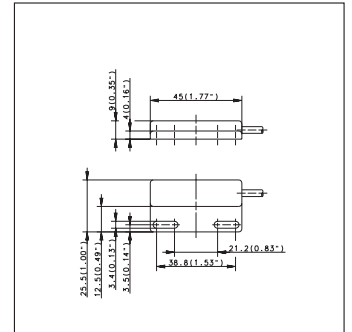
MA-43

Page 200



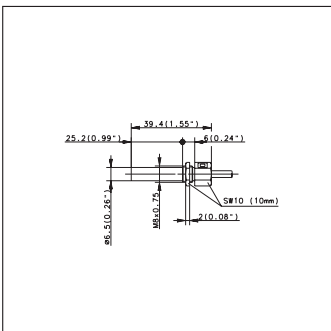
MA-44

Page 202



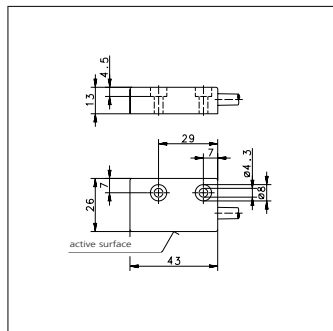
MA-45

Page 202



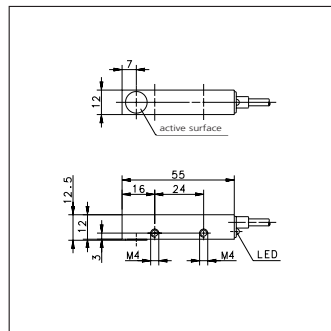
MA-46

Page 199



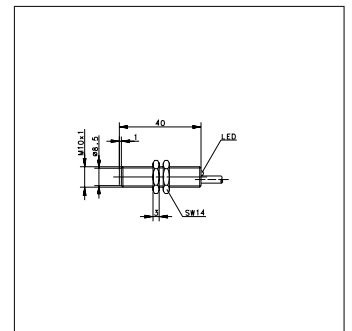
MA-52

Page 207



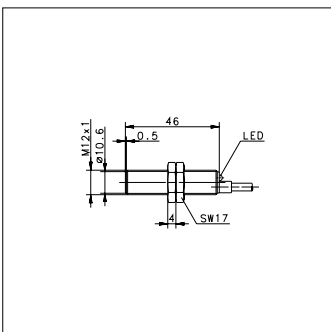
MA-55

Page 207



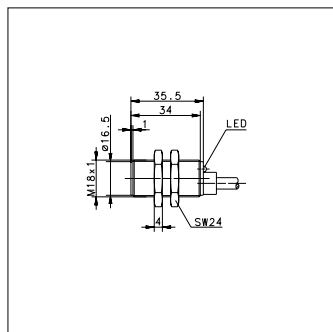
MA-61

Page 206



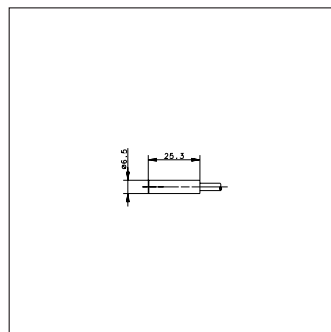
MA-62

Page 206



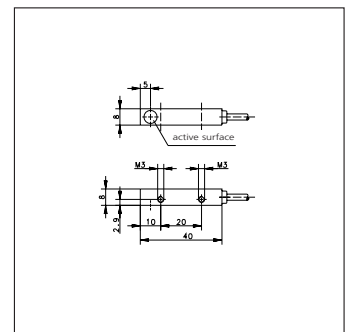
MA-63

Page 206



MA-70

Page 206



MA-80

Page 207

# Electromechanical magnetic switches

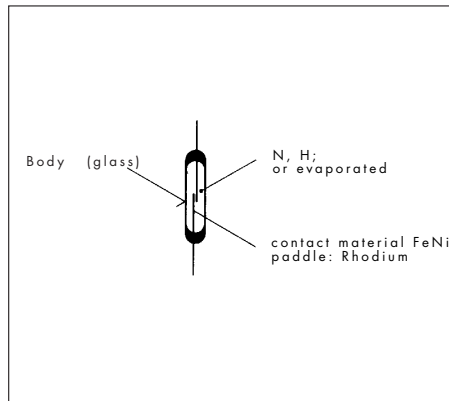
## Bernstein magnetic switches – the advantages

- 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 (> 10<sup>8</sup> 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.

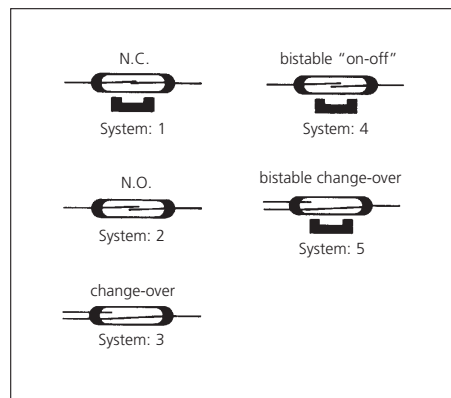
The magnetic switches and their auxiliary components (resistors, diodes, triacs, output stages etc.) are cast in high-quality isolating material or casting compound to increase their resistance to vibration and to guarantee the protection class up to IP 67. For use under extreme ambient conditions such 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.



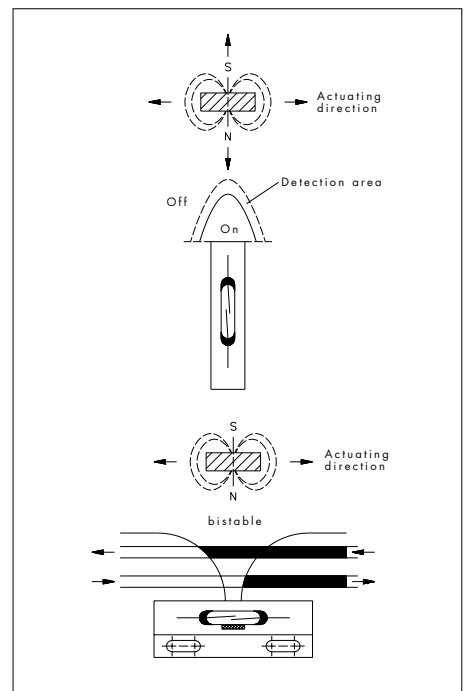
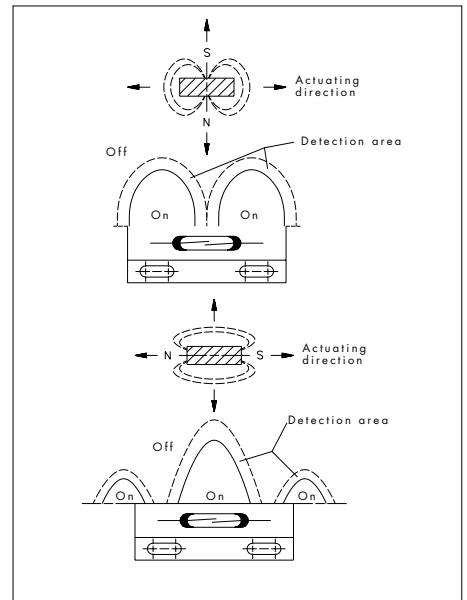
Types of reed contacts

### 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  $-5^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ . Special types are also available offering an extended operating temperature range of  $-40^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$ .

**Electrical life**

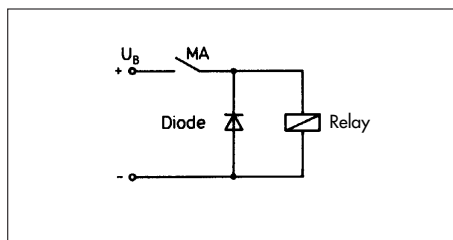
To maintain the long operational life of the electrical contacts, it is important to ensure the maximum supply voltage and maximum switching current are not exceeded. The following graphs show the load values for different contacts.

**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**

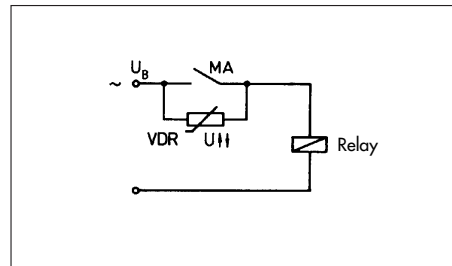
In DC voltage applications, contact protection is realised relatively easily with the help of a reverse polarity diode connected in parallel to the load. The diode polarity is selected so that it will block the normal operating voltage applied but will short-circuit any reverse voltage resulting from 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

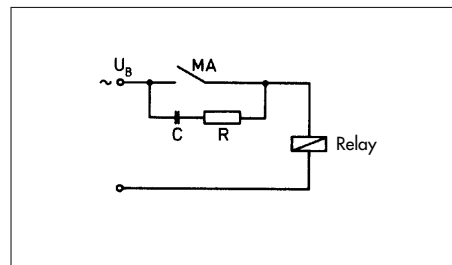
In AC voltage applications, two solutions may be applied.

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).

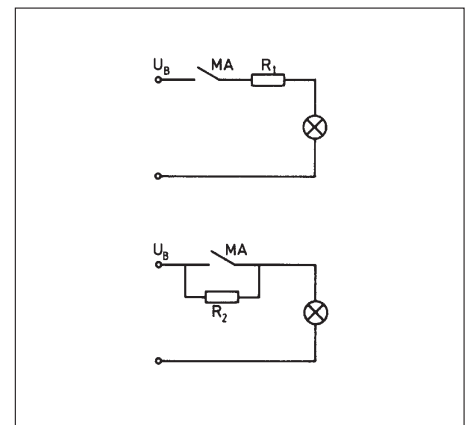
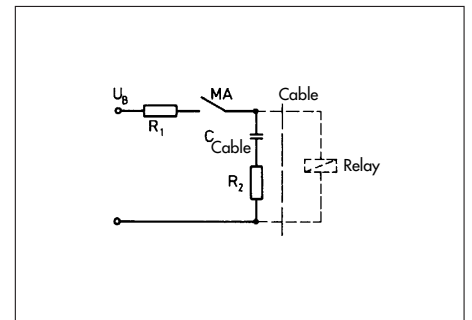


Suppression of reverse voltage peaks with RC network

**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<br>$S/I_{max.}$ | Switching voltage<br>$U_{max.}$ | Switching distance<br>$S_{an}$ | Output      | Housing material     | Connection |
|--|------------------------------------|---------------------------------|--------------------------------|-------------|----------------------|------------|
| MA-30<br>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<br>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<br>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<br>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<br>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<br>ø 13 x 108 mm                                     | 250 VA/5 A                         | 250 V                           | 13 mm                          | bistable    | plastic PA 6.6       | cable      |
| MA-04<br>ø 15.5 x 145 mm                                   | 80 VA/1 A                          | 250 V                           | 6 mm                           | change over | plastic PC           | plug       |
| MA-08<br>M 8 x 1 x 32 mm (Cable)<br>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<br>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<br>M 12 x 1 x 60 mm                                  | 60 VA/1 A                          | 250 V                           | 15 mm                          | N.O.        | plastic PA           | cable      |
| MA-23<br>M 12 x 1 x 80 mm                                  | 100 VA/3 A                         | 250 V                           | 6 mm                           | N.O.        | brass, nickel-plated | cable      |
| MA-33<br>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<br>Pg 9 x 60 mm                                      | 30 VA/0.5 A                        | 250 V                           | 12 mm                          | change over | plastic PA 6         | cable      |
| MA-43<br>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<br>PA 6.6 |   | MA-46, Ø 6.5 x 39 mm<br>PA 6 |  | MA-06, Ø 12 x 86 mm<br>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                     | <b>631.1230.571</b>          | <b>631.0330.572</b>   | <b>631.0246.500</b>          | <b>641.0346.336</b>  | <b>631.4206.246</b>       | <b>631.6306.248</b>   | <b>631.0406.554</b> |



| Smooth barrels                  | MA-06, Ø 12 x 86 mm<br>Al     |   | MA-16, Ø 12 x 86 mm<br>Stainless steel 1.4305 |  | MA-16, Ø 12 x 86 mm<br>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<br>-40°C...+150°C | Temp. range<br>-40°C...+150°C   | Standard                                      | Standard   | Temp. range<br>-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                     | <b>641.0206.399</b>           | <b>631.6306.004</b>   | <b>631.4216.476</b>                           | <b>631.6316.259</b>  | <b>631.4216.585</b>                           |   |

| Smooth barrels                  | MA-26, Ø 12 x 92 mm<br>PA 6 |   | MA-36, Ø 13 x 108 mm<br>PA 6.6 |  | MA-04, Ø 15.5 x 145 mm<br>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<br>Amphenol             |   |
| Designation                     | MAK-2612-F-1                | MAK-2613-L-1  | MAK-3614-P-2                   |  | MAK-0413-M-5                 |   |
| Part number                     | <b>631.4226.423</b>         | <b>631.6326.426</b>   | <b>631.0436.553</b>            |  | <b>631.7304.313</b>          |   |

# Overview electromechanical magnetic switches in threaded barrels

| Threaded barrels                | MA-08, M8 x 1 x 32 mm<br>Stainless steel 1.4305                                   |                     | MA-08, M8 x 1 x 39 mm<br>Stainless steel 1.4305                                    |  | MA-18, M12 x 1 x 60 mm<br>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<br>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                     | <b>631.1208.596</b>   | <b>631.0308.597</b> | <b>631.0308.595</b>  |  | <b>631.1218.294</b>   | <b>631.6318.002</b> |




| Threaded barrels                | MA-28, M12 x 1 x 60 mm<br>PA  |  | MA-23, M12 x 1 x 80 mm<br>CuZn39Pb3  |  | MA-33, M12 x 1 x 80 mm<br>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                     | <b>641.6228.260</b>   |  | <b>631.4223.268</b>  |  | <b>631.4233.002</b>   | <b>631.6333.005</b> | <b>641.0433.350</b> |

| Threaded barrels                | MA-17, Pg 9 x 60 mm<br>PA 6   |  | MA-43, Pg 9 x 80 mm<br>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                     | <b>631.5317.001</b>   |  | <b>631.6343.544</b>  |  |




# Selection guide electromechanical magnetic switches in rectangular housings

| Model                       | Switching capacity<br>$S/I_{max.}$ | Switching voltage<br>$U_{max.}$ | Switching distance<br>$S_{an}$ | Output      | Housing material      | Connection        |
|-----------------------------|------------------------------------|---------------------------------|--------------------------------|-------------|-----------------------|-------------------|
| MA-11<br>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<br>45 x 9 x 13 mm     | 10 VA/0.5 A                        | 250 V                           | 10 mm                          | N.O.        | plastic PA 6.6        | cable             |
| MA-45<br>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<br>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<br>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<br>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<br>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<br>85 x 24 x 26 mm    | 250 VA/5 A                         | 250 V                           | 16 mm                          | bistable    | plastic PBT           | cable<br>plug     |
| MA-42<br>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<br>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<br>PA 6.6   |                |               | MA-01, 45 x 9 x 13 mm<br>PA 6.6  |                |               | MA-45, 45 x 9 x 25.5 mm<br>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<br>PC  |                |               | MA-02, 80 x 15 x 20 mm<br>PA 6.6   |                |               | MA-02, 80 x 15 x 20 mm<br>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<br>-40°C...+150°C   | Temp. range<br>-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<br>PA 6.6  |                |               | MA-44, 80 x 15 x 30 mm<br>PA 6.6   |                |               | MA-32, 85 x 24 x 26 mm<br>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                  |

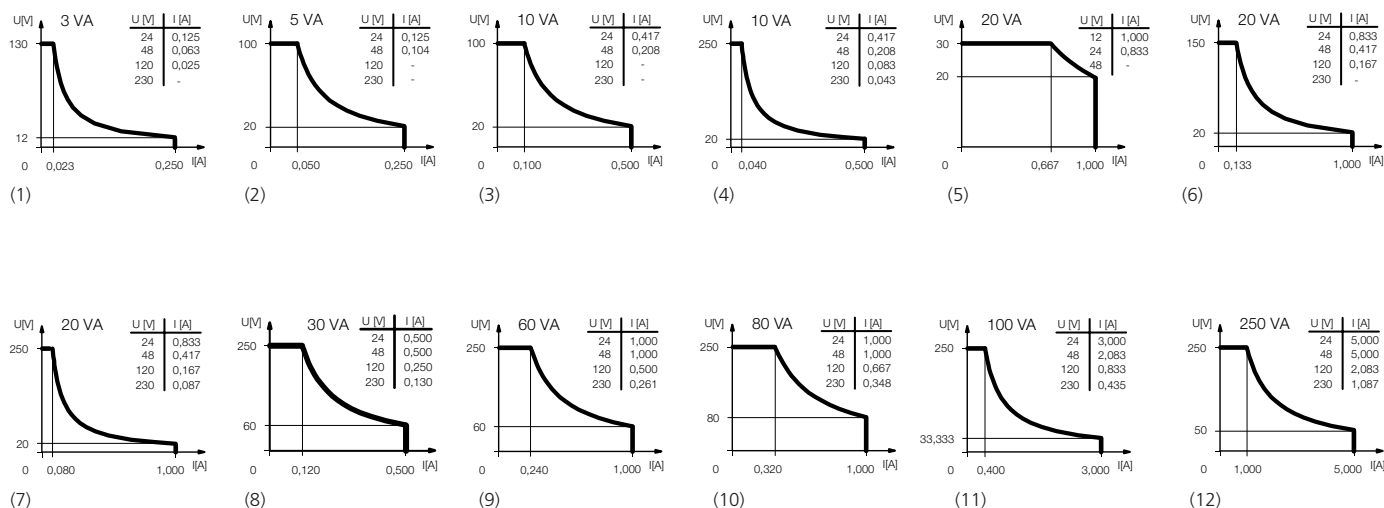
# Overview electromechanical magnetic switches in rectangular housings

| Rectangular housings            | MA-32, 85 x 24 x 26 mm<br>PBT   |                       | MA-42, 88 x 13 x 25 mm<br>PA 6.6   |                     |                     | MA-03, 100 x 29.5 x 58 mm<br>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<br>flat plug 6.3   | plug<br>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                     | <b>631.4432.612</b>   | <b>631.0432.590</b>   | <b>631.4242.533</b>  | <b>631.7342.535</b> | <b>631.0442.534</b> | <b>631.4203.232</b>   | <b>631.7303.312</b> | <b>631.9403.532</b> |

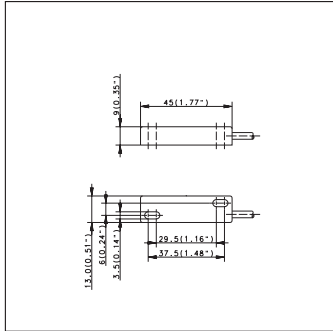
## Technical data standard versions electromechanical magnetic switches

|                                       |  |
|---------------------------------------|--|
| 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 <sup>8</sup> switching cycles |

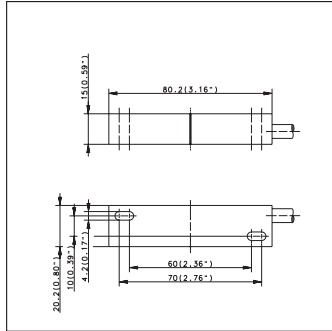
## Output diagrams electromechanical magnetic switches



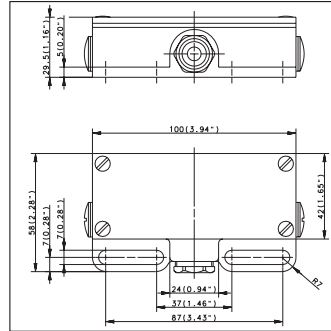
# Dimension diagrams magnetic switches



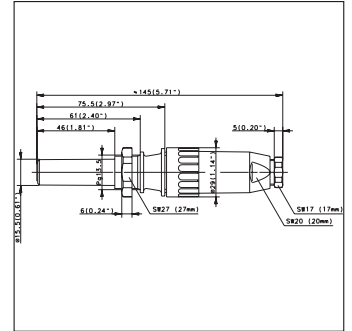
MA-01 Page 202



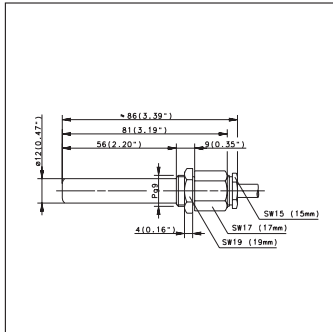
MA-02 Page 202



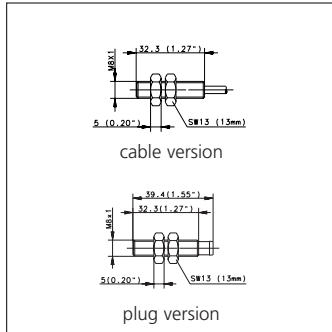
MA-03 Page 203



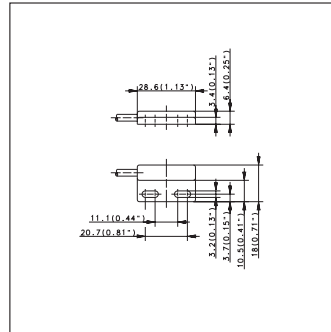
MA-04 Page 199



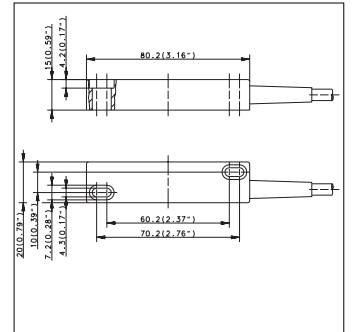
MA-06 Page 199



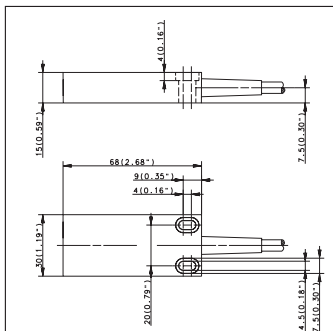
MA-08 Page 200



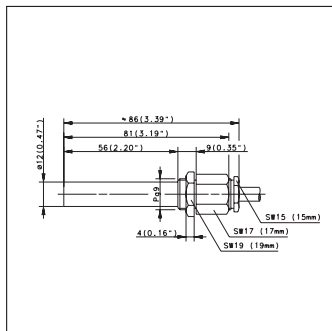
MA-11 Page 202



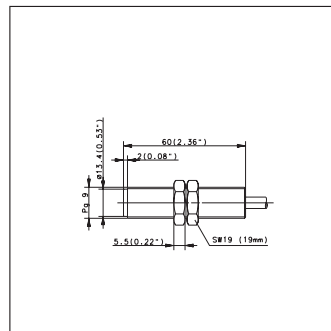
MA-12 Page 202



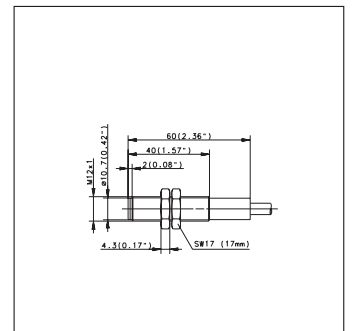
MA-13 Page 202



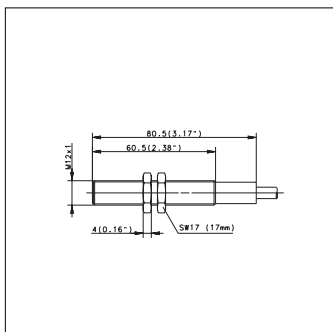
MA-16 Page 199



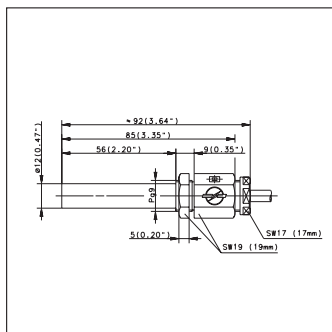
MA-17 Page 200



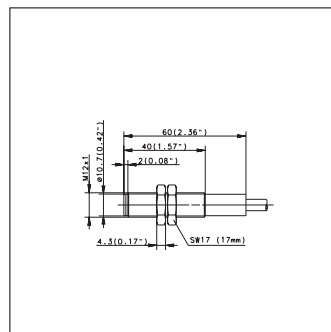
MA-18 Page 200



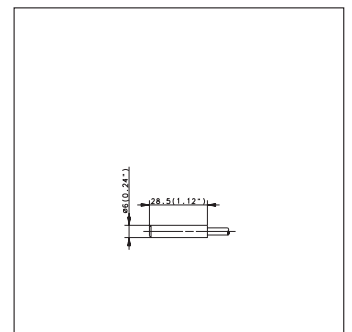
MA-23 Page 200



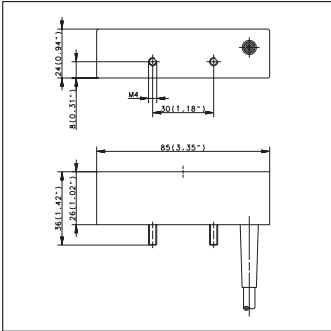
MA-26 Page 199



MA-28 Page 200

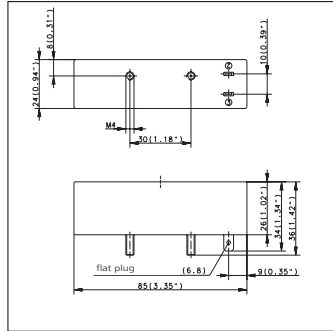


MA-30 Page 199



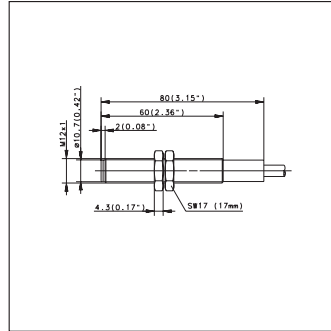
MA-32 (cable)

Page 202



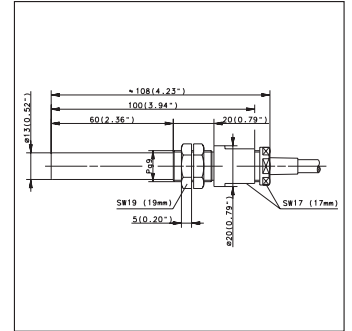
MA-32 (plug)

Page 203



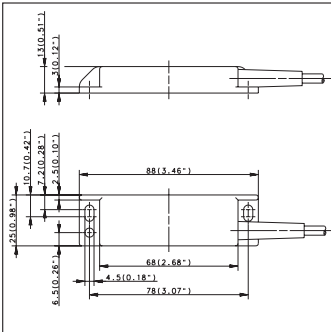
MA-33

Page 200



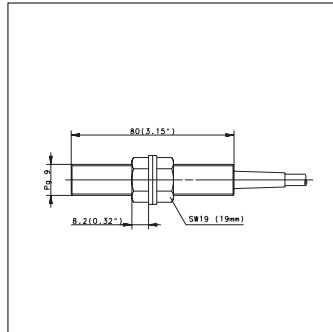
MA-36

Page 199



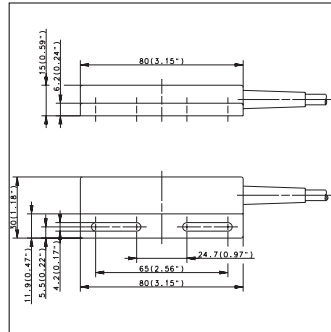
MA-42

Page 203



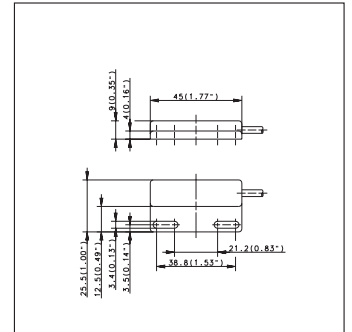
MA-43

Page 200



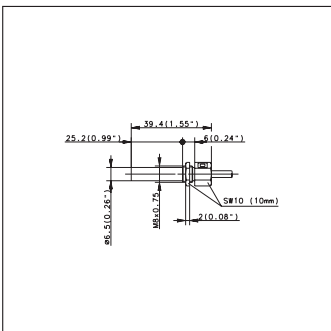
MA-44

Page 202



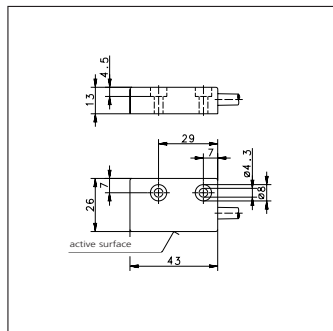
MA-45

Page 202



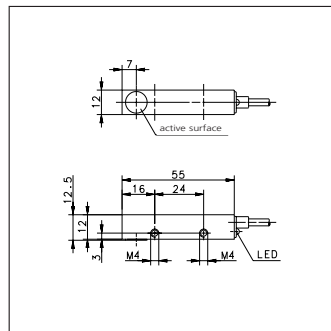
MA-46

Page 199



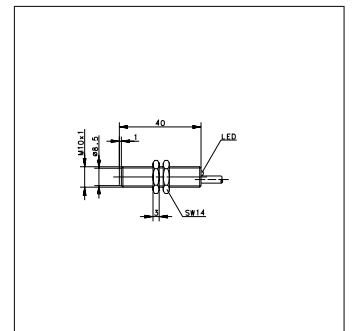
MA-52

Page 207



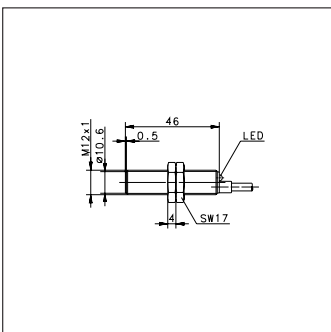
MA-55

Page 207



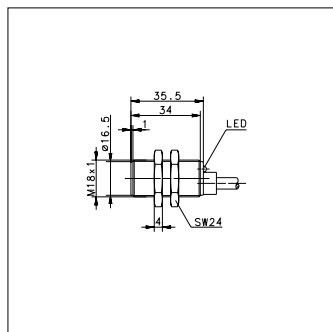
MA-61

Page 206



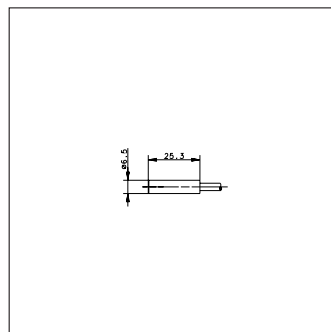
MA-62

Page 206



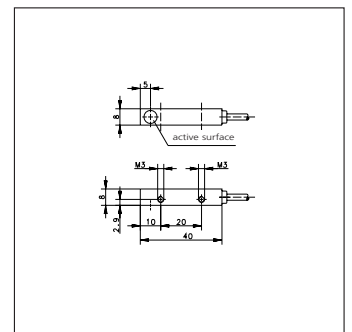
MA-63

Page 206



MA-70

Page 206



MA-80

Page 207