



User Manual

## MBA series

Rotating-paddle bin level indicators  
for bulk materials



## Impress

### User manual for the MBA bin level indicator series

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# 1 INTRODUCTION

## 1.1 Appropriate use

MBA bin level indicators are rugged electromechanical sensors, designed to detect the presence of bulk material at the place of installation and thus to control the filling of bulk materials containers.

Possible applications depend on the configuration of the individual unit. The variable features are, for example:

- Construction and size of the unit (= unit type)
- Size, shape, and material of the rotating paddle
- Material and construction of the rotating shaft
- The sealing between the housing and the rotating shaft
- Provided safety standard (e.g. explosion protection)
- Permissible operating temperatures

The corresponding properties for the unit can expand or restrict the range of possible applications (e.g. suitability for a particular type of bulk material). Please note carefully the specifications for your own particular unit.



### WARNING: Dangers from inappropriate use

- MBA bin level indicators are only to be installed and put into operation by technicians who are suitably qualified to carry out such work and are aware of the possible dangers.
- In addition to these instructions, compliance must be insured with all local regulations, technical rulings and company-internal instructions that are valid at the place of use.
- MBA bin level indicators may only be operated as it is described and specified in this manual. Otherwise the manufacturer's warranty is no longer valid, and the unit could be hazardous in use.



### DANGER: Danger of explosion

An MBA bin level indicator may only be used in explosion-hazardous areas if the individual specifications of the unit allow this (see the type and accompanying papers). In addition, check whether the specifications of the relevant official certification must be complied with.



You may not remove, add, or change any of the components in the instrument unless these changes are described and specified in an official information from the manufacturer. Otherwise the manufacturer's guarantee becomes invalid, and the official certification for use in explosion-hazardous areas is no longer valid.

## 1.2 Mode of functioning

### 1.2.1 Functional principle

An MBA bin level indicator consists of a monitor head and an extension arm:

- The monitor head contains the electrical and electromechanical components; it is attached to the outer wall of the bulk materials container.
- The extension arm protrudes into the container. It consists of a shaft with a paddle and, depending on the unit configuration, a protective tube and support bearings for the shaft.

The electric motor in the head makes the shaft and the paddle rotate slowly. When the bulk material surrounds the paddle, the rotation is blocked. The counter-torque is used to turn the motor mechanism against a switch which then turns the motor off. The switch has a second contact (potential-free) which is used for the status indication.

As soon as the bulk material releases the paddle again, a spring pulls the motor mechanism back into the working position. Thus the switch is released and the paddle starts rotating again.

### 1.2.2 Unit variations (options)

Please check the exact configuration of your unit on the basis of the accompanying papers. Your MBA bin level indicator can be equipped with additional functions:

- Special seal (DT, DTR): Protection against gases, vapours, and abrasive bulk materials.
- Pressure relief valve (D, D10): Allows use on containers with an internal pressure of up to +1 MPa (10 bar).
- Freewheel: A freewheel mechanism within the shaft drive prevents the unit from giving wrong indications caused by falling or swirling bulk material.
- Action monitoring: Provides additional electronics which monitor the internal switch contacts, the rotating movement, and the signal circuit. An additional signal contact is provided to output the error status.
- Time delay (only for AC models): The level status indication is triggered with a delay of approx. 5 seconds – optionally either when the paddle stops or else when the paddle starts rotating again.
- Internal heating for the head: Allows use with ambient temperatures down to -30 °C.
- Indicating light (lamp or LED): Indicates the current level status.
- Toggle switch: main switch for the MBA.

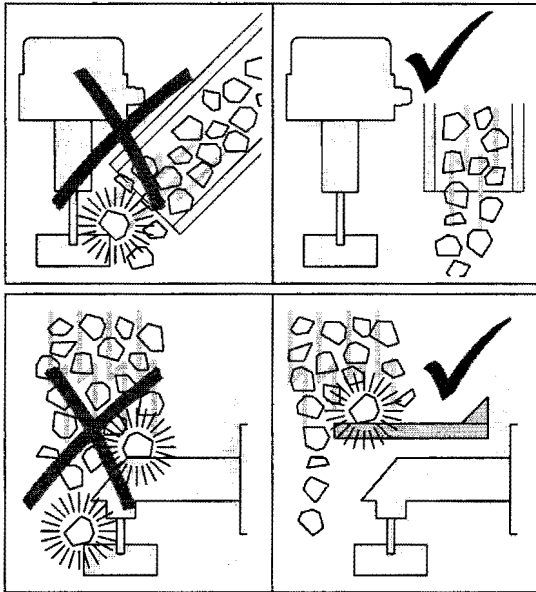
## 2 INSTALLATION

### 2.1 Protective roof/Deflector

#### Protection against the impact of bulk material

If at all possible, place the MBA unit in a position where falling bulk material will not directly strike onto the shaft or the paddle.

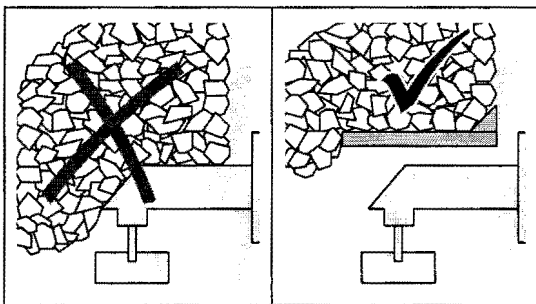
If required, install a stable deflector or protective roof in the container which protects the shaft and the paddle against direct impact of falling bulk material. This is highly recommended for heavy bulk materials that could damage the shaft or the paddle.



#### Protection against heavy loads

If the bulk material is heavy or can form large clumps:

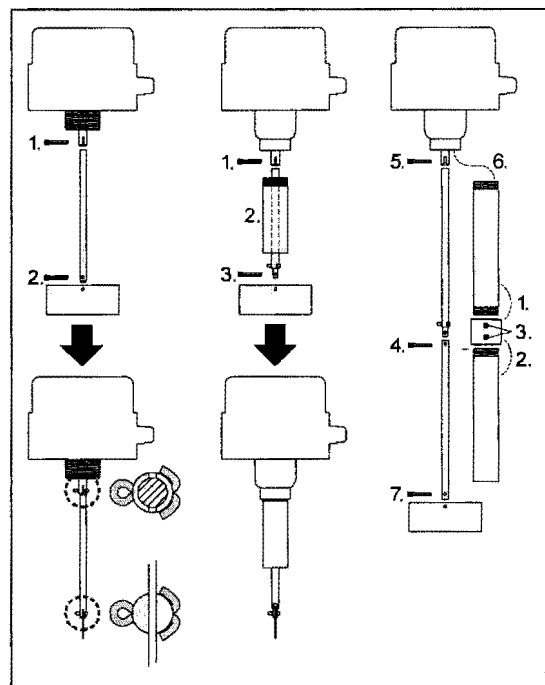
Install a stable protective roof within the container to shield the shaft (and the protective tube) from the weight of the bulk material. Provide sufficient space between protective roof and paddle to make sure that the bulk material can reach the paddle.



### 2.2 Assembly (if required)

If shaft and paddle and, if applicable, the protective tube were shipped in dismantled form to make transport easier:

- A) Install the shaft: Guide the smaller end of the shaft into the shaft joint of the housing. Use a split-pin to connect both parts (push it through and spread it out). – With two-part shafts: Join both parts of the shaft in the same way.
- B) Put together the protective tube (with two-part protective shafts): Take the locking screws out of the connecting coupling sleeve. Screw one of the protective tube parts into the coupling sleeve – up to about the middle of the coupling sleeve. Then screw-in the other part from the other side and firmly attach both parts of the protective tube. – Recommendation: Now make a small countersunk hole through the screw holes of the coupling sleeve into each part of the protective tube (using a metal drill of max. 3.2 mm diameter). – Put in the locking screws and tighten.
- C) Install the protective tube (for units with a protective tube): Undo the locking screw (2 mm Allen screw) in the coupling sleeve of the housing. Screw in the protective tube up to the stop and fix it in place with the locking screw.
- D) Shortening the cable (if required): Remove the tensioning weight from the end of the cable (undo the locking screw and pull out the cable). At the place where the cable must be cut, wrap some adhesive tape firmly around the cable, to protect against wire particles shooting from the cable. Wear protective goggles/glasses. Then cut the cable with a suitable wire cutter or a cutting disk. Remove the adhesive tape and attach the tensioning weight again.
- E) Install the paddle: Guide the flat end of the paddle into the slot of the shaft and attach it with the split-pin provided (push it through and spread it out).



- It may be necessary (or advantageous) to install the paddle at the very end of the installation procedure.
- Recommendation: Apply a threadlocking adhesive (such as »Loctite«) to all the locking screws.

## 2.3 Installation

### 2.3.1 Operational conditions

#### Pressure in the container

Standard configuration:	-50 ... +300 kPa (-0.5 ... +3.0 bar)
Configuration D10 (overpressure valve in the housing):	max. 1.0 MPa (10 bar)
In explosion-hazardous areas:	80 ... 110 kPa (0.8 ... +1.1 bar)

#### Ambient temperature

See the nameplate. Standard values: -20 ... +60 °C  
(-4 ... +76 °F).



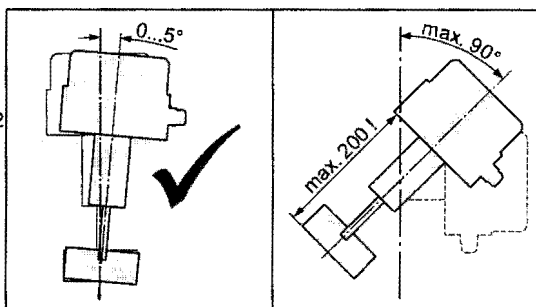
The suffix »Txxx« in the type designation (e.g. »MBA 5 T250«) relates to the temperature in the container and not to the permissible ambient temperature.

### 2.3.2 Installation position

#### Angle of inclination

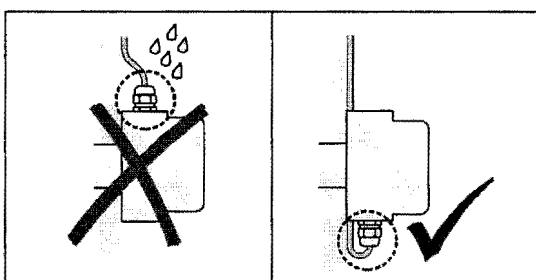
Units of types MBA 2, MBA 2.2, MBA 4, MBA 8, MBA 9 FL, and MBA 18 fundamentally may only be used with a vertically suspended shaft ( $\pm 5^\circ$ ). Exception: In the case of rigid shafts of up to 200 mm in length and with light bulk material, an angle of inclination of up to max. 90° is permissible (= side-mounting with horizontal shaft).

MBA 2  
MBA 2.2  
MBA 4  
MBA 5  
MBA 8  
MBA 18



#### Protection against the weather

If installed from the side (horizontal shaft), the unit must be installed in such a way that the cable glands are on the underside of the housing.



### 2.3.3 Attachment

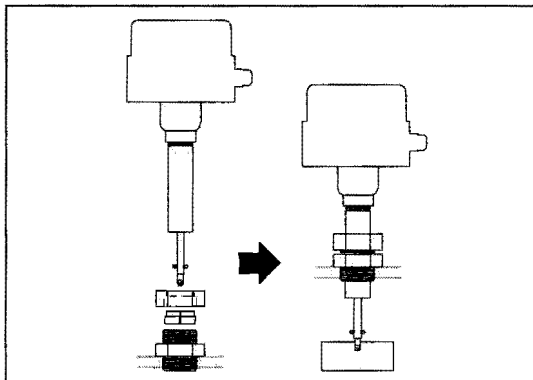
#### Standard configurations (except for MBA 20)

1. Make a hole for the extension arm in the wall of the container (suitable for the paddle or shaft / shaft supports / protective tube, depending on the model of the unit and the requirements). When using flange attachment, make four flange holes in addition. See »Technical Data« for the dimensional details.
2. Install the MBA housing / flange externally on the wall of the container. Insert a seal (against water and dust) between the container wall and the MBA housing / flange to meet the protection requirements of IP 65 (European standard EN 60529).  
A suitable sealing ring is already included in the scope of supply with the MBA 4, MBA 18, and MBA 19 FL.

#### Option »height adjustment«

Units with height adjustment are supplied with a special fitting which holds and fixes the protective tube at variable insertion depth:

1. Install the threaded part in the container wall.
2. Put the clamping nut and the clamping ring over the protective tube.
3. Guide the protective tube through the threaded part (caution: do not damage the sealing ring) and bring it into the desired position.
4. Screw-up and tighten the clamping nut.



#### MBA 20 (without protective cage)

1. In the bottom wall of the container, make a precision bore-hole that fits to the cylindrical part of the MBA housing (diameter matching MBA's sealing ring).
2. Near this bore-hole, install a pin (or similar) matching the hole in the MBA 20 chassis plate, to prevent it from turning.
3. Insert the MBA 20 into the bore-hole, then fix it with a nut on the bulk materials side.
4. Provide a suitable protective covering over the electro-mechanical part.



#### DANGER in the event of incorrect installation (only MBA 20)

The MBA 20 is designed as a built-in unit and thus has no housing. To ensure safe operation, an additional housing (or a similar form of protection) must be installed, in order to protect the mechanical parts from being touched, and to provide safe electrical condition. Selection and installation of these components is the responsibility of the user.

#### MBA 20 with protective cage

1. Make a suitably-sized circular cutout in the container wall.
2. Attach the plate of the protective cage to the inner side of the container.
3. Provide a suitable protective covering over the electromechanical part (on the outside).

## 2.4 Electrical connection



- MBA bin level indicators are provided with 4 different types of electronics. The accompanying papers will tell you which MBA model you have. Moreover, you can identify the model by comparing the wiring terminals inside the unit with the circuit diagrams.
- The circuit diagrams in this manual show the switching status when the paddle is rotating.



MBA's motor mechanism requires around 3 seconds to indicate stopping or restarting of the paddle (switching delay due to the mechanical sequence). For units with fast-rotating paddle (option), the delay is around 0.6 seconds.

There can be some more timing delays due to

- the characteristics of the bulk material
- torsion effects (e.g. cable shaft, rubber paddle)



### WARNING: Danger of destruction

Carefully observe the mains voltage specification on the nameplate. Overvoltages can immediately destroy internal electronic components.

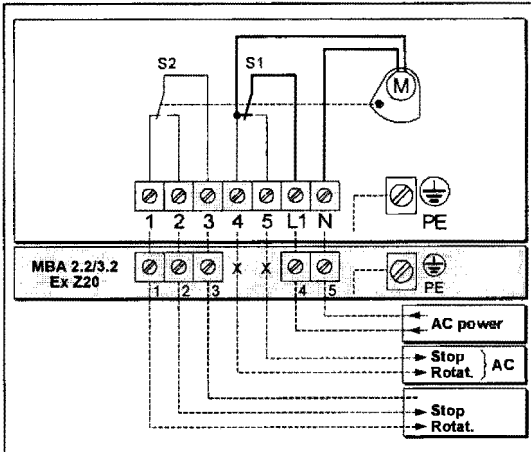


### Notes on protection against explosion

When the MBA used in explosion-hazardous areas:

- Only units whose specifications explicitly permit their use in such areas may be installed (see the accompanying papers and the nameplate).
- Only cable glands may be used which have been specifically approved (ATEX-certified) for use in the respective explosion-hazardous area.
- The cables must fit to the cable glands. The outer diameter of the cables must be 6 ... 12 mm.
- All connected cables must be fixed in place, i.e. the cables must be fastened down over their entire length.
- In addition to the protective earth (PE) connection, an equipotential bonding connection must be installed, using the terminal on the outside of the housing.

### 2.4.1 Standard version for AC



#### Status contacts

S1 and S2 are directly actuated by the motor mechanism. S1 carries the power supply; S2 is potential-free.

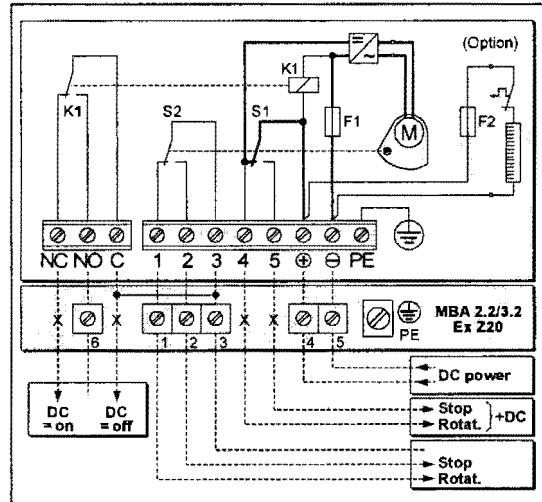
Permissible contact loadings:

AC:	250 VAC / 10 A
DC:	250 VDC / 0.25 A

#### Mains connection

Connect the mains supply line to terminals L1 and N (via an external fuse). Connect the protective earth (PE) conductor to the corresponding terminal in the housing.

### 2.4.2 Standard version for DC



#### Status contacts

S1 and S2 are directly actuated by the motor mechanism. S1 carries the power supply; S2 is potential-free. – K1 is activated when in an operational state and drops out if the power supply inside the unit fails.

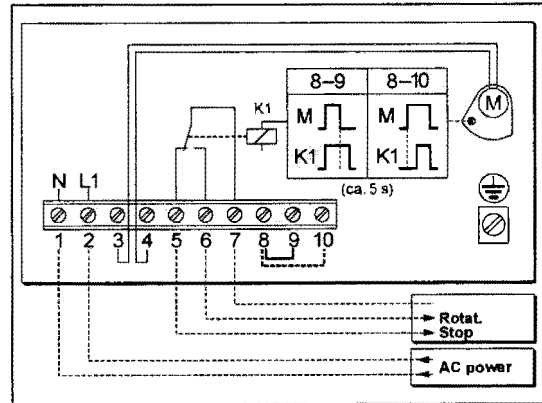
Permissible contact loadings:

AC:	250 VAC / 10 A
DC:	250 VDC / 0.25 A

#### Mains connection

Connect the power supply from the mains to terminals [+], [-] and PE (earth conductor).

### 2.4.3 Version with switching delay (option)



#### Status contacts

K1 follows the status of the motor mechanism, but with a delay of around 5 seconds – optionally when the paddle is stopping or when it starts rotating again:

- Terminals 8 and 9 connected = delay when switching off (when the paddle stops, i.e. for a »full« indication)
- Terminals 8 and 10 connected = delay when switching on (when the paddle is rotating again, i.e. for an »empty« indication)

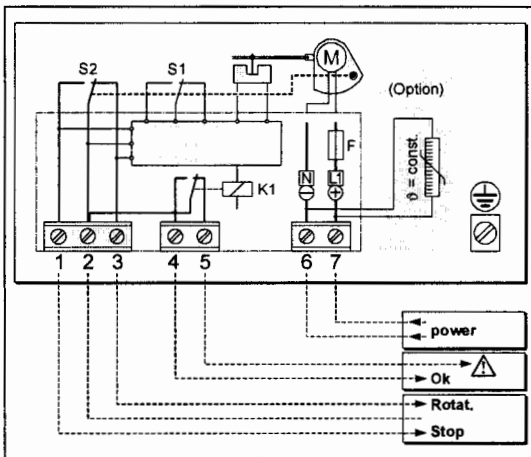
Permissible contact loadings:

AC:	250 VAC / 4 A
DC:	30 VDC / 5 A

#### Mains connection

Provide an external fuse in the mains supply. Connect the mains supply line to terminals L1 and N. Connect the protective earth (PE) conductor to the corresponding terminal in the housing.

## 2.4.4 Version with action monitoring (option)



### Status contacts

S2 is the signal contact for level indication and directly follows the status of the motor mechanism. S1 is used internally to switch-off the motor.

Error status contact K1 is activated when in the normal operating state. K1 drops out if an error is detected. A failure of the mains power supply is also indicated in this way.

Permissible contact loadings:

AC:	250 VAC / 4 A
DC:	250 VDC / 0.25 A

### Monitored functions

Internal function	Possible cause of the problem
Rotation of the paddle shaft	Defective motor/gearbox Broken motor coupling
Signal voltage at S2 (terminals 1–2 and 2–3) and	Defective external signal lamp Cable breakage Power failure
Switching status of S2 – as per the function selection –	Dirty contacts Sticking contacts Defective switching mechanism
Supply voltage	External fuse Defective cable

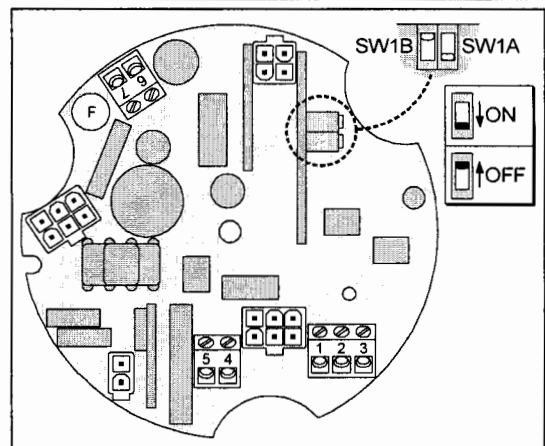
### Functions

- **Rotation:** The paddle shaft is equipped with a chopper plate which interrupts a light beam as it rotates. If the rotation stops although the filling status is »empty«, then the error status is indicated.
- **Switch contacts and external signal voltage:** This monitoring can be activated separately for the normally open and normally closed contact of S2. This device checks whether an external voltage of at least 3 V have been applied to terminals 1–2 or 2–3 respectively when the switch contact concerned is open. In addition, the actual status of the switch contact concerned is compared with the status of S1 (reference contact). If the external voltage is not present or if the switching status is not identical, then the error status is indicated. The error indication is triggered with a delay of around 5 seconds.

### Activation of switch contact monitoring

Monitoring of the internal switch contacts and the external signal voltage can be activated and deactivated as required, using the internal switches. ON = monitoring has been activated (see illustration).

Switch	activates monitoring by	Terminals
SW1A	normally open (make contact)	1–2
SW1B	normally closed (break contact)	2–3



The monitoring should only be activated if an external signal voltage (>3 V) is connected to the relevant switch contact at S2. Otherwise the error status will always be indicated when the switch contact is open.

### Mains connection

Connect the mains supply line to terminals L1 (= +DC) and N (= –DC). Connect the protective earth (PE) conductor to the corresponding terminal in the housing.

## 2.5 Closing the housing

### 2.5.1 Closing the cable glands

- Lay the connected cables internally in such a way that they do not interfere with the mechanism.
- After the cables have been installed, the cable glands must be closed-off to be dust-tight and spray-water resistant.
- Unused cable glands must either be blocked-off with stoppers or replaced with closing caps. If used in explosion-hazardous areas, these parts must have the corresponding official certification.

### 2.5.2 Closing the cover

- Before closing the housing, check whether there are any foreign bodies inside the housing (such as rests of cable). Remove them.
- Check whether the connected cables can interfere with the internal mechanism. Correct as necessary.
- Visually check the sealing of the housing cover. Clean or replace if necessary.
- Put the housing cover in place and screw it up tight.

## 3 FIRST START-UP

### 3.1 Switching on



**WARNING: Health hazard / risk from explosion**

The housing and the cable glands (if any) must be correctly closed during operation. Otherwise the specified type of protection or the specified explosion protection is not guaranteed.

### 3.2 Function test at first start-up

#### 3.2.1 Check the operative function

After the first start-up, check the indicating function:

1. Allow the paddle to rotate freely: check the »empty« indication.
2. Stop the paddle by hand: check the »full« indication.

#### 3.2.2 Check for triggering by the bulk material

**Procedure**

While visually watching the bulk material level, fill and empty the bulk materials container up to the MBA unit, and check that the indicating function is correctly triggered. This test should be made several times.

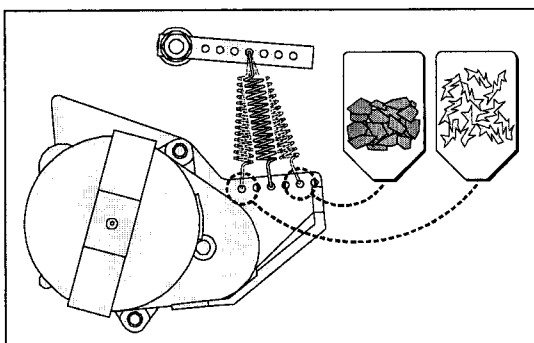
If the MBA unit does not correctly indicate the level status, check the options for mechanical adaptation (see below) and carry them out if necessary.



If the type of bulk material is changed, this test/adaptation must be done again.

**Possible ways of adapting the unit**

- Change the paddle:
  - To make it more sensitive (for lighter bulk material): Install a bigger paddle.
  - To make it less sensitive: Install a smaller paddle.
- Changing the lever arm of the spring (see illustration):
  - To make it more sensitive (for lighter bulk material): Bring the spring to a position closer to the shaft (= shorter lever arm).
  - To make it less sensitive: Bring the spring to a position further from the shaft (= longer lever arm).
- Changing the spring: If required, install a stronger or weaker spring (3 different types available).



## 4 MAINTENANCE

### 4.1 Recommended maintenance work

- Clean the moving external parts: Clean off deposits and dirt on paddle and shaft, using a (soft) scraper and/or a brush. Do not use force. Caution: Do not damage the shaft sealing. Do not allow bristles to get between the shaft and the shaft sealing.
- Clean the protective tube (if there is one): As a preventive measure, clean the inside of the protective tube to make sure that the shaft can always rotate freely. – Tip: If the unit is equipped with a purge gas connection at the external part of the protective tube, simply blowing compressed air through it may be adequate.
- Inspect the parts subject to wear (highly recommended in case of abrasive bulk material): Make a visual inspection of the parts that protrude into the container (shaft/cable, paddle, etc.). Pay special attention to the connecting parts (split-pins, etc.). Replace any damaged or dubious parts.

### 4.2 Preventive function check

If the indicating function is seldom triggered during operation (e.g. if the MBA is used as a safety switch):

1. Inform the connected stations that a test will be carried out.
2. Stop the paddle by hand and allow the paddle to rotate freely, and check the correct triggering of the indicating function.

### 4.3 Safety information on opening



**WARNING: Health hazard / risk from explosion**

Before opening the housing:

- Turn off the mains power supply at an external point. (Attention: The indicating function of the MBA is thereby disabled.)

In addition, in explosion-hazardous areas:

- Isolate the MBA from all external voltages (e.g. signal voltages). Exception: Connections to intrinsically-safe power circuits can remain.

Only open the housing when you are absolutely sure that there is no possible danger.



Protect the inside area to prevent it from getting dirty (e.g. from swirling sand or dust). Severe dirtiness can affect the proper functioning of the unit.

### 4.4 Spare parts

**Fuses for the electronic fuses**

Specifications	Part number
F 200 mA TR5	025726
T 250 mA TR5	025974
T 2.5 A TR5	026353



**WARNING: Danger of damage**

The replacement fuses must match the originals in the unit exactly (construction, turning-off current, characteristics).

**Other components**

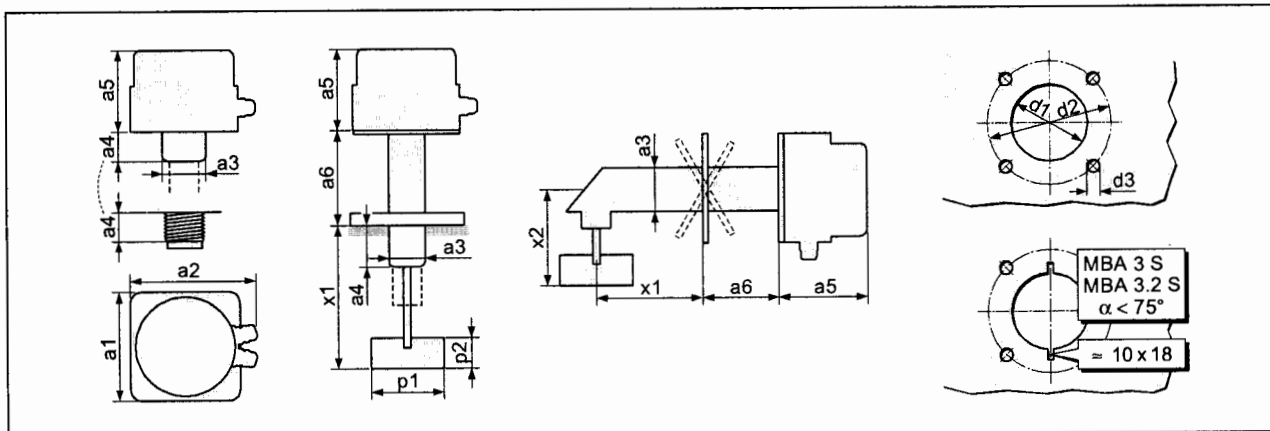
Please enquire for other spare parts.



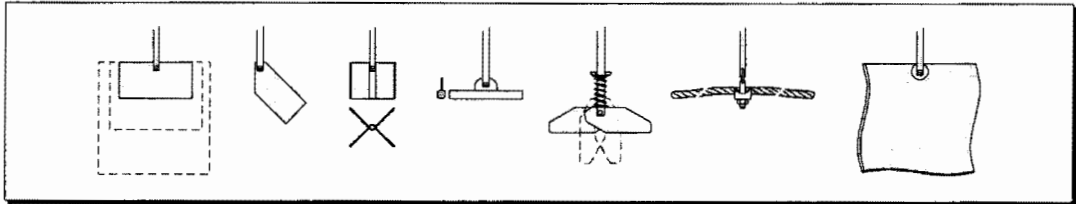
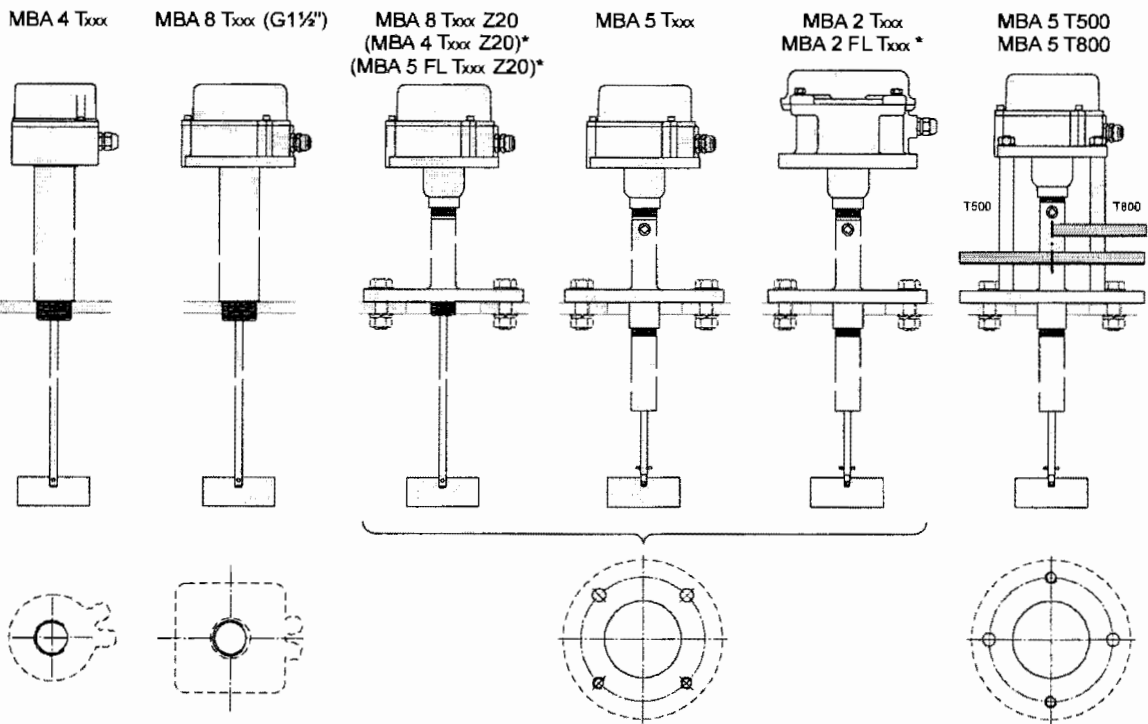
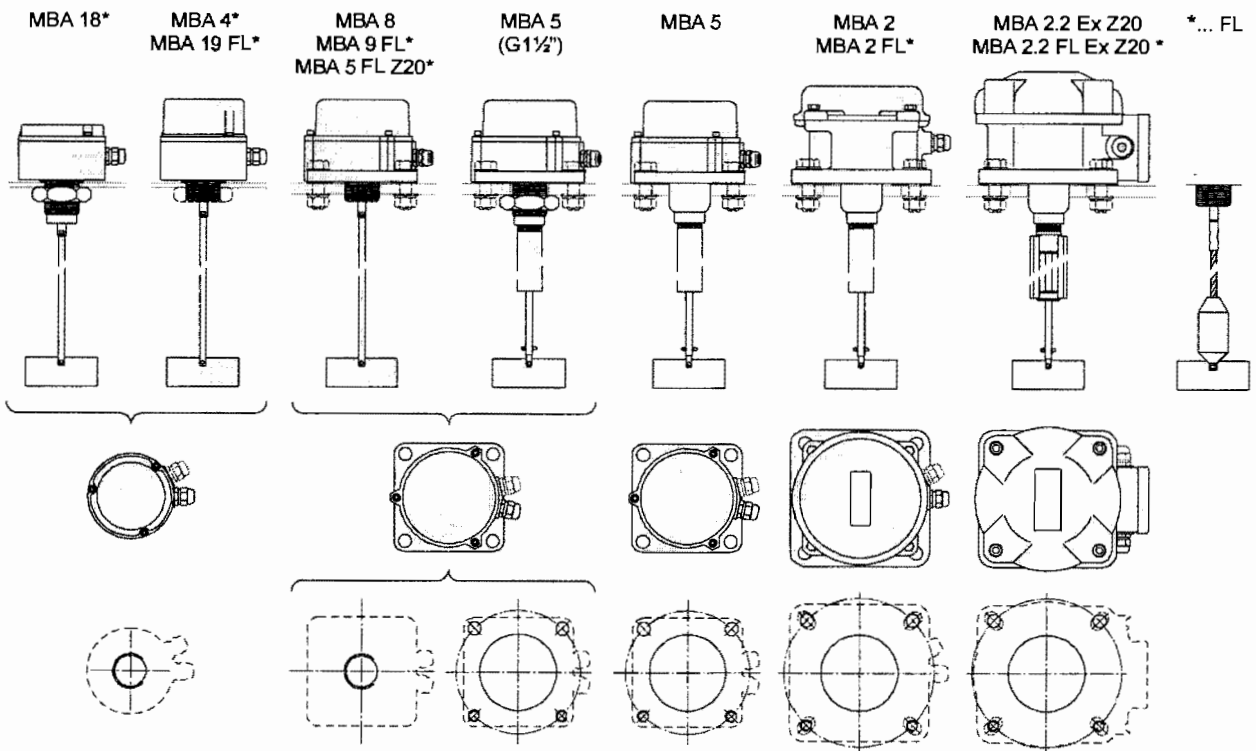
# 5 TECHNICAL DATA

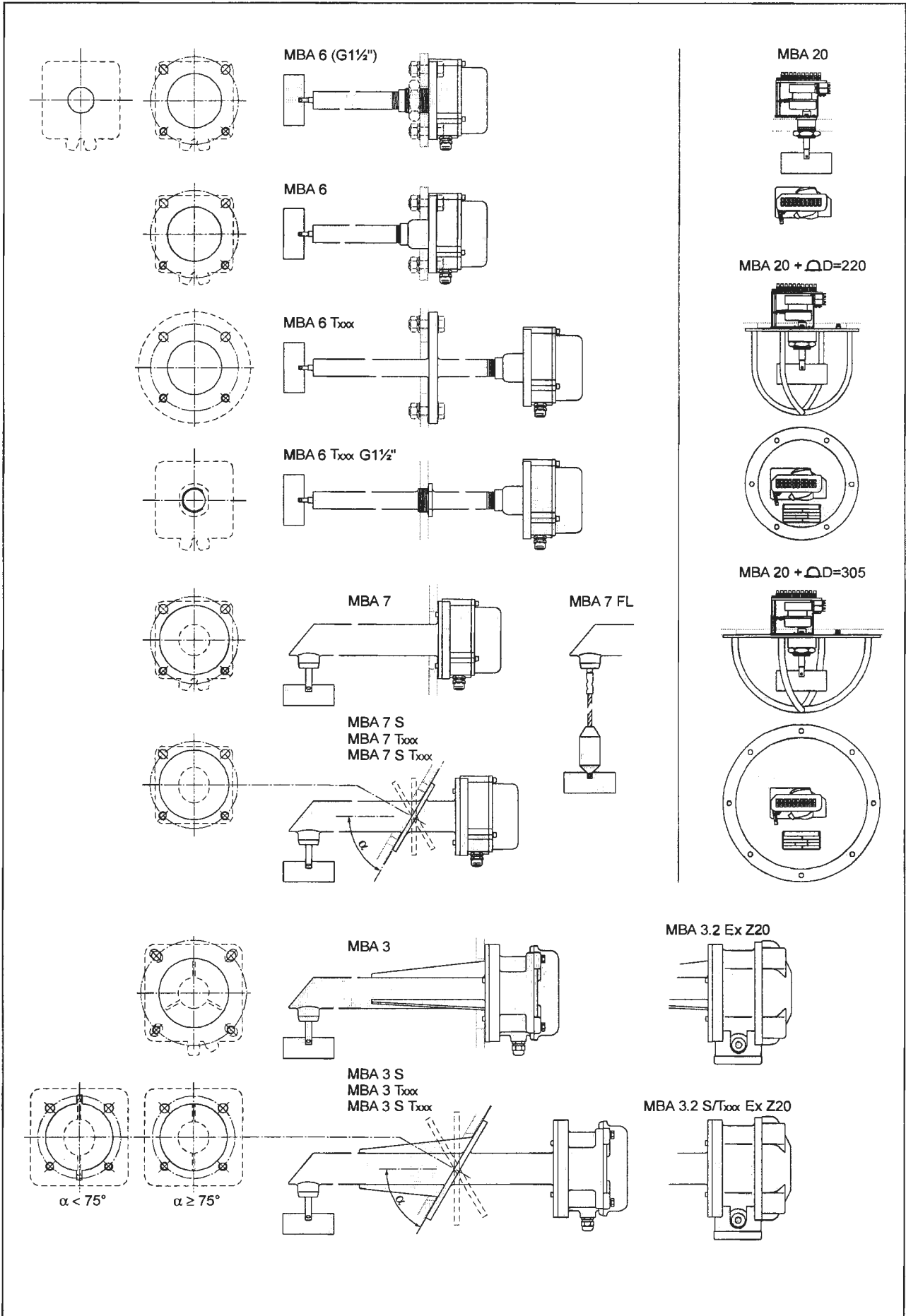
Mains voltage: see nameplate  
 Tolerance: ±15 %  
 Mains frequency (AC): 50 / 60 Hz

Power consumption: 4 VA  
 Response delay: approx. 3 s (fast-rotating version: approx. 0.6 s)  
 Ambient temperature: -20 ... +60 °C  
 Dimensions: see table  
 Further technical data: see data sheet



	a1	≈a2	a3	a4	a5	a6	d1	d2	d3	x1	x2
MBA 2	□189	≈220	55	-	134	-	∅105	∅205 ±5			
MBA 2 FL	□189	≈220	G1½"	30	134	-	∅105 / G1½"	∅205 ±5 / -			
MBA 2 Txxx	□189	≈220	41	-	134	191	∅105	∅170	∅18 / M16	var.	-
MBA 2 FL Txxx	□189	≈220	G1"	18	134	191	∅105	∅170			
MBA 2.2 Ex Z20	□202	235	55	-	153	-	∅105	∅205 ±5			
MBA 3	□189	≈220	61	-	142	-	∅135	∅205 ±5	∅18 / M16	var.	-
MBA 3 S							α ≥75°: ∅130				
MBA 3 Txxx	□189	≈220	61	-	142	192	∅130	∅160	∅15 / M14	var.	125
MBA 3 S							α <75°: ∅130 + 2x □				
MBA 3 S Txxx											
MBA 3.2 Ex Z20	□202	235	61	-	161	-	130	∅205 ±5	∅18 / M16	var.	-
MBA 3.2 S Ex Z20							α ≥75°: ∅130				
MBA 3.2 Txxx Ex Z20	□202	235	61	-	161	192	∅130	∅160	∅15 / M14	var.	125
MBA 3.2 S Ex Z20							α <75°: ∅130 + 2x □				
MBA 3.2 S Txxx Ex Z20											
MBA 4	∅118	≈150	G1½"	29	113	-	∅49 / G1½"	-	-		
MBA 4 Txxx Z20	∅118	≈150	G1"	18	113	191	∅105	∅170	∅18 / M16	var.	-
MBA 4 T200	∅118	≈150	G1½"	29	113	200	G1½"	-	-		
MBA 4 T500	∅118	≈150	G1½"	29	113	302					
MBA 5	□150	≈180	55	-	113	-	∅105	∅170			
MBA 5 (G1½")	□150	≈180	G1½"	46	113	-	∅105 / G1½"	∅170 / -			
MBA 5 FL Z20	□150	≈180	G1½"	29	113	-			∅18 / M16	var.	-
MBA 5 FL Txxx Z20	□150	≈180	G1"	18	113	191	∅105	∅170			
MBA 5 T250 / T350	□150	≈180	41	-	113	191					
MBA 5 T500 / T800	□150	≈180	41	-	113	200					
MBA 6 (G1½")	□150	≈180	G1½"	46	113	-	∅105 / G1½"	∅170 / -			
MBA 6	□150	≈180	55	-	113	-	∅105	∅170	∅18 / M16	var.	-
MBA 6 T250 / T350	□150	≈180	34	-	113	117					
MBA 6 Txxx G1½"	□150	≈180	G1½"	20	113	117	G1½"	-	-		
MBA 7	□150	≈180	61	-	113	-					
MBA 7 S	□150	≈180	61	-	113	-					
MBA 7 Txxx	□150	≈180	61	-	113	200	∅135	∅170	∅18 / M16	var.	125
MBA 7 S	□150	≈180	61	-	113	-					
MBA 7 S Txxx	□150	≈180	61	-	113	-					
MBA 8	□150	≈180	G1½"	-	113	-	∅105 / G1½"	∅170 / -			
MBA 8 Txxx Z20	□150	≈180	G1"	18	113	191	∅105	∅170	∅18 / M16	var.	-
MBA 8 T200	□150	≈180	G1½"	29	113	200					
MBA 8 T500	□150	≈180	G1½"	29	113	302					
MBA 9 FL	□150	≈180	G1½"	29	113	-	∅105 / G1½"	∅170 / -	∅18 / M16	var.	-
MBA 18	∅118	≈150	G1½"	50	80	-	∅49 / G1½"	-	-	var.	-
MBA 19 FL	∅118	≈150	G1½"	29	113	-	∅49 / G1½"	-	-	var.	-
MBA 20	72	108	34/G1"	37	91	-	∅34 H9	-	-	106	
MBA 20 + ∅D=220	∅220	-	-	-	87	-	∅172	∅195	∅9 / M8	var.	-
MBA 20 + ∅D=305	∅305	-	-	-	87	-	∅257	∅280	∅9 / M8	var.	-







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