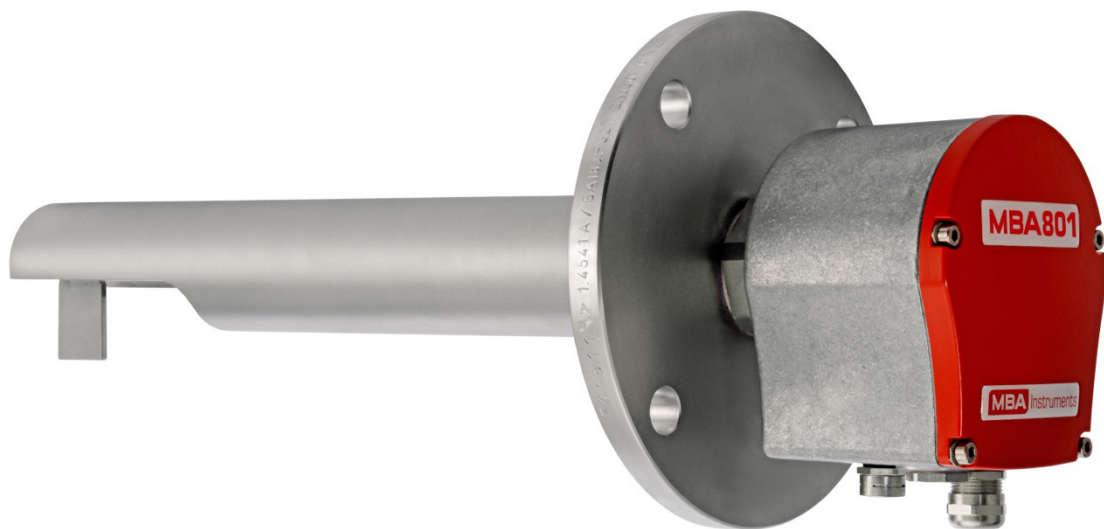


Digital swinging paddle MBA801 Halfpipe

OPERATING INSTRUCTIONS



Product name:	MBA801
Variations:	MBA811, MBA821
Version:	1.0
Dated:	12.2018
Language:	English

Keep these operating instructions for future use and make sure that the operating instructions are always available at the machine.

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Document information

Document identification

Title: SWINGING PADDLE PRODUCT SERIES MBA801
 Order number: 8011756
 Version: 1.0
 Dated: 12-2018

Described product

Product name: MBA801
 Variations: MBA811, MBA821

Manufacturer

MBA Instruments GmbH
 Friedrich-List-Straße 3-7 · D-25451 Quickborn

Warranty information

The given product characteristics and technical data do not constitute a declaration of warranty.

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Meaning of the warning symbols



General danger



Danger from electrical voltage



Danger in potentially explosive areas



Danger due to high temperature or hot surfaces

Warning levels

WARNING

Risk or hazardous situation which could result in severe personal injury or death.

CAUTION

Hazard or unsafe practice which could result in personal injury or

property damage.

Explanation of the information symbols



Important technical information for this product.



Important information on electrical or electronic functions



Supplemental information



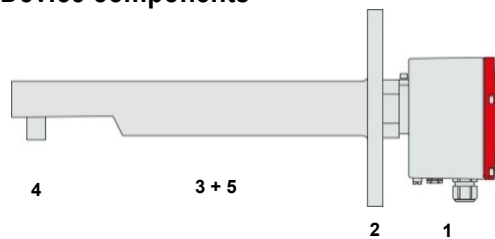
Tip

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1 Product description

1.1 Device components



- 1 *Unit head*: Contains the drive system and electronic components.
- 2 *Process connection*: thread or flange. Attached to the outer wall of the bulk material container.
- 3 *Shaft*: Connects the paddle to the unit head.
- 4 *Paddle*: Stops the shaft when the bulk material surrounds the paddle.
- 5 *Protective tube*: Covers the shaft inside the bulk material container.

1.2 Principle of operation

A stepper motor in the unit head makes the shaft and paddle rotate slowly. When the paddle hits the wall of the protective tube, the "halfpipe", the direction of rotation changes. That way the paddle swings below the half-open protective tube from wall to wall. When the bulk material surrounds the paddle, the turning movement is blocked in both directions and signalled by a switch contact. When the bulk material releases the paddle again, the status signal is deactivated and the paddle continues to rotate.



- The torque and response behaviour can be adapted to the application case (→ page 11, §2.6).
- The function mode with a reversal of direction is very well suited for moving bulk materials (e.g. for reliable detection of backing-up).

1.3 Product variations

- MBA811: Version for grid voltage (115...230 V AC) and 24 V DC.
- MBA821: Version for 24 V DC.

1.4 Optional equipment

- *Display lamp*: Indicates the current status. (not in potentially explosive area)
- *Compensating membrane*: Moisture and pressure compensating membrane on the unit head; safety requirement for operation on containers with high pressure inside (option "10 bar").

1.5 Appropriate use

Application area

Level indicators of series 801 are robust electromechanical sensors to detect the presence of bulk material at the place of installation. They are designed to monitor the filling of a bulk material container. Possible applications depend on the configuration of the individual unit.

Bin level indicators of MBA800 series 1 can be used with industrial bulk materials from organic and mineral substances. The unit must not be affected by chemically aggressive gases or fluids.



CAUTION: risk of explosion

A level indicator of type 801 may only be used in potentially explosive locations if the individual specification of the unit complies with this use.

- ▶ Check rating plate and accompanying papers.
- ▶ The requirements of the EC type examination certificate must be observed.

Design options

Variable design features are, for example:

- paddle size, shape and material
- material and construction of the rotating shaft
- sealing between the housing and rotating shaft

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 observe the individual specifications of the delivered unit.

1.6 Responsibility of the user

- ▶ Use the device only as described in these Operating Instructions. The manufacturer assumes no responsibility and no warranty for any other use.
- ▶ In addition to these Operating Instructions, follow all local laws, technical rules and internal company operating directives applicable at the respective installation location of the unit.
- ▶ No components may be removed from, added to or changed on the unit unless this is described and specified in the official manufacturer's information.
- ▶ *In potentially explosive areas*: Prior to installation and operation, observe the European standard EN 60079-14.



EN 60079-14: Electrical apparatus for use in the presence of combustible dust – Part 14: Selection and installation

Product versions which are certified for use in potentially explosive locations have been tested and approved according to 60079-0 and EN 60079-31.

1.7 Safety information for use in potentially explosive areas

- A level indicator of type MBA801 may only be used in potentially explosive locations if the individual specification of the unit complies with this use.
- Do not open when it is under voltage.
- After switching it off, wait 40 minutes before opening it.
- The temperature at the wire branching point can be up to 80 °C. Only harmonised cable may be used.
- A melting fuse with a circuit-breaking capacity of at least 1500 A must be connected ahead.
- Check the unit based on the rating plate and delivery slip in connection with the certification (ATEX).
- An approved unit bears the following marking:
II 1/2 D Ex ta/tb IIIC T100°C Da/Db
- The EC type examination certificate is an integral part of the Operating Instructions.
- Observe the regulations of the approvals
- Install a potential equalisation connection
- Prevent sparking from striking metal parts.
- Carry out the installation in accordance with the standard EN 60079-14.
- Observe zone separation (see Use section).
- Only perform the electrical installation in a suitable terminal housing.
- For process temperatures above +80 °C, suitable measures must be taken to ensure that the housing temperature at the transition from the shaft housing to the electronics box does not exceed +50 °C.

Responsibility of the user

- Use the device only as described in these Operating Instructions. The manufacturer assumes no responsibility and no warranty for any other use.
- In addition to these Operating Instructions, follow all local laws, technical rules and internal company operating directives applicable at the respective installation location of the unit.
- Observe the specifications in connection with the voltage and temperature on the rating plate.

Use

The MBA801 is used as a level detection switch for all types of bulk materials. The unit must only be used for permanent installation in industrial plants (large tools). The unit is designed for zone 21. Furthermore, the shaft end and paddle can be introduced in zone 20 if the process connection is installed in a partition wall and there is adequate seal tightness from the installation. The seal tightness of the process connection in terms of zone separation was not tested during the course of the EC type examination and must be ensured by the user.

Conformity:

Explosion protection, general requirements

EN 60079-0 :2012+ A11:2013

Equipment dust explosion protection by enclosure "t"

EN 60079-31:2014

EMC:

EN 61000-6-4: Sept. 2011 (industrial area)

EN 61000-6-2: March 2006 (industrial area)

Vibration:

IEC 60068-2-6, IEC 60068-2-27

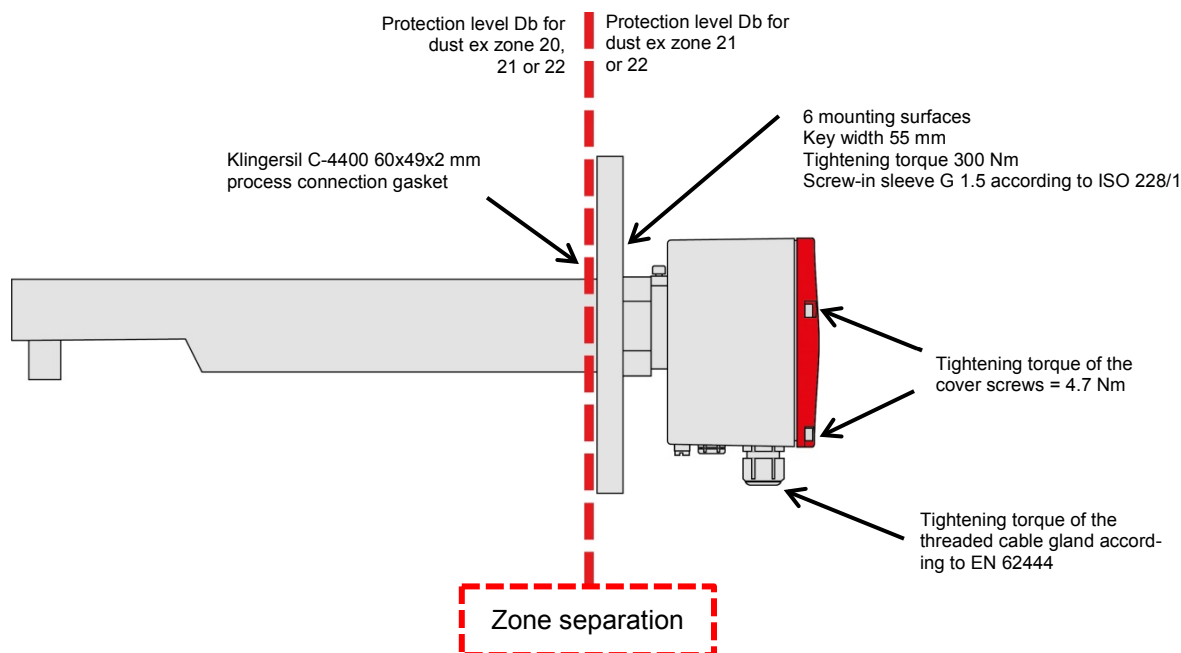
Low voltage:

EN 61010-1: 2011

2 Installation



No components may be removed from, added to or changed on the unit unless this is described and specified in the official manufacturer's information. Otherwise the any warranty of the manufacturer becomes invalid, and the approval for use in potentially explosive locations (if provided) is no longer valid.



2.1 Installation

2.1.1 Operating conditions

- ▶ Observe the temperature specifications on the rating plate (example → page 10, § 5.2, explanations → page 4, § 1.5).
- ▶ Keep the following pressure limits:

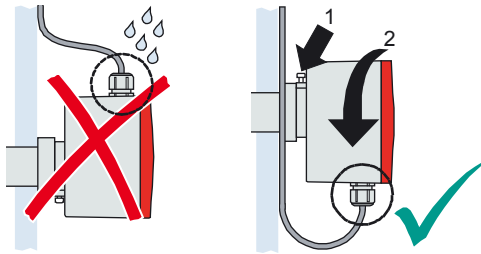
Standard version:	-50 ... +300 kPa (-0.5 ... +3.0 bar)
Design "D10"	max. 1.0 MPa (10 bar)
In potentially explosive areas:	80 ... 110 kPa (0.8 ... +1.1 bar)

2.1.2 Installation position

Devices of the MBA801 "Halfpipe" series can only be installed horizontally.

- ▶ *For side installation (horizontal)* Install the unit in such a way that the cable connections are on the underside of the housing.

The unit head can be turned (2) after the clamping screw (1) on the underside has been released.



In operating condition, the clamping screw must be fixed.

2.2 Fastening

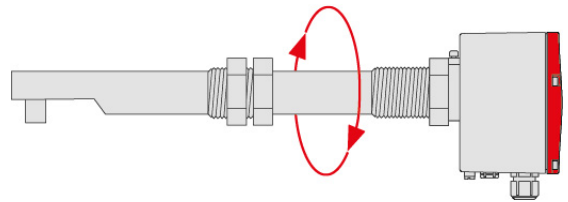
2.2.1 Standard versions

- ▶ Attach the MBA process connection to the container. (dimensions → page 11, § 5.6).
- ▶ *For protection class IP 65 (EN 60529):* Provide a suitable water/dust seal between unit and container.

2.2.2 Positioning aid (halfpipe)

After the installation, make absolutely sure that the protective tube is correctly aligned with the paddle. A marking is put on the housing head for this. It must point up vertically. Mount the clamp-ring fitting or alternatively the flange with the clamp-ring fitting on the container.

- Orientate yourself around the marking on the outside in order to align the halfpipe correctly.
- Mount the clamp-ring fitting or alternatively the flange with the clamp-ring fitting on the container.
- Put the coupling nut and the clamping ring of the clamp-ring fitting over the protective tube.
- Guide the protective tube through the compression fitting (caution: do not damage the sealing rings inside the fitting) and bring it into the desired position.
- Guide the clamping ring into the fitting. Screw-up and tighten the clamping nut.



2.3 Temperatures of the distance tube

Unit versions for container temperatures above 80 °C are equipped with a distance tube between unit head and connection thread/flange. The purpose of the distance tube is to keep high temperatures away from the unit head (max. 60 °C).

- ▶ If the container is equipped with thermal insulation: Keep the entire length of the distance tube free of thermal insulation, in order to allow cooling by the ambient air. Do not cover the distance tube with the insulation of the container. Otherwise the distance tube will not provide the required cooling effect and the unit head could overheat. The consequence is a loss of the function, damage.



WARNING: Risk of Injury

The distance tube is possibly hot enough to burn skin immediately when touched.

- ▶ *If the container is hot:* Protect the distance tube against accidental touching.



WARNING: Risk of explosion from dust deposits

The surface temperature of the distance tube can be significantly higher than the unit head temperature.

- ▶ Check if the dust-explosion limit value can be exceeded when the surface of the distance tube is covered with dust due to the high temperature of the distance tube.
- ▶ If this hazard exists: Make sure that the distance tube cannot be contaminated with dust, or that the dust is periodically removed as a preventive measure.

2.4 Electrical connection

2.4.1 Safety notes for the installation



CAUTION: Exposed contacts inside the unit

The electrical contacts inside the unit are not protected against accidental contact.

- ▶ Before opening the unit head, shut off the mains power supply and all connected signal voltage.



- ▶ Have the unit installed and put into operation by specialists who can carry out this work properly and are familiar with possible dangers.



The unit has neither a mains switch nor mains fuse.

- ▶ Install an isolating switch in the supply voltage line which can switch the mains power supply off.
- ▶ Install an external fuse for the supply voltage (power consumption → page 12, §5.3).

2.4.2 Power cord

- ▶ Use a power cord with the following conductor cross sections:
 - Solid conductor: max. 2.5 mm²
 - Stranded conductor: max. 1.5 mm²
- ▶ Use cables that are specified for an ambient temperature of at least 80 °C
- ▶ Protect all cables against heat. Avoid contact with hot surfaces (for example, the container wall). Consider thermal radiation and heat accumulation.

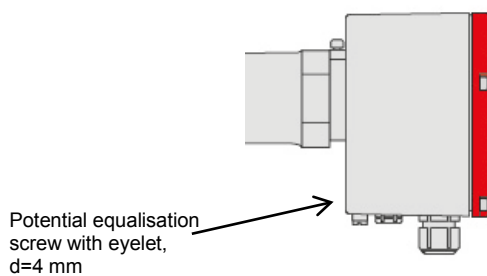
2.4.3 Protection against explosion



WARNING: risk of explosion

If the unit is used in a potentially explosive location, the following criteria must be observed:

- ▶ *Approval:*
 - Check if the unit is suitable for use in potentially explosive locations based on the rating plate and delivered documents.
 - Observe the “special conditions” which are specified in the approval.
- ▶ *Potential equalisation:* In addition to the protective earth connection (PE), install a potential equalisation connection. Use the terminal on the outside of the unit head for that purpose.



▶ *Housing temperature:*

For process temperatures above 50°C, suitable measures must be taken to ensure that the housing temperature at the transition from the shaft housing to the electronics box does not exceed 50°C. The unit may also be used at higher process temperatures if suitable measures are taken to ensure that the temperature of the shaft housing does not exceed the temperature given above. If the housing temperature of 50 °C cannot be complied with due to higher process temperatures, then suitable cooling measures (e.g. a cooling zone) must be taken.

▶ *Cable:*

Use only cables that are suitable for the cable glands. For standard versions of the unit, the outer diameter of the cables must be 7 ... 12 mm.

▶ *Permanent installation:*

Permanently install all connected cables, which means secure the cables along the entire length.

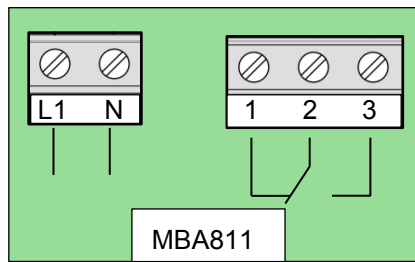
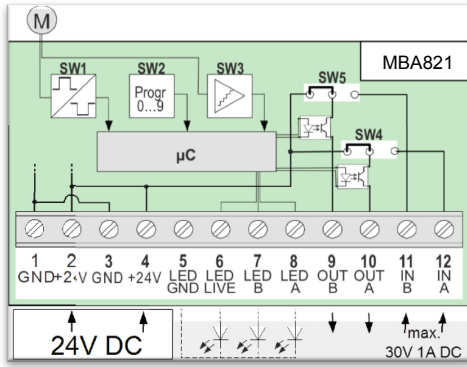
▶ *Sparks:*

Prevent the generation of sparks in the container. Sparks can be generated when the shaft or the paddle collides with metal parts. For units equipped with a flexible cable shaft, sparks could be produced when the shaft cable swings and the paddle collides with the container wall.

▶ *Installation standard:*

Carry out the installation in accordance with the standard EN 60079-14.

2.5 Wiring diagram



- L1 115 .. 230V AC operating voltage
- N 0
- 1 Switch contact NC (normally closed)
- 2 Main contact
- 3 Switch contact NO (normally open)

2.5.1 With M12 plug connector

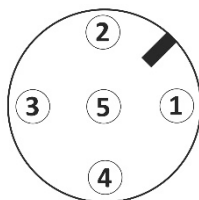
A 5 pin M12 coupling with A coding is required for the electrical connection.



- The cable must be permanently installed.
- Only connect and remove the connector voltage-free.
- After connection of the connector, the unit must be mounted in the locking clip.

Assignment of the coupling

PIN	Description		Terminal
1	Operating tension	24 V DC ± 10 %	2
2	Output signal	0/24 V	10
3	GND	0 V	1
4	Operating status	0/24 V DC	11



Locking clip

The locking clip prevents the connector from being removed unintentionally. To install it, place both ends around the connector and press them together until both halves snap into place.

2.5.2 Connect supply voltage

MBA811:

Connect the supply voltage 115 V ... 230 V 50/60 Hz to terminals "L1" and "N" or 24 V DC to "+24V" and "GND".

MBA821:

Connect the supply voltage to terminals "+24V" and "GND".



- Specification of the supply voltage – page 12 §5.3



There are two connection terminals so that the supply voltage can be forwarded from here ("looped").

2.5.3 Connect output signals

If inductive DC voltage loads are switched with the signal output, e.g. relays or electric motors, then the signal output must be protected against voltage spikes by a suppressor diode.

Function of the output signals

Output	Function	Output signal
OutA	Level status ¹	<i>If activated:</i> Supply voltage or InA ²
OutB	Operation	Supply voltage or InB ²

¹ Optionally "full" or "empty" (→ page 11 §2.6.1).

² Optionally (→ §2.6.4).

Reference potential of the output signals

The reference potential (–) of "OutA"/"OutB" depends on which signal voltage is selected (→ §2.6.4):

- If "internal" is selected: Reference potential = GND.
- If "external" is selected: The outputs are potential-free; the signal voltage comes from "InA" or alternatively "InB" without a galvanic connection to GND.



- Operating mode "Function test" → page 11 §2.6.2
- Electronic self-monitoring → page 12 §4.3.1

2.5.4 Connect external signal voltage

Only needed if external signal voltages are to be used for OutA/OutB.

Input	Function
InA	Signal voltage (+) for OutA
InB	Signal voltage (+) for OutB

The reference potential (–) for the signal connections is GND.

- ▶ If InA/InB are to be used: Test/select the right setting (→ page 11 §2.6.4).

2.5.5 Connect external LEDs (if required)

There are three outputs for status LEDs. The LEDs on the electronics card work identically.

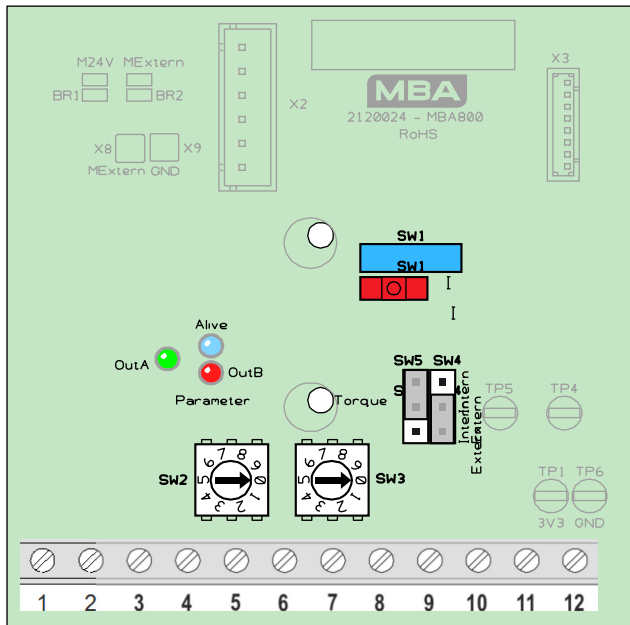
LED outputs

- Output signal: +3 V DC
- Load capability per LED output: max. 25 mA
- Reference potential (-): GND.

LED functions

LED	State	Meaning
Live/ Alive (blue)	off	No supply voltage
	on	Paddle rotating (motor on)
	flashes slowly	Paddle is blocked (motor off)
	flashes quickly	Blockage is being checked (motor on)
OutA (green)	off	Switch SW1 to I Paddle rotating
OutA (green)	on	Switch SW1 to II Paddle rotating
OutB (red)	on	Operation

2.6 Setting/adaptation



2.6.1 Select switch logic

SW1	Level status (OutA) "activated" means:
I	Signal comes when paddle blocked (full)
II	Signal comes when paddle rotates (empty)

2.6.2 Select function mode

- The halfpipe must be operated with parameter setting 0 or 3. Parameters 1, 2 and 4...8 will lead to malfunctions.

SW2	Recommended application
0	Silo full sensor [with reversal of direction] ^{1 2}
3	Back-up sensor [with reversal of direction] ¹



The operating behaviour is also affected by

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

2.6.3 Adjust sensitivity

SW3	Switching torque	
	Relative	Absolute
0	< 5 %	Very low switching torque – only for special application
1	< 10 %	
2	15 %	35 mNm
3	20 %	46 mNm
4	25 %	58 mNm
5	30 %	69 mNm
6	40 %	92 mNm
7	50 %	115 mNm
8	60 %	138 mNm
9	80 %	184 mNm



- For light, smooth bulk material, select a low switching torque. For heavy, coarse bulk material, select a high switching torque.
- If there is no empirical value: Determine the right setting during the initial start-up.

2.6.4 Select signal voltage

SW4	Output of OutA (if activated)
Internal	Supply voltage
External	Signal voltage of InA

SW5	Output of OutB (if activated)
Internal	Supply voltage
External	Signal voltage of InB



If "external" is selected, then outputs "OutA"/"OutB" are potential-free (→ page 10 §2.5.3).



For the MBA811, SW4 must be set to "internal" so that the relay functions.

2.7 Closing the housing

2.7.1 Sealing the cable glands

- After installation of the cables, seal the cable glands so that they are dust-tight and water-tight.
- Unused cable glands must only be sealed with original sealing plugs in accordance with the manufacturer's specifications.

2.7.2 Close housing

- Before closing cover of the unit, check whether there are any foreign bodies inside the unit head (such as cable residue).
- Visually check the sealing of the cover of the unit. Clean or replace if necessary.
- Put on the cover of the unit and tighten the screws using 4.7 Nm.
- The cap nuts must be tightened with the following torque:
Plastic threaded cable gland: 4,5 Nm +/- 10%
Metal threaded cable gland: 8 Nm +/- 10%

1 Explanation → page 5, § 1
2 Factory setting

3 Start-up

3.1 Switching-on



WARNING: Health risk / explosion hazard

During operation, the unit head and the cable gland(s) must be correctly closed and sealed. Otherwise the specified type of protection and the specified explosion protection (option) is not guaranteed.

- After switching on the supply voltage, the paddle turns at high power for around 1 minute.
- After that, the MBA800 is operational.

3.2 Function test at first start-up

3.2.1 Check operability

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

- ▶ Allow the paddle to rotate freely → check status of "OutA"
- ▶ Stop the paddle by hand → check status of "OutA"



The status of "OutA" depends on whether "full sensor" or "empty sensor" is set (→ §2.6.1).

3.2.2 Check for triggering by the bulk material

- ▶ Carefully fill or alternatively empty the bulk material container up to the level indicator. Watch the process and check whether the level is shown correctly.



If the bulk material has been changed:

- ▶ Carry out this test/adaptation again.

4 Maintenance

4.1 Recommended maintenance work

- ▶ *Clean moving external parts:* Clean off deposits and dirt on paddle and shaft roughly using a scraper and/or a brush. Do not use force. Attention: Do not damage the shaft sealing. Do not allow bristles to get between the shaft and the shaft sealing.
- ▶ *Inspect wearing parts* (highly recommended in case of abrasive bulk material): Inspect all parts that protrude into the bulk material container. Pay special attention to the connecting parts (split-pins, etc.). Replace damaged or questionable parts.
- ▶ *Clean protective tube* Preventatively clean the inside of the protective tube to make sure that the shaft can always rotate freely.
- ▶ *Clean distance tube* (is present – if required for explosion protection → page 9 §0): Remove dust deposits from the distance tube.

4.2 Preventive functional check

If the indicating function is rarely triggered during operation

(e.g. for use as a safety switch):

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

4.3 Internal malfunctions

4.3.1 Electronic self-monitoring

Self-monitoring is constantly active in the electronics.

If the self-monitoring detects a malfunction, then output "OutB" is deactivated (→ page 9 §2.5.3).

4.4 Safety information for opening



WARNING: Health risk / explosion hazard

- ▶ *Before opening the unit head:* switch-off the power supply and any connected signal voltage at an external point. (Attention: This disables the level indicator.)
- ▶ Only open the housing when you are absolutely sure that there is no possible danger.



- ▶ Do not open when it is under voltage.
- ▶ After switching it off, wait 40 minutes before opening it.


4.5 Removing the unit head (note)

The unit head can easily be separated from the process connection without opening the process connection:

- If the unit head is to be removed completely, disconnect the electric cables first.
- Loosen the clamping screw on the underside by approximately 3 mm (3 ... 4 turns).
- Carefully pull the unit head from the process connection along the direction of the shaft. This requires some strength due to the adhesion and friction of the sealing: use controlled force, but no brute force; risk of falling; be prepared for the unit head to become suddenly free.
- Reinstall in the reverse order.

5 Technical specifications

5.1 Identifier

Identification:	 II 1/2 D Ex ta/tb IIIC T100°C Da/Db
Type examination certificate:	DEKRA BVS 17 ATEX E 081 X

5.2 Specifications on the rating plate

- Unit type and version code
- Supply voltage
- Explosion protection classification
- Housing protection class
- Minimum surface temperatures:
 - The temperature value T_i applies to the parts of the unit that protrude into the container.
 - The temperature value T_a applies to the unit head.



Specifications on the rating plate apply with higher priority.

5.3 Electrical data

MBA811

Supply voltage:	115 ... 230 V AC, 50/60 Hz
Power consumption:	6 VA (max.) without connected consumer

MBA821

Supply voltage:	24 V DC \pm 10 %
Power consumption:	6 W (max.) without connected consumer

5.4 Ambient conditions

Ambient temperature outside the container (without ATEX):	-30 ... +60 °C
Ambient temperature outside the container (with ATEX):	-20 ... +50 °C
Maximum surface temperature of the product:	see rating plate

5.5 Product materials

Product materials in contact with the bulk material

Shaft, protective tube, process connection, paddle	Steel/stainless steel ¹ aluminium ² / silicon
Seals:	Viton/silicon and PTFE or graphite ²

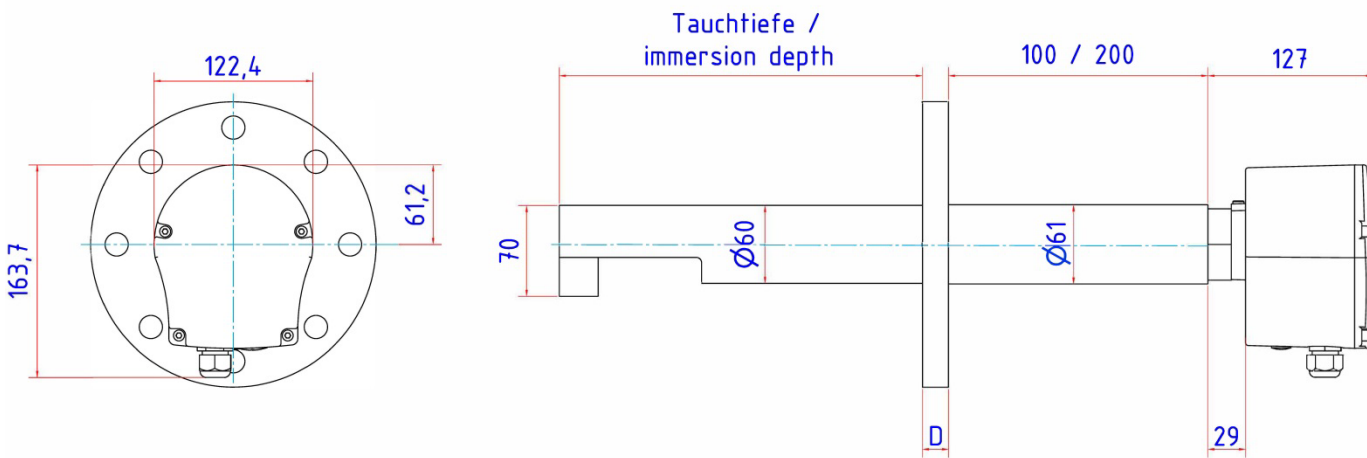
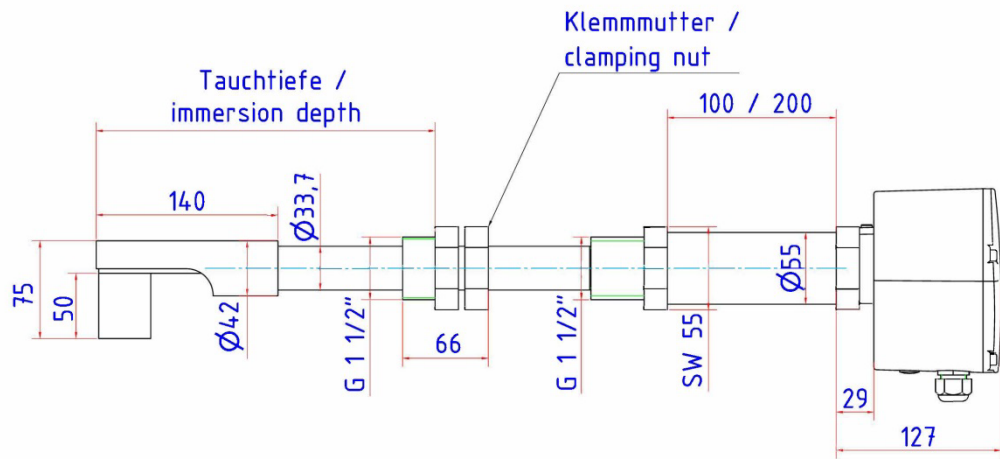
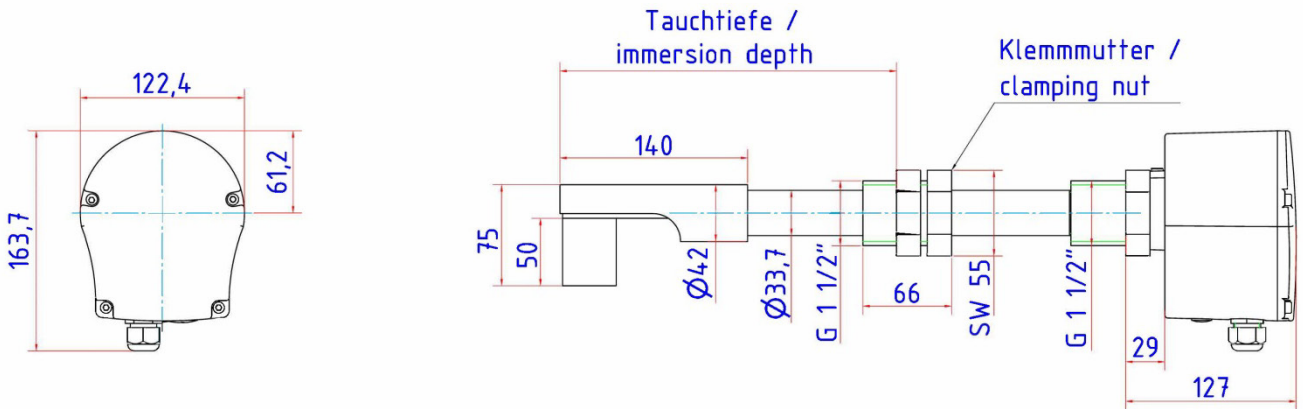
¹ Depending on the unit version

² Version for 350 °C

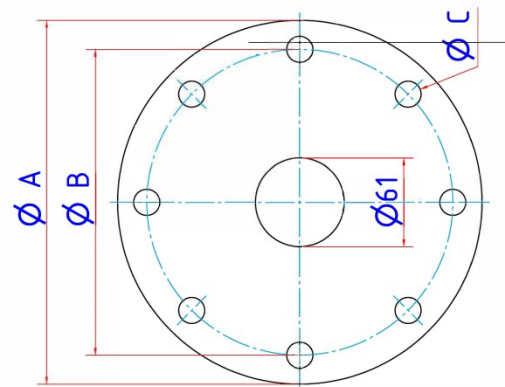
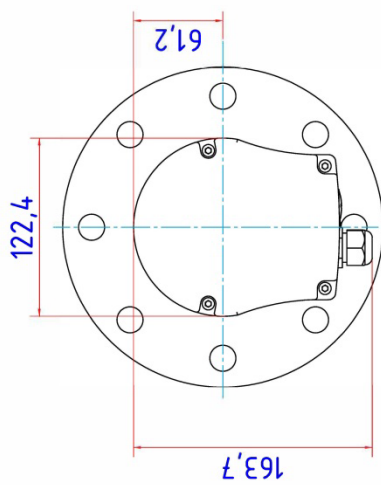
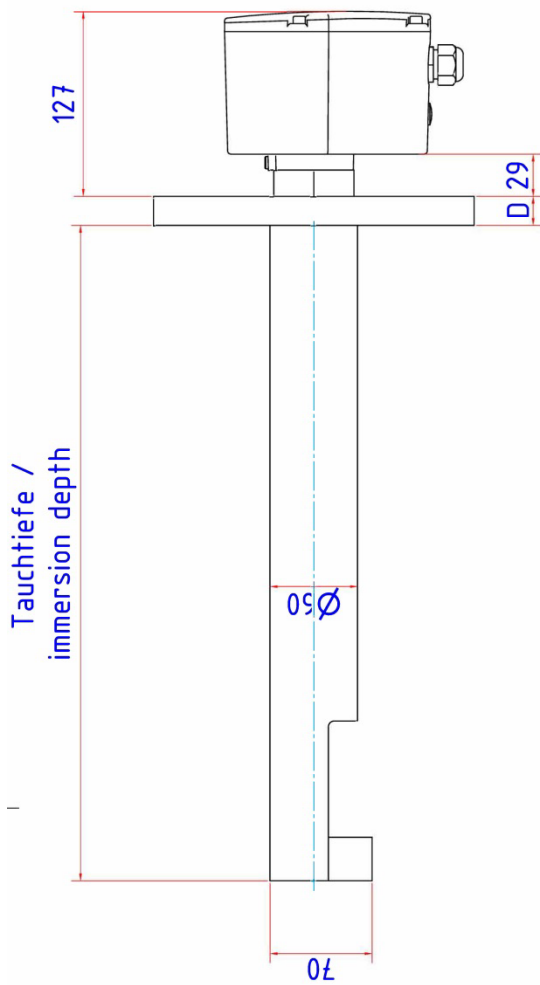
Materials of the unit head

Housing body:	Aluminium
Housing cover:	Aluminium
Housing seal:	Silicon (VMQ)
Screw connections:	PA (gasket: NBR) <i>Option:</i> brass, nickel plated (gaskets: NBR/FPM)
Sealing plugs:	PA
Compensating membrane:	● Polyester/PTFE (gasket: silicon) ● ATEX version in stainless steel

5.6 Dimensions

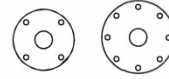


5.7 Dimensions



Flansch	A	B	C	D	Anz. Bohrungen / quantity of drillings
DN 100 PN 6	210	170	18	18	4
DN 100 PN 16	220	180	18	18	8
DN 125 PN 6	240	200	18	18	8
DN 125 PN 16	250	210	18	18	8
4" ANSI Class 150	228.6	190.5	19		8
5" ANSI Class 150	224.5	215.9	22.2		8

mm





Product name:	MBA801
Variations:	MBA811, MBA821
Version:	1.0
Dated:	12.2018
Language:	English

Keep these operating instructions for future use and make sure that the operating instructions are always available at the machine.

MBA Instruments GmbH

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