

# Electromechanical Level Measurement Systems *silopilot FMM 760, FMM 760 Z*

**Level measurement system of high versatility  
for bulk solids and liquids**



Silopilot FMM 760 with  
standard sensing weight

## Application

The Silopilot FMM 760, FMM 760 Z is an electromechanical level measurement system. Appropriate weights, which sense the surface of the product, are available to suit the application. Depending on the weight selected, the level of product in silos or bunkers can be measured, whether the product be dusty, fine or coarse-grained. The level of liquids in tanks can also be measured. Versions of the Silopilot FMM 760 are available for level measurement in silos or tanks with an operating temperature up to 150 °C, at an operating pressure up to 2 bar or in aggressive atmosphere, e. g. acid vapour.

## Features and Benefits

- Measurement of levels up to 70 m independent of product properties
- Accuracy of  $\pm 1$  pulse, therefore precise detection of the level
- Electronic minimum fail-safe mode, therefore no running down of the sensing weight into the silo outlet, no damage of conveying systems
- Lifting power up to 850 N, therefore reliable lifting of the sensing weight
- Manual or automatic operation with remote start and indication, therefore ideal device for automatic silo control and monitoring
- Compact design, quick and economic mounting, easy maintenance
- Version FMM 760 Z with BVS certificate for application in dust explosion hazardous areas Zones 10 and 11.

Endress + Hauser

Nothing beats know-how

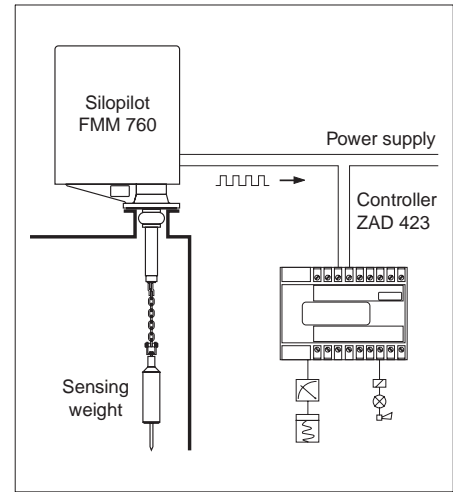


## Measuring System

A complete measuring system comprises:

- Silopilot FMM 760 with sensing weight
- Controller ZAD 423  
or  
subtracting electromechanical counter ZCD 151, ZCD 152, ZCD 155 or ZCD 156
- Connected peripherals, such as signalling systems, registration units, etc.

The module concept allows electrical and mechanical components to be combined to create a system entirely appropriate to the application requirements (see section “Product Structure”).



Measuring system with controller ZAD 423

## Measurement Principle

A measuring tape with a sensing weight attached to the end is driven down into the bunker. When the weight touches the surface of the product, the tape slackens and the motor reverses. The weight returns to the start “parked” position. During the downward or upward movement of the weight, the

Silopilot emits pulses equivalent to the length of the extended tape. The pulses are recorded by the controller ZAD 423 or by an electromechanical counter. The measured value is stored until the next measuring cycle. This is initiated by a start button or a timer.

## Versions

### Version FMM 760 Z (Dust-Ex)

For application in flammable dust hazardous areas Zones 10 and 11.

### Mechanical and Electrical Versions

- With heating:  
Thermostatically controlled, electrical housing heater 230 V, 50/60 Hz for ambient temperatures to  $-45\text{ }^{\circ}\text{C}$  (indicate min. ambient temperature when placing an order). Also recommended for moist vessel and ambient temperature below  $0\text{ }^{\circ}\text{C}$ .
- Pressure-tight up to 2 bar silo gauge pressure.
- Climatic protection:  
All metal parts coated against acids, alkalis, humidity and heat.
- Stove enamelled:  
Cover and housing base stove enamelled.
- High temperature version:  
All parts within silo temperature-resistant up to  $150\text{ }^{\circ}\text{C}$ .
- With weather protection cover (this is also available separately, see Sect. “Accessories”).

### Minimum Fail-Safe Function

Optional electrical function that causes a descent limiting of sensing weight.

### Signal Function for Tape Running and Control

Maximum four of the following output signals may be selected:

- Upper parked position of sensing weight
- Tape break alarm
- Tape reverse / slack band
- Descent of sensing weight
- Ascent of sensing weight
- Energising the circuit for minimum fail-safe mode.

### Sensing Weights

See section “Sensing Weights”.

### Other Options

- Counting step and tape length
- Metal parts in silo and tape-wipe mechanism
- Power supply for control and motor.

For a complete list of available versions refer to Sect. “Product Structure”.



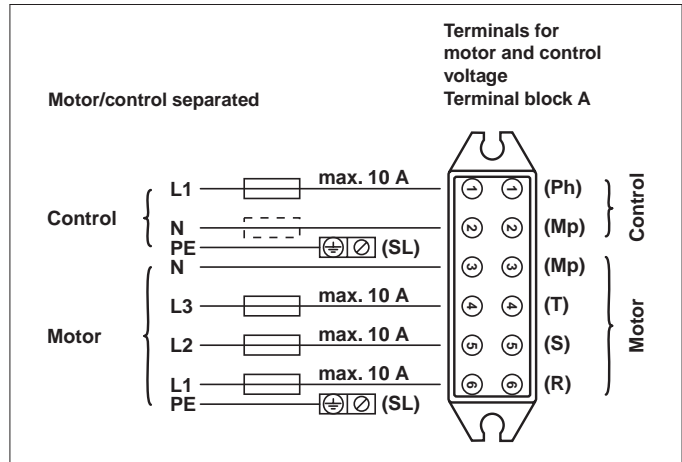
# Electrical Connection

## Connection of Motor and Control voltages

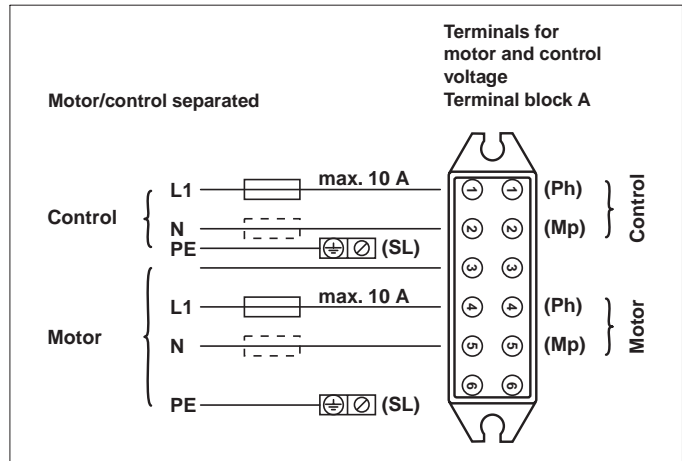
Connecting a Silopilot FMM 760 with three-phase or single-phase motor, respectively: see Figs.

Max. cable cross section for the terminals: 4 mm<sup>2</sup>.  
Fuse: mains cables max. 10 A.

Connection Silopilot FMM 760 with three-phase motor



Connection Silopilot FMM 760 with single-phase motor

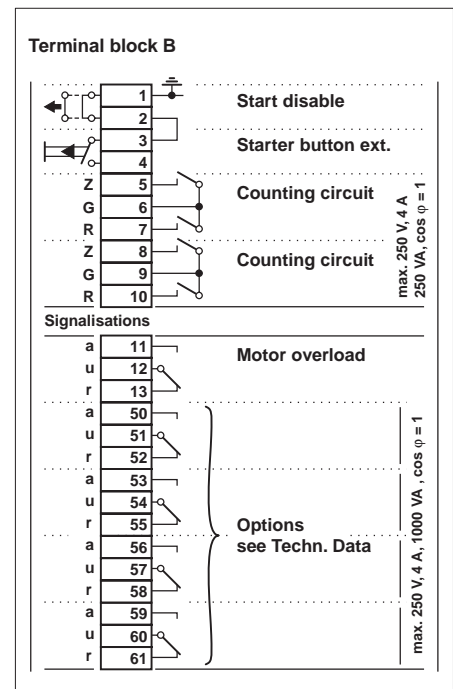


## Connection of Control and Alarm systems

All corresponding connections are located on terminal block B; see Fig. Max. cable cross section for the terminals: 2.5 mm<sup>2</sup>.

Separate cables for external start and start disabling from signal and supply cables.

Connection of control and alarm systems



# Sensing Weights



## Variants

The following shapes are available and will be described on the following pages:

- Normal cylindrical sensing weight with spike
- Umbrella weight
- Bag weight
- Cage weight
- Oval float (for FMM 760 only)
- Bell weight.

## Selection

Observe the following points when selecting the sensing weight:

- The sensing weight must neither sink into the product nor slip on the cone during measurement.
- The sensing weight must match the chemical product properties and the temperature in the bunker.

Special versions for particular applications are available on request.

## Mounting

Normal weight, umbrella weight and bag weight can be introduced into the bunker through the DN 100 mounting flange.

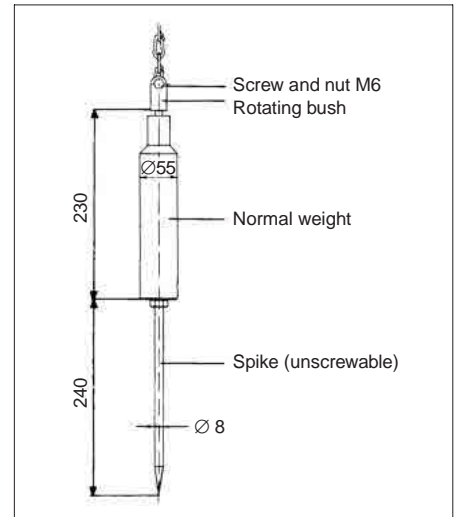
The measuring tape is pressed into the tape assembly by two screws. A third screw takes the chain. At the lower part of the chain, a rotating bush is located. Its function is to absorb the rotations of the sensing weight.

In standard version, the weight fastening (tape assembly, chain and rotating bush) is made out of galvanised steel. However, the parts are as well available in a special version of stainless steel. The measuring tape is made out of stainless steel also in standard version.

## Sensing Weights (continued)

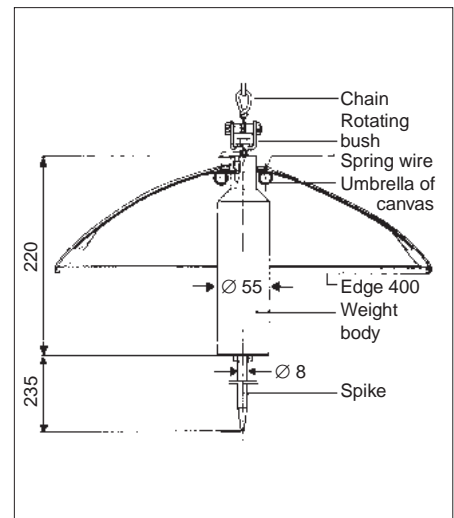
### Normal Weight

- Application:  
For coarse-grained solids, e. g. coal, ore or stones, and for granules.
- The spike can be unscrewed.
- If a crusher or mill is connected to the bunker, then we recommend the electrical signal function “tape break” or the use of a cage weight. This will prevent damage of the plant in case of a tape break.
- Materials:  
steel or stainless steel.
- Weight: 3.5 kg.



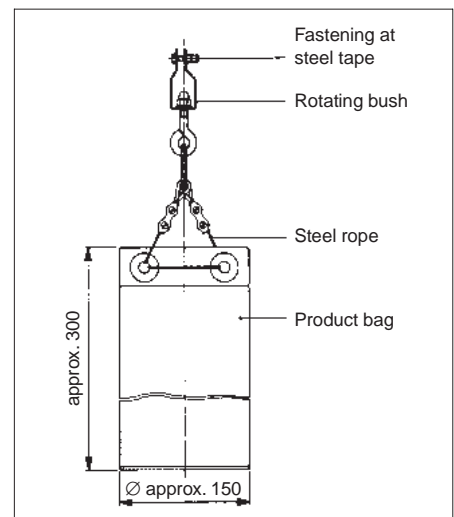
### Umbrella Weight

- Application:  
For very light and loose solids, e. g. flour or coaldust.
- The umbrella weight has a large square surface. This will prevent deep sinking into the product.
- In folded state, the weight can be introduced into the bunker through the DN 100 mounting flange.
- Max. permissible temperature: 100 °C.
- Materials:  
steel or stainless steel, canvas.
- Weight: 3.5 kg.



### Bag Weight

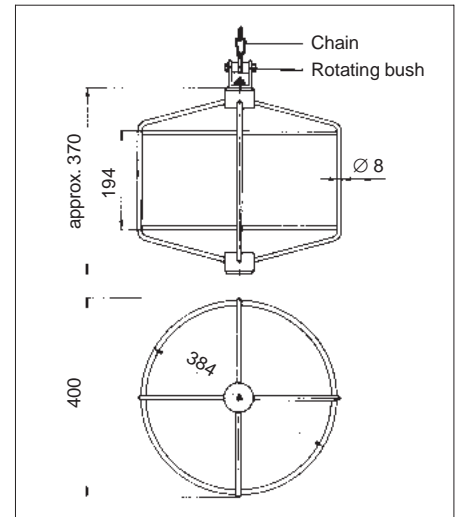
- Application:  
In bunkers to which e. g. mills are connected.
- The bag contains the product stored in the bunker.
- Max. permissible temperature: 100 °C.
- Materials:  
bag of linen, loops reinforced by leather, all metal parts of stainless steel.
- Weight: empty 0.25 kg, filled 3.5 kg.
- Tie up the bag at the top. This will prevent the contents from falling out, if the bag is upset when hitting the slope of a product cone.



## Sensing Weights (continued)

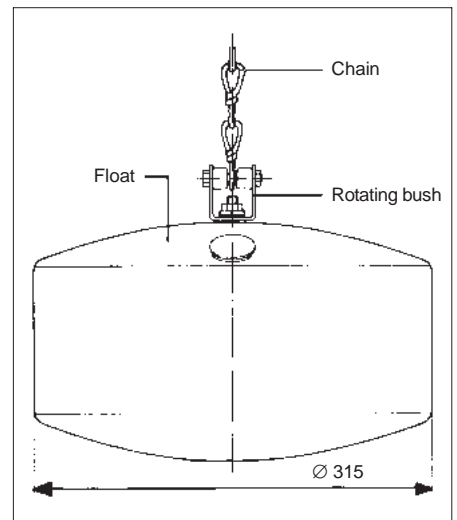
### Cage Weight

- Application:  
For fine solids in silos with relatively small product outlet that must never be blocked by a broken sensing weight.
- Also suitable for high temperatures that do not allow the use of a bag.
- The weight can get stuck over the outlet, but lets the product pass.
- Since the cage cannot get into a conveyor system (e. g. cellular wheel feeder or screw conveyor), it will prevent consequent damage.
- Standard dimensions: see Fig.  
Other dimensions on request.
- Material: steel.
- Weight: 3.5 kg.



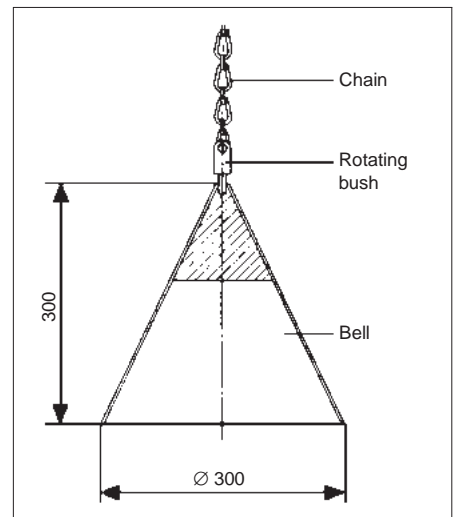
### Oval Float (for FMM 760 only)

- Application:  
For liquids, e. g. fuel oil, also for granules.
- Material: hard PVC.
- Max. permissible temperature: 60 °C.
- The float must be filled with product up to the total weight of 3.5 kg.



### Bell Weight

- Application:  
For light and loose solids; especially in cases where high temperatures and particular product properties do not allow the use of an umbrella weight.
- Materials:  
steel or stainless steel.
- Weight: 4.3 kg.



**Counting steps / tape length**

- A Pulse per 1 dm, tape length 25 m
- B Pulse per 1 dm, tape length 50 m
- C Pulse per 1 dm, tape length 70 m
- D Pulse per 0.5 dm, tape length 25 m
- E Pulse per 0.5 dm, tape length 50 m
- F Pulse per 0.5 dm, tape length 70 m
- G Pulse per 1 in, tape length 25 m
- H Pulse per 1 in, tape length 50 m
- J Pulse per 1 in, tape length 70 m
- K Pulse per 1/10 ft, tape length 25 m
- L Pulse per 1/10 ft, tape length 50 m
- M Pulse per 1/10 ft, tape length 70 m
- N Pulse per 1 cm, tape length 10 m
- Y Special version on request

**Minimum fail-safe function**

- 0 Without minimum fail-safe function
- 1 With minimum fail-safe function
- 9 Special version on request

**Signal function for tape running and control**

- 00 Without additional status message relays
  - 01 One relay for maximum message
  - 02 One relay for tape break message
  - 04 One relay for tape reverse message
  - 08 One relay for descent message
  - 16 One relay for ascent message
  - 32 One relay for minimum message
- Combinations are defined by addition of the codes.  
Maximum 4 functions can be combined.

**Metal parts in silo and tape-wipe**

- A Metal parts of steel, tape-wipe short, of cast aluminum
- K Metal parts of steel, tape-wipe 500 mm long, of cast aluminum
- L Metal parts of steel, tape-wipe 1000 mm long, of cast aluminum
- B Metal parts of 1.4571, tape-wipe short, of cast aluminum
- C Metal parts of 1.4571, tape-wipe 500 mm long, of cast aluminum
- D Metal parts of 1.4571, tape-wipe 1000 mm long, of cast aluminum
- E Metal parts of 1.4571, tape-wipe short, of 1.4571
- F Metal parts of 1.4571, tape-wipe 500 mm long, of 1.4571
- G Metal parts of 1.4571, tape-wipe 1000 mm long, of 1.4571
- Y Special version on request

**Mechanical and electrical variants**

- 00 Without additional features
  - 01 With heating 230 V, 50/60 Hz
  - 02 Pressure-tight up to 2 bar
  - 04 With climatic protection
  - 08 Stove enamelled
  - 16 High temperature version
  - 32 With weather protection cover
- Combinations are defined by addition of the codes.

**Power supply for control**

- Q Power supply 575 V, 50/60 Hz
- P Power supply 550 V, 50/60 Hz
- N Power supply 500 V, 50/60 Hz
- T Power supply 440 V, 50/60 Hz
- S Power supply 415 V, 50/60 Hz
- R Power supply 400 V, 50/60 Hz
- J Power supply 240 V, 50/60 Hz
- E Power supply 230 V, 50/60 Hz
- G Power supply 127 V, 50/60 Hz
- F Power supply 115 V, 50/60 Hz
- B Power supply 110 V, 50/60 Hz
- C Power supply 48 V, 50/60 Hz
- K Power supply 42 V, 50/60 Hz
- D Power supply 24 V, 50/60 Hz
- Y Special power supply on request

FMM 760 – [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Product designation, first part  
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FMM 760 Z – [ ] [ ] [ ] [ ] [ ] [ ] [ ] [ ]

Product designation, first part  
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## Product Structure (continued)

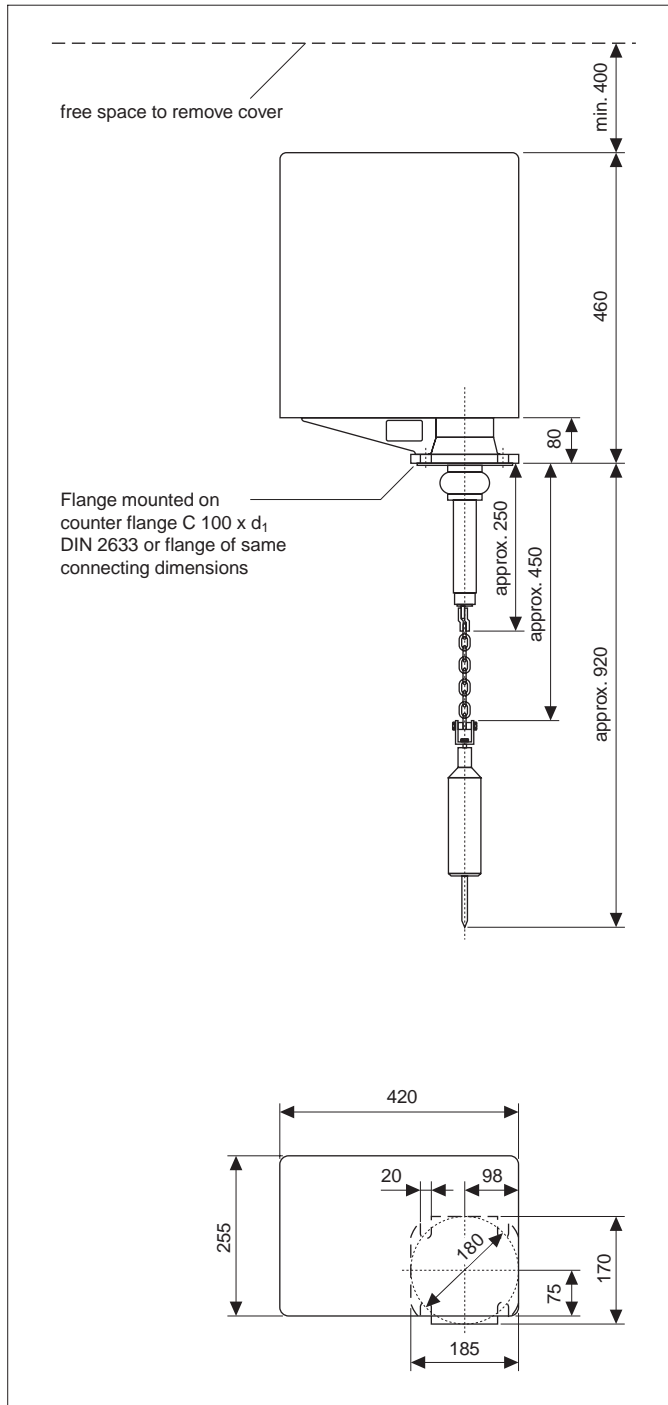
Silopilot FMM 760, FMM 760 Z							
<b>Power supply for motor</b>							
Q	Three-phase motor 3 × 575 V, 50 Hz						
N	Three-phase motor 3 × 500 V, 50 Hz						
L	Three-phase motor 3 × 440 V, 50 Hz						
J	Three-phase motor 3 × 415 V, 50 Hz						
G	Three-phase motor 3 × 400 V, 50 Hz						
1	Three-phase motor 3 × 230 V, 50 Hz						
C	Three-phase motor 3 × 127 V, 50 Hz						
W	One-phase motor 240 V, 50 Hz						
2	One-phase motor 230 V, 50 Hz						
3	One-phase motor 115 V, 50 Hz						
R	Three-phase motor 3 × 575 V, 60 Hz						
P	Three-phase motor 3 × 500 V, 60 Hz						
M	Three-phase motor 3 × 440 V, 60 Hz						
K	Three-phase motor 3 × 415 V, 60 Hz						
H	Three-phase motor 3 × 400 V, 60 Hz						
4	Three-phase motor 3 × 230 V, 60 Hz						
D	Three-phase motor 3 × 127 V, 60 Hz						
X	One-phase motor 240 V, 60 Hz						
5	One-phase motor 230 V, 60 Hz						
6	One-phase motor 115 V, 60 Hz						
Y	Special version on request						
<b>Sensing weight</b>							
0	Without sensing weight						
1	Standard sensing weight of steel						
2	Sensing weight of 1.4571						
3	Umbrella weight of steel / canvas						
4	Umbrella weight of 1.4571 / canvas						
5	Linen bag weight						
6	Cage weight of steel						
7	Oval float of hard PVC (for FMM 760 only)						
8	Bell weight of steel						
9	Special version on request						
FMM 760 –							Complete product designation
FMM 760 Z –							Complete product designation

## Preferred Packages

Silopilot FMM 760 with standard sensing weight of steel and with controller ZAD 423	
<p>Used options of Silopilot FMM 760:</p> <ul style="list-style-type: none"> <li>– Counting: 1 dm, Tape: 50 m</li> <li>– Minimum level alarm included</li> <li>– 3 relays (maximum, breakage, tape reversal)</li> <li>– Tape wipe 300 mm, steel parts</li> <li>– With sun protection cover</li> <li>– Power supply, control: 230 V AC</li> <li>– Motor: three-phase 3 x 400 V AC, 50 Hz</li> </ul> <p>Used options of controller ZAD 423:</p> <ul style="list-style-type: none"> <li>– For non hazardous area</li> <li>– MINIPAC housing 100 mm with terminal block</li> <li>– Power supply: 230 V AC</li> </ul>	<p><b>Order No:</b> <b>941260-0000</b></p>
<p><b>same version as before but with linen bag weight</b></p>	<p><b>941260-0010</b></p>



# Dimensions



Dimensions  
 Silopilot FMM 760 with  
 normal sensing weight

# Accessories

- ❑ Weather protection of white plastic (ASA 776)  
 metal parts of stainless steel  
 ambient temperature max. +60 °C  
 dimensions (H × W × L):  
 415 × 285 × 478 mm
- ❑ Subtracting electromechanical counters  
 ZCD 151, ZCD 152  
 ZCD 155, ZCD 156
- ❑ Sensing weights  
 see Sect. "Sensing Weights"
- ❑ Controller ZAD 423

## Accessories (continued)



Weather protection  
cover



Counter ZCD 151, 152



Controller ZAD 423



Counter ZCD 155, 156

## Supplementary Documentation

- ❑ Controller ZAD 423  
Technical Information TI 277F/00/en
- ❑ Counter ZCD 151, ZCD 152  
Technical Information TI 11.73.04
- ❑ Counter ZCD 155, ZCD 156  
Technical Information TI 08.78.01

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