

Electromechanical level measurement system *Controller ZAD 423*

Control unit and signal converter for the
Silopilot FMM level measurement transmitter



Application

Controller for level measurement with the Silopilot FMM 760 or FMM 460 electromechanical level sensor:

- Automatic start pulses for the Silopilot
- Digital level display
- Conversion of level measured into a standard output signal
- Two limit signal outputs

Features and Benefits

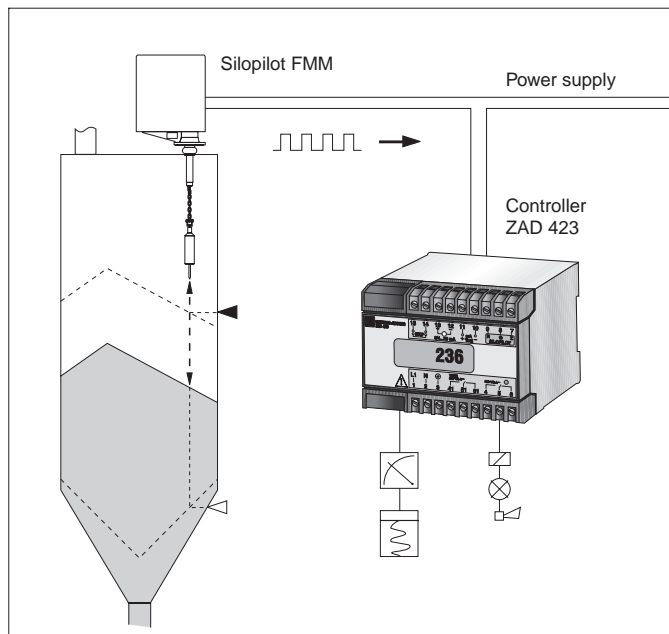
- Only **one** unit in the control cabinet for controlling the measuring system and evaluating the signal = simple overview of the measuring line
- Monitoring of the Silopilot FMM level sensor and signal cables = reliable operation
- Calibration and operation of the measuring system from the control room = simple and cost-effective
- Calibration elements under the hinged front panel = protected from unauthorised use but still easily accessible

Endress + Hauser

Nothing beats know-how



Measuring System



The measuring system consists of:

- Silopilot FMM 760 or FMM 460
- Controller ZAD 423 with
 - integrated time switch,
 - digital display,
 - analogue output,
 - limit signal transmitter
- Connected peripherals, such as signalling systems, registration units, etc.

Measurement System

Operating Principle

Start-Up

The integrated time switch (timer) for the Silopilot can be adjusted in ten minute intervals for automatic activation ranging from every 10 minutes up to 24 hours.

The timer can also be deactivated, e.g. during filling, to prevent the sensor weight from being buried. The ZAD 423 controller can also be activated manually.

Level Measurement

The controller is set in the units of distance with which the Silopilot measures the section from the start to the surface of the solid (e.g. cm, dm, in, 1/10 ft).

The controller receives a pulse reset from the Silopilot every time measurement begins. It then counts the number of pulses transmitted by the Silopilot.

At the end of the measurement cycle, the level in the silo is shown on the digital display of the ZAD 423 controller in the units required (e.g. m, in, ft).

Output Signal

The (0/4 ... 20 mA) analogue signal is derived from the digital measurement signal at the end of the measurement cycle. It can be inverted and set to indicate either the level of material or the space remaining in the silo.

On fault, the output signal can be selected to

- remain unchanged (HOLD),
- rise to 110 % (MAX) or
- fall to -10 % (MIN).

Limit Signals

The integrated relay with potential-free changeover contact can be activated to energise when a freely selectable height has been reached and to de-energise at another (two-point control) or else to switch at a limit point.

The relay switching status is shown by an LED.

The relay de-energises on error (power fail, defective cable, breakdown of Silopilot).

Planning and Installation

The ZAD 423 controller must be installed in a control cabinet (outside the explosion-hazardous area) or else in a protective housing.

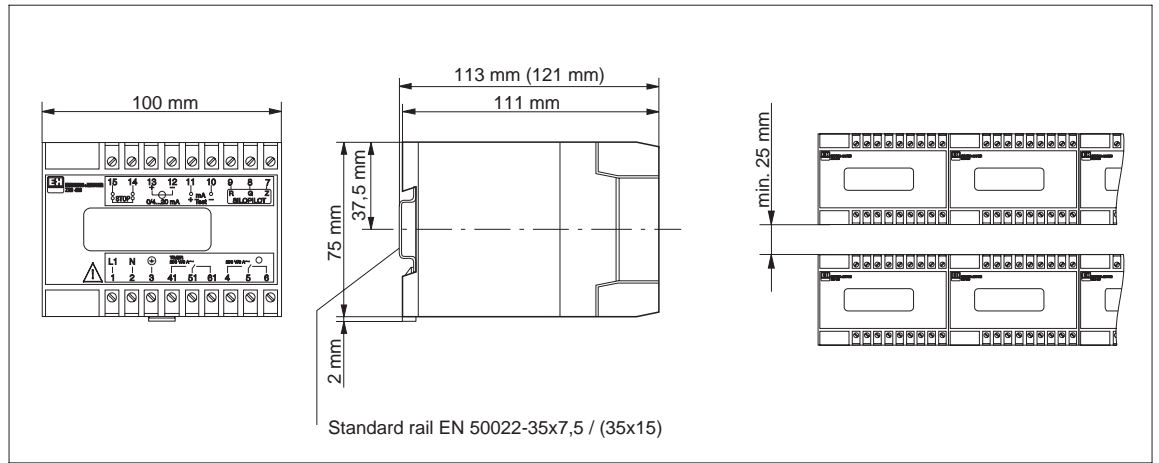
The instrument is in Minipac form for single or row-mounting on a top-hat rail to EN 50022-35x7.5 or EN 50022-35x15. See dimensional sketch for dimensions and minimum intervals.

A protective housing with ingress protection IP 55 is available for mounting in the open; see accessories. Note the permissible ambient temperature which is dependent on the type of mounting.

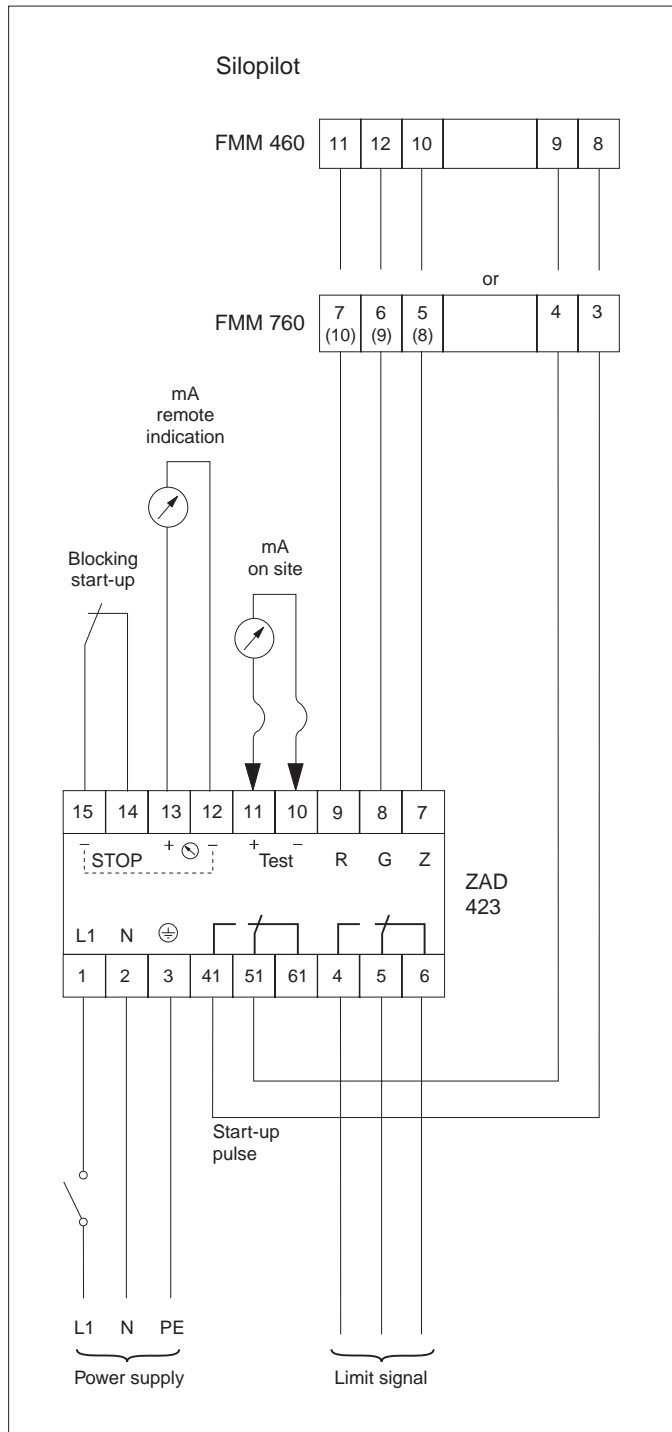
Avoid aggressive atmospheres and excessive humidity which can cause corrosion to the contacts or condensation on the printed circuit board.

Dimensions in mm and minimum interval between rows of instruments

100 mm = 3.94 in



Electrical Connection



Note:

- The ZAD 423 controller is to be connected to **one** Silopilot FMM level sensor.
- The ZAD 423 controller and counters must not be connected in parallel to the same pulse counting outputs of the Silopilot FMM.
- Only operational low voltages are present at the upper terminal block of the ZAD 423 controller.

Connecting the Silopilot FMM to the ZAD 423 controller

Start-up (Terminals 41, 51)

- To connect to the **FMM 460**:
The two-wire connection cable for start-up can be unscreened or screened commercial cable for line voltage.
Cable diameter min. 1.5 mm², max. 2.5 mm² (strands with end sleeves).
Cable length max. 250 m (see FMM 460 operating manual for lengths up to 3000 m).
- To connect to the **FMM 760**:
The two-wire connection cable for start-up can be screened or unscreened commercial cable for low voltages (10 V).
Cable diameter max. 2.5 mm² (strands with end sleeves).
Cable length max. 500 m.

Pulse counter (Terminals 7, 8, 9)

- The three-wire connection cable for pulse counting can be screened or unscreened commercial cable for low voltages.
Cable diameter min. 1.5 mm², max. 2.5 mm² (strands with end sleeves).
Cable length max. 500 m.

To prevent mutual interference, start-up and pulse counter lines should be realised as separate cables.

Blocking Start-Up (Stop)

(Terminals 14, 15)

Connecting Terminals 14 and 15 together blocks automatic and manual start-up of the controller. This can be used, e.g. during the filling cycle to prevent the sensor weight of the Silopilot FMM from being buried.

A suitable control switch or relay contact can be connected using screened or unscreened commercial cable or multi-purpose, multi-wire cable up to 500 m.

Contact load: max. 5 V, max. 1 mA.

Analogue Output Signal, Current Output

(Terminals 12, 13)

Standard 0 ... 20 mA or 4 ... 20 mA signal for 0 ... 100 % measuring range or inverted 100 ... 0 % as required. Connection of non-grounded display units, plotters, limit signal transmitters etc. in series if the total load including the cable resistance is less than 500 Ω. Screened or unscreened commercial cable or multi-purpose, multi-wire cable can be used.

If the output signal must be galvanically isolated from the rest of the circuit we recommend the use of a direct current isolator, e.g. HAA 420 TSP.

Test Output

(Terminals 10, 11)

For direct connection of an ammeter on site to monitor the analogue output signal, without interrupting the current output.

Limit Signal Output

(Terminals 4, 5, 6)

When connecting other devices to the relay contact, the operation of the limit signal transmitter depends on the setting and the level.

For contact load see "Output, limit signal" in the technical data.

Power Supply

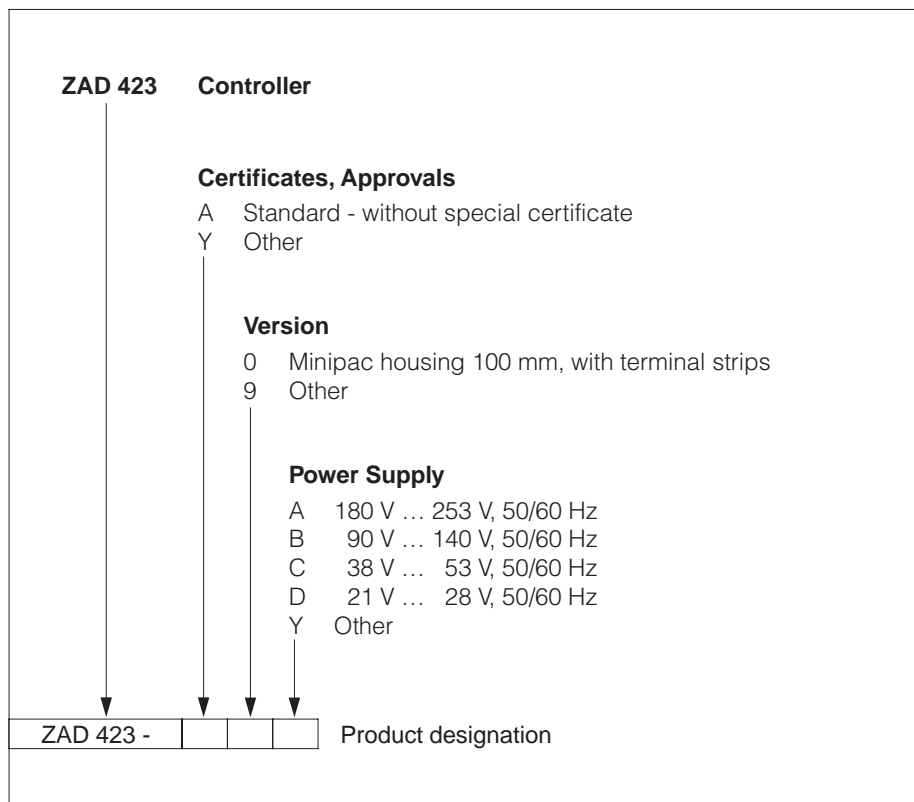
(Terminals 1, 2, 3)

See Product Structure for power supply versions.

An isolating switch for a power supply should be installed near to the instrument.

A fine-wire fuse is built into the ZAD 423 controller so that the connection of another fine-wire fuse is not required. The protective line (PE) **must** be connected to Terminal 3.

Product Structure



Technical Data

General specifications

Manufacturer	Endress+Hauser GmbH+Co.
Instrument family	Silopilot
Designation	ZAD 423 controller
Function	Controlling a Silopilot FMM and signal evaluation

Application

Level measurement with the Silopilot electromechanical level system	Regular request for the height in a silo, preferably bulk solids; Digital display of height, converting the digital signal into an analogue signal for remote transmission, registering limit status
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Operation and system design

Measuring principle	Measuring the free space from the silo roof to the surface of the material in predefined intervals. Converting the intervals into a digital display of height and into a level or free-space-proportional analogue signal
Modularity	Level measuring system, consisting of: Silopilot FMM on the silo and the ZAD 423 in the control room
Signal processing	Countdown of pulse step values coming from the Silopilot, stored until the next measurement cycle
Galvanic isolation	Between power supply and electronics; between electronics and relay contacts

Input

Measured variable	Number of pulses / height in subdivided steps
Measuring range	1 ... 9999 pulses, for every Silopilot FMM version

Output

Output signal	On the display: digital display of level Analogue signal for remote transmission: 0 / 4 ... 20 mA for 0 ... 100 % of level, Can be inverted for displaying free space
Signal on fault	Adjustable: -10 % (-2 / +2.4 mA) or 110 % (22 mA) or unchanged
Load	Max. 500 Ω , including cable
Limit signal, Fail-safe circuit	Potential-free changeover contact, maximum contact load U~ 250 V, I~ 6 A, P~ 1500 VA at $\cos \varphi = 1$, 750 VA at $\cos \varphi \geq 0.7$ U= 250 V, I= 6 A, P= 200 W Minimum or maximum quiescent current protection
Start signal for Silopilot	Potential-free changeover contact, maximum contact load U~ 250 V, I~ 6 A, P~ 1500 VA at $\cos \varphi = 1$, 750 VA at $\cos \varphi \geq 0.7$ U= 250 V, I= 6 A, P= 200 W Pulse width 350 ms

Accuracy

Reference conditions	Temperature T = 20 °C (70 °F)
Measured error	Digital display max. 1 pulse Analogue output: < 0.4 %
Repeatability	< 0.1 %
Hysteresis	< 0.1 %
Settling time	Approx. 3 s after the end of the counting pulse from the Silopilot
Long-term drift	Analogue output: < 0.1 %

Operating conditions

Installation

Mounting	On 35x7.5 or 35x15 rail standard to EN 50022 in a control cabinet or protective housing
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Environmental conditions

Ambient temperature range	For single mounting: -20 °C ... +60 °C (0 ... 140 °F) For row mounting: -20 °C ... +50 °C (0 ... 120 °F) In protective housing: -20 °C ... +50 °C (0 ... 120 °F)
Limiting temperature range	-25 °C ... +70 °C (-10 °F ... +160 °F)
Storage temperature range	-40 °C ... +85 °C (-40 °F ... +185 °F)
Climate class	Class C, climatic protection to EN 68068, EN 60721
Ingress protection	Housing IP 40, terminals IP 20 to EN 60529
Vibration resistance	To IEC 68, Part 2-6, 10 ... 55 Hz, 0.15 mm
Electromagnetic compatibility	Interference immunity to EN 50082-2 and industrial standard NAMUR (field strength 10 V/m), Interference emission to EN 50081-1

Technical Data (Continued)

Mechanical construction

Design	Minipac housing, 100 mm wide, for row mounting on a standard rail
Dimensions	See dimensional sketch on Page 3
Weight	0.5 kg (1.1 lbs)
Materials	Housing ABS Terminal blocks ABS Front panel PA
Electrical connection	One terminal block for connecting the signal cables with function low voltage, one terminal block for connecting the power supply and relay contacts: for max. 2.5 mm ² strands in end sleeves A 2.5 - 7 to DIN 46228. Cable: commercial installation cable

User interface

Display field	LCD, 4 characters, 12 mm high, for digital display of level in present units of length Bar graph, 40 mm long, for analogue display 0 ... 100 % Symbols for showing the control field, time switching mode and faults
LED	1 red LED for showing relay status
Pushbuttons	3 pushbuttons to select one of 10 control fields and to enter calibrating values 1 pushbutton for manual start of the Silopilot behind folding front panel to protect against unauthorised use
Quick operating instructions	on the reverse of the front panel

Power supply

Power supply, versions	180 ... 253 V, 50 / 60 Hz; <— switchable —> 90 ... 140 V, 50 /60 Hz 38 ... 53 V, 50 / 60 Hz; <— switchable —> 21 ... 28 V, 50 /60 Hz
Power consumption	< 2 W

Certificates and approvals

CE Mark	The device fulfils the legal requirements of the EU directives: Directive 89/336/EEC (electromagnetic compatibility) Directive 73/23/EEC (directive on use of low voltages)
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Ordering

Product designation	See Product Structure on Page 4	
Accessories	Standard rail 35x7.5, 100 mm wide Protective housing IP 55 for 1 unit Isolator HAA 420 TSP in Minipac housing (Direct current isolator without power supply for input/output signal 0/4 ... 20 mA)	Order No. 917256-0001 Order No. 917081-0000 Order No. 208330-0000
Supplementary documentation	Mounting accessories for Minipac instruments General Information on EMC (Test procedures, installation)	Technical Information TI 009F/00/en Technical Information TI 241F/00/en

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