

Hydrostatic Level Measurement *silometer FMB 672 Z, FMB 677 Z*

**Commutec transmitters for level measurement
of liquids, pastes and sludge
Certified for use in explosion hazardous areas**



Silometer FMB 672 Z
in Monorack housing
with LC display and
buttons for local
operation



Silometer FMB 677 Z
in Monorack housing:
for operation with a
Commulog VU 260 Z
handheld terminal or
via a ZA 67... gateway

Application

Used in combination with Deltapilot DB 40...43 and DB 32 A/C hydrostatic probes, the Silometer FMB 672 Z/677 Z transmitter measures the level of liquids, pastes and sludges:

- Continuous level measurement on two channels in vented or open vessels
- Simultaneous level and pressure measurement in pressurized tanks with over- or underpressure
- Differential measurement between two levels
- Density-compensated level measurement in vented or open vessels
- Density measurement.

Features and Benefits

- Intrinsically safe with certificate for [EEx ia] IIC
- Suitable as stand-alone unit or as addressable station in process control systems
- Can be calibrated without the need to fill the vessel
- Linearisation function for volume measurement in horizontal cylinders or tanks with conical outlet
- Standard current, voltage and limit relay outputs
- Self-monitoring with immediate indication of fault condition

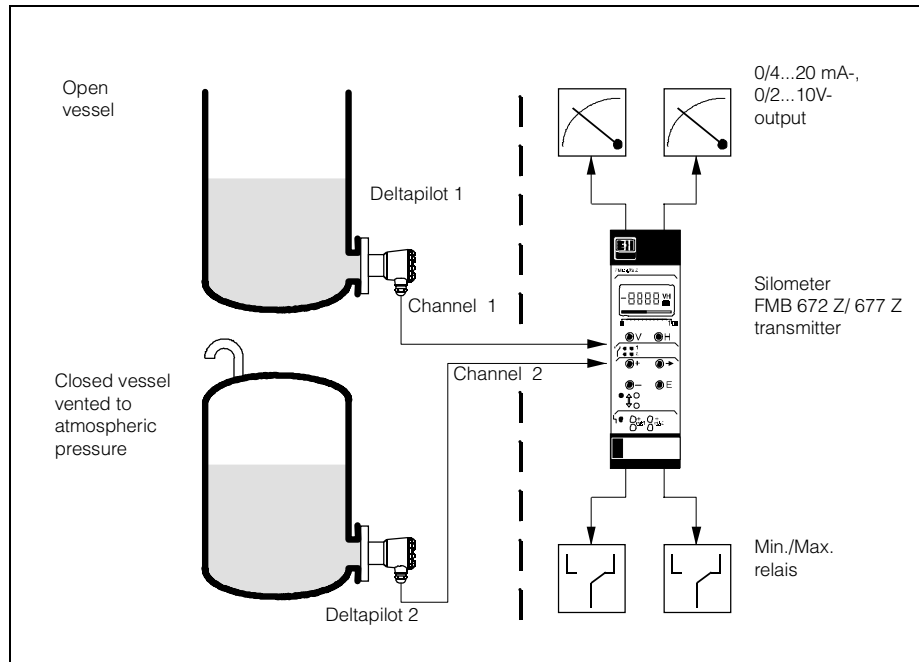
Endress + Hauser

Nothing beats know-how



Measurement System

Standard application with Silometer FMB providing level measurement in two open vessels



Measurement System

The measurement system comprises:

- Silometer FMB 672 Z/677 Z transmitter
- one or two Deltapilot hydrostatic sensors
- one or two electronic inserts:
EB 17 Z for gauge pressure
EB 27 Z for under- or overpressure.

Output Signals

The Silometer FMB offers two standard 0/4...20mA and 0/2...10V analogue signals proportional to level or volume:

- Start and end of range values can be set as required
- Two limit relays can be operated independently of each other in minimum or maximum fail-safe mode with freely adjustable hysteresis.

Signal Input Circuit

An two-wire cable connects the Deltapilot sensor to the Silometer FMB transmitter. The Silometer supplies the power and the sensor returns an interference-free pulse frequency modulated signal proportional to pressure. The intrinsically safe signal input is electrically isolated from the transmitter supply and the outputs. The measured value obtained from the signal:

- is displayed at the transmitter (Silometer FMB 672 Z)
- can be read by a Commulog VU 260 Z handheld terminal or over the Rackbus.

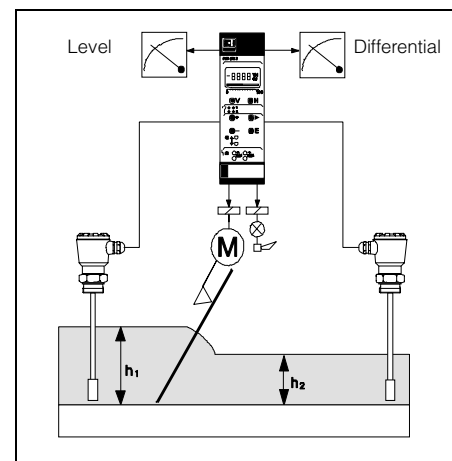
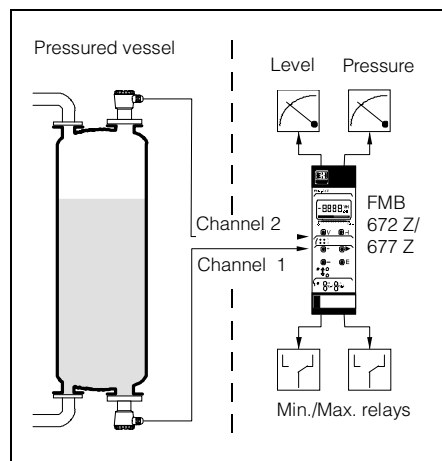
Self-Monitoring Function

The Silometer FMB continuously monitors all signal lines from sensor to analog outputs and fails to safe if a fault is detected.

- An alarm relay with potential-free changeover contacts de-energises on fault condition
- The analogue signal switches to -10%, +110% or holds the last measured value
- The output relays de-energise or follow the analogue output signal, depending on the programmed setting.

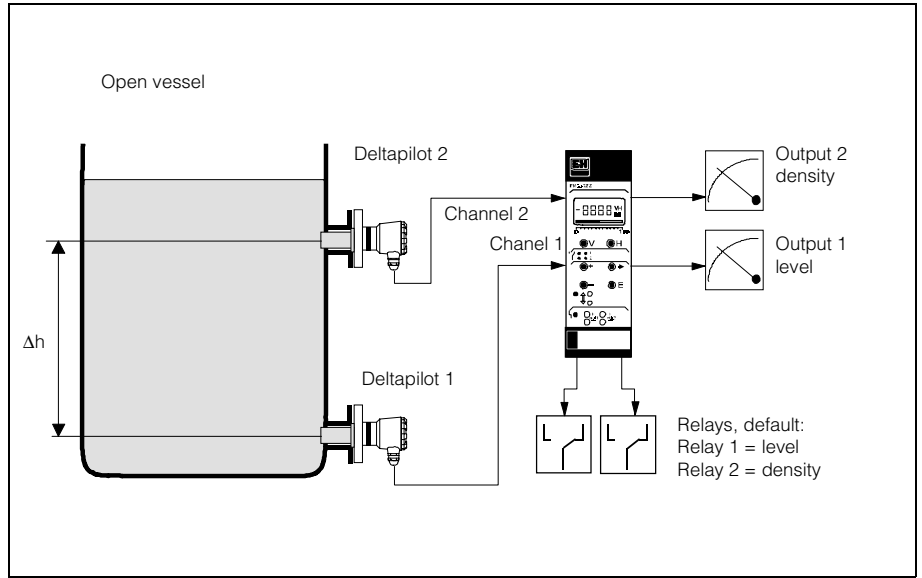
Left:
Level measurement in a pressurized vessel

Right:
Differential level measurement for automatic screen cleaning



Measurement Principle

Density compensated level measurement in an open vessel



Measurement in Open Vessels

The level is derived from the hydrostatic pressure exerted by a column of liquid:

$$p_1 = \rho \times g \times h \quad (1)$$

whereby

- p_1 = hydrostatic pressure
- ρ = density of the liquid
- g = acceleration due to gravity
- h = height of the liquid column.

Assuming a constant density, the level of the liquid can be calculated from the pressure measured by the Deltapilot.

Measurement in Pressurized Vessels

In a pressurized or evacuated vessel, the pressure exerted is:

$$p_{tot} = p_2 + \rho \times g \times h \quad (2)$$

whereby

- p_{tot} = total pressure
- p_2 = pressure above liquid

The difference between the total pressure at Deltapilot 1 and the pressure above the liquid at Deltapilot 2, provides the level (and pressure) measurement.

Density Measurement

When the distance between two Deltapilots is known and both are covered, the density of the liquid can be calculated as follows:

$$\rho = \Delta p / g \times \Delta h \quad (3)$$

whereby

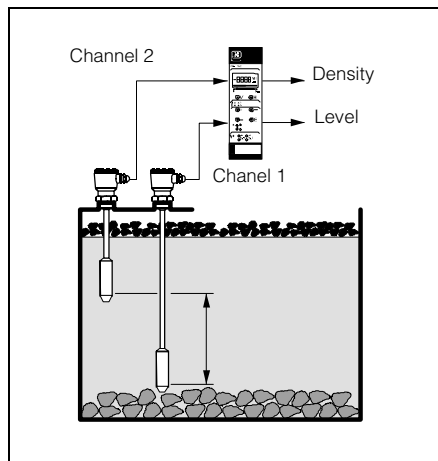
- Δp = difference in pressures measured by Deltapilots
- Δh = difference in height

The density can be measured in both a closed and open vessel. If however, level is to be corrected by the measured density, the measurement can be made in open vessels only.

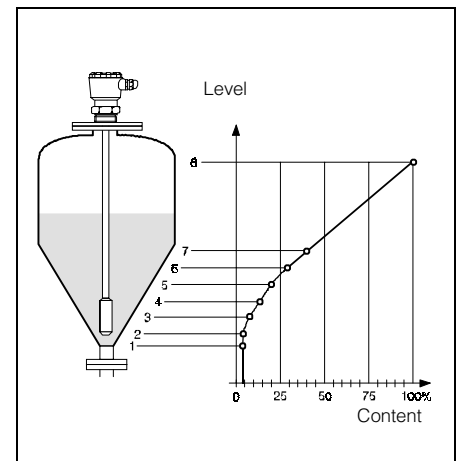
Volume Measurement

For tanks with conical outlets, a volume measurement can be obtained by entering a vessel characteristic. The most common shape, a horizontal cylinder is programmed as a standard feature.

Left:
Level and density measurement in a coal flotation plant

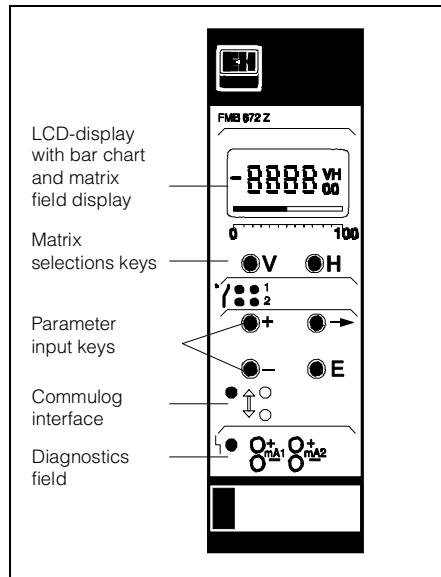


Right:
Volume measurement in a vessel with conical outlet

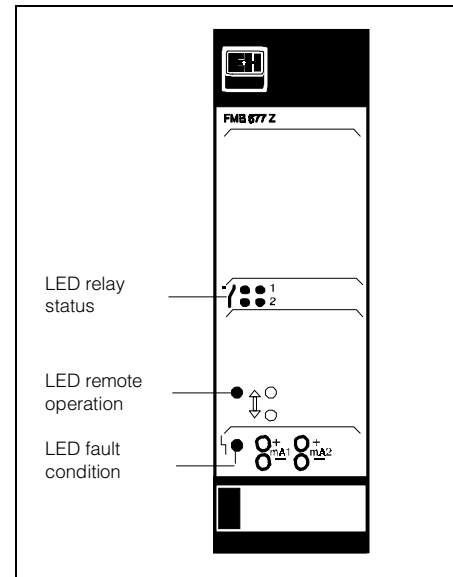


Operation

Left:
Silometer FMB 672 Z
front panel with
configuration and
display elements



Right:
Silometer FMB 677 Z:
front panel with status
LEDs



Configuration at Front Panel

Silometer FMB 672 Z transmitters can be configured at the front panel.

- Six keys access a parameter matrix, defined by a vertical (V) and horizontal (H) position, in which relevant data can be entered
- The selected matrix field and parameter are indicated in the LC-display
- A continuous display of level, volume etc. is available during operation
- A horizontal 10-step LCD bar strip indicates level or volume as a function of the analogue output.

Remote Configuration

Both Silometer FMB 672 Z and 677 Z transmitters can be configured by a Commulog handheld terminal or over the Rackbus.

- The Commulog is plugged into the front panel
- The data exchanged are displayed with supplementary information in plain language on the large LC-display.

Operational Status

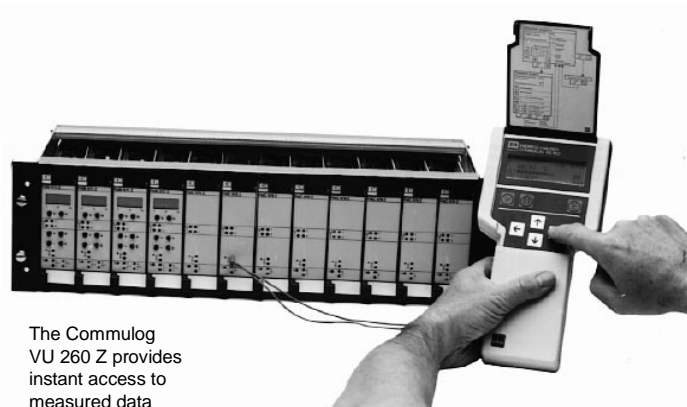
The operational status of the transmitter is indicated by means of six LEDs which can be clearly seen from a distance.

- The green and red LEDs in the central field indicate the limit relay status: red de-energised, green energised
- The green LED below lights when the Silometer is communicating with the Commulog VU 260 Z handheld terminal or the ZA 67... computer gateway
- The red LED in the diagnostics field flashes to indicate a warning or lights for a fault condition.

Diagnosis

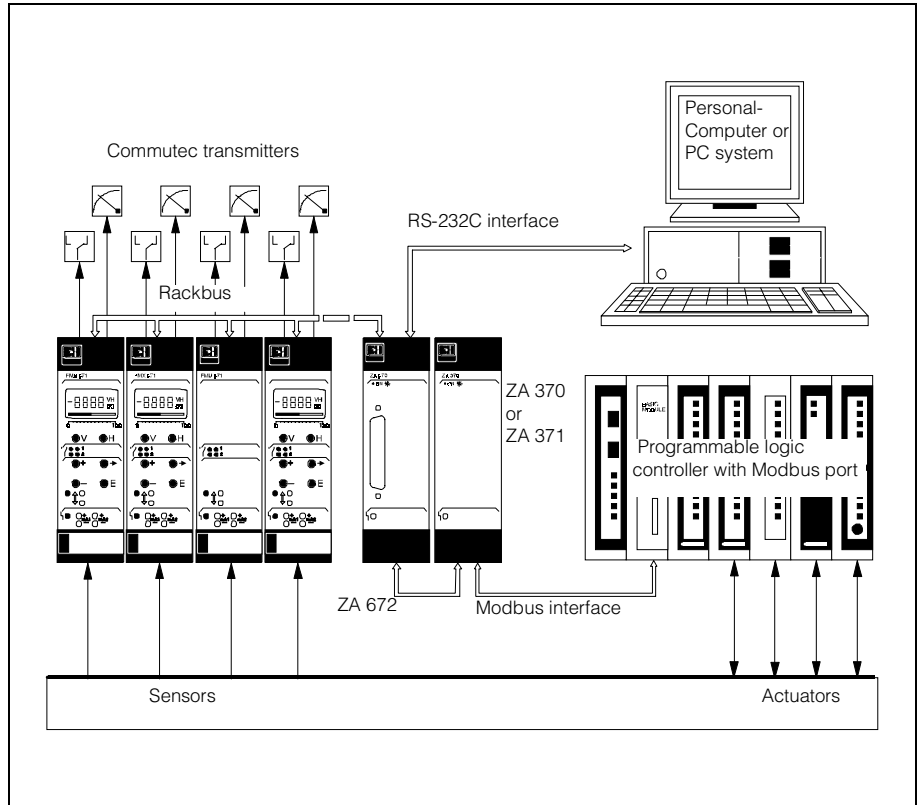
There are three possibilities for on-line diagnosis:

- an error code can be read from the matrix position V9H0
- the current output can be monitored at the sockets on the front panel - analogue signals can also be simulated to check connected instrumentation
- the transmitter can be connected to a personal computer with e.g. Commutool commissioning and service software.



The Commulog
VU 260 Z provides
instant access to
measured data

Remote Control



The Silometer FMB communicates with a supervisory controller via the two-core Rackbus and a ZA 67... computer gateway

Process Control Systems

Silometer transmitters are easily integrated into supervisory control systems.

- Silometer parameters are addressed over the Rackbus by the ZA 67... gateway which presents them in appropriate format to the connected network
- Up to 64 transmitters (max. 128 measuring points) can be individually controlled and operated on-line from the control room. Each is accessed via a unique address

- Gateways and operating programs are available for a variety of fieldbuses, programmable logic controllers (PLC), process control systems (PCS) and personal computers (PC).

The resulting dialogue between supervisory controller and subordinate transmitters makes for a safer and more flexible plant organisation.



Commutec operating programs provide an overview of process variables for small and medium-sized plants

Installation

Mounting

Racksyst plug-in cards must be installed outside explosive hazardous areas in a rack or protective housing. Endress+Hauser can provide the following alternatives:

- 19" rack (84 HP wide) for mounting up to 12 Silometers in the control room
- Half 19" wide field housing with Protection IP 65
- Monorack housing (7 HP) for single or multiple mounting in the control panel.



Field housing



Monorack housing

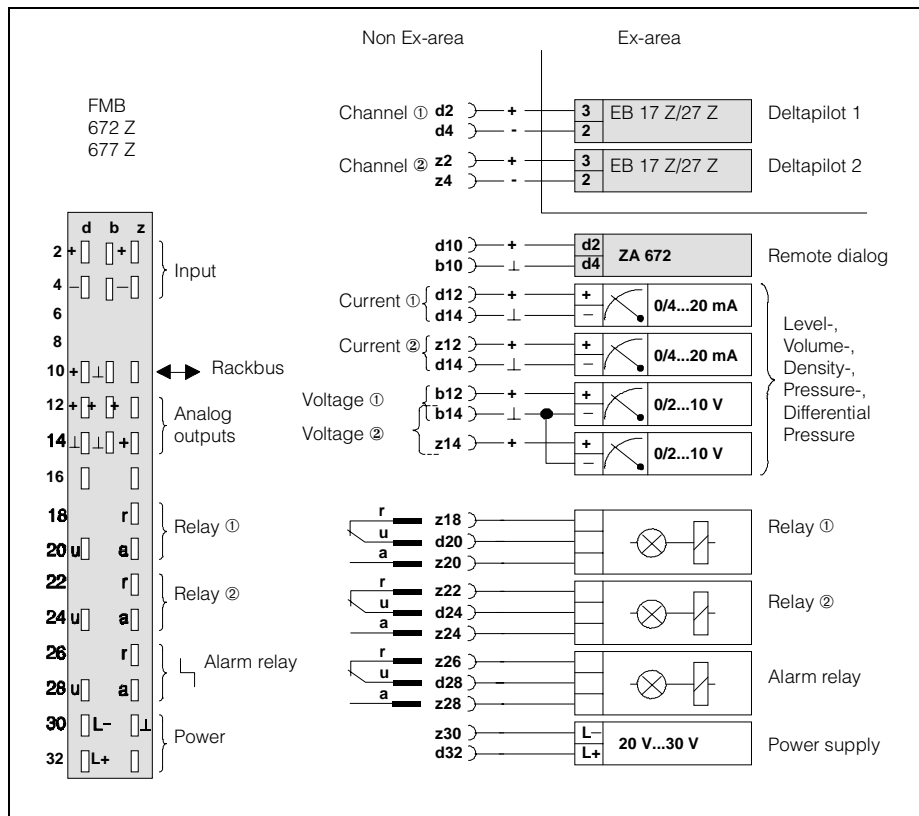
Connection of Instrumentation

The negative terminals of the output signals and 24 V supply are connected to the circuit zero of the Silometer.

- For instruments with a non-isolated input (eg. HTA 470 Z): only one instrument can be directly connected to the current output
- Several instruments can be connected to the voltage output in parallel, if their potentials are all related to the negative terminal of the 24 V supply
- There is no restriction on potential-free instruments, except for the minimum or maximum load.
- The ground leads of the two current outputs must be routed separately to the Silometer backplane connector

Sensor Connection

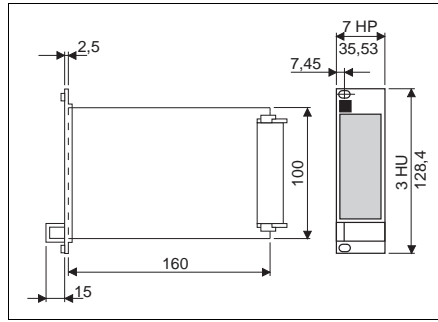
- Use two-core installation cable, max. resistance 25Ω per core
- Use shielded cable, grounded at both ends, if electromagnetic interference is to be expected.
- Note local regulations when laying cable in hazardous areas.



Connection diagram for the Silometer FMB

Technical Data

Dimensions in mm of
plug-in card



Technical Data: Plug-In Card

- Format: Racksyst card to DIN 41494 (Europa card, see diagram)
- Front panel: black synthetic with inlaid blue field, with grip and label area
- Protection to DIN 40050: Front panel IP20, Card IP00
- Weight: approx. 0.3 kg
- Operating temperature: 0°C...+70°C
Storage temperature: -20°C...+85°C

Plug-In Connection

- Multipoint strip conforming to DIN 41612, part 3, Type F (28-pole)
- Coding pins in strip: Positions 1 and 24

Power Supply

- DC voltage: 24 V (20 V...30 V)
Permissible ripple U_{-pp} : 2 V within tolerance
- Current: approx. 90 mA, max. 125 mA
Integral fine-blow fuse

Signal Inputs

- Intrinsically safe [EEx ia] IIC or IIB, electrically isolated from the rest of the circuitry
- Sensors:
DB 40...43 with EB 17 Z or EB 27 Z electronic inserts
DB 32 A/C

Signal Outputs

- Current output:
0...20 mA/4...20 mA selectable,
 R_L max. 500 Ω
- Voltage output:
0...10 V/2...10 V selectable
 R_L min. 10 k Ω
- Limit switches
Two independent relays each with a potential-free change-over contact.
Switch points and switching hysteresis fully adjustable.
Fail-safe mode selectable, minimum or maximum,
- Fault alarm:
relay with potential-free change-over contact
- Switching capacity:
max. 2.5 A, max. 250 VAC, max. 300 VA at $\cos \varphi > 0.7$
max. 100 VDC, max. 90 W
- Rackbus: Baudrate 19 200 bits/s,
2-core cable

Indication and Configuration

- Silometer FMB 672 Z
LCD Display and 6 buttons for in situ dialogue, 6 LEDs for function control.
- Silometer FMB 677 Z
6 LEDs for function control

Certificates

- Explosion protection PTB No. Ex-88.B.2050 X
- Overspill protection for non-flammable liquids (Germany): IfBT PA-VI 810.60
- German Lloyd:
GL No. 97511 HH

Subject to change.

How to Order

Silometer FMB 672 Z
with LC-display and operating elements

Order. No. 918266-0041











Silometer FMB 677 Z
for remote configuration

Order. No. 918267-0041

Supplementary Documentation

- Racksyst Planning Hints for rack-mounting or Racksyst field housings and self-adhesive connection schematics
- Monorack
Technical Information TI 047F/00/e
- Deltapilot DB
System Information SI 006F/00/e
- Planning Notes Deltapilot DB
Technical Information TI 142F/00/e
- Electronic inserts EB 17 Z/ EB 27 Z
Technical Information TI 033F/00/e
- Commulog VU 260 Z
Technical Information TI 140F/00/e
- ZA 672 Modbus Gateway
Technical Information TI 148F/00/e
- ZA 673 PROFIBUS Gateway
Technical Information TI 162F/00/e
- ZA 674 FIP Gateway
Technical Information TI 167F/00/e
- Commute Operating Program
Technical Information TI 113F/00/e

Level Probes Deltapilot

Type	Compact version		Compact version		Tube version		Cable version		Cable version	
Application	Standard	Ex-area	Foodstuffs		Standard	Ex-area	Standard	Ex-area	For open vessels and water level measurement	
										
Process connection	Type	Type	Type	Type	Type	Type	Type	Type	Type	Type
Thread	DB 40 G...	DB 40 GA	DB 40 RL		DB 41 G...	DB 41 GA	DB 42 G...	DB 42 GA	DB 43 with clamp	DB 32 C *
Flange	DB 40 F...	DB 40 FA			DB 41 F...	DB 41 FA	DB 42 F...	DB 42 FA		
Certificates	Cenelec	VbF, WHG Cenelec			Cenelec	VbF, WHG Cenelec	Cenelec	VbF, WHG Cenelec		* with reduced meas. head dia.
Range dependent on measuring cell	-900 mbar to 4000 mbar	-900 mbar to 4000 mbar	-900 mbar to 4000 mbar	-900 mbar to 4000 mbar	-900 mbar to 4000 mbar	-900 mbar to 4000 mbar	-900 mbar to 4000 mbar	-900 mbar to 4000 mbar	0 bar to 16 bar	0 bar to 16 bar
Technical Information	TI 031/00/e	TI 031/00/e	TI 032/00/e	TI 032/00/e	TI 031/00/e	TI 031/00/e	TI 031/00/e	TI 031/00/e	TI 031/00/e	TI 141/00/e

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