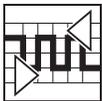
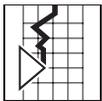
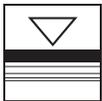


# Differential Pressure Transmitter

## *deltabar S PMD 230 / 235*

## *deltabar S FMD 230 / 630*

**Deltabar S with ceramic and silicon sensors**  
**Overload resistant with function monitoring**  
**HART® or PROFIBUS protocols**



FMD 230 Flush Mount



PMD 230 with Oval Flange



PMD 235 with Remote Seals

### Applications

- Measurement of flow, level or differential pressure of gases, vapors and liquids
- Measuring spans from 0.4 inH<sub>2</sub>O to 580 psi (1 mbar to 40 bar)
- Nominal pressure up to 6000 psi (420 bar)
- Suitable for use in hazardous areas

### Features and Benefits

- Ceramic and silicon sensors with function monitoring
- Non-linearity less than 0.1% of the set measuring range (optional 0.05% with silicon sensor)
- Long-term stability, error less than 0.1% per year
- Consistent modular concept for differential pressure and gauge/absolute pressure (Deltabar S and Cerabar S), i.e.
  - housings or displays
  - sensor modules
  - common electronics for gauge/absolute pressure and differential pressure
- Smart features
- Zero and span freely adjustable with or without reference pressure

Quality made by  
Endress+Hauser



ISO 9001



Endress + Hauser

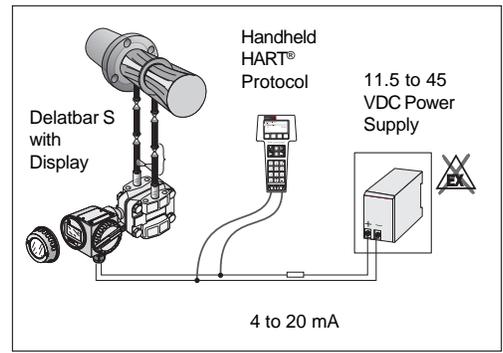
Nothing beats know-how



# Measuring System

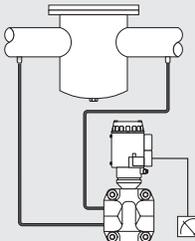
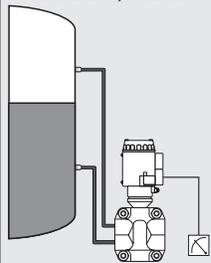
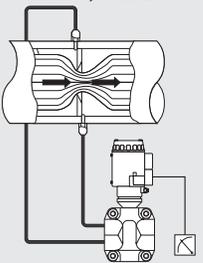
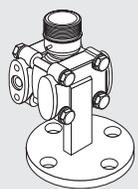
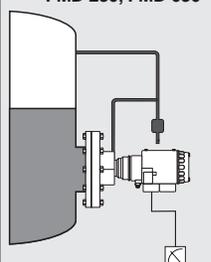
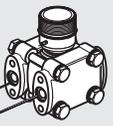
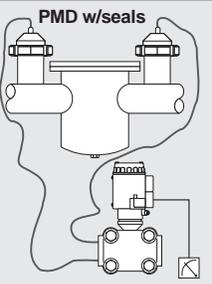
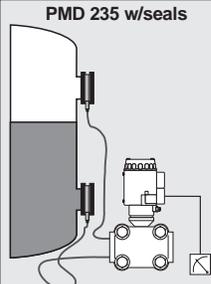
## System Components

- Deltabar S differential pressure transmitter with 4 to 20 mA output signal
- Optional four-digit display for pressure flow or level with bargraph for 4 to 20 mA output
- 11.5 to 45 VDC power supply. For transmitter electronics with HART® protocol, a digital communication signal is superimposed on the 4 to 20 mA signal. This is used for remote calibration and display.
- PROFIBUS PA bus protocol



Example: flow measurement with orifice plate

# Selection

|                    |   |   | <b>Differential pressure</b>  | <b>Level</b>   | <b>Flow</b>   |
|--------------------|--|--|---|--|---|
| <b>Oval Flange</b> | <b>Ceramic sensor</b><br><br>10 inH <sub>2</sub> O to 1200 inH <sub>2</sub> O    | <b>Silicon sensor</b><br><br>4 inH <sub>2</sub> O to 580 psi   | <b>PMD 230, PMD 235</b><br> | <b>PMD 230, PMD 235</b><br>  | <b>PMD 230, PMD 235</b><br> |
| <b>Flange</b>      | <b>FMD 230</b><br><br>flush-mounted ceramic, version with metal-free connection | <b>FMD 630</b><br><br>metal diaphragm seal as required, versions with extended diaphragm seal             |   | <b>FMD 230, FMD 630</b><br> |   |
| <b>Remote Seal</b> |  | <b>PMD 235 w/seals</b><br>connections for sanitary applications and other diaphragm seal applications<br> | <b>PMD w/seals</b><br>    | <b>PMD 235 w/seals</b><br>  |   |

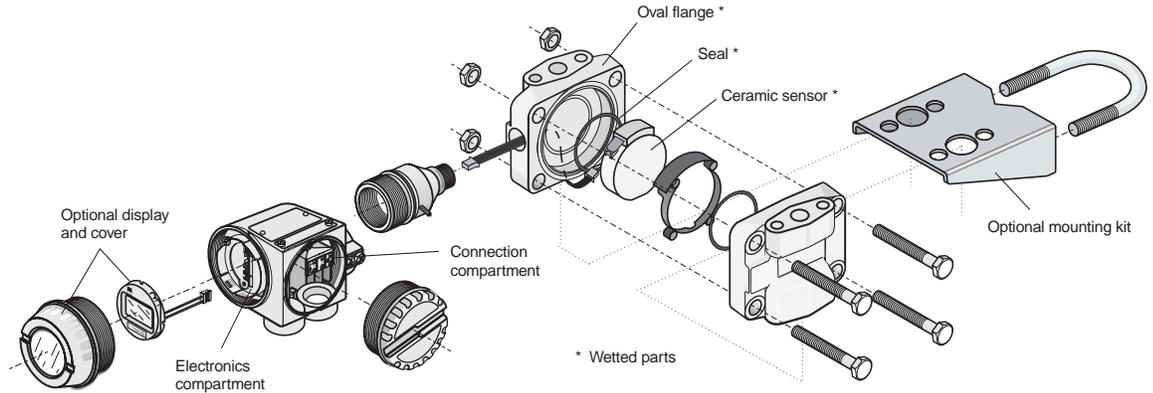
# Mechanical Construction

## Universal Solution

- NEMA 4X housing protected from corrosion by a polyester powder coating
- Separate electronics and connection compartments. The display is in the electronics compartment ensuring that terminals in the connection compartment are always accessible.

## Modular Process Interface

- The process seals and flanges are easily exchanged
  - less units need to be stocked
  - allows preventive replacement of wetted parts operating under extremely corrosive conditions
- For level, application versions with flush-mounted ceramic sensors are available as well as diaphragm seals or remote seals for practically all process interfaces.



Deltabar S PMD 230

## Housing and Adjustment

- The external calibrating keys are protected against unauthorized access. The calibration can also be checked or altered on-site in hazardous areas.
- The housing can still be rotated after installation of the transmitter, up to 270°. Its flexible design simplifies installation and allows optimum positioning of the display and electrical connections, even in confined areas.

## Four-Digit Display with 4 to 20 mA Bargraph

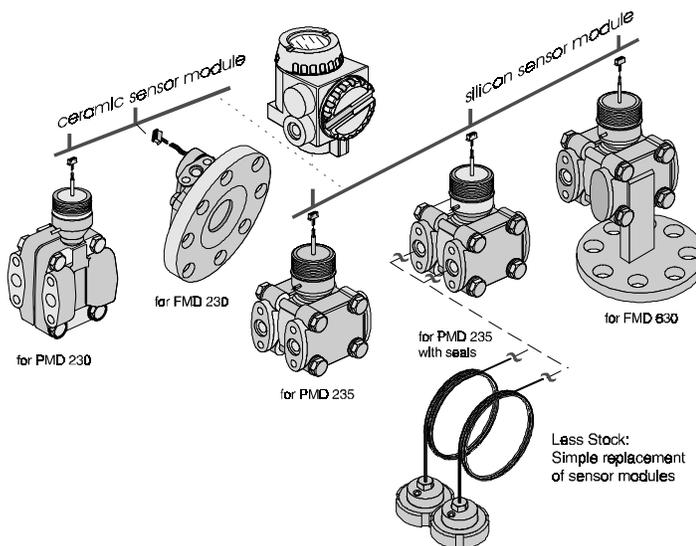
The Deltabar S transmitter with display can be calibrated on-site without any special electrical or mechanical tools. The display can be mounted in hazardous areas and is easy to retrofit.

## Consistent Modular Concept

An ASIC (application specific integrated circuit) which stores all sensor data is attached to the sensor.

### Benefits:

- Sensor modules can be exchanged; such as a ceramic sensor with 40 inH<sub>2</sub>O (100 mbar) measuring range for a silicon sensor with 400 inH<sub>2</sub>O (1000 mbar) measuring range.
- The electronics can be exchanged; such as from HART® to PROFIBUS protocol.



When the Deltabar S is switched on, the electronics upload the data from the calibrated sensor module. The transmitter is immediately ready for operation.

## Certificates

The versatility of the Deltabar S is underlined by world-wide approvals; intrinsically safe, explosion proof (FM, CSA, CENELEC, RIIS), overspill protection to VbF and WHG (Germany).

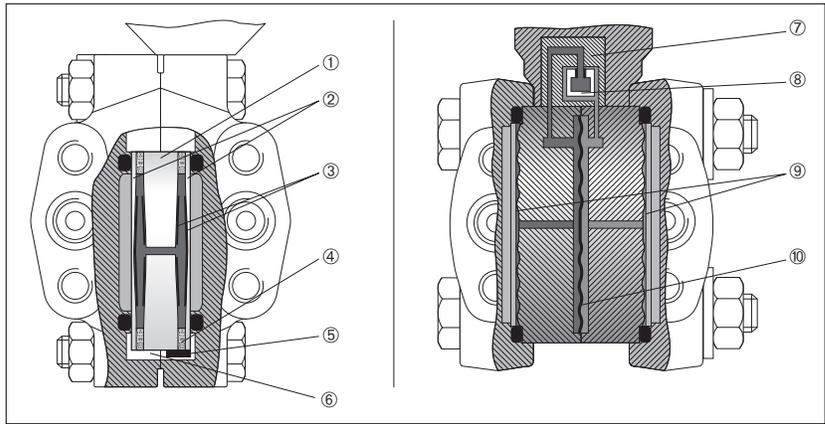
# Operating Principle

## Ceramic sensor (left)

- ① ceramic substrate
- ② thick diaphragm for abrasive and corrosive media
- ③ capacitor electrodes
- ④ fritted glass
- ⑤ integrated temperature sensor for self-monitoring
- ⑥ fill liquid in a single chamber

## Silicon sensor (right)

- ⑦ measuring element
- ⑧ silicon diaphragm
- ⑨ isolating diaphragm
- ⑩ built-in overload resistance



### Rugged Single-Chamber Ceramic Sensor for up to 1200 inH<sub>2</sub>O (3000 mbar)

The ceramic sensor consists of a substrate ① and two diaphragms ②. The diaphragms and substrate constitute two measuring surfaces and are connected by a capillary. Silicone oil, mineral oil or inert fill serve as a filling fluid. A differential pressure proportional to the change in the capacitance is measured by the electrodes ③ on the ceramic substrate and diaphragms.

#### Advantages of the Ceramic Sensor

Ceramic is resistant to most aggressive products. Ceramic materials do not age, and therefore provide high measurement quality over many years. The Deltabar S is the first differential pressure transmitter which also monitors the diaphragms of the sensor.

#### Additional Transmitter Functions

- Local switch for linear/square root function
- Adjustable damping 0 to 40 seconds
- Linearization function for output and display in volume, etc.
- Selectable engineering units
- Display value freely programmable

### Silicon Sensors for up to 580 psi (40 bar)

The measuring element ⑥ comprises a silicon diaphragm ⑦, which has pressure sensitive thin-film resistors. The differential pressure acting at the isolating diaphragms ⑨ is transmitted to the measuring element by silicon or inert fill fluid. The silicon diaphragm deflects accordingly causing a change in resistance which is measured and processed by the transmitter electronics.

#### Advantages of the Silicon Sensor

The silicon sensor offers a wide temperature range, a small and easily compensated temperature coefficient and long-term stability. Its good elasticity properties ensure high reproducibility and low hysteresis.

- Low flow cut-off freely adjustable
- Record of min/max pressure
- Record of min/max temperature
- Advanced self-diagnostics with error code and selectable fail safe mode
- Density factor for easy adjustment in event the process medium changes
- Optional flow totalizer

# Electrical Connection

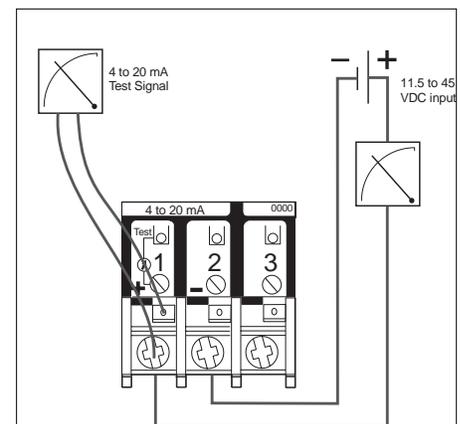
## Wiring - 4 to 20 mA

The wiring is connected to screw terminals designed for AWG 13 wiring. Ground terminals are available on the housing and in the connection compartment.

The transmitter is protected against reverse polarity, HF interference and overvoltage peaks. Permitted power supply voltage, load resistance and cable entries are given in the Technical Data section.

## Test Signal

An ammeter can be connected between terminal 1 and its terminal plug to measure the output current without interrupting the measurement.



Standard wiring connections for the Deltabar S

# Remote Operation



## Handheld Terminal

A handheld terminal can be connected at any point in the 4 to 20 mA line to check, configure and read additional information from the Deltabar S. The handheld universal HART® Communicator DXR 275 for HART® protocol is used for this purpose.

A large display gives detailed and self-explanatory information. The transmitter continues to measure normally while the data is entered.

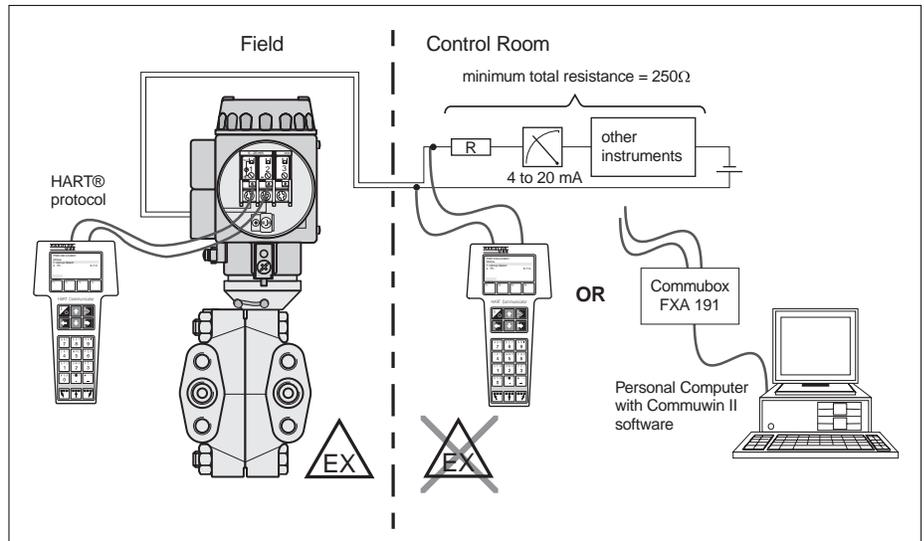
## Function

A digital communication signal is superimposed on the 4 to 20 mA signal line and provides all information required for remote calibration (SMART). Other devices connected to the current output are not affected by this digital signal.

## Operation Using the Commubox FXA 191 and Personal Computer

The Commubox FXA 191 connects 4 to 20 mA Smart transmitters that have a HART® protocol to the RS 232 C serial interface of a personal computer. This enables the transmitter to be remotely operated with the Endress+Hauser Commuwin II operating program.

The Commubox FXA 191 is used for intrinsically safe signal circuits.



Connecting the handheld terminal for HART® protocol. Commubox FXA 191 is wired identical to the hand held terminal.

## Electrical Connection HART®

The intrinsically safe handheld terminal or FXA 191 is connected either:

- directly to the transmitter
- in the control room
- to any point in the signal cable

To ensure reliable communication, the 4 to 20 mA signal line must exhibit a minimum resistance between the connection points and the power supply.

HART®: Minimum line resistance greater than 250Ω, max. 180 nF.

R ≤ 0.0076 Ω/ft (25 Ω/km), max. length 3280 ft (1 km).

A separate shielded two-wire cable is recommended for transmitters with HART® communication interface. Ground the shield in accordance to any hazardous location regulations. For non-hazardous applications, the shield should be grounded at one end only.

**NOTE:** If shielded cable is not used, interference may affect the digital communication signal.

## PROFIBUS PA

The PROFIBUS PA is an open fieldbus standard for connecting sensors and actuators, which may also be in hazardous areas using one bus cable. The two-wire sensors are supplied with power over the PROFIBUS PA line and the process information of the sensor is digitally transmitted.

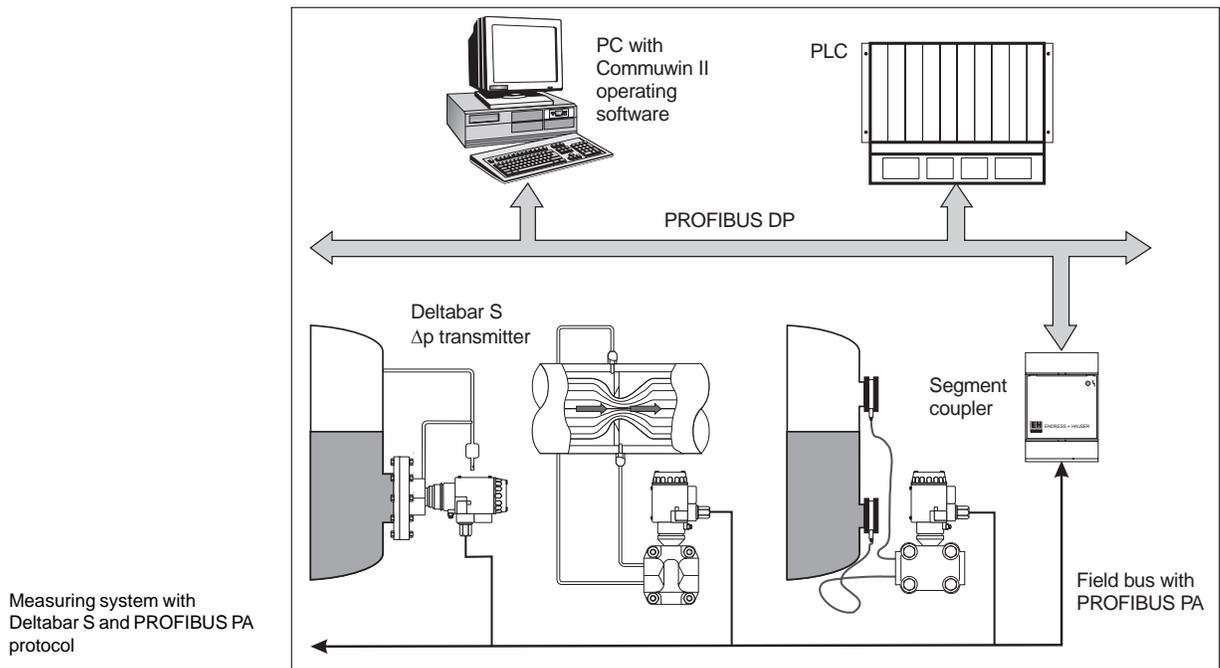
The Deltabar S with PA electronics is connected to a segment coupler which supplies signal to a PLC or personal computer with Communwin II software.

The number of instruments at one bus segment:

- up to 10 intrinsically safe Deltabar S applications
- up to 32 standard Deltabar S applications for non-hazardous areas

The above quantities can be operated on a bus segment, the Deltabar S consumes a maximum of 11 mA per unit.

PROFIBUS PA is an open bus which allows any PROFIBUS PA device to be connected to the bus segment; such as valves, actuators, or other measuring devices.



## Electrical Connection

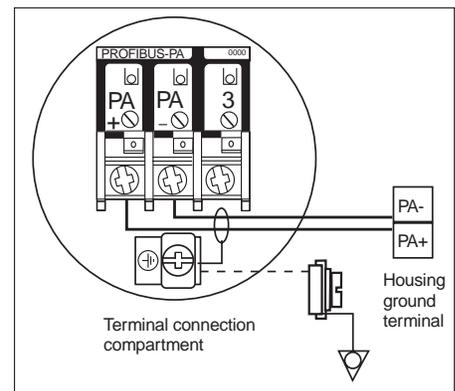
### Electrical Connection, PROFIBUS PA

Connection to a PROFIBUS system requires two-wire twisted cable with shield for installation with the following specifications (for hazardous areas):

Loop Resistance (DC): 15 to 150 W/km

Inductance per Unit Length: 0.4 to 1 mH/km

Capacitance per Unit Length: 80 to 200 nF/km

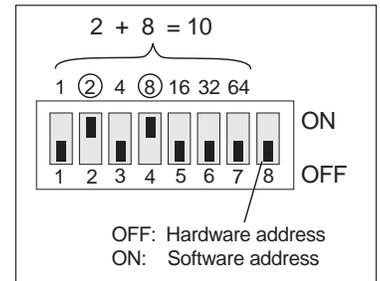
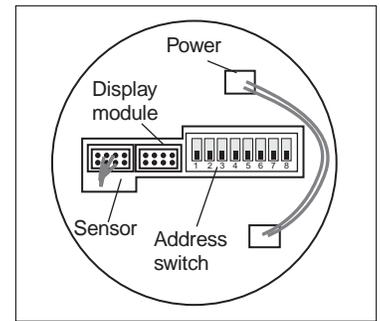


### Bus Address

Every device is given a unique bus address. The address can be set using DIP switches inside the electronic housing or through the Communwin II operating software (ensure DIP switch 8 is ON when using Communwin software).

- Remove electronic housing cover
- Remove display module or coverplate
- Set address (1 to 126) at binary switches 1 to 7
- Set switch 8 to OFF (ON = software address)
- Turn power off and on to activate new address.
- Reinstall coverplate or display module
- Reinstall housing cover

A diskette with the unit parameter file is required for each device. This file must be loaded into the communication unit before the system is commissioned.



## Calibration

### Adjustment Range

Zero and span values are freely adjustable within the measuring limits:

- lower limit: -100% of rating
- upper limit: +100% of rating
- Shifting the zero point leaves the span unchanged
- Non-linearity better than 0.1%
- Accurate measurement with 20 : 1 turndown
- 4 to 20 mA signal can be inverted
- Adjustable output damping; 0 to 16 s via switch, 0 to 40 s via handheld terminal

## Display

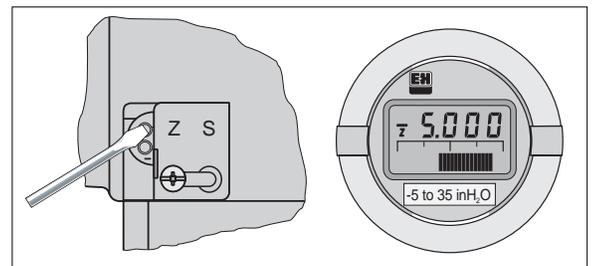
### Rapid On-Site Measurement Check

- Large four-digit pressure display with bargraph (28 section analog display of current)
- Information on the instrument status and diagnosis available without special tools
- Calibration mode: display of zero and span, both showing measuring limits of sensor (and bias pressure). Advantage: zero and span can be calibrated with digital accuracy
- The display can be rotated in 90° steps
- \* Display units freely programmable via HART / PROFIBUS PA protocol

### Display in Calibration Mode

Example (see figure below): Measuring limits -40 to 40 inH<sub>2</sub>O with a rating of 40 inH<sub>2</sub>O. The display shows the digitally accurate pressure value for the zero point (4 mA) which has been set: Z = -5.000 inH<sub>2</sub>O. The bargraph shows that the measuring range lies within the set limits.

In calibration mode, pressing a Z key switches the zero point display



# Installation

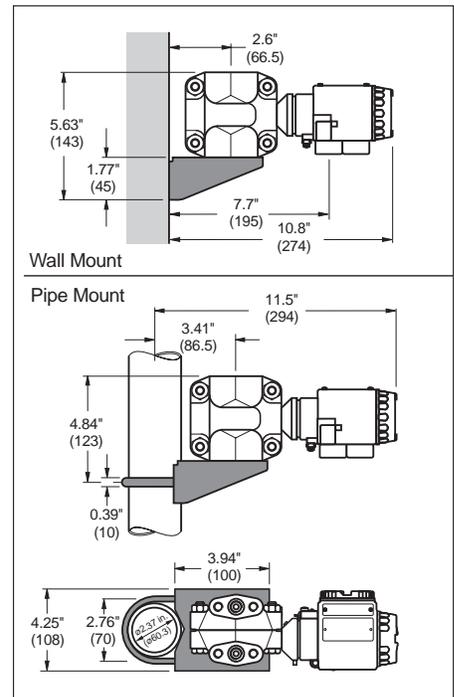
## Zero Point Correction

The Deltabar S is calibrated in the factory according to the zero point method as per DIN 16 086. There is a difference of 0.8 inH<sub>2</sub>O (2 mbar) for the zero point between the vertical and horizontal positions due to the hydrostatic column of the fluid in the sensor. Diaphragm seals thus influence the zero point depending on orientation. This is corrected for when calibrating the zero point.

A 3-valve manifold can be mounted directly to the PMD 230 or PMD 235 which facilitates easy shut-off, removal and equalization of the measuring point (refer to page 12 for manifold information).

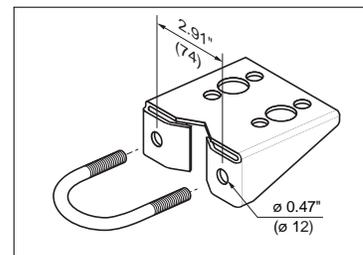
### Mounting Tip:

Use the manifold mounting bracket, it simplifies removal of the transmitter and secures piping.

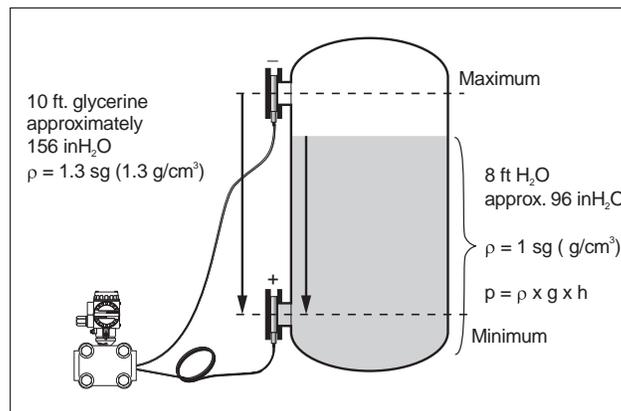


## Mounting Position Importance for Measuring Range

The columns of fluid in the capillary tubes for the PMD 235 with seals and piping to the PMD 230 and PMD 235 produce a differential pressure which depends on the difference in height between the two process connections (see figure below). When selecting the measuring range, the zero point shift must lie within the nominal range of the sensor.



### Example: Sensor selection



The measuring cell selected must be greater than 156 inH<sub>2</sub>O

# Planning Hints for FMD 630, PMD 235 with Seals



## Diaphragm Seal Fluid

To ensure reliable measurement, the process temperature and pressure must be taken into consideration when the fluid for the diaphragm seal filling is selected. The compatibility of the fluid with the process medium must also be considered.

- For food processing, only non-toxic liquids such as NEOBEE M-20 may be used
- Special diaphragm seal fluids are to be used with very low or high process temperatures

Refer to the chart below for seal fluids currently available.

## Mounting Instructions for Capillaries

If the transmitter is to be mounted above or below the measuring pressure point, then the maximum height difference should be 23 feet (7 m). With glycerine, the maximum height difference is 13 feet (4 m). Failure to observe this maximum will cause the liquid column in the capillary to outgas and result in damage to the remote seal. The minimum bending radius of the capillary is 4 inches (100 mm).

When measuring in a vacuum (negative pressure) in a tank, the transmitter should always be mounted below the position of the lower pressure tapping point.

| Diaphragm seal liquid             | Temperature of medium<br>0.75 psia $\leq$ pabs $\leq$ 15 psia<br>(0.05 bar $\leq$ pabs $\leq$ 1bar) | Temperature of medium<br>pabs $\geq$ 15 psia<br>(pabs $\geq$ 1bar) | Note  |
|-----------------------------------|---|--|---|
| Silicon Oil                       | -40° to 356°F<br>(-40° to 180°C)  | -50° to 400°F<br>(-45° to 205°C)                                   | Standard  |
| Syltherm 800 High Temperature Oil | 14° to 392°F<br>(-10° to 200°C)   | -50° to 600°F<br>(-45° to 315°C)                                   |   |
| Halocarbon                        | -40° to 176°F<br>(-40° to 80°C)   | -40° to 450°F<br>(-40° to 230°C)                                   | Inert fill fluid for oxygen service grease free |
| NEOBEE M-20                       | 14° to 248°F<br>(-10° to 120°C)   | 0° to 400°F<br>(-18° to 205°C)                                     | for food processing                             |

## NOTE

To protect the transmitter or diaphragm seals, the protective caps should be removed just before installation. The isolating diaphragms or diaphragm seals must not be depressed or cleaned with pointed or hard objects. A diaphragm seal and the transmitter form a closed and calibrated system. It is filled with diaphragm seal fluid through an opening in the diaphragm seal and body of the sensor. This opening is sealed shut and may not be opened.

## Recommended Spans and Diaphragm Sizes

The expansion of the diaphragm seal fluid with temperature introduces an additional influence on the pressure measurement. The following points should be noted when selecting the diaphragm seal:

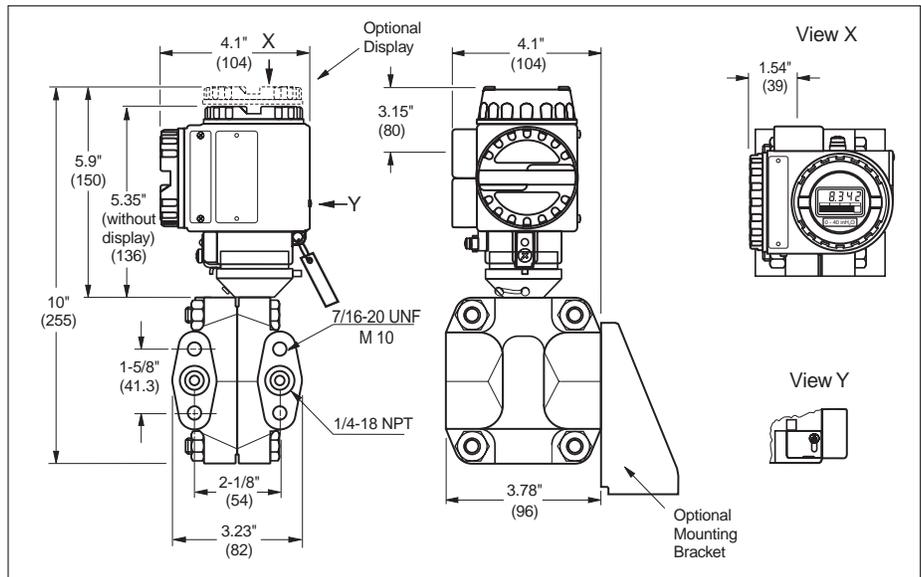
- The nominal width of the diaphragm seal is determined by the diameter of the diaphragm
- The larger the diameter of the diaphragm, the smaller the temperature effect.
- For small measuring spans, the largest possible diaphragm diameter should be used to limit the effects of temperature and increase sensitivity.

## Temperature Effects

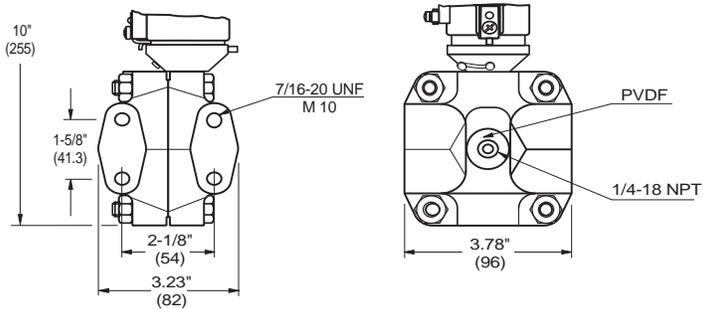
Changes in temperature may have a negative effect on the performance and or accuracy of a transmitter with seals. The fill fluid expansion / contraction at varying temperatures will cause changes in pressure at the measuring cell. By selecting the correct type of seal, fill fluid and length of capillaries, the effects may be reduced. Please contact Endress+Hauser for selection of the best solution for your application.

# Dimensions

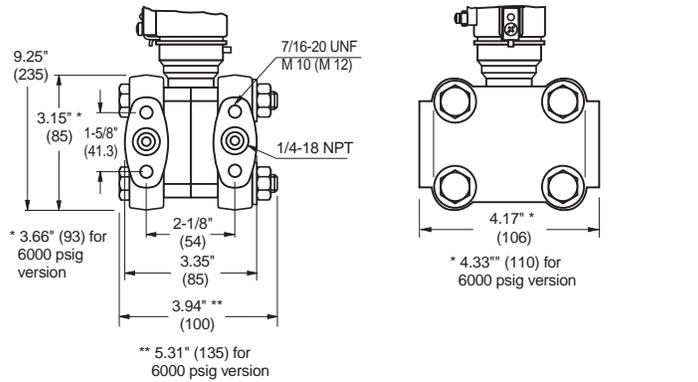
PMD 230 Deltabar S  
with ceramic sensor



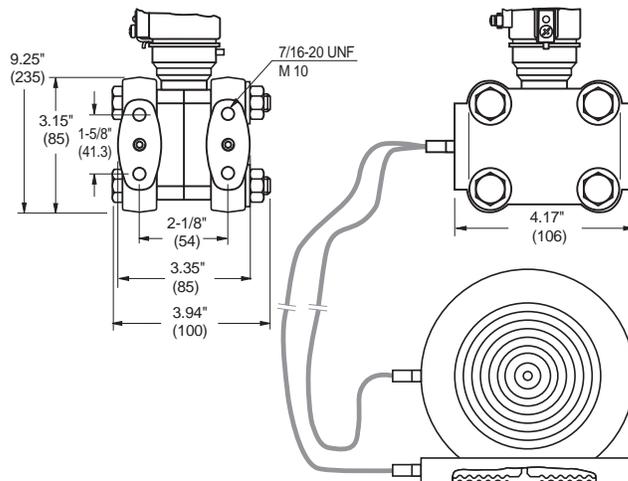
PMD 230 Deltabar S  
with PVDF flange for  
metal-free applications



PMD 235 Deltabar S  
with silicon sensor



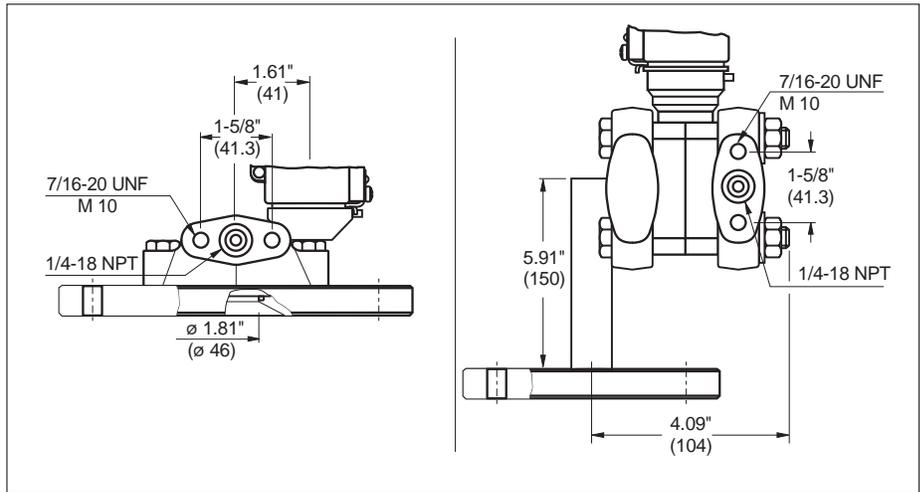
PMD 235 Deltabar S  
with remote seals



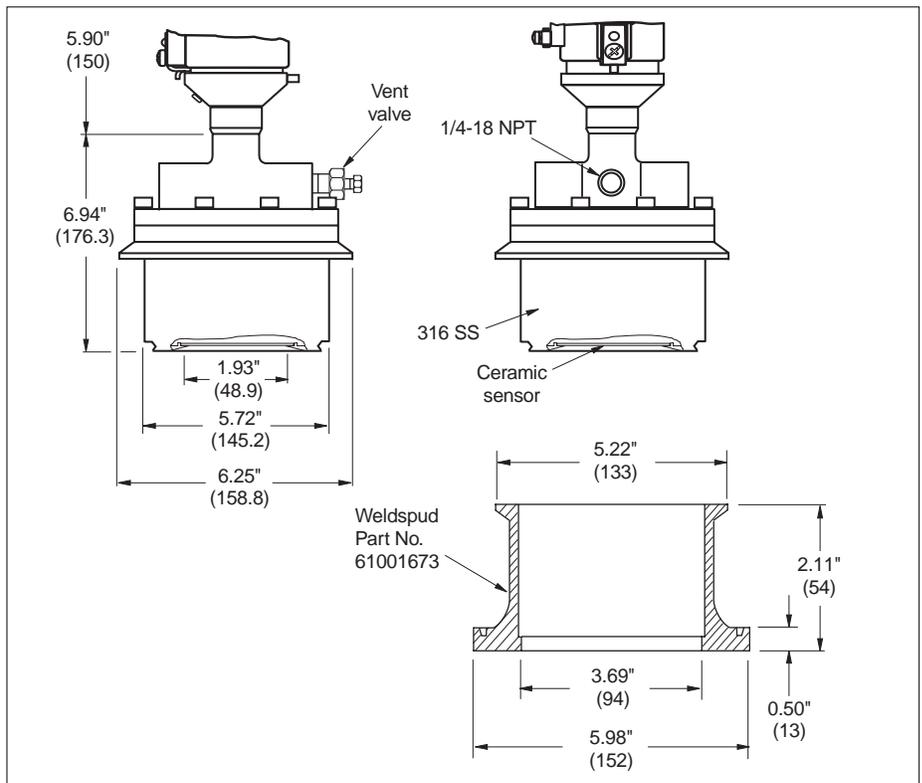
# Dimensions

Left: FMD 230 Deltabar S with flush-mounted ceramic sensor, optional ECTFE-laminated (HALAR) flange for metal-free applications

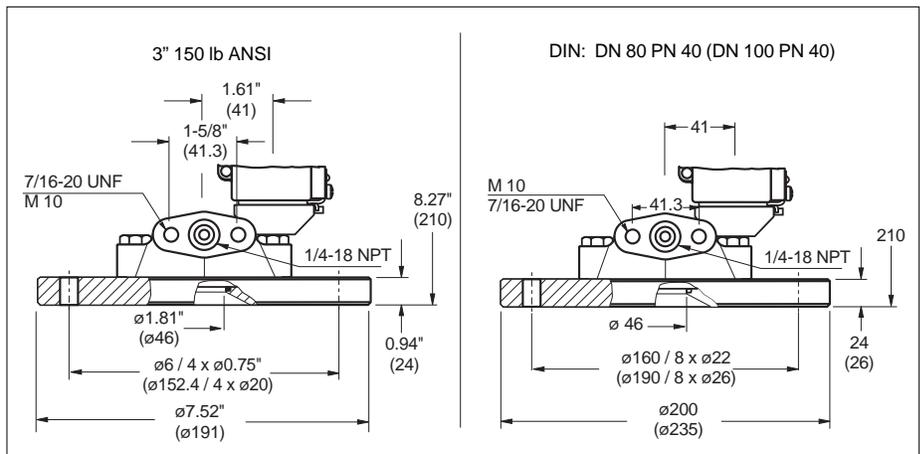
Right: FMD 630 Deltabar S with diaphragm seal for direct mounting



FMD 230 Deltabar S with tank spud



FMD 230 Deltabar S Flush mounted ceramic



# Dimensions

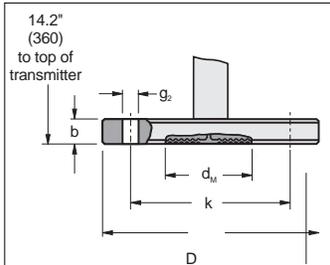
**FMD 630**  
Diaphragm seal - mounting dimensions per ANSI B 16.5

| Order Code | Pipe Nominal Diameter | Flange           |                |           |                           |                             | Mounting Holes       |                    |                      | Diaphragm Seal  |                         |                   |
|------------|-----------------------|------------------|----------------|-----------|---------------------------|-----------------------------|----------------------|--------------------|----------------------|-----------------|-------------------------|-------------------|
|            |                       | Nominal Pressure | Outer Diameter | Thickness | Extended Diaphragm Length | Extended Diaphragm Diameter | Number               | Bolt Hole Diameter | Bolt Hole Circle     | Diaphragm Width | Temperature Coefficient | Weight of FMD 630 |
|            | in.                   | psi              | D (in.)        | b (in.)   | L (in.)                   | d <sub>s</sub> (in.)        | g <sub>2</sub> (in.) | k (in.)            | d <sub>w</sub> (in.) | Tk (psi/10°F)   | lbs                     |                   |
| P          | 2                     | 150              | 6              | 0.75      | NA                        | NA                          | 4                    | 0.75               | 4.75                 | 1.75            | 0.040                   | 19.8              |
| R          | 3                     | 150              | 8.25           | 0.937     | NA                        | NA                          | 4                    | 0.75               | 6                    | 2.75            | 0.024                   | 24.3              |
| S          | 3                     | 150              | 8.25           | 0.937     | 2                         | 3                           | 4                    | 0.75               | 6                    | 2.75            | 0.024                   | 28.7              |
| T          | 3                     | 150              | 8.25           | 0.937     | 4                         | 3                           | 4                    | 0.75               | 6                    | 2.75            | 0.032                   | 33.1              |
| U          | 3                     | 150              | 8.25           | 0.937     | 8                         | 3                           | 4                    | 0.75               | 6                    | 2.75            | 0.032                   | 39.7              |
| W          | 4                     | 300              | 10             | 1.5       | NA                        | NA                          | 8                    | 0.937              | 6                    | 2.75            | 0.016                   | 28.7              |

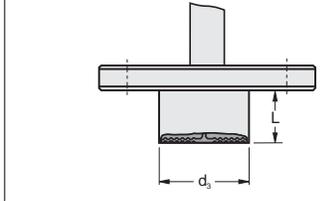
**FMD 630 Diaphragm seal - mounting dimensions per DIN 2501**

| Order Code | Pipe Nominal Diameter | Flange           |                |           |                           |                             | Mounting Holes      |                    |                     | Diaphragm Seal  |                         |                   |
|------------|-----------------------|------------------|----------------|-----------|---------------------------|-----------------------------|---------------------|--------------------|---------------------|-----------------|-------------------------|-------------------|
|            |                       | Nominal Pressure | Outer Diameter | Thickness | Extended Diaphragm Length | Extended Diaphragm Diameter | Number              | Bolt Hole Diameter | Bolt Hole Circle    | Diaphragm Width | Temperature Coefficient | Weight of FMD 630 |
|            | mm                    | bar              | D (mm)         | b (mm)    | L (mm)                    | d <sub>s</sub> (mm)         | g <sub>2</sub> (mm) | k (mm)             | d <sub>w</sub> (mm) | Tk (mbar/10K)   | kg                      |                   |
| A          | 50                    | 40               | 165            | 20        | NA                        | NA                          | 4                   | 18                 | 125                 | 46              | +5                      | 9                 |
| C          | 80                    | 40               | 200            | 24        | NA                        | NA                          | 8                   | 22                 | 160                 | 70              | +3                      | 11                |
| D          | 80                    | 40               | 200            | 24        | 50                        | 76.5                        | 8                   | 22                 | 160                 | 70              | +3                      | 13                |
| E          | 80                    | 40               | 200            | 24        | 100                       | 76.5                        | 8                   | 22                 | 160                 | 70              | +4                      | 15                |
| F          | 80                    | 40               | 200            | 24        | 200                       | 76.5                        | 8                   | 22                 | 160                 | 70              | +4                      | 18                |
| G          | 100                   | 40               | 235            | 26        | NA                        | NA                          | 8                   | 26                 | 190                 | 70              | +2                      | 13                |

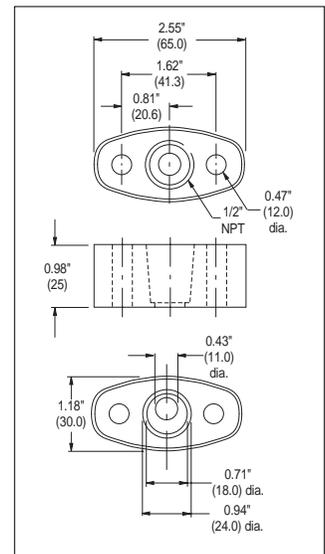
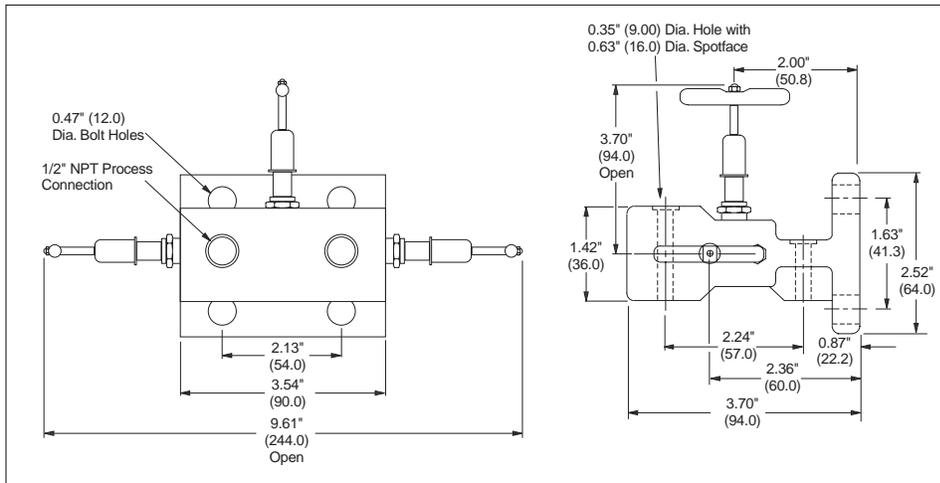
FMD 630 diaphragm seal, flush mount



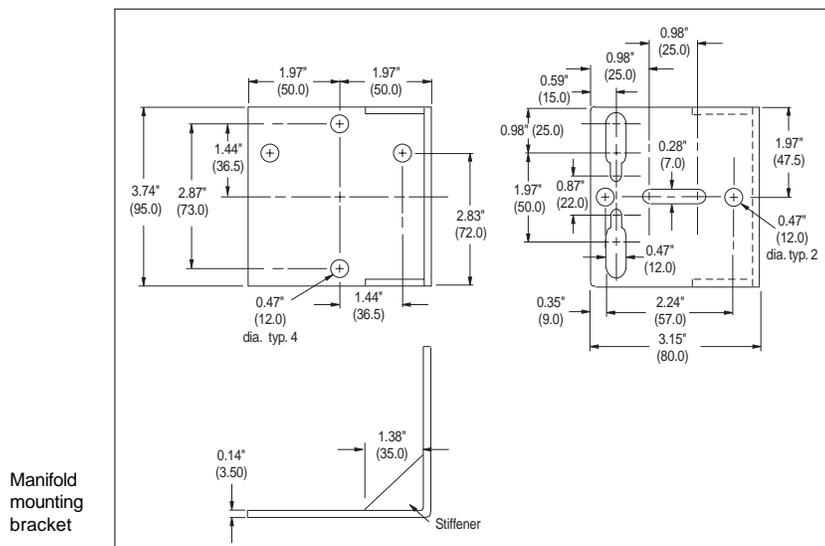
FMD 630 diaphragm seal, extended



## Three-valve Manifold



1/2" FNPT offset adapter



Manifold mounting bracket

**NOTE:** Refer to Accessories ordering information on page 16 for the manifold, bracket and adapter materials and part numbers.

# Technical Data

## General Information

|                      |   |
|----------------------|---|
| Manufacturer         | Endress+Hauser  |
| Product Name         | Deltabar S; PMD 230, PMD 235, FMD 230, FMD 630  |
| Instrument Function  | Transmitter for differential pressure, flow, or level   |
| Type of Pressure     | Differential, positive and negative overpressure  |
| Measuring Principle  | PMD 230, FMD 230: capacitive single-chamber ceramic sensor<br>PMD 235, FMD 630: piezoresistive silicon sensor                       |
| Reference Conditions | DIN IEC 770, T <sub>amb</sub> = 77°F (25°C) or as stated  |
| Interface            | 4 to 20 mA, can be superimposed with communications signal as required (HART®). PROFIBUS PA digital communication is also available |
| CE Approval          | By attaching the CE mark, Endress+Hauser confirms that the Deltabar S fulfils all legal requirements of the relevant EC directives. |

## Mechanical Construction

|                       |  |
|-----------------------|--|
| Pressure Connection   | Common threaded connections and flanges as specified in the Ordering Information section.  |
| Electrical Connection | Selectable entries, 1/2-14 NPT, PG 13.5, M 20 x 1.5, G 1/2 or PG 13 cable gland. Wiring terminals are for AWG 20 to AWG 13, interlock diode integrated. 2-wire connection using commercial instrument cable (with shield for PROFIBUS connection). |
| Weight                | PMD 230, approximately 11 lbs (5 kg)<br>PMD 235, 8.8 to 13 lbs (4 to 6 kg) depending on version<br>FMD 230, with 3" flange, 17.6 lbs (8 kg)  |

## Input Characteristics

Ceramic Sensor:

| Nominal Value                                    | Limits                                 |                                      | Span                              |                                      | System Pressure         |                         | Pressure transmission sensor fluid |
|--|--|--------------------------------------|-----------------------------------|--------------------------------------|-------------------------|-------------------------|------------------------------------|
|  | lower-range value                      | upper-range value                    | minimum                           | maximum                              | overload one side       | overload both sides     |                                    |
| <b>PMD 230</b><br><b>FMD 230</b>                 |  |                                      |                                   |                                      |                         |                         |                                    |
| <b>10 inH<sub>2</sub>O</b><br><b>25 mbar</b>     | -10 inH <sub>2</sub> O<br>-25 mbar     | 10 inH <sub>2</sub> O<br>25 mbar     | 0.4 inH <sub>2</sub> O<br>1 mbar  | 10 inH <sub>2</sub> O<br>25 mbar     | 145 psi<br>10 bar       | 145 psi<br>10 bar       | silicon oil **                     |
| <b>40 inH<sub>2</sub>O</b><br><b>100 mbar</b>    | -40 inH <sub>2</sub> O<br>-100 mbar    | 40 inH <sub>2</sub> O<br>100 mbar    | 2 inH <sub>2</sub> O<br>5 mbar    | 40 inH <sub>2</sub> O<br>100 mbar    | 230 psi *<br>16 bar *   | 230 psi *<br>16 bar *   | silicon oil **                     |
| <b>200 inH<sub>2</sub>O</b><br><b>500 mbar</b>   | -200 inH <sub>2</sub> O<br>-500 mbar   | 200 inH <sub>2</sub> O<br>500 mbar   | 10 inH <sub>2</sub> O<br>25 mbar  | 200 inH <sub>2</sub> O<br>500 mbar   | 1450 psi *<br>100 bar * | 2000 psi *<br>140 bar * | mineral oil **                     |
| <b>1200 inH<sub>2</sub>O</b><br><b>3000 mbar</b> | -1200 inH <sub>2</sub> O<br>-3000 mbar | 1200 inH <sub>2</sub> O<br>3000 mbar | 60 inH <sub>2</sub> O<br>150 mbar | 1200 inH <sub>2</sub> O<br>3000 mbar | 1450 psi *<br>100 bar * | 2000 psi *<br>140 bar * | mineral oil **                     |

\* 145 psi (10 bar) for process connection PVDF with PMD 230. 580 psi (40 bar) with process flange for FMD 230.  
\*\* Voltalef 1A for oxygen service, grease free.

Silicon Sensor:

| Nominal Value                                    | Limits                             |                                   | Span                             |                                   | System Pressure             |                             | Pressure transmission sensor fluid |
|--|------------------------------------|-----------------------------------|----------------------------------|-----------------------------------|-----------------------------|-----------------------------|------------------------------------|
|  | lower-range value                  | upper-range value                 | minimum                          | maximum                           | overload one side           | overload both sides         |                                    |
| <b>PMD 235</b><br><b>FMD 630</b>                 |                                    |                                   |                                  |                                   |                             |                             |                                    |
| <b>4 inH<sub>2</sub>O</b> *<br><b>10 mbar</b> *  | -4 inH <sub>2</sub> O<br>-10 mbar  | 4 inH <sub>2</sub> O<br>10 mbar   | 0.4 inH <sub>2</sub> O<br>1 mbar | 4 inH <sub>2</sub> O<br>10 mbar   | 2000 psi<br>140 bar         | 2000 psi<br>140 bar         | silicon oil **                     |
| <b>16 inH<sub>2</sub>O</b> *<br><b>40 mbar</b> * | -16 inH <sub>2</sub> O<br>-40 mbar | 16 inH <sub>2</sub> O<br>40 mbar  | 2 inH <sub>2</sub> O<br>5 mbar   | 16 inH <sub>2</sub> O<br>40 mbar  | 2000 psi<br>140 bar         | 2000 psi<br>140 bar         | silicon oil **                     |
| <b>64 inH<sub>2</sub>O</b><br><b>160 mbar</b>    | -64 inH <sub>2</sub> O<br>-160 bar | 64 inH <sub>2</sub> O<br>160 mbar | 4 inH <sub>2</sub> O<br>10 mbar  | 64 inH <sub>2</sub> O<br>160 mbar | 2000 psi<br>140 bar         | 2000 psi<br>140 bar         | silicon oil **                     |
| <b>400 inH<sub>2</sub>O</b><br><b>1 bar</b>      | -400 inH <sub>2</sub> O<br>-1 bar  | 400 inH <sub>2</sub> O<br>1 bar   | 20 inH <sub>2</sub> O<br>50 mbar | 400 inH <sub>2</sub> O<br>1 bar   | 6000 psi ***<br>420 bar *** | 6000 psi ***<br>420 bar *** | silicon oil **                     |
| <b>87 psi</b><br><b>6 bar</b>                    | -87 psi<br>-6 bar                  | 87 psi<br>6 bar                   | 4.35 psi<br>300 mbar             | 87 psi<br>6 bar                   | 6000 psi ***<br>420 bar *** | 6000 psi ***<br>420 bar *** | silicon oil **                     |
| <b>580 psi</b> *<br><b>40 bar</b> *              | -580 psi<br>-40 bar                | 580 psi<br>40 bar                 | 29 psi<br>2000 mbar              | 580 psi<br>40 bar                 | 1450 psi<br>100 bar         | 6000 psi ***<br>420 bar *** | silicon oil **                     |

\* PMD 235 only  
\*\* Voltalef 1A for oxygen service, grease free  
\*\*\* Check nominal pressure rating of flange

|                             |   |
|-----------------------------|---|
| Minimum Static Pressure     | PMD 230, PMD 235, FMD 230: $p_{abs}$ greater than 0.0145 psia (1 mbar) for all sensors and measuring ranges<br>FMD 630: $p_{abs}$ greater than 0.145 psia (10 mbar) for all sensors and measuring ranges  |
| Wetted Parts Materials      | PMD 230, FMD 230: ceramic diaphragm, process connection and seal as required<br>PMD 235, FMD 630: 316 SST for the sensor metallic separating diaphragm, process connection and seal as required<br>PMD 235 with seals: metallic separating diaphragm of the diaphragm seal and process connection as required.  |
| Pressure Transmission Fluid | PMD 230, FMD 230: silicon oil for sensors 10 inH <sub>2</sub> O (25 mbar) and 40 inH <sub>2</sub> O (100 mbar), mineral oil for sensors 200 inH <sub>2</sub> O (500 mbar), and 1200 inH <sub>2</sub> O (3000 mbar).<br>Voltalef 1A for oxygen service, grease free.<br>PMD 235, FMD 630: for sensor, silicon oil. Voltalef 1A for applications in purified gas, e.g. oxygen. For diaphragm seal, fluid as required. |

**Output Parameters**  
(PROFIBUS, see next page)

| Output  | 4 to 20 mA (optional superimposed communication signal for HART®). Linear (proportional to differential pressure) or square root (proportional to flow), switchable.<br>Under-run 3.8 mA (4 mA selectable), over-run 20.5 mA (as per NAMUR).<br>On fault, selectable 3.6 mA, 21.5 mA or hold.  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
|---|--|-----|-----|---------------------------------|-------------------------|----------------------------------|-------------------------|-----------------------------------|---------------------------|-------------------------------------|---------------------------|-----|-----|--------------------------------|---------------------------|---------------------------------|---------------------------|----------------------------------|---------------------------|---|---------------------------|-----|-----|----------------------------------|---------------------------|---|---------------------------|
| Resolution  | Better than 6 mA   |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Adjustable Range  | Zero and span are freely adjustable within measurement limits  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Warm-up Time  | 2 seconds  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Response Time   | Depending on measuring range, from 0.5 seconds   |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Rise Time   | Depending on measuring range, from 0.4 seconds   |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Long-term Drift   | Ceramic sensor, 0.1%/12 months<br>Silicon sensor, 0.1%/6 months  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Accuracy  | PMD 230, 235 standard versions; FMD 230, FMD 630:<br>(Turn Down = Upper Range Limit / Span)<br>With TD $\leq$ 10, accuracy = 0.1% x Span<br>With TD > 10, accuracy = 0.1% x TD/10 x Span<br>PMD 235 Platinum version<br>With TD $\leq$ 10, accuracy = 0.05% x Span<br>With TD > 10, accuracy = 0.05% x TD/10 x Span  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Thermal Coefficient (TK) on Zero and Span                         | PMD 230, 235 standard versions; FMD 230: (FMD 630, see table on page 12)<br>0.04% of URL per 50°F (30 K) for T = 14°F to 140°F (-10°C to 60°C)<br>0.1% of URL per 50°F (30 K) for T = -40° to 14°F and 140° to 185°F (-40° to -10°C and 60° to 85°C)<br>PMD 235 Platinum version:<br>0.03% of URL per 50°F (30 K) for T = 14°F to 140°F (-10°C to 60°C)<br>0.08% of URL per 50°F (30 K) for T = -40° to 14°F and 140° to 185°F (-40° to -10°C and 60° to 85°C)   |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| Static Pressure Effect  | PMD 230, FMD 230 $y$ = value in % of URL (Upper Range Limit)<br><table border="1" style="margin-left: 40px;"> <thead> <tr> <th>URL</th> <th><math>y</math></th> </tr> </thead> <tbody> <tr> <td>10 inH<sub>2</sub>O (25 mbar)</td> <td>0.5% / 145 psi (10 bar)</td> </tr> <tr> <td>40 inH<sub>2</sub>O (100 mbar)</td> <td>0.2% / 230 psi (16 bar)</td> </tr> <tr> <td>200 inH<sub>2</sub>O (500 mbar)</td> <td>0.2% / 1450 psi (100 bar)</td> </tr> <tr> <td>1200 inH<sub>2</sub>O (3000 mbar)</td> <td>0.2% / 1450 psi (100 bar)</td> </tr> </tbody> </table> <hr/> PMD 235, FMD 630<br><table border="1" style="margin-left: 40px;"> <thead> <tr> <th>URL</th> <th><math>y</math></th> </tr> </thead> <tbody> <tr> <td>4 inH<sub>2</sub>O (10 mbar)</td> <td>1.5% / 1450 psi (100 bar)</td> </tr> <tr> <td>16 inH<sub>2</sub>O (40 mbar)</td> <td>0.5% / 1450 psi (100 bar)</td> </tr> <tr> <td>64 inH<sub>2</sub>O (160 mbar)</td> <td>0.2% / 1450 psi (100 bar)</td> </tr> <tr> <td>400 inH<sub>2</sub>O, 87 psi, 580 psi (1000, 6000, 40,000 mbar)</td> <td>0.1% / 1450 psi (100 bar)</td> </tr> </tbody> </table> <hr/> PMD 235 Platinum<br><table border="1" style="margin-left: 40px;"> <thead> <tr> <th>URL</th> <th><math>y</math></th> </tr> </thead> <tbody> <tr> <td>64 inH<sub>2</sub>O (160 mbar)</td> <td>0.2% / 1450 psi (100 bar)</td> </tr> <tr> <td>400 inH<sub>2</sub>O, 87 psi, 580 psi (1000, 6000, 40,000 mbar)</td> <td>0.1% / 1450 psi (100 bar)</td> </tr> </tbody> </table> | URL | $y$ | 10 inH <sub>2</sub> O (25 mbar) | 0.5% / 145 psi (10 bar) | 40 inH <sub>2</sub> O (100 mbar) | 0.2% / 230 psi (16 bar) | 200 inH <sub>2</sub> O (500 mbar) | 0.2% / 1450 psi (100 bar) | 1200 inH <sub>2</sub> O (3000 mbar) | 0.2% / 1450 psi (100 bar) | URL | $y$ | 4 inH <sub>2</sub> O (10 mbar) | 1.5% / 1450 psi (100 bar) | 16 inH <sub>2</sub> O (40 mbar) | 0.5% / 1450 psi (100 bar) | 64 inH <sub>2</sub> O (160 mbar) | 0.2% / 1450 psi (100 bar) | 400 inH <sub>2</sub> O, 87 psi, 580 psi (1000, 6000, 40,000 mbar) | 0.1% / 1450 psi (100 bar) | URL | $y$ | 64 inH <sub>2</sub> O (160 mbar) | 0.2% / 1450 psi (100 bar) | 400 inH <sub>2</sub> O, 87 psi, 580 psi (1000, 6000, 40,000 mbar) | 0.1% / 1450 psi (100 bar) |
| URL   | $y$  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 10 inH <sub>2</sub> O (25 mbar)                                   | 0.5% / 145 psi (10 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 40 inH <sub>2</sub> O (100 mbar)                                  | 0.2% / 230 psi (16 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 200 inH <sub>2</sub> O (500 mbar)                                 | 0.2% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 1200 inH <sub>2</sub> O (3000 mbar)                               | 0.2% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| URL   | $y$  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 4 inH <sub>2</sub> O (10 mbar)                                    | 1.5% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 16 inH <sub>2</sub> O (40 mbar)                                   | 0.5% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 64 inH <sub>2</sub> O (160 mbar)                                  | 0.2% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 400 inH <sub>2</sub> O, 87 psi, 580 psi (1000, 6000, 40,000 mbar) | 0.1% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| URL   | $y$  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 64 inH <sub>2</sub> O (160 mbar)                                  | 0.2% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |
| 400 inH <sub>2</sub> O, 87 psi, 580 psi (1000, 6000, 40,000 mbar) | 0.1% / 1450 psi (100 bar)  |     |     |                                 |                         |                                  |                         |                                   |                           |                                     |                           |     |     |                                |                           |                                 |                           |                                  |                           |   |                           |     |     |                                  |                           |   |                           |

## Output, PROFIBUS

|                        |   |
|------------------------|---|
| PROFIBUS PA Function   | Slave   |
| Transmission Rate      | 31.25 kByte/s   |
| Response Time          | Slave; approximately 20 ms. PLC; approximately 600 ms for approximately 30 devices                    |
| Signal on Alarm        | PROFIBUS PA, signal status bit is set, last valid measured value held. Display, error code displayed. |
| Damping                | 0 to 40 seconds via communication   |
| Communication Resistor | None, separate PROFIBUS PA termination  |
| Physical Layer         | IEC 1158-2  |

## Operating Conditions

|                                     |  |
|-------------------------------------|--|
| Process Temperature                 | -40° to 185°F (-40° to 85°C)   |
| Ambient Temperature                 | -40° to 185°F (-40° to 85°C)   |
| Storage Temperature                 | Ceramic, -40° to 212°F (-40° to 100°C)<br>Silicon, -58° to 212°F (-50° to 100°C)   |
| Ingress Protection                  | NEMA 4X (IP 65). Optional NEMA 6P (IP 68) for PMD 235 and FMD 630  |
| Climatic Class                      | G P C to DIN 40 040  |
| Electromagnetic Compatibility (EMC) | Interference immunity to EN 50 082-2; interference emission to EN 50 081-1; industry standard NAMUR at 30 V/m  |
| Vibration Effects                   | Ceramic sensor: ± 0.1% (to DIN IEC 68, part 2-6 for span)<br>Silicon sensor: ± 0.1% (to DIN IEC 68, part 2-6 for span measured on sensor 87 psig (6000 mbar))  |
| Housing                             | Copper-free die-cast aluminum with polyester finish to RAL 5012 (blue), cover RAL 7045 (gray), seawater resistant, saltwater spray test DIN 50 021 (504 h) passed, nameplate AISI 316 L SS, process connection as required, O-ring in BUNA-N (NBR) for cover seal, mounting set C22.8 steel  |
| Approvals                           | PMD 230: FM approved intrinsically safe, Class I, II, III; Division 1; Groups A-G. Non-incendive, Class I, Division 2; Groups A-D. Dust-ignition proof, Class II, III; Division 1; Groups E-G<br>PMD 235: FM approved explosion proof, Class I; Division 1; Groups A-D. Dust ignition proof, Class II, III; Division 1; Groups E-G. Intrinsically safe, Class I, II, III; Division 1; Groups A-G. Non-incendive, Class I, Division 2; Groups A-D.<br>FMD 230: FM approved intrinsically safe, Class I, II, III; Division 1; Groups A-G. Non-incendive, Class I, Division 2; Groups A-D. Dust-ignition proof, Class II, III; Division 1; Groups E-G<br>FMD 630: FM approved explosion proof, Class I; Division 1; Groups A-D. Dust ignition proof, Class II, III; Division 1; Groups E-G. Intrinsically safe, Class I, II, III; Division 1; Groups A-G. Non-incendive, Class I, Division 2; Groups A-D. Equivalent Cenelec and CSA approvals available. |
| Maximum Entity Parameters           | $V_{max} = 30V$ , $I_{max} = 180 mA$ , $P_{max} = 1W$ , $C_i = 11.2 nF$<br>$L_i = 455 mH$  |

## Power Supply

|                  |  |
|------------------|--|
| Voltage Range    | Standard 11.5 to 45 VDC (refer to charts below). Refer to PROFIBUS voltage below for power requirements.   |
|                  |  |
| Residual Ripple  | To 5% ripple without effect (within permissible voltage range)   |
| PROFIBUS Voltage | 9 to 32 VDC, non-hazardous areas. 9 to 24 VDC for hazardous areas. Loop resistance (DC) 15 to 150 $\omega/km$ . Inductance per unit length, 0.4 to mH/km. Capacitance per unit length, 80 to 200 nF/km. Connection to a PROFIBUS system requires two-wire twisted cable with shield. |

# Ordering Information

## PMD 230 Differential pressure transmitter with ceramic sensor



PMD 230 -  1  2  3  4  5  6  7

- 1 Certificate / Cable Entry
  - C EEx ia IIC T4/T6, PG 13.5 cable entry
  - W FM approved intrinsically safe, CL I, II, III; Div. 1; Grps A-G  
Non-incendive, CL I; Div. 2; Grps A-D  
Dust-Ignition, CL II, III; Div. 1; Grps E-G  
1/2" NPT conduit entry
- 2 CSA IS (non-incendive), CL I, II, III; Div. 1; Grps A-G  
1/2" NPT conduit entry
  - Y Special version
- 2 Electronics, display, housing
  - B 4 to 20 mA HART, LCD display, top cover
  - H 4 to 20 mA HART, without display, top cover
  - U 4 to 20 mA HART, LCD display, side cover
  - M 4 to 20 mA HART, without display, side cover
  - D PROFIBUS PA, LCD display, top cover
  - I PROFIBUS PA, without display, top cover
  - P PROFIBUS PA, LCD display, side cover
  - X PROFIBUS PA, without display, side cover
  - Y Special version
- 3 Ceramic sensor min/max span (maximum static pressure)
  - 1B 0.4 to 10 inH<sub>2</sub>O (145 psi)                      1 to 25 mbar (10 bar)
  - 2D 2 to 40 inH<sub>2</sub>O (230 psi)                            5 to 100 mbar (16 bar)
  - 3F 10 to 200 inH<sub>2</sub>O (1450 psi)                      25 to 500 mbar (100 bar)
  - 3H 60 to 1200 inH<sub>2</sub>O (1450 psi)                    150 to 3000 mbar (100 bar)
  - 9Y Special version
- 4 Calibration / Units
  - 1 Nominal value / mbar, bar; linear
  - 2 Nominal value / kPa, MPa; linear
  - 3 Nominal value / mmH<sub>2</sub>O; linear
  - 4 Nominal value / inH<sub>2</sub>O; linear
  - 5 Nominal value / kgf, cm<sup>2</sup>; linear
  - 6 Nominal value / psi; linear
  - 9 State initial and end value, units in writing; linear or square root
- 5 Accessories (fittings)
  - EA Without
  - EB 2 blind taps, SS
  - ED 2 vent valves, SS
  - EG 2 blind taps, 1 mounting bracket
  - EH 2 vent valves, 1 mounting bracket
  - EM 1 mounting bracket for wall and pipe
  - EY Special version
- 6 Process seal (wetted parts)
  - 1 FPM (Viton, fluoroelastomer)
  - 3 PTFE faced Hastelloy C-4 for p<sub>abs</sub> > 13 psia (900 mbar)
  - 4 EPDM
  - 6 FPM Viton for oxygen service, grease free (T<sub>max</sub> 140°F, P<sub>max</sub> 1000 psi)
  - 7 Kalrez
  - 8 Viton o-ring, Silicon free, grease free (not for oxygen service)
  - 9 Special version
- 7 Process connection (1/4-18 NPT)
  - A Oval flange, C22.8, DIN 19213, M10 threaded
  - B Oval flange, C22.8, 7/16-20 UNF
  - C Oval flange, 316L SS, DIN19213, M10 threaded
  - D Oval flange, 316L SS, 7/16-20 UNF
  - F Oval flange, Hastelloy C, 7/16-20 UNF
  - G Oval flange, PVDF, 7/16-20 UNF, maximum pressure 145 psi (10 bar)
  - Y Special version

### Accessories

### Part Numbers

|  |                            |
|--|----------------------------|
| SST mounting set for pipe or wall<br>(includes hardware, order both part numbers)          | 943153-1001<br>943153-0031 |
| Carbon steel mounting set for pipe or wall<br>(includes hardware, order both part numbers) | 943153-1000<br>943153-0030 |
| 3-valve manifold, 316 SS, 6000 psi, 1/2" pipe and flange                                   | 84600538                   |
| 3-valve manifold, CS, 6000 psi, 1/2" pipe and flange                                       | 84600539                   |
| Manifold, 316 SS, 2" mounting bracket  | 84600541                   |
| Offset center, 1/2" FNPT adapters  | 84600362                   |

**PMD 235 Differential pressure transmitter with silicon sensor**



PMD 235 - 1 2 3 4 5 6 7

- 1 Certificate / Cable Entry
  - C EEx ia IIC T4/T6, PG 13.5 cable entry
  - T EEx d IIC T5/T6, PG 13.5 cable entry
  - W FM approved intrinsically safe, CL I, II, III; Div. 1; Grps A-G  
Non-incendive, CL I; Div. 2; Grps A-D  
Dust-Ignition, CL II, III; Div. 1; Grps E-G  
1/2" NPT conduit entry
  - U FM approved explosion proof, CL I, II, III; Div. 1: Grps A-G  
1/2" NPT conduit entry
- 2 CSA IS (non-incendive), CL I, II, III; Div. 1; Grps A-G  
1/2" NPT conduit entry
  - 1 CSA explosion proof, CL I, II, III; Div. 1; Groups B-G  
1/2" NPT conduit entry
  - Y Special version
- 2 Electronics, display, housing
  - B 4 to 20 mA HART, LCD display, top cover
  - H 4 to 20 mA HART, without display, top cover
  - U 4 to 20 mA HART, LCD display, side cover
  - M 4 to 20 mA HART, without display, side cover
  - D PROFIBUS PA, LCD display, top cover
  - I PROFIBUS PA, without display, top cover
  - P PROFIBUS PA, LCD display, side cover
  - X PROFIBUS PA, without display, side cover
  - Y Special version
- 3 Silicon sensor min/max span, sensor material (maximum static pressure)
  - 4A 0.4 to 4 inH<sub>2</sub>O, 316 SS (2000 psi) 1 to 10 mbar (140 bar)
  - 4C 2 to 16 inH<sub>2</sub>O, 316 SS (2000 psi) 5 to 40 mbar (140 bar)
  - 4E 4 to 64 inH<sub>2</sub>O, 316 SS (2000 psi) 10 to 160 mbar (140 bar)
  - 4G 20 to 400 inH<sub>2</sub>O, 316 SS (2000 psi) 50 to 1000 mbar (140 bar)
  - 4K 4.35 to 87 psi, 316 SS (2000 psi) 0.3 to 6 bar (140 bar)
  - 4M 29 to 580 psi, 316 SS (2000 psi) 2 to 40 bar (140 bar)
  - 5G 20 to 400 inH<sub>2</sub>O, 316 SS (6000 psi) 50 to 1000 mbar (420 bar)
  - 5K 4.35 to 87 psi, 316 SS (6000 psi) 0.3 to 6 bar (420 bar)
  - 5M 29 to 580 psi, 316 SS (6000 psi) 2 to 40 bar (420 bar)
  - BA 0.4 to 4 inH<sub>2</sub>O, Hastelloy C (2000 psi) 1 to 10 mbar (140 bar)
  - BC 2 to 16 inH<sub>2</sub>O, Hastelloy C (2000 psi) 5 to 40 mbar (140 bar)
  - BE 4 to 64 inH<sub>2</sub>O, Hastelloy C (2000 psi) 10 to 160 mbar (140 bar)
  - BG 20 to 400 inH<sub>2</sub>O, Hastelloy C (2000 psi) 50 to 1000 mbar (140 bar)
  - BK 4.35 to 87 psi, Hastelloy C (2000 psi) 0.3 to 6 bar (140 bar)
  - BM 29 to 580 psi, Hastelloy C (2000 psi) 2 to 40 bar (140 bar)
  - HG 20 to 400 inH<sub>2</sub>O, Hastelloy C (6000 psi) 50 to 1000 mbar (420 bar)
  - HK 4.35 to 87 psi, Hastelloy C (6000 psi) 0.3 to 6 bar (420 bar)
  - HM 29 to 580 psi, Hastelloy C (6000 psi) 2 to 40 bar (420 bar)
- 4 Calibration / Units
  - C Nominal calibration 0.05%, psi, platinum version
  - 1 Nominal value / mbar, bar; linear
  - 2 Nominal value / kPa, MPa; linear
  - 3 Nominal value / mmH<sub>2</sub>O; linear
  - 4 Nominal value / inH<sub>2</sub>O; linear
  - 5 Nominal value / kgf, cm<sup>2</sup>; linear
  - 6 Nominal value / psi; linear
  - 9 State initial and end value, units in writing; linear or square
- 5 Accessories (fittings)
  - EA Without
  - EB 2 blind taps, SS
  - ED 2 vent valves, SS
  - EG 2 blind taps, 1 mounting bracket
  - EH 2 vent valves, 1 mounting bracket
  - EM 1 mounting bracket for wall and pipe
  - EY Special version
- 6 Process seal (wetted parts)
  - 1 FPM (Viton, fluoroelastomer)
  - 2 NBR (Buna-N)
  - 3 PTFE from 0.0145 psia (1 mBar)
  - 6 FPM Viton, grease free for oxygen use (T<sub>max</sub> = 140°F, P<sub>max</sub> = 1000 psi)
  - 8 Viton o-ring, grease free
  - 9 Special version
- 7 Process connection (1/4-18 NPT)
  - A Oval flange, C22.8, DIN 19213, (PN140, M10 mounting, PN420, M12 mounting)
  - B Oval flange, C22.8, 7/16-20 UNF
  - C Oval flange, 316L SS, DIN19213, (PN140, M10 mounting, PN420, M12 mounting)
  - D Oval flange, 316L SS, 7/16-20 UNF
  - F Oval flange, Hastelloy C, 7/16-20 UNF
  - Y Special version

NOTE: For remote diaphragm seals, please contact Endress+Hauser

**FMD 230 Differential pressure transmitter, flush mounted ceramic sensor**



FMD 230 "WH" version



FMD 230 -  1  2  3  4  5  6  7  8

- 1 Certificate / Cable Entry
  - C EEx ia IIC T4/T6, PG 13.5 cable entry
  - W FM approved intrinsically safe, CL I, II, III; Div. 1; Grps A-G  
Non-incendive, CL I; Div. 2; Grps A-D  
Dust-Ignition, CL II, III; Div. 1; Grps E-G  
1/2" NPT conduit entry
- 2 CSA IS (non-incendive), CL I, II, III; Div. 1; Grps A-G  
1/2" NPT conduit entry
  - Y Special version
- 2 Electronics, display, housing
  - B 4 to 20 mA HART, LCD display, top cover
  - H 4 to 20 mA HART, without display, top cover
  - U 4 to 20 mA HART, LCD display, side cover
  - M 4 to 20 mA HART, without display, side cover
  - D PROFIBUS PA, LCD display, top cover
  - I PROFIBUS PA, without display, top cover
  - P PROFIBUS PA, LCD display, side cover
  - X PROFIBUS PA, without display, side cover
  - Y Special version
- 3 Ceramic sensor min/max range, (maximum static pressure)
  - 2D 2 to 40 inH<sub>2</sub>O (230 psi) 5 to 100 mbar (16 bar)
  - 3F 10 to 200 inH<sub>2</sub>O (1450 psi) 25 to 500 mbar (100 bar)
  - 3H 60 to 1200 inH<sub>2</sub>O (1450 psi) 150 to 3000 mbar (100 bar)
  - 9Y Special version
- 4 Calibration / Units
  - 1 Nominal value / mbar, bar; linear
  - 2 Nominal value / kPa, MPa; linear
  - 3 Nominal value / mmH<sub>2</sub>O; linear
  - 4 Nominal value / inH<sub>2</sub>O; linear
  - 5 Nominal value / kgf, cm<sup>2</sup>; linear
  - 6 Nominal value / psi; linear
  - 9 State initial and end value, units in writing; linear or square
- 5 Accessories (fittings)
  - EA Without
  - EC One vent valve, 316 SS
  - EY Special version
- 6 Process seal (wetted parts)
  - 1 FPM (Viton, fluoroelastomer)
  - 3 PTFE faced Hastelloy C-4 for p<sub>abs</sub> > 13 psia (900 mbar)
  - 4 EPDM
  - 6 FPM Viton for oxygen service, grease free (T<sub>max</sub> 140°F, P<sub>max</sub> 1000 psi)
  - 7 Kalrez
  - 8 Viton o-ring, grease free
  - 9 Special version
- 7 Low side process connection (1/4-18 NPT)
  - A Oval flange, C22.8, DIN 19213, M10 threaded
  - B Oval flange, C22.8, 7/16-20 UNF
  - C Oval flange, 316L SS, DIN19213, M10 threaded
  - D Oval flange, 316L SS, 7/16-20 UNF
  - F Oval flange, Hastelloy C, 7/16-20 UNF
  - Y Special version
- 8 High side process connection "+"
  - DK 3" 150 lb ANSI flange; 316L SS
  - DM 3" 150 lb ANSI flange; ECTFE coated (HALAR)
  - DN 3" 150 lb ANSI flange, Hastelloy C-276
  - DR 4" 150 lb ANSI flange; 316L SS
  - DS 4" 150 lb ANSI flange; ECTFE coated (HALAR)
  - DT 4" 150 lb ANSI flange, Hastelloy C-276
  - WH Sanitary tank weld spud, 2" extension, clamp mount  
316L SS, low pressure side 1/4-18 FNPT
  - BK DN 80, PN 40; 316L SS
  - BM DN 80, PN 40; ECTFE coated flange
  - BN DN 80, PN 40; Hastelloy C-276 flange
  - BR DN 100, PN 40; 316L SS
  - BS DN 100, PN 40; ECTFE coated flange
  - BT DN 100, PN 40; Hastelloy C-276 flange
  - YY Special version

**Accessories**

**Part Numbers**

|   |          |
|---|----------|
| Weldspud for "WH" process connection option | 61001673 |
| 4" clamp for weldspud                       | 61001674 |

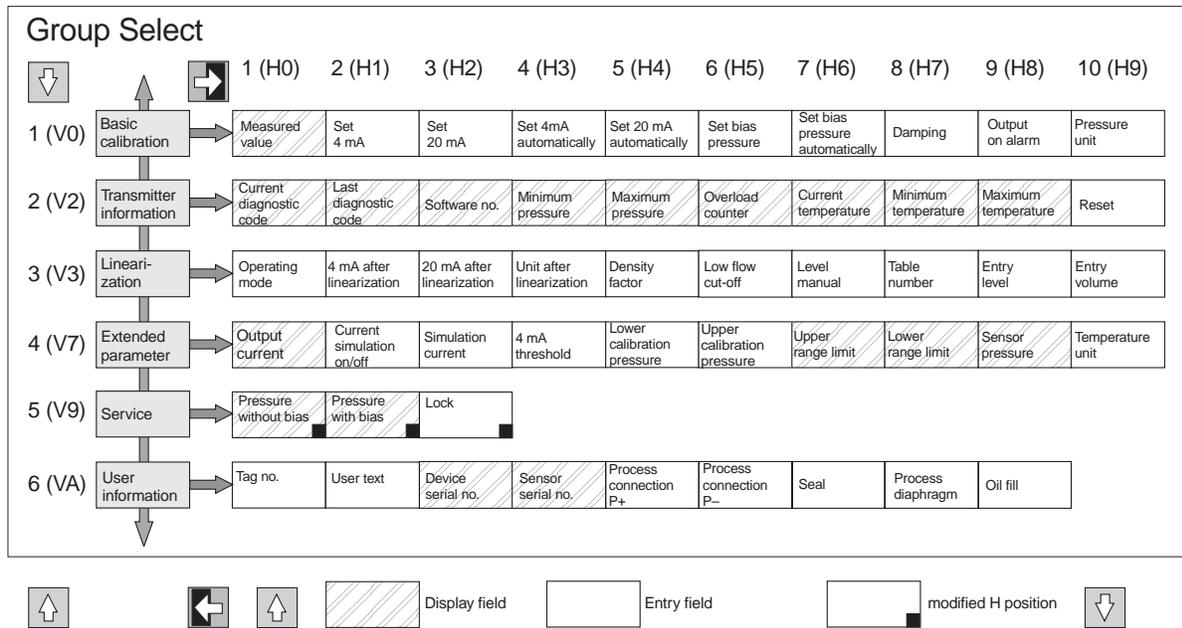
**FMD 630 Differential pressure transmitter with diaphragm seal for level measurement**



FMD 630 - 1 2 3 4 5 6 7 8 9

- 1 Certificate / Cable Entry
  - C EEx ia IIC T4/T6, PG 13.5 cable entry
  - T EEx d IIC T5/T6, 1/2" NPT
  - W FM approved intrinsically safe, CL I, II, III; Div. 1; Grps A-G  
Non-incendive, CL I; Div. 2; Grps A-D  
1/2" NPT conduit entry
  - U FM approved explosion proof, CL I; Div. 1; Grps A-D  
Dust ignition proof, Class II, III; Div 1; Grps E-G  
1/2" NPT conduit entry
- 2 CSA IS (non-incendive), CL I, II, III; Div. 1; Grps A-G  
1/2" NPT conduit entry
  - 1 CSA explosion proof, CL I, II, III; Div. 1; Grps B-G  
1/2" NPT conduit entry
  - Y Special version
- 2 Electronics, display, housing
  - B 4 to 20 mA HART, LCD display, top cover
  - H 4 to 20 mA HART, without display, top cover
  - U 4 to 20 mA HART, LCD display, side cover
  - M 4 to 20 mA HART, without display, side cover
  - D PROFIBUS PA, LCD display, top cover
  - I PROFIBUS PA, without display, top cover
  - P PROFIBUS PA, LCD display, side cover
  - X PROFIBUS PA, without display, side cover
  - Y Special version
- 3 Ceramic sensor min/max span, (maximum static pressure)
  - 4E 4 to 64 inH<sub>2</sub>O (2000 psi) 10 to 160 mbar (140 bar)
  - 4G 20 to 400 inH<sub>2</sub>O (2000 psi) 50 to 1000 mbar (140 bar)
  - 4K 4.35 to 87 psi (2000 psi) 300 to 6000 mbar (140 bar)
  - 9Y Special version
- 4 Calibration / Units
  - 1 Nominal value / mbar, bar; linear
  - 2 Nominal value / kPa, MPa; linear
  - 3 Nominal value / mmH<sub>2</sub>O; linear
  - 4 Nominal value / inH<sub>2</sub>O; linear
  - 5 Nominal value / kgf, cm<sup>2</sup>; linear
  - 6 Nominal value / psi; linear
  - 9 State initial and end value, units in writing; linear or square
- 5 Accessories (fittings)
  - EA Without
  - EC One vent valve, 316 SS
  - EY Special version
- 6 Process seal (wetted parts)
  - 1 FPM (Viton, fluoroelastomer)
  - 2 NBR (Buna-N)
  - 3 PTFE
  - 6 FPM Viton for oxygen service, grease free (T<sub>max</sub> 140°F, P<sub>max</sub> 1000 psi)
  - 8 Viton o-ring, grease free
  - H Copper (for use with Process Connection "H" only)
  - 9 Special version
- 7 Low side process connection (1/4-18 NPT)
  - A Oval flange, C22.8, DIN 19213, M10 threaded
  - B Oval flange, C22.8, 7/16-20 UNF
  - C Oval flange, 316L SS, DIN19213, M10 threaded
  - D Oval flange, 316L SS, 7/16-20 UNF
  - H Oval flange for diaphragm seal mounting
  - Y Special version
- 8 High side process connection "+"
  - P 2" 150 lb ANSI flange; 316L SS
  - R 3" 150 lb ANSI flange; 316L SS
  - S 3" 150 lb ANSI flange; 2" extension, 316L SS
  - T 3" 150 lb ANSI flange; 4" extension, 316L SS
  - U 3" 150 lb ANSI flange; 8" extension, 316L SS
  - W 4" 300 lb ANSI flange; 316L SS
- A DN 50, PN 40; 316L SS flange
  - C DN 80, PN 40; 316L SS flange
  - D DN 80, PN 40; extension, 50 mm, 316L SS
  - E DN 80, PN 40; extension, 100 mm, 316L SS
  - F DN 80, PN 40; extension, 200 mm, 316L SS
  - G DN 100, PN 40; 316L SS flange
  - 9 Special version
- 9 Diaphragm material and seal liquid
  - A Hastelloy C, Silicon fill
  - D Hastelloy C, high-temp oil fill
  - F Tanatium, Silicon fill
  - G Tantalum, high-temp oil fill
  - 1 316L SS, Silicon fill
  - 2 316L SS, Neobee-M20 oil fill
  - 3 316L SS, Glycerin fill
  - 4 316L SS, high-temp oil fill
  - 5 316L SS, oil fill for oxygen application
  - 9 Special diaphragm and fill fluid

# Deltabar S HART® Program Matrix



## Pressure Unit Conversion Table

| From \ To              | Pa (N/m <sup>2</sup> )  | kPa                      | MPa                      | bar                      | mbar                     | mm H <sub>2</sub> O     | kg/cm <sup>2</sup>       | atm                      | inch Hg                  | mm Hg                    | inch H <sub>2</sub> O    | psi                       |
|------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|---------------------------|
| Pa (N/m <sup>2</sup> ) | 1                       | 10 <sup>-3</sup>         | 10 <sup>-6</sup>         | 10 <sup>-5</sup>         | 10 <sup>-2</sup>         | 0.1020                  | 1.020 x 10 <sup>-5</sup> | 9.869 x 10 <sup>-6</sup> | 2.953 x 10 <sup>-4</sup> | 7.501 x 10 <sup>-3</sup> | 4.016 x 10 <sup>-3</sup> | 1.451 x 10 <sup>-4</sup>  |
| kPa                    | 10 <sup>3</sup>         | 1                        | 10 <sup>-3</sup>         | 10 <sup>-2</sup>         | 10                       | 102.0                   | 0.0102                   | 9.869 x 10 <sup>-3</sup> | 0.2953                   | 7.501                    | 4.016                    | 0.14505                   |
| MPa                    | 10 <sup>6</sup>         | 10 <sup>3</sup>          | 1                        | 10                       | 10 <sup>4</sup>          | 1.020 x 10 <sup>5</sup> | 10.20                    | 9.869                    | 295.3                    | 7501                     | 4016                     | 145.05                    |
| bar                    | 10 <sup>5</sup>         | 100                      | 0.1                      | 1                        | 10 <sup>3</sup>          | 1.020 x 10 <sup>4</sup> | 1.020                    | 0.9869                   | 29.530                   | 750.1                    | 401.6                    | 14.505                    |
| mbar                   | 100                     | 0.1                      | 10 <sup>-4</sup>         | 10 <sup>-3</sup>         | 1                        | 10.20                   | 1.020 x 10 <sup>-3</sup> | 9.869 x 10 <sup>-4</sup> | 0.0295                   | 0.7501                   | 0.4016                   | 0.0145                    |
| mm H <sub>2</sub> O    | 9.807                   | 9.807 x 10 <sup>-3</sup> | 9.807 x 10 <sup>-6</sup> | 9.807 x 10 <sup>-5</sup> | 9.807 x 10 <sup>-2</sup> | 1                       | 10 <sup>-4</sup>         | 9.678 x 10 <sup>-5</sup> | 2.891 x 10 <sup>-3</sup> | 0.0734                   | 0.0394                   | 1.4224 x 10 <sup>-3</sup> |
| kg/cm <sup>2</sup>     | 9.807 x 10 <sup>4</sup> | 98.07                    | 0.0981                   | 0.98077                  | 980.7                    | 10 <sup>4</sup>         | 1                        | 0.9678                   | 28.910                   | 734.2                    | 393.7                    | 14.224                    |
| atm                    | 1.013 x 10 <sup>5</sup> | 101.3                    | 0.1013                   | 1.013                    | 1013                     | 1.033 x 10 <sup>4</sup> | 1.033                    | 1                        | 29.922                   | 760.1                    | 406.7                    | 14.68                     |
| inch Hg                | 3.386 x 10 <sup>3</sup> | 3.386                    | 3.386 x 10 <sup>-3</sup> | 0.0339                   | 33.864                   | 345.9                   | 0.0346                   | 0.0334                   | 1                        | 25.40                    | 13.62                    | 0.4912                    |
| mm Hg                  | 133.3                   | 0.1333                   | 1.333 x 10 <sup>-4</sup> | 1.333 x 10 <sup>-3</sup> | 1.333                    | 13.62                   | 1.362 x 10 <sup>-3</sup> | 1.316 x 10 <sup>-3</sup> | 0.0394                   | 1                        | 0.5362                   | 0.0193                    |
| inch H <sub>2</sub> O  | 249.1                   | 0.2491                   | 2.491 x 10 <sup>-4</sup> | 2.491 x 10 <sup>-3</sup> | 2.491                    | 25.40                   | 2.54 x 10 <sup>-3</sup>  | 2.458 x 10 <sup>-3</sup> | 0.0734                   | 1.8650                   | 1                        | 0.0361                    |
| psi                    | 6.895 x 10 <sup>3</sup> | 6.895                    | 6.895 x 10 <sup>-3</sup> | 0.0689                   | 68.948                   | 704.3                   | 0.0704                   | 0.0680                   | 2.036                    | 51.71                    | 27.73                    | 1                         |

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