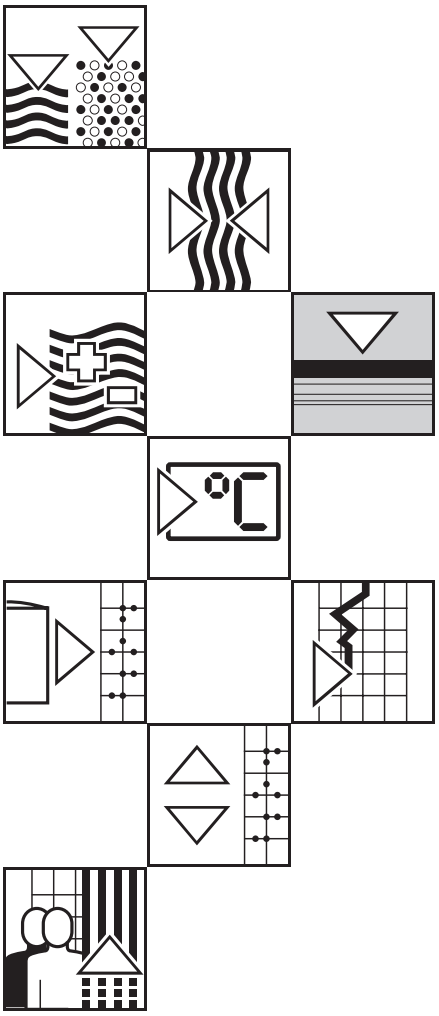
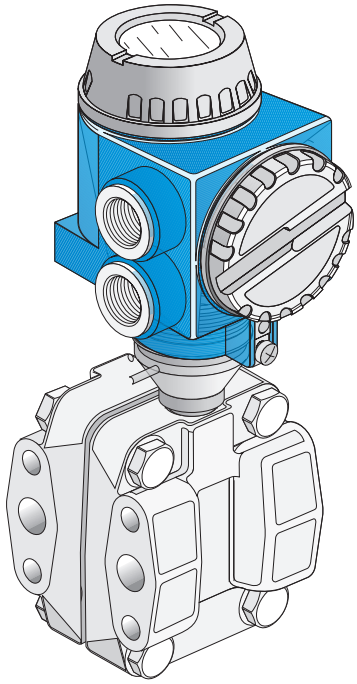
BA 167P/00/en/08.02
Software version 2.2
52014747

deltabar S
PROFIBUS-PA
Differential Pressure Measurement

Operating Instructions

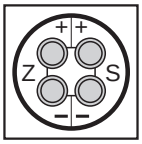




PROFI PROCESS FIELD BUS ®

Endress + Hauser
The Power of Know How

Short Operating Instructions



Comissioning on-site
– Differential pressure
– Level
– Flow
Chapters 4.1 and 5

Remote operation via Commuwin II

Chapters 4.2, 6, 7 and 8

Differential pressure, level or flow?

Differential pressure Chapter 6

– Calibration
– Damping
– Locking/unlocking the operation
– Measuring point information

Level Chapter 7

– Calibration
– Density correction

Empty/full calibration

Dry calibration

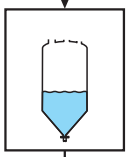
Flow Chapter 8

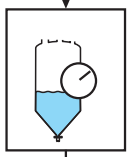
– Calibration
– Creep flow supression
– Damping
– Locking/unlocking the operation
– Measuring point information

Linearisation Chapter 7.4

no

yes





– Damping
– Locking/unlocking the operation
– Measuring point information

Table of Contents

Software History

Software	Changes	Significance
1.0	Original Software DPV1 (profile 2.0)	
1.1	– OUT Status codes changed – Slot/Index table changed	
2.0	PROFIBUS-PA version 3.0 (profile 3.0)	PROFIBUS-PA parameter, new matrix fields for Commuwin II V6H0 Ident. number V6H1 Set unit to bus V6H2 Out Value (Analog Input Block) V6H3 Out Status (Analog Input Block) V6H4 Select 2nd cyclic value V6H5 Select V0H0 (Display value) V6H6 Out Value from PLC V6H7 Profile version
		Two further values can be read cyclically.
		Data can be sent cyclically to the device.
		V9H5 Zero correction V9H6 Zero correction value (Display)
2.1	– Corrections in communication stack – Ccorrection of parameter attributes	
2.2	– Corrections in communication stack – Ccorrection of one parameter attribute	

Note!

Note!
Second generation Deltabar S PROFIBUS-PA devices with 3.0 profiles are cyclical downwards compatible with the first generation Deltabar S PROFIBUS-PA devices with 2.0 profiles, i.e. first generation devices can be replaced with second generation devices.
However, to use the additional functions of second generation devices with 3.0 profiles, such as cyclical reading of two additional values, the PLC must be configured with the GSD (EH3x1504.gsd or EH3_1504.gsd).
If the additional functions of the 3.0 profile are not required, the PLC configuration with the first generation GSD (EH__1504.gsd) can be kept.

Notes on Safety

Approved usage

The Deltabar S is a differential pressure transmitter for measuring differential pressure, flow and level.

Mounting, commissioning, operation

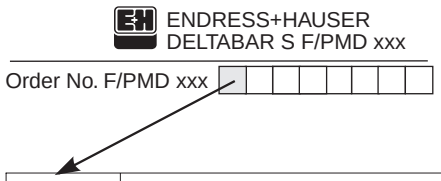
The Deltabar S has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise, e.g. product overflow due to incorrect installation or calibration. For this reason, the instrument must be installed, connected, operated and maintained according to the instructions in this manual: personnel must be authorised and suitably qualified. The manual must have been read and understood, and the instructions followed. Modifications and repairs to the device are permissible only when they are expressly approved in the manual.

Please pay particular attention to the technical data on the nameplate.

Explosion hazardous areas

If the device is to be installed in an explosion hazardous area, then the specifications in the certificate as well as all national and local regulations must be observed. The instrument can be delivered with the certificates listed in the table below. The certificate can be identified from the first letter of the order code stamped on the nameplate.

- Ensure that all personnel are suitably qualified.
- Observe the specifications in the certificate as well as national and local regulations.
- Take special care with regard to the grounding of the bus cable screening, see e.g. IEC 60079-14.



Certificates for applications in explosion hazardous areas

Code	Certificate	Explosion protection
A, F, K, S, 3, 5	Standard	none
B, N	ATEX	ATEX II 3 G EEx nA II T6
C, I, L, 6	PTB	ATEX II 1/2 G EEx ia IIC T4/T6
D	PTB	PMD 235: ATEX II 1/2 G EEx ia IIC T4/T6, Zone 0
T	PTB	ATEX II 2 G EEx d IIC T4/T6
W	FM	IS Class I, II, III, Div. 1, Groups A…G
2	CSA	IS Class I, II, III, Div. 1, Groups A…G

Safety Conventions and Symbols

In order to highlight safety-relevant or alternative operating procedures in the manual, the following conventions have been used, each indicated by a corresponding icon in the margin.

Safety conventions

Symbol	Meaning
 Note!	**Note!** A note highlights actions or procedures which, if not performed correctly, may indirectly affect operation or may lead to an instrument response which is not planned.
 Caution!	**Caution!** Caution highlights actions or procedures which, if not performed correctly, may lead to personal injury or incorrect functioning of the instrument.
 Warning!	**Warning!** A warning highlights actions or procedures which, if not performed correctly, will lead to personal injury, a safety hazard or destruction of the instrument.

Explosion protection

	**Device certified for use in explosion hazardous area** If the device has this symbol embossed on its name plate it can be installed in an explosion hazardous area.
	**Explosion hazardous area** Symbol used in drawings to indicate explosion hazardous areas. – Devices located in and wiring entering areas with the designation "explosion hazardous areas" must conform with the stated type of protection.
	**Safe area (non-explosion hazardous area)** Symbol used in drawings to indicate, if necessary, non-explosion hazardous areas. – Devices located in safe areas still require a certificate if their outputs run into explosion hazardous areas.

Electrical symbols

	**Direct voltage** A terminal to which or from which a direct current or voltage may be applied or supplied.
	**Alternating voltage** A terminal to which or from which an alternating (sine-wave) current or voltage may be applied or supplied.
	**Grounded terminal** A grounded terminal, which as far as the operator is concerned, is already grounded by means of an earth grounding system.
	**Protective grounding (earth) terminal** A terminal which must be connected to earth ground prior to making any other connection to the equipment.
	**Equipotential connection (earth bonding)** A connection made to the plant grounding system which may be of type e.g. neutral star or equipotential line according to national or company practice.

1 Introduction

Application

The Deltabar S family of devices is used for the measurement of differential pressure, level and flow in gases, vapours and liquids. They are used in all sectors of industry. You can operate the additonal flow and level measurement functions using Commuwin II.

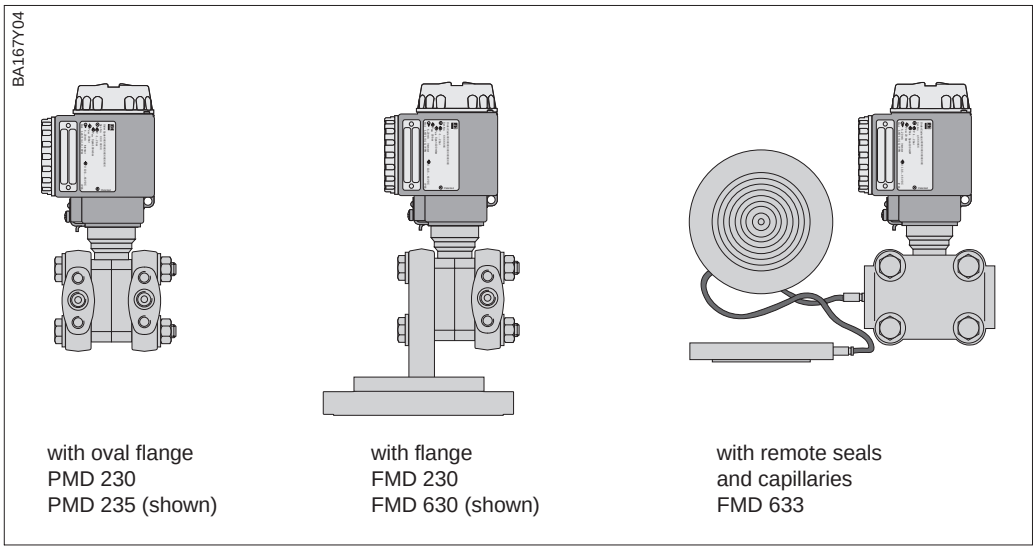


Figure 1.1
Deltabar S versions

Operating principle

Metal sensor
The system pressure deflects the separating diaphragm and a fill fluid transmits the pressure to a resistance bridge. The pressure dependent change in bridge output voltage is measured and processed further.

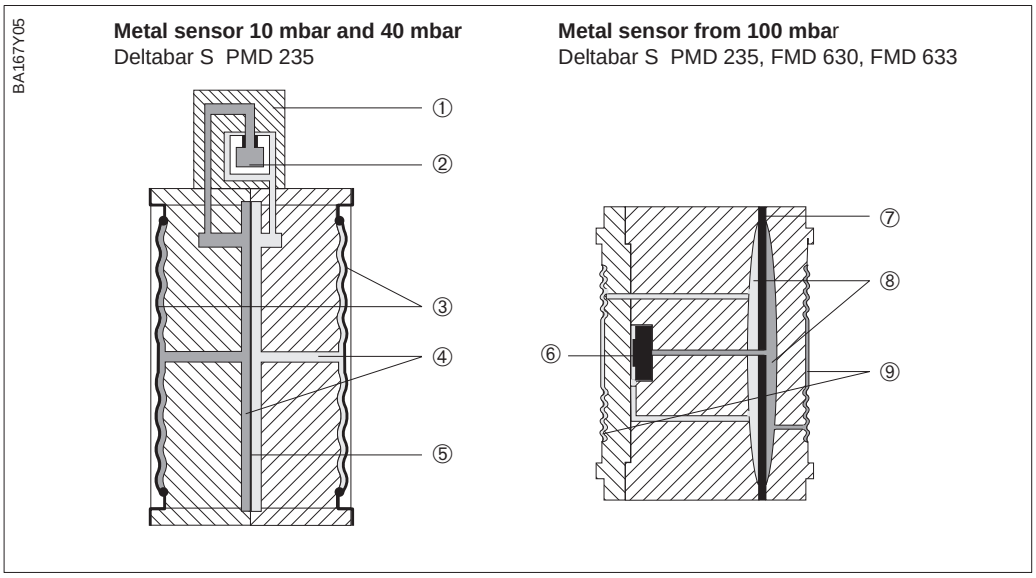


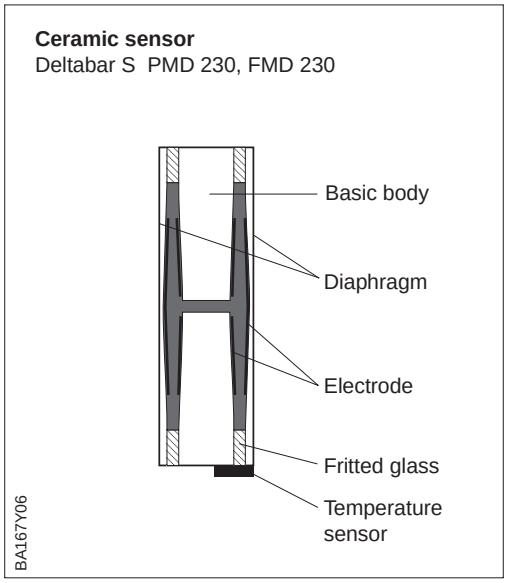
Figure 1.2

Metal sensor
10 mbar, 40 mbar
① *Measuring element*
② *Silicon membran*
③ *Separting diaphragm and membran bed*
④ *Filling fluid*
⑤ *Integrated overload protection*

Metal sensor
from 100 mbar
⑥ *Measuring element*
⑦ *Overload diaphragm*
⑧ *Filling fluid*
⑨ *Separting diaphragm and membran bed*

Ceramic sensor
The system pressure acts directly on the robust ceramic diaphragm of the pressure sensor and deflects it by maximum 0.025 mm. A change in capacitance proportional to the pressure acting is measured by electrodes on the ceramic substrate and diaphragm. The measuring range is determined by the thickness of the ceramic diaphragm.

Ceramic sensor
Deltabar S PMD 230, FMD 230



1.1 Measuring system

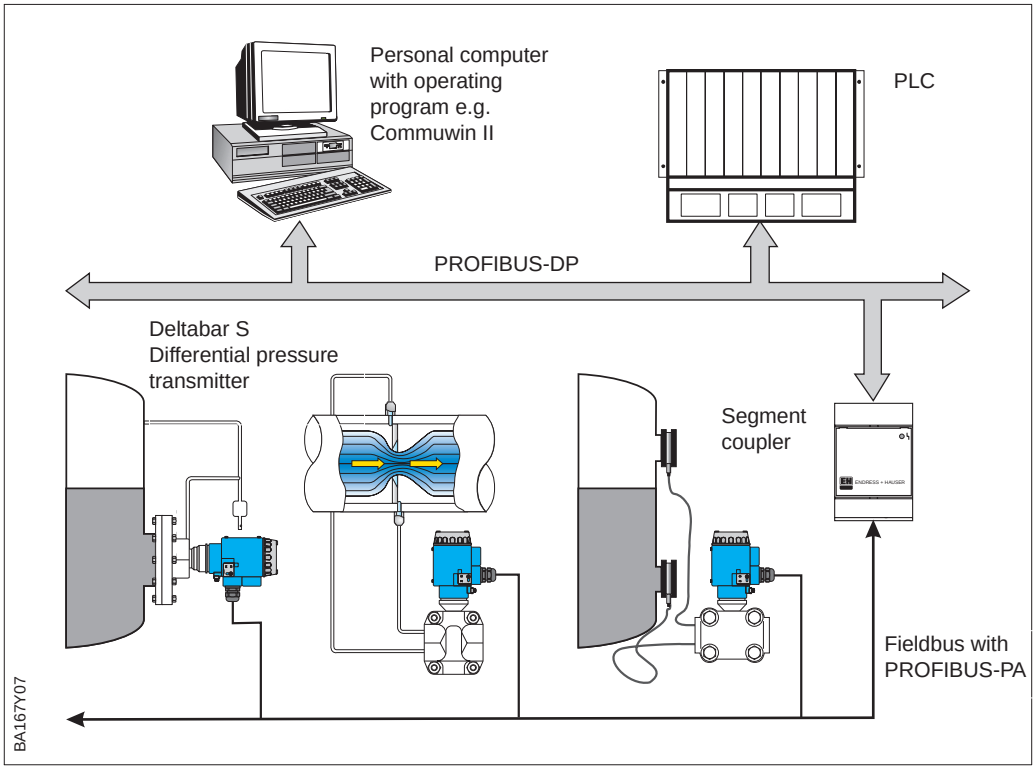


Figure 1.3
Measuring system Deltabar S with PROFIBUS-PA protocol

Measuring point

In the simplest case, the measuring point comprises:
- Deltabar S with PROFIBUS-PA protocol
- PLC or personal computer with an operating program e.g. Commuwin II
- Segment coupler
- PROFIBUS-PA terminating resistor

Number of transmitters

The maximum number of transmitter on one bus segment is determined by their consumption, the power of the bus coupler and the required bus length, see Operating Instructions BA 198F/00/en. Normally however:

- max. 10 Deltabar S for hazardous area applications
- max. 32 Deltabar S for non-hazardous area applications

can be operated on one bus segment. Deltabar S consumes max. 11 mA per device.

For further information, see Operating Instructions BA 198F "PROFIBUS-DP/-PA: Guidelines for planning and commissioning", the PNO Guidelines or under the Internet address http://www.PROFIBUS.com and for operation in hazardous ia areas: EN 50020 (FISCO model).

Sensor overload limits

The sensor overload limits are to be found in Chapter 11 "Technical Data".

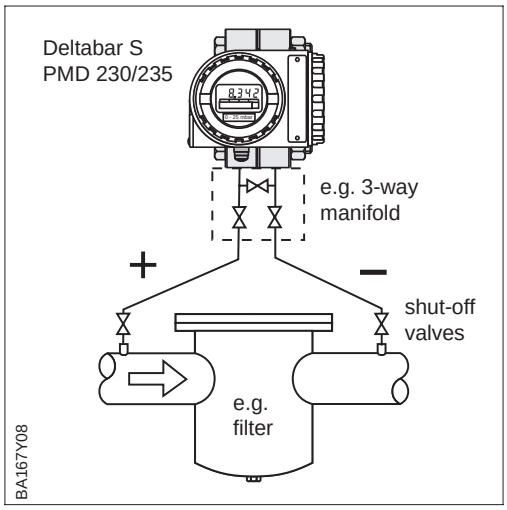
2 Installation

This Chapter describes:
- the measuring set-up of the Deltabar S for the most common installations
- and the electrical connection.

2.1 Measuring system for differential pressure measurement

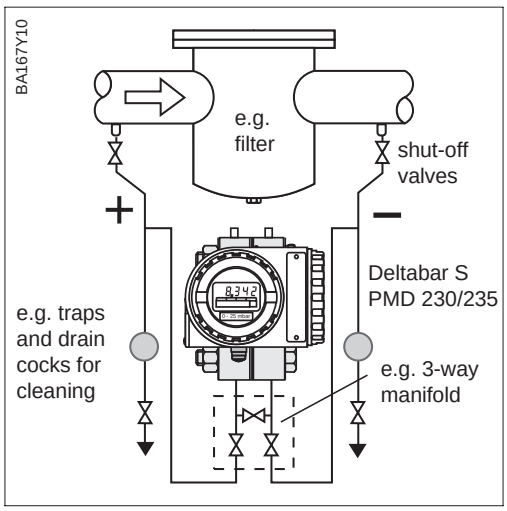
Note!
- General recommendations for laying pressure piping may be taken from DIN 19210 "Methods for measurement of fluid flow; differential pressure piping for flow measurement devices" or the appropriate national or international standards.
- Check that pressure piping installed outdoors is adequately insulated and/or heated.

Gases and vapours



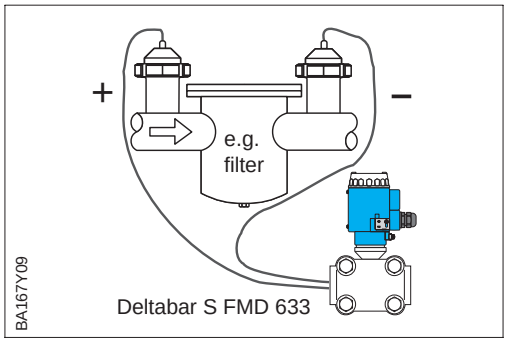
- Mount the Deltabar S above the tapping point, so that condensation can run back into the process piping.
- Use a three-way manifold for simple mounting without interruption of the process.
- Install the pressure piping with a continuous fall of at least 10%.

Liquids



- Mount the Deltabar S below the tapping point, so that the pressure piping is always filled with liquid and gas bubbles can back into the process pipe.
- Use a three-way manifold for simple mounting without interruption of the process.
- Traps prevent the build up of dirt in the pressure piping.
- Install the pressure piping with a continuous fall of at least 10%.

Gases, vapours and liquids with diaphragm seals and capillaries

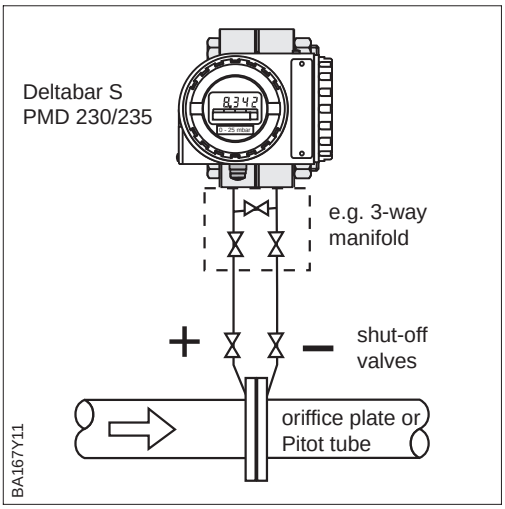


- FMD 633: Mount the remote seals on flanges above the process pipe.
- For vacuum: Mount the transmitter below the tapping point.
- There should be no temperature difference between the capillaries.
- Always use two identical diaphragm seals (e.g. diameter, material etc.) for the plus and minus sides.

2.2 Measuring system for flow measurement

Note!
General recommendations for laying pressure piping may be taken from DIN 19210 "Methods for measurement of fluid flow; differential pressure piping for flow measurement devices" or the appropriate national or international standards.

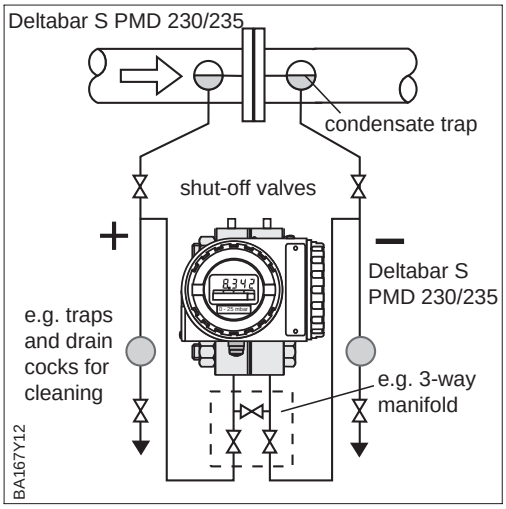
Note!



Measurement with orifice plate or Pitot tube

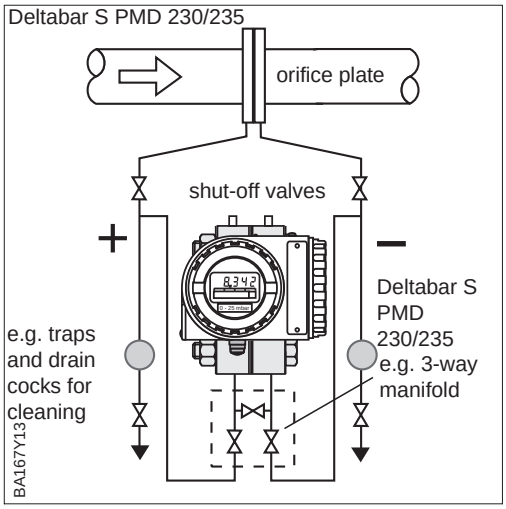
Gases

- Mount the Deltabar S above the tapping point, so that condensation can run back into the process piping.
- Use a three-way manifold for simple mounting without interruption of the process.
- Install the pressure piping with a continuous fall of at least 10%.



Vapours

- Mount the Deltabar S below the tapping point.
- Mount condensate traps at the same level as the tapping points.
- Before comissioning, fill the pressure piping to the level of the condensate trap.
- Use a three-way manifold for simple mounting without interruption of the process.
- Install the pressure piping with a continuous fall of at least 10%.



Liquids

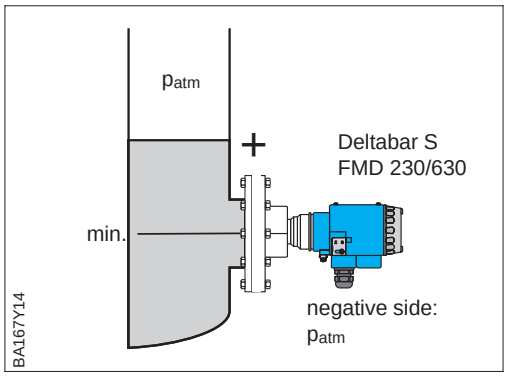
- Mount the Deltabar S below the tapping point, so that the pressure piping is always filled with liquid and gas bubbles can back into the process pipe.
- Use a three-way manifold for simple mounting without interruption of the process.
- Traps prevent the build up of dirt in the pressure piping.
- Install the pressure piping with a continuous fall of at least 10%.

2.3 Measuring system for level measurement

Note!

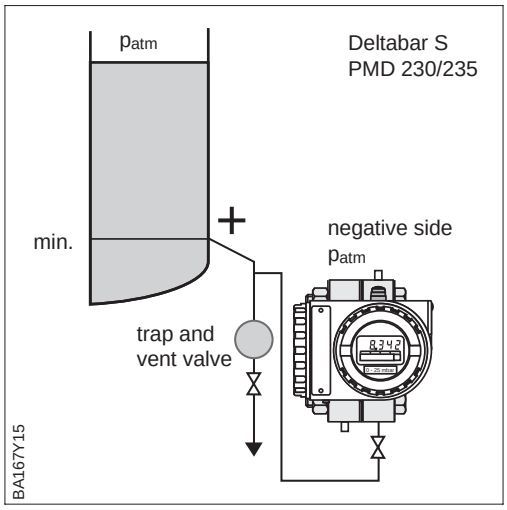
Note!
General recommendations for laying pressure piping may be taken from DIN 19210 "Methods for measurement of fluid flow; differential pressure piping for flow measurement devices" or the appropriate national or international standards.

Open tank



FMD 230, FMD 630

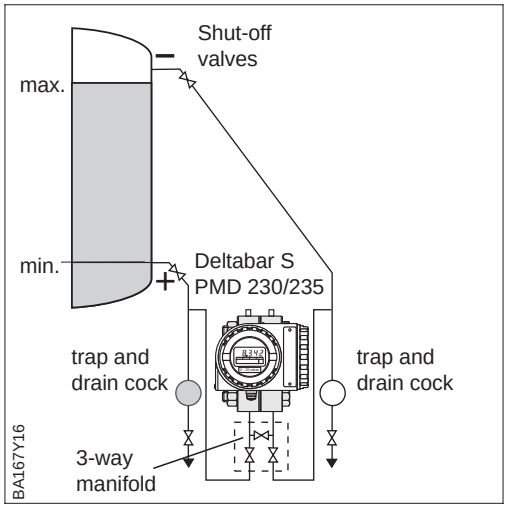
- Mount the Deltabar S direct on the tank.
- The negative side is open to atmosphere pressure.



PMD 230, PMD 235

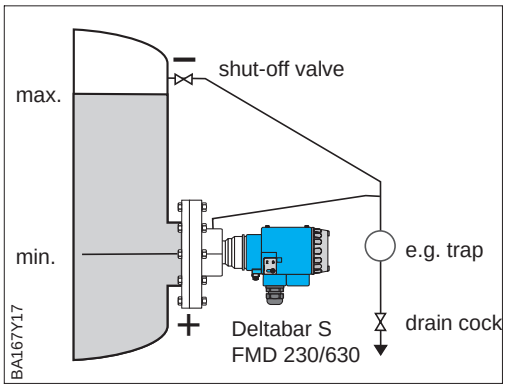
- Mount the Deltabar S below the lower tapping, so that the pressure piping is always filled with liquid.
- The negative side is open to atmosphere pressure.
- A trap prevents the build up of dirt in the pressure piping.
- Install the pressure piping with a continuous fall of at least 10%.

Closed tank



PMD 230, PMD 235

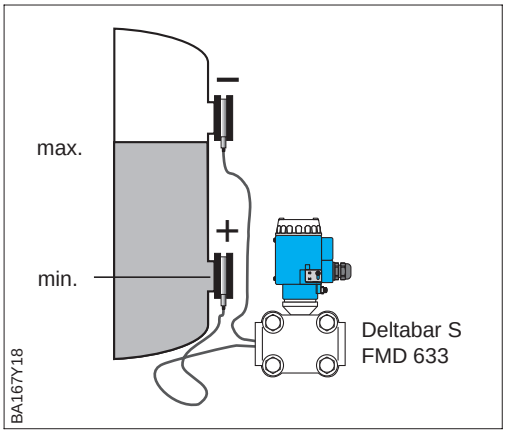
- Mount the Deltabar S below the lower tapping so that the pressure piping is always filled with liquid.
- The negative side must be above the maximum level to be measured.
- Traps prevent the build up of dirt in the pressure piping.
- Use a three-way manifold for simple mounting without interrupting the process.
- Install the pressure piping with a continuous fall of at least 10%.



Closed tank

FMD 230, FMD 630

- Mount the Deltabar S direct on the tank.
- The negative side is open to atmosphere pressure.
- A trap prevents the build up of dirt in the pressure piping.
- Install the pressure piping with a continuous fall of at least 10%.

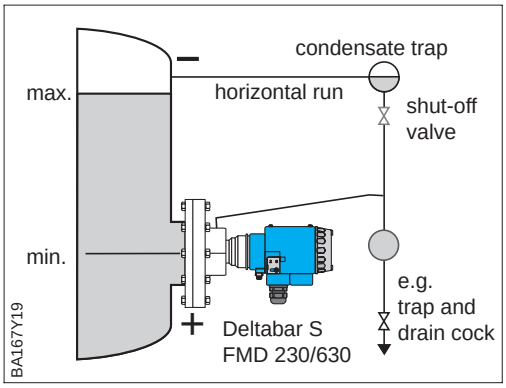


FMD 633

- Mount the Deltabar S below the tapping point.
- Mount the remote seals with capillaries onto the tank.
- Always use two identical diaphragm seals (e.g. diameter, material etc.) for the plus and minus sides.

Note!
Level measurement can only be carried out between the upper edge of the lower remote seal and the lower edge of the upper remote seal.

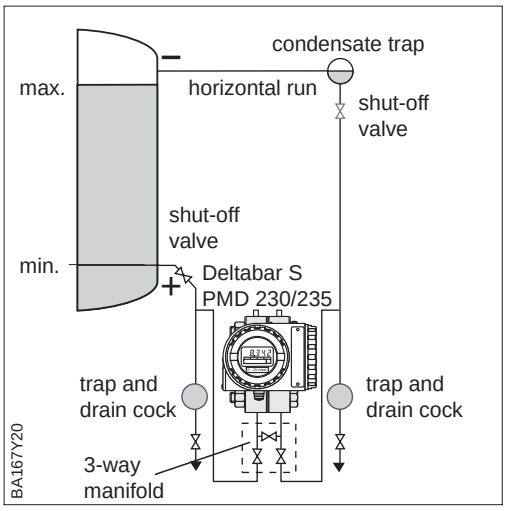
Note!



Closed tank with steaming liquids

FMD 230, FMD 630

- Mount the Deltabar S direct on the tank.
- The tapping for the negative side must be above the maximum level to be measured.
- A condensate trap ensures constant pressure on the negative side.
- Install the pressure piping with a continuous fall of at least 10%.



PMD 230, PMD 235

- Mount the Deltabar S below the lower tapping, so that the pressure piping is always filled with liquid.
- The tapping for the negative side must be above the maximum level to be measured. The condensate trap ensures a constant pressure.
- Traps prevent the build up of dirt in the pressure piping.
- Use a three-way manifold for simple mounting without interruption of the process.
- Install the pressure piping with a continuous fall of at least 10%.

2.4 Mounting

Diaphragm seal

- Do not clean or touch the diaphragm seal with pointed or hard objects.
- Remove the protective cap just before installation.

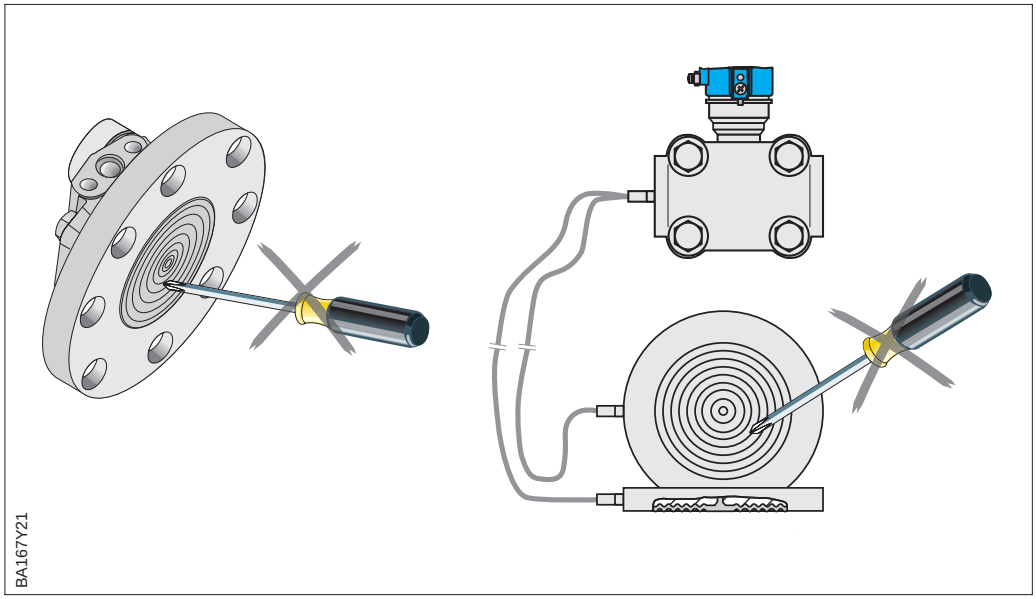


Figure 2.1
Handle diaphragm seals with care!

Seal for flange mounting

The recommended seal depends on the flange: DIN 2690 or ANSI B 16.5.

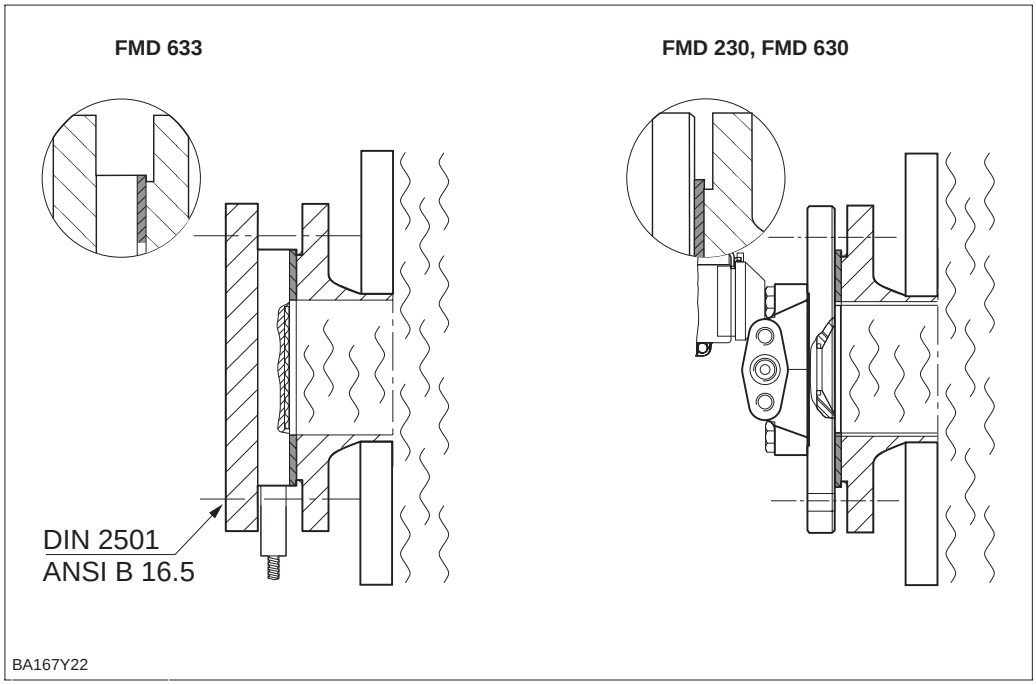


Figure 2.2
Mounting of the version with flange or diaphragm seal
left:
FMD 633 with cell diaphragm seal and capillary lines
right:
FMD 230/FMD 630 with fange connection

Wall and pipe mounting

If transmitters with remote seals are mounted on vertical pipes, sufficient tension relief must be provided otherwise the capillaries may kink.

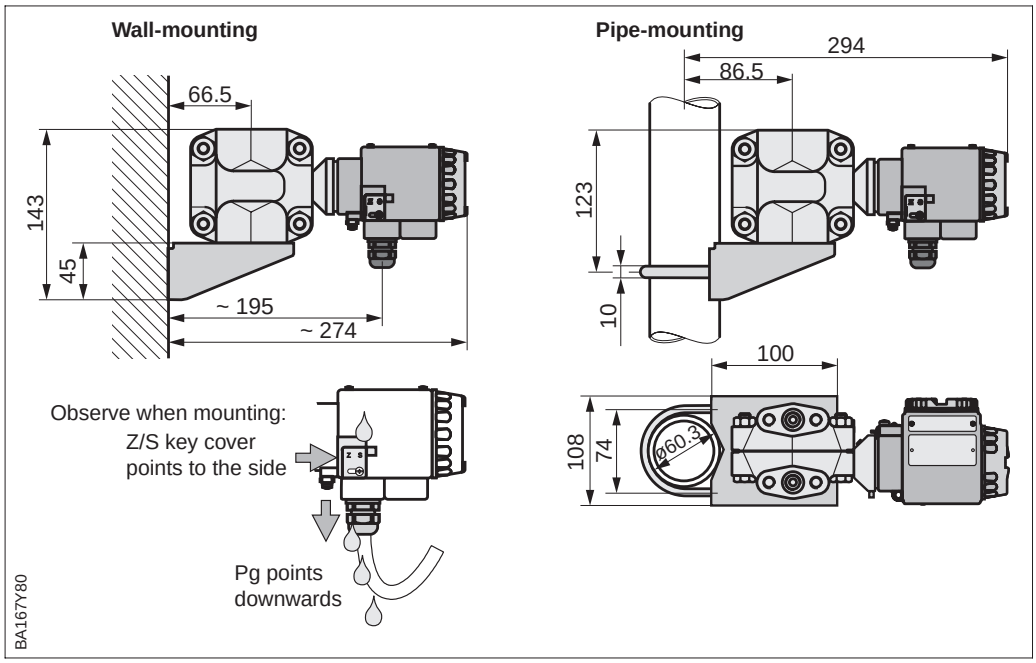


Figure 2.3
Wall- and pipe-mounting

Caution!

Caution!
Mount the housing such that:
- *The cable gland always points downwards so that condensatiuon on the connection cable runs off and not into the housing.*
- *The Z/S key cover points the side so that it´s protected from water.*

Align housing

After the Deltabar S has been mounted, the housing can be aligned such that:

- the terminal compartment is easily accessible,
- the display can be easily read,
- the cable gland and the cover of the Z/S keys are protected from water.

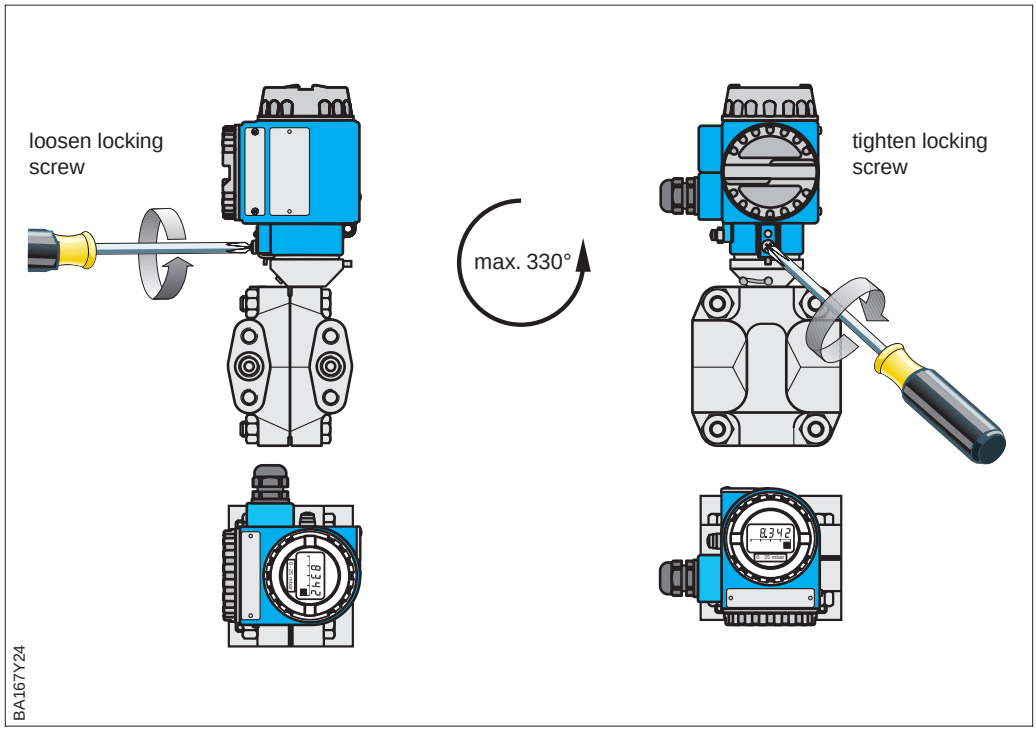


Figure 2.4
Align housing

2.5 Electrical connection

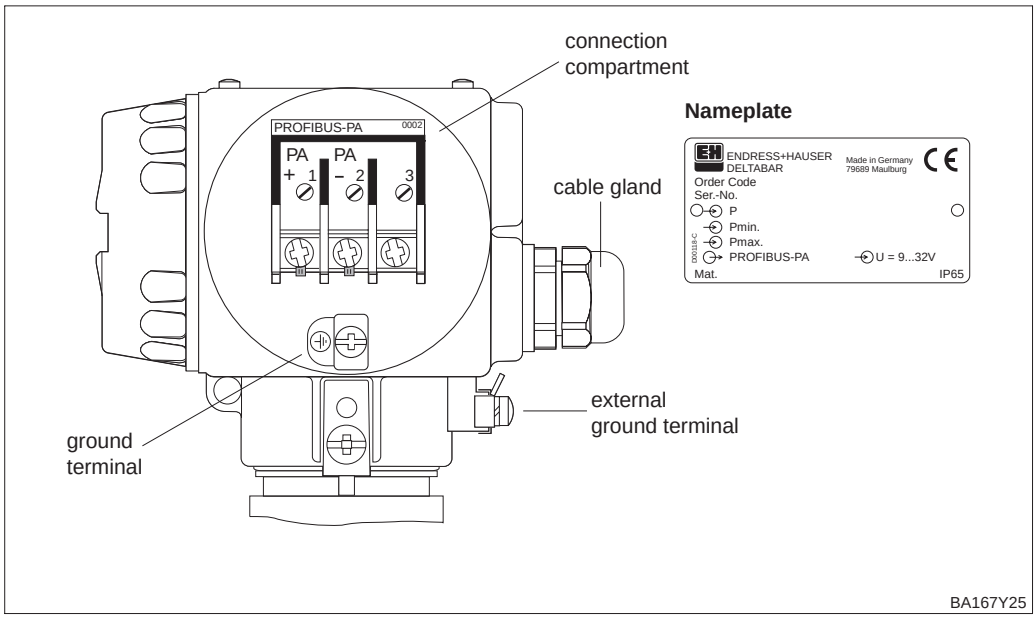


Figure 2.5
Deltabar S connection compartment and nameplate

General note

The Deltabar S with PROFIBUS-PA output is a two-wire transmitter.
Before connecting the device, please note the following points:

- Turn off the power.
- Only devices for hazardous area: Ground the device using the external ground terminal.

Power

The Deltabar S has the following power requirements:
I = 10 mA ± 1 mA
Non-Ex-area: U = 9...32 V DC
Ex-area: U = 9…24 V DC

Bus cable

Always use a twisted, screened two-wire cable.
The following specification must be met for explosion hazardous application (EN 50020, FISCO model):

– Loop-resistance (DC): 15…150 Ω/km,
– Specific inductance: 0.4…1 mH/km,
– Specific capacitance: 80…200 nF/km

The following cable types are suitable:

Non-Ex-area:
- Siemens 6XV1 830-5BH10 (grey)
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL (grey)
- Belden 3076F (orange)

Ex-area:
- Siemens 6XV1 830-5AH10 (blue)
- Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST+C)YFL (blue)

Screening

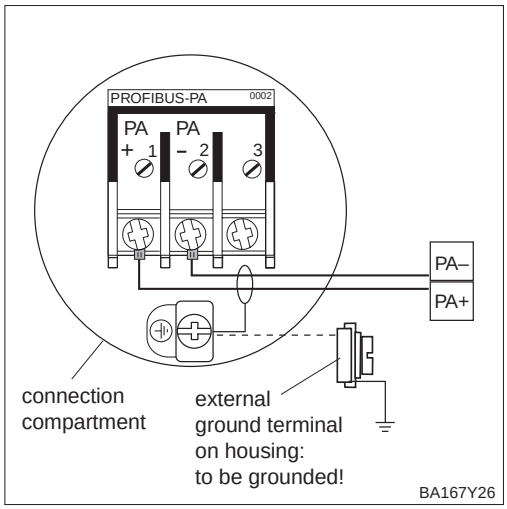
For maximum EMC protection, e.g. near to frequency converters, it is advisable to connect the housing and cable screening using a potential equalisation line (PEL) (max. wire cross-section area: 2.5 mm^2, fixed conductor).

Please pay attention to the following points:
- Ground the device using the external ground terminal.
- The bus cable screen may not be interrupted.
- Ground the screen at each end of the cable, and always try to keep the connecting cable between the screening and ground as short as possible.
- If there are large potential differences between the individual points, you only need to connect one point to the reference ground. Connect all the other ends of the screen using a high frequency capable capacitor with reference potential. (e.g. ceramic capacitor 10 nF/250 V~).

Caution!
The multiple grounding of the bus cable in explosion hazardous areas is permissible only under specific conditions, see IEC 60079-14.


Caution!

Information on the structure and grounding of the network are given in Operating Instructions BA 198F "PROFIBUS-PA: Guidelines for planning and commissioning" and the PNO Guidelnie.



Connect device

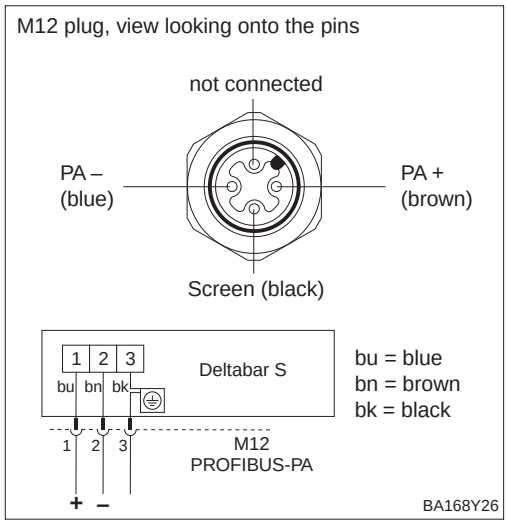
The bus line is connected as follows:
- Switch off power.
- If necessary, connect external ground terminal to potential equalisation line.
- Unscrew the connection compartment lid.
- Thread cable through the cable entry.
- Connect cable cores to PA+ and PA–. Reversed polarity has no effect on operation.
- Connect the screen to the internal ground terminal.
- Srew down the connection compartment lid.

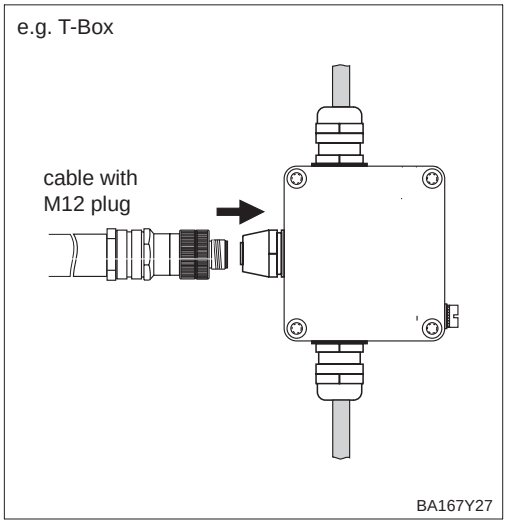
M12 plug

The Deltabar S PROFIBUS-PA version with M12 plug is supplied ready wired and need only be connected to bus by means of a suitable cord set.


Note!

Note!
To avoid the effects of vibration, always connect the Deltabar S using a cable.
- Push connector into the socket.
- Securely tighten the knurled screw.
- Ground the device and T-Box using the grounding system selected, see Operating Instructions BA 198F.





3 PROFIBUS-PA Interface

3.1 Synopsis

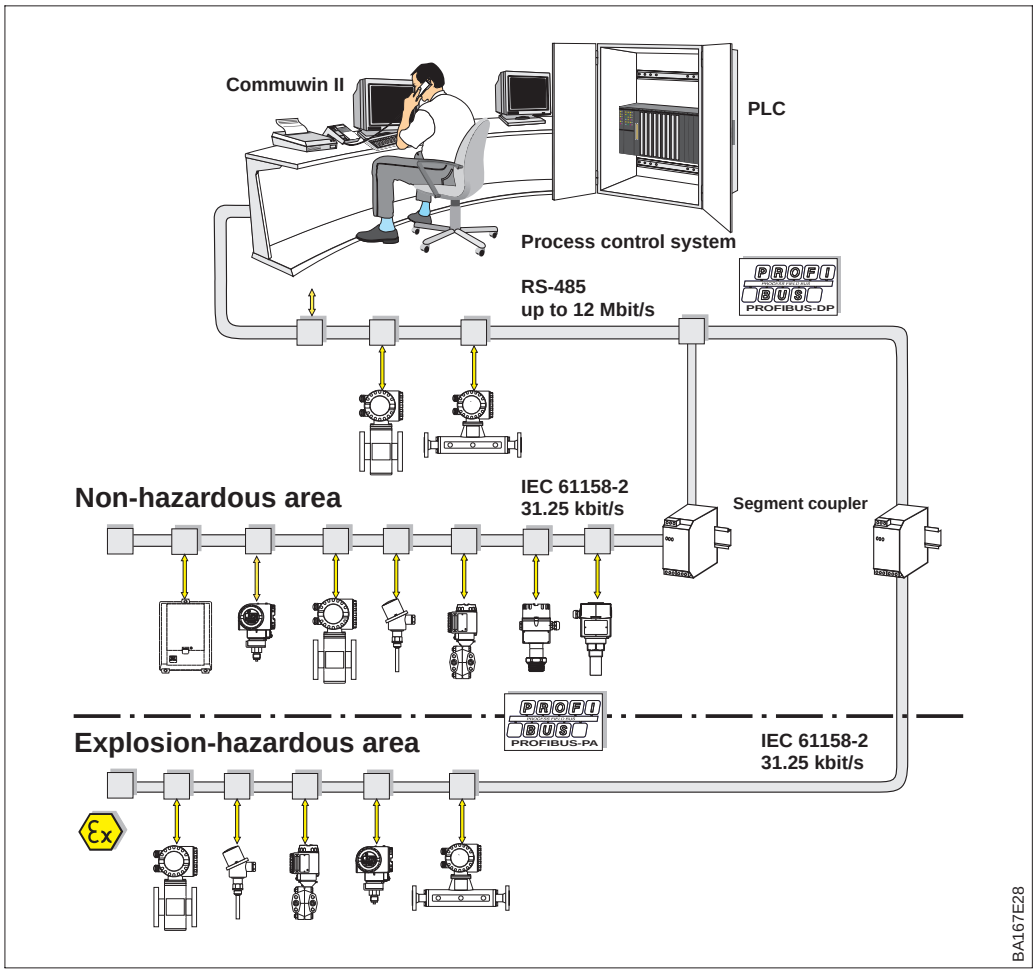


Figure 3.1
PROFIBUS-DP/-PA principle of operation

Note!

Note!
Additional planning information on the fieldbus PROFIBUS-PA can be found in the Operating Instructions BA 198F "PROFIBUS-DP/-PA: Guidelines for planning and commissioning.

3.2 Setting the device address

Every PROFIBUS-PA device must be given an address. If the address is not set correctly, the device will not be recognised by the process control system.

- Addresses between 0 and 126 are valid, whereby all Endress+Hauser devices are supplied ex-works with the software address 126.
- A device address may appear only once within a particular PROFIBUS-PA network, see Operating Instructions BA 198F.

The default address can be used to check the function of the device and connect it to an operating PROFIBUS-PA system. Afterwards the address must be changed to allow other devices to be connected to the network.

There are two possibilities to set the address of the Deltabar S:

- remotely by using an operating program, e.g. Commuwin II, running as a PROFIBUS-DP Class 2 master
- locally at the device DIP-switches that are to be found behind the operating and display module in the display compartment.

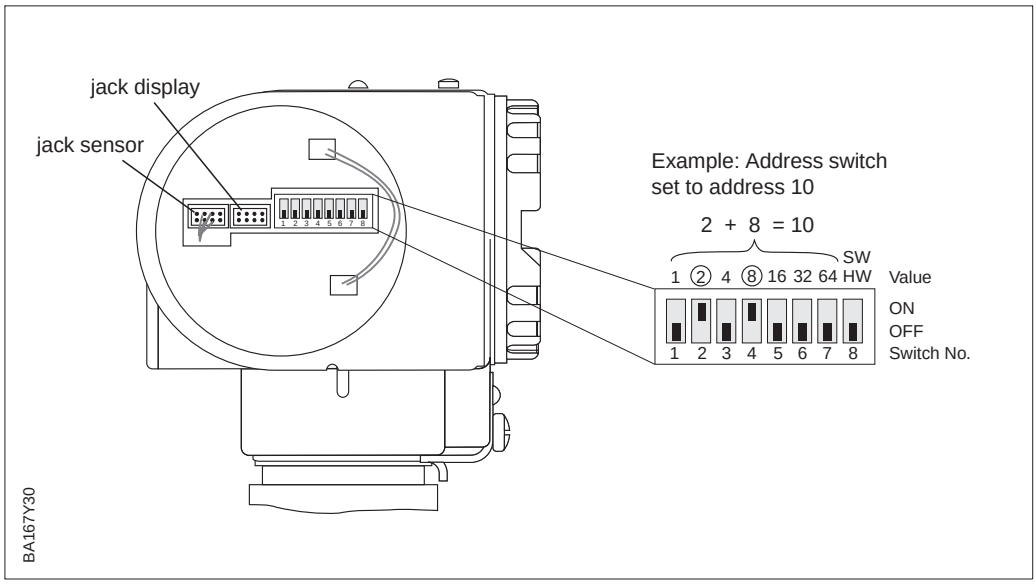


Figure 3.2
Deltabar S address switch

Addressing mode

Set the addressing mode at Switch 8:

- ON = software addressing via the bus system (default setting) (SW)
- OFF = hardware addressing at the device via DIP switches 1 to 7 (HW).

Hardware address

Proceed as follows to set a hardware address:

1. Set Switch 8 to OFF = hardware addressing.
2. Set a unique hardware address at Switches 1 to 7 according to the table below.
3. The address becomes effective 10 s after the switches have been changed.

Switch No.	1	2	3	4	5	6	7
Value in position "off"	0	0	0	0	0	0	0
Value in position "on"	1	2	4	8	16	32	64

Software address

The procedure for changing a software address is described in BA 198F.

3.3 Device database and type files

A device database file contains a description of the properties of the PROFIBUS-PA device, e.g. the supported transmission rates and the type and format of the digital information output to the PLC. The bitmap files also belong to the .gsd files. These allow the measuring point to be represented by an icon. The device database file and corresponding bitmaps are required by the network design tool of the PROFIBUS-DP network.

Every device is allocated an identity code by the PROFIBUS User Organisation (PNO). This appears in the device data base file name (.gsd). For Endress+Hauser devices, the identity code is always 15xx, where xx is device dependent.

Name of device	ID No.:	Data base file	Type file	Bitmaps
Deltabar S	1504 (hex)	EH3x_1504.gsd	EH31504x.200	EH1504_d.bmp EH1504_n.bmp EH1504_s.bmp

The full set of device data base files for Endress+Hauser devices can be obtained as follows:

- INTERNET:
  Endress+Hauser → *http://www.endress.com*
  then → Products → Process Solutions
  → PROFIBUS → GSD files
  PNO → *http://www.PROFIBUS.com* (GSD library)
- As CD-ROM direct from Endress+Hauser: Order No. 56003894

Note!

Note!
The PNO also provides a universal database file with the designation PA_x9700.gsd for devices with one analog output block. Should this be used instead of the Deltabar S file, then only the process value can be transmitted. The transmission of a second measured value (2nd Cyclic Value) or a display value are not supported. The universal profile must also be selected in field V6H0 in Commuwin II.

Working with GSD files

The GSD files must be loaded into a specific subdirectory in the PROFIBUS-DP network design software of your PLC.

- GSD files and bitmaps that are located in the directory "Typdat5x", for example, are required for the planning software STEP7 used by the Siemens S7-300/400 PLC family.
- x.200 files and bitmaps that are located in the directory "Extended" are required for the planning software COM ET200 for the Siemens S5.
- The GSD files located in the directory "standard" are for PLCs that support the "identifier byte" (0x94) but not the "identifier format". These are for use e.g. with the Allen-Bradley PLC5.

More details about the directories used for storing the GSD files can be found in Chapter 6.4 of BA 198F which describes the network design.

3.4 Cyclic data exchange

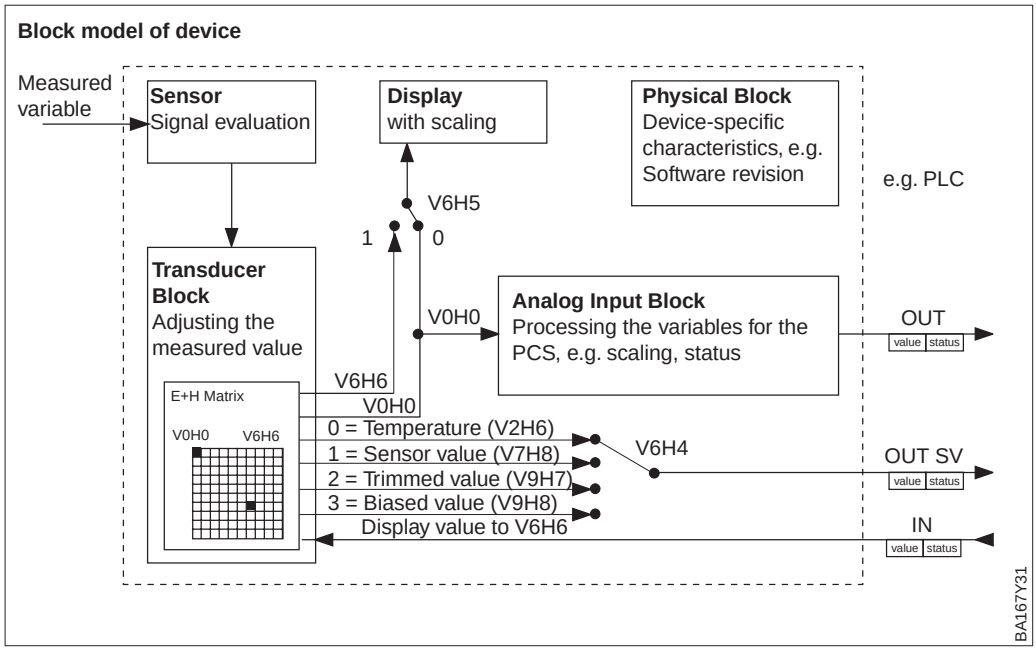


Figure 3.3
Block model of the Deltabar S with PROFIBUS-PA profile 3.0

Fields in brackets apply to the matrix positions in Commuwin II.

Block model

Fig. 3.3 shows a block model of the Deltabar S. The primary value V0H0 is output by the transducer block and used as the process value for the analog input block. Here it is scaled, processed and rescaled before being output as cyclic data to the PLC as the variable OUT. This comprises a value and status.

The on-site display and the matrix field V0H0 normally show the same value. The on-site display can also be set to show a cyclical output value (Display Value) using a PLC. For this the matrix field V6H5 in Commuwin II is set to "Display Value" (or 1). Example: A Deltabar S measures the volume flow (see also Chapter 8). The temperature and pressure are also measured simultaneously at the measuring point. All measured values are transferred to a PLC. The PLC calculates the vapour volume from the measured volume flow, temperature and pressure values. The calculated value is assigned to the matrix field V6H6 and the on-site display.

A Deltabar S can still supply two other values to the PLC. The field V6H4 in Commuwin II allows one of four values to be selected (see following Section, Step 7).

Configuration

The data exchange is configured in the network design tool and Commuwin II.

1) Using the network design tool for your PLC, add the Deltabar S to the network, taking care that the address assigned corresponds to that set at the device.
2) Select the Deltabar S and call up the configuration tool: five options appear:
   – "Main Process Value", "2nd Cyclic Value", "3rd Cyclic Value", "Display Value", "FREE PLACE"
3) Select "Main Process Value". If no additional value is required apart from the "Main process value", close the configuration window.
4) Select "2nd Cyclic Value" or "FREE PLACE" (= function deactivated), select "3rd Cyclic Value" or "FREE PLACE" (= function deactivated) and select "Display Value" or "FREE PLACE" (= function deactivated). Then close the configuration window.
5) Start Commuwin II and open the connection using the PA-DPV1 server. Generate a live list, locate the device address and click on "Deltabar S".
6) Open the device menu and select the parameter matrix.
7) If a secondary value is to be output, select the type in V6H4: *0 = Temperature, 1 = Sensor value, 2 = Trimmed value, 3 = Biased value*.
8) To display a cyclic output value on the on-site display, set V6H5 = "Display Value" (or 1)
9) The data exchange is now configured for the Deltabar S.

Deltabar S → PLC (input data)

A PLC can read the input data of Deltabar S from the response telegram of the Data_Exchange service. The cyclic data telegram has the following structure:

Index input data	Data	Access	Data format/remarks
0, 1, 2, 3	Primary value, pressure or level	read	32 bit floating point number (IEEE-754)
4	Status code for primary value	read	see status codes
5, 6, 7, 8	Secondary value, temperature, sensor value, trimmed value or biased value	read	32 bit floating point number (IEEE-754)
9	Status code for secondary value	read	see status codes
10, 11, 12, 13	Third value: Totalizer	read	32 bit floating point number (IEEE-754)
14	Status code for third value	read	see status codes

PLC → Deltabar S (output data)

The output data from the PLC for the local display are structured as follows:

Index output data	Data	Access	Data format/remarks
0, 1, 2, 3	Display value	write	32 bit floating point number (IEEE-754)
4	Status code	write	see status codes for secondary values

Status codes

The following status codes are supported by the Deltabar S for the primary and secondary values.

Status-Code	Device status	Significance	Primary value	Secondary value
0F Hex	BAD	Non-specific	x	x
1F Hex	BAD	Out-of-service (target mode)	x	
40 Hex	UNCERTAIN	Non-specific (simulation)	x	x
47 Hex	UNCERTAIN	Last usable value (fail-safe mode active)	x	
4B Hex	UNCERTAIN	Substitute set (fail-safe mode active)	x	
4F Hex	UNCERTAIN	Initial value (fail-safe mode active)	x	
5C Hex	UNCERTAIN	Configuration error (limits not set correctly)	x	
80 Hex	GOOD	OK	x	x
84 Hex	GOOD	Active block alarm (static revision counterincremented)	x	
89 Hex	GOOD	LOW_LIM (alarm active)	x	
8A Hex	GOOD	HI_LIM (alarm active)	x	
8D Hex	GOOD	LOW_LOW_LIM (alarm active)	x	
8E Hex	GOOD	HI_HI_LIM (alarm active)	x	

3.5 Acyclic data exchange

The device parameters in the physical block, transducer block and analog input block, see Fig. 3.3, as well as the device management can be accessed by a Class 2 PROFIBUS-DP master using the acyclic data services. Figs 3.4 and 3.5 show block diagrams of the transducer and analog input blocks. A full description of the device management, standard parameters and the physical block is to be found in Chapter 7 of Operating Instructions BA 198F.

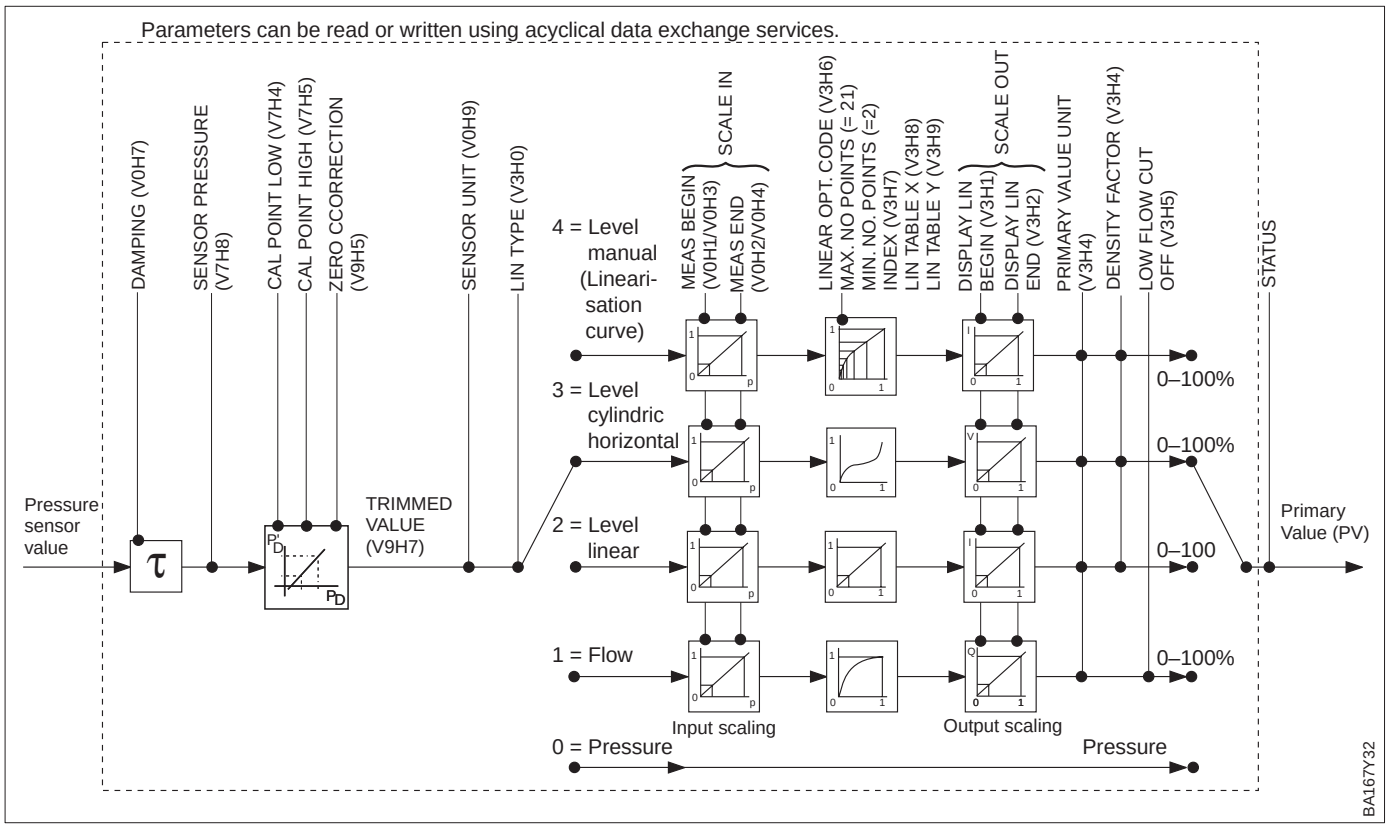


Figure 3.5
Schematic diagram of the Deltabar S transducer block.
Parameter designations correspond to those designations in the Slot/Index List. Parameters with data for a matrix field (in brackets) can be accessed by Commuwin II.

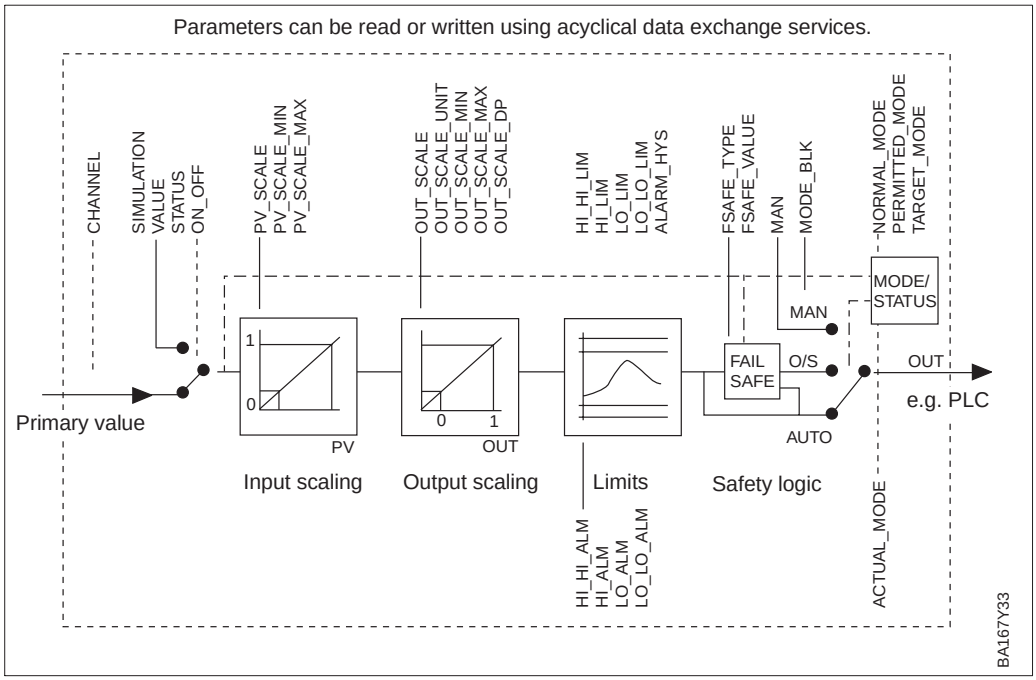


Figure 3.4
Schematic diagram of the Deltabar S analog input block

Slot/index tables

The device parameters are listed in the following tables. The parameters are accessed via the slot and index number. The analog output, transducer and physical blocks contain standard parameters, block parameters and manufacturer-specific parameters.

If Commuwin II the operating program is used, then the matrix and the graphical operation are available as the user interface. If the standard operating parameters are to be found in any of the device blocks, then any changes made to them are automatically mapped to the block parameters. The dependencies are indicated in the column "E+H matrix". See also Figs 3.4 and 3.5.

Device management

Parameter	E+H matrix	Slot	Index	Size (bytes)	Type	Read	Write	Storage Class
Directory object header		1	0	12	Array of UNSIGNED16	X		C
Composite list directory entries		1	1	24	Array of UNSIGNED16	X		C
GAP directory continuous		1	2-8					
GAP reserved		1	9-15					

Analog input block

Parameter	E+H matrix	Slot	Index	Size (bytes)	Type	Read	Write	Storage class
Standard parameters								
AI Block data		1	16	20	DS-32*	X		C
Static revision		1	17	2	UNSIGNED16	X		N
Device tag	VAH0	1	18	32	OSTRING	X	X	S
Strategy		1	19	2	UNSIGNED16	X	X	S
Alert key		1	20	1	UNSIGNED8	X	X	S
AI Target mode		1	21	1	UNSIGNED8	X	X	S
AI Mode block		1	22	3	DS-37*	X		D/N/C
AI Alarm summary		1	23	8	DS-42*	X		D
Batch		1	24	10	DS-67*	X	X	S
Gap		1	25					
Block parameters								
OUT		1	26	5	DS-33*	X		D
PV scale		1	27	8	Array of FLOAT	X	X	S
OUT scale		1	28	11	DS-36*	X	X	S
Linearisation type		1	29	1	UNSIGNED8	X	X	S
Channel		1	30	2	UNSIGNED16	X	X	S
Gap		1	31					
PV fail safe time		1	32	4	FLOAT	X	X	S
Fail safe type		1	33	1	UNSIGNED8	X	X	S
Fail safe value		1	34	4	FLOAT	X	X	S
Alarm Hysteresis		1	35	4	FLOAT	X	X	S
Gap		1	36					
HI HI Limit		1	37	4	FLOAT	X	X	S
Gap		1	38					
HI Limit		1	39	4	FLOAT	X	X	S
Gap		1	40					
LO Limit		1	41	4	FLOAT	X	X	S
Gap		1	42					
LO LO Limit		1	43	4	FLOAT	X	X	S
Gap		1	44-45					
HI HI Alarm		1	46	16	DS-39*	X		D
HI Alarm		1	47	16	DS-39*	X		D
LO Alarm		1	48	16	DS-39*	X		D
LO LO Alarm		1	49	16	DS-39*	X		D
Simulate*		1	50	6	DS-50*	X	X	S
OUT unit text		1	51		OSTRING	X	X	S
Gap reserved		1	52-60					
Gap		1	61-65					

* See Chapter 3.6, Section "data strings" or PROFIBUS-PA specification part 1.
C = constant, N = non-volatile (remains stored), S = static (is counted), D = dynamic

Physical block

Parameter	E+H matrix	Slot	Index	Size (bytes)	Type	Read	Write	Storage Class
Standard parameters								
PB Block data		1	66	20	DS-32*	X		C
Static revision		1	67	2	UNSIGNED16	X		N
Device tag	VAH0	1	68	32	OSTRING	X	X	S
Strategy		1	69	2	UNSIGNED16	X	X	S
Alert key		1	70	1	UNSIGNED8	X	X	S
PB Target mode		1	71	1	UNSIGNED8	X	X	S
PB Mode block		1	72	3	DS-37*	X		D/N/C
PB Alarm summary		1	73	8	DS-42*	X		D
Block parameters								
Software revision		1	74	16	OSTRING	X		C
Hardware revision		1	75	16	OSTRING	X		C
Device manufacturer identity		1	76	2	UNSIGNED16	X		C
Device identity		1	77	16	OSTRING	X		C
Device serial number	VAH2	1	78	16	OSTRING	X		C
Diagnosis		1	79	4	OSTRING	X		D
Diagnosis extension		1	80	6	OSTRING	X		D
Diagnosis mask		1	81	4	OSTRING	X		C
Diagnosis mask extension		1	82	6	OSTRING	X		C
Device certiffication		1	83	16	OSTRING	X		N
Security locking	V9H9	1	84	2	UNSIGNED16	X	X	N
Factory reset	V2H9	1	85	2	UNSIGNED16		X	S
Descriptor		1	86	32	OSTRING	X	X	S
Device message	VAH1	1	87	32	OSTRING	X	X	S
Device installation date		1	88	8	OSTRING	X	X	S
reserved		1	89					
Identification number	V6H0	1	90	1	UNSIGNED8	x	x	S
HW write protection		1	91	1	UNSIGNED8	x		D
reserved		1	92...98					
Gap		1	99...103					
Matrix error code	V2H0	1	104	2	UNSIGNED16	X		D
Matrix last error code	V2H1	1	105	2	UNSIGNED16	X	X	D
UpDown features supported		1	106	1	OSTRING	X		C
UpDown control		1	107	1	UNSIGNED8		X	D
UpDown data		1	108	20	OSTRING	X	X	D
Bus address		1	109	1	UNSIGNED8	X		D
Matrix device software number	V2H2	1	110	2	UNSIGNED16	X		C
PA set unit to bus	V6H1	1	111	1	UNSIGNED 8	x	x	S
PA input value	V6H6	1	112	6	FLOAT+U8+U8	x		D
PA select V0H0	V6H5	1	113	1	UNSIGNED8	x	x	S
PA profile revision	V6H7	1	114	4	OSTRING	x		C
Gap		1	115-119					
PA select second cyclc value	V6H4	1	120	1	UNSIGNED8	x		S
PA identity number	V6H0	1	121	2	UNSIGNED16	x	x	D
PA identity string		1	122	32	OSTRING	x	x	C
PA DP status		1	123	1	UNSIGNED8	x		D
Gap		1	124-128					

* See Chapter 3.6, Section "data strings" or PROFIBUS-PA specification part 1.
C = constant, N = non-volatile (remains stored), S = static (is counted), D = dynamic

View_1 parameters

Parameter	E+H matrix	Slot	Index	Size (bytes)	Type	Read	Write	Storage class
View 1 Physical block		1	216	17	RECORD	X		D/N/C
Gap reserved		1	217-221					
View 1 Transducer block		1	222	22	RECORD	X		D/N/C
Gap reserved		1	223-227					
View 1 Analog Input block		1	228	18	RECORD	X		D/N/C
Gap reserved		1	229-233					

Transducer block

Parameter	E+H matrix	Slot	Index	Size (bytes)	Type	Read	Write	Storage class
Standard parameters								
TB Block data		1	129	20	DS-32*	X		C
Static revision		1	130	2	UNSIGNED16	X		N
Device tag	VAH0	1	131	32	OSTRING	X	X	S
Strategy		1	132	2	UNSIGNED16	X	X	S
Alert key		1	133	1	UNSIGNED8	X	X	S
TB Target mode		1	134	1	UNSIGNED8	X	X	S
TB Mode		1	135	3	DS-37*	X		D/N/C
TB Alarm summary		1	136	8	DS-42*	X		D
Block parameters								
Sensor value	V7H8	1	137	4	FLOAT	X		D
Sensor high limit	V7H7	1	138	4	FLOAT	X		N
Sensor low limit	V7H6	1	139	4	FLOAT	X		N
Calibration point high	V7H5	1	140	4	FLOAT	X	X	S
Calibration point low	V7H4	1	141	4	FLOAT	X	X	S
Calibration minimum span		1	142	4	FLOAT	X	X	N
Sensor unit	V0H9	1	143	2	UNSIGNED16	X	X	N
Trimmed value	V9H7	1	144	5	DS-33*	X		D
Sensor type		1	145	2	UNSIGNED16	X		N
Sensor serial number	VAH3	1	146	4	UNSIGNED32	X		N
Primary value	V0H0	1	147	5	DS-33*	X		D
Primary value unit	V3H3	1	148	2	UNSIGNED16	X		N
Primary value type		1	149	2	UNSIGNED16	X		N
Sensor diaphragm material	VAH7	1	150	1	UNSIGNED8	X	X	S
Sensor fill fluid	VAH8	1	151	1	UNSIGNED8	X	X	S
Gap		1	152					
Sensor O-ring material	VAH6	1	153	2	UNSIGNED16	X	X	S
Process connection type		1	154	2	UNSIGNED16	X	X	S
Process connection material	VAH4	1	155	2	UNSIGNED16	X	X	S
Temperature	V2H6	1	156	5	DS-33*	X		D
Temperature unit	V7H9	1	157	2	UNSIGNED16	X	X	S
Secondary value 1		1	158	5	DS-33*	X		D
Secondary value 1 unit	V0H9	1	159	2	UNSIGNED16	X	X	S
Secondary value 2		1	160	5	DS-33*	X		D
Secondary value 2 unit	V0H9	1	161	2	UNSIGNED16	X		D
Linearisation type	V3H0	1	162	1	UNSIGNED8	X	X	S
Scale in	V0H1/2	1	163	2*4	Array of FLOAT	X	X	S
Scale out	V3H1/2	1	164	2* 4	Array of FLOAT	X	X	S
Low flow cut off	V3H5	1	165	4	FLOAT	X	X	S
Flow linear sqrt point		1	166	4	FLOAT	X		S
Table actual number (linearisation)		1	167	1	UNSIGNED8	X	X	S
Table index (linearisation)	V3H7	1	168	1	UNSIGNED8	X	X	S
Table max. no. of points		1	169	1	UNSIGNED8	X	X	S
Table min. no. of points		1	170	1	UNSIGNED8	X	X	S
Table option code (linearisation)	V3H6	1	171	1	UNSIGNED8	X	X	S
Table status		1	172	1	UNSIGNED8	X	X	S
Table XY value		1	173	2*4	Array of FLOAT	X	X	S
Max. sensor value	V2H4	1	174	4	FLOAT	X	X	S
Min. sensor value	V2H3	1	175	4	FLOAT	X	X	S
Max temperature	V2H8	1	176	4	FLOAT	X	X	S
Min temperature	V2H7	1	177	4	FLOAT	X	X	S
Gap reserved		1	178-187					

* See Chapter 3.6, Section "data strings" or PROFIBUS-PA specification part 1.
C = constant, N = non-volatile (remains stored), S = static (is counted), D = dynamic

Transducer block (continuation)

Parameters	E+H matrix	Slot	Index	Size (bytes)	Type	Read	Write	Storage class
Endress+Hauser Parameters								
Measure begin	V0H1	1	188	4	FLOAT	X	X	S
Measure end	V0H2	1	189	4	FLOAT	X	X	S
Automatically measure begin	V0H3	1	190	1	UNSIGNED8	X	X	S
Automatically measure end	V0H4	1	191	1	UNSIGNED8	X	X	S
Bias pressure	V0H5	1	192	4	FLOAT	X	X	S
Automatically bias pressure	V0H6	1	193	1	UNSIGNED8	X	X	S
Damping	V0H7	1	194	4	FLOAT	X	X	S
Max. pressure event counter	V2H5	1	195	1	UNSIGNED8	X	X	S
Display linearisation begin	V3H1	1	196	4	FLOAT	X	X	S
Display linearisation end	V3H2	1	197	4	FLOAT	X	X	S
Density	V3H4	1	198	4	FLOAT	X	X	S
Linearisation table edit mode	V3H6	1	199	1	UNSIGNED8	X	X	S
Linearisation table x (level)	V3H8	1	200	4	FLOAT	X	X	S
Linearisation table y (volume)	V3H9	1	201	4	FLOAT	X	X	S
Totalizer value	V5H0	1	202	4	FLOAT	X		D
Totalizer display select	V5H1	1	203	1	UNSIGNED8	X	X	S
Totalizer operation mode	V5H2	1	204	1	UNSIGNED8	X	X	S
Totalizer convention factor	V5H3	1	205	4	FLOAT	X	X	S
Totalizer unit	V5H4	1	206	2	UNSIGNED16	X	X	S
Sensor Trim off	V9H5	1	207	4	FLOAT	X		S
Sensor Trim off value	V9H6	1	208	4	FLOAT	X		S
Biased pressure	V9H8	1	209	4	FLOAT	X		D
Process connection material	VAH5	1	210	2	UNSIGNED16	X	X	S
Gap reserved		1	211-215					

* See Chapter 3.6, Section "data strings" or PROFIBUS-PA specification part 1.
C = constant, N = non-volatile (remains stored), S = static (is counted), D = dynamic

3.6 Data formats

IEEE 754 float

The measured value is transmitted as a IEEE 754 floating point number, whereby

$$\text{Measured value} = (-1)^{\text{Sign}} \times 2^{(E-127)} \times (1 + F)$$

D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
Sign	Exponent (E)								Fraction (F)						
	2^7	2^6	2^5	2^4	2^3	2^2	2^1	2^0	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}
Fraction (F)															
2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}	2^{-16}	2^{-17}	2^{-18}	2^{-19}	2^{-20}	2^{-21}	2^{-22}	2^{-23}

Figure 3.6
IEEE-754 floating point number

Example

40 F0 00 00 hex = 0**100 0000 1**111 0000 0000 0000 0000 0000 binary

$$\text{Value} = (-1)^0 \times 2^{(129-127)} \times (1 + 2^{-1} + 2^{-2} + 2^{-3})$$
$$= 1 \times 2^2 \times (1 + 0.5 + 0.25 + 0.125)$$
$$= 1 \times 4 \times 1.875$$
$$= 7.5$$

Note!

- Not all PLCs support the IEEE 754 format. For this reason a conversion module must often be used or written.
- Depending on how the data are stored in the PLC (MSB or LSB), it might be necessary to use a byte swapping routine in the PLC.

Note!

Data strings

The data types marked with an asterisk in the slot/index table. e.g. DS-36, are data strings that are structured according to the PROFIBUS-PA specification Part 1, Version 3.0. They comprise several elements that can be addressed via the slot, index and subindices, as shown in the following two examples:

Parameter type	Slot	Index	Element	Sub-index	Type	Size
DS-33	1	26	OUT Value	1	FLOAT	4
			OUT Status	5	UNSIGNED8	1

Parameter type	Slot	Index	Element	Sub-index	Type	Size
DS-36		27	OUT Scale Max.	1	FLOAT	4
			OUT Scale Min	5	FLOAT	4
			OUT Scale Unit.	9	UNSIGNED16	2
			OUT Scale DP (decimal point).	11	INTEGER8	1

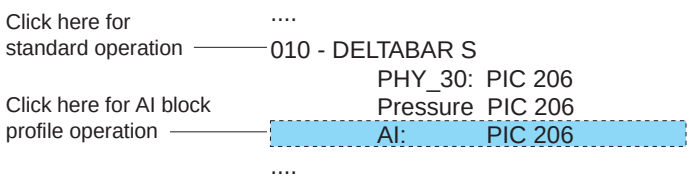
3.7 Configuration of profile parameters

The block parameters can be accessed by a PROFIBUS-DP Class 2 master, for example, Commuwin II. Commuwin II runs on an IBM-compatible computer or laptop. The computer must be equipped with a PROFIBUS interface, i.e. PROFIBOARD for PCs and PROFICARD for laptops. During the system integration, the computer is registered as a Class 2 master.

Operation

The PA-DPV1 server must be installed. The connection to Commuwin II is opened from the PA-DPV1 server.

- Generate a live list with "Tags"



- E+H operation is selected by clicking on the device name, e.g. Deltabar S.
- Profile operation is selected by clicking on the appropriate tag,
  e.g. AI: PIC 206 = Analog input block Deltabar S,
  or by selecting the appropriate device profile in the E+H graphic template.
- The settings are entered in the device menu.

Device menu

The device menu allows matrix or graphical operation to be selected.

- In the case of matrix operation, the device or profile parameters are displayed in a matrix. A parameter can be changed when the corresponding matrix field is selected.
- In the case of graphical operation, the operating sequence is shown in a series of templates with parameters. For profile operation, the pictures *Diagnosis, Scaling, Simulation and Block* are of interest.

Output scaling

The Deltabar S on-site display and the digital output operate completely independently of each other. In "Pressure" mode, the measured value is transferred in the unit given on the nameplate. In "Level" and "Flow" modes, the digital output value (OUT Value) delivers a value based on the pressure between 0 and 100 %.

Digital output value (OUT Value) = Display value of the on-site display

So that the display value and the digital output produce the same value, the following operating options are available:
– Set the values for the lower and upper limits of PV Scale and OUT Scale in the Analog Input Block; PV Scale min. = OUT Scale min. and PV Scale max. = OUT Scale max., refer to this Chapter, Slot/Index Table and Chapter 12.2 "Matrix Analog Input Block (AI Transmitter)",
– scale the limits of PV Scale und OUT Scale in Commuwin II in graphic mode, refer to figure below or
– confirm "Set unit to bus" parameter according to Chapter 6.1. Section "Selecting pressure unit". Confirming this parameter automatically sets the PV scale and OUT scale limits to the same level.

Digital output value (OUT Value) ≠ Display value of the on-site display

If you require a differently scaled output value for your PLC than the one which is shown on the display, the following operating options are available:
– Set the upper and lower limit values for PV scale and OUT scale in the Analog Input Block according to requirements, refer to Slot/Index Table in this Chapter and Chapter 12.2 "Matrix Analog Input Block (AI Transmitter)" or
– scale the limits for PV scale and OUT scale in Commuwin II in graphic mode, refer to figure below.

Note!
If you which to make a position calibration for the value indicated on the on-site display using bias pressure (see Chapter 6.1, Section "Position calibration – display (bias pressure)"), this must be done before changing the values for OUT Scale min. and OUT Scale max.

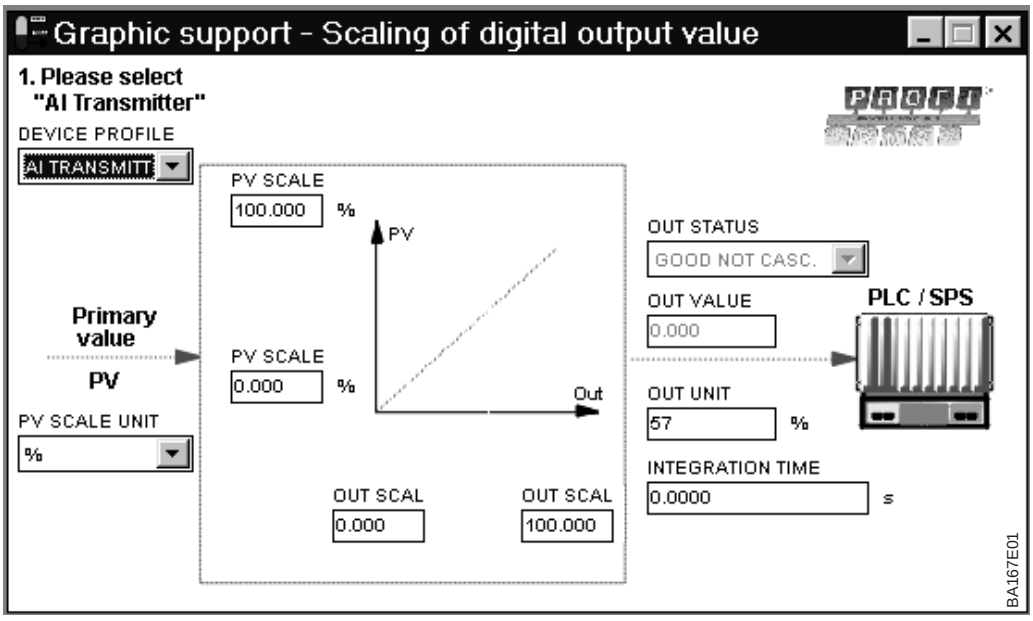


Figure 3.7
Scaling of the Out Value via graphic support in Commuwin II

4 Operation

4.1 On-site operation

Operating elements

Four keys, which allow the lower range-value and upper range-value to be set, are available for on-site operation. In "Pressure" mode, this setting only affects the bar graph in the display module. The lower and upper range-values have no influence on the digital output value or the display value in the diplay module. The key functions are listed in the table below.

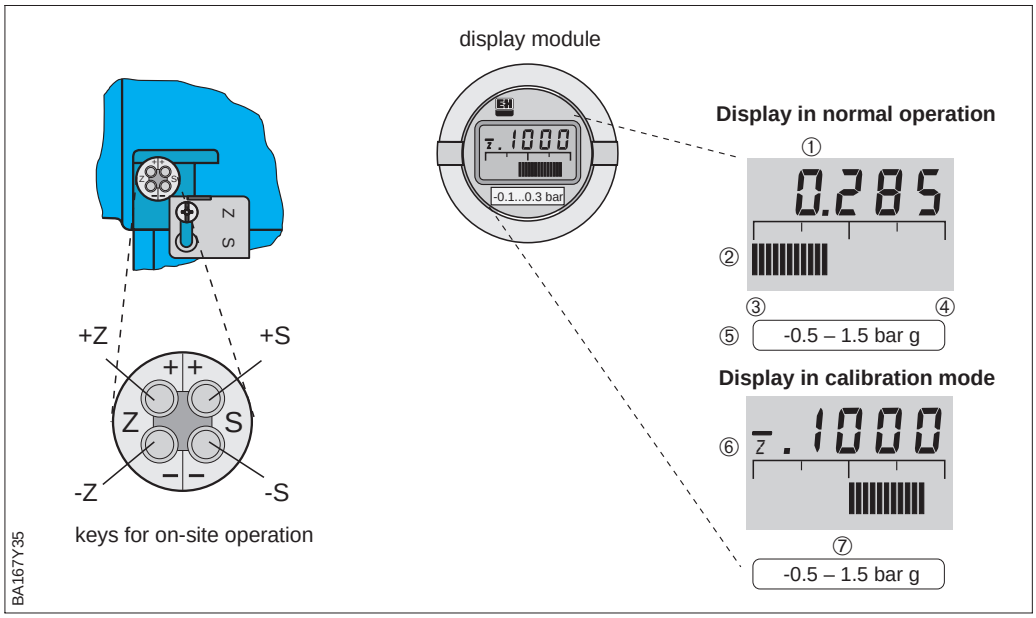


Figure 4.1
User interface of the Deltabar S, with optional display

Display in normal operation
① *4-figure display of measured value and entered parameters*
② *Bar graph of measured value*
③ *Lower range-value (zero)*
④ *Upper range-value (span)*
⑤ *Nominal measuring range*
In additional for display in calibration mode
⑥ *display in calibration point (Z=Zero, S=Span)*
⑦ *set measurement range within the llimits of the measuring point*

Display module

The local display module (optional) has two display modes:

- Display during measurement: standard operational mode
- Display during calibration: is activated by pressing one of the keys +Z, –Z, +S, –S twice. Automatically returns to measurement mode after 2 s.

Key function	
+Z	increases the lower range-value (zero) by +1 digit*
–Z	decreases the lower range-value (zero) –1 digit*
+S	increases the upper range-value (span) +1 digit*
–S	decreases the upper range-value (span) –1 digit*
Key combinations (press keys simultaneously)	
Keys	**Function**
Calibration	
2 x +Z and –Z	the acting pressure is taken as lower range-value (zero)
2 x +S and –S	the acting pressure is taken as upper range-value (span)
Bias pressure	
2 x +Z and +S	the acting pressure is taken as bias pressure**
1 x +Z and +S	the current bias pressure** is displayed
2 x –Z and –S	the current bias pressure** is deleted
Secure measuring point	
2 x +Z and –S	lock measuring point
2 x –Z and +S	unlock measuring point

Table 4.1
Key functions

** Note: Pressing once activates the display, only by pressing again the display begin to count. When first pressing the key the values slowly change and then increase in speed.*

*** If the display indicates process pressure zero not as zero after calibrating the lower range-value (depending on position), you can correct the display value to zero by adopting a bias pressure. The position calibration over a bias pressure has no influence on the digital output value (OUT Value), which is transferred over the bus. Please refer to Chapter 6.1, Section "Position calibration – display (bias pressure)".*

4.2 Operation with Commuwin II

When operating the Commuwin II display and operating program the Deltabar S is set and operated either using:

- Matrix mode or
- Graphic mode.

The server PA-DPV1 must be activated via the "Connect/open connection". For a description of the Commuwin II operating program, please refer to Operating Instructions BA 124F.

Note!
You can obtain the current device description (DD) either from your local Endress+Hauser Sales Center or via the Internet (http://www.endress.com → Products → Process Solutions → CommuWIN II → Updates/Downloads).

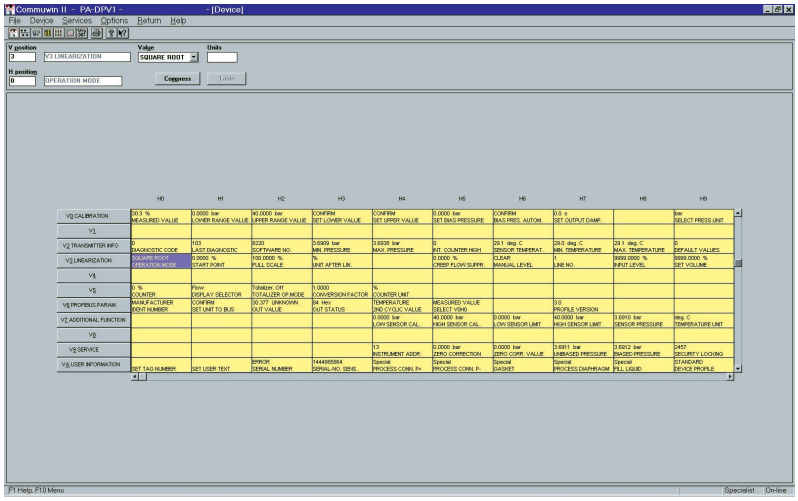
Note!

Matrix mode (Menu Device)

You can access the extended funtions of the Deltabar S, such as level measurement, using the "Device/Parameter Matrix" menu.

- Each row is allocated to a particular function.
- Each field sets or displays one parameter.

Enter the setting parameters in the appropriate fields and confirm by pressing ↵. You can use the matrix field "Device Profile" (VAH9) to switch between the block circuit diagrams: Standard, Physical Block, Press Block and AI Transmitter.

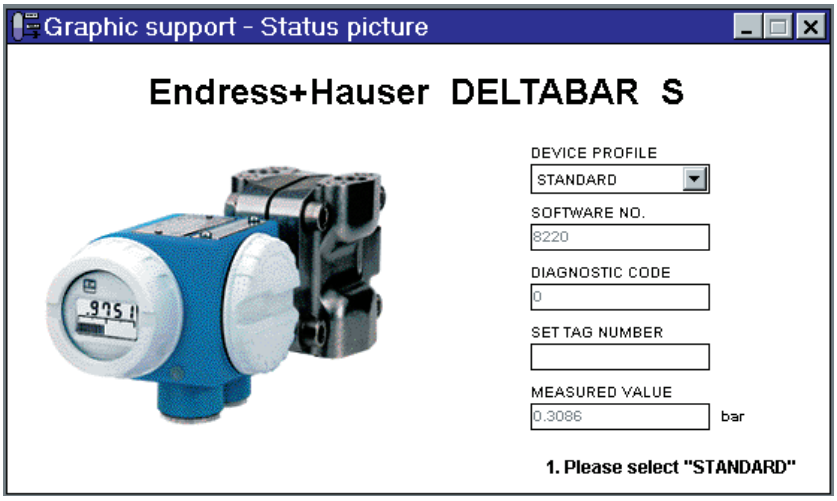


BA167E02

Figure 4.2
Menu "Device /Parameter matrix" in Commuwin II

Graphic mode (Menu Device)

Commuwin II offers graphic examples of certain configuration procedures which you can access from the "Device/Graphics" menu. There you can directly modify parameters and confirm by pressing ↵. The block profile parameters are also accessible using the graphical interfaces, see Chapter 3.7.



BA167E03

Figure 4.3
Menu "Device/Graphics" in Commuwin II

5 Commissioning the Measuring Point

Deltabar S PMD 230/235: This Chapter describes how measuring points equipped with three-way manifolds are operated. Since the valves are usually operated manually, the position calibration (bias pressure) is made on-site using the keys.

Deltabar S FMD 230/630/633: After the opening of any shut-off valves, the transmitter can be calibrated on-site or via PROFIBUS-PA.

Note!

Note!
All operations can be made over the local keys or the Commuwin II operating program. Further information such as activation of level and flow measurement, attunation or low flow cut off can only be carried out via communication. For more information, refer to the following Chapters.

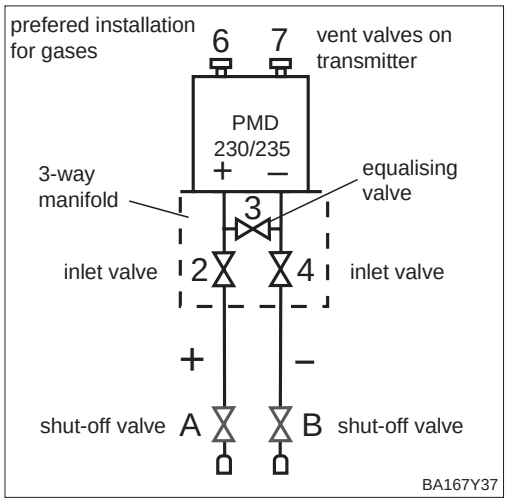
5.1 Function of manifolds

Three-way manifold

The three-way manifold comprises two inlet valves and an equalising valve:

- Inlet valves (2 and 4):
  Cut off the transformer from the pressure piping.
- Equalising valve (3):
  Equalises the pressure on the positive and negative sides.

It is often necessary to shut-off the pressure piping from the tapping points by using two shut-off valves (A and B).

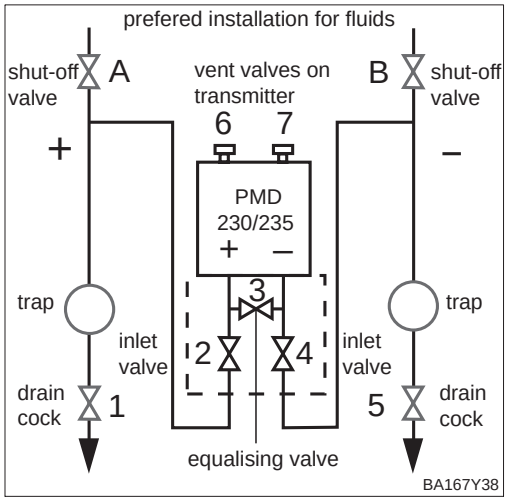


Dirty liquids

Drain cocks or blow-off valves are usually required in dirty liquids which tend to build-up.

- Drain cocks (1 and 5):
  Drain or blow off deposits in the pressure piping
- Inlet valves (2 and 4):
  Cut off the transformer from the pressure piping.
- Equalising valve (3):
  Equalises the pressure on the positive and negative sides.

It is often necessary to shut-off the pressure piping from the tapping points by using two shut-off valves (A and B).



Note!

Note!
In power stations, this arrangement is often realised as a special five-way manifold.

5.2 Differential pressure measurement

This Chapter contains the following information:

- General description of operation with keys
- Commissioning the measuring point

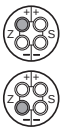
Chapter 6 describes "Differential pressure measurement" and operation using Commuwin II.

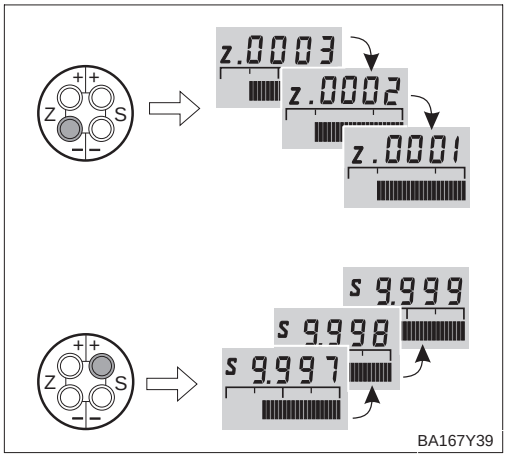
Note!
Use the keys of the on-site operation to set the lower and upper range-values of the bar graph in the display module. The lower and upper range-values have no influence of the digital output value or on the display value in the display module.

Note!

Lower and upper range-values: calibration without reference pressure

The desired lower and upper range-values are set using keys.

#	Key	Entry
1		**Set lower range-value:** Press +Z or –Z several times. (As the span remains constant, the upper range-value is shifted to the same extent as the lower range-value.)
2		**Set upper range-value:** Press +S or –S serveral times (The lower range-value is unaffected.)



Lower and upper range-values: calibration with reference pressure

A reference pressure which corresponds exactly to the desired lower and upper range-values is available.

#	Key	Entry
1	Exact pressure for lower range-value is acting.	
2		Simultaneously press +Z and –Z twice. (As the span remains constant, the upper range-value is shifted to the same extent as the lower range-value.)
3	Exact pressure for upper range-value is acting.	
4		Simultaneously press +S or –S twice. (The lower range-value is unaffected.)

Position calibration – display (bias pressure)

If the display does not show zero after zero point adjustment (due to position), then you can correct the display value to zero by adopting the bias pressure acting (depending on position). These has no influence on the digital output value (OUT Value)

#	Key	Entry
1		**Correct display:** Press +Z and +S twice simoultaneously. The bias pressure acting is adoted.
2		**Display bias pressure:** Press +Z and +S once simoultaneously. The bias pressure entered is shown briefly.
3		**Delete bias pressure:** Press –Z and –S twice simoultaneously. The bias pressure entered is deleted.

Commissioning the measuring point in steps

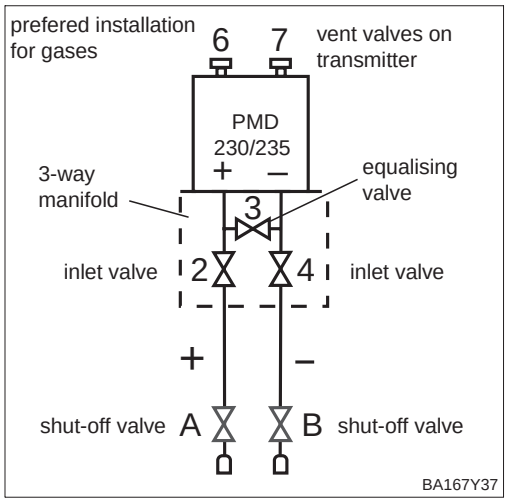
Before using the Deltabar S for measuring differential pressure, clean the pressure piping and fill the device with medium. The span (upper range-value – lower range-value) is either preset (see pages 35), or is calibrated during commissioning.

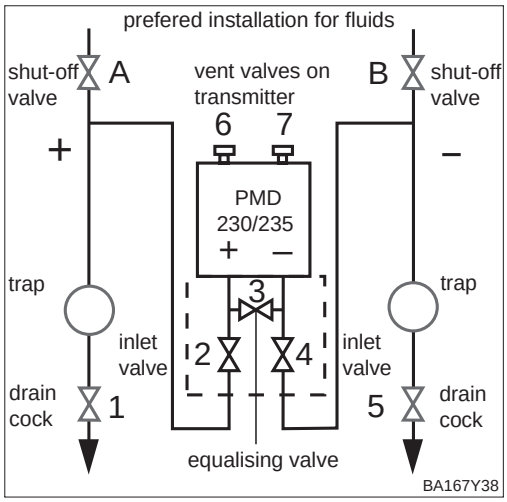
#	Valve	Significance
1	Close 3	
2	Fill measuring system with medium	
	Open A, B, 2, 4	Let in medium
3	Clean pressure pipes if required* – for gases with compressed air – for liquids by washing out	
	Close 2 and 4	Shut off transmitter
	Open 1 and 5*	Blow out/wash out pressure piping
	Close 1 and 5*	Close valves after cleaning
4	Let air out of transmitter	
	Open 2 and 4	Let in medium
	Close 4	Close negative side
	Open 3	Connect positive and negative side
	Briefly open 6 and 7 then close again	Fill transmitter with medium and let air out
5	Set the measuring point in operation	
	Close 3	Shut off positive from negative side
	Open 4	Connect negative side
	Now: 1*, 3, 5*, 6 and 7 are closed 2 and 4 are open A and B are open (if present)	
6	Set lower range-value to initial pressure and display to zero – Filters: Shut off flow or enter minimum flow for clean filters – Tanks or pipe pressure: enter initial pressure	
		Lower range-value: Press +Z and –Z simultaneously twice
		If appropriate correct the display: Press +Z and +S simultaneously twice**
7	Set upper range-value to final pressure – Filters: Shut off or allow minimum flow for contaminated filters – Tanks or pipe pressure: enter final pressure	
		Upper range-value: Press +S and –S simultaneously twice
8	If necessary, set damping and select "Pressure" operating mode according to Chapter 6.	
9	Measuring point is ready for operation	


Caution!


Note!

* For arrangements with five valves only





Caution!
When opening and closing valves to the process, care must be taken to avoid overheating or one-sided overloading (beyond specifications) of the measuring cell. If the measuring range is adjusted, the output signal may not lead to impermissible jumps in the control loop.

****Note!**
The position calibration carried out using the +Z and +S key has no influence on the digital output value (OUT Value), which is transferred over the bus. So that the display value in the display module and the digital output value show the same value, you must confirm "Set unit to bus" parameter in Commuwin II after calibration (after Step 8). Note that a change of the digital output value can influence the controller. Refer also to Chapter 6.1, Section "Position calibration – display (bias pressure).

5.3 Level measurement

This Chapter contains the following information:

- General description of operation with keys
- Commissioning the measuring point

Note: Calibration with keys
After the first on-site commissioning with keys, the display module shows the current measured value as the pressure value. The measured value can be displayed in other units (level, volume or mass) using an operating program such as Commuwin II.

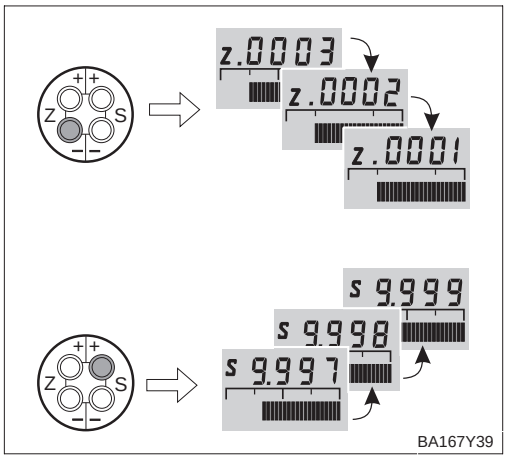
Note!

Chapter 7 describes "Level measurement" and operation using Commuwin II.

Lower and upper range-values: calibration without reference pressure

The desired lower and upper range-values are set using keys.

#	Key	Entry
1		**Set lower range-value:** Press +Z or –Z several times. (As the span remains constant, the upper range-value is shifted to the same extent as the lower range-value.)
2		**Set upper range-value:** Press +S or –S several times. (The lower range-value is unaffected.)



Lower and upper range-values: calibration with reference pressure

A reference pressure which corresponds exactly to the desired upper and lower range-values is available.

#	Key	Entry
1	Exact pressure for lower range-value is acting.	
2		Simultaneously press +Z and –Z twice. (As the span remains constant, the upper range-value is shifted to the same extent as the lower range-value.)
3	Exact pressure for upper range-value is acting.	
4		Simultaneously press +S and –S twice. (The lower range-value is unaffected.)

Position calibration – display only (bias pressure)

If the **display** does not show zero after zero point adjustment (due to position), then you can correct the display value to zero by adopting the bias pressure acting (depending on position). These has no influence on the digital output value (OUT Value).

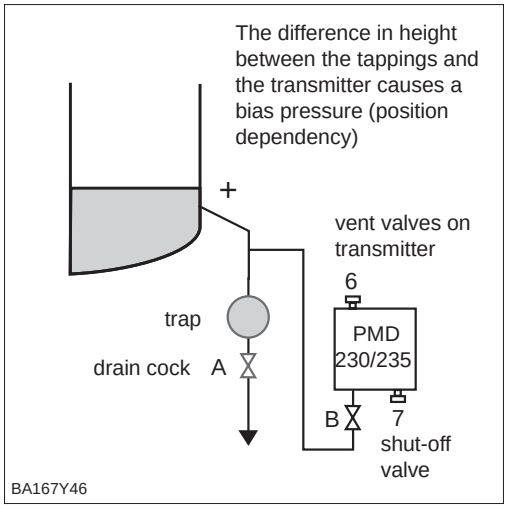
#	Key	Entry
1		**Correct display:** Press +Z and +S twice simoultaneously. The bias pressure acting is adopted.
2		**Display bias pressure:** Press +Z and +S once simoultaneously. The bias pressure entered is shown briefly.
3		**Delete bias pressure:** Press –Z and –S twice simoultaneously. The bias pressure entered is deleted.

Caution!

Caution!

When opening and closing values to the process, care must be taken to avoid overheating or one-sided overloading (beyond specifications) of the measuring cell. If the measuring range is adjusted, the output signal may not lead to impermissible jumps in the control loop.

Commissioning the measuring point – open tank

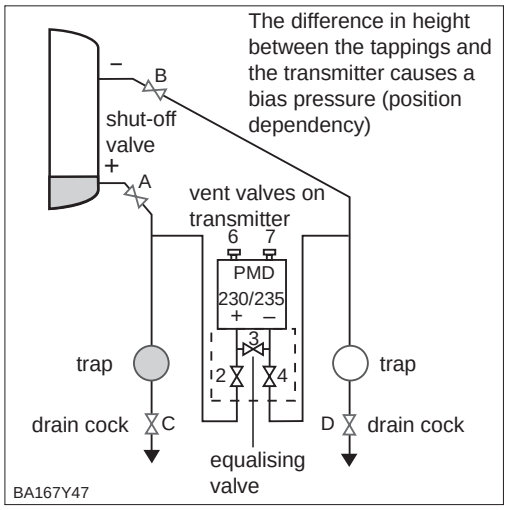


#	Valve	Significance
1	Fill tank to a level above the tapping	
2	Fill measuring system with medium	
	Open B	Open shut-off valve
3	Let air out of transmitter	
	Briefly open 6 then shut again	Fill transmitter with medium and let out air
4	Making the measuring point ready for operation	
	Now: A and 6 are closed B is open	
5	Calibrate transmitter using keys (pages 37 and 38) or using Commuwin II (Chapter 7).	
6	Using Commuwin II (Chapter 7): Select "Level" operating mode . Set upper and lower range-values for "level empty" and "level full". Set "Unit after linearisation" (V3H3) and "Output damping" (V0H7) parameters.	
7	Measuring point is ready for measurement	

Note!

Note!

- If present, the trap is washed out with valve A.
- The negative side of the Deltabar S is open to atmospheric pressure.
- For calibration, the positive pressure piping must be filled with medium.
- Version FMD 230/630 is ready for measurement after opening the shut-off valve.



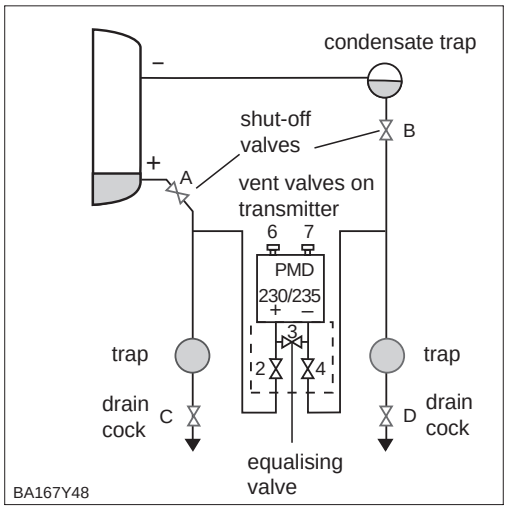
#	Valve	Significance
1	Fill tank to a level above the lower tapping	
2	Fill measuring system with medium	
	Close 3 Open A and B	Shut off positive from negative side Open shut-off valve
3	Let out air on positive side (if necessary drain negative side)	
	Open 2 and 4	Let medium into positive side
	Briefly open 6 and 7 then shut again	Fill positive side with medium and let out air
4	Making the measuring point ready for operation Now: 3, 6 and 7 are closed 2, 4, A and B are open	
5	Calibrate transmitter using keys (pages 37 and 38) or using Commuwin II (Chapter 7).	
6	Using Commuwin II (Chapter 7): Select "Level" operating mode. Set upper and lower range-values for "level empty" and "level full". Set "Unit after linearisation" (V3H3) and "Output damping" (V0H7) parameters.	
7	Measuring point is ready for measurement	

Commissioning the measuring point – closed tank

Note!
- If present, the traps are washed out with valves C and D.
- For empty calibration, the pressure piping "+" must be filled with medium.
- Version FMD 230/630 is ready for measurement after the opening of the shut-off valves if present.
- Version FMD 633 is immediately ready for measurement.

Note!

Closed tank with steaming liquid



#	Valve	Significance
1	Fill tank to a level above the lower tapping	
2	Fill measuring system with medium	
	Open A and B	Open shut-off valves
	Fill condensate trap or wait until enough condensate has collected. This can take some minutes.	
3	Let air out of transmitter	
	Open 2 and 4	Let in medium
	Close 4	Shut off negative side
	Open 3	Connect possible and negative side
	Briefly open 6 and 7 then shut again	Fill transmitter with medium and let out air
4	Making the measuring point ready for operation	
	Close 3	Shut off positive from negative side
	Open 4	Connect negative side
	Now: 3 is closed 6 and 7 are closed 2 and 4 are open A and B are open (if present)	
5	Calibrate transmitter using keys (pages 37 and 38) or using Commuwin II (Chapter 7).	
6	Using Commuwin II (Chapter 7): Select "Level" operating mode. Set upper and lower range-values for "level empty" and "level full". Set "Unit after linearisation" (V3H3) and "Output damping" (V0H7) parameters.	
7	Measuring point is ready for operation	

Note!

Note!

- Any dirt or condensate trap is washed out with valves C or D.
- For calibration, both positive and negative pressure piping must be filled with medium.
- Version FMD 230/630 is ready for measurement after the opening of the shut-off valve if present. The "–" pressure piping must be filled with medium.
- Version FMD 633 is immideately ready for measurement.

5.4 Flow measurement with differential pressure

This Chapter contains the following information:

- General description of calibration with keys
- Commissioning the measuring point

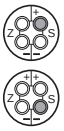
Note: Calibration with keys
After the first on-site commissioning with keys, the display module shows the current measured value as the pressure value. The measured value can be displayed in other units (flow) using an operating program such as Commuwin II.

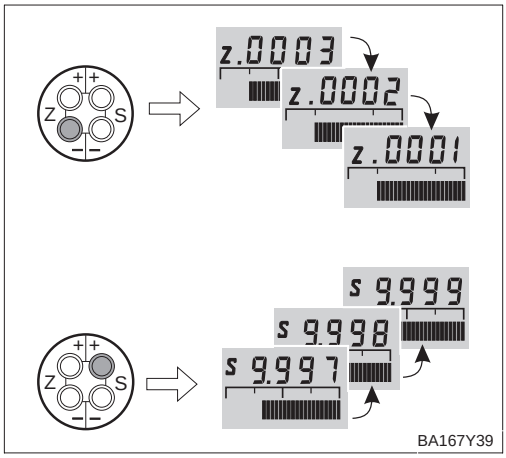
Note!

Chapter 8 describes "Flow measurement" and operation using Commuwin II.

Lower and upper range-values: calibration without reference pressure

Set the required lower and upper range-values with the keys. The flow is determined using the differential pressure and primary elements, e.g. pitot tube or orifice plate. The lower range-value corresponds to a flow of zero (differential pressure = 0 mbar). The upper range-value corresponds to the differential pressure at maximum flow (see also the Deltatop/Deltaset design sheet).

#	Key	Entry
1		**Set lower range-value:** Press +Z or –Z several times. (As the span remains constant, the upper range-value is shifted to the same extent as the lower range-value.)
2		**Set upper range-value:** Press +S or –S several times. (The lower range-value is unaffected.)



Lower and upper range-values: calibration with reference pressure

A reference pressure is available corresponding exactly to the required lower or upper range-values. The lower range-value corresponds to a flow of zero (differential pressure = 0 mbar). The upper range-value corresponds to the differential pressure at maximum flow (see also the Deltatop/Deltaset design sheet).

#	Key	Entry
1	Exact pressure for lower range-value is acting.	
2		Simultaneously press +Z and –Z twice. (As the span remains constant, the upper range-value is shifted to the same extent as the lower range-value.)
3	Exact pressure for upper range-value is acting.	
4		Simultaneously press +S and –S twice. (The lower range-value is unaffected.

Position calibration – display (bias pressure)

If the display does not show zero after zero point adjustment (due to position), then you can correct the display value to zero by adopting the bias pressure acting (depending on position). These has no influence on the digital output value (OUT Value).

#	Key	Entry
1		**Correct display:** Press +Z and +S twice simoultaneously. The bias pressure acting is adoted.
2		**Display bias pressure:** Press +Z and +S once simoultaneously. The bias pressure entered is shown briefly.
3		**Delete bias pressure:** Press –Z and –S twice simoultaneously. The bias pressure entered is deleted.

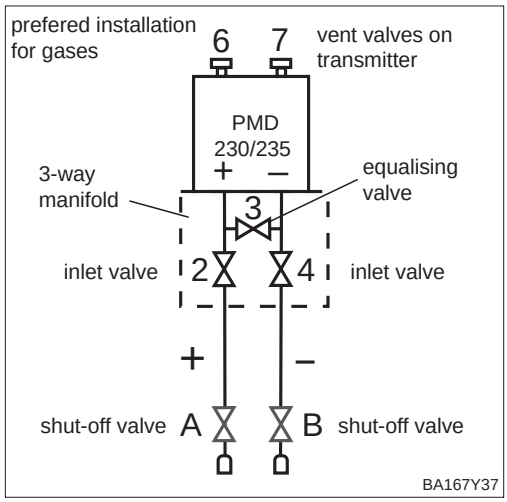
Commissioning the measuring point

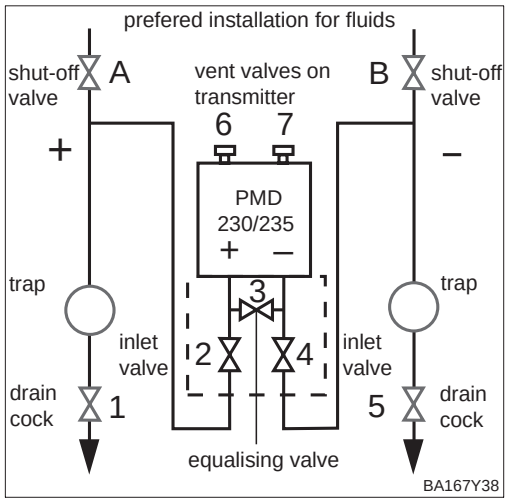
Before using the Deltabar S for measuring differential pressure, clean the pressure piping and fill the device with medium. The span (upper range-value – lower range-value) is either preset (see pages 41 and 42), or only the lower range-value is set during commissioning, as described below.

#	Valve	Significance
1	Close 3	
2	Fill measuring system with medium	
	Open A, B, 2, 4	
3	Clean pressure pipes if required* – for gases with compressed air – for liquids by washing out	
	Close 2 and 4	Shut off transmitter
	Open 1 and 5*	Blow out/wash out pressure piping
	Close 1 and 5*	Close valves after cleaning
4	Let air out of transmitter	
	Open 2 and 4	Let in medium
	Close 4	Close negative side
	Open 3	Connect positive and negative side
	Briefly open 6 and 7 then close again	Fill transmitter with medium and let out air
5	Set lower range-value and display to zero **Note:** The following entries are only appropriate here if: – the process cannot be shut off **and** – the tapping points (A and B) are at the same height. If the flow can be shut off then this calibration of zero and display is to be carried out **after** step 6.	
		Lower range-value: Press +Z and –Z simultaneously twice
		If appropriate correct display: Press +Z and +S twice simultaneously
6	Set the measuring point in operation	
	Close 3	Shut off positive from negative side
	Open 4	Connect negative side
	Now: 1*, 3, 5*, 6 and 7: are closed 2 and 4 are open A and B are open (if present)	
Set lower range-value and display to zero If flow can be shut off, then this calibration of zero and display is to be carried out here. Step 5 is then ignored.		
7	Shut off flow	
		Lower range-value: Press +Z and –Z simultaneaoulsy twice
		If appropriate correct display: Press +Z and +S twice simultaneously
	Open flow	

#	Valve	Significance
8	Using Commuwin II (Chapter 7): Select "Square root" (flow) operating mode. Set upper and lower range-values for "flow min" and "flow max". Set "Unit after linearisation" (V3H3) and "Output damping" (V0H7) parameters.	
9	Measuring point is ready for operation	

***** For arrangements with five valves only.





Caution!

Caution!

When opening and closing values to the process, care must be taken to avoid overheating or one-sided overloading (beyond specifications) of the measuring cell. If the measuring range is adjusted, the output signal may not lead to impermissible jumps in the control loop.

6 Differential Pressure Measurement

If the Deltabar S is started up as described in Chapter 5.2, it can start measurement immediately. The measuring range corresponds to the specification on the nameplate. Normally, the measured variable is transmitted via PROFIBUS-PA in the unit given on the nameplate. After a reset "code 5140", the measured variable is transmitted in "bar" (refer also to Chapter 9.3).

It is not possible to adjust zero and span in the convential sense. The measured value is, however, transferred at a resolution which offers an accuracy of 0.1 % at a "turndown" 10:1 (see also Chapter 11, Technical Data). This Chapter contains the following information:

- Calibration via Commuwin II (with and without reference pressure)
- Damping
- Locking/Unlocking the operation
- Measuring point information

6.1 Calibration via Commuwin II

The calibration is made via operating matrix (remote operation) using Commuwin II.

Matrix field	Significance
V0H1	Entry of pressure for lower range-value (only affects the bar graph in the display module)
V0H2	Entry of pressure for upper range-value (only affects the bar graph in the display module)
V0H3	Acting pressure is taken as lower range-value (only affects the bar graph in the display module)
V0H4	Acting pressure is taken as upper range-value (only affects the bar graph in the display module)
V0H5	Entry bias pressure (only affects the bar graph in the display module and the matrix fields V0H0, V0H1 and V0H2)
V0H6	Acting pressure is taken as bias pressure (only affects the bar graph in the display module and the matrix fields V0H0, V0H1 and V0H2)
V0H7	Entry of damping τ (0...40 s)
V0H9	Selecting pressure unit
V3H0	Operating mode: 0 = pressure
V6H1	You can select various pressure units using "Select pressure unit" parameter (V0H9). The pressure-specific parameters are converted and displayed in Commuwin II with the selected unit. So that the converted values can be transferred over the bus, "Set unit to bus" parameter (V6H1) must be confirmed once. For information, see the "Selecting pressure unit" Section of this Chapter.
V9H5	Position calibration, for information, see "Zero correction" Section of this Chapter.

Selecting pressure unit

You can select a pressure unit using the "Select pressure unit" parameter (V0H9). If you select a new pressure unit in V0H9, all pressure-specific parameters are converted and displayed in Commuwin II with the new pressure unit. The pressure units in the table below are available.

#	VH	Entry	Significance
1	All pressure-specific parameters are given in pressure unit "bar". e.g. Measured value (V0H0) = 1 bar		
2	V0H9	e.g. psi	Select pressure unit
3	All pressure-specific parameters are given in pressure unit "psi". Measured value (V0H0) = 14.5 psi		

mbar	bar	Pa	hPa
kPa	MPa	mmH_2O	m H_2O
in H_2O	ft H_2O	psi	g/cm^2
kg/cm^2	kgf/cm2	atm	lb/ft^2
Torr	mmHg	inHg	

If you want the pressure value to be displayed in "%", follow the instructions in the Section "Output Pressure in %" below.

Note!

As standard, the measured value is transferred over the bus in the pressure unit given on the nameplate. So that the digital output value and the measured value in the matrix field V0H0 - even after selecting a new pressure unit - display the same value, you must confirm the "Set unit to bus" parameter in V6H1 once. Note that a change of the digital output value can influence the controller.

Note!

#	VH	Entry	Significance
1	e.g. Measured value (V0H0) = 1 bar		
2	V0H9	e.g. psi	Select pressure unit
3	Display Measured value (V0H0) = 14.5 psi Value 1 is transferred over the bus. V6H2 shows: 1.0 UNKNOWN		
4	V6H1	Confirm "Set unit to bus" parameter with Enter	V6H2 shows: 14.5 psi
5	Value 14.5 is now transferred over the bus.		

Output pressure in "%"

If you want the pressure value to be displayed in % set the operating mode to "Pressure %". As standard, the lower and upper range-values of the PROFIBUS-PA signal are assigned to the values 0 and 100 %, i.e. the OUT Value in the Analog Input Block is automatically converted to "%". The "Start point" (V3H1) and "Full Scale" (V3H2) parameters set the lower and upper range-values. Select "%" in the "Unit after linearisation" (V3H3) parameter.

#	VH	Entry	Significance
1	V3H0	Level linear	Select "Level linear" operating mode
2	V3H1	e.g. 0	Enter lower range-value
3	V3H2	e.g. 100	Enter upper range-value
4	V3H3	%	Select unit
5	e.g. current Measured value (V0H0) = 7 %		

Note!

Note!
The parameters "Lower range value" (V0H1/V0H3) and "Upper range value" (V0H2/V0H4) set the bar graph in the display module. The lower and upper range-value settings have no influence on the digital output value (OUT Value) or on the "Measured value" in matrix field V0H0.

Calibration without reference pressure

The desired lower and upper range-values are set. No particular pressure must be acting.

#	VH	Entry	Significance
1	V0H9	e.g. mbar	Select pressure unit
2	V3H0	Pressure	Select "Pressure" operating mode
3	V0H1	e.g. 0	Set pressure value for lower range-value
4	V0H2	e.g. 100	Set pressure value for upper range-value
5	e.g. current Measured value (V0H0) = 0.7 bar		

Calibration with reference pressure

An acting reference pressure or process pressure corresponds exactly to the lower and upper range-values.

#	VH	Entry	Significance
1	V0H9	e.g. mbar	Select pressure unit
2	V3H0	Pressure	Select "Pressure" operating mode
3	Exact pressure for lower range-value is acting.		
4	V0H3	Confirm with "Enter"	Acting pressure is taken for upper range-value
5	Exact pressure for upper range-value is acting.		
6	V0H2	Confirm with "Enter"	Acting pressure is taken for upper range-value
7	e.g. current Measured value (V0H0) = 0.7 bar		

Position calibration – display (bias pressure)

The display does not show zero after zero point adjustment (due to position), then you can correct the display value to zero by entering a bias pressure or by adopting the bias pressure acting (depending on position).

Entry of a bias pressure

#	VH	Entry	Significance
1	V0H5	e.g. 0.1	Enter bias pressure
2	If necessary, equate output value (OUT Value) with "Measured value" (V0H0).		
	V6H1	Confirm with "Enter"	Equate output value (OUT Value) with "Measured value" (V0H0)

Registration of an acting bias pressure

#	VH	Entry	Significance
1	V0H6	Confirm with "Enter"	Adopt applied pressure as bias pressure
2	If necessary, equate output value (OUT Value) with "Measured value" (V0H0).		
	V6H1	Confirm with "Enter"	Equate output value (OUT Value) with "Measured value" (V0H0)

Note!

Note!
- In liquids and steam a bias pressure can only be adopted if the pressure piping is filled.
- The position calibration over a bias pressure has no influence on the digital output value (OUT Value), which is transferred over the bus. So that the "Measured value" (V0H0) and OUT Value display the same value, you must confirm the "Set unit to bus" parameter in matrix field V6H1.

Zero correction

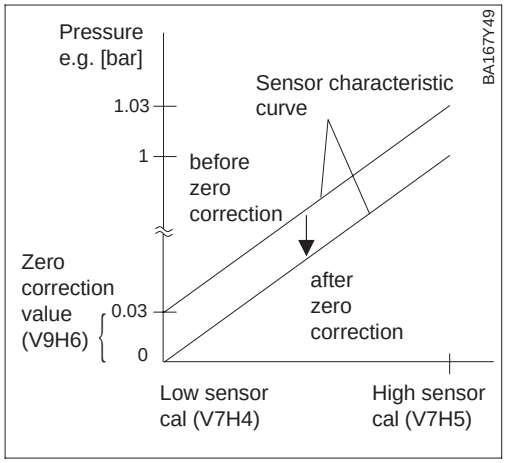
The "Zero correction" (V9H5) parameter offers a further possibility of carrying out position calibration. Besides the display value, and in contrast to position calibration using bias pressure (V0H5/V0H6), the current value is balanced with the on-site display (measured value (V0H0)).

When carrying out a zero correction, an applied pressure is assigned a correction value using "Zero correction" (V9H5). This shifts the sensor characteristic curve according to the diagram and the "Low sensor cal" (V7H4) and "High sensor cal" (V7H5) values are recalculated. The "Zero correction value" (V9H6) matrix field indicates the value by which the sensor characteristic curve was shifted.

The "Zero correction value" (V9H6) is calculated as follows:

- "Zero correction value" (V9H6) =
  "Sensor pressure" (V7H8) – "Zero correction" (V9H5)

  The "Sensor pressure" (V7H8) indicates the current applied pressure.



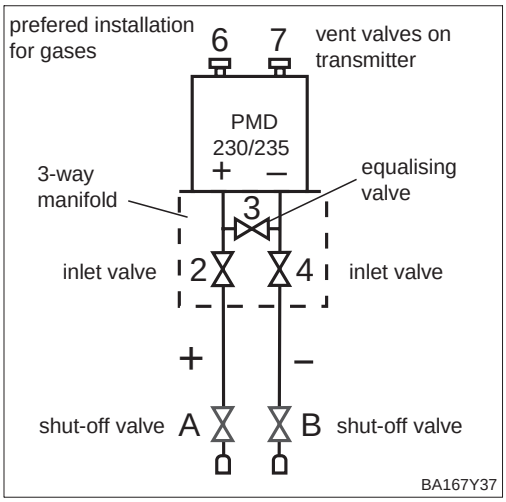
#	VH	Entry	Significance
1	– Display Measured value (V0H0) = 0.03 bar (position-dependent pressure) – OUT Value (V6H2) = 0.03 – Lower range value (V0H1) 0.0 bar.		
2	The pressure for zero correction is: Sensor pressure (V7H8) = 0.03 bar (corresponds to the position-dependent pressure)		
3	V9H5	0.0	The value 0.0 is assigned to the applied pressure.
4	After making inputs into the "Zero correction" (V9H5) parameter, the parameters adopt the following values: – Zero correction value (V9H6): V9H6 = V7H8 – V9H5 V9H6 = 0.03 bar – 0.0 bar V9H6 = 0.03 bar – Measured value (V0H0) = 0.0 bar – V6H2 = 0.0		

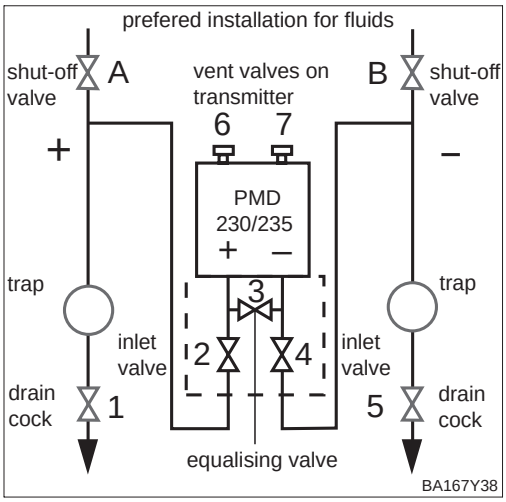
Commissioning the measuring point

Before using the Deltabar for measuring differential pressure, clean the pressure piping and fill the device with medium. The span (upper range-value – lower range-value) is either preset (see page 46), or is calibrated during operation.

#	Valves	Significance
1	Close 3	
2	Fill measuring measuring system with medium	
	Open A, B, 2, 4	Lets medium in
3	If appropriate clean pressure piping * – for gases with compressed air – for liquids by washing out	
	Close 2 and 4	Shut off transmitter
	Open 1 and 5*	Blow out/wash out pressure piping
	Close 1 and 5*	Close valves after cleaning
4	Let air out of transmitter	
	Open 2 and 4	Let in medium
	Close 4	Close negative side
	Open 3	Connect positive and negative side
	Briefly open 6 and 7 then close again	Fill transmitter with medium and let out air
5	Make measuring point ready for operation	
	Close 3	Shut off positive from negative side
	Open 4	Close negative side
	Now: 1*, 3, 5*, 6 and 7 are closed 2 and 4 open A and B are open (if present)	
6	Set lower range-value and display to zero – Filters: Shut off or allow minimum flow for clean filters – Tanks or pipe pressure: Enter zero pressure	
	Parameter V0H3 Set lower value	Acting pressure is taken for lower range-value
	Parameter V0H5 Bias pressure automatically	Set display to "0" (Position calibration)**
7	Set upper range-value to final pressure – Filters: Minimum flow is acting for contaminated filters – Tanks or pipe pressure: Final pressure is acting	
	Parameter V0H4 Set upper value	Acting pressure is taken for upper range-value
	Parameter V3H0: "Pressure"	Select "Pressure" operating mode
8	If necesssary, set "Output damping" (V0H7) parameter.	
9	Measuring point is ready for operation	

* For arrangement with five valves only





Caution!

Caution!
When opening and closing valves to the process, care must be taken to avoid overheating or one-sided overloading (beyond specifications) of the measuring cell. If the measuring range is adjusted, the output signal may not lead to impermissible jumps in the control loop.

Note!

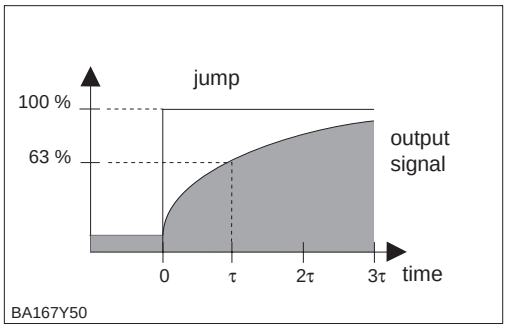
****Note!**
The position calibration carried out using V0H5 or V0H6 parameter has no influence on the digital output value (OUT Value), which is transferred over the bus. So that the display module and the digital output value show the same value, you must confirm the "Set unit to bus" parameter in matrix field V6H1 after calibration (after Step 7). See also this Chapter, Section "Position calibration – display (bias pressure)".

6.2 Damping

Damping τ (Integration time)

The damping influences the time with which the display in V0H0 and the output signal react to a change in pressure.

#	VH	Entry	Significance
1	V0H7	e.g. 30	Damping (0...40 s)



6.3 Locking/Unlocking the operation

After calibrating or entering all parameters, the operation can be locked:

- via the keys +Z and –S or
- via the matrix by entering a code. Enter a number between 1 and 9998 as the code. Do not use the numbers 130 and 2457.

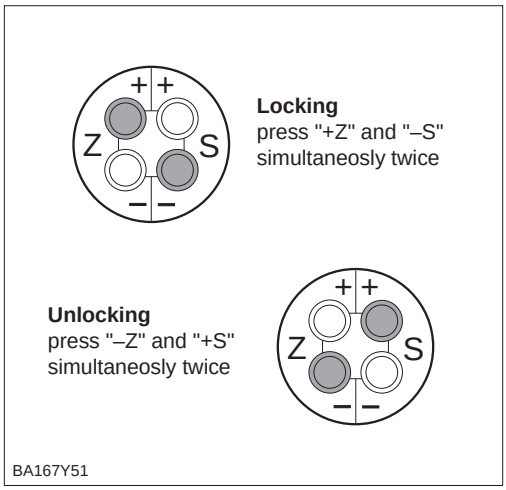
This protects the measuring point from accidental and unauthorised entries.

Keys

#	Key	Entry
1		**Lock operation**: Press +Z and –S simultaneously twice
2		**Unlock operation**: Press +S and –Z simultaneously twice

Matrix

#	VH	Entry	Significance
1	V9H9	e.g. 131	Operation locked
2	V9H9	130 or 2457	Operation unlocked



Locking with keys has priority

The table below summarises the locking function:

Locking via	Display/reading of parameters	Changing/writing of parameters		Unlocking via	
		Keys	Communication	Keys	Communication
Keys	yes	no	no	yes	no
Matrix	yes	no	no	yes	yes

6.4 Measuring point information

The following information about the measuring point can be read via the matrix in Commuwin II:

Matrix field	Significance
Measured values	
V0H0	Main measured value: pressure
V2H6	Current sensor temperature (units selectable in V7H9)
V6H2/V6H3	OUT Value, OUT Status (Analog Input Block)
V7H8	Current sensor pressure (units selectable in V0H9)
Sensor data	
V0H1	Lower range-value (zero)
V0H2	Upper range-value (span)
V2H5	Overload counter pressure (0…255)
V7H4	Low Sensor Calibration (units selectable in V0H9)
V7H5	High Sensor Calibration (units selectable in V0H9)
V7H6	Lower range-limit of sensor (units selectable in V0H9)
V7H7	Upper range-limit of sensor (units selectable in V0H9)
V9H7	Pressure before bias correction (units selectable in V0H9)
V9H8	Pressure after bias correction (units selectable in V0H9)
Measuring point information	
V2H2	Device and software number
Error response	
V2H0	Current diagnostic code
V2H1	Last diagnostic code

Display messages for diagnosis

The level indicator enables the smallest and largest measured values for pressure and temperature to be called up. The value is not lost on switching off the device.

Matrix field	Significance
V2H3	Minimum pressure (maximum pointer function)
V2H4	Maximum pressure (maximum pointer function)
V2H7	Minimum temperature (maximum pointer function)
V2H8	Maximum temperature (maximum pointer function)
V2H5	Overload counter pressure (0…255)
V2H6	Current sensor temperature (units selectable in V7H9)

User informationen

The matrix field VAH2 indicates the device serial number. The matrix field VAH3 indicates the sensor serial number. Fields VAH0, VAH1 and VAH4 - VAH8 offer the possibility of saving further information on the measuring point and the device.

Matrix field	Significance
VAH0 *	Measuring point tag (Physical Block)
VAH1 *	User text (Physical Block)
VAH2	Display serial number (transmitter)
VAH3	Serial number sensor
VAH4 – VAH8	Information about the device (selection)

* Entry up to 32 characters (ASCII)

7 Level Measurement

This Chapter describes the "Level linear", "Level cylindrical horizontal" and "Level manual", modes which can only be activated via communication. In these modes, the current pressure value is converted to "%". i.e. the digital output value (OUT Value) and the measured value in V0H0 is converted to "%". You can select other units for level, volume and weight using the "Unit after linearisation" parameter (V3H3).
This Chapter contains the following information:

- Calibration via Commuwin II
- Calibration with reference pressure (empty/full calibration)
- Dry calibration (Calibration without reference pressure)
- Linearisation
- Damping
- Locking/Unlocking the operation
- Measuring point information

7.1 Calibration via Commuwin II

The calibration is made via operating matrix (remote operation) using Commuwin II.

Matrix field	Significance
V0H1	Entry pressure value for lower range-value (pressure for level "empty")
V0H2	Entry pressure value for upper range-value (pressure for level "full")
V0H3	Acting pressure is taken as lower range-value (pressure for level "empty")
V0H4	Acting pressure is taken as upper range-value (pressure for level "full")
V0H5	Entry bias pressure (only affects the bar graph in the display module and the matrix fields V0H0, V0H1 and V0H2)
V0H6	Acting pressure is taken as bias pressure (only affects the bar graph in the display module and the matix fields V0H0, V0H1 and V0H2)
V0H7	Entry of damping τ (0...40 s)
V0H9	Selecting pressure unit
V3H0	Operating modes: 2 = Level linear, 3 = Level cyl. horizontal, 4 = Level manual
V3H1	Lower range-value for level, volume or weight (empty)
V3H2	Upper range-value for level, volume or weight (full)
V3H3	Selecting unit for level, volume or weight
V3H4	Density factor
V3H6 *	Linearisation mode: Activate table, Manual, Semi-automatic, clear table
V3H7 *	Entry line no. of linearisation table
V3H8 *	Entry level value in %
V3H9 *	Entry volume value in %
V6H1	Equate output value (OUT Value) with "Measured value" (V0H0).

* only in "Level manual" operating mode, see Chapter 7.4 "Linearisation"

Selecting pressure unit

You can select a pressure unit using the "Selecting pressure unit" parameter (V0H9). If you select a new pressure unit in V0H9, all pressure-specific parameters are converted and displayed in Commuwin II with the new pressure unit.

#	VH	Entry	Significance
1	All pressure-specific parameters are given in pressure unit "bar". e.g. Measured value (V0H0) = 1 bar		
2	V0H9	e.g. psi	Select pressure unit
3	All pressure-specific parameters are given in pressure unit "psi". Measured value (V0H0) = 14.5 psi		

The pressure units in the table below are available.

mbar	bar	Pa	hPa	kPa	MPa	mmH_2O
m H_2O	in H_2O	ft H_2O	psi	g/cm^2	kg/cm^2	kgf/cm^2
atm	lb/ft^2	Torr	mmHg	inHg		

Selecting unit for level, volume or weight (Units after linearisation)

The units for level, volume or weight are selectable using the "Unit after linearisation" (V3H3) parameter. Selecting one of these units helps to improve the display. This has no influence on the digital output value (OUT Value) and the "Measured value" (V0H0).

#	VH	Entry	Significance
1	e.g. Measured value (V0H0) = 55 %		
2	V3H3	e.g. hl	Select unit for level, volume or weight
3	Measured value (V0H0) = 55 hl		

Units for "Level linear" and "Manual level" operating modes:

%	cm	dm	m	inch	ft
l	hl	cm^3	dm^3	m^3	ft^3
US gal	Imp gal	ton	kg	t	lb

Units for "Level cylindrical horizontal" operating mode :

%	l	hl	cm^3	dm^3	m^3
ft^3	US gal	Imp gal	ton	kg	t
lb					

When you want to display the measured variable (V0H0) converted into the selected level unit, enter converted values for the minimum and maximum level values. The "Start point" (V3H1) parameter corresponds to the minimum level value and the "Full scale" (V3H2) parameter to the maximum level value.

#	VH	Entry	Significance
1	Excample: Lower and upper range-values are set. Lower range value (V0H1) = 0 mbar Upper range value (V0H2) = 1500 mbar		
2	The current measured value (V0H0) displays in the pressure mode = 750 mbar.		
3	V3H0	Level linear	Select "Level linear operating mode
4	The minimum level, maximum level and current measured variable are displayed as follows: – Start point (V3H1) = 0 % – Full scale (V3H2) = 100 % – Measured value (V0H0) = 50 %		
5	V3H3	e.g. m	Select unit for level, volume or weight

#	VH	Entry	Significance
6	V3H1	e.g 0 (m)	Enter the converted minimum level value
7	V3H2	e.g. 15 (m)	Enter the converted maximum level value

Results:
- The parameters for the minimum and maximum level value indicate:
  – "Start point" (V3H1) = 0 m
  – "Full scale" (V3H2) = 15 m
- The current measured value (V0H0) indicates:
  – "Measured value" (V0H0) = 7.5 m

Density correction

If the calibration has been made with water or the product changes at a later date, the calibration values can be corrected by entering a density factor.

$$\text{density factor} = \text{current factor} \times \frac{\text{new density}}{\text{old density}}$$

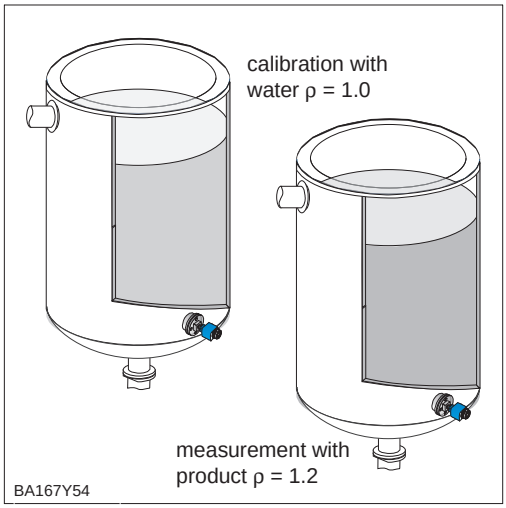
Determining the density factor

Example: A tank is filled with water and calibrated. The density of the water (old density) is 1 g/cm3. Later the tank will be used as a storage tank and be filled with the actual medium to be measured. The new density is 1.2 g/cm3. V3H4 still contains the factory setting 1, i.e. the current factor is 1.

$$\text{density factor} = 1.0 \times \frac{1.2\ \text{g/cm}^3}{1.0\ \text{g/cm}^3} = 1.2$$

#	VH	Entry	Significance
1	V3H4	e.g. 1.2	Density factor
2	V0H0	e.g. 62.5 %	Corrected level

Result
- The measured value in V0H0 is divided by the density factor and is thus correct for the new product.



Note!
The density factor affects the level measurement. If the product density changes, first enter the new density factor before using any existing linearisation curve.

Note!

7.2 Calibration with reference pressure

The tank is filled for either the lower range-value or the upper range-value for calibration.

Selecting the operating mode enables two tank shapes to be chosen:
- vertical – "level linear" and
- horizontal – "level cylindrical horizontal".

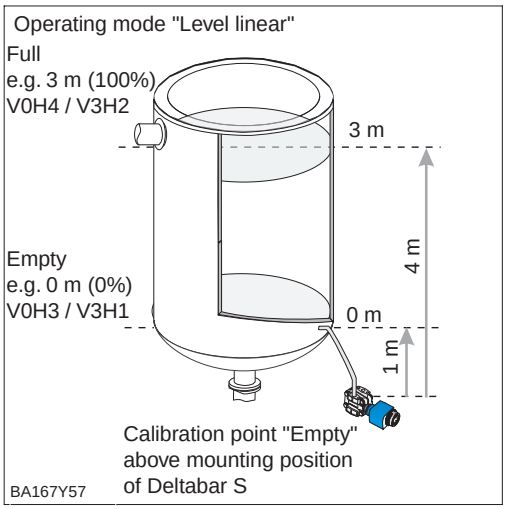
Note!

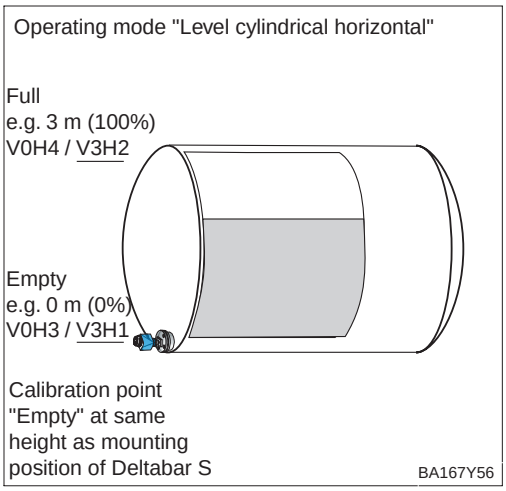
Note!
- If the device has a display and is installed below the "Empty level", an applied pressure can be adopted as a bias pressure in V0H6 (depending on position).
- For Step 3, you can also carry out a zero correction according to the procedure described in Chapter 6.1, page 47.

Calibration

#	VH	Entry	Significance
1	Measuring point ready for operation? Refer also to Chapter 5.3. If the lower and upper range-values have already been set using the keys, as explained in the Chapter 5.3 then continue the calibration from Step 7.		
2	Fill tank to the lower range-value		
3	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H6	Confirm with "Enter"	Set bias pressure automatically
4	V0H3	Confirm with "Enter"	Adopt applied pressure for lower range-value
5	Fill tank to the upper range-value		
6	V0H4	Confirm with "Enter"	Adopt applied pressure for upper range-value
7	V3H0	Level linear **or** Level cylindrical horizontal	Select operating mode for vertical tank **or** horizontal tank
8	V3H1	e.g. 0	Set level, volume or weight for "empty"
9	V3H2	e.g. 3	Set level, volume or weight for "full"
10	V3H3	e.g. m	Select unit for level, volume or weight (see tables, page 52)

Result
- The measured value is displayed in the matrix field V0H0 as a level value, here, for example, in metres.





7.3 Dry calibration

Dry calibration based on calculation and which can be carried out when the Deltabar S is not mounted or with an empty tank. *It is not recommended for transmitters with capillaries or closed tanks with steam.* The calibration point "empty" can be at the same height (flanged version) or above the tapping point of the Deltabar S. The requirements for dry calibration are

- The levels for the calibration points "empty" and "full" are known.
- The density factor is known.
- The pressure for "empty" and "full" is calculated (p = ρgh)

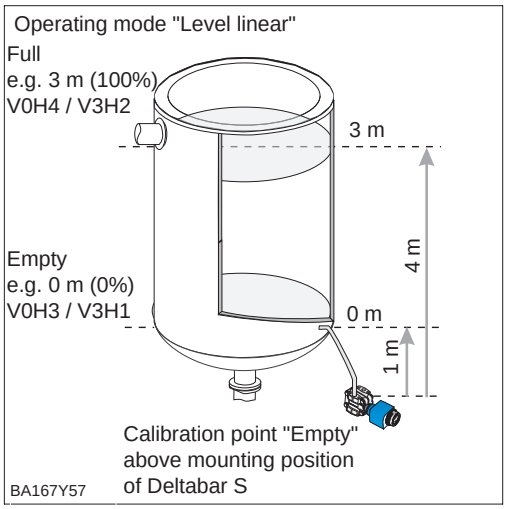
Selecting the operating mode enables two tank shapes to be chosen:
- vertical – "level linear" and
- horizontal – "level cylindrical and horizontal".

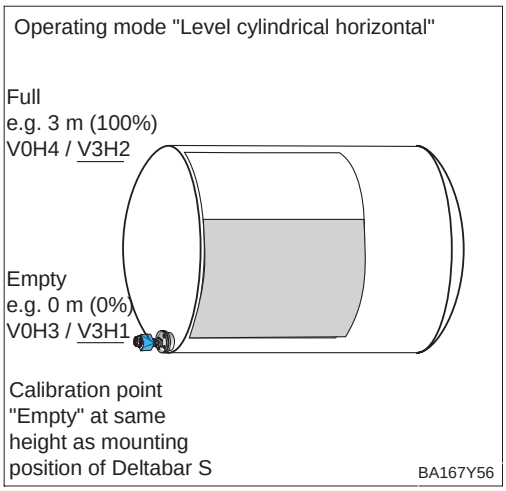
Note!
- If the device has a display and is installed below the "Empty level", an applied pressure can be entered as a bias pressure in V0H5 (depending on position).
- For Step 3, you can also carry out a zero correction according to the procedure described in Chapter 6.1, page 47.

Note!

Calibration

#	VH	Entry	Significance
1	Measuring point ready for operation? Refer also to Chapter 5.3. If the lower and upper range-values have already been set using the keys, as explained in the Chapter 5.3 then continue the calibration from Step 6.		
2	V0H9	e.g. bar	Select pressure unit
3	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H5	e.g. 0.1	Enter bias pressure
4	V0H1	0	Set pressure value for calibration point "empty"
5	V0H2	e.g. 0.3	Set pressure value for calibration point "full"
6	V3H0	Level linear **or** Level cylindrical horizontal	Select operating mode for vertical tank **or** horizontal tank
7	V3H1	e.g. 0	Set level, volume or weight for "empty"
8	V3H2	e.g. 3	Set level, volume or weight for "full"
9	V3H3	e.g. m	Select level, volume or weight (see tables page 52)





Result
- The measured value is displayed in the matrix field V0H0 as a level value, here, for example, in metres.

After a dry calibration, the first filling of the tank should be carefully observed, so that any errors or uncertainties are immediately detected.

Check after installation

7.4 Linearisation

Linearisation mode

Linearisation enables volumetric measurement to be carried out in vessels, e.g. with conical outlets in which the volume is not directly proportional to the level. The table below gives a summary of the linearisation function (V3H6) that is available with the operating mode "Level manual" (V3H0). Linearisation follows a calibration in the volumetric units required. The units for level, volume or weight are selectable using the "Unit after linearisation" (V3H3) parameter (see also tables, page 52).

Entry V3H6	Linearisation mode	Significance
1	Manual entry	For a linearisation curve max. 21 pairs of values for a % level and the appropriate % volume are entered.
2	Semi-automatic entry of a linearisation curve "gauging"	With semi-automatic entry of the linearisation curve the tank is filled or emptied. The height is automatically determined by the Deltabar S by the hydrostatic pressure, the appropriate volume is entered.
In addition V3H6 offers the functions:		
0	Activating table	The entered linearisation table only comes into effect after it has been activated.
3	Deleting table	Before a new linearisation table is entered, any previously active table must be deleted. On deletion the linearisation mode is automatically set to linear.

Warnings

When activated, the linearisation curve is checked for plausibility.
The following warnings may occur:

Code	Type	Significance
E602	Warning	The linearisation curve does not rise continuously. The number of the last valid pair automatically appears in V3H7. All value pairs from this number onwards must be re-entered.
E604	Warning	The linearisation curve comprises less than two value pairs. Enter more value pairs.

After selection the operating mode "level curve", the following error message may be displayed:

Code	Type	Significance
E605	Alarm	The manual linearisation curve is not complete or there is no linearisation curve present. Enter the linearisation curve in the operating mode "linear" and then select the operation mode table.

Manual entry

The requirements for a manual linearisation are as follows:

- The max. 21 value pairs for the linearisation curve are known.
- The curve is entered as % level (% pressure span) versus % volume. The linearisation curve must rise or fall continuously.
- The measured value is output as a volume.

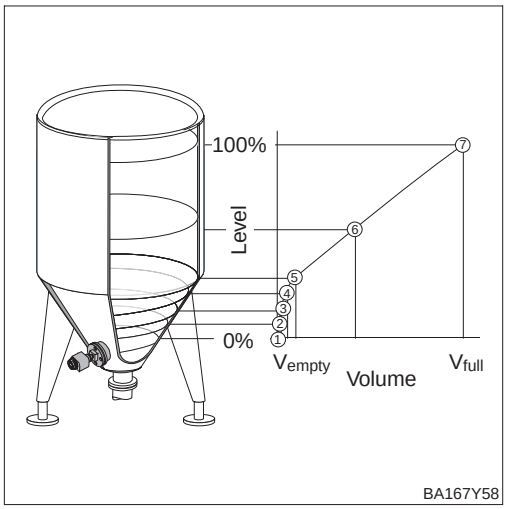
$$\text{volume at x \% level} = \frac{\text{total volume} \bullet \text{volume (\%)}}{100}$$

The entries in the table are made after an empty/full or dry calibration in %. The procedure which follows includes a dry calibration.

#	VH	Entry	Significance
1	Measuring point ready for operation? Refer also to Chapter 5.3. If the lower and upper range-values have already been set using the keys, as explained in the Chapter 5.3 then continue the calibration from Step 6.		
2	V0H9	e.g. bar	Select pressure unit
3	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H5	e.g. 0.1	Enter bias pressure
4	V0H1	e.g. 0	Set pressure value for calibration point "empty"
5	V0H2	e.g. 0.5	Set pressure value for calibration point "full"
6	V3H0	Level manual	Select "Level manual" operating mode
7	V3H1	e.g. 0	Set level, volume or weight for "empty"
8	V3H2	e.g. 10	Set level, volume or weight for "full"
9	V3H3	e.g. hl	Select unit for level, volume or weight
10	V3H6	Clear table	Delete existing curve
11	V3H6	Manual	Select "Manual" linearisation mode
12	V3H7	e.g. 1	Enter line no.
13	V3H8	e.g. 0 %	Enter level
14	V3H9	e.g. 0 %	Enter volume
15	Repeat steps 12...14 for other value pairs (max. 21)		
16	V3H6	Activate table	Activate table

Result

- The measured value is displayed in the matrix field V0H0 as a volume value, here, for example, in hectolitres.



Specimen table

Point	Measured Value (mbar)	Level (%)	Volume (%)
1	0	0	0
2	100	20	8
3	200	40	20
…			
7	500	100	100

Note!

Note!

- For Step 3, you can also carry out a zero correction according to the procedure described in Chapter 6.1, page 47.
- An empty/full calibration can be made at Steps 2 – 5, see page 54 "Calibration with reference pressure".
- In edit mode V3H6 = Manual, you can delete individual points in a linearisation table by entering "9999" for level or volume. But first activate the linearisation table.

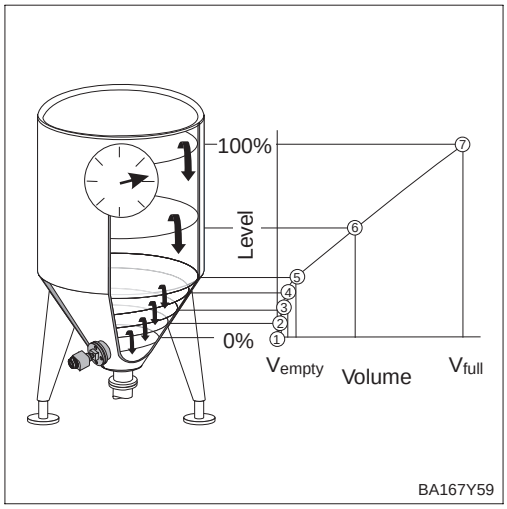
Semi-automatic entry

The requirements for a semi-automatic entry of the table is as follows:

- The max. 21 value pairs for the linearisation curve are known.
- The tank can be filled, for example, for the empty/full calibration and gradually emtpied for the linearisation. The level is automatically detected from the hydrostatic pressure. The associated volume must be entered in %.
- The measured value is supplied as a volume.

$$\text{volume at x \% level} = \frac{\text{total volume} \bullet \text{volume (\%)}}{100}$$

The entries in the table are made after an empty/full or dry calibration in %. The procedure which follows includes an empty/full calibration.



Specimen table			
Point	Measured Value (mbar)	Level (%)	Volume (%)
1	0	0	0
2	100	20	8
3	200	40	20
…			
7	500	100	100

Note!

Note!
- For Step 3, you can also carry out a zero correction according to the procedure described in Chapter 6.1, page 47.
- An dry calibration can be made at Steps 2 – 7, see page 55.
- In edit mode V3H6 = Manual, you can delete individual points in a linearisation table by entering "9999" for level or volume. But first activate the linearisation table.

#	VH	Entry	Significance
1	Measuring point ready for operation? Refer also to Chapter 5.3. If the lower and upper range-values have already been set using the keys, as explained in the Chapter 5.3 then continue the calibration from Step 7.		
2	Fill tank to lower range-value		
3	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H6	Confirm with "Enter"	Set bias pressure automatically
4	V0H3	Confirm with "Enter"	Adopt applied pressure for lower range-value
5	Fill tank to upper range-value		
6	V0H4	Confirm with "Enter"	Adopt applied pressure for upper range-value
7	V3H0	Level manual	Select "Level manual" operating mode
8	V3H1	e.g. 0	Set level, volume or weight for "empty"
9	V3H2	e.g. 100	Set level, volume or weight for "full"
10	V3H3	e.g. hl	Select unit for level, volume or weight
11	V3H6	Clear table	Delete existing curve
12	V3H6	Semi-automatic	Selecct "Semi-automatic" linearisation mode
13	V3H7	e.g. 1	Enter line no.
14	V3H8	Confirm with "Enter"	Enter level
15	V3H9	e.g. 0 %	Enter volume
16	Repeat steps 13...15 for other value pairs (max. 21)		
17	V3H6	Activate table	Activate table

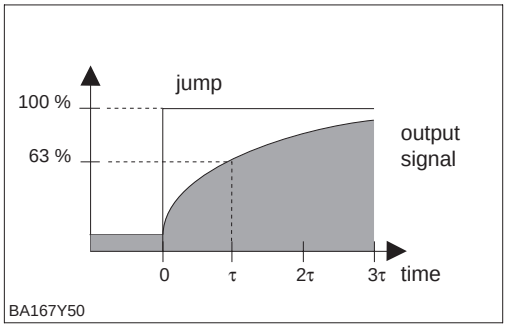
Result
- The measured value is displayed in the matrix field V0H0 as a volume value, here, for example, in hectolitres.

7.5 Damping

Damping τ (Integration time)

The damping influences the time with which the display in V0H0 and the output signal react to a change in level. By increasing the damping, the effect of a turbulent product surface on the measured value and maximum pointer displays can be damped, for example.

#	VH	Entry	Significance
1	V0H7	e.g. 30	Damping (0...40 s)



7.6 Locking/Unlocking the operation

After calibrating or entering all parameters, the operation can be locked:

- via the keys +Z and –S or
- via the matrix by entering a code. Enter a number between 1 and 9998 as the code. Do not use the numbers 130 and 2457.

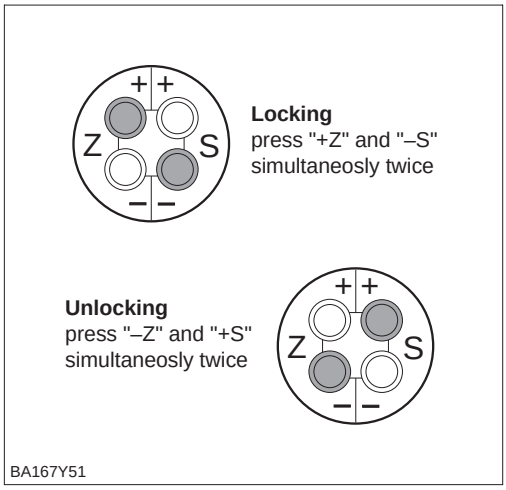
This protects the measuring point from accidental and unauthorised entries.

Key

#	Key	Entry
1		**Lock operation**: Press +Z and –S simultaneously twice
2		**Unlock operation**: Press +S and –Z simultaneously twice

Matrix

#	VH	Entry	Significance
1	V9H9	e.g. 131	Operation locked
2	V9H9	130 or 2457	Operation unlocked



Locking with keys has priority

The table below summarises the locking function:

Locking via	Display/reading of parameters	Changing/writing of parameters		Unlocking via	
		Keys	Communication	Keys	Communication
Keys	yes	no	no	yes	no
Matrix	yes	no	no	yes	yes

7.7 Measuring point information

The following information about the measuring point can be read via the matrix in Commuwin II:

Matrix field	Significance
Measured values	
V0H0	Main measured value: level, volume, weight
V2H6	Current sensor temperature (units selectable in V7H9)
V6H2/V6H3	OUT Value, OUT Status (Analog Input Block)
V7H8	Current sensor pressure (units selectable in V0H9)
Sensor data	
V0H1	Lower range-value (zero)
V0H2	Upper range-value (span)
V2H5	Overload counter pressure (0…255)
V7H4	Low Sensor Calibration (units selectable in V0H9)
V7H5	High Sensor Calibration (units selectable in V0H9)
V7H6	Lower range-limit of sensor (units selectable in V0H9)
V7H7	Upper range-limit of sensor (units selectable in V0H9)
V9H7	Pressure before bias correction (units selectable in V0H9)
V9H8	Pressure after bias correction (units selectable in V0H9)
Measuring point information	
V2H2	Device and software number
Error response	
V2H0	Current diagnostic code
V2H1	Last diagnostic code

Display messages for diagnosis

The level indicator enables the smallest and largest measured values for pressure and temperature to be called up. The value is not lost on switching off the device.

Matrix field	Significance
V2H3	Minimum pressure (maximum pointer function)
V2H4	Maximum pressure (maximum pointer function)
V2H7	Minimum temperature (maximum pointer function)
V2H8	Maximum temperature (maximum pointer function)
V2H5	Overload counter pressure (0…255)
V2H6	Current sensor temperature (units selectable in V7H9)

User information

The matrix field VAH2 indicates the device serial number. The matrix field VAH3 indicates the sensor serial number. Fields VAH0, VAH1 and VAH4 - VAH8 offer the possibility of saving further information on the measuring point and the dvice.

Matrix field	Significance
VAH0 *	Measuring point tag (Physical Block)
VAH1 *	User text (Physical Block)
VAH2	Display serial number (transmitter)
VAH3	Serial number sensor
VAH4 – VAH8	Information about the device (selection)

* Entry up to 32 characters (ASCII)

8 Flow Measurement

This Chapter describes the "Flow" operating mode which can only be activated via communication. The flow is determined using the differential pressure and primary elements, e.g. pitot tube or orifice plate. The pressure measuring range corresponds to the specifications on the nameplate. As standard, the lower an upper range-values of the PROFIBUS-PA signal are assigned to the values 0 and 100 %, i.e. OUT Value in the Analog Input Block is automatically converted to "%".
This Chapter contains the following information:

- Calibration via Commuwin II (with and without reference pressure)
- Damping
- Locking/Unlocking the operation
- Totalizer
- Measuring point information

8.1 Calibration via Commuwin II

The calibration is made via operating matrix (remote operation) using Commuwin II.

Matrix field	Significance
V0H1	Entry pressure value for lower range-value (pressure for flow "zero")
V0H2	Entry pressure value for upper range-value (pressure for flow "max")
V0H3	Acting pressure is taken as lower range-value (pressure for flow "zero")
V0H4	Acting pressure is taken as upper range-value (pressure for flow "max")
V0H5	Entry bias pressure (only affects the bar graph in the display module and the matix fields V0H0, V0H1 and V0H2)
V0H6	Acting pressure is taken as bias pressure (only affects the bar graph in the display module and the matix fields V0H0, V0H1 and V0H2)
V0H7	Entry damping τ (0...40 s)
V0H9	Selecting pressure unit
V3H0	Operating mode: 1 = flow (square root)
V3H1	Lower range-value for flow "min" (enter "0")
V3H2	Upper range-value for flow "max"
V3H3	Selecting unit for flow
V3H5	Creep flow suppression
V5H0	Diplay: current flow rate or total flow rate
V5H1	Operating mode display selection: current flow rate (Flow) or total flow rate (Totalizer)
V5H2	Activate the totalizer and selection counter mode for negative flow values: Off, neg. flow: Stop, neg. flow Decr., neg. flow: Incr.
V5H3	Conversion factor for conversion of current flow rate into total flow rate
V5H4	Selecting counter unit

Selecting pressure unit

You can select a pressure unit using the "Select pressure unit" parameter (V0H9). If you select a new pressure unit in V0H9, all pressure-specific parameters are converted and displayed in Commuwin II with the new pressure unit. The pressure units in the table below are available.

#	VH	Entry	Significance
1	All pressure-specific parameters are given in pressure unit "bar". e.g. Measured value (V0H0) = 1 bar		
2	V0H9	e.g. psi	Select pressure unit
3	All pressure-specific parameters are given in pressure unit "psi". Measured value (V0H0) = 14.5 psi		

mbar	bar	Pa	hPa
kPa	MPa	mmH_2O	m H_2O
in H_2O	ft H_2O	psi	g/cm^2
kg/cm^2	kgf/cm2	atm	lb/ft^2
Torr	mmHg	inHg	

Selecting unit for flow rate (Unit for linearisation)

The unit for flow is selectable using "Unit after linearisation" (V3H3) parameter. Selecting a flow rate unit helps to improve the display. This has no influence on the digital output value (OUT Value) and the "Measured value" (V0H0). The flow rate units in the table below are available.

#	VH	Entry	Significance
1	e.g. Measured value (V0H0) = 55 %		
2	V3H3	e.g. hl	Select unit for flow rate
3	Measured value (V0H0) = 55 m^3/h		

%	ft^3/min	m^3/h	l/s
ft^3/s	m^3/s	norm m^3/h	std ft^3/min
m^3/min	USG/h	USG/d	MGal/d
g/min	kg/s	kg/min in	kg/h
t/min	t/h	t/d	lb/s
lb/min	lb/h		

When you want to display the measured value (V0H0) converted into the selected flow rate unit, enter the calculated values for the minimum and maximum flow rate values. See also the specifications in the Deltatop/Deltaset design sheet. The "Start point" (V3H1) parameter corresponds to the minimum flow rate value and the "Full scale" (V3H2) parameter to the maximum flow rate value.

	VH	Entry	Significance
1	Example: Lower and upper range-values are set. Lower range value (V0H1) = 0 mbar Uper range value (V0H2) = 200 mbar		
2	The current measured value displays in the pressure mode (V0H0) = 128 mbar.		
3	V3H0	Square root	Select "Flow" operating mode
4	The minimum flow rate, maximum flow rate and current measured variable are displayed as follows: – Start point (V3H1) = 0 % – Full scale (V3H2) = 100 % – Measured value (V0H0) = 80 %		
5	V3H3	e.g. m^3/h	Select unit for flow rate
6	V3H1	e.g. 0 (m^3/h)	Enter the converted minimum flow rate value
7	V3H2	e.g. 3500 (m^3/h)	Enter the converted maximum flow rate value (see also Deltatop/Deltaset design sheet)

Results

- The parameters for the minimum and maximum flow rate value indicate:
  – "Start point" (V3H1) = 0 m^3/h
  – "Full scale" (V3H2) = 3400 m^3/h
- The current measured value (V0H0) indicates:
  – "Measured value" (V0H0) = 2720 m^3/h

Calibration without reference pressure

Set the required lower and upper range-values via communication. The flow is determined using the differential pressure and primary elements, e.g. pitot tube or orifice plate. The lower range-value corresponds to a flow of zero (differential pressure = 0 mbar). The upper range-value corresponds to the differential pressure at maximum flow (see also the Deltatop/Deltaset design sheet).

#	VH	Entry	Significance
1	V0H9	e.g. mbar	Select pressure unit
2	V0H1	e.g. 0	Set pressure value for lower range-value
3	V0H2	e.g. 100	Set pressure value for upper range-value

Calibration with reference pressure

A reference pressure is available corresponding exactly to the required lower and upper range-values. A reference pressure is available corresponding exactly to the required lower or upper range-values. The lower range-value corresponds to a flow of zero (differential pressure = 0 mbar). The upper range-value corresponds to the differential pressure at maximum flow (see also the Deltatop/Deltaset design sheet).

#	VH	Entry	Significance
1	V0H9	e.g. mbar	Select pressure unit
2	Exact pressure for lower range-value is acting.		
3	V0H3	Confirm with "Enter"	Acting pressure is taken for lower range-value
4	Exact pressure for upper range-value is acting.		
5	V0H4	Confirm with "Enter"	Acting pressure is taken for upper range-value

Position calibration – display (bias pressure)

If the display does not show zero flow after zero point adjustment (due to position), then you can correct the display value to zero by entering a bias pressure or by adopting the bias pressure acting (depending on position). The position calibration over a bias pressure has no influence on the digital output value (OUT Value), which is transferred over the bus.

Entry of a bias pressure

#	VH	Entry	Significance
1	V0H5	e.g. 0.1	Enter bias pressure

Registration of an acting bias pressure

#	VH	Entry	Significance
1	V0H6	Confirm with "Enter"	Adopt applied pressure as bias pressure

Note!

In liquids and steams a bias pressure (position-dependent pressure) can only be adopted if:

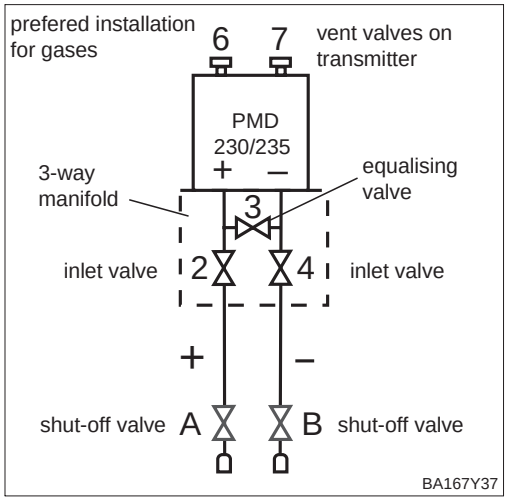
- the flow is shut off or
- the tapping points are at the same height.
- The pressure piping must always be filled.

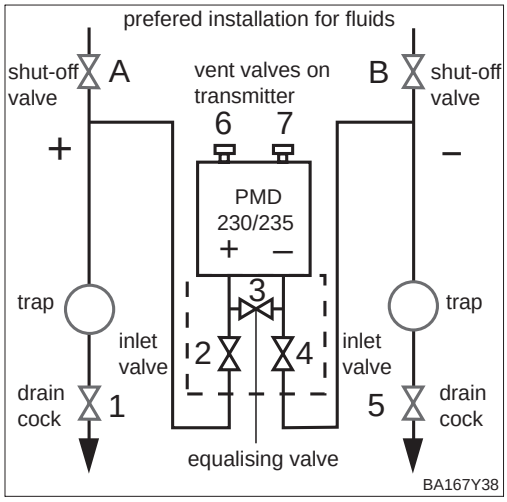
Note!

Commissioning the measuring point

Before using the Deltabar S for measuring differential pressure, clean the pressure piping and fill the device with medium. The measuring span (upper range-value – lower range-value) is either preset (see pages 62 and 63), or only the lower range-value is set during commissioning, as described below.

#	Valves	Significance
1	Close 3	
2	Fill measuring system with medium	
	Open A, B, 2, 4	
3	If appropriate clean pressure piping* – for gases with compressed air – for liquids by washing out	
	Close 2 and 4	Shut off transmitter
	Open 1 and 5*	Blow out/wash out pressure piping
	Close 1 and 5*	Close valves after cleaning
4	Let air out of transmitter	
	Open 2 and 4	Let in medium
	Close 4	Close negative side
	Open 3	Connect positive and negative side
	Briefly open 6 and 7 then close again	Fill transmitter with medium and let out air
5	Set upper range-value and display to zero **Note:** The following entries are only appropriate here if: – the process cannot be shut off **and** – the tapping points (A and B) are at the same height. If the flow can be shut off then this calibration of zero and display is to be carried out **after** Step 6.	
	Parameter V0H3 Set lower value	Acting pressure is taken as lower range-value
	Parameter V0H6 Bias pres. autom.	Set display to "0" (position calibration)
6	Make measuring point ready for operation	
	Close 3	Shut off positive from negative side
	Open 4	Close negative side
	Now: 1*, 3, 5*, 6 and 7 are closed 2 and 4 are open A and B are open (if present)	
7	Set lower range-value and display to zero If the flow can be shut off then this calibration of lower range-value and display is to be carried out here. Step 5 is therefore ignored.	
	Shut off flow	
	Parameter V0H3 Set lower value	Acting pressure is taken as lower range-value
	Parameter V0H5 Bias pres. autom.	Set display to "0" (position calibration)
	Open flow	
8	Select "Square root" (flow) operating mode. Set lower and upper range-values for "min. flow" and "max. flow", select unit, see page 62	
9	Measuring point is ready for operation	





* For arrangements with five valves only

Caution!

Caution!!

When opening and closing values to the process, care must be taken to avoid overheating or one-sided overloading (beyond specifications) of the measuring cell. If the measuring range is adjusted, the output signal may not lead to impermissible jumps in the control loop.

Characteristic curve
Flow display
Flow rate units

After starting up the measuring point in accordance with Chapter 5.4 or pages 62 and 63, select the operating mode and the values for "Min." flow rate and "Max." flow rate.

#	VH	Entry	Significance
1	Measuring point ready for operation? See Steps 1-7, page 62 or Chapter 5.4, page 42.		
2	V3H0	Square root	Select "Flow" operating mode
3	V3H1	0	Set value for minimum flow
4	V3H2	e.g. 100	Set value for maximum flow
5	V3H3	e.g. l/s	Select unit for flow rate

Result:
- The measured value is displayed in the matrix field V0H0 as a flow rate unit, here, for example, in litres per second.

Remote calibration for flow measurement

If configuration is carried out via communication or if only part of the measuring range is used, enter the pressure and the associated flow values for the lower and upper range-values.

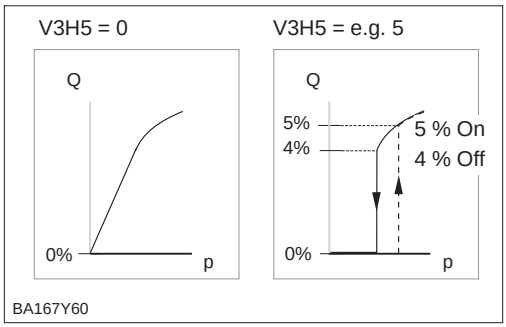
#	VH	Entry	Significance
1	Measuring point ready for operation? See Steps 1-6, page 61.		
2	If necessary, set display to "0" by entering a known bias pressure (position-dependent pressure)		
	V0H5	e.g. 0.1	Enter bias pressure
3	V0H1	e.g. 0	Set pressure value for flow "min."
4	V0H2	e.g. 100	Set pressure value for flow "max"
5	V3H0	Square root	Select "Flow" operating mode
6	V3H1	0	Set value for minimum flow
7	V3H2	e.g. 500	Set value for maximum flow
8	V3H3	e.g. l/s	Select unit for flow rate (see table page 62)

Result:
- The measured value is displayed in the matrix field V0H0 as a flow rate unit, here, for example, in litres per second.

Creep flow suppression

In the lower flow range small flows – creep leads to large flow variations. By entering a value for creep suppression, these flows will no longer be registered. Entries are always in % of flow. It is practical to suppress 3…6% of the measuring range.

#	VH	Entry	Significance
1	V3H5	e.g. 5 %	Creep flow suppression

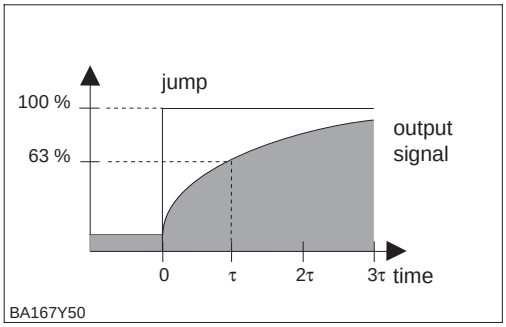


8.2 Damping

Damping τ (Integration time)

The damping influences the time with which the display in V0H0 and the output signal react to a change in pressure.

#	VH	Entry	Significance
1	V0H7	e.g. 30	Damping (0...40 s)



8.3 Locking/Unlocking the operation

After calibrating or entering all parameters, the operation can be locked:

- via the keys +Z and –S or
- via the matrix by entering a code. Enter a number between 1 and 9998 as the code. Do not use the numbers 130 and 2457.

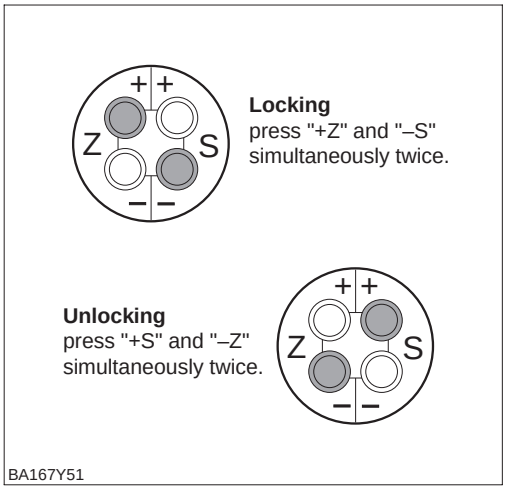
This protects the measuring point from accidental and unauthorised entries.

Matrix

#	Key	Entry
1		**Lock operation**: Press +Z and –S simultaneously twice.
2		**Unlock operation**: Press +S and –Z simultaneously twice.

Keys

#	VH	Entry	Significance
1	V9H9	e.g. 131	Operation locked
2	V9H9	130 or 2457	Operation unlocked



Locking with keys has priority.

The table below summarises the locking function:

Locking via	Display/reading of parameters	Changing/writing of parameters		Unlocking via	
		Keys	Communication	Keys	Communication
Keys	yes	no	no	yes	no
Matrix	yes	no	no	yes	yes

8.4 Totalizer

Function

The "Totalizer" function is included as standard in software version 2.1. These function enables the flow rate to be determined and totalled in units of volume or mass by entering a conversion factor as flow quantity.

Before selecting the function "Totalizer", the Deltabar S must be mounted and calibrated according to chapter 2.2 "Measuring system for flow measurement".
Note the following instructions:
- The flow rate entered for "Start point" (V3H1) should always be 0.
- The function "Totalizer" can only be selected in the mode "Square root (flow)" (V3H0).

Display selector

The display can be selected for current flow rate or total flow rate.

- **Flow:** Display showing current flow rate.
  The bar graph shows the current flow rate.
- **Totalizer:** Display showing total flow rate.
  The bar graph shows the current flow rate.

#	VH	Entry	Significance
1	V5H1	e.g. Totalizer	Select operating mode display

The "Counter" (V5H0) parameter always outputs the total flow rate irrespective of the choice of operating mode display.

Note!
The totalizer can count with up to 7 digits before the decimal point. The display module of the Deltabar S can show only 4 digits. Thus, for values with more than four digits the digits 1…4 and 5…7 are shown alternately every 4 seconds.

Note!

When incrementing, the counter jumps from 9 999 999 to 0 and when decrementing from 0 to 9 999 999.

Example: Counter value 7654321

Display of the first 4 digits approx. 4 s

Changing to the remaining digits Display approx. 4 s

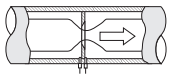
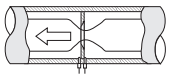
Display again showing the first 4 digits approx. 4 s

Figure 8.1
Display
- The digits show alternately the total flow rate.
- The bar graph always shows the current flow rate.

Totalizer operation mode (Counter mode)

The Totalizer Operation Mode field is used to activate the totalizer and determine how negative flow values are totalled.

#	VH	Entry	Significance
1	V5H2	e.g. neg. Flow Decr.	Select counter mode

	Case 1: positive flow	Case 2: negative flow
		
Totalizer: Off	Totalizer does not count	Totalizer does not count
neg. flow: Stop	Total increases	Total remains constant
neg. flow: Decr.	Total increases	Total decreases
neg. flow: Incr.	Total increases	Total increases

Counter unit

Selecting a volume or mass unit only helps to improve the display. This has no influence on the digital output value (OUT Value) and the display in V5H0. By default, the flow rate is indicated in "%".

#	VH	Entry	Significance
1	e.g. Counter (V5H0) = 649 %		
2	V5H4	e.g. l	Select counter unit
3	Counter (V5H0) = 649 l		

%	l	hl	cm^3
dm^3	m^3	10 x m^3	100 x m^3
ft^3	10 x ft^3	100 x ft^3	US gal
l Gal	ton	kg	t
lb	special		

Conversion factor

Entry of the conversion factor allows internal conversion of the measured flow rate into a total flow rate.

#	VH	Entry	Significance
1	V5H3	e.g. 13.62605	Enter conversion factor

The conversion factor is derived from the "Units of flow" (V3H3) and the "Counter units" (V5H4) selected. The conversion factors for most units are shown in the tables on the following pages. The conversion factors are calculated as shown in the following example:

Example:
Flow rate from 0…100% should be shown as a measured value (V0H0) in 0…50 m^3/h. The "Counter" (V5H0) should be counting in US Gal.

- Converting the flow rate units into flow units per second
  50 m^3/h = 50 m^3 / [60 (min) x 60 (s)] = 0.013888 m^3/s
- Converting the flow rate units per second into counter units per second
  0.013888 m^3/s x 264.2 US Gal/m^3 = 3.6694 US Gal/s
  (1 m^3 corresponds to 254.2 US Gal)
- Calculating the conversion factor by dividing the flow rate by the previously calculated counter value
  50 / 3.6694 = 13.62604

Conversion factor for volumetric flow units

	Counter units											
	l	**hl**	**cm^3**	**dm^3**	**m^3**	**m^3 x 10**	**m^3 x 100**	**ft^3**	**ft^3 x 10**	**ft^3 x 100**	**US Gal**	**Imp. Gal**
ft^3/min	2.1186	211.86	0.002118	2.1186	2118.6	21186	211860	60	600	6000	8.018925	9.63
m^3/h	3.6	360	0.0036	3.6	3600	36000	360000	101.954	1019.54	10195.41	13.62604	16.3636
l/s	1	100	0.001	1	1000	10000	100000	25.3206	283.206	2832.058	3.785011	4.54545
ft^3/s	0.03531	3.531	0.000035	0.03531	35.31	353.1	3531	1	10	100	0.133649	0.1605
m^3/s	0.001	0.1	0.000001	0.001	1	10	100	0.02832	0.238321	2.832058	0.003785	0.00455
m^3/min	0.06	6	0.00006	0.06	60	600	6000	1.69924	16.9924	169.9235	0.227101	0.27273
Gal/h	951.12	95112	0.95112	951.12	951120	9511200	—	26936.3	269363	2693627	3600	4323.27
Gal/day	22826.88	2282688	22.82688	22826.9	—	—	—	646471	6464707	—	86400	103759
Mgal/day	0.022826	2.28269	0.000023	0.02283	22.82688	228.2688	2282.688	0.64647	6.46471	64.64706	0.0864	0.10376

Example: conversion factor for flow rate units in m^3/h in counter units US gal = 13.62604

Conversion factor for mass flow units

	Counter units				
	ton (UK) (long ton)	**ton (US) (short ton)**	**kg**	**t**	**lb**
g/min	—	—	60000	—	27210.88
kg/s	1016.053	907.4410	1	1000	0.453514
kg/min	60963.21	54446.46	60	60000	27.21088
kg/h	3657793	3266787	3600	3600000	1632.653
metric t/min	60.96321	54.44646	0.06	60	0.027210
metric t/h	3657.793	3266.787	3.6	3600	1.632653
metric t/day	87787.03	78402.90	86.4	86400	39.18367
lb/s	2240.398	2000.907	2.205	2205	1
lb/min	134423.8	120054.4	132.3	132300	60
lb/h	8065433	7203266	7938	7938000	3600

Calculating volumetric units

	l	hl	cm^3	dm^3	m^3	m^3 x 10	m^3 x 100	ft^3	ft^3 x 10	ft^3 x 100	US Gal	Imp.Gal
1 l	1	0.01	1000	1	0.001	0.0001	0.00001	0.03531	0.003531	0.000353	0.2642	0.22
1 hl	100	1	100000	100	0.1	0.01	0.001	3.531	0.3531	0.03531	26.42	22
1 cm^3	0.001	0.00001	1	0.001	—	—	—	—	—	—	0.000264	0.00022
1 dm^3	1	0.01	1000	1	0.001	0.01	0.1	0.03531	0.003531	0.000353	0.2642	0.22
1 m^3	1000	10	—	1000	1	0.1	0.01	35.31	3.531	0.3531	264.2	220
1 m^3 x 10	10000	100	—	10000	10	1	0.1	353.1	35.31	3.531	2642	2200
1 m^3 x 100	100000	1000	—	100000	100	10	1	3531	353.1	35.31	26420	22000
1 ft^3	28.32	0.2832	28320	28.32	0.02832	0.002832	0.000283	1	0.1	0.01	7.492	6.23
1 ft^3 x 10	283.2	2.832	283200	283.2	0.2832	0.02832	0.002832	10	1	0.1	74.92	62.3
1 ft^3 x 100	2832.05	28.32	2832000	2832	2.832	0.2832	0.02832	100	10	1	749.2	623
1 US Gal	3.785	0.03785	3785	3.785	0.003785	0.000378	0.000037	0.1336	0.01336	0.001336	1	0.8326
1 Imp. Gal	3 4.545	0.04545	4545	4.545	0.004545	0.000454	0.000045	0.1605	0.01605	0.001605	1.201	1

Example: 1m = 264.2 US Gal

Calculating mass units

	ton (UK) (long ton)	ton (US) (short ton)	kg	t	lb
1 ton (UK) (long ton)	1	1.12	1016.05	1.0165	2240
1 ton (US) (short ton)	0.8928	1	907.2	0.9072	2000
1 kg	0.000993	0.001102	1	0.001	2.205
1 t	0.9934	1.102	1000	1	2205
1 lb	0.000446	0.0005	0.4535	0.000453	1

8.5 Measuring point information

The following information about the measuring point can be read via the matrix in Commuwin II:

Matrix field	Significance
Measured values	
V0H0	Main measured value: flow rate
V2H6	Current sensor temperature (units selectable in V7H9)
V6H2/V6H3	OUT Value, OUT Status (Analog Input Block)
V7H8	Current sensor pressure (units selectable in V0H9)
Sensor data	
V0H1	Lower range-value (pressure value for flow "zero")
V0H2	Upper range-value (pressure value for flow "max")
V2H5	Overload counter pressure (0…255)
V3H1	Lower range-value for flow "min." (enter "0")
V3H2	Upper range-value for flow "max."
V7H6	Lower range-limit of sensor (units selectable in V0H9)
V7H7	Upper range-limit of sensor (units selectable in V0H9)
V9H7	Pressure before bias correction (units selectable in V0H9)
V9H8	Pressure after bias correction (units selectable in V0H9)
Measuring point information	
V2H2	Device and software number
Error response	
V2H0	Current diagnostic code
V2H1	Last diagnostic code

Display messages for diagnosis

The level indicator enables the smallest and largest measured values for pressure and temperature to be called up. The value is not lost on switching off the device.

Matrix field	Significance
V2H3	Minimum pressure (maximum pointer function)
V2H4	Maximum pressure (maximum pointer function)
V2H7	Minimum temperature (maximum pointer function)
V2H8	Maximum temperature (maximum pointer function)
V2H5	Overload counter pressure (0…255)
V2H6	Current sensor temperature (units selectable in V7H9)

User informationen

The matrix field VAH2 indicates the device serial number. The matrix field VAH3 indicates the sensor serial number. Fields VAH0, VAH1 and VAH4 - VAH8 offer the possibility of saving further information on the measuring point and the device.

Matrix field	Significance
VAH0 *	Measuring point tag (Physical Block)
VAH1 *	User text (Physical Block)
VAH2	Display serial number (transmitter)
VAH3	Serial number sensor
VAH4 – VAH8	Information about the device (selection)

* Entry up to 32 characters (ASCII)

9 Diagnosis and Warnings

9.1 Diagnosis of errors and warnings

Errors

When the Deltabar S detects an error:

- an error code is transmitted along with the measured value
- with a plugged in display, the bar graph assumes the value selected on error and flashes.
- The actual error code can be read in V2H0, the last error code in V2H1.

Warnings

When the Deltabar S detects a warning:

- An error code is transmitted along with the measured value: the Deltabar S continues measuring.
- The actual error code can be read in V2H0, the last error code in V2H1.

Error codes in V2H0 und V2H1

If several errors occur simultaneously, then they are displayed in sequence corresponding to the priority of the error.

Code	Type	Cause and Remedy	Priority
E 101	Error	Sensor Checksum Error Error reading checksums from the EEPROM of the sensor. – Checksum incorrect, transmission errror during read process due to effects of EMC (larger than specified in Chapter 11, Technical Data). *Block EMC effects.* – EEPROM of the sensor defective. *Replace sensor.*	3
E 102	Warning	Electronic fault in maximum counter function – *Reset system (Code 5140), recalibrate sensor.* – Main electronics defective. *Replace electronics.*	19
E 103	Error	Initialisation active – The electronics are initialised after the device is connected. *Wait for end of initialisation process.*	17
E 104	Warning	Sensor calibration – Values in V7H4 and V7H5 (Low Sensor Cal and High Sensor Cal) are too close together, e.g. after sensor recalibration. *Reset system (Code 2509), recalibrate sensor.*	18
E 106	Error	Download active (Commuwin II) – *Wait for end of download.*	10
E 110	Error	Checksum error – During the write process to processor, the power supply is interrupted. *Restore the power supply. Reset system (Code 5140) if necessary. If necessary, recalibrate sensor.* – EMC effects (larger than specified in Chapter 11, Technical Data). *Block EMC effects.* – Main electronics defective. *Replace electronics.*	12
E 111	Error	No connection to EEPROM of the sensor – Cable connections from sensor electronics via main electronics to display (internal bus) interrupted or sensor electronics defective. *Check plug to sensor. Check cable connection. Replace sensor.*	2
E 112 PMD 230, FMD 230	Error	No connection to sensor analogue/digital converter – Cable connection from sensor to main electronics interrupted. *Check cable connection.* – Main electronics defective. *Replace electronics.* – Sensor electronics defective. *Replace sensor.*	4

Error codes in V2H0 and V2H1 (continuation)

Code	Type	Cause and Remedy	Priority
E 113 PMD 230, FMD 230	Error	Measuring error during pressure and temperature measurement The sensor electronics are no longer correctly converting the measured pressure and temperature values. – "Pressure signal" (PIN 6) connection disconnected at the plug. *Reconnect.* Sensor or sensor electronics defetive. *Replace sensor.*	5
E 113 PMD 235, FMD 630, FMD 633	Error	Measuring errors during pressure and temperature measurement Incorrect transfer of analogue signals from sensor to main electronics. – Cable connection between sensor and main electronics interrupted. *Check cable connection.* – Main electronics defective. *Replace electronics.* – Sensor electronics defective. *Replace sensor.*	5
E 114	Error	Measuring error during temperature measurement. Difference between temperature calculated in sensor and measured temperature is greater than 50 K. – Cable connection between sensor and main electronics interrupted. *Check cable connection.* – Sensor electronics defective. *Replace sensor.*	6
E 115	Error	Sensor overpressure plus side – Overpressure present. *Reduce pressure until message disappears.* – Cable conntection between sensor and main electronics interrupted. *Check cable connection.* – Sensor defective. *Replace sensor.*	7
E 116	Error	Download error (PC → Transmitter) – During the download, the data is not being correctly transferred to the processor, e.g. due to an open cable connection, voltage peaks (ripple) on supply voltage, EMC effects. *Check the cable connection between PC and transmitter.* *Reset system (Code 5140), restart download.*	11
E 118	Error	Calibration error Editing limits[1)] or maximum turn down exceeded, e.g. due to inappropriate download. *– Reset system (Code 5140). Repeat download.*	13
E 120	Error	Sensor underpressure minus side – Pressure too low. *Increase pressure until message disappears.* – Cable connection between sensor and main electronics interrupted. *Check cable connection.* – Sensor defective. *Replace sensor.*	8
E 121	Error	Checksummenfehler – Main electronics defective. *Replace electronics.*	1
E 602	Warning	Linearisation curve does not increase or decrease monotonically. – Value pairs for the linearisation curve entered incorrectly. *Check Level Manual for plausibility. (E.g. does the volume increase with the level?) If necessary, carry out linearisation again or re-enter the value pairs, see chapter 7.4 Linearisation.*	16
E 604	Warning	Linearisation curve contains less than 2 value pairs. – *Check manual level. If necessary, carry out linearisation again or add more value pairs, see chapter 7.4 Linearisation.*	15
E 605	Error	No linearisation curve saved – Linearisation curve not activated, although the "Level manual" operating mode was selected. *After entering the value pairs for the linearisation curve, activate the Level Manual using the V3H6 (manual level) matrix field.* Note: The message also appears, if, during entry, the value pairs of the "Level manual" are selected.	14

1) The editing limits are described in Chapter 9.4.

Error codes on-site display

Code	Type	Cause and Remedy
E 670 2)	Warning	Lower range-valuee was not transferred – The upper range-value is outside the editing limits1). As the span remains constant during a change to the lower range-value, the upper range-value shifts with the lower range-valuee. This warning only appears when calibrating with reference pressure using the Z– and Z+ keys. *Carry out the calibration again. The upper range-value must be within these editing limits. If necessary, set the upper range-value to a smaller value. After this, first calibrate the lower range-value and then the upper range-value.*
E 672 2)	Warning	Editing limit1) for lower range-value reached. – Lower or upper editing level reached for lower range-value. This warning appears when calibrating the lower range-value without a reference pressure using the Z+ or Z– keys. The value is not accepted. *Carry out the calibration again and make sure that the lower/upper editing limits for the lower range-value are not undershot or exceeded.*
E 673 2)	Warning	Editing limit1) for upper range-value reached. – Lower or upper editing level reached for upper range-value. This warning appears when calibrating the upper range-value without a reference pressure using the S+ or S– keys. The value is not accepted. *Carry out the calibration again and make sure that the lower/upper editing limits for the upper range-value are not undershot or exceeded.*
E 674 2)	Warning	Calibration error: turn down too big. – The maximum possible turn down was exceeded. This warning appears during a calibration using the keys of the on-site operating terminal. The value is not accepted. *Carry out calibration again. The pressure value for the calibration of the upper range-value may not be too close to pressure value for the lower range-value.*
E 675 2)	Warning	Current pressure value outside the sensor limits. – The currently applied pressure for calibrating the lower or upper range-values is outside the editing limits1) (calibration with reference pressure and using the Z+ and Z– or S+ and S– keys). The value is not accepted. *Carry out calibration again. The currently applied pressure for calibrating the lower range-value and the upper range-value must be within the editing limits.*

1) The editing limits are described in Chapter 9.4.

2) These error codes only appear on the on-site display.

9.2 Simulation

You have the option of simulating either the output value (OUT Value) or the function of the Analog Input Block. The matrix fields in brackets give the matrix position in the Analogue Input Block diagram in Commuwin II. See also Chapter 12.2 "Matrix Analog Input Block (AI Transmitter)."

Simulation OUT Value

You can simulate the output value (OUT Value) as follows:

1. If necessary unlock the matrix using code 130 or 2457 in matrix field V9H9.
2. Using matrix field V9H9, switch from the Standard to the Analog Input Block matrix.
3. Set the "Target Mode" parameter (V8H0) to "on".
   – You can now enter the simulation value for the "OUT Value" (V0H0).
   – Afterwards, check the change to the OUT Value, e.g. at the PLC.
4. Set the "Target Mode" parameter back to "off".

Note!
Commuwin II offer the further option of entering an OUT Value using the graphical interface in the "Simulation AI-Block" menu.

Note!

Simulation Analog Input Block

You can simulate the function of the Analogue Input Block as follows:

1. If necessary, unlock the matrix using code 130 or 2457 in matrix field V9H9.
2. Using matrix field V9H9, switch from the Standard to the Analogue Input Block matrix.
3. Set the "Simulation" parameter in the Analogue Input Block (V7H2) to "on".
   – You can now enter the simulation value directly for the "Simulation value" (V7H0) which changes the values for OUT Scale Min. and OUT scale Max. (V1H3/V1H2).
   – Afterwards, check the change to the OUT Value, e.g. on the PLC.
4. Set the "Simulation" parameter back to "off".

9.3 Reset

By entering a code, the entries in the matrix are reset partially or completely to factory settings.

#	VH	Entry	Significance
1	V2H9	e.g. 5140	Reset to factory setting

The Deltabar S differentiates between different reset codes with different effects. To find out which parameters are reset with the 5140 or 1, 2380 and 731 reset codes, refer to the table on page 76.

Other reset codes have the following effects:
- 2506: Device warm start
- 2509: This reset sets the lower and upper sensor calibration limits and the zero correction value to the factory setting. I. e.:
  Low sensor cal = Lower sensor limit (V7H4 = V7H6),
  High sensor cal = Upper sensor limit (V7H5 = V7H7).
  Zero correction value (V9H6) = 0.0
- 2712: The device adress set over the bus reset to the default value 126.

Reset Codes		H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
1 / 5140 2380 731	**V0**	**Measured Value**	**Lower range value** 0.0 0.0 0.0	**Upper range value** = V7H7 = V7H7 = V7H7	**Set lower value**	**Set upper value**	**Set bias pressure** 0.0 0.0 0.0	**Bias pressure autom.**	**Set output damping [s]** 0.0 0.0 0.0		**Select pressure unit** bar
	V1										
1 / 5140 2380 731	**V2**	**Diagnostic code**	**Last diagnostic code** 0 0 0	**Software no.**	**Min. pressure** =V7H8[1)] =V7H8[1)]	**Max. pressure** =V7H8[1)] =V7H8[1)]	**Internal counter high** 0 0	**Sensor temp.**	**Min. temp.** =V2H6[2)] =V2H6[2)]	**Max. temp.** =V2H6[2)] =V2H6[2)]	**Default value**
1 / 5140 2380 731	**V3**	**Operation mode** Pressure	**Start point[3)]** 0.0 % 0.0 % 0.0 %	**Full scale [3)]** 100.0 % 100.0 % 100.0 %	**Unit after lin.[3)]** %	**Density factor[4)]** 1.0 1.0 1.0	**Creep flow suppr. %[5)]** 0.0 % 0.0 %	**Manual level** delete	**Line no.** 1	**Input level** 9999.0%	**Set volume** 9999.0%
	V4										
1 / 5140 2380 731	**V5**	**Counter** 0 %	**Display selector** Flow	**Totalizer operation mode** Off	**Conver. factor** 1.0	**Counter unit** %					
1 / 5140 2380 731	**V6**	**Identity Number**	**Set unit to bus**	**AI Out Value** [6)] [6)]	**AI Out Status**	**2nd cyclic value**	**Select V0H0** Meas. Val. Meas. Val.	**OUT Value SPS**	**Profile version**		
1 / 5140 2380 731	**V7**					**Low sensor cal** = V7H6 = V7H6	**High sensor cal** = V7H7 = V7H7	**Low sensor limit**	**High sensor limit**	**Sensor pressure**	**Temp. unit** °C
	V8										
1 / 5140 2380 731	**V9**					**Instrument address**	**Zero correction** 0.0	**Zero correction value** 0.0	**Unbiased pressure** = V7H8[1)] = V7H8[1)]	**Biased pressure** = V7H8[1)] = V7H8[1)]	**Security locking** 2457
1 / 5140 2380 731	**VA**	**Set Tag Number** delete delete	**Set User Text** delete delete	**Serial Number**	**Serial No. Sensor**	**Process conn. P+** special	**Process conn. P–** special	**Gasket** special	**Process diaphragm** special	**Fill liquid** special	**Device Profile**

1) After a reset, fields V2H3, V2H4, V9H7 and V9H8 show the currently applied pressure.
2) After a reset, fields V2H7 and V2H8 show the currently measured temperature.
3) Fields V3H1, V3H2 and V3H3 are not displayed in "Pressure" operating mode.
4) Field V3H4 (Density Factor) is displayed in the "Level lin", "Level cyl. linear" and "Level Manual" operating modes.
5) Field V3H5 (Creep flow suppression %) is only shown in the "Square root" (flow) operating mode.
6) After a "5140" or "2380" reset, field V6H2 displays the current digital output value: As the unit is unknown, UNKNOWN is displayed.

9.4 Editing limits

To avoid incorrect device functioning because of excessively large or excessively small values, for some parameters there is a minimum and maximum permissible input value (editing limits). The set measuring range must be within these editing limits. An attempt to exceed or undershoot these editing limits generates an error message (refer to Chapter 9.1 Diagnosis of errors and warnings).

The following parameters are checked to make sure they are within the editing limits:

- Lower range value (V0H1)
- Upper range value (V0H2)
- Set lower value (V0H3)
- Set upper value (V0H4)
- Set bias pressure (V0H5)
- Bias pressure automatically (V0H6)

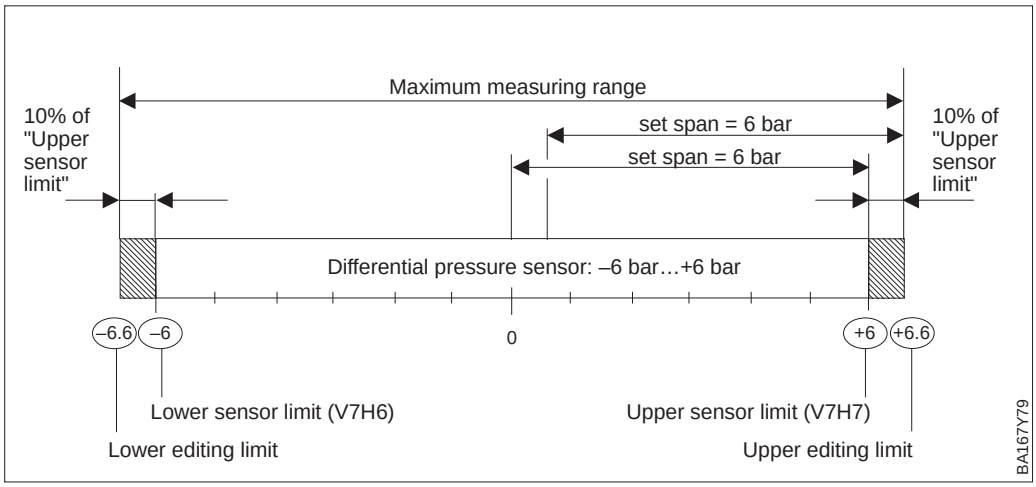
The table below lists the editing limits and the smallest span which you can set:

Sensor range	Low sensor limit (V7H6)	High sensor limit (V7H7)	Lower editing limit	Upper editing limit	Smallest span
Ceramic sensor PMD 230/FMD 230					
–25…25 mbar	–25 mbar	25 mbar	–27.5 mbar	27.5 mbar	0.5 mbar
–100…100 mbar	–100 mbar	100 mbar	–110 mbar	110 mbar	2 mbar
–500…500 mbar	–500 mbar	500 mbar	–550 mbar	550 mbar	10 mbar
–3…3 bar	–3 bar	3 bar	–3.3 bar	3.3 bar	0.06 bar
Silicon sensor PMD 235/FMD 630/FMD 633					
–10…10 mbar	–10 mbar	10 mbar	–11 mbar	11 mbar	0.2 mbar
–40…40 mbar	–40 mbar	40 mbar	–44 mbar	44 mbar	0.8 mbar
–100…100 mbar	–100 mbar	100 mbar	–110 mbar	110 mbar	2 mbar
–160…160 mbar	–160 mbar	160 mbar	–176 mbar	176 mbar	3.2 mbar
–500…500 mbar	–500 mbar	500 mbar	–550 mbar	550 mbar	10 mbar
–1…1 bar	–1 bar	1 bar	–1.1 bar	1.1 bar	0.02 bar
–3…3 bar	–3 bar	3 bar	–3.3 bar	3.3 bar	0.06 bar
–6…6 bar	–6 bar	6 bar	–6.6 bar	6.6 bar	0.12 bar
–16…16 bar	–16 bar	16 bar	–17.6 bar	17.6 bar	0.32 bar
–40…40 bar	–40 bar	40 bar	–44 bar	44 bar	0.8 bar

Editing limits are calculated as follows:

- Lower editing limit =
  "Low sensor limit" (V7H6) – 10% of "High sensor limit" (V7H7)
- Upper editing limit =
  "High sensor limit" (V7H6) + 10% of "High sensor limit" (V7H7)

Example of editing limits for a differential pressure sensor –6…+6 bar



Note!

Note!

To reverse the impact of the digital output value, assign the smaller pressure value to the upper range-value and the larger value to the lower range-value. To keep within the editing limits, carry out the calibration according to the table below. In the first step, enter the lower editing limit value for the lower range-value (V0H2) (see also table on page 77).

#	VH	Entry	Significance
1	V0H2	e.g. – 1 (bar)	Enter pressure value for upper range-value
2	V0H1	e.g. 1 (bar)	Enter pressure value for lower range-value
3	V0H2	e.g. 0 (bar)	Enter pressure value for upper range-value

There are also editing limits for the "Low sensor cal" (V7H4), "High sensor cal" (V7H5) and "Zero correction" (V9H5) parameters. For the parameters, the editing limits are defined by the sensor limits and the applied pressure.

To carry out a sensor calibration or a zero correction, the device must have a reference pressure (Refer to Chapter 6.1, Section on "Zero correction" and Chapter 10.5 "Sensor Calibration"). Enter a value assigned to the applied pressure using the relevant "Low sensor cal" (V7H4), "High sensor cal" (V7H5) or "Zero correction value" (V9H5) parameters.

- Calculation of the value for the lower editing limit of V7H4, V7H5 und V9H5: "Sensor pressure" (V7H8) – 10% of the sensor end value
- Calculation of the value for the upper editing limit of V7H4, V7H5 und V9H5: "Sensor pressure" (V7H8) + 10% of the sensor end value

The "Sensor pressure" parameter (V7H8) shows the applied pressure on the device.

#	**Example:**
1	Sensor: –3...3 bar (Sensor end value = 3 bar) applied pressure = "Sensor pressure" (V7H8) = 0.1 bar (e.g. depending on position)
2	The applied pressure (V7H8) can be assigned to a value between the upper and lower editing limits using the "Zero Correction" (V9H5) parameter. I.e., for the sensors listed above, values of 0.2 to 0.4 bar are calculated (see calculations below). Value for lower editing limit, V9H5 = "Sensor pressure" – 10% of sensor end value 0.1 bar – 0.1 • 3 bar = 0.1 bar – 0.3 bar = –0.2 bar Value for upper editing limit, V9H5 = "Sensor pressure" + 10% of sensor end value 0.1 bar + 0.1 • 3 bar = 0.1 bar + 0.3 bar = 0.4 bar

10 Maintenance and Repair

10.1 Repair

If the Deltabar S must be sent to Endress+Hauser for repair, then a note should be enclosed containing the following information:

- An exact description of the application.
- The chemical and physical characteristics of the product.
- A brief description of the error.

Before sending in the Deltabar S to Endress+Hauser for repair, please take the following protective measures:

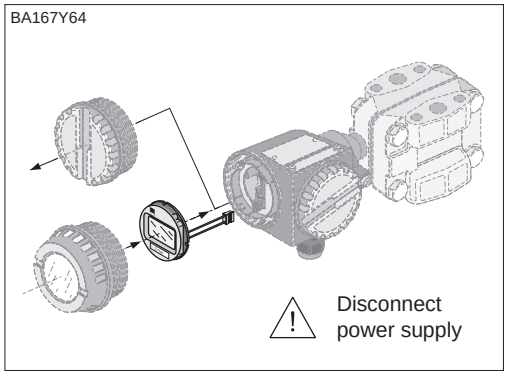
- Remove all traces of product.
  This is particularly important if the product is dangerous to health, i.e. corrosive, poisonous, carcinogenic, radioactive, etc.
- We do request that no device should be returned to us without all dangerous material being completely removed first as it can, e.g. penetrate into fissures or diffuse through plastic.


Caution!

Caution!
Devices with certificates of conformity or design approval must be sent in for repair as complete units only.

10.2 Mounting the display

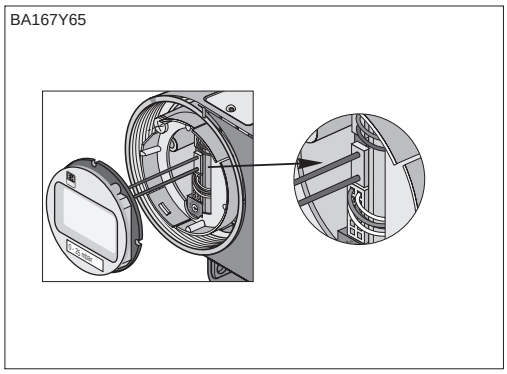
BA167Y64



Mounting the display

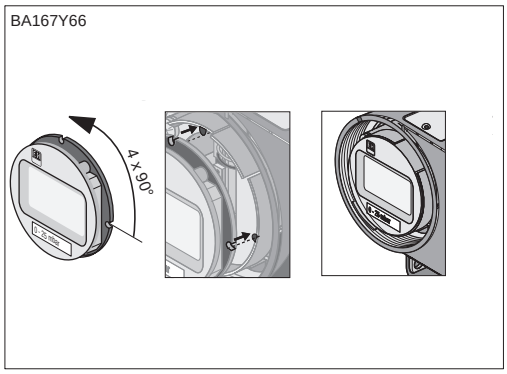
- Switch off power supply.
- Open the cover to the display compartment (use a cover with sight glass after mounting the display).

BA167Y65



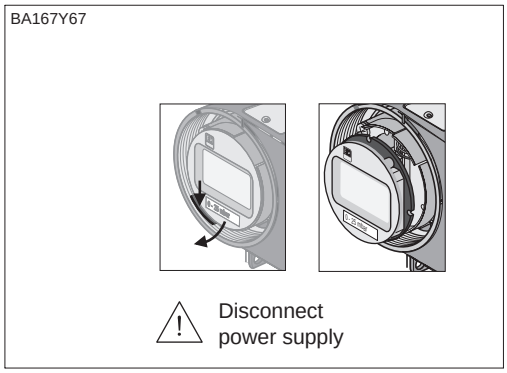
- Insert the plug of the display in the centre jack. Note the coding of the plug and jack.

BA167Y66



- Attach display.
  The display can be rotated through 90°.
- Screw down the cover.
  (Use a cover with sight glass).

BA167Y67



Removing the display

- Switch off power supply.
- Open the cover to the display compartment.
- Press down the latch at the front.
- Tilt the display forward and remove.
- Remove plug.
- Screw down the cover.

10.3 Exchanging the sensor module and electronics

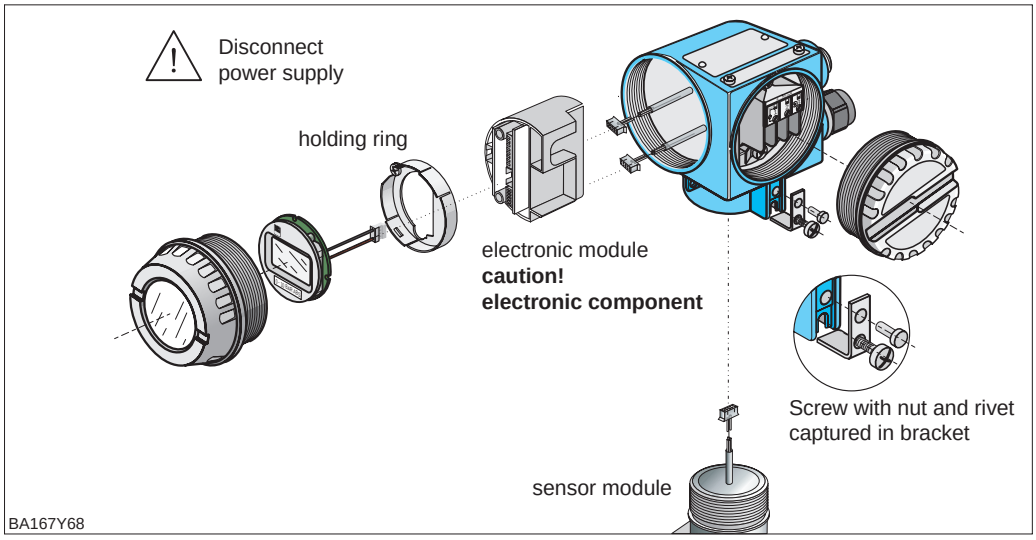
Warning!
If the device is operated in an explosion hazardous zone of type EEx ia, please note the following:
- Only specially trained personnel or E+H Service is allowed to replace the sensor module and electronics.
- Comply with prevailing standards, national explosion protection regulations and safety instructions (XA…).
- After replacing the sensor module and electronics, make sure that the electrical strength between the intrinsically safe circuit and the housing is 500 V AC.

Caution!
The electronic module is an electronic component. Electrostatic discharge can affect the operation of the device or cause damage to its electronic components. Contact should be made with a grounded object before handling the electronic module. Switch off power supply.

Changing the electronics

Removal
- Open the cover to the display compartment.
- Remove the display.
- Remove the plug from the electronic module.
- Undo the two screws on the holding ring and remove.
- Remove the electronics module.

Mounting
- Insert the electronic module.
- Mount the holding ring.
- Insert the plug, noting size and coding.
- Attach display of cover and screw down the cover to the display compartment.

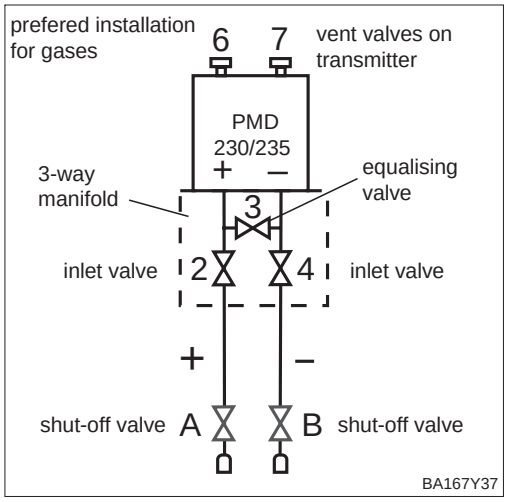


Changing the sensor module

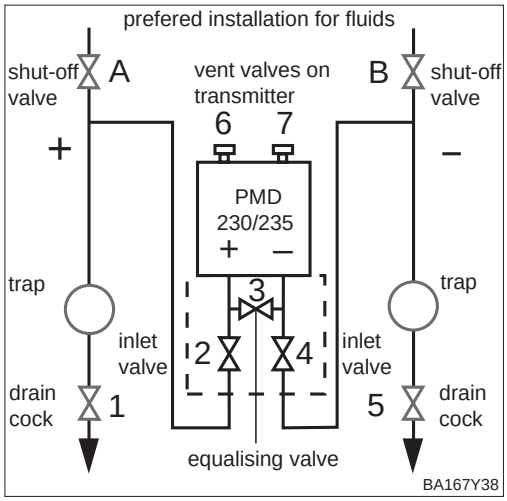
Removal
- Remove the complete electronics from the housing.
- Position the bracket and smooth face on the sensor module parallel to each other. Remove the stud and lift out the bracket. When unsrewing the sensor module, carefully rotate the cable with it.
- For version with oval flanges, unscrew retaining bolts and remove complete sensor module.

Mounting
- If appropriate, reassemble the oval flanges around the new sensor cell.
- Insert the cable with plug into the display compartment.
- Screw in the sensor module right to the stop, taking care to turn the cable with it.
- To ensure that the Deltabar S can be fully turned when mounted, turn the unit in the other direction by one complete turn.
- Position the bracket and smooth face parallel to the sensor module.
- Secure the bracket with the stud and screw.
- Mount the electronics and insert the plug, noting size and coding.

10.4 Exchanging the transmitter



#	Valve	Significance
1	Close A and B	Close shut-off valves
2	Close 4	Close negativ side
3	Open 3	Connect positive and negative side
4	Close 2	Shut-off transmitter to positive side
5	Exchange transmitter	
6	Commission new transmitter, see Chapter 5	



10.5 Sensor calibration

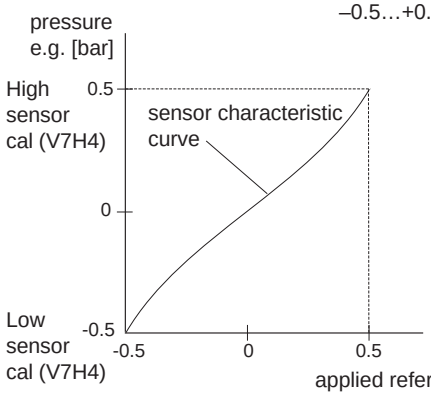
If you want to fit the pressure transmitter with a diaphragm seal you can recalibrate the sensor using the "Low sensor cal" (V7H4) and "High sensor cal" (V7H5) parameters.

The highest measurement accuracy is obtained when the value for the "Low sensor cal" (V7H4) parameter corresponds to the lower range calibration value (V0H1/V0H3) and the value for the "High sensor cal" (V7H5) parameter to the upper range calibration value (V0H2/V0H4).

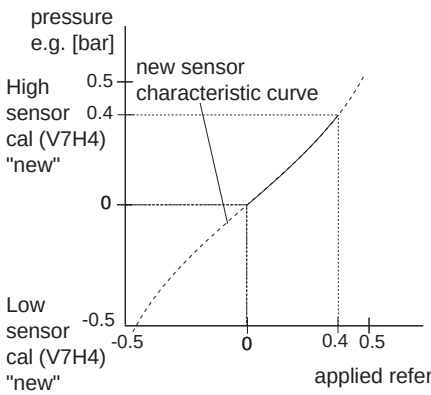
There must be a known reference pressure when setting a new lower or upper sensor characteristic curve value. The more accurate the reference pressure is during sensor calibration, the higher the accuracy of the pressure transmitter will be later. A new value is assigned to the applied pressure using the "Low sensor cal" (V7H4) and "High sensor cal" (V7H5) parameters.

#	VH	Entry	Significance
1	A device with a sensor: –0.5…0.5 bar must be recalibrated for the 0.0…4.0 bar range.		
2	Reference pressure for "Low sensor cal" (V7H4) = 0.0 bar.		
3	V7H4	0.0	The value 0.0 is assigned to the applied pressure.
4	Reference pressure for "High sensor cal" (V7H5) = 0.4 bar.		
5	V7H5	0.4	The value 0.4 is assigned to the applied pressure.
6	The sensor is now calibrated for 0.0…0.4 bar. The "Low sensor cal" and "High sensor cal" parameters indicate: Low sensor cal (V7H4) = 0.0 bar High sensor cal (V7H5) = 0.4 bar		

Sensor characteristic curve for the default factory calibration – here for a differential pressure sensor: –0.5…+0.5 bar



Sensor characteristic curve – recalibrated for the measuring range: 0.0…0.4 bar



Note!

Note!

- By entering the reset code "2509" in the V2H9 matrix field, you return the following parameters to the factory setting:
  – Low sensor cal = Lower sensor limit (V7H4 = V7H6),
  – High sensor cal = Upper sensor limit (V7H5 = V7H7),
  – Zero correction value (V9H6) = 0.0
- When the "Low sensor cal" (V7H4) and "High sensor cal" (V7H5) values are too close together, the device outputs the error message "E 104".

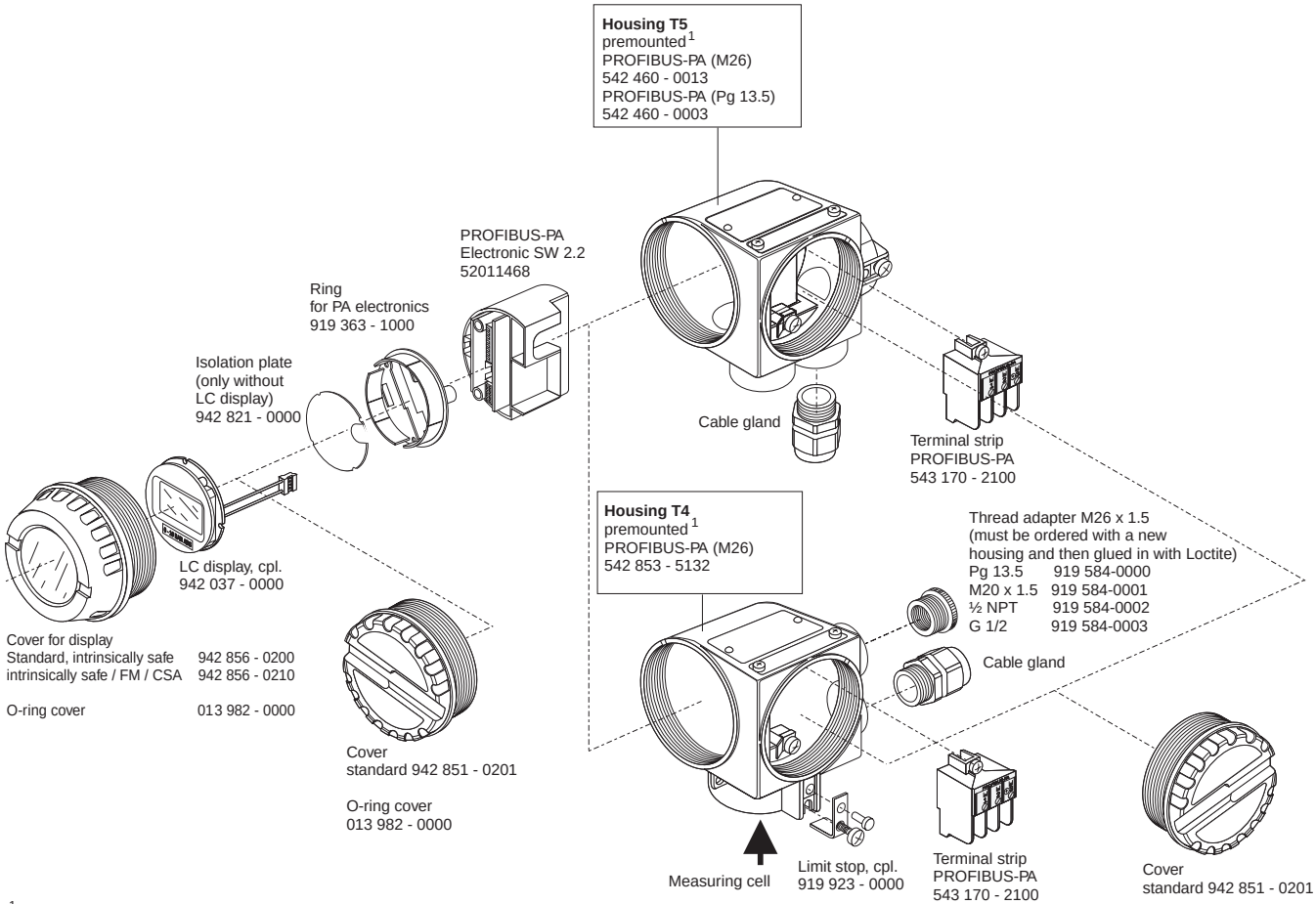
10.6 Replacement parts

The diagram below shows all replacement parts, together with their order numbers, which can be ordered from Endress+Hauser.

When ordering replacement parts, please note the following:
- If parts given in the order code are to be replaced, then it must be ensured that the order code (device designation) on the nameplate is still valid.
- If the device designation on the nameplate has changed then a modified nameplate must also be ordered. The information about the new device must then be entered on the modified nameplate. This must then be attached to the housing of the Deltabar S.
- Some spare parts are available both in the standard version and in the version for explosion-hazardous areas (e.g. cover). In this case, only hazardous area versions of the spare parts may only be used on devices for explosion-hazardous areas.
- It is not possible to convert a standard device into an Ex device by replacing its parts.

Note!
Each spare part comes with exchange instructions. For more information on service and spare parts contact the Service Department at Endress+Hauser.


Note!



[1] The premounted housing consists of preassembly:
- Key insertation
- Terminal strip
- Earth clamp

11 Technical Data

General Information

Manufacturer	Endress+Hauser
Instrument	Drucktransmitter
Designation	Deltabar S PMD 230, PMD 235, FMD 230, FMD 630, FMD 633
Technical Documentation Version Technical Data	BA 167P/00/en 08.02 DIN 19259

Input

Measured variables	Differential pressure for deriving flow rate (volumetric or mass flow), level, mass or volume

Measuring range

Nom. value ceramic sensor	Measurement limits		Recommended span		Overload		Sensor
PMD 230 FMD 230 [mbar]	Lower (LRL) [mbar]	Upper (URL) [mbar]	Minimum [mbar]	Maximum [mbar]	One sided [bar]	Two sided (System pres. PN) [bar]	Fill fluid 2)
25	–25	25	2	25	10	10	mineral oil
100	–100	100	5	100	16 1)	16 1)	mineral oil
500	–500	500	25	500	100 1)	100 1)	silicone oil
3000	–3000	3000	150	3000	100 1)	140 1)	silicone oil

1) 10 bar with PVDF process connection for PMD 230, 40 bar with process connection for FMD 230
2) Voltalef 1A for applications in very pure gases

Nom. value Silicon sensor (URL)	Measurement limits		Recommended span		System pressure 3)	Overload		Sensor
PMD 235 FMD 630 FMD 633 [mbar]	Lower (LRL) [mbar]	Upper (URL) [mbar]	Minimum [mbar]	Maximum [mbar]	PN [bar]	One sided	Two sided 4)	Fill fluid 2)
10 1)	–10	10	0.5	10	160 5)	PN	1.5 x PN	silicone oil
40 1)	–40	40	2	40	160 5)	PN	1.5 x PN	silicone oil
100	–100	100	5	100	160 5)	PN	1.5 x PN	silicone oil
500	–500	500	25	500	160 420	PN	1.5 x PN	silicone oil
3000	–3000	3000	150	3000	160 420	PN	1.5 x PN	silicone oil
16000	–16000	16000	800	16000	160 420	PN	1.5 x PN	silicone oil
160	–160	160	8	160	160 5)	PN	1.5 x PN	silicone oil
1000	–1000	1000	800	1000	160 420	PN	1.5 x PN	silicone oil
6000	–6000	6000	300	6000	160 420	PN	1.5 x PN	silicone oil
40000 1)	–40000	40000	2000	40000	160 420	100 bar	1.5 x PN	silicone oil

1) PMD 235 only
2) Voltalef 1A for applications in very pure gases, other fill fluids on request
3) 160 bar version with stainless steel bolts, 420 bar version with chromized steel bolts
4) Type tested for burst pressure (FM) up to 1120 bar on both sides with PN 420 bar version
5) High pressure 420 bar version on request

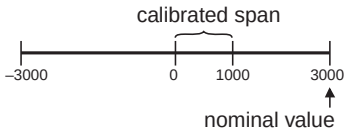
Output

Output signal	Digital communication signal PROFIBUS-PA
PA function	Slave
Transmission rate	31. 25 kBit/s
Reponse time	Slave: 200 ms PLC: 300…600 ms for appr. 30 transmitters (depending on system coupler)
Signal on alarm	Signal: Status bit set, last measured value will be held Display module: Error code
Damping (Integration time)	0…40 s adjustable via communication
Communication resistance	none, separate PROFIBUS-PA termination resistor
Physical layer	MBP (Manchester coded and Bus Powered)

Accuracy

Explanation of terms:

Turn down (TD)
= Nominal value / calibrated span



Example:
nominal value = 3000 mbar
calibrated span = 1000 mbar
turn down (TD) = 3:1

"**Platinum**"
***** Values for transmitters with improved accuracy ("Platinium")
(PMD 235 – ****A****
PMD 235 – ****B****
PMD 235 – ****C****)

Root values
For root characteristic curves: The accuracy specificationd of the Deltabar S are reduced by a factory of ½ when calculating flow rates.

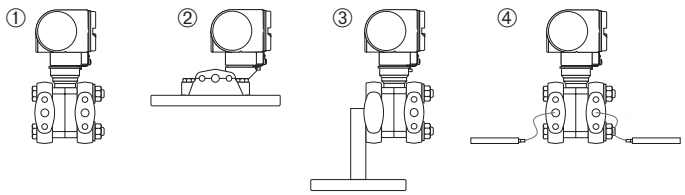
Reference conditions	According to DIN IEC 770 T_U=25°C Accuracy data apply for the case when the values for "Low sensor calibration" and "High sensor calibration" are used for the lower range-value and upper range-value respectively.
Terminal based linearity to IEC 770 including hysteresis and repeatability	to TD 10:1: ±0.1% (* ±0.05%) of the calibrated span from TD 10:1 to 20:1: ±0.1% (* 0.05%) x [nominal value / (calibrated span x 10)] of the calibrated span
Long-term drift	±0.1 % of nominal value per year, ±0.25 % of nominal value per 5 years
Effect of process pressure on zero (on span) Values in percent of nominal value	**Metal sensor** / **Ceramic sensor**

Metal sensor		Ceramic sensor	
Nom. value	Deviation	Nom. value	Deviation
10 mbar	1.5 (0.5)%/100 bar	25 mbar	0.5 (0.2)%/10 bar
40 mbar	0.5 (0.2)%/100 bar	100 mbar	0.2 (0.2)%/16 bar
100 mbar	0.3 (0.2)%/100 bar	500 mbar	0.2 (0.2)%/100 bar
160 mbar, 500 mbar, 1 bar, 3 bar, 6 bar, 16 bar 40 bar	0.2 (0.2)%/100 bar	3000 mbar	0.2 (0.2)%/100 bar

Temperature coefficient	–10 to 60°C: 0.04% (* 0.03%) of nominal value/30 K and –40 to –10°C or 60 to 85°C: 0.1% (* 0.08%) of nominal value/30 K
Temperature coefficient of diaphragm seal	See technical information TI 256P, Dimensions Deltabar S FMD 633, column "diaphragm seal", T_K
Thermal effects (max. TD 20:1)	(0.2 % x TD + 0.2 %) of the calibrated span
Vacuum resistanc	PMD 230, 235, FMD 230: to 1 $mbar_{abs}$ FMD 630, 633: to 10 $mbar_{abs}$

Operation conditions

Installation conditions

Calibration position ① PMD 230 ② PMD 235, FMD 230 ③ FMD 630 ④ FMD 633	
Orientation	As required, orientation-dependent zero shift can be fully corrected, with no effect on span

Process conditions

Medium temperature range in process	PMD 230/FMD 230: –40…+85°C PMD 235: –40…+120°C FMD 630/633: up to +350°C Please note also the temperature limits of the gasket used, see tables page 88. For FMD 230 and FMD 630: Please note the temperature limits of the oil used, see Technical Information TI 256P, Section "Instructions for Diaphragm Seal")
Process pressure	Corresponds to permissible overload (see page 86)

Ambient conditions

Ambient temperature	–40…+85°C (for Ex see Safety Instructions)
Storage temperature	–40…+100°C (for Ex see Safety Instructions)
Climatic class	G P C to DIN 40040
Vibrational resistance	Ceramic sensor: ± 0.1% of span (DIN IEC 68 part 2-6) Metal sensor: ± 0.1% of span (DIN IEC 68 part 2-6)
Ingress protection	IP 65/NEMA 4X
Electromagnetic compatibility	Interference emission to EN 61326, electrical equipment class B; Interference immunity to EN 61326; Annex A (industrial) and NAMUR recommendation EMC (NE 21); Interference immunity to EN 61000-4-3: 30 V/m.

Mechanical construction

Gaskets for ceramic sensor		Temperature limits
1	FPM, Viton	–20°C [1]
3	PTFE-bounded Hastelloy C4	–40°C [1]
4	EPDM	–30°C [1, 2]
C	FFKM Chemraz	–10°C [1]
7	FFKM Kalrez	+5°C [1]
8	FPM, Viton oil and grease free	–10°C [1]
6	FPM, Viton cleaned for oxygen service Compound V70G3	–10…+60°C

Gaskets for metal sensors		Temperature limits
1	FPM, Viton	–20°C [1]
2	NBR	–20…+80°C
3	PTFE	–40°C [1]
8	FPM, Viton oil and grease free	–10°C [1]
6	FPM, Viton cleaned for oxygen service Compound V70G3	–10…+60°C
H	Copper	–40°C [1]

Design

Dimensions	See Technical Information TI 256P
Housing	Housing T4 (display on side) or T5 (display on top), Housing can be rotated up to 330°, Separated electronics and connection compartments, Optional electrical connection – Cable gland M 20x1,5 – Cable entry G ½, ½ NPT – M12 plug or Harting Han7D plug Terminal connection for wire cross wire section 0.5…2.5 mm^2 (AWG 20…13)
Process connection	Optional flange or diaphragm seal with capillary extension available, see also Technical Information TI 256P

Materials

Housing	– Cast aluminium housing with protective polyester-based RAL 5012 (blue), cover RAL 7035 (grey), salt water spray test DIN 50021 (504 h) passed – Stainless steel 1.4435 (AISI 316L)
Nameplate	1.4301 (AISI 304)
Process connection	optional: 1.4435 (AISI 316L), Steel C 22.8, Hastelloy 2.4819 (C279)
Process diaphragm	Ceramic sensor: Al_2O_3 Aluminium oxide ceramic Metal sensor: alternatively 1.4401 (AISI 316), Hastelloy C, Monel, Tantal, optional 1.4435 (AISI 316L)
Filling fluid in diaphragm seals	Silicone oil AK 100, High-temperature oil, Fluorolube, glycerine, vegetable oil
Gasket ceramic sensor	FPM Viton, PTFE-bounded Hastelloy C-4 seal for p_{abs}>900 mbar, EPDM, FFKM Chemraz, FFKM Kalrez, FPM Viton oil and grease-free, FPM Viton, cleaned for oxygen service [3] (see table on left side "gaskets for ceramic sensors")
metal sensor	FPM Viton, NBR, PTFE, FPM Viton oil and grease-free, FPM Viton cleaned for oxygen service [3], Copper (see table on left side "gaskets for metal sensors")
O-ring for cover seal	NBR
Mounting accessories	Mounting set with screws 1.4301 (AISI 304)

Display and operating interface

Display (optional)	Plug-in display module with digital display and bar graph (28 segments)
On-site operation	Via four keys Z–, Z+, S–, S+
Remote operation	Segment coupler for connection to PLC or PC, e.g. with the Commuwin II operating program
Communication interface	PROFIBUS-PA

Power supply

Power voltage	Standard: 9…32 V DC, Ex: 9…24 V DC (see also Safety Instructions XA…)
Current consumption	10 mA ± 1 mA (for Ex see Safety Instructions XA…)
Power up current	Corresponds to Table 4, IEC 1158-2

Certificates and Approvals

CE mark	By attaching the CE Mark, Endress+Hauser confirms that the instrument fulfils all the requirements of the relevant EC directives.

1) For the upper temperature limit, refer to page 85 "Medium temperature range".
2) Gaskets for lower temperatures on request.
3) Observe operating limits for oxygen service for non-metallic materials.

Further details on the dimensions and clearances of the transmitter versions can be taken fron Technical Information TI 256P.

Dimensions Deltabar S

Conversion factors
- 1 mm = 0.039 in
  1 in = 25.4 mm

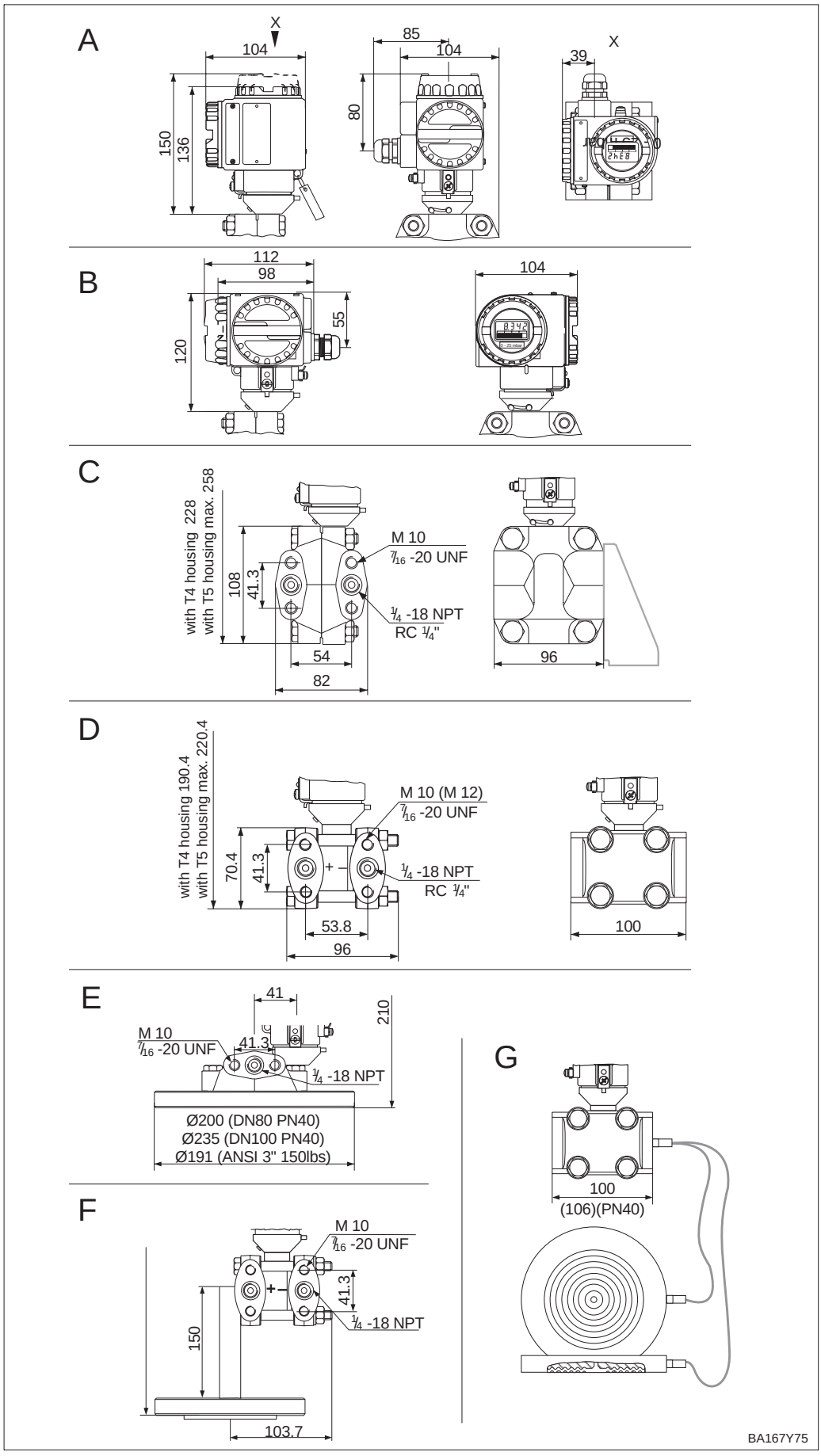


Figure 11.1
Deltabar S
A T5 housing (display on top)
B T4 housing (display on side)
C PMD 230 (ceramic sensor) with oval flange
D PMD 235 (metal sensor) with oval flange
E FMD 230 with flush-mounted ceramic diaphragm
F FMD 630 (metal sensor) with diaphragm seal
G FMD 633 (metal sensor) with capillary and remote seals

Dimensions are in mm

12 Operating Matrix

12.1 Matrix Commuwin II

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 Calibration	Measured value	Lower range value	Upper range value	Set lower value	Set upper value	Set bias pressure	Bias pressure automatic.	Damping 0...40 s		Select pressure unit
V1										
V2 Transmitter information	Diagnostic code	Last diagnostic code	Software-no.	Min. pressure	Max. pressure	Internal counter high	Sensor temperature	Min. temperature	Max. temperature	Reset (Default values)
V3 Linearisation	Op. mode Pressue: 0 Flow 1 Level: 2 Horiz.: 3 Manual: 4	Start point[1]	Full scale[1]	Unit after linearisation[1]	Density factor[2]	Creep flow suppression[3]	Activate table: 0 manual: 1 semi-autom.: 2 clear: 3	Line no. (1…21)	Input level %	Input volume %
V4										
V5 Totalizer	Counter[3]	Display selector[3]	Totalizer Operation. mode[3]	Conversion factor[3]	Counter unit[3]					
V6 PA data	Identity number	Set unit to bus	AI OUT Value	AI OUT Status	2nd cyclic value	Select V0H0	Out_Value von SPS	Profile version		
V7 Additional function					Low sensor calibration	High sensor calibration	Low sensor limit	High sensor limit	Sensor pressure	Temperature unit
V8										
V9 Service					Instrument address	Zero correction	Zero correction value	Unbiased pressure	Biased pressure	Security locking[4]
VA User inform.	Set tag number	Set user text	Serial number	Serial number sensor	Process connection P+	Process connection P–	Gasket	Process diaphragm	Fill liquid	Device profile

Display field

1) Not in "Pressure" mode.
2) Only in the "Level cyl. horizontal, "Level Manual" modes.
3) Only in the "Square root" (flow) mode.
4) Locking ≠ 130/2457, Unlocking = 130/2457
When the operating is interlocked using +Z and –S-keys, the matrix field indicates 9999.

This matrix povides a summary of all factory settings.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0		0	V7H7	—	—	0	—	0		bar
V1										
V2	0	0	xxxx	current pressure	current pressure	0	current temp.	current temp.	current temp.	0
V3	Pressure									
V4										
V5										
V6	0				0					
V7					V7H6	V7H7			current pressure	°C
V8										
V9								—	—	2457
VA	———-	———-	xxxx	xxxx						

12.2 Matrix Analog Input Block (AI Transmitter)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 OUT	OUT Value	OUT Status	OUT Status	OUT Sub Status	OUT Limit		Fail Safe Action	Fail Safe Value		
V1 Scaling	PV Scale Min	PV Scale Max	Type of Linearisa-tion	OUT Scale Min	OUT Scale Max	OUT Unit	User Unit	Decimal Point OUT	Rising Time	
V2 Alarm Limits	Alarm Hysteresis									
V3 HI HI Alarm	HI HI Limit	Value	Alarm State	Switch-on Point	Switch-off Point					
V4 HI Alarm	HI Limit	Value	Alarm State	Switch-on Point	Switch-off Point					
V5 LO Alarm	LO Limit	Value	Alarm State	Switch-on Point	Switch-off Point					
V6 LO LO Alarm	LO LO Limit	Value	Alarm State	Switch-on Point	Switch-off Point					
V7 Simulation	Simulation Value	Simulation Status	Simulation Mode							
V8 Block Mode	Target Mode	Actual	Permitted	Normal		Channel		Unit Mode		
V9 Alarm Config.	Current	Disable				Static Revision				
VA Block Parameter	Set Tag Number	Strategy	Alert Key	Profile Version	Batch ID	Batch Rup	Batch Phase	Batch Operation		Device Profile

.

12.3 Description of parameters

Parameter	Description
Measured value * (V0H0)	This parameter indicates the current measured value. The matrix field V0H0 corresponds to the on-site display. For the "Pressure" operating mode, select a pressure unit using the parameter "Select pressure unit" (V0H9). The measured value is converted and displayed in the pressure unit you selected. Note: The measured value in the pressure unit specified on the nameplate is transferred as standard over the bus. To transfer the converted measured value over the bus, confirm the parameter "Set unit to bus" once in the matrix field V6H1. Refer to the parameter description of "Set unit to bus" (V6H1). In the "Level" and "Square root" (flow rate) modes, the measured variable is displayed in "%" as standard. Use the parameter "Unit after linearisation" (V3H3) to select a level, volume, weight or flow rate unit. This unit is only for display. The measured variable is not converted to the unit you selected.
Lower range value * (V0H1)	Enter a pressure value for the lower range-value (calibration without reference pressure). These parameters set the lower range-value for the bar graph of the on-site display. In the "Pressure" mode, this parameter has no influence on the digital output value. In the "Level" and "Square root" (flow rate) modes, specify a pressure value for lower range-value as this pressure value is assigned to "Level empty" or "Min. flow rate" in these modes. Factory Setting: 0.0
Upper range value * (V0H2)	Enter a pressure value for upper range-value (calibration without reference pressure). These parameters set the upper range-value for the bar graph of the on-site display. In "Pressure" mode, this parameter has no influence on the digital output value. In the "Level" and "Square root" (flow rate) modes, specify a pressure value for upper range-value as this pressure value is assigned to "Level full" or "Max. flow rate" in these modes. Factory Setting: "High sensor limit" (V7H7)
Set lower value * (V0H3)	If you confirm this parameter, the current pressure value is set as the lower range-value (calibration with reference pressure). The value is displayed in the parameter "Lower range value" (V0H1). This is equivalent to pressing the +Z and –Z keys twice simultaneously in on-site operation.
Set upper value * (V0H4)	If you confirm this parameter, the current pressure value is set as upper range-value (calibration with reference pressure). The value is displayed in the parameter "Upper range value" (V0H2). This is equivalent to pressing the +S and –S keys twice simultaneously in on-site operation.
Set bias pressure * (V0H5)	If the on-site display indicates process pressure zero not as zero after calibrating the lower range-value (dependent on position), you can correct the value indicated on the on-site display to zero by entering a pressure value (bias pressure). The parameters "Measured value" (V0H0), "Lower range value" (V0H1) and "Upper range value" (V0H2) are corrected by the bias pressure value. Note: In "Pressure" mode, compensation by a bias pressure has no influence on the digital output value (parameter "OUT Value") which is transferred over the bus. Confirm the parameter "Set unit to bus" in matrix field V6H1 so that the on-site display and the "OUT Value" (V6H2) indicate the same value. Refer to Chapter 6.1, Section "Position calibration – display (bias pressure)". Factory Setting: 0.0
Bias pressure automatic * (V0H6)	If you confirm this parameter, the current pressure value is taken over as the bias pressure. The value is displayed in the parameter "Set bias pressure" (V0H5). This is equivalent to pressing the +Z and +S keys twice simultaneously. Refer to the parameter description "Set bias pressure" (V0H5).
Set output damping (V0H7)	Damping (output damping) affects the speed at which the output signal and the value indicated respond to a change in pressure. Damping is adjustable from 0 to 40 s. Factory Setting: 0.0

* The electronics check the input value of this parameter for compliance with editing limits, refer to Chapter 9.4.

Description of parameters (continuation)

Parameter	Description
Select pressure unit (V0H9)	Selects a pressure unit. When you select a new pressure unit, all pressure-related parameters are converted and indicated together with the new pressure unit. Note: The measured value in the pressure unit specified on the nameplate is transferred as standard over the bus. To transfer the converted measured value over the bus, confirm the parameter "Set unit to bus" once in the matrix field V6H1. Refer to the parameter description of "Set unit to bus" (V6H1) and Chapter 6.1, Section "Selecting pressure unit". Factory Setting: bar
Diagnostic code (V2H0)	If the pressure transmitter detects an error or a warning, it generates an error code. This parameter indicates the current error code. See Chapter 9.1 for a description of error codes
Last diagnostic code (V2H1)	Indicates the last error code. See Chapter 9.1 for a description of error codes Factory Setting: 0
Software no. (V2H2)	Indicates the device and software number. The first two digits represent the device number and digits 3 and 4 the software version. Deltabar S PROFIBUS-PA SW 2.2 = 8222
Minimum pressure (V2H3)	Indicates the smallest measured pressure value (maximum pointer). This parameter is reset to the current pressure value when you confirm by pressing the ENTER key.
Maximum pressure (V2H4)	Indicates the largest pressure value measured (maximum pointer). This parameter is reset to the current pressure value when you confirm by pressing the ENTER key.
Internal counter high (V2H5)	This counter indicates the how often a measured pressure was above the upper sensor limit (V7H7). Maximum value = 255 This parameter is reset to zero when you confirm by pressing the ENTER key.
Sensor temperature (V2H6)	Indicates the current temperature measured. The unit for displaying the temperature is selectable using the parameter "Temperature unit" (V7H9).
Minimum Temperature (V2H7)	Indicates the lowest temperature measured (maximum pointer). This parameter is reset to the current temperature value when you confirm by pressing the ENTER key.
Maximum temperature (V2H8)	Indicates the largest temperature measured (maximum pointer). This parameter is reset to the current temperature value when you confirm by pressing the ENTER key.
Default values (Reset) (V2H9)	Enters a reset code. Possible reset codes include: 5140 or 1, 2380, 731, 2506, 2509 and 2712. Chapter 9.3 lists the parameters which the reset codes reset to the factory settings.
Operation mode (V3H0)	Select the operating mode: – Pressure: for linear pressure measurements. The measured value (V0H0) indicates the pressure in the selected pressure unit (V0H9). Refer to Chapter 6. – Square Root *: for flow measurements, e.g. with an orifice plate or a Pitot tube. A square root function converts the measured differential pressure to a flow-proportional output signal. Refer to Chapter 8. – Level linear *: for level, volume or weight measurements for standing tanks. The level is linear to the measured pressure. Refer to Chapter 7.4 – Level cylindrical horizontal *: for level, volume or weight measurements with cylindrical horizontal tanks. The volume or the weight is not proportional to the level. A linearisation table is integrated. Refer to Chapter 7.4 – Level manual *: for precise volume or weight measurement where the volume or weight is not proportional to the level or to the measured pressure, e.g. tanks with tapered outlet. Use the parameters "Line no." (V3H7), "Input level" (V3H8) and "Set volume" (V3H9) to enter a linearisation table. This linearisation table us used to calculate the output signal. Refer to Chapter 7.4. Factory Setting: Pressure * In these modes, the measured value (V0H0) factory setting is displayed in %. To obtain a better presentation, use the parameters "Unit after linearisation" (V3H3) to select a level, volume, weight or flow rate unit. Refer to the parameter description of "Unit of linearisation" (V3H3).

Description of parameters (continuation)

Parameter	Description
Start point (V3H1)	Only for operating modes "Square root" (flow rate), "Level linear" and "Level cylindrical horizontal". Enter a value for the measuring point "Min. flow rate" or "Level empty". The value is assigned to the parameter "Lower range value" (V0H1). The parameter is displayed as standard in %. To obtain a better presentation, select a different unit using the parameter "Unit after linearisation" (V3H3). Factory Setting: 0%
Full scale (V3H2)	Only for operating modes "Square root" (flow rate), "Level linear" and "Level cylindrical horizontal". Enter a value for the measuring point "Max. flow rate" or "Level full". The value is assigned to the parameter "Upper range value" (V0H2). The parameter is displayed as standard in %. To obtain a better presentation select a different unit using the parameter "Unit after linearisation" (V3H3). Factory Setting: 100%
Unit after linearisation (V3H3)	Only for operating modes "Square root" (flow rate), "Level linear", "Level cylindrical horizontal" and "Level manual". Selects a level, volume, weight or flow rate unit. The options depend on the selected operation mode. The unit is only for display. The "Measured value" (V0H0) is not converted to the selected unit. Example V0H0 = 55%. After selected the unit "hl", V0H0 indicates 55 hl. When you want to display the "Measured value" (V0H0) converted into the selected unit, enter a calculated value for the parameters "Start point" (V3H1) and "Full scale" (V3H2). Refer also to Chapters 7.1 or 8.1, Section "Selecting unit for level, volume or weight" or "Selecting unit for flow rate". Factory Setting: %
Density factor (V3H4)	Only for operating modes "Level linear", "Level cylindrical horizontal" and "Level manual". The Density Factor matches the output value and the "Measured value" (V0H0) to changes in the density of a liquid measuring medium. The density factor results from the ratio between "New density" and "Old density". Factory Setting: 1.0
Creep flow suppression (V3H5)	Only for operating mode "Square root" (flow rate). In the lower measuring range, small flow rates can lead to large fluctuations in measured value. By entering a low flow cut off, these flow rates are no longer detected. Input is always in % flow rate. Refer to Chapter 8.1, Section "Creep flow suppression". Factory Setting: 0.0 %
Manual level (linearisation) (V3H6)	Only for operating mode "Level manual". Selects the Edit mode for the linearisation table. Options: Activate Table, Manual, Semi-automatic and Clear Table. Refer to Chapter 7.4 Linearisation. Factory Setting: Clear table
Line no. (V3H7)	Only for operating mode "Level manual". Enter line numbers for the linearisation table. Use the parameters "Line no." (V3H7), "Input level" (V3H8) and "Set volume" (V3H9) to enter a linearisation table. Number of lines in linearisation table: Min. = 2 and Max. = 21 Refer to Chapter 7.4 Linearisation. Factory Setting: 1
Input level (V3H8)	Only for operating mode "Level manual". Enter a fill value in the linearisation table. The input is in %. If you enter "9999.0" for this parameter, you can delete single items from the linearisation table. First activate the linearisation table using the parameter "Manual level" (V3H6). Refer to this table, parameter "Line no." (V3H7) and Chapter 7.4 Linearisation. Factory setting: 9999.0 %
Set volume (V3H9)	Only for operating mode "Level manual". Enter a volume value in the linearisation table. The input is in %. If you enter "9999.0" for this parameter, you can delete single items from the linearisation table. First activate the linearisation table using the parameter "Manual level" (V3H6). Refer to this table, parameter "Line no." (V3H7) and Chapter 7.4 Linearisation. Factory setting: 9999.0 %

Description of parameters (continuation)

Parameter	Description
Counter (V5H0)	Only for operating mode "Square root" (flow rate). Indicates the total flow rate measured. After a reset "5140" the counter is reset to zero. Refer to Chapter 8.4 "Totalizer". Factory Setting: 0
Display selector (V5H1)	Only for operating mode "Square root" (flow rate). Selects the operation mode for the on-site display. Options: – Flow rate: Indicates the current volume or mass flow measurement, equivalent to the display of the parameter "Measured value" (V0H0). Select the unit using the parameter "Unit after linearisation" (V3H3). – Counter: Indicates the total flow rate, equivalent to the display of the parameter "Counter" (V5H1). Select the unit using the parameter "Counter unit" (V5H4). The bar graph always indicates the current flow rate measured. Refer to Chapter 8.4 "Totalizer". Factory Setting: Flow rate
Totalizer operation mode (V5H2)	Only for operating mode "Square root" (flow rate). This parameter activates the totalizer function and defines how to count negative flows. Refer to Chapter 8.4 "Totalizer". Factory Setting: OFF
Conversion factor (V5H3)	Only for operating mode "Square Root" (flow rate). The Conversion Factor converts the current flow rate into a total flow rate. Refer to Chapter 8.4 "Totalizer". Factory Setting 1.0
Counter unit (V5H4)	Only for operating mode "Square root" (flow rate). Selects a volume or a mass unit for the parameter "Counter" (V5H0). Only select for display. The "Counter" (V5H0) is not converted to the selected unit. Example: V5H0 = 55%. After selected the unit "l", V5H0 indicates 55 hl. Refer to Chapter 8.4 "Totalizer". Factory Setting: %
Identity number (V6H0)	Select the ID Number. Options: – Profile: General ID Number of the PNO (PROFIBUS User Organisation): "9700 (hex)". To configure the PLC, use the device data base (GSD) of the PNO. – Manufacturer: Device ID Number for Deltabar S PROFIBUS-PA: "1504 (hex)". To configure the PLC, use the device-specific GSD. Refer to Chapter 3.3 Device database and type files (GSD).
Set unit to bus (V6H1)	In the following cases, the digital output value (OUT Value) and the on-site display or the parameter "Measured value" (V0H0) do not indicate the same value: – if you selected a new pressure unit using the parameter "Select pressure unit" (V0H9) and/or – if you carried out a calibration in operation mode "Pressure" by entering a bias pressure (V0H5/V0H6). So that the digital output value indicates the same value as the on-site display and V0H0 in these cases, confirm the parameter "Set unit to bus" in matrix field V6H1 after calibration. Note that any change in the digital output value could affect control. Refer to Chapter 6.1, Section "Selecting pressure unit" and "Position calibration – display (bias pressure)".
OUT value (V6H2)	This parameter indicates the OUT Value of the Analog Input Block (digital output value transferred over the bus). While the matrix field V6H2 still indicates UNKNOWN, the parameter "Set unit to bus" has not been confirmed in matrix field V6H1.
OUT status (V6H3)	This parameter indicates the status of the OUT Value (digital output value). See Chapter 3.4, Section "Status Codes" for a description of the status codes.
2nd cyclic value (V6H4)	Use this field to select a second parameters, which are sent cyclically to the PLC. Options: Temperature (V2H6), Sensor value (V7H8), Trimmed value (V9H7) and Biased value (V9H8). Refer to Chapter 3.4, Fig. 3.3 Factory Setting: Measured value (V0H0)
Select V0H0 (V6H5)	The on-site display and the matrix field V0H0 indicate the same value as standard. A PLC can also provide the on-site display with a cyclical output value. To do this, set this parameter to "Display Value" (or 1). Refer to Chapter 3.4.

Description of parameters (continuation)

Parameter	Description
OUT value from PLC (V6H6)	Indicates a cyclical OUT value from the PLC. Refer to Chapter 3.4, Fig. 3.3.
Profile version (V6H7)	Indicates the PROFIBUS-PA profile version.
Low sensor calibration * (V7H4)	Enter the lower point of the sensor level for sensor calibration. Use this parameter to assign a new value to a reference pressure applied to the device. The applied pressure value and the value entered for "Low sensor cal" are equivalent to the lower point of the sensor level. Refer to Chapter 10.5 "Sensor calibration". Factory Setting: "Low sensor limit" (V7H6)
High sensor calibration * (V7H5)	Enter the upper point of the sensor level for a sensor calibration. Use this parameter to assign a new value to a reference pressure applied to the device. The applied pressure value and the value entered for "High sensor cal" are equivalent to the upper point of the sensor level. Refer to Chapter 10.5 "Sensor calibration". Factory Setting: "High sensor limit" (V7H7)
Low sensor limit (V7H6)	Indicates the lower sensor limit.
High sensor limit (V7H7)	Indicates the upper sensor limit.
Sensor pressure (V7H8)	Indicates the current pressure applied.
Temperature unit (V7H9)	Selects a temperature unit. Options: °C, K,°F When you select a new temperature unit, all temperature-specific parameters (V2H6, V2H7, V2H8) are converted and the new temperature unit is displayed. Factory Setting: °C
Instrument address (V9H4)	Indicates the device address in the bus. The address can either be set by software or on-site using a DIP switch. Refer to Chapter 3.2. Factory Setting: 126
Zero correction * (V9H5)	Use this parameter to carry out a calibration (zero correction) for the values indicated on the on-site display ("Measured value" (V0H0)) and for the digital output value (OUT Value) at the same time. Use this parameter to enter a new value for a pressure applied to the device. The sensor level is shifted by this value and the parameters "Low sensor cal" (V7H4) and "High sensor cal" (V7H5) are recalculated. Refer to Chapter 6.1, Section "Zero correction". Factory Setting: 0.0
Zero correction value (V9H6)	Indicates the value by which the sensor level was shifted for a zero correction. Refer to parameter description "Zero Correction" (V9H5) and Chapter 6.1, Section "Zero Correction". Factory Setting: 0.0
Unbiased pressure (V9H7)	This parameter indicates the current damped pressure without any bias correction. Refer to parameter description "Set bias pressure" (V0H5).
Biased pressure (V9H8)	This parameter indicates the current damped pressure with bias correction. Refer to parameter description "Set bias pressure" (V0H5). Calculation: "Biased pressure" (V9H8) = "Unbiased pressure" (V9H7) – "Set bias pressure" (V0H5) In "Pressure" operation mode, this parameter and the parameter "Measured value" (V0H0) indicate the same value.
Security locking (V9H9)	Enter a code to lock or unlock the operation matrix and on-site operating unit. Lock operation: – Using the parameter "Security locking" (V9H9): Enter a number from 1 to 9998, except for numbers 130 and 2457, – using on-site operation: Press the +Z und –S keys twice simultaneously. Unlock operation: – Using the parameter "Security locking" (V9H9): Enter 130 or 2457 – using the on-site operation: Press –Z and +S keys twice simultaneously. The matrix field V9H9 is only editable if operation was not locked previously using the on-site keys. Refer to Chapters 6.3, 7.6 and 8.3.

* The electronics check the input values for these parameters for compliance with editing limits, refer to Chapter 9.4.

Description of parameters (continuation)

Parameter	Description
Measuring point description (VAH0)	Enter a text describing the measuring point (up to 32 ASCII characters).
Set user text (VAH1)	Enter a text as additional information (up to 32 ASCII characters).
Device serial number (VAH2)	Indicates the serial number of the device.
Serial no. sensor (VAH3)	Indicates the serial number of the sensor.
Process connection P+ (VAH4)	Select and display the process connection material on the positive side. Options: steel, 304 stainless, 316 stainless, Hastelloy C, Monel, tantalum, titanium, PTFE (Teflon), 316L stainless, PVC, Inconel, ECTFE and special (for custom versions)
Process connection P– (VAH5)	Select and the process connection material on the negative side. Options: refer to parameter "Process Connection" (VAH4)
Gasket (VAH6)	Select and indicate the gasket material. Options: FPM Viton, NBR, EPDM, urethane, IIR, KALREZ, FPM Viton for oxygen applications, CR, MVQ and special (for custom versions)
Process diaphragm (VAH7)	Select and indicate the diaphragm material. Options: 304 stainless, 316 stainless, Hastelloy C, Monel, tantalum, titanium, PTFE (Teflon), ceramic, 316L stainless, Inconel, special (for custom versions)
Fill liquid (VAH8)	Select and indicate the oil filling. Options: silicon oil, vegetable oil, glycerine, inert oil, HT oil (high-temperature oil), special (for custom versions)
Device profile (VAH9)	Use this matrix field to change between the various blocks: standard (E+H matrix), physical block, press block and AI transmitter (analog input block).

Index

O

P

R

S

T

U

V

Z

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