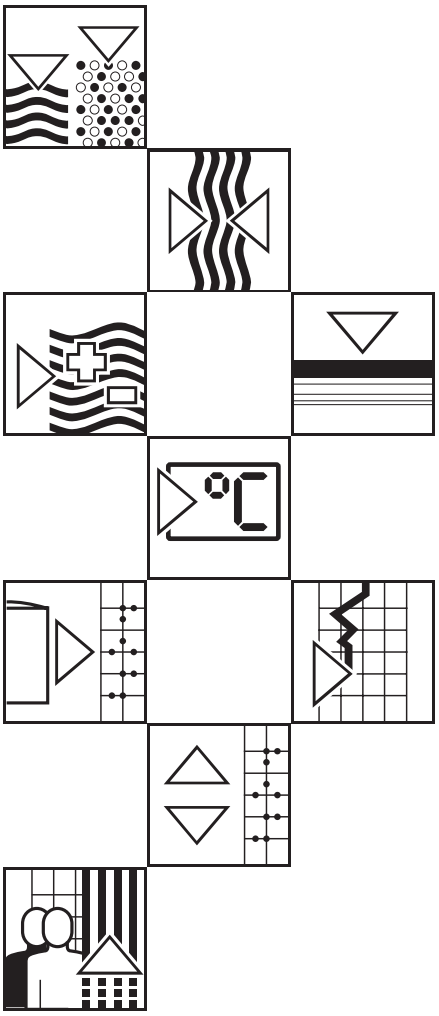
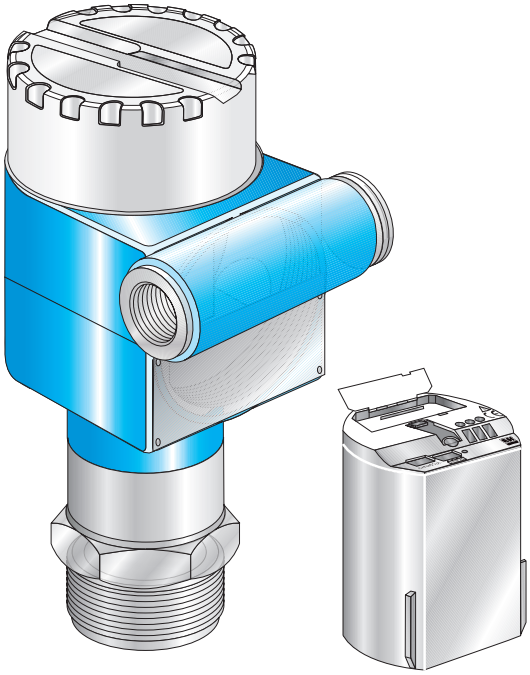
BA164F/00/en/08.08
Software version 2.2
71078913

Deltapilot S
PROFIBUS-PA Hydrostatic Level Measurement

Operating Instructions



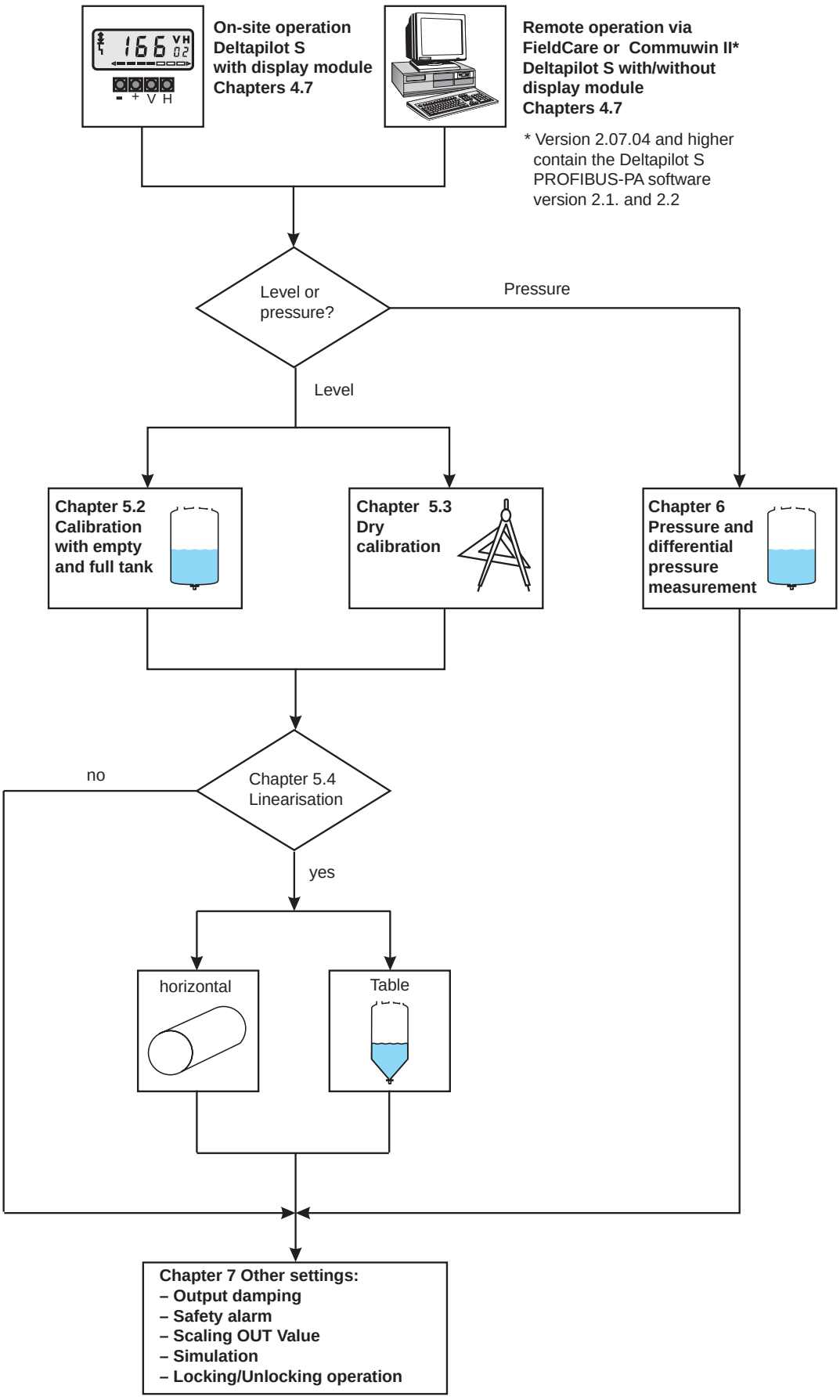


PROFI® PROCESS FIELD BUS

Endress + Hauser

The Power of Know How

Overview


On-site operation
Deltapilot S
with display module
Chapters 4.7
Remote operation via
FieldCare or Commuwin II*
Deltapilot S with/without
display module
Chapters 4.7
* Version 2.07.04 and higher
contain the Deltapilot S
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Level or
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Calibration
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Chapter 6
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Linearisation
no
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Table
Chapter 7 Other settings:
– Output damping
– Safety alarm
– Scaling OUT Value
– Simulation
– Locking/Unlocking operation

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Software History

Software	Changes	Significance
1.0	Original Software DPV1 (profile 2.0)	
1.3	New parameters added.	V0H3 Decimal point V0H5 PV Scale min V0H6 PV Scale max V2H4 Nominal diameter V2H5 Max. volume V3H1 Select unit V9H9 Security locking VAH0 Set tag number VAH5 Serial number VAH6 to VAH9 Service data
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
		One further value can be read cyclically.
		Data can be sent cyclically to the device.
		"Service data" parameter (VAH9), moved from matrix field VAH9 to matrix field VAH4.
2.1	– Correction in communication stack – Correction of parameter attributes	
2.2	– Correction in communication stack	

Note!

Note!
Second generation Deltapilot S PROFIBUS-PA devices with 3.0 profiles are cyclical downwards compatible with the first generation Deltapilot 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 one additional value, the PLC must be configured with the GSD (EH3x1503.gsd or EH3_1503.gsd).
If the additional functions of the 3.0 profile are not required, the PLC configuration with the first generation GSD (EH__1503.gsd) can be kept.
Refer also to Chapter 3.3 "Device database and type files".

Notes on Safety

Approved usage

The hydrostatic pressure sensor Deltapilot S with electronic insert FEB 24 (P) is a PROFIBUS-PA device which is used for continuous level measurement. It can also be used to measure pressure and differential pressure (by using a PLC and a second sensor).

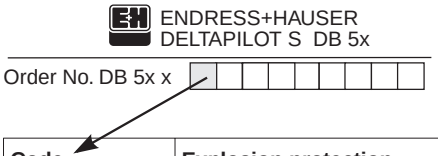
Installation, commissioning, operation

The Deltapilot 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.

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	Explosion protection
A	Version for non-hazardous area
E	Version for non-hazardous area, overfill protection WHG
C	ATEX II 1/2 G EEx ia IIC T6, flame barrier
1	ATEX II 1/2 G EEx ia IIB T6, flame barrier
D	ATEX II 1/2 G EEx ia IIC T6, overfill protection: WHG
4	ATEX II 1/2 G EEx ia IIB T6, overfill protection: WHG
B	ATEX II 1/2 G EEx ia IIC T6, flame barrier, overfill protection: WHG
2	ATEX II 1/2 G EEx ia IIB T6, flame barrier, overfill protection WHG
G	ATEX II 1/2 G EEx ia IIC T6
3	ATEX II 1/2 G EEx ia IIB T6
H	ATEX II 2 G EEx ia IIC T6
N	ATEX II 3 G EEx nA II T6
O	FM Class I, Division 1, 2, Groups A-D
S	CSA Class I, Division 1, Groups A-D
T	CSA Class I, Division 2, Groups A-D

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 convention

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 electronic insert FEB 24 (P) serves as transmitter for the hydrostatic pressure sensors Deltapilot S DB 50 (A), DB 50 L, DB 50 S, DB 51 (A), DB 52 (A) and DB 53 (A). Deltapilot S sensors are used for continuous level measurement of liquids and pastes. They find application in the chemical, pharmaceutical and food industries as well as in fresh and wastewater treatment plants.

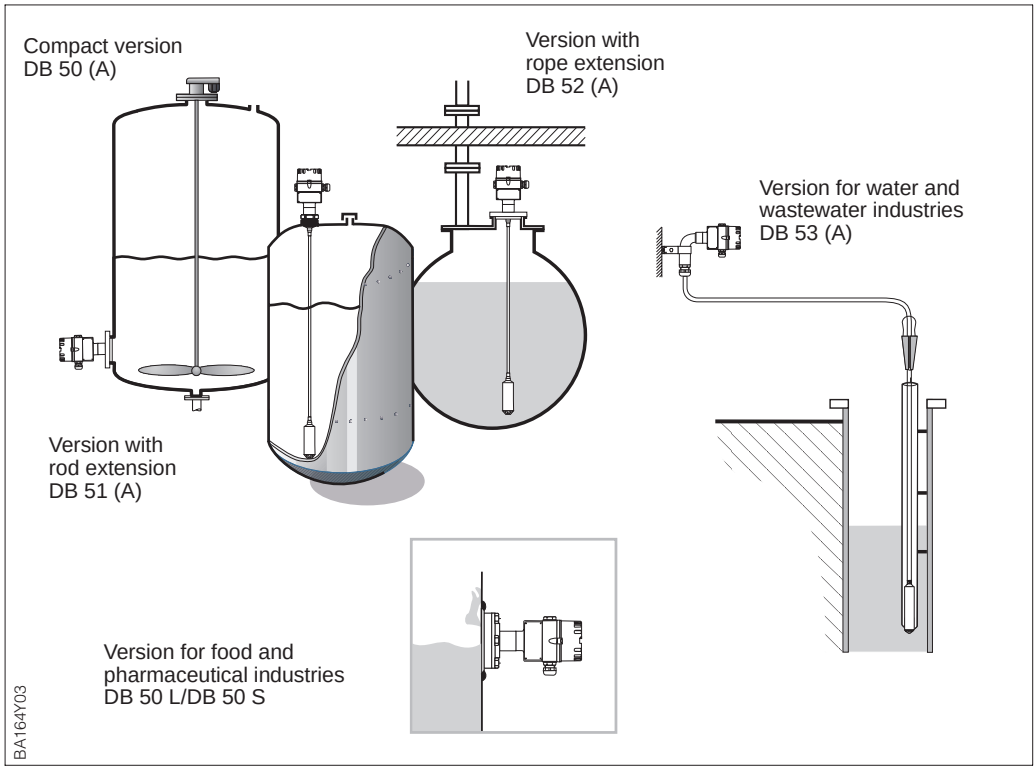


Figure 1.1
Deltapilot S
pressure sensor versions

Operating principle

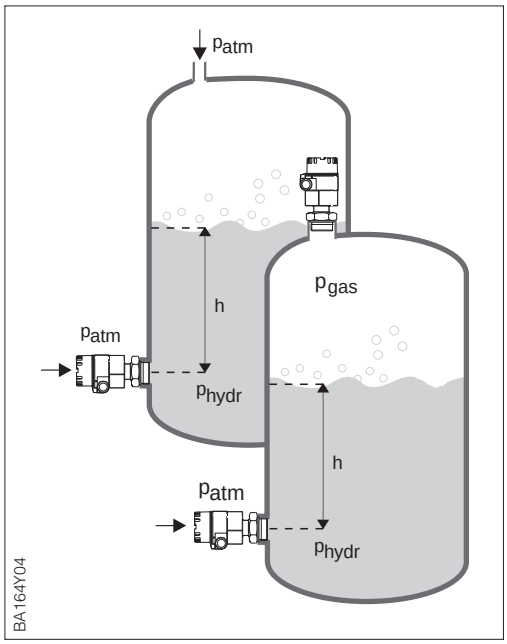


Figure 1.2
Principle of hydrostatic level measurement

The level of a column of liquid of known density ρ can be determined by measuring its hydrostatic pressure with a suitable sensor.

$$h = p_{hydr}/\rho \cdot g$$

The pressure sensor Deltapilot S converts the pressure acting upon its process diaphragm into an electrical signal. The electronic insert takes this signal and outputs it as a direct digital signal.

Using two Deltapilot S units, you can, for example, measure the differential pressure in a pressurised tank. The pressure measured values of the probes are sent to a PLC. The PLC calculates the pressure difference and, if necessary, calculates the level from this.

1.1 Measuring system

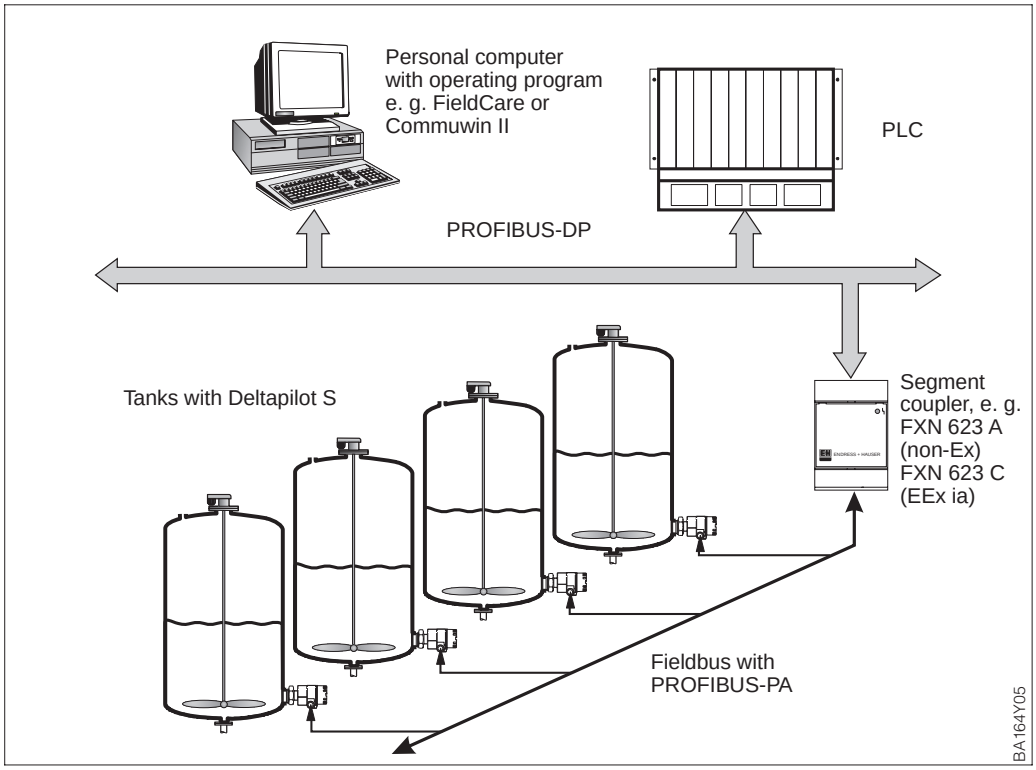


Figure 1.3
Measuring system Deltapilot S with PROFIBUS-PA protocol

Measuring point

In the simplest case, the measuring point comprises:
- Deltapilot S with PROFIBUS-PA protocol
- PLC or personal computer with an operating program e.g. FieldCare or 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 "PROFIBUS-DP/-PA: Guidelines for planning and commissioning". Normally however:

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

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

Refer also to PROFIBUS-PA specification EN 50170 (DIN 19245), explosion hazardous areas: EN 50020, FISCO model or to the Internet address "http://www.PROFIBUS.com".

2 Installation

This chapter describes:
- the mechanical installation of the Deltapilot S
- the electrical connection of the electronic insert

2.1 Installation instructions

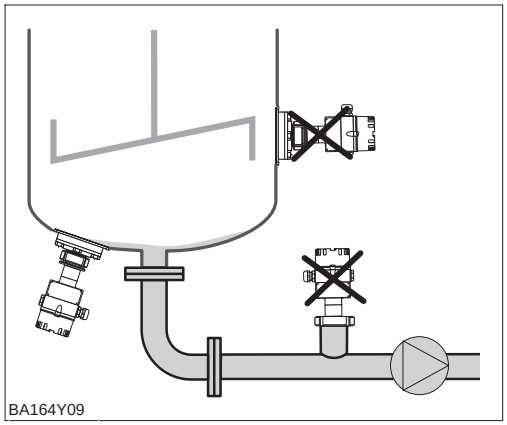


Figure 2.1
Do not mount Deltapilot S in the tank outlet or near agitators.

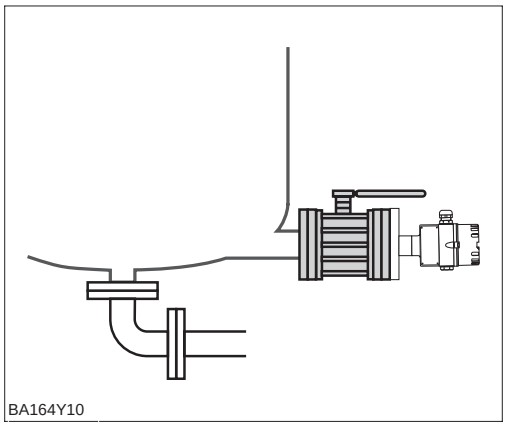


Figure 2.2
Mounting the Deltapilot S device DB 50, DB 50 A, DB 50 L, DB 50 S downstream of a shut-off device.

Mounting point

Compact version
DB 50, DB 50 A, DB 50 L, DB 50 S
- Always install the device below the lowest measuring point.
- Do not mount the device at the following locations: in the filling stream, in the tank outlet or at a point in the tank where pressure pulses from an agitator can occur.
- Calibration and functional testing can be carried out more easily if the device is mounted downstream of a shut-off device.

Rod and rope version
DB 51 (A)/DB 52 (A)/DB 53 (A)
- Mount the rope version at a point free from currents and turbulence. To protect the probe from any contact caused by lateral movement, mount the probe in a guide pipe (preferably plastic) or attach it to a mounting clamp. Please refer also to Certificates and Safety Instructions for hazardous area applications.
- The length of the support cable or the probe rob depends on the zero point of the level. The tip of the probe should be at least 5 cm (2 inch) below it.

Process diaphragm

- Do not use sharp or hard objects to handle or clean the process diaphragm. Build-up has no effect on the measurement result as long as it is porous and does not present a mechanical load on the diaphragm of the pressure measuring cell.
- The process diaphragm on all Deltapilot S with rod or rope extension is protected against mechanical damage by means of a plastic cap.

Temperature effect

- The Deltapilot S must also be insulated in fluids which can harden when cold. The rod or rope version can also be used.
- If there are extreme temperature differences between calibration and operation, then the device needs approx. 10 to 15 minutes to warm up before it can measure correctly.

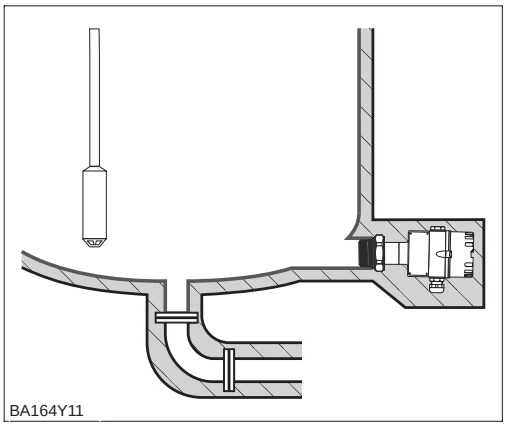


Figure 2.4
In applications where the product can harden, the Deltapilot S must also be covered by insulation.

Seal

Deltapilot S with G 1 ½- thread:
- When screwing the device into the tank, the flat seal supplied must be placed on the sealing surface of the process connection.
  To avoid additional strain on the process diaphragm, do not seal the thread with hemp or similar materials.

Deltapilot S with NPT thread:
- Wrap and seal the thread with Teflon tape.
- Tighten the device at the hexagon head only. Do not turn the device by the housing.
- Do not screw in the thread too tightly. Max. starting torque 20…30 Nm.

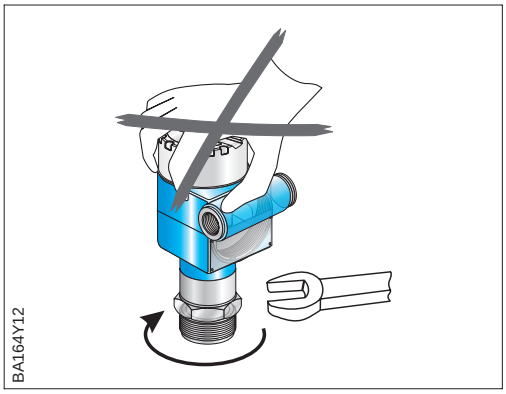


Figure 2.3
Screw in sensor at hexagonal nut only!

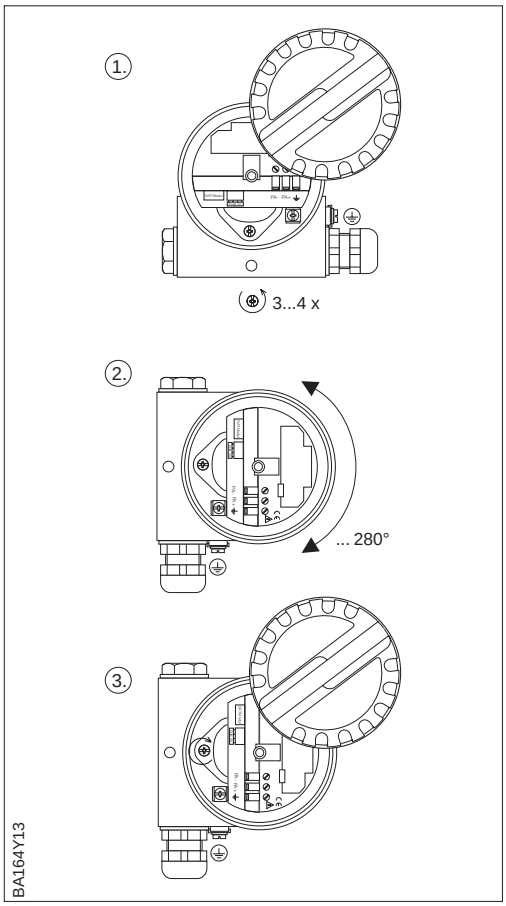


Figure 2.5
Turning the sensor housing

Turning the housing

You can turn the housing to align the cable entry.
- The cable entry should point downwards when the device is mounted laterally in the tank.
- The cable entry should always be horizontal when the device is mounted with a protective cover.
  – Protective cover for devices with sightglass, Order No.: 942262-0001
  – Protective cover for devices with flat cover, Order No.: 942262-0000

Turn the housing as follows:
- Unscrew the cover.
- Loosen Phillips screw.
- Turn housing (max. 280°).
- Tighten Phillips screw.

Sealing the probe housing

No moisture should enter the housing during mounting, when connecting the electronic insert and during operation.
- Always screw the housing cover and the cable entries tight.
- The O-ring seal in the housing cover and the thread of the aluminium cover are lubricated. It the lubricant is removed, replace it with silicone grease or graphite paste, for example, so that the cover seals tight. Do not use mineral-oil based greases! These can destroy the O-ring.

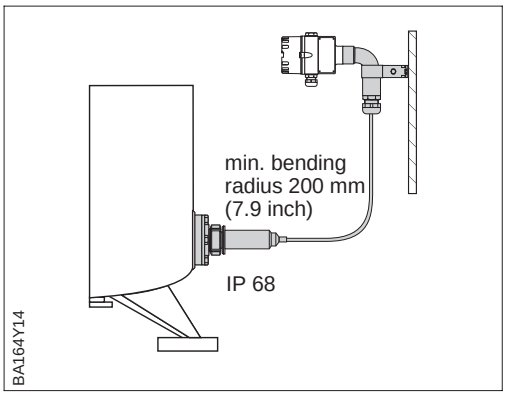


Figure 2.6
Use of the housing adapter

Housing adapter

The housing and the electronic insert can be mounted remotely from the measuring point by using the housing adapter.
– Housing adapter with 5 m cable length or with cable length up to 30 m, Ordercode see TI257P, chapter "Accessories".

This allows for trouble-free measurement:
- under especially difficult measuring conditions, e. g. very damp environment, or danger of flooding.
- in narrow or hard-to-reach mounting locations.

2.2 Electrical connection

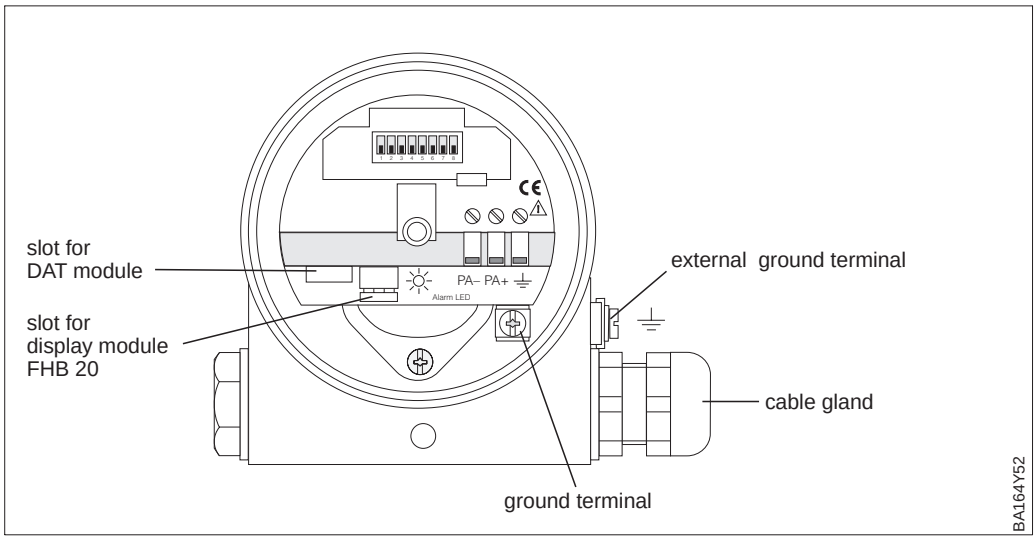


Figure 2.7
Deltapilot S
connection compartment

DAT module

All the specific data of the measuring cell is saved in the DAT module. On device power-up, this data is loaded from the DAT module to the memory of the electronic insert. So that the device produces accurate measured values, the measuring cell and the DAT module must always match. The measuring cell number can be found on the measuring cell, on the DAT module and on a sign inside the housing.
If lost, you can re-order the DAT module individually from Endress+Hauser, Order No.: 542585-0000. Please supply the measuring cell number when ordering.

General note

The Deltapilot 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 Deltapilot 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, screen 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 mm², 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-DP/PA: Guidelines for planning and commissioning" and the PROFIBUS-PA specification EN 50170 (DIN 19245).

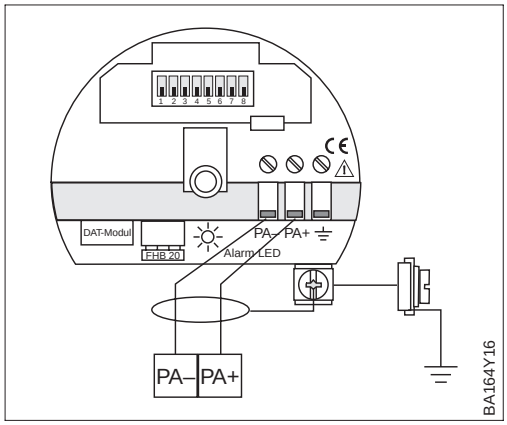


Figure 2.8
Electrical connection Deltapilot S

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.
- If necessary, plug the dispaly module back in.
- Srew down the connection compartment lid.

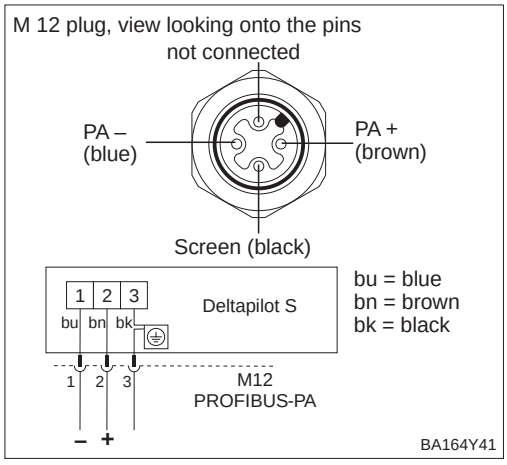
M12 plug

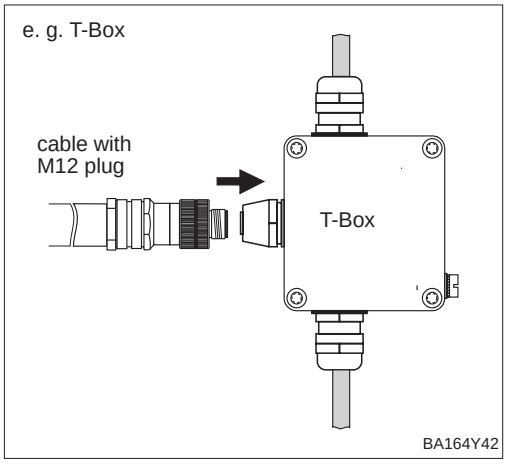
The Deltapilot S PROFIBUS-PA version with M12 plug is supplied ready wired and need only be connected to bus by means of a suitable cord set.

Note!
To protect the device against vibrations, always connect the Deltapilot S to the T-box via cable. See Figure, bottom right.


Note!

- 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

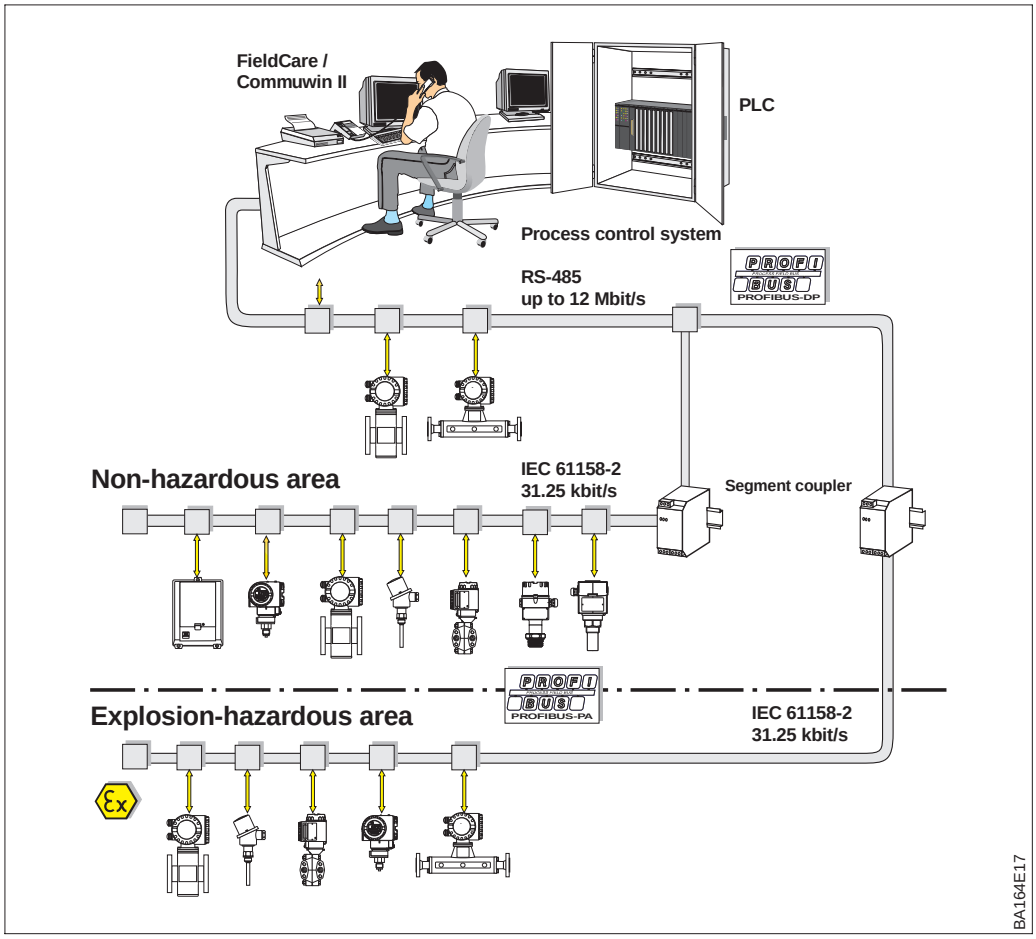


Figure 3.1
PROFIBUS-DP/-PA principle of operation

Note!

Note!
Additional planning information on the fieldbus PROFIBUS-PA can be found in the Operating Instructions BA 198F/00/en, "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 Deltapilot S:

- remotely by using an operating program, e.g. FieldCare or 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.

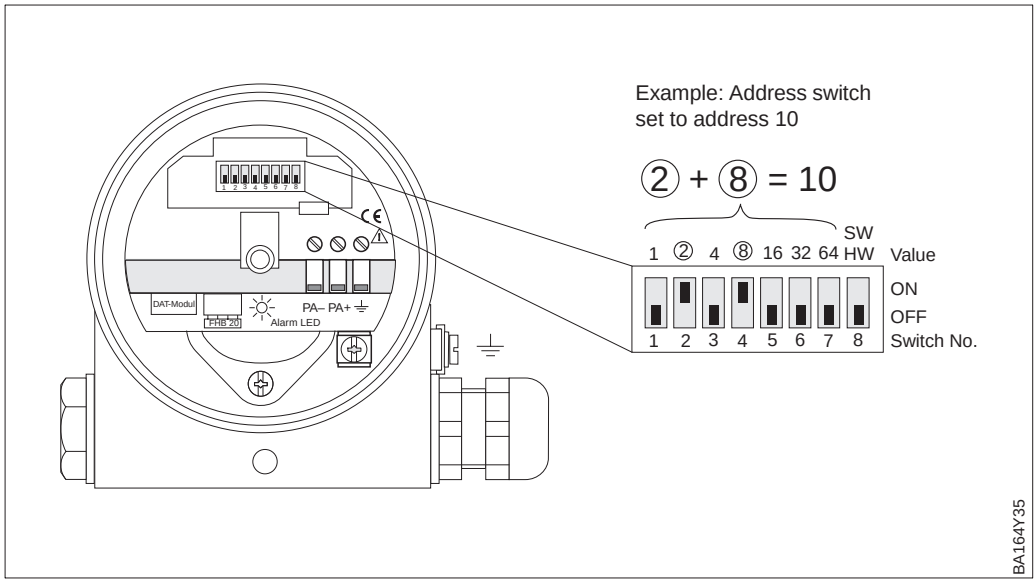


Figure 3.2
Set device address via address switch

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 "ON"	1	2	4	8	16	32	64
Value in position "OFF"	0	0	0	0	0	0	0

Software address

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

3.3 Device database and type files (GSD)

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
Deltapilot S	1503 (hex)	EH3x1503.gsd	EH31503x.200	EH1503_d.bmp EH1503_n.bmp EH1503_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*
  select your country
  → Automation
  → Fieldbus → Fieldbus device integration
  → PROFIBUS
  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 Deltapilot 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 via matrix field V6H0 in operating prgram.

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

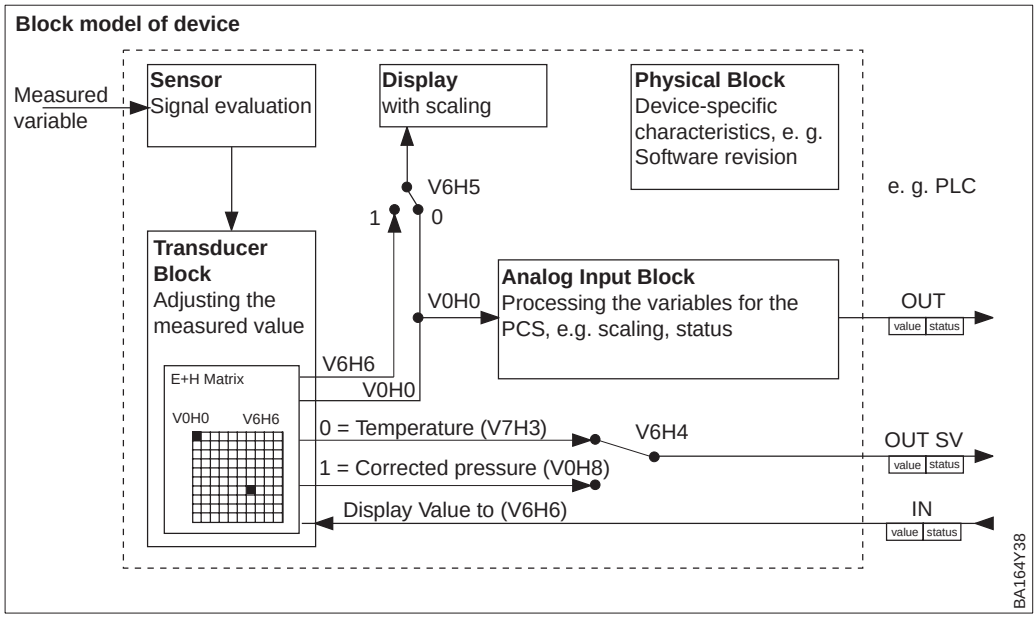


Figure 3.3
Block model of Deltapilot S with PROFIBUS-PA profile 3.0

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

Block model

Fig. 3.3 shows a block model of the Deltapilot 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 display the same value as standard. However, a cyclical output value (Display value) from a PLC can also be made available to the on site-display. For this purpose, the matrix field V6H5 in an operating program must be set to "Display value" (or 1).
Example: One Deltapilot S measures the head pressure and another the hydrostatic pressure in a tank. Both measured values are sent to the PLC. The PLC calculates the pressure difference and then calculates the level from this. The level calculated is assigned to the "Select V0H0" parameter (V6H6) and to the on-site display. See Chapter 6 also.

A Deltapilot S can still supply one other value to the PLC. The field V6H4 in an operating program 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 an operating program.

1) Using the network design tool for your PLC, add the Deltapilot S to the network, taking care that the address assigned corresponds to that set at the device.
2) Select the Deltapilot S and call up the configuration tool: four options appear: "Main Process Value", "2nd 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) and select "Display Value" or "FREE PLACE" (= function deactivated). Then close the configuration window.
5) Start Commuwin II or FieldCare and open the connection using the PA-DPV1 server or PROFIdtmDPV1 (FieldCare). Generate a live list, locate the device address and click on "Deltapilot 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 (V7H3), 1 = Corrected pressure (V0H8)*
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 Deltapilot S.

Deltapilot S → PLC (Input data)

A PLC can read the input data of Deltapilot 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 * or corrected pressure	read	32 bit floating point number (IEEE-754)
9	Status code for secondary value	read	see status codes

* This value displays the temperature measured value of the internal temperature sensor. The temperature measured value of the internal measuring sensor is used in the measuring cell for compensation purposes. In other words, this is only a temperature value which is close to the process.

PLC → Deltapilot 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 Deltapilot 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	
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 the Operating Instructions BA 198F.

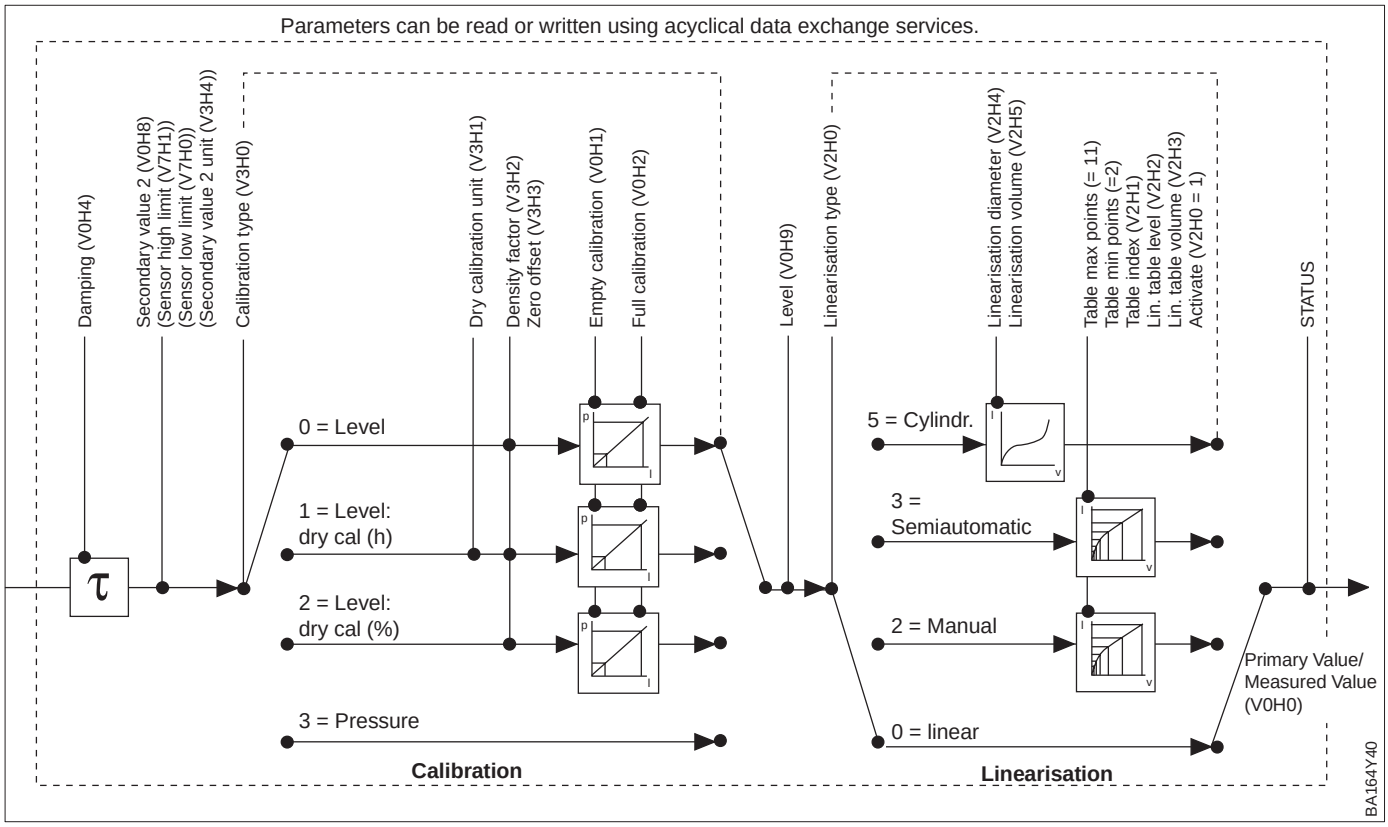


Figure 3.4
Schematic diagram of the Deltapilot S Transducer Block.
Parameter designations correspond to those designations in the Slot/Index List. Parameters with data for a matrix field (in brackets) can be accessed by Commuwin II.

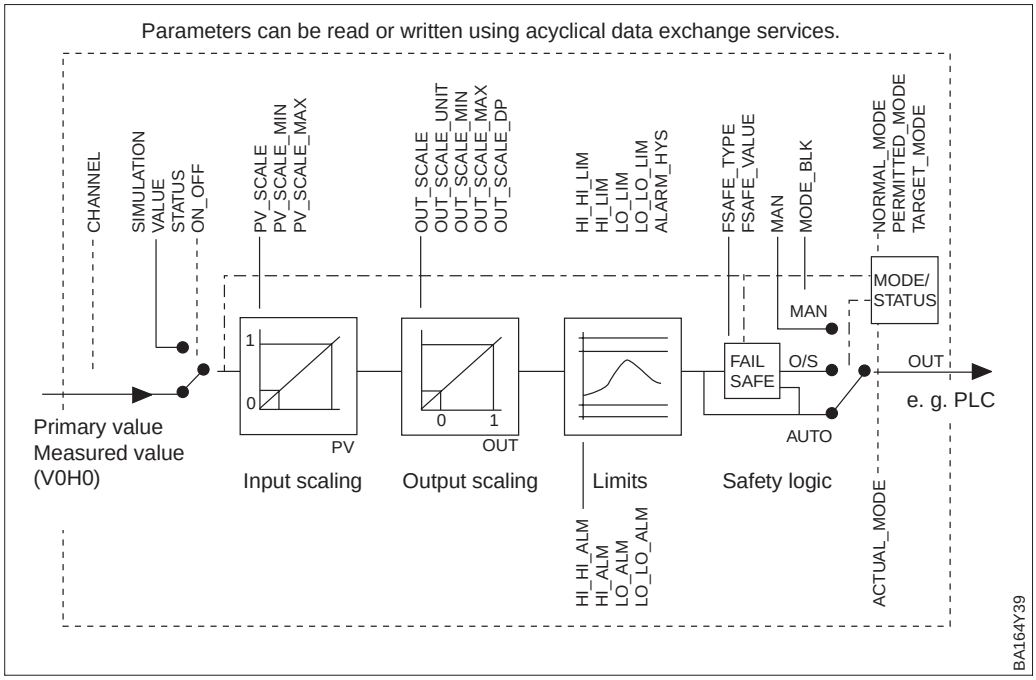


Figure 3.5
Schematic diagram of the Deltapilot S Analog Input Block

Slot/Index table

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/FieldCare 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		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	V6H2/3	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 FTIME		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-51*	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		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	VAH5	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 certification		1	83	32	OSTRING	X	X	N
Security locking	V9H9	1	84	2	UNSIGNED16	X	X	N
Factory reset	V9H5	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	UNSIGNED 8	x	x	S
HW write protection		1	91	1	UNSIGNED 8	x	x	S
Gap reserved		1	92...98					
Gap		1	99...103					
Matrix error code	V9H0	1	104	2	UNSIGNED16	X		D
Matrix last error code	V9H1	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	V9H4	1	109	1	UNSIGNED8	X		D
Matrix device software number	V9H3	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	x	D
PA select V0H0	V6H5	1	113	1	UNSIGNED8	x	x	S
PA profile revision	V6H7	1	114	16	OSTRING	x		C
Gap		1	115-119					
PA select second cyclic value	V6H4	1	120	1	UNSIGNED8	x	x	S
PA identity number	V6H0	1	121	2	UNSIGNED16	x	x	S
PA identity string		1	122	32	OSTRING	x	x	S
PA DP status		1	123	1	UNSIGNED8	x		
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	209	17	OSTRING	X		D/N/C
Gap reserved		1	210-214					
View 1 Transducer Block		1	215	22	OSTRING	X		D/N/C
Gap reserved		1	216-220					
View 1 Analog Input Block		1	221	18	OSTRING	X		D/N/C
Gap reserved		1	222-226					

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		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								
Primary value	V0H0	1	137	5	DS-33*	X		D
Primary value unit		1	138	2	UNSIGNED16	X	X	S
Level	V0H9	1	139	4	FLOAT	X		D
Level unit	VAH2	1	140	2	UNSIGNED16	X	X	S
Sensor value	V3H6	1	141	4	FLOAT	X		D
Sensor unit	V3H4	1	142	2	UNSIGNED16	X	X	S
Secondary value 1		1	143	5	DS-33*	X		D
Secondary value 1 unit	VAH2	1	144	2	UNSIGNED16	X	X	S
Secondary value 2	V0H8	1	145	5	DS-33*	X		D
Secondary value 2 unit	V3H4	1	146	2	UNSIGNED16	X	X	S
Sensor offset	V3H7	1	147	4	FLOAT	X	X	S
Calibration type	V3H0	1	148	4	UNSIGNED8	X	X	S
Calibration point low		1	149	4	FLOAT	X	X	S
Calibration point high		1	150	4	FLOAT	X	X	S
Level low		1	151	4	FLOAT	X	X	S
Level high		1	152	4	FLOAT	X	X	S
Level offset		1	153	4	FLOAT	X		D
Linearisation type	V2H0	1	154	1	UNSIGNED8	X	X	S
Linearisation diameter	V2H4	1	155	4	FLOAT	X	X	S
Linearisation volume	V2H5	1	156	4	FLOAT	X	X	S
Sensor high limit	V7H1	1	157	4	FLOAT	X		C
Sensor low limit	V7H0	1	158	4	FLOAT	X		C
Max. sensor value	V7H2	1	159	4	FLOAT	X	X	N
Min. sensor value		1	160	4	FLOAT	X	X	N
Temperature	V7H3	1	161	4	FLOAT	X		D
Temperature unit	V3H5	1	162	2	UNSIGNED16	X	X	S
Max temperature	V7H4	1	163	4	FLOAT	X	X	N
Min temperature		1	164	4	FLOAT	X	X	N
Table index (linearisation)	V2H1	1	165	1	UNSIGNED8	X	X	S
Table X/Y number	V2H2/3	1	166	2*4	Array of FLOAT	X	X	S
Table min number		1	167	1	UNSIGNED8	X		C
Table max number		1	168	1	UNSIGNED8	X		C
Table option code		1	169	1	UNSIGNED8	X	X	S
Table status		1	170	1	UNSIGNED8	X	X	S
Linearisation: actual no. of points		1	171	1	UNSIGNED8	X	X	S
Gap reserved		1	172-181					
Gap		1	182-186					

* 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)

Endress+Hauser parameters								
Empty calibration	V0H1	1	187	4	FLOAT	X	X	S
Full calibration	V0H2	1	188	4	FLOAT	X	X	S
Display format	V0H3	1	189	1	UNSIGNED8	X	X	S
Damping	V0H4	1	190	4	FLOAT	X	X	S
Fail Safe	V0H7	1	191	1	UNSIGNED8	X	X	S
Linearisation table level	V2H2	1	192	4	FLOAT	X	X	S
Linearisation table volume	V2H3	1	193	4	FLOAT	X	X	S
Dry calibration unit	V3H1	1	194	2	UNSIGNED16	X	X	S
Density factor	V3H2	1	195	4	FLOAT	X	X	S
Zero offset	V3H3	1	196	4	FLOAT	X	X	S
Simulation mode	V9H6	1	197	1	UNSIGNED8	X	X	S
Simulation value	V9H7	1	198	4	FLOAT	X	X	S
Volume unit	VAH3	1	199	2	UNSIGNED16	X	X	S
Empty pressure	VAH6	1	200	4	FLOAT	X		N
Empty density	VAH7	1	201	4	FLOAT	X		N
Full pressure	VAH8	1	202	4	FLOAT	X		N
Full density	VAH4	1	203	4	FLOAT	X		N
Gap		1	204-208					

* 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 binär

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

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 (Pages 21-24) 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/FieldCare. Commuwin II/FieldCare 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. For further information, please refer to Operating Instructions BA 124F "Commuwin II".

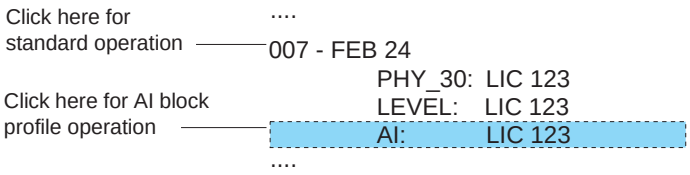
Operation via FieldCare

The operating of FieldCare are described in the integrated FieldCare online help. The PROFIdtmDPV1 server has to be installed for operation.

Operation via Commuwin II

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. Deltapilot S.
- Profile operation is selected by clicking on the appropriate tag, e.g. AI: LIC 123 = Analog Input Block Deltapilot 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 Deltapilot S on-site display and the digital output operate completely independently of one another. In the "Pressure" operating mode, the measured value is transmitted in "mbar". As standard in the "Level" operating mode, the digital OUT Value sends out 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 also to Chapter 3.5, Section "Slot/Index table" and Chapter 11.2 "Matrix Analog Input Block (AI Transmitter)",
– scale the limits of PV Scale and OUT Scale in Commuwin II in graphic mode, refer to figure below or
– confirm "Set unit to bus" parameter according to Chapter 7.4. 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

You have the following possibilities if you require an output value with a different scale for your PLC:
– Set the upper and lower limit values for PV scale and OUT scale in the Analog Input Block according to requirements. Refer also to Chapter 3.5, Section "Slot/Index table", Chapter 7.3 "Scaling OUT Value" and Chapter 11.2 "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.

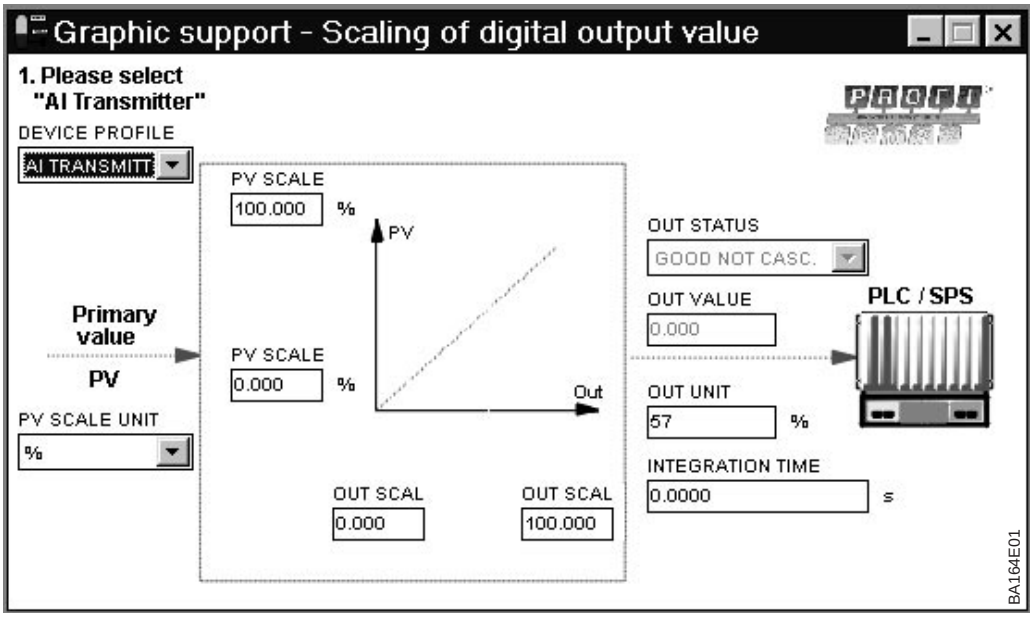


Figure 3.7
Scaling of the OUT Value via graphic support in Commuwin II

4 Operation

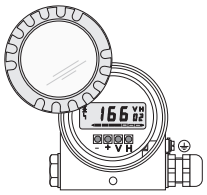
4.1 On-site operation

Operating matrix

The Deltapilot S is configured and operated by means of a 10 x 10 matrix. The matrix is illustrated in Chapter 11.1. In this matrix,

- each row is assigned to a function group and
- each field is assigned to a parameter.

The possible settings are described in Chapters 5-7. After entering all the parameters, you can lock the operation against unauthorised inputs, see Chapter 7.7.



Unscrew housing cover, the operating and display module is inserted and connected.

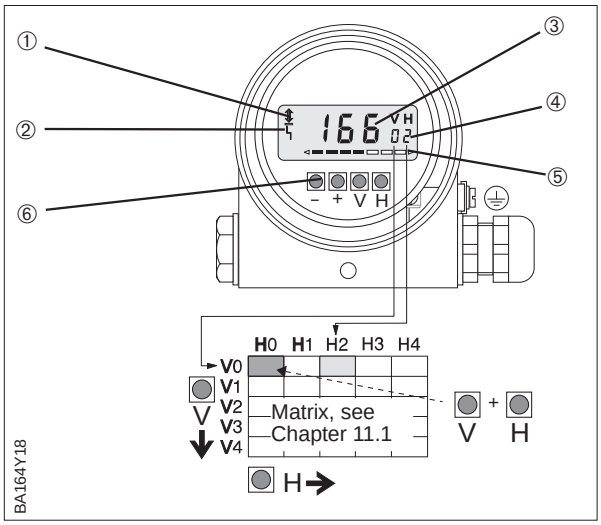


Figure 4.1
User interface of electronic insert with operating and display module FHB 20
① *Communication signal: lights on operation via PA interface*
② *Fault indication*
③ *4½-figure display of measured values and entry parameters*
④ *Current matrix position*
⑤ *Bar graph of measured value*
⑥ *Operating keys*

4.2 Operating and display module FHB 20

If ordered, the operating and display module is stowed away in the housing. It functions as follows:

Keys	Function
Selection of matrix field	
V	Selection of vertical matrix position
H	Selection of horizontal matrix position
V and H	Display springs to V0H0 when V and H pressed simultaneously
Parameter entry	
+ or –	Activates selected matrix position. The selected digit flashes.
+	Changes value of flashing digit by +1
–	Changes value of flashing digit by –1
+ and –	Resets the value entered to the original value, provided it has not yet been registered.
Registering entry	
V or H; V and H	Registers entry and quits the matrix field
Locking/Unlocking	
+ and V or – and H	+ and V lock, – and H unlock the matrix

Note!

Note!
Once you have set your device using the operating and display module FHB 20, you can disconnect it and use it to configure other Deltapilot S sensors.

4.3 Operation via Endress+Hauser operating program

Operation via FieldCare

FieldCare is an Endress+Hauser asset management tool based on FDT technologiy. With FieldCare, you can configure all Endress+Hauser devices as well as devices from other manufacturers that support the FDT standard.

FieldCare supports the following functions:

- Configuration of transmitters in online operation
- Loading and saving device data (upload/download)
- Documentation of the measuring point

Connection options:

- PROFIBUS PA via segment coupler and PROFIBUS interface card
- Graphic mode

Note!
For more information, see www.endress.com

Hinweis!

Operation via Commuwin II

When operating the Commuwin II display an operating program the Deltapilot 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 BA124F.

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 Product Portfolio → Process Solutions → Commuwin II → Updates/Downloads)

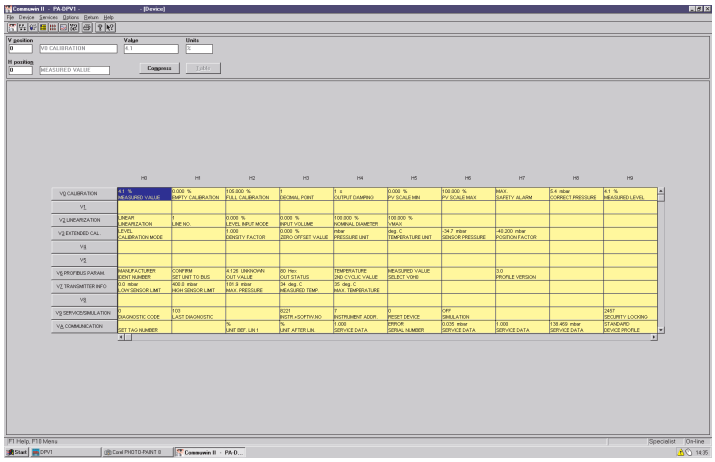
Hinweis!

Matrix mode (Menu Device)

You can configure the Deltapilot S using the "Device Data/Matrix Operation" menu. In this matrix,

- each row is assigned to a function group and
- each field is assigned to a 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. Refer also to Chapters 11.1 and 11.2.

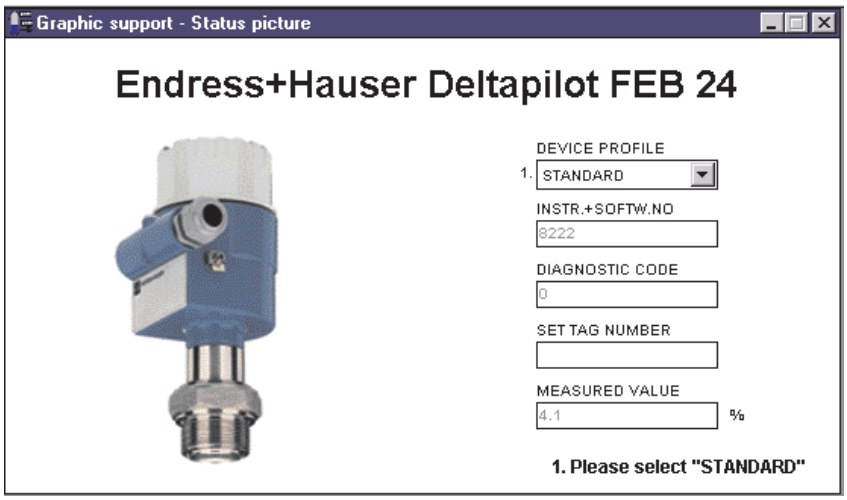


B164E02

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.



BA164E03

Figure 4.3
Menu "Device/Graphics" in Commuwin II

5 Level Measurement

This chapter describes the configuration which is required for level measurement with a Deltapilot S with electronic insert FEB 24 (P).

- Note on on-site operation
- Mounting position effects
- Empty and full calibration
- Dry calibration
- Linearisation

Other possible settings, such as damping or locking/unlocking the operation are explained in Chapter 7 "Other Settings".

Note on on-site operation!
You must confirm every parameter entry if you are configuring via the FHB 20 display module. Use the keys "V", "H" or "V" and "H" to confirm your entries. When you confirm with the "V" key, the display automatically goes forward a vertical matrix position, e.g. from V0H0 to V1H0. When you confirm with the "H" key, the display automatically goes forward a horizontal matrix position, e. g.: from V0H0 to V0H1. Confirm your entry by pressing the "V" and "H" keys simultaneously – the matrix position V0H0 is automatically displayed.
You have a choice for some parameters. Numbers are assigned to the various options for these parameters. Enter the corresponding number if configuring via the display module. The corresponding numbers are listed in brackets in the "Entry" column in the following tables, e. g. (=1).


Note!

Note Fieldcare!
The VH position corresponds to the parameter name in FieldCare.
Example: V0H0 = parameter name "V0H0".


Note!

5.1 Mounting position effects

Depending on the orientation of the device, there may be a slight shift in the measured value. This means that if the container is empty, the on-site display does not display zero but rather a very slight pressure. Please refer also to Chapter 10 "Technical data", "Position when calibrating". To correct the reading, enter the pressure difference for the "Position factor" parameter (V3H7). The "Sensor pressure" parameter (V3H6) displays the pressure currently measured.

#	VH	Entry	Significance
1	Reset parameter to factory setting if required please refer to Chapter 8.2 also. **Please note that a customer-specific calibration carried out by the factory is also reset to the default values during a reset!**		
	V9H5	333 or 7864 or 1	Reset parameter
2	Measured value (V0H0) display in calibration mode "Pressure" (V3H0) = 2.0 mbar = Sensor pressure (V3H6) display = position-dependent pressure		
3	Read off currently measured pressure in the matrix field V3H6.		
	V3H6	–	Read off value e. g. 2 mbar
4	V3H7	2 (mbar)	Correct display value

Result:
- The pressure value entered for the "Position factor" parameter (V3H7) is subtracted from the "Sensor pressure" (V3H6) currently measured.
- The "Corrected pressure" parameter (V0H8) displays the corrected pressure value.

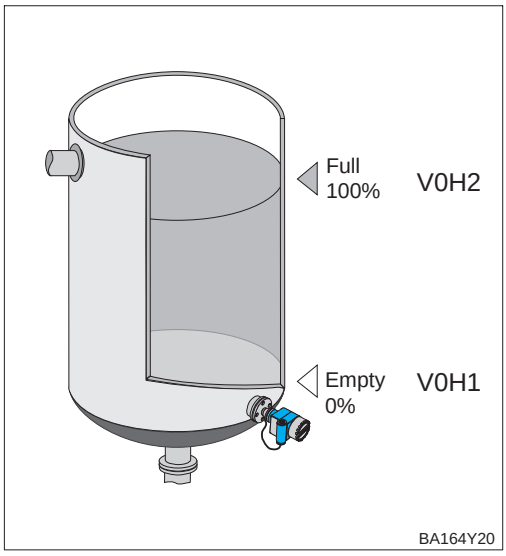
5.2 Empty and full calibration

The container is filled or emptied for this calibration. If the container cannot be completely filled or emptied, partial filling or emptying is also possible. The further apart the "empty" and "full" calibration points are, the more exact the measurement result. By entering a value for each of the parameters "Empty calibration" (V0H1) and "Full calibration" (V0H2), you assign a level to the currently measured pressure.
Empty and full calibration can also be carried out in reversed order. In this case, carry out the calibration for the "empty" point first and then for the "full" point.

The prerequisites for an empty and full calibration are as follows:

- The Deltapilot S is mounted.
- The container can be filled or emptied.

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1.		
2	V3H0	Level (= 0)	Select calibration mode
3	VAH2	%	Select unit
4	Fill container to the "empty" level.		
5	V0H1	e. g. 0%	Assign a value for "empty" level to the measured pressure
6	Fill container to the "full" level.		
7	V0H2	e. g. 100%	Assign a value for "full" level to the measured pressure



Result:
- The V0H0 matrix field displays the measured value in the unit of calibration – here in % for example.

Selecting unit (Unit before linearisation – VAH2)

For the "Level" calibration mode, a unit for level, volume or weight can be selected by means of the "Unit before linearisation" parameter (VAH2). The unit is for display purposes only. This means that if a new unit is selected, the parameters are not converted. You can choose from the units in the following table.

Units for "Unit before linearisation" parameter			
%	m	cm	dm
ft	inch	l	hl
m^3	dm^3	cm^3	ft^3
us gal	Imp gal	kg	t
lb	ton	None	

#	VH	Entry	Significance
1	e. g. Measured value (V0H0) = 45%		
2	VAH2	e. g. hl	Select new unit
3	Measured value (V0H0) = 45 hl		

Note!

Note!
The "Unit before linearisation" parameter (VAH2) cannot be selected by means of the display module.

Density correction

If calibration is to take place with water, or if the product changes at a later stage, simply correct your calibration values by entering a density factor.

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

Calculating the density factor

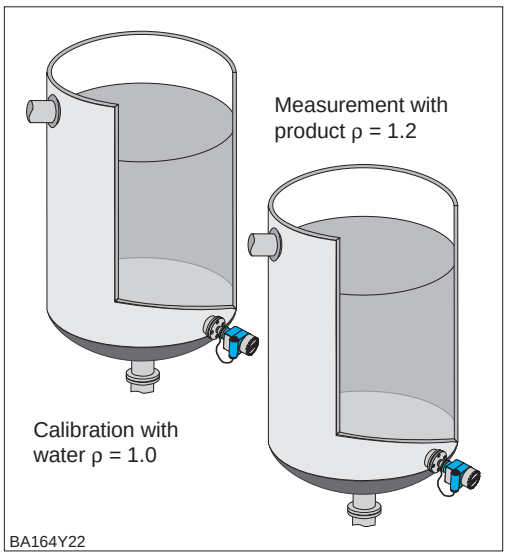
Example: A container is filled with water and calibrated. The density of water (old density) is 1 g/cm^3. The container is used later as a storage tank and is filled with the new fluid to be measured. The new density is 1.2 g/cm^3. The "Density factor" parameter (V3H2) still displays the factory setting "1", i.e. the current factor is 1.

$$\text{Density factor} = 1 \times \frac{1.2\ \text{g/cm}^3}{1\ \text{g/cm}^3} = 1.2$$

#	VH	Entry	Significance
1	e. g. Measured value (V0H0) = 75%		
2	V3H2	e. g. 1.2	Density factor
3	Measured value (V0H0) = 62.5%		

Result:

- The matrix field V0H0 displays the measured value adjusted to the new product.



Note!

- The density factor affects the level measurement. Please ensure that you use the new density factor if the product density changes.
- If you change from the "Level" calibration mode to the "Dry calibration.H" or "Dry calibration.%" calibration mode, the "Zero offset value" (V3H3) and "Density factor" (V3H2) parameters are reset to the factory setting.

Note!

5.3 Dry calibration

Dry calibration is a theoretical calibration which you can carry out even if the Deltapilot S is not mounted or if the container is empty. The "Empty" calibration point is always at the probe mounting point. The "Empty calibration" parameter (V0H1) is not displayed in the "Dry calibration.H" and "Dry calibration.%" calibration modes. The parameter is automatically set to zero. Zero offset must be carried out if measurement is to start at another level.

You have a choice between two dry calibration modes via "Calibration mode" (V3H0):

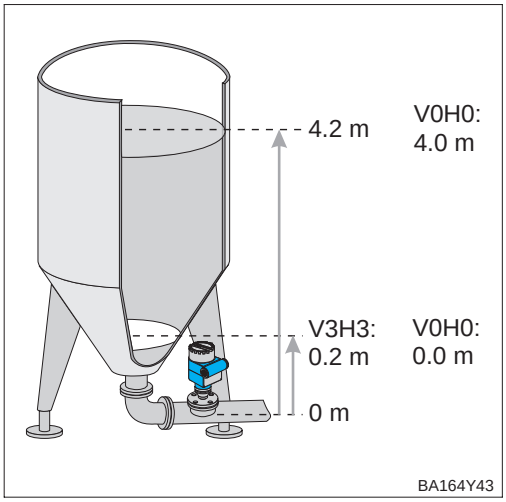
- Dry calibration.H (= 1): Measured value display in the unit selected
  Select the unit by means of the "Select unit" parameter (V3H1).
- Dry calibration.% (= 2): Measured value display in %

Calibration
Dry calibration.H

The prerequisites for a dry calibration.H are as follows:

- The density factor is known.
- The pressure for the maximum level should not exceed the high sensor limit (p = ρgh).

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1.		
2	V3H0	Dry calibration.H (= 1)	Select calibration mode
3	V3H1	e. g. m (= 0)	Select unit
4	V3H2	e. g. 1.2	Set density factor
5	V3H3	e. g. 0.2 m	Set zero offset value



Result:

- The measured value in V0H0 displays the current level at the value corrected by the zero offset, e.g. in meters in this example.

Selecting unit
(Select unit – V3H1)

A unit for level can be selected for the "Dry calibration.H" calibration mode by means of the "Select unit" parameter (V3H1). Once a new unit is selected, the parameters, such as the "Measured value", are converted and displayed with the new unit. You can choose from the units in the following table. Enter the corresponding number if configuring via the display module.

No.	Unit	No.	Unit	No.	Unit
0	m	1	cm	2	ft
3	inch				

#	VH	Entry	Significance
1	e. g. Measured value (V0H0) = 4 m		
2	V3H1	e. g. inch (=3)	Select new unit
3	Measured value (V0H0) = 157.48 inch		

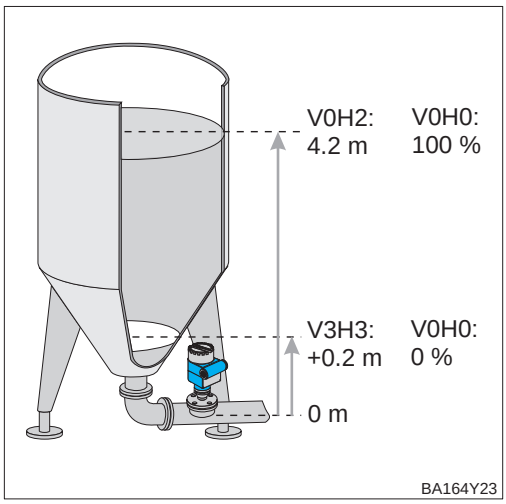
Calibration
Dry calibration.%

In this calibration mode, enter the maximum level value for the "Full calibration" parameter (V0H2). 100% is automatically assigned to this value. The measured value is automatically converted to a %.
Always enter a unit of length for the maximum level for the "Full" calibration point (V0H2) and the "Zero offset value" (V3H3). Select the unit with the "Select unit" parameter (V3H1).

The prerequisites for the dry calibration.% are as follows:

- The density factor is known.
- The level for the "full" calibration point is known for the "Dry calibration.%" calibration mode. Any zero offset value is taken into account.
- The pressure for the maximum level should not exceed the high sensor limit ($p = \rho g h$).

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1.		
2	V3H0	Dry calibration.% (= 2)	Select calibration mode
3	V3H1	e. g. m (= 0)	Select unit
4	V3H2	e. g. 1.2	Set density factor
5	V3H3	e. g. 0.2 m	Set zero offset value
6	V0H2	e. g. 4.2 m	Assign maximum level value 100%



Result:
- The measured value in V0H0 displays the current level at the value corrected by the zero offset. The measured value is automatically displayed in %.

Note!
After the zero offset, all further entries, e.g. for linearisation as per Chapter 5.4, refer to the adjusted zero point.

Note!

Correction after installation

The first filling of the container should be supervised carefully after a dry calibration so that any possible errors or inaccuracies can be identified immediately. A dry calibration which has been carried out can be applied to the "Level" calibration mode. Any errors or inaccuracies can then be corrected in this calibration mode.

Note!

Note!

- If you change from the "Dry calibration.H" or "Dry calibration.%" calibration mode to the "Level" calibration mode, the "Zero offset value" (V3H3)" and "Density factor" parameters (V3H1) are carried over. Pay special attention to both parameters when making corrections in the "Level" calibration mode. For example, if you have carried out a zero offset during the dry calibration, the values for the "empty" (V0H1) and "full" (V0H2) calibration points always refer to the installation site of the sensor.
- If you change from the "Dry calibration.%" calibration mode to the "Level" calibration mode, the parameters "Empty calibration" (V0H1), "Full calibration" (V0H2) and "Zero offset value" (V3H3) are converted to %. The pressure values assigned to the "Empty calibration" and "Full calibration" parameters are displayed in the matrix fields "Service data, pressure value at empty calibration" (VAH6) and "Service data, pressure value at full calibration" (VAH4).

Example

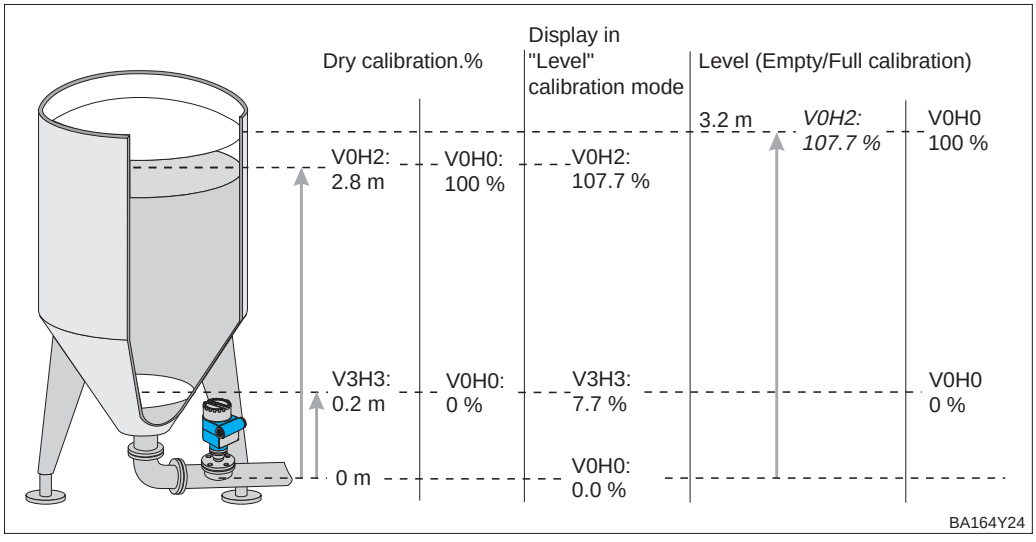
A dry calibration is carried out for level measurement. The actual maximum level is achieved during operation. The value for the "Full" calibration point is corrected in the "Level" calibration mode.

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1.		
2	V3H0	Dry calibration.% (= 2)	Select calibration mode
3	V3H1	e. g. m (= 0)	Select unit
4	V3H3	e. g. 0.2 m	Set zero offset value
5	V2H0	e. g. 2.8 m	Assign maximum level value 100%

#	VH	Entry	Significance
6	V3H0	Level (= 0)	Change calibration mode
	Display in "Level" calibration mode: – Empty calibration (V0H1) = 0.0% – Full calibration (V0H2) = 107.7% – Zero offset value (V3H3) = 7.7%		
7	The container is filled to the maximum level, for example.		
8	V0H2	e. g. 107.7%	Assign a value for "full" level to the measured pressure

Result:

- The matrix field V0H0 now displays the corrected level.



5.4 Linearisation

Linearisation mode

Linearisation makes volume or weight measurement possible in containers with a conical outlet, for example, in which the volume or weight is not directly proportional to the level. The table provides an overview of the linearisation functions which are available for the "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes. Enter the corresponding number if configuring via the display module.

Entry V2H0	Linearisation mode V2H0	Significance
0	linear (factory setting)	The container is linear, e. g. vertical cylindrical tank. If calibration was carried out in a volume unit, the measured value can be read off in the volume unit without any further input.
1	Activate table	A linearisation table entered does not come into effect until it is activated.
2	Manual	The container must neither be filled nor emptied for manual mode. A max. of 11 value pairs made up of a level and the corresponding volume or weight are entered for a linearisation curve.
3	Semiautomatic	The tank is gradually filled or emptied in semiautomatic mode. The Deltapilot S automatically records the level via the hydrostatic pressure; the associated volume is entered.
4	Clear table	Any tables which may exist must be cleared before entering a linearisation table. In doing so, the linearisation mode automatically switches to linear.
5	Horizontal cylinder	Select this linearisation mode for horizontal cylindrical containers. The table is saved to the program memory. You must only enter the cylinder diameter and the cylinder volume.

Warnings

While entering a linearisation table, the "Diagnostic code" parameter (V9H0) and the display module display the error code "E605". The red alarm-LED on the display module is lit.

Code	Type	Significance
E605	Error	The manual linearisation curve is incomplete. The error message disappears once the linearisation curve is activated.

Once activated, the plausibility of the linearisation curve is checked.
The following warnings can occur:

Code	Type	Significance
E602	Warning	The linearisation curve does not increase monotonically. The number of the last valid value pair automatically appears in V2H1. It may be necessary to re-enter all value pairs starting from this number.
E604	Warning	The linearisation curve comprises less than two value pairs. Add another value pair.

Prerequisites

The prerequisites for a manual and semiautomatic linearisation are as follows:

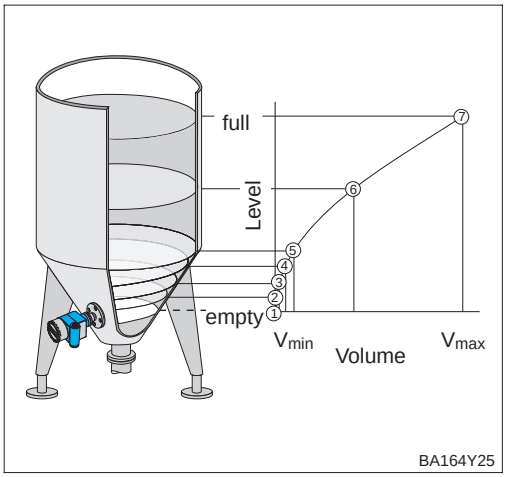
- Basic calibration, empty, full or dry calibration, was carried out.
- The value pairs for the points of the linearisation curve are known, min.: 2 value pairs, max.: 11 value pairs.
- The linearisation curve must be monotonic ascending.
- To achieve a more exact measurement result, the levels for the first and last point of the linearisation curve should correspond to the minimum and maximum level.
- The parameter by means of which you select the unit for the "Level input mode" (V2H2) and "Nominal diameter" (V2H4) parameters, is dependent on the calibration mode. Please refer also to Section "Units", Page 40.

Note!

Note!
If you have carried out a zero offset, all further entries refer to the adjusted zero point.

Manual entry

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1.		
2	Carry out calibration as per Chapter 5.2 or 5.3.		
3	V2H0	Clear (= 4)	Clear existing curve
4	V2H0	Manual (= 2)	Select linearisation mode
5	VAH3	e. g. hl	Select unit
6	V2H1	e. g. 1	1st value pair
7	V2H2	e. g. 0	Level point 1
8	V2H3	e. g. 0.6 (hl)	Volume point 1
9	Repeat steps 6...8, min.: 2 value pairs, max.: 11 value pairs		
10	V2H0	Table (= 1)	Activate table



Result:

- The matrix field (V0H0) displays the current volume, e.g. in hectolitres in this example.
- The matrix field (V0H9) displays the current level.

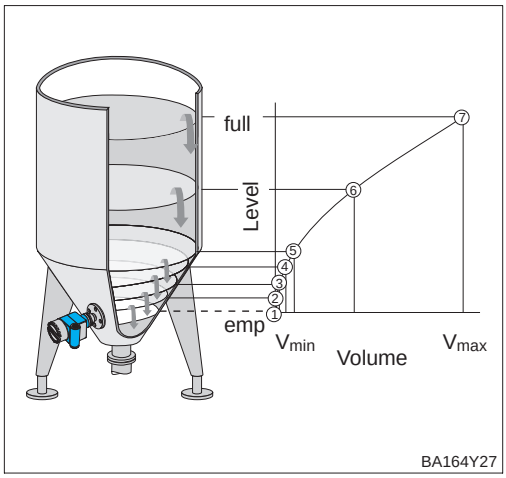
Semiautomatic entry

The container can, for example, be filled during calibration and emptied gradually during linearisation. The level is automatically calculated via the hydrostatic pressure. You must enter the associated volume or weight.

Note!
If you empty the container and then enter the linearisation curve, start with the highest value pair. See table below, steps 6…8.

Note!

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1.		
2	Carry out calibration as per Chapter 5.2 or 5.3.		
3	V2H0	Clear (= 4)	Clear existing curve
4	V2H0	Semiautom. (= 3)	Select linearisation mode
5	VAH3	e.g.	Select unit
6	V2H1	e.g. 7	7th value pair
7	V2H2	Read value	Current level
8	V2H3	e.g. 0.6 (hl)	Enter volume for point 7
9	Repeat steps 6...8, min.: 2 value pairs, max.: 11 value pairs		
10	V2H0	Table (= 1)	Activate table



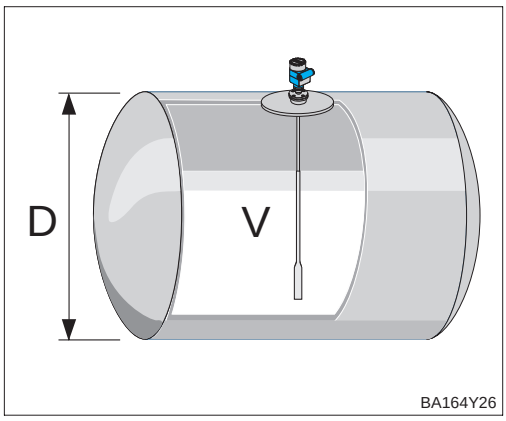
Result:
- The matrix field (V0H0) displays the current volume or weight.
- The matrix field (V0H9) displays the current level.

Horizontally cylindrical tank

The device accesses a preset linearisation table for horizontally cylindrical tanks; only the following values must be entered:

- Tank nominal diameter, D (V2H4). The entry is in the units for basic calibration. Please refer also to the following section "Units".
- Maximum tank volume or weight, V (V2H5). The entry is in the unit required. Please refer also to the following section "Units".

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1.		
2	Carry out calibration as per Chapter 5.2 or 5.3.		
3	V2H0	Horiz. cylindrical (= 5)	Select linearisation mode
4	VAH3	e. g. hl	Select unit
5	V2H4	D	Enter tank diameter
6	V2H5	V	Enter tank volume



Result:
- The matrix field (V0H0) displays the current volume or weight.
- The matrix field (V0H9) displays the current level.

Units

The parameter by means of which you select the unit for the "Level input mode" (V2H2) and "Nominal diameter" (V2H4) parameters, is dependent on the calibration mode. In the "Level" calibration mode, the parameters are not converted when a new unit is selected. Always select the unit for the "Input volume" (V2H3), "Max. volume" (V2H5) and "Measured value" (V0H0) parameters by means of the "Unit after linearisation" parameter (VAH3). The parameters are not converted if a new unit is selected.

The following table shows the assignment of the calibration mode and the choice of unit:

	Calibration mode (V3H0)		
	Level	**Dry calibration.H**	**Dry calibration.%**
Select unit for – basic calibration as per Chapter 5.2 or 5.3 – Level input mode (V2H2) – Nominal diameter (V2H4)	Unit before linearisation (VAH2)	Select unit (V3H1)	automatically in %
Convert parameter mentioned above if unit is changed.	no	yes	–
Select unit for – Input volume (V2H3) – Max. volume (V2H5) – Measured value (V0H0)	Unit after linearisation (VAH3)	Unit after linearisation (VAH3)	Unit after linearisation (VAH3)
Convert parameter mentioned above if unit is changed.	no	no	no

Selecting unit (Unit after linearisation – VAH3)

The following units are available by means of the "Unit after linearisation" parameter (VAH3):

Units for "Unit after linearisation" parameter			
%	m	cm	dm
ft	inch	l	hl
m^3	dm^3	cm^3	ft^3
us gal	Imp gal	kg	t
lb	ton	None	

Note!

Note!
The "Unit after linearisation" parameter (VAH3) cannot be selected by means of the display module.

6 Pressure and Differential Pressure Measurement

In the "Pressure" calibration mode, the on-site display and the "Measured value" parameter (V0H0) display the measured pressure value. The measuring range corresponds to the data on the nameplate. As standard, the measured value is transmitted via the bus in the pressure unit stated on the nameplate. Using two Deltapilot S units, you can, for example, measure the differential pressure in a pressurised tank. This chapter contains the following information:

- Note on on-site operation
- Mounting position effects
- Pressure measurement
- Differential pressure measurement

Other possible settings, such as damping or locking/unlocking the operation are explained in Chapter 7 "Other Settings".

Note on on-site operation!

Note!

You must confirm every parameter entry if you are configuring via the FHB 20 display module. Use the keys "V", "H" or "V" and "H" to confirm your entries. When you confirm with the "V" key, the display automatically goes forward a vertical matrix position, e.g. from V0H0 to V1H0. When you confirm with the "H" key, the display automatically goes forward a horizontal matrix position, e. g.: from V0H0 to V0H1. Confirm your entry by pressing the "V" and "H" keys simultaneously – the matrix position V0H0 is automatically displayed.
You have a choice for some parameters. Numbers are assigned to the various options for these parameters. Enter the corresponding number if configuring via the display module. The corresponding numbers are listed in brackets in the "Entry" column in the following tables, e. g. (=1).

6.1 Mounting position effects

Depending on the orientation of the device, there may be a slight shift in the measured value. This means that if the container is empty, the on-site display does not display zero but rather a very slight pressure. Please refer also to Chapter 10 "Technical data", "Position when calibrating". To correct the reading, enter the pressure difference for the "Position factor" parameter (V3H7). The "Sensor pressure" parameter (V3H6) displays the pressure currently measured.

#	VH	Entry	Significance
1	Reset parameter to factory setting if required, please refer to Chapter 8.2 also. **Please note that a customer-specific calibration carried out by the factory is also reset to the default values during a reset!**		
	V9H5	333 or 7864 or 1	Reset parameter
2	Measured value (V0H0) display in calibration mode "Pressure" (V3H0) = 2.0 mbar = Sensor pressure (V3H6) display = position-dependent pressure		
3	Read off currently measured pressure in the matrix field V3H6.		
	V3H6	–	Read off value e. g. 2 mbar
4	V3H7	2 (mbar)	Correct display value

Result:
- The pressure value entered for the "Position factor" parameter (V3H7) is subtracted from the "Sensor pressure" (V3H6) currently measured.
- The "Corrected pressure" parameter (V0H8) displays the corrected pressure value.

6.2 Pressure measurement

In this calibration mode, the measured pressure is output directly as "Measured value" (V0H0). Select the pressure unit by means of the "Pressure unit" parameter (V3H4).

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 6.1.		
2	V3H0	Pressure (= 3)	Select calibration mode
3	V3H4	e. g. mbar (= 0)	Select pressure unit (see table below)

Result:
- The matrix field V0H0 displays the current pressure measured value in the pressure unit selected, e.g. here in mbar.

Selecting the pressure unit

You can select another pressure unit by means of the "Pressure unit" parameter (V3H4). If a new pressure unit is selected in V3H4, all pressure-specific parameters are converted and displayed with the new pressure unit in Commuwin II. You do not have to recalibrate. You can choose from the pressure units in the table below. Enter the corresponding number if configuring via the display module.

#	VH	Entry	Significance
1	All pressure-specific parameters are displayed in the pressure unit mbar. e. g. Measured value (V0H0) = 100 mbar		
2	V3H4	psi (= 4)	Select new pressure unit
3	All pressure-specific parameters are displayed in the pressure unit psi. Measured value (V0H0) = 1.45 psi		

No.	Unit	No.	Unit	No.	Unit
0	mbar	1	bar	2	m H_2O
3	mm H_2O	4	psi	5	ft H_2O
6	in H_2O	7	Pa	8	MPa
9	hPa	10	mm Hg	11	in Hg
12	g / cm^2	13	kg / cm2	14	lb / ft^2
15	kgf / cm^2				

Note!

Note!
As standard, the measured value is transmitted via the bus in the pressure unit stated on the nameplate. The "Set unit to bus" parameter in V6H1 must be confirmed once so that the digital output value (OUT Value) and the "Measured value" (V0H0) display the same value even after a new pressure unit has been selected. Please note that changing the digital output value could have an effect on the control. Please refer also to Chapter 7.4.

#	VH	Entry	Significance
1	e. g. Measured value (V0H0) = 100 mbar		
2	V3H4	psi (= 4)	Select new pressure unit
3	Measured value display (V0H0) = 1.45 psi The value 100 is still transmitted via the bus. OUT Value display (V6H2) = 100.0 UNKNOWN		
4	V6H1	Confirm "Set unit to bus" with Enter	OUT Value display (V6H2) = 1.45 psi

Result:
- The "Measured value" (V0H0) and the digital output value (OUT Value) are equal. Here the value 1.45 (psi), for example, is transmitted via the bus.

6.3 Differential pressure measurement

Using two Deltapilot S units, you can, for example, measure the differential pressure in a pressurised tank. The pressure measured values of the two probes are sent to a PLC. The PLC calculates the pressure difference and, if necessary, calculates the level or the density from this.

Sample measurement in a pressurised tank: **Example**

- Probe ① measures the total pressure (hydrostatic pressure and head pressure).
- Probe ② only measures the head pressure.

Note!

- The measuring cells of the two probes must be suitable for the measuring task.
- The measuring diaphragm of probe ② must not be flooded. This creates an additional hydrostatic pressure which makes the measurement incorrect.
- The ratio of hydrostatic pressure to head pressure should be max. 1:6.
- The pressure units selected and the scaling of the OUT Value for both probes must match. Please refer to Chapter 7.3.

Note!

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 6.1.		
2	V3H0	Pressure (= 3)	Select calibration mode
3	V3H4	e. g. mbar (= 0)	Select pressure unit (see Table page 39)
4	Scale OUT Value, see Chapter 7.3		
5	Calibrate probe 2 as per steps 1-4		

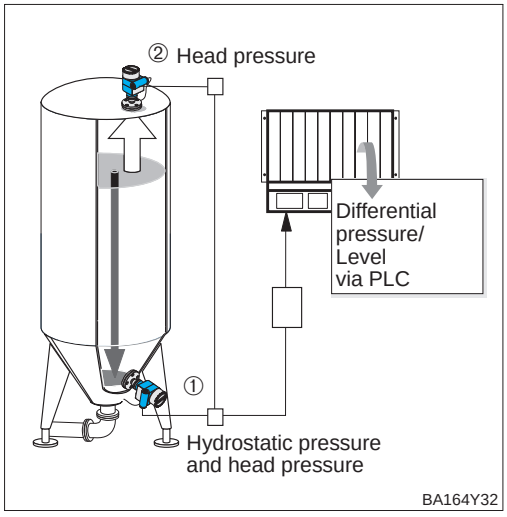


Figure 6.1
Example: measurement in a pressurised tank

Result:

- The PLC calculates the pressure difference from the total pressure and head pressure. If necessary, the level and density can also be calculated.
- The measured values (V0H0) and on-site displays both display the measured pressure.
  Deltapilot ①: hydrostatic pressure and head pressure;
  Deltapilot ②: head pressure

Note!

The on-site display can also display a cyclical output value from the PLC, such as the pressure difference for example. To do so, you must set the "Select V0H0" parameter (V6H5) to "Display value" (or 1). Please refer also to Chapter 3.4.

Note!

7 Other Settings

This chapter describes additional possible settings for a Deltapilot S with electronic insert FEB 24 (P).

- Not on on-site operation
- Output damping (Integration time τ)
- Safety alarm
- Scaling OUT Value
- "Set unit to bus" parameter
- Simulation
- Operation locking/unlocking
- Measuring point information

Note on on-site operation!

Note!

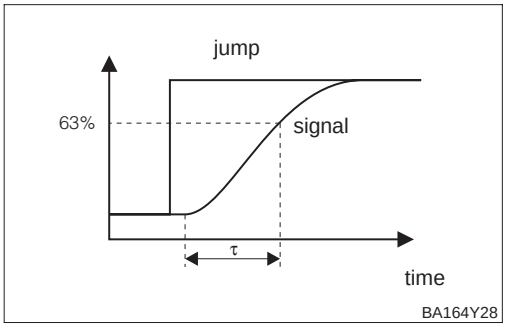
You must confirm every parameter entry if you are configuring via the FHB 20 display module. Use the keys "V", "H" or "V" and "H" to confirm your entries. When you confirm with the "V" key, the display automatically goes forward a vertical matrix position, e.g. from V0H0 to V1H0. When you confirm with the "H" key, the display automatically goes forward a horizontal matrix position, e. g.: from V0H0 to V0H1. Confirm your entry by pressing the "V" and "H" keys simultaneously - the matrix position V0H0 is automatically displayed.
You have a choice for some parameters. Numbers are assigned to the various options for these parameters. Enter the corresponding number if configuring via the display module. The corresponding numbers are listed in brackets in the "Entry" column in the following tables, e. g. (=1).

7.1 Damping

Output damping (Integration time τ)

The output damping affects the speed at which the V0H0, V0H8 and V0H9 displays react to changes in the level. By increasing the output damping, the influence of agitated fluid surfaces on the measured value display and the maximum indicator function, for example, can be attenuated.

#	VH	Entry	Significance
1	V0H4	e. g. 30 (s)	Output damping (0...99 s)

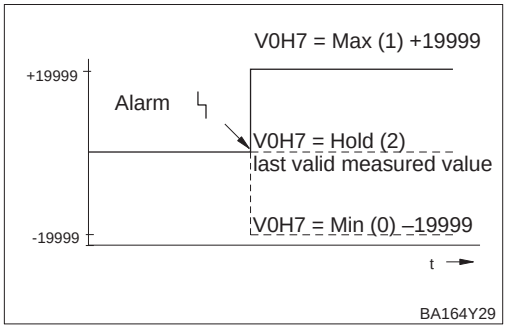


7.2 Safety alarm

Safety alarm

In the event of a fault, an error code is transmitted with the measured value. The display adopts the value you selected.

#	VH	Entry	Significance
1	V0H7	e. g. Min (0)	Safety alarm Min (0) = –19999 Max (1) = +19999 Hold (2) = last valid measured value



Note!

The "Safety alarm" parameter (V0H7) only affects the on-site display and the matrix field V0H0. The PROFIBUS-PA "Fail safe type" and "Fail safe value" parameters must be used for the OUT Value of the Analog Input Block. Please refer to Chapter 3.5, Section "Slot/Index table, Analog Input Block" and Chapter 11.2 "Matrix Analog Input Block (AI transmitter).

Please refer to the PROFIBUS-PA specification, Part 3 for further information.

Note!

7.3 Scaling OUT Value

The Deltapilot S on-site display or the "Measured value" (V0H0) and the digital output value (OUT Value) are not interdependent.
Use the "PV Scale min" (V0H5) and "PV Scale max" (V0H6) parameters to scale the output value of the Transducer Block. A standardised value between 0…1 appears after this scaling and is also displayed on the bar graph in the display module.

The value "0" is assigned to the "PV Scale min" parameter and the value "1" to the "PV Scale max" parameter. You can destandardise the value by means of the "OUT Scale min" and "OUT Scale max" Analog Input parameters and rescale it to your own requirements. The factory setting for both parameters is "PV Scale min" = 0 and "PV Scale max" = 100. The unit with which these parameters are displayed depends on the calibration mode (V3H0) and linearisation mode (V2H0) selected.

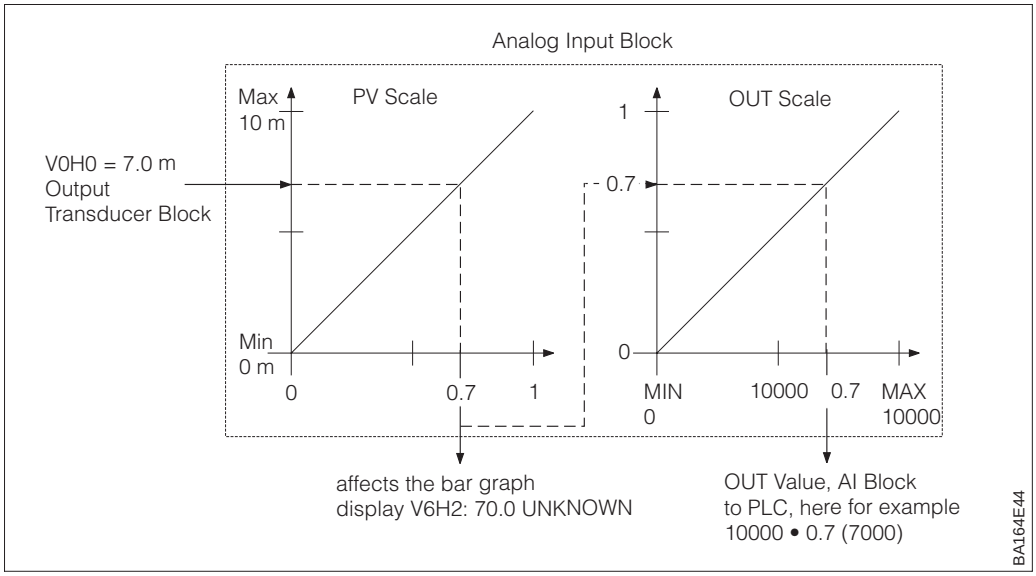
Example

A Deltapilot S with a 0...1200 mbar measuring cell is used for level measurement in a tank 10 m in height. In the "Dry calibration.H" calibration mode, the "PV Scale min" and "PV Scale max" parameters display 0 m and 100 m.

Task:
- Optimum use of the bar graph in the display module.
- Rescale the OUT Value to 0…10000.

#	VH	Entry	Significance
1	Carry out dry calibration as per Chapter 5.3. Select unit "m" by means of the "Select unit" parameter (V3H1).		
2	– PV scale min display (V0H5) = 0 m – PV Scale max display (V0H6) = 100 m		
3	V0H5	–	0 m remains set for PV Scale min.
4	V0H6	10 m	Set 10 m for PV scale max
5	VAH0	AI Transmitter	Change to the Analog Input Block diagram
6	V1H3 AI Block	–	Value 0 remains set for OUT Scale min
7	V1H4 AI Block	10000	Set 10000 for OUT Scale max

Result:
The OUT Value is scaled for a range 0…10000. At a level of 7 m, for example, an OUT Value of 7000 is output to the PLC.



7.4 "Set unit to bus" parameter

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

In the following situations, the digital output value (OUT Value) and the on-site display or the "Measured value" parameter (V0H0) do not display the same value:
– if you change the calibration mode
– if you change the values of the "PV Scale min" (V0H5) and "PV Scale max" (V0H6) parameters,
– if you change the values of the "OUT Scale min" and "OUT Scale max" parameters,
– or if you change the unit.

You have the following options to make the digital output and the display output the same value:
– Set the value for the upper and lower limit of PV Scale and OUT Scale in the Analog Input Block as equal; PV Scale min = OUT Scale min and PV Scale max = OUT Scale max. Please refer also to Chapter 3.5, Section "Slot/Index table" and Chapter 11.2 "Matrix Analog Input Block (AI Transmitter)",
– Scale the limits of PV Scale and OUT Scale in Commuwin II in graphics mode, see Chapter 3.7.
– Confirm "Set unit to bus" parameter (V6H1). By confirming this parameter, the values for PV Scale and OUT Scale are automatically set equal. Please refer to the following section.

Example

Changing pressure unit from "mbar" to "psi":

#	VH	Entry	Significance
1	e. g. Measured value (V0H0) = 100 mbar		
2	V3H4	psi (= 4)	Select new pressure unit
3	Measured value display (V0H0) = 1.45 psi The value 100 is still transmitted via the bus. OUT Value display (V6H2) = 100.0 UNKNOWN		
4	V6H1	Confirm "Set unit to bus" with Enter	Display OUT Value (V6H2) = 1.45 psi

Result:
The "Measured value" (V0H0) and the digital output value (OUT Value) are equal. Here the value 1.45 (psi), for example, is transmitted via the bus.

Note!
- If the matrix field V6H2 still also displays UNKNOWN, the "Set unit to bus" parameter in the matrix field V6H1 has not been confirmed.
- If you confirm the "Set unit to bus" parameter (V6H1), please note that a change in the digital output value could affect the control.

Note!

7.5 Simulation value

Simulation gives you the possibility of checking your calibration and simulating a measured value. You have the following options:

- Pressure simulation
- Level simulation
- Volume simulation

The simulation modes "Level" and "Volume" are not available for the "Pressure" calibration mode (V3H0).

When operating by means of the display module, select the simulation mode by entering the corresponding number.

No.	Mode	No.	Mode	No.	Mode
0	Off	1	Pressure	2	Level
3	Volume				

Note!

Note!
- As soon as you activated the simulation, the error message signal flashes on the display and the "Diagnostic code" parameter (V9H0) displays the warning W 613. This status remains for the duration of the simulation.
- To return to standard operation, you must deactivate the simulation by means of the "Simulation" parameter (V9H6) = Off.
- The device automatically returns to normal operation after an interruption in power supply, after a reset or after a change in calibration mode.

Pressure simulation

A pressure measured value is simulated in this simulation mode. The corrected pressure (V0H8) is always simulated. Depending on the calibration and linearisation mode, the measured value (V0H0) displays a value for pressure, level or volume. Select the unit for the simulation value by means of the "Pressure unit" parameter (V3H4). The value entered must lie between the low and high sensor limit (V7H0 / V7H1).

#	VH	Entry	Significance
1	V9H6	Pressure (= 1)	Select simulation mode
2	V3H4	mbar (= 0)	Select unit
3	V9H7	e. g. 40 mbar	Set simulation value

Result:
- In the "Pressure" calibration mode, the "Measured value" (V0H0) displays the pressure value entered, for example 40 mbar here.

#	VH	Entry	Significance
1	If necessary, correct reading due to mounting position effects as per Chapter 5.1 or 6.1.		
2	V3H0	Dry calibration.H (=1)	Select calibration mode
3	V3H1	e. g. m (= 0)	Select unit
4	V3H2	e. g. 1.2	Set density factor
5	V0H3	2	Set number of places after decimal point
6	V9H6	Pressure (= 1)	Select simulation mode
7	V3H4	mbar (= 0)	Select unit
8	V9H7	e. g. 40 mbar	Set simulation value

Result:
- In the "Dry calibration" calibration mode, the measured value displays the calculated level value.

Level simulation

A level value is simulated in this simulation mode. The value entered must lie between –19999 and +19999. If you have selected "Linear" linearisation (V2H0), the measured value (V0H0) displays a level value. If you have selected "Activate table" or "Horiz. cylindrical" linearisation (V2H0), the measured value (V0H0) displays the matching volume value. In this way you can check the linearisation curve entered, for example.
The units for the "Simulation value" (V9H6) and "Measured value" (V0H0) parameters depend on the calibration mode and linearisation mode selected. In the "Dry calibration.H" calibration mode, always enter the simulation values in meters.

#	VH	Entry	Significance
1	V9H6	Level (= 2)	Select simulation mode
2	V3H1	e. g. m (= 0)	Select unit
3	V9H7	40 m	Set simulation value

Volume simulation

A volume value is simulated in this simulation mode. The value entered must lie between –19999 and +19999. In this way, the settings for "PV Scale min" and "PV Scale max" are checked, for example.
Select the unit for the simulation value by means of the "Unit after linearisation" parameter (VAH3). The volume corresponds to the level if no linearisation curve has been entered.

#	VH	Entry	Significance
1	V9H6	Volume (= 3)	Select simulation mode
2	VAH3	e.g. hl	Select unit
3	V9H7	e.g. 40 hl	Set simulation value

7.6 OUT Value and AI Block simulation

It is possible to simulate either the output value (OUT Value) or the function of the Analog Input Block. The matrix fields in brackets indicate the matrix position in the Analog Input Block diagram in Commuwin II; please refer also to Chapter 11.2 "Matrix Analog Input Block (AI Transmitter)."

OUT Value simulation

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

1. If necessary, unlock the matrix by means of the matrix field V9H9 with code 2457 or 333.
2. Change from the standard diagram to the Analog Input Block diagram by means of the matrix field VAH9.
3. Set mode of "Target Mode" parameter (V8H0) to "on".
   – Now you can directly enter a simulation value for the "OUT Value" (V0H0).
   – Then check the change in the OUT Value at the PLC, for example.
4. Reset "Target Mode" parameter to "off".

Note!

Note!
Commuwin II provides another possibility for specifying an OUT Value by means of the graphic operation, "Simulation AI Block " menu.

Analog Input Block simulation

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

1. If necessary, unlock the matrix by means of the matrix field V9H9 with code 2457 or 333.
2. Change from the standard diagram to the Analog Input Block diagram by means of the matrix field VAH9.
3. Set "Simulation Mode" parameter in the Analog Input Block (V7H2) to "on".
   – Now you can directly enter a simulation value for "Simulation value" (V7H0) or you can change the value for "OUT Scale min" (V1H3) and "OUT Scale max" (V1H4)
   – Then check the altered OUT Value (V0H0) and at the PLC.
4. Reset "Simulation" parameter to "off".

7.7 Operation locking/unlocking

Once all parameters have been entered, the operation can be locked:

- by means of the keys on the display and operating module FHB 20
- by means of the matrix by entering a code. Apart from the numbers 2457 and 333, you can enter any number between 0 and 9998 as the code.

In this way, the entries in your measuring point are safeguarded against any unintentional or unauthorised change. The matrix field V9H9 displays "9999" if operation was locked by means of the keys on the on-site operation. In this case, you can only undo the locking by means of the keys on the display module.

#	VH	Entry	Significance
Locking operation			
1	V9H9	e. g. 100	Operation locked (except V9H9)
Unlocking operation			
2	V9H9	2457/ 333	Operation unlocked

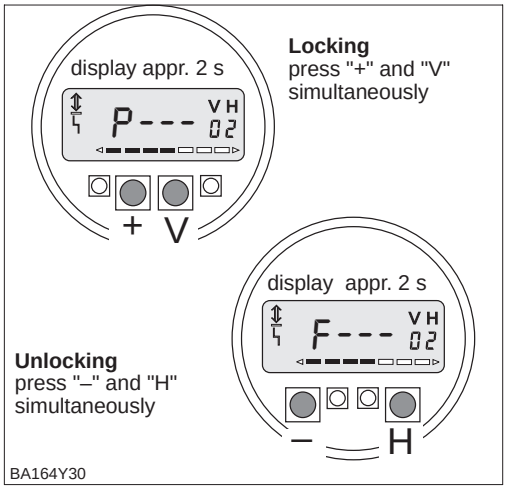


Figure 7.1
Locking and unlocking the matrix using FHB 20

The table provides an overview of the locking functions:

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

7.8 Measuring point information

You can call up the following information on the measuring point:

Matrix field	Display or entry
Measured values	
V0H0	Measured value: level, volume, weight or pressure
V0H8	Sensor pressure (units selectable in V3H4)
V0H9	Level before linearisation
V7H3	Sensor temperature [1] (unit selectable in V3H5)
Sensor data	
V7H0	Low sensor limit (unit selectable in V3H4)
V7H1	High sensor limit (unit selectable in V3H4)
Measuring point information	
V9H3	Instrument- and softwarenumber
Display error codes	
V9H0	Current diagnostic code
V9H1	Last diagnostic code

1) This value displays the temperature measured value of the internal temperature sensor. The temperature measured value of the internal measuring sensor is used in the measuring sensor is used in the measuring cell for compensation purposes. In other words, this is only a temperature value is close to the process.

Maximum indicator function

The maximum indicator function makes it possible to call up the largest measured value for pressure and temperature at a later stage. The parameters are reset to the current measured value by confirming with the Enter key.

Matrix field	Display
V7H2	Max. pressure (unit selectable in V3H4)
V7H4	Max. temperature (unit selectable in V3H5)

Communication level

The matrix line »VA Communication« can only be called up and configured by means of Communication (Commuwin II/FieldCare).

Matrix field	Display or selection
VAH0	Tag no. (entry up to 32 characters ASCII)
VAH2	Selection of units before linearisation
VAH3	Selection of units after linearisation
VAH5	Display device serial number
Service data	
VAH4 [2]	Display density factor at full calibration
VAH6 [1]	Display pressure at empty calibration
VAH7 [1]	Display density factor at empty calibration
VAH8 [2]	Display pressure at full calibration

1) Display only relevant for "Level" calibration mode.
2) Display only relevant for "Level" and "Dry calibration.H" calibration modes.

8 Diagnosis and Troubleshooting

8.1 Warning and error diagnosis

Errors

If the Deltapilot S detects an error:

- an error code is transmitted with the measured value,
- the error message signal on the on-site display or the red LED lights up,
- the measured value adopts the value selected for fault messages (min.: –19999, max.: +19999 or Hold: the last value measured value is retained).
- The current error code can be read off in matrix field V9H0 and the previous error code in V9H1.

Warnings

If the Deltapilot S detects a warning:

- an error code is transmitted with the measured value,
- the error message signal on the display or the red LED flashes; the Deltapilot S continues measuring.
- The current error code can be read off in matrix field V9H0 and the previous error code in V9H1.

Error codes in V9H0 and V9H1

If several errors occur at the same time, the sequence in which they are displayed corresponds to the priority of the error.

Code	Type	Cause and Remedy	Priority
E 101	Error	Check sum error, sensor EEPROM (DAT module) Error when reading the check sum from the sensor EEPROM. – *Switch off and then switch on supply voltage.* – Faulty DAT module electronic insert connection. *Check connection. Replace DAT module, if necessary.* *Please supply the cell number when ordering.* – Check sum incorrect, transmission error during reading as EMC influences larger than specified, Chapter 10 "Technical Data". *Block off EMC influences.*	4
E 102	Warning	Electronic instrument error in maximum indicator function – *Reset "Max. pressure" (V7H2) and "Max. temperature" (V7H4) parameters by pressing the Enter key.* – *Perform reset, code 333 or code 7864 or 1, if necessary.*	17
E 103	Warning	Initialisation active, duration approx. 6 The electronics are initialised when the data are first written to the EEPROM. – *Wait until initialisation is completed.* – *Replace electronic insert if the warning remains for an extended period and after several restarts.*	2
E 106	Error	Download active – *Wait until download is completed.*	9
E 110	Error	Check sum error, electronic insert EEPROM, configuration data not loaded – The power supply is interrupted when writing to the processor. *Reconnect power supply.* – *Perform reset, code 333 or code 7864 or 1, if necessary.* – EMC influences greater than specified in Chapter 10, "Technical data". *Block off EMC influences.* – Electronic insert faulty. *Replace electronic insert.*	11
E 112	Error	No connection electronic insert sensor EEPROM (DAT module) This fault can only be detected during power-up. The device does not display a fault if the connection is interrupted after power-up. – Faulty DAT module – electronic insert connection. *Check connection DAT module electronic insert.* *Replace DAT module, if necessary. Please supply the cell number when ordering.* – Electronic insert connection faulty. *Replace electronic insert.*	5

Error codes in V9H0 and V9H1 (continuation)

Code	Type	Cause and Remedy	Priority
E 114	Error	Writing error, electronic insert EEPROM – *Switch off and then switch on supply voltage.* – The electronic insert is faulty if the fault continues to be displayed. *Replace electronic insert.*	1
E 116	Error	Download error (PC → transmitter) – *Perform reset, code 333 or code 7864 or 1, if necessary.* – Incorrect data record downloaded, e.g. older software version. Time allowed exceeded due to transmission problems. *Carry out download again.*	10
E 117	Error	Sensor electronics error, temperature signal too small – Sensor electronics faulty. *Replace the measuring cell.* Please refer also to the note on the following page.	8
E 121	Error	Check sum error electronic insert EEPROM, production data – Electronic insert faulty. *Replace electronic insert.*	3
E 122	Error	No connection electronic insert – measuring cell. – DB 50: Faulty electronic insert – measuring cell connection. *Check connection. Replace measuring cell and/or electronic insert, if necessary.* – *DB 51 (pipe version), DB 52 and DB 53 (rope versions):* Faulty electronic insert – measuring cell connection. *Check signal line. Replace pipe or support cable if necessary.* – Electronic insert faulty. *Replace electronic insert.* – Sensor electronics faulty. *Replace the measuring cell.* Please refer also to the note on the following page.	7
E 125	Error	Sensor electronics error, signal exceeded or not achieved. – DB 50: Faulty electronic insert measuring cell connection. *Check connection. Replace measuring cell and/or electronic insert, if necessary.* – DB 51 (pipe version), DB 52 and DB 53 (rope versions): Faulty electronic insert – measuring cell connection. *Check signal line. Replace pipe or support cable if necessary.* – Sensor electronics faulty. *Replace the measuring cell.* – Electronic insert faulty. *Replace electronic insert.* Please refer also to the note on the following page.	6
E 602	Warning	Linearisation curve is not monotone ascending. – Value pairs for the linearisation curve have not been entered correctly. Check plausibility of manual characteristic curve (e. g. does the volume increase with the level?) *If necessary, perform linearisation again or re-enter value pairs, see Chapter 5.4, "Linearisation".*	15
E 604	Warning	The linearisation curve comprises less than 2 value pairs. – *Check manual characteristic curve. If necessary, perform linearisation again or add more value pairs. See Chapter 5.4 "Linearisation".*	14
E 605	Error	Linearisation curve editing active. – The "manual" or "semiautomatic" mode is switched on via the "Calibration mode" parameter (V2H0). *Set "Calibration mode" parameter to equal either "Activate table", "Linear" or "Horiz. cylindrical". Activate the linearisation curve by means of the parameter "Calibration mode" = "Activate table".*	16
E 610	Error	Calibration error, same pressure value for the "Empty calibration" (V0H1) and "Full calibration" (V0H2) parameters. – *Check calibration, see also parameters VAH6 and VAH4 (pressure values for "Empty calibration" and "Full calibration"). Perform calibration again.* – *If necessary, perform reset, code 333.*	13
E 613	Warning	Device in simulation operation – *Switch off simulation by means of the parameter (V9H6).*	12

Note!


Note!

Changing the measuring cell:
- The Deltapilot S is available with snap (replaceable) and welded measuring cells. To replace a snap measuring cell you require an Endress+Hauser Service Tool, the extractor, Order No.: 015860-0000. Snap measuring cells are ordered as spare parts; please refer also to Chapter 9.4, "Spare parts." Welded measuring cells are ordered with the process connection by means of the product structure, see Endress+Hauser Price List.

Replacing the pipe or support cable:
- DB 51 with snap (replaceable) or welded measuring cell: In these versions, replace the extension pipe with process connection and measuring cell, see Endress+Hauser Price List.
- DB 52/DB 53, snap measuring cell: In these versions, replace the support cable with process connection and measuring cell pipe, see Chapter 9.4, "Spare parts."
- DB 52/DB 53, welded measuring cell: In these versions, replace the support cable with process connection, measuring cell pipe and measuring cell, see Endress+Hauser Price List.

8.2 Reset

By entering a certain code, you can completely, or partially, reset the entries in the matrix to the factory settings. Please note, any customer-specific configuration carried out by the factory is reset to the default values in the event of a reset!

#	VH	Entry	Significance
1	V9H5	e.g. 333	Reset parameters partially

The Deltapilot S differentiates between various reset codes with different effects. Please refer to the following table for information as to which parameters are reset to the factory setting by the reset codes 7864 or 1 or 333.

Other reset codes have the following effects:
- 2506: Device warm-start
- 2712: The instrument address set by means of the bus is reset to the factory value 126.

Note!


Note!

Operation must be unlocked before carrying out a reset. To unlock the operation, enter the codes "2457" or "333" into the matrix field V9H9. The operation has been locked by means of the display module if the V9H9 field displays "9999". In this case, undo the locking by means of the "–" and "H" keys on the display module. Please refer to Chapter 7.7 also.

Reset Codes		H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
	V0	**Measured value**	**Empty calibration**	**Full calibration**	**Decimal point**	**Output damping [s]**	**PV Scale min**	**PV Scale max**	**Safety alarm**	**Corrected pressure**	**Measured level**
1 / 7864			0.0 %	100.0 %	1	1	0.0 %	100.0 %	Max.	= V3H6	
333			0.0 [1]	100.0 [1]	1	1	0.0 [1]	100.0 [1]	Max.	= V3H6	
	V1										
	V2	**Linearisation**	**Line no.**	**Level input mode**	**Input volume**	**Nominal diameter**	**Max. volume**				
1 / 7864		Linear	1	0.0 %	100.0 %	100.0 %	100.0 %				
333		Linear	[2]	[2]	[2]	100.0 [1]	100.0 [3]				
	V3	**Calibration mode**	**Select unit**	**Density factor**	**Zero offset value**	**Pressure unit**	**Temp. unit**	**Sensor pressure**	**Position factor**		
1 / 7864		Level	m [4]	1.0	0.0 %	mbar	°C		0.0 mbar		
333		Level		1.0	0.0 [1]				0.0 [5]		
	V4...V5										
	V6	**Ident number**	**Set unit to bus**	**OUT Value**	**OUT Status**	**2. cyclic value**	**Select V0H0**	**OUT Value PLC**	**Profile version**		
1 / 7864				[6]		Temp.	Meas. val.				
333				[6]		Temp.	Meas. val.				
	V7	**Low sensor limit**	**High sensor limit**	**Max. pressure**	**Measured temp.**	**Max. temp.**					
1 / 7864											
333											
	V8										
	V9	**Diagnostic code**	**Last diagnostic code**		**Instrument and software no.**	**Instrument adress**	**Reset device**	**Simulation**	**Simulation value**		**Security locking**
1 / 7864			0					Off			2457
333			0					Off			2457
	VA	**Set tag number**		**Unit before linearis.**	**Unit after linearis.**	**Service data**	**Serial number**	**Service data**	**Service data**	**Service data**	**Device profile**
1 / 7864		deleted			%	1.0		= V7H0	1.0	= V7H1	
333		deleted		%		1.0		= V7H0	1.0	= V7H1	

1) The values are reset to the factory settings after a "333" reset. The unit selected remains. Select the unit for these parameters by means of the "Unit before linearisation" parameter (VAH2).
2) After a "333" reset, the calibration mode is "Level" and the linearisation "Linear". The linearisation table is not cleared.
3) The values are reset to the factory settings after a "333" reset. The unit selected remains. Select the unit for this parameter by means of the "Unit after linearisation" parameter (VAH3).
4) This field is not displayed after a reset. This field is not displayed again until you select the "Dry calibration.H" or "Dry calibration.%" calibration mode.
5) The value is reset to the factory setting after a "333" reset. The unit selected remains. Select the unit for this parameter by means of the "Pressure unit" parameter (V3H4).
6) The V6H2 field displays the current digital output value after a reset "333" or "7864" or "1". UNKNOWN is displayed as the unit is not known. See Chapter 7.4 also.

9 Maintenance and Repair

9.1 Maintenance

In general, no special maintenance is required on the Deltapilot S.

Cleaning

In general, the measuring probe must neither be cleaned nor cleared of material build-up. Build-up has no effect on the measurement result as long as it is porous and does not present a mechanical load on the diaphragm of the pressure measuring cell.

Note!
Maintenance during cleaning processes with strong temperature deviations, measuring errors may occur over a short period.

Note!

Please note the following when cleaning the device:

- The cleaning agent used should not corrode the surfaces and seals.
- Avoid mechanical damage to the diaphragm or the pipe or supporting cable.

9.2 Repair

The Endress+Hauser repairs concept provides for measuring devices to have a modular design and the customer may carry out repairs.

Note!
- For certified devices, please consult Chapter 9.3 "Repair of Ex-certified devices".
- For more information on service and spare parts contact the Endress+Hauser Service.

Note!

9.3 Repair of certified devices

Warning!
When repairing certified devices, please note the following:

Warning!

- Only specialist personnel or Endress+Hauser Service may undertake repairs of certified devices.
- Relevant standards, national hazardous area regulations and Safety Instructions (XA…) and Certificates must be observed.
- Only genuine Endress+Hauser spare parts may be used.
- When ordering spare parts, please check the device designation on the nameplate. Identical parts may only be used as replacements.
- Electronic inserts or measuring cells already in use in a standard instrument may not be used as spare parts for a certified device.
- Carry out repairs according to the instructions. After repairs, the device must fulfil the requirements of the specified tests.
- A certified device may only be converted into another certified variant by Endress+Hauser Service.
- All repairs and modifications must be documented.

Note!
For more information on service and spare parts contact the Endress+Hauser Service.

Note!

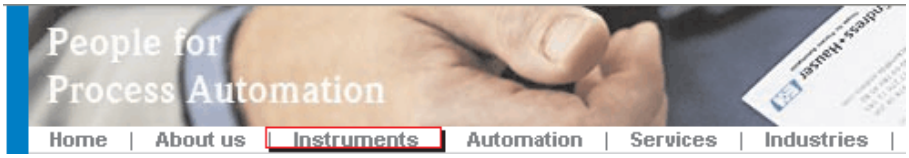
9.4 Spare parts

Note!

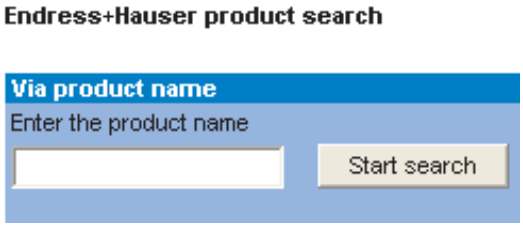
Note!
An overview of the spare parts for your device is available in the internet at www.endress.com. To obtain information on the spare parts, proceed as follows:

1. Go to "www.endress.com" and select your country.

2. Click "Instruments".

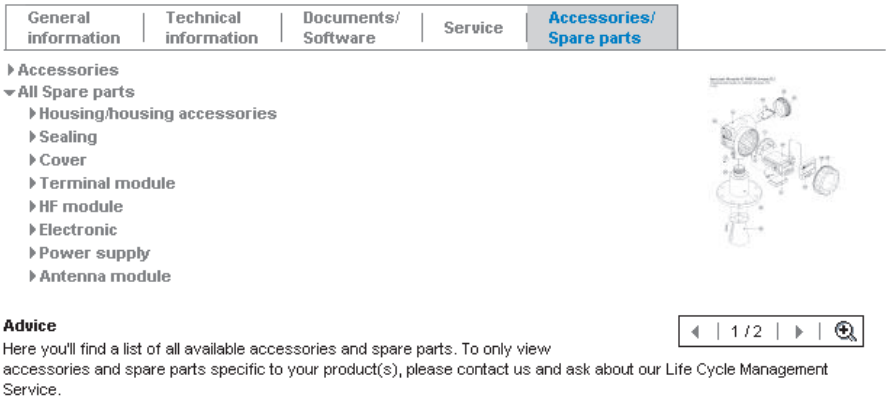


3. Enter the product name into the "product name" field.



4. Select the device.

5. Click the "Accessories/Spare parts" tab.



6. Select the required spare parts (You may also use the overview drawing on the right side of the screen.).

When ordering spare parts, always quote the serial number indicated on the nameplate. As far as necessary, the spare parts also include replacement instructions.

9.5 Returning the device

Before you send in a device for repairs or checking:

- Remove all signs of fluids, paying particular attention to seal grooves and gaps in which fluid can become lodged. This is especially important if the fluid is hazardous to health. Please refer also to the "Declaration of Contamination", Page75.

Please enclose the following when returning the device:

- Please fill out completely and sign the "Declaration of Contamination", see Page 75. It is only then possible for Endress+Hauser to inspect or repair the returned device.
- The chemical and physical properties of the fluid.
- A description of the application.
- A description of the error which occurred.
- Special instructions on handling, if necessary, e.g. a safety data sheet as per EN 91/155/EEC.

Caution!
With regard to devices with certificates of conformity or design approval, the entire device must be returned when in need of repair.


Caution!

10 Technical Data

General Information

Manufacturer	Endress+Hauser
Designation	Deltapilot S with electronic insert FEB 24 or FEB 24 P (PROFIBUS-PA)
Technical Documentation	TI257P/00/EN

Input

Measured variables	Level using hydrostatic pressure of a column of liquid
Measuring range	

Measuring range [mbar]	Overload [bar]	Vacuum resistance [mbar]
0…100	8	–100
0…400	8	–400
0…1200	24	–900
0…4000	24	–900
–100…100	8	–100
–400…400	8	–400
–900...1200	24	–900
–900...4000	24	–900
–0.9…10	40	–0.9

Output

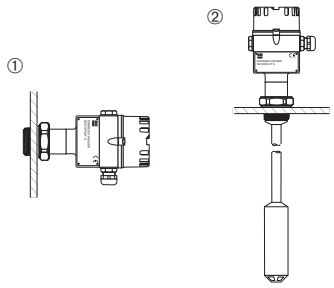
Output signal	Digital communication signal PROFIBUS-PA
PROFIBUS-PA function	Slave
Transmission rate	31.25 kByte/s
Reponse time	Slave: ca. 20 ms PLC: 300…600 ms for appr. 30 transmitters (depending on system coupler)
Signal on alarm	PROFIBUS-PA: Status bit set, last measured value will be held Display: optional –19999, +19999 or HOLD (last valid measured value)
Damping (Integration time)	0…99 s adjustable via the FHB20 display and operating module, PC with operating program or handheld terminal, factory setting: 1 s
Commuincation resistance	none, separate PROFIBUS-PA termination resistor
Physical layer	IEC 61158-2
Integrated overvoltage protection	Only for electronic insert FEB 24 P: Protective diodes: gas discharger 230 V, Nominal surge current: 10 kA

Measuring accuracy

Reference conditions	According to DIN 16086, calibration temperature: 25°C (77°F)
Linearity (to terminal-based method)	± 0.2% of set measuring range optional: ± 0.1% of set measuring range
Hysteresis	± 0.1% of full scale
Long-term drift	± 0.1% of full scale per 6 month
Influence of ambient temperature	± 0.1%/10 K of full scale
Influence of medium temperature	± 0.1%/10 K of full scale

Operation conditions

Installation conditions

Calibration conditions ① DB 50 (A), DB 50 L, DB 50 S ② DB 51 (A), DB 52 (A), DB 53 (A)	
Orientation	– DB 50 (A), DB 50 L, DB 50 S: always below the lowest measuring point. – DB 51 (A), DB 52 (A), DB 53 (A): installation from above, see also Chapter 1.1 For further information see Chapter 2.1. Orientation-dependent measuring errors can be completely corrected, see also Chapter 5.1.

Ambient conditions

Ambient temperature range	–20…+60°C (–4…+140°F) With separate electronics: –20 to +85°C (–4 to +185°F) For devices approved for use in hazardous areas, see Certificate, Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM).
Ambient temperature limits	–40…+85°C (–40…+185°F) (You may operate the Deltapilot S in this temperature range. The values quoted in the specifications may then be exceeded, e. g. measuring accuracy. Also refer to DIN 16086.)
Storage temperature range	–40…+85°C (–40…+185°F)
Climatic class	D to DIN IEC 654-1
Degree of protection	Housing: IP 66/NEMA 4X Housing adapter: IP 68 (1 mH_2O forr 24 h)
Shock resistance	to DIN IEC 68-2-6
Vibrational resistance	10…55 Hz, 2 g, to DIN IEC 68-2-6
Electromagnetic compatibility	Interference emission to EN 61326, Equipment Class B; Interference immunity to EN 61326, Appendix A (industrial usage) and NAMUR recommendation EMC (NE21)

Process conditions

Medium temperature range	– DB 50 (A), DB 50 L, DB 50 S: –10…+100°C (+14…+212°F) – DB 51 (A), DB 52 (A) and DB 53 (A) with rope insulation FEP: –10…+80°C (+14…176°F) – DB 53 (A) with rope insulation PE: –10…+70°C (+14…158°F) For devices approved for use in hazardous areas, see Certificate, Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM).
Cleaning temperature	Only DB 50 L, DB 50 S: +135°C (+275°F) for max. 30 min
Medium pressure limits (permissible pressure range)	See table "Measuring range", Page 60.

Construction

Design

Dimensions	See Technical Information TI257P and Page 63.
Process connection	– DB 50 (A), DB 51 (A), DB 52 (A): several customary flanges and threads available – DB 50 L, DB 50 S: several sanitary connections available For further information see Technical Information TI257P.

Construction (Continuation)

Materials	
Housing	– Aluminium housing (housing type F6): Material: GD-Al Si 10 Mg, with plastic coating (blue/grey) Sealing for housing cover: O-ring in EPDM – Stainless steel housing (housing type F8): Material: Stainless steel AISI 316 L (DIN 1.4404), Sealing for housing cover: profiled O-ring in silicone VMQ – Polyester housing (housing type F 10) Material: Glass fibre reinforced polyester blue/grey (PBT) Sealing for housingcover: O-ring in silicone
Electronic insert	Housing plastic ABS, potted electronic insert
Process connections	Thread and flange*) versions and all sanitary connection in stainless steel 1.4435 (AISI 316 L) or Hastelloy C4 (2.4610).
Probe tube DB51	1.4435 (AISI 316L) or Alloy C4 (2.4610)
Measuring cell tube DB51/52/53	1.4435 (AISI 316L) or Hastelloy C4 (2.4610)/C22 (2.4602)
Rope DB52/53	Multicore cable with steel mesh, insulation FEP (max. 80°C/ 176°F) or PE (max. 70°C/158°F)
*) DIN/EN flanges Endress+Hauser supplies DIN/EN flanges made of stainless steel AISI 316L as per material numbers 1.4435 or 1.4404. With regard to their stability-temperature property, the materials 1.4435 and 1.4404 are grouped together under 13EO in EN 1092-1 Tab. 18. The chemical composition of the two materials can be identical.	

Seals	– DB 50 (A), DB 51 (A), DB 52 (A), DB 53 (A): Measuring cell seal optional Viton, EPDM, Kalrez or measuring cell welded on (elastomer-free) – DB 50 L, DB 50 S: Measuring cell seal welded on or silicone profiled seal for universal process adapter, suitable for foodstuffs as per BGA XV and FDA 177.2600 Seal welding flange DB 50 L, DB 50 S: PTFE
Process membrane	Hastelloy C276 (2.4819)
Protective cover for diaphragm	DB 51 (A), DB 52 (A), DB 53 (A): plastic PFA (Perflouralkoxy)
Attachment accessories	– For DB 50 (A), DB 51 (A), DB 52 (A): Housing adapter with mounting bracket – For DB 53 (A): Mounting clamp, galvanised steel with plastic jaws

Display and operating interface

Display and operating module FHB 20 (optional)	Plug-in display module with digital display and bar graph and four keys for operation
On-site operation	Via four keys –, +, V, H on the display and operating module FHB 20
Remote operation	Segment coupler for connection to PLC or PC, e. g. with Commuwin II or FieldCare operating program
Communication interface	PROFIBUS-PA

Power supply

Supply voltage FEB 24	– Standard: 9…32 V DC – Ex: 9…24 V DC, see also Certificate, Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM)
FEB 24 P	– Standard: 9.6…32 V DC – Ex: 9.6…24 V DC, see also Certificate, Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM)
Current consumption	10 mA ±1 mA, For devices approved for use in hazardous areas, see Certificate, Safety Instructions (XA…), Installation Drawing (CSA) or Control Drawing (FM).
Power up current	Corresponds to Table 4, IEC 61158-2

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.

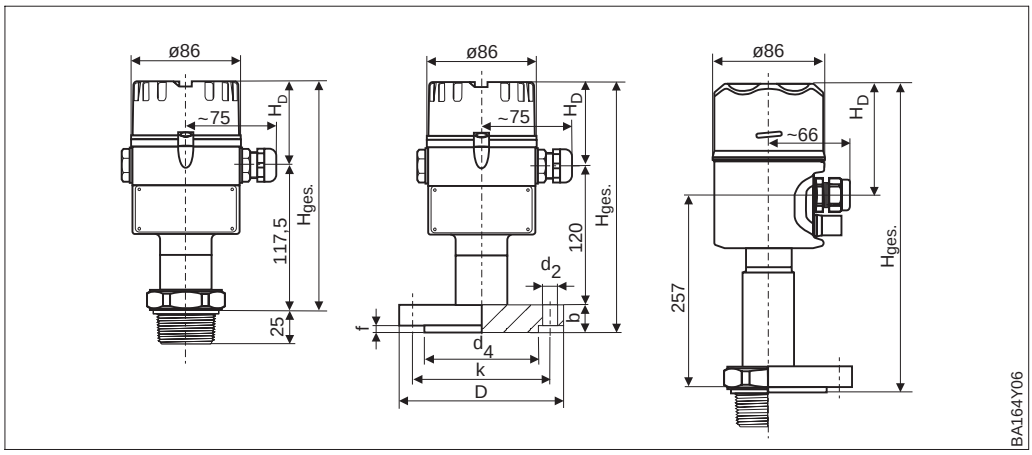


Figure 10.1
Deltapilot S DB 50
left: with thread G 1 ½ or 1 ½ NPT
centre: with flange, see Table
right: Version Ex Zone 0 FRG stainless steel housing

		Housing F10 (polyester)	Housing F6 (aluminium)	Housing F8 (stainless steel)
Cover height		75.0	86.0	80
Process connection $H_{ges.}$				
Process connection	Thread	192.5	203.5	190
	Flange	b + 195	b + 206	b + 193
Version Ex Zone 0	Thread	342	353	337
	Flange	b + 542	b + 353	b + 337

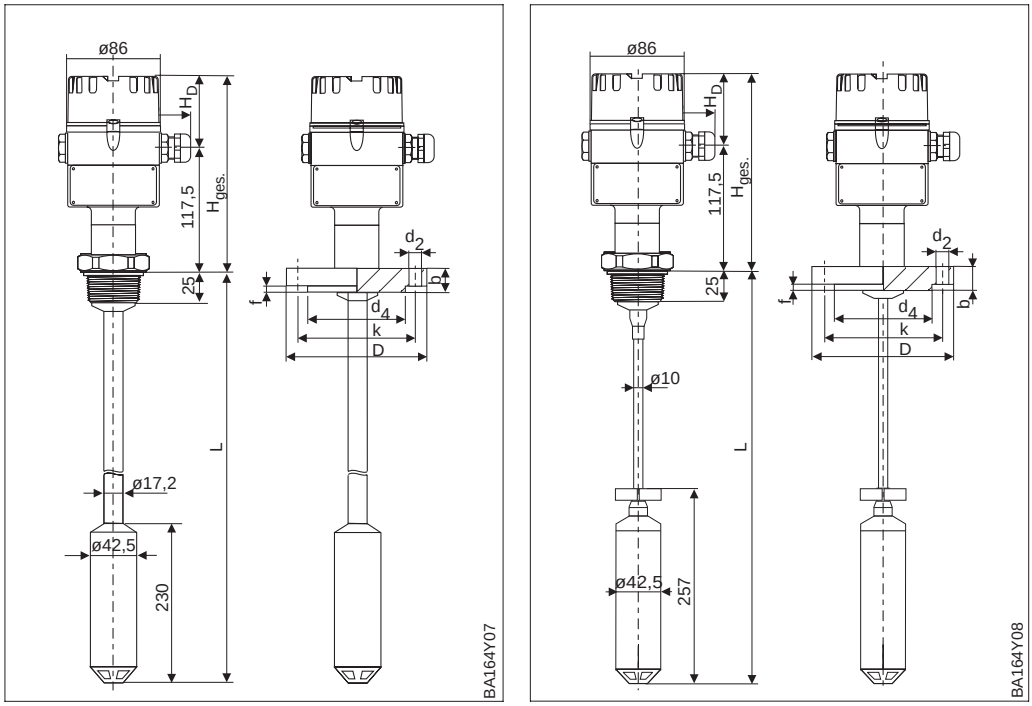


Figure 10.2
left: Deltapilot S DB 51 (rod version)
right: Deltapilot S DB 52 (rope version)
with G 1 ½ or 1 ½ NPT or Flange

Size	Flange			Raised face		Bore	
	D	b	k	d_4	f_d	Number	d_2
DN40 PN16	150	16	110			4	18
DN50 PN16	165	18	125			4	18
DN80 PN16	200	20	160	70	2	8	18
DN100 PN16	220	20	180	90	2	8	18
ANSI 1 1/2"	127	127.5	98.6	73.2	1.6	4	15.7
ANSI 2"	152.4	19.1	120,7	91.9	1.6	4	19.1
ANSI 3"	190.5	23.5	152.4	127.0	1.6	4	19.1
ANSI 4"	228.6	23.9	190.5	157.2	1.6	8	19.1

11 Operating Matrix and Parameter Description

11.1 Matrix Commuwin II

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 Calibration	Measured value	Empty calibration [1, 2]	Full calibration1	Decimal point	Output damping 0…99 s	PV Scale min	PV Scale max	Safety alarm	Corrected pressure	Measured level [1]
V1										
V2 Linearisation	Linearisation [1, 4]	Line no. [1] (1…11)	Level input mode [1]	Input volume [1]	Nominal diameter [1, 5]	Max. Volume [1, 5]				
V3 Extended calibration	Calibration mode [6]	Select unit [1, 3]	Density factor 1	Zero offset value [1]	Pressure unit	Temp. unit	Sensor pressure	Position factor		
V4…V5										
V6 PROFIBUS parameter	Ident number	Set unit to bus	OUT Value	OUT Status	2. cyclic value	Select V0H0		Profile version		
V7 Transmitter info	Low sensor limit	High sensor limit	Max. pressure	Measured temperature	Max. temperature					
V8										
V9 Service/ Simulation	Diagnose code	Last Diagnose code		Instrument and software no.	Instrument address	Reset device – 333 – 1/7864	Simulation	Simulation value [7]		Security locking
VA Communication	Set tag number		Unit before lin. [1, 2]	Unit after lin. 1	Service data (density)	Serial-number	Service data (pressure)	Service data (density)	Service data (pressure)	Device profile

Display field

1) These matrix fields are not displayed in the "Pressure" calibration mode.
2) These matrix fields are not displayed in the "Dry calibration.H" calibration mode.
3) This matrix field is not displayed in the "Level" calibration mode.
4) Choice of linearisation - Linear, Activate table, Manual, Semiautomatic, Horiz. cylindrical.
5) Parameter for the "Horiz. cylindrical" linearisation mode.
6) Choice of calibration mode - Level, Dry calibration.H, Dry calibration.% and Pressure.
7) This parameter is not displayed if the Simulation parameter is set to "Off".

This matrix provides a summary of all factory settings. You can also enter your own values here.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0		0.0%	100.0%	1	1 s	0.0%	100.0%	max.	= V3H6	
V1										
V2	Linear	1	0.0%	100.0%	100.0%	100.0%				
V3	Level	m	1.0	0.0%	mbar	°C		0.0 mbar		
V4…V5										
V6					Temp.	Measured value		3.0		
V7										
V8										
V9		0			126		Off			2457
VA	————		%	%	1.0		= V7H0	1.0	= V7H1	

11.2 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 Type)	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

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11.3 Parameter description

Parameter (VH position)	Description
Measured value (V0H0)	This parameter displays the value currently measured. The matrix field V0H0 corresponds to the on-site display. The unit with which this parameter is displayed depends on the calibration mode (V3H0) and linearisation mode (V2H0) selected. Select the unit as follows: – For the "Level" calibration mode and the "Linear" linearisation, select the unit by means of the "Unit before linearisation" parameter (VAH2). The "Measured value" parameter is not converted to the unit selected. – For the "Dry calibration.H" calibration mode and the "Linear" linearisation, select the unit by means of the "Select unit" parameter (V3H1). The "Measured value" parameter is converted to the unit selected. – In the "Dry calibration.%" calibration mode and the "Linear" linearisation, the "Measured value" parameter is displayed in %. – For the "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes and the "Activate table" and "Horiz. cylindrical" linearisation, select the unit by means of the "Unit after linearisation" parameter (VAH3). The "Measured value" parameter is not converted to the unit selected. – For the "Pressure" calibration mode, select the unit by means of the "Pressure unit" parameter (V3H4). The "Measured value" parameter is converted to the unit selected. Set the number of places after the decimal point by means of the "Decimal point" parameter (V0H3).
Empty calibration (V0H1)	"Level" calibration mode: The container is either empty or partly full. By entering a value for this parameter you assign a level value to the pressure currently measured. In the event of a partial filling, enter the relevant value here, e.g. 10%. Select the unit by means of the "Unit before linearisation" parameter (VAH2). Please refer also to Chapter 5.2, "Empty and full calibration." Factory setting: 0.0% "Dry calibration.H" and Dry calibration.%" calibration modes: The parameter is not displayed in these calibration modes. The "empty" calibration point is always at the probe mounting point for these calibration modes. Zero offset must be carried out if measurement is to start at another level. Please refer also to Chapter 5.2, "Dry calibration."
Full calibration (V0H2)	"Level" calibration mode: The container is either completely full or almost full. By entering a value for this parameter you assign a level value to the pressure currently measured. In the event of partial filling, enter the relevant value here, e.g. 90%. Select the unit by means of the "Unit before linearisation" parameter (VAH2). Please refer also to Chapter 5.2, "Empty and full calibration." Factory setting: 100.0% "Dry calibration.%" calibration mode: In this calibration mode, 100% is automatically assigned to the value entered here, e.g. 4 m correspond to 100%. The "Measured value" (V0H0) is converted to a %, e.g. 2 m would then correspond to 50%. Select the unit for this parameter by means of the "Select unit" parameter (V3H1). Please refer also to Chapter 5.3, "Dry calibration." Factory setting: 100.0% "Dry calibration.H" calibration mode: For this calibration mode the "Full calibration" parameter is not relevant. Factory setting: Height, taken from the high sensor limit (V7H1)
Decimal point (V0H3)	Specify to how many decimal places the measured value should be displayed in the matrix field (V0H0) and on the on-site display. Options: 1 to 3. Factory setting: 1
Output damping (V0H4) (Integration time)	The output damping affects the speed at which the "Measured value" (V0H0) and the digital output value react to a change in the level. The damping can be set between 1 and 99 s. Factory setting: 1 s

Parameter description (continuation)

Parameter (VH position)	Description
PV Scale min (V0H5)	Standardisation and scaling of Transducer Block output, lower scaling value for input scaling of the Analog Input Block. Use the "PV Scale min" (V0H5) and "PV Scale max" (V0H6) parameters to scale the measured value. A standardised value between 0 and 1 appears after this scaling and is also displayed on the bar graph of the on-site display. The value "0" is assigned to "PV Scale min" and the value "1" to "PV Scale max". You can destandardise the value by means of the "OUT Scale min" and "OUT Scale max" Analog Input parameters and rescale it to your own requirements. The unit with which this parameter is displayed depends on the calibration mode (V3H0) and linearisation mode (V2H0) selected. Please refer also to Chapters 3.7, 7.3. and 7.4. Factory setting: 0.0%
PV Scale max (V0H6)	Standardisation and scaling of Transducer Block output, upper scaling value for input scaling of the Analog Input Block. Please refer to parameter description of "PV Scale min". Factory setting: 100.0%
Safety alarm (V0H7)	In the event of an error, the "Measured value" (V0H0) and the on-site display are set to the value selected here. – Min (0) = –19999 – Max (1) = +19999 – Hold (2) = last valid measured value is retained. Note! This parameter only affects the measured value and the on-site display. The PROFIBUS-PA "Fail safe type" and "Fail safe value" parameters must be used for the OUT Value of the Analog Input Block. Please refer also to Chapter 7.2. Factory setting: Max
Corrected pressure (V0H8)	The pressure currently measured is displayed, corrected with position factor. The following applies: Corrected pressure (V0H8) = Sensor pressure (V3H6) – Position factor (V3H7). In the "Pressure" calibration mode, this parameter corresponds to the display in the "Measured value" matrix field (V0H0). Select the unit by means of the "Pressure unit" parameter (V3H4). Please refer also to Chapter 5.1 or 6.1. Factory setting: 0.0 mbar
Measured level (V0H9)	Only for "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes. In the "Activate table" or "Horiz. cylindrical" linearisation, the matrix field V0H0 displays the measured value as a value converted by means of the linearisation table. The "Measured level" parameter displays the associated level currently measured. After a zero value offset, and if "Linear" linearisation is selected, this parameter displays the current level without the zero offset value. The unit with which this parameter is displayed depends on the calibration mode (V3H0) selected. Select the unit as follows: "Level" calibration mode: Unit before linearisation (VAH2), "Dry calibration.%" calibration mode: Display automatically in %, "Dry calibration.H" calibration mode: Select unit (V3H1)
Linearisation (V2H0)	Only for "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes. Options: Linear/not activated (0) , Activate table (1), Manual (2), Semiautomatic (3), Clear (4) and Horiz. cylindrical (5). Enter the corresponding number if configuring via the display module. Please refer also to Chapter 5.4, "Linearisation". Factory setting: Linear
Line no. (V2H1)	Only for "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes. A line number for the linearisation table is entered. A linearisation table is entered by means of the "Line no." (V2H1), "Level input mode" (V2H2) and "Input volume" (V2H3) parameters. Number of lines for linearisation table: Min =2 and Max = 11. Please refer also to Chapter 5.4 "Linearisation". Factory setting: 1

Parameter description (continuation)

Parameter (VH position)	Description
Level input mode (V2H2)	Only for "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes. "Manual" linearisation (V2H0) must be selected. Here, enter a level value in the linearisation table which matches the current line number and volume/weight. The unit with which this parameter is displayed depends on the calibration mode (V3H0) selected. Select the unit as follows: "Level" calibration mode: Unit before linearisation (VAH2), "Dry calibration.%" calibration mode: Display automatically in %, "Dry calibration.H" calibration mode: Select unit (V3H1). Please refer also to Chapter 5.4, "Linearisation". Factory setting: 0.0%
Input volume (V2H3)	Only for "Level" "Dry calibration.H" and "Dry calibration.%" calibration modes. "Manual" or "Semiautomatic" linearisation (V2H0) must be selected. Here, enter a value for volume/weight in the linearisation table which matches the level and the current line number. Select the unit by means of the "Unit after linearisation" parameter (VAH3). Please refer also to Chapter 5.4, "Linearisation". Factory setting: 0.0%
Nominal diameter (V2H4)	Only for "Level" "Dry calibration.H" and "Dry calibration.%" calibration modes. "Horiz. cylindrical" linearisation (V2H0) must be selected. Enter the nominal diameter of the container here. The unit with which this parameter is displayed depends on the calibration mode (V3H0) selected. Select the unit as follows: "Level" calibration mode: Unit before linearisation (VAH2), "Dry calibration.%" calibration mode: Display automatically in %, "Dry calibration.H" calibration mode: Select unit (V3H1). Please refer also to Chapter 5.4 "Linearisation", "Horizontal cylindrical containers" section. Factory setting: 100.0%
Max. volume (Vmax) (V2H5)	Only for "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes. "Horiz. cylindrical" linearisation (V2H0) must be selected. Enter the maximum volume of the container here. Select the unit by means of the "Unit after linearisation" parameter (VAH3). Please refer also to Chapter 5.4 "Linearisation", "Horizontal cylindrical containers" section. Factory setting: 100.0%
Calibration mode (V3H0)	The calibration mode can be selected here. "Level" calibration mode: The container is filled or emptied for this calibration. By entering a value for each of the parameters "Empty calibration" (V0H1) and "Full calibration" (V0H2), a level value is assigned to the pressure value currently measured. Please refer also to Chapter 5.2, "Empty and full calibration." "Dry calibration.H" calibration mode: Dry calibration.H is a theoretical calibration. The level is calculated from the measured pressure and the density, "Density factor" parameter (V3H2), using the formula $h = p/\rho \bullet g$. Please refer also to Chapter 5.3, "Dry calibration." "Dry calibration.%" calibration mode: Dry calibration.% is a theoretical calibration. The level is calculated as in the "Dry calibration.H" calibration mode. In this calibration mode, enter the maximum level value for the "Full calibration" parameter (V0H2). 100% is automatically assigned to this value, e.g. 4 m correspond to 100%. The "Measured value" (V0H0) is converted to a %, e.g. 2 m would then correspond to 50%. Please refer also to Chapter 5.3, "Dry calibration". "Pressure" calibration mode: In this calibration mode, the measured pressure is output directly as "Measured value" (V0H0). Select the unit by means of "Pressure unit" (V3H4). Please refer also to Chapter 6 "Pressure and Differential Pressure Measurement". Enter the corresponding number if configuring via the display module. Options: Level (0) , Dry calibration.H (1), Dry calibration.% (2) and Pressure (3). Factory setting: Level

Parameter description (continuation)

Parameter (VH position)	Description
Select unit (V3H1)	Only for "Dry calibration.H" and "Dry calibration.%" calibration modes. A unit of length is selected. In the "Dry calibration.H" calibration mode, the V0H0, V0H2, V0H5, V0H6, V0H9, V2H2, V2H4 and V3H3 parameters are displayed with the unit selected and converted if a new unit is selected. In the "Dry calibration.%" calibration mode, only the V0H2 and V3H3 parameters are displayed with the unit selected and converted if a new unit is selected. The V0H0, V0H5, V0H6, V0H9, V2H2 and V2H4 parameters are displayed in %. Example: 100 cm correspond to 1 m or 3.2808 feet. Options: m (0), cm (1), feet (2), inch (3). Enter the corresponding number if configuring via the display module. Factory setting: m
Density factor (V3H2)	Only for "Level" "Dry calibration.H" and "Dry calibration.%" calibration modes. The density factor adjusts the "Measured value" (V0H0) and the digital output value to the density of the medium. The density factor is calculated from the ratio of the "new density" to the "old density". Please refer also to Chapter 5.2, "Density correction" and "Calculating the density factor" sections. Input range 0.01 to 9.999. Factory setting: 1.0
Zero offset value (V3H3)	Only for "Level" "Dry calibration.H" and "Dry calibration.%" calibration modes. Carry out a zero offset if the measurement is not to start at the mounting point of the measuring probe. The "Measured value" (V0H0) displays the corrected measured value. The "Measured level" parameter (V0H9) displays the current level without the zero offset value. Please refer also to Chapter 5.3, "Calibration – Dry calibration.H", "Calibration – Dry calibration.%" and "Correction after installation" sections. "Dry calibration.H" and "Dry calibration.%" calibration modes: Select the unit by means of the "Select unit" parameter (V3H1). Factory setting: Height, taken from the minimum sensor limit (V7H0)
Pressure unit (V3H4)	Only for "Pressure" calibration mode. A pressure unit is selected. If a new pressure unit is selected, all pressure-specific parameters are converted and displayed with the new pressure unit. Options: mbar (0), bar (1), mH_2O (2), mmH_2O (3), psi (4), ftH_2O (5), inH_2O (6), Pa (7), MPa (8), hPa (9), mmHg (10), inHg (11), g/cm^2 (12), kg/cm^2 (13), lb/ft^2 (14), kgf/cm^2 (15). Enter the corresponding number if configuring via the display module. Factory setting: mbar
Temperature unit (V3H5)	A temperature unit can be selected here. If a new temperature unit is selected, the "Measured temperature" (V7H3) and "Max. temperature" (V7H4) parameters are converted and displayed with the new temperature unit. Options: °C (0), °F (1). Enter the corresponding number if configuring via the display module. Factory setting: °C
Sensor pressure (V3H6)	The pressure currently detected is displayed.
Position factor (V3H7)	Depending on the orientation of the device, there may be a slight shift in the measured value. This means that if the container is empty, the on-site display and the "Measured value" (V0H0) do not display zero but rather a very slight pressure. To correct the reading, enter the pressure difference for this parameter. The "Sensor pressure" parameter (V3H6) displays the pressure currently measured. The following applies: Measured value (V0H0) = Sensor pressure (V3H6) – Position factor (V3H7). Please refer also to Chapter 5.1 or 6.1. Factory setting: 0.0 mbar

Parameter description (continuation)

Parameter (VH position)	Description
Ident number (V6H0)	The ID number can be selected here. Options: – Profile: General ID number of the PNO (PROFIBUS User Organisation): "9700 (hex)". The Device Master File (GSD) of the PNO must be used to configure the PLC. – Manufacturer: Device ID number for Deltapilot S PROFIBUS-PA: "1503 (hex)". The device-specific GSD must be used to configure the PLC. Please refer also to Chapter 3.3 "Device database and type files (GSD)".
Set unit to bus (V6H1)	In the following situations, the digital output value (OUT Value) and the on-site display or the "Measured value" parameter (V0H0) do not display the same value: – if you change the calibration mode, – if you change the values of the "PV Scale min" (V0H5) and "PV Scale max" (V0H6) parameters, – if you change the values of the "OUT Scale min" and "OUT Scale max" parameters, or – if you change the unit. The "Set unit to bus" parameter in the matrix field V6H1 must be confirmed so that the digital output value displays the same value as the on-site display or the "Measured value" (V0H0). Please note that changing the digital output value could have an effect on the control. Please refer also to Chapter 7.4.
OUT Value (V6H2)	This parameter displays the OUT Value of the Analog Input Block (digital output value which is transmitted via the bus). If the matrix field V6H2 still also displays UNKNOWN, the "Set unit to bus" parameter in the matrix field V6H1 has not been confirmed.
OUT Status (V6H3)	OUT Status (V6H3) This parameter displays the status of the OUT Values (digital output value). Please refer to Chapter 3.4, "Status codes" section, for a description of the status codes.
2 nd cyclic value (V6H4)	By means of this field, you can select a second parameter which is output cyclically to the PLC. Options: Measured temperature (V7H3), Corrected pressure (V0H8). Please refer also to Chapter 3.4, Fig. 3.3. Factory setting: Measured temperature (V7H3)
Select V0H0 (V6H5)	As standard, the on-site display and the matrix field V0H0 display the same value. However, a cyclical output value can also be made available to the on-site display by means of a PLC. To do so, you must set this parameter to "Display value" (or 1). Please refer also to Chapter 3.4. Options: "Measured value" and "Display value" Factory setting: Main measured value (V0H0)
OUT Value from PLC (V6H6)	A cyclical OUT Value of the PLC is displayed. This parameter is only displayed if the "Select V0H0" parameter (V6H5) is set to "Display value". Please refer also to Chapter 3.4, Fig. 3.3.
Profile version (V6H7)	The PROFIBUS-PA profile version is displayed.
Low sensor limit (V7H0)	The low sensor limit is displayed.
High sensor limit (V7H1)	The high sensor limit is displayed.
Max. pressure (V7H2)	The largest pressure value measured is displayed (maximum indicator). This parameter is reset to the current pressure value by confirming with the "Enter" key.
Measured temperature (V7H3)	This value displays the temperature measured value of the internal temperature sensor. The temperature measured value of the internal sensor is used in the measuring cell for compensation purposes. In other words, this is only a temperature value which is close to the process. The unit can be selected by means of the "Temperature unit" (V3H5) parameter.
Max. temperature (V7H4)	The highest temperature measured is displayed (maximum indicator). This parameter is reset to the current temperature value by confirming with the "Enter" key.

Parameter description (continuation)

Parameter (VH position)	Description
Diagnostic code (V9H0)	An error code is output if the device detects an error or a warning. This parameter displays the current error code. Please refer to Chapter 8.1. for a description of the error codes.
Last diagnostic code (V9H1)	The last error code is displayed. This parameter is reset to "0" by confirming with the Enter key. Please refer to Chapter 8.1. for a description of the error codes. Factory setting: 0
Instrument and software number (V9H3)	The instrument and software number is displayed. The first two digits indicate the device number and the 3rd and 4th digits the software version. Deltapilot S PROFIBUS-PA SW 2.2 = 8222
Instrument address (V9H4)	The set instrument address in the bus is displayed. The address can be set either on-site via DIP switch or via software. Please refer also to Chapter 3.2. Factory setting: 126
Reset device (V9H5)	A reset code is entered. Possible reset codes are: 7864 or 1, 333, 2506 and 2712. Chapter 8.2 lists the parameters which are reset to the factory setting by the individual reset codes.
Simulation (V9H6)	The type of simulation is selected. Options: Off (0), Pressure (1), Level (2) and Volume (3). The "Level" and "Volume" types of simulation cannot be selected for the "Pressure" calibration mode. Enter the corresponding number if configuring via the display module. Please refer also to Chapter 7.5. Factory setting: Off
Simulation value (V9H7)	A simulated measured value is entered to check a calibration or configuration. The value entered must lie between the low and high sensor limit (V7H0/V7H1) for the "Pressure" simulation option. You can enter values between –19999 and +19999 for the "Level" and "Volume" simulation options. This field is not displayed if you have selected "Off" for the "Simulation" parameter (V9H6). During simulation, the "Last diagnostic code" matrix field (V9H1) displays the warning "613". Please refer also to Chapter 7.5.
Security locking (V9H9)	A code is entered to lock or unlock the operating matrix and the on-site operation. Locking the operation: – by means of the "Security locking" parameter (V9H9): enter a number between 0 and 9998, apart from the numbers 2457 and 333, – by means of the on-site operation: simultaneously press the "+" key and the "V" key once. Unlocking the operation: – by means of the "Security locking" parameter (V9H9): enter the number 2457 or 333, – by means of the on-site operation: simultaneously press the "–" key and the "H" key once. The matrix field V9H9 can only be edited if the operation has not been locked beforehand by means of the on-site keys. Please refer also to Chapter 7.7.

Parameter description (continuation)

Parameter (VH position)	Description
Set tag number (VAH0)	A text is entered to describe the measuring point (up to 32 ASCII characters).
Unit before linearisation (VAH2)	Only for the "Level" calibration mode and "Linear" linearisation. A unit is selected for level, volume or weight for the V0H0, V0H1, V0H2, V0H5, V0H6, V0H9, V2H2, V2H4, and V3H3 parameters. The unit is for display purposes only. The parameters are not converted. This parameter cannot be selected by means of the display module. Options: %, m, cm, dm, ft, inch, l, hl, m^3, dm^3, cm^3, ft^3, us gal, i gal, kg, t, lb, ton, None. Factory setting: %
Unit after linearisation (VAH3)	Only for the "Level", "Dry calibration.H" and "Dry calibration.%" calibration modes. "Activate table" or "Horiz. cylindrical" linearisation must be selected. A unit is selected for level, volume or weight for the V0H0, V0H5, V0H6, V0H9, V2H2, V2H3, V2H5 and V3H3 parameters. The unit is for display purposes only. The parameters are not converted. This parameter cannot be selected by means of the display module. Options: %, m, cm, dm, ft, inch, l, hl, m^3, dm^3, cm^3, ft^3, us gal, i gal, kg, t, lb, ton, None. Factory setting: %
Service data (VAH4) (Density factor at full calibration)	Only for the "Level" and "Dry calibration.%" calibration modes. The "Density factor" (V3H2) is displayed which was saved when entering the value for the "Full calibration" parameter (V0H2). Factory setting 1.0
Serial number (VAH5)	The serial no. of the device is displayed.
Service data (VAH6) (Pressure at empty calibration)	Only for the "Level" calibration mode. The corrected pressure is displayed which was saved when the value for the "Empty calibration" parameter (V0H1) was entered. Factory setting: Low sensor limit (V7H0)
Service data (VAH7) (Density factor at empty calibration)	Only for the "Level" calibration mode. The "Density factor" (V3H2) is displayed which was saved when entering the value for the "Empty calibration" parameter (V0H1). Factory setting: 1.0
Service data (VAH8) (Pressure at full calibration)	Only for the "Level" and "Dry calibration.%" calibration modes. The corrected pressure is displayed which was saved when the value for the "Full calibration" parameter (V0H2) was entered. Factory setting: High sensor limit (V7H1)
Device profile (VAH9)	You can change between the different blocks by means of this matrix field: Standard (E+H Matrix), Physical block, Press block and AI Transmitter (Analog Input Block).

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Endress+Hauser

People for Process Automation

Declaration of Hazardous Material and De-Contamination

Erklärung zur Kontamination und Reinigung

RA No. ☐☐☐☐☐☐☐☐

Please reference the Return Authorization Number (RA#), obtained from Endress+Hauser, on all paperwork and mark the RA# clearly on the outside of the box. If this procedure is not followed, it may result in the refusal of the package at our facility.

Bitte geben Sie die von E+H mitgeteilte Rücklieferungsnummer (RA#) auf allen Lieferpapieren an und vermerken Sie diese auch außen auf der Verpackung. Nichtbeachtung dieser Anweisung führt zur Ablehnung ihrer Lieferung.

Because of legal regulations and for the safety of our employees and operating equipment, we need the "Declaration of Hazardous Material and De-Contamination", with your signature, before your order can be handled. Please make absolutely sure to attach it to the outside of the packaging.

Aufgrund der gesetzlichen Vorschriften und zum Schutz unserer Mitarbeiter und Betriebseinrichtungen, benötigen wir die unterschriebene "Erklärung zur Kontamination und Reinigung", bevor Ihr Auftrag bearbeitet werden kann. Bringen Sie diese unbedingt außen an der Verpackung an.

Type of instrument / sensor
Geräte-/Sensortyp _____

Serial number
Seriennummer _____

☐ **Used as SIL device in a Safety Instrumented System /** *Einsatz als SIL Gerät in Schutzeinrichtungen*

Process data/ *Prozessdaten*

Temperature / *Temperatur*_____ [°F] _____ [°C]
Pressure / *Druck* _____ [psi] _____ [Pa]
Conductivity / *Leitfähigkeit* _____ [µS/cm]
Viscosity / *Viskosität* _____ [cp] _____ [mm²/s]

Medium and warnings
Warnhinweise zum Medium

	Medium /concentration *Medium /Konzentration*	Identification CAS No.	flammable *entzündlich*	toxic *giftig*	corrosive *ätzend*	harmful/ irritant *gesundheits-schädlich/ reizend*	other * *sonstiges**	harmless *unbedenklich*
Process medium / *Medium im Prozess*								
Medium for process cleaning / *Medium zur Prozessreinigung*								
Returned part cleaned with / *Medium zur Endreinigung*								

* explosive; oxidising; dangerous for the environment; biological risk; radioactive
* *explosiv; brandfördernd; umweltgefährlich; biogefährlich; radioaktiv*

Please tick should one of the above be applicable, include safety data sheet and, if necessary, special handling instructions.
Zutreffendes ankreuzen; trifft einer der Warnhinweise zu, Sicherheitsdatenblatt und ggf. spezielle Handhabungsvorschriften beilegen.

Description of failure / *Fehlerbeschreibung* _____

_____

_____

Company data / *Angaben zum Absender*

Company / *Firma* _____

Address / *Adresse*

_____

_____

Phone number of contact person / *Telefon-Nr. Ansprechpartner:*

_____

Fax / E-Mail _____

Your order No. / *Ihre Auftragsnr.* _____

"We hereby certify that this declaration is filled out truthfully and completely to the best of our knowledge.We further certify that the returned parts have been carefully cleaned. To the best of our knowledge they are free of any residues in dangerous quantities."
"Wir bestätigen, die vorliegende Erklärung nach unserem besten Wissen wahrheitsgetreu und vollständig ausgefüllt zu haben. Wir bestätigen weiter, dass die zurückgesandten Teile sorgfältig gereinigt wurden und nach unserem besten Wissen frei von Rückständen in gefahrbringender Menge sind."

_____ (place, date / *Ort, Datum)*

_____ Name, dept./ *Abt.* (please print / *bitte Druckschrift*)

_____ Signature / *Unterschrift*

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