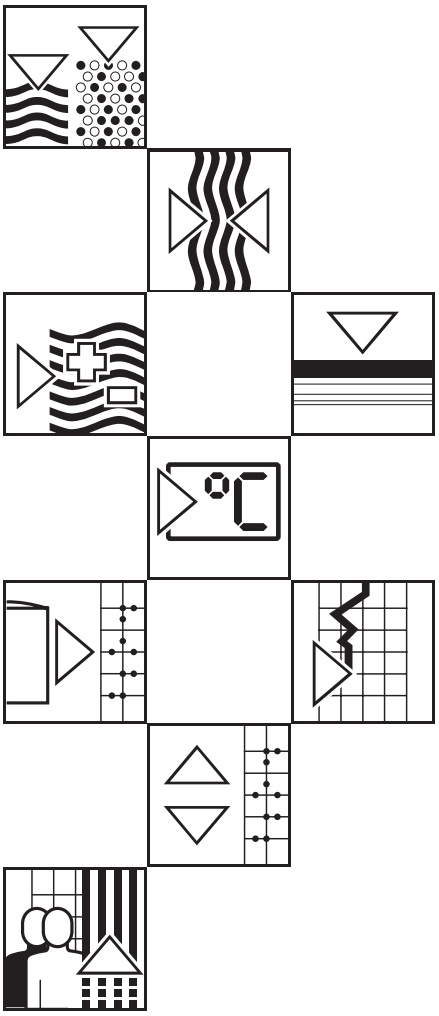
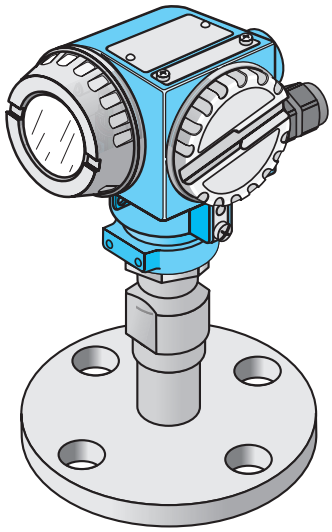
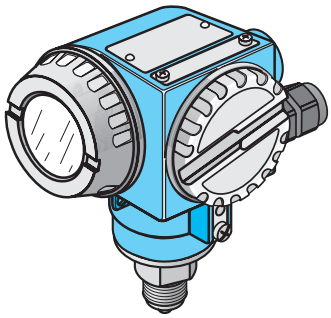
BA 168P/00/en/01.04
Software version 2.2
52022674

cerabar S
PROFIBUS-PA
Pressure Transmitter

Operating Instructions



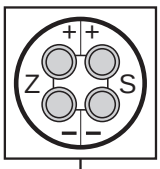


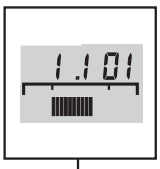


Endress+Hauser

The Power of Know How

Short Operating Instructions





On-site operation
Cerabar S
without/with display

On-site operation via keys:
Chapters 4.1 and 5.1
– only pressure measurement

Remote operation
via Commuwin II

Chapters 4.2 and 5.2

MR = Measuring range

set MR
= required MR?

yes

no

Chapter 5.1
Calibration with keys

Pressure

Level
or pressure?

Level

Chapter 5.2
Calibration via Commuwin

Chapter 6.2
Calibration with reference pressure

Chapter 6.3
Dry calibration

Damping?

no

yes

Chapter 5.3
Damping
(only via Commuwin II)

Linearisation?

no

Linearisation
Chapter 6.4

yes

Table

Automatic

Chapter 5.4
Locking/unlocking with keys

Chapter 5.3 - 5.4
Locking/unlocking and other settings

Chapter 6.5 - 6.6
Locking/unlocking and other settings

Table of Contents

Software History

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

Note!

Note!

Second generation Cerabar S PROFIBUS-PA devices with 3.0 profiles are cyclical downwards compatible with the first generation Cerabar S PROFIBUS-PA devices with 2.0 profiles, i.e. first generation devices can be replaced with second generation devices.

However, to use the additional functions of second generation devices with 3.0 profiles, such as cyclical reading of two additional values, the PLC must be configured with the GSD (EH3x1501.gsd or EH3_1501.gsd).

If the additional functions of the 3.0 profile are not required, the PLC configuration with the first generation GSD (EH__1501.gsd) can be kept.

Notes on Safety

Approved usage

The Cerabar S is a pressure transmitter used for measuring gauge or absolute pressure, depending on the version. You can display the measured pressure value as a level value using the Commuwin II operating and display program.

Mounting, commissioning operation

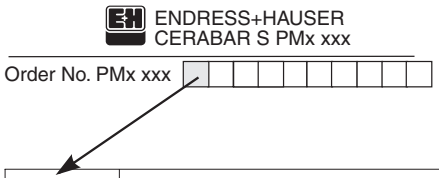
The Cerabar S has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise, e.g. product overflow due to incorrect installation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

Please pay particular attention to the technical data on the nameplate. p_{max} (maximum allowed pressure) is specified on the nameplate. The value refers to a reference temperature of 20°C (68°F) or 100°F for ANSI flanges.
- Test pressure (over pressure limit OPL) = p_{max}
- The pressure values permitted at higher temperatures can be found in the following standards: EN 1092-1: 2001 Tab. 18; ASME B 16.5a – 1998 Tab. 2-2.2 F316; ASME B 16.5a – 1998 Tab. 2.3.8 N10276; JIS B2201

Explosion hazardous areas

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

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



Certificates for applications in explosion hazardous areas

Code	Certificate	Explosion protection
R	Standard	none
C	ATEX	ATEX II 3 G EEx nA II T6
G	ATEX	ATEX II 1/2 G or 2 G EEx ia IIC T4/T6
O	FM	IS Class I, II, III, Div. 1, Groups A…G
S	CSA	IS Class I, II, III, Div. 1, Groups A…G

Safety Conventions and Symbols

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

Safety conventions

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

Explosion protection

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

Electrical symbols

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

1 Introduction

Applications

The Cerabar S pressure transmitter measures the pressure of gases, steam/vapour and liquids and can be used in all areas of chemical and process engineering.

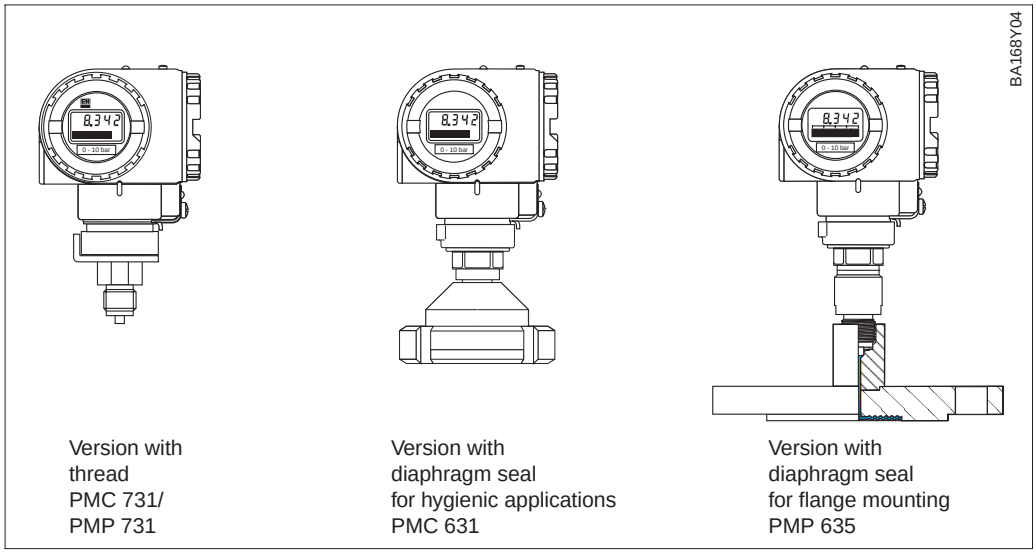


Figure 1.1
Examples of the Cerabar S pressure transmitter

Operating principle

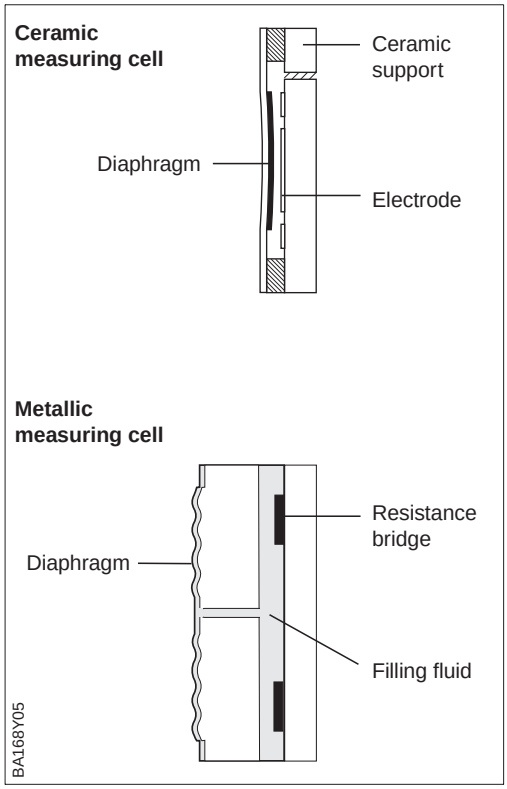


Figure 1.2
Ceramic and metallic measuring cell

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

Metal sensor
The process pressure deflects the separating diaphragm with a filling liquid transmitting the pressure to a resistance bridge. The bridge output voltage, which is proportional to pressure, is then measured and processed.

Level measurement
The hydrostatic pressure of a column of liquid enables its level to be measured continuously by a pressure transmitter if the density ρ of the liquid is known.

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

1.1 Measuring system

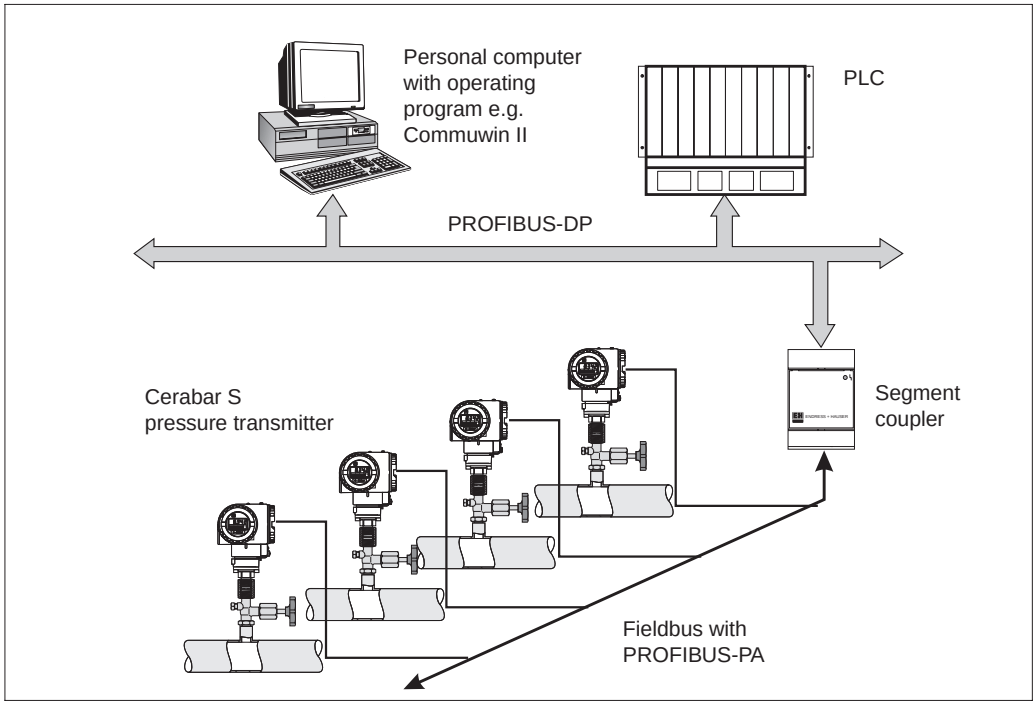


Figure 1.3
Measuring system Cerabar S with PROFIBUS-PA protocol

Measuring point

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

Number of transmitters

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

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

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

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

2 Installation

This Chapter describes:
- the mechanical installation of Cerabar S with and without diaphragm seals
- the electrical connection

2.1 Mounting instructions without diaphragm seal (PMC/PMP 731)

The Cerabar S without diaphragm seal is mounted in the same way as a manometer (DIN EN 839-2). The use of shut-off valves and pigtails is recommended. Its position depends upon the application.

Cerabar S without diaphragm seal
– PMC 731
– PMP 731

- Measurement in gases:
  Mount the shut-off valve above the tapping point so that condensate can run back into the process.

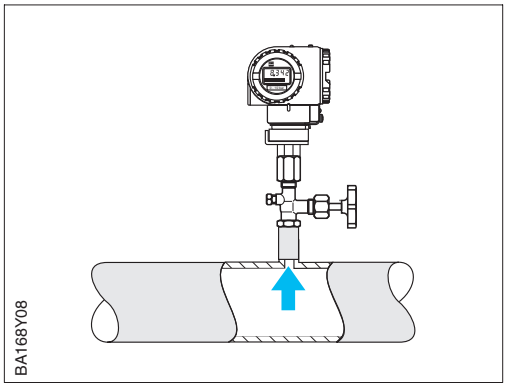


Figure 2.1
Mounted on a shut-off valve for measuring gases

- Measurement in steam:
  Mount with a pigtail below the tapping point.
  The pigtail reduces the temperature in front of the diaphragm to almost ambient temperature. The pigtail must be filled with fill fluid before start-up.

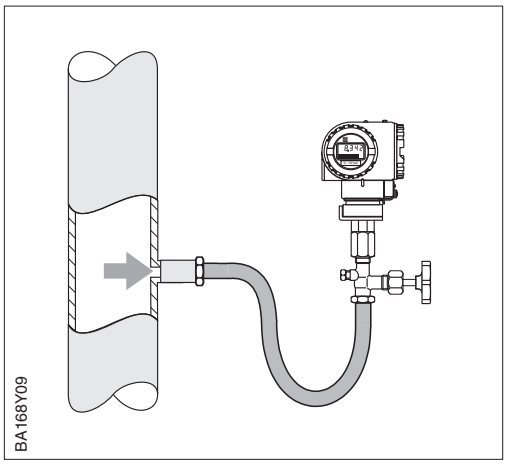


Figure 2.2
Mounted with U-shaped pigtail for measuring steam/vapour

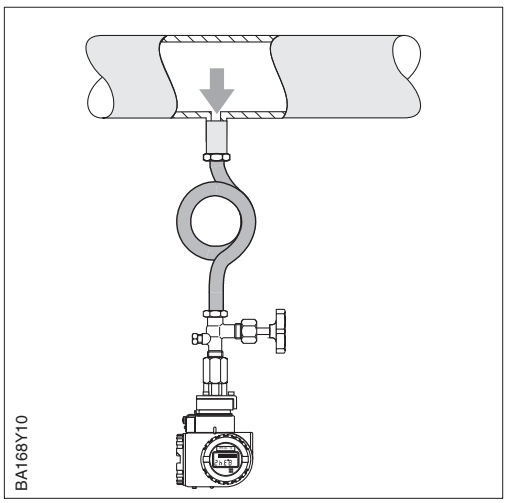


Figure 2.3
Mounted with circular pigtail for measuring steam/vapour

• Measurement in liquids:
Mount on the shut-off valve below the tapping point or at the same height.

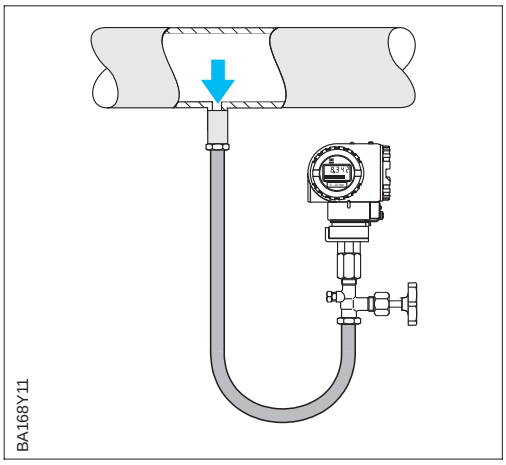


Figure 2.4
Mounted on a shut-off valve for measuring liquids

PVDF adapter

For instruments with PVDF adapter, a maximum torque of 7 Nm is permitted. The thread connection may become loose at high temperatures and pressures. This means that the integrity of the thread must be checked regularly and may need to be tightened using the torque given above. Teflon tape is recommended for sealing with the ½ NPT thread.

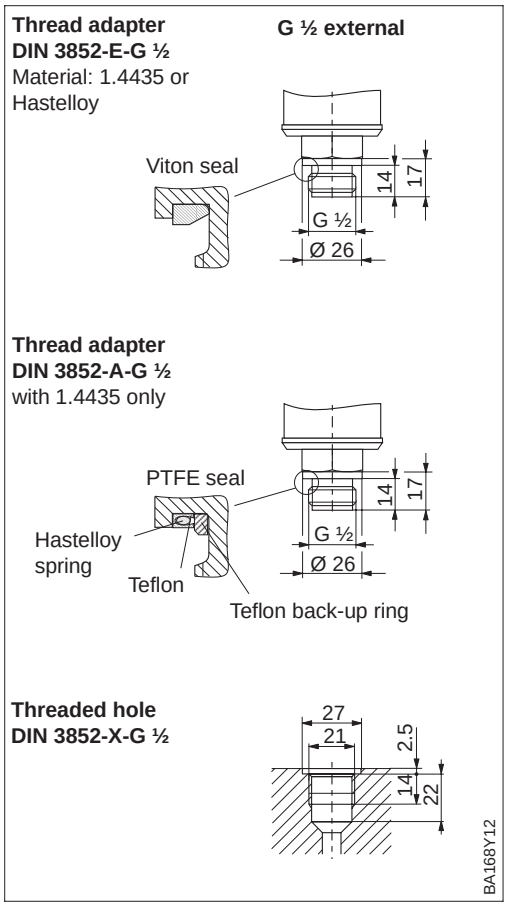
Mounting the PMP 731

The PMP 731 with metallic sensor is available in the following versions:
• with flush-mounted diaphragm or
• with adapter (screwed on or welded in) and internal diaphragm.

A seal is enclosed appropriate to the material used and version.

Note!

Note!
The diaphragm of the Cerabar S must not be pressed in or cleaned with pointed or hard objects.



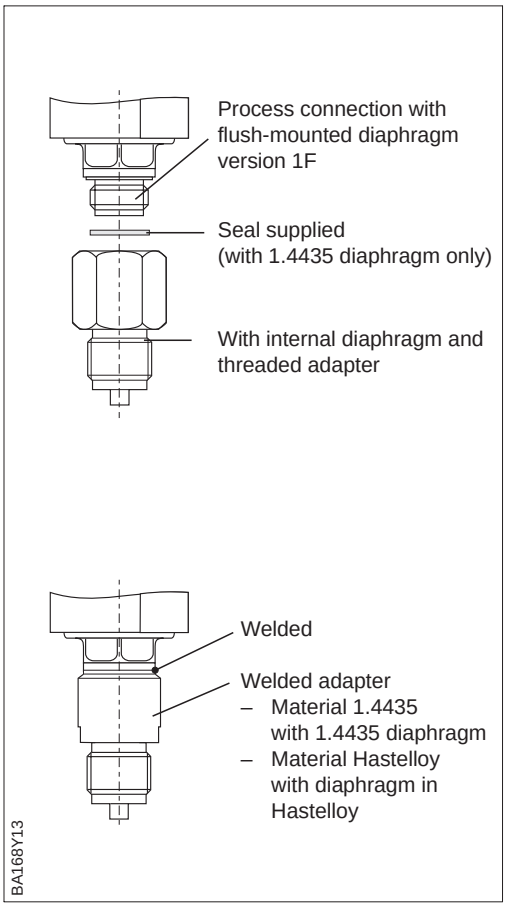
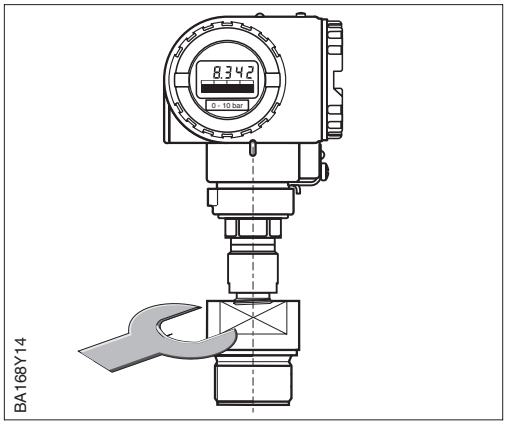


Figure 2.5
left:
An elastomer seal to DIN 3852-E-G ½ is supplied with the thread adapter
right:
With internal diaphragm and welded or threaded adapter

2.2 Mounting instructions with diaphragm seal (PMC 631, PMP 635)

The Cerabar S with diaphragm seal is screwed in, flanged or clamped, depending on the type of diaphragm seal.

- The protective cap of the diaphragm seal should only be removed just before mounting in order to protect the diaphragm.
- The membrane of the diaphragm seal of the Cerabar S must not be pressed in or cleaned with pointed or hard objects.
- The diaphragm seal and the pressure sensor together form a closed and calibrated system which is filled with filling fluid through a hole in the upper part. The following rules should be observed:
  – This hole is sealed and not to be opened.
  – The device may only be rotated on the surface provided on the diaphragm seal instrument and not on the housing.

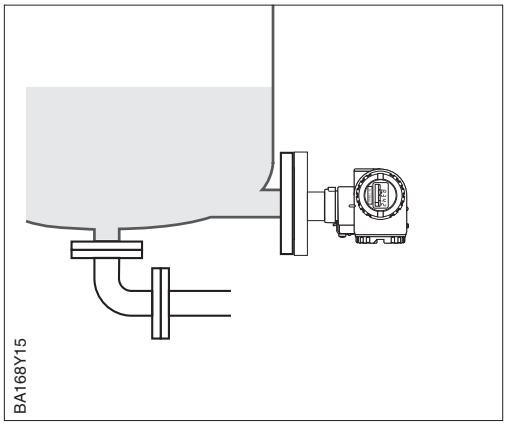


Cerabar S with diaphragm seal
– PMC 635
– PMP 635

Figure 2.6
When screwing in the Cerabar S with diaphragm seals, turn by the diaphragm seal only, not by the housing.

For level measurement the Cerabar S must always be installed below the lowest measuring point.

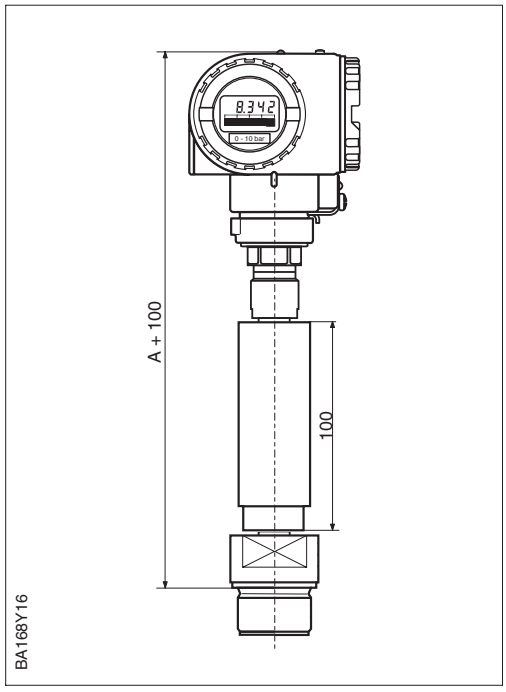
- The instrument should not be installed within the flow of material, in the outlet of the tank or at a place in the tank where pressure pulses from agitator blades may occur.
- Calibration and function testing are easier to carry out if the Cerabar S is mounted downstream from a shut-off valve.



Level measurement

The use of temperature spacers is recommended for continuous extreme product temperatures.

- Note when mounting that the temperature spacer increases the maximum height by 100 mm.
- Due to the hydrostatic column in the temperature spacer, the increased height also causes a zero point shift of approx. 10 mbar.
  See Chapter 5.1, page 32 and Chapter 5.2, pages 34…35 for information concerning position calibration (display only) or zero-point correction.

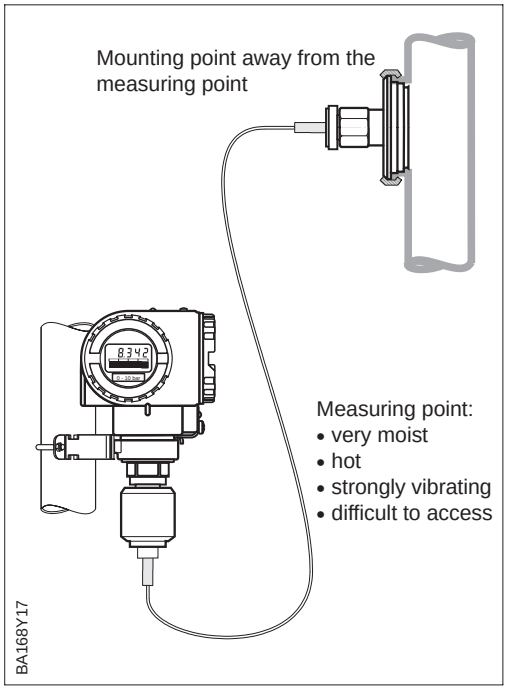


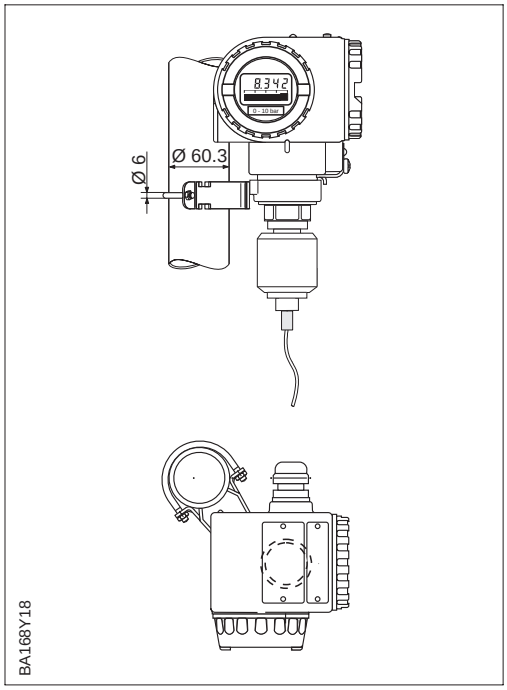
Mounting with temperature spacers

Figure 2.7
Information on the maximum installation height A is given on pages 64.65

Mounting with capillary tubing

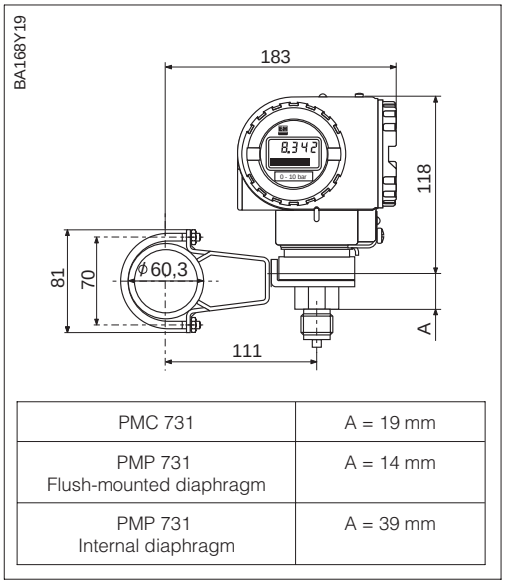
To protect from high temperatures, moisture or vibration, or where the mounting point is not easily accessible, the housing of the Cerabar S can be mounted with capillary tubing away from the measuring point.
A bracket for wall or pipe mounting is available.



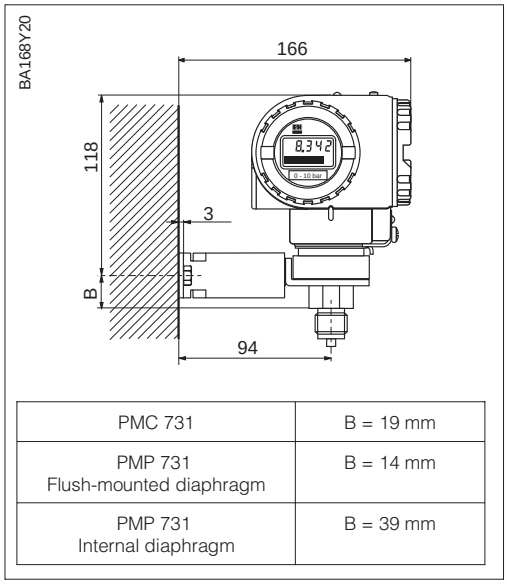


2.3 Mounting accessories

Wall and pipe mounting with accessories



PMC 731	A = 19 mm
PMP 731 Flush-mounted diaphragm	A = 14 mm
PMP 731 Internal diaphragm	A = 39 mm



PMC 731	B = 19 mm
PMP 731 Flush-mounted diaphragm	B = 14 mm
PMP 731 Internal diaphragm	B = 39 mm

Figure 2.8
left:
- *Mounted with bracket on horizontal piping*

right:
- *Mounted with bracket on a wall*

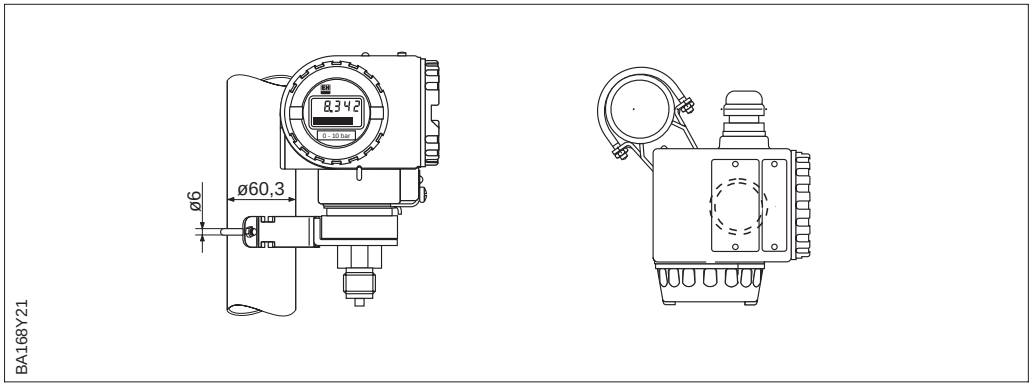


Figure 2.9
Mounted with bracket on vertical piping

2.4 Mounting position

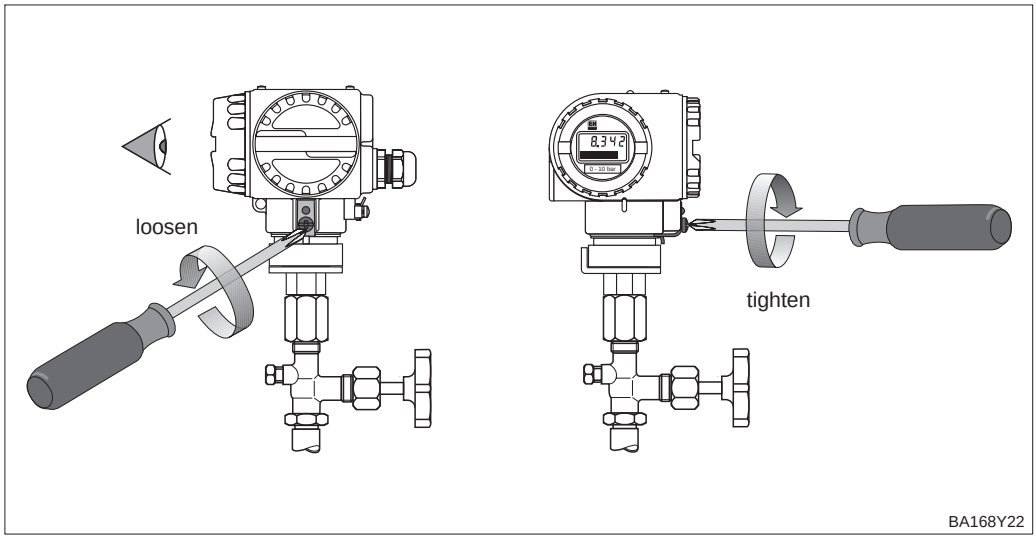
Positioning the housing

After the Cerabar S has been mounted, the housing can be positioned so that:

- the terminal connection compartment can be accessed easily,
- the display can be seen optimally,
- the cable entry and cover of the Z/S keys are protected from water.

The housing can turned through 270°:

- to turn the housing undo the screw below the connection compartment,
- turn the housing,
- tighten the screw again.



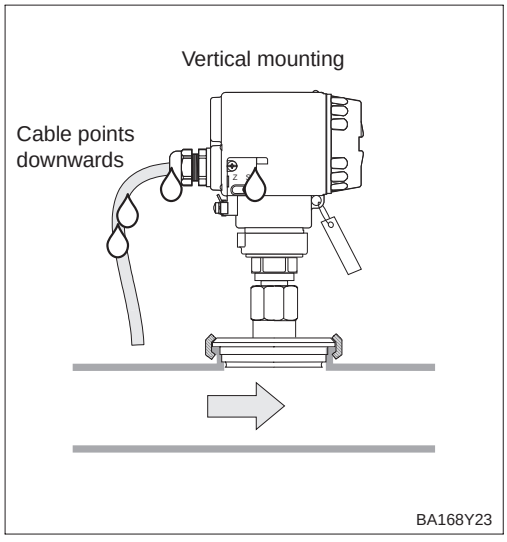


Figure 2.10
Mounting of the Cerabar S
- *cable points downwards*
- *The cover for the Z/S keys is on the side of the instrument*

2.5 Electrical connection

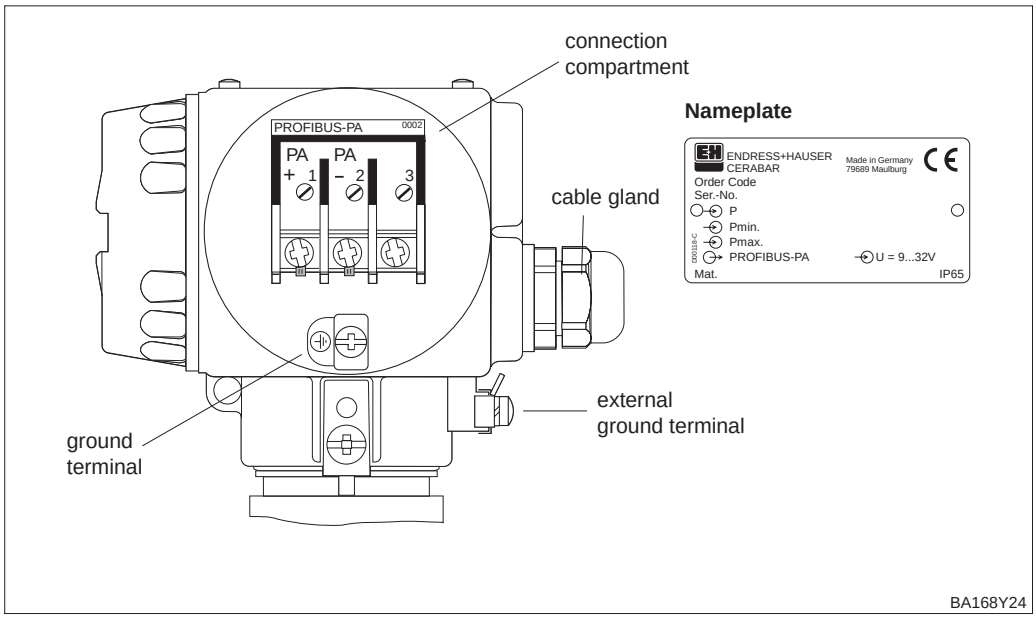


Figure 2.11
Cerabar S connection compartment and nameplate

General note

The Cerabar 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 Cerabar 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 mm^2, fixed conductor).

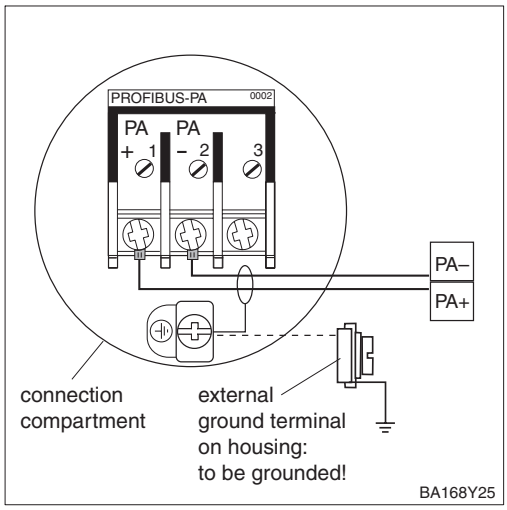
Please pay attention to the following points:
- Ground the device using the external ground terminal.
- The bus cable screen may not be interrupted.
- Ground the screen at each end of the cable, and always try to keep the connecting cable between the screening and ground as short as possible.
- If there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

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


Caution!

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

Connect device



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

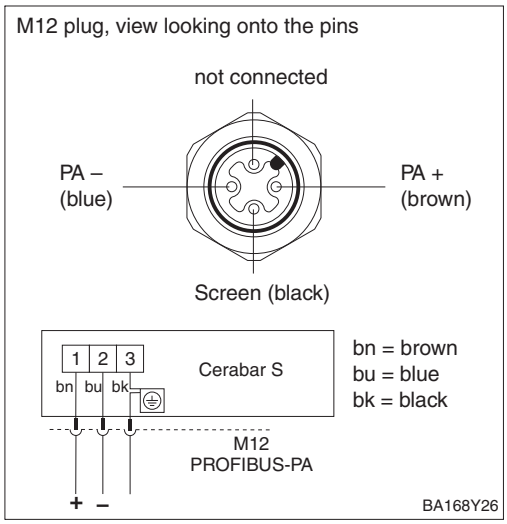
M12 plug

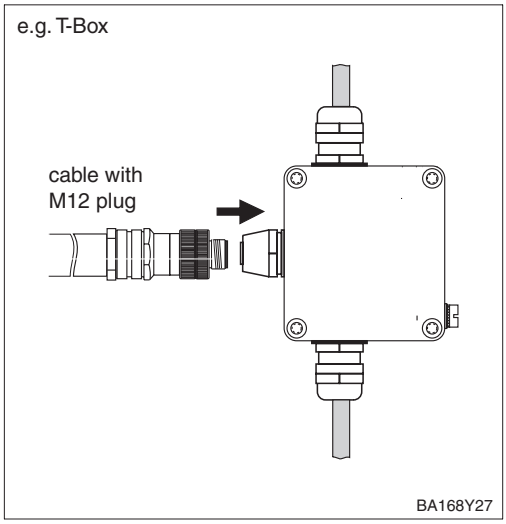
The Cerabar S PROFIBUS-PA version with M12 plug is supplied ready wired and need only be connected to bus by means of a suitable cord set.

Note!
To avoid the effects of vibration, always connect the Cerabar S using a cable.


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, Chapter 5.





3 PROFIBUS-PA Interface

3.1 Synopsis

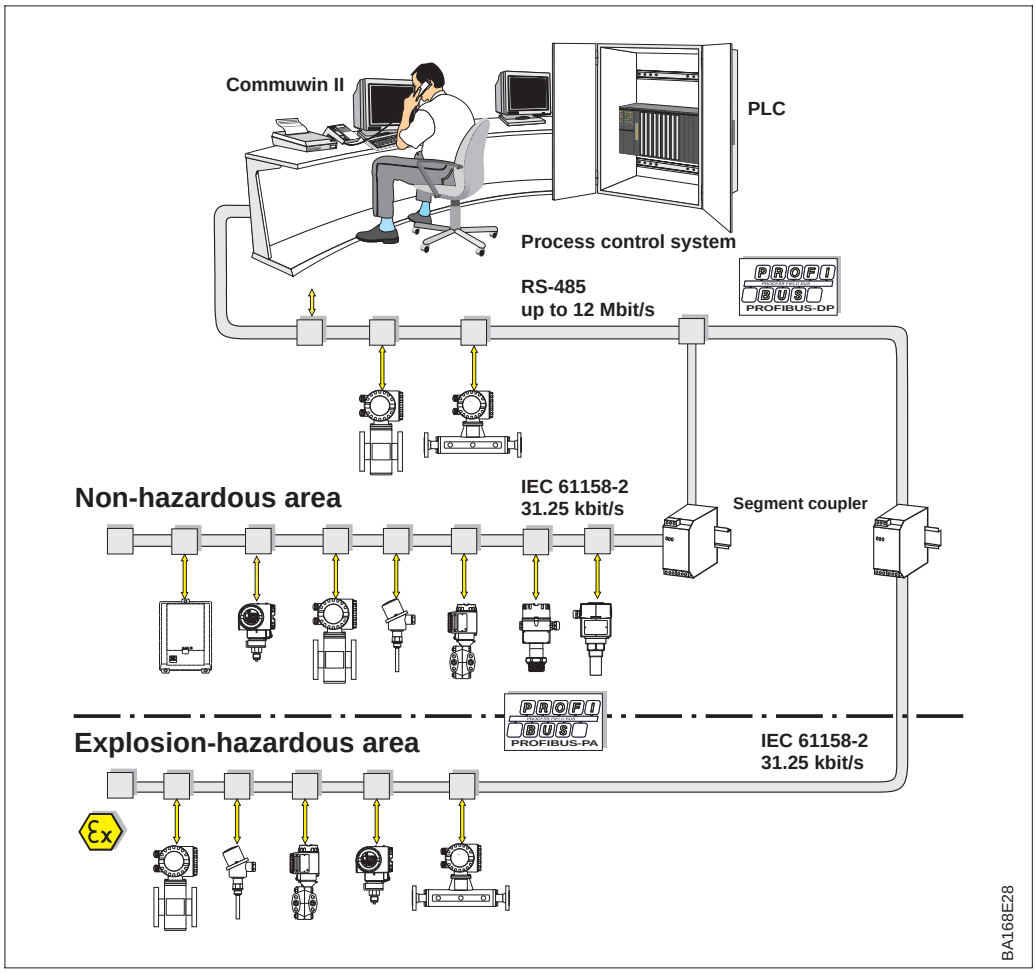


Figure 3.1
PROFIBUS-DP/-PA principle of operation

Note!

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

3.2 Setting the device address

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

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

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

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

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

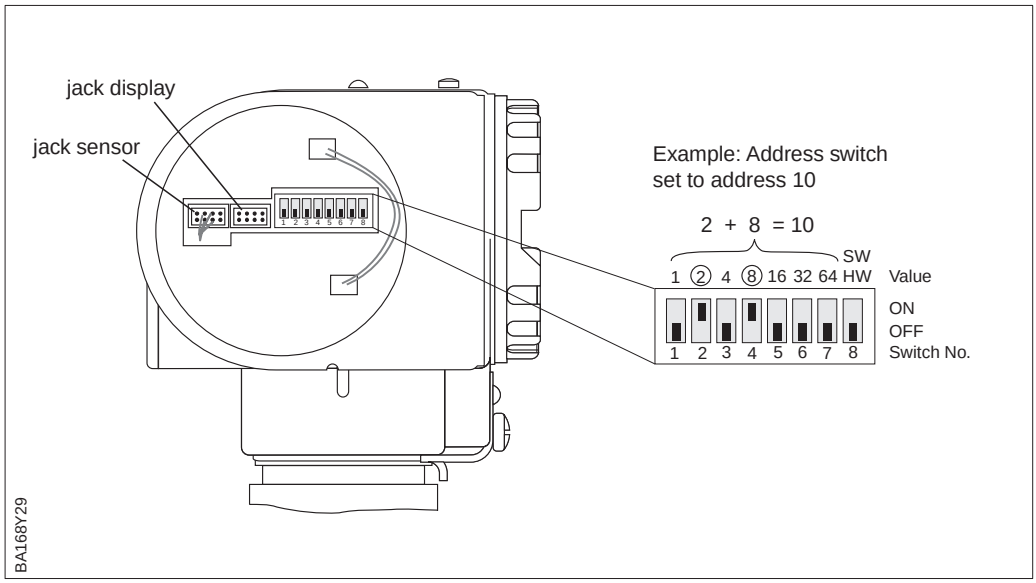


Figure 3.2
Cerabar S address switch

Addressing mode

Set the addressing mode at Switch 8:

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

Hardware address

Proceed as follows to set a hardware address:

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

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

Software address

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

3.3 Device database and type files

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

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

Name of device	ID No.:	Data base file	Type file	Bitmaps
Cerabar S	1501 (hex)	EH3x_1501.gsd	EH31501x.200	EH1501_d.bmp EH1501_n.bmp EH1501_s.bmp

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

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

Note!

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

Working with GSD files

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

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

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

3.4 Cyclic data exchange

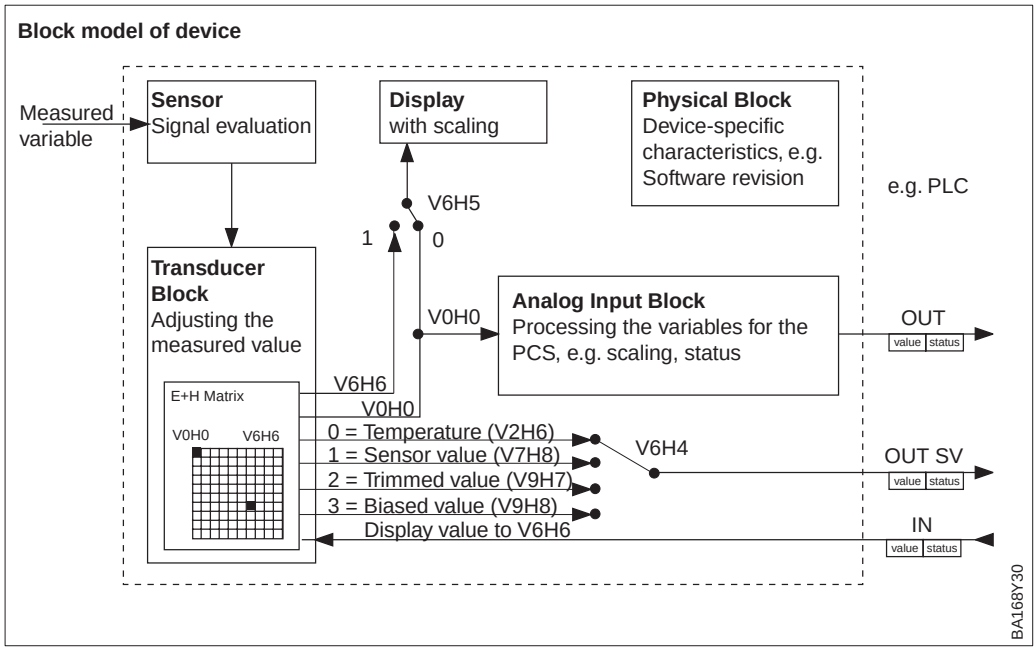


Figure 3.3
Block model of the Cerabar S with PROFIBUS-PA profile 3.0

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

Block model

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

The on-site display and the matrix field V0H0 normally show the same value. The on-site display can also be set to show a cyclical output value (Display Value) using a PLC. For this the matrix field V6H5 in Commuwin II is set to "Display Value" (or 1). Example: Two Cerabar S transmitters measure the pressure drop across a filter. The differential pressure is registered in the PLC and then allocated to the matrix field V6H6.

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

Configuration

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

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

Cerabar S → PLC (input data)

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

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

** The third value (Totalizer) is only relevant for differential pressure transmitters.*

PLC → Cerabar 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 Cerabar S for the primary and secondary values.

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

3.5 Acyclic data exchange

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

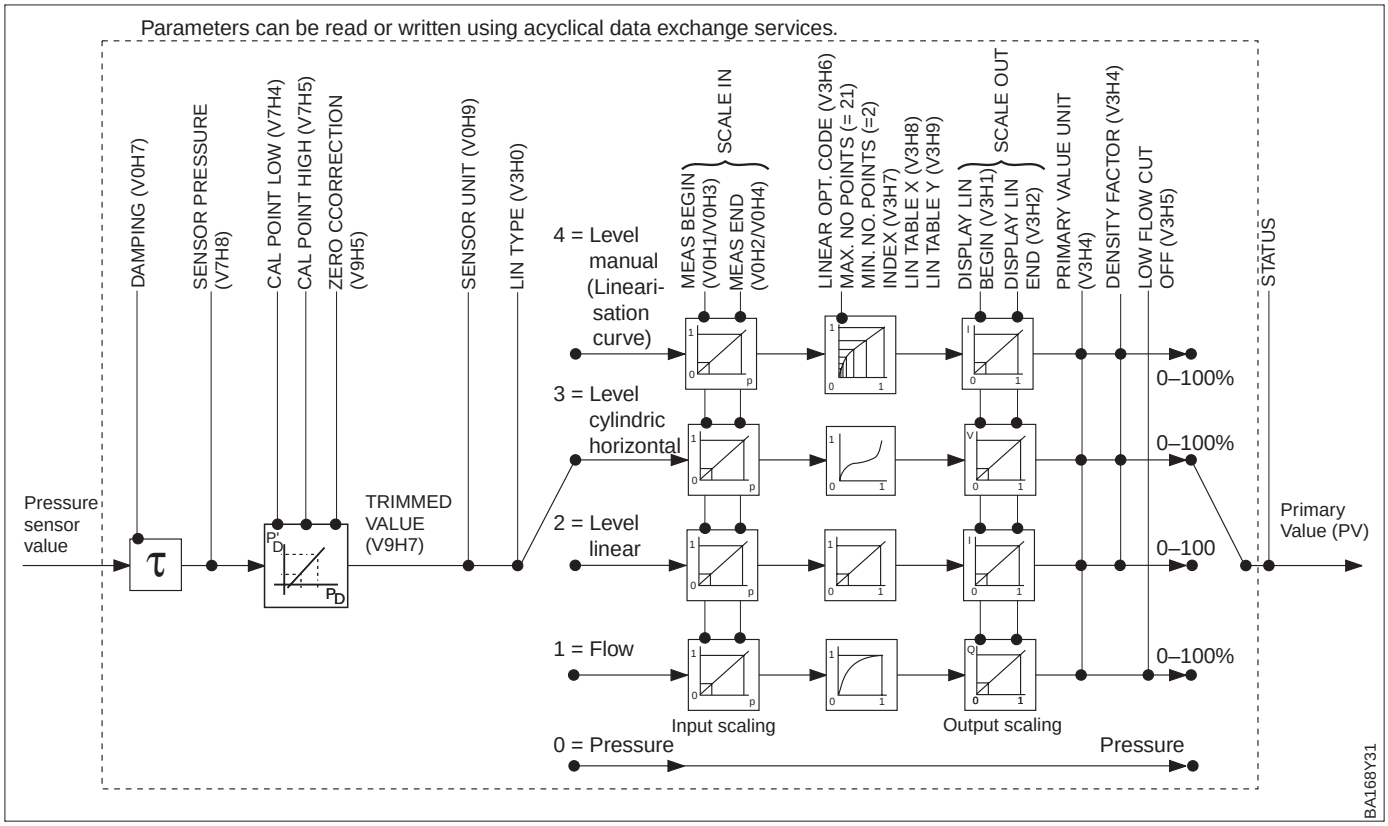


Figure 3.5
Schematic diagram of the Cerabar S transducer block.
Parameter designations correspond to those designations in the Slot/Index List. Parameters with data for a matrix field (in brackets) can be accessed by Commuwin II. The flow measurement is only relevant for differential pressure transmitters.

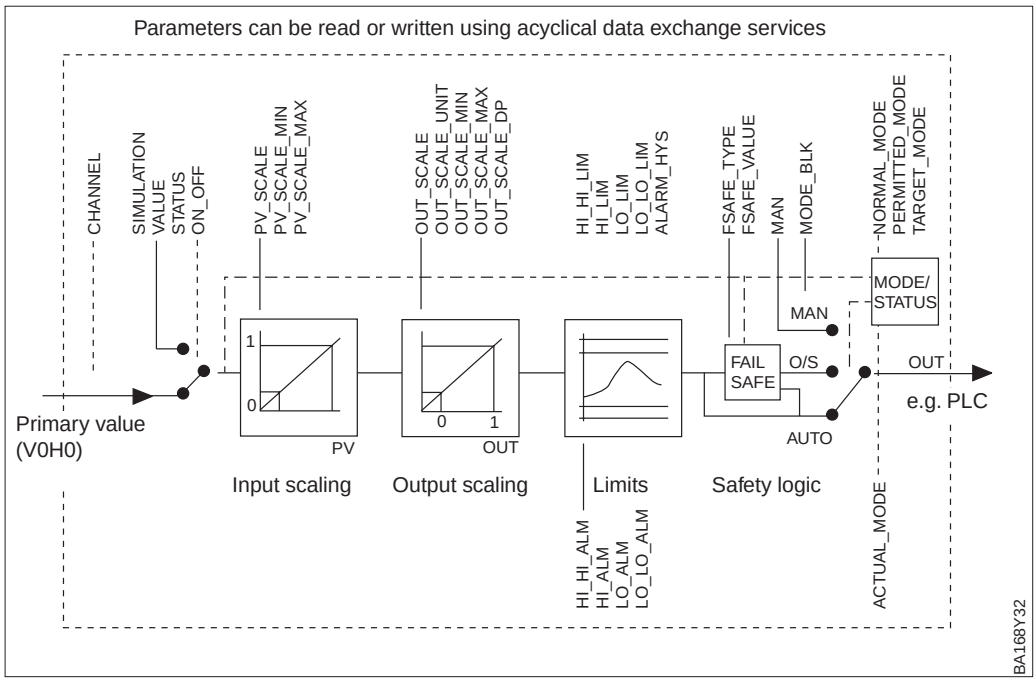


Figure 3.4
Schematic diagram of the Cerabar S analog input block

Slot/index tables

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

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

Device management

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

Analog input block

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

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

Physical block

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

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

View_1 parameters

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

Transducer block

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

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

Transducer block (continuation)

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

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

3.6 Data formats

IEEE 754 float

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

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

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

Figure 3.6
IEEE-754 floating point number

Example

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

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

Note!

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.

Data strings

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

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

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

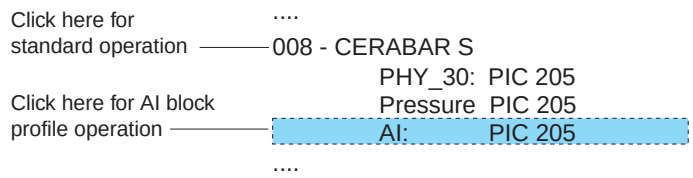
3.7 Configuration of profile parameters

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

Operation

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

- Generate a live list with "Tags"



- E+H operation is selected by clicking on the device name, e.g. Cerabar S.
- Profile operation is selected by clicking on the appropriate tag, e.g. AI: PIC 206 = Analog input block Cerabar 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 Cerabar S on-site display and the digital output operate completely independently of each other. In "Pressure" mode, the measured value is transferred in the unit given on the nameplate. In "Level" mode, the digital output value (OUT Value) delivers a value based on the pressure between 0 and 100 %.

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

So that the display value and the digital output produce the same value, the following operating options are available:
– Set the values for the lower and upper limits of PV Scale and OUT Scale in the Analog Input Block; PV Scale min. = OUT Scale min. and PV Scale max. = OUT Scale max., refer to this Chapter, Slot/Index Table and Chapter 10.2 "Matrix Analog Input Block (AI Transmitter)",
– scale the limits of PV Scale und OUT Scale in Commuwin II in graphic mode, refer to figure below or
– confirm "Set Unit to Bus" parameter according to Chapter 5.1. Section "Select pressure unit". Confirming this parameter automatically sets the PV scale and OUT scale limits to the same level.

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

If you require a differently scaled output value for your PLC than the one which is shown on the display, the following operating options are available:
– Set the upper and lower limit values for PV scale and OUT scale in the Analog Input Block according to requirements, refer to Slot/Index Table in this Chapter and Chapter 10.2 "Matrix Analog Input Block (AI Transmitter)" or
– scale the limits for PV scale and OUT scale in Commuwin II in graphic mode, refer to figure below.

Note!

Note!
If you which to make a position calibration for the value indicated on the on-site display using bias pressure (see Chapter 5.1 "Position calibration – bias pressure"), this must be done before changing the values for OUT Scale min. and OUT Scale max.

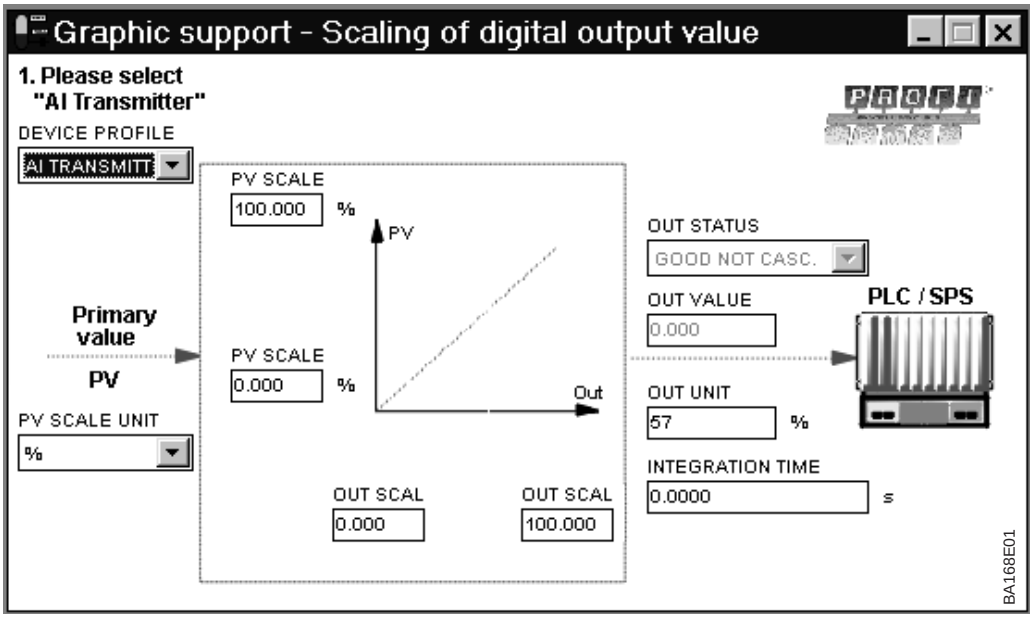


Figure 3.7
Scaling of the Out Value via graphic support in Commuwin II

4 Operation

4.1 On-site operation

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

Operating elements

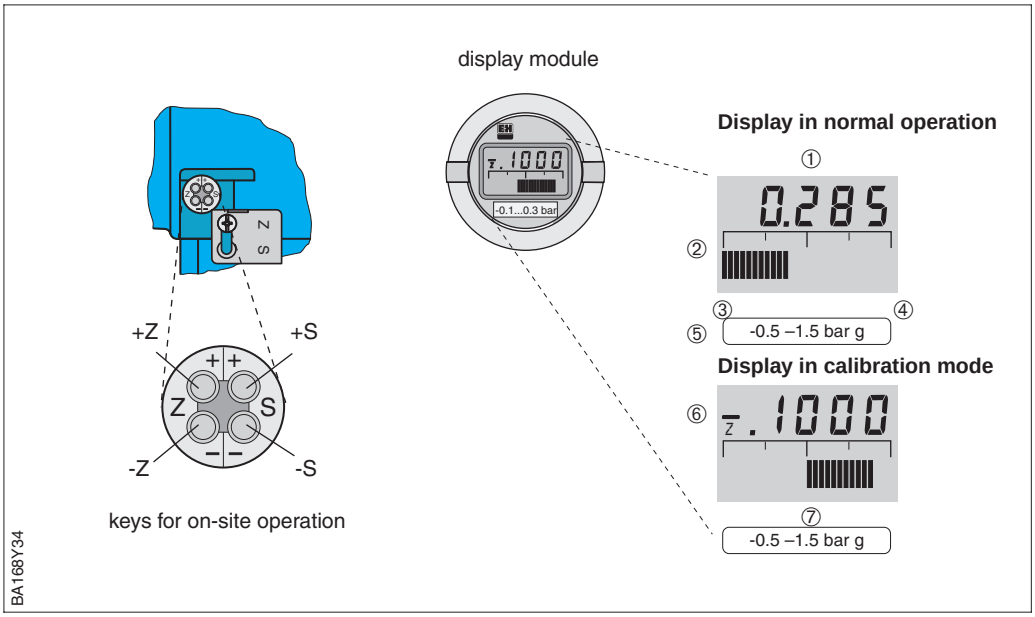


Figure 4.1
User interface of the Cerabar S, with optional display

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

Display module

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

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

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

Table 4.1
Key functions

** Note: Pressing once activates the display, only by pressing again the display begin to count. When the key is pressed the value begins to run slowly at first, then faster and faster.*

*** If the display indicates zero not zero at process pressure after calibrating the lower range-value (depending on position), you can correct the display value to zero by adopting a bias pressure. The position calibration over a bias pressure has no influence on the digital output value (OUT Value), which is transferred over the bus. Please refer to Chapter 5.1, Section "Position calibration – display (bias pressure)".*

4.2 Operation with Commuwin II

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

- Matrix mode or
- Graphic mode.

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

Note!

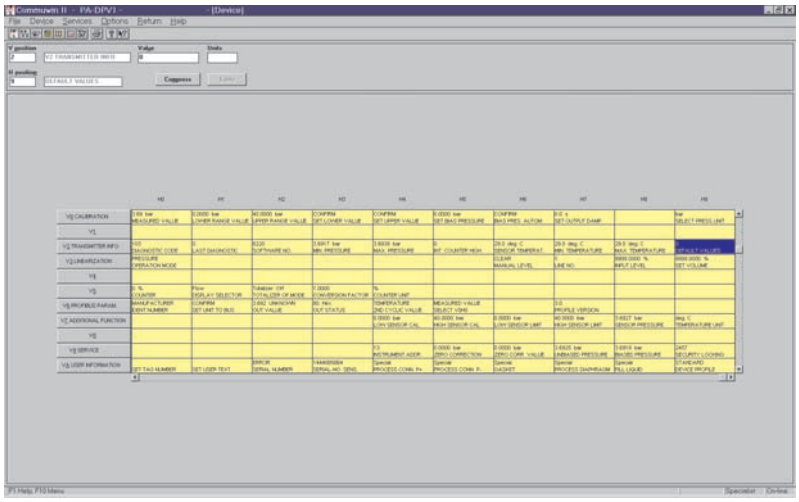
Note!
You can obtain the current device description (DD) either from your local Endress+Hauser Sales Center or via the Internet (http://www.endress.com → Products → Product Portfolio → Process Solutions → Commuwin II → Updates/Downloads).

Matrix mode (Menu Device)

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

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

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

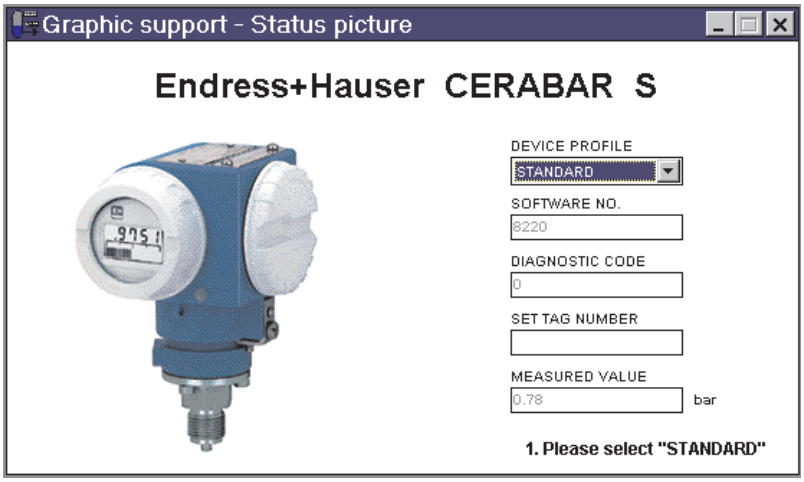


BA168E02

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.



BA168E03

Figure 4.3
Menu "Device/Graphics" in Commuwin II

5 Pressure Measurement

If the Cerabar S is started up as described in chapter 5.2, it can start measurement immediately. The measuring range corresponds to the specification on the nameplate. Normally, the measured variable is transmitted via PROFIBUS-PA in the unit given on the nameplate. After a reset “code 5140", the measured variable is transmitted in ”bar" (refer also to Chapter 7.3).

It is not possible to adjust zero and span in the convential sense. The measured value is, however, transferred at a resolution which offers an accuracy of 0.1 % at a “turndown” 10:1 (see also Chapter 9, Technical Data). This Chapter contains the following information:

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

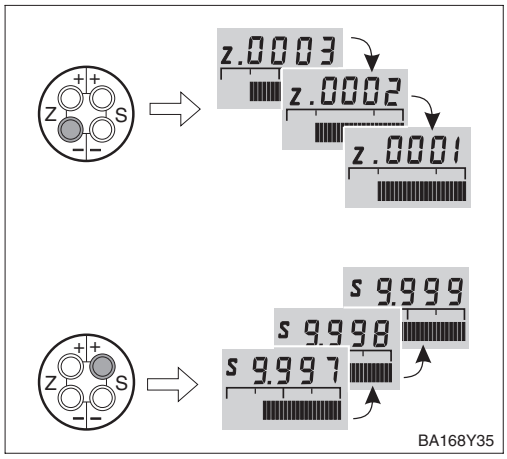
5.1 Calibration with keys

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

Note!

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

Lower and upper range-values: calibration without reference pressure



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

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

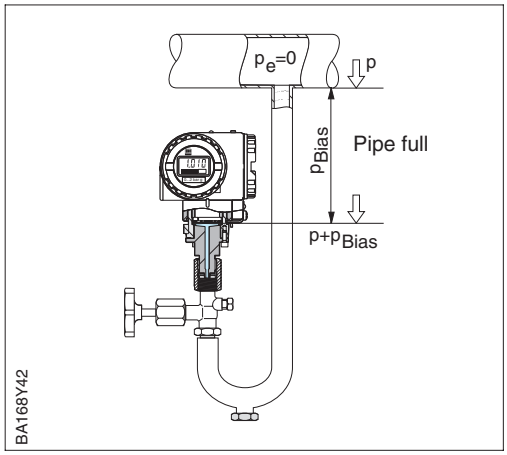
Lower and upper range-values: calibration with reference pressure

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

Position calibration – display (bias pressure)

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

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



Note!


Note!

The position calibration over a bias pressure has no influence on the digital output value (OUT Value), which is transferred over the bus. So that the display and the output value show the same value, you must confirm the "Set unit to bus" parameter in the matrix field V6H1. Refer also to Chapter 5.2, Section "Position calibration – display (bias pressure).

5.2 Calibration via Commuwin II

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

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

Selecting pressure unit

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

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

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

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

Note!

Note!

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

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

Output pressure in "%"

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

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

Note!

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

Calibration without reference pressure

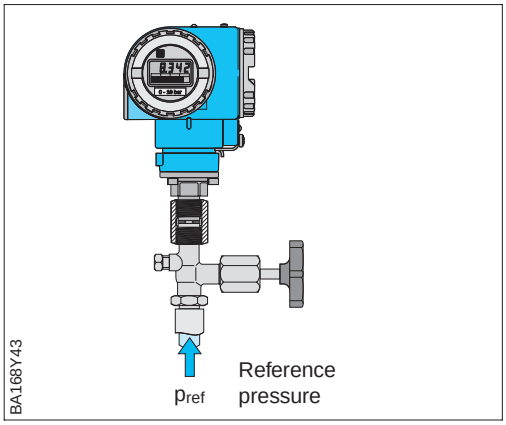
The desired lower and upper range-values are set. No particular pressure must be acting.

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

Calibration with reference pressure

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

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



Position calibration – display (bias pressure)

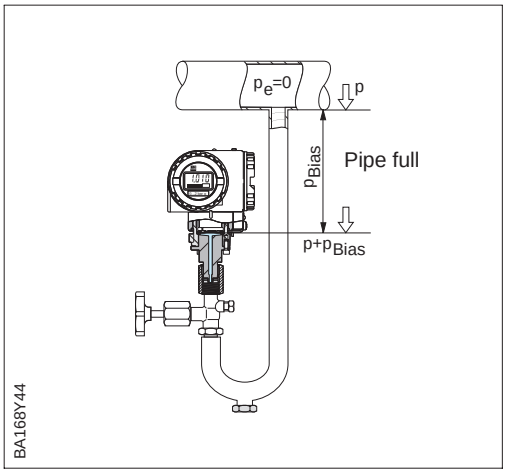
The display does not show zero after zero point adjustment (due to position), then you can correct the display value to zero by entering a bias pressure or by adopting the bias pressure acting (depending on position).

Entry of a bias pressure

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

Registration of an acting bias pressure

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



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


Note!

Zero correction

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

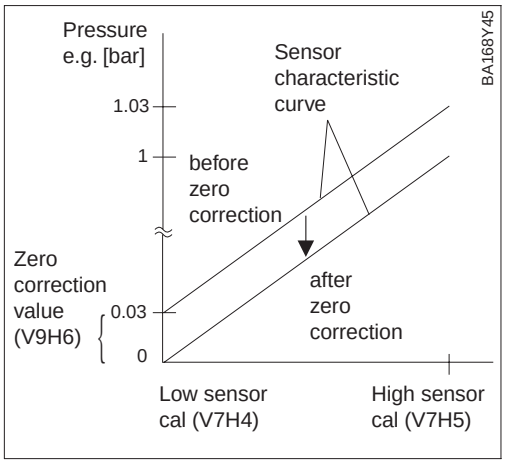
When carrying out a zero correction, an applied pressure is assigned a correction value using "Zero correction" (V9H5). This shifts the sensor characteristic curve according to the diagram and the "Low sensor cal" (V7H4) and "High sensor cal" (V7H5) values are recalculated. The "Zero correction value"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

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

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

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

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

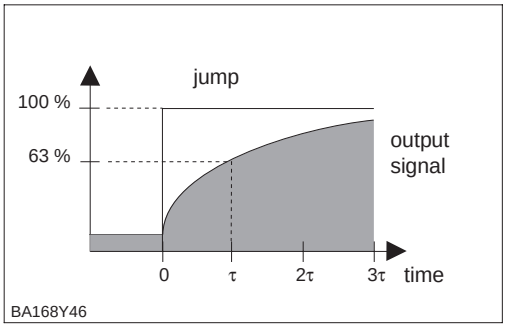


5.3 Damping

Damping τ (Integration time)

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

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



5.4 Locking/Unlocking the operation

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

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

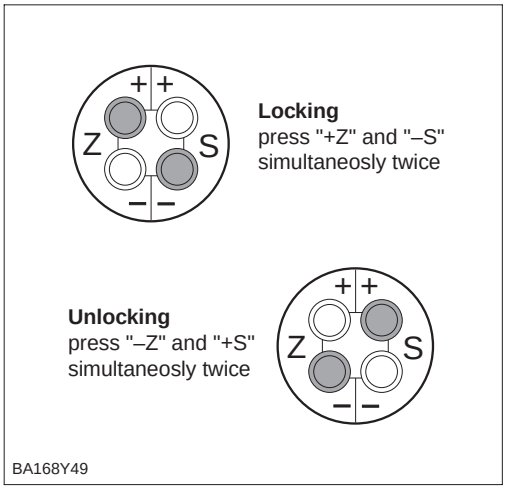
This protects the measuring point from accidental and unauthorised entries.

Keys

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

Matrix

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



Locking with keys has priority

The table below summarises the locking function:

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

5.5 Measuring point information

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

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

Display messages for diagnosis

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

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

User informationen

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

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

* Entry up to 32 characters (ASCII)

6 Level Measurement

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

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

6.1 Calibration via Commuwin II

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

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

* only in "Level manual" operating mode, see Chapter 6.4 "Linearisation"

Selecting pressure unit

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

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

The pressure units in the table below are available.

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

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

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

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

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

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

Units for "Level cylindrical horizontal" operating mode :

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

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

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

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

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

Density correction

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

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

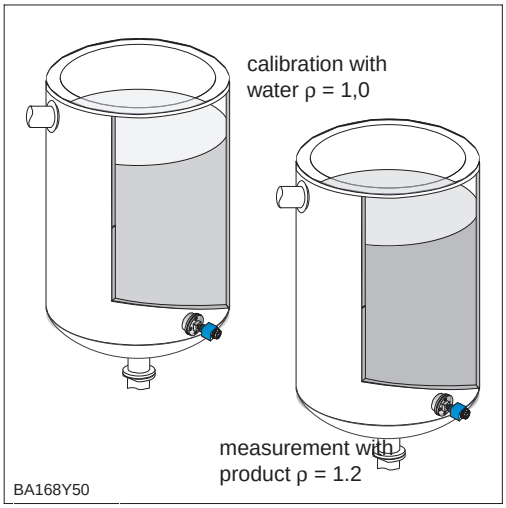
Determining the density factor

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

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

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

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



Note!

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

6.2 Calibration with reference pressure

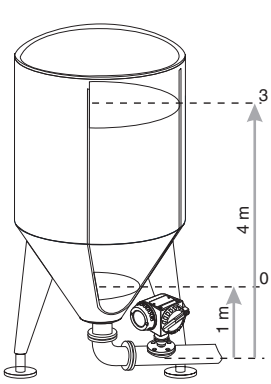
For calibration the tank is filled to each the lower range-value and the upper range-value.

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

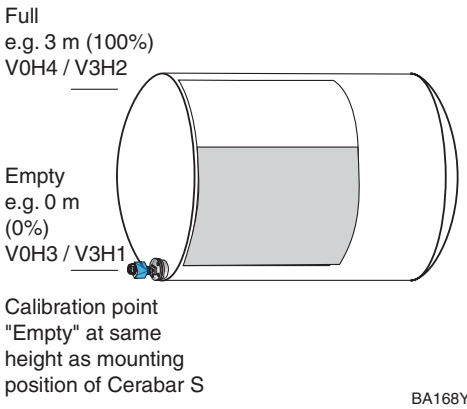
Note!
- If the device has a display and is installed below the "Empty level", an applied pressure can be adopted as a bias pressure in V0H6 (depending on position).
- For Step 3, you can also carry out a zero correction according to the procedure described in Chapter 5.2, page 35.

Note!

Operating mode "Level linear"



Operating mode "Level cylindrical



Calibration

#	VH	Entry	Significance
1	Fill tank to the lower range-value		
2	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H6	Confirm with "Enter"	Set bias pressure automatically
3	V0H3	Confirm with "Enter"	Adopt applied pressure for lower range-value
4	Fill tank to the upper range-value		
5	V0H4	Confirm with "Enter"	Adopt applied pressure for upper range-value
6	V3H0	Level linear **or** Level cylindrical horizontal	Select operating mode for vertical tank **or** horizontal tank
7	V3H1	e.g. 0	Set level, volume or weight for "empty"
8	V3H2	e.g. 3	Set level, volume or weight for "full"
9	V3H3	e.g. m	Select unit for level, volume or weight (see tables, page 39)

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

6.3 Dry calibration

Dry calibration is a theoretical calibration which can be carried out even though the Cerabar S is not mounted and with a vessel filled to any height. The "empty" calibration point "empty" can be at the same height (flanged version) or above the tapping point of the Cerabar S. The requirements for dry calibration are:

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

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

Note!

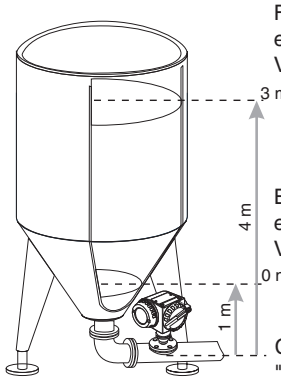
Note!
- If the device has a display and is installed below the "Empty level", an applied pressure can be adopted as a bias pressure in V0H6 (depending on position).
- For Step 3, you can also carry out a zero correction according to the procedure described in Chapter 5.2, page 35.

Calibration

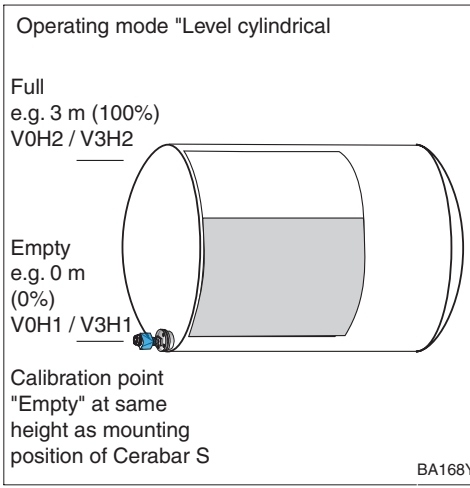
#	VH	Entry	Significance
1	V0H9	e.g. bar	Select pressure unit
2	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H5	e.g. 0.1	Enter bias pressure
3	V0H1	0	Set pressure value for calibration point "empty"
4	V0H2	e.g. 0.3	Set pressure value for calibration point "full"
5	V3H0	Level linear **or** Level cylindrical horizontal	Select operating mode for vertical tank **or** horizontal tank
6	V3H1	e.g. 0	Set level, volume or weight for "empty"
7	V3H2	e.g. 3	Set level, volume or weight for "full"
8	V3H3	e.g. m	Select level, volume or weight (see tables page 39)

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

Operating mode "Level linear"



Operating mode "Level cylindrical



Check after installation

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

6.4 Linearisation

Linearisation mode

Linearisation enables volumetric measurement to be carried out in vessels, e.g. with conical outlets in which the volume is not directly proportional to the level. The table below gives a summary of the linearisation function (V3H6) that is available with the operating mode "Level manual" (V3H0). Linearisation follows a calibration in the volumetric units required. The units for level, volume or weight are selectable using the "Unit after linearisation" (V3H3) parameter (see also tables, page 39).

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

Warnings

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

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

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

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

Manual entry

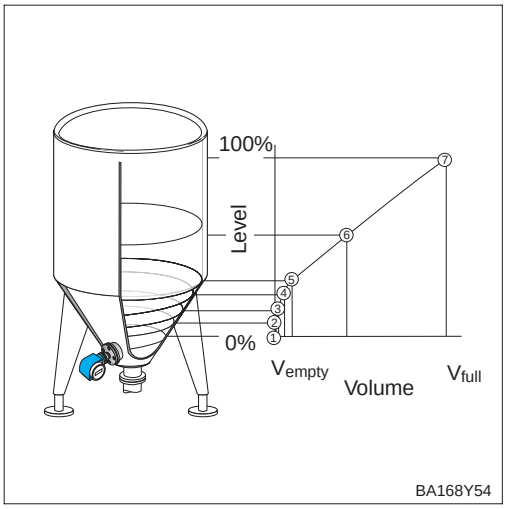
The requirements for a manual linearisation are as follows:

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

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

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

#	VH	Entry	Significance
1	V0H9	e.g. bar	Select pressure unit
2	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H5	e.g. 0.1	Enter bias pressure
3	V0H1	e.g. 0	Set pressure value for calibration point "empty"
4	V0H2	e.g. 0.5	Set pressure value for calibration point "full"
5	V3H0	Level manual	Select "Level manual" operating mode
6	V3H1	e.g. 0	Set level, volume or weight for "empty"
7	V3H2	e.g. 10	Set level, volume or weight for "full"
8	V3H3	e.g. hl	Select unit for level, volume or weight
9	V3H6	Clear table	Delete existing curve
10	V3H6	Manual	Select "Manual" linearisation mode
11	V3H7	e.g. 1	Enter line no.
12	V3H8	e.g. 0 %	Enter level
13	V3H9	e.g. 0 %	Enter volume
14	Repeat steps 11...13 for other value pairs (max. 21)		
15	V3H6	Activate table	Activate table



Specimen table

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

Result

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

Note!

Note!

- For Step 2, you can also carry out a zero correction according to the procedure described in Chapter 5.2, page 35.
- An empty/full calibration can be made at Steps 1 – 4, see page 41 "Calibration with reference pressure".
- In edit mode V3H6 = Manual, you can delete individual points in a linearisation table by entering "9999" for level or volume. But first activate the linearisation table.

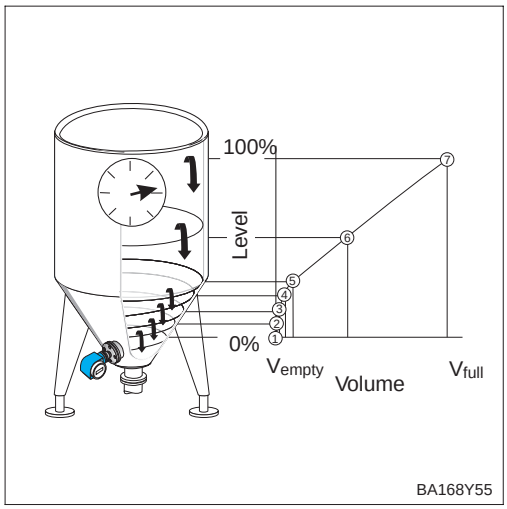
Semi-automatic entry

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

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

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

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



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

Note!

Note!
- For Step 2, you can also carry out a zero correction according to the procedure described in Chapter 5.2, page 35.
- An dry calibration can be made at steps 1 – 5, see page 42.
- In edit mode V3H6 = Manual, you can delete individual points in a linearisation table by entering "9999" for level or volume. But first activate the linearisation table.

#	VH	Entry	Significance
1	Fill tank to lower range-value		
2	If necessary, set display to "0" by adopting a known pressure (position-dependent pressure)		
	V0H6	Confirm with "Enter"	Set bias pressure automatically
3	V0H3	Confirm with "Enter"	Adopt applied pressure for lower range-value
4	Fill tank to upper range-value		
5	V0H4	Confirm with "Enter"	Adopt applied pressure for upper range-value
6	V3H0	Level manual	Select "Level manual" operating mode
7	V3H1	e.g. 0	Enter level, volume or weight for "empty"
8	V3H2	e.g. 100	Enter level, volume or weight for "full"
9	V3H3	e.g. hl	Select unit for level, volume or weight
10	V3H6	Clear table	Delete existing curve
11	V3H6	Semi-automatic	Select "Semi-automatic" linearisation mode
12	V3H7	e.g. 1	Enter line no.
13	V3H8	Confirm with "Enter"	Enter level
14	V3H9	e.g. 0 %	Enter volume
15	Repeat steps 12...14 for other value pairs (max. 21)		
16	V3H6	Activate table	Activate table

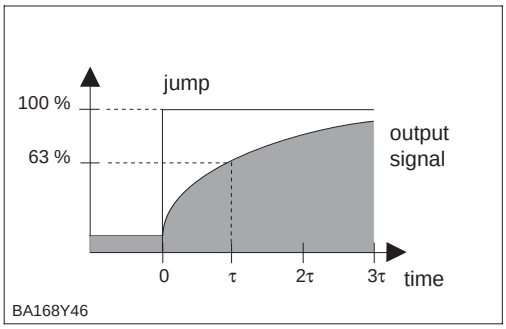
Result
- The measured value is displayed in the matrix field V0H0 as a volume value, here, for example, in hectolitres.

6.5 Damping

Damping τ (Integration time)

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

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



6.6 Locking/Unlocking the operation

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

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

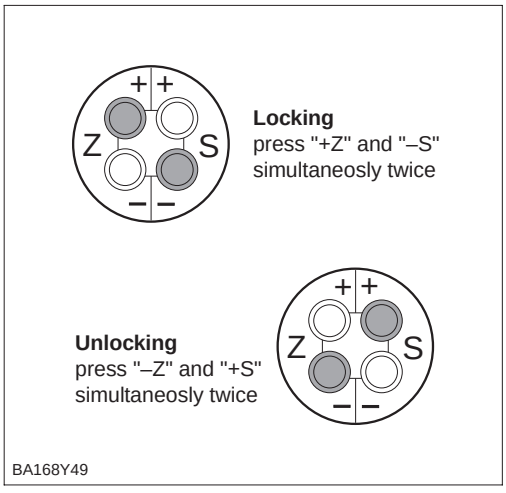
This protects the measuring point from accidental and unauthorised entries.

Key

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

Matrix

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



Locking with keys has priority

The table below summarises the locking function:

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

6.7 Measuring point information

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

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

Display messages for diagnosis

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

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

User information

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

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

* Entry up to 32 characters (ASCII)

7 Diagnosis and Warnings

7.1 Diagnosis of errors and warnings

Errors

When the Cerabar S detects an error:

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

Warnings

When the Cerabar S detects a warning:

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

Error codes in V2H0 und V2H1

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

Code	Type	Cause and Remedy	Priority
E 101	Error	Sensor Checksum Error Error reading checksums from the EEPROM of the sensor. – Checksum incorrect, transmission error during read process due to effects of EMC (larger than specified in Chapter 9, Technical Data). *Block EMC effects.* – EEPROM of the sensor defective. *Replace sensor.*	3
E 102	Warning	Electronic fault in maximum counter function – *Reset system (Code 5140), recalibrate sensor.* – Main electronics defective. *Replace electronics.*	19
E 103	Error	Initialisation active – The electronics are initialised after the device is connected. *Wait for end of initialisation process.*	17
E 104	Warning	Sensor calibration – Values in V7H4 and V7H5 (Low Sensor Cal and High Sensor Cal) are too close together, e.g. after sensor recalibration. *Reset system (Code 2509), recalibrate sensor.*	18
E 106	Error	Download active (Commuwin II) – *Wait for end of download.*	10
E 110	Error	Checksum error – During the write process to processor, the power supply is interrupted. *Restore the power supply. Reset system (Code 5140) if necessary. If necessary, recalibrate sensor.* – EMC effects (larger than specified in Chapter 9, Technical Data). *Block EMC effects.* – Main electronics defective. *Replace electronics.*	12
E 111	Error	No connection to EEPROM of the sensor – Cable connections from sensor electronics via main electronics to display (internal bus) interrupted or sensor electronics defective. *Check plug to sensor. Check cable connection. Replace sensor.*	2
E 112 PMC 631, PMC 731	Error	No connection to sensor analogue/digital converter – Cable connection from sensor to main electronics interrupted. *Check cable connection.* – Main electronics defective. *Replace electronics.* – Sensor electronics defective. *Replace sensor.*	4

Error codes in V2H0 and V2H1 (continuation)

Code	Type	Cause and Remedy	Priority
E 113 PMC 631, PMC 731	Error	Measuring error during pressure and temperature measurement The sensor electronics are no longer correctly converting the measured pressure and temperature values. – "Pressure signal" (PIN 6) connection disconnected at the plug. *Reconnect.* Sensor or sensor electronics defetive. *Replace sensor.*	5
E 113	Error	Measuring errors during pressure and temperature measurement Incorrect transfer of analogue signals from sensor to main electronics. – Cable connection between sensor and main electronics interrupted. *Check cable connection.* – Main electronics defective. *Replace electronics.* – Sensor electronics defective. *Replace sensor.*	5
E 114	Error	Measuring error during temperature measurement. Difference between temperature calculated in sensor and measured temperature is greater than 50 K. – Cable connection between sensor and main electronics interrupted. *Check cable connection.* – Sensor electronics defective. *Replace sensor.*	6
E 115	Error	Sensor overpressure – Overpressure present. *Reduce pressure until message disappears.* – Cable conntection between sensor and main electronics interrupted. *Check cable connection.* – Sensor defective. *Replace sensor.*	7
E 116	Error	Download error (PC → Transmitter) – During the download, the data is not being correctly transferred to the processor, e.g. due to an open cable connection, voltage peaks (ripple) on supply voltage, EMC effects. *Check the cable connection between PC and transmitter.* *Reset system (Code 5140), restart download.*	11
E 118	Error	Calibration error Editing limits[1)] or maximum turn down exceeded, e.g. due to inappropriate download. *– Reset system (Code 5140). Repeat download.*	13
E 120	Error	Sensor underpressure – Pressure too low. *Increase pressure until message disappears.* – Cable connection between sensor and main electronics interrupted. *Check cable connection.* – Sensor defective. *Replace sensor.*	8
E 121	Error	Checksum error – Main electronics defective. *Replace electronics.*	1
E 602	Warning	Linearisation curve does not increase or decrease monotonically. – Value pairs for the linearisation curve entered incorrectly. *Check Level Manual for plausibility. (E.g. does the volume increase with the level?) If necessary, carry out linearisation again or re-enter the value pairs, see Chapter 6.4 Linearisation.*	16
E 604	Warning	Linearisation curve contains less than 2 value pairs. – *Check manual level. If necessary, carry out linearisation again or add more value pairs, see Chapter 6.4 Linearisation.*	15
E 605	Error	No linearisation curve saved – Linearisation curve not activated, although the "Level manual" operating mode was selected. *After entering the value pairs for the linearisation curve, activate the Level Manual using the V3H6 (manual level) matrix field.* Note: The message also appears, if, during entry, the value pairs of the "Level manual" are selected.	14

1) The editing limits are described in Chapter 7.4.

Error codes on-site display

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

1) The editing limits are described in Chapter 7.4.

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

7.2 Simulation

You have the option of simulating either the output value (OUT Value) or the function of the Analog Input Block. The matrix fields in brackets give the matrix position in the Analogue Input Block diagram in Commuwin II. See also Chapter 10.2 "Matrix Analog Input Block (AI Transmitter)."

Simulation OUT Value

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

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

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

Note!

Simulation Analog Input Block

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

7.3 Reset

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

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

The Cerabar S differentiates between different reset codes with different effects. To find out which parameters are reset with the 5140 or 1, 2380 and 731 reset codes, refer to the table on page 52.

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

Reset Codes		H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
1 / 5140 2380 731	**V0**	**Measured Value**	**Lower range value** 0.0 0.0 0.0	**Upper range value** = V7H7 = V7H7 = V7H7	**Set lower value**	**Set upper value**	**Set bias pressure** 0.0 0.0 0.0	**Bias pressure autom.**	**Set output damping [s]** 0.0 0.0 0.0		**Select pressure unit** bar
	V1										
1 / 5140 2380 731	**V2**	**Diagnostic code**	**Last diagnostic code** 0 0 0	**Software no.**	**Min. pressure** =V7H8[1)] =V7H8[1)]	**Max. pressure** =V7H8[1)] =V7H8[1)]	**Internal counter high** 0 0	**Sensor temp.**	**Min. temp.** =V2H6[2)] =V2H6[2)]	**Max. temp.** =V2H6[2)] =V2H6[2)]	**Default value**
1 / 5140 2380 731	**V3**	**Operation mode** Pressure	**Start point[3)]** 0.0 % 0.0 % 0.0 %	**Full scale [3)]** 100.0 % 100.0 % 100.0 %	**Unit after lin.[3)]** %	**Density factor[4)]** 1.0 1.0 1.0	**Creep flow suppr. %[5)]** 0.0 % 0.0 %	**Manual level** delete	**Line no.** 1	**Input level** 9999.0%	**Set volume** 9999.0%
	V4										
1 / 5140 2380 731	**V5**	**Counter[6)]** 0 %	**Display selector[6)]** Flow	**Totalizer operation mode[6)]** Off	**Conver. factor[6)]** 1.0	**Counter unit[6)]** %					
1 / 5140 2380 731	**V6**	**Identity Number**	**Set unit to bus**	**AI Out Value** [7)] [7)]	**AI Out Status**	**2nd cyclic value**	**Select V0H0** Meas. Val. Meas. Val.	**OUT Value SPS**	**Profile version**		
1 / 5140 2380 731	**V7**					**Low sensor cal** = V7H6 = V7H6	**High sensor cal** = V7H7 = V7H7	**Low sensor limit**	**High sensor limit**	**Sensor pressure**	**Temp. unit** °C
	V8										
1 / 5140 2380 731	**V9**					**Instrument address**	**Zero correction** 0.0	**Zero correction value** 0.0	**Unbiased pressure** = V7H8[1)] = V7H8[1)]	**Biased pressure** = V7H8[1)] = V7H8[1)]	**Security locking** 2457
1 / 5140 2380 731	**VA**	**Set Tag Number** delete delete	**Set User Text** delete delete	**Serial Number**	**Serial No. Sensor**	**Process conn. P+** special	**Process conn. P–[6)]** special	**Gasket** special	**Process diaphragm** special	**Fill liquid** special	**Device Profile**

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

7.4 Editing limits

To avoid incorrect device functioning because of excessively large or excessively small values, for some parameters there is a minimum and maximum permissible input value (editing limits). The set measuring range must be within these editing limits. An attempt to exceed or undershoot these editing limits generates an error message (refer to Chapter 7.1 Diagnosis of errors and warnings).

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

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

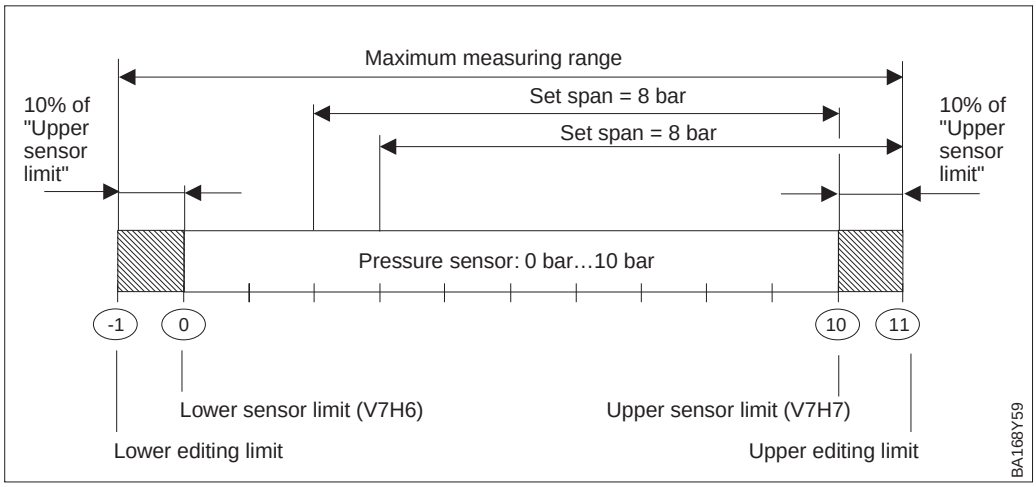
The table below lists the editing limits and the smallest span which you can set:

Measuring cell	Low sensor limit (V7H6)	High sensor limit (V7H7)	Lower editing limit	Upper editing limit	Smallest span
Ceramic sensor PMC 631 and PMC 731					
0.1 bar gauge pressure	–0.1 bar	0.1 bar	–0.11 bar	0.11 bar	0.002 bar
0.4 bar gauge pressure	–0.4 bar	0.4 bar	–0.44 bar	0.44 bar	0.008 bar
2 bar gauge pressure	–1 bar	2 bar	–1.2 bar	2.2 bar	0.03 bar
10 bar gauge pressure	–1 bar	10 bar	–2 bar	11 bar	0.11 bar
40 bar gauge pressure	–1 bar	40 bar	–5 bar	44 bar	0.41 bar
0.4 bar absolute pressure	0 bar	0.4 bar	–0.04 bar	0.44 bar	0.004 bar
2 bar absolute pressure	0 bar	2 bar	–0.2 bar	2.2 bar	0.02 bar
10 bar absolute pressure	0 bar	10 bar	–1 bar	11 bar	0.1 bar
40 bar absolute pressure	0 bar	40 bar	– 4 bar	44 bar	0.4 bar
Metal sensor PMP 635 and PMP 731					
1 bar gauge pressure	–1 bar	1 bar	–1.1 bar	1.1 bar	0.02 bar
2.5 bar gauge pressure	–1 bar	2.5 bar	–1.25 bar	2.75 bar	0.035 bar
10 bar gauge pressure	–1 bar	10 bar	–2 bar	11 bar	0.11 bar
40 bar gauge pressure	–1 bar	40 bar	–5 bar	44 bar	0.41 bar
100 bar gauge pressure	–1 bar	100 bar	–11 bar	110 bar	1.01 bar
400 bar gauge pressure	–1 bar	400 bar	–41 bar	440 bar	4.01 bar
1 bar absolute pressure	0 bar	1 bar	–0.1 bar	1.1 bar	0.01 bar
2.5 bar absolute pressure	0 bar	2.5 bar	–0.25 bar	2.75 bar	0.025 bar
10 bar absolute pressure	0 bar	10 bar	–1 bar	11 bar	0.1 bar
40 bar absolute pressure	0 bar	40 bar	–4 bar	44 bar	0.4 bar
100 bar absolute pressure	0 bar	100 bar	–10 bar	110 bar	1 bar
400 bar absolute pressure	0 bar	400 bar	–40 bar	440 bar	4 bar

Editing limits are calculated as follows:

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

Example of editing limits for a differential pressure sensor 0…10 bar



Note!

Note!

To reverse the impact of the digital output value, assign the smaller pressure value to the upper range-value and the larger value to the lower range-value. To keep within the editing limits, carry out the calibration according to the table below. In the first step, enter the lower editing limit value for the lower range-value (V0H2) (see also table on Page 53).

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

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

To carry out a sensor calibration or a zero correction, the device must have a reference pressure (Refer to Chapter 5.2, Section on "Zero correction" and Chapter 8.4 "Sensor Calibration"). Enter a value assigned to the applied pressure using the relevant "Low sensor cal" (V7H4), "High sensor cal" (V7H5) or "Zero correction value" (V9H5) parameters.

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

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

#	Example:
1	Sensor: 0…10 bar (Sensor end value = 10 bar) applied pressure = "Sensor pressure" (V7H8) = 0.1 bar (e.g. depending on position)
2	The applied pressure (V7H8) can be assigned to a value between the upper and lower editing limits using the "Zero Correction" (V9H5) parameter. In this example values from –0.9 bar to 1.1 bar. Value for lower editing limit, V9H5 = "Sensor pressure" – 10% of sensor end value 0.1 bar – 0.1 • 10 bar = 0.1 bar – 1.0 bar = –0.9 bar Value for upper editing limit, V9H5 = "Sensor pressure" + 10% of sensor end value 0.1 bar + 0.1 • 10 bar = 0.1 bar + 1.0 bar = 1.1 bar

8 Maintenance and Repair

8.1 Repair

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

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

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

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

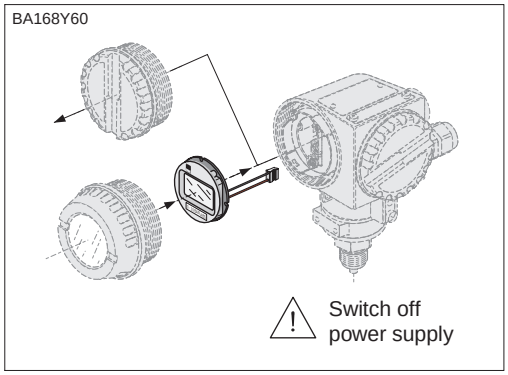
Caution!
Devices with certificates of conformity or design approval must be sent in for repair as complete units only.


Caution!

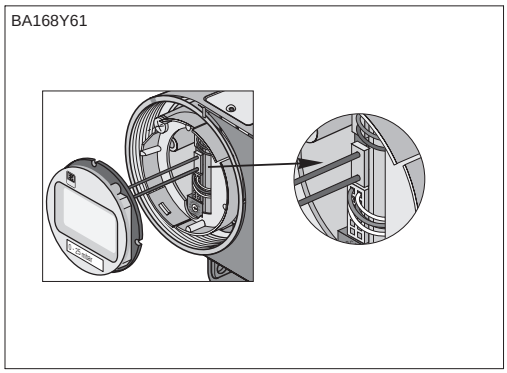
8.2 Mounting the display

Mounting the display

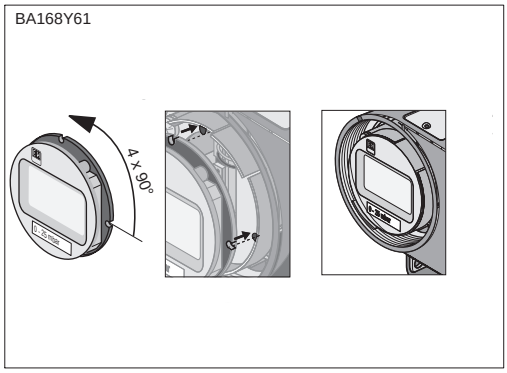
- Switch off power supply.
- Open the cover to the display compartment (use a cover with a sight glass after mounting the display).



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

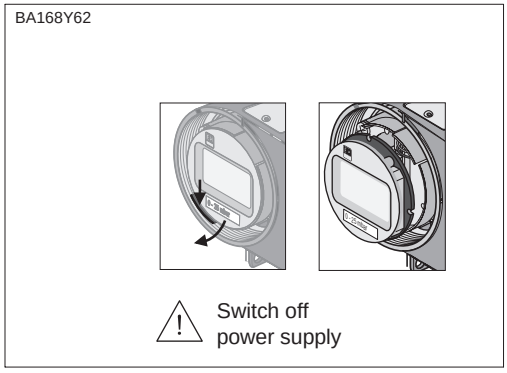


- Attach display.
  The display can be rotated through 90° steps.
- Screw down the cover.



Removing the display

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



8.3 Exchanging the sensor module and electronics

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

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

Changing the electronics

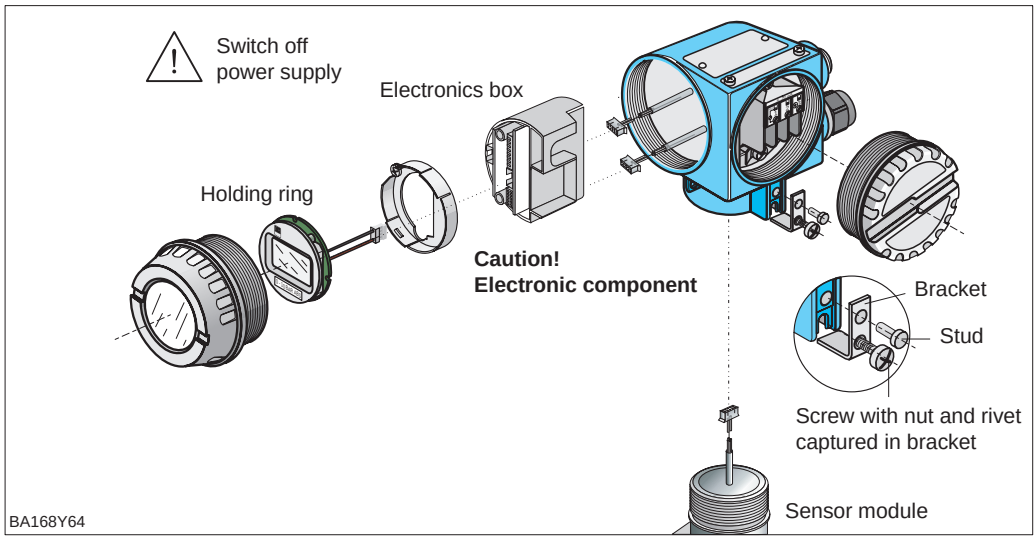
Removal
- Open the cover to the display compartment
- Remove the display
- Remove the plug from the electronic module
- Undo the two screws on the holding ring and remove
- Remove the electronic module

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

Changing the sensor module

Removal
- Remove the complete electronics and electronic box from the housing (see above).
- Position the bracket and smooth face on the sensor module parallel to each other. Remove the stud, undo the screw and lift out the bracket. When unscrewing the sensor module, carefully rotate the cable with it.

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



8.4 Sensor calibration

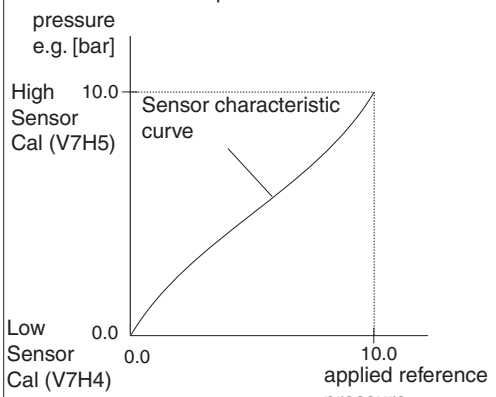
If you want to fit the pressure transmitter with a diaphragm seal you can recalibrate the sensor using the "Low Sensor Cal" (V7H4) and "High Sensor Cal" (V7H5) parameters.

The highest measurement accuracy is obtained when the value for the "Low Sensor Cal" (V7H4) parameter corresponds to the 4 mA calibration value (V0H1/V0H3) and the value for the "High Sensor Cal" (V7H5) parameter to the 20 mA calibration value (V0H2/V0H4).

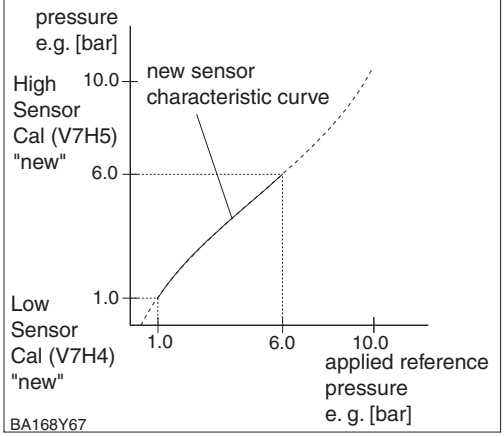
There must be a known reference pressure when setting a new lower or upper sensor characteristic curve value. The more accurate the reference pressure is during sensor calibration, the higher the accuracy of the pressure transmitter will be later. A new value is assigned to the applied pressure using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

#	Matrix	Path through the menus	Entry
1	A device with a sensor: 0.0…10.0 bar must be recalibrated for the 1.0…6.0 range.		
Main group: Additional funtions			
2	Reference pressure "Low Sensor Cal" (V7H4) value = 1.0 bar.		
3	The value 1.0 is assigned to the applied pressure.		
	V7H4	➤ Low Sensor Calibration	1.0 bar Confirm
4	Reference pressure "High Sensor Cal" (V7H5) value = 6.0 bar.		
5	The value 6.0 is assigned to the applied pressure.		
	V7H5	➤ High Sensor Calibration	6.0 bar Confirm
6	The sensor is now calibrated for 1.0…6.0 bar. The "Low Sensor Cal" and "High Sensor Cal" parameter indicate: Low Sensor Cal = 1.0 bar High Sensor Cal = 6.0 bar		

Sensor characteristic curve for the default factory calibration –here for a pressure sensor: 0.0..10.0 bar



Sensor characteristic curve –recalibrated for the measuring range: 1.0..6.0 bar



Note!

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

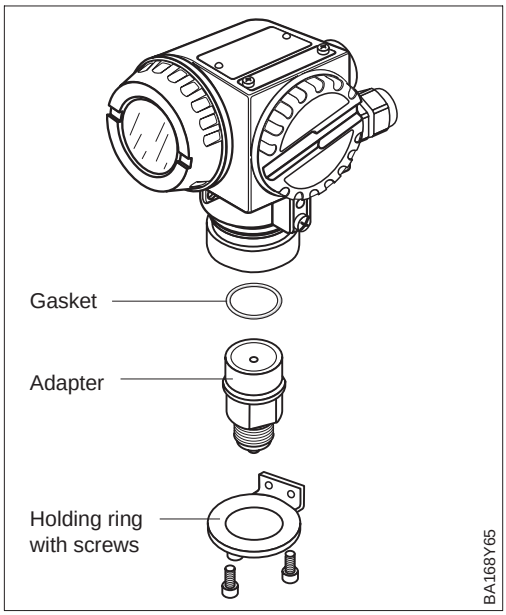
Note!

8.5 Changing the gasket

The gasket in contact with the medium inside the adapter of the Cerabar S PMC 731 can be replaced. Except for the PTFE gasket (Structure D), all gaskets can thus be interchanged as required. The different temperature limits should thus be observed for individual materials (see Chapter 9 "Technical Data").

Changing the gasket
- Loosen the screws on the retaining ring of the adapter.
- Remove the retaining ring and adapter.
- Replace gasket.
  The surfaces each side of the gasket and the gasket itself must be free from fibres and dirt.
- Secure the adapter with the retaining ring and screws

Changing the PTFE gasket
- Loosen the screws on the retaining ring of the adapter.
- Remove the retaining ring and adapter.
- Replace gasket.
  The surfaces each side of the gasket and the gasket itself must be free from fibres and dirt.
- Secure the adapter with the retaining ring and screws.
- Warm the instrument to 80…85°C and maintain at this temperature for about 2 hours to condition the gasket.



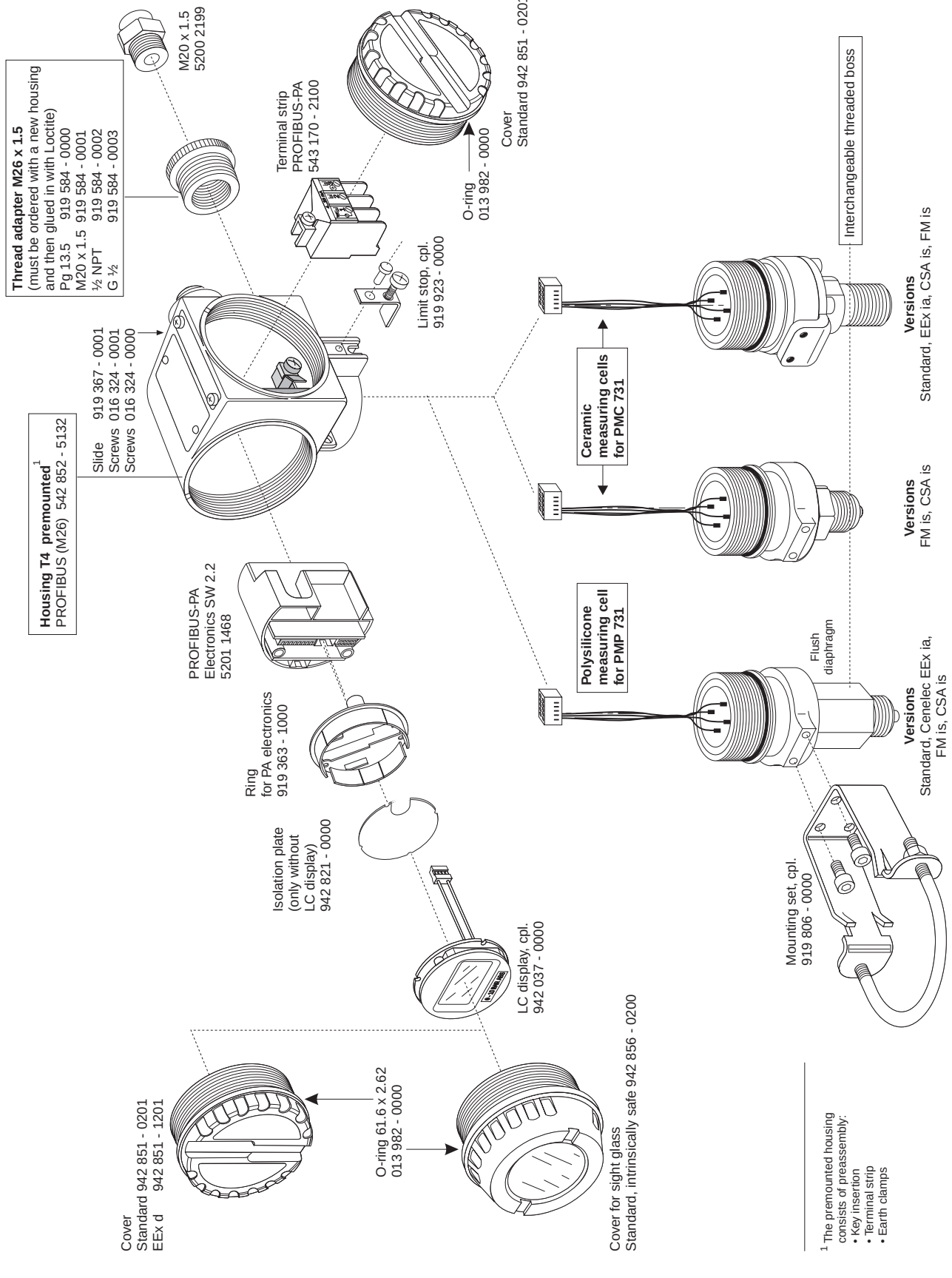
8.6 Replacement parts

The diagram on the next page shows all replacement parts needed for Cerabar S, together with their order numbers, which can be ordered from Endress+Hauser.

When ordering replacement parts, please note the following:
- If parts given in the order code are to be replaced, then it must be ensured that the order code (instrument designation) on the nameplate is still valid.
- If the instrument designation on the nameplate has changed then a modified nameplate must also be ordered. The information about the new instrument must then be entered on the modified nameplate. This must then be attached to the housing of the Cerabar S.
- It is not possible to convert a standard instrument into an Ex instrument by replacing its parts.

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


Note!


Thread adapter M26 x 1.5
(must be ordered with a new housing and then glued in with Loctite)
Pg 13.5 919 584 - 0000
M20 x 1.5 919 584 - 0001
½ NPT 919 584 - 0002
G ½ 919 584 - 0003
M20 x 1.5
5200 2199
Terminal strip
PROFIBUS-PA
543 170 - 2100
Cover
Standard 942 851 - 0201
O-ring
013 982 - 0000
Limit stop, cpl.
919 923 - 0000
Housing T4 premounted[1]
PROFIBUS (M26) 542 852 - 5132
Slide 919 367 - 0001
Screws 016 324 - 0001
Screws 016 324 - 0000
Ceramic measuring cells for PMC 731
Versions
Standard, EEx ia, CSA is, FM is
Interchangeable threaded boss
PROFIBUS-PA
Electronics SW 2.2
5201 1468
Versions
FM is, CSA is
Polysilicone measuring cell for PMP 731
Flush diaphragm
Ring
for PA electronics
919 363 - 1000
Versions
Standard, Cenelec EEx ia,
FM is, CSA is
Isolation plate
(only without
LC display)
942 821 - 0000
LC display, cpl.
942 037 - 0000
Mounting set, cpl.
919 806 - 0000
Cover
Standard 942 851 - 0201
EEx d 942 851 - 1201
O-ring 61.6 x 2.62
013 982 - 0000
Cover for sight glass
Standard, intrinsically safe 942 856 - 0200
[1] The premounted housing consists of preassembly:
• Key insertion
• Terminal strip
• Earth clamps

9 Technical Data

General information

Manufacturer	Endress+Hauser
Instrument	Pressure transmitter
Designation	Cerabar S PMC 631, PMP 635, PMC 731, PMP 731
Technical documentation Version Technical data	BA 168P/00/en 01.04 according to DIN 19259

Input

Measured variables	Absolute and gauge pressure in gases, vapours, liquids
Measuring ranges	As stated on nameplate
Adjusting the span (Turndown)	100:1

Output

Output signal	Digital communication signal PROFIBUS-PA
PA function	Slave
Transmission rate	31.25 kBit/s
Reponse time	Slave: 200 ms SPS: 300…600 ms for appr. 30 transmitters (depending on system coupler)
Signal on alarm	Signal: Status bit set, last measured value will be held Display module: Error code
Damping (Integration time)	0…40 s adjustable via communication
Communication resistance	none, separate PROFIBUS-PA termination resistor
Physical layer	MBP (Manchester coded and Bus Powered)

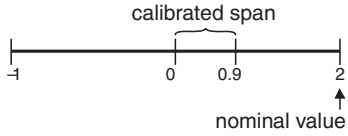
Accuracy

* Values for devices with diaphragm seals PMC 631, PMP 635

Reference conditions	as per IEC 60770 T_U = +25°C (+77°F) Accuracy data adopted after entering "Low sensor calibration" and "High sensor calibration" for lower range-value and upper range-value
Non-linearity including hysteresis and non-reproducibility (limit point method according to IEC 60770) [1), 2)]	to TD 10:1: ±0.1% (* ±0.2%) of calibrated span for TD 10:1 to 20:1: ±0.1% (* ±0.2%) x [nominal value/(calibrated span x 10)] of calibrated span
For small absolute pressure ranges more detailed information on linearity is required. This is specified by the smallest possible measurement error which can be supplied by the DKD calibration centre.	Absolute: for >30 mbar to <100 mbar span: ±0.3% for ≤ 30 mbar: ±1% of calibrated span
For gauge pressure measurements using absolute pressure sensors with measuring ranges ≤ 10 bar	Accuracy can be exceeded by fluctuating ambient air pressure
Settling time	Ceramic measuring cell: 500 ms, Metal measuring cell: 400 ms
Rise time (T_{90} time)	150 ms
Long-term drift	±0.1% of nominal value per 1 year ±0.25% of nominal value per 5 years
Thermal effects [1)] (applies to transmitters without diaphragm seals or capillary tubing; with reference to the calibrated span; max. TD 20:1)	for –10…+60°C (+14…+140°F): ±(0.1% x TD + 0.1%) for –40…–10°C (–40…+14°F) and +60°C…+85°C (+140…+185°F): ±(0.2% x TD + 0.2%) TD= nominal value/calibrated span
Thermal effect for Cerabar S with PTFE gasket (PMC 731 - # # ## # # # ## D, max. TD 20:1)	for –20…+85°C (–4…+185°F): ±(0.2% x TD + 0.4%): 0.1 bar ±(0.2% x TD + 0.2%): 0.4 bar; 2 bar ±(0.1% x TD + 0.1%): 10 bar; 40 bar

Explanation of terms:

Turn down (TD) =
nominal value/calibrated span



Example:
nominal value = 2 bar
calibrated span = 0.9 bar
turn down (TD) = 2:0.9

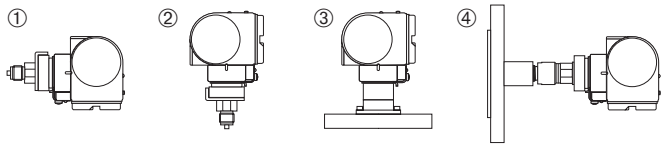
1) PMP 731, 1 bar gauge or absolute pressure sensor: values are doubled.
2) PMP 731 1 bar or 2.5 bar gauge or absolute pressure sensor with diaphragm in Alloy:
to TD 10:1= ±0.25% of calibrated span,
for TD 10:1 to 20:1= ±0.25% x nominal value/ (calibrated span x 10)

Accuracy (continuation)

Temperature coefficient [1] (applies to transmitters without diaphragm seals or capillary tubing; with reference to the calibrated span)	Zero signal and span: –10…+60°C (+14…+140°F): ±0.08%/10 K of nominal value –40…–10°C (–40…+14°F) and +60…+85°C (+140…+185°F): ±0.15%/10 K of nominal value
Temperature coefficient for Cerabar S with PTFE gasket (PMC 731 - # # ## # # # ## D, max. TD 20:1)	Zero signal and span: ±0.15% of nominal value/10 K at –20…+85°C (–4…+185°F)

Application conditions

Installation conditions

Position for the calibration ① PMC 731, PMP 731 ② PMP 731 (100 bar and 400 bar sensors only) ③ PMC 731 (ceramic sensor flush-mounted) ④ PMC 631, PMP 635	
Installation conditions	Any position, zero point shift due to position can be corrected, no effect on span

Ambient conditions

Ambient temperature	–40…+85°C (–40…+185°F) [3]
Ambient temperature range	–40…+100°C (–40…+212°F) [3, 4]
Storage temperature	–40…+100°C (–40…+212°F) [4]
Climatic class	4K4H to DIN EN 60721-3
Protection	IP 65/NEMA 4X (IP 68 on request)
Electromagnetic compatibility	Interference Emission to EN 61326; Electrical Equipment Class B; Interference Immunity to EN 61326; Annex A (Industrial) and NAMUR Recommendation EMC (NE 21); Interference immunity to EN 61000-4-3: 30 V/m

Process conditions

Process temperature	–40…+100°C (–40…+212°F) [3] Observe the temperature application limits of the corresponding gasket, see table below.
Temperature application limits gaskets	see tables below

*	Gaskets for PMC 731	Temperature application limits
1	FPM, Viton	–20°C (–4°F)**
6	FPM, Viton cleaned for oxygen service, Compound V70G3	–10…+60°C (+14…+140°F)
A	FPM, Viton oil- and grease-free Compound V70G3	–10°C (+14°F)**
2	NBR Compound 8307	–20°C (–4°F)**
7	FFKM, Kalrez Compound 4079	+5°C (+41°F)**
4	EPDM Compound EPDM 13-70	–30°C (–22°F)**
D	PTFE+Alloy C4	–20…+85°C (–4…+185°F)
C	Chemraz Compound Chemraz 505	–10°C (+14°F)**

*	Gaskets for PMP 731	Temperature application limits
1, 2, 4	FPM, Viton Compound YR859-V80G	–20°C (–4°F)**
3	Copper	–40°C (–40°F)**

* Version in order code e.g. PMC 731- ❑ ❑ ❑❑ ❑ ❑ ❑ ❑❑ _
** For the upper temperature application limit see this page "Process temperature"

1) PMP 731, 1 bar gauge or absolute pressure sensor: values are doubled.
3) For devices approved for use in hazardous areas, see Safety Instructions (XA…), Installation Drawing or Control Drawing (ZD…).
4) With display max. +85°C (+185°F).

Application conditions (continuation)

Process temperature limits	PMC 731, PMP 731: Cleaning temperature for Cerabar S flush-mounted with ceramic sensor: +140°C (+284°F) up to 60 minutes PMC 631, PMP 635: Depends on max. permissible temperature of the diaphragm seal fluid and the width of the diaphragm
Pressure specifications	See nameplate, observe pressure-temperature derating

Mechanical construction

Housing	Housing can be rotated up to 270°, Separate electronic and connection compartments, Optional electrical connection via – cable gland M 20x1.5 – cable entry G ½, ½ NPT – Harting plug Han 7D Terminals for cable cross-section 0.5…2.5 mm^2 (AWG 20 …13)
Process connections	All common thread and diaphragm seal versions [5]

Materials

Housing	– Cast aluminium housing with protective polyester-based powder coating RAL 5012 (blue), cover RAL 7035 (grey), seawater spray test DIN 50021 (504 h) passed – Stainless steel AISI 316L (1.4435)
Nameplates	AISI 304 (1.4301)
Process connections PMC 731	AISI 316L (1.4435) or Alloy C276 (2.4819)
PMP 731	AISI 316L (1.4435) or Alloy C276 (2.4819) with diaphragm in Alloy
PMC 631, PMP 635	AISI 316L (1.4435)
Process diaphragm PMC 731	Al_2O_3 Aluminium oxide ceramic
PMP 731	AISI 316L (1.4435) or Alloy C276 (2.4819)
PMC 631	AISI 316L (1.4435)
PMP 635	optional AISI 316L (1.4435), Alloy C276 (2.4819), Tantalum, PTFE film
Gaskets PMC 731	FPM Viton, FPM Viton cleaned for oxygen service [6], FPM Viton oil and grease-free, NBR, Kalrez, EPDM, PTFE+Alloy C4, Chemraz (see "Process conditions, Temperature application limits")
PMP 731	FPM Viton, PTFE+Alloy C4, Copper (see "Process conditions, Temperature application limits")
O-ring for sealing cover	NBR
Mounting accessories	Bracket for pipe and wall mounting AISI 304 (1.4301)
Filling fluid in diaphragm seals PMC 631, PMP 635	Silicone oil, vegetable oil, glycerine, high-temperature oil, Fluorolobe grease-free for oxygen service

Measuring cell

Oil filling PMC 731	None, dry sensor
PMP 731	Optional silicone or inert oil (Halocarbon 6.3), cleaned for oxygen service[6]

Display and operating interface

Display (optional)	Pluggable digital display and exra bar graph (28 segments) (Pressure display as four-digit number and also in relating to the set measuring range as bar graph).
On-site operation	Four keys on the device
Remote operation	Segment coupler for connection to PLC or PC, e.g. with the Commuwin II operating program
Communication interface	PROFIBUS-PA

Power supply

Power voltage	Standard 9…32 V DC [3]
Current consumption	10 mA ± 1 mA [3]
Power up current	Corresponds to Table 4, IEC 1158-2

Certificates and approvals

Pressure Equipment Directive	This device conforms to Article 3(3) of EC Directive 97/23/EG (Pressure Equipment Directive) and is developed and produced in sound engineering practice. – PMP 731 with threaded connection, PN >200 bar (except of flush membrane) and PMP 635 with threaded connection PN >200 bar and separator: suitable for stable gases in fluid group 1. – PMC 631 with pipe diaphragm seals > DN 25/1": suitable for stable gases in fluid group 1.
CE mark	By attaching the CE Mark, Endress+Hauser confirms that the instrument fulfils all the requirements of the relevant EC directives.

3) For devices approved for use in hazardous areas, see Safety Instructions (XA…), Installation Drawing or Control Drawing (ZD…).
5)) Note the Safety Instructions (XA) and electrostatic charging when using a PVDF process connection.
6) Observe operating limits for oxygen service for non-metallic materials.

Dimensions Cerabar S

Further information on dimensions of the various versions is found in the Technical Information TI 216P and 217P. The maximum installation height is given on the following pages.

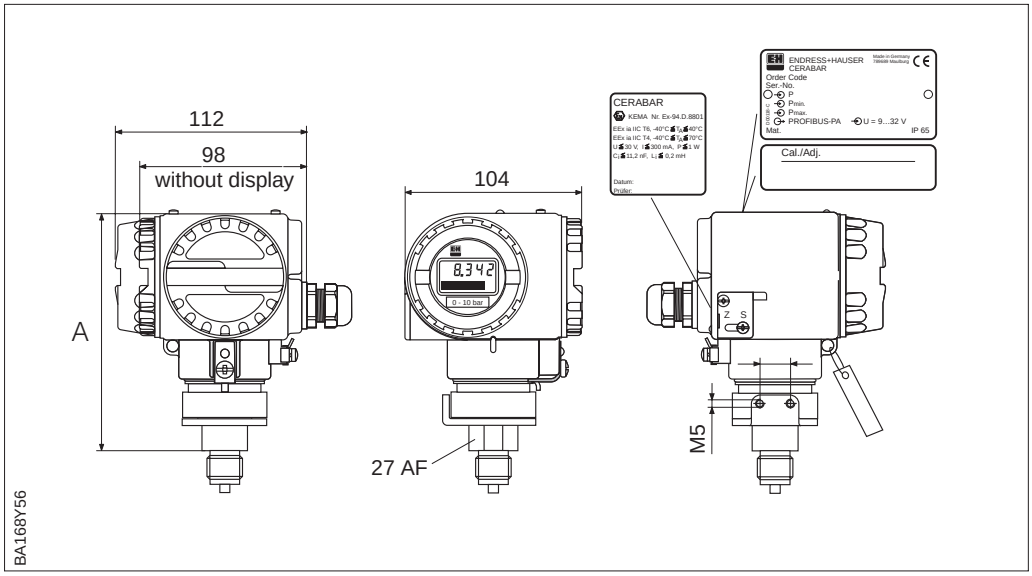


Figure 9.1
Cerabar S PMC 731/PMP 731

Device	Code for Process connection[1)]	Process connection	Installation height A in mm
PMC 731	1M/2M/5M	Thread G ½ external, DIN 16288	135/135/135
PMC 731	1P/1R	Thread G ½ external	135/135
PMC 731	1N/2N/1A/5G	Threads ½ NPT external	135/135/135/135
PMC 731	1S	Thread PF ½ external	135
PMC 731	1K	Thread PT ½ external	135
PMC 731	1T	Thread M 20x1.5 external	135
PMC 731	AL/AH	Hygienic Connections DIN 11851	163
PMC 731	DL	Hygienic Connection Clamp	163
PMC 731	LL	Hygienic Connection Varivent	163
PMC 731	KL	Hygienic Connection DRD flange	163
PMC 731	AG	Threaded connection G 1½	187
PMC 731	AR	Threaded connection G 2	187
PMC 731	BF	Threaded connection 1½ NPT	187
PMC 731	BR	Threaded connection 2 NPT	187
PMC 731	XK	Threaded connection M 44x1.25	187
PMC 731	EK	Flange DIN 2501, DN 50	163
PMC 731	KJ/KK	Flange ANSI B. 16.5, DN 2"	163
PMC 731	RI	RF flange	157

Table 9.1
Installation height A of the different versions of PMC 731 (see also TI 216P)

Device	Code for Process connection[1)]	Process connection	Installation height A in mm
PMP 731	1F	Thread G ½ external, flush-mounted diaphragm	132
PMP 731	1M	Thread G ½ external, internal diaphragm	160
PMP 731	1G	Thread ½ NPT external	160
PMP 731	1S	Thread PF ½ external	160
PMP 731	1K	Thread PT ½ external	160
PMP 731	1T	Thread M 20x1.5 external	160

Table 9.2
Installation height A of the different versions of PMP 731 (see also TI 216P)

1) Example for PMC 731 with thread G½ external, DIN 16288; installation height 135 mm

PMC 731 – ❑❑❑❑❑❑❑❑1 M❑

Code for process connection

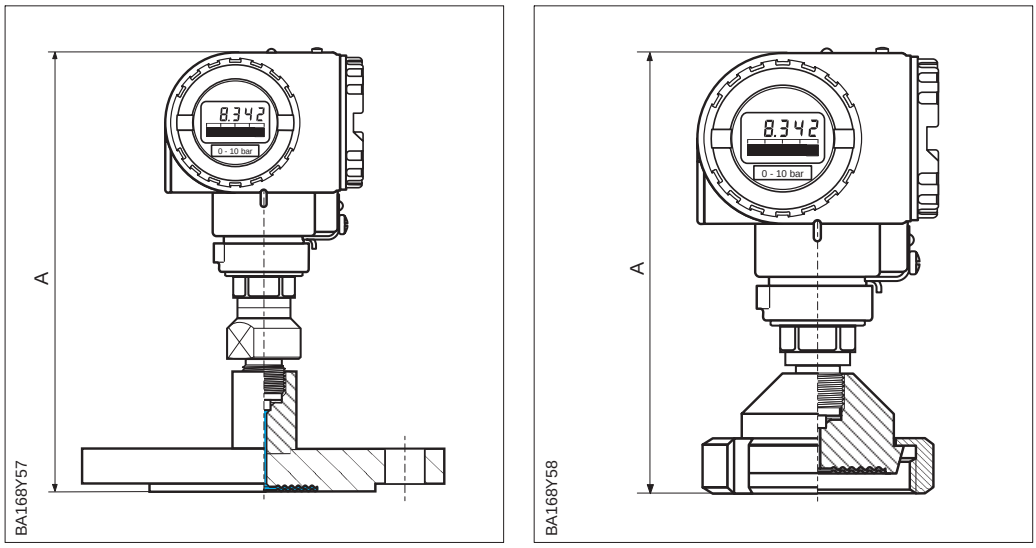


Figure 9.2
left:
Cerabar S PMP 635
with flange or thread

right:
Cerabar S PMC 631
with dairy thread

Device	Code for Process connection[1)]	Process connection	Installation height A in mm
PMC 631	AB/AG/AH/AL	Diaphragm seal DIN 11851	188/189/187/182
PMC 631	DG/DL	Clamp	182/187
PMC 631	EB/EG/EL	SMS	185/182/187
PMC 631	FB/FG/FL	RJT Adapter	190/190/190
PMC 631	GB/GG/GL	ISS Adapter	192/192/192
PMC 631	KL	DRD flange	203
PMC 631	LL	Varivent	197
PMC 631	PH/PL	Pipe diaphragm seal DIN 11851	200/205
PMC 631	SA/SB/SG/SL	Clamp pipe diaphragm seal	185/185/222/227

Table 9.3
Installation height A of the different versions of PMC 631 (see also TI 217P)

Device	Code for Process connection[1)]	Process connection	Installation height A in mm
PMP 635	AF/AG/AR	Threaded connection DIN ISO 228/1	200/201/206
PMP 635	BF/BG/BR	Threaded connection ANS I B 1.201	203/201/201
PMP 635	CA	Seperator with G1/2 DIN 16 288, form B	206
PMP 635	DA	Seperator with ½ NPT ANSI B 1.201	206
PMP 635	EC/ED/EF	Flanges DIN 2501, DN 25	224/224/224
PMP 635	EK / EM / EN / EP	Flanges DIN 2501, DN 50	224/224/224/256
PMP 635	EU	Flange DIN 2501, DN 80	228
PMP 635	FK/GK/JK	Flanges with extension DIN 2501, DN 50	224/224/224
PMP 635	FU/GU/JU	Flanges with Tubus DIN 2501, DN 80	228/228/228
PMP 635	KD/KE/KF	Flanges ANSI B 16.5, 1"	224/235/241
PMP 635	KJ/KK/KL/KM/KN	Flanges ANSI B 16.5, 2"	225/228/232/244/257
PMP 635	KU/KV	Flanges ANSI B 16.5, 3"	230/235
PMP 635	KW/KX	Flanges ANSI B 16.5, 4"	230/238
PMP 635	LJ/MJ/NJ	Flanges 2" with extension ANSI B 16.5	225/225/225
PMP 635	LU/MU/NU/PU/MV/ PV	Flanges 3" with extension ANSI B 16.5	230/230/230/230/235/235
PMP 635	LW/MW/NW	Flanges 4" with extension Tubus ANSI B 16.5	230/230/230

Table 9.4
Installation height A of the different versions of PMP 635, (see also TI 217P)

1) Example for PMC 631 with diaphragm seal DIN 11851, DN 25;
installation height 188 mm

PMC 631 – ❑❑❑❑❑❑❑A B

Code for process connection

10 Operating Matrix

10.1 Matrix Commuwin II

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

Display field

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

This matrix provides a summary of all factory settings.

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

10.2 Matrix Analog Input Block (AI Transmitter)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 OUT	OUT Value	OUT Status	OUT Status	OUT Sub Status	OUT Limit		Fail Safe Action	Fail Safe Value		
V1 Scaling	PV Scale Min	PV Scale Max	Type of Lineari-sation	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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10.3 Description of parameters

Parameter	Description
Measured value[1] (V0H0)	This parameter indicates the current measured value. The matrix field V0H0 corresponds to the on-site display. For the "Pressure" operating mode, select a pressure unit using the parameter "Select pressure unit" (V0H9). The measured value is converted and displayed in the pressure unit you selected. Note: The measured value in the pressure unit specified on the nameplate is transferred as standard over the bus. To transfer the converted measured value over the bus, confirm the parameter "Set unit to bus" once in the matrix field V6H1. Refer to the parameter description of "Set unit to bus" (V6H1). In the "Level" and "Square root" (flow rate)[2] modes, the measured variable is displayed in "%" as standard. Use the parameter "Unit after linearisation" (V3H3) to select a level, volume, weight or flow rate unit. This unit is only for display. The measured variable is not converted to the unit you selected.
Lower range value[1] (V0H1)	Enter a pressure value for the lower range-value (calibration without reference pressure). These parameters set the lower range-value for the bar graph of the on-site display. In the "Pressure" mode, this parameter has no influence on the digital output value. In the "Level" and "Square root" (flow rate)[2] modes, specify a pressure value for lower range-value as this pressure value is assigned to "Level empty" or "Min. flow rate" in these modes. Refer to Chapters 5.2 and 6.1. Factory Setting: 0.0
Upper range value[1] (V0H2)	Enter a pressure value for upper range-value (calibration without reference pressure). These parameters set the upper range-value for the bar graph of the on-site display. In "Pressure" mode, this parameter has no influence on the digital output value. In the "Level" and "Square root" (flow rate)2) modes, specify a pressure value for upper range-value as this pressure value is assigned to "Level full" or "Max. flow rate" in these modes. Refer to Chapters 5.2 and 6.1. Factory Setting: "High sensor limit" (V7H7)
Set lower value[1] (V0H3)	If you confirm this parameter, the current pressure value is set as the lower range-value (calibration with reference pressure). The value is displayed in the parameter "Lower range value" (V0H1). This is equivalent to pressing the +Z and –Z keys twice simultaneously in on-site operation.
Set upper value[1] (V0H4)	If you confirm this parameter, the current pressure value is set as upper range-value (calibration with reference pressure). The value is displayed in the parameter "Upper Range Value" (V0H2). This is equivalent to pressing the +S and –S keys twice simultaneously in on-site operation.
Set bias pressure[1] (V0H5)	If the on-site display indicates zero not zero at process pressure after calibrating the lower range-value (dependent on position), you can correct the value indicated on the on-site display to zero by entering a pressure value (bias pressure). The parameters "Measured value" (V0H0), "Lower range value" (V0H1) and "Upper range value" (V0H2) are corrected by the bias pressure value. Note: In "Pressure" mode, compensation by a bais pressure has no influence on the digital output value (parameter "OUT Value") which is transferred over the bus. Confirm the parameter "Set unit to bus" in matrix field V6H1 so that the on-site display and the "OUT Value" (V6H2) indicate the same value. Refer to Chapters 5.2 and 6.1. Factory Setting: 0.0
Bias pressure automatic[1] (V0H6)	If you confirm this parameter, the current pressure value is taken over as the bias pressure. The value is displayed in the parameter "Set bias pressure" (V0H5). This is equivalent to pressing the +Z and +S keys twice simultaneously. Refer to the parameter description "Set bias pressure" (V0H5).
Set output damping (V0H7)	Damping (output damping) affects the speed at which the output signal and the value indicated respond to a change in pressure. Damping is adjustable from 0 to 40s. Factory Setting: 0.0

1) The electronics check the input value of this parameter for compliance with editing limits, refer to Chapter 7.4.
2) The "Square root" (flow) operating mode is only relevant for differential pressure transmitters.

Description of parameters (continuation)

Parameter	Description
Select pressure unit (V0H9)	Selects a pressure unit. When you select a new pressure unit, all pressure-related parameters are converted and indicated together with the new pressure unit. Note: The measured value in the pressure unit specified on the nameplate is transferred as standard over the bus. To transfer the converted measured value over the bus, confirm the parameter "Set unit to bus" once in the matrix field V6H1. Refer to the parameter description of "Set unit to bus" (V6H1) and Chapter 5.2, Section "Selecting pressure unit". Factory Setting: bar
Diagnostic code (V2H0)	If the pressure transmitter detects an error or a warning, it generates an error code. This parameter indicates the current error code. See Chapter 7.1 for a description of error codes
Last diagnostic code (V2H1)	Indicates the last error code. See Chapter 7.1 for a description of error codes Factory Setting: 0
Software no. (V2H2)	Indicates the device and software number. The first two digits represent the device number and digits 3 and 4 the software version. Cerabar S PROFIBUS-PA SW 2.2 = 8222
Minimum pressure (V2H3)	Indicates the smallest measured pressure value (maximum pointer). This parameter is reset to the current pressure value when you confirm by pressing the ENTER key.
Maximum pressure (V2H4)	Indicates the largest pressure value measured (maximum pointer). This parameter is reset to the current pressure value when you confirm by pressing the ENTER key.
Internal counter high (V2H5)	This counter indicates the how often a measured pressure was above the upper sensor limit (V7H7). Maximum value = 255 This parameter is reset to zero when you confirm by pressing the ENTER key.
Sensor temperature (V2H6)	Indicates the current temperature measured. The unit for displaying the temperature is selectable using the parameter "Temperature unit" (V7H9).
Minimum temperature (V2H7)	Indicates the lowest temperature measured (maximum pointer). This parameter is reset to the current temperature value when you confirm by pressing the ENTER key.
Maximum temperature (V2H8)	Indicates the largest temperature measured (maximum pointer). This parameter is reset to the current temperature value when you confirm by pressing the ENTER key.
Default values (Reset) (V2H9)	Enters a reset code. Possible reset codes include: 5140 or 1, 2380, 731, 2506, 2509 and 2712. Chapter 9.3 lists the parameters which the reset codes reset to the factory settings.
Operation mode (V3H0)	Select the operation mode: – Pressure: for linear pressure measurements. The measured value (V0H0) indicates the pressure in the selected pressure unit (V0H9). Refer to Chapter 5. – Square Root[2)]: for flow measurements, e.g. with an orifice plate or a Pitot tube. A square root function converts the measured differential pressure to a flow-proportional output signal. – Level linear *: for level, volume or weight measurements for standing tanks. The level is linear to the measured pressure. Refer to Chapters 6.2 and 6.3 – Level cylindrical horizontal *: for level, volume or weight measurements with cylindrical horizontal tanks. The volume or the weight is not proportional to the level. A linearisation table is integrated. Refer to Chapters 6.2 and 6.3. – Level manual *: for precise volume or weight measurement where the volume or weight is not proportional to the level or to the measured pressure, e.g. tanks with tapered outlet. Use the parameters "Line no." (V3H7), "Input level" (V3H8) and "Set volume" (V3H9) to enter a linearisation table. This linearisation table us used to calculate the output signal. Refer to Chapter 6.4. Factory Setting: Linear pressure * In these modes, the measured value (V0H0) factory setting is displayed in %. To obtain a better presentation,, use the parameters "Unit after Linearisation" (V3H3) to select a level, volume, weight or flow rate unit. Refer to the parameter description "of "Unit of linearisation" (V3H3).

2) The "Square root" (flow) operating mode is only relevant for differential pressure transmitters.

Description of parameters (continuation)

Parameter	Description
Start point (V3H1)	Only for the modes "Square root" (flow rate)[2], "Level linear" and "Level cylindrical horizontal". Enter a value for the measuring point "Min. flow rate" or "Level empty". The value is assigned to the parameter "Lower range value" (V0H1). The parameter is displayed as standard in %. To obtain a better presentation, select a different unit using the parameter "Unit after linearisation" (V3H3). Factory Setting: 0%
Full scale (V3H2)	For operation modes "Square root" (flow rate)[2], "Level linear", "Level cylindrical horizontal". Enter a value for the measuring point "Max. flow rate" or "Level full". The value is assigned to the parameter "Upper range value" (V0H2). The parameter is displayed as standard in %. To obtain a better presentation select a different unit using the parameter "Unit after linearisation" (V3H3). Factory Setting: 100%
Unit after linearisation (V3H3)	Only for operation modes "Square root" (flow rate)[2], "Level linear", "Level cylindrical horizontal" and "Level manual". Selects a level, volume, weight or flow rate unit. The options depend on the selected operation mode. The unit is only for display. The "Measured value" (V0H0) is not converted to the selected unit. Example V0H0 = 55%. After selection of the unit "hl", V0H0 indicates 55 hl. When you want to display the "Measured value" (V0H0) converted into the selected unit, enter a calculates value for the parameters "Start point" (V3H1) and "Full scale" (V3H2). Refer also to Chapter 6.1, Section "Selecting unit for level, volume or weight". Factory Setting: %
Density factor (V3H4)	Only for operation modes "Level linear", "Level cylindrical horizontal" and "Level manual". Using the density factor matches the output value and the "measured value" (V0H0) are adjusted to a changed density of the liquid. The density factor results from the ratio between "New density" and "Old density". Factory Setting: 1.0
Creep flow suppression[3] (V3H5)	Only for operation mode "Square root" (flow rate)[2]. In the lower measuring range, small flow rates can lead to large fluctuations in measured value. By entering a low flow cut off, these flow rates are no longer detected. Input is always in % flow rate. Factory Setting: 0.0 %
Manual level (linearisation) (V3H6)	Only in operation mode "Level manual". Selects the Edit mode for the linearisation table. Options: Activate Table, Manual, Semi-automatic and Clear Table. Refer to Chapter 6.4 Linearisation. Factory Setting: Clear table
Line no. (V3H7)	Only in operation mode "Level manual". Enter line numbers for the linearisation table. Use the parameters "Line no." (V3H7), "Input level" (V3H8) and "Set volume" (V3H9) to enter a linearisation table. Number of lines in linearisation table: Min. = 2 and Max. = 21 Refer to Chapter 6.4 Linearisation. Factory Setting: 1
Input level (V3H8)	Only in operation mode "Level manual". Enter a fill value in the linearisation table. The input is in %. If you enter "9999.0" for this parameter, you can delete single items from the linearisation table. First activate the linearisation table using the parameter "Manual level" (V3H6). Refer to this table, parameter "Line no." (V3H7) and Chapter 6.4 Linearisation. Factory setting: 9999.0 %
Set volume (V3H9)	Only in operation mode "Level manual". Enter a volume value in the linearisation table. The input is in %. If you enter "9999.0" for this parameter, you can delete single items from the linearisation table. First activate the linearisation table using the parameter "Manual level" (V3H6). Refer to this table, parameter "Line no." (V3H7) and Chapter 6.4 Linearisation. Factory setting: 9999.0 %

2) The "Square root" (flow) operating mode is only relevant for differential pressure transmitters.
3) These parameters are only relevant for differential pressure transmitters.

Description of parameters (continuation)

Parameter	Description
Counter (V5H0)[3)]	Only in operation mode "Square root" (flow rate). Indicates the total flow rate measured. After a reset "5140" the counter is reset to zero. Factory Setting: 0
Display selector (V5H1)[3)]	Only in operation mode "Square root" (flow rate). Selects the operation mode for the on-site display. Options: – Flow rate: Indicates the current volume or mass flow measurement, equivalent to the display of the parameter "Measured value" (V0H0). Select the unit using the parameter "Unit after linearisation" (V3H3). – Counter: Indicates the total flow rate, equivalent to the display of the parameter "Counter" (V5H1). Select the unit using the parameter "Counter unit" (V5H4). The bar graph always indicates the current flow rate measured. Factory Setting: Flow rate
Totalizer operation mode (V5H2)[3)]	Only in operation mode "Square root" (flow rate). This parameter activates the totalizer function and defines how to count negative flows. Factory Setting: OFF
Conversion factor (V5H3)[3)]	Only in operation mode "Square Root" (flow rate). The Conversion Factor converts the current flow rate into a total flow rate. Factory Setting 1.0
Counter unit[3)] (V5H4)	Only in operation mode "Square root" (flow rate). Selects a volume or a mass unit for the parameter "Counter" (V5H0). Only select for display. The "Counter" (V5H0) is not converted to the selected unit. Example: V5H0 = 55%. After selected the unit "l", V5H0 indicates 55 hl. Factory Setting: %
Identity number (V6H0)	Select the ID Number. Options: – Profile: General ID Number of the PNO (PROFIBUS User Organisation): "9700 (hex)". To configure the PLC, use the device data base (GSD) of the PNO. – Manufacturer: Device ID Number for Cerabar S PROFIBUS-PA: "1501 (hex)". To configure the PLC, use the device-specific GSD. Refer to Chapter 3.3 Device database and type files (GSD).
Set unit to bus (V6H1)	In the following cases, the digital output value (OUT Value) and the on-site display or the parameter "Measured Value" (V0H0) do not indicate the same value: – if you selected a new pressure unit using the parameter "Pressure Unit" (V0H9) and/or – if you carried out a calibration in operation mode "Pressure" by entering a bias pressure (V0H5/V0H6). So that the digital output value indicates the same value as the on-site display or V0H0 in these cases, confirm the parameter "Set unit to bus" in matrix field V6H1 after calibration. Note that any change in the digital output value could affect control. Refer to Chapter 5.2, Sections "Selecting pressure unit" and "Position calibration – display (bias pressure)".
V6H2 OUT value (V6H2)	This parameter indicates the OUT Value of the Analog Input Block (digital output value transferred over the bus). While the matrix field V6H2 still indicates UNKNOWN, the parameter "Set unit to bus" has not been confirmed in matrix field V6H1.
OUT status (V6H3)	This parameter indicates the status of the OUT Value (digital output value). See Chapter 3.4, Section "Status Codes" for a description of the status codes.
2nd cyclic value (V6H4)	Use this field to select a second parameters, which are sent cyclically to the PLC. Options: Temperature (V2H6), Sensor value (V7H8), Trimmed value (V9H7) and Biased value (V9H8). Refer to Chapter 3.4, Fig. 3.3 Factory Setting: Measured value (V0H0)
Select V0H0 (V6H5)	The on-site display and the matrix field V0H0 indicate the same value as standard. A PLC can also provide the on-site display with a cyclical output value. To do this, set this parameter to "Display Value" (or 1). Refer to Chapter 3.4.

3) These parameters are only relevant for differential pressure transmitters.

Description of parameters (continuation)

Parameter	Description
OUT value from PLC (V6H6)	Indicates a cyclical OUT value from the PLC. Refer to Chapter 3.4, Fig. 3.3.
Profile version (V6H7)	Indicates the PROFIBUS-PA profile version.
Low sensor calibration 1) (V7H4)	Enter the lower point of the sensor level for sensor calibration. Use this parameter to assign a new value to a reference pressure applied to the device. The applied pressure value and the value entered for "Low sensor cal" are equivalent to the lower point of the sensor level. Refer to Chapter 8.4 "Sensor calibration". Factory Setting: "Low sensor limit" (V7H6)
High sensor calibration 1) (V7H5)	Enter the upper point of the sensor level for a sensor calibration. Use this parameter to assign a new value to a reference pressure applied to the device. The applied pressure value and the value entered for "High sensor cal" are equivalent to the upper point of the sensor level. Refer to Chapter 8.4 "Sensor calibration". Factory Setting: "High sensor limit" (V7H7)
Low sensor limit (V7H6)	Indicates the lower sensor limit.
High sensor limit (V7H7)	Indicates the upper sensor limit.
Sensor pressure (V7H8)	Indicates the current pressure applied.
Temperature unit (V7H9)	Selects a temperature unit. Options: °C, K,°F When you select a new temperature unit, all temperature-specific parameters (V2H6, V2H7, V2H8) are converted and the new temperature unit is displayed. Factory Setting: °C
Instrument address (V9H4)	Indicates the device address in the bus. The address can either be set by software or on-site using a DIP switch. Refer to Chapter 3.2. Factory Setting: 126
Zero correction 1) (V9H5)	Use this parameter to carry out a calibration (zero correction) for the values indicated on the on-site display ("Measured value" (V0H0)) and for the digital output value (OUT Value) at the same time. Use this parameter to enter a new value for a pressure applied to the device. The sensor level is shifted by this value and the parameters "Low sensor cal" (V7H4) and "High sensor cal" (V7H5) are recalculated. Refer to Chapter 5.2, Section "Zero correction". Factory Setting: 0.0
Zero correction value (V9H6)	Indicates the value by which the sensor level was shifted for a zero correction. Refer to parameter description "Zero Correction" (V9H5) and Chapter 6.1, Section "Zero Correction". Factory Setting: 0.0
Unbiased pressure (V9H7)	This parameter indicates the actual damped pressure without any bias correction. Refer to parameter description "Set bias pressure" (V0H5).
Biased pressure (V9H8)	This parameter indicates the actual damped pressure with bias correction. Refer to parameter description "Set bias pressure" (V0H5). Calculation: "Biased pressure" (V9H8) = "Unbiased pressure" (V9H7) – "Set bias pressure" (V0H5) In "Pressure" operation mode, this parameter and the parameter "Measured value" (V0H0) indicate the same value.
Security locking (V9H9)	Enter a code to lock or unlock the operation matrix and on-site operating unit. Lock operation: Using the parameter "Security locking" (V9H9): Enter a number from 1 to 9998, except for numbers 130 and 2457, Using on-site operation: Press the +Z und –S keys twice simultaneously. Unlock operation: Using the parameter "Security locking" (V9H9): Enter 130 or 2457 – using the on-site operation: Press –Z and +S keys twice simultaneously. The matrix field V9H9 is only editable if operation was not locked previously using the on-site keys. Refer to Chapters 5.4 or 6.6.

1) The electronics check the input values for these parameters for compliance with editing limits, refer to Chapter 7.4.

Description of parameters (continuation)

Parameter	Description
Measuring point description (VAH0)	Enter a text describing the measuring point (up to 32 ASCII characters).
Set user text (VAH1)	Enter a text as additional information (up to 32 ASCII characters).
Device serial number (VAH2)	Indicates the serial number of the device.
Serial no. sensor (VAH3)	Indicates the serial number of the sensor.
Process connection P+ (VAH4)	Select and display the process connection material on the positive side. Options: steel, 304 stainless, 316 stainless, Hastelloy C, Monel, tantalum, titanium, PTFE (Teflon), 316L stainless, PVC, Inconel, ECTFE and special (for custom versions)
Process connection P– 3) (VAH5)	Select and the process connection material on the negative side. Options: refer to parameter "Process Connection" (VAH4)
Gasket (VAH6)	Select and indicate the gasket material. Options: FPM Viton, NBR, EPDM, urethane, IIR, KALREZ, FPM Viton for oxygen applications, CR, MVQ and special (for custom versions)
Process diaphragm (VAH7)	Select and indicate the diaphragm material. Options: 304 stainless, 316 stainless, Hastelloy C, Monel, tantalum, titanium, PTFE (Teflon), ceramic, 316L stainless, Inconel, special (for custom versions)
Fill liquid (VAH8)	Select and indicate the oil filling. Options: silicon oil, vegetable oil, glycerine, inert oil, HT oil (high-temperature oil), special (for custom versions)
Device profile (VAH9)	Use this matrix field to change between the various blocks: standard (E+H matrix), physical block, press block and AI transmitter (analog input block).

3) These parameters are only relevant for differential pressure transmitters.

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