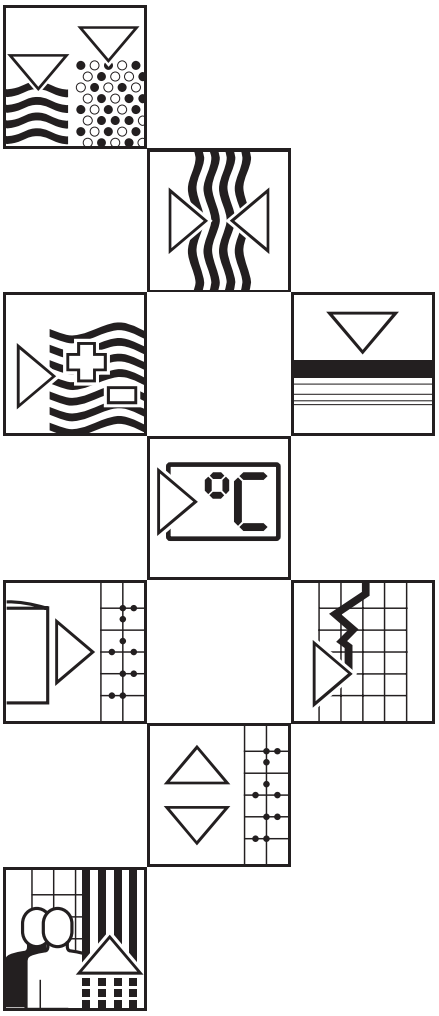
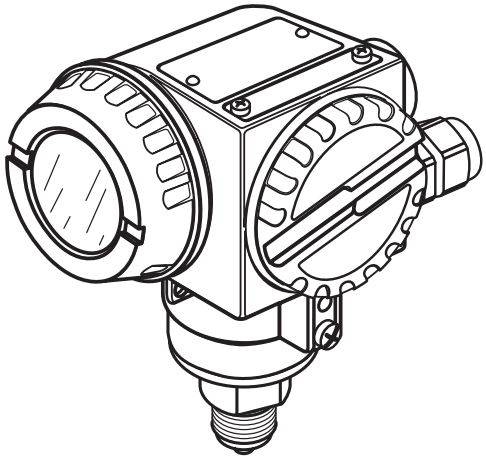
BA 234P/00/en/05.07
Software version 7.1
71036531

cerabar S PMP 71 K
Pressure Transmitter for use in Nuclear Power Plants

Operating Instructions

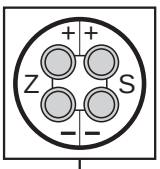


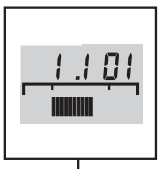


Endress + Hauser

The Power of Know How

Short Operating Instructions





Local operation
Cerabar S
without/with display

Local operation via keys
Chapter 3.1

Remote operation
via Commuwin II

MR = measuring range

set MR
= required MR?

yes

no

Chapter 4
Calibration with keys

Damping?

no

yes

Chapter 4
Damping

Chapter 4
Locking/Unlocking with keys

Level
or pressure?

Pressure

Level

Chapter 5.1
Commisioning the measuring point

Chapter 6.2
Calibration with reference pressure

Chapter 6.3
Dry calibration

Linearisation?

no

Linearisation
Chapter 6.4

yes

Table

Automatic

Chapter 5.2 - 5.3
Locking and other settings

Chapter 6.5 - 6.6
Locking and other settings

Table of Contents

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 or using the handheld operating terminals for HART.

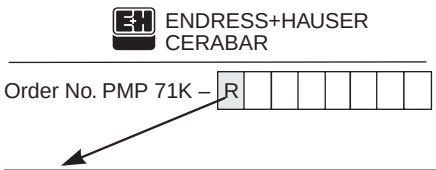
Mounting, commissioning, operation

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 overspill by incorrect installation or adjustment. For this reason, the instrument must be installed, connected, operated and maintained by personnel that are authorised by the user of the facility and who are suitably qualified. The manual must have been read and understood, and the instructions followed. Modifications and repairs to the device are permissible only when they are expressly approved in the manual.

Explosion hazardous area

The measuring system used in the explosion hazardous area must comply with all existing national standards. The certificates are designated by the first letter of the order code on the nameplate (see table below).

- Ensure that technical personnel are adequately trained.
- All measurement and safety regulations which apply to the measuring point are to be observed.



Code	Certificate	Explosion protection
R	Standard	None

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.

Notes on safety

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.

Ignition 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.

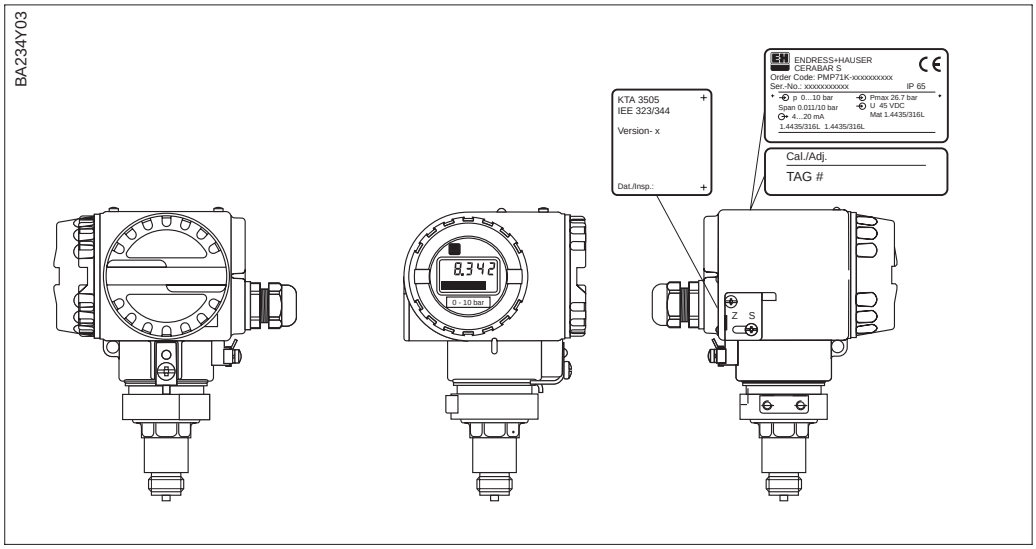


Figure 1.1
Examples of the Cerabar S pressure transmitter

Operating principle

Metal sensor
The process pressure deflects the separating diaphragm and a fill fluid transmitts 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.

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

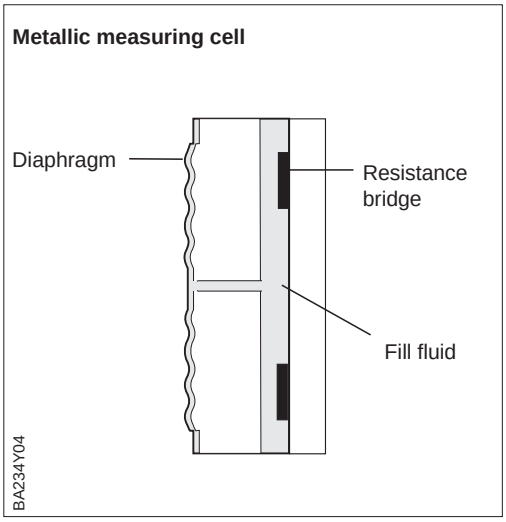


Figure 1.2
Ceramic and metallic measuring cell

1.1 Measuring system

The complete measuring system consists of
- Cerabar S pressure transmitter with 4…20 mA signal output
- optional four-character pressure display
- power supply 11.5…45 V DC

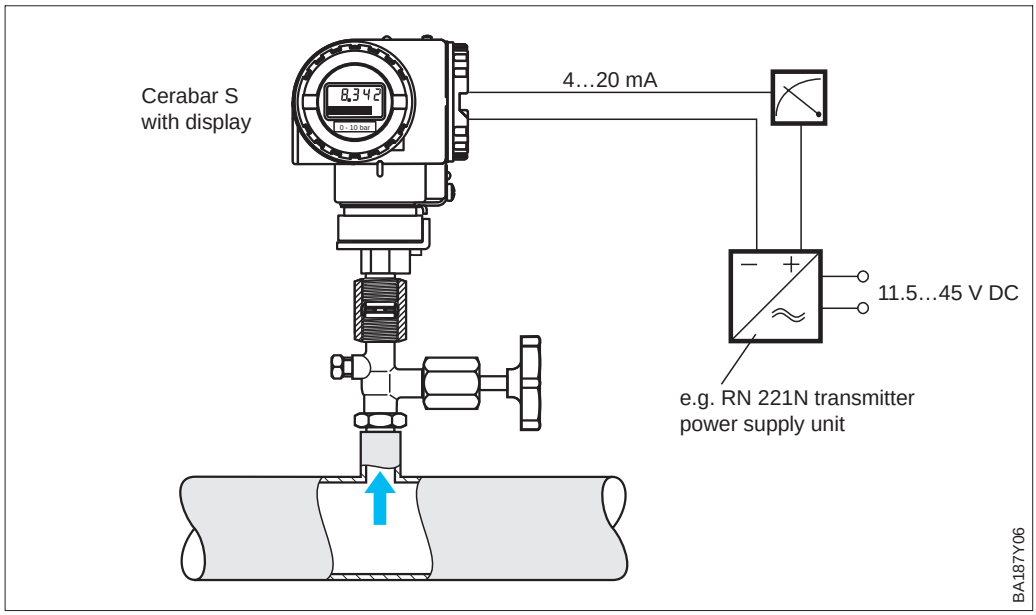


Figure 1.3
Cerabar S measurement system with display

For electronic versions with HART protocol, a digital communication signal is superimposed on the signal current and is used for remote calibration.
These instruments have additional functions also to measure level.

Operation can be carried out using:
- the Commuwin II operating program
- the Universal HART Communicator DXR 275 handheld (HART protocol)

2 Installation

This chapter describes:
- the mechanical installation of Cerabar S
- the electrical connection

2.1 Mounting instructions PMP 71 K

The Cerabar S 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.

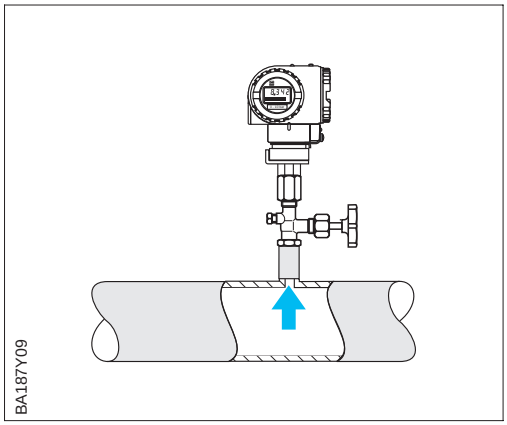


Figure 2.1
Mounted on a shut-off valve for measuring gases

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

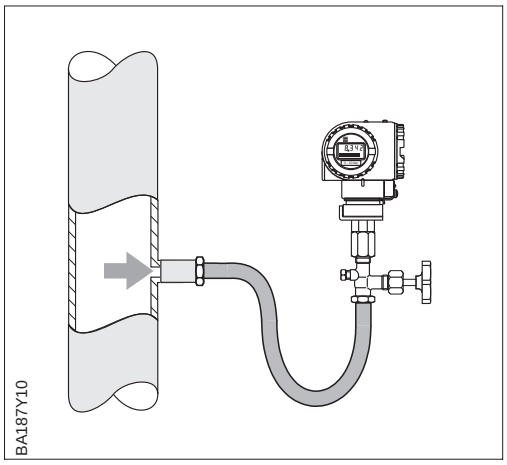


Figure 2.2
Mounted with U-shaped pigtail for measuring steam/vapour

- 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.

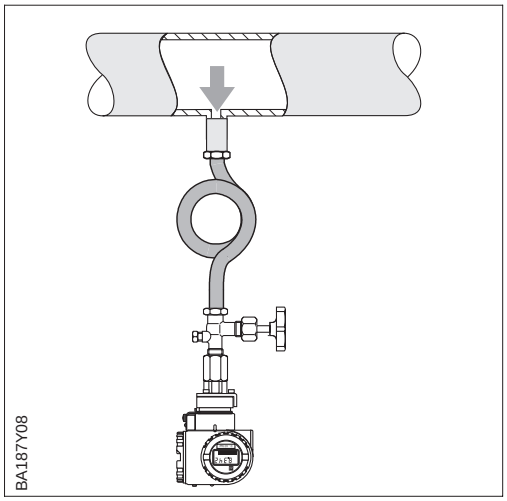


Figure 2.3
Mounted with circular pigtail for measuring steam/vapour

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

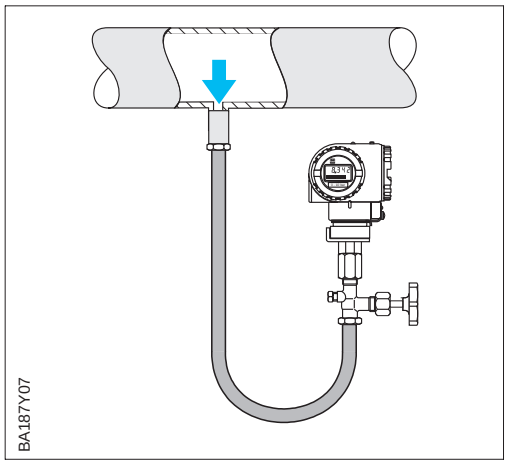


Figure 2.4
Mounted on a shut-off valve for measuring liquids

Mounting the PMP 71 K

The PMP 71 K with metallic sensor is available in the following version:
• with adapter (welded in) and internal diaphragm.

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

Note!

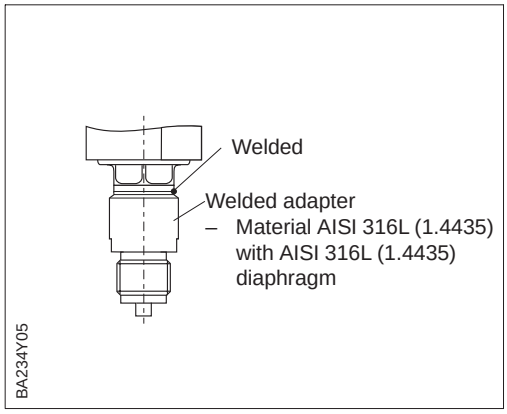


Figure 2.5
With internal diaphragm and welded adapter

2.2 Mounting accessories

Wall and pipe mounting with accessories

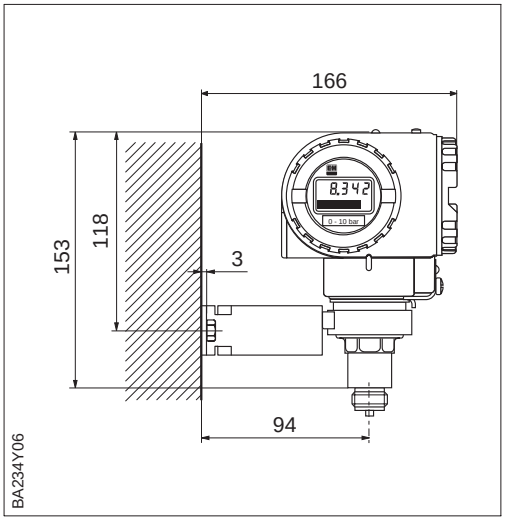


Figure 2.6
Mounted with bracket on a wall

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

Dimensions are in mm.

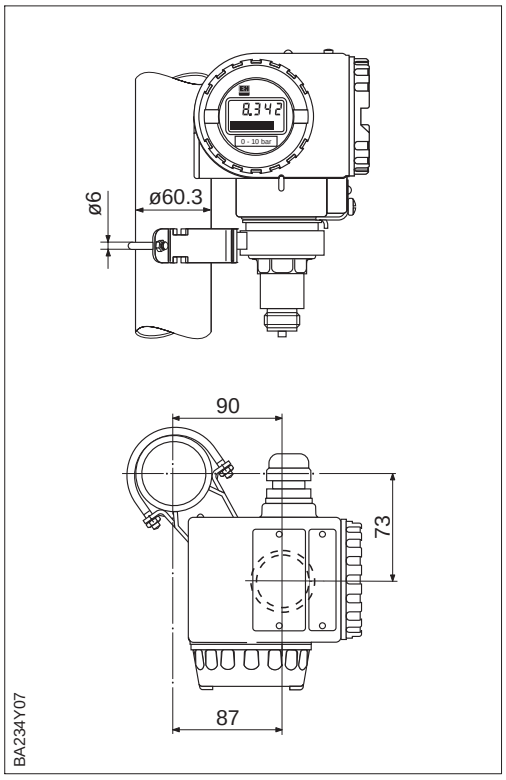


Figure 2.7
Mounted with bracket on vertical piping

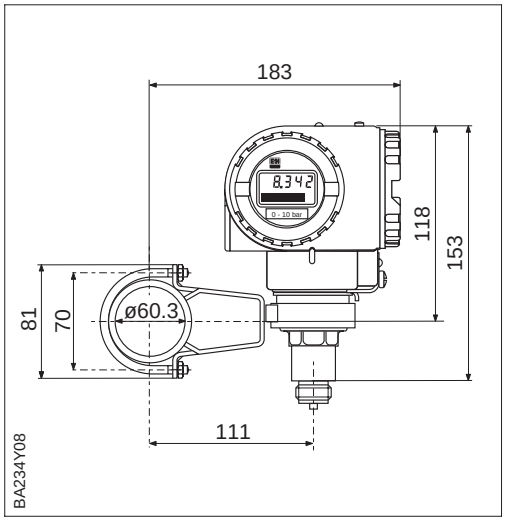


Figure 2.8
Mounted with bracket on horizontal piping

2.3 Mounting position

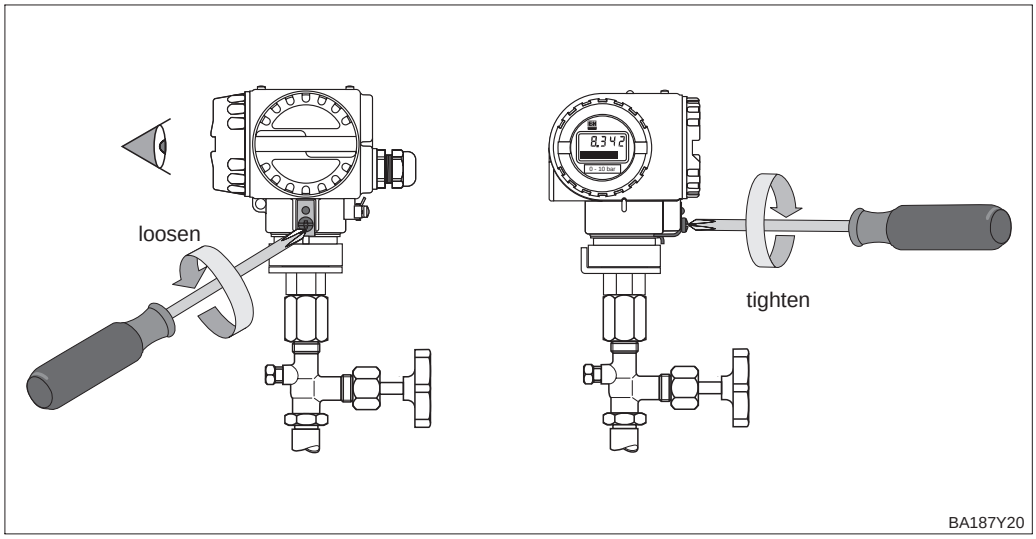
Positioning the housing

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.



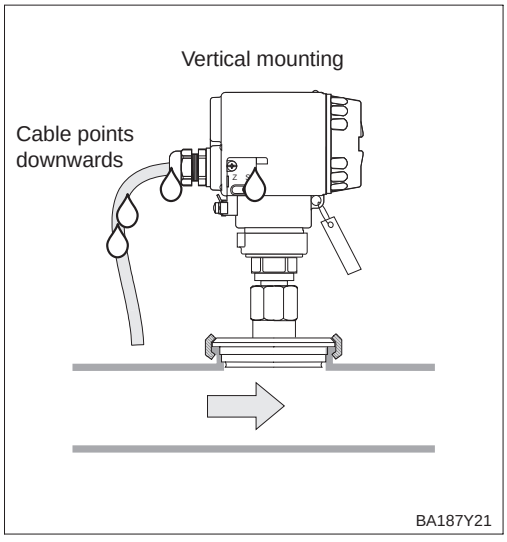


Figure 2.9
Mounting of the Cerabar S
- *cable points downwards*
- *The cover for the Z/S keys is on the side of the instrument*

2.4 Electrical connection

Screened twisted pairs are recommended for the instrumentation cable.
Supply voltage: 11.5…45 V DC
Internal protection circuits protect against reverse polarity, HF interference and overvoltage peaks.
A test signal can be measured using Terminals 1 and 3 without interrupting the process measurement.

Cable connection

- Unscrew the cover of the connection compartment.
- Insert the cable through the cable entry.
- Connect the cable wires as shown in the connection diagram.
- Screw down the cover.

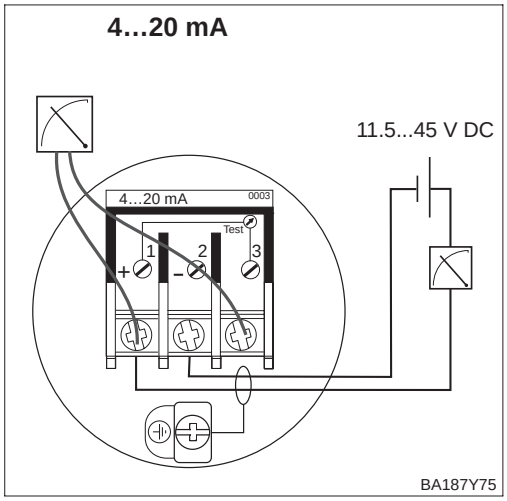


Figure 2.10
Electrical connection of the Cerabar S
For all versions with 4…20 mA

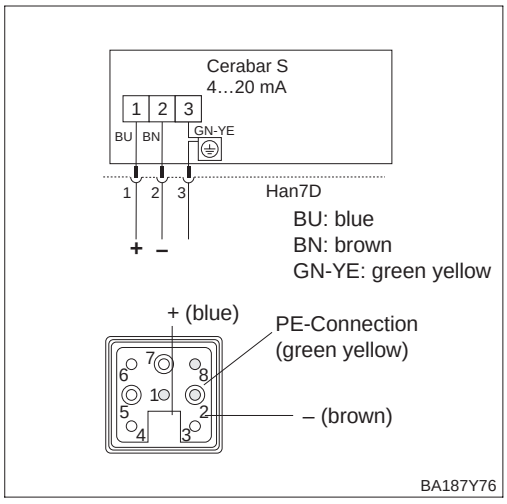


Figure 2.11
Harting plug pin assignment

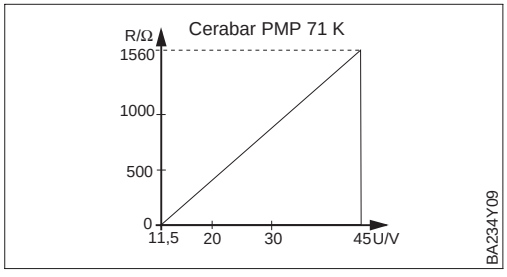


Figure 2.12
Load diagram

- Do not change batteries of the handheld terminal in explosion hazardous areas.
- For correct transmission of the communication signal, a minimum load of 250 Ω must be present between the connection points and the power supply.

Connecting handheld terminals

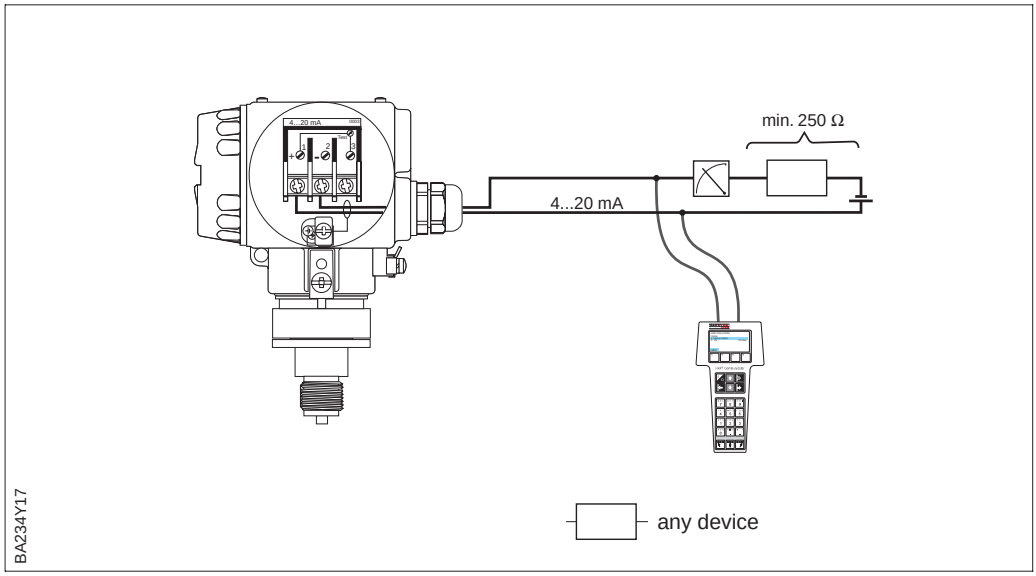


Figure 2.13
Handheld terminals can be connected anywhere along the 4…20 mA cable

Connecting the Commubox FXA 191 for operating via Commuwin II

The Commubox FXA 191 connects Smart transmitters with a HART protocol to the RS 232 C serial interface of a personal computer. This enables the transmitter to be remotely operated with the Endress+Hauser Commuwin II operating program.
The Commubox FXA191 is used for intrinsically safe signal circuits.

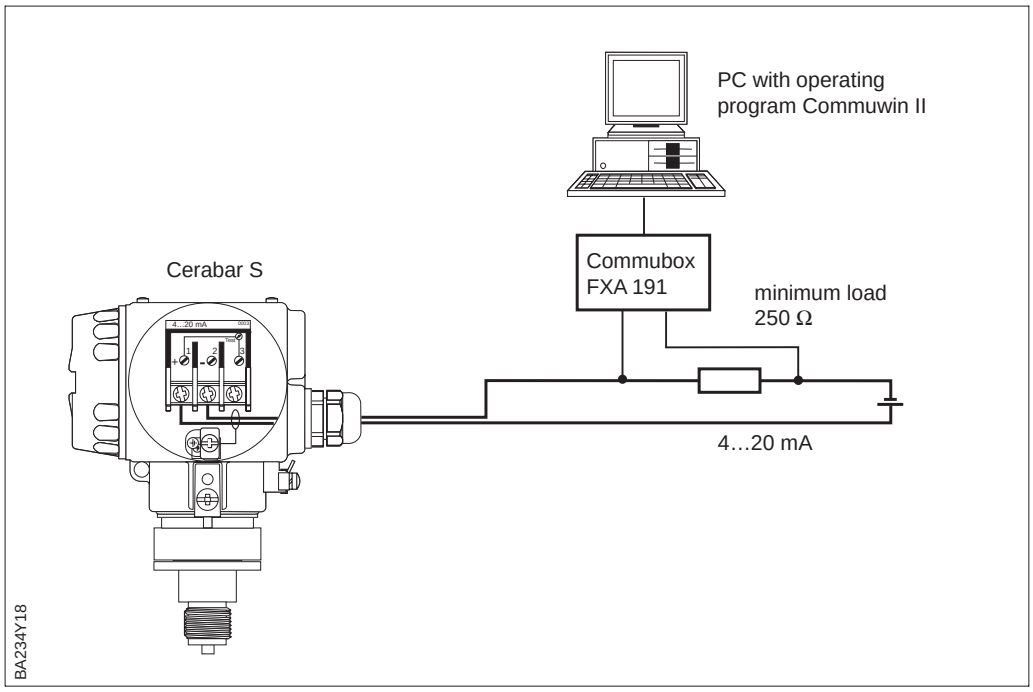


Figure 2.14
The Commubox can be connected anywhere along the 4…20 mA cable

3 Operation

3.1 On-site operation

Operating elements

Four keys, which allow the lower and upper range-values to be set, are available for on-site operation. The key functions are listed in the table below.

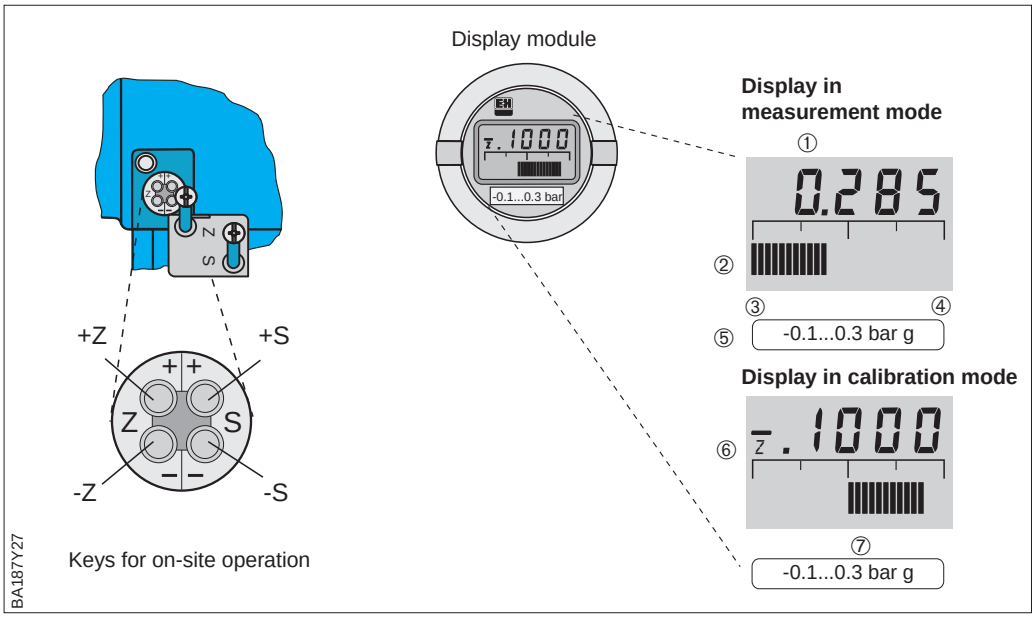


Figure 3.1
User interface of the Cerabar S, with optional display module

Display in measurement mode
① *4-figure display of measured value and input parameters*
② *Bar graph of measured value*
③ *Lower range-value*
④ *Upper range-value*
⑤ *Nominal measuring range*
With display in in calibration mode
⑥ *Display of the calibration point (Z=Zero, S=Span)*
⑦ *Set measuring range within the limits of the measuring cell*

Display module

The local display module admits two display modes:

- Display in measurement mode: This is shown as standard
- Display in calibration mode: This is shown after pressing one of the keys +Z, –Z, +S or –S once. Returns automatically to measurement mode after 2 seconds.

Key functions	
+Z	increases the lower range-value (zero) by +1 digit *
–Z	decreases the lower range-value (zero) by –1 digit *
+S	increases the upper range-value (span) by +1 digit *
–S	decreases the upper range-value (span) by –1 digit *

Key combinations (Press keys simultaneously)	
Keys	**Function**
Calibration	
+Z and –Z	the acting pressure is taken as lower range-value (4 mA)
+S and –S	the acting pressure is taken as upper range-value (20 mA)
Bias pressure	
2 times +Z and +S	the acting pressure is taken as bias pressure**
1 time +Z and +S	the current bias pressure** is shown
2 times –Z and –S	the current bias pressure** is deleted
Securing the measuring point by locking/unlocking	
+Z and –S	Locking the measuring point
–Z and +S	Unlocking the measuring point

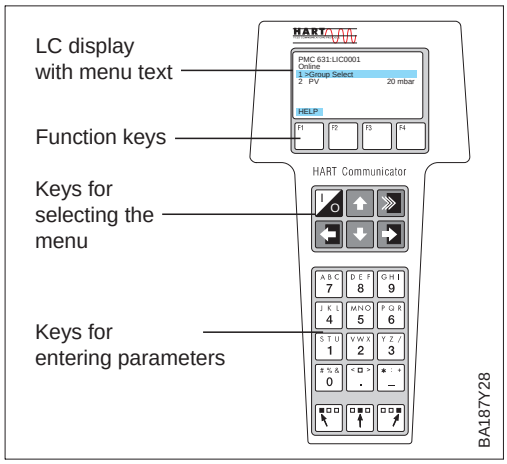
Table 3.1
Key functions

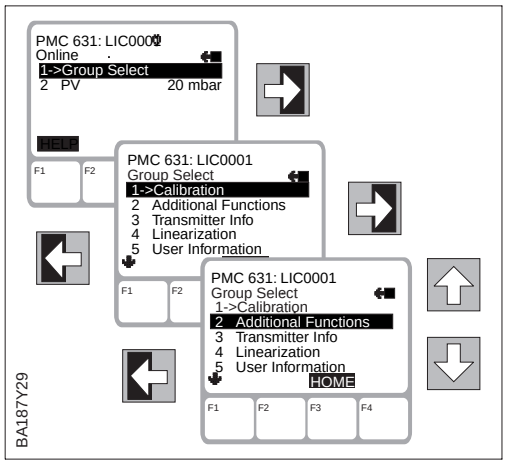
** Note: Pressing once activates the display, only by pressing again does the display begin to count. When the key is pressed, the value begins to run slowly at first, then faster and faster.*

*** If the display indicates process pressure zero not as zero after calibrating lower range-value (depending on position) you can correct the display value to zero by adopting a bias pressure. The position calibration using a bias pressure does not affect the current output.*

The procedure for commissioning the measuring point with local operation is described in Chapter 4.

3.2 Operation using the Universal HART Communicator DXR 275





When operating with the HART protocol an interactive menu operation is used derived from the operating matrix in Commuwin II (see also the operating manual for the handheld terminal).

- The menu "Group Select" calls up the matrix.
- The bar lines display the menu headings.
- Parameters are set using submenus.

Connecting the handheld terminal is described in Chapter 2.4, page 13.
The procedure for commissioning the measuring point with the Universal HART Communicator DXR 275 is described in Chapter 5 "Pressure Measurement" and Chapter 6 "Level Measurement".

3.3 Operation with Commuwin II

When operating the Commuwin II display and operating program (possible with Version 2.07.01 and higher), the Cerabar S is set and operated either using:

- Matrix mode or
- Graphic mode.

The appropriate server (e.g. HART or ZA 672) must therefore be activated. A description of the operating program Commuwin II is to be found in Operating Instructions BA 124F.

Matrix mode (Menu Device)

You can access the extended functions 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 ↵.

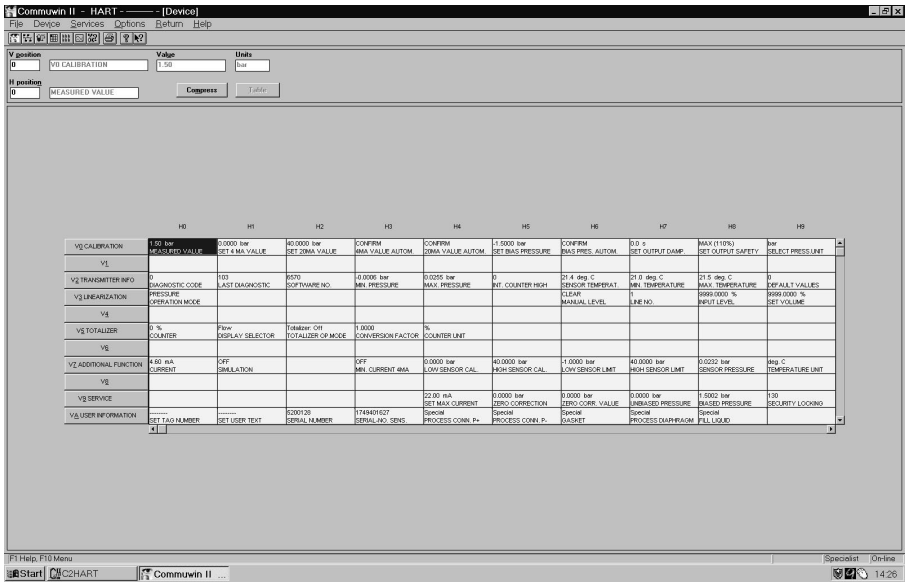


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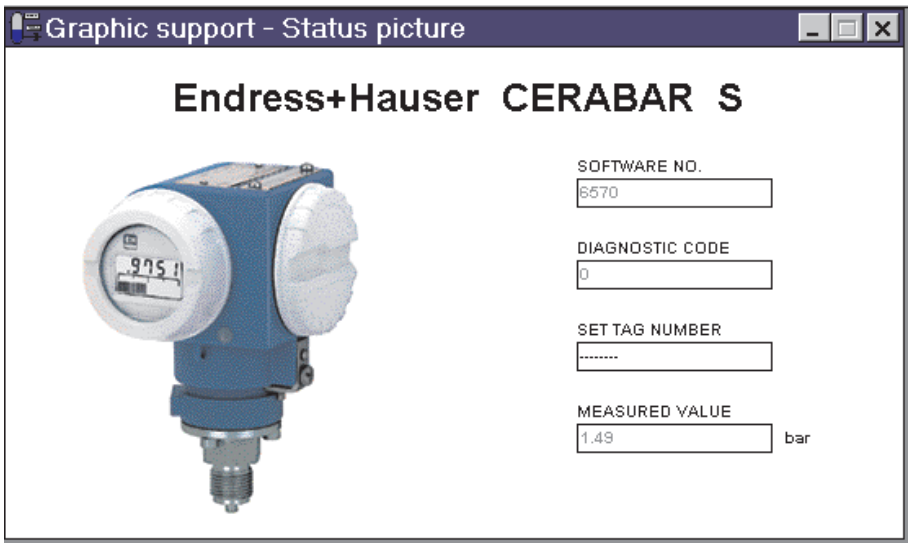
Figure 3.2
Menu "Device/Parameter matrix" in Commuwin II

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 ↵.



BA187E32

Figure 3.3
Menu "Device/Graphics" in Commuwin II

4 Local Operation

4.1 Commissioning the measuring point

Contents

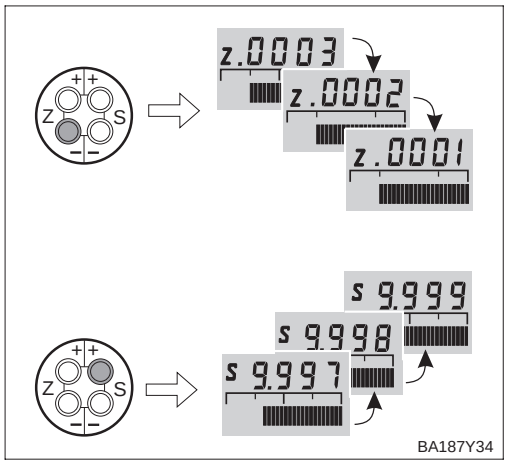
This Chapter contains the following information:

- General description of **operation with keys**
  - Setting lower and upper range-values: calibration without reference pressure
  - Adjusting lower and upper range-values: adjustment with reference pressure
  - Adjusting lower and upper range-values: reference pressure is near the lower and upper range-values
  - Position calibration (display only)
- Setting damping (integration time)
- Locking the measuring point

You can find **more information** in the **Operating Matrix**. Instructions on operating the handheld terminal or using the matrix are given in **Chapter 3** and **Chapter 5** "Pressure Measurement" and **6** "Level Measurement".

Lower and upper range-values: calibration without reference pressure

The lower and upper range-values are set with the local keys.



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

Lower and upper range-values: calibration with reference pressure

A reference pressure is available that corresponds exactly to lower and upper range-values required.

#	Key	Entry
1	Exact pressure for lower range-value is acting	
2		Press +Z and -Z simultaneously once. (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 ating	
4		Press +S and -S simultaneously once (The lower range-value is unaffected.)

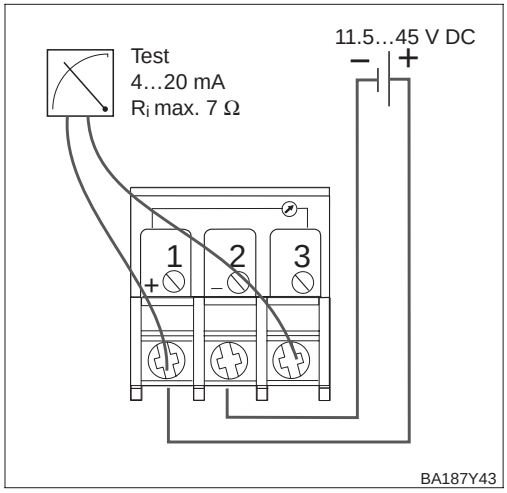
Lower and upper range-values: setting using reference pressure for devices without display

On devices without a display, you can set the lower and upper-range values with the reference pressure and an ammeter. The reference pressure should be near the lower and upper range-values. The associated current value must be calculated using the following equation:

$$I = 4\,mA + \frac{16\,mA \bullet (p - p_{URV})}{(p_{LRV} - p_{URV})}$$

I – Current value
p – Reference pressure is near lower or upper range-values
p_{LRV} – Pressure lower range-value
p_{URV} – Pressure upper range-value

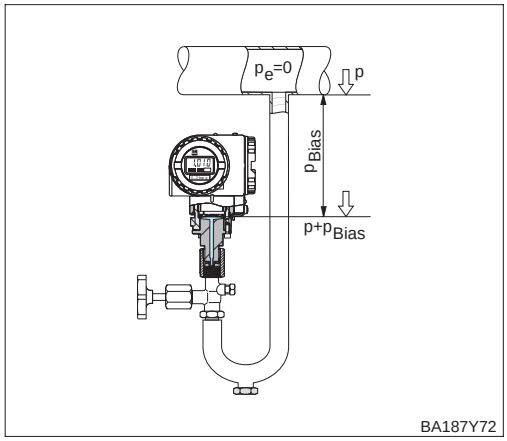
#	Key	Entry
1		Example: Set a pressure transmitter as follows: Lower range-value: p_{LRV} = 0 bar and Upper range-value: p_{URV} = 1.0. There are two reference pressures available: Near to lower range-value p = 0.1 bar Near to upper range-value p = 0.9 bar
2		Enter pressure near the lower range-value e.g. 0.1 bar
3		Calculate the associated current value for the applied reference pressure, e.g. 0.1 bar equals 5.4 mA
4		Set the current value 5.4 mA by pressing the +Z or –Z keys several times
5		Enter pressure near the upper range-value e.g. 0.9 bar
6		Calculate the associated current value for the applied reference pressure, e.g. 0.9 bar equals 18.4 mA
7		Set the current value 18.4 mA by pressing the +S or –S keys several times



Position calibration – display only (bias pressure)

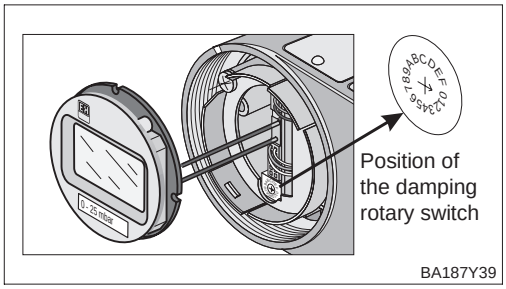
If the **display** does not show zero after zero point adjustment (due to mounting position), then you can correct the display value to zero by adopting the bias pressure acting (depending on mounting position). The position calibration using a bias pressure does not affect the current output.

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



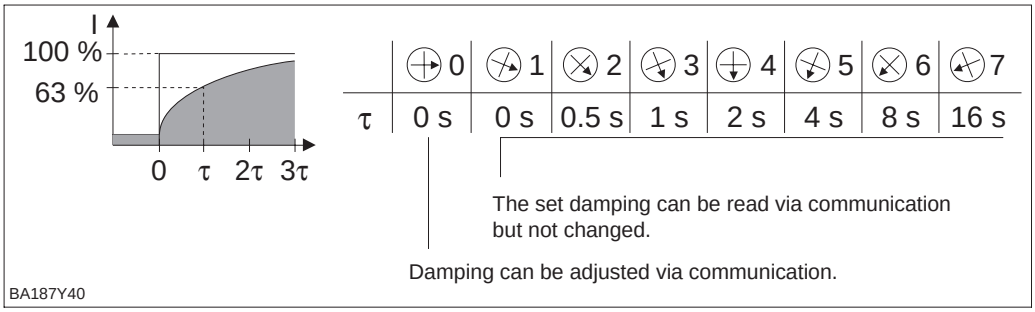
4.2 Damping τ

The damping affects the speed with which the output signal reacts to changes in pressure.



Fixed damping values are assigned to the switch positions **0…7**.
They can be adjusted directly on the instrument.
(Fixed damping values for root functions are assigned to the switch positions 8…F. This function cannot be selected for the Cerabar S.)

Damping-linear function: switch positions 0…7

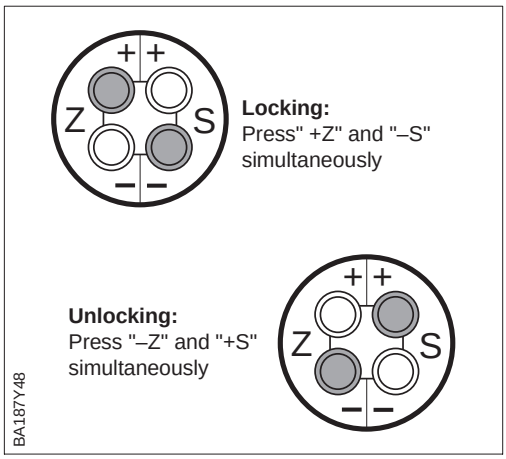


4.3 Locking/unlocking operation

Operation can be locked after commissioning. This protects the measuring point against unwanted or unauthorised changes to parameters entered.

Keys

#	Key	Entry
1		**Locking operation:** Press +Z and –S simultaneously once
1		**Unlocking operation:** Press +S and –Z simultaneously once



Locking with keys has priority

Note!
Locking using the local keys, blocks operation over the local keys as well as all operations via handheld terminals or Commuwin II. This is only released again by using the local keys.


Note!

5 Pressure Measurement

5.1 Start-up with the Universal HART Communicator DXR 275 or Commuwin II

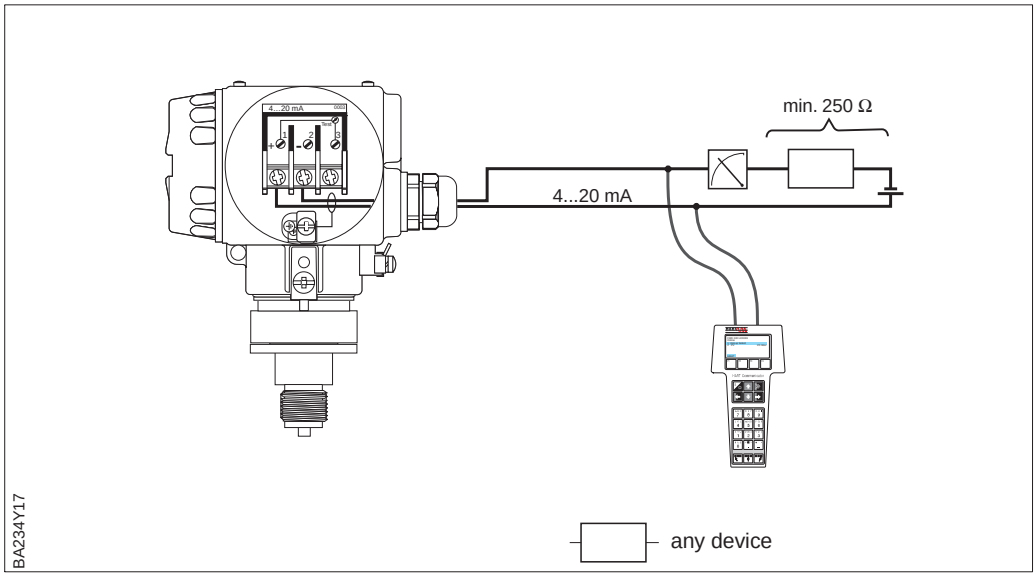
Contents

This Chapter contains the following information:
- Preparatory work for start-up
  - Resetting to factory settings
  - Setting damping
  - Selecting pressure units
- General description of the measuring range
  - Lower and upper range-values: calibration without reference pressure
  - Lower and upper range-values: adjustment with reference pressure
  - Position calibration (display only)
- Other entry procedures
  - Entering the 4 mA level value
  - Selecting the output on error
  - Securing the measuring point by locking
  - Retrieval of measuring point information

Resetting to factory settings

By entering a code, the entries in the matrix are reset partially or completely to factory settings. Further information on the various types of reset and their effects are given in Section 7.3 "Reset".

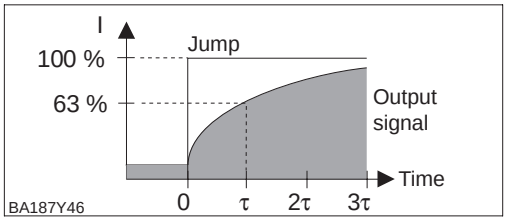
#	Matrix	Path through the menus	Entry
Main group: Transmitter information			
1	Reset to factory settings		
	V2H9	➤ Reset	2380 Confirm E



Damping τ

The damping affects the speed with which the display in V0H0 and the output signal react to changes in pressure.
Setting the damping by remote communication is only possible with switch position "0" (see position of the rotary switch page 19).

#	Matrix	Path through the menus	Entry
Main group: Basic settings			
1	Suppressing variations in the measured value		
	V0H7	➤ Damping τ = 0…40 s	e.g. 20 s Confirm E



Selecting pressure units

After selecting new pressure units all information on the pressure are converted into the new units.
Example: After selecting the units "psi" the measuring range from 0…10 bar is converted into 0…145.5 psi.

#	Matrix	Path through the menus	Entry
Main group: Basic settings			
1	Select pressure units		
	V0H9	➤ Selects pressure units	e.g. psi Confirm E

The pressure units in the table below are available:

mbar	bar	Pa	hPa	kPa	MPa	mmH_2O
mH_2O	inH_2O	ftH_2O	psi	g/cm^2	kg/cm^2	kgf/cm^2
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.

Output Pressure in %

If you want the pressure value to be displayed in "%", set the operating mode to "Pressure %". The "Display at 4 mA" (V3H1) and "Display at 20 mA" (V3H2) parameters set the lower and upper range-values. Select "%" in the "Unit after Linearisation" (V3H3) parameter.

#	Matrix	Path through the menus	Entry
Main group: Linearisation			
1	Select operation mode "Pressure %"		
	V3H0	➤ Operation mode Pressure %	Confirm E
2	Enter lower range-value		
	V3H1	➤ Display at 4 mA	e.g. 0% Confirm E
3	Enter upper range-value		
	V3H2	➤ Display at 20 mA	e.g. 100% Confirm E
4	Select "%" unit		
	V3H3	➤ Unit after Linearisation	% Confirm E

Lower and upper range-values: calibration without reference pressure

The required pressure for lower and upper range-value is set by remote communication.

#	Matrix	Path through the menus	Entry
Main group: Basic settings			
1	Enter known pressure for lower range-value		
	V0H1	➤ Sets 4 mA	e.g. 1 bar Confirm E
2	Enter known pressure for upper range-value		
	V0H2	➤ Sets 20 mA	e.g. 2 bar Confirm E

Lower and upper range-values: calibration with reference pressure

A reference pressure is available that corresponds exactly to the required lower range-value and the upper range-value.

#	Matrix	Path through the menus	Entry
Main group: Basic settings			
1	Acting pressure is taken for lower range-value		
	V0H3	➤ Sets 4 mA automatically	Confirm E
2	Acting pressure is taken for upper range-value		
	V0H4	➤ Sets 20 mA automatically	Confirm E

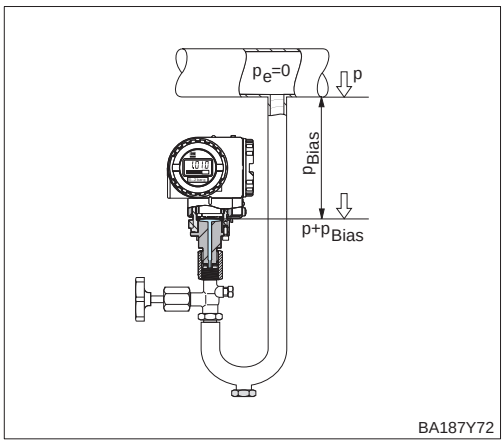
Position calibration – display only (bias pressure)

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

#	Matrix	Path through the menus	Entry
Main group: Basic settings			
1	Set display to zero A bias pressure acting (position-dependent pressure) is adopted as zero pressure.		
	V0H6	➤ Sets bias pressure automatically	Confirm E

Alternatively

2	Set display to zero by entering a known bias pressure (position-dependent pressure).		
	V0H5	➤ Sets bias pressure	e.g. 20 mbar Confirm E



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)).

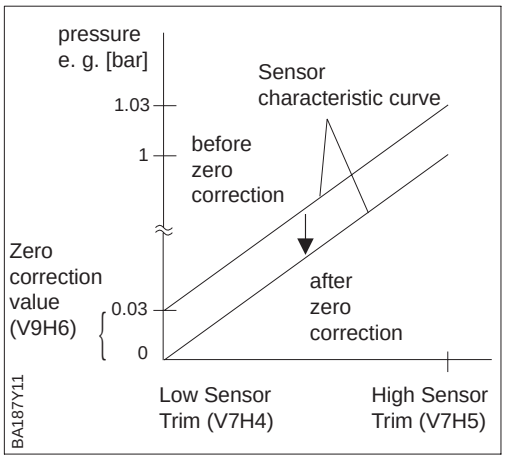
When carrying out a zero correction, an applied pressure is assigned a correction value using "Zero Correction" (V9H5). This shifts the sensor characteristics curve according to the diagram and the "Low Sensor Trim" (V7H4) and "High Sensor Trim" (V7H5) values are recalculated. The "Zero Correction Value" (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.

#	Matrix	Path through the menus	Entry
1	Display "Measured Value" (V0H0) = 0.03 bar (position-dependent pressure) Display "Current (V7H0) = 4.03 mA The 4 mA Value (V0H1) is set to 0.0 bar.		
2	The pressure for zero correction is: "Sensor Pressure" (V7H8) = 0.03 bar (corresponds to the position-dependent pressure)		
Main group: Service			
3	The value 0.0 is assigned to the applied pressure.		
	V9H5	➤ Zero correction	0.0 Confirm E
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 – "Current" (V7H0) = 4.00 mA		



4 mA level

The current signal is set to 3.8…20.5 mA as standard when operating correctly. When selecting the 4 mA level, it is ensured that a minimum current signal does not fall below 4 mA.

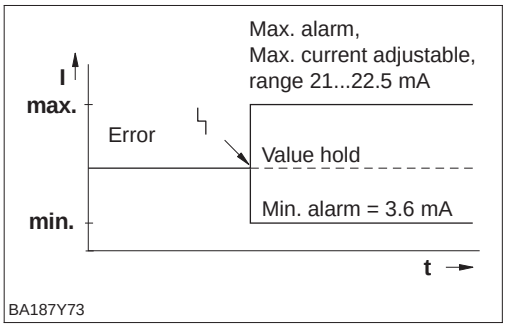
The following applies:
- OFF: lower current level of 3.8 mA
- ON: lower current level of 4 mA

#	Matrix	Path through the menus	Entry
Main group: Additional functions			
	V7H3	➤ Current output min. 4 mA	e.g. ON Confirm E

Alarm mode

To indicate an error, an error code is transmitted with the measured value.
The bar graph in the display adopts the value selected by the operator.
For the "Alarm mode" (V0H8) = "Max. alarm" setting, the current is adjustable from 21…22.5 mA using the "Max. alarm current" (V9H4) parameter (Factory setting: 22 mA).

#	Matrix	Path through the menus	Entry
Main group: Basic settings			
1	Select response on error		
	V0H8	➤ Alarm mode	e.g. Max. alarm Confirm E
Main group: Service			
2	Enter current "Max. alarm" value		
	V9H4	➤ Max. alarm current	z.B. 22 mA Confirm E



5.2 Locking/unlocking operation

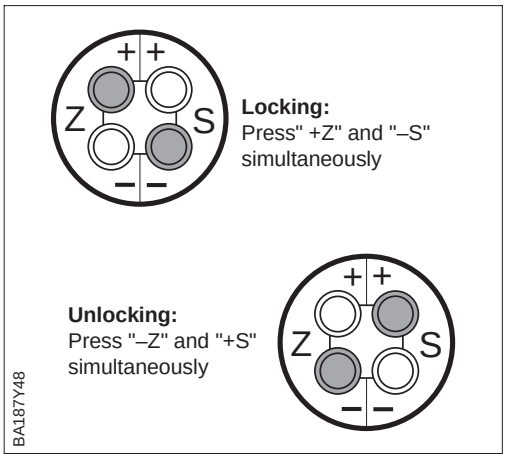
After calibrating or entering all parameters, operation can then be locked.

- via the keys +Z and –S or
- via the matrix by entering a three-character code number ≠ 130 in V9H9 (130 is the code for unlocking the measuring point).

This protects the measuring point against unwanted and unauthorised changes to parameters entered.

Keys

#	Key	Entry
1		**Locking operation:** Press +Z and –S simultaneously once
2		**Unlocking operation:** Press +S and –Z simultaneously once



Locking with keys has priority

Matrix

#	Matrix	Path through the menus	Entry
Main group: Service			
1	Locking operation (blocking)		
	V9H9	➤ Locking	e.g. 131 (≠ 130) Confirm E
2	Unlocking operation (releasing)		
	V9H9	➤ Unlocking	130 Confirm E

The table summarises the locking function:

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

5.3 Measuring point information

The following information on the measuring point can be retrieved:

Matrix field	Display or entry
Measured values	
V0H0	Main measured value: pressure
V2H6	Sensor temperature (units in V7H9 selectable)
V7H0	Output current in mA
V7H8	Sensor pressure (units in V0H9 selectable)
Sensor data	
V0H1	Lower range-value
V0H2	Upper range-value
V2H5	Overload count pressure (0…255)
V7H4	Low Sensor Trim (units in V0H9 selectable)
V7H5	High Sensor Trim (units in V0H9 selectable)
V7H6	Lower range-limit of sensor (units in V0H9 selectable)
V7H7	Upper range-limit of sensor (units in V0H9 selectable)
V9H7	Pressure before bias correction (units in V0H9 selectable)
V9H8	Pressure after bias correction (units in V0H9 selectable)
Measuring point information	
V2H2	Device and software number
Error response	
V2H0	Actual 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	Display
V2H3	Peak hold P Min (Maximum pointer for minimum pressure)
V2H4	Peak hold P Max (Maximum pointer for maximum pressure)
V2H7	Peak hold T Min (Maximum pointer for minimum temperature)
V2H8	Peak hold T Max (Maximum pointer for maximum temperature)
V2H5	Overload counter pressure (0…255)
V2H6	Current sensor temperature (units in V7H9 selectable)

Communication level

The matrix line "VA Communication" can only be called up and calibrated with the Commuwin II operating program or the Universal HART Communicator DXR 275 handheld.

VAH0	Measuring point tag The measuring point can be identified with a max. of 8 characters
VAH1	User text
VAH2 – VAH8	Information about the device

6 Level Measurement

6.1 Start-up with the Universal HART Communicator DXR 275 or Commuwin II

Function check

The "Level linear", "Level cylindrical horizontal" and "Level manual" modes are selectable via communication. In these modes, the current measured pressure value is automatically converted to "%". To improve the display, other level, volume and weight units can be selected using the "Unit after linearisation" parameter.

Your device can be checked for the advanced "level measurement" function as follows.

- The sixth position of the order code has an M or N for the electronic version
  Example: PMP 71 K - R 3 3L 1 **M** 3 1M A
- The function "linearisation" (in line V3 of the operating matrix) can be selected.
- Device and software No. are given in the matrix field V2H2 or below the main group "Transmitter Info": 6570

Contents

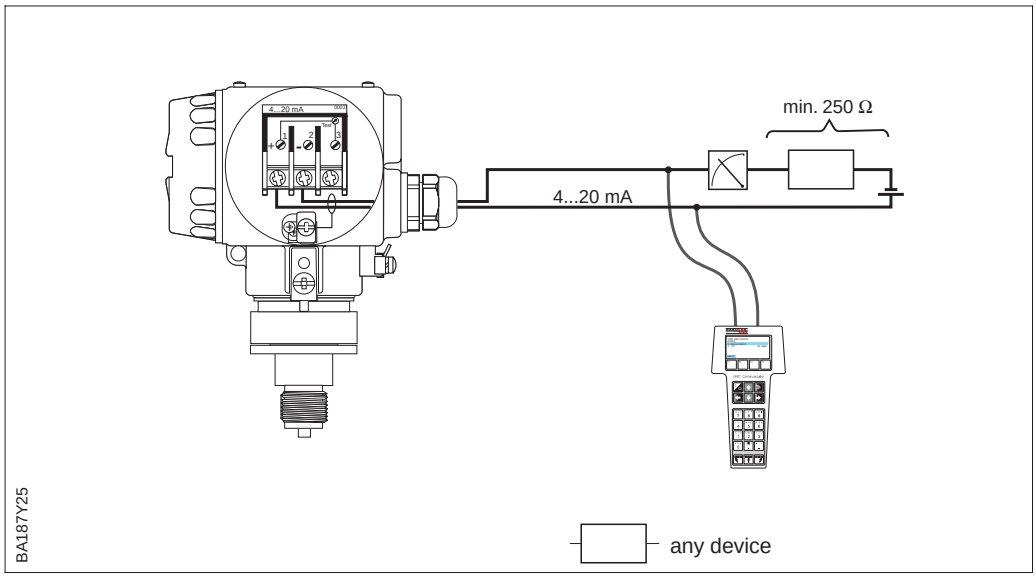
This Chapter contains the following information:

- Preparatory work for start-up
  – Resetting to factory settings
  – Setting damping
  – Selecting pressure units
  – Density correction
- General description for setting the measuring range
  – Adjustment with reference pressure
  – Dry calibration
- Level adjustments
  – Linearisation manual or semi-automatic
- Other entry procedures
  – Entering the 4 mA level value
  – Selecting the output on error
  – Securing the measuring point by locking
  – Retrieval of measuring point information

Resetting to factory settings

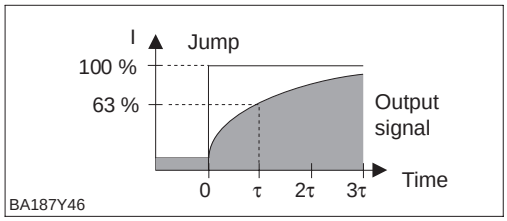
By entering a code, the entries in the matrix are reset partially or completely to factory settings. Further information on the various types of reset and their effects are given in Section 7.3 "Reset".

#	Matrix	Path through the menus	Entry
Main group: Transmitter information			
1	Reset to factory settings		
	V2H9	➤ Reset	2380 Confirm E



Damping τ

The damping affects the speed with which the display in V0H0 and the output signal react to changes in pressure.
Setting the damping by remote communication is only possible with switch position "0" (see position of the rotary switch page 19).



#	Matrix	Path through the menus	Entry
Main group: Basic calibration			
1	Suppressing variations in the measured value		
	V0H7	➤ Damping τ = 0…40 s	e.g. 20 s Confirm E

Selecting pressure units

After selecting new pressure units all information on the pressure are converted into the new units.
Example: After selecting the units "psi" the measuring range from 0…10 bar is converted into 0…145.5 psi.

#	Matrix	Path through the menus	Entry
Main group: Basic calibration			
1	Select pressure units		
	V0H9	➤ Selects pressure units	e.g. mbar Confirm E

Units for operation mode "Pressure":

mbar	bar	Pa	hPa	kPa	MPa	mmH_2O
mH_2O	inH_2O	ftH_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 (Unit after linearisation)

The units for level, volume or weight are selectable using the "Unit After Linearisation" (V3H3) parameter. Selecting a unit only helps to improve the display and does not affect the main measured value in the matrix field V0H0.
Example: After selecting the unit " t", "55 kg" is displayed as " 55 t".

#	Matrix	Path through the menus	Entry
Main group: Linearisation			
1	Select unit for level, volume or weight		
	V2H9	➤ Unit after linearisation	e.g. kg Confirm E

Units for operation mode " Level linear" and "Level curve":

%	cm	dm	m	inch	ft
l	hl	cm^3	dm^3	m^3	ft3
US gal	Imp gal	ton	kg	t	lb

Units for operation mode " Level cylindrical horizontal":

%	l	hl	cm^3	dm^3	m^3
m^3 • 10	m^3 • 100	ft^3	ft3 • 10	ft^3 • 100	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 "Display at 4 mA" (V3H1) parameter corresponds to the minimum level value and the "Display at 20 mA" (V3H2) parameter to the maximum level value.

#	Matrix	Path through the menus	Entry
1	Example: – Lower and upper range-values are set: "Set 4 mA Value" (V0H1) = 0 mbar "Set 20 mA Value" (V0H2) = 1500 mbar		
2	The current measured value (V0H0) displays in the pressure mode (V0H0) = 750 mbar.		
Main group: Linearisation			
3	Select operation mode e.g. "Level linear"		
	V3H0	➤ Level linear	Confirm E
4	The minimum level, maximum level and current measured variable are displayed as follows: – "Display at 4 mA" (V3H1) = 0 % – "Diplay at 20 mA" (V3H2) = 100 % – "Measured Value" (V0H0) = 50 %		
5	Select unit for level, volume or weight		
	V3H3	➤ Unit after linearisation	e.g. m Confirm E
6	Enter the converted minimum level value		
	V3H1	➤ Display at 4 mA	e.g. 0 (m) Confirm E
7	Enter the converted maximum level value		
	V3H2	➤ Display at 20 mA	e.g. 15 (m) Confirm E

Result
- The parameters for the minimum and maximum level value indicate:
  – "Display at 4 mA" (V3H1) = 0 m
  – "Display at 20 mA" (V3H2) = 15 m
- The current measured value (V0H0) indicates:
  – "Measured value" (V0H0) = 7.5 m

Density correction

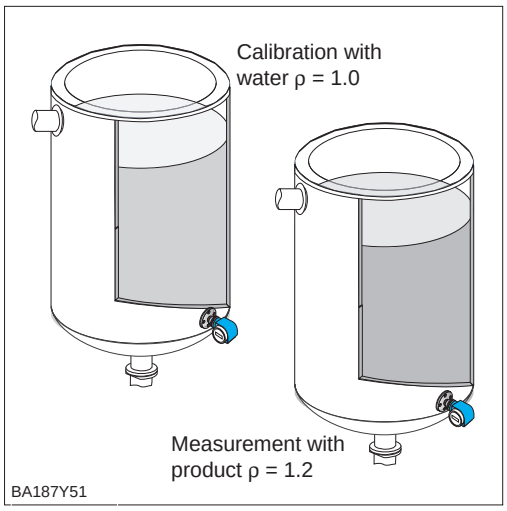
If calibration is carried out with water, or if the product changes, the calibration can be simply corrected by entering a density factor.

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

Determining the density factor

Example: A vessel is filled with water and then calibrated. The density of water (old density) is 1 g/cm^3. The vessel will be later used as a storage tank and filled with the new medium to be measured. The new density is 1.2 g/cm^3. V3H4 still contains the factory setting of 1, i.e. the actual factor is 1.

$$\text{density factor} = 1 \bullet \frac{1.2\ \text{g / cm}^3}{1\ \text{g / cm}^3}$$



#	Matrix	Path through the menus	Text
Main group: Linearisation			
1	Entering the density factor, e.g. after change of product		
	V3H4	➤ Density factor	e.g. 1.2 Confirm E

Result

- The measurement value in V0H0 is divided by the density factor and thus calibrated to the new product.

Note!

The density factor affects level measurement. When changing the product density, please note that an existing linearisation curve can only be used with the new density factor.


Note!

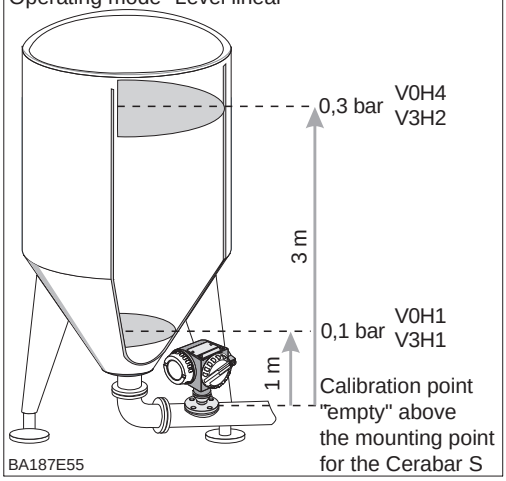
6.2 Calibration with reference pressure

For calibration, the vessel is filled to each the lower range-value and the upper range-value. Selecting the operating mode enables two vessel shapes to be chosen
- vertical – "level linear" and
- horizontal – "level cylindrical horizontal".

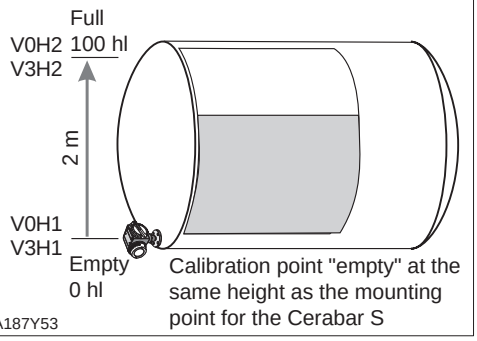
Calibration

#	Matrix	Path through the menus	Entry
Fill the vessel to the lower range-value (empty)			
1	Set the display to "0" by adopting an acting bias pressure (position-dependent pressure).		
	V0H6	➤ Sets bias pressure automatically	Confirm E
2	Adopting the acting pressure for the lower range-value		
	V0H3	➤ Sets 4 mA automatically	Confirm E
Fill the vessel to the upper range-value (full)			
3	Adopting the acting pressure for the upper range-value		
	V0H4	➤ Sets 20 mA automatically	Confirm E
#	Changing product? see "Density Correction" page 29		
Main group: Linearisation			
4	Select operation mode		
	V3H0	Operation mode ➤ Level linear **or** ➤ Level cylindrical horizontal	Confirm E Confirm E
5	Enter the level or volume at the minimum level		
	V3H1	➤ Display at 4 mA	e.g. 0 Confirm E
6	Enter the level or volume at the maximum level		
	V3H2	➤ Display at 20 mA	e.g. 100 Confirm E
7	Select the level or volume units (Select unit from the tables on page 28)		
	V3H3	➤ Unit after linearisation	e.g. hl Confirm E

Operating mode "Level linear"



Operating mode "Level horizontal cylinder"



Note!

Note!
For step 1, you can also carry out a zero correction according to the procedure described in Chapter 5.1, page 23.

6.3 Dry calibration

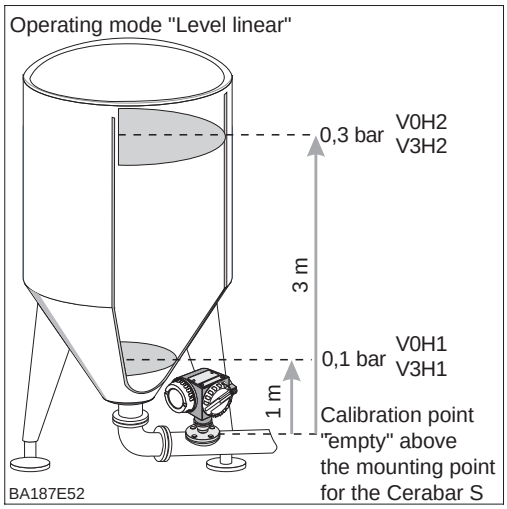
Dry calibration is a theoretical calibration which can be carried out even though the Cerabar S is not mounted and with a vessel filled to any height. The "empty" calibration point is usually at the mounting point of the measuring cell. If measurement starts at another level, then this must be included in the calculation. The requirements for a dry calibration are:

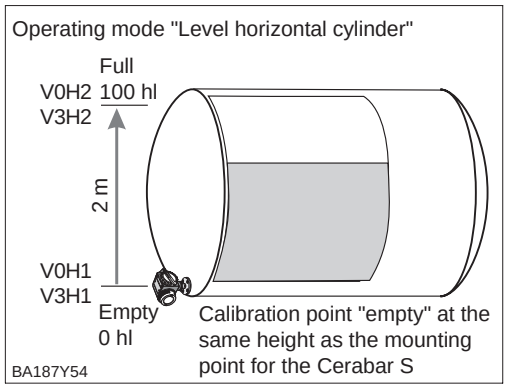
- The heights of the calibration points "empty" and "full" are known.
- The density factor is known.
- The pressure for "empty" and "full" has been calculated (p = ρgh)

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

Calibration

#	Matrix	Path through the menus	Entry
1	Set the display to "0" by entering a known bias pressure (position-dependent pressure).		
	V0H5	➤ Sets bias pressure	e.g. 0.1 bar Confirm E
2	Enter the theoretical pressure for the lower range-value (empty)		
	V0H1	➤ Sets 4 mA	e.g. 0.1 bar Confirm E
3	Enter the theoretical pressure for the upper range-value (full)		
	V0H2	➤ Sets 20 mA	e.g. 0.3 bar Confirm E
#	Change of product? see "Density Correction" page 29		
Main group: Linearisation			
4	Select operating mode		
	V3H0	Operation mode ➤ Level linear **or** ➤ Level cylindrical horizontal	Confirm E Confirm E
5	Enter the level or volume at minimum level		
	V3H1	➤ Display at 4 mA	e.g. 0 Confirm E
6	Enter the level or volume at maximum level		
	V3H2	➤ Display at 20 mA	e.g. 100 Confirm E
7	Select the level or volume units (Select unit from the tables on page 28)		
	V3H3	➤ Unit after linearisation	e.g. hl Confirm E





Note!
For step 1, you can also carry out a zero correction according to the procedure described in Chapter 5.1, page 23.

Note!

After a dry calibration, the first filling of the vessel should always be carried out under supervision in order to identify any errors or inaccuracies which may occur.

Checking after mounting

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 28).

Entry V3H6	Linearisation mode	Meaning
1	Manual entry	For a linearisation curve a 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	A linearisation table is valid only if it is specifically activated.
3	Deleting table	Before entering a linearisation table, any existing table must first be deleted. The linearisation mode automatically jumps to linear.

Warnings

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

Code	Type	Meaning
E602	Warning	The linearisation curve does not rise or fall evenly The number of the last valid pair of values appears automatically in V3H7. All pairs of values must be re-entered from this number onwards.
E604	Warning	The linearisation curve consists of less than two pairs of values. Further pairs of values must be entered.

After selecting the operating mode "Level manual", the following error message may be displayed:

Code	Type	Meaning
E605	Error	The manual linearisation curve is incomplete or no linearisation curve is stored. Enter the linearisation curve in the operation mode "Level linear" and then select the operation mode for the characteristic curve.

Requirements for manual linearisation are as follows:

- The max. 21 pairs of values for the points on the linearisation curve are known.
- The curve is given as a % level (% pressure span) against % volume. The linearisation curve must rise or fall continuously.
- The measured value is supplied as a volume.

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

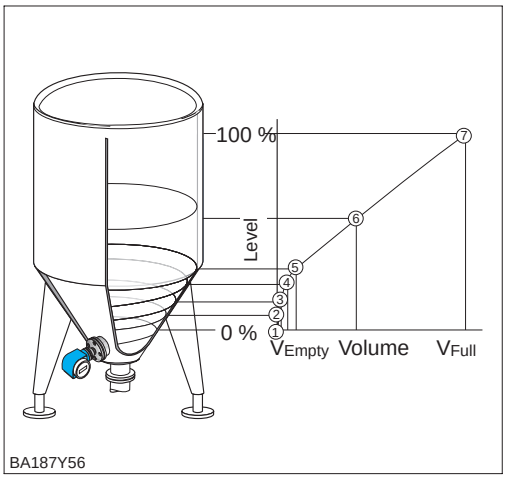


Table giving example

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 1, you can also carry out a zero correction according to the procedure described in Chapter 5.1, page 23.
- A calibration can also be made with a reference pressure using steps 1-3, see page 30.
- In edit mode V3H6 = Manual level, you can delete individual points in a linearisation table entering "9999" for level or volume. But first activate the linearisation table.

Entering the pairs of values for the linearisation curve is done after a calibration with reference pressure or a dry calibration in %. The procedure for dry calibration is described below (see also page 31).

Manual entry

#	Matrix	Path through the menus	Entry
1	Set the display to "0"		
	V0H5	➤ Sets bias pressure	e.g. 0.1 mbar Confirm E
2	Enter the theoretical pressure for the lower range-value		
	V0H1	➤ Sets 4 mA	0 mbar Confirm E
3	Enter the theoretical pressure for the upper range-value		
	V0H2	➤ Sets 20 mA	500 mbar Confirm E
#	Changing product? see "Density Correction" page 29		
Main group: Linearisation			
4	Select linearisation mode "Manual entry"		
	V3H6	Operation mode ➤ Manual level	Confirm E
5	Enter the table		
	V3H7	➤ Line No.	1 Confirm E
	V3H8	➤ Input level	e.g. 0 % Confirm E
	V3H9	➤ Set volume	e.g. 0 % Confirm E
	Repeat step 5 until all points have been entered.		
6	Activate the table		
	V3H6	➤ Activate table	Confirm E
7	Select operation mode "Level manual"		
	V3H0	➤ Level manual	Confirm E
8	Enter the level or volume at the minimum level		
	V3H1	➤ Display at 4 mA	e.g. 0 Confirm E
9	Enter the level or volume at the maximum level		
	V3H2	➤ Display at 20 mA	e.g. 10 Confirm E
10	Select the level or volume units (Select unit from the tables on 28)		
	V3H3	➤ Unit after linearisation	e.g. hl Confirm E

Semi-automatic entry

Requirements for semi-automatic entry of the linearisation curve are as follows:

- The vessel can be filled for e.g. empty/full calibration and for linearisation can be emptied as described below. The level is automatically determined from the hydrostatic pressure. The appropriate volume is given in %.
- The measured value is supplied as a volume.

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

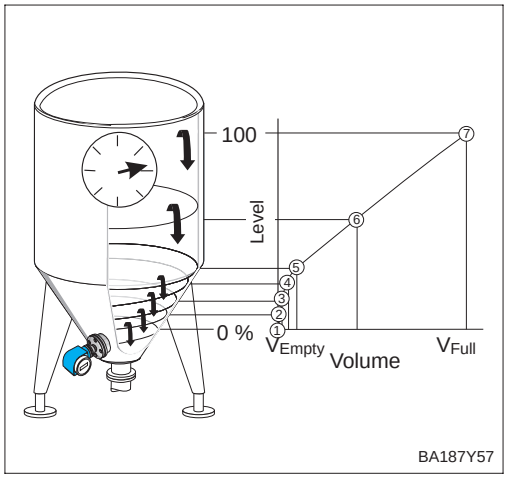


Table giving example

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 1, you can also carry out a zero correction according to the procedure described in Chapter 5.1, page 23.
- A dry calibration can also be made using steps 1-3, see page 31.
- In edit mode V3H6 = Manual level, you can delete individual points in a linearisation table entering "9999" for level or volume. But first activate the linearisation table.

Entering the pairs of values for the linearisation curve is done after a calibration with reference pressure or a dry calibration in %. The procedure with reference pressure is then carried out as described below.

#	Matrix	Path through the menus	Entry
Fill the vessel to the zero point			
1	Set the display to "0" by adopting an acting bias pressure.		
	V0H6	➤ Sets bias pressure automatically	Confirm E
2	Adopt the acting pressure for the lower range-value (empty)		
	V0H3	➤ Sets 4 mA automatically	Confirm E
Fill the vessel to the end point (full)			
3	Adopt the acting pressure for the upper range-value		
	V0H4	➤ Sets 20 mA automatically	Confirm E
#	Changing product? see "Density Correction" page 29		
Main group: Linearisation			
4	Select linearisation mode "semi-automatic entry"		
	V3H6	Operation mode ➤ semi-automatic	Confirm E
5	Enter the table		
	V3H7	➤ Line No.	7 Confirm E
	V3H8	➤ Input level	Confirm E
	The actual level is automatically determined		
	V3H9	➤ Set volume	e.g. 100% Confirm E
	Repeat step 5 until all points have been entered.		
6	Activate the table		
	V3H6	➤ Activate table	Confirm E
7	Select the operation mode "Level manual"		
	V3H0	➤ Level manual	Confirm E
8	Enter the level or volume at the minimum level		
	V3H1	➤ Display at 4 mA	e.g. 0 Confirm E
9	Enter the level or volume at the maximum level		
	V3H2	➤ Display at 20 mA	e.g. 10 Confirm E
10	Select the level or volume units (Select unit from the tables on page 28)		
	V3H3	➤ Unit after linearisation	e.g. hl Confirm E

4 mA level

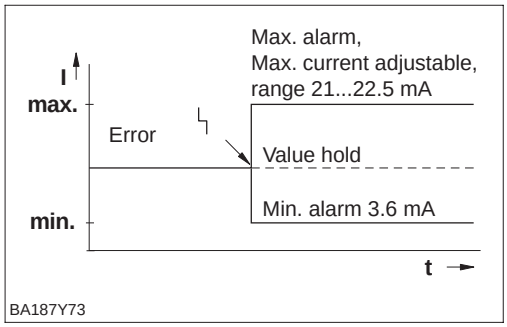
The current signal range is set to 3.8…20.5 mA as standard when operating correctly. When selecting the 4 mA level, a minimum current signal is not to fall below 4 mA.

Thus:
- OFF: lower current level of 3.8 mA
- ON: lower current level of 4 mA

#	Matrix	Path through the menus	Entry
Main group: Additional functions			
1	V7H3 (V1H3)	➤ Current output min. 4 mA	e.g. ON Confirm E

Alarm mode

To indicate an error, an error code is transmitted with the measured value.
The bar graph in the display adopts the value selected by the operator.
For the " Alarm mode" (V0H8) = "Max. alarm" setting, the current is adjustable from 21…22.5 mA using the "Max. alarm current" (V9H4) parameter (Factory setting: 22 mA).



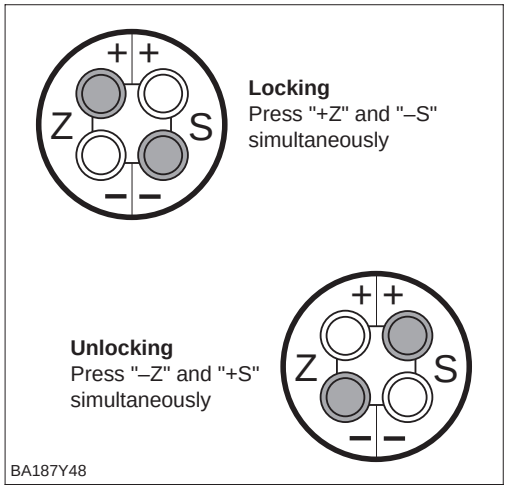
#	Matrix	Path through the menus	Entry
Main group: Basic settings			
1	Select response on error		
	V0H8	➤ Alarm mode	e.g. Max. alarm Confirm E
Main group: Service			
2	Enter current "Max. alarm" value		
	V9H4	➤ Max. alarm current	e.g. 22 mA Confirm E

6.5 Locking/unlocking operation

After calibration or entering all parameters, operation can then be locked.

- using the keys +Z and –S or
- via the matrix by entering a three-character code number ≠ 130 in V9H9 (130 is the code for unlocking the measuring point).

This protect the measuring point against unwanted and unauthorised changes to parameters entered.



Locking with keys has priority

Keys

#	Key	Entry
1		**Locking operation:** Press +Z and –S simultaneously once
2		**Unlocking operation:** Press +S and –Z simultaneously once

Matrix

#	Matrix	Path through the menus	Entry
Main group: Service			
1	Locking operation (blocking)		
	V9H9	➤ Locking	e.g. 131 (≠ 130) Confirm E
2	Unlocking operation (releasing)		
	V9H9	➤ Unlocking	130 Confirm E

The table summarises the locking function:

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

6.6 Measuring point information

The following information on the measuring point can be retrieved:

Matrix field	Display or entry
Measured values	
V0H0	Main measured value: level, volume or weight
V2H6	Sensor temperature (units in V7H9 selectable)
V7H0	Output current in mA
V7H8	Sensor pressure (units in V0H9 selectable)
Sensor data	
V0H1	Lower range-value, (pressure for level "empty")
V0H2	Upper range-value, (pressure for level "full")
V2H5	Overload counter pressure (0…255)
V3H1	Lower range-value for level, volume or weight ("empty")
V3H2	Upper range-value for level, volume or weight ("full")
V7H4	Low Sensor Trim (units in V0H9 selectable)
V7H5	High Sensor Trim (unit in V0H9 selectable)
V7H6	Lower range-limit of sensor (units in V0H9 selectable)
V7H7	Upper range-limit of sensor (units in V0H9 selectable)
Measuring point information	
V2H2	Device and software number
Error response	
V2H0	Actual 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	Display
V2H3	Peak hold P Min (Maximum pointer for minimum pressure)
V2H4	Peak hold P Max (Maximum pointer for maximum pressure)
V2H7	Peak hold T Min (Maximum pointer for minimum temperature)
V2H8	Peak hold T Max (Maximum pointer for maximum temperature)
V2H5	Overload counter pressure (0…255)
V2H6	Current sensor temperature (units in V7H9 selectable)

Communication level

The matrix line "VA Communication" can only be called up and calibrated with the Commuwin II operating program or the Universal HART Communicator DXR 275 handheld.

VAH0	Measuring point tag The measuring point can be identified with a max. of 8 (ASCII) characters
VAH1	User text
VAH2 – VAH8	Information about the device

7 Diagnosis and Trouble-Shooting

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 (min., max., or continue – the last measured value is kept) 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 and 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 103	Error	Initialisation active – The electronics are initialised after the device is connected. *Wait for end of initialisation process.*	2
E 104	Warning	Sensor calibration – Values in V7H4 and V7H5 (Low Sensor Trim and High Sensor Trim) are too close together, e.g. after sensor recalibration. *Reset system (Code 2509), recalibrate sensor.*	23
E 106	Error	Download active (Commuwin II) – *Wait for end of download.*	10
E 110	Error	Checksum error – During a write process (e.g. when display indicates "E 103") the power supply is interrupted. *Restore the power supply. Reset (Code 5140) if necessary.* – EMC effects (larger than specified in Chapter 9, Technical Data). *Block EMC effects.* – Main electronics defective. *Replace electronics.*	1
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.*	4
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.*	6
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.*	7

Code	Type	Cause and Remedy	Priority
E 115	Error	Sensor overpressure – Overpressure present. *Reduce pressure until message disappears.* – Cable connection between sensor and main electronics interrupted. *Check cable connection.* – Sensor defective. *Replace sensor.*	8
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. – *System reset (Code 5140). Repeat download.*	15
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.*	9
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.*	14
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.*	13
E 605	Error	No linearisation curve saved – Linearisation curve not activated, although the "Manual Level" 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 entering, the value pairs the "Level manual" mode is selected.	12
E 613	Warning	Current simulation active – Simulation is switched on using V7H1, i.e. the transmitter is not currently measuring. *Switch off simulation.*	22
E 620	Warning	Signal current is outside range – The current is outside the permitted range 3.8...20.5 mA or 4.0...20.5 mA, i.e. the output current does not fit the measured value. – The applied pressure is too high or too low. – The calibration values for "Set 4 mA Value" (V0H1) and "Set 20 mA Value" (V0H2) are incorrect. *Correct calibration values for V0H1 and V0H2.*	23
E 670[2]	Warning	4 mA value was not transferred – The 20 mA value is outside the editing limits[1]. As the span remains constant during a change to the 4 mA value, the 20 mA value shifts with the 4 mA value. This warning only appears when calibrating with reference pressure using the Z– and Z+ keys. *Carry out the calibration again. The 20 mA value must be within these editing limits. If necessary, set the 20 mA value to a smaller value. After this, first calibrate the 4 mA value and then the 20 mA.*	16
E 672[2]	Warning	Editing limit1) for 4 mA value reached. – Lower or upper editing level reached for 4 mA value. This warning appears when calibrating the 4 mA 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 4 mA value are not undershot or exceeded.*	17

1) The editing limits are described in Chapter 7.4.
2) These error codes only appear on the on-site display.

Error codes in V2H0 and V2H1 (continuation)

Code	Type	Cause and Remedy	Priority
E 673[2)]	Warning	Editing limit[1)] for 20 mA value reached. – Lower or upper editing level reached for 20 mA value. This warning appears when calibrating the 20 mA 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 20 mA value are not undershot or exceeded.*	18
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 20 mA value may not be too close to 4 mA value.*	19
E 675[2)]	Warning	Current pressure value outside the sensor limits. – The currently applied pressure for calibrating the 4 mA or 20 mA values is outside the editing limits (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 4 mA and the 20 mA values must be within the editing limits.*	20

1) The editing limits are described in Chapter 7.4.
2) These error codes only appear on the on-site display.

7.2 Current simulation

A signal current independent of the acting system pressure can be simulated if the function or specific responses of any evaluating instruments connected in the system are to be checked.
The current value is settable within the limits of 3.6 mA and 22 mA using the "Set Simulation Current" parameter (V7H2).

#	Matrix	Path through the menus	Entry
Main group: Additional functions			
1	V7H1	➤ Simulation	ON
2	V7H2	➤ Sets simulation current	e.g. 22 mA

7.3 Reset

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

#	Matrix	Path through the menus	Entry
Main group: Transmitter information			
1	V2H9	➤ Default values	e.g. 2380

The Cerabar S differentiates among different types of reset each with various responses. To find out which parameters are reset with the 5140, 2380 and 731 reset codes, refer to the table on page 40.

Other reset codes have the following effects:
- Device warm start = 62
- 2509: This reset sets the lower and upper sensor calibration limits and the zero correction value to the factory setting. I.e.:
  Low Sensor Trim = Low Sensor Limit (V7H4 = V7H6),
  High Sensor Trim = High Sensor Limit (V7H5 = V7H7).
  Zero Correction Value (V9H6) = 0.0

Reset Codes		H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
	V0	**Measured value**	**Set 4 mA value**	**Set 20 mA value**	**4 mA value autom.**	**20 mA value autom.**	**Set bias pressure**	**Bias pressure autom.**	**Set output damp. [s]**	**Alarm mode**	**Select pressure unit**
5140			0.0	= V7H7			0.0		0.0	max.	bar
2380			0.0	= V7H7			0.0		0.0	max.	
731			0.0	= V7H7			0.0		0.0	max.	
	V1										
	V2	**Diagnostic code**	**Last Diagnostic code**	**Software no.**	**Peak hold P Min**	**Peak hold P Max**	**Int. counter high**	**Sensor temperat.**	**Peak hold T Min**	**Peak hold T Max**	**Default values**
5140			0		=V7H8[1)]	=V7H8[1)]	0		=V2H6[2)]	=V2H6[2)]	
2380			0		=V7H8[1)]	=V7H8[1)]	0		=V2H6[2)]	=V2H6[2)]	
731			0								
	V3	**Operation mode**	**Display at 4 mA[3)]**	**Display at 20 mA[3)]**	**Unit after Lin.[3)]**	**Density factor[4)]**	**Creep flow suppr. %[5)]**	**Manual level**	**Line no.**	**Input Level**	**Input volume**
5140		1(pressure)	0.0%	100.0%	%	1.0	0.0%	delete	1	9999.0%	9999.0%
2380			0.0%	100.0%		1.0	0.0%				
731			0.0%	100.0%		1.0	0.0%				
	V4										
	V5	**Counter**	**Display selector**	**Totaliser op. mode**	**Convers. factor**	**Counter unit**					
5140		0%	Flow	Off	1.0	%					
2380											
731											
	V6										
	V7	**Current [mA]**	**Simulation**	**Set simulation current**	**Min. current 4 mA**	**Low Sensor Trim**	**High Sensor Trim**	**Low sensor limit**	**High sensor limit**	**Sensor pressure**	**Temperat. unit**
5140			Off		Off	= V7H6	= V7H7				°C
2380					Off	= V7H6	= V7H7				
731					Off						
	V8										
	V9					**Max. alarm current**	**Zero correction**	**Zero correction value**	**Unbiased pressure**	**Biased pressure**	**Security locking**
5140						22.0	0.0	0.0	= V7H8[1)]	= V7H8[1)]	130
2380									= V7H8[1)]	= V7H8[1)]	
731											
	VA	**Set tag number**	**Set user text**	**HART serial number**	**Serial number sensor**	**Process conn. P+**	**Process-conn. P–**	**Gasket**	**Process diaphragm**	**Fill liquid**	
5140		delete	delete			special	special	special	special	special	
2380		delete	delete								
731											

1) After a reset, field V2H3, V2H4, V9H7 and V9H8 show the applied pressure.
2) After a reset, fields V2H7 and V2H8 show the measured temperature.
3) Fields V3H1, V3H2 and V3H3 are not displayed in "Pressure" mode.
4) Field V3H4 (Density Factor) is displayed in the "Level lin", "Level cyl. linear" and "Level manual" modes.
5) Field V3H5 (Creepage %) is only shown in the "Square Root" (flow rate) mode.

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:

- Set 4 mA Value (V0H1)
- Set 20 mA Value (V0H2)
- Set 4 mA Value Automatically (V0H3)
- Set 20 mA Value Automatically (V0H4)
- Set Bias Pressure (V0H5)
- Bias Pressure Automatically (V0H6)

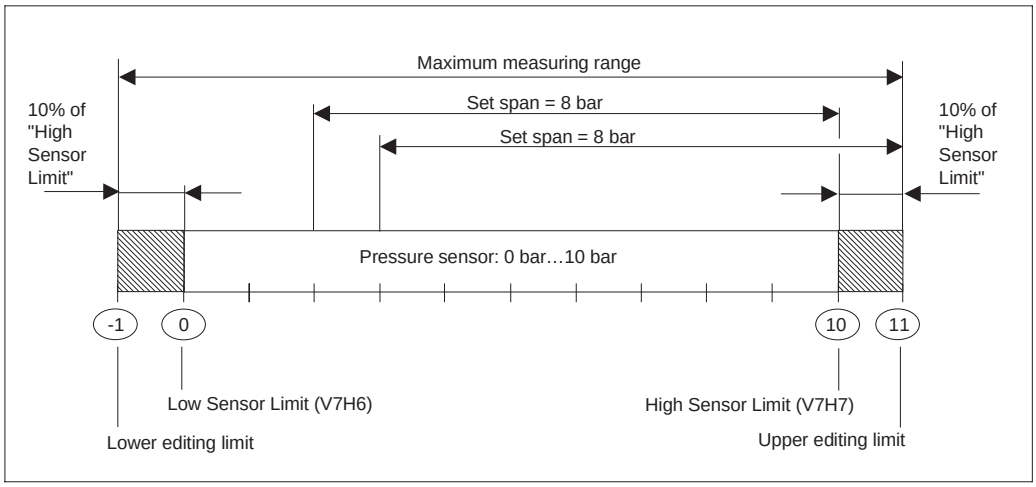
The table below lists the editing limits and the smallest span which you can set:

Measuring cell	Low Sensor Limit (V7H6)	High Sensor Limit (V7H7)	Lower editing limit	Upper editing limit	Smallest span
Metal sensor PMP 71 K					
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" (V7H7) + 10% of "High Sensor Limit" (V7H7)

Example of editing limits for pressure sensor 0…10 bar



Note!

Note!
If a reversal of action from the current output to the measured pressure is required (inverted output) i.e. the 4 mA calibration value corresponds to the upper range-value and the 20 mA calibration value corresponds to the lower range-value, then the calibration should be carried out as follows:

#	Matrix	Path through the menus	Entry
Main group: Basic setting			
1	Enter value for upper range-value		
	V0H2	➤ Sets 20 mA	e.g. –1 bar Confirm E
2	Enter known pressure for lower range-value		
	V0H1	➤ Sets 4 mA	e.g. 1 bar Confirm E
3	Enter known pressure for upper range-value		
	V0H2	➤ Sets 20 mA	e.g. 0 bar Confirm E

Editing limits for zero correction and recalibration

There are also editing limits for the "Low Sensor Trim" (V7H4), "High Sensor Trim" (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 recalibration or a zero correction, the device must have a reference pressure (Refer to Chapter 6.1, Section on "Zero Correction" and Chapter 9.5 "Recalibration"). Enter a value assigned to the applied pressure using the relevant "Low Sensor Trim" (V7H4), "High Sensor Trim" (V7H5) or "Zero Correction Value" (V9H5) parameters.

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

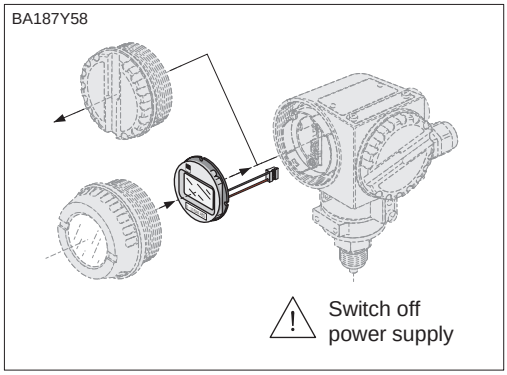
Caution!
Devices with certificates of conformity or design approval must be sent in for repair as complete units only.


Caution!

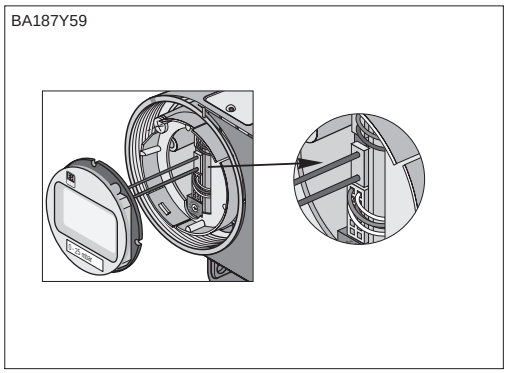
8.2 Mounting the display

Mounting the display

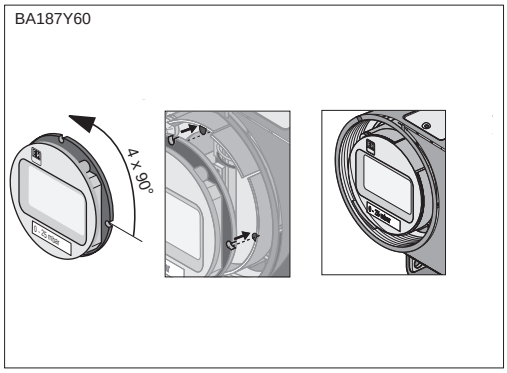
- Switch off power supply.
- Open the cover to the display compartment (use a cover with a sight glass after mounting the display).



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

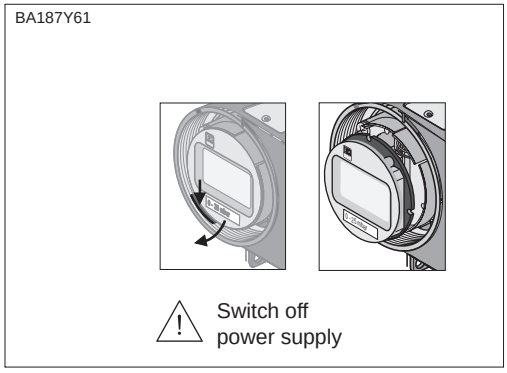


- Attach display.
  The display can be rotated through 90° steps.
- Screw down the cover.



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.



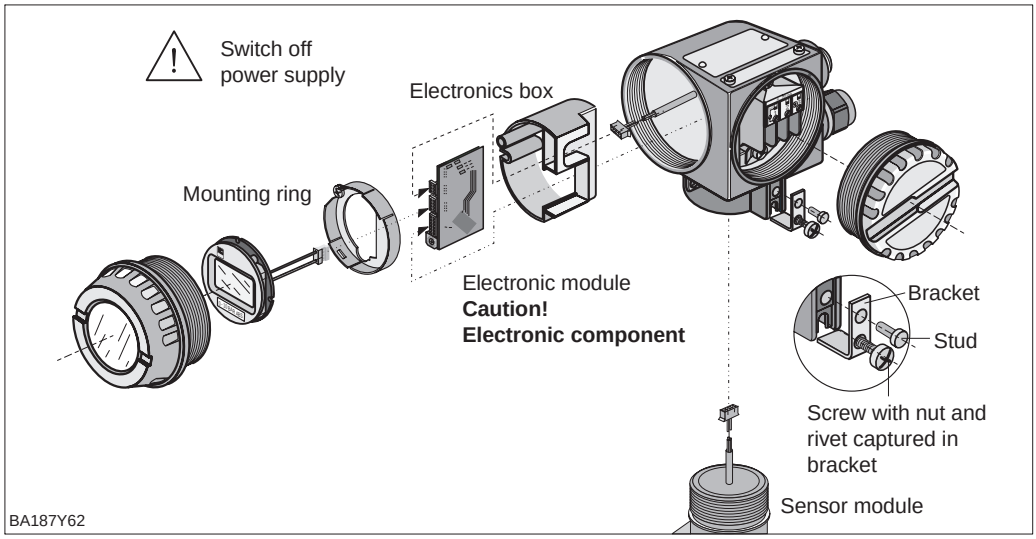
8.3 Exchanging the sensor module and electronics

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
- Unscrew the mounting ring and remove
- Remove the electronic module

Mounting
- Insert the electronic module
- Fix the mounting ring
- Plug in the connectors, 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.

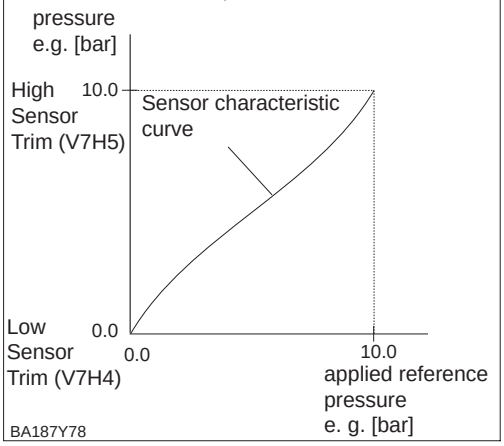
8.4 Recalibration

If you want to fit the pressure transmitter with a diaphragm seal you can recalibrate the sensor using the "Low Sensor Trim" (V7H4) and "High Sensor Trim" (V7H5) parameters. The highest measurement accuracy is obtained when the value for the "Low Sensor Trim" (V7H4) parameter corresponds to the 4 mA calibration value (V0H1/V0H3) and the value for the "High Sensor Trim" (V7H5) parameter to the 20 mA calibration value (V0H2/V0H4).

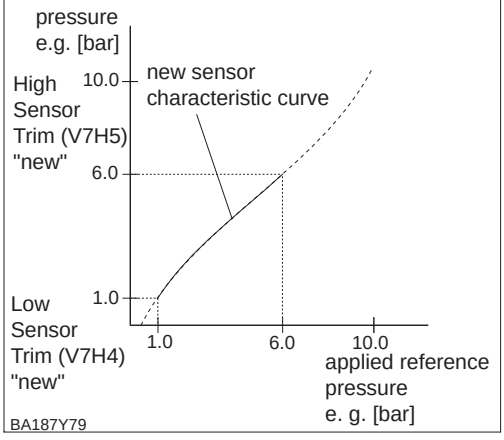
There must be a known reference pressure when setting a new lower or upper sensor characteristic curve value. The more accurate the reference pressure is during recalibration, the higher the accuracy of the pressure transmitter will be later. A new value is assigned to the applied pressure using the "Low Sensor Trim" (V7H4) and "High Sensor Trim" (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 Trim" (V7H4) value = 1.0 bar.		
3	The value 1.0 is assigned to the applied pressure.		
	V7H4	➤ Low Sensor Trim	1.0 bar Confirm E
4	Reference pressure "High Sensor Trim" (V7H5) value = 6.0 bar.		
5	The value 6.0 is assigned to the applied pressure.		
	V7H5	➤ High Sensor Trim	6.0 bar Confirm E
6	The sensor is now calibrated for 1.0…6.0 bar. The "Low Sensor Trim" and "High Sensor Trim" parameter indicate: Low Sensor Trim = 1.0 bar High Sensor Trim = 6.0 bar		

Sensor characteristic curve for the default factory calibration – here for a pressure sensor: 0.0…10 bar



Sensor characteristic curve – recalibrated for the measuring range: 0.0…6.0 bar



Note!

Note!

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

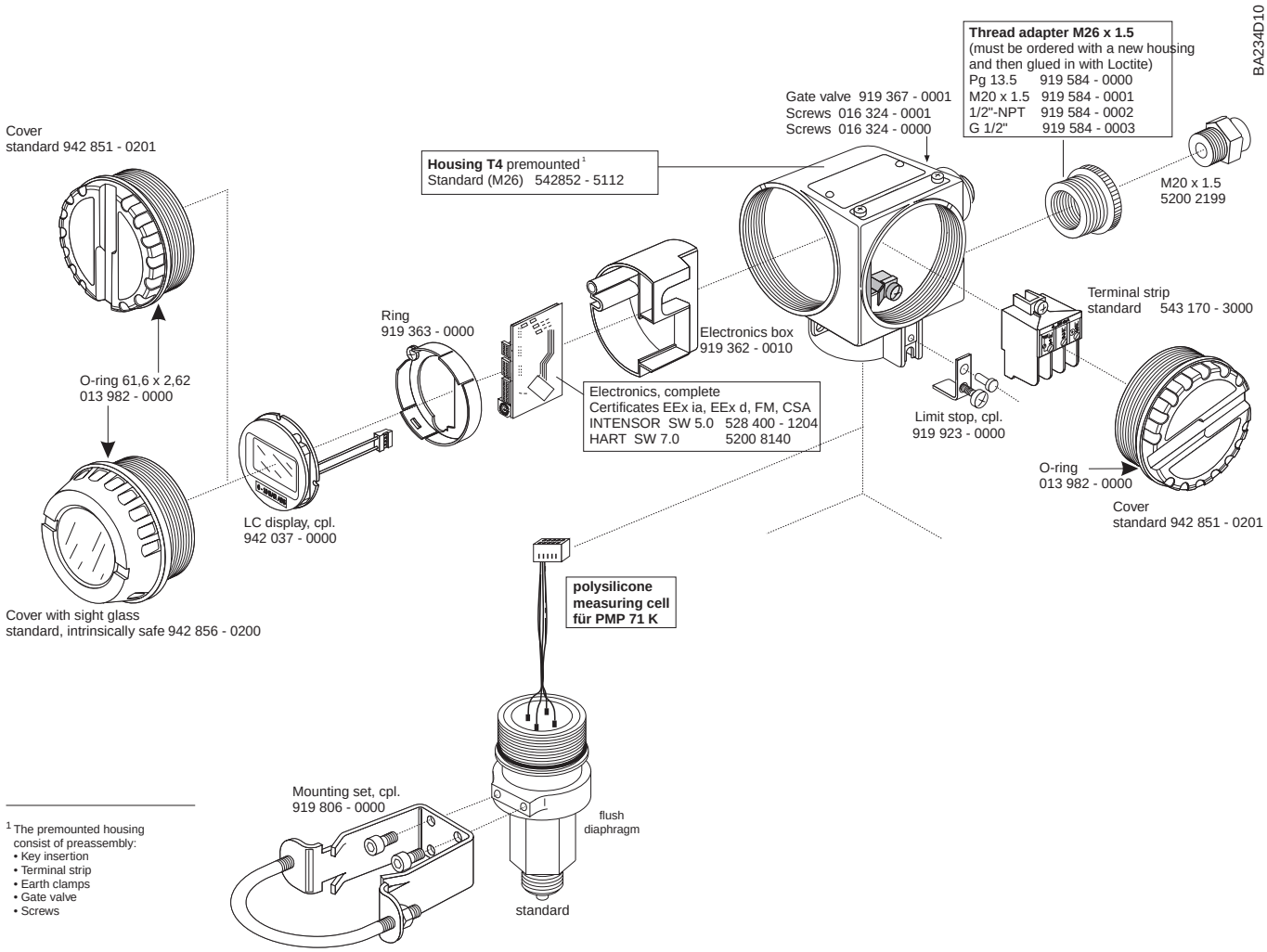
8.5 Replacement parts

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!



9 Technical Data

General information

Manufacturer	Endress+Hauser
Instrument	Pressure transmitter
Designation	Cerabar S PMP 71 K
Technical documentation Version Technical data	BA 234P/00/en 05.07 DIN 19259

Application

Measurement of absolute and gauge pressure in gases, vapours and liquids

Operation and System Design

Measuring principle

PMP 71 K with metal sensor	The process pressure acting on the metallic separating diaphragm of the sensor is transmitted via a fill fluid to a resistance bridge. The change in the output voltage of the bridge is proportional to the pressure and is then measured. Volume of chamber: approx. 1 mm^3 (0.039 in^3)

with 4…20 mA current output	Operation via four keys on the device and a plug-in display module

Construction	Threaded process connection according to European or American standards, refer to Technical Information TI 331P.

Input

Measured variables	Absolute or gauge pressure

Measuring ranges

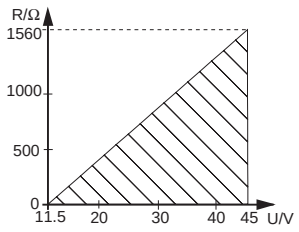
PMP 71 K				
Type of pressure	**Measurement limits**	**Nominal value**	**Minimum span**	**Overload**
	bar	**bar**	**bar**	**bar**
gauge	–1…1	1*	0.05	4
gauge	–1…2.5	2.5	0.125	10
gauge	–1…10	10	0.5	40
gauge	–1…40	40**	2	160
gauge	–1…100	100**	5	400
gauge	–1…400	400**	20	600
absolute	0…1	1*	0.05	4
absolute	0…2.5	2.5	0.125	10
absolute	0…10	10	0.5	40
absolute	0…40	40	2	160
absolute	0…100	100	5	400
absolute	0…400	400	20	600

* Technical data for linearity and temperature effect are doubled.
** Absolute pressure sensors

Vacuum resistance	to 10 $mbar_{absolute}$
Adjusting the span (turndown)	20:1
Zero point increase and decrease	Within measurement limits

Output

4…20 mA

Output signal	4…20 mA with HART protocol, under-run 3.8 mA (4 mA adjustable), over-run 20.5 mA
Load diagram	

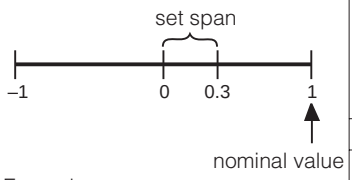
Output (Continuation)

Output signal	Standard: ≥ 21.5 mA Options: max.: settling in the range 21…22.5 mA continue: last measured value held min.: 3.6 mA
Resolution	1µA
Damping (Integration time)	adjustable, 0…16 s via rotary switch
Adjusting range	freely adjustable within the limits of lower range-value and upper range-value

Accuracy

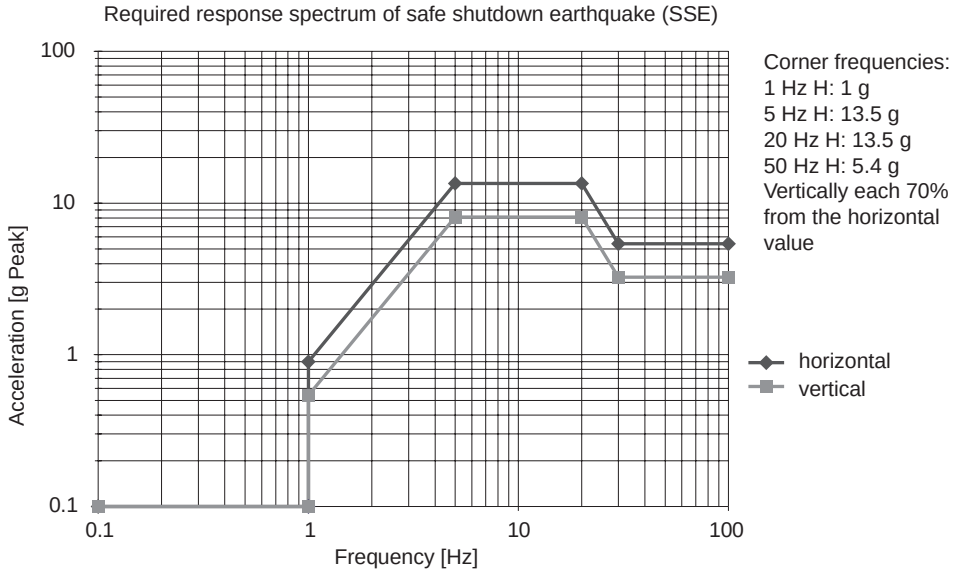
Explanation of terms:

Turndown (TD) =
nominal value/ set span



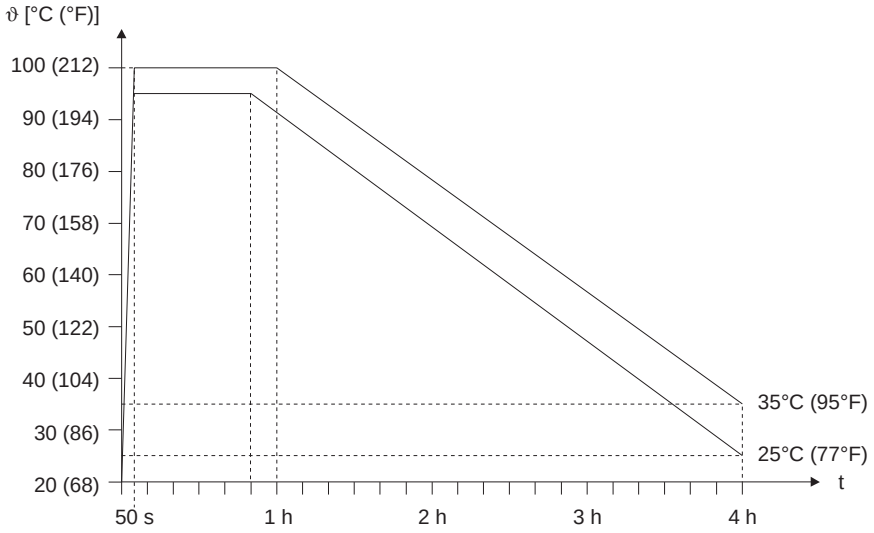
Example:
nominal value = 3000 mbar
set span = 1000 mbar
TD = 3:1

Reference conditions	DIN IEC 770 T_U=+25°C (+77°F) Accuracy data adopted after entering "Low Sensor Trim" and "High Sensor Trim" for lower range-value and upper range-value (span based on zero point)
Linearity including hysteresis and reproducibility based on the limit point method to IEC 770 ***** lower range-value=0	to TD 10:1: ± 0.1% of set span***** for TD 10:1 to 20:1: ±0.1% x [nominal value/(set span***** x 10)] 1 bar sensors: to TD 10:1: ± 0.2% of set span***** for TD 10:1 to 20:1: ±0.2% x [nominal value/(set span***** x 10)]
Long-term drift	±0.1% of nominal value per year
$T_{63\%}$ (τ)	300 ms
Thermal effects (with reference to the set span)	for –10…+60°C: ± (0.1% x TD + 0.1%) for –20…–10°C, +60…+85°C: ± (0.2% x TD + 0.2%) 1 bar sensors: for –10…+60°C: 2 x ± (0.1% x TD + 0.1%) for –20…–10°C, +60…+85°C: 2 x ± (0.2% x TD + 0.2%)
Temperature hysteresis	<0.1% (<0.2% for 1 bar sensors) of nominal value
Response under irradiation	max. deviation 6% at a cumulative total dose of 10 Gy
Vibration load	type-tested as per KTA 3505 and IEEE standard 323/344
Seismic construction	no deviation of the output signal at maximum twice-repeated effect of a mechanical load as per diagram

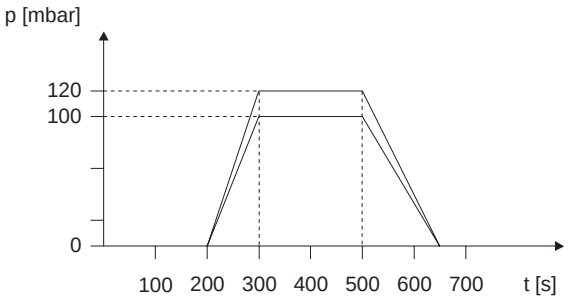


Accuracy (Continuation)

Loca (Loss of Coolant Accident)	Non-recurring permitted accident load, see temperature and pressure diagram. Deviation of <0.2% after influence has subsided (see diagram).



Temporal course of the temperature during the loss of coolant accident test



Temporal course of the ambient pressure during the loss of coolant accident test

Application conditions

Installation conditions	Any position; zero point shift due to position up to 3 mbar; can be corrected

Ambient conditions

Ambient temperature	–20…+85°C (–4…+185°F)
Storage temperature	–40…+85°C (–40…+185°F)
Ingress protection	IP 65
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	–20…+85°C (–4…+185°F)
Process pressure	Corresponds to permissible overload

Mechanical Construction

Design

Housing	Housing can be rotated, Optional electrical connection via M 20x1.5 with cable gland or G ½, ½ NPT cable entry or cable connection Harting Han7D plug Terminal connection for wire cross section 0.5…2.5 mm^2 (AWG 20…13)
Process connections	G ½ or ½ NPT

Mechanical Construction (Continuation)

Materials

Housing	Cast aluminium housing with protective polyester-based powder coating RAL 5012 (blue), cover RAL 7035 (grey), saltwater spray test DIN 50021 (504 h) passed
Nameplates	AISI 304 (1.4301)
Process connections	AISI 316L (1.4435)
Process diaphragm	AISI 316L (1.4435)
O-ring for cover gasket	NBR
Mounting accessories	Bracket for pipe and wall mounting AISI 304 (1.4301) (Mounting within scope of seismic IEEE-344 tests not taken into account.)

Measuring cell

Oil filling	Silicone oil

Display and Operating Interface

Display and operating module

Display	Plug-in display module with four-character pressure display and analogue display (bar graph) of current with 28 segments
Operation	via four keys on the device

Power Supply

Power voltage	11.5…45 V DC
Ripple	No effect for 4…20 mA signal up to ±5% residual ripple within permissible range

Certificates and Approvals

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

Dimensions Cerabar S

Further information on dimensions of the various versions is found in the Technical Information TI 331P.

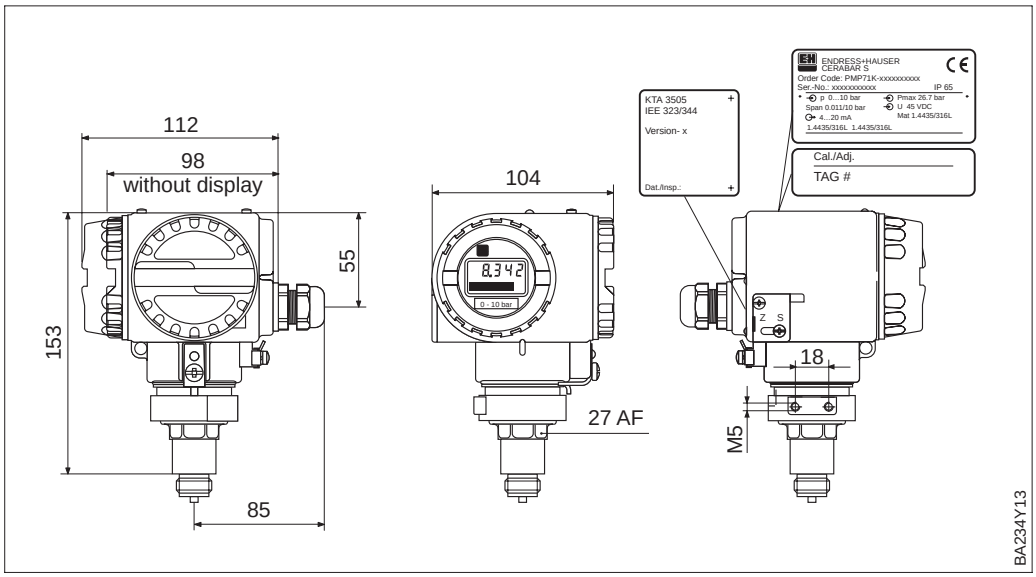
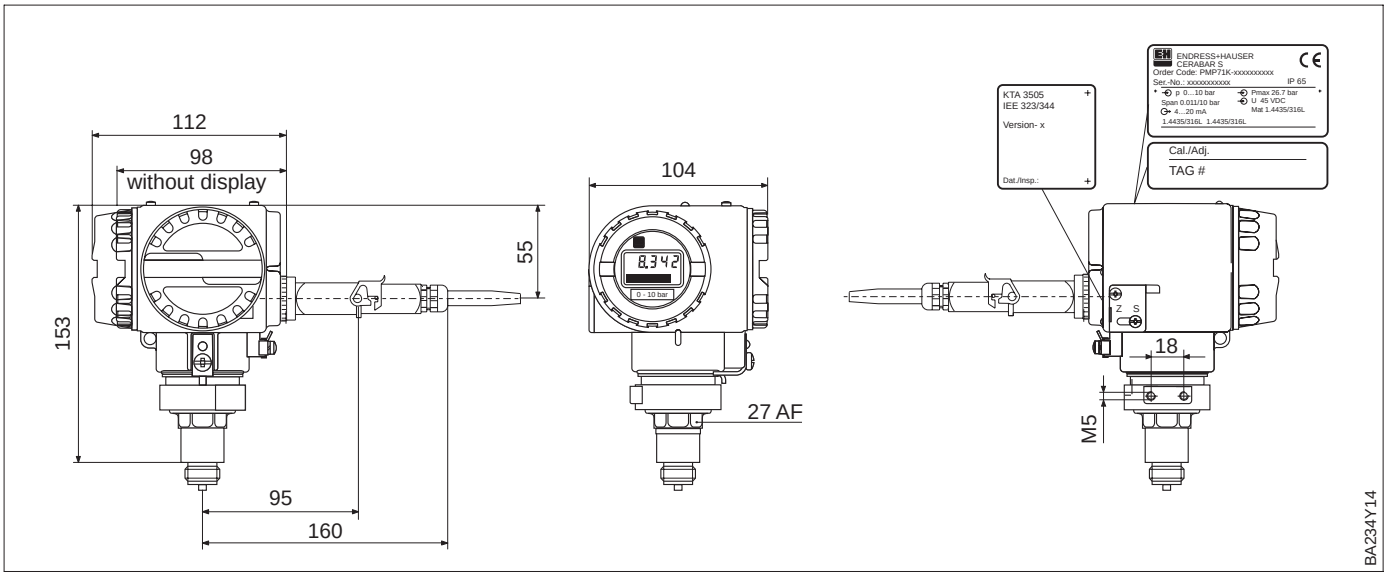


Figure 9.1
Dimensions
Cerabar S PMP 71 K



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

Dimensions are in mm.

10 Operating Matrix

10.1 Matrix Commuwin II (Software version 7.1)

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0 Basic calibration	Measured value	Set 4 mA value	Set 20 mA value	4 mA value automatic	20 mA value automatic	Set bias pressure	Bias pressure autom.	Set output damping	Alarm mode	Select pressure unit
V1										
V2 Transmitter information	Diagnostic code	Last Diagnostic code	Software No.	Peak hold P Min	Peak hold P Max	Int. counter high	Sensor temperat.	Peak hold T Min	Peak hold T Max	Default value
V3 Linearisation	Op. mode pressure: 1 Level: 3 Cyl. hor.: 4 Manual: 5 Press.%: 6 disabled[4]	Display at 4 mA[1]	Display at 20 mA[1]	Unit after linearisation[1]	Density factor[2]		Clear manuel level	Line no. (1…21)	Input level	Set volume
V4…V6										
V7 Additional functions	Current	Simulation	Set simulation current	Min. current 4 mA	Low sensor trim	High sensor trim	Low sensor limit	High sensor limit	Sensor pressure (P)	Temperat. unit
V8										
V9 Service					Max. alarm current	Zero correction	Zero correction value	Unbiased pressure	Biased pressure	Security locking[3]
VA User information	Set tag number	Set user text	HART serial number	Serial number sensor	Process connection P+	Process connection P–	Gasket	Process diaphragm	Fill liquid	

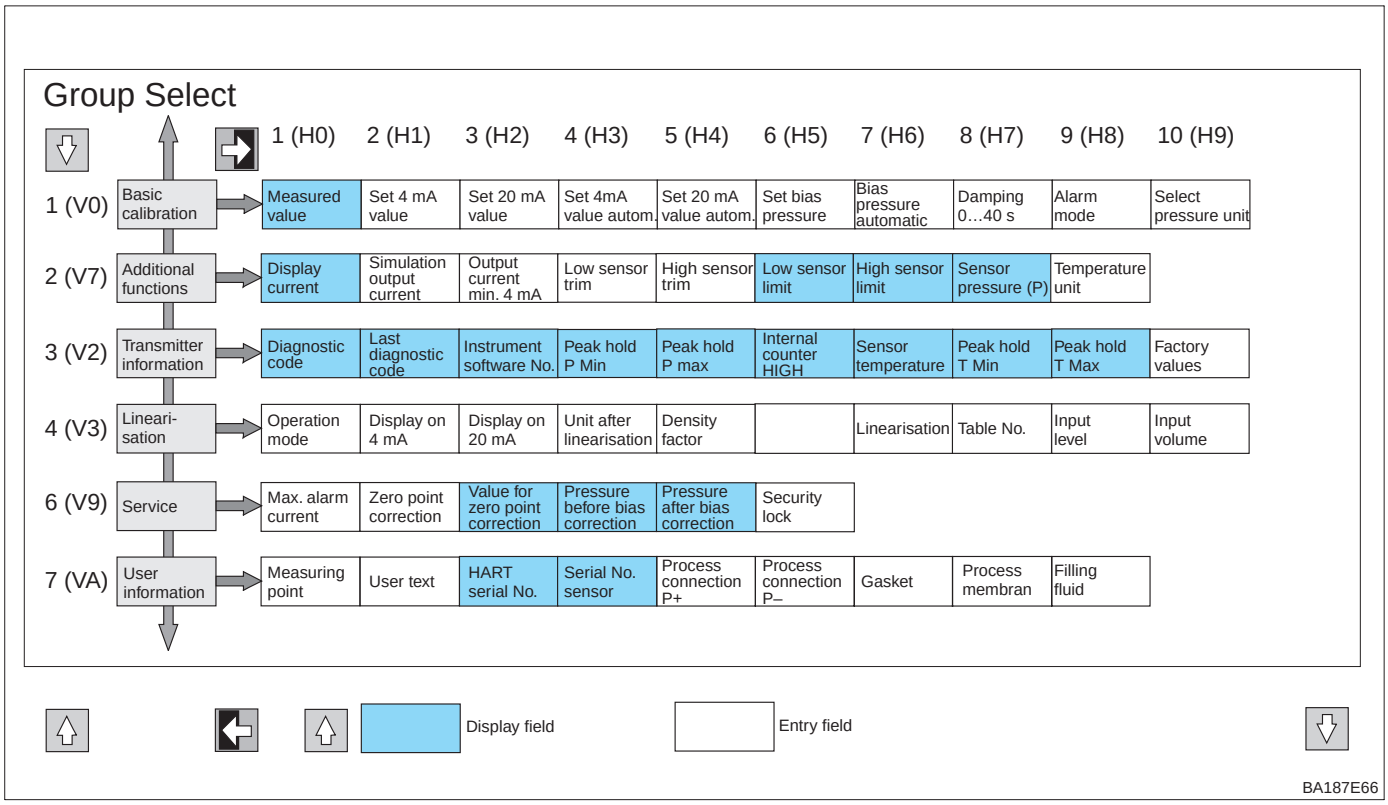
Display field

1) Not in “Pressure" mode”.
2) Only in the "Level linear", "Level cyl. linear" and "Level curve" operating modes.
3) Locking ≠ 130, Unlocking = 130.
When the operating is interlocked using the +Z and –S keys, the matrix field indicates 9999.
4) Check the position of the damping switch in the device. The switch positions 8…F are not available.
Refer to Chapter 4.2.

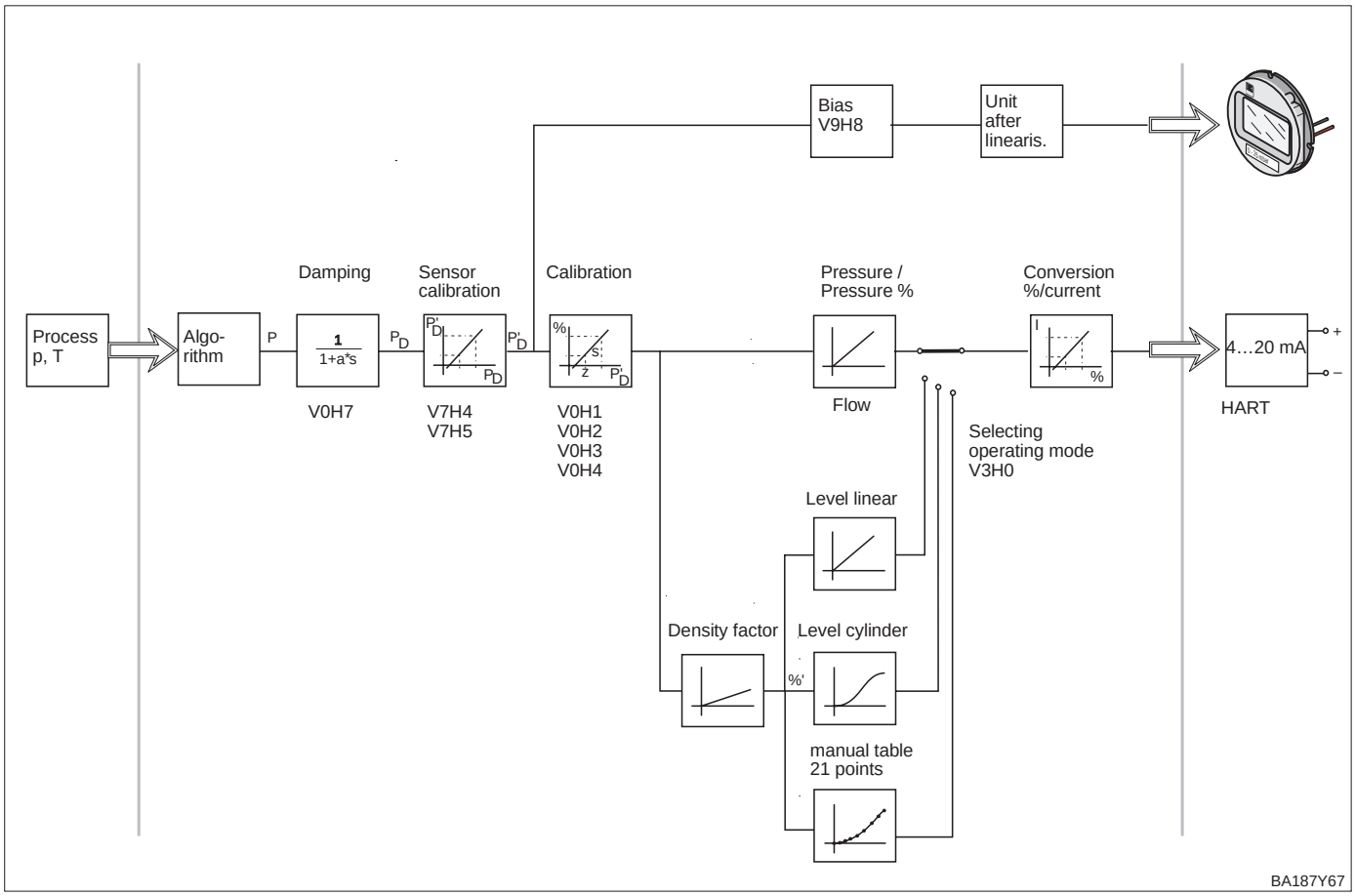
This matrix provides a summary of all factory settings.

	H0	H1	H2	H3	H4	H5	H6	H7	H8	H9
V0		0	V7H7	—	—	0	—	0	max.	1 (bar)
V1										
V2	0	0	xxxx	current pressure	current pressure	0	current temperature	current temperature	current temperature	0
V3	1 pressure									
V4...V6										
V7		Off		Off	V7H6	V7H7			current pressure	°C
V8										
V9					22.0	0.0	0.0	—	—	130
VA	———-	———-	xxxx	xxxx						

10.2 Matrix Universal HART Communicator DXR 275 (Software version 7.1)



10.3 Block diagram



10.4 Description of parameters

Parameter	Description
Measured Value (V0H0)	This parameter indicates the current value measured. 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. In the "Level" mode, the measured variable is displayed in "%" as standard. Use the parameter "Unit after Linearisation" (V3H3) to select a level, volume or weight. This unit is only for display. The measured variable is not converted to the unit you selected.
Set 4 mA Value [1] **(V0H1)**	Enter a pressure value for the 4 mA calibration value (calibration without reference pressure). In on-site operation, this is equivalent to incrementing the value by pressing the +Z key or decrementing the value by pressing the –Z key. Factory Setting: 0.0
Set 20 mA Value [1] **(V0H2)**	Enter a pressure value for the 20 mA calibration value (calibration without reference pressure). In on-site operation, this is equivalent to incrementing the value by pressing the +S key or decrementing the value by pressing the –S key. Factory Setting: "High Sensor Limit" (V7H7)
4 mA Value automatic [1] **(V0H3)**	If you confirm this parameter, the current pressure value is set as the 4 mA calibration value (Lower range-value) (calibration with reference pressure). The value is displayed in parameter "Set 4 mA Value" (V0H1). This is equivalent in on-site operation to pressing +Z and –Z once simultaneously.
20 mA Value automatic [1] **(V0H4)**	If you confirm this parameter, the current pressure value is set as the 20 mA calibration value (Upper range-value) (calibration with reference pressure). The value is displayed in parameter "Set 20 mA Value" (V0H2). This is equivalent in on-site operation to pressing +S and –S once simultaneously.
Set Bias Pressure [1] **(V0H5)**	If the on-site display indicates process pressure zero not as zero after calibrating the lower range-value (depending on position), you can correct the display value of the on-site display to zero (bias pressure) by entering a pressure value. The parameters "Measured Value" (V0H0), "Set 4 mA Value" (V0H1) and "Set 20 mA Value" (V0H2) are corrected by the bias pressure. Refer also pages 18 and 22. Factory Setting: 0.0
Bias Pressure automatic [1] **(V0H6)**	If you confirm this parameter, the current pressure value is adopted as bias pressure. The value is displayed in the parameter "Set Bias Pressure" (V0H5). This is equivalent in on-site operation to pressing the +Z and +S keys twice simultaneously. Refer to the parameter description "Set Bias Pressure" (V0H5).
Set Output Damping (V0H7)	Damping (integration time) affects the speed at which the output signal and the value indicated respond to a change in pressure. Damping is adjustable from 0 to 40 s. Factory Setting: 0.0
Alarm mode (V0H8)	In the event of an error, the current value is set to the value selected here. The bar graph on the on-site display indicates the current. Options: – Min. alarm: 3.6 mA – Value hold: last value is on hold. – Max. alarm: 21…22.5 mA. The current value for "Max. alarm" is adjustable via the parameter "Max. alarm current" (V9H4). Refer to Chapter 5.1 or 6.4, Section "Alarm mode". Factory Setting: Max. alarm (22.0 mA)
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. Factory Setting: bar
Diagnostic Code (V2H0)	If the pressure transmitter detects an error or a warning, it generates an error code. This parameter displays the current error code. See Chapter 7.1 for a description of error codes.
Last Diagnostic (V2H1)	Indicates the last error code. See Chapter 7.1 for a description of error codes. Factory Setting: 0

1) The electronics check the input value of this parameter for compliance with editing limits, refer to Chapter 7.4.

Description of parameters (continuation)

Parameter	Description
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 HART with SW 7.1 = 6571
Peak Hold P Min (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.
Peak Hold P Max (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 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).
Peak Hold T Min (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.
Peak Hold T Max (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, 2380, 731, 62 and 2509. Chapter 7.3 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. – Pressure %: for linear pressure measurement. The measured value (V0H0) is calculated and displayed in %. Refer to Chapter 5. – Level linear *: for level, volume or weight measurements for standing tanks. The level is linear to the measured pressure. Refer to Chapter 6. – Level cylindrical horizontal *: for level, volume or weight measurements with cylindrical horizontal tanks. The volume or the weight is not proportional to the level. A linearisation table is integrated. Refer to Chapter 6.4. – Level curve*: 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 conical outlet. Use the parameters "Line No." (V3H7), "Input Level" (V3H8) and "Set Volume" (V3H9) to enter a linearisation table. This linearisation table is used to calculate the output signal. Refer to Chapter 6.4. – Disabled: Check the position of the damping switch in the device. The switch positions 8...F are not available. Refer to Chapter 4.2. Factory Setting: pressure * In these modes, the measured value (V0H0) factory setting is displayed in %. To obtain a better presentation, use the parameters "Unit after Linearisation" (V3H3) to select a level, volume, weight or flow rate unit. Refer to the parameter description of "Unit after Linearisation" (V3H3).
Display at 4 mA (V3H1)	Only for operation modes "Pressure%", "Level linear" and "Level cylindrical horizontal" and "Square root" (flow) [2]. Enter a value for the measuring point "Level empty". The value is assigned to the 4 mA calibration point "Set 4 mA 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%
Display at 20 mA (V3H2)	For operation modes "Pressure%", "Level linear" and "Level cylindrical horizontal". Enter a value for the measuring point "Level full". The value is assigned to the 20 mA calibration point "Set 20 mA 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%

Description of parameters (continuation)

Parameter	Description
Unit after Linearisation (V3H3)	Only for operation modes "Pressure%", "Level linear", "Level cylindrical horizontal", "Level curve" and "Square root" (flow) 2). Selects a level, volume or weight 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 the calculated value for the parameters "Display at 4 mA" (V3H1) and "Display at 20 mA" (V3H2).) Refer also to Chapter 6.1, page 32. Factory Setting: %
Density Factor (V3H4)	Only for operation modes "Pressure%", "Level linear", "Level cylindrical horizontal" and "Level curve". Using the density factor 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". Refer also to Chapter 6.2. Factory Setting: 1.0
Manual Level (Linearisation) (V3H6)	Only in operation mode "Level curve". 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 curve". 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 curve". Enter a fill value in the linearisation table. The input is in %. If you enter "9999.0" for this parameter, you may delete individual points 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 curve". Enter a volume value in the linearisation table. The input is in %. If you enter "9999.0" for this parameter, you may delete individual points 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 %
Current (V7H0)	Displays actual signal current in mA. Refer to Chapter 7.2.
Simulation (V7H1)	Simulation of a output signal current, e.g. to test the function of looped devices. Set the simulation current using parameter "Set Simulation Current". OFF: Current simulation off ON: Current simulation on Refer to Chapter 7.2 Factory Setting: OFF
Set Simulation Current (V7H2)	Defines a simulation current. The current can be simulated within limits of 3.6 mA to 22 mA.
Min. Current 4 mA (V7H3)	Use this parameter to set the lower current limit. (Devices partly accept no value less than 4.0 mA.) OFF: Lower current limit = 3.8 mA EIN: Lower current limit = 4.0 mA Refer to Chapter 5.1 or 6.4, Section "4 mA level". Factory Setting: OFF
Low Sensor Trim 1) (V7H4)	Enter the lower point of the sensor characteristic curve during sensor calibration. Use this parameter to assign a new value to a reference pressure applied to the device. The pressure applied and the value entered for "Low Sensor Cal" correspond to the lower point of the sensor characteristic curve. Refer also to Chapter 9.5 "Recalibration". Factory Setting: "Low Sensor Limit" (V7H6)

1) The electronics check the input values for these parameters for compliance with editing limits, refer to Chapter 7.4.
2) These parameters are only relevant for diffenetial pressure transmitters.

Description of parameters (continuation)

Parameter	Description
High Sensor Trim [1] (V7H5)	Enter the upper point of the sensor characteristic curve for sensor calibration. Use this parameter to assign a new value to a reference pressure applied to the device. The applied pressure and the value entered for "High Sensor Cal" are equivalent to the upper point of the sensor characteristic curve. Refer also to Chapter 9.5 "Recalibration". 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
Max. Alarm Current (V9H4)	Default for current value for parameter "Alarm mode" (V0H8) = Max. alarm The current value is adjustable from 21 mA to 22.5 mA. Refer to Chapter 5.1 or 6.1, Section "Alarm mode". Factory Setting: 22 mA
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 signal current at the same time. For zero correction, a pressure applied to the device is assigned a new value using this parameter. The sensor characteristic curve is shifted by this value and the parameters "Low Sensor Trim" (V7H4) and "High Sensor Trim" (V7H5) are recalculated. Refer to Chapter 5.1, Section "Zero Correction". Factory Setting: 0.0
Zero Correction Value (V9H6)	Indicates the value by which the sensor characteristic curve was shifted for a zero correction. Refer to parameter description "Zero Correction" (V9H5) and Chapter 5.1, Section "Zero Correction". Factory Setting: 0.0
Unbiased Pressure (V9H7)	This parameter indicates the actual damped pressure without any bias correction. Refer to the parameter description "Set Bias Pressure" (V0H5).
Biased Pressure (V9H8)	This parameter indicates the actual damped pressure with bias correction. Refer to the 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": enter a number ≠ 130, – using on-site operation: press the +Z and –S keys once simultaneously. Unlock operation: – Using the parameter "Security Locking": enter the number 130, – using on-site operation: press the –Z and +S keys once simultaneously. The matrix field V9H9 is only editable if operation was not locked previously using the on-site keys. Refer to Chapters 5.2 or 6.5.
Set Tag Number (VAH0)	Enter a text describing the measuring point. (up to 8 characters, uppercase letters and numerals)
Set User Text (VAH1)	Enter a text as additional information. (up to 8 characters, uppercase letters and numerals)
HART Serial Number (VAH2)	Indicates the serial number of the device.

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
Serial No. Sensor (VAH3)	Indicates the serial number of the sensor.
Process Connection P+ (VAH4)	Select and display the process connection material on the plus side. Options: steel, 304 stainless, 316 stainless, Hastelloy C, Monel, tantalum, titanium, PTFE (Teflon), 316L stainless, PVC, Inconel, ECTFE and special (special versions)
Process Connection P– [2] (VAH5)	Select and display the process connection material on the minus side. For options, see parameter "Process Connection" (VAH4).
Gasket (VAH6)	Select and display the gasket material. Options: FPM Viton, NBR, EPDM, urethane, IIR, KALREZ, FPM Viton for oxygen applications, CR, MVQ and special (special versions).
Process Diaphragm (VAH7)	Select and display the diaphragm material. Options: 304 stainless, 316 stainless, Hastelloy C, Monel, tantalum, titanium, PTFE (Teflon), ceramic, 316L stainless, Inconel, special (special versions).
Fill Liquid (VAH8)	Select and display the oil filling. Options: silicon oil, vegetable oil, glycerine, inert oil, HT oil (high-temperature oil), special (special versions).

2) These parameters are only relevant for diffenetial pressure transmitters.

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