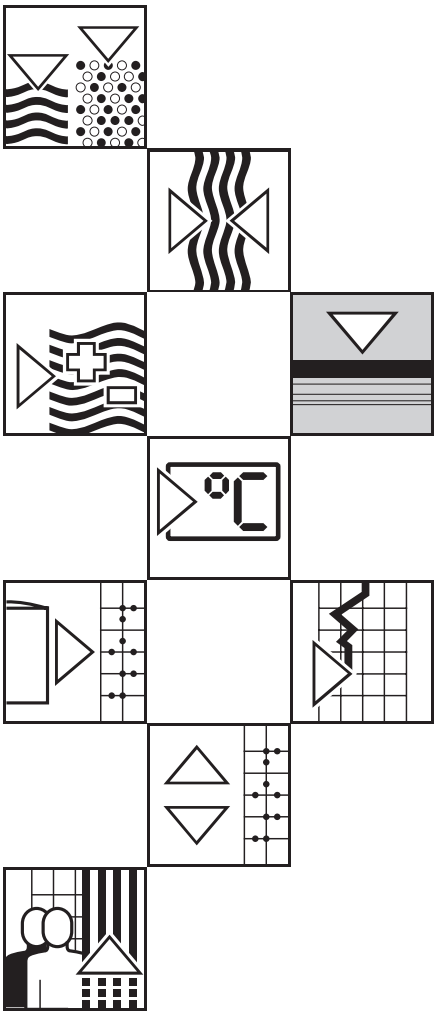
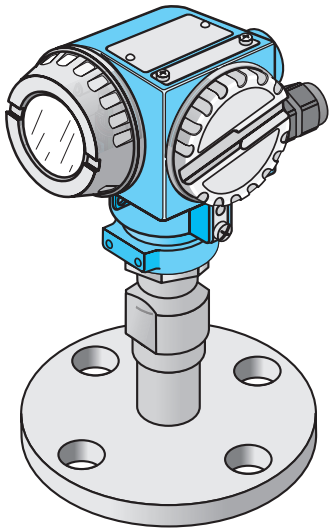
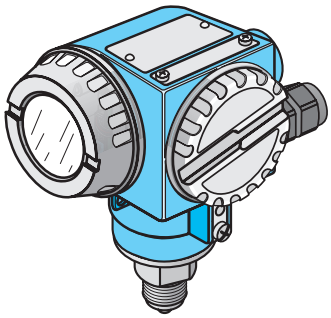
BA 211P/00/en/09.04
Software version 0.3
52006135

cerabar S
Foundation Fieldbus Pressure Measurement

Operating Instructions







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Short Operating Instructions

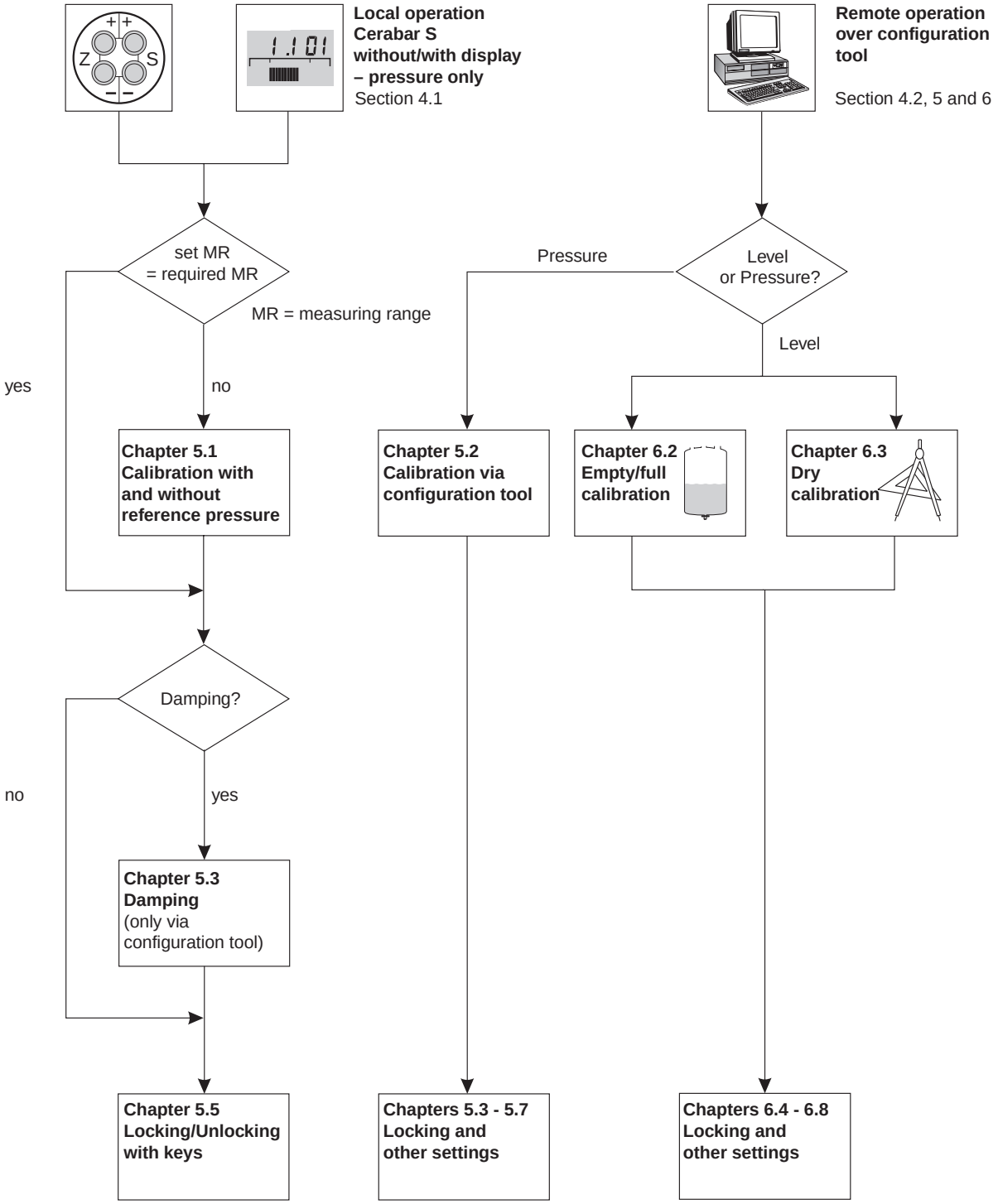


Table of Contents

Software History

Software	Changes	Significance
0.3		

Notes on Safety

Approved usage

The pressure transmitter Cerabar S is a Foundation Fieldbus device which, depending upon the version, is used for measuring gauge or absolute pressure. Level measurement is also possible when a Foundation Fieldbus tool is used.

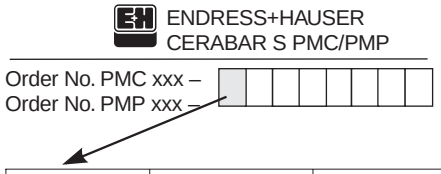
Installation, commissioning, operation

The Cerabar S has been designed to operate safely in accordance with current technical, safety and EU standards. If installed incorrectly or used for applications for which it is not intended, however, it is possible that application-related dangers may arise, e.g. product overflow due to incorrect installation or calibration. For this reason, the instrument must be installed, connected, operated and maintained to the instructions in this manual personnel must be authorised and suitably qualiflied. 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

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

- Ensure that all personnel are suitably qualified.
- Observe the specifications in the certificate as well as national and local regulations.
- Take special care with regard to the grounding of the bus cable screening. Recommendations are to be found in the FF specification or IEC 79–14.



Certificates for applications in explosion hazardous areas

Code	Certificate	Protection
R	Standard	none
G	CENELEC	EEx ia IIC T4/T6
G	ATEX 100	ATEX II 1/2 G EEx ia IIC T4/T6
I	ATEX 100	PMP: ATEX II 2 G EEx d IIC T5/T6 PMC: ATEX II 2 G EEx d [ia] IIC T6
D	PTB, Zone 0	EEx ia IIC T4/T6
Q	FM	Explosion proof Class I, II, III Div. 1, Groups A…G
O	FM	IS Class I, II, III, Div. 1, Groups A…G
S	CSA	IS Class I, II, III, Div.1, Groups A…G
U	CSA	Explosion proof Class I, II, III, Div. 1, Groups B…G (in preparation)

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.

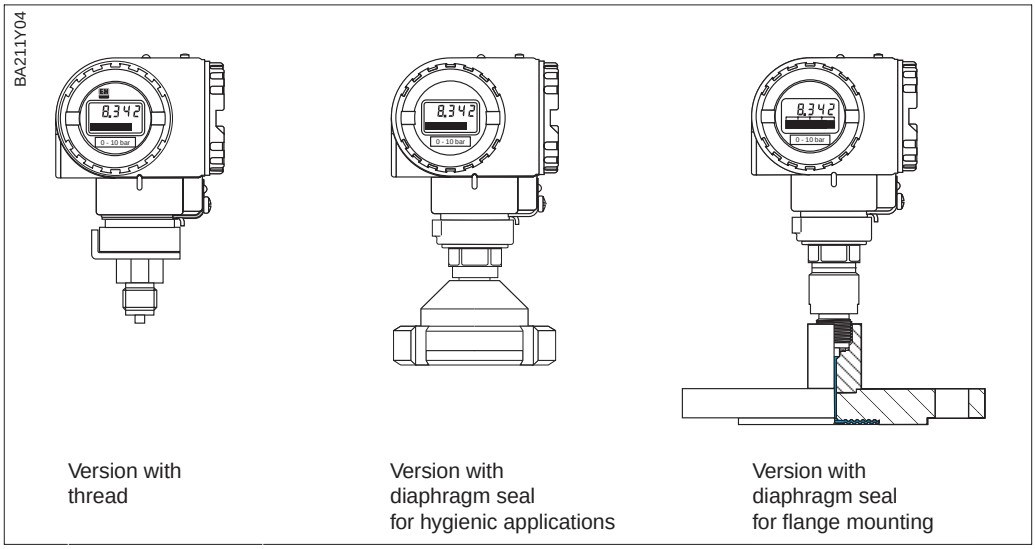


Figure 1.1
Examples of the Cerabar S pressure transmitter

Operating principle

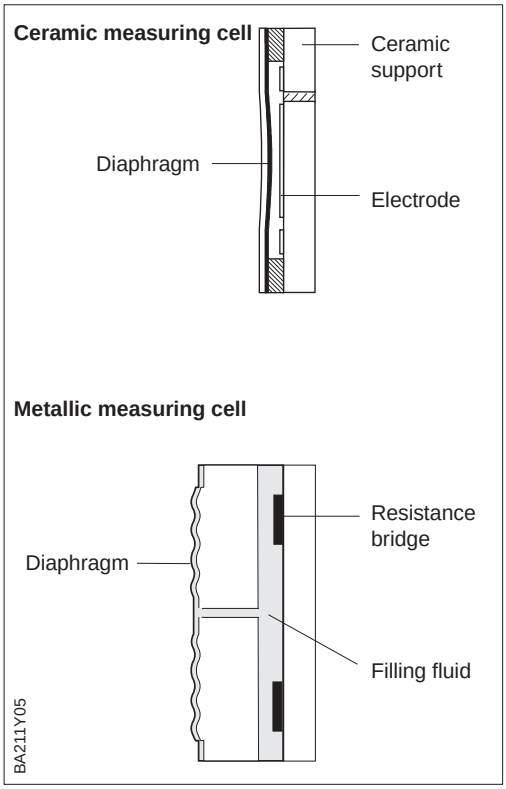


Figure 1.2
Ceramic and metallic measuring cells

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

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

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

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

1.1 Measuring system

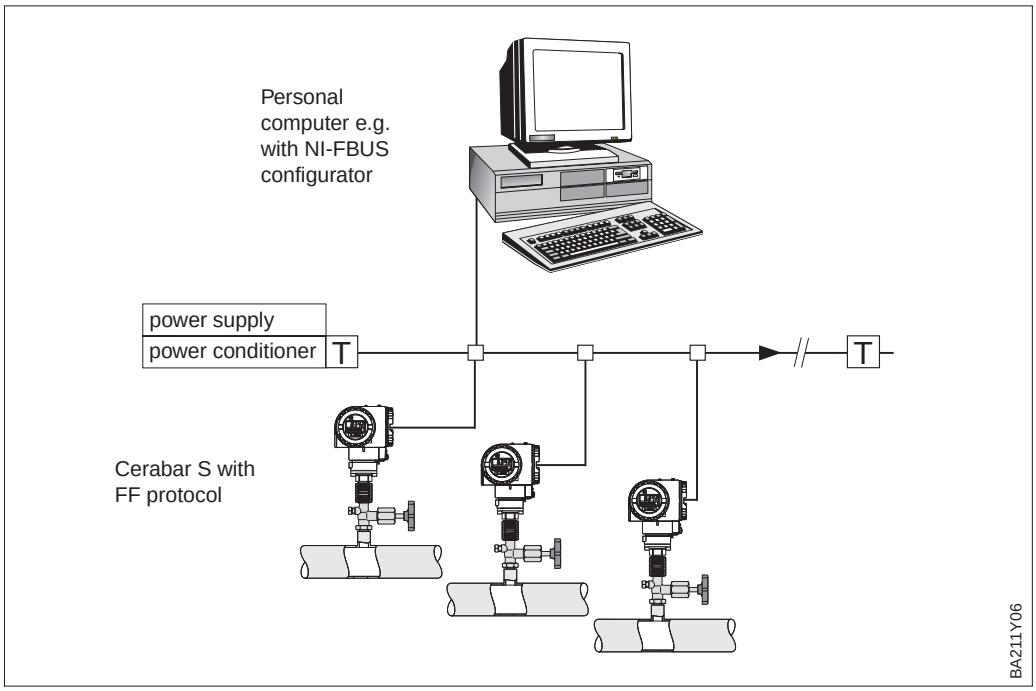


Figure 1.3
Measuring point with Cerabar S

T: bus terminator

Measuring point

In the simplest case, the complete measuring point comprises:
- Cerabar S transmitter with Foundation Fieldbus protocol
- Network Configuration Tool, e.g. National Instruments Fieldmanager

Number of transmitters

The maximum number of transmitters on a bus segment is determined by their current consumption, the required bus length and if installed the power of the link.
Normally, however:

- 10 Cerabar S for EEx ia applications
- max. 32 Cerabar S for non-hazardous application

can be operated on a bus segment. Cerabar S consumes max. 11.5 mA per device.

Refer also to the FF specification or IEC 61158-2 or to the Internet address "http://www.fieldbus.org".

2 Installation

This section describes the mechanical installation of Cerabar S with and without diaphragm seals.

2.1 Mounting instructions without diaphragm seal

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

Cerabar S without diaphragm seal
– PMC 731
– PMP 731

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

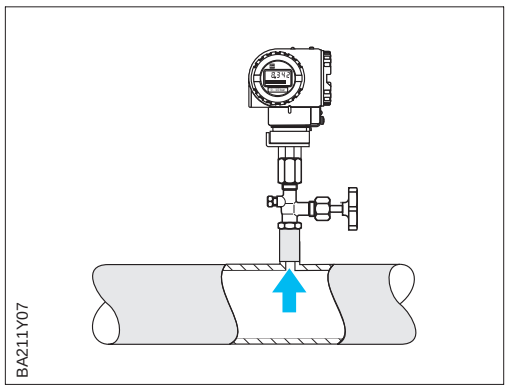


Figure 2.1
Mounted on a shut-off valve for measuring gases

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

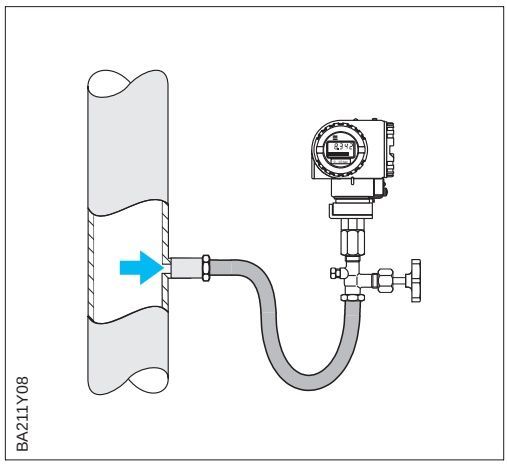


Figure 2.2
Mounted with U-shaped pigtail for measuring steam/vapour

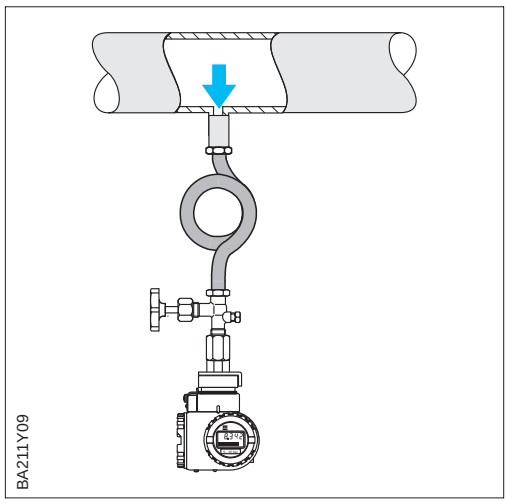


Figure 2.3
Mounted with circular pigtail for measuring steam/vapour

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

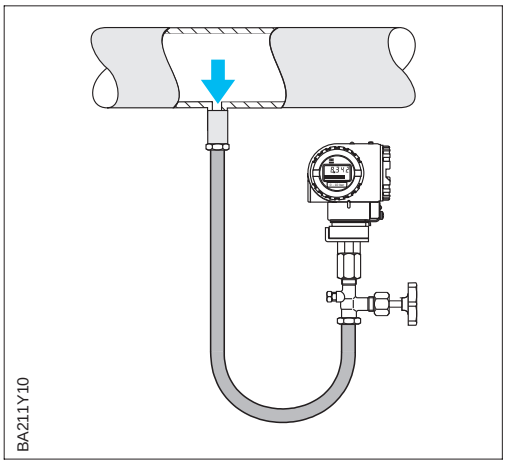


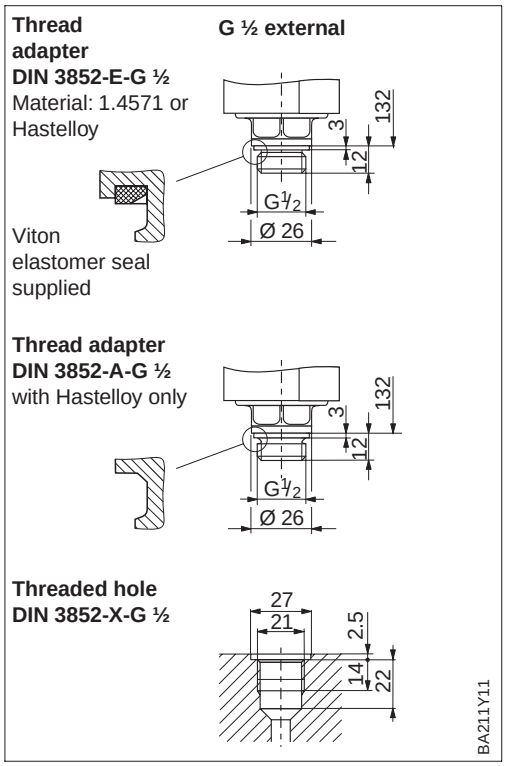
Figure 2.4
Mounted on a shut-off valve for measuring liquids

PVDF adapter

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

Mounting the PMP 731

The PMP 731 with metallic sensor is available in the following versions:
• with flush-mounted diaphragm or
• with adapter and internal diaphragm.
  The adapter can be screwed on or welded in.
A seal is enclosed appropriate to the material used and version.



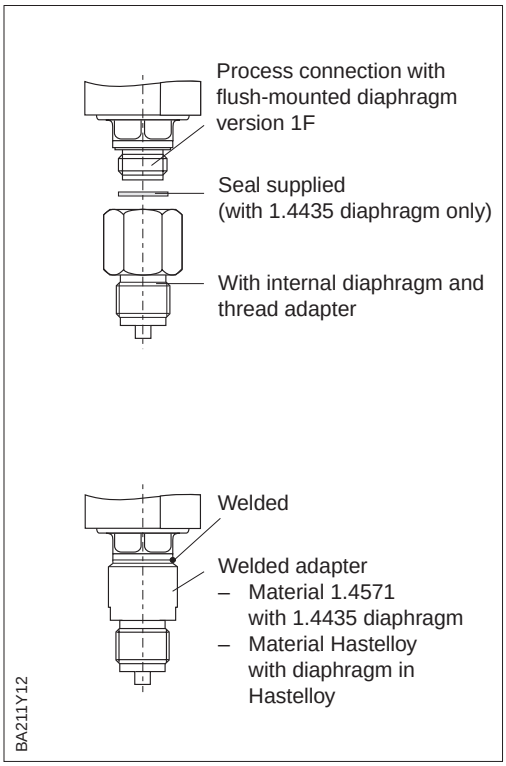
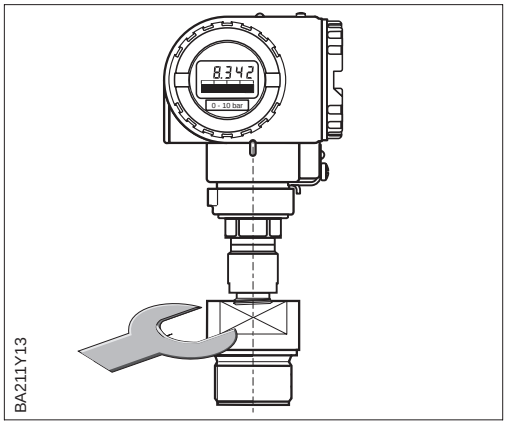


Figure 2.5
left:
An elastomer seal to DIN 3852-E-G ½ is supplied with the thread adapter
right:
With internal diaphragm and welded or thread adapter

2.2 Mounting instructions with diaphragm seal

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

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

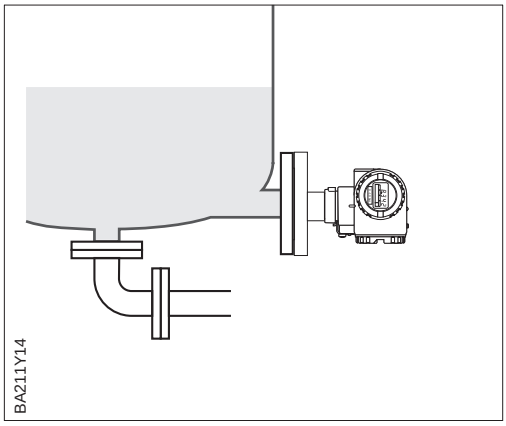


Cerabar S with diaphragm seal
– PMC 635
– PMP 635

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

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

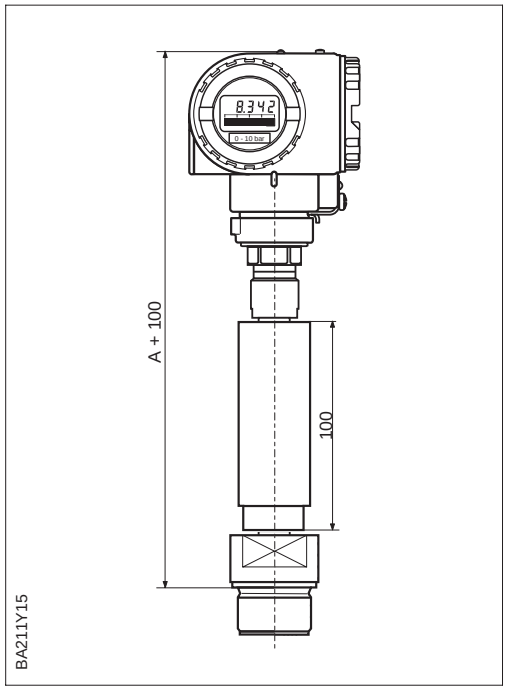
- The instrument should not be installed within the flow of material, in the outlet of the tank or at a place in the tank where pressure pulses from agitator blades may occur.
- Calibration and function testing are easier to carry out if the Cerabar S is mounted downstream from a shut-off valve.



Level measurement

The use of temperature spacers is recommended when the continuous extreme product temperatures cause the maximum permissible ambient temperature to exceed +85 °C.

- Note when mounting that the temperature spacer increases the maximum height by 100 mm.
- Due to the hydrostatic column in the temperature spacer, the increased height also causes a zero point shift of approx. 10 mbar.

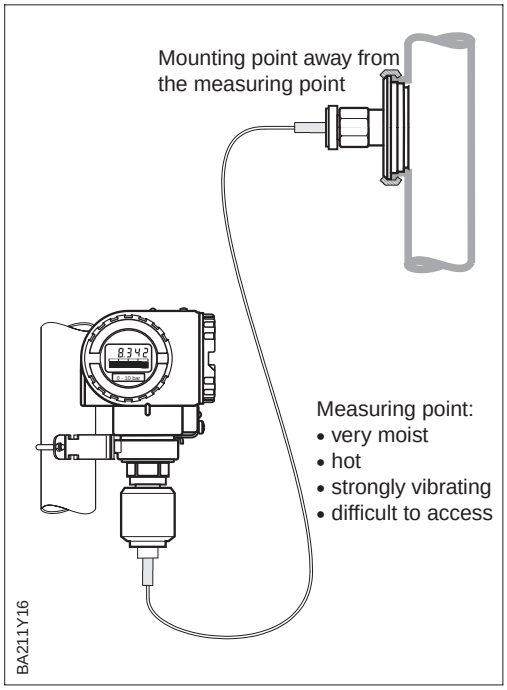


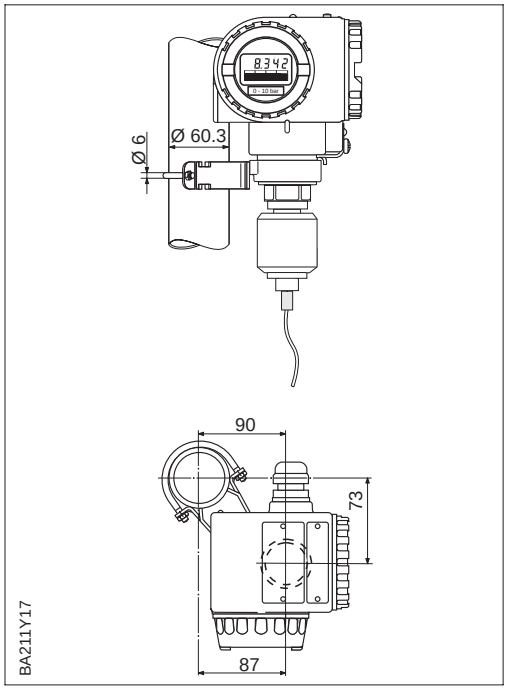
Mounting with temperature spacers

Figure 2.7
Temperature spacer

Mounting with capillary tubing

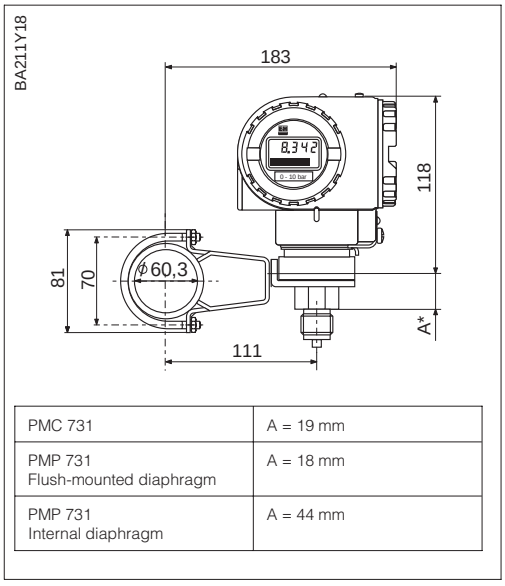
To protect from high temperatures, moisture or vibration, or where the mounting point is not easily accessible, the housing of the Cerabar S can be mounted with capillary tubing away from the measuring point.
A bracket for mounting on a wall or pipe is available for this.



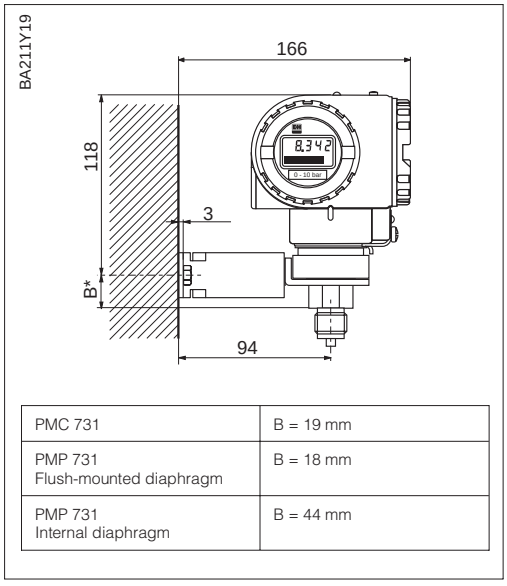


2.3 Mounting accessories

Wall and pipe mounting with accessories



PMC 731	A = 19 mm
PMP 731 Flush-mounted diaphragm	A = 18 mm
PMP 731 Internal diaphragm	A = 44 mm



PMC 731	B = 19 mm
PMP 731 Flush-mounted diaphragm	B = 18 mm
PMP 731 Internal diaphragm	B = 44 mm

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

right:
- *Mounted with bracket on a wall*

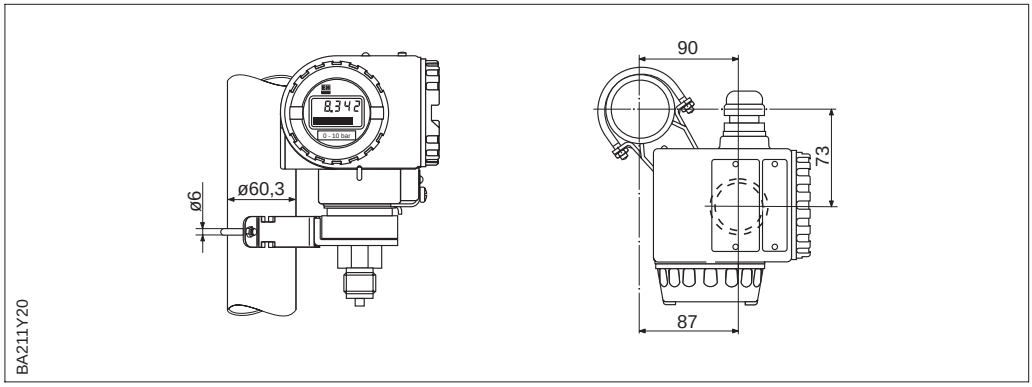


Figure 2.9
- *Mounted with bracket on vertical piping*

2.4 Mounting position

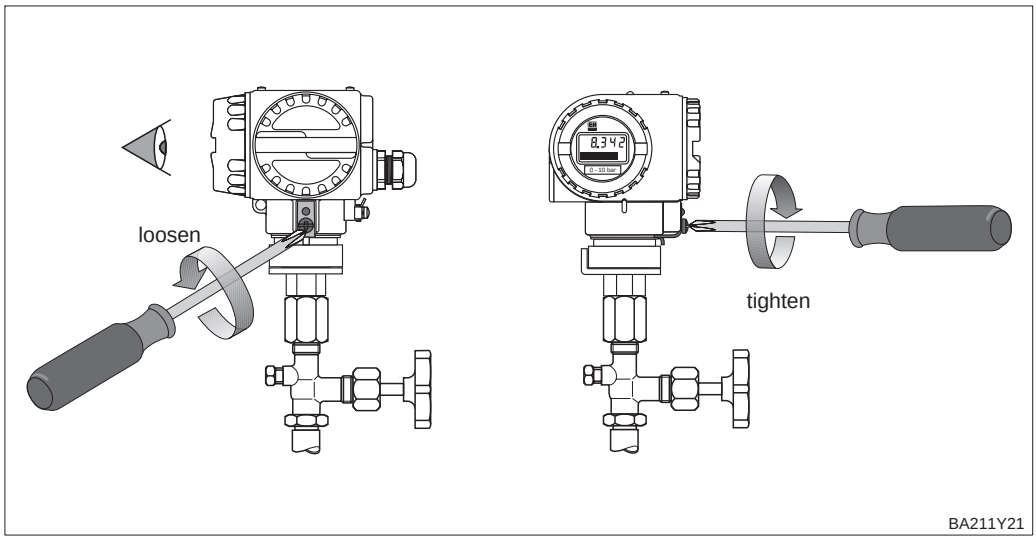
Positioning the housing

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

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

The housing can turned through 270°:

- To turn the housing undo the screw below the connection compartment
- Turn the housing
- Tighten the screw again



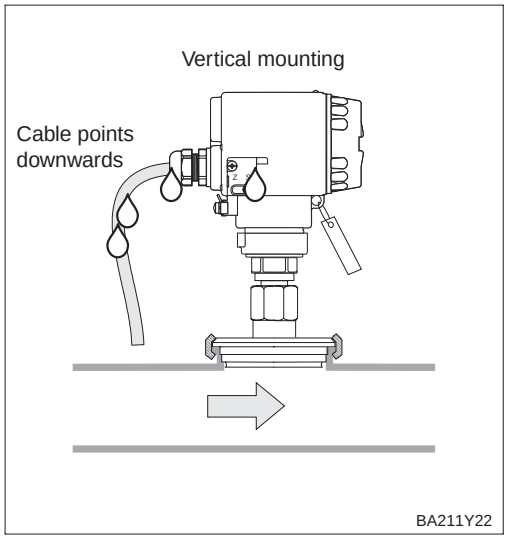


Figure 2.10
Mounting of the Cerabar S
- *cable points downwards*
- *The cover for the Z/S keys is on the side of the instrument*

2.5 Connection

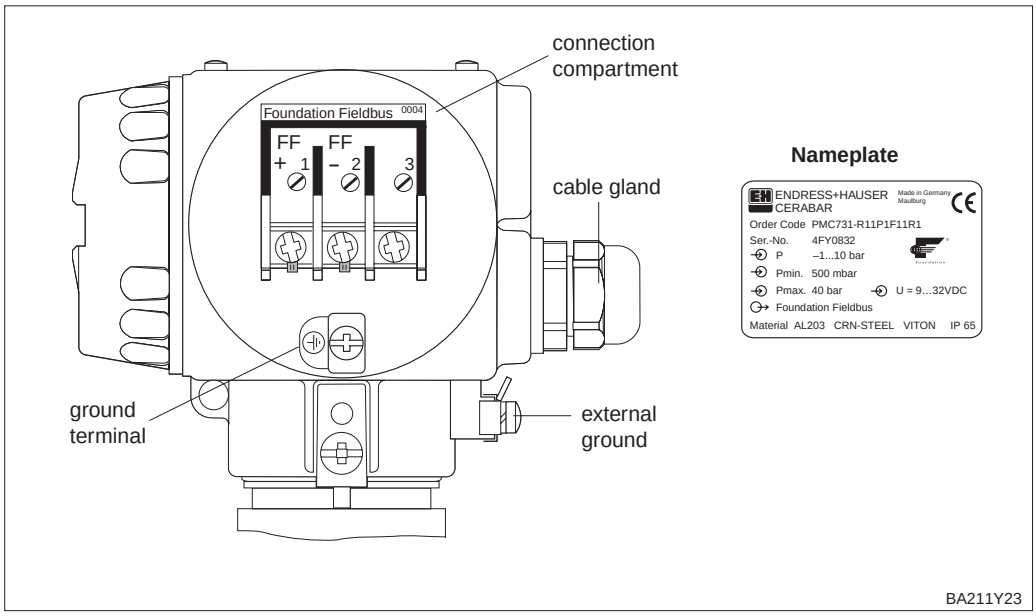


Figure 2.11
Cerabar S connection compartment and nameplate

General notes

Cerabar S is loop-powered transmitter (type 111) with Foundation Fieldbus output. Note the following before connecting up:

- Turn off the power before connecting up.
- Connect the external ground terminal of the transmitter to the plant grounding system before connecting up.

Power

The Cerabar S has the following power requirements:
I = 10.5 mA ± 1 mA
Non-Ex: U = 9...32 VDC
Ex: U = 9…24 VDC

Cable

Twisted, shielded pairs must be used. The cable specifications can be taken from the FF specification or IEC 61158-2. The following have been found suitable:

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

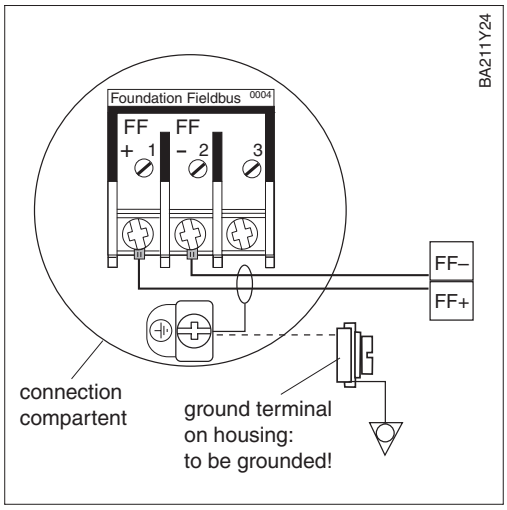
Ex-area: Siemens 6XV1 830-5AH10,
Belden 3076F,
Kerpen CEL-PE/OSCR/PVC/FRLA FB-02YS(ST)YFL

Screening

General information on wiring can be found at the Fieldbus Foundation website: www.fieldbus.org. For maximum protection against electromagnetic interference, e.g. when the bus is operating near frequency converters, it is recommened that high integrity potential bonding be provided between the housing and the cable screening.

The external ground terminal on the transmitter must be connected to ground.
The continuity of the cable screening between tapping points must be ensured.
The screening must be grounded at each end of the cable.
If there are large differences in potential between grounding points, the grounding should run via a capicitor that is suitable for high frequency use
(e.g. ceramic 10 nF/250 V~).

2.6 Wiring examples



Cable connection

The bus line also carries power and is connected as follows:

- Switch off power
- If necessary, connect external ground terminal to plant grounding system.
- Unscrew the connection compartment lid.
- Thread cable through cable entry.
- Connect cable cores to FF+ and FF–. Reversed polarity has no effect on operation.
- Connect the screen to the internal ground terminal
- Screw down the connection compartment lid.

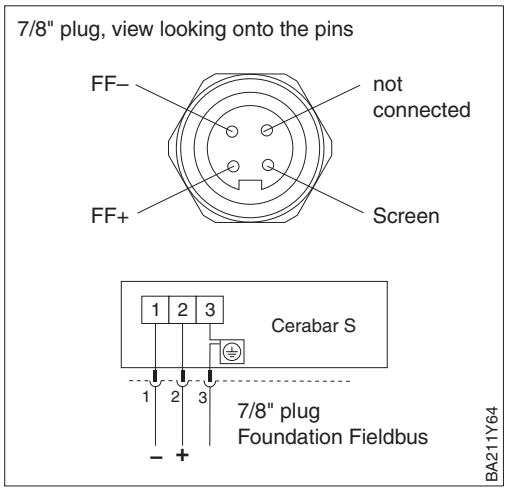
7/8" plug

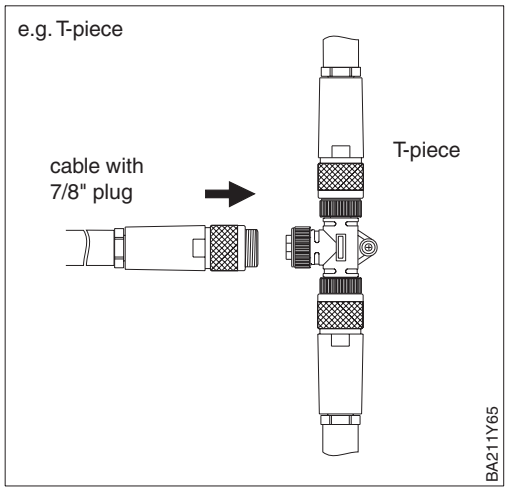
The Cerabar S Foundation Fieldbus version with 7/8" plug is supplied ready wired and need only be connected to the FF H1 bus by means of a suitable cord set.

Note!
To protect the device against vibrations, always connect the Cerabar S to the T-piece or to a FF junction box via cable. See Figure, bottom right.

Note!

- Push connector into the socket.
- Securely tighten the knurled screw.
- Ground the device and T-piece or FF junction box using the grounding system selected.





3 Foundation Fieldbus Interface

3.1 Synopsis

There are two possibilities of connecting up a foundation fieldbus:

- either with a direct connection to a FF/H1 card
- or with an indirect connection via a linking device

Figure 3.1 illustrates both possibilities.

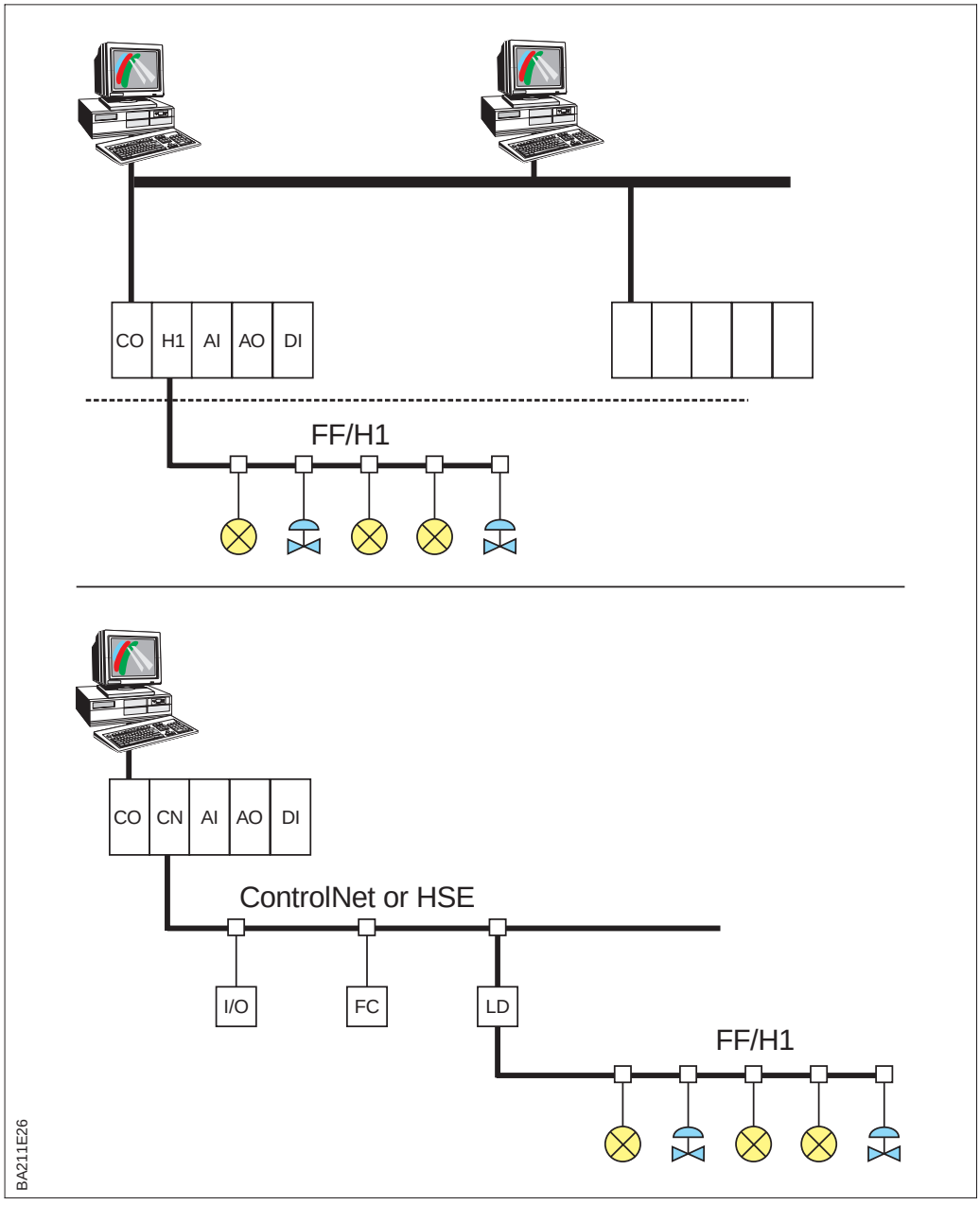


Figure 3.1
Foundation Fieldbus principle of operation

Above: Direct connection to FF/H1 card
Below: Connection via a linking device

CO: Controller
H1: H1 interface
AI: Analog input
AO: Analog output
DI: Digital input
I/O: Input/output
FC: Frequency converter
LD: Linking device

3.2 Hardware settings

A DIP-switch in the connection compartment of the Cerabar S controls allows the write protection and simulation functions to be set via hardware.

The default settings of the switches are as follows:

WP OFF: write protection via hardware is disabled
SIM ON: simulation is enabled (= allowed in configuration tool).

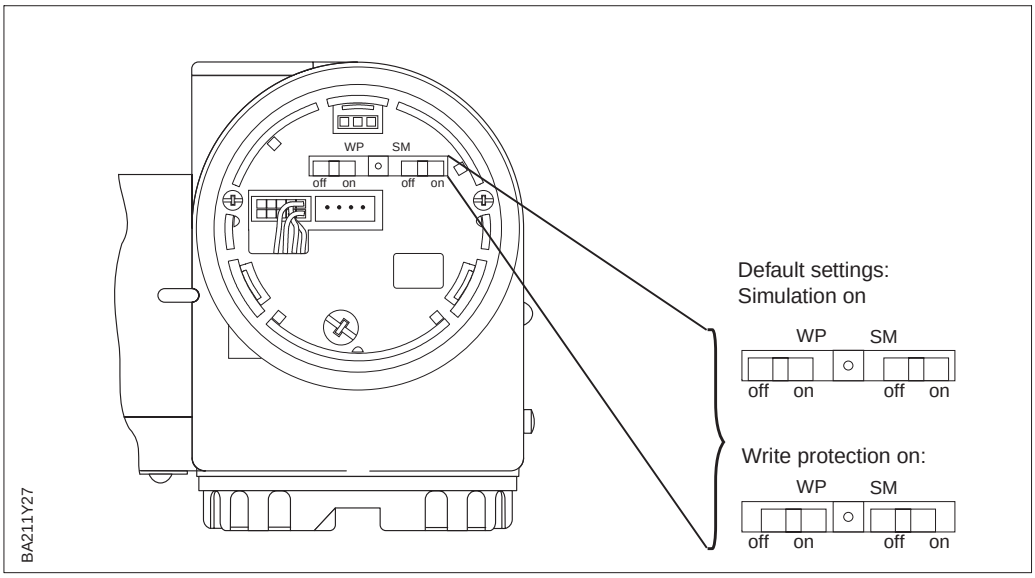


Figure 3.2
Cerabar S DIP-switch

Device identification

Foundation Fieldbus identifies the device by its identification code and automatically allocates an appropriate field address. There is no separate hardware switch for this purpose.

When the device has been integrated into the network, see Chapter 3.3, it appears as follows in the bus tree:

E+H_CERABAR_S_XXXXXXXX

A click on the name reveals the device tag, device ID and node address. The device ID is made up of the following components:

Device_ID = 452B481007-XXXXXXXX

whereby: 452B48 = ID code for Endress+Hauser
1007 = ID code for Cerabar S
XXXXXXXX = Device serial number, as printed on the name plate

A right-hand mouse click on the name opens up a menu from which the PD_TAG and NODE_ADDRESS can be changed.

3.3 Network configuration

During the configuration of the FF network, the device description (DD) of the Cerabar S must be downloaded into the directory foreseen for it.

- Start the interface configuration tool.
- Configure the interface.
- Call the DD download routine
- Download the device descriptions (.ffo and .sym files) to the directory offered.
- When the configuration is complete, close the tool and the FF stack (if open).

The Cerabar S device descriptions can be ordered direct from Endress+Hauser or downloaded from our website *www.endress.com*. They contain all data necessary to operate Endress+Hauser Foundation Fieldbus devices.

Start-up

Start the bus configuration tool. After start-up, the tool shows the network configuration in the form of an expandable tree. If the Cerabar S has been connected correctly, it can now be identified:

—
—E+H_CERABAR_S_XXXXXXXX
—

A double click on the name reveals the device data, see also page 17:

PD_TAG	the physical name of the device
DEVICE_ID	the unique device identifier
NODE_ADDRESS	the fieldbus node to which the device is connected (is automatically allocated by the Configurator)

A click on the name expands the device tree to show the function blocks available for it:

—
—E+H_CERABAR_S_XXXXXXXX
—RESOURCE_XXXXXXXX (RB)
—TRANSDUCER_XXXXXXXX (TBPR)
—ANALOG_INPUT_XXXXXXXX (AI)

The relationship between the blocks is shown in Fig. 3.3, the function of each block in Chapters 3.4 to 3.6.

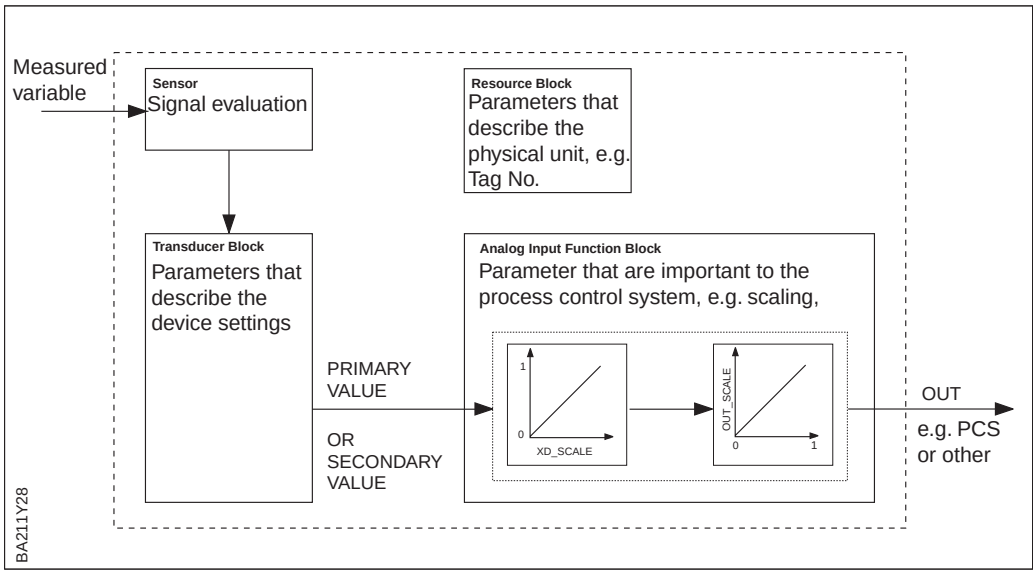


Figure 3.3
Block model of device

3.4 Resource block

The resource block contains the parameters used to describe physical resources of the device. It has no linkable inputs or outputs. It is opened by a click on the resource line.

—
—E+H_CERABAR_S_XXXXXXXX
—RESOURCE_XXXXXXXX (RB)
—TRANSDUCER_XXXXXXXX (TBPR)
—ANALOG_INPUT_XXXXXXXX (AI)

If the NI-FBUS Configurator is being used, a series of file tabs appears on the screen. The files can be opened to view and/or edit the parameters in the following table. A short description of the parameter function appears on the side of the screen. A change in the parameter is stored by pressing the WRITE CHANGES button when the block is out of service. Press the READ ALL button to check the values stored in the device. The following are of particular interest.

Parameter	Description
TAG_DESC	User description of the intended application of the block.
MODE_BLK	Lists the actual, target, permitted and normal operating modes of the block. Target: changes the operating mode of the block Actual: indicates the current operating mode of the block Permitted: states which operating modes are allowed Normal: indicates the normal operating mode of the block The possible operating modes of the resources block are: AUTO: the block is operating as normal OOS: the block is out of service. If the resource block is out of service, then all blocks within the device (resource) are forced into the same status.
RS_STATE	Indicates the state of the resource block application state machine On-line: block in AUTO mode Standby: block in OOS mode
WRITE_LOCK	Indicates the status of DIP-switch WP.
RESTART	Allows a manual restart: UNINITIALISED: no status RUN: normal operational status RESOURCE: resets the resource block parameters DEFAULTS: Resets all Foundation Fieldbus parameters within the device, but not the manufacturer specific parameters. PROCESSOR: make a warm start of the processor
BLOCK_ERROR	Shows error status of software and hardware components Out-of-Service: the block is in OOS mode Simulation active: shows the setting of DIP-switch WP
BLOCK_ALM	Shows any configuration, hardware, connection and system problems in the block. The cause of the alert is to be seen in the subcode field.

The function of the resource block parameters not described here can can be taken from the Foundation Fieldbus specification, see *"http://www.fieldbus.org"*.

3.5 Transducer block

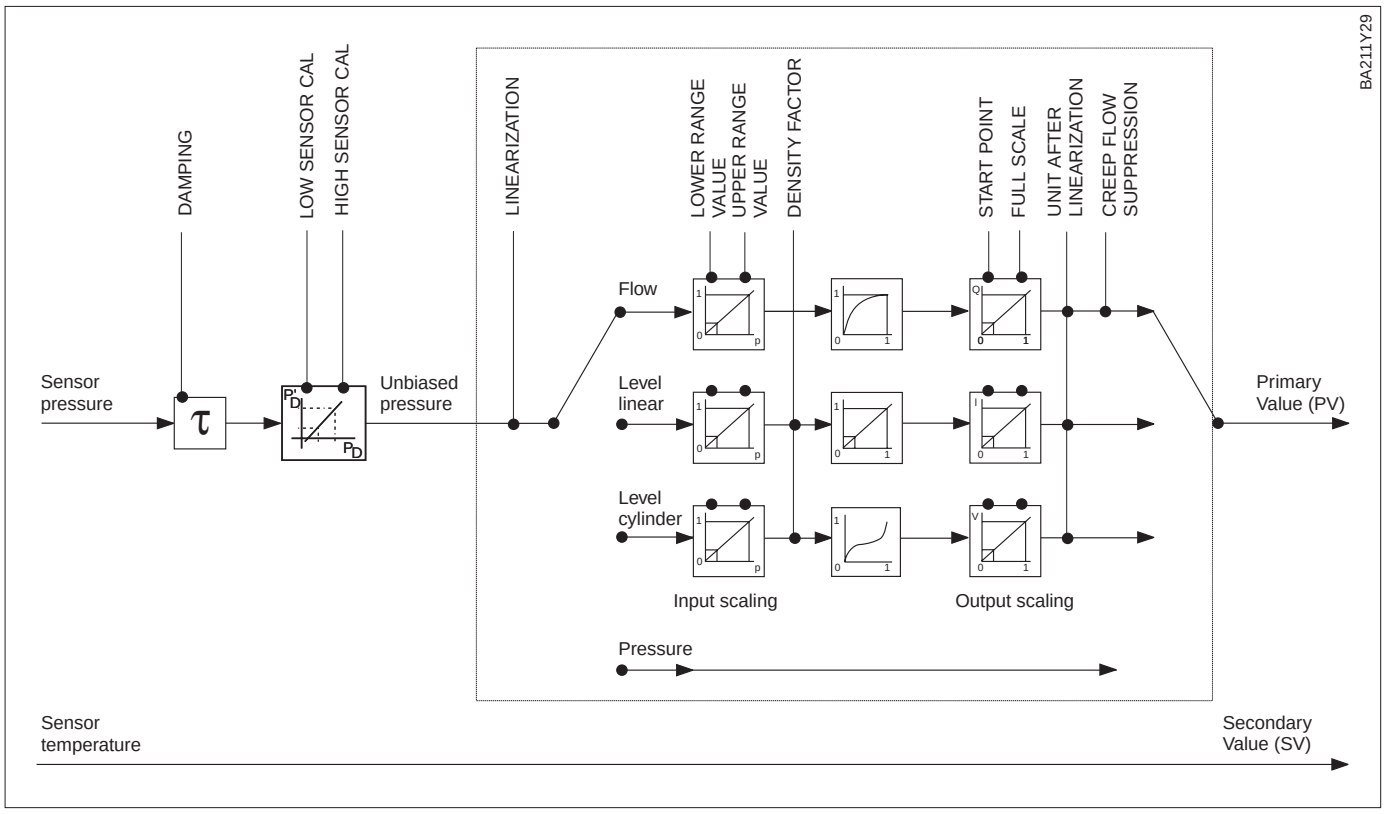


Figure 3.4
Schematic diagram of transducer block: the parameters shown represent a typical calibration sequence for a standard application

The transducer block contains the parameters required to calibrate the device.

Operation

The transducer block is opened by clicking on the transducer line.

—
—E+H_CERABAR_S_XXXXXXXX
—RESOURCE_XXXXXXXX (RB)
—TRANSDUCER_XXXXXXXX (TBPR)
—ANALOG_INPUT_XXXXXXXX (AI)

Parameters changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. Normally operation is resumed as soon as MODE-BLK is set to AUTO.

Block administration

Parameter	Description
MODE_BLK	See description in Resource block. The possible operating modes of the transducer block are: AUTO: the block is operating as normal. MAN: the block is operated with a manually entered primary value. OOS: the block is out of service.
TAG_DESC	User description of the intended application of the block.
BLOCK_ERROR	Shows the error status associated with the block components Out-of-Service: the block is in OOS mode. Simulation active: shows the setting of DIP-switch WP. Input failure/process variable has BAD status.

Output values

Parameter	Description
PRIMARY_VALUE	Primary value output by transducer block, here it is pressure or linearization value
SECONDARY_ VALUE	Secondary value output by transducer block, here it is temperature

Configuration parameters

The parameters listed in the following table are manufacturer-specific and can be used to configure the device as described in Chapter 5 and 6. Refer also to Fig.: 3.4.

The transducer block also contains standard profile parameters. Some of these, e.g. CAL_POINT_HI and CAL_POINT_LO can be changed but have no effect on the device. If the user desires, however, he can enter data relevant to the calibration in the SENSOR_CAL_ parameters and enter a tag description for the transducer block in TAG_DESC.

Parameter	Description
Measured Value *	Indicates the current value measured by the device.
Lower Range Value	Entry of pressure for lower range-value – zero, (affects bargraph)
Upper Range Value	Entry of pressure for upper range-value – span, max. turndown 20:1 (affects bargraph)
Set Lower Range Value	Acting pressure is taken as lower range-value – zero, (affects bargraph)
Set Upper Range Value	Acting pressure is taken as lower range-value – span, max. turndown 20:1, (affects bargraph)
Set Bias Pressure	Entry of bias pressure, parameter "Biased Pressure" adopts the new value. Operating mode "linear" (pressure): Display correction for parameters "Measured Value", "Upper Range Value" and "Lower Range Value"
Bias Pressure Automatically	Acting pressure is taken as bias pressure, parameter "Biased Pressure" adopts the new value. Operating mode "linear" (pressure): Display correction for parameters "Measured Value", "Upper Range Value" and "Lower Range Value"
Set Output Damping	Sets the damping time for the transducer block output signal (Primary Value), Range: 0 - 40 s

* Display value

Configuration parameters (cont.)

Parameter	Description
Select Pressure Unit	Changes the pressure units. Options: mbar, bar, Pa, hPa, kPa, MPa, mm H_2O, m H_2O, in H_2O, ft H_2O, psi, g/cm^2, kg/cm^2, kgf/cm^2, atm, lb/ft^2, Torr, mm Hg or in Hg (All pressure-specific parameters are recalculated and shown in these units.)
Diagnostic Code *	Indicates the current diagnostic code with associated message of any device alarm, see Chapter 7.1.
Last Diagnostic *	Indicates the previous diagnostic code with message registered by the device, see Chapter 7.1.
Clear Last Diagnostic Code	Clears last diagnostic code. Options: # – no action, clear – message is delected
Transducer_sw_ vers *	Indicates the measuring software version of the device.
Min. Pressure *	Maximum pointer function for the smallest measured pressure value
Reset Min. Pres Peak Hold	Options: # – no action, reset – Acting pressure value is adopted for the parameter "Min. Pressure".
Max. Pressure *	Maximum pointer function for the largest measured pressure value
Reset Max. Pres Peak Hold	Options: # – no action, reset – Acting pressure value is adopted for the parameter "Max. Pressure".
Integer Counter high *	Counter for pressure values above the upper range-limit (parameter "High Sensor Calibration"), max value = 255 Options: # – no action, clear – counter is reset to "0"
Sensor Temperature *	Display of actual measured temperature in the selected unit
Min. Temperature *	Maximum pointer function for the smallest measured temperature
Reset min Temp. Peak Hold	Options: # – no action, reset – Current temperature is adopted for the parameter "Min. Temperature".
Max. Temperature *	Maximum pointer function for the largest measured temperature
Reset max Temp. Peak Hold	Options: # – no action, reset – Current temperature is adopted for the parameter "Max. Temperature".
Default Values	When "5140" is entered here the device parameters are reset to their factory setting, see Chapter 7.2.
Linearization (operating mode)	Adjusting the operating mode. Options: linear (pressure), square root function (flow), level linear (level, volume or weight), level horizontal cylinder (volume and weight)
Start Point	For operating modes: "square root function", "level linear" and "level horizontal cylinder" – zero for output scaling (corresponds to lower range-value)
Full Scale	For operating modes: "square root function", "level linear" and "level horizontal cylinder" – scale value for output scaling (corresponds to upper range-value)
Unit After Liniarization	Selecting units for measuring the level, volume, weight or flow – the options depend on the operating mode selected. The linearized value is shown in "Measured Value" in these units. The measured value is not converted into the new units.

* Display value

Configuration parameters (cont.)

Parameter	Description
Density Factor	For operating modes: "level linear" and "level cylinder" - applications with media with a density not equal to 1 gm/cm³. The pressure is divided by this factor before carrying out the linearization function. This ensures that it is adapted to the material.
Creep Flow Suppression	Only for operating mode: "square root function" (flow). Entry is always in % of flow. Suppresses the display on small flow rates.
Low Sensor Calibration	Sets the low sensor calibration value.
High Sensor Calibration	Sets the high sensor calibration value.
Low Sensor Limit *	Lower range-limit of sensor (Unit selectable with "Select Pressure Unit")
High Sensor Limit *	Upper range-limit of sensor (Unit selectable with "Select Pressure Unit")
Sensor Pressure *	Sensor pressure (Unit selectable with "Select Pressure Unit")
Temperature Unit	Changes the temperature units. Options: °C, K,°F
Unbiased Pressure *	Display of current pressure value without bias correction
Biased Pressure *	Display of current pressure value with bias correction, (corresponds to the parameter "Measured Value", when the operating mode is set to "linear" (pressure)).
Security Locking	Software write lock for the parameters: a number ≠ 130 locks the parameter, 130 unlocks the parameter, see Chapters 5.5 and 6.6.
Serial-No. SENS. *	Display of the sensor serial number
Process Conn. P+	Material of process connection + side
Process Conn. P–	Material of process connection – side
Gasket	Material of seal
Process Diaphram.	Material of diaphragm
Fill Liquid	Oil filling

* Display value

3.6 Analog input block

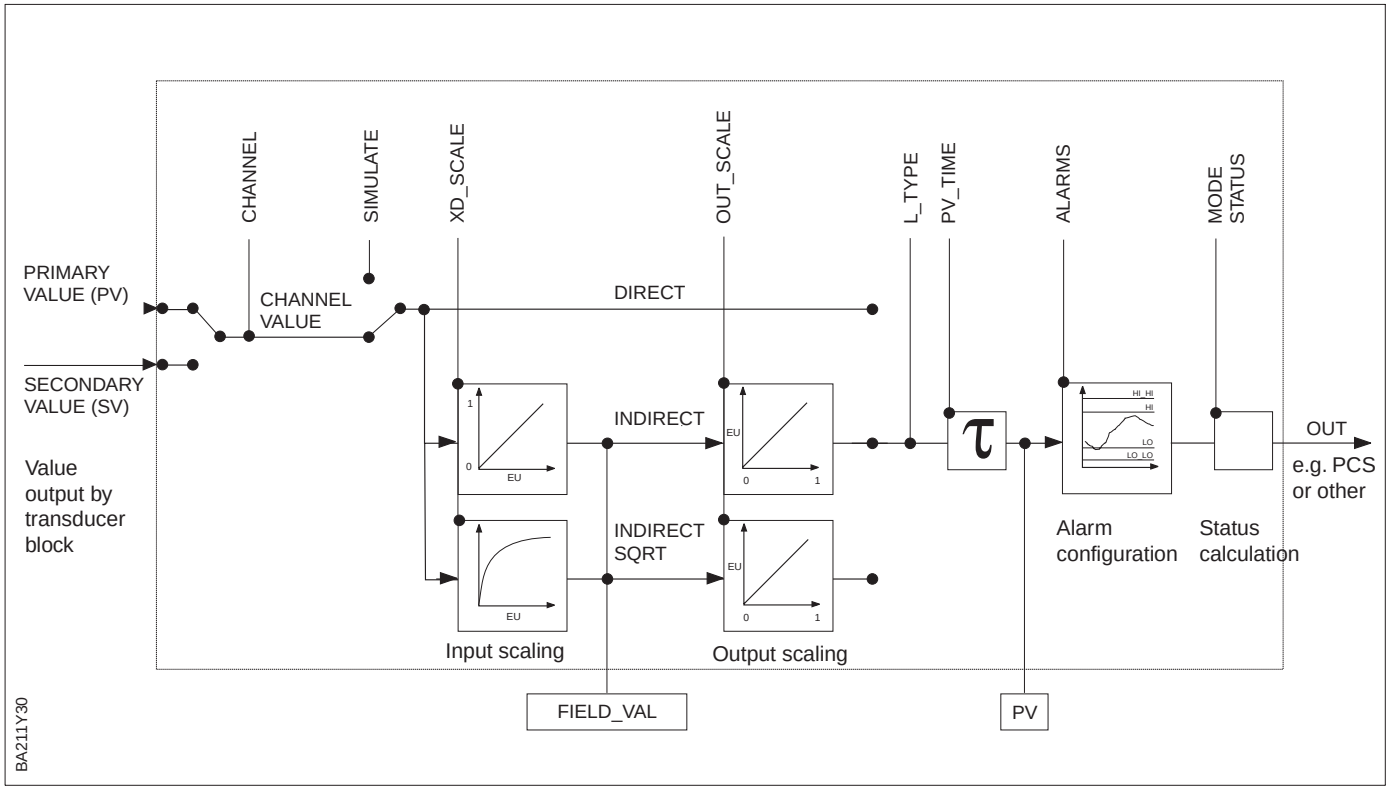


Figure 3.5
Schematic diagram of analog input block as used in AUTO mode

The analog input block conditions the signal output by the transducer block and outputs signal to the PCS or other function blocks.

Operation

The block is opened by a click on the analog input line.

—E+H_CERABAR_S_XXXXXXXX
—RESOURCE_XXXXXXXX (RB)
—TRANSDUCER_XXXXXXXX(TBPR)
—ANALOG_INPUT_XXXXXXXX (AI)

Parameters changes from the tool are made off-line while the device is operating. The changes are downloaded by first setting MODE_BLK = OOS then pressing the WRITE CHANGES button. Press the READ ALL button to check the values stored in the device. Normally operation is resumed as soon as MODE-BLK is set to AUTO.

Block administration

Parameter	Description
TAG_DESC	User description of the intended application of the block.
MODE_BLK	See description in Resource block The possible operating modes of the analogue input block are: AUTO: the block is operating as normal. MAN: the block is operated with a manually entered primary value. OOS: the block is out of service.
BLOCK_ERROR	Shows the error status associated with the block components. Out-of-Service: the block is in OOS mod.e Simulation active: shows the setting of DIP-switch WP. Input failure/process variable has BAD status

Output values

Parameter	Description
PV	Either the primary transducer block value used to execute the block or a process value associated with it. Comprises value and status.
OUT	The primary value output as a result of executing the analog input block. Comprises value and status.
FIELD_VALUE	Raw value of field device in % of PV range with a status reflecting the transducer condition before signal characterisation L_Type or filtering PV_TIME. Comprises value and status.

Scaling

Parameter	Description
CHANNEL	Selects the measured value to be input to the analogue input block 0 = no channel defined 1 = primary value, here it is pressure or linearization value 2 = secondary value, here it is: sensor temperature
XD_SCALE	Scales the transducer block value in the required engineering units (EU).
OUT_SCALE	Scales the output value in the required engineering units (EU).
L_TYPE	Sets the linearization type: DIRECT: the transducer block value bypasses the scaling functions INDIRECT:the transducer block value is fed through the linear scaling functions INDIRECT SQRT: the transducer block value is fed through the square root scaling functions

The relationship between the output values and scaling paramaters for the Cerabar S is as follows:

$$FIELD\_VAL = 100 \times \frac{(CHANNEL\ VALUE - XD\_SCALE\_MIN)}{(XD\_SCALE\_MAX - XD\_SCALE\_MIN)}$$

The L_TYPE parameter influences the signal conversion.

Direct:

$$PV = CHANNEL\_VALUE$$

Indirect:

$$PV = \frac{FIELD\_VAL}{100} \times (OUT\_SCALE\_MAX - OUT\_SCALE\_MIN) + OUT\_SCALE\_MIN$$

Indirect square root:

$$PV = \sqrt{\frac{FIELD\_VAL}{100}} \times (OUT\_SCALE\_MAX - OUT\_SCALE\_MIN) + OUT\_SCALE\_MIN$$

The XD_SCALE and OUT_SCALE values are expressed in engineering units at 0% for MIN and 100% for MAX.

Output response

Parameter	Description
LOW_CUT	**Not relevant to level measurement!** Determines a threshold for square root linearisation below which the output value is set to zero.
PV_FTIME	Sets the time constant for the output value.

Alarms

Parameter	Description
ACK_OPTION	Sets the way in which alarms and warnings are to be acknowledged.
ALARM_HYS	Sets the hysteresis (in output engineering units) for all configured alarms. A hysteresis of e.g. 2% on a HI_HI_LIMIT of 95% would cause the alarm to activate when the level reaches 95% and to deactivate when the level drops below 93%. A hysteresis of e.g. 2% on a LO_LO_LIMIT of 5% would cause the alarm to activate when the level drops below 5% and to deactivate when the level rises to 7%.
HI_HI_PRI	The priority (1 – 15) of the HI_HI alarm
HI_HI_LIM	Sets the HI_HI alarm limit in output engineering units
HI_PRI	The priority (1 – 15) of the HI alarm
HI_LIM	Sets the HI warning limit in output engineering units
LO_PRI	The priority (1 – 15) of the LO alarm
LO_LIM	Sets the LO warning limit in output engineering units
LO_LO_PRI	The priority (1 – 15) of the LO_LO alarm
LO_LO_LIM	Sets the LO_LO alarm limit in output engineering units

Alarm priorities

Priority	Description
0	Alarm is suppressed
1	Recognised by the system but not reported
2	Reported to the operator, but does not require his attention
3 – 7	Advisroy alarms of increasing priority
8 – 15	Critical alarms of increasing priority

Alarm status

Parameter	Description
HI_HI_ALM	The status of the HI_HI alarm
HI_ALM	The status of the HI alarm
LO_ALM	The status of the LO alarm
LO_LO_ALM	The status of the LO_LO alarm

Simulation

The SIMULATE parameter allows transducer block output value to be simulated, provided simulation has also been enabled at the device DIP switch. The simulation must be enabled, a value and/or status entered and the block must be in AUTO mode. During simulation the transducer output value is substituted by the simulated value.

A simulation is also possible by switching the block to manual and entering a value for OUT, see Chapter 7.2.

Parameter	Description
SIMULATE	Enables, sets and displays a simulated value, options: enable/disable simulated value output value

3.7 Control loops

The following is an example of a simple control loop which uses the level analog input block, flow analog input block, two PID blocks (e.g. from flowmeter and valve) and a valve analog output block. The connections between the function blocks can be made in the configuration tool.

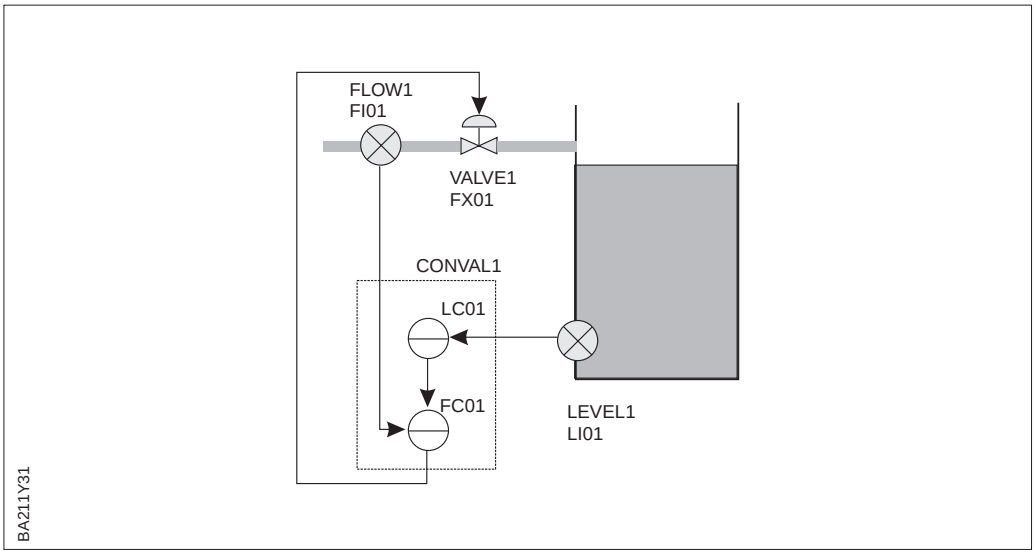


Figure 3.6
Schematic diagram of control loop

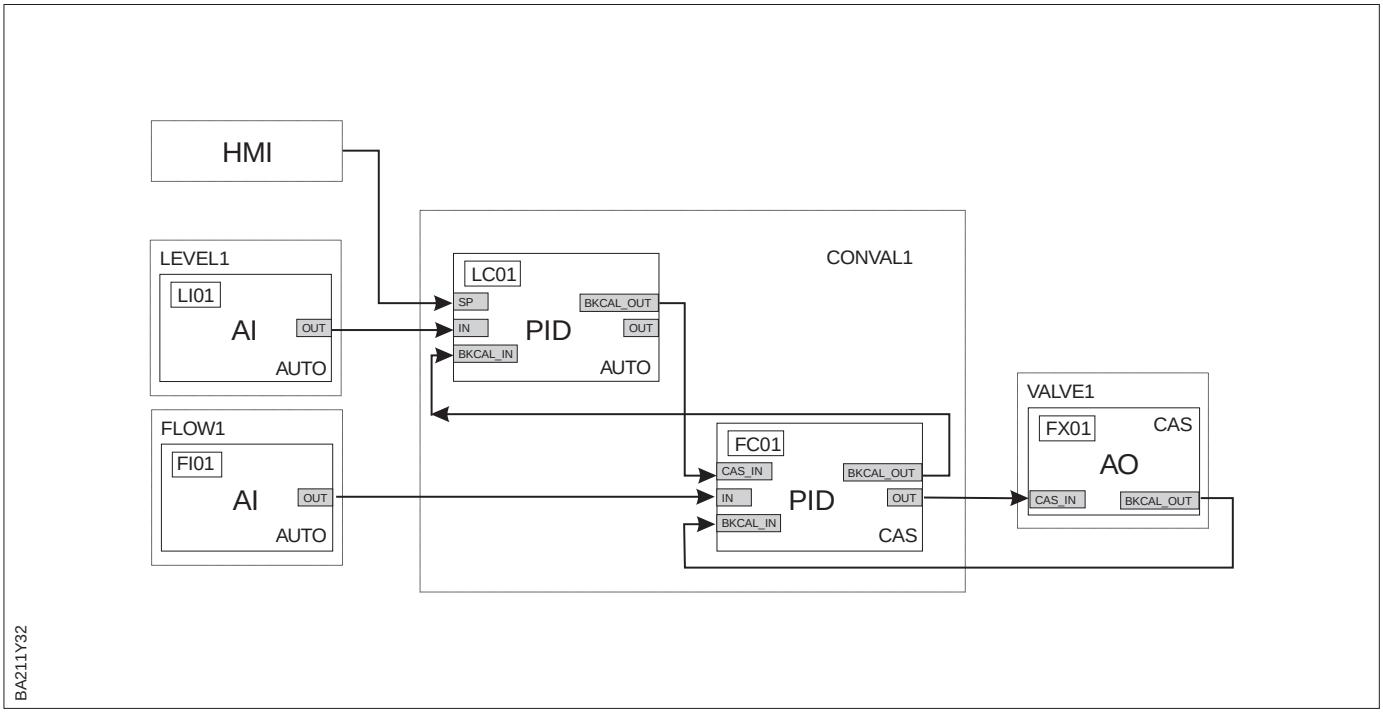


Figure 3.7
Function block connections

3.8 Methods

The Foundation Fieldbus specification provides for the use of so-called methods to simplify the operation of the device. A method is an interactive sequence of steps that must be followed in order to obtain a particular function from the device.

Thus, for example, the steps given in Chapters 5.2 and 5.3 for the basic calibration of the device:

- Reset
- Lower Range Value
- Upper Range Value
- Bias Pressure
- Damping

might comprise a method named "Basic calibration step 1". The user could call up this method to calibrate the device. He need do nothing else but supply the information which the method asks for as it progresses through each step. The setting of the block mode, reading, writing and checking of the parameters etc. are automatically done by the program.

A method is part of the device description supplied with the device. It is intended that methods will be provided for all Endress+Hauser devices. The current device description of the Cerabar S, however, does not support methods at this stage.

3.9 Checklist for commissioning

1. Configure the network and integrate the device.
   – Identify the device by means of the device ID and serial number.
   – If appropriate, assign a new PD_TAG, see page 17.

2. Configure the resource block, see Chapter 3.4.
   – Check the position of the hardware switch in WRITE_LOCK:
   – If "locked" is displayed, change the position of the DIP-switch, see Chapter 3.2.
   – If appropriate, change the block tag (right-hand click on tree).
   – Set MODE_BLK_TARGET to Out-of-Service.
   – Reset the device to factory values by using the function RESTART => Defaults
   (this function may also be available with a right-hand click on the device name).
   – If appropriate, assign a tag description (TAG_DESC).
   – Set MODE_BLK_TARGET to Auto.

3. Configure the transducer block, see Chapters 3.5, 5 and 6.
   – If appropriate, change the block tag (right-hand click on tree).
   – Set MODE_BLK_TARGET to Out-of-Service.
   – If appropriate, assign a tag description (TAG_DESC).
   – Configure the device as described in Chapters 5 or 6 (via configuration tool).
   – Set MODE_BLK_TARGET to Auto.

4. Configure the analog input block, see Chapters 5.6 and 6.7.
   – If appropriate, change the block tag (right-hand click on tree).
   – Set MODE_BLK_TARGET to Out-of-Service.
   – If appropriate, assign a tag description (TAG_DESC).
   – Set Channel to 1.
   – Set L_TYPE to "DIRECT" if the OUT value is to be in technical units e.g. bar
   to "INDIRECT" if the OUT value is to be scaled, see page 24 or Chapters 5.6 or 6.7.
   – Set the desired output damping in PV_TIME.
   – If appropriate, set the advisory and critical alarms.
   – Set MODE_BLK_TARGET to Auto.

5. Link the function blocks in the function block editor.

6. If appropriate, check the configuration by using the SIMULATE function,
   see also Chapter 8.2.

7. Download the configuration (right-hand click on device name).

4 Operation

4.1 On-site operation

Operating elements

Four keys, which allow the zero and span to be set, are available for on-site operation. In the "pressure" operating mode, they are effective only for the bargraph and numerals in the display module. The key functions are listed in the table below.

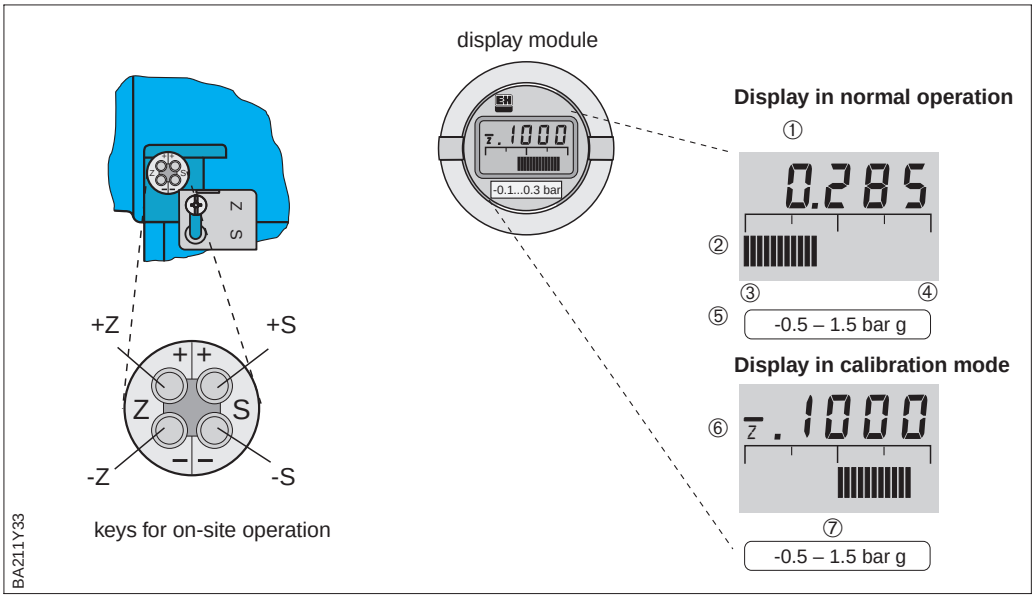


Figure 4.1
User interface of the Cerabar S with optional display module

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

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	
1x +Z and –Z	the acting pressure is taken as zero (lower range-value)
1x +S and –S	the acting pressure is taken as span (upper range-value)
Bias pressure	
2x +Z and +S	the acting pressure is taken as bias pressure
1x +Z and +S	the current bias pressure is displayed
2x –Z and –S	the current bias pressure is deleted
Secure measuring point	
1x +Z and –S	lock measuring point
1x –Z and +S	unlock measuring point

Table 4.1
Key functions

Display module

A display module is available as an option. It has two display modes:
Display during measurement: standard operational mode
Display during calibration: is activated by pressing one of the keys +Z, –Z, +S or –S twice. Automatically returns to measurement mode after 2 s.

4.2 Calibration via a configuration tool

The basic calibration and other functions can be set using a configuration tool. See Chapter 5 for pressure measurement and Chapter 6 for level measurement. The majority of the parameters are to be found as manufacturer's parameters in the transducer block, see Chapter 4.5. The scaling of the analog input block, Chapter 3.6, is also to be found in Chapter 5.6 or 6.7.

Procedure

1) Integrate the device into the configuration tool before calibrating, see Chapter 3.2.
2) Select the transducer block to perform the calibration, select the analog input block for the scaling.
3) Set the MODE_BLK parameter to "Out of Service" before proceeding.
4) **Download the edited parameter before proceding with the next step.**
5) Switch the MODE_BLK to "Auto" when the calibration is complete.

Note!
For the NI-FBUS configurator, the transducer block parameters are to be found in the "Others" folder, the analog input block parameters in the "Scaling" folder.

Note!

5 Pressure Measurement

The Cerabar S is immediately ready for measurement. The measuring range and pressure units correspond to those on the nameplate. The acting pressure is always transmitted via Foundation Fieldbus in these units. Other settings are possible via a configuration tool.

It is not possible to adjust zero and span in the conventional sense. The resolution of the measured value, however, is such that the specified accuracy of 0.1% of span is offered for "turndowns" down to 20:1. The "turndown" can be displayed via a configuration tool and the bargraph. This chapter contains the following information:

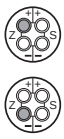
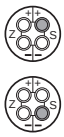
- Calibration with keys
- Calibration via tool
- Damping
- Locking/unlocking of the manufacturer´s-specific parameters
- Analog input block parameters
- Measuring point information

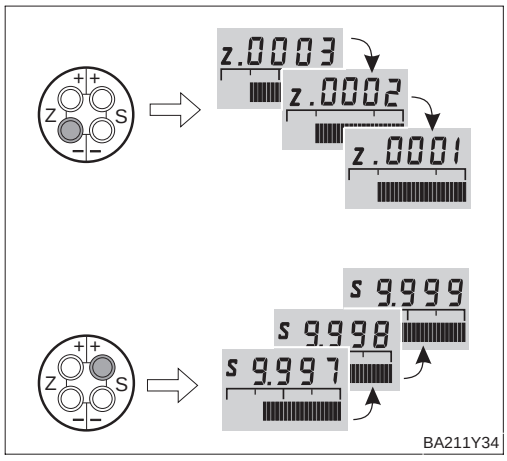
5.1 Calibration with keys

By using a reference pressure, the zero and span for the bargraph can be adjusted. The maximum turndown is 20:1.

Calibration without reference pressure

The lower and upper range values required are set with keys.

#	Key	Entry
1		Set the lower range value by repeatedly pressing the +Z and –Z keys (As the span remains constant, the upper range value is shifted to the same extent as the lower range value.)
2		Set the upper range value by repeatedly pressing the +S and –S keys (The lower range value is unaffected.)



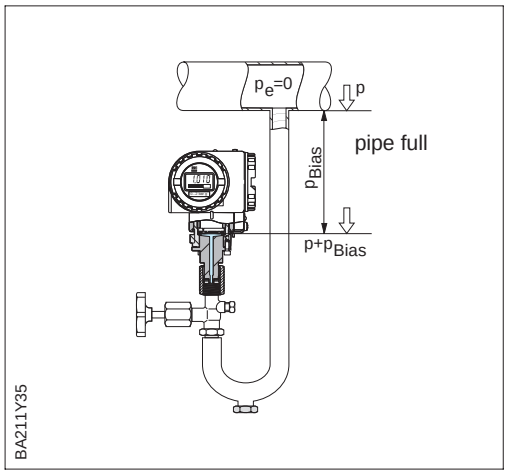
Calibration with reference pressure

A reference pressure which corresponds exactly to the desired zero and span is available.

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

Bias pressure

If the display (when present) does not display zero after calibration when the process pressure p_e = 0, then it can be corrected to zero by registering the bias pressure.



#	Key	Entry
1		Correct display: Press +Z and +S twice simultaneously: An acting bias pressure is registered
2		Display bias pressure: Press +Z and +S once simultaneously: An entered bias pressure is briefly displayed
3		Delete bias pressure: Press -Z and -S twice simultaneously: An entered bias pressure is deleted

5.2 Calibration via a configuration tool

The calibration is made via a configuration tool (remote operation).

Parameter	Description
Lower Range Value	Entry of lower range-value – zero (bargraph)
Upper Range Value	Entry of upper range-value – span; max. turndown 20:1 (bargraph)
Set Lower Range Value	Acting reference pressure is taken as lower range-value (bargraph)
Set Upper Range Value	Acting reference pressure is taken as upper range-value; max. turndown 20:1 (bargraph)
Set Bias Pressure	Entry bias pressure (only affects display module)
Bias Pres Autom	Acting pressure is taken as bias pressure (only affects display module)
Set Output Damp.	Entry of damping τ (0...40 s)
Select Press Unit	Options pressure unit: mbar, bar, Pa, hPa, kPa, MPa, mm H_2O, m H_2O, in H_2O, ft H_2O, psi, g / cm^2, kg / cm^2, kgf / cm^2, atm, lb / ft^2, torr, mm Hg or in Hg.
Linearization	Operating mode: linear (pressure)

Selecting pressure units

The units for pressure is selected with the parameter "Select Pressure Unit". 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 in 0…145.5 psi.

Calibration without reference pressure

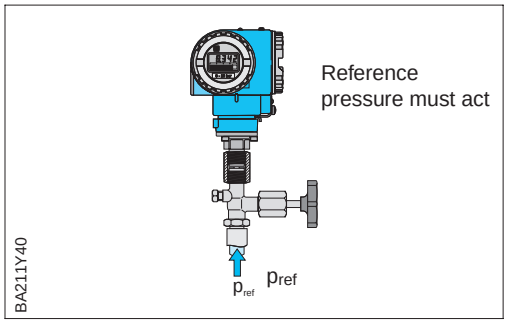
A pressure for the bargraph zero and span is entered into the device. No particular pressure must be acting.

#	Parameter	Entry	Significance
1	Default Values	5140	Reset to factory setting
2	Lower Range Value	e.g. 0	Zero
3	Upper Range Value	e.g. 100	Span
4	Measured Value	e.g. 15.5	Measured value in e.g. kPa

Calibration with reference pressure

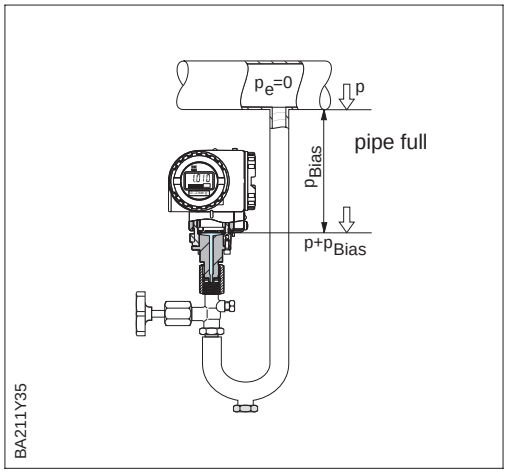
An acting reference pressure or process pressure corresponds exactly to the desired bargraph zero and span.

#	Parameter	Entry	Significance
1	Default Values	5140	Reset to factory setting
2	The exact pressure for zero is acting		
3	Set Lower Value	Confirm	Register zero
4	The exact pressure for span is acting		
5	Set Upper Value	Confirm	Register span
6	Measured Value	e.g. 15.5	Measured value in e.g. kPa



Bias pressure

If the display (when present) does not display zero after calibration when the process pressure p_e = 0, then it can be corrected to zero by registering the bias pressure.



Entry of a bias pressure

#	Parameter	Entry	Significance
1	Set Bias Pressure	e.g. 0.1	Enter bias pressure

Registration of an acting bias pressure

#	Parameter	Entry	Significance
1	Bias Press Autom	Confirm	Register bias pressure

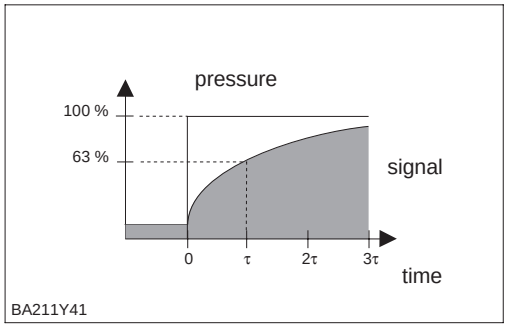
Pressure output in %

If it is desired that 0...100% pressure is output via Foundation Fieldbus, then the parameter "Linearization" has to be set to "level linear". The zero and span of the Foundation Fieldbus-Signal are automatically assigned the values 0% and 100%.

5.3 Damping

Output damping

The damping influences the time it takes for the display in "Measured Value" to react to a change in pressure.



#	Parameter	Entry	Significance
1	Set Output Damping	e.g. 30	Damping in transducer block increased to 30 s

Note!
Both the transducer block output and the analog input block can be damped. We recommend that the damping be set in the transducer block during commissioning and increased if necessary in the analog input block during normal operation. This prevents the device switching to "Out of Service" when the parameter is edited.


Note!

5.4 Maximum pointer function

Maximum pointer function

The maximum pointer function displays the maximum and minimum pressure and temperature measured since the last pointer reset.

The units for pressure and temperature are selected with the parameter "Select Pressure Unit" and "Select Temperature Unit" respectively. Please note that any change in the pressure units affects all pressure entries.

Parameter	Significance
Min. Pressure	Minimum pressure, Reset via the option "reset" to the acting pressure value using the parameter "Reset Min Pres Peak Hold"
Max. Pressure	Maximum pressure, Reset via the option "reset" to the acting pressure value using the parameter "Reset Max Pres Peak Hold"
Min. Temperature	Minimum temperature, Reset via the option "reset" to the acting temperature using the parameter "Reset min Peak Hold"
Max. Temperature	Maximum temperature, Reset via the option "reset" to the acting temperature using the parameter "Reset max Peak Hold"

5.5 Locking/unlocking

After all parameters have been entered, the manufacturer's specific parameters can be locked.

- via the keys +Z, –Z, +S and –S or
- via the parameter "Security Looking" by entering a three digit code ≠ 130. (130 is the code for unlocking the parameters)

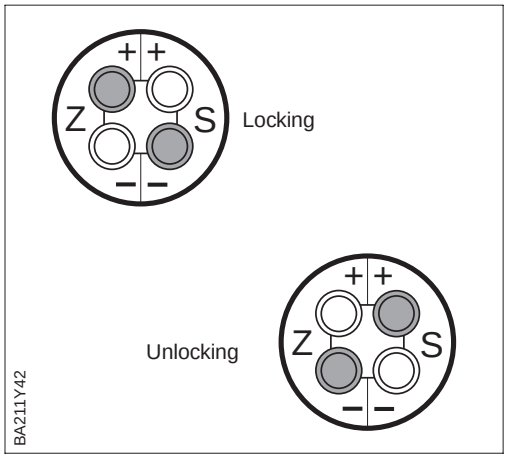
This protects the measuring point from accidental and unauthorised entries.

Keys

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

Parameter

#	Parameter	Entry	Significance
1	Security Looking	e.g. 131	Parameters locked
2	Security Looking	130	Parameters unlocked



Locking with keys has priority

The table below summarises the locking function.

Locking via	Display/ reading of parameters	Changing/writing via		Unlocking via	
		keys	communication	keys	communication
Keys	yes	no	no	yes	no
Parameter	yes	no	no	yes	yes

5.6 Analog input block parameters

Three sets of parameters can be set in the analog input block for:

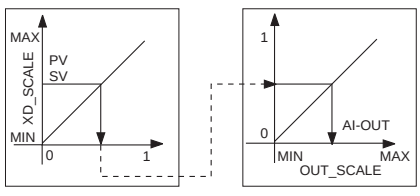
- Scaling of the input and output values
- Tuning of the outputs
- Setting of alarms

For the NI_FBUS tool, these are to be found in the Saling, Tuning and Alarms folders.

Parameters

Parameter	Significance
XD_SCALE..... XD_SCALE_MIN XD_SCALE_MAX XD_SCALE_UNIT XD_SCALE_DEC	Scales the input from the transducer block (result shown in FIELD_VAL) Comprises the lower and upper range-values, the code for the engineering units and the number of figures to the right of the decimal point. Is effective for L_TYPE = INDIRECT. Only of interest after a linearisation when the OUT value is to be different to the display value. Default 0% – 100%
OUT_SCALE..... OUT_SCALE_MIN OUT_SCALE_MAX OUT_SCALE_UNIT OUT_SCALE_DEC	Scales the output of the analog input block Comprises the lower and upper range-values, the code for the engineering units and the number of figures to the right of the decimal point. Only of interest when the OUT value is to be different to the display value, see example below. Default 0% – 100%.
L_TYPE	Sets the type of linearisation in the analog input block, for level: DIRECT bypasses the XD_SCALE and OUT_SCALE functions INDIRECT switches in the XD_SCALE and OUT_SCALE functions
PV_FTIME	Influences the time it takes for the output to react to a sudden change in level (63% of steady-state value), see also output damping, Chapter 5.3.
ACK_OPTION	Sets the way in which alarms and warnings are to be acknowledged.
ALARM_HYS	Sets the hysteresis (in output engineering units) for all configured alarms. A hystersis of e.g. 2% on a HI_HI_LIMIT of 95% would cause the alarm to activate when the level reaches 95% and to deactivate when the level drops below 93%. A hystersis of e.g. 2% on a LO_LO_LIMIT of 5% would cause the alarm to activate when the level drops below 5% and to deactivate when the level rises to 7%.
HI_HI_PRI	The priority (1 – 15,) of the HI_HI alarm
HI_HI_LIM	Sets the HI_HI alarm limit in output engineering units
HI_PRI	The priority (1 – 15) of the HI alarm
HI_LIM	Sets the HI advisory limit in output engineering units
LO_PRI	The priority (1 – 15) of the LO alarm
LO_LIM	Sets the LO advisory limit in output engineering units
LO_LO_PRI	The priority (1 – 15) of the LO_LO alarm
LO_LO_LIM	Sets the LO_LO alarm limit in output engineering units

Example: OUT value scaling (0 – 2^{15} = 32768)



PV: Primary Value
SV: Secondary Value

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#	Parameter	Entry	Significance
1	L_TYPE	INDIRECT	Switches in OUT_Scale function
2	Out_SCALE… _MIN _MAX _UNIT _DEC	0 32768 1997 0	Param. expands: lower range-value upper range-value code for units * decimal point positon

* Units selected from pull-down menu.

If the display and the OUT value of the analog input block are to provide the same value, then the lower and upper limits of XD_SCALE value during calibration or linearization must be entered as the lower and upper limits of the OUT_SCALE value (default = 0% and 100%).

5.7 Measuring point information

The following information about the measuring point can be read:

All blocks

Parameter	Significance
MODE_BLK	Indicates current operating mode of block

Resource block

Parameter	Significance
WRITE_LOCK	Indicates position of write protection DIP-switch WP

Transducer block

Parameter	Significance
PRIMARY_VALUE	Primary value output by transducer block, here it is pressure
SECONDARY_VALUE	Secondary value output by transducer block, here it is temperature
Measured Value	Pressure displayed by the device after calibration and any scaling/linearization.
Sensor pressure	Actual sensor pressure (Unit selectable with "Select Pressure Unit")
Lower Sensor Limit	Lower range-limit of sensor (Unit selectable with "Select Pressure Unit")
Upper Sensor Limit	Upper range-limit of sensor (Unit selectable with "Select Pressure Unit")
Lower Range Value	Lower range-value – zero (affects bargraph)
Upper Range Value	Upper range-value – span (affects bargraph)
Int. Counter high	Counter for pressure values above the upper range-limit, max. value = 255, Options: # – no action, clear – counter is reset to "0"
Sensor Temperature	Actual sensor temperature (Unit selectable with "Select Temperature Unit")
Unbiased Pressure	Current pressure value without bias correction
Biased Pressure	Current pressure value with bias correction
Transducer_sw_vers	Sofware version of the device
Diagnostic Code	Code with associated message of current device alarm
Last Diagnostic Code	Code with associated message of previous device alarm

Analog input block

Parameter	Significance
PV	The input value of the analog input block or a value associated with it (%)
FIELD_VAL	Output of transducer block in % of set range.
OUT	The value output by the analog input block
XD_SCALE...	The scaling values and engineering units for FIELD_VAL and PV These are always 0% and 100% for L_TYPE = DIRECT. For L_TYPE = INDIRECT they should be correspond to the range values set for the transducer block output value, e.g. during a linearization.
OUT_SCALE	The scaling values for the OUT value. These are always 0% and 100% for L_TYPE = DIRECT. For L_TYPE = INDIRECT they can be adjusted the desired OUT range.
L_TYPE	Type of linearisation: must always be set to DIRECT or INDIRECT
HI_HI_ALM	Flags status of upper alarm limit
HI_ALM	Flags status of upper warning limit
LO_ALM	Flags status of lower warning limit
LO_LO_ALM	Flags status of lower alarm limit

6 Level Measurement

This chapter describes the parameters which must be enterd to commision a Cerabar S for level measurement. This chapter contains the following information:

- Calibration via tool
- Empty/ Full calibration
- Dry calibration
- Damping
- Locking/unlocking of the manufacturer's-specific parameters
- Analog input block parameter
- Measuring point information

Note!
Additional functions that are required for level measurement, e.g. linearization can be accessed only via a Foundation Fieldbus tool.

Note!

6.1 Calibration via a configuration tool

The calibration is made via a configuration tool (remote operation).

Parameter	Significance
Lower Range Value	Entry of pressure for lower range-value – zero (bargraph and pressure for "empty")
Upper Range Value	Entry of pressure for upper range-value – span, max. turndown 20:1 (bargraph and pressure for "full")
Set Lower Range Value	Acting pressure is taken as lower range-value – zero (bargraph and pressure for "empty")
Set Upper Range Value	Acting pressure is taken as upper range-value – span, max. turndown 20:1 (bargraph and pressure for "full")
Set Bias Pressure	Entry of bias pressure (affects display module and parameter "Biased Pressure" only)
Bias Pres Autom	Acting pressure is taken as bias pressure (affects display module and parameter "Biased Pressure" only)
Set Output Damp.	Entry of damping τ (0...40 s)
Select Press Unit	Options pressure unit: mbar, bar, Pa, hPa, kPa, MPa, mm H_2O, m H_2O, in H_2O, ft H_2O, psi, g / cm^2, kg / cm^2, kgf / cm^2, atm, lb / ft^2, torr, mm Hg or in Hg.
Linearization	Operating mode: "level linear" (level, volume and weight) or "level horizontal cylinder" (volume and weight)
Start Point	Zero for output scaling (corresponds to lower range-value)
Full Scale	Scale value for output scaling (corresponds to upper range-value)
Unit After Linearization	Selecting units for mesuring the level, volume or weight – the options depend on the operating mode selected. The linearized value is shown in these units. The measured value is not converted into the new units.
Density Factor	Density factor – Applications with media with a density not equal to 1 g/cm^3.

Density correction

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

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

Determining the density factor

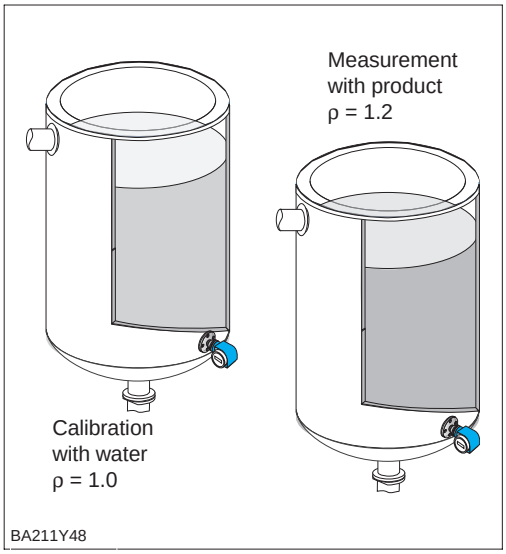
Example: A tank is filled with water and calibrated. The density of the water (old density) is 1 g/cm^3. Later the tank will be used as a storage tank and be filled with the actual medium to be measured. The new density is 1.2 g/cm^3. "Density Factory" still contains the factory setting "1", i.e. the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

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

#	Parameter	Entry	Significance
1	Density Factor	e.g. 1.2	Density correction
2	Measured Value	e.g. 62.5 %	Corrected level

Result

- The measured value in parameter "Measured Value" is divided by the density factor and is thus correct for the new product.



Note!

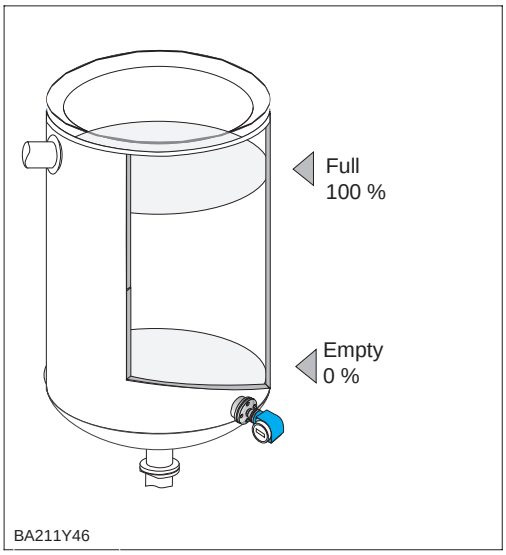
Note!

The density factor directly affects the level measurement. If the product density changes, make sure that the density factor is updated before an existing linearization curve is used.

6.2 Empty/full calibration

The empty/full calibration lays down the desired minimum and maximum levels for measurement. The entries can be made in any units. There are two prerequisites:

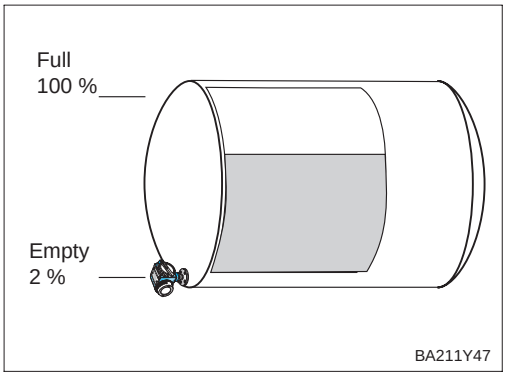
- The Cerabar S has been mounted.
- The tank can be filled.



"Level linear"

#	Parameter	Entry	Significance
1	Default Values	5140	Reset to factory setting
2	Linerazition	"level linear"	Operating mode
3	The tank is empty (0...40 %)		
4	Set Lower Value	Confirm	Register pressure
5	Start Point	e.g. 0	Current level = level for "empty"
6	The tank is full (60...100 %)		
7	Set Upper Value	Confirm	Register pressure
8	Full Scale	e.g. 100	Current level = level for "full"
9	Unit After Lin	e.g. %	Select level units

Result
- Level is displayed in "Measured Value"



"Level horizontal cylinder"

#	Parameter	Entry	Significance
1	Default Value	5140	Reset to factory setting
2	Linearization	"level horizontal cylinder"	Operating mode
3	The tank is empty (0...40 %)		
4	Set Lower Value	Confirm	Register pressure
5	Start Point	e.g. 2	Current level = level for "empty"
6	The tank is full (60...100 %)		
7	Set Upper Value	Confirm	Register pressure
8	Full Scale	e.g. 100	Current level = level for "full"
9	Unit After Lin	e.g. %	Select level units

Result
- Level is displayed in "Measured Value"

Unit After Linearization

The units for level, volumetric or weight are selected with the parameter "Unit After Linearization". Selecting these units is only to help the operator. It has no effect on the main measured value in parameter "Measured Value".

Example: 55 % is shown as 55 hl after selcting the unit "hl".

6.3 Dry calibration

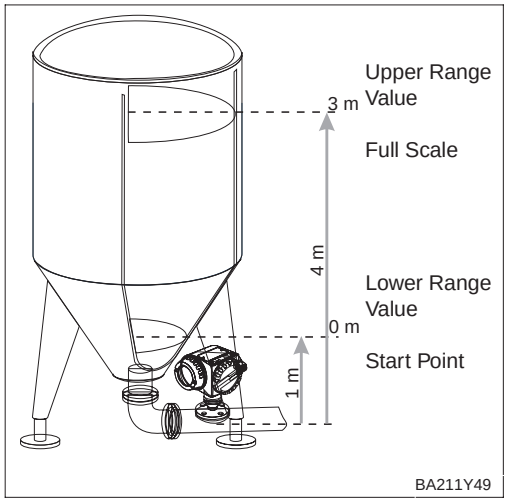
The dry calibration is a calculated calibration, which can be made with an empty tank or on the test bench. The "empty" calibration point is normally at the sensor mounting point. If the measurement is to begin at another level, then this must be considered in the calculation. The prerequisites for a dry calibration are:

- The empty and full levels are known.
- The density factor is known.
- The pressure for »empty« and »full« has been calculated (p = ρgh).

If the device has a display and the point of mounting is below the empty level, then a bias pressure must be entered in "Set Bias Pressure" (position correction).

"Level linear"

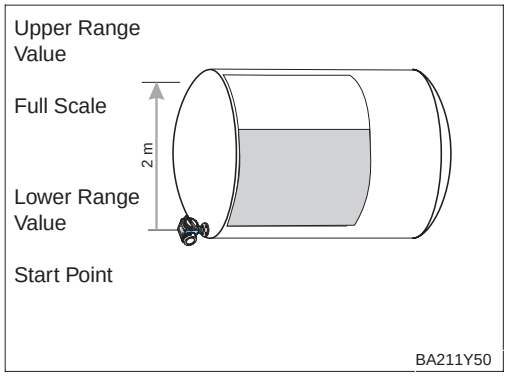
#	Parameter	Entry	Significance
1	Default Value	5140	Reset to factory setting
2	Select Press Unit	e.g. mbar	Select pressure unit
3	Set Bias Pressure	e.g. 100, = Lower Range Value	For display module bias pressure
4	Lower Range Value	e.g. 100	Pressure for "empty"
5	Upper Range Value	e.g. 400	Pressure for "full"
6	Linearization	"level linear"	Operating mode
7	Start Point	e.g. 0	Level for "empty"
8	Full Scale	e.g. 300	Level for "full"
9	Unit After Lin	e.g. hl	Select level units



Result:
- Level is displayed in "Measured Value".

"Level horizontal cylinder"

#	Parameter	Entry	Significance
1	Default Value	5140	Reset to factory setting
2	Select Press Unit	e.g. mbar	Select pressure unit
3	Lower Range Value	e.g. 100	Pressure for "empty"
4	Upper Range Value	e.g. 400	Pressure for "full"
5	Linearization	"level horizontal cylinder"	Operating mode
6	Start Point	e.g. 0	Level for "empty"
7	Full Scale	e.g. 200	Level for "full"
8	Unit After Lin	e.g. hl	Select level units



Result:
- Level is displayed in "Measured Value".

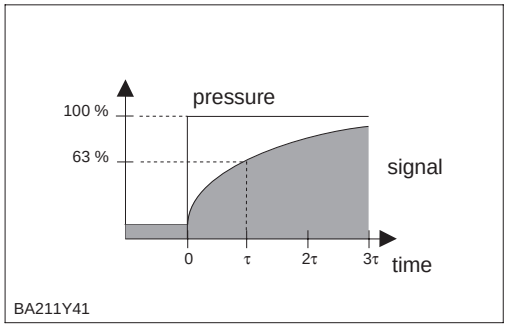
Check after installation

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

6.4 Damping

Output damping

The damping influences the time it takes for the display in "Measured Value" to react to a change in pressure.



#	Parameter	Entry	Significance
1	Set Output Damping	e.g. 30	Damping in transducer block increased to 30 s

Note!
Both the transducer block output and the analog input block can be damped. We recommend that the damping be set in the transducer bloch during commissioning and increased if necessary in the analog input block during normal operation. This prevents the device switching to "Out of Service" when the parameter is edited.


Note!

6.5 Maximum pointer function

Maximum pointer function

The maximum pointer function displays the maximum and minimum pressure and temperature measured since the last pointer reset.

The units for pressure and temperature are selected with the parameter "Select Pressure Unit" and "Select Temperature Unit" respectively. Please note that any change in the pressure units affects all pressure entries.

Parameter	Signifiance
Min. Pressure	Minimum pressure, Reset via the option "reset" to the acting pressure value using the parameter "Reset Min Pres Peak Hold"
Max. Pressure	Maximum pressure, Reset via the option "reset" to the acting pressure value using the parameter "Reset Max Pres Peak Hold"
Min. Temperature	Minimum temperature, Reset via the option "reset" to the acting temperature using the parameter "Reset min Peak Hold"
Max. Temperature	Maximum temperature, Reset via the option "reset" to the acting temperature using the parameter "Reset max Peak Hold"

6.6 Locking/unlocking

After all parameters have been entered, the manufacturer's-specific parameters can be locked.

- via the keys +Z, –Z, +S and –S or
- via the parameter "Security Looking" by entering a three digit code ≠ 130. (130 is the code for unlocking the parameters)

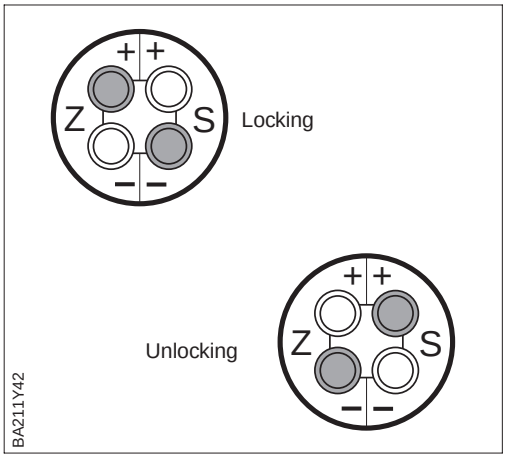
This protects the measuring point from accidental and unauthorised entries.

Keys

#	Key	Entry
1		Lock operation: Press +Z and -S simultaneously once
2		Unlock operation: Press -Z and +S simultaneously once

Parameter

#	Parameter	Entry	Significance
1	Security Looking	e.g. 131	Parameters locked
2	Security Looking	130	Parameters unlocked



Locking with keys has priority

The table below summarises the locking function.

Locking via	Display/ reading of parameters	Changing/writing via		Unlocking via	
		keys	communication	keys	communication
Keys	yes	no	no	yes	no
Parameter	yes	no	no	yes	yes

6.7 Analog input block parameters

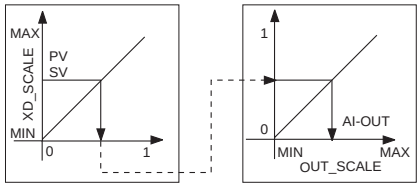
Three sets of parameters can be set in the analog input block for:

- Scaling of the input and output values
- Tuning of the outputs
- Setting of alarms

For the NI_FBUS tool, these are to be found in the Saling, Tuning and Alarms folders.

Parameters

Parameter	Significance
XD_SCALE..... XD_SCALE_MIN XD_SCALE_MAX XD_SCALE_UNIT XD_SCALE_DEC	Scales the input from the transducer block (result shown in FIELD_VAL) Comprises the lower and upper range-values, the code for the engineering units and the number of figures to the right of the decimal point. Is effective for L_TYPE = INDIRECT. Only of interest after a linearization when the OUT value is to be different to the display value. Default 0% – 100%
OUT_SCALE..... OUT_SCALE_MIN OUT_SCALE_MAX OUT_SCALE_UNIT OUT_SCALE_DEC	Scales the output of the analog input block Comprises the lower and upper range-values, the code for the engineering units and the number of figures to the right of the decimal point. Only of interest when the OUT value is to be different to the display value, see example below. Default 0% – 100%.
L_TYPE	Sets the type of linearisation in the analog input block, for level: DIRECT bypasses the XD_SCALE and OUT_SCALE functions INDIRECT switches in the XD_SCALE and OUT_SCALE functions
PV_FTIME	Influences the time it takes for the output to react to a sudden change in level (63% of steady-state value), see also output damping, Chapter 6.4.
ACK_OPTION	Sets the way in which alarms and warnings are to be acknowledged.
ALARM_HYS	Sets the hysteresis (in output engineering units) for all configured alarms. A hystersis of e.g. 2% on a HI_HI_LIMIT of 95% would cause the alarm to activate when the level reaches 95% and to deactivate when the level drops below 93%. A hystersis of e.g. 2% on a LO_LO_LIMIT of 5% would cause the alarm to activate when the level drops below 5% and to deactivate when the level rises to 7%.
HI_HI_PRI	The priority (1 – 15,) of the HI_HI alarm
HI_HI_LIM	Sets the HI_HI alarm limit in output engineering units
HI_PRI	The priority (1 – 15) of the HI alarm
HI_LIM	Sets the HI advisory limit in output engineering units
LO_PRI	The priority (1 – 15) of the LO alarm
LO_LIM	Sets the LO advisory limit in output engineering units
LO_LO_PRI	The priority (1 – 15) of the LO_LO alarm
LO_LO_LIM	Sets the LO_LO alarm limit in output engineering units



PV: Primary Value
SV: Secondary Value

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Example: OUT value scaling (0 – 2 ^{15} = 32768)

#	Parameter	Entry	Significance
1	L_TYPE	INDIRECT	Switches in OUT_Scale function
2	Out_SCALE… _MIN _MAX _UNIT _DEC	0 32768 1997 0	Param. expands: lower range-value upper range-value code for units * decimal point positon

* Units selected from pull-down menu.

If the display and the OUT value of the analog input block are to provide the same value, then the lower and upper limits of the XD_SCALE value during calibration or linearization must be entered as the lower and upper limits of the OUT_SCALE value (default = 0% and 100%).

6.8 Measuring point information

The following information about the measuring point can be read:

All blocks

Parameter	Significance
MODE_BLK	Indicates current operating mode of block

Resource block

Parameter	Significance
WRITE_LOCK	Indicates position of write protection DIP-switch WP

Transducer block

Parameter	Significance
PRIMARY_VALUE	Primary value output by transducer block, here it is linearization value
SECONDARY_VALUE	Secondary value output by transducer block, here it is temperature
Measured Value	Pressure displayed by the device after calibration and any scaling/linearization.
Sensor pressure	Actual sensor pressure (Unit selectable with "Select Pressure Unit")
Lower Sensor Limit	Lower range-limit of sensor (Unit selectable with "Select Pressure Unit")
Upper Sensor Limit	Upper range-limit of sensor (Unit selectable with "Select Pressure Unit")
Lower Range Value	Lower range-value – zero (affects bargraph and linearization)
Upper Range Value	Upper range-value – span (affects bargraph and linearization)
Int. Counter high	Counter for pressure values above the upper range-limit, max. value = 255, Options: # – no action, clear – counter is reset to "0"
Sensor Temperature	Actual sensor temperature (Unit selectable with "Select Temperature Unit")
Start Point	Zero for output scaling (correponds to lower range-value)
Full Scale	Scale value for output scaling (corresponds to upper range-value)
Unbiased Pressure	Current pressure value without bias correction
Biased Pressure	Current pressure value with bias correction
Transducer_sw_vers	Sofware version of the device
Diagnostic Code	Code with associated message of current device alarm
Last Diagnostic Code	Code with associated message of previous device alarm

Analog input block

Parameter	Significance
PV	The input value of the analog input block or a value associated with it (%)
FIELD_VAL	Output of transducer block in % of set range.
OUT	The value output by the analog input block
XD_SCALE...	The scaling values and engineering units for FIELD_VAL and PV These are always 0% and 100% for L_TYPE = DIRECT. For L_TYPE = INDIRECT they should be correspond to the range values set for the transducer block output value, e.g. during a linearisation.
OUT_SCALE	The scaling values for the OUT value. These are always 0% and 100% for L_TYPE = DIRECT. For L_TYPE = INDIRECT they can be adjusted the desired OUT range.
L_TYPE	Type of linearisation: must always be set to DIRECT or INDIRECT
HI_HI_ALM	Flags status of upper alarm limit
HI_ALM	Flags status of upper warning limit
LO_ALM	Flags status of lower warning limit
LO_LO_ALM	Flags status of lower alarm limit

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.
- If the display is present, the error code is displayed and flashes.
- The current error code is displayed in parameter "Diagnostic Code", the last error code in parameter "Last Diagnostic Code".

Warnings

When the Cerabar S detects a warning:

- An error code is transmitted along with the measured value: the Cerabar S continues measuring.
- The current error code is displayed in parameter "Diagnostic Code", the last error code in parameter "Last Diagnostic Code".

Error codes in "Diagnostic Code" and "Last Diagnostic Code"

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

Code	Type	Source and remedy
E 101	Error	Electronic instrument error – Remedy by Endress+Hauser Service
E 102	Warning	Electronic instrument error with the maximum counter function – Carry out reset (Code 5140), recalibrate the instrument
E 103	Error	Initialising in progress – Wait until the procedure is completed
E 104	Warning	Sensor calibration – Recalibrate sensor
E 110	Error	Check sum error – Carry out reset (Code 5140), the error remains – Remedy by Endress+Hauser Service
E 111, E 112, E 113, E 114	Error	Electronic instrument error – Remedy by Endress+Hauser Service
E 115	Error	Sensor overpressure – Remains until overpressure is no longer present
E 120	Error	Sensor underpressure – Remains until underpressure is no longer present
E 610	Error	Calibration error, same pressure value for "Lower Range Value" and "Upper Range Value" – Check the calibration
E 620	Warning	Measured value outside range

7.2 Simulation

Simualtion of the OUT value

The OUT value can also be simulated in the analog input block:

1. Check that the simulation is enabled at the DIP-switch WP, see Chapter 3.2.
2. Click on the SIMULATE parameter:
   – Set to enable
   – Enter a simulation value
   – Click on WRITE CHANGES button
   – Check the effect on the OUT value and any following links.
3. Disable the SIMULATE parameter.

During simulation, the BLOCK_ERROR shows the status "simulation active".

7.3 Reset

By entering a code, the entries in the manufacturer's-specific parameters are reset completely to factory settings.

#	Parameter	Entry	Significance
1	Default Values	5140	Reset to factory setting

The following table provides a summary of factory settings. (***** = display value)

Parameter	Default Value
Measured Value *	
Lower Range Value	0.0
Upper Range Value	= High Sensor Limit
Set Lower Range Value	
Set Upper Range Value	
Set Bias Pressure	0.0
Bias Pressure Automatically	
Set Output Damping	0.0
Select Pressure Unit	bar
Diagnostic Code *	0
Last Diagnostic *	0
Clear Last Diagnostic Code	
Transducer_sw_vers *	
Min. Pressure *	Act. pressure
Reset Min. Pres Peak Hold	
Max. Pressure *	Act. pressure
Reset Max. Pres Peak Hold	
Integer Counter high *	0
Sensor Temperature *	Act. temperature
Min. Temperature *	Act. temperature
Reset min Temp. Peak Hold	
Max. Temperature *	Act. temperature
Reset max Temp. Peak Hold	"Pressure linear"

Parameter	Default Value
Default Values	
Linearization (operating mode)	
Start Point	0.0
Full Scale	100.0
Unit After Liniarization	bar
Density Factor	1.0
Creep Flow Suppression	0.0
Low Sensor Calibration	= Low Sensor Limit
High Sensor Calibration	= High Sensor Limit
Low Sensor Limit *	
High Sensor Limit *	
Sensor Pressure *	Act. sensor press.
Temperature Unit	°C
Unbiased Pressure *	Act. sensor press.
Biased Pressure *	Act. sensor press.
Security Locking	130
Serial-No. SENS. *	
Process Conn. P+	special
Process Conn. P–	special
Gasket	special
Process Diaphram.	special
Fill Liquid	special

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.

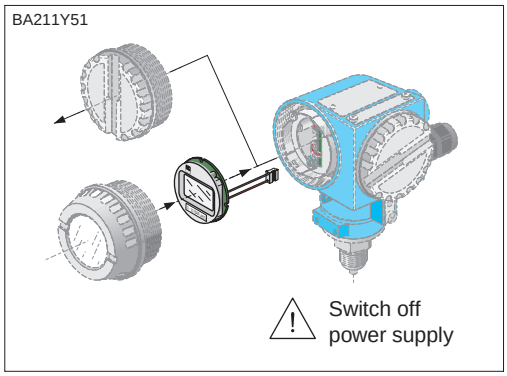
Caution!
Instruments with certificates of conformity or design approval must be sent in for repair as complete units only.


Caution!

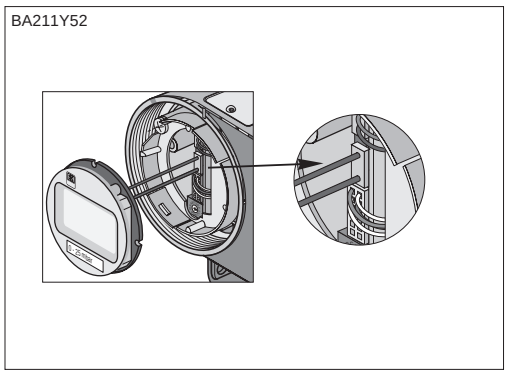
8.2 Mounting the display

Mounting the display

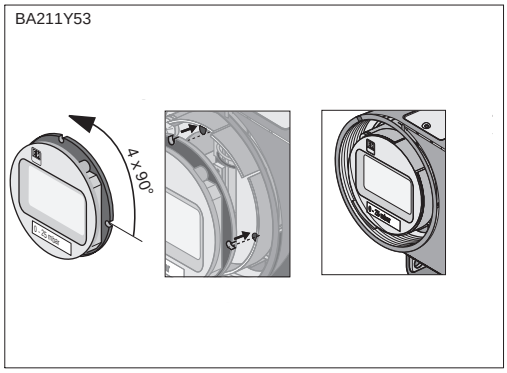
- Switch off power supply.
- Open the cover to the display compartment (use a cover with a sight glass after mounting the display).



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

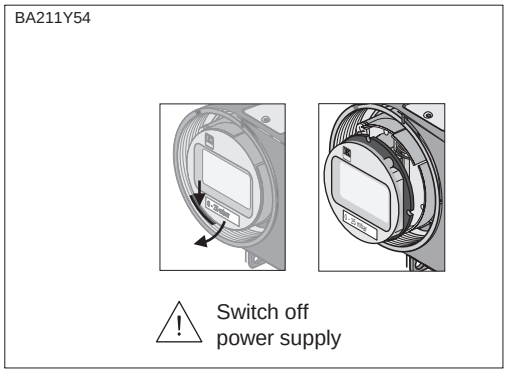


- Attach display.
  The display can be rotated through 90°.
- Screw down the cover.



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 Changing the sensor module and electronics

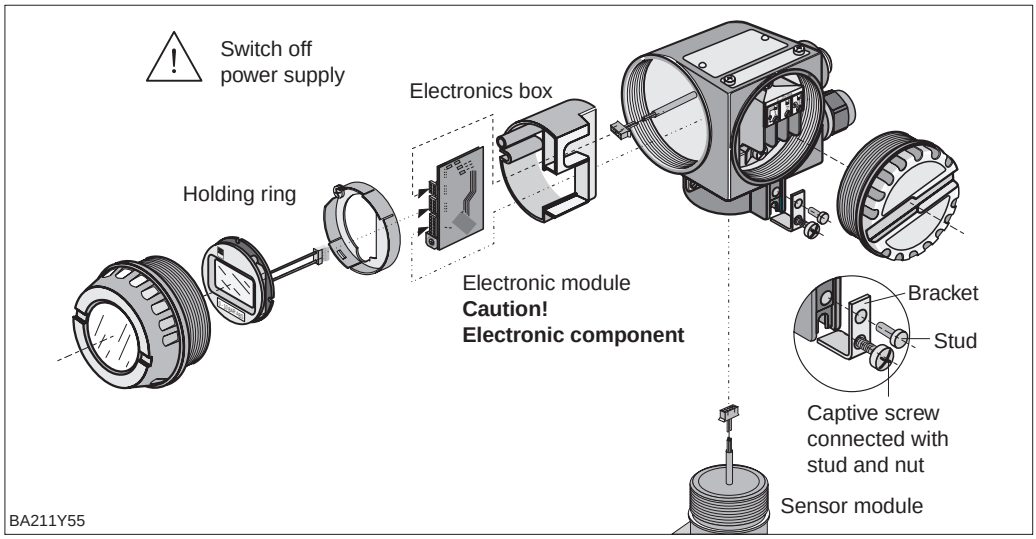
Warning!
The sensor module and electronics should only be replaced by E+H Service when using the instrument in EEx d and EEx ia areas.
The Cerabar S must be sent back to E+H Service as a complete unit.

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
- Undo the two screws on the holding ring and remove
- Remove the plug from the electronic module
- Remove the electronic module

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



Changing the sensor module

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

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

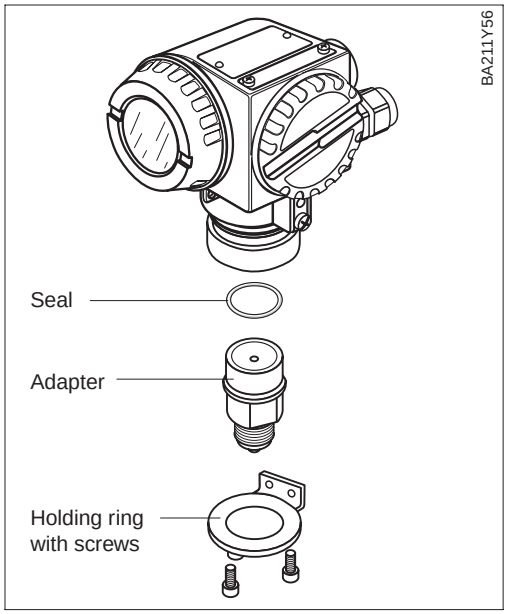
8.4 Changing the seal

The seal in contact with the medium inside the adapter of the Cerabar S PMC 731 can be replaced. Except for the PTFE seal (Structure D), all seals can thus be interchanged as required. The different temperature limits should thus be observed for individual materials.

Seal		Lower temperature limit
1	FPM, Viton	–20 °C
6	FPM, Viton grease-free	–10 °C
A	FPM, Viton oil and grease-free for oxygen	–10…+60 °C
8	NBR (DVGW)	–20…+80 °C
2	NBR	–20 °C
7	FFKM Kalrez	+5 °C
4	EPDM	–40 °C
D	PTFE and Hastelloy C 4	–20…+85 °C

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

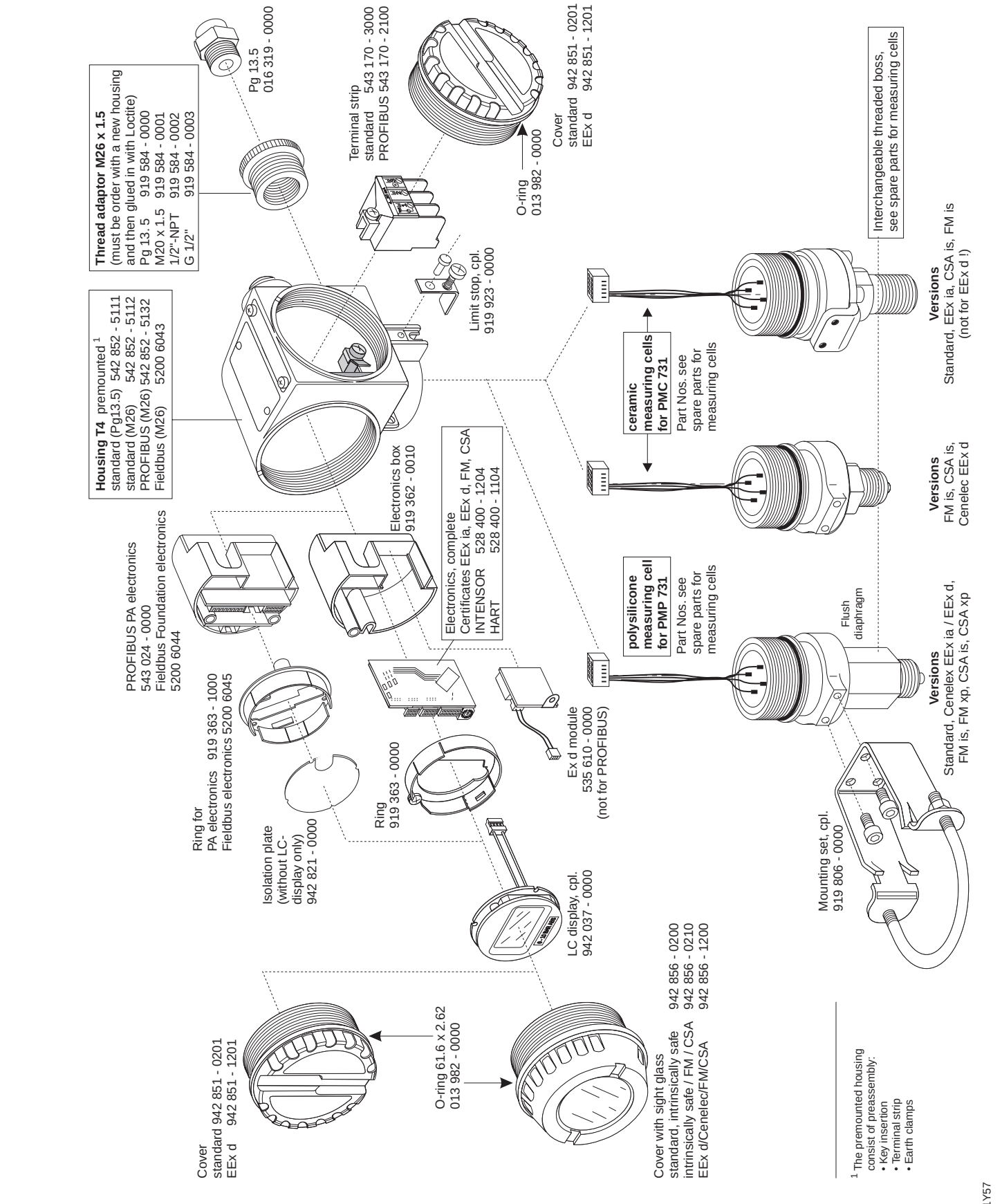
Changing the PTFE seal
- Loosen the screws on the retaining ring of the adapter.
- Remove the retaining ring and adapter.
- Replace seal.
  The surfaces each side of the seal and the seal itself must be free from fibres and dirt.
- Secure the adapter with the retaining ring and screws.
- Warm the instrument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



8.5 Replacement parts

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

When ordering replacement parts, please note the following:
- If parts given in the order code are to be replaced, then it must be ensured that the order code (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.


Thread adaptor M26 x 1.5
(must be order with a new housing and then glued in with Loctite)
Pg 13. 5 919 584 - 0000
M20 x 1.5 919 584 - 0001
1/2"-NPT 919 584 - 0002
G 1/2" 919 584 - 0003
Pg 13.5
016 319 - 0000
Terminal strip
standard 543 170 - 3000
PROFIBUS 543 170 - 2100
Cover
standard 942 851 - 0201
EEx d 942 851 - 1201
O-ring
013 982 - 0000
Housing T4 premounted [1]
standard (Pg13.5) 542 852 - 5111
standard (M26) 542 852 - 5112
PROFIBUS (M26) 542 852 - 5132
Fieldbus (M26) 5200 6043
Limit stop, cpl.
919 923 - 0000
Electronics box
919 362 - 0010
Electronics, complete
Certificates EEx ia, EEx d, FM, CSA
INTENSOR 528 400 - 1204
HART 528 400 - 1104
PROFIBUS PA electronics
543 024 - 0000
Fieldbus Foundation electronics
5200 6044
Ring for
PA electronics 919 363 - 1000
Fieldbus electronics 5200 6045
Isolation plate
(without LC-display only)
942 821 - 0000
Ring
919 363 - 0000
Ex d module
535 610 - 0000
(not for PROFIBUS)
LC display, cpl.
942 037 - 0000
ceramic measuring cells for PMC 731
Part Nos. see spare parts for measuring cells
polysilicone measuring cell for PMP 731
Part Nos. see spare parts for measuring cells
Interchangeable threaded boss, see spare parts for measuring cells
Versions
Standard, EEx ia, CSA is, FM is
(not for EEx d !)
Versions
FM is, CSA is,
Cenelec EEx d
Flush diaphragm
Versions
Standard, Cenelec EEx ia / EEx d,
FM is, FM xp, CSA is, CSA xp
Mounting set, cpl.
919 806 - 0000
Cover
standard 942 851 - 0201
EEx d 942 851 - 1201
O-ring 61.6 x 2.62
013 982 - 0000
Cover with sight glass
standard, intrinsically safe 942 856 - 0200
intrinsically safe / FM / CSA 942 856 - 0210
EEx d/Cenelec/FM/CSA 942 856 - 1200
[1] The premounted housing consist of preassembly:
• Key insertion
• Terminal strip
• Earth clamps
BA211Y57

9 Technical Data

General information

Manufacturer	Endress+Hauser
Instrument	Pressure transmitter
Designation	Cerabar S PMC 631, PMP 635, PMC 731, PMP 731
Technical documentation Version Technical data	BA 211P/00/en 04.00 DIN 19259

Input

Measured variables	Absolute and gauge pressure in gases, vapours, liquids
Measuring ranges	As stated on nameplate

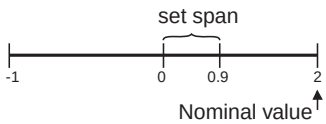
Output

Output signal	Digital communication signal, Foundation Fieldbus protocol
FF function	Publisher-Subscriber
Transmission rate	31.25 kBit/s
Signal on alarm	Signal: Status bit set, last valid measured value will be held Display module: error code
Damping	0…40 s via configuration tool
Communication resistance	Foundation Fieldbus termination resistor

Accuracy

* Values for instruments with diaphragm seals PMC 631, PMP 635 are identified by *

Explanation of terms:
Turndown (TD) =
Nominal value / set span



Example: Nominal value = 2 bar
set span = 0.9 bar

Reference conditions	DIN IEC 770 T_U=25 °C Accuracy data adopted after entering "Low sensor calibration" and "High sensor calibration" for lower range value and upper range value
Linearity including hysteresis and repeatability based on the limit point method to IEC 770	to TD 10:1: ±0.1 % (* ±0.2 %) of set span for TD 10:1 to 20:1: ±0.1 % (* ±0.2 %) x [nominal value/(set span x 10)]
For small absolute pressure ranges more detailed information on linearity is required. This is specified by the smallest possible measurement error which can be supplied by the DKD calibration centre.	Absolute: for >30 mbar <100 mbar span: ±0.3 % for ≤ 30 mbar: ±1 % of set span
Thermal changes (applies to transmitters without diaphragm seals or capillary tubing)	for –10…+60 °C: ±(0,1 % x TD + 0,1 %) for –40…–10 °C, +60 °C…+85 °C: ±(0.2 % x TD + 0.2 %) with reference to the set span
Thermal changes for Cerabar S with PTFE seal PMC 731 - # # ## # # # ## D	for –20…+85 °C: ±(0.2 % x TD + 0.4 %): 0.1 bar ±(0.2 % x TD + 0.2 %): 0.4 bar, 2 bar ±(0.1 % x TD + 0.1 %)10 bar, 40 bar
Temperature coefficient (for the set span; applies to transmitters without diaphragm seals or capillary tubing)	Zero signal and output span: ±0.02 % of nominal value / 10 K at –10…+60 °C ±0.05 % of nominal value / 10 K at –40…–10 °C and +60…+85 °C
Temperature coefficient for Cerabar S with PTFE seal PMC 731 - # # ## # # # ## D	Zero signal and output span: ±0.05 % of nominal value / 10 K at –20…+85 °C
Settling time	Ceramic measuring cell: ± 500 ms, metal measuring cell: ±400 ms
Rise time	150 ms (T_{90} time)
Long-term drift with reference to span	0.1 year

Process conditions

Process temperature	–40…+100 °C (for EEx see Certificate of Conformity)
Ambient temperature	–40…+85 °C (for EEx see Certificate of Conformity)
Ambient temperature range	–40…+100 °C (for EEx see Certificate of Conformity)
Storage temperature	–40…+100 °C (for EEx see Certificate of Conformity)
Electromagnetic compatibility	Interference emission to EN 61 326 electrical equipment B Interference immunity to EN 61 326 Annex A (industrial) and NAMUR directive NE 21, Interference immunity to EN 61 000-4-3: 30 V/m Use twisted screened two-wire cabling.
Protection	IP 65
Climatic class	4K4H to DIN EN 60721-3

Mechanical construction

Dimensions	See Fig. 10.1 and 10.2 as well as TI 216P and 217P
Housing	Housing can be rotated, Separate electronic and connection compartments, Optional electrical connection via Pg 13.5 with cable gland or M 20x1.5, G ½, ½ NPT thread, Terminal connection for cable cross-section 0.5…2.5 mm
Process connections	All common thread and diaphragm seal versions

Materials

Housing	Cast aluminium housing with protective polyester-based powder coating RAL 5012 (blue), cover RAL 7035 (grey), seawater resistant, seawater spray test DIN 50021 (504 h) passed
Nameplate	1.4301 (AISI 304)
Process connections PMC 731	1.4571 (AISI 316 Ti) or Hastelloy 2.4819 (C276)
PMP 731	1.4571 (AISI 316 Ti) or Hastelloy 2.4819 with diaphragm in Hastelloy
PMC 631, PMP 635	1.4571 (AISI 316 Ti)
Process diaphragm PMC 731	Al_2O_3 Aluminium oxide ceramic
PMP 731	1.4435 (AISI 316 L) or Hastelloy 2.4819
PMC 631	1.4435 (AISI 316 L)
PMP 635	optional 1.4435 (AISI 316 L), Hastelloy 2.4819, Tantalum, PTFE film
Seals PMC 731	FPM Viton, FPM Viton grease-free, FPM Viton oil and grease-free for oxygen applications, NBR (DVGW), NBR, Kalrez, EPDM, PTFE
O-ring for sealing cover	NBR
Mounting accessories	Bracket for pipe and wall mounting 1.4301 (AISI 304)
Filling fluid in diaphragm seals PMC 631, PMP 635	Silicone oil, vegetable oil, glycerine, high-temperature oil, Fluorolobe grease-free for oxygen

Measuring cell

Oil filling PMC 731	None, dry sensor
PMP 731	Optional silicone or inert oil (Voltalef) for oxygen

Display and operating interface

Display (optional)	Four-character LC display, with segment display of signal current
Operation	Via four keys Z–, Z+, S–, S+
Remote operation	Via interface card H1 direct connection to PC with operating program or via Link and interface card H1 connection to PC with operating program
Communication interface	Foundation Fieldbus

Power supply

Power supply voltage	Standard: 9…32 V DC; EEx: 9…24 V DC
Current consumption	10.5 mA ±1 mA
Power up current	Corresponds to Table 4, IEC 1158-2

Dimensions Cerabar S

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

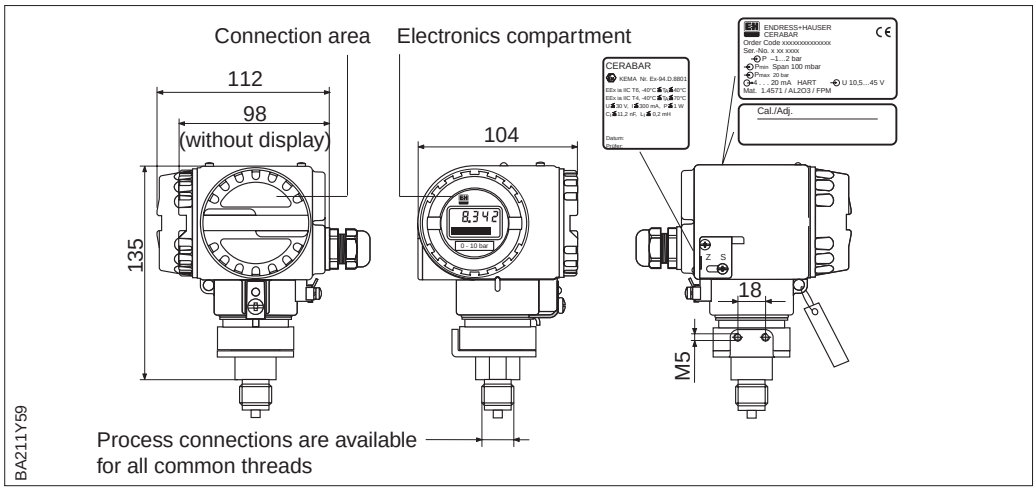
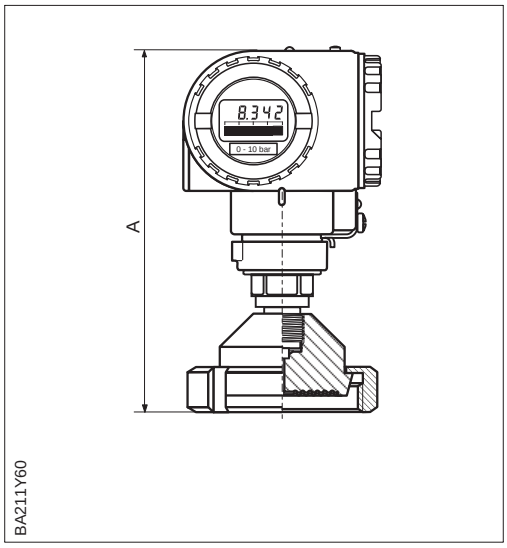


Figure 9.1
Cerabar PMC 731/PMP 731



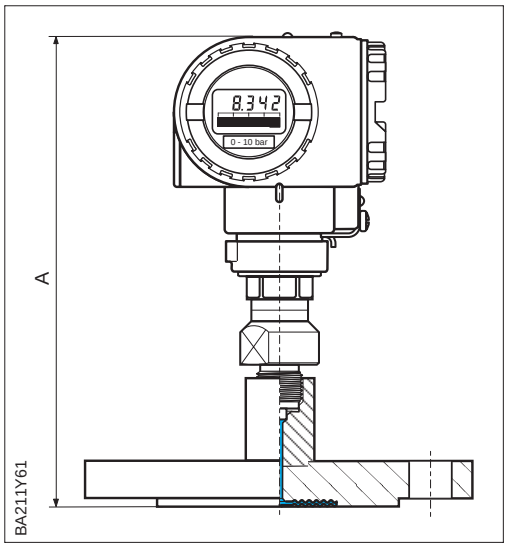


Figure 9.2
left:
Cerabar S PMC 631
with dairy thread
right:
Cerabar S PMP 635 with flange.
See TI 216P and TI 217P for other process connections

Index

S

T

W

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