



ACCU P

**Pressure transmitter
ACCU P320/P420 with 4 to 20 mA/HART**

Operating Instructions

ACCU3..-.....-.... (ACCU P320)
ACCU4..-.....-.... (ACCU P420)

09/2019

Legal information

Warning notice system

This manual contains notices you have to observe in order to ensure your personal safety, as well as to prevent damage to property. The notices referring to your personal safety are highlighted in the manual by a safety alert symbol, notices referring only to property damage have no safety alert symbol. These notices shown below are graded according to the degree of danger.

DANGER

indicates that death or severe personal injury **will** result if proper precautions are not taken.

WARNING

indicates that death or severe personal injury **may** result if proper precautions are not taken.

CAUTION

indicates that minor personal injury can result if proper precautions are not taken.

NOTICE

indicates that property damage can result if proper precautions are not taken.

If more than one degree of danger is present, the warning notice representing the highest degree of danger will be used. A notice warning of injury to persons with a safety alert symbol may also include a warning relating to property damage.

Qualified Personnel

The product/system described in this documentation may be operated only by **personnel qualified** for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel are those who, based on their training and experience, are capable of identifying risks and avoiding potential hazards when working with these products/systems.

Proper use of S.K.I. products

Note the following:

WARNING

S.K.I. products may only be used for the applications described in the catalog and in the relevant technical documentation. If products and components from other manufacturers are used, these must be recommended or approved by S.K.I.. Proper transport, storage, installation, assembly, commissioning, operation and maintenance are required to ensure that the products operate safely and without any problems. The permissible ambient conditions must be complied with. The information in the relevant documentation must be observed.

Trademarks

All names identified by © are registered trademarks of S.K.I. AG. The remaining trademarks in this publication may be trademarks whose use by third parties for their own purposes could violate the rights of the owner.

Disclaimer of Liability

We have reviewed the contents of this publication to ensure consistency with the hardware and software described. Since variance cannot be precluded entirely, we cannot guarantee full consistency. However, the information in this publication is reviewed regularly and any necessary corrections are included in subsequent editions.

Inhalt

1	Getting Started.....	8
1.1	Commissioning the device without display	8
1.2	Commissioning the device with display	9
2	Introduction.....	13
2.1	Purpose of this documentation	13
2.2	Document history	13
2.3	Product compatibility	14
2.4	Scope of validity of this document	14
2.5	Checking the consignment.....	14
2.6	Security information	15
2.7	Transportation and storage	15
2.8	Notes on warranty	16
3	Safety information	17
3.1	Precondition for use	17
3.1.1	Warning symbols on the device	17
3.1.2	Laws and directives	17
3.1.3	Conformity with European directives	17
3.2	Requirements for special applications	18
3.3	Use in hazardous areas	18
4	Description.....	19
4.1	Area of application	19
4.2	Structure.....	21
4.3	Nameplate layout	22
4.4	Functional principle	23
4.4.1	How the electronics work	24
4.4.2	Measuring cell operation	25
4.5	System configuration	30
5	Installing/mounting	33
5.1	Basic safety instructions	33
5.1.1	Installation location requirements	35
5.1.2	Proper mounting.....	36
5.2	Installation	36
5.2.1	Installation configuration	36
5.2.2	Fastening with the mounting bracket	38
5.3	Installing electrical connections and cable entries.....	39

5.4	Rotating the display	39
5.5	Rotating the enclosure	42
5.6	Removing	43
6	Connecting	45
6.1	Basic safety instructions	45
6.2	Connecting the device	46
6.2.1	Opening the device	46
6.2.2	Connecting the device	47
6.2.3	Closing the device.....	49
6.3	Connect the Han cable socket to the cable	49
6.4	Connect M12 cable socket to the cable	50
7	Operating.....	53
7.1	Buttons	53
7.2	Operating the device with display	54
7.2.1	Display	54
7.2.2	Navigating in the views	55
7.2.3	Measurement view	55
7.2.4	Parameter view	57
7.2.5	Edit view.....	59
7.3	Remote operation	61
7.4	Locking the device	61
7.4.1	Enable write protection with jumper	61
7.4.2	Enable user PIN.....	63
7.4.3	Enabling button lock.....	63
8	Commissioning	65
8.1	Basic safety instructions	65
8.2	Switching on the supply voltage	66
8.3	Commissioning the device without display	66
8.4	Commissioning the device with display	68
8.5	Application examples	70
8.5.1	gauge pressure, absolute pressure from the differential pressure series and absolute pressure from the gauge pressure series	70
8.5.2	Differential pressure and volume flow.....	73
9	Parameter assignment	79
9.1	Overview of parameters and functions	79
9.2	Parameter assignment over device with display	84
9.2.1	Pressure units [01]	84
9.2.2	Set lower range value [02]/Set upper range value [03]	86
9.2.3	Damping value [04]	88
9.2.4	Application [05]	88
9.2.5	Application point [06].....	95
9.2.6	Zero point adjustment [07]	95

9.2.7	Apply lower range value [08]/Apply upper range value [09]	98
9.2.8	Select fault current [10]	100
9.2.9	Lower fault current [11]	101
9.2.10	Upper fault current [12]	101
9.2.11	Lower saturation limit [13]	102
9.2.12	Upper saturation limit [14]	102
9.2.13	SV selection [15]	103
9.2.14	Units [16]	103
9.2.15	Temperature units [17]	105
9.2.16	Lower scaling point [18]	105
9.2.17	Upper scaling point [19]	106
9.2.18	Low flow cut-off [20]	107
9.2.19	Button lock [23]	108
9.2.20	Change user PIN [24]	109
9.2.21	Recovery ID [25]	110
9.2.22	PIN recovery [26]	111
9.2.23	User PIN [27]	112
9.2.24	Active device mode [28]	114
9.2.25	Functional Safety [29]	114
9.2.26	Display test [30]	115
9.2.27	Loop test [31]	115
9.2.28	Start view [32]	116
9.2.29	Pressure reference [33]	117
9.2.30	Identify the device [34]	117
9.2.31	Reset [35]	118
9.3	Parameter assignment over remote operation	120
9.3.1	Introduction	120
9.3.2	Quick start	120
9.3.3	Identification	121
9.3.4	Simulation	121
9.3.5	Customized characteristic curve	124
9.3.6	Sensor calibration	126
9.3.7	Digital-to-analog converter adjustment (DAC adjustment)	127
9.3.8	Diagnostics functions	128
10	Service and maintenance	133
10.1	Basic safety instructions	133
10.2	Cleaning	133
10.2.1	Cleaning the enclosure	133
10.3	Maintenance and repair work	134
10.3.1	Basic safety instructions	134
10.3.2	Checking the gaskets	135
10.3.3	Check cable glands	136
10.3.4	Replacing spare parts	136
10.4	Return procedure	139
10.5	Disposal	140
11	Diagnostics and troubleshooting	141
11.1	Device status symbols	141

11.2	Diagnostic messages	144
12	Technical data	151
12.1	Input	151
12.1.1	Gauge pressure	151
12.1.2	Gauge pressure with front-flush diaphragm	152
12.1.3	Gauge pressure from the differential pressure series	153
12.1.4	Absolute pressure from the gauge pressure series	154
12.1.5	Absolute pressure with front-flush diaphragm	155
12.1.6	Absolute pressure from the differential pressure series	156
12.1.7	Differential pressure and flow	157
12.2	Measuring accuracy of ACCU P320	159
12.2.1	Reference conditions	159
12.2.2	Effect of auxiliary power supply	159
12.2.3	Gauge pressure	159
12.2.4	Gauge pressure from the differential pressure series	160
12.2.5	Absolute pressure from gauge and differential pressure series	162
12.2.6	Absolute pressure with front-flush diaphragm	163
12.2.7	Gauge pressure with front-flush diaphragm	164
12.2.8	Differential pressure and flow	165
12.3	Measuring accuracy of ACCU P420	167
12.3.1	Reference conditions	167
12.3.2	Effect of auxiliary power supply	168
12.3.3	Gauge pressure	168
12.3.4	Gauge pressure from the differential pressure series	169
12.3.5	Absolute pressure from gauge and differential pressure series	171
12.3.6	Absolute pressure with front-flush diaphragm	172
12.3.7	Gauge pressure with front-flush diaphragm	173
12.3.8	Differential pressure and flow	173
12.4	Output	177
12.5	Operating conditions	177
12.6	Vibration resistance	181
12.7	Construction	183
12.8	Torques	186
12.9	Display, keyboard and auxiliary power	186
12.10	certificates and approvals	187
13	Dimension drawings	189
13.1	ACCU P320/P420 for gauge pressure and absolute pressure from the gauge pressure series.....	189
13.2	ACCU P320/P420 for differential pressure, gauge pressure, flow and absolute pressure from the differential pressure series	191
13.2.1	Note 3A and EHDG.....	193
13.2.2	Connections as per EN and ASME.....	194
A.1	Technical support.....	195
B.1	Pressure transmitter abbreviations	197

Getting Started

1.1 Commissioning the device without display

Introduction

In this section, you will learn how to commission the device step-by-step.

Before you start, please read the following safety information:

- General safety information (Page 17)
- Basic safety information: Installing/mounting (Page 33)
- Basic safety information: Connecting (Page 45)
- Basic safety information: Commissioning (Page 65)

Read the entire device manual in order to achieve the optimum performance of the device.

Procedure

1. Mount the device.
Installation (except level) (Page 36)
2. Connect the device.
Connecting the device (Page 46)
3. Switch on the power supply.
Switching on the supply voltage (Page 66)

4. Open the cover of the buttons:

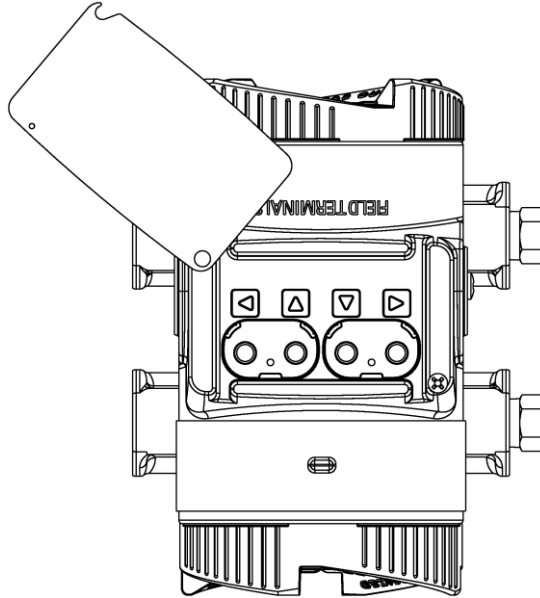


Figure 1-1 Top view

5. Operate the buttons as follows:

Apply lower range value (with pressure applied)	Hold down the button ▼ for 3 seconds.
Apply upper range value (with pressure applied)	Hold down the button ▲ for 3 seconds.
Zero point adjustment	Hold down the buttons ▲ and ▼ for 3 seconds.
Set Upper fault current	Hold down the button ◀ for 3 seconds.
Set Lower fault current	Hold down the button ▶ for 3 seconds.

Further functions are available via remote operation (e.g. SIMATIC PDM).

See also

Parameter assignment (Page 79)

Diagnostics and troubleshooting (Page 141)

1.2 Commissioning the device with display

Introduction

In this section, you will learn how to commission the device step-by-step.

Before you start, please read the following safety information:

- General safety information (Page 17)
- Basic safety information: Installing/mounting (Page 33)
- Basic safety information: Connecting (Page 45)
- Basic safety information: Commissioning (Page 65)

Read the entire device manual in order to achieve the optimum performance of the device.

Procedure

1. Mount the device.
Installation (except level) (Page 36)
2. Connect the device.
Connecting the device (Page 46)
3. Switch on the power supply.
Switching on the supply voltage (Page 66)
4. Open the cover of the buttons:

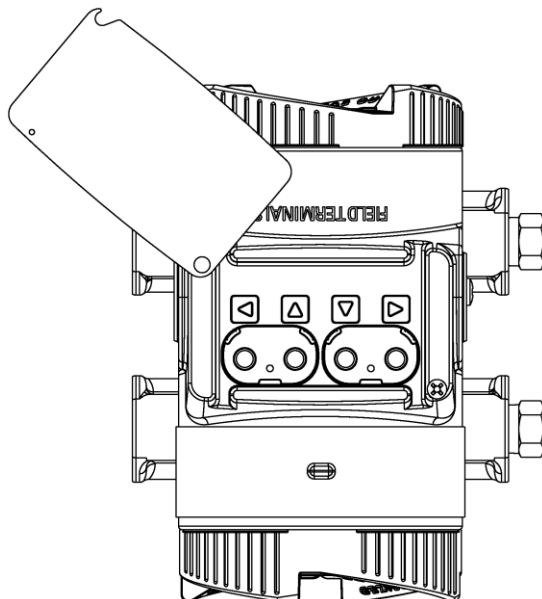


Figure 1-2 Top view

5. Set the measuring range.
Set lower range value/upper range value (without pressure available) (Page 87)
Apply lower range value/upper range value (with pressure present) (Page 98)
6. Set the pressure unit.
Setting the pressure units (Page 85)

7. Set the application of your device.
Set application (Page 95)
8. Set the scaling points.
Set lower scaling point (Page 106)
Set upper scaling point (Page 107)
9. Set the zero point.
Adjusting zero point (gauge pressure) (Page 96)
Adjusting the zero point (differential pressure) (Page 96)
Adjusting zero point (absolute pressure) (Page 97)
10. Lock the device.
Locking the device (Page 61)
11. Enable Functional Safety (for devices with Functional Safety).
Enabling Functional Safety over device with display.
You can find additional functions in the section Parameter assignment (Page 79)

See also

Diagnostics and troubleshooting (Page 141)

Introduction

2.1 Purpose of this documentation

These instructions contain all information required to commission and use the device. Read the instructions carefully prior to installation and commissioning. In order to use the device correctly, first review its principle of operation.

The instructions are aimed at persons mechanically installing the device, connecting it electronically, configuring the parameters and commissioning it, as well as service and maintenance engineers.

2.2 Document history

The overview below summarizes the most important changes in the documentation when compared to the previous edition.

Edition	Note
06/2019	First edition

2.3 Product compatibility

The following table describes the compatibility between the edition of this manual, the device revision, the engineering system and the associated EDD.

Edition	Comments	Product compatibility	Compatibility with device integration package
09/2019	First edition	HART 7 FW: 1.00.08 or higher HW: 1.00.00 or higher	SIMATIC PDM V9.0 or higher AMS Device Manager V13 or higher DTM Pactware V4.1 SP4 FC475 V3.9 or higher

2.4 Scope of validity of this document

Variant	ACCU P320 mA/HART	ACCU P420 mA/HART
Gauge pressure	ACCU300	ACCU400
Gauge pressure from the differential pressure series	ACCU310	ACCU410
Absolute pressure from the gauge pressure series	ACCU320	ACCU420
Absolute pressure from the differential pressure series	ACCU330	ACCU430
Differential pressure and flow rate, PN 160 (MAWP 2320 psi)	ACCU340	ACCU440
Differential pressure and flow rate, PN 420 (MAWP 6092 psi)	ACCU350	ACCU450
Level	ACCU360	ACCU460

2.5 Checking the consignment

1. Check the packaging and the delivered items for visible damages.
2. Report any claims for damages immediately to the shipping company.
3. Retain damaged parts for clarification.
4. Check the scope of delivery by comparing your order to the shipping documents for correctness and completeness.

WARNING

Using a damaged or incomplete device

Risk of explosion in hazardous areas.

- Do not use damaged or incomplete devices.

See also

Return procedure (Page 139)

Technical data (Page 151)

2.6 Security information

S.K.I. provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines, and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. S.K.I.' products and solutions only form one element of such a concept.

Customer is responsible to prevent unauthorized access to its plants, systems, machines and networks. Systems, machines and components should only be connected to the enterprise network or the internet if and to the extent necessary and with appropriate security measures (e.g. use of firewalls and network segmentation) in place.

Additionally, S.K.I.' guidance on appropriate security measures should be taken into account. You can find more information about industrial security by visiting:
<https://www.S.K.I..com/industrialsecurity>.

S.K.I.' products and solutions undergo continuous development to make them more secure. S.K.I. strongly recommends you apply product updates as soon as available and always use the latest product versions. Use of product versions that are no longer supported, and failure to apply latest updates may increase customer's exposure to cyber threats.

To stay informed about product updates, subscribe to the S.K.I. Industrial Security RSS Feed under
<https://www.S.K.I..com/industrialsecurity>.

2.7 Transportation and storage

To guarantee sufficient protection during transport and storage, observe the following:

- Keep the original packaging for subsequent transportation.
- Devices/replacement parts should be returned in their original packaging.
- If the original packaging is no longer available, ensure that all shipments are properly packaged to provide sufficient protection during transport. S.K.I. cannot assume liability for any costs associated with transportation damages.

NOTICE**Insufficient protection during storage**

The packaging only provides limited protection against moisture and infiltration.

- Provide additional packaging as necessary.

Special conditions for storage and transportation of the device are listed in Technical data (Page 151).

2.8 Notes on warranty

The contents of this manual shall not become part of or modify any prior or existing agreement, commitment or legal relationship. The sales contract contains all obligations on the part of S.K.I. as well as the complete and solely applicable warranty conditions. Any statements regarding device versions described in the manual do not create new warranties or modify the existing warranty.

The content reflects the technical status at the time of publishing. S.K.I. reserves the right to make technical changes in the course of further development.


Safety information

3.1 Precondition for use

This device left the factory in good working condition. In order to maintain this status and to ensure safe operation of the device, observe these instructions and all the specifications relevant to safety.

Observe the information and symbols on the device. Do not remove any information or symbols from the device. Always keep the information and symbols in a completely legible state.

3.1.1 Warning symbols on the device

Symbol	Explanation
	Consult operating instructions

3.1.2 Laws and directives

Observe the safety rules, provisions and laws applicable in your country during connection, assembly and operation. These include, for example:

- National Electrical Code (NEC - NFPA 70) (USA)
- Canadian Electrical Code (CEC) (Canada)


3.1.3 Conformity with European directives

The CE mark on the device is a sign of conformity with the following European directives:

Electromagnetic compatibility EMC 2014/30/EU	Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to electromagnetic compatibility
--	---

Pressure Equipment Directive PED 2014/68/EU	Directive of the European Parliament and of the Council on the harmonization of the laws of the Member States relating to the making available on the market of pressure equipment
---	--

The directives applied can be found in the EU declaration of conformity for the associated device.

 WARNING
Improper device modifications <ul style="list-style-type: none">• Only carry out modifications that are described in the instructions for the device. Failure to observe this requirement cancels the manufacturer's warranty and the product approvals.


3.2 Requirements for special applications

Due to the large number of possible applications, each detail of the described device versions for each possible scenario during commissioning, operation, maintenance or operation in systems cannot be considered in the instructions. If you need additional information not covered by these instructions, contact your local S.K.I. office or company representative.

Note

Operation under special ambient conditions

We highly recommend that you contact your S.K.I. representative or our application department before you operate the device under special ambient conditions as can be encountered in nuclear power plants or when the device is used for research and development purposes.

 DANGER
Using equipment with approval-related restrictions <p>Risk of explosion, damage to property due to operating conditions not in conformity with the approval (e.g. temperature and pressure limits exceeded)</p> <ul style="list-style-type: none">• Take note of the approval restrictions before using the device. You can find the information on this in the current certificates.

3.3 Use in hazardous areas

The devices are not suitable for use in hazardous areas.

4

Description

4.1 Area of application

Overview

Depending on the variant, the pressure transmitter measures corrosive, non-corrosive and hazardous gases, vapors and liquids.

You can use the pressure transmitter for the following measuring tasks:

- Gauge pressure
- Absolute pressure
- Differential pressure

With the appropriate configuration and the necessary add-on parts (e.g. limiters and remote seals), you can also use the pressure transmitter for the following measuring tasks:

- Volume flow
- Mass flow
- Volume
- Customized characteristic curve

The output signal for all measuring tasks is a direct current of 4 to 20 mA.

You can install the "intrinsically-safe" or "flameproof enclosure" version of the pressure transmitter in hazardous areas. The devices have a test certification and comply with the corresponding directives.

Pressure transmitters with remote seals of various shapes can be provided for special applications. For example, measuring high-viscosity substances is a special application.

Operate the device in accordance with the specifications in section Technical data (Page 151).

Gauge pressure

This version measures aggressive, non-aggressive and hazardous gases, vapors and liquids.

There are two series: a "differential pressure" series and a "gauge pressure" series. The "differential pressure" series is distinguished by a high overload capability.

4.1 Area of application

Differential pressure and flow rate

This version measures corrosive, non-corrosive and hazardous gases, vapors and liquids. You can use this version for the following measurement types:

- Differential pressure, e.g. effective differential pressure
- Gauge pressure, suitable for small positive or negative pressure value
- In combination with a restrictor device: flow rate $q \sim \sqrt{\Delta p}$

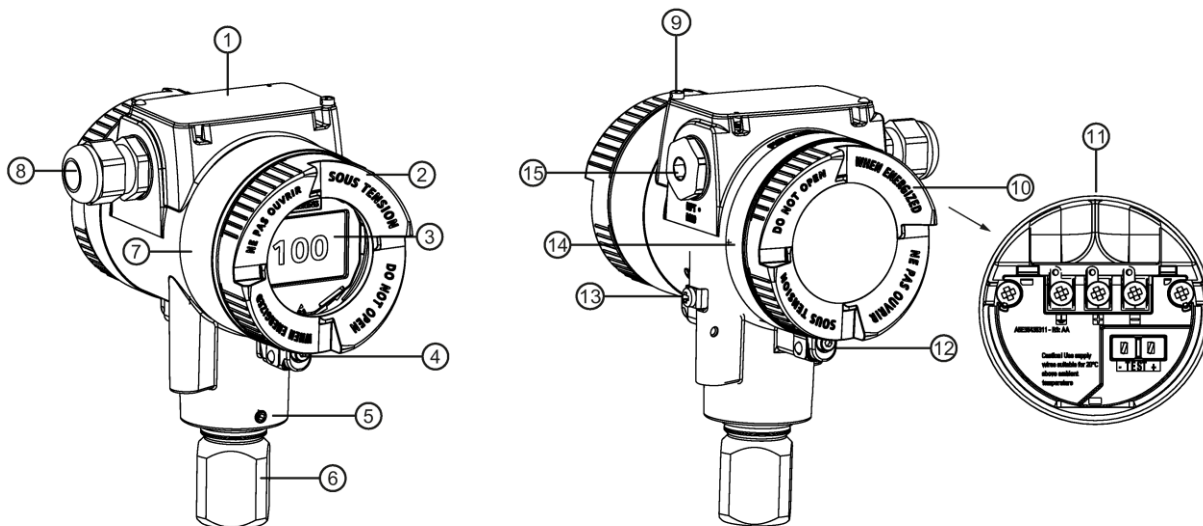
Absolute pressure

This version measures the absolute pressure of aggressive, non-aggressive and hazardous gases, vapors and liquids.

There are two series: a "differential pressure" series and a "gauge pressure" series. The "differential pressure" series is distinguished by a high overload capability.

4.2 Structure

Depending on a customer-specific order, the device comprises different parts.



- | | |
|---|--|
| ① Cover over buttons and nameplate with general information | ⑨ Screw for the cover over the buttons |
| ② Cover (front), optionally with inspection window | ⑩ Cover (rear) for electrical terminal compartment |
| ③ Display (optional) | ⑪ Electrical terminal compartment |
| ④ Safety catch (front) | ⑫ Safety catch (back) |
| ⑤ Retaining screw for locking the enclosure (Page 42) | ⑬ Ground terminal |
| ⑥ Process connection | ⑭ Nameplate with information on the remote seal |
| ⑦ Nameplate with approval information | ⑮ Blanking plug |
| ⑧ Cable inlet, optionally with cable gland | |

Figure 4-1 Example

- The electronics enclosure is made of die cast aluminum or precision cast stainless steel.
- The housing has a removable cover at the front and the back.
- Depending on the device version, the front cover ② may be designed with an inspection window.
- The cable gland ⑧ to the electrical terminal compartment is at the side; either the left or right-hand one can be used. The unused opening is closed with a blanking plug ⑮.
- The ground terminal ⑬ is located on the side.
- The electrical terminal compartment ⑪ for the supply voltage and shield is accessible when you remove the back cover ⑩.
- The measuring cell with a process connection ⑥ is located in the lower section of the enclosure.

The measuring cell is prevented from rotating by a retaining screw ⑤.

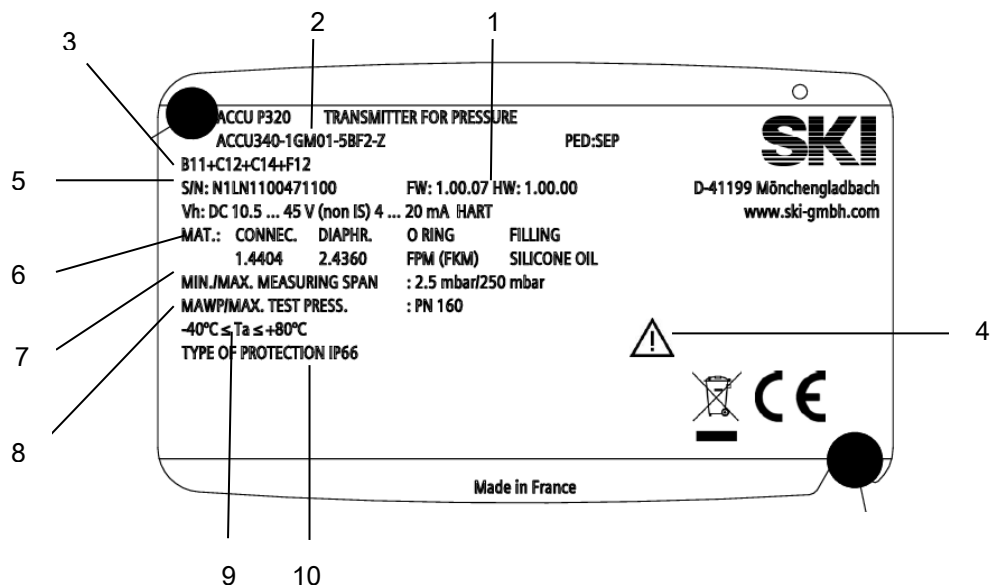
4.3 Nameplate layout

- The cover of the 4 buttons ① is located on the upper face of the enclosure. The nameplate with general information is located on the cover.

4.3 Nameplate layout

Nameplate with general information

The nameplate with the article number and other important information, such as design details and technical data, is located on the cover over the buttons.



- | | |
|---|--|
| ① Firmware and hardware identification | ⑦ Minimum/maximum measuring span |
| ② Article number (MLFB number) | ⑧ Maximum allowable operating pressure / maximum allowable test pressure |
| ③ Order supplement (order code) | ⑨ Permitted ambient temperature |
| ④ Note operating instructions, certificates and approvals | ⑩ Protection class |
| ⑤ Serial number | |
| ⑥ Materials, connection, diaphragm, O-ring, oil | |

Figure 4-2 Example

Measuring point label

The measuring point label is fastened with a wire under the front cover.

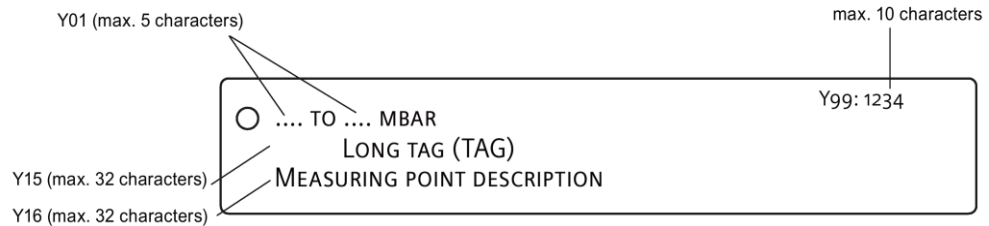


Figure 4-3 Example

4.4 Functional principle

This chapter describes how the pressure transmitter works.

First the electronics are described, and then the physical principle of the sensors which are used with the various device versions for the individual measurement types.

4.4.1 How the electronics work

Description

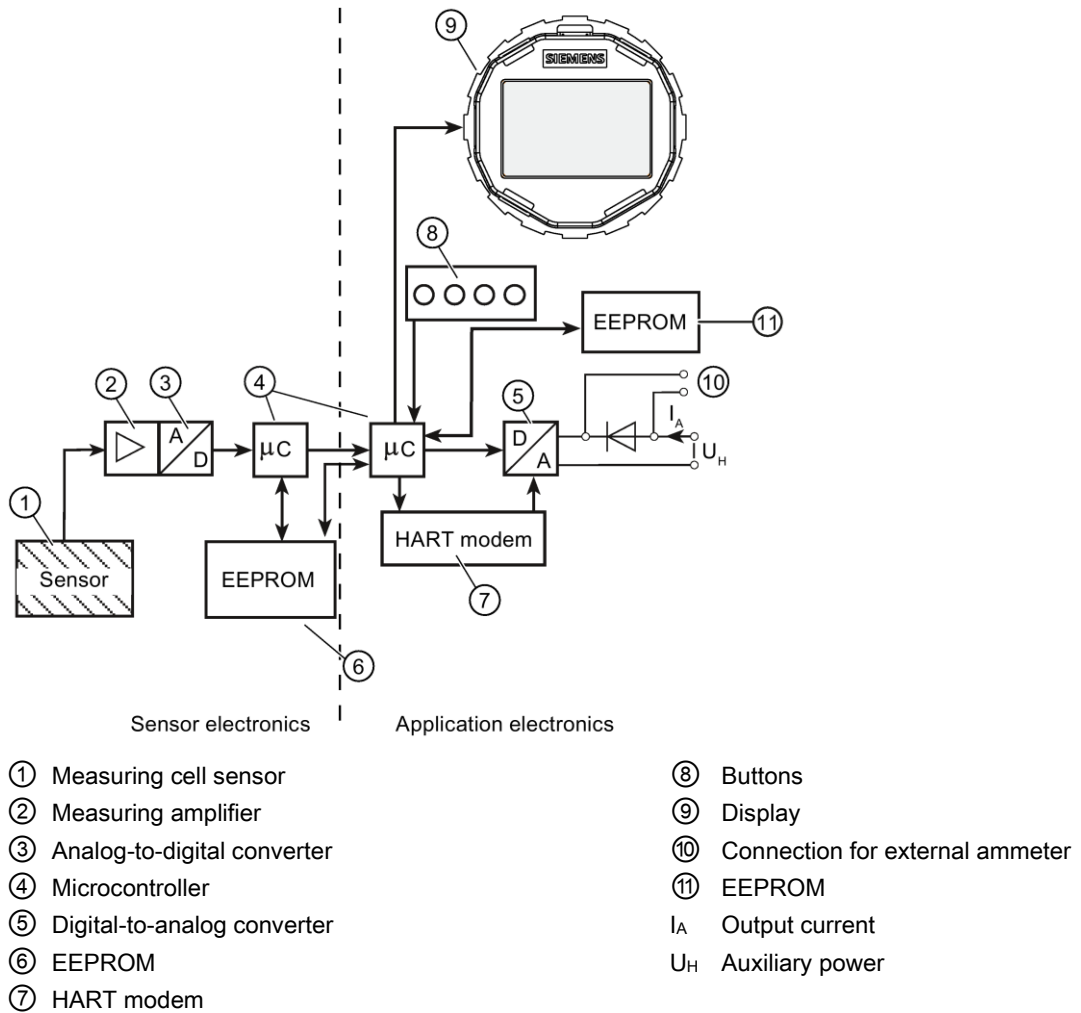


Figure 4-4 How the electronics work

Function

- The input pressure is converted into an electrical signal by the sensor ①.
- This signal is amplified by the measuring amplifier ② and digitized in an analog-to-digital converter ③.
- The digital signal is analyzed in a microcontroller ④ and corrected with regard to linearity and thermal characteristics.
- The digital signal is then converted in a digital-to-analog converter ⑤ into the output current of 4 to 20 mA.


A diode circuit provides reverse polarity protection.


- You can make an uninterrupted current measurement with a low resistance ammeter at the connection ⑩.
- The measuring cell-specific data, electronics data and parameter assignment data are saved in two EEPROM modules. The first EEPROM module ⑥ is linked to the measuring cell, the second EEPROM module ⑪ to the electronics.

Operation

- The buttons ⑧ can be used to call up individual functions.
- If you have a device with a display ⑨, you can view the measurement results, parameter values and messages.
- With a computer and HART modem ⑦, you can operate the device via the engineering system (e.g. SIMATIC PDM).

4.4.2 Measuring cell operation

 WARNING
<p>Destruction of the seal diaphragm</p> <p>Danger of injury or damage to device</p> <p>If the seal membrane is destroyed, the sensor may also be destroyed. If the seal membrane is destroyed, no reliable measured values can be output.</p> <p>Hot, toxic and corrosive process media can be released.</p> <ul style="list-style-type: none"> • Ensure that the material of the device parts wetted by the process medium is suitable for the medium. Refer to the information in section Technical data (Page 151). • Make sure that the device is suitable for the maximum operating pressure of your system. Refer to the information on the nameplate and/or in Technical data (Page 151). • Define maintenance intervals for regular inspections in line with device use and empirical values. The maintenance intervals will vary from site to site depending on corrosion resistance.

 WARNING
<p>Wetted parts unsuitable for the process medium</p> <p>Danger of injury or damage to device.</p> <p>Hot, toxic and corrosive media could be released if the process medium is unsuitable for the wetted parts.</p> <ul style="list-style-type: none"> • Ensure that the material of the device parts wetted by the process medium is suitable for the medium. Refer to the information in section Technical data (Page 151).

In the following sections, the process variable to be measured is called general inlet pressure.

Overview

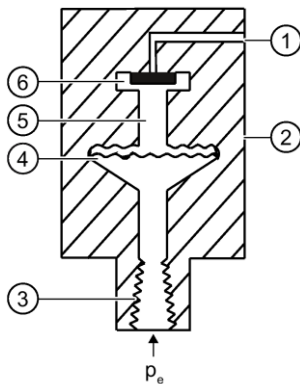
The following modes of operation are described:

- Gauge pressure
- Absolute pressure
- Differential pressure and flow rate
- Level

The following process connections are available, for example:

- G1/2 B, 1/2-14 NPT
- Male thread: M20
- Flange connection in accordance with EN 61518
- Flush-mounted process connections

4.4.2.1 Measuring cell for gauge pressure



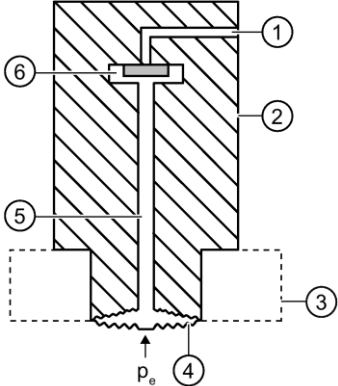
- | | | | |
|---|----------------------------|-------|-----------------------|
| ① | Reference pressure opening | ⑤ | Filling liquid |
| ② | Measuring cell | ⑥ | Gauge pressure sensor |
| ③ | Process connection | p_e | Inlet pressure |
| ④ | Seal diaphragm | | |

Figure 4-5 Function chart of measuring cell for gauge pressure

The inlet pressure (p_e) is transferred to the gauge pressure sensor ⑥ via the seal diaphragm ④ and the fill fluid ⑤, displacing its measuring diaphragm. The displacement changes the resistance of the four piezoresistors (bridge circuit) of the gauge pressure sensor. The change in the resistance causes a bridge output voltage proportional to the inlet pressure.

Pressure transmitters with measuring span ≤ 63 bar measure the inlet pressure against atmosphere, those with measuring spans ≥ 160 bar the inlet pressure against vacuum.

4.4.2.2 Measuring cell for gauge pressure, front-flush membrane



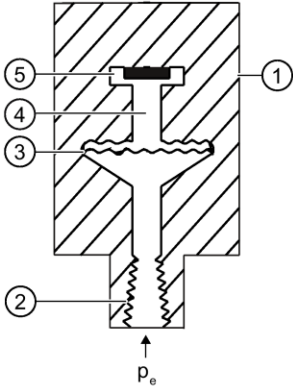
- ① Reference pressure opening
- ② Measuring cell
- ③ Process connection
- ④ Seal diaphragm
- ⑤ Filling liquid
- ⑥ Gauge pressure sensor
- p_e Inlet pressure

Figure 4-6 Function chart of the measuring cell for gauge pressure, flush mounted diaphragm

The inlet pressure (p_e) is transferred to the gauge pressure sensor ⑥ via the seal diaphragm ④ and the filling liquid ⑤, displacing its measuring diaphragm. The displacement changes the resistance of the four piezoresistors (bridge circuit) of the gauge pressure sensor. The change in the resistance causes a bridge output voltage proportional to the inlet pressure.

Pressure transmitters with measuring span ≤ 63 bar measure the inlet pressure against atmosphere, those with measuring spans ≥ 160 bar the inlet pressure against vacuum.

4.4.2.3 Measuring cell for absolute pressure from the gauge pressure series



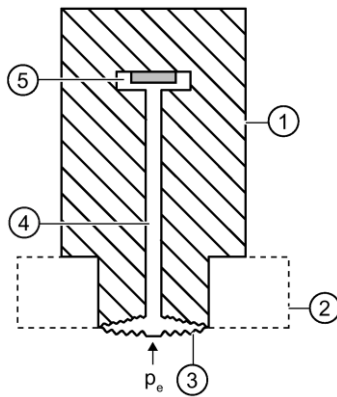
- ① Measuring cell
- ② Process connection
- ③ Seal diaphragm
- ④ Filling liquid
- ⑤ Absolute pressure sensor
- P_e Inlet pressure

Figure 4-7 Function chart of measuring cell for absolute pressure

4.4 Functional principle

- The inlet pressure (p_e) is transferred to the absolute pressure sensor ⑤ via the seal diaphragm ③ and the fill fluid ④, displacing its measuring diaphragm.
- The displacement changes the resistance of the four piezoresistors (bridge circuit) of the absolute pressure sensor.
- The change in the resistance causes a bridge output voltage proportional to the inlet pressure.

4.4.2.4 Measuring cell for absolute pressure, front-flush membrane



- | | |
|----------------------|----------------------------|
| ① Measuring cell | ④ Filling liquid |
| ② Process connection | ⑤ Absolute pressure sensor |
| ③ Seal diaphragm | p_e Inlet pressure |

Figure 4-8 Function chart of the measuring cell for absolute pressure, flush mounted diaphragm

- The inlet pressure (p_e) is transferred to the absolute pressure sensor ⑤ via the seal diaphragm ③ and the filling liquid ④, and displaces its measuring diaphragm.
- The displacement changes the resistance of the four piezoresistors (bridge circuit) of the absolute pressure sensor.
- The change in the resistance causes a bridge output voltage proportional to the inlet pressure.

4.4.2.5 Measuring cell for absolute pressure from the differential pressure series

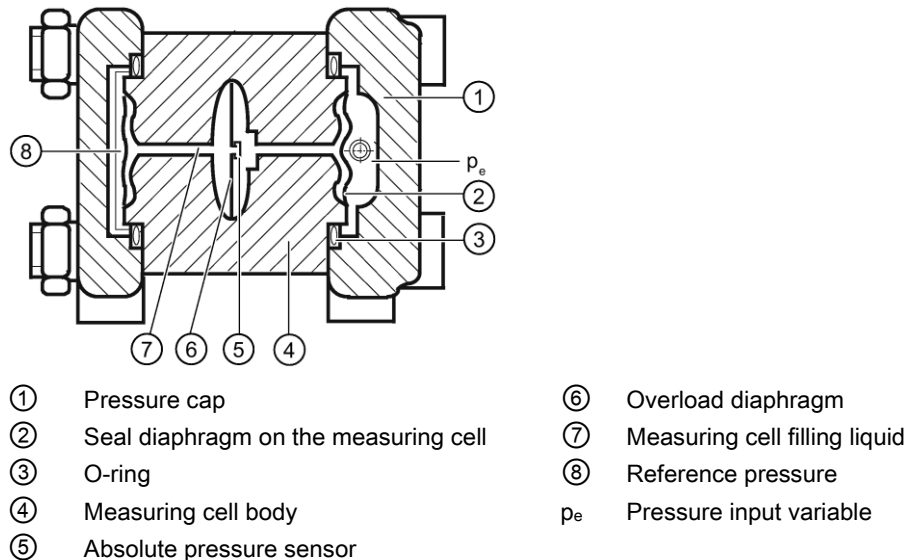
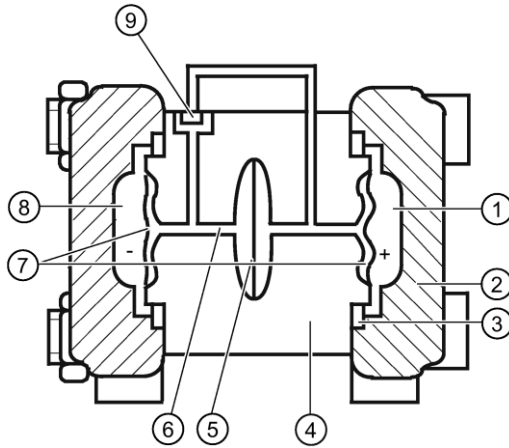


Figure 4-9 Function chart of measuring cell for absolute pressure

- Absolute pressure is transmitted to the absolute pressure sensor ⑤ through the seal diaphragm ② and the filling liquid ⑦.
- When measuring limits are exceeded, the overload diaphragm ⑥ is displaced until the seal diaphragm ② rests on the measuring cell body ④. The seal diaphragm thus protects the absolute pressure sensor ⑤ from overload.
- The difference between the inlet pressure (p_e) and the reference pressure ⑧ on the negative side of the measuring cell displaces the seal diaphragm ②. The displacement changes the resistance of the four piezoresistors (bridge circuit) of the absolute pressure sensor.
- The change in the resistance causes a bridge output voltage proportional to the absolute pressure.

4.4.2.6 Measuring cell for differential pressure and flow rate



- | | | | |
|---|-------------------------------|---|-------------------------------|
| ① | Inlet pressure P ₊ | ⑥ | Filling liquid |
| ② | Pressure cap | ⑦ | Seal diaphragm |
| ③ | O-ring | ⑧ | Inlet pressure P ₋ |
| ④ | Measuring cell body | ⑨ | Differential pressure sensor |
| ⑤ | Overload diaphragm | | |

Figure 4-10 Function chart of the measuring cell for differential pressure and flow rate

- Differential pressure is transmitted to the differential pressure sensor ⑨ through the seal diaphragms ⑦ and the filling liquid ⑥.
- When measuring limits are exceeded, the seal diaphragm ⑦ is displaced until the seal diaphragm rests on the measuring cell body ④. The differential pressure sensor ⑨ is thus protected against overloading since no further deflection of the overload diaphragm ⑤ is possible.
- The seal diaphragm ⑦ is displaced by the differential pressure. The displacement changes the resistance of the four piezoresistors (bridge circuit) of the differential pressure sensor.
- The change in the resistance causes a bridge output voltage proportional to the differential pressure.

4.5 System configuration

Overview

The pressure transmitter can be used in a number of system configurations:

- As a stand-alone version, supplied with the necessary auxiliary power
- As part of a complex system environment, e.g. SIMATIC S7

System communication

Communication is via the HART protocol, using:

- HART Communicator (load 230 ... 1100 Ω)
- PC with HART modem on which appropriate software is installed, e.g. SIMATIC PDM (load 230 ... 600 Ω)
- Control system which can communicate via the HART protocol, e.g. SIMATIC PCS7

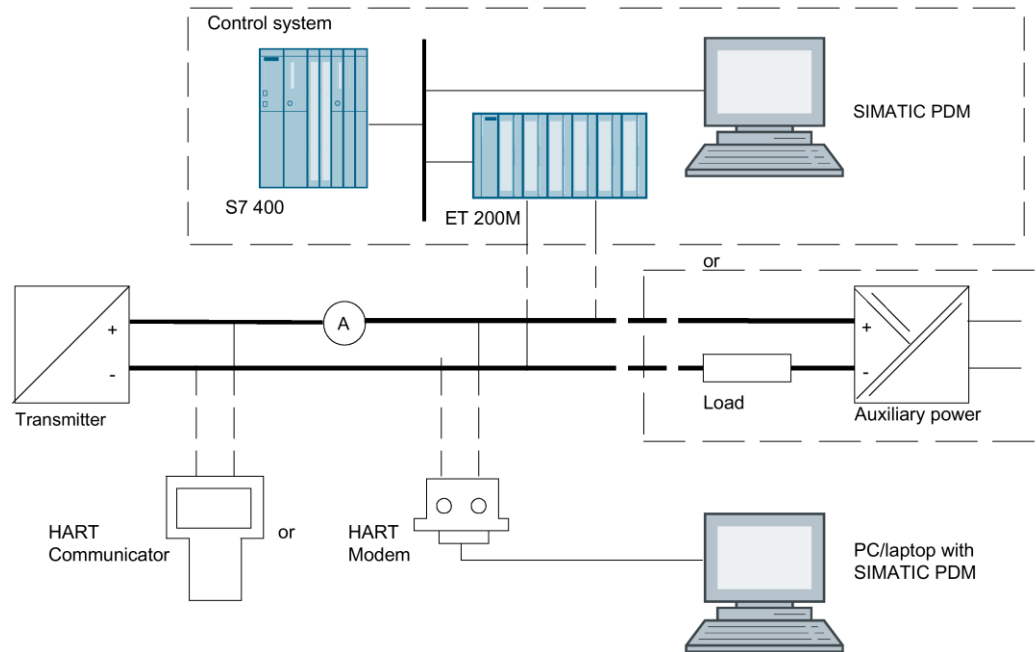


Figure 4-11 Possible system configuration

Installing/mounting

5.1 Basic safety instructions

DANGER

Pressure applications

Danger to personnel, system and environment will result from improper disassembly.

- Never attempt to loosen, remove, or disassemble process connection while vessel contents are under pressure.

WARNING

Wetted parts unsuitable for the process media

Risk of injury or damage to device.

Hot, toxic and corrosive media could be released if the process medium is unsuitable for the wetted parts.

- Ensure that the material of the device parts wetted by the process medium is suitable for the medium. Refer to the information in Technical data (Page 151).


WARNING


Unsuitable connecting parts


Risk of injury or poisoning.


In case of improper mounting, hot, toxic, and corrosive process media could be released at the connections.

- Ensure that connecting parts (such as flange gaskets and bolts) are suitable for connection and process media.

 WARNING
Exceeded maximum permissible operating pressure Risk of injury or poisoning. The maximum permissible operating pressure depends on the device version, pressure limit and temperature rating. The device can be damaged if the operating pressure is exceeded. Hot, toxic and corrosive process media could be released. Ensure that maximum permissible operating pressure of the device is not exceeded. Refer to the information on the nameplate and/or in Technical data (Page 151).

 WARNING
Vibrations in the plant Risk of injury or damage to device. Vibration leads to material fatigue, for example, cracks and weld seams breaks. Hot, toxic and corrosive process media can emerge. <ul style="list-style-type: none">• Make sure that you have mounted the pressure transmitter (including accessories) protected against vibration. Refer to the information on vibration resistance in the section Technical specifications.

 CAUTION
Hot surfaces resulting from hot process media Risk of burns resulting from surface temperatures above 65 °C (149 °F). <ul style="list-style-type: none">• Take appropriate protective measures, for example contact protection.• Make sure that protective measures do not cause the maximum permissible ambient temperature to be exceeded. Refer to the information in Technical data (Page 151).

 CAUTION
External stresses and loads Damage to device by severe external stresses and loads (e.g. thermal expansion or pipe tension). Process media can be released. <ul style="list-style-type: none">• Prevent severe external stresses and loads from acting on the device.

Note

Material compatibility

S.K.I. can provide you with support concerning selection of sensor components wetted by process media. However, you are responsible for the selection of components. S.K.I. accepts no liability for faults or failures resulting from incompatible materials.

5.1.1 Installation location requirements

 WARNING
--

Insufficient air supply

The device may overheat if there is an insufficient supply of air.
--

- | |
|--|
| <ul style="list-style-type: none">• Install the device so that there is sufficient air supply in the room.• Observe the maximum permissible ambient temperature. Refer to the information in the section Technical data (Page 151). |
|--|

 CAUTION
--

Aggressive atmospheres

Damage to device through penetration of aggressive vapors.
--

- | |
|---|
| <ul style="list-style-type: none">• Ensure that the device is suitable for the application. |
|---|

NOTICE

Direct sunlight

Increased measuring errors.

- | |
|--|
| <ul style="list-style-type: none">• Protect the device from direct sunlight. |
|--|

Make sure that the maximum ambient temperature is not exceeded. Refer to the information in the section Technical data (Page 151).
--

5.1.1.1 Devices with marine approval

Note

For vibrations in the direction of the measuring cell diaphragm, the measuring accuracy of the pressure transmitter with flush-mounted diaphragm can deviate no more than 0.2% from the respective specification.

- Install the device so that no or almost no vibrations occur in the direction of the diaphragms.
- To avoid measuring values that fluctuate strongly, use the damping function.

For information on vibration resistance, refer to the marine approval certificate.

5.1.2 Proper mounting

NOTICE
Incorrect mounting The device can be damaged, destroyed, or its functionality impaired through improper mounting. <ul style="list-style-type: none">• Before installing ensure there is no visible damage to the device.• Make sure that process connectors are clean, and suitable gaskets and glands are used.• Mount the device using suitable tools. Refer to the information in Technical data (Page 151).

5.2 Installation

5.2.1 Installation configuration

The pressure transmitter can be configured above or below the pressure sampling point. The recommended configuration depends on the aggregate state of the process medium.

Installation configuration for gases

Install the pressure transmitter above the pressure sampling point.

Lay the pressure tubing with a constant gradient to the pressure sampling point, so that any condensation produced can drain in the main line and thereby avoid corruption of the measured values.

Installation configuration for vapor and liquid

Install the pressure transmitter below the pressure sampling point.

Lay the pressure tubing with a constant gradient to the pressure sampling point so that any gas pockets can escape in the main line.

Mounting location

Verify that the mounting location meets the following conditions:

- Accessible
- Close to the measuring point
- Vibration-free
- Within the permitted ambient temperature values

Protect the pressure transmitter from:

- Direct heat radiation
- Rapid temperature fluctuations
- Heavy contamination
- Mechanical damage
- Direct sunlight

Requirement

- You have compared the desired operating data with the data on the nameplate.
- You have adhered to the information on the remote seal during its installation.

Procedure

1. Attach the pressure transmitter to the process connection.
Use an appropriate tool (e.g. open-ended wrench with width across flats 36). Otherwise, the measuring cell may be damaged.
2. Turn only on the key area above the process connection.
Caution: If you turn the pressure transmitter on the housing, the measuring cell may be damaged.
3. To guarantee secure and vibration-free installation of the pressure transmitter, fasten it to a mounting bracket (Page 38).

See also

Commissioning the device with display (Page 9)

5.2.2 Fastening with the mounting bracket

Introduction

You mount the pressure transmitter with the mounting bracket as described below:

- On a mounting range
- On a vertical or horizontal pipe (Ø 50 to 60 mm)

When securing, observe the torques in the section Torques (Page 186).

Note

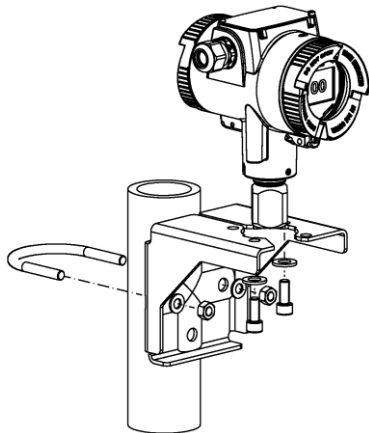
Install the device so that the pressure transmitter and the differential pressure lines are not subject to different vibrations. Otherwise there is a danger that the differential pressure lines will rupture.

Example 1: Pipe mounting of pressure transmitter (gauge pressure series)

The mounting bracket for the gauge pressure series includes, among other things:

- 2 screws
- One pipe clamp with nuts
- Washers

Mount the pressure transmitter as follows:

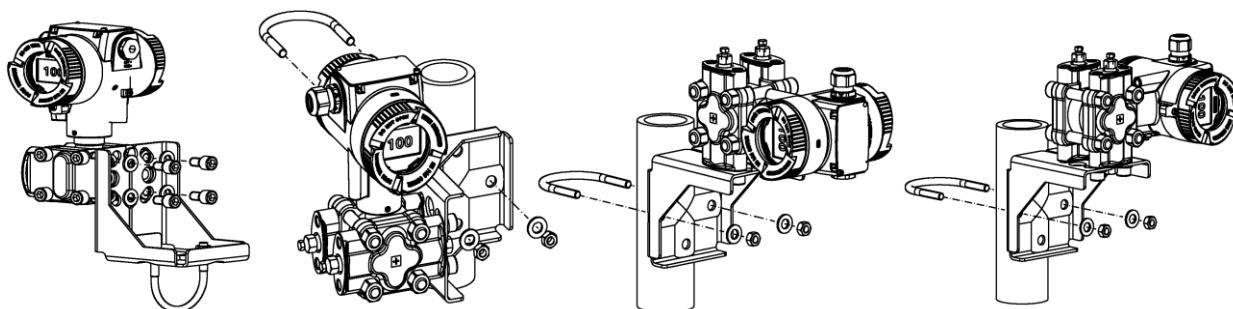


Example 2: Pipe mounting of pressure transmitter (differential pressure series)

The mounting bracket for the differential pressure series includes, among other things:

- 4 screws
- One pipe clamp with nuts
- Washers

You can then mount the pressure transmitter in different positions:

**5.3 Installing electrical connections and cable entries**

The device is delivered with dust caps installed on both sides at the factory.

You use the order options A.. to define the type of electrical connections and cable entries (cable gland, sealing plug or device plug) for your device.

These components are delivered with the device.

- To order the device with installed electrical connections and cable entries, select an additional order option A.. for the installation (e.g.: device plug installed on right).

Procedure

For the first installation follow these steps:

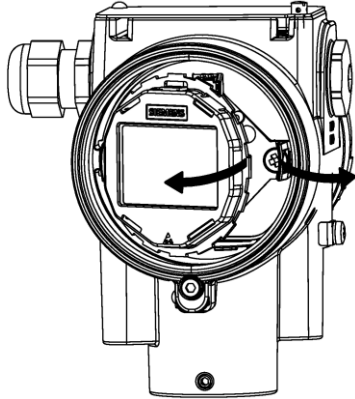
1. Ensure that the seals are clean and undamaged.
2. To ensure the IP degree of protection and explosion protection of the pressure transmitter, close the cable entries with a sealing plug, a cable gland or a device plug.

5.4 Rotating the display

To read the display in any mounting position, you have the option of gradually rotating the display 360°.

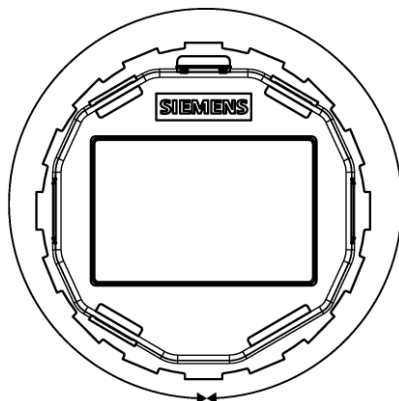
Procedure

1. De-energize the device.
2. If available, loosen the front safety catch with a 3 mm Allen key.
3. Unscrew the front cover.
4. Remove the display from the holder.

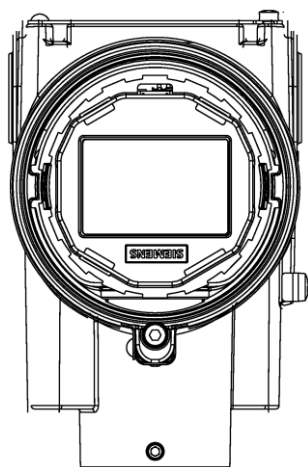


5. Leave the display cable plugged into the electronics.

6. Rotate the display to the desired position.



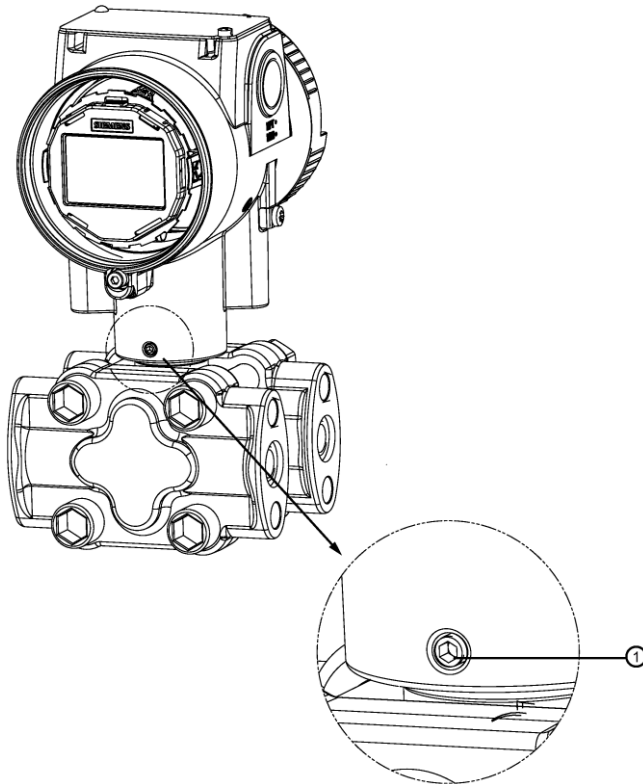
7. Press the display into the holder until it engages.



5.5 Rotating the enclosure

Introduction

To make the device easier to operate in any mounting position, you have the option of adjusting the position of the enclosure within a range of 360°.



① Retaining screw

One retaining screw ① for the aluminum enclosure and two retaining screws (front and back) for the stainless steel enclosure prevent that the flat ribbon cable is damaged while rotating the enclosure.

The flat ribbon cable connects the sensor to the electronics.

The tightening torques of the retaining screws are different for the aluminum enclosure and the stainless steel enclosure. For the tightening torques of the retaining screws, refer to section Torques (Page 186).

Requirement

You have a 2.5 mm Allen key.

Rotating the aluminum enclosure


1. Loosen the retaining screw ① by half a rotation.
2. Rotate the enclosure to the desired position (but no further than the end stop).
3. Tighten the retaining screw.

Rotating the stainless steel enclosure

1. Loosen the front retaining screw by half a rotation.
2. Loosen the back retaining screw by half a rotation.
3. Rotate the enclosure to the desired position (but no further than the end stop).
4. Tighten the front and back retaining screw.

To prevent the enclosure from turning in case of vibration, make sure that the front and back retaining screw are tightened.

5.6 Removing

 WARNING
Incorrect disassembly
The following risks may result from incorrect disassembly:
- Injury through electric shock
- Risk through emerging media when connected to the process
- Risk of explosion in hazardous area
In order to disassemble correctly, observe the following:
• Before starting work, make sure that you have switched off all physical variables such as pressure, temperature, electricity etc. or that they have a harmless value.
• If the device contains hazardous media, it must be emptied prior to disassembly. Make sure that no environmentally hazardous media are released.
• Secure the remaining connections so that no damage can result if the process is started unintentionally.

Connecting

6.1 Basic safety instructions

NOTICE**Ambient temperature too high**

Damage to cable sheath.

- At an ambient temperature $\geq 60\text{ °C}$ (140 °F), use heat-resistant cables suitable for an ambient temperature at least 20 °C (36 °F) higher.

NOTICE**Condensation in the device**

Damage to device through formation of condensation if the temperature difference between transportation or storage and the mounting location exceeds 20 °C (36 °F).

- Before taking the device into operation let the device adapt for several hours in the new environment.

NOTICE**Incorrect measured values with incorrect grounding**

The device must not be grounded using the "+" connection. It may otherwise malfunction and be permanently damaged.

- If necessary, ground the device using the "-" connection.

Note**Electromagnetic compatibility (EMC)**

You can use this device in industrial environments, households and small businesses.

For metal housings there is an increased electromagnetic compatibility compared to high-frequency radiation. This protection can be increased by grounding the housing, see Technical data (Page 151).

Note

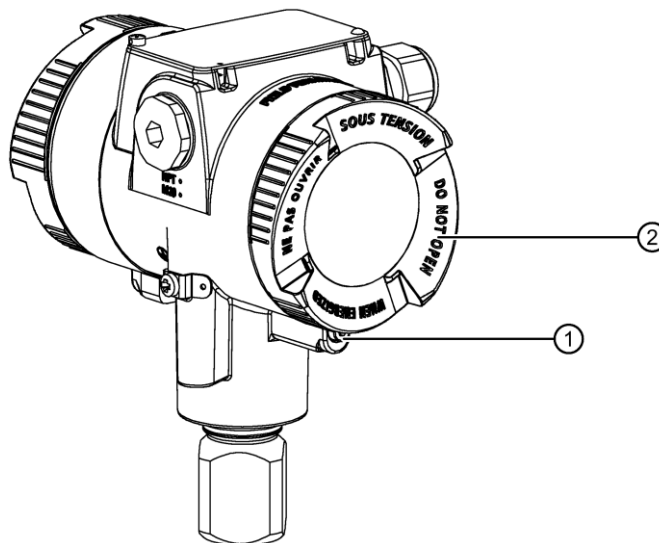
Improvement of interference immunity

- Lay signal cables separate from cables with voltages > 60 V.
 - Use cables with twisted wires.
 - Keep device and cables at a distance from strong electromagnetic fields.
 - Take account of the conditions for communication specified in the Technical data (Page 151).
 - Use shielded cables to guarantee the full specification according to HART/PA/FF.
-

6.2 Connecting the device

6.2.1 Opening the device

Procedure



- ① Safety catch (optional)
- ② Cover of the electrical cable compartment.

Figure 6-1 Rear view of pressure transmitter

1. Use a 3 mm Allen key to loosen the safety catch ①.
2. Unscrew the cover of the electrical cable compartment ②.

6.2.2 Connecting the device

Procedure

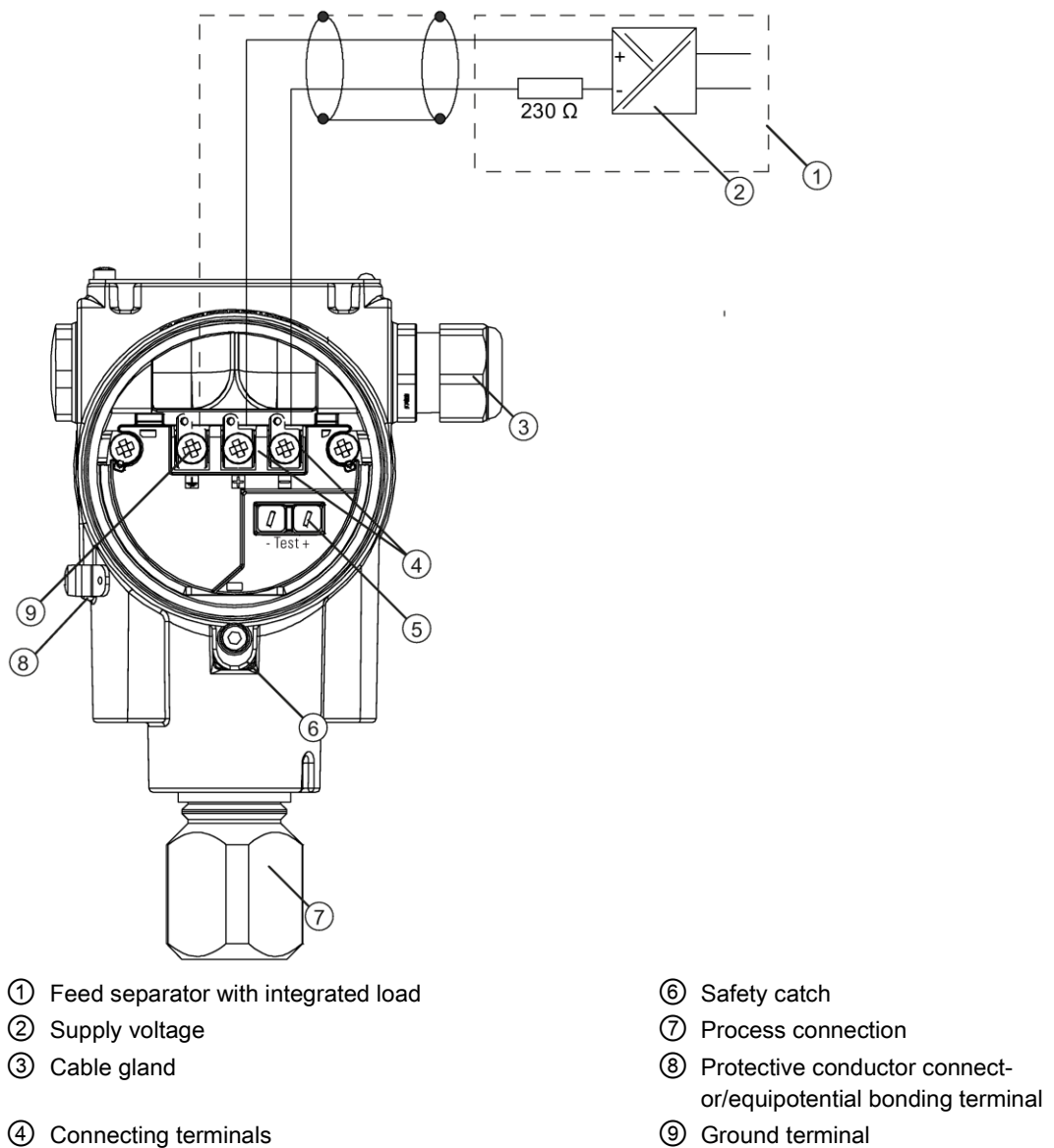


Figure 6-2 Example: Electrical connection with feed separator

1. Connect the device to the system via the existing protective ground connection ⑧ by observing the torques.
 - Use a cable with a diameter of 1 ... 4 mm².
2. Insert the connecting cable through the cable gland ③.

3. Connect the wires to the connection terminals ④ "+" and "-", observing the polarity and the torques.

- Use wires with a diameter of 0.5 ... 2.5 mm².
- If you use stranded wire used, you need a ferrule.

4. Apply the shield to the screw of the ground terminal ⑨.

The screw of the ground terminal is electrically connected to the external protective conductor connection.

NOTICE
Incorrect measured values with incorrect grounding
The device must not be grounded using the "+" connection. It may otherwise malfunction and be permanently damaged.
<ul style="list-style-type: none">• If necessary, ground the device using the "-" connection.

See also

Torques (Page 186)

6.2.3 Closing the device

Procedure

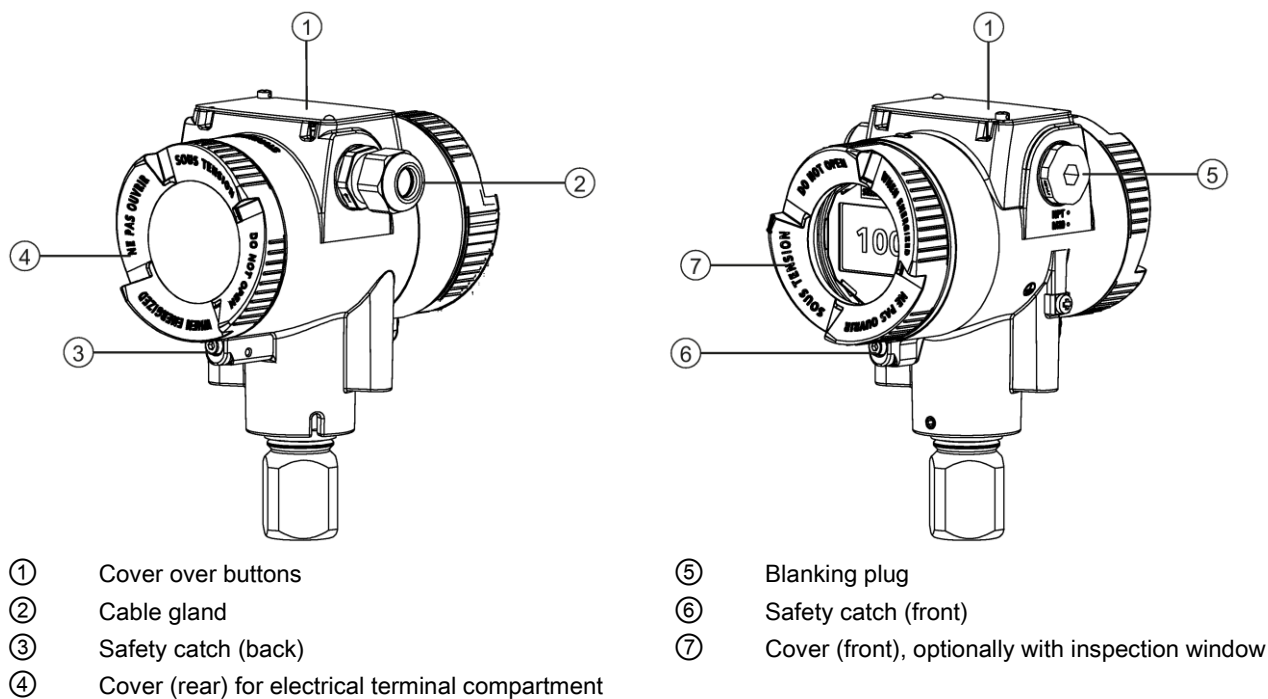


Figure 6-3 View of the pressure transmitter: Left: Back right: Front view

1. Screw on the cover ④ and ⑦ as far as it will go.
Make sure that there is no gap between enclosure and cover.
2. Secure each cover with the cover catch ③ and ⑥ by removing the screw.
3. Close the cover over the buttons ①.
4. Tighten the screw for the cover over the buttons.
5. Check the tightness of the blanking plug ⑤ and cable gland ② in accordance with the degree of protection.

6.3 Connect the Han cable socket to the cable

Note

Observe the protection class of the Han plug when defining the protection class.

The contact parts for the cable socket are supplied.

6.4 Connect M12 cable socket to the cable

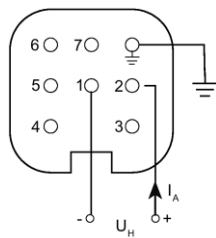
For devices with a Han plug mounted on the enclosure, make the connection via the cable socket.

Requirement

- The terminal area of the cable socket is suitable for cables with diameters ranging from 6 to 12 mm.
- These cables use stranded wires with 1 mm² as single conductors ("+", "-" and ground).
- You are using a crimping tool from HARTING (article number 09 99 000 0110).

Procedure

1. Slide the sleeve and the screwed joint on the cable.
2. Strip approx. 8 mm of the cable ends.
3. Crimp the contact parts on the cable ends.
4. Assemble the cable socket.




I_A Output current
U_H Auxiliary power

Connector pin assignment with Han 7D or Han 8D plug or cable socket

6.4 Connect M12 cable socket to the cable

Procedure

 WARNING
Loss of safety required for approval by using the Han plug
The connector may only be used for Ex ia devices and non-Ex devices; otherwise the safety required for the approval is not guaranteed.

Note

A conductive connection must not exist between the shield and the connector housing.

Note

Observe the protection class of the M12 device plug when defining the protection class.

In devices where a plug is already mounted on the enclosure, the connection is made via a cable socket.

1. Thread the parts of the cable socket as described by the manufacturer.
2. Strip approximately 18 mm of the bus cable ①.
3. Twist the shield.
4. Thread the shield in the insulating sleeve.
5. Draw 8 mm of shrink sleeve over the cable, wires and shield up to the reference edge ②.
6. Screw the cable ends and the shield in the pin insert.
7. Fasten the parts of the cable socket as described by the manufacturer.

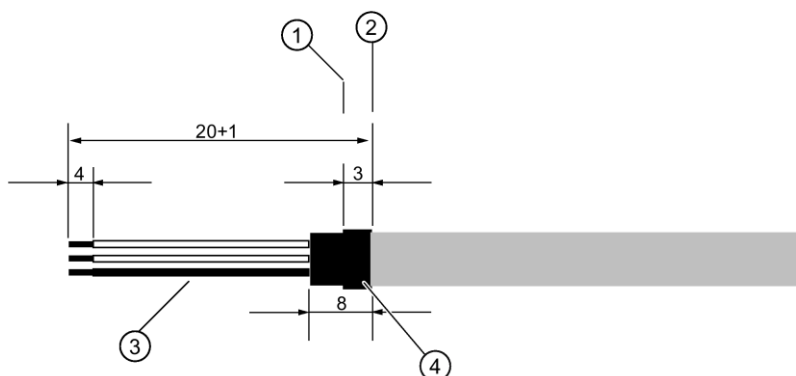
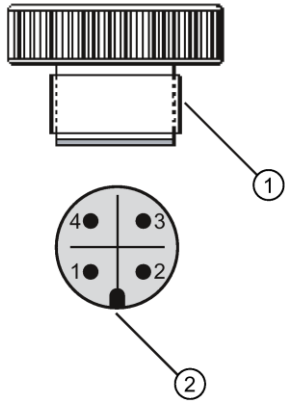


Figure 6-4 Preparing the connecting cable

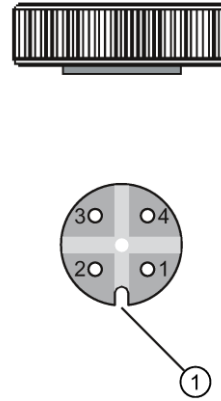
- | | | | |
|---|--|---|-----------------------------------|
| ① | Reference edge for stripping | ③ | Insulating sleeve over the shield |
| ② | Reference edge for the dimension specifications for cable assembly | ④ | Shrink sleeve |

Pin assignment



Layout for M12 device connector

- ① M12 x 1 thread
- ② Positioning catch
- 1 +
- 2 Not connected
- 3 -
- 4 Shield



Assignment diagram M12-cable socket

- ① Positioning slot
 - 1 +
 - 2 Not connected
 - 3 -
 - 4 Shield
- Middle contact of the cable socket not connected

Operating

Introduction

You operate the device using the keys.

If you have a device with a display, you can view the measured values, parameter values and messages.

If you have a device without a display, you also have several functions available:

Commissioning the device without display (Page 66)

7.1 Buttons

The four buttons are located below the cover:

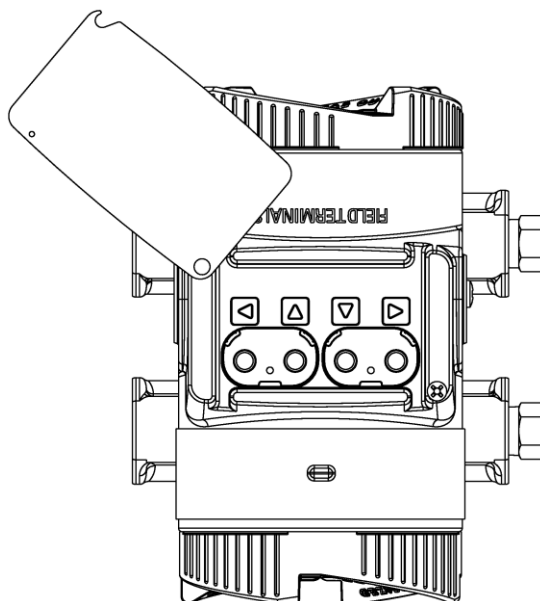


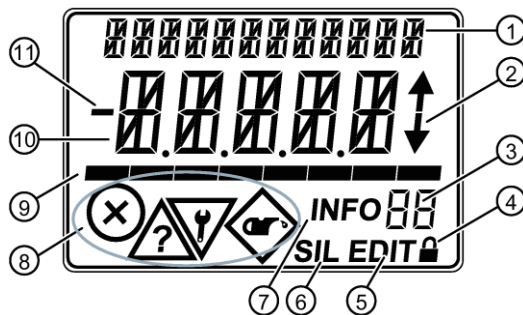
Figure 7-1 Top view

7.2 Operating the device with display

7.2.1 Display

This display has three different views.

- Measurement view
- Parameter view
- Edit view






- ① Display of:
 - Name and unit of measured values (Measurement view)
 - Name and unit of parameters (Parameter view, Edit view)
- ② Specifies whether there are previous parameters or subsequent parameters.
- ③ Display of:
 - Measured value number
 - Parameter number
 - ID of the messages ⑦
- ④ Device is write-protected.
- ⑤ Device in the parameter view: When you press the ► button in the parameter view, the parameter can be edited and the "EDIT" symbol flashes.
- ⑥ Functional Safety is enabled.
- ⑦ The ID ③ and the displayed "INFO" symbol serve to identify the diagnostic message.
For the IDs of the messages and their meaning, refer to the section "Diagnostics and troubleshooting (Page 141)".
- ⑧ NE 107 symbols. For a description and priority, refer to the section "Diagnostics and troubleshooting (Page 141)".
- ⑨ Bar graph display for measured values or progress indicator in wizards
- ⑩ Main line; 5-digit display of measured values and parameter values.
- ⑪ Sign of the measured value.

7.2.2 Navigating in the views

Procedure

You navigate in the views with the Buttons (Page 53) buttons:

Views	Buttons
<p>Measurement view</p> 	<p>After the initialization, the measurement view is displayed.</p> <ol style="list-style-type: none"> 1. Select a random measured value with the buttons ▲ or ▼. 2. Change to the parameter view with the ► button. 3. Return to the measurement view with the ◀ button.
<p>Parameter view</p> 	<p>The "EDIT" symbol has been activated permanently.</p> <ol style="list-style-type: none"> 1. Select a parameter with the buttons ▲ or ▼. 2. Change to the edit view with the ► button. 3. Return to the measurement view with the ◀ button.
<p>Edit view</p> 	<p>The "EDIT" symbol flashes.</p> <ol style="list-style-type: none"> 1. Change the parameter value with the ▲ or ▼ button. 2. Save the change with the ► button. <p>You are in the parameter view.</p> <ol style="list-style-type: none"> 3. Return to the measurement view with the ◀ button. <p>If you do not change any parameters, you return from the edit view to the parameter view with the ◀ button.</p>

7.2.3 Measurement view

The measurement view shows the current measured values as well as status and diagnostic messages:



- ① Name and unit of the measured value (alternating)
- ② Measured value
- ③ Measured value ID
- ④ Bar display

Figure 7-2 Example of measurement view

- ① shows the name of the measured value and the set unit as alternating values.
- Measured value IDs ③ start with "P".

The bar display shows the following information:

- The position of a measured value within the set measuring span (e.g. pressure).
- The position of the temperature value within the sensor limits.
- The scaling of the process values calculated from the pressure value (e.g. volume flow).

7.2.3.1 Display of measured values

The following measured values are always displayed:

- Pressure (P1)
- Sensor temperature (P2)
- Electronics temperature (P3)
- Percent of range (P9)
- Loop current (PA)
- Terminal voltage (PB)

The following values are calculated from the measured pressure value and are displayed depending on your application:

- Level (P4)
- Volume (P5)
- Volume flow (P6)
- Mass flow (P7)
- Customized characteristic curve (P8)

Measured value ID	Name of measured value	Meaning
P1	PRESSURE	Pressure
	PRESS GAUGE	Gauge pressure
	PRESS ABS	Absolute pressure
P2	SENSOR TEMP	Sensor temperature
P3	ELECTR TEMP	Electronics temperature
P4	LEVEL	Level
P5	VOLUME	Volume
P6	VOLUME FLOW	Volume flow
P7	MASS FLOW	Mass flow
P8	USER DEFINED	Customized characteristic curve
P9	% OF RANGE	Percent of range
PA	LOOP CURRENT	Loop current
PB	CURR VOLTAGE	Terminal voltage

You use the "Start view" parameter [32] to select the measured value that is displayed as the first measured value in the measurement view.

Start view [32] (Page 116)

7.2.3.2 Navigating in the measurement view

Requirement

You have disabled the button lock.

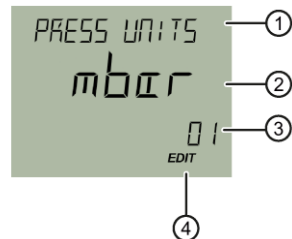
Disabling button lock (Page 109)

Procedure

1. Use the ▲ and ▼ buttons to navigate in the measurement view.
2. To switch to the parameter view, press the ► button.

7.2.4 Parameter view

The parameter view shows the parameters, parameter values and the wizards of the device.



- ① Name and unit of the parameter (alternating)
- ② Parameter value
- ③ Parameter ID
- ④ "EDIT" symbol (permanently enabled)

Figure 7-3 Example of parameter view

For parameters with an associated unit, the parameter name and unit are displayed as alternating values in ①. Example: Lower range value in mA.

7.2.4.1 List of parameters on the display

The parameters are displayed with parameter ID and parameter name.

Depending on the parameter settings of your device, some parameters are not visible.

Parameter ID	Parameter name on the display	Meaning
01	PRESS UNITS	Pressure units (Page 84)
02	LOWER RANGE	Set lower range value (without pressure applied) (Page 86)
03	UPPER RANGE	Set upper range value (without pressure applied) (Page 86)
04	DAMPING	Damping value (Page 88)
05	APPLICATION	Application ¹⁾ (Page 88)
06	SQRT POINT	Application point for volume flow and mass flow (VSLN and MSLIN) (Page 95)
07	ZERO POINT	Zero point adjustment (Page 95)
08	APPLY LRV	Apply lower range value (with pressure applied) (Page 98)
09	APPLY URV	Apply upper range value (with pressure applied) (Page 98)
10	FAULT CURR	Select fault current (Page 100)
11	LO FAULT CUR	Lower fault current (Page 101)
12	UP FAULT CUR	Upper fault current (Page 101)
13	SATURAT LOW	Lower saturation limit (Page 102)
14	SATURAT HI	Upper saturation limit (Page 102)
15	SV SELECT	SV selection, set secondary variable (Page 103)
16	LEVEL UNITS	Level unit (Page 103)
16	VOL UNITS	Volume units (Page 103)
16	VFLOW UNITS	Volume flow units (Page 103)
16	MFLOW UNITS	Mass flow units (Page 103)
17	TEMP UNITS	Temperature units for sensor and electronics temperature (Page 105)
18	LOWER SCALNG	Lower scaling point (Page 105)
19	UPPER SCALNG	Upper scaling point (Page 106)
20	LOW FLOW CUT	Low flow cut-off for volume flow and mass flow (VSOFF and MSOFF) (Page 107)
23	BUTTON LOCK	Enable and disable button lock (Page 108)
24	CHANGE PIN	Change user PIN (Page 109)
25	RECOVERY ID	Display Recovery ID (Page 110)
26	PIN RECOVERY	PIN recovery (Page 111)
27	USER PIN	Enable and disable user PIN (Page 112)
28	DEVICE MODE	Active device mode (Page 114)
29	FUNCT SAFETY	Enable and disable Functional Safety (Page 114)
30	DISPLAY TEST	Display test (Page 115)
31	LOOP TEST	Loop test (Page 115)
32	START VIEW	Start view (Page 116)
33	PRESSURE REF	Pressure reference (Page 117)
34	IDENTIFY	Identify the device (Page 117)
35	RESET	Reset (Page 118)

1) The "Application" parameter is also called the "Transfer function" in certain configuration tools.

Hereinafter, the parameter ID is always written inside parentheses after the parameter name.
Example: Parameter "Damping value" [04].

See also

Parameter assignment over device with display (Page 84)

7.2.4.2 Navigating in the parameter view

Requirement

The button lock is disabled.

Disabling button lock (Page 109)

Procedure

1. Use the ▲ or ▼ buttons to navigate within the parameters.
To navigate faster, keep the ▲ or ▼ button pressed.
After the last parameter, you jump to the first parameter, and vice versa.
2. To switch to edit view, press the ► button.
3. To return to the measurement view, press the ◀ button.

7.2.5 Edit view

You change the parameter values in the edit view. Wizards are available for specific parameters.

Parameter values

There are various parameter values:

- Enumerations (e.g. unit)
- Numerical values (e.g. damping)

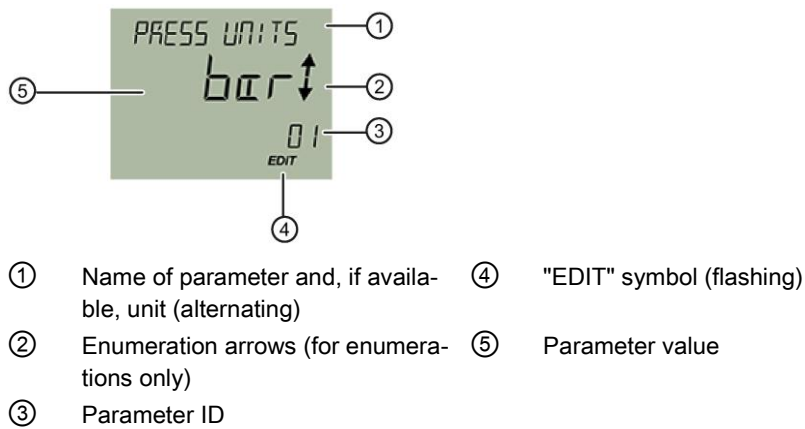


Figure 7-4 Example of edit view

For parameters with an associated unit, the parameter name and unit are displayed as alternating values in ①. Example: Lower range value in mA.

7.2.5.1 Changing parameter values

Requirement

The button lock is disabled.
Disabling button lock (Page 109)

Procedure

1. Navigate to the parameter view (Page 55).
2. Select the desired parameter with the ▲ or ▼ button.
Use the ► button to confirm.
You are in the edit view.
3. Change the parameter value with the ▲ or ▼ button.
To navigate faster, keep the ▲ or ▼ button pressed.
4. Save the change with the ► button.
Or, cancel the change with the ◀ button.

7.3 Remote operation


You can operate the device using HART communication. The following is required for this purpose:

- A handheld (e.g. FC475) or PC software such as SIMATIC PDM.
- A HART modem to connect a PC with the device or a lead to connect the handheld with the device.

7.4 Locking the device

The following options are available to lock the device:

- Enabling write protection using the jumper.
- Enabling write protection using the user PIN.
- Enabling write protection using the button lock.

Write protection	Sym- bol	ID	Read measured values on the display	Read parameters on the display	Change parameters via the device with display
Jumper set		L	Yes	No	No
User PIN ¹⁾ enabled		LP	Yes	Yes	Yes, after input of the user PIN
Button lock enabled		LL	Yes	No	No

¹⁾The user PIN is factory set to 2457 in the device. When delivered, write protection is disabled using the user PIN.

Devices with functional safety

To enable functional safety, you first enable the user PIN.

See also

Enable write protection with jumper (Page 61)

User PIN [27] (Page 112)

Button lock [23] (Page 108)

7.4.1 Enable write protection with jumper

Introduction

The jumper is used for enabling write protection.

Procedure

1. Switch off the power supply.
2. Remove the front cover connector of the device.
3. Remove the display from the holder.

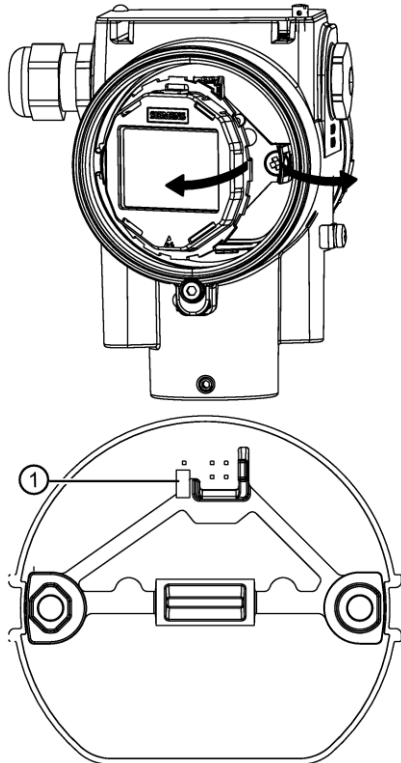
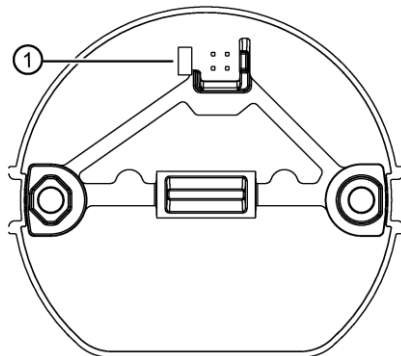


Figure 7-5 Position of the jumper ① on the board of the device as delivered

4. Set the jumper ① as follows:



Result

When the jumper is set, only the measured values can be read.
The display changes automatically between the measured values.
Operation via the buttons is disabled.

7.4.2 Enable user PIN

Requirement

The User PIN is disabled.

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the parameter "User PIN".
3. Use the ► button to confirm.
The message "USER PIN ON" (User PIN enabled) appears for 2 seconds.

Result

The User PIN is activated after about 10 minutes or after a device restart.



7.4.3 Enabling button lock

Procedure

1. Navigate into the parameter view.
Navigating in the views (Page 55)
2. In the parameter view, select the "Button lock" parameter.
3. Press the ► button.
The "EDIT" symbol flashes.
4. Select ON with the ▲ or ▼ button.



5. Use the ► button to confirm.

Result


- The display automatically returns to the measurement view.
- The display automatically changes between the measured values every 12 seconds.
- The symbol for button lock "LL" and the measured value ID are displayed alternately.


Note


For a device without display, you activate the button lock using remote operation.

Commissioning

8.1 Basic safety instructions

 DANGER
Toxic gases and liquids
Danger of poisoning when venting the device: if toxic process media are measured, toxic gases and liquids can be released.
<ul style="list-style-type: none">• Before venting ensure that there are no toxic gases or liquids in the device, or take the appropriate safety measures.

 WARNING
Commissioning and operation with pending error
If an error message appears, correct operation in the process is no longer guaranteed.
<ul style="list-style-type: none">• Check the gravity of the error.• Correct the error.• If the error still exists:<ul style="list-style-type: none">– Take the device out of operation.– Prevent renewed commissioning.

 WARNING
Opening device in energized state
Risk of explosion in hazardous areas
<ul style="list-style-type: none">• Only open the device in a de-energized state.• Check prior to commissioning that the cover, cover locks, and cable inlets are assembled in accordance with the directives.
Exception: Devices having the type of protection "Intrinsic safety Ex i" may also be opened in energized state in hazardous areas.

Note

Hot surfaces

Hot process medium and high ambient temperatures lead to hot surfaces which can cause burns.

- Take corresponding protective measures, for example wear protective gloves.
-

8.2 Switching on the supply voltage

Requirement

- You have connected the device correctly.
- The terminal voltage on the device is correct. (Page 186)

Procedure

Switch on the power supply.

- Product name and firmware version appear briefly on the display.
- The measured values are shown on the display.

For a device without a display, you read off the current output as follows:

- Over the remote control (e.g. SIMATIC PDM).
- With a DC current measuring device.

Connecting the device (Page 46)

Result

The device is now ready for operation.

8.3 Commissioning the device without display

Introduction

In this section, you will learn how to commission the device step-by-step.

Before you start, please read the following safety information:

- General safety information (Page 17)
- Basic safety information: Installing/mounting

- Basic safety information: Connecting
- Basic safety information: Commissioning

Read the entire device manual in order to achieve the optimum performance of the device.

Procedure

1. Mount the device.
Installation (except level) (Page 36)
2. Connect the device.
Connecting the device (Page 46)
3. Switch on the power supply.
Switching on the supply voltage (Page 66)
4. Open the cover of the buttons:

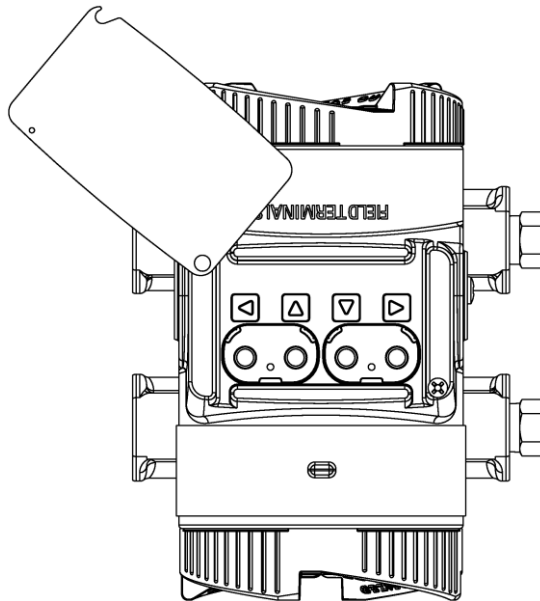


Figure 8-1 Top view

5. Operate the buttons as follows:

Apply lower range value (with pressure applied)	Hold down the button ▼ for 3 seconds.
Apply upper range value (with pressure applied)	Hold down the button ▲ for 3 seconds.
Zero point adjustment	Hold down the buttons ▲ and ▼ for 3 seconds.
Set Upper fault current	Hold down the button ◀ for 3 seconds.
Set Lower fault current	Hold down the button ▶ for 3 seconds.

Further functions are available via remote operation (e.g. SIMATIC PDM).

See also

Parameter assignment (Page 79)

8.4 Commissioning the device with display

Introduction

In this section, you will learn how to commission the device step-by-step.

Before you start, please read the following safety information:

- General safety information (Page 17)
- Basic safety information: Installing/mounting (Page 33)
- Basic safety information: Connecting (Page 45)
- Basic safety information: Commissioning (Page 65)

Read the entire device manual in order to achieve the optimum performance of the device.

Procedure

1. Mount the device.
Installation (except level) (Page 36)
2. Connect the device.
Connecting the device (Page 46)
3. Switch on the power supply.
Switching on the supply voltage (Page 66)

4. Open the cover of the buttons:

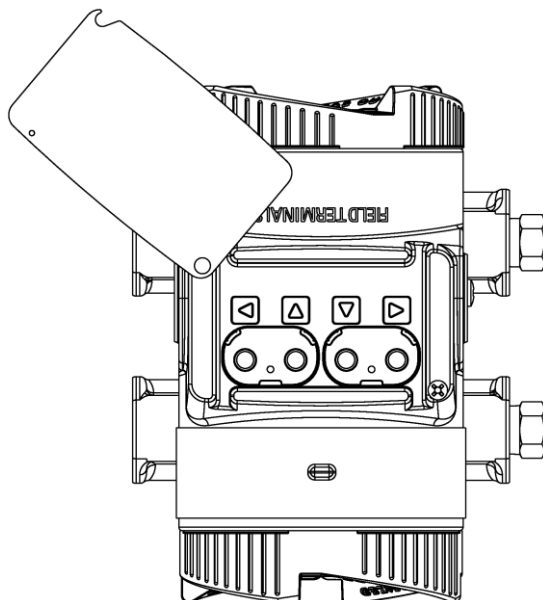


Figure 8-2 Top view

5. Set the measuring range.
 - Set lower range value/upper range value (without pressure available) (Page 87)
 - Apply lower range value/upper range value (with pressure present) (Page 98)
 6. Set the pressure unit.
 - Pressure units [01] (Page 84)
 7. Set the application of your device.
 - Application [05] (Page 88)
 8. Set the scaling points.
 - Lower scaling point [18] (Page 105)
 - Upper scaling point [19] (Page 106)
 9. Set the zero point.
 - Adjusting zero point (gauge pressure) (Page 96)
 - Adjusting the zero point (differential pressure) (Page 96)
 - Adjusting zero point (absolute pressure) (Page 97)
 10. Lock the device.
 - Locking the device (Page 61)
 11. Enable Functional Safety (for devices with Functional Safety).
 - Enabling Functional Safety over device with display.
- You can find additional functions in the section Parameter assignment (Page 79)

8.5 Application examples

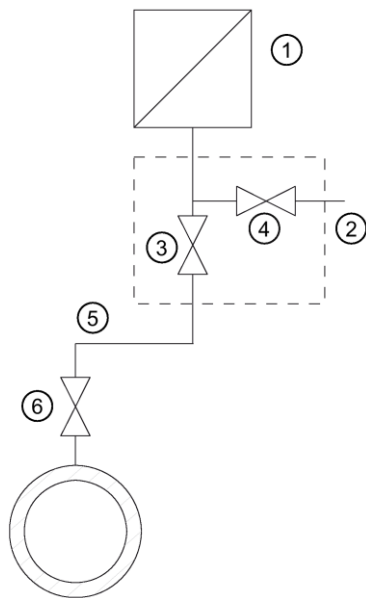
8.5.1 gauge pressure, absolute pressure from the differential pressure series and absolute pressure from the gauge pressure series

8.5.1.1 Commissioning for gases

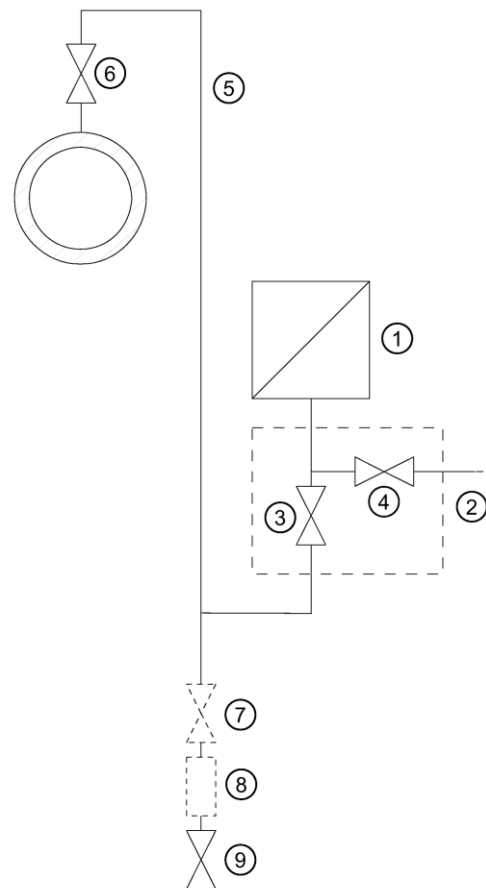
Requirement

All valves are closed.

Procedure



Example: Measuring gases above the pressure tapping point



Example: Measuring gases below the pressure tapping point

- | | | | |
|---|--|---|------------------------------|
| ① | Pressure transmitter | ⑤ | Pressure line |
| ② | Shut-off valve | ⑥ | Shut-off valve |
| ③ | Shut-off valve to process | ⑦ | Shut-off valve (optional) |
| ④ | Shut-off valve for test connection
or for bleed screw | ⑧ | Condensate vessel (optional) |
| | | ⑨ | Blowout valve |

To commission the pressure transmitter for gases, proceed as follows:

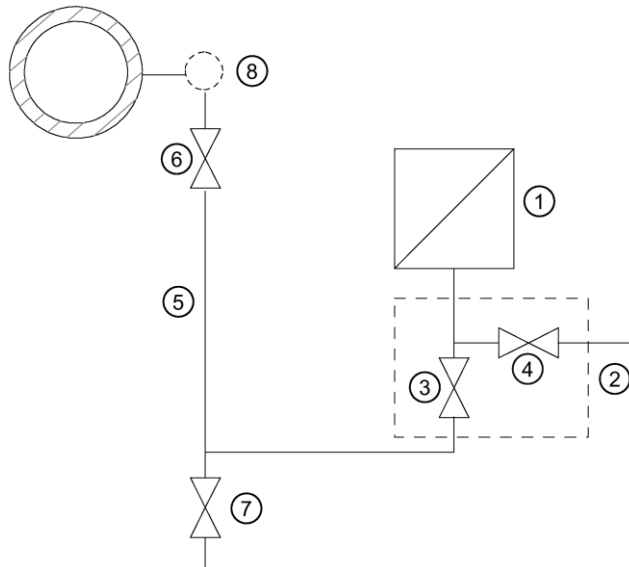
1. Open the shut-off valve for the test connection ④.
2. Via the test connection of the shut-off valve ②, apply the pressure corresponding to the start of scale value to the pressure transmitter.
3. Ensure that the lower range value corresponds to the desired value. Otherwise, correct the value.
4. Close the shut-off valve for the test connection ④.
5. Open the shut-off valve ⑥ at the pressure tapping point.
6. Open the shut-off valve for the process ③.

8.5.1.2 Commissioning with steam or liquid

Requirement

All valves are closed.

Procedure



- ① Pressure transmitter
- ② Shut-off valve
- ③ Shut-off valve to process
- ④ Shut-off valve for test connection or for bleed screw
- ⑤ Pressure line
- ⑥ Shut-off valve
- ⑦ Drain valve
- ⑧ Compensation vessel (steam only)

To commission the pressure transmitter for steam or liquid, proceed as follows:

1. Open the shut-off valve for the test connection ④.
2. Via the test connection of the shut-off valve ②, apply the pressure corresponding to the start of scale value to the pressure transmitter.
3. Ensure that the lower range value corresponds to the desired value. Otherwise, correct the value.
4. Close the shut-off valve for the test connection ④.
5. Open the shut-off valve ⑥ at the pressure tapping point.
6. Open the shut-off valve for the process ③.

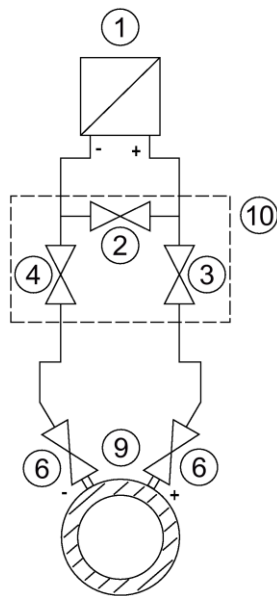
8.5.2 Differential pressure and volume flow

8.5.2.1 Commissioning in gaseous environments

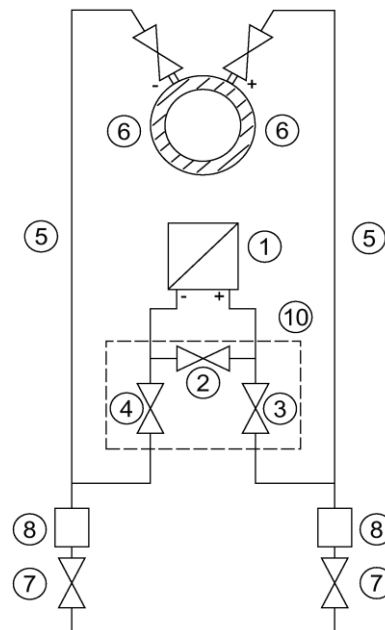
Requirement

All shut-off valves are closed.

Procedure



Pressure transmitter above the differential pressure transducer



Pressure transmitter below the differential pressure transducer

- | | | | |
|------|------------------------------|---|----------------------------------|
| ① | Pressure transmitter | ⑦ | Blowout valves |
| ② | Stabilizing valve | ⑧ | Condensate vessels (optional) |
| ③, ④ | Differential pressure valves | ⑨ | Differential pressure transducer |
| ⑤ | Differential pressure lines | ⑩ | 3-way valve manifold |
| ⑥ | Shut-off valves | | |

To commission the pressure transmitter for gases, proceed as follows:


1. Open both the shut-off valves ⑥ at the pressure tapping point.
2. Open the stabilizing valve ②.
3. Open the differential pressure valve (③ or ④).
4. Check and, if necessary, correct the zero point when the start-of-scale value is 0 bar (4 mA).

5. Close the stabilizing valve ②.
6. Open the other differential pressure valve (③ or ④).

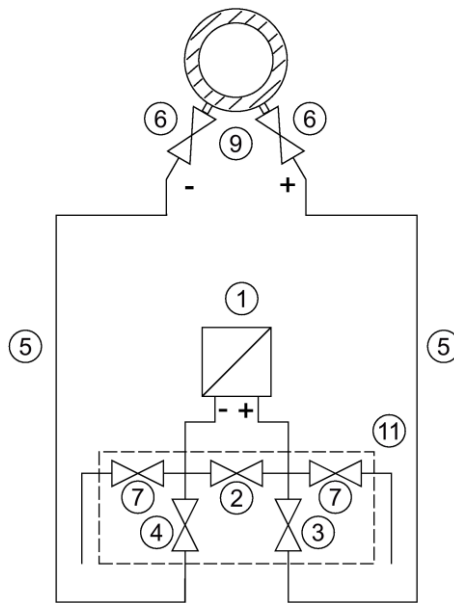
8.5.2.2 Commissioning for liquids

Requirement

All valves are closed.

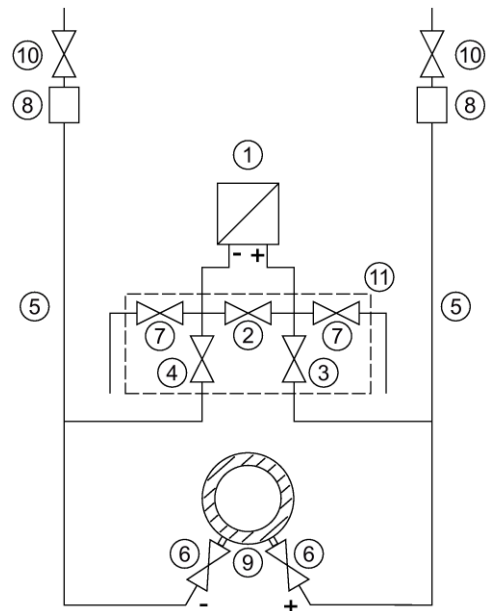
 DANGER
Toxic liquids
Danger of poisoning when the device is vented.
If toxic process media are measured with this device, toxic liquids can escape when the device is vented.
<ul style="list-style-type: none">• Before venting, make sure there is no liquid in the device or take the necessary safety precautions.

Procedure



Pressure transmitter below the differential pressure transducer

- ① Pressure transmitter
- ② Stabilizing valve
- ③, ④ Differential pressure valves
- ⑤ Differential pressure lines
- ⑥ Shut-off valves



Pressure transmitter above the differential pressure transducer

- ⑦ Drain valves
- ⑧ Gas collector vessels (optional)
- ⑨ Differential pressure transducer
- ⑩ Vent valves
- ⑪ 5-way valve manifold

To commission the pressure transmitter for liquids, proceed as follows:


1. Open both the shut-off valves ⑥ at the pressure tapping point.
2. Open the stabilizing valve ②.
3. With **pressure transmitters below the differential pressure transducer**, partially open both drain valves ⑦ one after the other until liquid emerges without bubbles.
In the case of a **pressure transmitter above the differential pressure transducer**, partially open both vent valves ⑩ one after the other until liquid emerges without bubbles.
4. Close both drain valves ⑦ or vent valves ⑩.
5. Partially open the differential pressure valve ③ and the vent valve (sealing plug with vent valve) on the positive side of the pressure transmitter until liquid escapes without bubbles.
6. Close the vent valve (sealing plug with vent valve).
7. Partially open the vent valve (sealing plug with vent valve) on the negative side of the pressure transmitter until liquid escapes without bubbles.
8. Close the differential pressure valve ③.
9. Partially open the differential pressure valve ④ until liquid escapes without bubbles.


10. Close the differential pressure valve.
11. Close the vent valve (sealing plug with vent valve) on the negative side of the pressure transmitter.
12. Open the differential pressure valve ③ with half a revolution.
13. For a lower range value of 0 bar, check the zero point (4 mA) and correct the lower range value if it is different.
14. Close the stabilizing valve ②.
15. Open the differential pressure valves (③ and ④) completely.

8.5.2.3 Commissioning with vapor

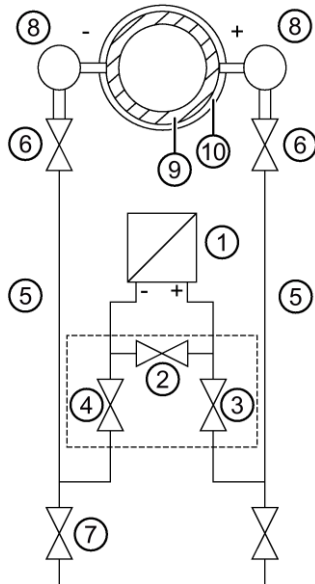
Requirement

All valves are closed.

 WARNING
Hot vapor Danger of injury or damage to device. If the shut-off valves ⑥ and the differential pressure valve ③ are both open and the stabilizing valve ② is then opened, the pressure transmitter ① can be damaged by the flow of vapor. <ul style="list-style-type: none">• Follow the specified procedure for commissioning.

 WARNING
Hot vapor Danger of injury. You can briefly open the drain valves ⑦ to clean the line. Hot vapor can escape in the process. <ul style="list-style-type: none">• Only open the drain valves ⑦ briefly, and close them again before vapor escapes.

Procedure



- | | | | |
|---|------------------------------|---|--|
| ① | Pressure transmitter | ⑦ | Drain valves |
| ② | Stabilizing valve | ⑧ | Condensate pots |
| ③ | Differential pressure valves | ⑨ | Differential pressure transducer/Orifice plate |
| ④ | | ⑩ | Insulation |
| ⑤ | Differential pressure lines | ⑪ | 3-way valve manifold |
| ⑥ | Shut-off valves | | |

To commission the pressure transmitter for vapor, proceed as follows:

1. Open both the shut-off valves ⑥ at the pressure tapping point.
2. Open the stabilizing valve ②.
3. Wait until the steam in the differential pressure lines ⑤ and in the equalizing vessels ⑧ has condensed.
4. Partially open the differential pressure valve ③ and the vent valve (sealing plug with vent valve) on the positive side of the pressure transmitter until condensate escapes without bubbles.
5. Close the vent valve (sealing plug with vent valve).
6. Partially open the vent valve (sealing plug with vent valve) on the negative side of the pressure transmitter until condensate escapes without bubbles.
7. Close the differential pressure valve ③.
8. Partially open the differential pressure valve ④ until condensate escapes without bubbles.
9. Close the vent valve with blanking plug on the negative side ①.
10. Close the differential pressure valve.
11. Open the differential pressure valve ③ by half a revolution.

12. For the start of scale value 0 bar, check the zero point (4 mA).
If the differential pressure lines ⑤ have equally high condensate columns with the same temperature, the measurement result is error-free. Otherwise, repeat the zero-point adjustment.
13. Close the stabilizing valve ②.
14. Fully open the differential pressure valves ③ and ④.

Cleaning process cable

1. To clean the line, briefly open the drain valves ⑦.
2. Close the drain valve ⑦ before vapor escapes.

Parameter assignment

9.1 Overview of parameters and functions

Introduction

You can operate the device via local operation or remote operation (e.g. HART communicator, SIMATIC PDM).

- The parameters that you can reach over the device with a display are marked by the parameter ID. Hereinafter, the parameter ID is always written inside parentheses after the parameter name. Example: Parameter "Damping value" [04].
- You can access the complete number of parameters via remote operation.

The device-specific parameters are available in each tool for configuration.

The instructions or online help for these tools will provide you with information on how to use the different tools for parameter assignment.

List of parameters and functions

The following parameters are available via the local operation and via remote operation (e.g. SIMATIC PDM).

The parameters are grouped according to their function in the following overview:

Quick start	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Quick start wizard	Menu command "Device > Wizard - Quick start..."	-	-

Current output	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Apply lower range value (with pressure applied) Apply upper range value (with pressure applied)	Menu command "Device > Apply values"	Apply lower range value parameter [08] (Page 98) Apply upper range value parameter [09] (Page 98)	Commissioning the device without display (Page 8)
Set lower range value (without pressure applied) Set upper range value (without pressure applied)	"Settings > Current output" parameter group	Set lower range value parameter [02] (Page 86) Set upper range value parameter [03] (Page 86)	-

9.1 Overview of parameters and functions

Current output	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Set damping value	"Settings > Current output" parameter group	Damping value [04] (Page 88)	-
Set fault current	"Settings > Current output" parameter group	Select fault current [10] (Page 100) Lower fault current [11] (Page 101) Upper fault current [12] (Page 101)	Commissioning the device without display (Page 8)
Set saturation limits	"Settings > Current output" parameter group	Lower saturation limit [13] (Page 102)/Upper saturation limit [14] (Page 102)	-
Digital-to-analog converter adjustment	Menu command "Device > DAC trim"	-	-
Loop test	Menu command "Device > Loop test"	Loop test [31] (Page 115)	-

Application	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Select pressure units	"Settings > Units" parameter group	Display of the pressure units (Page 85)	-
Select the temperature unit for sensor and electronics temperature	"Settings > Sensor temperature units" parameter group	Temperature units [17] (Page 105)	-
Set additional measuring task (e.g. level, volume flow, mass flow, volume, set customized characteristic curve)	"Settings > Select output > Application" parameter group	Application [05] (Page 88)	-
Set customized characteristic curve	Menu command "Device > Customized characteristic curve"	-	-
Set scaling points	"Settings > Current output > Scaling"	Lower scaling point [18] (Page 105)/Upper scaling point [19] (Page 106)	-
Select unit of scaled value	"Settings > Current output > Scaling > Units"	Units [16] (Page 103)	-

Calibration	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Correct the zero point error	Menu command "Device > Zero point adjustment"	Zero point adjustment [07] (Page 95)	Commissioning the device without display (Page 8)
Apply lower range value Apply upper range value	Menu command "Device > Apply values"	Apply lower range value parameter [08] (Page 98) Apply upper range value parameter [09] (Page 98)	Commissioning the device without display (Page 8)

Simulation	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Simulate fixed pressure value / simulate ramp	Menu command "Device > Simulation > Process values"	-	-

Identification	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Read and configure identification data of your device	"Identification" parameter group	-	-

Maintenance and diagnostics	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Read diagnostic log	Menu command "Device > Diagnostic log"	-	-
Display of the diagnostics	Menu command "Diagnostics > Diagnostics"	Diagnostics and troubleshooting (Page 141)	-
Simulate diagnostics	Menu command "Device > Simulation > Diagnostics"	-	-
Limit monitoring and event counter	Menu command "Device > Limit monitoring and event counter"	-	-
Device maintenance, sensor maintenance, service, calibration	Menu command "Maintenance"	-	-
Display operating time Operating hours counter (Page 132)	Menu command "Diagnostics > Device status > HART status"	-	-

9.1 Overview of parameters and functions

Maintenance and diagnostics	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Set peak values Reset peak values	"Maintenance and diagnostics > Peak values" parameter group Menu command "Device > Reset peak values"	-	-
Configure trend log Show trend log	Menu command "Device > Trend log settings" Menu command "Diagnostics > Trend log"	-	-
Display number of measuring cells or measuring transducer electronics replacement	Parameter group "Maintenance and diagnostics > Audit trail > HW change counter"	-	-

HART communication	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Configure HART address	Menu command "Device > Assign address"	-	-
Set the loop current value in multidrop mode	"Settings > Current output > Loop current value in multidrop mode"	-	-
Enable or disable the device identification via HART command "Find device"	-	Identify the device [34] (Page 117)	-
Select secondary variable (SV)	"Settings > Select output > SV selection" parameter group	SV selection [15] (Page 103)	-
Select tertiary variable (TV)	"Settings > Select output > TV selection" parameter group	-	-
Select quaternary variable (QV)	"Settings > Select output > QV selection" parameter group	-	-

Write protection	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Enable and disable user PIN	Menu command "Device > Security"	User PIN [27] (Page 112)	-
Change user PIN	Menu command "Device > Security > Change user PIN"	Change user PIN [24] (Page 109)	-

Write protection	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Display Recovery ID	Menu command "Device > Security > PIN recovery"	Recovery ID [25] (Page 110)	-
Restore user PIN	Menu command "Device > Security > PIN recovery"	PIN recovery [26] (Page 111)	-
Enable and disable button lock	"Security > Button lock" parameter group	Button lock [23] (Page 108)	-

Display	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Set pressure reference (absolute, gauge)	"Display > Pressure reference" parameter group	Pressure reference [33] (Page 117)	-
Set start view	-	Start view [32] (Page 116)	-
Display test	Menu command "Device > Squawk"	Display test [30] (Page 115)	-

Reset	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Device restart	Menu command "Device > Device restart"	-	-
Reset digital-to-analog converter to factory setting	Menu command "Device > Reset > Restore to factory DAC calibration"	Reset DAC trim to the factory setting (Page 118)	-
Restore ordered configuration	Menu command "Device > Reset > Restore ordered configuration"	Restore ordered configuration (Page 119)	-
Factory reset	Menu command "Device > Reset > Factory reset"	Restore factory settings (Page 119)	-
Reset to sensor calibration	Menu command "Device > Reset > Reset to sensor calibration"	Reset to sensor calibration (Page 118)	-

Functional Safety

The following additional functionality is available for devices with Functional Safety:

Functional Safety	SIMATIC PDM	Device with display (local operation)	Device without display (local operation)
Enable and disable Functional Safety	Menu command "Device > Functional Safety"	Functional Safety [29] (Page 114)	-

9.2 Parameter assignment over device with display

Introduction

This section describes all parameters that you can reach over the device with a display.

You will find information on operating the device with display in the section Operating the device with display (Page 54).

You can find the list of available parameters with ID and parameter name in the section List of parameters on the display (Page 57).

9.2.1 Pressure units [01]

Introduction

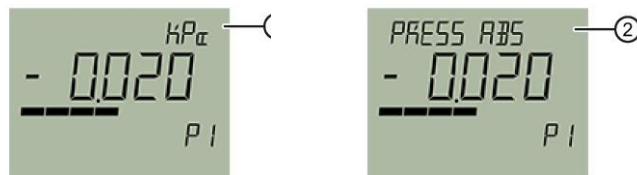
With the "Pressure units" [01] parameter, you select the unit of the "Pressure" (P1) measured value that is displayed in the measurement view.

You can find a description of the pressure units that you can set in the section Display of the pressure units (Page 85).

With the "Pressure reference" parameter [33], you adapt the display of the pressure units to your application, if necessary (absolute pressure or gauge pressure).

Both parameters are available using a local operation or over the remote operation.

Example



Pressure units ① and Pressure reference ② (alternating)

See also

Pressure reference [33] (Page 117)

9.2.1.1 Display of the pressure units

Certain units are displayed differently on the display and over remote operation.

Example: Display of unit "mmH₂O" on the display

Unit ① in the title bar



Unit ② as enumeration

Setting range:	Display (header line)	Display (enumeration)	Remote operation
	mbar	mbar	mbar
	bar	bar	bar
	Pa	Pa	Pa
	KPa	KPa	KPa
	MPa	MPa	MPa
	PSI	PSI	psi
	G/cm ²	G/cm ²	g/cm ²
	KG/cm ²	KG/c ²	kg/cm ²
	KGF/cm ²	KF/c ²	kgf/cm ²
	mmH ₂ O	mmW68	mmH ₂ O
	mH ₂ O(4 °C)	mW4	mH ₂ O (4 °C)
	inH ₂ O	inW68	inH ₂ O
	inH ₂ O(4 °C)	inW4	inH ₂ O (4 °C)
	mmHG	mmHG	mmHg
	inHG	inHG	inHg
	hPa	hPa	hPa
	atm	atm	atm
	torr	torr	torr
Factory setting:	mbar or as specified in the order		

9.2.1.2 Setting the pressure units**Requirements**

You know the parameter values for the "Pressure units" parameter. (Page 85)

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the "Pressure units" parameter [01].
3. Press the ► button.
4. Select the desired unit with the ▲ or ▼ button.
The pressure measurement is converted to the new pressure unit.
5. Use the ► button to confirm.
6. Navigate to the "Pressure reference" parameter [33].
7. Press the ► button.
8. Select the specific pressure unit for your application (absolute pressure, gauge pressure, none) with the ▲ or ▼ button.

Result

- The selected pressure unit and pressure reference are displayed as alternating values in the measurement view.
- If the converted pressure measurement has more than 5 digits, "#####" appears in the measurement view.

9.2.2 Set lower range value [02]/Set upper range value [03]

9.2.2.1 Set lower range value parameter [02]

Sets the lower range value without applied pressure.

Setting range:	Within the measuring limits
Factory setting:	0 bar, or as specified in order

9.2.2.2 Set upper range value parameter [03]

Sets the upper range value without applied pressure.

Setting range:	Within the measuring limits
Factory setting:	Upper measuring range limit, or as specified in order

9.2.2.3 Set lower range value/upper range value (without pressure available)

Introduction

The lower range value (4 mA) corresponds to 0% of the measuring range. The upper range value (20 mA) corresponds to 100% of the measuring range.

Without pressure available, you have the following options for assigning the desired pressure measurements to the lower range value and the upper range value:









	Device without display	Device with display	Remote operation
Set lower range value	-	"Lower range value" parameter [02]	Settings > Current output > Lower range value
Set upper range value	-	"Upper range value" parameter [03]	Settings > Current output > Upper range value

The minimum permissible measuring span of the measuring cell must not be fallen below. You can find the minimum permissible measuring span of your measuring cell in the section Technical data (Page 151)

Requirement

- No pressure is present.
- You have a device with display.

Procedure

1. Navigate into the parameter view.
Navigating in the views (Page 55)
2. In the parameter view, set the "Lower range value" parameter [02].
3. Press the  button.
4. Enter a value within the measuring limits with the  and  buttons.
5. Use the  button to confirm.
The lower range value is set. Note that the upper range value does not move automatically.
6. Navigate to the "Set upper range value" parameter [03].
7. Press the  button.
8. Enter a value within the measuring limits with the  and  buttons.
9. Use the  button to confirm.
The upper range value is set.

Result

You have set your measuring range.

- If the minimum permissible measuring span is fallen below, the message "FAILED" appears.

9.2.3 Damping value [04]

Sets the damping (filtering) for smoothing of sudden process value variations.

Setting range:	0.01 s ... 100 s, in steps of 0.01 s
Factory setting:	2 s, or as specified in order

The damping influences the reaction time of the device: When you increase the damping value, the response time of the pressure transmitter to changes in the pressure measurement increases.

- Reduce the damping value for faster response times. Specify a value that meets the requirements regarding signal stability and response time.

9.2.3.1 Set damping value

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the "Damping value" parameter.
3. Press the ► button.
4. Set the damping with the ▲ and ▼ buttons.
5. To set the damping in steps of 0.10 s, press and hold down the buttons.
6. Use the ► button to confirm.

Result

You have set the damping value.

9.2.4 Application [05]

You use the "Application" parameter to adjust the device for the following measuring tasks.

- Pressure measurement
- Level measurement
- Volume flow measurement

- Mass flow measurement
- Volume measurement
- Customized characteristic curve (only available via remote operation). (Page 124)

Characteristic curves

The device uses a linear characteristic curve for pressure and level measurements.

For volume and mass flow measurements, the device uses adjustable square root functions.

For volume measurement, the device uses the tank characteristic curves for various vessel geometries.

In the "Customized characteristic curve" application, enter the breakpoints of the characteristic curve using remote operation (e.g. SIMATIC PDM).

The set application acts directly on the current output:

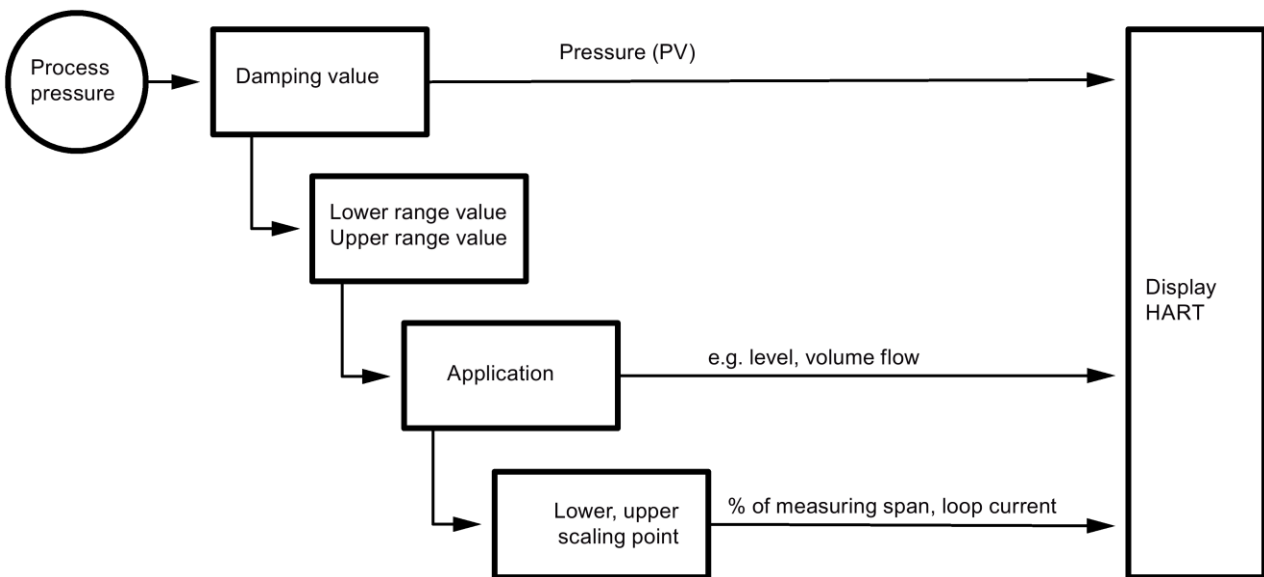


Figure 9-1 Flow diagram

You have various options for setting the measuring task of your device:

Device with display	Remote operation
"Application" parameter [05]	Settings > Select output > Application or using the Quick start wizard

Setting range:	Application	Characteristic curve	
	Pressure	PRESS	Linear, proportional to pressure
	Level	LEVEL	Linear, proportional to level
	Volume flow	VSLN	Linear, square root Proportional to flow rate, linear up to the application point (Page 95)

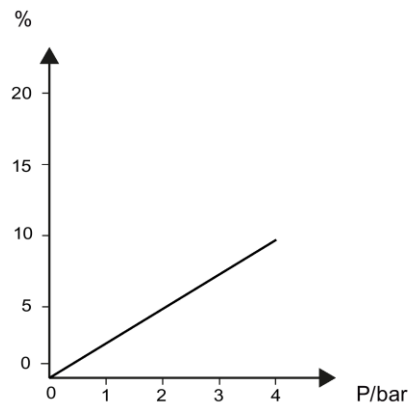
9.2 Parameter assignment over device with display

		VSOFF	Hold at 0, square root Proportional to flow rate, deactivated up to the suppression of the residual flow (Page 107)
		VSLN2	Two-step linear - square root Proportional to flow, two-step linear up to the application point
		VSL2B	Two-step linear, square root (bidirectional)
	Volume	CYLIN	Cylinder vessel
		SPHER	Sphere vessel
		VLIN	Linear vessel
		CONIC	Conical bottom vessel
		PARAB	Parabolic bottom vessel
		HALF	Half sphere bottom vessel
		FLAT	Flat sloped bottom vessel
		PARAE	Parabolic ends vessel
	Mass flow	MSLN	Linear, square root Proportional to flow rate, linear up to the application point (Page 95)
		MSOFF	Hold at 0, square root Proportional to flow rate, deactivated up to the suppression of the residual flow (Page 107)
		MSLN2	Two step linear, square root Proportional to flow, two-step linear up to the application point
		MSL2B	Two-step linear, square root (bidirectional)
	Customized characteristic curve	CUSTM	Custom
	Factory setting:	PRESS, or as specified in order	

9.2.4.1 Pressure measurement

To set the application of the device for the pressure measurement, select the "linear" characteristic curve using the "Application" parameter (PRESS).

- The device uses a linear characteristic curve:



- If the device is set for pressure measurement, no other measured variables (e.g. volume flow) are available.

Example

For the pressure measurement, you set the following values, for example:

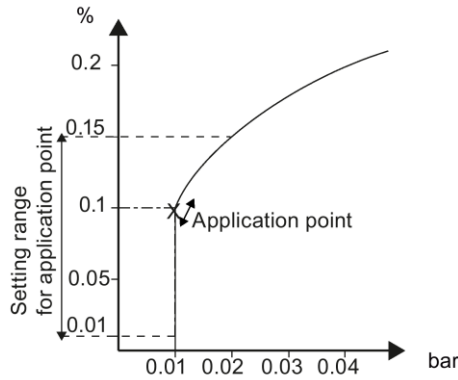
Damping value:	2.0 s
Lower range value:	0.0 bar
Upper range value:	5.0 bar
Application:	Pressure: linear (PRESS)
Unit:	bar
Lower scaling point:	-
Upper scaling point:	-

9.2.4.2 Volume and mass flow measurements

The following characteristic curves are available for volume and mass flow measurements:

- **Hold at 0, square root (VSOFF, for volume or MSOFF, for mass flow)**

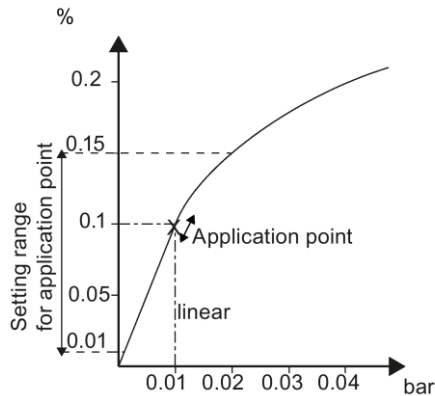
The loop current is 4 mA up to the application point (**low flow cut-off** (Page 107)). Starting from the application point, scaling occurs according to the square root:



Y Loop current or flow
X Set measuring span

- **Linear, square root (VSLN, for volume or MSLN, for mass flow)**

The loop current has a linear relationship with the differential pressure up to the application point (Page 95). Starting from the application point, scaling occurs according to the square root:

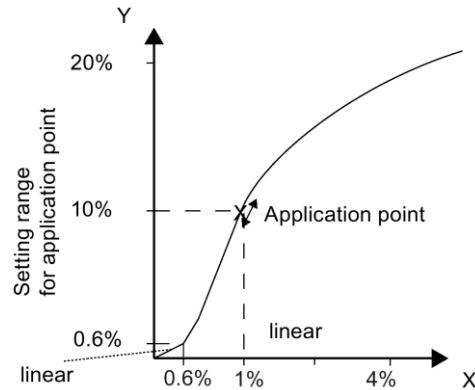


Y Loop current or flow
X Set measuring span

- **Two step linear, square root (VSLN2, for volume or MSLN2, for mass flow)**

The loop current has a proportional relationship with the flow rate, two step linear up to the application point (Page 95).

The square root SLIN2 has a permanently defined application point of 10%. The range up to this point contains two linear characteristic curve sections. The first section ranges from the zero point to 0.6% of the output value and 0.6% of the pressure value. The second section runs at a steeper slope up to the application point at 10% of the output value and 1% of the pressure value.



Y Loop current or flow

X Set measuring span

- **Two step linear, square root or bidirectional flow measurement (VSL2B, for volume or MSL2B for mass flow)**

For bidirectional flow measurement, enter symmetrical scaling values.

Select a lower scaling value that is symmetrical to the upper scaling value.

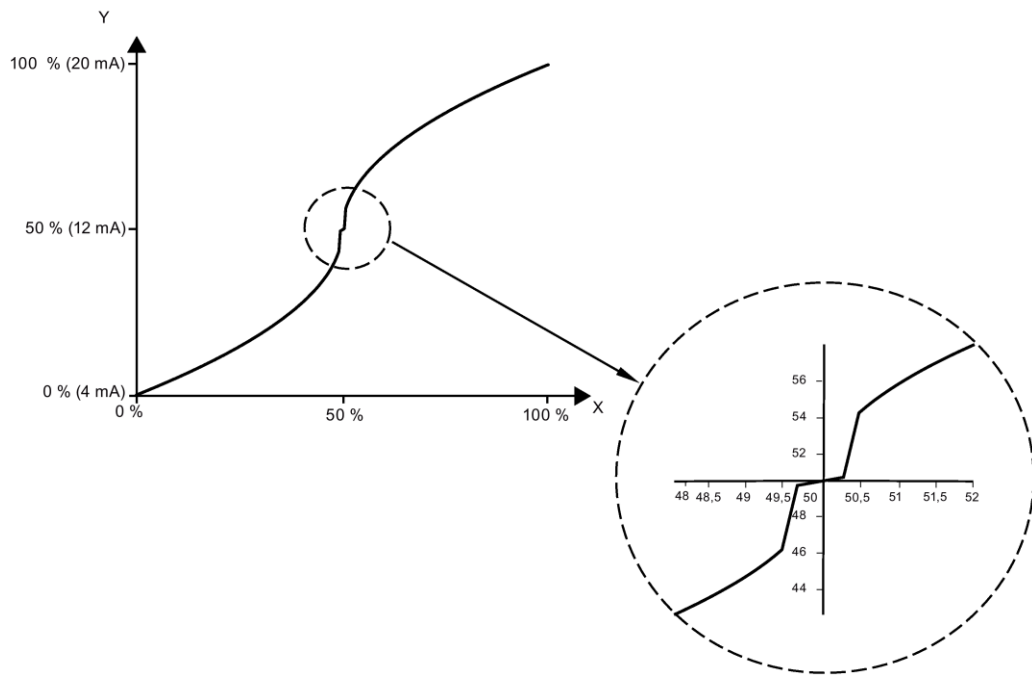
Example:

Upper scaling value: 1000 m³/s

Lower scaling value: -1000 m³/s

The output current in the range of 4 to 20 mA is halved in each case for the forward and reverse measurements.

- The output current of 4 to 12 mA is used for the reverse measurement.
- The output current of 12 to 20 mA is used for the forward measurement.



Y Loop current or flow
X Set measuring span

Example: Volume flow (linear)

For the volume flow measurement, you set the following values, for example:

- Damping value: 2.0 s
- Lower range value: 0.0 mbar
- Upper range value: 0.6 bar
- Application: Linear, square root (VSLN)
- Unit: m³/h
- Lower scaling point: 0.0 m³/h
- Upper scaling point: 300 m³/h

Example: Mass flow (linear)

For the mass flow measurement, you set the following values, for example:

- Damping value: 1 s
- Lower range value: 0.0 mbar
- Upper range value: 600 mbar
- Application: Linear, square root (MSLN)
- Unit: t/h
- Lower scaling point: 0.0 t/h
- Upper scaling point: 300 m³/ s

9.2.4.3 Set application

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the "Application" parameter [05].
3. Select the parameter value.
Application [05] (Page 88)

Result

You have set the application of your device.

9.2.5 Application point [06]

Sets the application point from which scaling occurs according to the square root. Before the application point, the scaling occurs in a linear relationship with the differential pressure.

This parameter is only visible when you have selected the characteristic curve "Linear, square root" (VSLIN or MSLIN) using the "Application" parameter.

Setting range:	5 to 15%
Factory setting:	10%

See also

Volume and mass flow measurements (Page 92)

9.2.6 Zero point adjustment [07]

Introduction

A series of factors, such as installation, static pressure, temperature or long-term stability, can cause zero-point errors.

The following options are available to correct zero-point errors:

Device without display	Device with display	Remote operation
Press the ▼ button and hold for 3 seconds.	"Zero point adjustment" parameter	Device > Zero point adjustment

9.2 Parameter assignment over device with display

For special applications (e.g. level measurement for a closed vessel), you have the option of shifting the zero point to a desired pressure value using the "Zero point adjustment" parameter.

You proceed differently depending on the device version.

9.2.6.1 Adjusting zero point (gauge pressure)

Requirement

The pressure measurement is stable.

Procedure

1. Vent the pressure connection of the device.
2. Navigate into the parameter view.
 Navigating in the views (Page 55)
3. In the parameter view, select the "Zero point adjustment" parameter [07].
4. Press the ► button.
5. Set the zero point to 0.
6. Change to the measurement view with the ◀ button.

Note

Depending on the damping setting, a settling time elapses until the pressure measurement 0 appears in the measurement view.

- For this reason, vent the pressure connection of the device up to the end of the operation.
-

Result

- The device displays the pressure measurement 0 in the set unit.
- The effective measuring range is reduced by the amount of the upstream pressure.
 Example: With an upstream pressure of 100 mbar, the effective measuring range of a 1-bar pressure transmitter is reduced to a point between 0 and 0.9 bar.

9.2.6.2 Adjusting the zero point (differential pressure)

Requirement

The pressure measurement is stable.

Procedure

1. Make sure there is identical pressure in the two process connections.
2. Navigate into the parameter view.
Navigating in the views (Page 55)
3. In the parameter view, select the "Zero point adjustment" parameter [07].
4. Press the ► button.
5. Set the zero point to 0.
6. Change to the measurement view with the ◀ button.

Note

Depending on the damping setting, a settling time elapses until the pressure measurement 0 is displayed.

- Make sure there is identical pressure in the two process connections until the end of the operation.
-

Result

- The device displays pressure measurement 0 in the set unit.
- The effective measuring range is reduced by the amount of the upstream pressure.
Example: At a pre-load pressure of 25 mbar, the upper measuring range limit of a 250 mbar pressure transmitter is reduced to 225 mbar.

9.2.6.3 Adjusting zero point (absolute pressure)

Requirement

You have created a reference pressure that is within the measurement limits.

Procedure

1. In the parameter view, select the "Zero point adjustment" parameter [07].
2. Navigate into the parameter view.
Navigating in the views (Page 55)
3. Press the ► button.
4. The value "0" appears on the display.
5. Confirm the value by pressing the ► button.
6. Change to the measurement view with the ◀ button.

Result

The device displays pressure measurement 0.0 in the set unit.

Depending on the set damping, the settling time is extended until the pressure measurement 0 is displayed.

Note

For devices for absolute pressure, the lower range value is at vacuum (0 bar a).

The zero point adjustment for devices for absolute pressure that do not measure absolute pressure (0 bar a) leads to incorrect settings.

Note

The effective measuring range is reduced by the amount of the upstream pressure.

Example: With an upstream pressure of 10 mbar, the effective measuring range of a 1300 mbar pressure transmitter is reduced to a point between 0 and 1290 mbar.

9.2.7 Apply lower range value [08]/Apply upper range value [09]

9.2.7.1 Apply lower range value parameter [08]

Sets the lower range value to the current reference pressure.

Setting range:	Within the measuring limits
Factory setting:	See nameplate (depending on measuring cell)

9.2.7.2 Apply upper range value parameter [09]

Sets the upper range value to the current reference pressure.

Setting range:	Within the measuring limits
Factory setting:	See nameplate (depending on measuring cell)

9.2.7.3 Apply lower range value/upper range value (with pressure present)

Introduction

The lower range value (4 mA) corresponds to 0% of the measuring range. The upper range value (20 mA) corresponds to 100% of the measuring range.

With pressure present, you have the following options for assigning the desired pressure measurements to the lower range value and the upper range value:

	Device without display	Device with display	Remote operation
Apply lower range value	Hold down the button ▲ for 3 seconds.	"Apply lower range value" parameter [08]	"Device > Apply values" menu
Apply upper range value	Hold down the button ▼ for 3 seconds.	"Apply upper range value" parameter [09]	"Device > Apply values" menu

The minimum permissible measuring span of the measuring cell must not be fallen below. You can find the minimum permissible measuring span of your measuring cell in the section Technical data (Page 151)

Example: Measuring cell 0 to 16 bar

1. The measuring range is from 0 to 16 bar.



2. You set the lower range value from 0 bar to 1 bar.

In order for the measuring span to stay constant, the upper range value is automatically shifted from 16 bar to 17 bar.



3. You set the upper range value from 17 bar to 15 bar.



The measuring span is 14 bar.

Requirement

- A pressure is applied, e.g. the device is already mounted.
- The pressure is within the measuring limits.

Procedure

1. Navigate into the parameter view.
 Navigating in the views (Page 55)
2. Select the "Apply lower range value" parameter [08].
3. Press the ► button.
 The existing pressure is displayed.
4. Use the ► button to confirm.
 The wizard starts.
 The wizard ends with the "COMPL" message.
5. Navigate to the "Apply upper range value" parameter [09].
 The existing pressure is displayed.
6. Press the ► button.
 The wizard starts.
 The wizard ends with the "COMPL" message.

Note

The wizard ends with the "FAILED" message in the following cases:

- The pressure exceeds or falls below the measuring limits.
 - The measuring span is below the minimum permissible span.
-

9.2.8 Select fault current [10]

Selects whether the lower or upper fault current is output when a fault occurs (e.g. hardware/firmware error, sensor break).

Setting range:	UPPER	Upper fault current
	LOWER	Lower fault current
Factory setting:	LOWER , or as specified in order	

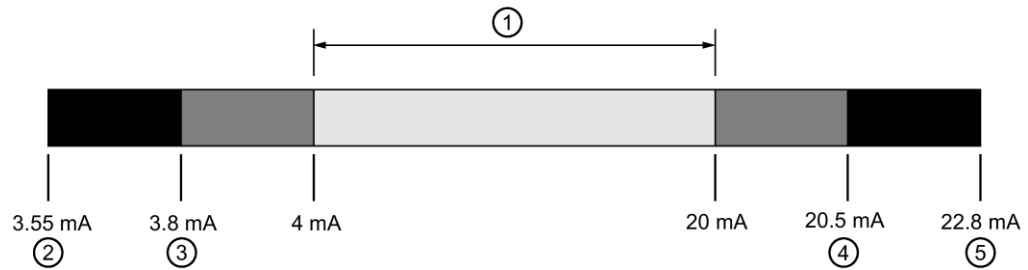
Devices with functional safety

When a safety-critical error is detected in the device in "Functional Safety enabled" device mode, the current output signal corresponds to the upper fault current ≤ 3.55 mA.

9.2.9 Lower fault current [11]

Adjusts the magnitude of the lower fault current ②.

Setting range:	Between 3.55 mA and lower saturation limit ③
Factory setting:	3.55 mA, or as specified in order

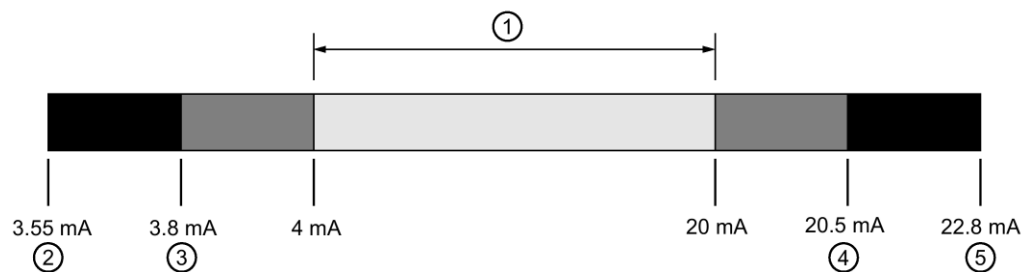


- ① Normal operation
- ② Lower fault current (factory setting)
- ③ Lower saturation limit (factory setting)
- ④ Upper saturation limit (factory setting)
- ⑤ Upper fault current (factory setting)

9.2.10 Upper fault current [12]

Adjusts the magnitude of the upper fault current ⑤.

Setting range:	Between upper saturation limit ④ und 22.8 mA
Factory setting:	22.8 mA, or as specified in order



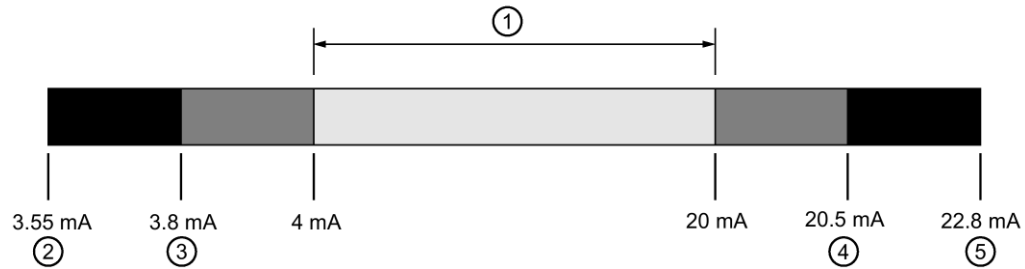
- ① Normal operation
- ② Lower fault current (factory setting)
- ③ Lower saturation limit (factory setting)
- ④ Upper saturation limit (factory setting)
- ⑤ Upper fault current (factory setting)

9.2.11 Lower saturation limit [13]

Sets the lower threshold for the lower saturation limit③.

The loop current cannot drop below the set threshold.

Setting range:	Between lower fault current② and 4 mA
Factory setting:	3.8 mA, or as specified in order

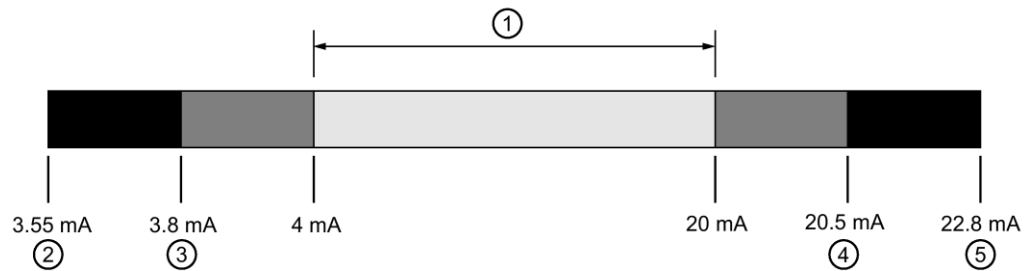


- ① Normal operation
- ② Lower fault current (factory setting)
- ③ Lower saturation limit (factory setting)
- ④ Upper saturation limit (factory setting)
- ⑤ Upper fault current (factory setting)

9.2.12 Upper saturation limit [14]

Sets the threshold for the upper saturation limit④.

Setting range:	Between 20 mA and the upper fault current
Factory setting:	20.5 mA, or as specified in order



- ① Normal operation
- ② Lower fault current (factory setting)
- ③ Lower saturation limit (factory setting)
- ④ Upper saturation limit (factory setting)
- ⑤ Upper fault current (factory setting)

9.2.13 SV selection [15]

Sets a measured value as a secondary variable (SV).

Setting range:	TEMP	Sensor temperature
	ETEMP	Electronics temperature
	LEVEL	Level
	VOL	Volume
	VFLOW	Volume flow
	USER	Custom
	MFLOW	Mass flow
Factory setting:	As specified in order	

9.2.14 Units [16]

Introduction

Depending on the application of the device that you have selected using the "Application" parameter, you have the option of selecting a unit:

- Level
- Volume
- Volume flow
- Mass flow

The selected unit is displayed in the measurement view.

Use the remote operation to set the associated unit for the "Customized characteristic curve" application.

See also

Application [05] (Page 88)

9.2.14.1 Volume flow units [16]

Selects the unit for the "Volume flow" measurement.

This parameter is only visible when you have selected a volume flow characteristic curve using the "Application" parameter.

Certain units are displayed differently on the display and over remote operation. (Page 85)

Setting range:	Display (header line)	Display (enumeration)	Remote operation
	m3/sec	m3/S	m ³ /s
	m3/min	m3/m	m ³ /min
	m3/h	m3/h	m ³ /h

9.2 Parameter assignment over device with display

	m3/d	m3/d	m³/d
	l/Sec	l/S	l/s
	l/min	l/m	l/min
	l/h	l/h	l/h
	MI/d	MI/d	MI/d
	FT3/Sec	Ft3/S	ft³/s
	Ft3/min	Ft3/m	ft³/min
	Ft3/h	Ft3/h	ft³/h
	Ft3/d	Ft3/d	ft³/d
	SCF/min	SCF/m	SCF/min
	SCF/h	SCF/h	SCF/h
	NI/h	NI/h	NI/h
	Nm3/h	Nm3/h	Nm³/h
	Gal[UK]/Sec	IGa/S	gal (UK)/s
	Gal[UK]/min	IGa/m	gal (UK)/min
	Gal [UK]/h	IGal/h	gal (UK)/h
	Gal[UK]/d	IGa/d	gal (UK)/d
	Gal/Sec	Ga/S	gal/s
	Gal/min	Ga/m	gal/min
	Gal/h	Ga/h	gal/h
	Gal/d	Ga/d	gal/d
	Mgal/d	MGI/d	Mgal/d
	bbbl/d	bbbl/d	bbbl/d
	bbbl/h	bbbl/h	bbbl/h
	bbbl/min	bbbl/m	bbbl/min
	bbbl/Sec	bbbl/S	bbbl/s
Factory setting:	m³/s		

9.2.14.2 Mass flow units [16]

Selects the unit for the mass flow measurement.

This parameter is only visible when you have selected a mass flow characteristic curve using the "Application" parameter.

Certain units are displayed differently on the display and over remote operation. (Page 85)

Setting range:	Display (header line)	Display (enumeration)	Remote operation
	KG/Sec	KG/S	kg/s
	Gr/Sec	G/S	g/s
	Gr/min	G/m	g/min
	Gr/h	G/h	g/h
	KG/min	KG/m	kg/min
	KG/h	KG/h	kg/h
	KG/d	KG/d	kg/d

	t/min	t/m	t/min
	t/h	t/h	t/h
	t/d	t/d	t/d
	lb/Sec	lb/S	lb/s
	lb/min	lb/m	lb/min
	lb/h	lb/h	lb/h
	lb/d	lb/d	lb/d
	ton/min	sto/m	ton/min
	ton/h	sto/h	ton/h
	ton/d	sto/d	ton/d
	ton(UK)/h	Lto/h	ton (UK)/h
	ton(UK)/d	Lto/d	ton (UK)/d
Factory setting:	kg/s		

9.2.15 Temperature units [17]

Selects the temperature unit for the "Sensor temperature" and "Electronics temperature" measurements that are displayed in the measurement view.

Setting range:	K
	°C
	°F
	°R
Factory setting:	°C

9.2.16 Lower scaling point [18]

Sets the lower range value for the scaling.

Depending on the application of the device, you set the lower scaling point as follows:

Volume flow

Setting range:	Freely selectable numeric value
Factory setting:	0 m ³ /s
Setting range:	Freely selectable numeric value
Factory setting:	0

Mass flow

Setting range:	Freely selectable numeric value
Factory setting:	0 kg/s
Setting range:	Freely selectable numeric value
Factory setting:	0

Custom units

Setting range:	Freely selectable numeric value
Factory setting:	USER DEFINED (custom), or as specified in order

Note

Bidirectional volume and mass flow measurement

Select a lower scaling value that is symmetrical to the upper scaling value. Example:

- Upper scaling value: 1000 m³/s
- Lower scaling value: -1000 m³/s

9.2.16.1 Set lower scaling point

Procedure

1. Navigate to the parameter view.
 Navigating in the views (Page 55)
2. Select the "Lower scaling point" parameter [18].
3. Use the ► button to confirm.
4. Set the lower scaling point.

9.2.17 Upper scaling point [19]

Sets the upper range value for the scaling.

Depending on the application of the device, you set the upper scaling point as follows:

Volume flow

Setting range:	Freely selectable numeric value
Factory setting:	1000 m ³ /s

Mass flow

Setting range:	Freely selectable numeric value
Factory setting:	1000 kg/s

Custom units

Setting range:	Freely selectable numeric value
Factory setting:	USER DEFINED (custom), or as specified in order

9.2.17.1 Set upper scaling point

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the "Upper scaling point" parameter [19].
3. Use the ► button to confirm.
4. Set the upper scaling point.

9.2.18 Low flow cut-off [20]

Sets the flow value for the low flow cut-off. The flow value is suppressed up to certain percentage of the output value.

The parameter is visible when you have selected the "Hold at 0, square root" (VSOFF or MSOFF) characteristic curve using the "Application" parameter.

Setting range:	0% - 100%
Factory setting:	10%

See also

Volume and mass flow measurements (Page 92)

9.2.19 Button lock [23]

Enables the button lock. You can continue operating the device via HART.

Setting range:	ON	Button lock enabled
	OFF	Button lock disabled
Factory setting:	OFF	

9.2.19.1 Enabling button lock

Procedure

1. Navigate into the parameter view.
Navigating in the views (Page 55)
2. In the parameter view, select the "Button lock" parameter.
3. Press the ► button.
The "EDIT" symbol flashes.
4. Select ON with the ▲ or ▼ button.



5. Use the ► button to confirm.

Result

- The display automatically returns to the measurement view.
- The display automatically changes between the measured values every 12 seconds.
- The symbol for button lock "LL" and the measured value ID are displayed alternately.

Note

For a device without display, you activate the button lock using remote operation.

9.2.19.2 Disabling button lock

Procedure

To disable the button lock, press and hold the ► button for 5 seconds.

Result

- The symbol for Button lock "LL" is hidden.
- You can operate the device using the buttons.

Note

For a device without display, you deactivate the button lock using remote operation.

9.2.20 Change user PIN [24]

Used to change the User PIN.

Setting range:	1 to 65535
Factory setting:	2457

Requirement

The "User PIN (Page 113)" parameter is enabled.

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the parameter "Change user PIN".



3. Press the ► button.
4. Enter the old user PIN.

9.2 Parameter assignment over device with display

- 5. Enter the new user PIN with a value between 1 and 65535.

Changing parameter values (Page 60)



- 6. Use the ► button to confirm.
- 7. Repeat the new user PIN and use the ► button to confirm.



Result

- If both user PINs match, the "COMPL" message appears. The user PIN has been successfully changed.
- If the two user PINs do not match, the "FAILED" message appears. Then repeat the described procedure.

9.2.21 Recovery ID [25]

Shows the recovery ID.

If you have forgotten your user PIN, you will need a recovery ID. The "Recovery ID" parameter shows a number that is necessary for restoring the user PIN.



Figure 9-2 Example

9.2.21.1 Display Recovery ID

Requirements

The "User PIN" parameter is enabled.

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the "Recovery ID" parameter.
This Recovery ID is displayed.

Result

Please contact the Technical Support (Page 195) with the displayed recovery ID and the serial number of your device.

You can find the serial number of the device on the nameplate or via remote operation.

S.K.I. Technical Support will give you a PUK (PIN Unlock Key) that you use to reset the user PIN to the factory setting 2457.

9.2.22 PIN recovery [26]

Used to reset the user PIN to the factory setting.

The user PIN is factory set to 2457 in the device.

9.2.22.1 Recovering the user PIN


Requirement

- You have received the PUK from Technical Support. (Page 110)
- The "User PIN (Page 113)" parameter is enabled.

Procedure

1. In the parameter view, select the "PIN recovery" parameter.

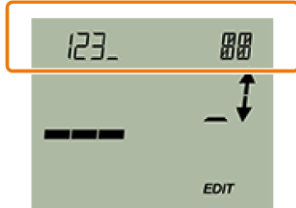


2. Press the  button.
The cursor and the "EDIT" symbol flash.

9.2 Parameter assignment over device with display

3. Enter the digits of the PUK:
 - Use the ▲ or ▼ button to change.
 - Use the ► button to confirm.
 - Use the ◀ button to delete.

The complete PUK is shown on the top line of the display.



4. When the PUK is complete, use the ► button to confirm.

Result

- If you have entered the correct PUK, the message "NEW PIN - 2457" appears. The user PIN has been reset to the factory setting 2457.
- If the PUK was not correctly entered, the message "FAILED" appears. Then repeat the described procedure.

9.2.23 User PIN [27]

Used to enable or disable the user PIN.

Setting range:	ON	Enable user PIN
	OFF	Disable user PIN
Factory setting:	User PIN disabled	

When the user PIN is enabled, the measured values and parameters are read-only.

- To change the parameters and use the device functions, the user PIN must be input.

The user PIN 2457 is factory preset in the device.

Note

Write protection is automatically enabled 10 minutes after the last button operation.

- Enter the user PIN.

9.2.23.1 Enable user PIN

Requirement

The User PIN is disabled.

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the parameter "User PIN".
3. Use the ► button to confirm.
The message "USER PIN ON" (User PIN enabled) appears for 2 seconds.

Result

The User PIN is activated after about 10 minutes or after a device restart.



9.2.23.2 Disable user PIN

Requirement

The user PIN is enabled.

Procedure

1. Navigate to the parameter view.
Navigating in the views (Page 55)
2. Select the parameter "User PIN".
3. Use the ► button to confirm.

9.2 Parameter assignment over device with display

- 4. Select YES with the ▲ or ▼ button.



- 5. Use the ► button to confirm.

The message "USER PIN OFF" appears for 2 seconds.

Result

The User PIN is disabled.



9.2.24 Active device mode [28]

Shows the mode in which the device is operated.

The parameter is only visible for devices with Functional Safety.

Setting range:	STD	Functional Safety is disabled
	FUNCT	Validation of the safety-related parameters and/or the fail-safe behavior is performed
	SAFE	Functional Safety is enabled
	ERROR	Safety critical device error
	O/S	Out of service mode, non-safe mode
Factory setting:	STD	

9.2.25 Functional Safety [29]

Enables Functional Safety.

The parameter is only visible for devices with Functional Safety.

9.2.26 Display test [30]

Used to check that numbers, texts and symbols appear correctly on the display.

- To start the display test, press the ► button and select "START".
When the display test is complete, the message "COMPL" appears.
- To cancel the display test, press the ◀ button.

9.2.27 Loop test [31]

Sets a constant loop current for test purposes.

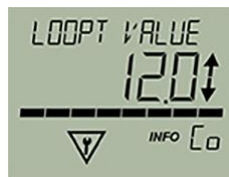
You have the option of selecting preset values or a user-defined value.

Setting range:	3.55 mA	
	4 mA	
	12 mA	
	20 mA	
	22.8 mA	
	USER	User defined
Factory setting:	12 mA	

9.2.27.1 Loop test with preset loop current value

Procedure

1. Navigate into the parameter view.
Navigating in the views (Page 55)
2. In the parameter view, select the "Loop test" parameter.
3. Use the ► button to confirm.



The loop test starts:

- The "EDIT" symbol flashes.
 - The "Function check" symbol is displayed.
 - The "Co" symbol (constant current mode) is displayed.
4. Change the preset value with the ▲ or ▼ button.

9.2 Parameter assignment over device with display

5. Use the ► button to confirm.
The loop test starts.
6. End the loop test with the ◀ button.

9.2.27.2 Loop test with user defined loop current value

Procedure

1. Navigate into the parameter view.
Navigating in the views (Page 55)
2. In the parameter view, select the "Loop test" parameter.
3. Use the ► button to confirm.



The loop test starts:

- The "EDIT" symbol flashes.
 - The "Function check" symbol is displayed.
 - The "Co" symbol (constant current mode) is displayed.
4. Change to "USER" with the ▲ or ▼ button.
 5. Use the ► button to confirm.
 6. Set a value between 3.6 mA and 22.8 mA using the buttons ▲ or ▼.
 7. Use the ► button to confirm.
The loop test starts.
 8. End the loop test with the ◀ button.

9.2.28 Start view [32]

Selects the value that is displayed as the first measured value in the measurement view.

For the selection to take effect, change from the parameter view to the measurement view or restart the device.

Setting range:	Edit view	Measurement view
	PRESS	Pressure (P1)
	STEMP	Sensor temperature (P2)
	ETEMP	Electronics temperature (P3)
	LEVEL	Level (P4)

	VOL	Volume (P5)
	VFLOW	Volume flow (P6)
	MFLOW	Mass flow (P7)
	USER	Customized characteristic curve (P8)
	%	Percent of range (P9)
	LOOPC	Loop current (PA)
	CVOLT	Terminal voltage (PB)
Factory setting:	PRESS	

Note

To have the process value for "Level", "Volume", "Mass flow", "Volume flow" or "Customized characteristic curve" shown as the "Start view", first set the associated characteristic curve using the "Application" (Page 88) parameter.

9.2.29 Pressure reference [33]

Used to adapt the display of the pressure unit to your application.

Setting range:	NONE	Not specified
	GAUGE	Gauge pressure
	ABS	Absolute pressure
Factory setting:	NONE	

See also

Pressure units [01] (Page 84)

9.2.30 Identify the device [34]

Enables or disables the device identification via HART.

When device identification is enabled, the device signals its identification data via HART.

With device identification enabled, the device responds to a request with the HART command "Find device".

Setting range:	ON	Device identification enabled
	OFF	Device identification disabled
Factory setting:	OFF	

9.2.31 Reset [35]

Used to reset the following settings:

Setting range:	Restore ordered configuration	CUST
	Reset to sensor calibration	SENSR
	Reset DAC trim to the factory setting	DAC
	Factory reset	FACT

9.2.31.1 Reset to sensor calibration

Resets the zero point and sensor calibration to the factory setting.

9.2.31.2 Reset DAC trim to the factory setting

Resets the DAC trim (digital-to-analog converter trim) to the factory setting.

The DAC trim is used to calibrate the 4 mA and 20 mA end points of the analog output with an external reference (e.g. current measurement device).

The DAC trim is available over remote operation.

9.2.31.3 Restore ordered configuration

With this function you return your device to its delivery state.

- The ordered configuration of the following parameters is restored:
 - Pressure units
 - Quick start
 - Pressure reference
 - Long tag (TAG)
 - Short tag (TAG)
 - Lower range value
 - Upper range value
 - Lower limit of the measuring range
 - Upper limit of the measuring range
 - Damping value
 - Application and related values (e.g.: vessel shapes and application points)
 - Fault current selection
 - Lower fault current
 - Upper fault current
 - Lower saturation limit
 - Upper saturation limit
 - Custom units
- The parameters that you have not configured via the order are reset to the factory settings.

9.2.31.4 Restore factory settings

With this function you return your device to its factory setting.

The following settings are reset to the factory setting among other things:

- Sensor calibration
- DAC trim
- The defaults that you have configured in your order.

These defaults can then deviate from the ordered configuration. To restore the ordered configuration, use the "Restore ordered configuration (Page 119)" parameter.

9.3 Parameter assignment over remote operation

9.3.1 Introduction

This section describes the most important parameters and functions that are available additionally over remote operation:

- "Quick Start" wizard
- Identification (TAG)
- Simulation
- Customized characteristic curve
- Sensor calibration
- Digital-to-analog converter adjustment (DAC adjustment)
- Diagnostics functions
 - Limit monitoring and event counter
 - Trend log (not available on ACCU P320)
 - Operating hours counter

9.3.2 Quick start

You use the "Quick start" wizard to configure your device in five steps for the required application:

- Step 1: Identification
- Step 2: Application
- Step 3: Scaling

Note that you set the displayed pressure unit with the "Pressure units" (Page 85) parameter and not with the wizard.

Set the unit of the selected application (e.g. volume, mass flow) also via the parameter group "Settings > Current output > Scaling > Unit".

- Step 4: Fault current
- Step 5: Summary

The summary provides an overview of the "old" and "new" parameters.

To store the parameters in SIMATIC PDM and transfer them to the device, click the "Apply" button.

9.3.3 Identification

Define the data that you need to identify your device under the "Identification" parameter group. A distinction is made between data you can set yourself and values that are preset in the factory. The default values are write-protected and cannot be changed by the user. The corresponding allocation is set out below:

Designation	Adjustable	Preset	Factory setting
Short tag	X	-	
Long tag (TAG)	X	-	
Description	X	-	
Message	X	-	
Installation date	X	-	dd.mm.yyyy
Device			
Manufacturer_id	-	X	S.K.I.
Product name	-	X	ACCU P420 ¹⁾
Article number	-	X	e.g. ACCU440-1GL01-5AF2-Z ¹⁾
Order option 1/ Order option 2	-	X	e.g. A01+C11+C12+C14+C20+E00+H01+Y01+Y15+Y21 ¹⁾
Serial number	-	X	in accordance with the measuring cell selection/device manufacture
Final assembly number	X	-	
Sensor serial number	-	X	in accordance with the measuring cell selection/device manufacture
Hardware version	-	X	in accordance with the measuring cell selection/device manufacture
Firmware version	-	X	in accordance with the measuring cell selection/device manufacture
EDD version	-	X	
Sensor serial number	-	X	in accordance with the measuring cell selection/device manufacture
Sensor type	-	X	in accordance with the measuring cell selection/device manufacture
Maximum measuring span	-	X	in accordance with the measuring cell selection/device manufacture

¹⁾ in accordance with the order

9.3.4 Simulation

You can use the device to simulate the following via remote operation (e.g. field communicator, SIMATIC PDM):

- Input and output values
 - Constant pressure values
 - Ramp function
- Diagnostics

NOTICE

Timeout of simulation

10 minutes after changing (editing) a simulation parameter (the "Simulation value" parameter is the exception), the simulation is automatically disabled and the device returns to normal measuring mode. When a timeout occurs, the "Simulation mode" parameter switches to "Disabled" and the error code "Cb" is no longer shown on the display. (Device status conditions are also reset in PDM, AMS, FDT and FC375/475.)

9.3.4.1 Simulate constant pressure values

Procedure

To simulate a constant pressure value via remote operation (e.g. SIMATIC PDM), follow these steps:

1. For the "Simulation mode" parameter, set the "Enabled" option to simulate a constant pressure value.
2. Select the pressure value ("Process value") to be simulated from the drop-down list under the "Simulation selection" parameter.
3. For the "Simulation value" parameter, set the desired constant pressure value for the simulation.
4. Set status to be simulated for the "PV status" parameter.
5. Click "Transfer" to start the simulation.
6. For the "Simulation mode" parameter, set the "Disabled" option to stop the simulation.

Result

The measured value is replaced by a constant simulation value. The simulation influences the output signal.

The diagnostic ID "Cb" is displayed on the device.

Note

The simulated pressure value has a direct effect on the configured process value (e.g. volume or flow rate) and thus on the current output dependent on it.

9.3.4.2 Simulate ramp function

Procedure

To simulate a ramp function via remote operation (e.g. SIMATIC PDM), follow these steps:

1. For the "Simulation mode" parameter, set the "Ramp" option to simulate a changing pressure value.
2. Select the pressure value ("Process value") to be simulated from the drop-down list under the "Simulation selection" parameter.
3. For the "Simulation value" parameter, set the desired start value for the simulation.
4. Set status to be simulated for the "PV status" parameter.
5. Set the "Ramp end" parameter .
6. Set the "Ramp steps" parameter to define the number of steps in the ramp simulation.
7. Set the "Ramp duration" parameter to define the time interval (in seconds) for each step in the simulation.
8. Click "Transfer" to start the simulation.
9. For the "Simulation mode" parameter, set the "Disabled" option to stop the simulation.

Note

The simulated pressure value has a direct effect on the configured process value (e.g. volume or flow rate) and thus on the current output dependent on it.

9.3.4.3 Simulate diagnostics

Procedure

To simulate diagnostics via remote operation (e.g. SIMATIC PDM), follow these steps:


1. Open the "Device" menu in SIMATIC PDM and select "Simulation > Diagnostics".
2. To put the device into simulation mode, press the "Enable" button in the "Simulation diagnostics" tab.
(Button switches between "Enable" and "Disable").
3. Select the diagnostics you want to simulate from the drop-down box of the "Diagnostics" field.
4. Select "Action" for each selected diagnostic action to be simulated: "On" or "Off".
5. To start the simulation, click on the "Apply and transfer" button.

The diagnostic status of the simulation selected for each diagnostic is displayed in additional tabs in the dialog box. The simulated diagnostics is indicated by a check mark in the check box.

End diagnostics simulation

You close the simulation in the "Diagnostics simulation" tab:

- To disable a specific diagnostic action, click "Off" (under the "Action" field).
- To end the diagnostics simulation, click on the "Disable" button.

 WARNING
When diagnostics simulation is enabled, diagnostic events of the real process are neither recorded nor evaluated.
With activated diagnostics simulation, only the simulated diagnostics are displayed on the device display.
Stop diagnostics simulation immediately after use:
<ul style="list-style-type: none">• Click "Disable" in the "Diagnostics simulation" tab before you close the "Diagnostics" dialog.• Alternatively, you can restart the device.

9.3.5 Customized characteristic curve

9.3.5.1 Introduction

For special applications, a customized characteristic curve is available.

This application is used, for example, for volume measurement in vessels with unusual shapes.

You define the relationship between inlet pressure and outlet current according to your user-specific requirements.

You have up to 32 breakpoints available for this, which you enter using the engineering system and display graphically.

Example

For measurement with the customized characteristic curve, you set the following values, for example:

Damping value:	2.0 s
Lower range value:	0 bar
Upper range value:	10 bar
Application:	Custom (CUSTM)
Unit:	Cans
Lower scaling point:	0 cans
Upper scaling point:	250 cans

x values: 0%, 25%, 50%, 75%, 100%
 y values: 0%, 25%, 50%, 75%, 100%

9.3.5.2 "Custom units" parameter

Selects a custom unit.

The selected unit is displayed in the measurement view (Page 56).

Setting range:	Up to 12 characters
Factory setting:	0 or as specified in order

This parameter is only visible when you have selected a custom characteristic curve using the "Application" parameter.

9.3.5.3 Set customized characteristic curve

Requirement

- You have set the "Customized characteristic curve" application.
- You have set a custom unit.
- You have set the lower scaling point and the upper scaling point.

Procedure

1. Select the "Customized characteristic curve" menu.
2. Read the data from the device.
3. Enter the desired number of breakpoints.
You can enter a minimum of two and up to 32 breakpoints.
4. Enter the x values and y values.

Note

The x values must increase monotonically. Otherwise, the x values are not accepted by the device.

The characteristic curve is displayed as diagram.

The x values are shown as pressure value or as percentage of the set pressure range.

The y values are displayed in the user-specific unit or as a percentage of the configured user-specific range.

5. Transfer the characteristic to the device.

Result

The output current now follows the set characteristic.

Values below the first breakpoint or above the last breakpoint are extrapolated.

See also

Application [05] (Page 88)

9.3.6 Sensor calibration

You use the sensor calibration to set the characteristic curve of the device at two trim points. The results are then correct measured values at the sensor trim points.

The sensor trim points can be selected as any points within the nominal range.

Devices that are not turned down prior to delivery are trimmed at 0 bar and the high limit of the nominal range.

Devices that are turned down prior to delivery are trimmed at the low and high limits of the set measuring range.

Examples

- For a particular device that is not turned down (e.g. 63 bar), the typical measured value is 50 bar. To attain the highest possible accuracy for this value, set the upper sensor trim at 50 bar.
- A 63-bar pressure transmitter is turned down to 4 to 7 bar. You can attain the highest possible accuracy by selecting 4 bar for the low trim point and 7 bar for the high trim point.
- A 250-mbar absolute pressure transmitter shows 25 mbar at 20 mbar. A reference pressure of 20 mbar is available. To correct the zero point, perform a sensor trim at the lower trim point with 20 mbar.

Note

Use a test device whose accuracy is at least three times as high as the accuracy of the pressure transmitter.

Sensor calibration at the low calibration point

1. Use remote control (e.g. SIMATIC PDM) to select the menu command "Device > Sensor calibration".
2. Apply the pressure for the low calibration point at the device.
3. Apply the pressure value that you have created and assign the pressure value to the device.

The device applies the set value.

The device carries out an offset correction of the characteristic curve.

Sensor calibration at the high calibration point

1. Use remote control (e.g. SIMATIC PDM) to select the menu command "Device > Sensor calibration".

2. Apply the pressure for the high calibration point at the device.

The high calibration point needs to be greater than the low calibration point.

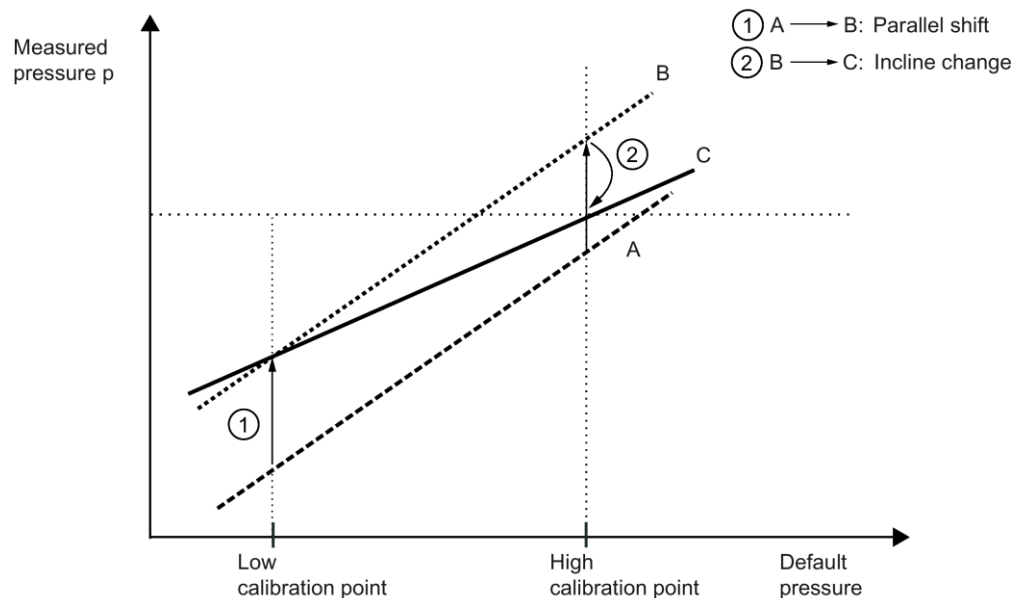
3. Apply the pressure value that you have created and assign the pressure value to the device.

The device applies the set value.

The device carries out an offset correction of the characteristic curve.

The low calibration point is not affected by this.

Result



- A Original characteristic
B Characteristics after sensor calibration at the low calibration point
C Characteristics after sensor calibration at the high calibration point

9.3.7 Digital-to-analog converter adjustment (DAC adjustment)

Introduction

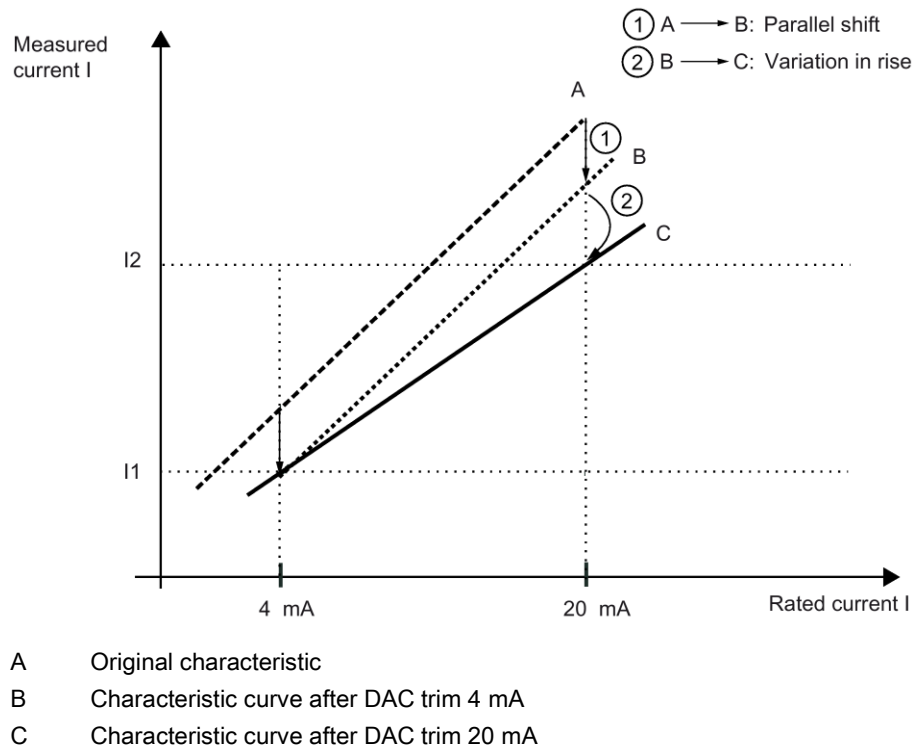
The current that is output by the device can be trimmed independently of the measuring circuit. This function is designed for compensating inaccuracies in the processing chain following the device.

Procedure

- Trim at 4 mA:
Use the menu command "DAC trim" to instruct the device to put out 4 mA. You read the measured value at an ammeter and enter this value. The device uses this value for offset correction of the current.
- Trim at 20 mA:
Use the menu command "DAC trim" to instruct the device to put out 20 mA. You read the measured value at an ammeter and enter this value. The device uses this value for gradient correction of the current. The value for 4 mA is not affected by this.

Note

If a multimeter is used, it must always be sufficiently accurate.



9.3.8 Diagnostics functions

9.3.8.1 Limit monitoring and event counter

Used to monitor selected process values, count associated events based on configured limits and triggers, acknowledge and reset alarms and warnings.

Configuring variables for monitoring

Configure a process value for each "Limit monitoring" tab. Select the process value to be monitored in the "Monitored value" drop-down list. Enter the values for upper limit, lower limit and hysteresis that trigger an event.

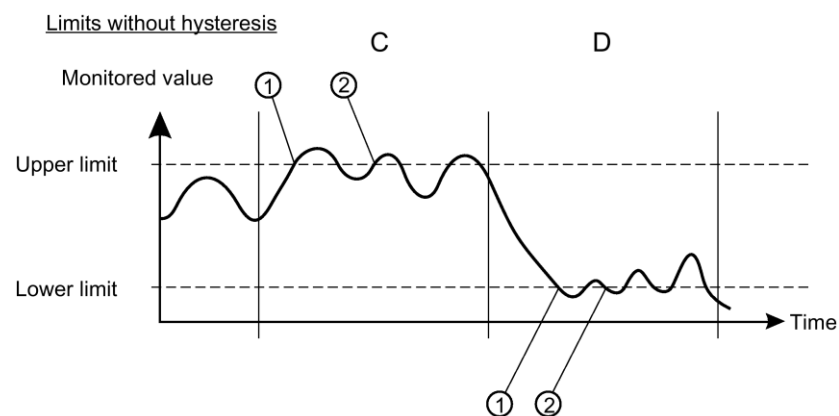
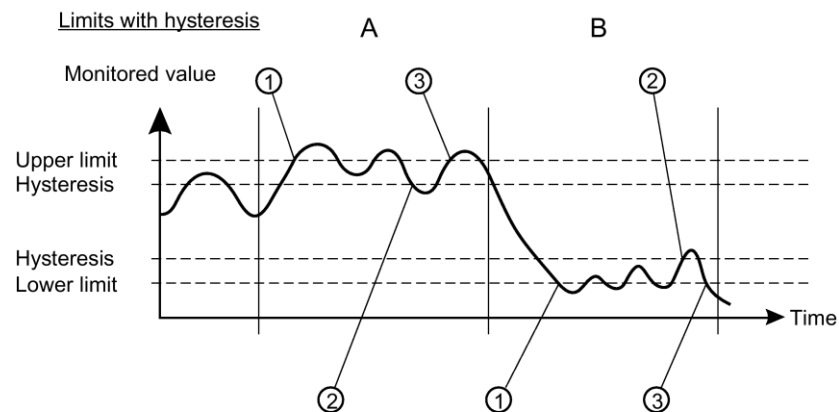
Limits

Each process value (monitored value) is assigned limits. The following limit parameters are available:

- Upper limit
- Lower limit
- Hysteresis

Hysteresis

The hysteresis works as follows:



A: Upper limit with hysteresis

An overrun event is counted when the process value rises above the upper limit (1). The next overrun event is counted when the process value falls below the lower limit minus hysteresis (2), and then rises above the upper limit (3).

9.3 Parameter assignment over remote operation

When hysteresis is enabled (value not equal to zero entered), two events are counted within the time period specified by 'A'.

B:Lower limit with hysteresis

An underrun event is counted when the process value falls below the lower limit (1). The next underrun event is counted when the process value first rises above the lower limit plus hysteresis (2), and then falls below the lower limit (3).

C:Lower limit without hysteresis

An underrun event is counted when the process value falls below the lower limit (1). The next underrun event is counted when the process value rises above the lower limit (2) by a given value (since the hysteresis is set to zero), and then falls below the lower limit (2). When hysteresis is disabled (no value entered), three events are counted within the period specified by 'C'.

D:Upper limit without hysteresis

An overrun event is counted when the process value rises above the upper limit (1). The next overrun event is counted when the process value falls below the lower limit (2) by a given value (since the hysteresis is set to zero), and then rises above the upper limit (2).

Limit monitoring not requiring acknowledgment

If limit monitoring display is enabled, a "process value alarm" is set for each limit violation (high or low violation).

This process value alarm is reset when the monitored process value is again within the limits. It is not necessary to acknowledge the process value alarm.

Limit monitoring requiring acknowledgment with event counter

With this type of monitoring, the configured diagnostics is only triggered after the specified number of limit violations has been reached (e.g. maintenance required).

This diagnostic message must be acknowledged. During acknowledgment, the event counters of the monitored process value and the diagnostic messages are reset.

Events and actions

If the process value rises above the upper limit (overrun) or falls below the lower limit (underrun), an event is counted with an adjustment by any hysteresis.

Process alarms and warnings are displayed as symbols for the status in the device status dialog in the engineering system and on the device screen.

All alarms and warnings that have been triggered remain pending until the event counter is reset. Disabling the action means that no new alarms or warnings are triggered for the configured limits although the counter remains in operation.

Actions and fail-safe mode

Process alarms can trigger fail-safe behavior at the signal output, while process warnings only serve as information available via local operation and the engineering system. Process values set the signal output to fail-safe mode if:

- Specific errors occur (the mA output is set to fail-safe mode). (See Diagnostic messages (Page 144).)
- A maintenance alarm occurs at a process value selected at the output.

Enable monitoring

Once the monitored variable is configured, you must ensure that the limit monitoring is set to Enabled and then select Apply and transfer to the device. To monitor a different process value, repeat the steps in a new tab page for limit monitoring.

Displaying and resetting event counters

If process alarms or warnings are triggered during device operation, return to this dialog and select Reset and acknowledge. The event counter is reset and process alarms and warnings are acknowledged and deleted.

9.3.8.2 Trend log

Requirement

- You have the ACCU P420 product version.
- You operate the device via remote control (e.g. SIMATIC PDM).

Set trend log

1. Select the menu command "Device > Trend log settings".
2. Define the number of process values you wish to log.
Only pressure values or sensor temperature values are logged.
3. Use the "Logging behavior" parameter to define the buffer behavior.
 - To fill the buffer with a variable number of logging points between 1 to 735 per process value, select "Fill and stop".
The buffer is deleted and filled up to the number of set logging points. Then logging is stopped.
 - If you select the buffer behavior "Overwrite", the buffer is completely deleted. After the buffer size of 735 logging points per process value has been reached, the 15 oldest logging points are cyclically replaced with 15 new logging points.
4. In the "Logging interval" parameter, enter the interval in seconds between the logging points.
5. Assign the pressure or the sensor temperature to the first and second process value.
6. Click on "Transfer" to write the log settings to the device.
The buffer with the existing logging points is deleted and overwritten with new logging points.

Show trend log

1. Select the menu command "Diagnostics > Trend log".
2. Click on "Read".
 - The number of available process values is displayed.
 - The current number of logging points per process value that are already in the buffer is displayed.
 - The time stamp for the start time is displayed.
3. To show the first or second process value in the chart, enable the associated check box.
4. Click on "Read".
 - The logging points in the buffer are read from the device and shown in the chart.
 - The process values for pressure and sensor temperature are shown in different colors in the chart.

When you click on "Reset", the buffer is deleted and trend logging starts again.

9.3.8.3 Operating hours counter

Operating hours counter for transmitter electronics

- Monitors the number of operating hours during which the transmitter remained in continuous operation.
- Starts with the first commissioning at the factory.
- The operating hours counter cannot be reset or adjusted by the user.

Operating hours counter for sensor electronics

- Is only displayed when the measuring transducer electronics was replaced.
- Monitors the number of operating hours during which the sensor electronics remained in continuous operation.

Procedure

1. Use remote control (e.g. SIMATIC PDM) to select the menu command "Diagnostics > Device status".
2. Select the "HART status" tab.

The operating time and, if available, the sensor operating time is displayed.


Service and maintenance

10.1 Basic safety instructions

The device is maintenance-free. However, a periodic inspection according to pertinent directives and regulations must be carried out.

An inspection can include check of:

- Ambient conditions
- Seal integrity of the process connections, cable entries, and cover screws
- Reliability of power supply, lightning protection, and grounds

 CAUTION
<p>Releasing button lock</p> <p>Improper modification of parameters could influence process safety.</p> <ul style="list-style-type: none"> • Make sure that only authorized personnel may cancel the button locking of devices for safety-related applications.

NOTICE
<p>Penetration of moisture into the device</p> <p>Device damage.</p> <ul style="list-style-type: none"> • Make sure when carrying out cleaning and maintenance work that no moisture penetrates the inside of the device.

10.2 Cleaning

10.2.1 Cleaning the enclosure


Cleaning the enclosure


- Clean the outside of the enclosure with the inscriptions and the display window using a cloth moistened with water or a mild detergent.
- Do not use any aggressive cleansing agents or solvents, e.g. acetone. Plastic parts or the painted surface could be damaged. The inscriptions could become unreadable.


10.3 Maintenance and repair work

10.3.1 Basic safety instructions

10.3.1.1 Defining the maintenance interval

 WARNING
No maintenance interval has been defined Device failure, device damage, and risk of injury. <ul style="list-style-type: none">• Define a maintenance interval for recurring tests depending on the use of the device and your own experience.• The maintenance interval will vary from site to site depending on corrosion resistance.

 WARNING
Impermissible accessories and spare parts Risk of explosion in areas subject to explosion hazard. <ul style="list-style-type: none">• Only use original accessories or original spare parts.• Observe all relevant installation and safety instructions described in the instructions for the device or enclosed with the accessory or spare part.

 WARNING
Hot, toxic or corrosive process media Risk of injury during maintenance work. When working on the process connection, hot, toxic or corrosive process media could be released. <ul style="list-style-type: none">• As long as the device is under pressure, do not loosen process connections and do not remove any parts that are pressurized.• Before opening or removing the device ensure that process media cannot be released.

 **WARNING**

Improper connection after maintenance

Risk of explosion in areas subject to explosion hazard.

- Connect the device correctly after maintenance.
- Close the device after maintenance work.

Refer to Technical data (Page 151).

 **CAUTION**

Hot surfaces

Risk of burns during maintenance work on parts having surface temperatures exceeding 70 °C (158 °F).

- Take corresponding protective measures, for example by wearing protective gloves.
- After carrying out maintenance, remount touch protection measures.

10.3.2 Checking the gaskets

Inspect the seals at regular intervals

Note

Incorrect seal changes

Incorrect measured values will be displayed. Changing the seals in a process flange of a differential pressure measuring cell can alter the start-of-scale value.

- Changing seals in devices with differential pressure measuring cells may only be carried out by personnel authorized by S.K.I..

Note

Using the wrong seals

Using the wrong seals with flush-mounted process connections can cause measuring errors and/or damage the diaphragm.

- Always use seals which comply with the process connection standards or are recommended by S.K.I..

-
1. Clean the enclosure and seals.
 2. Check the enclosure and the seals for cracks and damage.
 3. If necessary, lubricate the seals or replace them.

10.3.3 Check cable glands

- Check the tightness of the cable glands at regular intervals.
- Tighten the cable glands if necessary.

10.3.4 Replacing spare parts

10.3.4.1 Replacing electrical connections and cable entries

Procedure

1. Read the operating data and the approval information on the nameplates of your device.
2. Order a suitable electrical connection or cable entry for your device (cable gland, sealing plug or device plug).

To do this, use the article number "7MF7906-..".

Notes for cable glands and device plugs

- When you order a cable gland or a device plug as spare part, consider the following criteria:
 - Thread
 - Material
 - Approval
 - IP degree of protection
 - Permissible ambient temperature
- The permissible ambient temperature for devices with dust explosion protection deviates from the permissible ambient temperature of the cable gland and the device plug.
You should therefore not use any cable glands or device plugs from third-party manufacturers for devices with dust explosion protection.

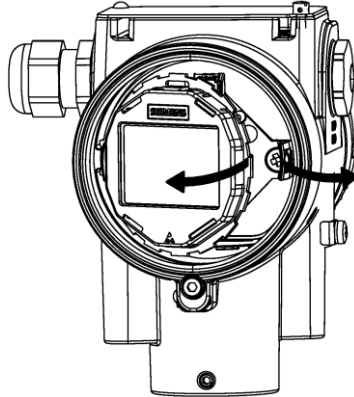
10.3.4.2 Replacing the display

Removing the display

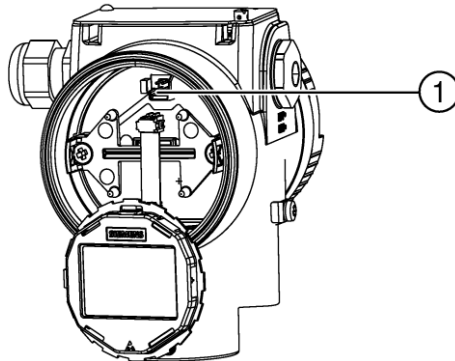
Procedure

1. De-energize the device.
2. Use a 3 mm Allen key to loosen the front safety catch.
3. Unscrew the front cover.

4. Remove the display from the holder.



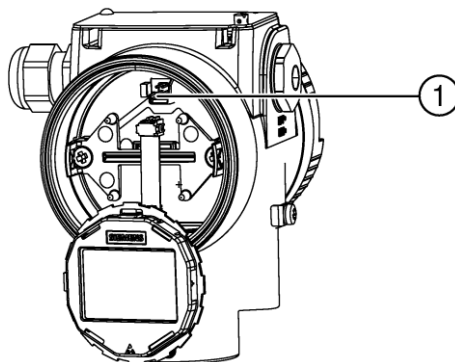
5. Disconnect the cable of the display from the 4-pole connector ①.



Installing the display

Procedure

1. Connect the cable of the display with the 4-pole connector ① by observing the poling:



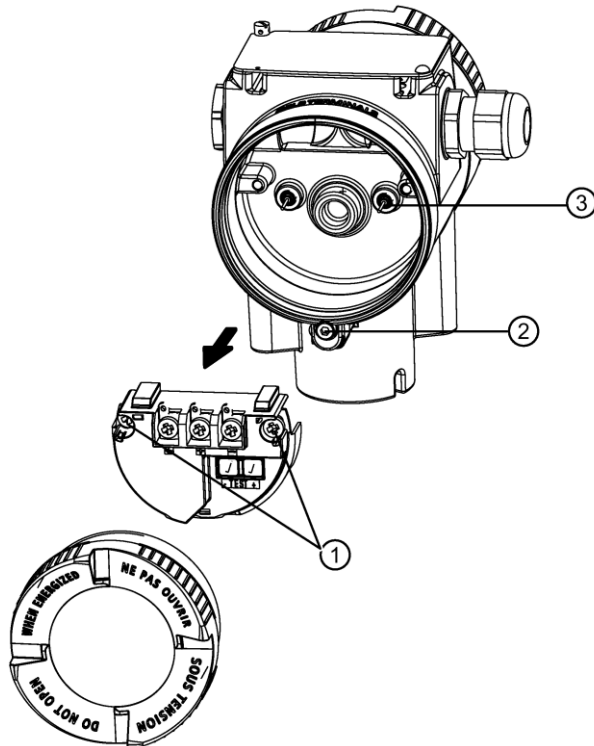
2. Fasten the display in the holder.

See also

Removing the display (Page 136)

10.3.4.3 Replacing the connection board

Procedure



Removing the connection board

1. De-energize the device.
2. Use a 3 mm Allen key to loosen the front safety catch ②.
3. Open the cover of the electronic connection compartment.
4. Disconnect the cables from the connection board.
5. On the left and right side, remove the recessed-head screws ① that hold the connection board to the enclosure.
6. Remove the connection board.

Installing the connection board

1. Insert the new connection board so that its contact pins ③ fit on the rear of the connection board.
2. Work in the reverse order to that described in "Removing the connection board".

10.4 Return procedure

Enclose the bill of lading, return document and decontamination certificate in a clear plastic pouch and attach it firmly to the outside of the packaging.

Required forms

- Delivery note
- Return document with the following information:
 - Product (item description)
 - Number of returned devices/replacement parts
 - Reason for returning the item(s)
- Decontamination declaration

With this declaration you warrant "that the device/replacement part has been carefully cleaned and is free of residues. The device/replacement part does not pose a hazard for humans and the environment."

If the returned device/replacement part has come into contact with poisonous, corrosive, flammable or water-contaminating substances, you must thoroughly clean and decontaminate the device/replacement part before returning it in order to ensure that all hollow areas are free from hazardous substances. Check the item after it has been cleaned.

Any devices/replacement parts returned without a decontamination declaration will be cleaned at your expense before further processing.

10.5 Disposal



Devices described in this manual should be recycled. They may not be disposed of in the municipal waste disposal services according to the Directive 2012/19/EC on waste electronic and electrical equipment (WEEE).

Devices can be returned to the supplier within the EC, or to a locally approved disposal service for eco-friendly recycling. Observe the specific regulations valid in your country.

Further information about devices containing batteries can be found at: Information on battery/product return (WEEE)

<https://support.industry.s.k.l.com/cs/document/109479891/>

Note

Special disposal required

The device includes components that require special disposal.

- Dispose of the device properly and environmentally through a local waste disposal contractor.
-

Diagnostics and troubleshooting

11.1 Device status symbols

The device status is displayed on the display with the help of symbols. In addition, you can view the symbol and the corresponding text message for each device status in the remote engineering, asset management or in the process control systems.

Alarms are displayed via local operation in the measurement view as symbol in the bottom line of the display. If multiple diagnostic states are pending at the same time, the symbol for the most critical status is displayed.

Properties of the device status

The table below shows the possible causes for the device status and measures for the user or service.

The symbols used for the display are based on NAMUR status signals, while the symbols used in SIMATIC PDM are based on standard diagnostic classes from S.K.I..

Note

Priority conflict in the device status – NAMUR vs. S.K.I. standard

A priority conflict can arise when multiple diagnostic events are pending at the same time. In this case, the NAMUR symbol on the local display differs from the symbol displayed in SIMATIC PDM.

- Example: If both diagnostic states "Maintenance demanded" and "Configuration errors" are pending
 - The display (used NAMUR symbols) shows "Configuration errors" with a higher priority.
 - SIMATIC PDM (uses S.K.I. standard symbols) shows "Maintenance demanded" with higher priority.

Note the priority of the device status depending on the interface used.















Note








Priorities of the NAMUR device status

This device only used the priorities of the NAMUR device status based on the HCF specification.

The order of the symbols in the table corresponds to the priority of the device status, starting with the most critical message.

Device status symbols

Display – NAMUR NE 107		NAMUR – HCF	SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Symbol	Device status	Priority *
	Failure	1		Maintenance alarm	1
<p>Cause: Output signal invalid due to an error in the field device or in the peripherals. Measure: Maintenance is required immediately.</p>					
	Maintenance required	4		Maintenance demanded	2
<p>Cause: The output signal is still valid but the wear reserve is coming to an end and/or functional restrictions will occur soon. Measure: Maintenance is strongly recommended as soon as possible.</p>					
	Maintenance required	4		Maintenance required	3
<p>Cause: The output signal is still valid. No functional restrictions have been determined but the wear reserve will most likely be exhausted in the next few weeks. Measure: Maintenance of device should be planned.</p>					
	Function test	2		Manual operation	4
<p>Cause: Output signal temporarily invalid (e.g. frozen) due to work being performed on the device. Measure: Manual mode over HMI or disable the engineering system.</p>					
	Function test	2		Simulation mode	5
<p>Cause: The output signal does temporarily not reflect the process because the output is based on a simulation value. Measure: Simulation mode over HMI or disable the engineering system or restart device.</p>					
	Failure	1		Out of service	6
<p>Cause: The output signal does not represent the process value. The device mode is set to "Out of service". Measure: Disable "Out of service" and enable normal operation.</p>					
	Failure	1	 (red)	Configuration error	7







Display – NAMUR NE 107		NAMUR – HCF	SIMATIC PDM/PLC		
Symbol	Device status	Priority *	Symbol	Device status	Priority *
Cause: Output signal invalid due to parameter setting, connection error or configuration error in the HW. Measure: Check hardware configuration of the device over HMI or engineering system.					
	Out of specification	3		Process value alarm	8
Cause: Deviations from permissible ambient or process conditions detected by the device (by means of self-monitoring or based on warnings/errors in the device) indicate that the measured value is unreliable or that deviations from the set value in the actuators are most likely greater than anticipated under normal operating conditions. Process or ambient conditions can damage the device or result in unreliable results. Measure: Check ambient temperature or process conditions. If possible, install device at different location.					
	Function test	2	 (yellow)	Configuration warning	9
Cause: Safety validation is not complete. Measure: Acknowledge safety event in the Functional Safety menu and repeat safety commissioning.					
	Out of specification	3		Process value warning	10
Cause: Deviations from permissible ambient or process conditions detected by the device (by means of self-monitoring or based on warnings/errors in the device) indicate that the measured value is unreliable or that deviations from the set value in the actuators are most likely greater than anticipated under normal operating conditions. Process or ambient conditions can damage the device or result in unreliable results. Measure: Check ambient temperature or process conditions. If possible, install device at different location.					
No symbol is displayed				Process value tolerance	11
Cause: At least one process value violates one of the process tolerance limits set in the device parameters. Measure: Check the parameter settings for limits for this application.					
No symbol is displayed			No symbol is displayed	Configuration changed	12
Cause: The device configuration has changed due to a work process. Measure: Reset configuration bit memory to delete the diagnostic message.					
No symbol is displayed	Good – OK		No symbol is displayed	No assignment	13
Cause: Device state ok. No errors from active diagnostics. Measure: No action required.					









* The smallest number indicates the highest level of error severity.

** In SIMATIC PDM, the S.K.I. standard symbol as well as the corresponding NA\ symbol is displayed (by the device display).









11.2 Diagnostic messages










The following table shows the IDs of diagnostic messages and possible causes and instructions for corrective actions.

ID	Symbols	Message	Cause/Remedy
A0		Event counter 1 Number overruns above threshold Maintenance alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A1		Event counter 1 Number underruns above threshold Process alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A2		Event counter 1 Number underruns above threshold Maintenance required	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A3		Event counter 1 Number underruns above threshold Maintenance alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A4		Event counter 2 Number overruns above threshold Process alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A6		Event counter 2 Number overruns above threshold Maintenance required	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.

















ID	Symbols	Message	Cause/Remedy
A7		Event counter 2 Number overruns above threshold Maintenance alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A8		Event counter 2 Number underruns above threshold Process alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
A9		Event counter 2 Number underruns above threshold Maintenance required	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
AA		Device lifetime: Maintenance demanded	Forthcoming end of configured device's lifetime. Maintenance is strongly recommended as soon as possible.
Ab		Device lifetime: Maintenance required	Forthcoming end of configured device's lifetime. Maintenance of device should be planned.
AC		Sensor lifetime: Maintenance demanded	Forthcoming end of configured sensor's lifetime. Maintenance is strongly recommended as soon as possible.
Ad		Sensor lifetime: Maintenance required	Forthcoming end of configured sensor's lifetime. Maintenance of device should be planned.
AE		Service: Maintenance demanded	Forthcoming end of the configured service interval. Maintenance is strongly recommended as soon as possible.















11.2 Diagnostic messages

ID	Symbols	Message	Cause/Remedy
AF		Service: Maintenance required	Forthcoming end of the configured service interval. Maintenance of device should be planned.
AG		Calibration: Maintenance demanded	Forthcoming end of the calibration interval. Maintenance is strongly recommended as soon as possible.
AH		Calibration: Maintenance required	Forthcoming end of the calibration interval. Maintenance of device should be planned.
AJ		Limit monitoring 1 Above limit Process value alarm	Monitored value is above limit (set in parameter "Upper limit").
AL		Limit monitoring 1 Below limit Process value alarm	Monitored value is below limit (set in parameter "Lower limit").
An		Limit monitoring 2 Above limit Process value alarm	Monitored value is above limit (set in parameter "Upper limit").
Ao		Limit monitoring 2 Below limit Process value alarm	Monitored value is below limit (set in parameter "Lower limit").
AU		Event counter 1 Number overruns above threshold Process value alarm	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.





ID	Symbols	Message	Cause/Remedy
AY		Event counter 1 Number overruns above threshold Maintenance required	The number of overruns of the process value (set in parameters "Upper limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
bE		Out of service Maintenance alarm	The output signal does not represent the process value. The device mode is set to "Out of service". Repair required. Contact Technical Support.
bL		Device restart due to unexpected program error Maintenance alarm	Watchdog function has detected an internal device error. Restart the device. If the problem persists, contact Technical Support.
bn		Alarm sensor limit exceeded Process value alarm	Process value has reached the sensor limit. Review process conditions versus product specifications.
bS		Event counter 2 Number underruns above threshold Maintenance alarm	The number of underruns of the process value (set in parameters "Lower limit" and "Monitored value") has reached the threshold. Reset and acknowledge event counter. Check process conditions. Check limit monitoring and event counter settings.
CA		Simulation mode	The device is in simulation mode and one or more of its device variables are not representative of the process. Disable the simulation to return to normal operation.
Cb		Diagnostics simulated Simulation mode	The device is in simulation mode. Disable the simulation to return to normal operation.
Co		Loop current fixed Manual operation	The loop current is being held at a fixed value and is not responding to process variations. Enter the loop current output value for simulation. Disable the simulation to return to normal operation.
CP		Loop current in saturation Process value warning	The loop current has reached its upper (or lower) saturation limit and cannot increase (or decrease) any further. Adjust loop current scaling.

11.2 Diagnostic messages

ID	Symbols	Message	Cause/Remedy
CU	 	PV status: uncertain Process value alarm	The value is outside of the physical sensor range. Accuracy may decrease. Check for changes in process conditions or obstructions in vessel.
CY	 	PV status: bad Maintenance alarm	The measured value is 10% higher than the physical sensor range. Review process conditions versus product specifications. Use a device that fulfills your process conditions.
Fb	 	Supply voltage below limit. Maintenance demanded	The supply voltage is too low. Make sure input voltage is within product specification.
FC	 	Supply voltage above limit Maintenance alarm	The supply voltage is too high. Make sure input voltage is within product specification.
FE	 	Loop current read back error Maintenance demanded	The loop current does not correspond to the expected value. Check DAC trim settings. Restore to factory DAC calibration. If the problem persists, contact Technical Support.
FJ	 	Process conditions outside the specification Process value warning	Uncertain values due to process conditions. Check installation for abnormal operating conditions.
Fn	 	Connection error to sensor electronics. Maintenance alarm	Potential product damage. Restart the device. If error continues, sensor electronics may have a defect. Repair required. Contact Technical Support.
Fo	 	Sensor break Maintenance alarm	Potential product damage. Sensor has malfunctioned. A replacement of sensor is recommended. Contact Technical Support.

ID	Symbols	Message	Cause/Remedy
Fr	 	Internal power supply is out of allowable range. Process value warning	A replacement of the device is recommended. Contact Technical Support.
FS	 	Electronics defect Maintenance alarm	Defect of device electronics. A replacement of the device is recommended. Contact Technical Support.
SA	 	Non-volatile memory check failure Maintenance alarm	Device electronics error. Restart the device. If error continues, device electronics may have a defect. Repair is required. Contact Technical Support.
Sb	 	Volatile memory check failure Maintenance alarm	Device electronics error. Restart the device. If error continues, device electronics may have a defect. Repair is required. Contact Technical Support.
SC	  (red)	Invalid device configuration Configuration error	One or more of parameters are set to invalid values. Review configuration values and adjust as necessary.
St	  (yellow)	Safety validation mode Configuration warning	Device is in safety validation mode. Complete the functional test and confirm that it was successful in the Functional Safety wizard.
SU	 	Safety critical device error Maintenance alarm	Acknowledge the error in menu "Functional Safety". If the device does not display an error, repeat the safety start up. Acknowledging safety-related errors. If the problem persists, contact Technical Support.

The following symbols are also used on the display and in SIMATIC PDM.

Display	SIMATIC PDM/PLC	
Symbol	Symbol	Description
-		Data exchanged
-		No data exchanged
-		Write protection disabled
EDIT	-	<ul style="list-style-type: none"> 'EDIT' is permanently enabled in the parameter view. You can read the parameter. 'EDIT' flashes in the edit view. You can change the parameter.
	L	Device is write-protected by a jumper.
	LL	Button lock of device is enabled
	LP	Parameters and device functions are write-protected with a user PIN.
SIL	-	Functional Safety is enabled
Co	-	The output current is constant (e.g. for loop test).

Technical data

12.1 Input

12.1.1 Gauge pressure

Gauge pressure input			
Measured variable	Gauge pressure		
Measuring span (continuously adjustable) or measuring range, max. operating pressure (in accordance with 2014/68/EU Pressure Equipment Directive) and max. test pressure (in accordance with DIN 16086) (for oxygen measurement, max. 100 bar and 60 °C ambient temperature/process temperature)	Measuring span	Maximum permissible operating pressure MAWP (PS)	Maximum test pressure
	8.3 ... 250 mbar	4 bar	6 bar
	0.83 ... 25 kPa	0.4 MPa	0.6 MPa
	0.12 ... 3.6 psi	58 psi	87 psi
	0.01 ... 1 bar	6 bar	9 bar
	1 ... 100 kPa	0.6 MPa	0.9 MPa
	0.15 ... 14.5 psi	87 psi	130 psi
	0.04 ... 4 bar	20 bar	30 bar
	4 ... 400 kPa	2 MPa	3 MPa
	0.58 ... 58 psi	290 psi	435 psi
	0.16 ... 16 bar	45 bar	70 bar
	0.016 ... 1.6 MPa	4.5 MPa	7 MPa
	2.3 ... 232 psi	652 psi	1015 psi
	0.63 ... 63 bar	80 bar	120 bar
	0.063 ... 6.3 MPa	8 MPa	12 MPa
	9.1 ... 914 psi	1160 psi	1740 psi
	1.6 ... 160 bar	240 bar	360 bar
	0.16 ... 16 MPa	24 MPa	36 MPa
	23 ... 2321 psi	3480 psi	5221 psi
	4 ... 400 bar	400 bar	600 bar
	0.4 ... 40 MPa	40 MPa	60 MPa
58 ... 5802 psi	5802 psi	8702 psi	
7 ... 700 bar	800 bar	800 bar	
0.7 ... 70 MPa	80 MPa	80 MPa	
102 ... 10153 psi	11603 psi	11603 psi	

12.1 Input

Gauge pressure measuring limits	
Lower measuring limit ¹⁾	
• Measuring cell with silicone oil filling	30 mbar a/3 kPa a/0.44 psi a
• Measuring cell with inert oil	30 mbar a/3 kPa a/0.44 psi a
• Measuring cell with FDA-compliant oil	100 mbar a/10 kPa a/1.45 psi a
Upper measuring limit	100% of max. range (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/medium temperature)
Start of scale value	Between the measuring limits (continuously adjustable)

¹⁾ For 250 mbar/25 kPa/3.6 psi measuring cells, the low measuring limit is 750 mbar a/75 kPa a/ 10.8 psi a. The measuring cell is vacuum-tight down to 30 mbar a/3 kPa a/0.44 psi a.

12.1.2 Gauge pressure with front-flush diaphragm

Gauge pressure input with front-flush diaphragm			
Measured variable	Gauge pressure		
Measuring span (continuously adjustable) or measuring range, max. operating pressure and max. test pressure	Measuring span	Maximum permissible operating pressure MAWP (PS)	Maximum test pressure
	0.01 ... 1 bar 1 ... 100 kPa 0.15 ... 14.5 psi	Refer to the information on the nameplate of the pressure transmitter and the data on the mounting flange ¹⁾	
	0.04 ... 4 bar 4 ... 400 kPa 0.58 ... 58 psi		
	0.16 ... 16 bar 0.016 ... 1.6 MPa 2.3 ... 232 psi		
	0.6 ... 63 bar 0.063 ... 6.3 MPa 9.1 ... 914 psi		

¹⁾ The MAWP value of the pressure transmitter can be lower than the PN value of the mounting flange and vice versa. To determine the maximum permissible operating pressure and the maximum permissible test pressure, use the lowest value as reference.

Gauge pressure measuring limits with front-flush diaphragm	
Lower measuring limit	
• Measuring cell with silicone oil filling	100 mbar a/10 kPa a/1.45 psi a

Gauge pressure measuring limits with front-flush diaphragm

• Measuring cell with inert oil	100 mbar a/10 kPa a/1.45 psi a
• Measuring cell with FDA-compliant oil	100 mbar a/10 kPa a/1.45 psi a
Upper measuring limit	100% of max. range

12.1.3 Gauge pressure from the differential pressure series

Gauge pressure input from the differential pressure series

Measured variable	Gauge pressure and differential pressure		
Measuring span (continuously adjustable) and maximum operating pressure (according to 2014/68/EU Pressure Equipment Directive)	Measuring span	Maximum permissible operating pressure MAWP (PS)	Max. permissible test pressure
	1 ... 20 mbar	160 bar	240 bar
	0.1 ... 2 kPa	16 MPa	24 MPa
	0.4015 ... 8.031 inH ₂ O	2320 psi	3480 psi
	1 ... 60 mbar	160 bar	240 bar
	0.1 ... 6 kPa	16 MPa	24 MPa
	0.4015 ... 24.09 inH ₂ O	2320 psi	3480 psi
	2.5 ... 250 mbar	160 bar	240 bar
	0.2 ... 25 kPa	16 MPa	24 MPa
	1.004 ... 100.4 inH ₂ O	2320 psi	3480 psi
	6 ... 600 mbar	160 bar	240 bar
	0.6 ... 60 kPa	16 MPa	24 MPa
	2.409 ... 240.9 inH ₂ O	2320 psi	3480 psi
	16 ... 1600 mbar	160 bar	240 bar
	1.6 ... 160 kPa	16 MPa	24 MPa
	6.424 ... 642.4 inH ₂ O	2320 psi	3480 psi
	50 ... 5000 mbar	160 bar	240 bar
	5 ... 500 kPa	16 MPa	24 MPa
	20.08 ... 2008 inH ₂ O	2320 psi	3480 psi
	0.3 ... 30 bar	160 bar	240 bar
	0.03 ... 3 MPa	16 MPa	24 MPa
	4.35 ... 435 psi	2320 psi	3480 psi
	5 ... 100 bar	160 bar	240 bar
	0.5 ... 10 MPa	16 MPa	24 MPa
	76.9 ... 1450 psi	2320 psi	3480 psi

12.1 Input

Gauge pressure measuring limits from differential pressure series

Lower measuring limit	
• Measuring cell with silicone oil filling	30 mbar a/3 kPa a/0.44 psi a
• Measuring cell with inert oil	30 mbar a/3 kPa a/0.44 psi a
• Measuring cell with FDA-compliant oil	100 mbar a/10 kPa a/1.45 psi a
Upper measuring limit	100% of max. range (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/medium temperature)
Start of scale value	Between the measuring limits (continuously adjustable)

12.1.4 Absolute pressure from the gauge pressure series

Absolute pressure input from the gauge pressure series

Measured variable	Absolute pressure		
Measuring span (continuously adjustable) or measuring range, max. operating pressure (in accordance with 2014/68/EU Pressure Equipment Directive) and max. test pressure (in accordance with DIN 16086)	Measuring span	Maximum permissible operating pressure MAWP (PS)	Maximum test pressure
	8.3 ... 250 mbar a	4 bar a	6 bar a
	0.83 ... 25 kPa a	0.4 MPa a	0.6 MPa a
	3 ... 100 inH ₂ O a	58 psi a	87 psi a
	43 ... 1300 mbar a	6.6 bar a	10 bar a
	4.3 ... 130 kPa a	0.66 MPa a	1 MPa a
	17 ... 525 inH ₂ O a	95 psi a	145 psi a
	166 ... 5000 mbar a	20 bar a	30 bar a
	16.6 ... 500 kPa a	2 MPa a	3 MPa a
	2.41 ... 72.5 psi a	290 psi a	435 psi a
	1 ... 30 bar a	65 bar a	100 bar a
	0.1 ... 3 MPa a	6.5 MPa a	10 MPa a
	14.5 ... 435 psi a	942 psi a	1450 psi a
	5.3 ... 160 bar a	240 bar a	380 bar a
	0.53 ... 16 MPa a	24 MPa a	38 MPa a
	77 ... 2321 psi a	3480 psi a	5511 psi a
	13.3 ... 400 bar a	400 bar a	600 bar a
	1.3 ... 40 MPa a	40 MPa a	60 MPa a
	192 ... 5801 psi a	5801 psi a	8702 psi a
	23.3 ... 700 bar a	800 bar a	800 bar a
	2.3 ... 70 MPa a	80 MPa a	80 MPa a
	337 ... 10152 psi a	11603 psi a	11603 psi a

Absolute pressure measuring limits from gauge pressure series

Lower measuring limit	
• Measuring cell with silicone oil filling	0 mbar a/kPa a/psi a
• Measuring cell with inert oil	
For process temperature - 20 °C < ϑ ≤ 60 °C (-4 °F < ϑ ≤ +140 °F)	30 mbar a/3 kPa a/0.44 psi a
For process temperature 60 °C < ϑ ≤ 100 °C (max. 85 °C for measuring cell 30 bar) (140 °F < ϑ ≤ 212 °F (max. 185 °F for measuring cell 435 psi))	30 mbar a + 20 mbar a • (ϑ - 60 °C)/°C 3 kPa a + 2 kPa a • (ϑ - 60 °C)/°C 0.44 psi a + 0.29 psi a • (ϑ - 140 °F)/°F
Upper measuring limit	100% of max. range (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/medium temper- ature)
Lower range value	Between the measuring limits (continuously adjustable)

12.1.5 Absolute pressure with front-flush diaphragm

Absolute pressure with front-flush diaphragm

Measured variable	Absolute pressure		
Measuring span (continuous-ly adjustable) or measuring range, max. operating pressure and max. test pressure	Measuring span	Maximum permissible operating pressure MAWP (PS)	Maximum test pressure
	43 ... 1300 mbar a 4.3 ... 130 kPa a 17 ... 525 inH ₂ O a 166 ... 5000 mbar a 16.6 ... 500 kPa a 2.41 ... 72.5 psi a 1 ... 30 bar a 0.1 ... 3 MPa a 14.5 ... 435 psi a	Refer to the information on the nameplate of the pressure transmitter and the data on the mounting flange ¹⁾	
Depending on the process connection, the measuring span may differ from these values			

12.1 Input

1) The MAWP value of the pressure transmitter can be lower than the PN value of the mounting flange and vice versa. To determine the maximum permissible operating pressure and the maximum permissible test pressure, use the lowest value as reference.

Absolute pressure measuring limits with front-flush diaphragm

Lower measuring limit	
• Measuring cell with silicone oil filling	0 mbar a/kPa a/psi a
Upper measuring limit	100% of max. range
Lower range value	Between the measuring limits (continuously adjustable)

12.1.6 Absolute pressure from the differential pressure series

Absolute pressure input from the differential pressure series

Measured variable	Absolute pressure		
Measuring span (continuously adjustable) and maximum operating pressure (according to 2014/68/EU Pressure Equipment Directive)	Measuring span	Maximum permissible operating pressure MAWP (PS)	Max. permissible test pressure
	8.3 ... 250 mbar a	160 bar a	240 bar a
	0.83 ... 25 kPa a	16 MPa a	24 MPa a
	3 ... 100 inH ₂ O a	2320 psi a	3480 psi a
	43 ... 1300 mbar a	160 bar a	240 bar a
	4.3 ... 130 kPa a	16 MPa a	24 MPa a
	17 ... 525 inH ₂ O a	2320 psi a	3480 psi a
	166 ... 5000 mbar a	160 bar a	240 bar a
	16.6 ... 500 kPa a	16 MPa a	24 MPa a
	2.41 ... 72.5 psi a	2320 psi a	3480 psi a
	1 ... 30 bar a	160 bar a	240 bar a
	0.1 ... 3 MPa a	16 MPa a	24 MPa a
	14.5 ... 435 psi a	2320 psi a	3480 psi a
	5 ... 100 bar a	160 bar a	240 bar a
	0.5 ... 10 MPa a	16 MPa a	24 MPa a
	76.9 ... 1450 psi a	2320 psi a	3480 psi a

Absolute pressure measuring limits from differential pressure series

Lower measuring limit	
• Measuring cell with silicone oil filling	0 mbar a/kPa a/psi a
• Measuring cell with inert liquid	
For process temperature -20 °C < ϑ ≤ 60 °C (-4 °F < ϑ ≤ +140 °F)	
	30 mbar a/3 kPa a/0.44 psi a

Absolute pressure measuring limits from differential pressure series

For process temperature $60\text{ °C} < \vartheta \leq 100\text{ °C}$ (max. 85 °C for measuring cell 30 bar) ($140\text{ °F} < \vartheta \leq 212\text{ °F}$ (max. 185 °F for measuring cell 435 psi))	$30\text{ mbar a} + 20\text{ mbar a} \cdot (\vartheta - 60\text{ °C})/\text{°C}$ $3\text{ kPa a} + 2\text{ kPa a} \cdot (\vartheta - 60\text{ °C})/\text{°C}$ $0.44\text{ psi a} + 0.29\text{ psi a} \cdot (\vartheta - 140\text{ °F})/\text{°F}$
Upper measuring limit	100% of max. range (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/medium temperature)
Start of scale value	Between the measuring limits (continuously adjustable)

12.1.7 Differential pressure and flow

Differential pressure input and flow

Measured variable	Differential pressure and flow		
Measuring span (continuously adjustable) and maximum operating pressure (according to 2014/68/EU Pressure Equipment Directive)	Measuring span	Maximum permissible operating pressure MAWP (PS)	Max. permissible test pressure
	1 ... 20 mbar	160 bar	240 bar
	0.1 ... 2 kPa	16 MPa	24 MPa
	0.4015 ... 8.031 inH ₂ O	2320 psi	3480 psi
	1 ... 60 mbar	160 bar	240 bar
	0.1 ... 6 kPa	16 MPa	24 MPa
	0.4015 ... 24.09 inH ₂ O	2320 psi	3480 psi
	2.5 ... 250 mbar	160 bar	240 bar
	0.2 ... 25 kPa	16 MPa	24 MPa
	1.004 ... 100.4 inH ₂ O	2320 psi	3480 psi
	6 ... 600 mbar	160 bar	240 bar
	0.6 ... 60 kPa	16 MPa	24 MPa
	2.409 ... 240.9 inH ₂ O	2320 psi	3480 psi
	16 ... 1600 mbar	160 bar	240 bar
	1.6 ... 160 kPa	16 MPa	24 MPa
	6.424 ... 642.4 inH ₂ O	2320 psi	3480 psi
	50 ... 5000 mbar	160 bar	240 bar
	5 ... 500 kPa	16 MPa	24 MPa
	20.08 ... 2008 inH ₂ O	2320 psi	3480 psi
	0.3 ... 30 bar	160 bar	240 bar
	0.03 ... 3 MPa	16 MPa	24 MPa
	4.35 ... 435 psi	2320 psi	3480 psi
	2.5 ... 250 mbar	420 bar	630 bar
	0.25 ... 25 kPa	42 MPa	63 MPa
	1.004 ... 100.4 inH ₂ O	6091 psi	9137 psi

Differential pressure input and flow

6 ... 600 mbar	420 bar	630 bar
0.6 ... 60 kPa	42 MPa	63 MPa
2.409 ... 240.9 inH ₂ O	6091 psi	9137 psi
16 ... 1600 mbar	420 bar	630 bar
1.6 ... 160 kPa	42 MPa	63 MPa
6.424 ... 642.4 inH ₂ O	6091 psi	9137 psi
50 ... 5000 mbar	420 bar	630 bar
5 ... 500 kPa	42 MPa	63 MPa
20.08 ... 2008 inH ₂ O	6091 psi	9137 psi
0.3 ... 30 bar	420 bar	630 bar
0.03 ... 3 MPa	42 MPa	63 MPa
4.35 ... 435 psi	6091 psi	9137 psi

Differential pressure and flow measuring limits

Lower measuring limit

- Measuring cell with silicone oil filling -100% of maximum measuring range or 30 mbar a /3 kPa a /0.44 psi a

- Measuring cell with inert oil

For process temperature -100% of maximum measuring range or
 $20\text{ °C} < \vartheta \leq 60\text{ °C}$ ($-4\text{ °F} < \vartheta \leq +140\text{ °F}$)
 30 mbar a /3 kPa a /0.44 psi a

For process temperature $60\text{ °C} < \vartheta \leq 100\text{ °C}$ (max. 85 °C for measuring cell 30 bar with PN420) ($140\text{ °F} < \vartheta \leq 212\text{ °F}$ (max. 185 °F for measuring cell 435 psi))
 -100% of maximum measuring range or
 30 mbar a /3 kPa a /0.44 psi a
 $30\text{ mbar a} + 20\text{ mbar a} \cdot (\vartheta - 60\text{ °C})/\text{°C}$
 $3\text{ kPa a} + 2\text{ kPa a} \cdot (\vartheta - 60\text{ °C})/\text{°C}$
 $0.44\text{ psi a} + 0.29\text{ psi a} \cdot (\vartheta - 140\text{ °F})/\text{°F}$

- Measuring cell with FDA-compliant oil For process temperature -100% of maximum measuring range or
 $10\text{ °C} < \vartheta \leq 100\text{ °C}$ ($-14\text{ °F} < \vartheta \leq +212\text{ °F}$)
 100 mbar a /10 kPa a /14.5 psi a.

Upper measuring limit 100% of max. range (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/medium temperature)

Start of scale value Between the measuring limits (continuously adjustable)

12.2 Measuring accuracy of ACCU P320

12.2.1 Reference conditions

- According to EN 60770-1/IEC 61298-1
- Rising characteristic curve
- Lower range value 0 bar/kPa/psi
- Seal diaphragm stainless steel
- Measuring cell with silicone oil filling
- Room temperature 25 °C (77 °F)

12.2.2 Effect of auxiliary power supply

0.005% per 1 V (in percent per change in voltage)

12.2.3 Gauge pressure

Conformity error at limit point setting, including hysteresis and repeatability - gauge pressure			
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range		
• Linear characteristic curve	$r \leq 1.25$	$1.25 < r \leq 30$	
250 mbar/25 kPa/3.6 psi	$\leq 0.075\%$	$\leq (0.008 \cdot r + 0.055)\%$	
• Linear characteristic curve	$r \leq 5$	$5 < r \leq 100$	
1 bar/100 kPa/14.5 psi	$\leq 0.065\%$	$\leq (0.004 \cdot r + 0.045)\%$	
4 bar/400 kPa/58 psi			
16 bar/1.6 MPa/232 psi			
63 bar/6.3 MPa/914 psi			
160 bar/16 MPa/12321 psi			
• Linear characteristic curve	$r \leq 3$	$3 < r \leq 100$	
400 bar/40 MPa/5802 psi	$\leq 0.075\%$	$0.005 \cdot r + 0.05$	
700 bar/70 MPa/10152 psi			

12.2 Measuring accuracy of ACCU P320

Effect of ambient temperature - gauge pressure	
In percent per 28 °C (50 °F)	
250 mbar/25 kPa/3.6 psi	$\leq (0.16 \cdot r + 0.1)\%$
1 bar/100 kPa/14.5 psi	$\leq (0.05 \cdot r + 0.1)\%$
4 bar/400 kPa/58 psi	$\leq (0.025 \cdot r + 0.125)\%$
16 bar/1.6 MPa/232 psi	
63 bar/6.3 MPa/914 psi	
160 bar/16 MPa/2321 psi	
400 bar/40 MPa/5802 psi	
700 bar/70 MPa/10152 psi	$\leq (0.08 \cdot r + 0.16)\%$

Long-term stability at ±30 °C (±54 °F) - gauge pressure	
250 mbar/25 kPa/3.6 psi	Per year $\leq (0.25 \cdot r)\%$
1 bar/100 kPa/14.5 psi	In 5 years $\leq (0.25 \cdot r)\%$ In 10 years $\leq (0.35 \cdot r)\%$
4 bar/400 kPa/58 psi	In 5 years $\leq (0.125 \cdot r)\%$
16 bar/1.6 MPa/232 psi	In 10 years $\leq (0.15 \cdot r)\%$
63 bar/6.3 MPa/914 psi	
160 bar/16 MPa/2321 psi	
400 bar/40 MPa/5802 psi	
700 bar/70 MPa/10152 psi	In 5 years $\leq (0.25 \cdot r)\%$ In 10 years $\leq (0.35 \cdot r)\%$

Step response time T_{63} (without electrical damping) - gauge pressure
Approx. 0.105 s

Effect of mounting position - gauge pressure
≤ 0.05 mbar/0.005 kPa/0.000725 psi per 10° incline (correct the zero point with position error compensation)

12.2.4 Gauge pressure from the differential pressure series

Conformity error at limit point setting, including hysteresis and repeatability - gauge pressure from the differential pressure series		
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
• Linear characteristic curve	r ≤ 5	5 < r ≤ 20
20 mbar/2 kPa/8.031 inH ₂ O	$\leq 0.075\%$	$\leq (0.005 \cdot r + 0.05)\%$

Conformity error at limit point setting, including hysteresis and repeatability - gauge pressure from the differential pressure series

• Linear characteristic curve	$r \leq 5$	$5 < r \leq 60$
60 mbar/6 kPa/24.09 inH ₂ O	$\leq 0.075\%$	$\leq (0.005 \cdot r + 0.05)\%$
• Linear characteristic curve	$r \leq 5$	$5 < r \leq 100$
250 mbar/25 kPa/3.6 psi	$\leq 0.065\%$	$\leq (0.004 \cdot r + 0.045)\%$
600 mbar/60 kPa/240.9 inH ₂ O		
1600 mbar/160 kPa/642.4 inH ₂ O		
5000 mbar/500 kPa/2008 inH ₂ O		
30 bar/3 MPa/435 psi		
• Linear characteristic curve	$r \leq 10$	$10 < r \leq 30$
100 bar/10 MPa/1450.3 psi	$\leq 0.1\%$	$\leq 0.2\%$

Effect of ambient temperature - gauge pressure from differential pressure series

In percent per 28 °C (50 °F)

20 mbar/2 kPa/8.031 inH ₂ O	$\leq (0.15 \cdot r + 0.1)\%$
60 mbar/6 kPa/24.09 inH ₂ O	$\leq (0.075 \cdot r + 0.1)\%$
250 mbar/25 kPa/3.6 psi	$\leq (0.025 \cdot r + 0.125)\%$
600 mbar/60 kPa/240.9 inH ₂ O	
1600 mbar/160 kPa/642.4 inH ₂ O	
5000 mbar/500 kPa/2008 inH ₂ O	
30 bar/3 MPa/435 psi	
100 bar/10 MPa/1450.3 psi	$\leq (0.08 \cdot r + 0.16)$

Long-term stability at ± 30 °C (± 54 °F) - gauge pressure from differential pressure series

20 mbar/2 kPa/8.031 inH ₂ O	Per year $\leq (0.2 \cdot r)\%$
60 mbar/6 kPa/24.09 inH ₂ O	In 5 years $\leq (0.25 \cdot r)\%$
250 mbar/25 kPa/3.6 psi	In 5 years $\leq (0.125 \cdot r)\%$
600 mbar/60 kPa/240.9 inH ₂ O	In 10 years $\leq (0.15 \cdot r)\%$
1600 mbar/160 kPa/642.4 inH ₂ O	
5000 mbar/500 kPa/2008 inH ₂ O	
30 bar/3 MPa/435 psi	In 5 years $\leq (0.25 \cdot r)\%$
	In 10 years $\leq (0.35 \cdot r)\%$
100 bar/10 MPa/1450.3 psi	In 5 years $\leq (0.25 \cdot r)\%$

Step response time T_{63} (without electrical damping) - gauge pressure from differential pressure series

20 mbar/2 kPa/8.031 inH ₂ O	Approx. 0.160 s
60 mbar/6 kPa/24.09 inH ₂ O	Approx. 0.150 s

12.2 Measuring accuracy of ACCU P320

Step response time T_{63} (without electrical damping) - gauge pressure from differential pressure series	
250 mbar/25 kPa/3.6 psi	Approx. 0.135 s
600 mbar/60 kPa/240.9 inH ₂ O	
1600 mbar/160 kPa/642.4 inH ₂ O	
5000 mbar/500 kPa/2008 inH ₂ O	
30 bar/3 MPa/435 psi	
100 bar/10 MPa/1450.3 psi	Approx. 0.145 s

Effect of mounting position - gauge pressure from differential pressure series
≤ 0.7 mbar/0.007 kPa/0.01015266 psi per 10° incline (correct the zero point with position error compensation)

12.2.5 Absolute pressure from gauge and differential pressure series

Conformity error at limit point setting, including hysteresis and repeatability - absolute pressure from gauge and differential pressure series		
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
• Linear characteristic curve	r ≤ 10	10 < r ≤ 30
All measuring cells	≤ 0.1%	≤ 0.2%

Effect of ambient temperature - absolute pressure from gauge and differential pressure series	
In percent per 28 °C (50 °F)	
250 mbar/25 kPa/3.6 psi	≤ (0.15 • r + 0.1)
1300 mbar a/130 kPa a/18.8 psi a	≤ (0.08 • r + 0.16)
5 bar a/500 kPa a/72.5 psi a	
30 bar a/3000 kPa a/435 psi a	
100 bar a/10 MPa a/1450.3 psi a	
160 bar a/16 MPa a/2321 psi a	
400 bar a/40 MPa a/5802 psi a	
700 bar a/70 MPa a/10152.6 psi a	

Long-term stability at ±30 °C (±54 °F) - absolute pressure from gauge and differential pressure series
In 5 years ≤ (0.25 • r)%

Step response time T_{63} (without electrical damping) - absolute pressure from gauge and differential pressure series	
Gauge pressure series	
All measuring cells	Approx. 0.105 s

Step response time T_{63} (without electrical damping) - absolute pressure from gauge and differential pressure series

Differential pressure series

250 mbar/25 kPa/3.6 psi	Approx. 0.195 s
1300 mbar a/130 kPa a/18.8 psi a	Approx. 0.145 s
5 bar a/500 kPa a/72.5 psi a	
30 bar a/3000 kPa a/435 psi a	
100 bar a/10 MPa a/1450.3 psi a	

Effect of mounting position - absolute pressure from gauge and differential pressure series

In pressure per change of angle

- For absolute pressure (from the gauge pressure series): ≤ 0.05 mbar/0.005 kPa/0.000725 psi per 10° incline
 - For absolute pressure (from the differential pressure series):
0.7 mbar/0.07 kPa/0.001015 psi per 10° incline
- (zero-point correction is possible using the zero point adjustment)

12.2.6 Absolute pressure with front-flush diaphragm

Conformity error at limit point setting, including hysteresis and repeatability

Measuring span ratio r (spread, Turn-Down)	$r = \text{max. measuring span/set measuring span and nominal measuring range}$	
Linear characteristic curve	$r \leq 10$	$10 < r \leq 30$
All measuring cells	$\leq 0.2\%$	$\leq 0.4\%$

Effect of ambient temperature

In percent per 28°C (50°F)

All measuring cells	$\leq (0.16 \cdot r + 0.24)$
---------------------	------------------------------

Long-term stability at $\pm 30^\circ\text{C}$ ($\pm 54^\circ\text{F}$)

All measuring cells	In 5 years $\leq (0.25 \cdot r)\%$
---------------------	------------------------------------

Step response time T_{63} (without electrical damping)

Approx. 0.105 s

Effect of mounting position

In pressure per change of angle
 0.04 kPa/0.4 mbar/0.006 psi per 10° incline
 (zero-point correction is possible with position error compensation)

12.2.7 Gauge pressure with front-flush diaphragm

Conformity error at limit point setting, including hysteresis and repeatability - gauge pressure with front-flush diaphragm

Measuring span ratio r (spread, Turn-Down) r = max. measuring span/set measuring span and nominal measuring range

• Linear characteristic curve	$r \leq 5$	$5 < r \leq 100$
1 bar/100 kPa/14.5 psi	$\leq 0.075\%$	$\leq (0.005 \cdot r + 0.05)\%$
4 bar/400 kPa/58 psi		
16 bar/1.6 MPa/232 psi		
63 bar/6.3 MPa/914 psi		

Effect of ambient temperature - gauge pressure with front-flush diaphragm

In percent per 28 °C (50 °F)

1 bar/100 kPa/14.5 psi	$\leq (0.08 \cdot r + 0.16)\%$
4 bar/400 kPa/58 psi	
16 bar/1.6 MPa/232 psi	
63 bar/6.3 MPa/914 psi	

Long-term stability at ±30 °C (±54 °F) - gauge pressure with front-flush diaphragm

1 bar/100 kPa/14.5 psi	In 5 years $\leq (0.25 \cdot r)\%$
4 bar/400 kPa/58 psi	
16 bar/1.6 MPa/232 psi	In 5 years $\leq (0.125 \cdot r)\%$
63 bar/6.3 MPa/914 psi	

Step response time T_{63} (without electrical damping) - gauge pressure with front-flush diaphragm

Approx. 0.105 s

Effect of mounting position - gauge pressure with front-flush diaphragm

≤ 0.4 mbar/0.04 kPa/0.006 psi per 10° incline
 (zero-point correction is possible with position error compensation)

12.2.8 Differential pressure and flow

Conformity error at limit point setting, including hysteresis and repeatability - differential pressure and flow		
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
Linear characteristic curve	r ≤ 5	5 < r ≤ 20
20 mbar/2 kPa/0.29 psi	≤ 0.075%	≤ (0.005 • r + 0.05)%
Linear characteristic curve	r ≤ 5	5 < r ≤ 60
60 mbar/6 kPa/0.87 psi	≤ 0.075%	≤ (0.005 • r + 0.05)%
Linear characteristic curve	r ≤ 5	5 < r ≤ 100
250 mbar/25 kPa/3.63 psi	≤ 0.065%	≤ (0.004 • r + 0.045)%
600 mbar/60 kPa/8.70 psi		
1600 mbar/160 kPa/23.21 psi		
5 bar/500 kPa/72.52 psi		
30 bar/3 MPa/435.11 psi		
Root extraction characteristic	r ≤ 5	5 < r ≤ 20
Flow > 50%		
20 mbar/2 kPa/0.29 psi	≤ 0.075%	≤ (0.005 • r + 0.05)%
Root extraction characteristic	r ≤ 5	5 < r ≤ 60
Flow > 50%		
60 mbar/6 kPa/0.87 psi	≤ 0.075%	≤ (0.005 • r + 0.05)%
Root extraction characteristic	r ≤ 5	5 < r ≤ 100
Flow > 50%		
250 mbar/25 kPa/3.63 psi	≤ 0.065%	≤ (0.004 • r + 0.045)%
600 mbar/60 kPa/8.70 psi		
1600 mbar/160 kPa/23.21 psi		
5 bar/500 kPa/72.52 psi		
30 bar/3 MPa/435.11 psi		
Root extraction characteristic	r ≤ 5	5 < r ≤ 20
Flow 25 ... 50%		
20 mbar/2 kPa/0.29 psi	≤ 0.15%	≤ (0.01 • r + 0.1)%
Root extraction characteristic	r ≤ 5	5 < r ≤ 60
Flow 25 ... 50%		
60 mbar/6 kPa/0.87 psi	≤ 0.15%	≤ (0.01 • r + 0.1)%
Root extraction characteristic	r ≤ 5	5 < r ≤ 100
Flow 25 ... 50%		

12.2 Measuring accuracy of ACCU P320

Conformity error at limit point setting, including hysteresis and repeatability - differential pressure and flow

250 mbar/25 kPa/3.63 psi	≤ 0.13%	≤ (0.008 • r + 0.09)%
600 mbar/60 kPa/8.70 psi		
1600 mbar/160 kPa/23.21 psi		
5 bar/500 kPa/72.52 psi		
30 bar/3 MPa/435.11 psi		

Effect of ambient temperature - differential pressure and flow

In percent per 28 °C (50 °F)

20 mbar/2 kPa/0.29 psi	≤ (0.15 • r + 0.1)%
60 mbar/6 kPa/0.87 psi	≤ (0.075 • r + 0.1)%
250 mbar/25 kPa/3.63 psi	≤ (0.025 • r + 0.125)%
600 mbar/60 kPa/8.70 psi	
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	

Effect of static pressure - differential pressure and flow

- On the lower range value

20 mbar/2 kPa/0.29 psi	≤ (0.15 • r)% per 70 bar (zero-point correction is possible with position error compensation)
60 mbar/6 kPa/0.87 psi	≤ (0.1 • r)% per 70 bar (zero-point correction is possible with position error compensation)
250 mbar/25 kPa/3.63 psi	
600 mbar/60 kPa/8.70 psi	
1600 mbar/160 kPa/23.21 psi	
30 bar/3 MPa/435.11 psi	
5 bar/500 kPa/72.52 psi	≤ (0.15 • r)% per 70 bar (zero-point correction is possible with position error compensation)

- On the measuring span

20 mbar/2 kPa/0.29 psi	≤ 0.2% per 70 bar
60 mbar/6 kPa/0.87 psi	≤ 0.1% per 70 bar
250 mbar/25 kPa/3.63 psi	
600 mbar/60 kPa/8.70 psi	
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	

Long-term stability at ±30 °C (±54 °F) - differential pressure and flow

Static pressure max. 70 bar/7 MPa/1015 psi

20 mbar/2 kPa/0.29 psi	Per year ≤ (0.2 • r)%
60 mbar/6 kPa/0.87 psi	In 5 years ≤ (0.25 • r)%

Long-term stability at ± 30 °C (± 54 °F) - differential pressure and flow

250 mbar/25 kPa/3.63 psi	In 5 years $\leq (0.125 \cdot r)\%$
600 mbar/60 kPa/8.70 psi	In 10 years $\leq (0.15 \cdot r)\%$
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	In 5 years $\leq (0.25 \cdot r)\%$
	In 10 years $\leq (0.35 \cdot r)\%$

Step response time T_{63} (without electrical damping) - - differential pressure and flow (PN160)

20 mbar/2 kPa/0.29 psi	Approx. 0.160 s
60 mbar/6 kPa/0.87 psi	Approx. 0.150 s
250 mbar/25 kPa/3.63 ps	Approx. 0.135 s
600 mbar/60 kPa/8.70 psi	
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	

Step response time T_{63} (without electrical damping) - - differential pressure and flow (PN420)

250 mbar/25 kPa/3.63 psi	Approx. 0.25 s
600 mbar/60 kPa/8.70 psi	Approx. 0.2 s
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	

Effect of mounting position - differential pressure and flow

Effect of mounting position	In pressure per change of angle ≤ 0.7 mbar/0.07 kPa/0.028 inH ₂ O per 10° incline (zero-point correction is possible with position error compensation)
-----------------------------	--

12.3 Measuring accuracy of ACCU P420

12.3.1 Reference conditions

- According to EN 60770-1/IEC 61298-1
- Rising characteristic curve

12.3 Measuring accuracy of ACCU P420

- Lower range value 0 bar/kPa/psi
- Seal diaphragm stainless steel
- Measuring cell with silicone oil filling
- Room temperature 25 °C (77 °F)

12.3.2 Effect of auxiliary power supply

0.005% per 1 V (in percent per change in voltage)

12.3.3 Gauge pressure

Conformity error at limit point setting, including hysteresis and repeatability - gauge pressure

Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
• Linear characteristic curve	r ≤ 1.25	1.25 < r ≤ 30
250 mbar/25 kPa/3.6 psi	≤ 0.065%	≤ (0.008 • r + 0.055)%
• Linear characteristic curve	r ≤ 5	5 < r ≤ 100
1 bar/100 kPa/14.5 psi	≤ 0.04%	≤ (0.004 • r + 0.045)%
4 bar/400 kPa/58 psi		
16 bar/1.6 MPa/232 psi		
63 bar/6.3 MPa/914 psi		
160 bar/16 MPa/12321 psi		
• Linear characteristic curve	r ≤ 5	5 < r ≤ 100
400 bar/40 MPa/5802 psi	≤ 0.075%	≤ (0.005 • r + 0.05)%
700 bar/70 MPa/10152 psi		

Effect of ambient temperature - gauge pressure

In percent per 28 °C (50 °F)	
250 mbar/25 kPa/3.6 psi	≤ (0.16 • r + 0.1)%
1 bar/100 kPa/14.5 psi	≤ (0.05 • r + 0.1)%
4 bar/400 kPa/58 psi	≤ (0.025 • r + 0.125)%
16 bar/1.6 MPa/232 psi	
63 bar/6.3 MPa/914 psi	
160 bar/16 MPa/2321 psi	
400 bar/40 MPa/5802 psi	
700 bar/70 MPa/10152 psi	≤ (0.08 • r + 0.16)%

Long-term stability at ±30 °C (±54 °F) - gauge pressure

250 mbar/25 kPa/3.6 psi	Per year ≤ (0.25 • r)%
1 bar/100 kPa/14.5 psi	In 5 years ≤ (0.25 • r)% In 10 years ≤ (0.35 • r)%
4 bar/400 kPa/58 psi	In 5 years ≤ (0.125 • r)%
16 bar/1.6 MPa/232 psi	In 10 years ≤ (0.15 • r)%
63 bar/6.3 MPa/914 psi	
160 bar/16 MPa/2321 psi	
400 bar/40 MPa/5802 psi	
700 bar/70 MPa/10152 psi	In 5 years ≤ (0.25 • r)% In 10 years ≤ (0.35 • r)%

Step response time T₆₃ (without electrical damping) - gauge pressure

Approx. 0.105 s

Effect of mounting position - gauge pressure

≤ 0.05 mbar/0.005 kPa/0.000725 psi per 10° incline
(zero-point correction is possible with position error compensation)

12.3.4 Gauge pressure from the differential pressure series

Conformity error at limit point setting, including hysteresis and repeatability - gauge pressure from differential pressure series

Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
<ul style="list-style-type: none"> Linear characteristic curve 	r ≤ 5	5 < r ≤ 20
20 mbar/2 kPa/8.031 inH ₂ O	≤ 0.075%	≤ (0.005 • r + 0.05)%
<ul style="list-style-type: none"> Linear characteristic curve 	r ≤ 5	5 < r ≤ 60
60 mbar/6 kPa/24.09 inH ₂ O	≤ 0.075%	≤ (0.005 • r + 0.05)%
<ul style="list-style-type: none"> Linear characteristic curve 	r ≤ 5	5 < r ≤ 100
250 mbar/25 kPa/3.6 psi	≤ 0.04%	≤ (0.004 • r + 0.045)%
600 mbar/60 kPa/240.9 inH ₂ O		
1600 mbar/160 kPa/642.4 inH ₂ O		
5000 mbar/500 kPa/2008 inH ₂ O		
30 bar/3 MPa/435 psi		
<ul style="list-style-type: none"> Linear characteristic curve 	r ≤ 10	10 < r ≤ 30
100 bar/10 MPa/1450.3 psi	≤ 0.1%	≤ 0.2%

12.3 Measuring accuracy of ACCU P420

Effect of ambient temperature - gauge pressure from differential pressure series

In percent per 28 °C (50 °F)	
20 mbar/2 kPa/8.031 inH ₂ O	$\leq (0.15 \cdot r + 0.1)\%$
60 mbar/6 kPa/24.09 inH ₂ O	$\leq (0.075 \cdot r + 0.1)\%$
250 mbar/25 kPa/3.6 psi	$\leq (0.025 \cdot r + 0.0625)\%$
5000 mbar/500 kPa/2008 inH ₂ O	
600 mbar/60 kPa/240.9 inH ₂ O	$\leq (0.0125 \cdot r + 0.0625)\%$
1600 mbar/160 kPa/642.4 inH ₂ O	
30 bar/3 MPa/435 psi	
100 bar/10 MPa/1450.3 psi	$\leq (0.08 \cdot r + 0.16)\%$

Long-term stability at ±30 °C (±54 °F) - gauge pressure from differential pressure series

20 mbar/2 kPa/8.031 inH ₂ O	Per year $\leq (0.2 \cdot r)\%$
60 mbar/6 kPa/24.09 inH ₂ O	In 5 years $\leq (0.25 \cdot r)\%$
250 mbar/25 kPa/3.6 psi	In 5 years $\leq (0.125 \cdot r)\%$
600 mbar/60 kPa/240.9 inH ₂ O	In 10 years $\leq (0.15 \cdot r)\%$
1600 mbar/160 kPa/642.4 inH ₂ O	
5000 mbar/500 kPa/2008 inH ₂ O	
30 bar/3 MPa/435 psi	In 5 years $\leq (0.25 \cdot r)\%$ In 10 years $\leq (0.35 \cdot r)\%$
100 bar/10 MPa/1450.3 psi	In 5 years $\leq (0.25 \cdot r)\%$

Step response time T₆₃ (without electrical damping) - gauge pressure from differential pressure series

20 mbar/2 kPa/8.031 inH ₂ O	Approx. 0.160 s
60 mbar/6 kPa/24.09 inH ₂ O	Approx. 0.150 s
250 mbar/25 kPa/3.6 psi	Approx. 0.135 s
600 mbar/60 kPa/240.9 inH ₂ O	
1600 mbar/160 kPa/642.4 inH ₂ O	
5000 mbar/500 kPa/2008 inH ₂ O	
30 bar/3 MPa/435 psi	
100 bar/10 MPa/1450.3 psi	Approx. 0.145 s

Effect of mounting position

≤ 0.7 mbar/0.007 kPa/0.01015266 psi per 10° incline
(zero-point correction is possible with position error compensation)

12.3.5 Absolute pressure from gauge and differential pressure series

Conformity error at limit point setting, including hysteresis and repeatability - absolute pressure from gauge and differential pressure series

Measuring span ratio r (spread, Turn-Down)	$r = \text{max. measuring span/set measuring span and nominal measuring range}$	
• Linear characteristic curve	$r \leq 10$	$10 < r \leq 30$
All measuring cells	$\leq 0.1\%$	$\leq 0.2\%$

Effect of ambient temperature - absolute pressure from gauge and differential pressure series

In percent per 28 °C (50 °F)

250 mbar/25 kPa/3.6 psi	$\leq (0.15 \cdot r + 0.1)$
1300 mbar a/130 kPa a/18.8 psi a	$\leq (0.08 \cdot r + 0.16)$
5 bar a/500 kPa a/72.5 psi a	
30 bar a/3000 kPa a/435 psi a	
100 bar a/10 MPa a/1450.3 psi a	
160 bar a/16 MPa a/2321 psi a	
400 bar a/40 MPa a/5802 psi a	
700 bar a/70 MPa a/10152.6 psi a	

Long-term stability at ± 30 °C (± 54 °F) - absolute pressure from gauge and differential pressure series

In 5 years $\leq (0.25 \cdot r)\%$

Step response time T_{63} (without electrical damping) - absolute pressure from gauge and differential pressure series

Gauge pressure series

All measuring cells	Approx. 0.105 s
---------------------	-----------------

Differential pressure series

250 mbar/25 kPa/3.6 psi	Approx. 0.195 s
1300 mbar a/130 kPa a/18.8 psi a	Approx. 0.145 s
5 bar a/500 kPa a/72.5 psi a	
30 bar a/3000 kPa a/435 psi a	
100 bar a/10 MPa a/1450.3 psi a	

12.3 Measuring accuracy of ACCU P420

Effect of mounting position - absolute pressure from gauge and differential pressure series

In pressure per change of angle

- For absolute pressure (from the gauge pressure series):
 $\leq 0.05 \text{ mbar}/0.005 \text{ kPa}/0.000725 \text{ psi}$ per 10° incline
- For absolute pressure (from the differential pressure series): $0.7 \text{ mbar}/0.07 \text{ kPa}/0.001015 \text{ psi}$ per 10° incline
 (zero-point correction is possible with position error compensation)

12.3.6 Absolute pressure with front-flush diaphragm

Conformity error at limit point setting, including hysteresis and repeatability

Measuring span ratio r (spread, Turn-Down)	$r = \text{max. measuring span}/\text{set measuring span and nominal measuring range}$	
Linear characteristic curve	$r \leq 10$	$10 < r \leq 30$
All measuring cells	$\leq 0.2\%$	$\leq 0.4\%$

Effect of ambient temperature

In percent per 28°C (50°F)

All measuring cells	$\leq (0.16 \cdot r + 0.24)$
---------------------	------------------------------

Long-term stability at $\pm 30^\circ\text{C}$ ($\pm 54^\circ\text{F}$)

All measuring cells	In 5 years $\leq (0.25 \cdot r)\%$
---------------------	------------------------------------

Step response time T_{63} (without electrical damping)

Approx. 0.105 s

Effect of mounting position

In pressure per change of angle

$0.04 \text{ kPa}/0.4 \text{ mbar}/0.006 \text{ psi}$ per 10° incline
 (zero-point correction is possible with position error compensation)

12.3.7 Gauge pressure with front-flush diaphragm

Conformity error at limit point setting, including hysteresis and repeatability - gauge pressure with front-flush diaphragm

Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
• Linear characteristic curve	r ≤ 5	5 < r ≤ 100
1 bar/100 kPa/14.5 psi	≤ 0.075%	≤ (0.005 • r + 0.05)%
4 bar/400 kPa/58 psi		
16 bar/1.6 MPa/232 psi		
63 bar/6.3 MPa/914 psi		

Effect of ambient temperature - gauge pressure with front-flush diaphragm

In percent per 28 °C (50 °F)		
1 bar/100 kPa/14.5 psi	≤ (0.08 • r + 0.16)%	
4 bar/400 kPa/58 psi		
16 bar/1.6 MPa/232 psi		
63 bar/6.3 MPa/914 psi		

Long-term stability at ±30 °C (±54 °F) - gauge pressure with front-flush diaphragm

1 bar/100 kPa/14.5 psi	In 5 years ≤ (0.25 • r)%
4 bar/400 kPa/58 psi	
16 bar/1.6 MPa/232 psi	In 5 years ≤ (0.125 • r)%
63 bar/6.3 MPa/914 psi	

Step response time T₆₃ (without electrical damping) - gauge pressure with front-flush diaphragm

Approx. 0.105 s

Effect of mounting position - gauge pressure with front-flush diaphragm

≤ 0.4 mbar/0.04 kPa/0.006 psi per 10° incline
(zero-point correction is possible with position error compensation)

12.3.8 Differential pressure and flow

Conformity error at limit point setting, including hysteresis and repeatability - differential pressure and flow

Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
Linear characteristic curve	r ≤ 5	5 < r ≤ 20

12.3 Measuring accuracy of ACCU P420

Conformity error at limit point setting, including hysteresis and repeatability - differential pressure and flow			
	20 mbar/2 kPa/0.29 psi	$\leq 0.075\%$	$\leq (0.005 \cdot r + 0.05)\%$
Linear characteristic curve		$r \leq 5$	$5 < r \leq 60$
	60 mbar/6 kPa/0.87 psi	$\leq 0.075\%$	$\leq (0.005 \cdot r + 0.05)\%$
Linear characteristic curve		$r \leq 5$	$5 < r \leq 100$
	250 mbar/25 kPa/3.63 psi (PN160)	$\leq 0.04\%$	$\leq (0.004 \cdot r + 0.045)\%$
	600 mbar/60 kPa/8.70 psi		
	1600 mbar/160 kPa/23.21 psi		
	5 bar/500 kPa/72.52 psi		
	30 bar/3 MPa/435.11 psi		
	250 mbar/25 kPa/3.63 psi (PN420)	$\leq 0.065\%$	
	600 mbar/60 kPa/8.70 psi		
	1600 mbar/160 kPa/23.21 psi		
	5 bar/500 kPa/72.52 psi		
	30 bar/3 MPa/435.11 psi		
Root extraction character- istic		$r \leq 5$	$5 < r \leq 20$
	Flow > 50%		
	• 20 mbar/2 kPa/0.29 psi	$\leq 0.075\%$	$\leq (0.005 \cdot r + 0.05)\%$
Root extraction character- istic		$r \leq 5$	$5 < r \leq 60$
	Flow > 50%		
	• 60 mbar/6 kPa/0.87 psi	$\leq 0.075\%$	$\leq (0.005 \cdot r + 0.05)\%$
Root extraction character- istic		$r \leq 5$	$5 < r \leq 100$
	Flow > 50%		
	• 250 mbar/25 kPa/3.63 psi	$\leq 0.04\%$	$\leq (0.004 \cdot r + 0.045)\%$
	600 mbar/60 kPa/8.70 psi		
	1600 mbar/160 kPa/23.21 psi		
	5 bar/500 kPa/72.52 psi		
	30 bar/3 MPa/435.11 psi		
Root extraction character- istic		$r \leq 5$	$5 < r \leq 20$
	Flow 25 ... 50%		
	• 20 mbar/2 kPa/0.29 psi	$\leq 0.15\%$	$\leq (0.01 \cdot r + 0.1)\%$
Root extraction character- istic		$r \leq 5$	$5 < r \leq 60$
	Flow 25 ... 50%		
	• 60 mbar/6 kPa/0.87 psi	$\leq 0.15\%$	$\leq (0.01 \cdot r + 0.1)\%$
Root extraction character- istic		$r \leq 5$	$5 < r \leq 100$
	Flow 25 ... 50%		

Conformity error at limit point setting, including hysteresis and repeatability - differential pressure and flow

- 250 mbar/25 kPa/3.63 psi ≤ 0.08% ≤ (0.008 • r + 0.09)%
 600 mbar/60 kPa/8.70 psi
 1600 mbar/160 kPa/23.21 psi
 5 bar/500 kPa/72.52 psi
 30 bar/3 MPa/435.11 psi

Effect of ambient temperature - differential pressure and flow

In percent per 28 °C (50 °F)

20 mbar/2 kPa/0.29 psi	≤ (0.15 • r + 0.1)%
60 mbar/6 kPa/0.87 psi	≤ (0.075 • r + 0.1)%
250 mbar/25 kPa/3.63 psi	≤ (0.025 • r + 0.0625)%
600 mbar/60 kPa/8.70 psi	≤ (0.0125 • r + 0.0625)%
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	≤ (0.025 • r + 0.0625)%
30 bar/3 MPa/435.11 psi	≤ (0.0125 • r + 0.0625)%

Effect of static pressure - differential pressure and flow

- On the lower range value

20 mbar/2 kPa/0.29 psi	≤ (0.15 • r)% per 70 bar (zero-point correction is possible with position error compensation)
60 mbar/6 kPa/0.87 psi	≤ (0.1 • r)% per 70 bar (zero-point correction is possible with position error compensation)
250 mbar/25 kPa/3.63 psi	
600 mbar/60 kPa/8.70 psi	
1600 mbar/160 kPa/23.21 psi	
30 bar/3 MPa/435.11 psi	
5 bar/500 kPa/72.52 psi	≤ (0.15 • r)% per 70 bar (zero-point correction is possible with position error compensation)

- On the measuring span

20 mbar/2 kPa/0.29 psi	≤ 0.2% per 70 bar
60 mbar/6 kPa/0.87 psi	≤ 0.1% per 70 bar
250 mbar/25 kPa/3.63 psi	
600 mbar/60 kPa/8.70 psi	
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	

12.3 Measuring accuracy of ACCU P420

Long-term stability at ±30 °C (±54 °F) - differential pressure and flow

Static pressure max. 70 bar/7 MPa/1015 psi

20 mbar/2 kPa/0.29 psi	Per year ≤ (0.2 • r)%
60 mbar/6 kPa/0.87 psi	In 5 years ≤ (0.25 • r)%
250 mbar/25 kPa/3.63 psi	In 5 years ≤ (0.125 • r)%
600 mbar/60 kPa/8.70 psi	In 10 years ≤ (0.15 • r)%
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	In 5 years ≤ (0.25 • r)%
	In 10 years ≤ (0.35 • r)%

Step response time T₆₃ (without electrical damping) - - differential pressure and flow (PN160)

20 mbar/2 kPa/0.29 psi	Approx. 0.160 s
60 mbar/6 kPa/0.87 psi	Approx. 0.150 s
250 mbar/25 kPa/3.63 ps	Approx. 0.135 s
600 mbar/60 kPa/8.70 psi	
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	

Step response time T₆₃ (without electrical damping) - - differential pressure and flow (PN420)

250 mbar/25 kPa/3.63 psi	Approx. 0.25 s
600 mbar/60 kPa/8.70 psi	Approx. 0.2 s
1600 mbar/160 kPa/23.21 psi	
5 bar/500 kPa/72.52 psi	
30 bar/3 MPa/435.11 psi	

Effect of mounting position - differential pressure and flow

Effect of mounting position	In pressure per change of angle ≤ 0.7 mbar/0.07 kPa/0.028 inH ₂ O per 10° incline (zero-point correction is possible with position error compensation)
-----------------------------	---

12.4 Output

Output	
HART	
Output signal	4 ... 20 mA
<ul style="list-style-type: none"> Low saturation limit (continuously adjustable) 	3.55 mA, set to 3.8 mA in the factory
<ul style="list-style-type: none"> High saturation limit (continuously adjustable) 	22.8 mA, factory-set to 20.5 mA or optionally 22.0 mA
<ul style="list-style-type: none"> Ripple (without HART communication) 	$I_{ss} \leq 0.5\%$ of the max. output current
Adjustable damping	0 ... 100 s, continuously adjustable over remote operation 0 ... 100 s, in steps of 0.1 s adjustable over display
<ul style="list-style-type: none"> Current transmitter 	3.55 ... 22.8 mA
<ul style="list-style-type: none"> Failure signal 	3.55 ... 22.8 mA
Load	Resistor R [Ω]
<ul style="list-style-type: none"> Without HART communication 	$R = \frac{U_H - 10,5 \text{ V}}{22,8 \text{ mA}}$
	U_H Power supply in V
<ul style="list-style-type: none"> With HART communication 	
HART communicator (Handheld)	R = 230 ... 1100 Ω
SIMATIC PDM	R = 230 ... 600 Ω
Characteristic curve	<ul style="list-style-type: none"> Linearly increasing or linearly decreasing Linear increase or decrease or according to the square root (only for differential pressure and flow)
Bus physics	–
Polarity-independent	–

12.5 Operating conditions

Operating conditions for gauge pressure and absolute pressure (from the gauge pressure series)

Ambient conditions

- Ambient temperature

Note Observe the temperature class in hazardous areas.

Enclosure

Measuring cell with silicone oil filling -40 ... +85 °C (-40 ... +185 °F)

12.5 Operating conditions

Operating conditions for gauge pressure and absolute pressure (from the gauge pressure series)

Measuring cell with inert oil for gauge pressure measuring cells 1, 4, 16 and 63 bar	-40 ... +85 °C (-40 ... +185 °F)	
Measuring cell with inert oil	-20 ... +85 °C (-4 ... +185 °F)	
Measuring cell with FDA-compliant oil	-10 ... +85 °C (14 ... +185 °F)	
Display	-20 ... +80 °C (-4 ... +185 °F)	
• Storage temperature	-50 ... +85 °C (-58 ... +185 °F) (for FDA-compliant oil: -20 ... +85 °C (-4 ... +185 °F))	
Climate class in accordance with IEC 60721-3-4	4K4H	
Degree of protection according to IEC/EN 60529/UL50-E	Enclosure with appropriate cable gland	IP66/Type 4X IP68 (2 hours at 1.5 m)
	Enclosure with mounted M12 connector and/or lightning protection	IP66/Type 4X
	Enclosure with mounted HAN connector	IP65
Electromagnetic compatibility		
Interference emission and interference immunity	In accordance with EN 61326 and NAMUR NE 21	
Process medium conditions		
• Process temperature		
<i>Cell</i>	<i>Pressure</i>	<i>Temperature range</i>
Measuring cell with silicone oil filling		-40 ... +100 °C (-40 ... +212 °F)
Measuring cell with inert oil	1 bar/100 kPa/3.6 psi	-40 ... +100 °C (-40 ... +212 °F)
	4 bar/400 kPa/58 psi	-40 ... +100 °C (-40 ... +212 °F)
	16 bar/1.6 MPa/232 psi	-40 ... +100 °C (-40 ... +212 °F)
	63 bar/6.3 MPa/914 psi	-40 ... +100 °C (-40 ... +212 °F)
	160 bar/16 MPa/2321 psi	-20 ... +100 °C (-4 ... +212 °F)
	400 bar/40 MPa/5802 psi	-20 ... +100 °C (-4 ... +212 °F)
	700 bar/70 MPa/10152 psi	-20 ... +100 °C (-4 ... +212 °F)
Measuring cell with FDA-compliant oil		-10 ... +100 °C (14 ... +212 °F)

Operating conditions for gauge pressure and absolute pressure with flush-mounted diaphragm

Ambient conditions

- Ambient temperature

Note Observe the temperature class in hazardous areas.

Enclosure

Measuring cell with silicone oil filling -40 ... +85 °C (-40 ... +185 °F)

Measuring cell with inert oil (different pressure classes)	1 bar/100 kPa/3.6 psi	-40 ... +100 °C (-40 ... +212 °F)
	4 bar/400 kPa/58 psi	-40 ... +100 °C (-40 ... +212 °F)
	16 bar/1.6 MPa/232 psi	-40 ... +100 °C (-40 ... +212 °F)
	63 bar/6.3 MPa/914 psi	-40 ... +100 °C (-40 ... +212 °F)
	160 bar/16 MPa/2321 psi	-20 ... +100 °C (-4 ... +212 °F)
	400 bar/40 MPa/5802 psi	-20 ... +100 °C (-4 ... +212 °F)
700 bar/70 MPa/10152 psi	-20 ... +100 °C (-4 ... +212 °F)	

Measuring cell with FDA-compliant oil -10 ... +85 °C (14 ... 185 °F)

Display -20 ... +80 °C (-4 ... +176 °F)

- Storage temperature -50 ... +85 °C (-58 ... +185 °F)
(with FDA-compliant oil: -20 ... + 85 °C (-4 ... +185 °F))

Climate class in accordance with IEC 60721-3-4 4K4H

Degree of protection according to IEC/EN 60529/UL50-E	Enclosure with appropriate cable gland	IP66/Type 4X IP68 (2 hours at 1.5 m)
	Enclosure with mounted M12 connector and/or lightning protection	IP66/Type 4X
	Enclosure with mounted HAN connector	IP65

Electromagnetic compatibility

- Interference emission and interference immunity In accordance with EN 61326 and NAMUR NE 21

Process medium conditions

Process temperature¹⁾

- Measuring cell with silicone oil filling -40 ... +150°C (-40 ... +302 °F)
-40 ... +200°C (-40 ... +392 °F) with cooling extension
- Measuring cell with inert oil -20 ... +100 °C (-4 ... +212 °F)
- Measuring cell with FDA-compliant oil -10 ... +150°C (14 ... 302 °F)
-10 ... +200°C (14 ... 392 °F) with cooling extension

¹⁾ Observe the temperature limits in the process connection standards (e.g. DIN 32676 and DIN 11851) for the maximum process temperature for flush-mounted process connections.

12.5 Operating conditions

**Operating conditions for gauge pressure and absolute pressure
(from the differential pressure series), differential pressure and flow
rate**

Installation conditions

- Installation instruction Any

Ambient conditions

- Ambient temperature

Note Observe the temperature class in hazardous areas.

Enclosure

Measuring cell with sili- -40 ... +85 °C (-40 ... +185 °F)
cone oil filling

- Measuring cell -20 ... +85 °C (-4 ... +185 °F)
30 bar (435 psi),
PN420
- For flow: -20 ... +85 °C (-4 ...
+185 °F)

Measuring cell with inert -20 ... +85 °C (-4 ... +185 °F)
oil

Measuring cell with FDA- -10 ... +85 °C (14 ... 185 °F)
compliant oil

Display -20 ... +80 °C (-4 ... +185 °F)

- Storage temperature -50 ... +85 °C (-58 ... +185 °F)
(with FDA-compliant oil: -20 ... + 85
°C (-4 ... +185 °F))

Climate class in accordance 4K4H
with IEC 60721-3-4

Degree of protection accord- Enclosure with appropriate cable IP66/Type 4X
ing to IEC/EN 60529/UL50-E gland IP68 (2 hours at 1.5 m)

Enclosure with mounted M12 con- IP66/Type 4X
connector and/or lightning protection

Enclosure with mounted HAN con- IP65
nector

Electromagnetic compatibility

Interference emission and In accordance with EN 61326 and
interference immunity NAMUR NE 21

Process medium conditions

- Process temperature

Measuring cell with sili- -40 ... +100 °C (-40 ... +212 °F)
cone oil filling

- Measuring cell -20 ... +85 °C (-4 ... +185 °F)
30 bar (435 psi),
PN420

Measuring cell with inert -20 ... +100 °C (-4 ... +212 °F)
oil

**Operating conditions for gauge pressure and absolute pressure
(from the differential pressure series), differential pressure and flow
rate**

<ul style="list-style-type: none"> Measuring cell 30 bar (435 psi), PN420 	-20 ... +85 °C (-4 ... +185 °F)
Measuring cell with FDA-compliant oil	-10 ... +100°C (14 ...+212°F)
In conjunction with dust explosion protection	-40 ... +85 °C (-4 ... +185 °F)

12.6 Vibration resistance

General operating conditions	Gauge pressure series ²⁾ Aluminum and stainless steel enclosure	Differential pressure series ¹⁾ Aluminum and stainless steel enclosure
Vibrations (sine) IEC 60068-2-6		2 ... 9 Hz at 0.3 mm 9 ... 200 Hz at 5 m/s ² 1 octave/min 5 cycles/axis
Continuous shocks (half-sine) IEC 60068-2-27		70 m/s ² 30 ms 6 shocks/axis
Continuous shocks (half-sine) IEC 60068-2-27		250 m/s ² 6 ms 1000 shocks/axis

1) Without mounting bracket

2) With mounting bracket

Technical data

12.6 Vibration resistance

Operating conditions according to KTA 3503	Gauge pressure series²⁾ Aluminum and stainless steel enclosure	Differential pressure series²⁾ Aluminum and stainless steel enclosure
Vibrations (sine) IEC 60068-2-6	9 ... 35 Hz at 10 m/s ² 1 octave/min 1 cycle/axis	
Vibrations (sine) IEC 60068-2-6	5 ... 7 Hz at 20 mm 9 ... 100 Hz at 20 m/s ² 10 octave/min 1 cycle/axis	
Continuous shocks (half-sine) IEC 60068-2-27	300 m/s ² 11 ms 6 shocks/axis	

2) With mounting bracket

Operating conditions according to IEC 61298-3 (2g normal)	Gauge pressure series²⁾ Aluminum and stainless steel enclosure	Differential pressure series¹⁾²⁾ Aluminum and stainless steel enclosure
Vibrations (sine) IEC 60068-2-6	10 ... 58 Hz at 0.3 mm 58 ... 1000 Hz at 20 m/s ² 1 octave/min 20 cycles/axis	

1) Without mounting bracket

2) With mounting bracket

Operating conditions according to IEC 61298-3 (5g enhanced)	Differential pressure series¹⁾ Aluminum and stainless steel enclosure
Vibrations (sine) IEC 60068-2-6	10 ... 58 Hz at 0.7 mm 58 ... 1000 Hz at 50 m/s ² 1 octave/min 20 cycles/axis

1) Without mounting bracket

Operating conditions for marine (only in combination with order option E):	Gauge pressure series ¹⁾²⁾	Differential pressure series ³⁾
DNV-GL (Det Norske Veritas/Germanischer Lloyd)	2 ... 25 Hz at 3.2 mm	25 ... 100 Hz at 40 m/s ²
Lloyd's Register		0.5 octave/min
Bureau Veritas		1 frequency sweep/axis
ABS (American Bureau of Shipping)		Amplification factor (Q) < 2, 30 Hz/90 min
RINA (Registro Italiano Navale)		Amplification factor (Q) > 2, resonant frequency/90 min
CCS (China Classification Society)		

- 1) Without bracket and aluminum enclosure
- 2) With mounting bracket, aluminum and stainless steel enclosure
- 3) Without mounting bracket, aluminum and stainless steel enclosure

12.7 Construction

Construction for gauge pressure and absolute pressure (from the gauge pressure series)

Weight	Approx. 1.8 kg (3.9 lb) with aluminum enclosure Approx. 3.8 kg (8.3 lb) with stainless steel enclosure
Material	
<ul style="list-style-type: none"> • Wetted parts materials 	
Process connection	Stainless steel, material no. 1.4404/316L or Alloy C22, material no. 2.4602
Oval flange	Stainless steel, mat. no. 1.4404/316L
Seal diaphragm	Stainless steel, material no. 1.4404/316L or Alloy C276, material no. 2.4819
<ul style="list-style-type: none"> • Non-wetted parts materials 	
Electronics housing	<ul style="list-style-type: none"> • Low-copper die-cast aluminum GD-AISI 12 or stainless steel precision casting, mat. no. 1.4409/ CF-3M • Standard: Powder coating with polyurethane Option: 2 coats: Coat 1: epoxy-based; coat 2: Polyurethane • Stainless steel nameplate (1.4404/316L)
Mounting bracket	Steel, galvanized, stainless steel 1.4301/304, stainless steel 1.4404/316L

Construction for gauge pressure and absolute pressure (from the gauge pressure series)

Process connection	<ul style="list-style-type: none"> • Connection pin G¹/₂A in accordance with DIN EN 837-1 • Female thread ¹/₂-14 NPT • Oval flange (PN 160 (MAWP 2320 psi g)) with fastening screw thread: <ul style="list-style-type: none"> – ⁷/₁₆-20 UNF in accordance with EN 61518 – M10 in accordance with DIN 19213 • Oval flange (PN 420 (MAWP 2320 psi g)) with fastening screw thread: <ul style="list-style-type: none"> – ⁷/₁₆-20 UNF in accordance with EN 61518 – M12 in accordance with DIN 19213 • Male thread M20 x 1.5 and ¹/₂-14 NPT
Electrical connection	<p>Cable inlet using the following screwed joints:</p> <ul style="list-style-type: none"> • M20 x 1.5 • ¹/₂-14 NPT • Han 7D/Han 8D connector¹⁾ • M12 connector

¹⁾ Han 8D is identical to Han 8U.

Construction for gauge pressure, with flush mounted diaphragm

Weight (pressure transmitter without mounting flange)	<p>Approx. 1.8 kg (3.9 lb) with aluminum enclosure</p> <p>Approx. 3.8 kg (8.3 lb) with stainless steel enclosure</p>
---	--

Material

• Wetted parts materials

Process connection	Stainless steel, mat. no. 1.4404/316L
Seal diaphragm	Stainless steel, material no. 1.4404/316L or Alloy C276, material no. 2.4819

• Non-wetted parts materials

Electronics housing	<ul style="list-style-type: none"> • Low-copper die-cast aluminum GD-AISI 12 or stainless steel precision casting, mat. no. 1.4409/CF-3M • Standard: Powder coating with polyurethane D20 option: 2 coats: Coat 1: epoxy-based; coat 2: Polyurethane • Stainless steel nameplate (1.4404/316L)
---------------------	---

Mounting bracket	Steel, galvanized, stainless steel 1.4301/304, stainless steel 1.4404/316L
------------------	--

Construction for gauge pressure, with flush mounted diaphragm

Process connection	<ul style="list-style-type: none"> • Flanges as per EN and ASME • F&B and Pharma flange • BioConnect/BioControl • PMC style
Electrical connection	Cable inlet using the following screwed joints: <ul style="list-style-type: none"> • M20x1.5 • ½-14 NPTM • Han 7D/Han 8D connector¹⁾ • M12 connector

¹⁾ Han 8D is identical to Han 8U.

Construction for gauge pressure and absolute pressure (from the differential pressure series), differential pressure and flow rate

Weight	Approx. 3.9 kg (8.5 lb) with aluminum enclosure Approx. 5.9 kg (13 lb) with stainless steel enclosure
--------	--

Material

• Wetted parts materials

Seal diaphragm	Stainless steel, mat. no. 1.4404/316L, Alloy C276, mat. no. 2.4819, Monel 400, mat. no. 2.4360, tantalum or gold
Pressure caps and vents	Stainless steel, mat. no. 1.4408 to PN 160, mat. no. 1.4571/316Ti for PN 420, Alloy C22, 2.4602 or Monel 400, mat. no. 2.4360
O-ring	FKM (Viton) or optionally: PTFE, FEP, FEPM and NBR

• Non-wetted parts materials

Electronics housing	<ul style="list-style-type: none"> • Low-copper die-cast aluminum GD-AISI 12 or stainless steel precision casting, mat. no. 1.4409/CF-3M • Standard: Powder coating with polyurethane D20 option: 2 coats: Coat 1: epoxy-based; coat 2: Polyurethane • Stainless steel nameplate (1.4404/316L)
Pressure cap screws	Stainless steel ISO 3506-1 A4-70
Mounting bracket	Steel, galvanized, stainless steel 1.4301/304, stainless steel 1.4404/316L
Process connection	1/4-18 NPT female thread and flange connection with 7/16-20 UNF fastening screw thread in accordance with EN 61518 or M10 fastening screw thread in accordance with DIN 19213 (M12 for PN 420 (MAWP 6092 psi))
Electrical connection	Screw terminals Cable inlet using the following screwed joints: <ul style="list-style-type: none"> • M20 x 1.5 • ½-14 NPT • Han 7D/Han 8D connector¹⁾ • M12 connector

¹⁾ Han 8D is identical to Han 8U.

12.8 Torques

Torques	
Terminal compartment	
• Connecting terminals	0.4 to 0.8 Nm (0.3 to 0.6 ft lb)
Cable glands/blanking plugs	
• Screw-in torque for plastic gland in all enclosures	4 Nm (3 ft lb)
• Screw-in torque for metal/stainless steel glands in aluminum/stainless steel enclosure	6 Nm (4.4 ft lb)
• Screw-in torque for NPT adapter made of metal/stainless steel in aluminum/stainless steel enclosure	15 Nm (11.1 ft lb)
• Tightening torque for union nut made of plastic	2.5 Nm (1.8 ft lb)
• Tightening torque for union nut made of metal/stainless steel	4 Nm (3 ft lb)
Screws for mounting bracket (option)	
• Tightening torque for thread M8 or $5/16$ -24 UNF	18 Nm (13.2 ft lb)
• Tightening torque for thread M10 or $7/16$ -20 UNF	36 Nm (26.5 ft lb)
Retaining screws for rotation of the enclosure	
• Tightening torque for aluminum enclosure	3.8 Nm (2.8 ft lb)
• Tightening torque for stainless steel enclosure	3.5 Nm (2.5 ft lb)

12.9 Display, keyboard and auxiliary power

Display and user interface	
Buttons	4 buttons for operation directly on the device
Display	<ul style="list-style-type: none"> • With or without integrated display (optional) • Cover with inspection window (optional)

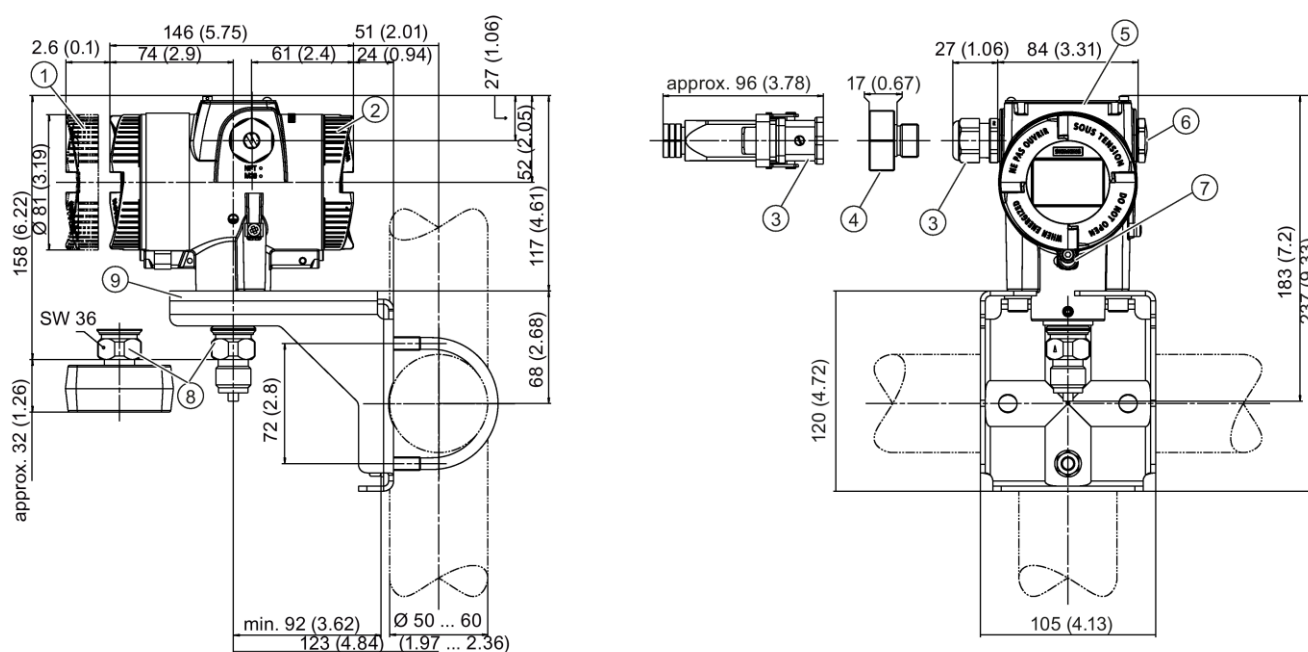
Auxiliary power U _H	
HART	
Terminal voltage on pressure transmitter	<ul style="list-style-type: none"> • DC 10.5 V ... 45 V • In the case of intrinsically safe operation 10.5 V ... 30 V DC
Auxiliary power	–
Separate supply voltage	–

12.10 certificates and approvals

Certificates and approvals	
Classification according to pressure equipment directive (PED 2014/68/EU)	<ul style="list-style-type: none"> • For gases of fluid group 1 and liquids of fluid group 1; complies with requirements of article 4, paragraph 3 (sound engineering practice) • Only for flow rate: For gases of Fluid Group 1 and liquids of Fluid Group 1; fulfills the basic safety requirements as per article 3, Para 1 (appendix 1); classified as category III, module H conformity evaluation by TÜV Nord
Drinking water	Available soon
<ul style="list-style-type: none"> • WRAS (England) • ACS (France) • DVGW (Germany) • NSF (USA) 	
CRN (Canada)	Available soon

Dimension drawings

13.1 ACCU P320/P420 for gauge pressure and absolute pressure from the gauge pressure series



- ① Electronics side, display
(longer for cover with inspection window)¹⁾
- ② Connection end
- ③ Electrical connection:
 - M20 x 1.5 gland³⁾
 - ½-14 NPT gland
 - Han 7D/Han 8D plug^{2) 3)}
 - M12 connector²⁾³⁾
- ④ Harting adapter
- ⑤ Cover over buttons and nameplate with general information
- ⑥ Blanking plug
- ⑦ Safety catch
(only for flameproof enclosure)
- ⑧ Process connection: G½B connection pin or oval flange
- ⑨ Mounting bracket (optional)

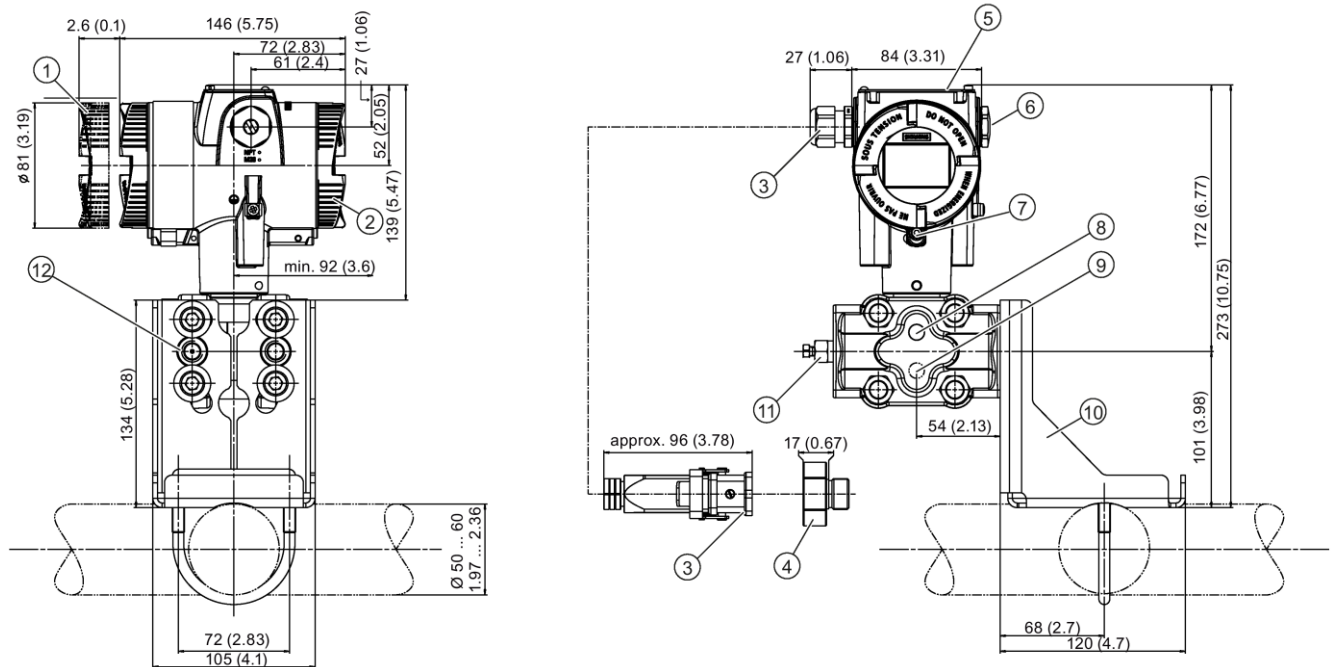
¹⁾ In addition, allow approx. 22 mm (0.87 inch) for the thread length when removing the covers

A.1 Technical support

- 2) Not with "flameproof enclosure" type of protection
- 3) Not for "FM + CSA [is + XP]" type of protection

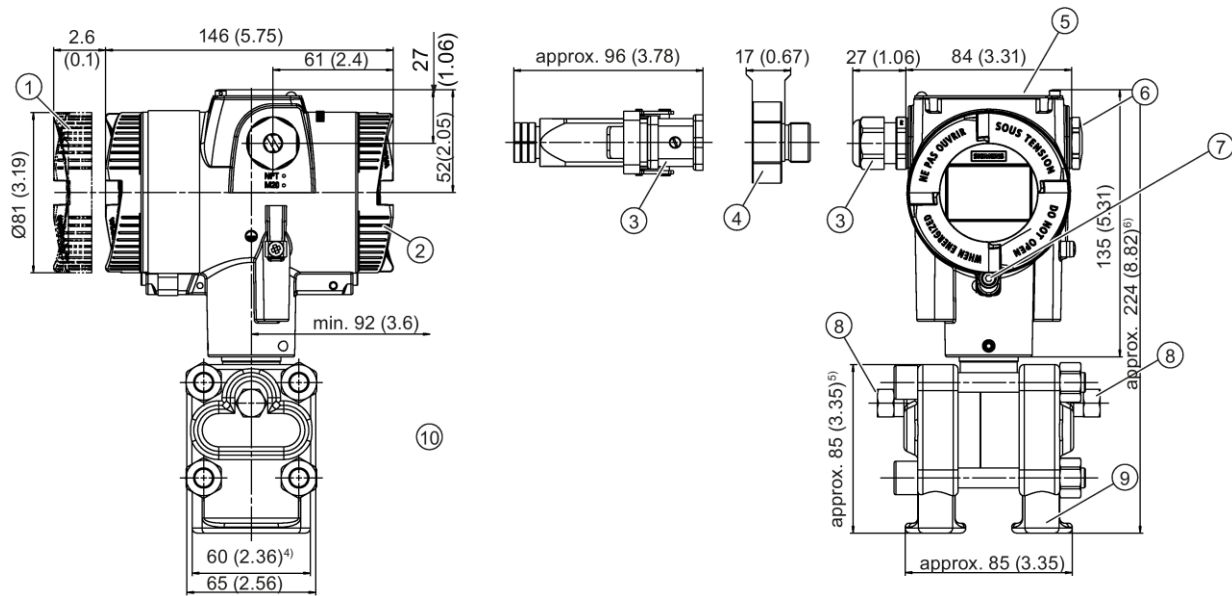
Figure 13-1 ACCU P320 and ACCU P420 pressure transmitters for absolute pressure, from the gauge pressure series, dimensions in mm (inches)

13.2 ACCU P320/P420 for differential pressure, gauge pressure, flow and absolute pressure from the differential pressure series



- ① Electronics side, display
(longer for cover with inspection window)¹⁾
 - ② Connection end
 - ③ Electrical connection:
 - M20 x 1.5 gland
 - ½-14 NPT gland
 - Han 7D/Han 8D plug^{2) 3)}
 - M12 connector²⁾³⁾
 - ④ Harting adapter
 - ⑤ Cover over buttons and nameplate with general information
 - ⑥ Blanking plug
 - ⑦ Safety catch
(only for "flameproof enclosure" type of protection)
 - ⑧ Lateral ventilation for liquid measurement (standard)
 - ⑨ Lateral ventilation for gas measurement (addition K85)
 - ⑩ Mounting bracket (optional)
 - ⑪ Sealing plug, with valve (optional)
 - ⑫ Process connection: ¼-18 NPT (EN 61518)
- 1) In addition, allow approx. 22 mm (0.87 inch) for the thread length when removing the covers
- 2) Not with "flameproof enclosure" type of protection
- 3) Not for "FM + CSA [IS + XP]" type of protection

Figure 13-2 ACCU P320 and ACCU P420 pressure transmitters for differential pressure and flow, dimensions in mm (inches)



- ① Electronics side, display
(longer for cover with inspection window)¹⁾
- ② Connection end
- ③ Electrical connection:
 - M20 x 1.5 gland
 - ½-14 NPT gland
 - Han 7D/Han 8D plug²⁾³⁾
 - M12 connector²⁾³⁾
- ④ Harting adapter
- ⑤ Cover over buttons and nameplate with general information
- ⑥ Blanking plug
- ⑦ Safety catch
(only for "flameproof enclosure" type of protection)
- ⑧ Sealing plug, with valve (optional)
- ⑨ Process connection: ¼-18 NPT (IEC 61518)
- ⑩ Clearance for rotating the enclosure

- 1) In addition, allow approx. 22 mm (0.87 inch) for the thread length when removing the covers
- 2) Not with "flameproof enclosure" type of protection
- 3) Not for "FM + CSA [is + XP]" type of protection
- 4) 74 mm (2.9 inch) for PN ≥ 420 (MAWP ≥ 6092 psi)
- 5) 91 mm (3.6 inch) for PN ≥ 420 (MAWP ≥ 6092 psi)
- 6) 226 mm (8.62 inch) for PN ≥ 420 (MAWP ≥ 6092 psi)

Figure 13-3 ACCU P320 and ACCU P420 pressure transmitters for differential pressure and flow with caps for vertical pressure lines (addition K81), dimensions in mm (inches)

13.2.1 Note 3A and EHDG

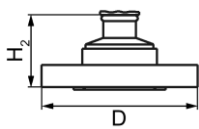
Note

Approvals

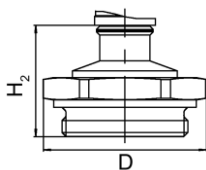
The references to the approvals for "EHEDG" and "3A" refer to the respective process connections and are not device-specific. Please refer to the technical specifications of the respective pressure transmitter to see whether the desired certificate is available for your device/flange combination.

13.2.2 Connections as per EN and ASME

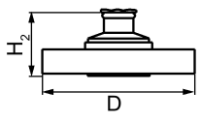
Flange according to EN

EN 1092-1				
	DN	PN	ØD	H ₂
	25	40	115 mm (4.5")	Approx. 52 mm (2")
	40	40	150 mm (5.9")	
	40	100	170 mm (6.7")	
	50	16	165 mm (6.5")	
	50	40	165 mm (6.5")	
	80	16	200 mm (7.9")	
	80	40	200 mm (7.9")	

Threaded connections

G3/4", G1" and G2" In accordance with DIN 3852				
	DN	PN	ØD	H ₂
	¾"	60	37 mm (1.5")	approx. 45 mm (1.8")
	1"	60	48 mm (1.9")	approx. 47 mm (1.9")
	2"	60	78 mm (3.1")	Approx. 52 mm (2")

Flange according to ASME

ASME B 16.5				
	DN	CLASS	ØD	H ₂
	1"	150	110 mm (4.3")	Approx. 52 mm (2")
	1½"	150	125 mm (4.9")	
	1½"	300	155 mm (6.1")	
	2"	150	150 mm (5.9")	
	2"	300	165 mm (6.5")	
	3"	150	190 mm (7.5")	
	3"	300	210 mm (8.1")	
	4"	150	230 mm (9.1")	
	4"	300	255 mm (10.0")	

A.1 Technical support

If this documentation does not provide complete answers to any technical questions you may have, contact Technical Support at +49 2166 623170

List of abbreviations

B.1 Pressure transmitter abbreviations

List of abbreviations

Table B- 1 Units

Abbreviation	Display in the edit view	In full	Meaning
bar	bar	bar	
bar a		bar absolute	Pressure unit for absolute pressure
bar g		bar gauge	Pressure unit for gauge pressure
mbar	mbar	Millibars	
torr	torr	torr	
atm	atm	Atmospheres	
inH ₂ O a		inches of water absolute	Pressure unit for absolute pressure
inH ₂ O g		inches of water gauge	Pressure unit for gauge pressure
inH ₂ O (60 °F)	inW60	inches of water at 60 °F	
inH ₂ O (4 °C)	inW4	inches of water at 4 °C	
inH ₂ O	inW68	inches of water at 68 °F	
inH ₂ O (4 °C)	mmW4	millimeters of water at 4 °C	
mmH ₂ O	mmW68	millimeters of water at 68 °F	
FtH ₂ O	FtW68	feet of water at 68 °F	
inHg	inHG	inches of mercury at 0 °C	
mmHg	mmHG	millimeters of mercury at 0 °C	
g/cm ²	G/cm2	grams per cm ²	
lb		Pound	Unit of weight
psi	PSI	pounds per square inch	
psi a		psi absolute	Pressure unit for absolute pressure
psi g		psi gauge	Pressure unit for gauge pressure
Pa	Pa	Pascal	
KPa	KPa	Kilopascal	
MPa	MPa	Megapascal	

List of abbreviations

B.1 Pressure transmitter abbreviations

Abbreviation	Display in the edit view	In full	Meaning
hPa	hPa	Hectopascal	
Pa a		Pascal absolute	Pressure unit for absolute pressure
Pa g		Pascal gauge	Pressure unit for gauge pressure

Table B- 2 Other abbreviations

Abbreviation	In full	Meaning
PED	Pressure Equipment Directive	
HART	Highway Addressable Remote Transducer	Standardized protocol for transmission of information between field device and automation system.
LRL	Engl.: Lower Range Limit	Lower end of the measuring range
LRV	Engl.: Lower Range Value	Lower end of the set measuring span
MA	Start of scale value	Lower end of the set measuring span
ME	Full scale value	Upper end of the set measuring span
MAWP	Engl.: Maximum Allowable Working Pressure (PS)	Maximum permissible operating pressure
NFPA	National Fire Protection Association	US - American Fire Protection Organization
F&B	Food and beverage industry	
PDM	Engl.: Process Device Manager	Tool for communication with HART devices (manufacturer: S.K.I.)
URL	Engl.: Upper Range Limit	Upper end of the measuring range
URV	Engl.: Upper Range Value	Upper end of the set measuring span

Glossary

Auxiliary power supply

Auxiliary power supply refers to an electrical supply or reference voltage which some electrical circuits require apart from the standard supply. The auxiliary power supply can, for example, be specially stabilized, have a particular level or polarity and/or other properties which are important for the correct functioning of switch components.

Auxiliary voltage

→ *Auxiliary power supply*

EEPROM

EEPROM (Electrically Erasable Programmable Read-Only Memory): a non-volatile, electronic memory module.

EEPROMs are often used where individual bytes of data (e.g. configuration data or runtime meters) change over time and must be stored safely in the event of a mains power failure.

Failure/Fault/Error

Failure:

A resource is no longer capable of executing a required function.

Fault/Error:

Undesired state of a resource indicated by its incapability of executing a required function.

Fault/Error

→ *Failure/Fault/Error*

Final controlling element

Converter that converts electrical signals into mechanical or other non-electric variables.

Firmware

Firmware (FW) is software that is embedded on a chip in electronic devices – in contrast to software which is saved on hard disks, CD-ROMs or other media. These days, firmware is mostly stored in a flash memory or EEPROM.

Firmware usually contains the elementary functions for controlling the device, as well as input and output routines.

Frequency shift keying

Frequency shift keying is a simple form of modulation, where the digital values 0 and 1 modulate the actual current signal by means of two different frequencies.

Frequency Shift Keying (FSK)

→ *Frequency shift keying*

HART

HART (Highway Addressable Remote Transducer) is a standardized, widely used communications system used to structure industrial fieldbuses. The communications system provides digital communications for multiple participants (field devices) via a common databus. HART is based especially on the equally widely used 4/20 mA standard for the transfer of analog sensor signals. The cabling from existing older systems can be used directly and both systems operated in parallel.

HART specifies several protocol levels in the OSI model. It facilitates the transfer of process and diagnostics data and control signals between field devices and high-level control systems. Standardized parameter sets can be used for the manufacture-independent operation of all HART devices.

Typical applications include transmitters for measuring mechanical and electrical dimensions.

Non-volatile memory

→ *EEPROM*

Risk

Combination of the probability of damage occurring and the extent of the damage.

Safety function

Defined function executed by a safety-instrumented system with the objective of attaining or maintaining a safe system state by taking a defined hazardous incident into account.

Example:

Limit pressure monitoring

Example:

A safety-instrumented system is made up of a pressure transmitter, a limit signal sensor and a control valve.

Sensor

Converter that converts mechanical or other non-electric variables into electrical signals.

Total error

Total Error is sum of Total Performance and the long-term stability.

Total Error(s)

→ *Total error*

Total Performance

Total Performance is the square root of the sum of the squares of the three deviations resulting from the influence of the static pressure, the temperature and the characteristic deviation.

TP

→ *Total Performance*

Index

3

3A, 193

A

Ambient temperature, 177, 179, 180,
 Effect, 163, 172
Application, (Transfer function)
APPLICATION, 58
APPLY LRV, 58
APPLY URV, 58
Approval
 3A, 193
 EHEDG, 193

B

Bidirectional flow measurement, 93
Blowout valve, 71
Blowout valves, 73
Bridge output voltage, 26, 30,
BUTTON LOCK, 58

C

Certificates, 17,
CHANGE PIN, 58
Compact Operating Instructions,
CONIC, 90
CUSTM, 90
Customer Support, (Refer to Technical Support)
CYLIN, 90

D

DAMPING, 58
DEVICE MODE, 58
Diagnostic messages, 144
Differential pressure, 20, 20
Direct sunlight, 35
Disassembly, 43
Display, 54
DISPLAY TEST, 58
Document history, 13

E

Edit view, 59
EHEDG, 193
Electromagnetic compatibility, 178, 179, 180,
EMC, 178, 179, 180,
ETEMP, 103

F

Fail-safe behavior,
FAULT CURR, 58
Filling liquid, 26, 29,
Fingerprint,
Flange,
FLAT, 90
FUNCT SAFETY, 58
Function chart, 27

H

HALF, 90
HART Modem, 31
Hotline, (Refer to Support request)

I

Identification data
 define, 121
IDENTIFY, 58
In accordance with the square root function
 see square-root extraction, 92
Install
Installation, 36, 36

J

Jumper, 61

L

Laws and directives
Layout of nameplate with general information, 22
LO FAULT CUR, 58

Load, 177
Long tag, (TAG)
LOOP TEST, 58
LOW FLOW CUT, 58
Low flow cut-off, 92, 107
LOWER RANGE, 58
LOWER SCALNG, 58

M

Maintenance, 133
Manuals,
MAWP, 198
Measurement view, 55
Measuring cell
 Absolute pressure, 27
 Differential pressure and flow rate, 30
 Gauge pressure, 26
MFLOW, 103
MFLOW UNITS, 58
Modifications
 correct usage, 18
 improper, 18
Mounting flange,
MSL2B, 90
MSLN, 90
MSLN2, 90
MSOFF, 90
MWP, (See MAWP)

N

Nameplate, 22

O

Order supplement, 22
Overview of parameters and functions, 79

P

PARAB, 90
PARAE, 90
Parameter view, 57
PIN RECOVERY, 58
PRESS, 89
PRESS UNITS, 58
PRESSURE REF, 58
Pressure reference, 84
Pressure units, 84

Q

Quick start wizard, 79

R

Recovery ID, 110
RECOVERY ID, 58
RESET, 58

S

SATURAT HI, 58
SATURAT LOW, 58
Scope of delivery, 14
Shut-off valve, 72, 73, 75, 77, 77
SPHER, 90
SQRT POINT, 58
Square root function
 Hold at 0, square root, 92
 Linear, square root, 92
 Two step linear, square root, 93
Stabilizing valve, 73, 74, 75, 77
START VIEW, 58
Structure, 21
SV SELECT, 58

T

Tank connection,
TEMP, 103
TEMP UNITS, 58
Test certificates, 17

U

UP FAULT CUR, 58
UPPER RANGE, 58
UPPER SCALNG, 58
USER, 103
User PIN, 112
 Factory setting, 109
USER PIN, 58

V

Vent valve, 75, 77
VFLOW, 103
VFLOW UNITS, 58
VLIN, 90

VOL, 103
VOL UNITS, 58
VSL2B, 90
VSLN, 89
VSLN2, 90
VSOFF, 90

W

Warranty, 16
Write protection, 61

Z

ZERO POINT, 58

