SIEMENS

SITRANS

Pressure transmitter
SITRANS P DS III/P410 with PROFIBUS PA

Operating Instructions

Edition 02/2016

Answers for industry.

SIEMENS

SITRANS

Pressure transmitter SITRANS P DS III/P410 with PROFIBUS PA

Operating Instructions

7MF4.34

02/2016

A5E00053276-08

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 Siemens products

Note the following:

⚠WARNING
Siemens 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 Siemens. 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 Siemens 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.

Siemens AG
Division Process Industries and Drives
Postfach 48 48
90026 NÜRNBERG
GERMANY

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Introduction 1

1.1 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.

1.2 Product information

The programming manual is an integral part of the CD, which is either supplied or can be ordered. The programming manual is also available on the Siemens homepage.

On the CD, you will also find the catalog extract with the ordering data, the Software Device Install for SIMATIC PDM for additional installation, and the required software.

See also

Process instrumentation catalog (http://www.siemens.com/processinstrumentation/catalogs)

Product information on SITRANS P in the Internet (http://www.siemens.com/sitransp)

1.3 History

This history establishes the correlation between the current documentation and the valid firmware of the device.

The documentation of this edition applies to the following firmware:

Edition	Firmware identifier nameplate	System integration
12/2015	FW:300.01.08 FW:301.01.10 PROFIsafe FW:301.02.03 FW:301.02.04	SIMATIC PDM V8.x

The most important changes in the documentation when compared with the respective previous edition are given in the following table.

Edition	Remark
12/2015	All safety information has been revised. The following chapters have also been changed: • "Functional safety" chapter • "Technical data" chapter

1.4 Scope of the instructions

Table 1- 1 "7MF4.34.." stands for:

Order number	SITRANS P DS III/P410 for
7MF4034..	Gauge pressure
7MF4134..	Gauge pressure, flush mounted diaphragm
7MF4234..	Absolute pressure from the gauge pressure series
7MF4334..	Absolute pressure from the differential pressure series
7MF4434..	Differential pressure and flow rate, PN 32/160 (MAWP 464/2320 psi)
7MF4534..	Differential pressure and flow rate, PN 420 (MAWP 6092 psi)
7MF4634..	Level

1.5 Checking the consignment

1. Check the packaging and the delivered items for visible damage.
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**
>
> Danger of explosion in hazardous areas.
>
> • Do not use damaged or incomplete devices.

See also

Return procedure (Page 187)

1.6 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. Siemens cannot assume liability for any costs associated with transportation damages.

> **CAUTION**
>
> **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 193).

1.7 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 Siemens 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. Siemens reserves the right to make technical changes in the course of further development.

Safety information 2

2.1 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.

Symbol	Explanation
	Consult operating instructions

2.1.1 Laws and directives

Observe the test certification, 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)

Further provisions for hazardous area applications are for example:

- IEC 60079-14 (international)
- EN 60079-14 (EC)

2.1.2 Conformity with European directives

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

Electromagnetic Compatibility EMC 2004/108/EC	Directive of the European Parliament and of the Council on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC.
Atmosphère explosible ATEX 94/9/EC	Directive of the European Parliament and the Council on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres.
Pressure Equipment Directive PED 97/23/EC	Directive of the European Parliament and of the Council on the approximation of the laws of the Member States concerning pressure equipment.

The standards applied can be found in the EC declaration of conformity for the device.

2.2 Improper device modifications

WARNING

Improper device modifications

Danger to personnel, system and environment can result from modifications to the device, particularly in hazardous areas.

- 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.

2.3 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 Siemens office or company representative.

Note

Operation under special ambient conditions

We highly recommend that you contact your Siemens 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.

2.4 Use in hazardous areas

Qualified personnel for hazardous area applications

Persons who install, connect, commission, operate, and service the device in a hazardous area must have the following specific qualifications:

- They are authorized, trained or instructed in operating and maintaining devices and systems according to the safety regulations for electrical circuits, high pressures, aggressive, and hazardous media.
- They are authorized, trained, or instructed in carrying out work on electrical circuits for hazardous systems.
- They are trained or instructed in maintenance and use of appropriate safety equipment according to the pertinent safety regulations.

> ⚠ WARNING
>
> **Unsuitable device for the hazardous area**
>
> Danger of explosion.
>
> - Only use equipment that is approved for use in the intended hazardous area and labelled accordingly.

See also

Technical data (Page 193)

> ⚠ WARNING
>
> **Loss of safety of device with type of protection "Intrinsic safety Ex i"**
>
> If the device has already been operated in non-intrinsically safe circuits or the electrical specifications have not been observed, the safety of the device is no longer ensured for use in hazardous areas. There is a danger of explosion.
>
> - Connect the device with type of protection "Intrinsic safety" solely to an intrinsically safe circuit.
> - Observe the specifications for the electrical data on the certificate and/or in Chapter "Technical data (Page 193)".

2.4.1 Use of incorrect device parts in potentially explosive environments

WARNING

Use of incorrect device parts in potentially explosive environments

Devices and their associated device parts are either approved for different types of protection or they do not have explosion protection. There is a danger of explosion if device parts (such as covers) are used for devices with explosion protection that are not expressly suited for this type of protection. If you do not adhere to these guidelines, the test certificates and the manufacturer warranty will become null and void.

- Use only device parts that have been approved for the respective type of protection in the potentially explosive environment. Covers that are not suited for the "explosion-proof" type of protection are identified as such by a notice label attached to the inside of the cover with "Not Ex d Not SIL".
- Do not swap device parts unless the manufacturer specifically ensures compatibility of these parts.

WARNING

Risk of explosion due to electrostatic charge

To prevent the build-up of an electrostatic charge in a hazardous area, the key cover must be closed during operation and the screws tightened.

The key cover may be opened temporarily at any time for the purposes of operating the pressure transmitter, even during plant operation; the screws should then be tightened again.

2.4.2 Electrostatic-sensitive devices

NOTICE
Electrostatic-sensitive devices The device contains electrostatic-sensitive devices (ESD). ESD can be destroyed by voltages far too low to be detected by humans. These voltages can occur if you simply touch a component part or the electrical connections of a module without being electrostatically discharged. The damage to a module caused by overvoltage cannot normally be detected immediately; it only becomes apparent after a longer period of operating time has elapsed. Protective measures against the discharge of static electricity: • Make sure that no power is applied. • Before working with modules, make sure that you discharge static from your body, for example by touching a grounded object. • Devices and tools used must be free of static charge. • Hold modules only by their edges. • Do not touch connector pins or conductor tracks on a module with the ESD notice.

Description 3

3.1 System configuration

Overview

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

Use with the SIMATIC PCS 7 Automation System is described below.

System communication

The operator station of the SIMATIC PCS 7 process control system allows easy and safe control of the process by the operating personnel via OS clients.

The maintenance station assists the maintenance engineer in guaranteeing high plant availability, securing this long-term using optimization measures, and implementing the maintenance measures using a minimum of personnel, materials, energy, expenses, etc.

The field devices are integrated over PROFIBUS PA with:

- PA Link to the gateway between PROFIBUS PA and PROFIBUS DP
- Control system, e.g. SIMATIC PCS 7 Automation System, which communicates over PROFIBUS
- Engineering station, SIMATIC PDM (Process Device Manager) which communicates over Industrial Ethernet

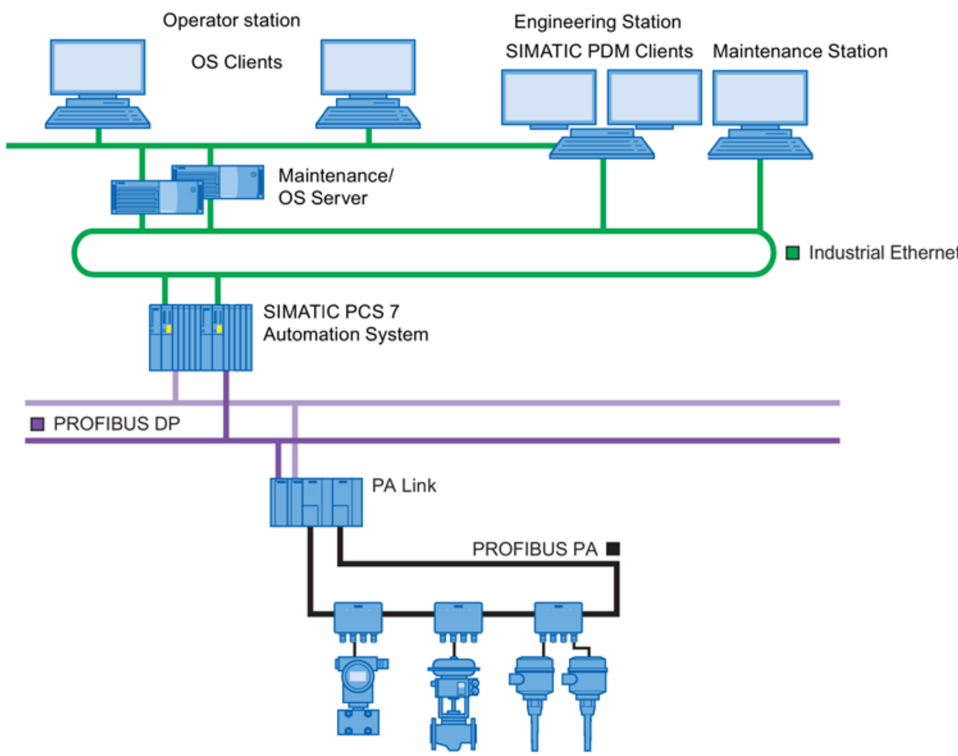


Image 3-1 Possible system configuration

3.2 Application

Overview

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

Depending on the device version, you can use the pressure transmitter for the following types of measurement:

- Gauge pressure
- Absolute pressure
- Differential pressure

With appropriate parameter settings and the necessary add-on parts (e.g. flow limiters and remote seals), the pressure transmitter can also be used for the following measurements:

- Level
- Volume
- Mass
- Volume flow
- Mass flow

The output signal is a process-based, digital PROFIBUS PA/FOUNDATION™ Fieldbus FF signal.

You can install the "intrinsically-safe" or "flameproof enclosure" version of the pressure transmitter in hazardous areas. The devices have an EC-Type Examination Certificate, and comply with the corresponding harmonized European directives of the CENELEC.

The pressure transmitter is available with various designs of the remote seal for special applications. A special application, for example, is the measurement of highly viscous materials.

Gauge pressure

This version measures the gauge pressure of corrosive, non-corrosive and toxic gases, vapors and liquids.

The smallest nominal measuring range is 0.01 bar g/1kPa g/14.5 psi g, the largest is 700 bar g/70 MPa g/10153 psi g.

Absolute pressure

This version measures the absolute pressure of corrosive, non-corrosive and toxic gases, vapors and liquids.

There are two series: A "Differential pressure" series and a "Gauge pressure" series. The "Differential pressure" series features a high overload capacity.

The smallest nominal measuring range of the "Differential pressure" series is 8.3 mbar a/0.83kPa/3.63 psi a, the largest is 100 bar a/10 MPa a/1450 psi a.

The smallest nominal measuring range of the "Gauge pressure" series is 8.3 mbar a/0.83kPa/3.63 psi a, the largest is 30 bar a/3 MPa/435 psi a.

Differential pressure and flow rate

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

- Differential pressure
- Gauge pressure, suitable for small positive or negative pressure value
- In combination with a primary element: flow rate $q \sim \sqrt{\Delta p}$

The smallest nominal measuring range is 20 mbar (8.03 in H_2O), the largest is 30 bar (435 psi).

Level

This version with mounting flange measures the level of non-corrosive, corrosive and toxic liquids in open and closed containers. The smallest nominal measuring range is 250 mbar (3.63 psi), the largest is 5 bar (72.5 psi). The nominal diameter of the mounting flange is DN 80 or DN 100, or 3" or 4".

For the level measurement on open containers, the low-pressure side of the measuring cell remains open. This measurement is referred to as "Measurement against atmospheric pressure". For the measurement on closed containers, the low-pressure side is usually connected to the container. This balances out the static pressure.

The parts wetted by the medium are made of various materials according to the corrosion resistance required.

3.3 SITRANS P DS III and SITRANS P410

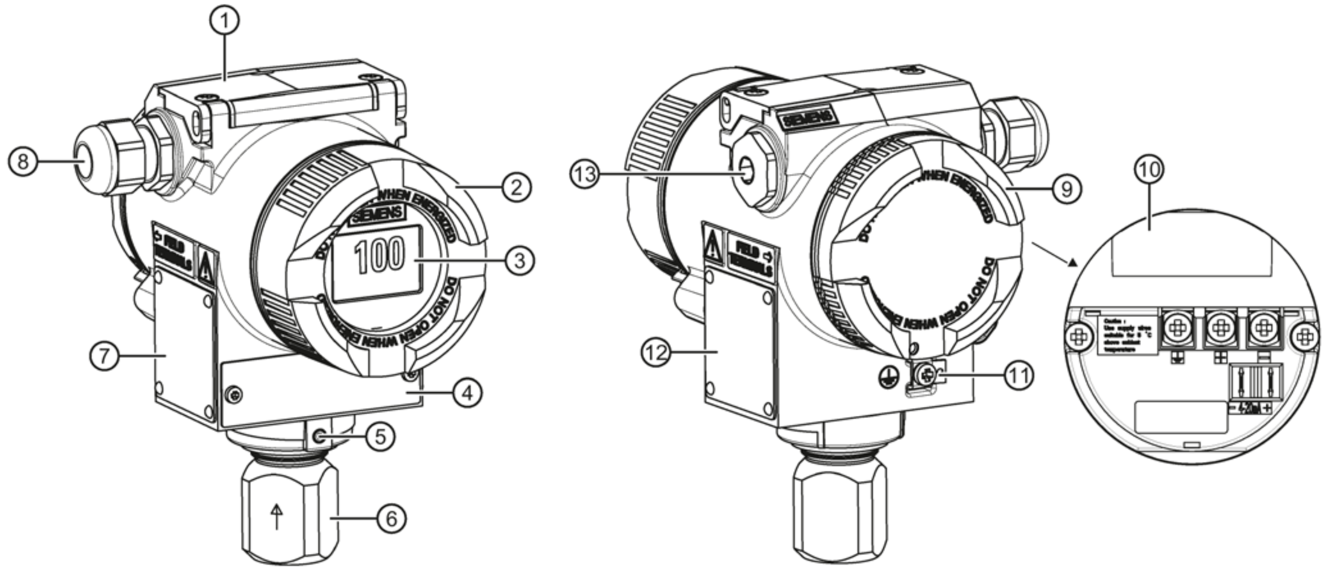
SITRANS P DS III and SITRANS P410

These instructions describe the pressure transmitters SITRANS P DS III and SITRANS P410. The main difference of the SITRANS P410 is the higher measuring precision compared to the SITRANS P DS III. Refer to the information in the section Technical data (Page 193).

You order SITRANS P410 using the order option C41 for specific device versions.

3.4 Structure

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



①	Key cover	⑧	Cable inlet, optionally with cable gland
②	Cover (front), optionally with inspection window	⑨	Cover (rear) for electrical terminal compartment
③	Display (optional)	⑩	Electrical terminal compartment
④	Measuring point label	⑪	Protective conductor connector/equipotential bonding terminal
⑤	Retaining screw; twist proofing of the measuring cell in relation to the electronics enclosure	⑫	Nameplate (approval information)
⑥	Process connection	⑬	Blanking plug
⑦	Nameplate (general information)		

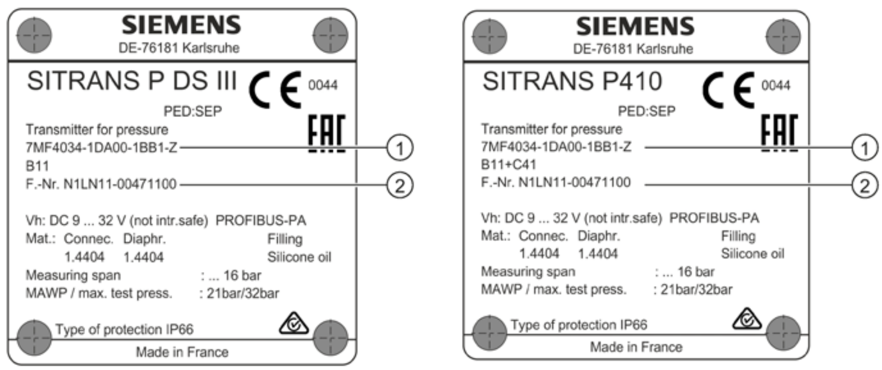
Image 3-2 View of the pressure transmitter: Left: Front right: Rear view

- The electronics enclosure is made of die cast aluminum or precision cast stainless steel.
- The housing has a removable circular cover at the front and the back.
- Depending on the device version, the front cover ② may be designed as an inspection window. You can read the measured values straight off the digital display through this inspection window.
- The cable inlet 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 ⑬.
- The protective conductor terminal/equipotential bonding terminal ⑪ is located at the back of the enclosure.
- The electrical terminal compartment ⑩ for the auxiliary power and shield is accessible when you remove the back cover ⑨.
- The measuring cell with a process connection ⑥ is located in the lower section of the enclosure. This measuring cell is secured against twisting by a retaining screw ⑤. Thanks to the modular design of the pressure transmitter, the measuring cell and application electronics or connection board can be replaced if required.
- On the upper face of the enclosure you can see crosshead screws which secure the key cover ①, under which there are 3 keys for local operation.

3.5 Nameplate layout

Nameplate with general information

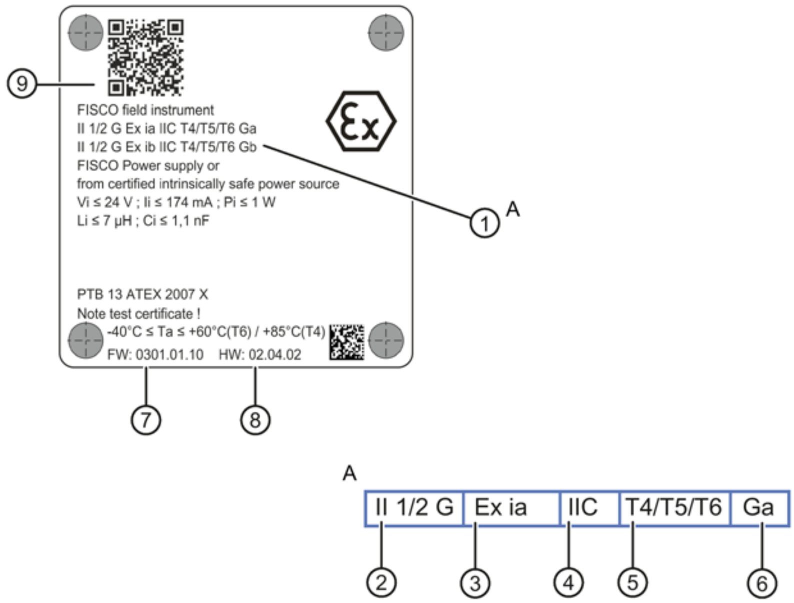
The label which bears the Order No. and other important information such as design details or technical data is present on the side of the housing.



① Order number (machine-readable product code)
② Serial number

Nameplate with approval information

On the opposite side is the nameplate with approval information. This nameplate shows the firmware and hardware versions, for example. You must also observe the information in the relevant certificate for a pressure transmitter version for use in hazardous areas.



①	Characteristics of the hazardous area	⑤	Maximum surface temperature (temperature class)
②	Category of the operating range	⑥	Device protection level
③	Type of protection	⑦	Firmware identifier
④	Group (gas, dust)	⑧	Hardware identifier
⑨	QR code to the mobile website with device-specific information on the product	A	More detailed information on the characteristics ①

3.6 Measuring point label layout

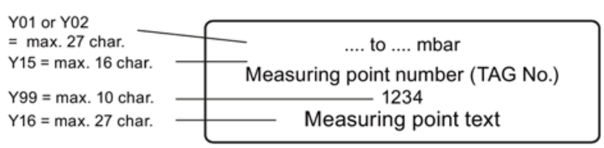


Image 3-3 Example of measuring point label

3.7 Principle of operation

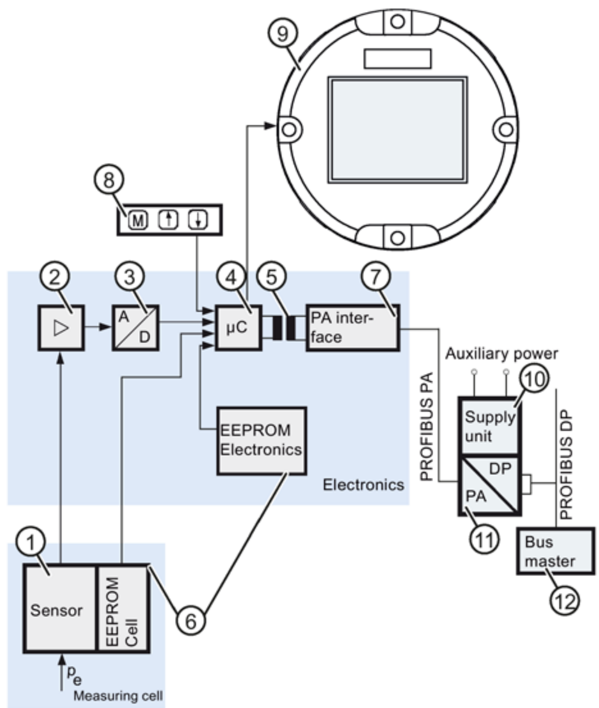
3.7.1 Overview of mode of operation

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.

3.7.2 Operation of the electronics

Description



①	Measuring cell sensor	⑧	Buttons (local operation)
②	Measuring amplifier	⑨	Display
③	Analog-to-digital converter	⑩	Power supply
④	Microcontroller	⑪	DP/PA coupler or DP/PA link
⑤	Electrical isolation	⑫	Bus master
⑥	Each with an EEPROM in the measuring cell and in the electronics	p_e	Input variable
⑦	PROFIBUS PA interface		

Image 3-4 Principle of operation of the electronics with PA communication

Function

- The inlet 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 signal is available at an electrically isolated PA interface ⑦ on the PROFIBUS PA.

- The data specific to the measuring cell, the electronics data, and the parameterization data are stored in two EEPROMs ⑥. The first memory is linked with the measuring cell, the second with the electronics.
- The results with the status values and diagnostics data are transmitted cyclically over the PROFIBUS PA. Parameterization data and error messages are transmitted acyclically by SIMATIC PDM.

Operation

- The buttons ⑧ can be used to call up individual functions, so-called modes.
- If you have a display ⑨, you can track the mode settings and other messages on it.

3.7.3 Principle of operation of the measuring cell

WARNING

Destruction of the seal diaphragm

Danger of injury or damage to device

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.

Hot, toxic and corrosive process media can be released.

- 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 193).
- 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 193).
- 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.

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

Overview

The following modes of operation are described:

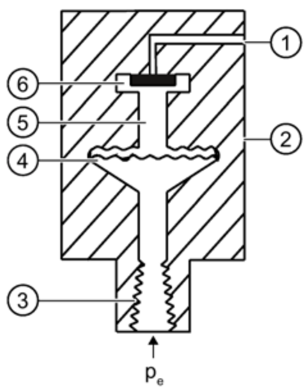
- Gauge pressure
- Absolute pressure
- Differential pressure and flow rate
- Level

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

3.7.3.1 Measuring cell for gauge pressure



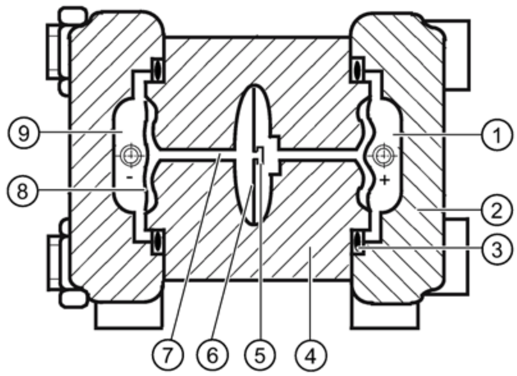
①	Reference pressure opening	⑤	Filling liquid
②	Measuring cell	⑥	Gauge pressure sensor
③	Process connection	p_e	Inlet pressure
④	Seal diaphragm		

Image 3-5 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 spans ≤ 6.3 MPa measure the inlet pressure against atmosphere, those with spans ≥ 16 MPa the inlet pressure against vacuum.

3.7.3.2 Measuring cell for differential pressure and flow rate

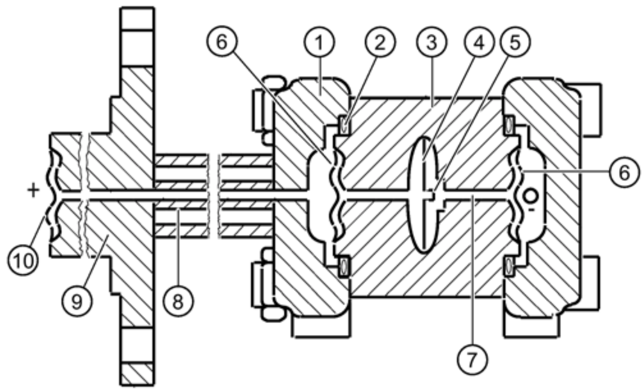


①	Inlet pressure P_+	⑥	Overload diaphragm
②	Pressure cap	⑦	Filling liquid
③	O-ring	⑧	Seal diaphragm
④	Measuring cell body	⑨	Inlet pressure P_-
⑤	Differential pressure sensor		

Image 3-6 Function chart of the measuring cell for differential pressure and flow rate

- Differential pressure is transmitted to the differential pressure sensor ⑤ through the seal diaphragms ⑧ and the filling liquid ⑦.
- When measuring limits are exceeded, the seal diaphragm ⑧ is displaced until the seal diaphragm rests on the measuring cell body ④. The differential pressure sensor ⑤ is thus protected against overloading since no further deflection of the overload diaphragm ⑥ is possible.
- The seal diaphragm ⑧ 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.

3.7.3.3 Measuring cell for level

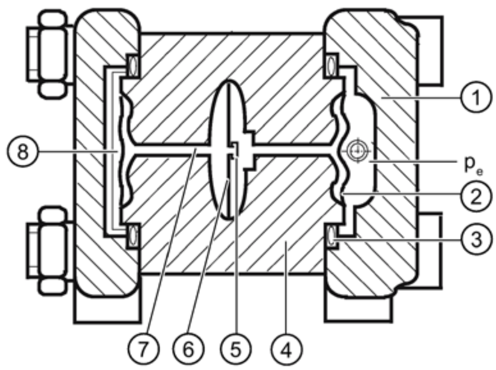


①	Pressure cap	⑥	Seal diaphragm on the measuring cell
②	O-ring	⑦	Filling liquid of the measuring cell
③	Measuring cell body	⑧	Capillary tube with the fill fluid of the mounting flange
④	Overload diaphragm	⑨	Flange with a tube
⑤	Differential pressure sensor	⑩	Seal diaphragm on the mounting flange

Image 3-7 Function chart of the measuring cell for level

- The inlet pressure (hydrostatic pressure) works hydraulically on the measuring cell through the seal diaphragm ⑩ on the mounting flange ⑩.
- Differential pressure at the measuring cell is transmitted to the differential pressure sensor ⑤ through the seal diaphragms ⑥ and the filling liquid ⑦.
- When measuring limits are exceeded, the overload diaphragm ④ is displaced until one of the seal diaphragms ⑥ or ⑩ rests on the measuring cell body ③. The seal diaphragms ⑥ thus protect the differential pressure sensor ⑤ from overload.
- The seal diaphragm ⑥ is displaced by the differential pressure. The displacement changes the resistance of the four doped piezoresistors in the bridge circuit.
- The change in the resistance causes a bridge output voltage proportional to the differential pressure.

3.7.3.4 Measuring cell for absolute pressure from the differential pressure series

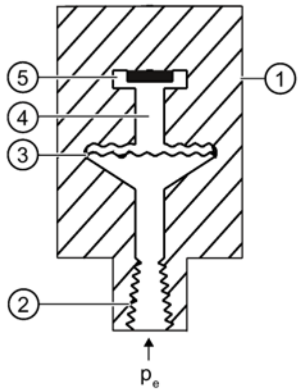


①	Pressure cap	⑥	Overload diaphragm
②	Seal diaphragm on the measuring cell	⑦	Measuring cell filling liquid
③	O-ring	⑧	Reference pressure
④	Measuring cell body	p_e	Pressure input variable
⑤	Absolute pressure sensor		

Image 3-8 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.

3.7.3.5 Measuring cell for absolute pressure from the gauge pressure series

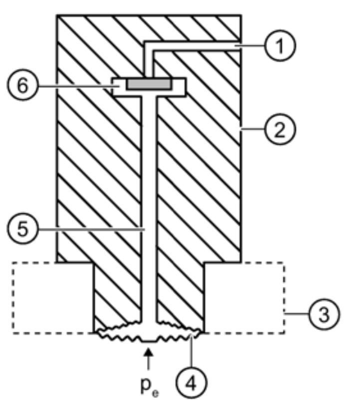


①	Measuring cell	④	Filling liquid
②	Process connection	⑤	Absolute pressure sensor
③	Seal diaphragm	P_e	Inlet pressure

Image 3-9 Function chart of measuring cell for absolute pressure

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.

3.7.3.6 Measuring cell for gauge pressure, front-flush membrane



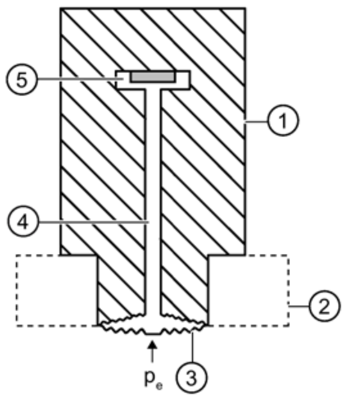
①	Reference pressure opening	⑤	Filling liquid
②	Measuring cell	⑥	Gauge pressure sensor
③	Process connection	p_e	Inlet pressure
④	Seal diaphragm		

Image 3-10 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.

3.7.3.7 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

Image 3-11 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.

3.8 Remote seal

Product description

- A remote seal measuring system comprises the following elements:
  - Remote seal
  - Transmission line, e.g. capillary line
  - Pressure transmitter.

Note

Malfunction of the remote seal measuring system

If you separate the components of the remote seal measuring system, this results in malfunctioning of the system.

Do not separate the components under any circumstances.

- The measuring system based on a hydraulic principle is used to transfer pressure.
- The capillary line and the remote seal diaphragm are the most sensitive components in the remote seal measuring system. The material thickness of the remote seal diaphragm is only ~ 0.1 mm.
- The smallest of leakages in the transmission system leads to the loss of transmission fluid.
- The loss of transmission fluid results in inaccuracies in the measurement and failure of the measuring system.
- In order to avoid leaks and measuring errors, please observe the installation and maintenance instructions in addition to the safety notes.

3.9 SIMATIC PDM

SIMATIC PDM is a software package for configuring, parameter assignment, commissioning, diagnostics and maintenance of this device and other process devices.

SIMATIC PDM offers simple monitoring of process values, alarms, and device status information.

SIMATIC PDM allows the process device data to be:

- displayed
- set
- modified
- saved
- diagnosed
- checked for plausibility

- managed
- simulated

3.10 PROFIBUS

The Process Fieldbus (PROFIBUS) is an open communications system for automation technology and is specified in the international standard IEC 61158.

PROFIBUS Process Automation (PROFIBUS PA) is a variant of PROFIBUS Decentral Peripherals (PROFIBUS DP), which is widely used in process technology.

3.10.1 Transmission technology

The PROFBUS PA has the special transmission technique MBP (Manchester coded Bus Powered) and therefore satisfies the requirements of process automation and process engineering requirements.

This transmission technology is defined in the international standard IEC 61158-2.

The PROFIBUS PA is based on the FISCO model (Fieldbus Intrinsically safe Concept) and can therefore be used in hazardous areas.

3.10.2 Bus topology

The bus topology is mainly able to be selected as desired. Therefore, line, star and tree structures, and mixed forms are possible. All types of field devices such as transmitters, actors, analysis devices, etc. can be connected to the PROFIBUS PA.

Advantages include:

- Savings on installation costs
- More extensive diagnostics, leading to increased availability of installation sections
- Automatic management of installation documentation
- Installation optimization on the fly during operation

In an automation system, there are generally multiple PROFIBUS PA lines connected to fast PROFIBUS DP via coupler units. This is also connected to the process control system.

Both bus systems use the same protocol layer. This makes PROFIBUS PA a "communications-compatible" extension of the PROFIBUS DP into the field.

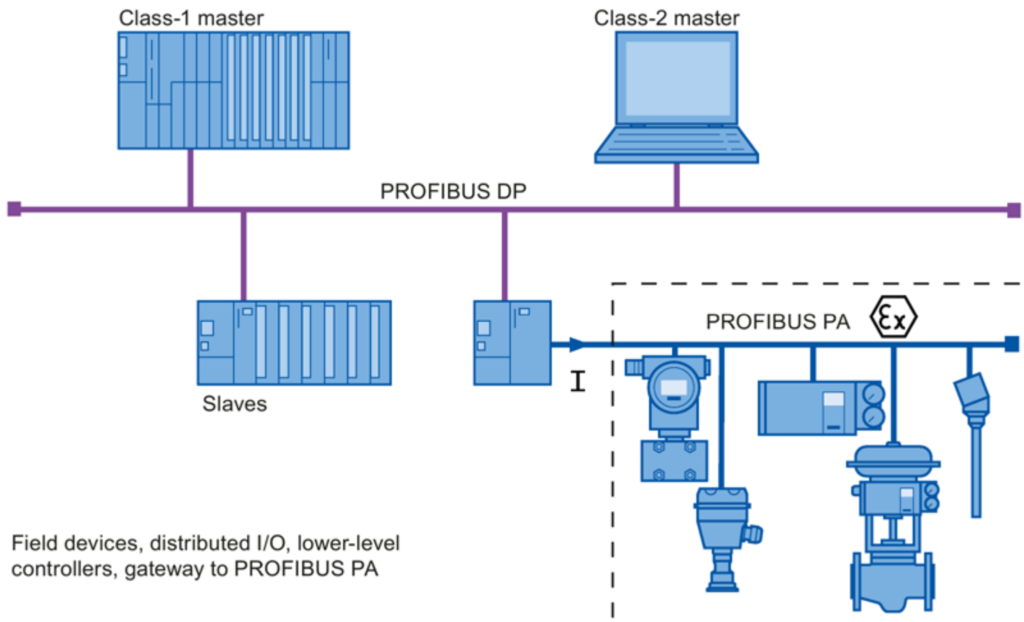


Image 3-12 Functional principle of the PROFIBUS automation system

The figure shows a section of a typical PROFIBUS automation system. The control system consists of two masters with distributed tasks.

The class-1 master recognizes the control and regulation tasks. The class-2 master enables the operating and monitoring functions. Between the class-1 master and the field devices there is a periodic exchange of measurement and settings data. The status information from the field devices is transmitted parallel to this data, and evaluated in the class-1 master. Assignment of parameters for the field devices or the reading of additional device information is not performed during periodic operation.

Besides periodic operation, one or more class-2 masters can access the field devices asynchronously. Using this type of communication, additional information can be retrieved from the devices or settings sent to them.

3.10.3 Properties

PROFIBUS PA allows bidirectional communication between a bus master and field devices. At the same time, the shielded two-strand wiring provides auxiliary power to the two-wire field devices.

4 Installing / mounting

4.1 Basic safety instructions

WARNING

Wetted parts unsuitable for the process media

Danger 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 193).

WARNING

Incorrect material for the diaphragm in Zone 0

Danger of explosion in the hazardous area. If operated with intrinsically safe supply devices of category "ib" or devices of the flameproof enclosure version "Ex d" and simultaneous use in Zone 0, pressure transmitter explosion protection depends on the tightness of the diaphragm.

- Ensure that the material used for the diaphragm is suitable for the process medium. Refer to the information in the section "Technical data (Page 193)".

WARNING

Unsuitable connecting parts

Danger 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.

Note

Material compatibility

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

WARNING

Exceeded maximum permissible operating pressure

Danger of injury or poisoning.

The maximum permissible operating pressure depends on the device version. The device can be damaged if the operating pressure is exceeded. Hot, toxic and corrosive process media could be released.

- Make sure that the device is suitable for the maximum permissible operating pressure of your system. Refer to the information on the nameplate and/or in "Technical data (Page 193)".

WARNING

Exceeded maximum ambient or process media temperature

Danger of explosion in hazardous areas.

Device damage.

- Make sure that the maximum permissible ambient and process media temperatures of the device are not exceeded. Refer to the information in Chapter "Technical data (Page 193)".

WARNING

Open cable inlet or incorrect cable gland

Danger of explosion in hazardous areas.

- Close the cable inlets for the electrical connections. Only use cable glands or plugs which are approved for the relevant type of protection.

WARNING

Incorrect conduit system

Danger of explosion in hazardous areas as result of open cable inlet or incorrect conduit system.

- In the case of a conduit system, mount a spark barrier at a defined distance from the device input. Observe national regulations and the requirements stated in the relevant approvals.

See also

Technical data (Page 193)

WARNING

Incorrect mounting at Zone 0

Danger of explosion in hazardous areas.

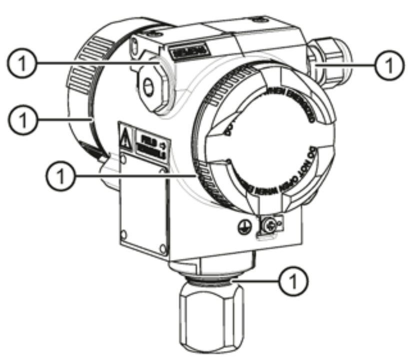
- Ensure sufficient tightness at the process connection.
- Observe the standard IEC/EN 60079-14.

WARNING

Danger with "flameproof enclosure" protection

Danger of explosion in hazardous areas. An explosion may be caused by hot gas escaping from the flameproof enclosure if there is too little space between it and the fixed parts.

- Ensure that there is a space of at least 40 mm between the flameproof joint and the fixed parts.



① Flameproof joint

WARNING

Loss of explosion protection

Danger of explosion in hazardous areas if the device is open or not properly closed.

- Close the device as described in Chapter "PROFIBUS assembly guidelines (Page 66)".

WARNING

Use of incorrect device parts in potentially explosive environments

Devices and their associated device parts are either approved for different types of protection or they do not have explosion protection. There is a danger of explosion if device parts (such as covers) are used for devices with explosion protection that are not expressly suited for this type of protection. If you do not adhere to these guidelines, the test certificates and the manufacturer warranty will become null and void.

- Use only device parts that have been approved for the respective type of protection in the potentially explosive environment. Covers that are not suited for the "explosion-proof" type of protection are identified as such by a notice label attached to the inside of the cover with "Not Ex d Not SIL".
- Do not swap device parts unless the manufacturer specifically ensures compatibility of these parts.

CAUTION

Hot surfaces resulting from hot process media

Danger of burns resulting from surface temperatures above 70 °C (155 °F).

- 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 Chapter "Technical data (Page 193)".

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.

- Prevent severe external stresses and loads from acting on the device.

4.1.1 Installation location requirements

WARNING

Insufficient air supply

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

- 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 193)".

CAUTION

Aggressive atmospheres

Damage to device through penetration of aggressive vapors.

- Ensure that the device is suitable for the application.

NOTICE

Direct sunlight

Increased measuring errors.

- 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 193).

4.1.2 Proper mounting

NOTICE

Incorrect mounting

The device can be damaged, destroyed, or its functionality impaired through improper mounting.

- 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 193) for installation torque requirements.

⚠ CAUTION
Loss of degree of protection Damage to device if the enclosure is open or not properly closed. The degree of protection specified on the nameplate or in Chapter "Technical data (Page 193)" is no longer guaranteed. • Make sure that the device is securely closed.

See also

PROFIBUS assembly guidelines (Page 66)

4.2 Disassembly

4.2.1 Incorrect disassembly

⚠ WARNING
Incorrect disassembly The following dangers may result through incorrect disassembly: - Injury through electric shock - Danger through emerging media when connected to the process - Danger 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 dangerous 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.

4.3 Installation (except level)

4.3.1 Installation mounting (except for level)

Requirements

Note

Compare the desired operating data with the data on the nameplate.

Please also refer to the information on the remote seal if this is fitted.

Note

Protect the pressure transmitter from:

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

Note

The housing may only be opened for maintenance, local operation or to make electrical connections.

The installation location is to be as follows:

- Easily accessible
- As close as possible to the measuring point
- Vibration-free
- Within the permitted ambient temperature values

Installation configuration

The pressure transmitter may in principle be configured above or below the pressure tapping point. The recommended configuration depends on the medium.

Installation configuration for gases

Install the pressure transmitter above the pressure tapping point.

Lay the pressure tubing with a constant gradient to the pressure tapping point, so that any condensate 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 tapping point.

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

4.3.2 Installation (except level)

Note

Damage to measuring cell

When installing the process connection of the pressure transmitter, do not rotate the housing. Rotating the housing may damage the measuring cell.

To avoid damage to the device, tighten the threaded nuts of the measuring cell using a wrench.

Procedure

Attach the pressure transmitter to the process connection with an appropriate tool.

4.3.3 Fastening

Fastening without the mounting bracket

You can fasten the pressure transmitter directly to the process connection.

Fastening with the mounting bracket

You can fasten the mounting bracket as follows:

- On a wall or a mounting frame using two screws
- On a vertical or horizontal mounting tube (Ø 50 to 60 mm) using a tube bracket

Fasten the pressure transmitter mounting bracket using the two screws provided.

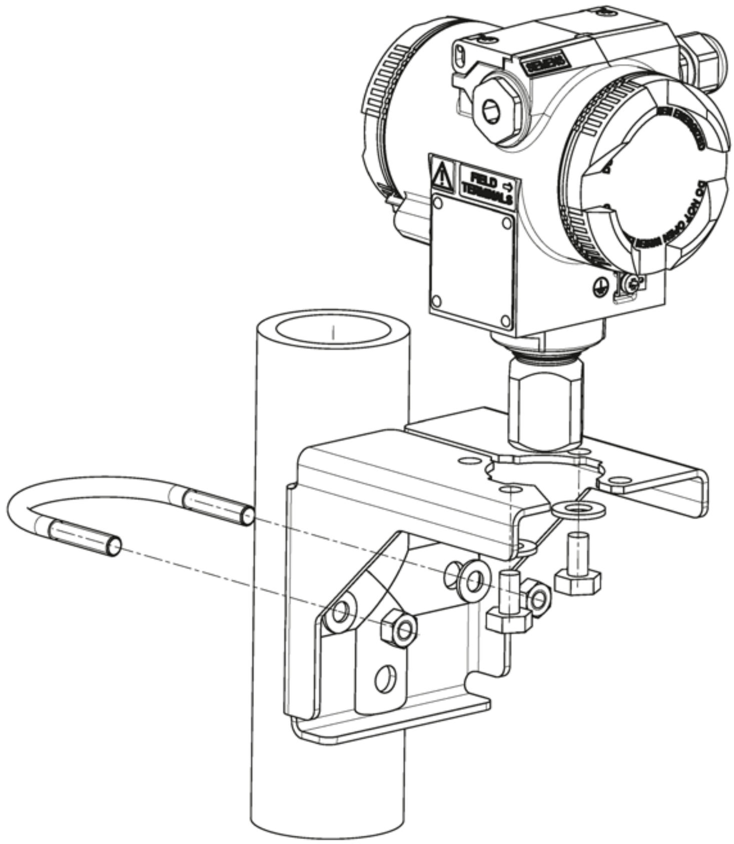


Image 4-1 Fastening the pressure transmitter on the mounting bracket

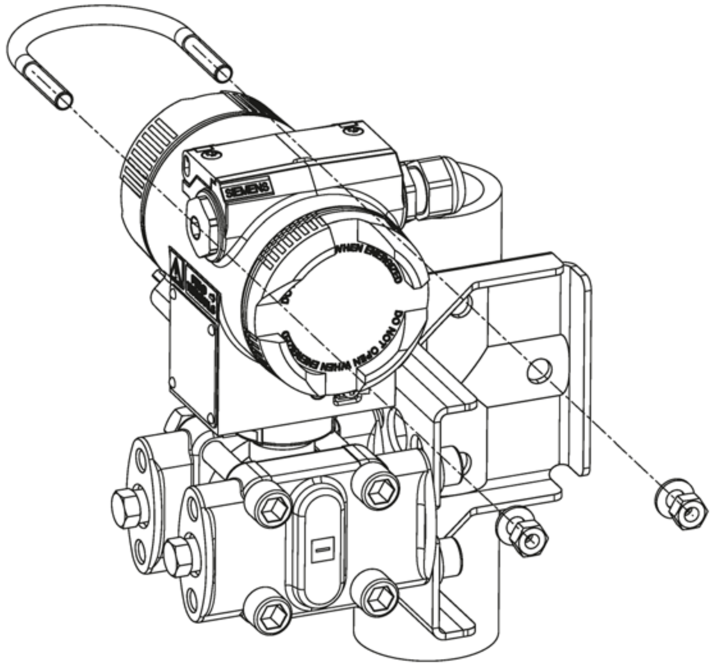


Image 4-2 An example of fastening the pressure transmitter on the mounting bracket in the case of differential pressure and horizontal differential pressure lines

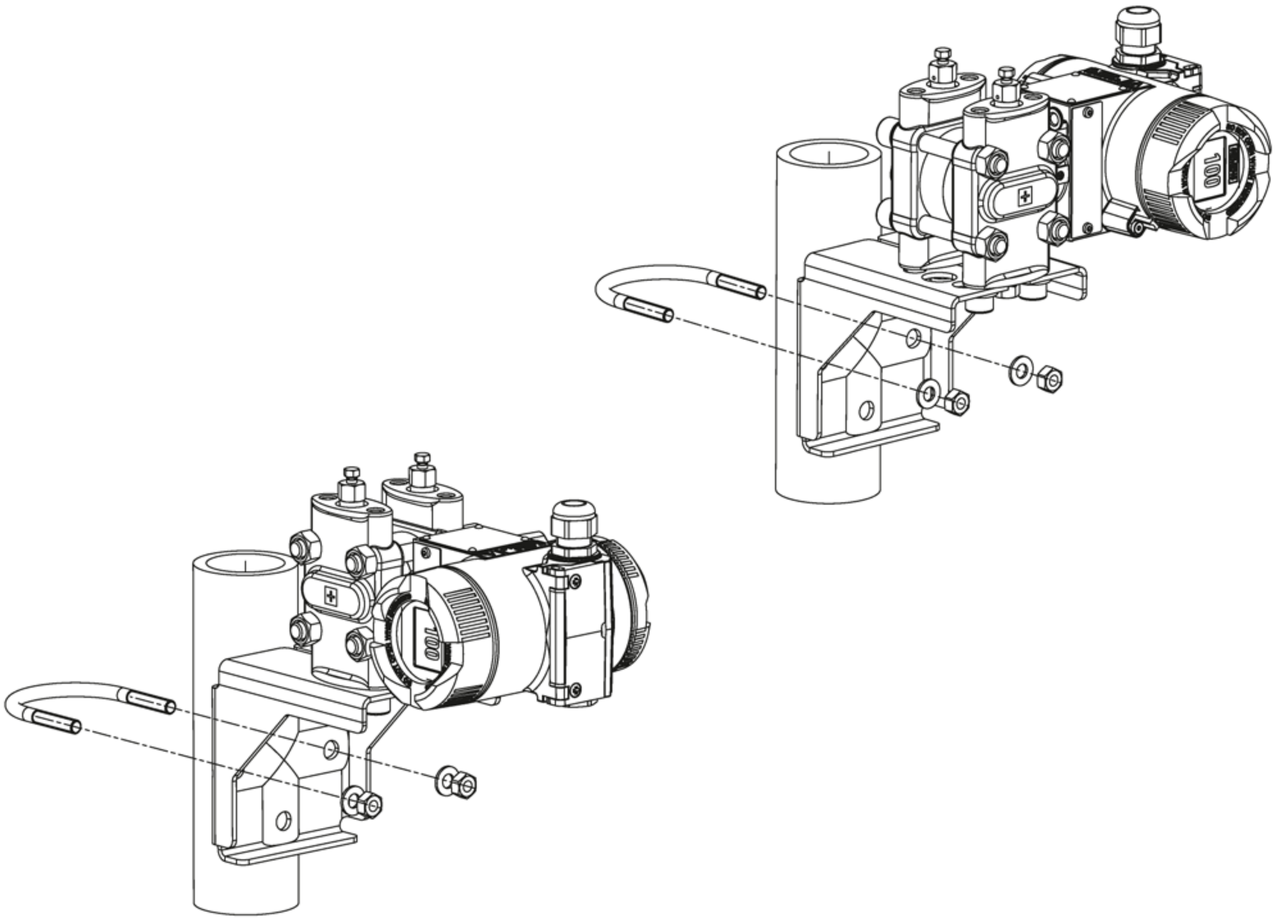


Image 4-3 An example of fastening on the mounting bracket in the case of differential pressure and vertical differential pressure lines

4.4 "Level" installation

4.4.1 Instructions for level installation

Requirements

Note

Compare the desired operating data with the data on the nameplate.

Please also refer to the information on the remote seal if this is fitted.

Note

Protect the pressure transmitter from:

- Direct thermal radiation
- Rapid temperature fluctuations
- Severe soiling
- Mechanical damage
- Direct sunlight

Note

Select the height of the mounting flange such that the pressure transmitter is always mounted below the lowest fill height to be measured.

The installation location is to be as follows:

- Easily accessible
- The measuring point must be as close as possible
- Vibration-free
- Within the permitted ambient temperature values

4.4.2 Installation for level

Note

Seals are required for the installation. The seals must be compatible with the medium to be measured.

Seals are not included in the delivery.

Procedure

To install the pressure transmitter for level, proceed as follows:

1. Attach the seal to the container's mating flange.

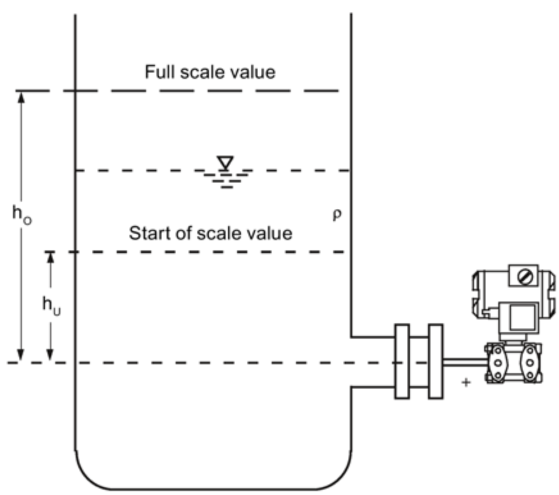
   Ensure that the seal is centrically positioned and that it does not restrict the movement of the flange's seal diaphragm in any way as otherwise the tightness of the process connection is not guaranteed.
2. Screw on the pressure transmitter's flange.
3. Observe the installation position.

4.4.3 Connection of the negative pressure line

Assembly on an open container

A line is not required when taking measurements in an open container since the negative chamber is connected with the atmosphere.

Ensure that no dirt enters the open connection ports, for example by using connection screws with a 7MF4997-1CP bleed valve.



Formula:

Start of scale value: $p_{MA} = \rho \cdot g \cdot h_U$

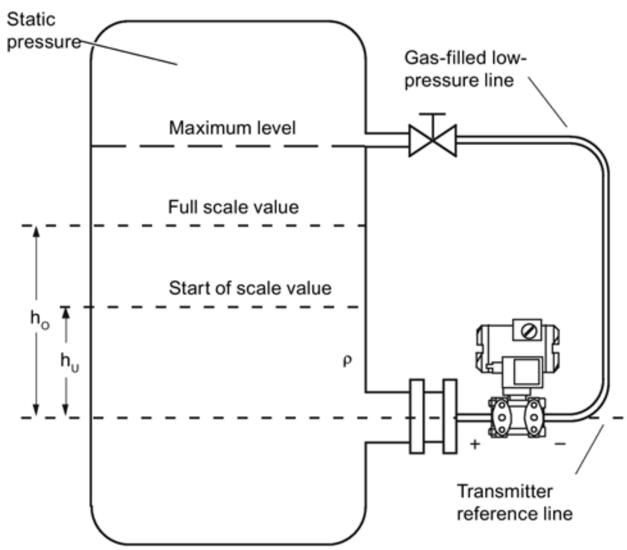
Full-scale value: $p_{ME} = \rho \cdot g \cdot h_O$

Measurement assembly on an open container

h_U	Lower filling level	Δp_{MA}	Start of scale value
h_O	Upper filling level	Δp_{ME}	Full-scale value
p	Pressure	ρ	Density of the measured medium in the container
		g	Acceleration due to gravity

Assembly on a closed container

When taking measurements in a closed container without or with little condensate formation, the negative pressure line is not filled. Lay the line in such a way that pockets of condensate do not form. Install a condensation container if required.



Measurement assembly on a closed container (no or little condensate separation)

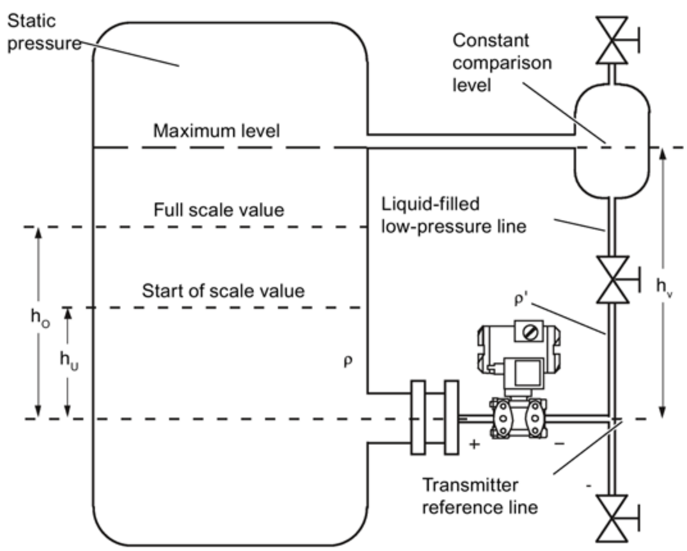
Formula:

Start-of-scale value: $\Delta p_{MA} = \rho \cdot g \cdot h_U$

Full-scale value: $\Delta p_{ME} = \rho \cdot g \cdot h_O$

h_U	Lower filling level	Δp_{MA}	Start of scale value
h_O	Upper filling level	Δp_{ME}	Full-scale value
p	Pressure	ρ	Density of the measured medium in the container
		g	Acceleration due to gravity

When taking measurements in a closed container with strong condensate formation, you must fill the negative pressure line (mostly with the condensate of the measured medium) and install a condensate pot. You can cut off the device using the dual pneumatic block 7MF9001-2.



Formula:

Start-of-scale value:
$\Delta p_{MA} = g \cdot (h_U \cdot \rho - h_V \cdot \rho')$

Full-scale value:
$\Delta p_{MA} = g \cdot (h_O \cdot \rho - h_V \cdot \rho')$

Measurement assembly on a closed container (strong condensate formation)

h_U	Lower filling level	Δp_{MA}	Start of scale value
h_O	Upper filling level	Δp_{ME}	Full-scale value
h_V	Gland distance	ρ	Density of the measured medium in the container
p	Pressure	ρ '	Density of fluid in the negative pressure line corresponds to the prevailing temperature there
		g	Acceleration due to gravity

The process connection on the negative side is a female thread 1/4-18 NPT or an oval flange.

Lay the line for the negative pressure using a seamless steel tube 12 mm x 1.5 mm.

4.5 "Remote seal" installation

4.5.1 Remote seal installation

General installation instructions

- Keep the measuring system in the factory packing until it is installed in order to protect it from mechanical damage.
- When removing from the factory packing and installing: ensure that damage to and mechanical deformations in the membrane are prevented.
- Never loosen the sealed filling screws on the remote seal and the measuring instrument.
- Do not cause damage to the remote separating membrane; scratches on the remote separating membrane, e.g. due to sharp-edged objects, are the main starting points for corrosion.
- Select suitable gaskets for sealing.
- Use a gasket having an adequately large inner diameter for flanging. Insert the gasket concentrically; contact with the membrane leads to deviations in measurements.
- When using gaskets made of soft materials or PTFE: follow the guidelines of the gasket manufacturer, especially regarding the tightening torque and setting cycles.
- At the time of installation, use suitable fastening components such as screws and nuts that are compliant with fitting and flange standards.
- Excessive tightening of screwed joints on the process connection may displace the zero point on the pressure transmitter.

Note

Commissioning

If a shut-off valve exists, open the shut-off valve slowly when commissioning in order to avoid pressure surges.

Note

Permissible ambient and operating temperatures

Install the pressure measuring device such that the permissible limits of ambient and measured medium temperatures are not overshot or undershot even with the consideration of the effect of convection and heat radiation.

- Note the effect of temperature on the measuring accuracy.
- When selecting the remote seals, ensure that fittings and flange components have adequate pressure-temperature resistance by selecting suitable materials and pressure ratings. The pressure rating specified on the remote seal applies to reference conditions according to IEC 60770.
- For the maximum permissible pressure at higher temperatures, please refer to the standard specified on the remote seal.

Using remote seals with pressure measuring device for hazardous areas:

- When using remote seals with pressure measuring device for hazardous areas, the permissible limits of ambient temperatures for the pressure transmitter must not be exceeded. Hot surfaces on the cooling section (capillaries or cooling elements) are a possible source of ignition. Initiate suitable measures.
- When remote seals with a flame arrestor are used, the pressure measuring instrument determines the permissible ambient temperature. In the case of potentially explosive gaseous atmosphere, the temperature around the flame arrestor must not exceed +60 °C.

4.5.2 Installation of the remote seal with the capillary line

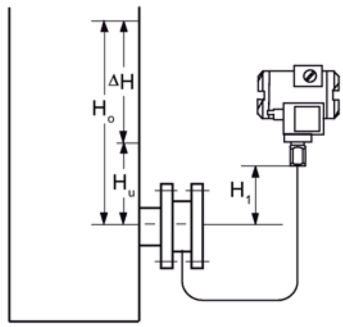
Notes

- Do not transport the measuring assembly (pressure transmitters, flange and capillary) using the capillary line.
- Do not bend capillary lines; risk of leakages and/or risk of considerable increase in the setting time of the measuring system.
- Owing to the risk of bending and breakages, pay attention to mechanical overloads at the joints such as capillary line-remote seal and capillary line-measuring device.
- Unwinding the excess capillary lines with a radius of at least 150 mm.
- Fasten the capillary line such that there are no vibrations.
- Permissible height differences:
  - When installing the pressure measuring device above the measuring point, keep the following in mind: In the case of remote seal measuring systems with silicon, glycerin or paraffin oil filling, the height difference of $H_{1max.}$ = 7 m must not be exceeded.
  - If halocarbon oil is used as a fill fluid, this maximum height difference is only $H_{1max.}$ = 4 m; see installation type A and installation type B.

If negative overpressure is observed during measurements, reduce the permissible height difference accordingly.

Installation type for gauge pressure and level measurements (open containers)

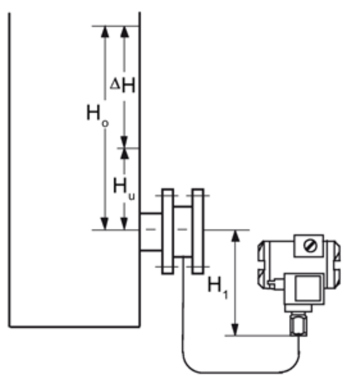
Installation type A



Pressure transmitter above the measuring point

Start of scale value:
$p_{MA} = \rho_{FL} * g * H_U + \rho_{oil} * g * H_1$
Full-scale value:
$p_{ME} = \rho_{FL} * g * H_O + \rho_{oil} * g * H_1$

Installation type B



Pressure transmitter below the measuring point

Start of scale value:
$p_{MA} = \rho_{FL} * g * H_U - \rho_{oil} * g * H_1$
Full-scale value:
$p_{ME} = \rho_{FL} * g * H_O - \rho_{oil} * g * H_1$

$H_1 \leq 7$ m (23 ft); with halocarbon oil as the filling liquid, only $H_1 \leq 4$ m(13.1 ft)

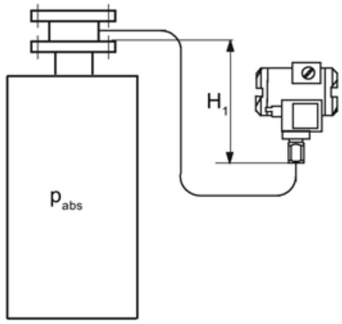
Key

p_{MA}	Start of scale value
p_{ME}	Full-scale value
ρ_{FL}	Density of the process medium in the container
ρ_{oil}	Density of the filling oil in the capillary line of the remote seal
g	Acceleration due to gravity
H_U	Lower filling level
H_O	Upper filling level
H_1	Distance between the container flange and the pressure transmitter

For absolute pressure measurements (vacuum), install the measuring device at least at the height of the remote seal or below it (see installation types C).

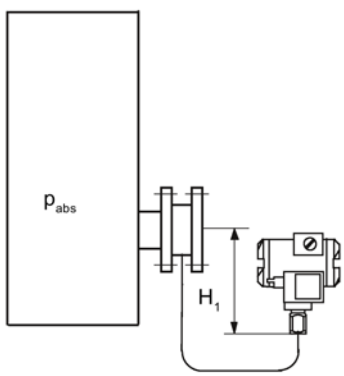
Installation types for absolute pressure measurements (closed containers)

Installation type C_1



Start of scale value:
$p_{MA} = p_{start} + \rho_{oil} * g * H_1$
Full-scale value:
$p_{ME} = p_{end} + \rho_{oil} * g * H_1$

Installation type C_2



Pressure transmitter for absolute pressure always below the measuring point: $H_1 \geq 200$ mm (7.9 inch)

Key

p_{MA}	Start of scale value
p_{ME}	Full-scale value
p_{start}	Start of scale pressure
p_{end}	Full scale pressure
ρ_{oil}	Density of the filling oil in the capillary line of the remote seal
g	Acceleration due to gravity
H_1	Distance between the container flange and the pressure transmitter

---

Note

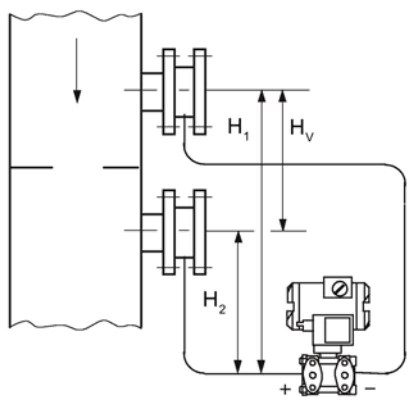
Effects of temperature

Keep the following instructions in mind in order to minimize keep the effects of temperature in remote seal measuring systems with the differential pressure measuring device:

Install the device such that the positive and negative sides are symmetrical as far as ambient effects, especially ambient temperatures, are concerned.

Installation type for differential pressure and flow rate measurements

Installation type D



Start of scale value:

$p_{MA} = p_{start} - \rho_{oil} * g * H_V$

Full-scale value:

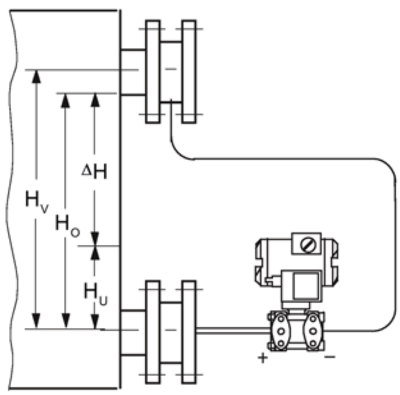
$p_{ME} = p_{end} - \rho_{oil} * g * H_V$

Key

p_{MA}	Start of scale value
p_{ME}	Full-scale value
p_{start}	Start of scale pressure
p_{end}	Full scale pressure
ρ_{oil}	Density of the filling oil in the capillary line of the remote seal
g	Acceleration due to gravity
H_V	Gland distance

Installation types for level measurements (closed containers)

Installation type E



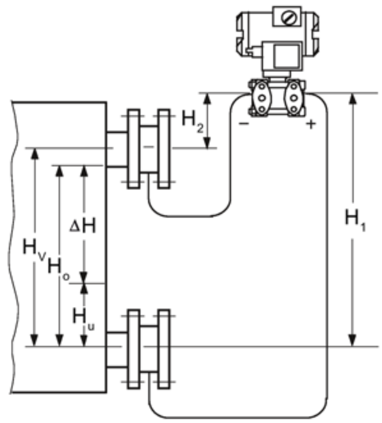
Start of scale value:
$p_{MA} = \rho_{FL} * g * H_U - \rho_{oil} * g * H_V$

Full-scale value:
$p_{ME} = \rho_{FL} * g * H_U - \rho_{oil} * g * H_V$

Key

p_{MA}	Start of scale value
p_{ME}	Full-scale value
ρ_{FL}	Density of the process medium in the container
ρ_{oil}	Density of the filling oil in the capillary line of the remote seal
g	Acceleration due to gravity
H_U	Lower filling level
H_O	Upper filling level
H_V	Gland distance

Installation type G



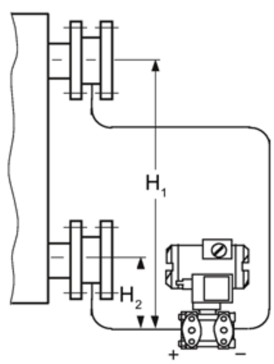
Pressure transmitter for differential pressure above the upper measuring point, no vacuum

$H_1 \leq 7$ m (23 ft), for halocarbon oil, however only H1 ≤ 4 m (13.1 ft)

Start of scale value:
$p_{MA} = \rho_{FL} * g * H_U - \rho_{oil} * g * H_V$

Full-scale value:
$p_{ME} = \rho_{FL} * g * H_O - \rho_{oil} * g * H_V$

Installation type H

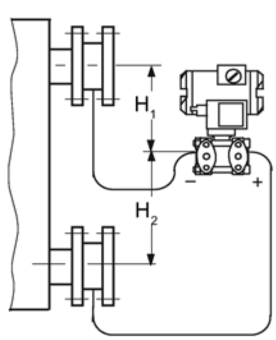


Below the lower measuring point

Start of scale value:
$p_{MA} = \rho_{FL} * g * H_U - \rho_{oil} * g * H_V$

Full-scale value:
$p_{ME} = \rho_{FL} * g * H_O - \rho_{oil} * g * H_V$

Installation type J



Between the measuring points, no vacuum

$H_2 \leq 7$ m (23 ft); with halocarbon oil as the filling liquid, only $H_2 \leq 4$ m(13.1 ft)

Start of scale value:
$p_{MA} = \rho_{FL} * g * H_U - \rho_{oil} * g * H_V$

Full-scale value:
$p_{ME} = \rho_{FL} * g * H_O - \rho_{oil} * g * H_V$

Key

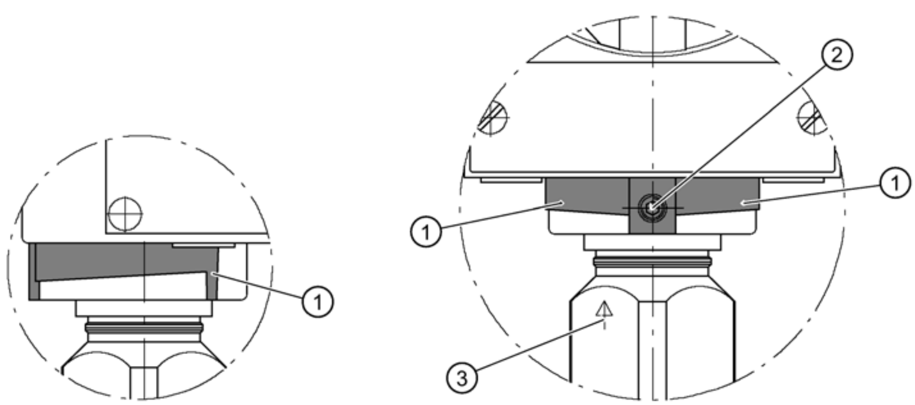
p_{MA}	Start of scale value
p_{ME}	Full-scale value
ρ_{FL}	Density of the process medium in the container
ρ_{oil}	Density of the filling oil in the capillary line of the remote seal
g	Acceleration due to gravity
H_U	Lower filling level
H_O	Upper filling level
H_V	Gland distance

4.6 Turing the measuring cell against housing

Description

You can turn the measuring cell against the housing. Rotating the pressure transmitter facilitates its operation when it is installed at an angle, for example. The buttons and the current connection can thus also be operated for an external measuring device. The display also remains visible in enclosure covers with an inspection window.

Only limited turning is permissible! The turning range ① is marked at the foot of the electronic housing. An orientation mark ③ is provided at the throat of the measuring cell. This mark must remain in the marked section when turning.



① Turning range
② Retaining screw
③ Orientation mark

Image 4-4 Example: Turning range of pressure transmitters for pressure and absolute pressure from the gauge pressure series

The turning range for pressure transmitters for differential pressure and flow rate, absolute pressure from the differential pressure series and level is identified in a similar manner.

Procedure

NOTICE
Damage to the ribbon cable If the pressure transmitter enclosure is rotated against the measuring cell, this can damage the ribbon cable (sensor connection to the electronics). • Comply with the specified range of rotation ① as detailed.

1. Loosen the retaining screw ② (Allen screw 2.5 mm).
2. Turn the electronic housing against the measuring cell. Follow the marked turning range ① while doing so.
3. Tighten the retaining screw (torque: 3.4 to 3.6 Nm).

4.7 Rotating the display

You can rotate the display in the electronics enclosure. This makes it easier to read the display if the device is not being operated in a vertical position.

Procedure

1. Unscrew the cover of the electrical cable compartment. See section Structure (Page 24). An identification text "FIELD TERMINAL" is provided at the side of the housing.
2. Unscrew the display. Depending on the application position of the pressure transmitter, you can reinstall it at four different positions. You can turn it by ±90° or ±180°.
3. Screw the covers back on as far as they will go.
4. Secure the covers with the cover catch.

Connecting up 5

5.1 Basic safety instructions

⚠ WARNING
Unsuitable cables and/or cable glands
Danger of explosion in hazardous areas. • Only use suitable cables and cable glands complying with the requirements specified in Chapter "Technical data (Page 193)". • Tighten the cable glands in accordance with the torques specified in Chapter "Technical data (Page 193)". • When replacing cable glands use only cable glands of the same type. • After installation check that the cables are seated firmly.

5.1.1 Hazardous contact voltage in versions with 4-conductor extension

⚠ WARNING
Hazardous contact voltage in versions with 4-conductor extension
Danger of electrocution in case of incorrect connection. • Observe the instructions in the 4-conductor extension operating manual for the electrical connection.

⚠ WARNING
Improper power supply
Danger of explosion in hazardous areas as result of incorrect power supply, e.g. using direct current instead of alternating current. • Connect the device in accordance with the specified power supply and signal circuits. The relevant specifications can be found in the certificates, in Chapter "Technical data (Page 193)" or on the nameplate.

WARNING

Unsafe extra-low voltage

Danger of explosion in hazardous areas due to voltage flashover.

- Connect the device to an extra-low voltage with safe isolation (SELV).

WARNING

Lack of equipotential bonding

Danger of explosion through compensating currents or ignition currents through lack of equipotential bonding.

- Ensure that the device is potentially equalized.

Exception: It may be permissible to omit connection of the equipotential bonding for devices with type of protection "Intrinsic safety Ex i".

WARNING

Unprotected cable ends

Danger of explosion through unprotected cable ends in hazardous areas.

- Protect unused cable ends in accordance with IEC/EN 60079-14.

WARNING

Improper laying of shielded cables

Danger of explosion through compensating currents between hazardous area and the non-hazardous area.

- Only ground shielded cables that run into the hazardous area at one end.
- If grounding is required at both ends, use an equipotential bonding conductor.

WARNING

Connecting device in energized state

Danger of explosion in hazardous areas.

- Connect devices in hazardous areas only in a de-energized state.

Exceptions:

- Circuits of limited energy may also be connected in the energized state in hazardous areas.
- Exceptions for type of protection "Non-sparking nA" (Zone 2) are regulated in the relevant certificate

⚠ WARNING

Incorrect selection of type of protection

Danger of explosion in areas subject to explosion hazard.

This device is approved for several types of protection.

1. Decide in favor of one type of protection.
2. Connect the device in accordance with the selected type of protection.
3. In order to avoid incorrect use at a later point, make the types of protection that are not used permanently unrecognizable on the nameplate.

NOTICE

Ambient temperature too high

Damage to cable sheath.

- At an ambient temperature ≥ 60 °C (140 °F), use heat-resistant cables suitable for an ambient temperature at least 20 °C (36 °F) higher.

5.1.2 Incorrect measured values with incorrect grounding

NOTICE

Incorrect measured values with incorrect grounding

The device must not be grounded via 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 Chapter "PROFIBUS assembly guidelines (Page 66)".

5.2 Connecting the device

5.2.1 PROFIBUS assembly guidelines

Further information on PROFIBUS and PROFINET can be found on the Internet "PI PROFIBUS - PROFINET (http://www.profibus.com/home/)" > DOWNLOADS under "Installation guidelines".

Opening the device

1. Use a 3 mm Allen key to loosen the cover (if present).
2. Unscrew the cover of the electrical cable compartment. An identification text "FIELD TERMINALS" is provided at the side of the housing.

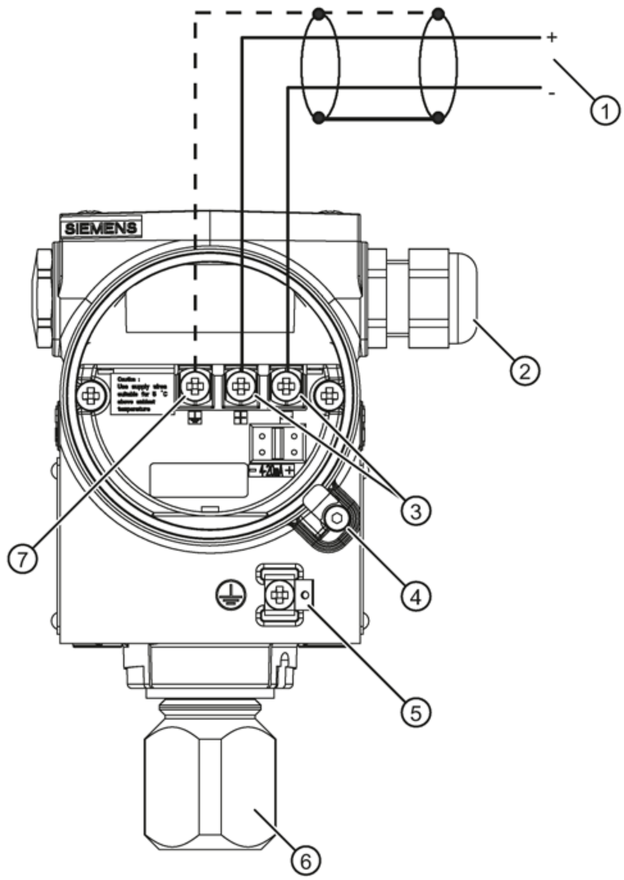
Procedure

1. Insert the connecting cable through the cable gland ②.
2. Connect the device to the plant with the protective conductor connection ⑥.

3. Connect the wires to the terminals "+" and "-" ③.

   The device is not polarity sensitive.

4. If necessary, ground the shield to the screw of the ground terminal ⑧. The ground terminal is electrically connected to the external protective conductor connection.



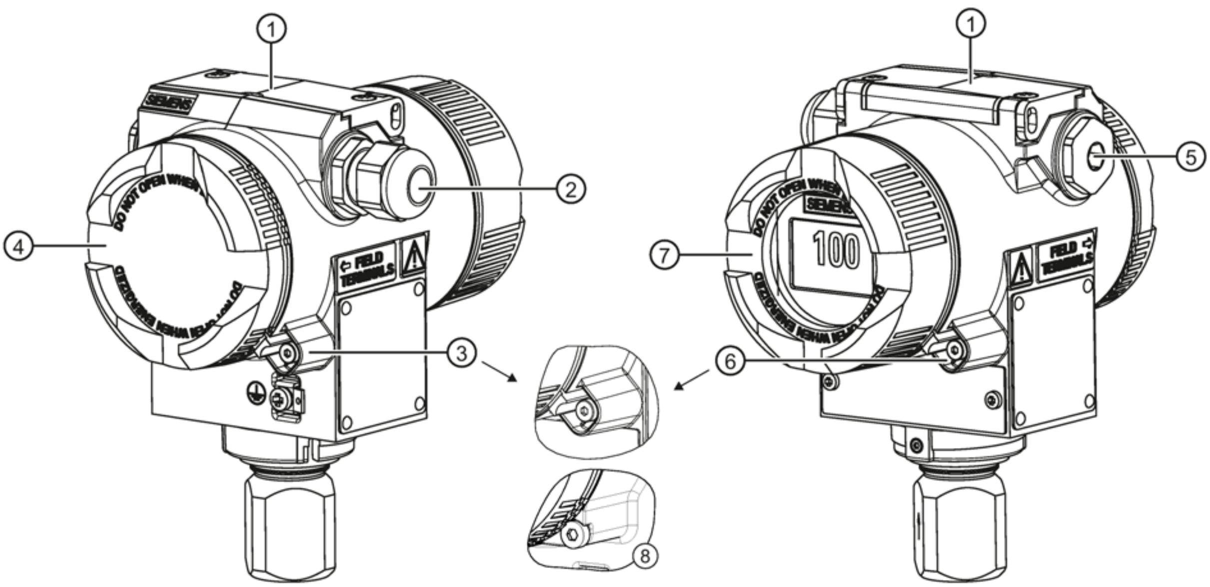
① PROFIBUS PA/FOUNDATION™ Fieldbus FF
② Cable entry
③ Connecting terminals
④ Safety catch
⑤ Protective conductor connector/equipotential bonding terminal
⑥ Process connection
⑦ Grounding terminal

Image 5-1 Electrical connection, power supply

Closing the device

1. Screw the covers ④⑦ back on as far as they will go.
2. Secure each cover with the cover catch ③⑥.
3. Close the key cover ①.

4. Tighten the screws in the key cover.
5. Check the tightness of the blanking plugs ⑤ and cable gland ② in accordance with the degree of protection.



①	Key cover	⑤	Blanking plug
②	Cable gland	⑥	Safety catch (front)
③	Safety catch (back)	⑦	Cover (front), optionally with inspection window
④	Cover (rear) for electrical terminal compartment	⑧	Safety catch for stainless steel enclosure

Image 5-2 View of the pressure transmitter: Left: Back right: Front view

See also

Structure (Page 24)

5.3 Connecting the M12 connector

Procedure

CAUTION

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

WARNING

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

Observe the protection class of the M12 connector when defining the protection class.

For devices in which a connector is already available on the housing, the connection is established using a cable jack.

1. Thread the parts of the cable jack as described by the connector 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. Fix the parts of the cable jack as described by the connector manufacturer.

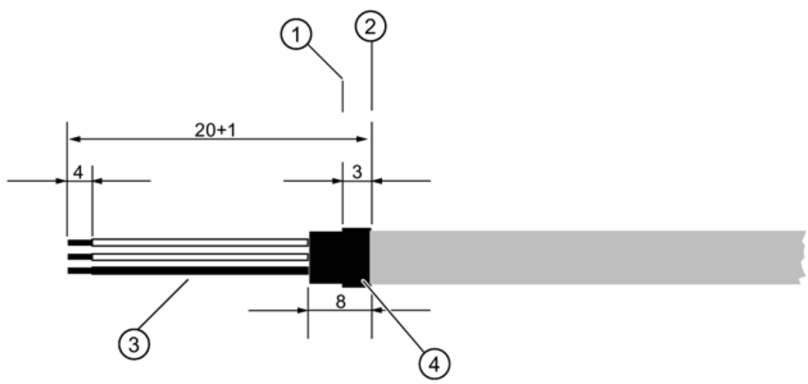
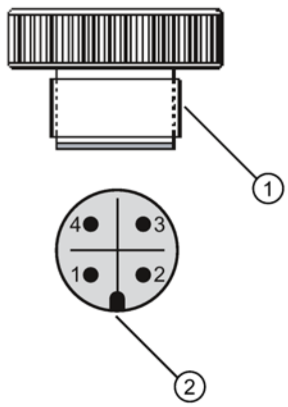


Image 5-3 Preparing the connecting cable

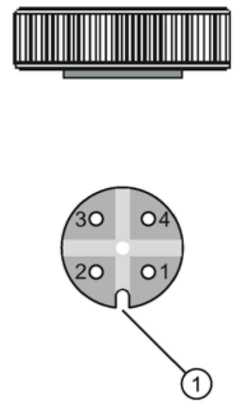
①	Reference edge for stripping	③	Insulating sleeve over the shield
②	Reference edge for the dimension specifications for cable assembly	④	Shrink sleeve

Pin assignment



Layout for M12 connector

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



Layout for M12 jack

①	Positioning slot
1	+
2	Not connected
3	-
4	Shield
	Middle jack contact not connected

Operation 6

6.1 Overview of operation

Introduction

The following description provides an overview of the operating functions which can be executed with the pressure transmitter and the safety information which is to be observed when doing so. You can operate the pressure transmitter locally and over PROFIBUS. Local operation will be described first, and then the operating functions over PROFIBUS.

Chapter contents:

Overview of operating functions

You can operate the basic settings of the pressure transmitter using the buttons on the device. The entire range of settings can be operated via PROFIBUS.

The following table describes the basic operating functions offered by a device with display.

Table 6- 1 Operating functions

Function	With buttons	Over PROFIBUS
Electrical damping	Yes	Yes
Zero point calibration (position correction)	Yes	Yes
Key lock and write protection	Yes	Yes
Measured value display	Yes	Yes
Unit	Yes	Yes
Bus address	Yes	Yes
Device mode	Yes	Yes
Decimal point	Yes	Yes
Zero point drift	Yes	Yes
LO calibration	Yes	Yes
HI calibration	Yes	Yes
Customized characteristic curve	No	Yes
Diagnostics function	No	Yes
Measurement type	No	Yes

Further operating functions are accessible via PROFIBUS for special applications.

6.2 Basic safety instructions

Note

Incorrect reproduction of the process pressure

If you have changed the basic functions of the pressure transmitter, the display and the measurement output could be set such that the actual process pressure is not reproduced.

Therefore, check the basic parameters before commissioning.

6.3 Information on operation

The following rules apply to operation of the pressure transmitter:

- The device always increments numerical values in steps from the displayed digit of least significance.

  If you press the button longer, it increments the next displayed digit of higher significance. This procedure can be used for fast coarse setting over a wide numerical range. For the fine adjustment, release the [↑] or [↓] button again. Then press the button again.

Violations of the measured value limits are output on the display by ⬆ or ⬇.

- If you wish to operate the device using the buttons, the lock must be canceled.
- If you are operating the pressure transmitter locally, write operations over PROFIBUS are rejected during this time.

  It is possible to read data at any time, e.g. measured values.

Note

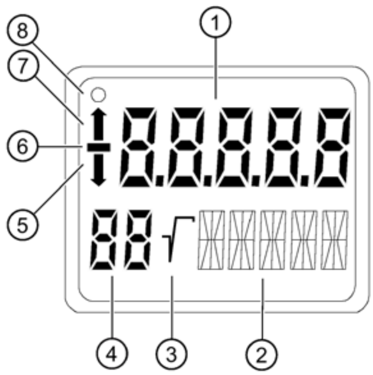
If you allow more than 2 minutes to pass following the pressing of a button, the setting is saved and the measured-value display is returned to automatically.

The operating instructions in the section "Local operation (Page 76)" apply if the device has been delivered with a dummy cover.

6.4 Display

6.4.1 Display elements

Structure



①	Measured value	⑤	Violation of lower limit
②	Unit/bar graph	⑥	Symbol for measured value
③	Root display	⑦	Violation of higher limit
④	Mode/button lock	⑧	Communication display

Image 6-1 Display layout

Description

The display is used for the local display of the measured value ① with:

- Unit ②
- Mode ④
- Sign ⑥
- Statuses ⑤ and ⑦

The display ① outputs the measured value in a physical unit ② which can be selected by the customer.

The *Violation of lower limit* ⑤ and *Violation of upper limit* ⑦ displays are also referred to as status since they have meanings dependent on the settings.

If the communication display ⑧ blinks, this indicates an active communication.

6.4.2 Units display

Description

The unit display comprises five 14-segment fields for representing the unit as a percentage value or physical unit. A bar graph showing the percentage measured value range from 0 to 100% can be displayed as an alternative to the unit. The bar graph function is disabled by default.

Display

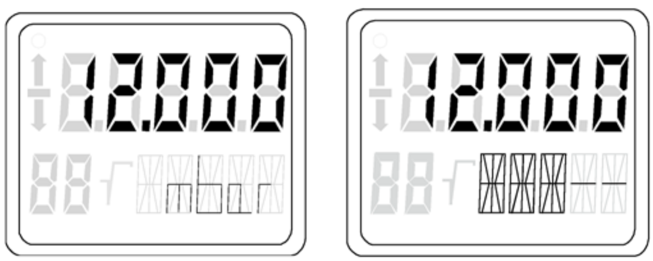


Image 6-2 Examples of measured-value display and bar graph

The following messages may appear as a ticker in the bottom line of the display.

Table 6- 2 Message as ticker

Ticker	Meaning
"DIAGNOSTIC WARNING"	Is always displayed if: • An event configured by the user is to be signaled with a warning. For example: – Limit reached – Event counter for limit values exceeded – Calibration time expired • The status of one of the device variables is "UNCERTAIN".
"SIMULATION"	Is always displayed when the simulation of a pressure value or temperature value is active.

6.4.3 Error display

Description

If hardware faults, software errors or diagnostic interrupts occur in the pressure transmitter, the message "Error" appears in the measured value display.

A status code indicating the type of error appears in the bottom line of the display. This diagnostic information is also available via PROFIBUS.

Error messages are displayed for about 10 seconds after the occurrence of the error.

Display

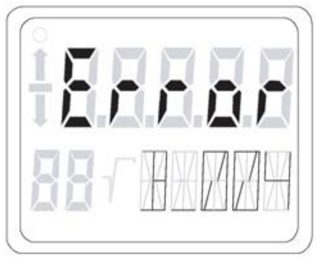


Image 6-3 Example of error message

See also

Overview of status codes (Page 189)

6.4.4 Mode display

Description

The selected active mode is shown in the mode display.

Display

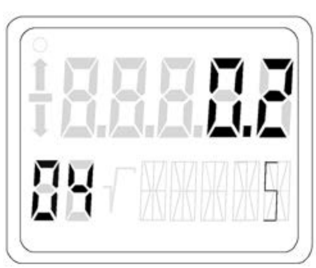


Image 6-4 Example for mode display

In the example, a damping of 0.2 seconds was set in mode 4.

6.4.5 Status display

Description

The arrows of the status display have a different meaning depending on the mode setting. The table below shows the meanings of the arrows in the respective functions.

Meaning

Table 6- 3 Meaning of the arrow displays

Function	Mode	Display ⬆	Display ⬇
Measured value display		Pressure exceeds the upper sensor limit.	Pressure falls below the lower sensor limit.
Adjusting damping	4	Exceeds the upper damping value	Falls below the lower damping value
LO calibration	19	–	Calibration span too low
HI calibration	20	Calibration span too high	–
Alarm		Upper alarm limit reached	Lower alarm limit reached
Warning		Upper warning limit reached	Lower warning limit reached

See also

Overview of status codes (Page 189)

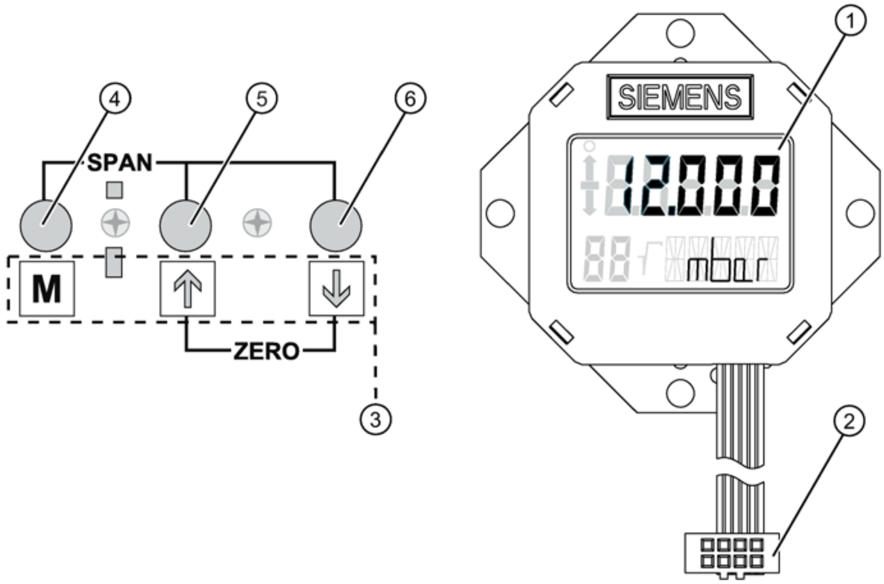
6.5 Local operation

6.5.1 Control elements for local operation

Introduction

The pressure transmitter can be operated on-site using the keys. You can select and execute the functions described in the table using adjustable modes. Operation by buttons is not available for devices without display.

Control elements



①	Display	④	Mode key
②	Connecting plug for the display	⑥	Increment button
③	Button symbols (see cap)	⑤	Decrement button

Image 6-5 Position of keys and display

Operating functions

Note

Zero point calibration

For absolute pressure transmitters, the start of scale value is at vacuum.

A zero-point calibration with pressure transmitters which do not measure absolute pressure leads to faulty settings.

Note

Locking of buttons and functions

Local operation is possible if you are in measuring mode and neither "L", "LA" nor "LL" is output in the mode display.

If operations are disabled, parameters can still be read. An error message is output if you try to change parameters.

Table 6- 4 Operating functions using buttons

Function	Mode	Button function			Display, explanations	
	[M]	[↑]	[↓]	[↑] and [↓]		
Measured value	Here you can select the modes.				The current measured value is displayed as you have set it in the function "Measured-value display, mode 13".	
Error display					Error	A fault exists.
Electrical damping	4	Increase damping	Decreased damping	Set to 0	Time constant T_{63} in seconds Range of adjustment: 0.0 s to 100.0 s	
Zero point calibration (position correction)	7[1)]	Increase correction value	Decrease correction value	Apply	Pressurize the pressure transmitter for gauge pressure, differential pressure, flow rate or level. Evacuate pressure transmitter for absolute pressure (< 0.1 ‰ of the measuring span). Measured value in pressure unit	
Locking of buttons and functions	10	Change		Cancel 5 s *)	L	Locking of buttons and functions (hardware write protection); local operation disabled
					LC	Write blocking; local operation possible
					LA	Enabling of local operation
					LL	Combination of write blocking and no enabling of local operation
					*) Does not apply to "Safe (PROFIsafe) mode". In this case, refer to the information in section "PROFIsafe (Page 141)".	
Measured value display	13	Select from various possibilities.		–	Selection of various variables	
Unit	14	Select from table for measured value display.		First value in each case from the physical unit table	Physical unit	
Bus address	15	Increase	Decrease		Node address on the PROFIBUS Value between 0 and 126	
Operating mode of device, see also Device operation type (Page 88)	16	Change			Selection of operating mode of device • Profile-compatible 1 AI • Profile-compatible with extensions • Old SITRANS P/PA device • Profile-compatible 1 AI, 1 TOT	
Decimal point	17	To left	To right		Position of decimal point in display	
Zero point adjustment	18				Display of current measuring range	
LO calibration	19	Increase value	Decrease value	Apply	Calibrate bottom point of characteristic	
HI calibration	20	Increase value	Decrease value	Apply	Calibrate top point of characteristic	

1) Mode 7 is not available with transmitter for absolute pressure. Please note the information in the sections "" and "".LO calibration (Page 91)HI calibration (Page 92)

6.5.2 Operation using buttons

Introduction

This overview informs you about the most important safety notes to be observed when operating the pressure transmitter. Furthermore, the overview guides you in adjusting the operating functions on site.

Requirement

The keyboard must have been unlocked in order to operate the device using the buttons.

Procedure

In the default setting, the device is in the measured value display.

To adjust the operating functions, proceed as follows:

1. Loosen both the screws of the keyboard cover and lift it upwards.
2. Press the [M] button until the desired mode is displayed.
3. Keep pressing the [↑] or [↓] button until the desired value is displayed.
4. Press the [M] button.

   Now you have saved the values and the device goes to the next mode.
5. Close the keyboard cover using the two screws.

Note

If you allow more than 2 minutes to pass after pressing a button, the setting is saved and the measured value display is returned to automatically.

6.5.3 Setting/adjusting electrical damping

Difference between setting and adjusting

You can set or adjust the time constant of electrical damping using the buttons. Setting means that the time constant is automatically set to 0 seconds. Adjusting means that the time constant is adjusted between 0 and 100 seconds using the increments of 0.1 seconds. This electrical damping also has an effect on the built-in basic damping of the device.

Condition for "setting"

You are familiar with the correct operation of the pressure transmitter and the associated safety information.

Setting electrical damping

To set electrical damping to 0 seconds, proceed as follows:

1. Set mode 4.
2. Press the [↑] and [↓] buttons simultaneously.
3. Save with the [M] button.

Result

Electrical damping has been set to 0 seconds.

Condition for "adjusting"

The default adjusting of steps is an interval of 0.1 seconds. If you press the [↑] or [↓] button for a long time, the steps are increased.

Adjusting electrical damping

To adjust electrical damping, proceed as follows:

1. Set mode 4.
2. Adjust the desired damping.
3. Save with the [M] button.

Result

Electrical damping has been set to the desired time constant.

See also

Operation using buttons (Page 79)

Electrical damping (filter time constant) (Page 116)

6.5.4 Calibrate zero point

Introduction

A zero point calibration is used to correct zero errors resulting from the mounting position of the transmitter. You must proceed differently depending on the device version.

Requirement

You are familiar with the correct operation of the pressure transmitter and the associated safety information.

Zero point calibration for gauge pressure transmitter

To calibrate the zero point, proceed as follows:

1. Pressurize the pressure transmitter.
2. Set mode 7.
3. Press the [↑] und [↓] buttons simultaneously for 2 seconds.
4. Save with the [M] button.

Note

Zero point calibration for absolute pressure transmitter

Mode 7 is not available with transmitter for absolute pressure. Please note the information in the sections "Balance LO (Page 91)" and "HI calibration (Page 92)".

6.5.5 Locking of buttons and functions

Introduction

In mode 10 you can lock the functions which are always possible using the buttons. An example of locking is the saving of stored parameter settings.

Requirement

Note

Check the measured value display to establish that this indicates the desired setting.

Activation of locking of buttons and functions

To lock the buttons, proceed as follows:

1. Set mode 10.
2. Activate the locking of buttons and functions.
3. Save with the [M] button.

"L" is output in the mode display.

Deactivate the locking of buttons and functions

To unlock the buttons, proceed as follows:

1. Set mode 10.
2. Press the [↑] und [↓] buttons simultaneously for 5 seconds.

Locking of the buttons and functions is now deactivated.

"- -" is output in the mode display.

See also

Key lock and write protection (Page 116)

6.5.6 Measured value display

Introduction

In mode 13, select a variable which represents the source of the measured value display. The variable is based on the measurement type set at the factory or over the bus. The measurement type cannot be set locally.

The measurement type options available can be set in SIMATIC PDM using the "transmitter type" parameter. Find the following values under this parameter:

- Pressure
- Flow, not relevant for relative and absolute pressure
- Level
- Volume

Procedure

To select the source for the measured value display, proceed as follows:

1. Set mode 13.
2. Select the variable.
3. Save with the [M] button.

Parameter

The following tables give the meaning of the variables, depending on the value of the "transmitter type" parameter. This allows you to select the units available in mode 14.

Table 6- 5 Measurement type "Absolute pressure", "Differential pressure" and "Pressure"

Source of measured value display	Variable	Available unit	
From analog input function block:			
[0] : Output :	OUT	(P) (U)	Pressure User specific
From pressure transducer block:			
[1] : Secondary variable 1	SEC 1	(P)	Pressure
[2] : Measurement value (primary variable)	PRIM	(P)	Pressure
[3] : Sensor temperature	TMP S	(T)	Temperature
[4] : Electronics temperature	TMP E	(T)	Temperature
[7] : Raw pressure value	SENS	(P)	Pressure

Table 6- 6 Measurement type "Flow"

Source of measured value display	Variable	Available unit	
From analog input function block:			
[0] : Output	OUT	(L) (U)	Level User specific
From pressure transducer block:			
[1] : Secondary variable 1	SEC 1	(P)	Pressure
[2] : Measurement value (primary variable)	PRIM	(L)	Level
[3] : Sensor temperature	TMP S	(T)	Temperature
[4] : Electronics temperature	TMP E	(T)	Temperature
[5] : Secondary variable 3:	SEC 3	(M)	Mass flow
[7] : Raw pressure value	SENS	(P)	Pressure
From totalizer function block:			
[6] : Totalizer output	TOTAL	(V) (ΣM) *)	Volume Total mass flow Flow not relevant for relative and absolute pressure
*) The option of selecting the physical unit is additionally determined by the channel setting (mass or volume) of the analog input and totalizer function blocks.			

Table 6- 7 Measurement type "Level (height)"

Source of measured value display	Variable	Available units	
From analog input function block:			
[0] : Output	OUT	(L) (U)	Level User specific
From pressure transducer block:			
[1] : Secondary variable 1	SEC 1	(P)	Pressure
[2] : Measurement value (primary variable)	PRIM	(L)	Level
[3] : Sensor temperature	TMP S	(T)	Temperature
[4] : Electronics temperature	TMP E	(T)	Temperature

Table 6- 8 Measurement type "Level (volume)"

Source of measured value display	Variable	Available units	
From analog input function block:			
[0] : Output	OUT	(V) (U)	Volume User specific
From pressure transducer block:			
[1] : Secondary variable 1	SEC 1	(P)	Pressure
[2] : Measurement value (primary variable)	PRIM	(V)	Volume
[3] : Sensor temperature	TMP S	(T)	Temperature
[4] : Electronics temperature	TMP E	(T)	Temperature

See also

Block model for collection and processing of measured values (Page 95)

Pressure transducer block (transducer block 1) (Page 98)

6.5.7 Unit

Introduction

In mode 14, set the physical unit in which the device's measured value display should be represented.

Requirement

You have already selected the desired source for the measured value display in mode 13.

Procedure

To adjust the physical unit, proceed as follows:

1. Set mode 14.

   The physical unit used appears in the bottom line of the display.
2. Select a unit.
3. Save with the [M] button.

The following tables show the physical units available in each measurement type.

Units

Table 6- 9 Unit for pressure (P)

Unit	Display		Unit	Display
Pa	Pa		g/cm²	G/cm2
MPa	MPa		kg/cm²	KGcm2
kPa	KPa		inH2O	INH2O
hPa	hPa		inH2O(4°C)	INH2O
bar	bar		mmH2O	mmH2O
mbar	mbar		mmH2O(4°C)	mmH2O
torr	Torr		ftH2O	FTH2O
atm	ATM		inHg	IN HG
psi	PSI		mmHg	mm HG

Table 6- 10 Unit for volume (V)

Unit	Display		Unit	Display
m^3	m3		ft^3	FT3
dm^3	dm3		yd^3	Yd3
cm^3	cm3		pint (US)	Pint
mm^3	mm3		quart (US)	Quart
l	L		US gallon	GAL
cl	cL		imp. gallon	ImGAL
ml	mL		bushel	BUSHL
hl	hL		barrel	bbl
in^3	IN3		barrel liquid	bblli

Table 6- 11 Unit for volume flow (F)

Unit	Display		Unit	Display
m^3 / second	m3/S		ft^3 / hour	FT3/H
m^3 / minute	m3/M		ft^3 / day	FT3/D
m^3 / hour	m3/H		Gallons / second	Gal/S
m^3 / day	m3/D		Gallons / minute	Gal/M
Liters / second	L/S		Gallons / hour	Gal/H
Liters / minute	L/M		Gallons / day	Gal/D
Liters / hour	L/H		British barrel liquid / second	bbl/S
Liters / day	L/D		British barrel liquid / minute	bbl/M
Millions of liters / day	ml/D		British barrel liquid / hour	bbl/H
ft^3 / second	FT3/S		British barrel liquid / day	bbl/D
ft^3 / minute	FT3/M			

Table 6- 12 Unit for mass flow (M)

Unit	Display		Unit	Display
g / s	G/S		Pound / s	P/S
g / min	G/MIN		Pound / min	lb/M
g / h	G/H		Pound / h	lb/H
g / d	G/D		Pound / d	lb/D
Kg / s	KG/S		Short tons / s	ST/S
Kg / min	KG/M		Short tons / min	ST/m
Kg / h	KG/H		Short tons / h	ST/h
Kg / d	KG/D		Short tons / d	ST/d
T / s	T/S		Long tons / s	LT/s
T / min	T/M		Long tons / m	LT/m
T / h	T/H		Long tons / h	LT/h
T / d	T/D		Long tons / d	LT/d

Table 6- 13 Unit for level (L)

Unit	Display		Unit	Display
m	m		ft	FT
cm	cm		in	IN
mm	mm		yd	Yd

Table 6- 14 Unit for mass (M)

Unit	Display		Unit	Display
kg	KG		lb	lb
g	G		STon	STon
t	T		LTon	LTon
oz	oz			

Table 6- 15 Unit for temperature (T)

Unit	Display		Unit	Display
K	K		°F	°F
°C	°C		°R	°R

Table 6- 16 Unit for user-specific (U)

Unit	Display
arbitrary	Max. 16 characters, If more than 5 characters, the display shows the unit as a ticker. The input of the characters to be displayed can only be performed through the PROFIBUS.
%	%

Note

The profile allows a much larger number of possible units. There is no limitation on some physical values special to the output of the analog input function block. For instance, if you have selected a unit with SIMATIC PDM which does not appear in the corresponding valid list, the current measurement value will be shown without a unit in the measured value display.

See also

Units of the pressure transducer block (Page 102)

6.5.8 Bus address

Introduction

The node address of the device on the PROFIBUS, the so-called bus address, is set in mode 15. The permissible range runs from 0 to 126.

Note

Do not change the bus address of the device while your system is running. The device will then no longer be visible from the application program.

Procedure

To change the bus address, proceed as follows:

1. Set mode 15.

   The currently set bus address of the device appears in the measured value display.
2. Select the bus address within the permissible range.
3. Save with the [M] button.

6.5.9 Device operation type

Introduction

Set the device mode to mode 16.

The device mode [1] is preset on the pressure transmitter. Other device modes are only suitable if you have set another operation type through PROFIBUS.

Table 6- 17 Device mode

Display	Meaning
[0]	Profile-compliant: Exchangeable for pressure transmitters with PROFIBUS PA Profile 3.0, with analog input function block, without totalizer
[1]	Delivery state Profile-compatible with extensions: Full functionality of the SITRANS P with: • Analog input function block • Totalizer

Display	Meaning
[2]	Exchangeable for previous SITRANS P/PA device
[128]	Profile-compliant: Exchangeable for pressure transmitter with PROFIBUS PA Profile 3.0 with: • Analog input function block • Totalizer.

Procedure

To change the device mode, proceed as follows:

1. Set mode 16.

   The current operation type "0", "1", "2" or "128" appears in the measured value display.
2. Select the device mode.

   The local operation type must match the operation type in PROFIBUS.
3. Save with the [M] button.

Note

Each device operation type is assigned a particular device master data file (GSD file).

If the configuration of your PROFIBUS-PA strand does not correspond to the device mode selected, the device will not start periodic data exchange. Successful establishment of communication is identified by the indicator "o" at the top left of the display.

Note

If the device is exchanging period data, no change is possible to the device operating type.

Table 6- 18 Device master data file

Display	File name
[0]	pa_29700.gsd or pa_39700.gsd
[1]	siem80A6.gsd
[2]	sip1804B.gsd
[128]	pa_29740.gsd or pa_39740.gsd

See also

Errors (Page 192)

6.5.10 Position of the decimal point

Introduction

Set the position of the decimal point in mode 17. The device can display measured values with up to four decimal places.

Procedure

To move the decimal point, proceed as follows:

1. Set mode 17.

   A mask appears in the display showing the current position of the decimal point.
2. Select the desired display format.

   8.8888

   88.888

   888.88

   8888.8

   88888
3. Save with the [M] button.

Note

If you set the decimal point too far to the right, the resolution of the display may be too low. The display may show e.g. "0" instead of "0.43".

If you set the decimal point too far to the left, it can overflow. The display will then show the character sequence 9.9.9.9.9 and error code F_004 instead of the measured value.

See also

Errors (Page 192)

6.5.11 Display of the zero-point adjustment

Introduction

The zero-point adjustment is shown in mode 18. The zero point adjustment is carried out by the zero point calibration in mode 7 or by the calibration procedure in modes 19 and 20.

Procedure

To display the current zero-point adjustment, proceed as follows:

1. Set mode 18.

   The current zero offset appears in the display.
2. Close with the [M] button.

6.5.12 LO calibration

Introduction

The slope of the characteristic is changed in mode 19. This rotates the characteristic around setting point HI.

This function replaces the zero-point calibration (mode 7) which is not permitted for absolute pressure transmitters.

The unit in which you want to calibrate is set using the following functions:

- In mode 13, set the source of the measured value display[7] : Raw pressure value, variable SENS.
- In mode 14, select the desired pressure unit.

Note

If you change this setting, the measurement range can be restricted to the point that the permissible sensor limits are violated even with small pressure changes.

Procedure

To calibrate LO, proceed as follows:

1. Set mode 19.

   The display shows the value of the last calibration procedure, with the appropriate unit.
2. Create the reference pressure.
3. Press the [↑] or [↓] button.

   The measured value display switches to the current pressure value. Using the [↑] and [↓] keys, you can enter the reference value starting from there.
4. Press the [↑] und [↓] buttons simultaneously for 2 seconds.
5. Save with the [M] button.

Note

In the case of transmitters for absolute pressure, note the following information:

- You need a thruster to apply the reference pressure.
- The value of the reference pressure can be changed by only about 10%.

Result

If the calibration was successful, the current measurement value of the device will be displayed, and will correspond to the calibration value as long as the reference pressure is still applied.

If you switch to the measured value display without taking a sufficiently large calibration span into account, the pressure status "Bad" B_004 will be displayed.

The failure logic of the function block is activated. The output has the status "Unsure" U_0xx, depending on the setting.

If the two trim points are too close together, status F_006 is displayed. The smallest calibration span depends on the nominal measurement range. Select either the higher reference pressure in mode 20, or the lower reference pressure in mode 19.

As long as mode 19 is active, you can repeat this procedure as often as necessary.

View LO calibration

To view the LO calibration, proceed as follows:

1. Set mode 19.

   The display shows the value of the last calibration procedure, with the appropriate unit.

2. Leave the mode by pressing [M].

See also

Errors (Page 192)

Calibrating the sensor (Page 125)

6.5.13 HI calibration

Introduction

The slope of the characteristic is changed in mode 20. This rotates the characteristic around setting point LO.

The unit in which you want to calibrate is set using the following functions:

- In mode 13, set the source of the measured value display[7] : Raw pressure value, variable SENS.
- In mode 14, select the desired pressure unit.

Note

If you change this setting, the measurement range can be restricted to the point that the permissible sensor limits are violated even with small pressure changes.

Procedure

To calibrate HI, proceed as follows:

1. Set mode 20.

   The display shows the value of the last calibration procedure, with the appropriate unit.
2. Create the reference pressure.
3. Press the [↑] or [↓] button.

   The measured value display switches to the current pressure value. Using the [↑] and [↓] keys, you can enter the reference value starting from there.
4. Press the [↑] und [↓] buttons simultaneously for 2 seconds.
5. Save with the [M] button.

Note

In the case of transmitters for absolute pressure, note the following information:

- You need a thruster to apply the reference pressure.
- The value of the reference pressure can be changed by only about 10%.

Result

If the calibration was successful, the current measurement value of the device will be displayed, and will correspond to the calibration value as long as the reference pressure is still applied.

If you switch to the measured value display without taking a sufficiently large calibration span into account, the pressure status "Bad" B_004 will be displayed.

The failure logic of the function block is activated. The output has the status "Unsure" U_0xx, depending on the setting.

If the two trim points are too close together, status F_006 is displayed. The smallest calibration span depends on the nominal measurement range. Select either the higher reference pressure in mode 20, or the lower reference pressure in mode 19.

As long as mode 20 is active, you can repeat this procedure as often as necessary.

Viewing the HI calibration

To view the HI calibration, proceed as follows:

1. Set mode 20.

   The display shows the value of the last calibration procedure, with the appropriate unit.
2. Leave the mode by pressing [M].

See also

Errors (Page 192)

Calibrating the sensor (Page 125)

7 Operator control functions via PROFIBUS

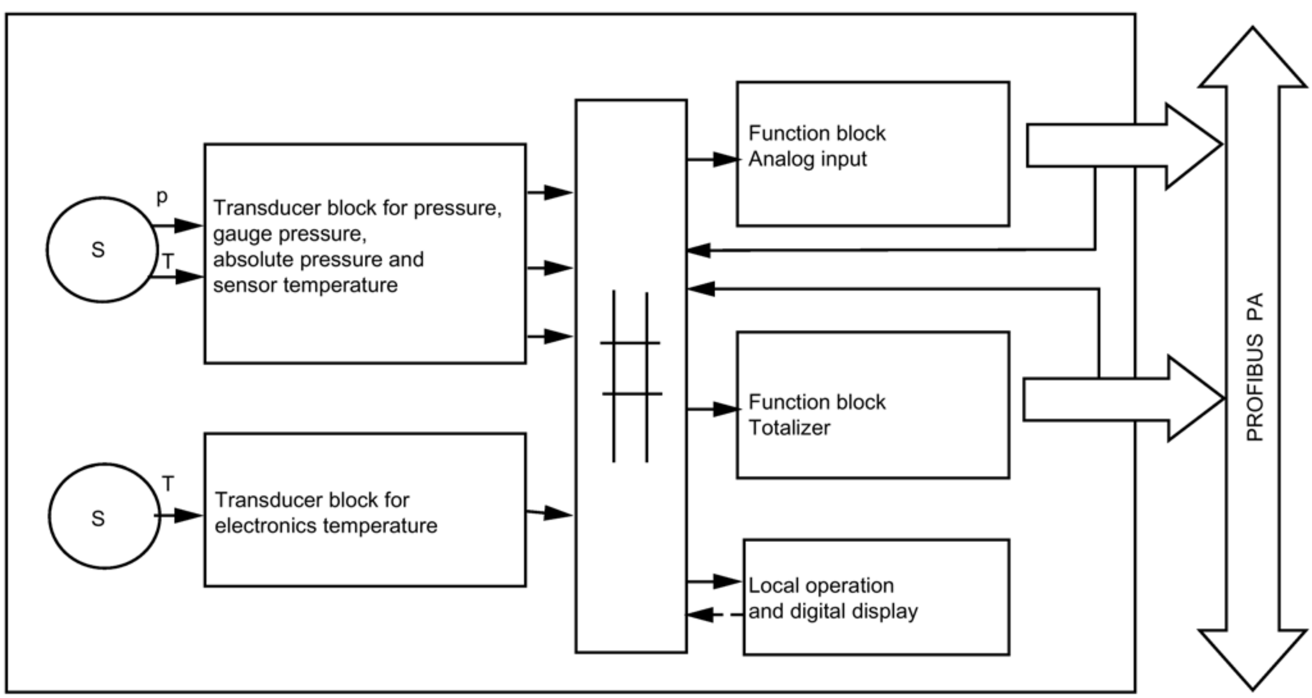
7.1 Communications structure for PROFIBUS PA

7.1.1 Overview

This chapter describes the processing method of the device-specific function blocks using a graphical block model which is resolved into its individual layers step by step. Knowledge of the physical block is assumed: This block is therefore not explained in this chapter.

7.1.2 Block model for collection and processing of measured values

The device functions are subdivided into blocks of different task areas. They can be parameterized during asynchronous data transmission.



p Pressure
T Temperature
S Sensor

Image 7-1 Block circuit diagram of collection and processing of measured values

Pressure transducer block

The transducer block for pressure handles the adaptation to the pressure sensor. Its output value is the linearized and temperature-compensated measurement result. When measuring levels and flow, the necessary recalculation of the measurement value is performed in the pressure transducer block. The output value is the linearized and temperature-compensated measurement result.

The pressure transducer block also processes the temperature measurement of the pressure sensor and monitors the pressure and temperature limits.

Example

In hydrostatic level measurement, the pressure transducer block converts the incoming pressure value into height or volume.

Electronics temperature transducer block

The electronics temperature transducer block executes the required temperature measurement functions and monitors the permissible temperature limits.

Analog input function block

The analog input function block further processes the selected measurement value and passes it on to the automation task.

Example

For a container full of water, you measure the volume. The analog input function block calculates the container volume [m^3] in a user-specific volume unit [bottles]. The output of this block gives the measured value and the corresponding status on the PROFIBUS.

Totalizer function block

The totalizer function block totals the volumes or mass that flowed during flow measurement. Its function is very similar to that of a water meter.

The output of this block forwards the totalized values and the corresponding status information via PROFIBUS.

Local operation and display

The display shows the desired measured value with its physical unit. You can select different functions for local operation.

Connection between blocks via parameters

The output values of the transducer blocks for pressure and electronics temperature can be fed to the analog input and totalizer function blocks as input values for further processing. To do this, the parameter "Channel" must be correctly set in each function block.

Table 7- 1 Connection between blocks

Transducer block	Output value (Parameters)	Usable in the analog input function block	Usable in the totalizer function block
Pressure	Temperature	X	
	Secondary variable 1	X	
	Secondary variable 2	X	
	Measurement value (primary variable)	X	X
	Secondary variable 3	X	X
Electronics temperature	Electronics temperature	X	

Parameters for measured value display

The values of the following parameters from the measurement and function blocks can be shown on the display. The parameter "Source for display" must be set appropriately.

Table 7- 2 Visualization on the display

Block	Parameter	Can be shown on the display
Pressure transducer block	Temperature	X
	Secondary variable 1	X
	Secondary variable 2	
	Measurement value (primary variable)	X
	Secondary variable 3	X
	Raw pressure value	X
Electronics temperature transducer block	Electronics temperature	X
Analog input function block	Output	X
Totalizer function block	Totalizer output	X

See also

Measured value display (Page 82)

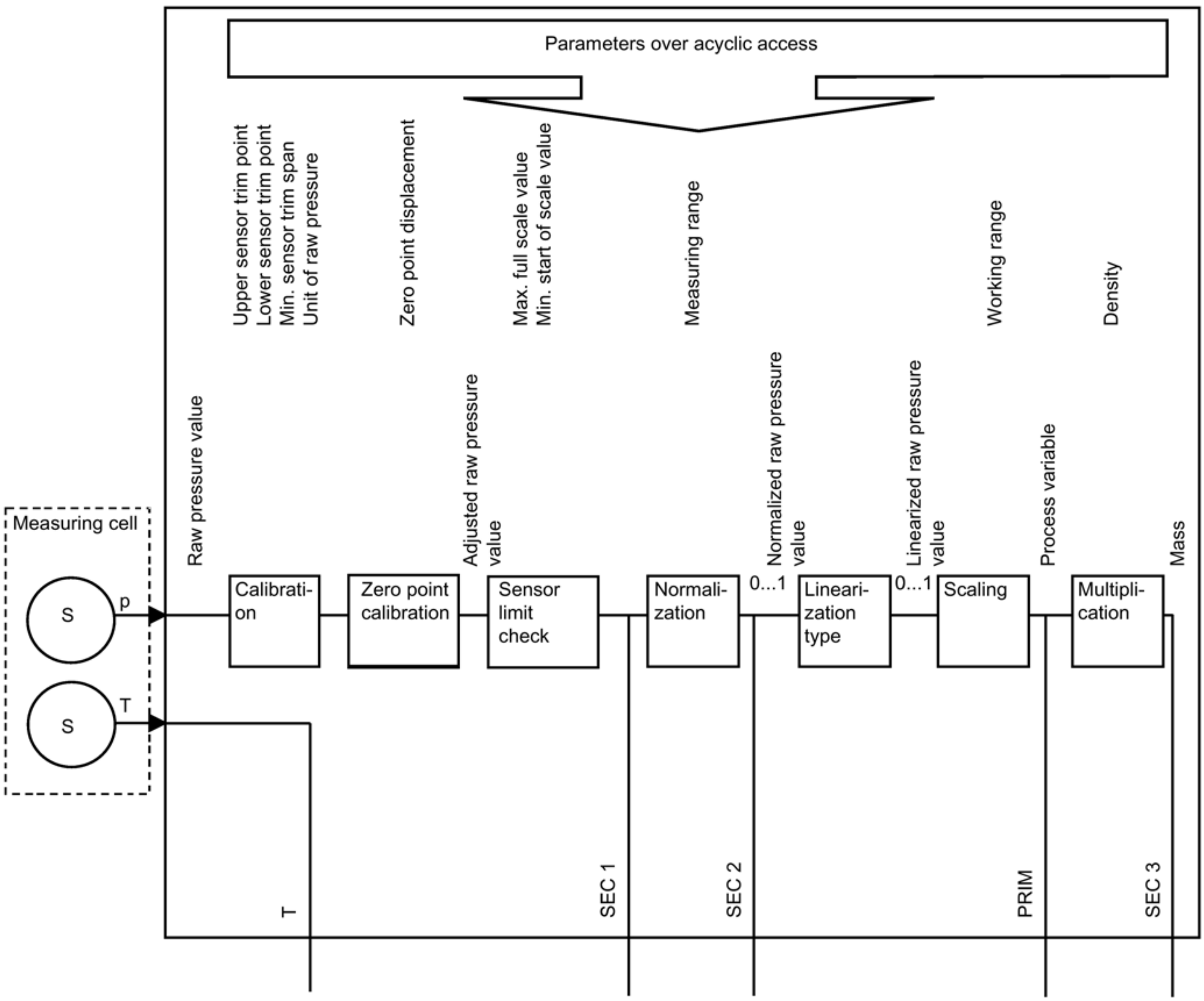
Cyclical data transfer (Page 165)

Acyclic data transfer (Page 170)

7.1.3 Pressure transducer block

7.1.3.1 Pressure transducer block (transducer block 1)

The following figure shows the signal flow of measurement values from the sensor cell through the pressure transducer block into the appropriate output values, e.g. temperature, measurement value (primary variable), etc. The parameters of the individual functions, e.g. measurement range, output range, etc. can be changed using acyclic access.



p	Pressure	SEC 1	Secondary variable 1
S	Sensor	SEC 2	Secondary variable 2
T	Temperature	PRIM	Primary variable
		SEC 3	Secondary variable 3

Image 7-2 Function groups of the pressure transducer block

Functional principle

The **raw pressure value** first passes through a **calibration**. The resulting **cleaned-up pressure value** is checked for **sensor limits**. Any violation of the limits results in status "Bad" and a diagnostic error of "error collecting measured value". The cleaned-up pressure value is stored in **SEC 1**.

Then, it is subjected to a **normalization**, where the input signal is expressed in the range 0 to 10 (percentage/100). The **normalized pressure value** is stored in **SEC 2**.

Afterwards, depending on the measurement task, it is fed through one of four different **linearization types**. **Scaling** uses the preset **working range** (minimum and maximum values) to determine the normalized and linearized measured value (pressure, height, or volume) of the actual process variable. This is stored in **PRIM**.

By means of a **multiplication** with the **density** the volume is used to compute the **mass**. This is stored in **SEC 3**.

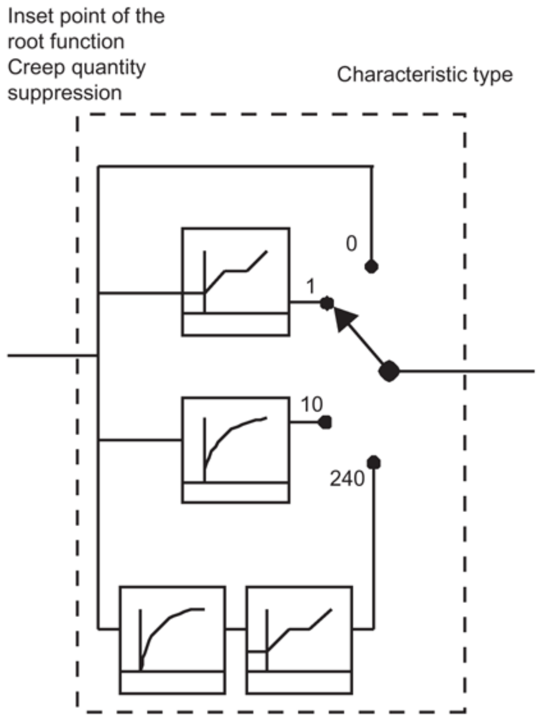
The **temperature value of the pressure sensor** is available in the "**temperature**" parameter.

See also

Acyclic data transfer (Page 170)

7.1.3.2 Linearization type function group

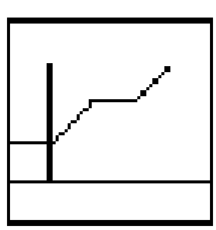
The normalized pressure is fed through the linearization algorithms for adjustment to the various process requirements, as shown in the following figure. The algorithm is switched using the "Characteristic curve type" parameter.

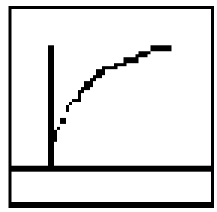
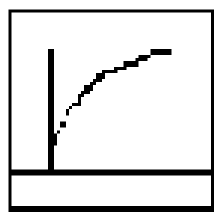
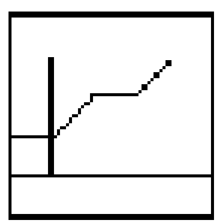


0	Linear	1	User-defined "table"
10	Root	240	Root/table

Image 7-3 Linearization type function group

Table 7- 3 Available linearization functions

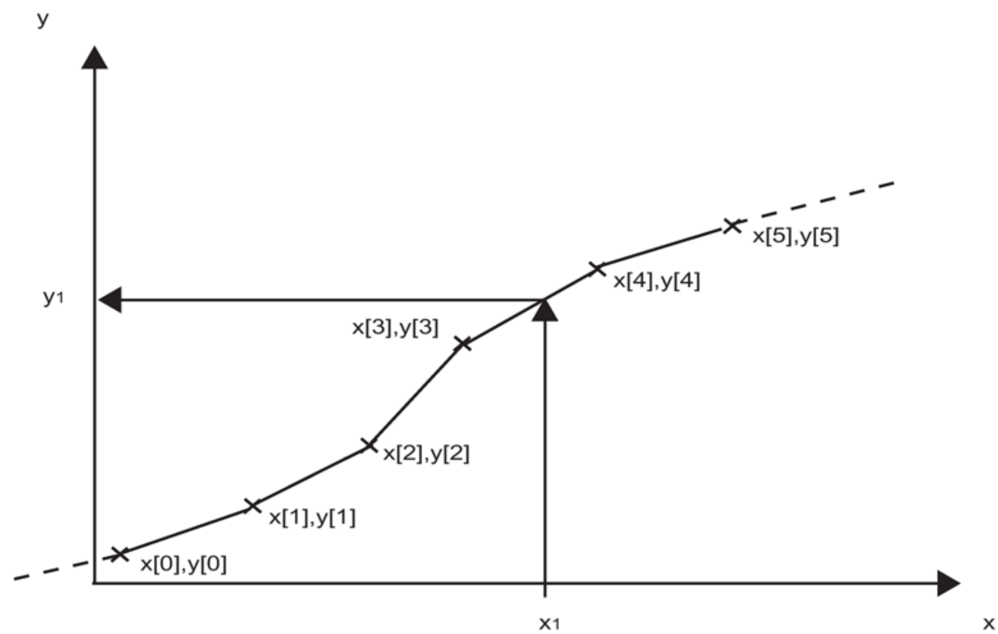
Measurement task	Linearization symbol	Character-istic curve type	Description
Pressure meas-urement	-	Linear	No linearization
Level: Height	-	Linear	No linearization
Level: Volume		User de-fined (table)	Linearization of container characteris-tics. The relationship between level and volume is described using a maximum of 31 nodes at arbitrary intervals.

Measurement task	Linearization symbol	Characteristic curve type	Description
Flow: Mass/volume flow without correction		Root extracted	Square root extraction of the input value for measurement using the orifice plate method. Additional parameters for the root function: Application point of the root function and creep quantity suppression.
Flow: Mass/volume flow with correction	 	Root extracted and table	Square root extraction of the input value for measurement using the orifice plate method. With the orifice plate method, the accuracy is greatest when the operating point is at the design point. If there are deviations, the measurement deviation is also greater. For this reason, the measurement accuracy is corrected using a characteristic curve with 31 nodes.

To input a characteristic curve, select the characteristic curve type "user-defined (table)". Enter the "New number of nodes" which you will later want to enter.

The nodes must always be entered in pairs. For each point x[n] in the working range, a point y[n] is required.

The device checks which pair of nodes bracket the pressure (secondary variable 1) relative to the measurement range. To convert the pressure to the measured value (primary variable), the device interpolates on a line between the interpolation nodes.



x Measurement range, here e.g. pressure (secondary variable 1)

y Working range, here e.g. volume, measured value (primary variable)

Image 7-4 Entry of a user-defined characteristic using nodes x(i), y(i)

The following table describes the vendor-specific parameters used with the flow measurement type and that supplement the root function.

Table 7- 4 Vendor-specific parameters for flow measurement

Parameter	Description
Application point of the root function	This parameter specifies the flow point as a % at which the differential pressure is set in a linear relationship to the flow.
Creep volume suppression	This parameter specifies the flow point as a % below which the flow becomes 0.

7.1.3.3 Units of the pressure transducer block

In the pressure transducer block you have the option of setting units in four different places. Depending on the measurement type, units are allowed from the following measurement functions:

Table 7- 5 Overview of available units

Variable	Measurement type				
	Pressure	Level	Volume	Volume flow	Mass flow
Raw pressure value	P	P	P	P	P
Secondary variable 1	P	P	P	P	P

Variable	Measurement type				
	Pressure	**Level**	**Volume**	**Volume flow**	**Mass flow**
Measurement value (primary variable)	P	L	V	F	F
Secondary variable 3	---	---	---	---	M

P	Pressure	F	Volume flow
L	Level	M	Mass flow
V	Volume		

For the measurement values (primary variables) you can also set the unit "%" for all measurement types.

Secondary variable 2 is a value normalized to one in all measurement types. The unit is fixed at "none".

See also

Unit (Page 84)

7.1.4 Electronics temperature transducer block

The electronics temperature transducer block is manufacturer-specific and not described in the profile. The transducer block is responsible for monitoring the internal temperature of the device electronics. The transducer block cannot change the pressure value, only its status.

The permissible limits correspond to those of the permissible ambient temperature. If a limit is violated, the status changes to "GOOD – Active Critical Alarm – High/Low-limit". The status of the cleaned-up pressure value in the pressure transducer block receives the status "UNCERTAIN – Value not accurate – high/low-limit". This procedure is accompanied by a PROFIBUS diagnostic message "Electronics temperature too high".

There are also peak indicators for maximum and minimum values available.

See also

Min/max indicator (Page 122)

Status (Page 167)

7.1.5 Analog input function block

The analog input function block is part of the standard functions of pressure transmitters. The following figure shows the processing of the measured values up to the **output**.

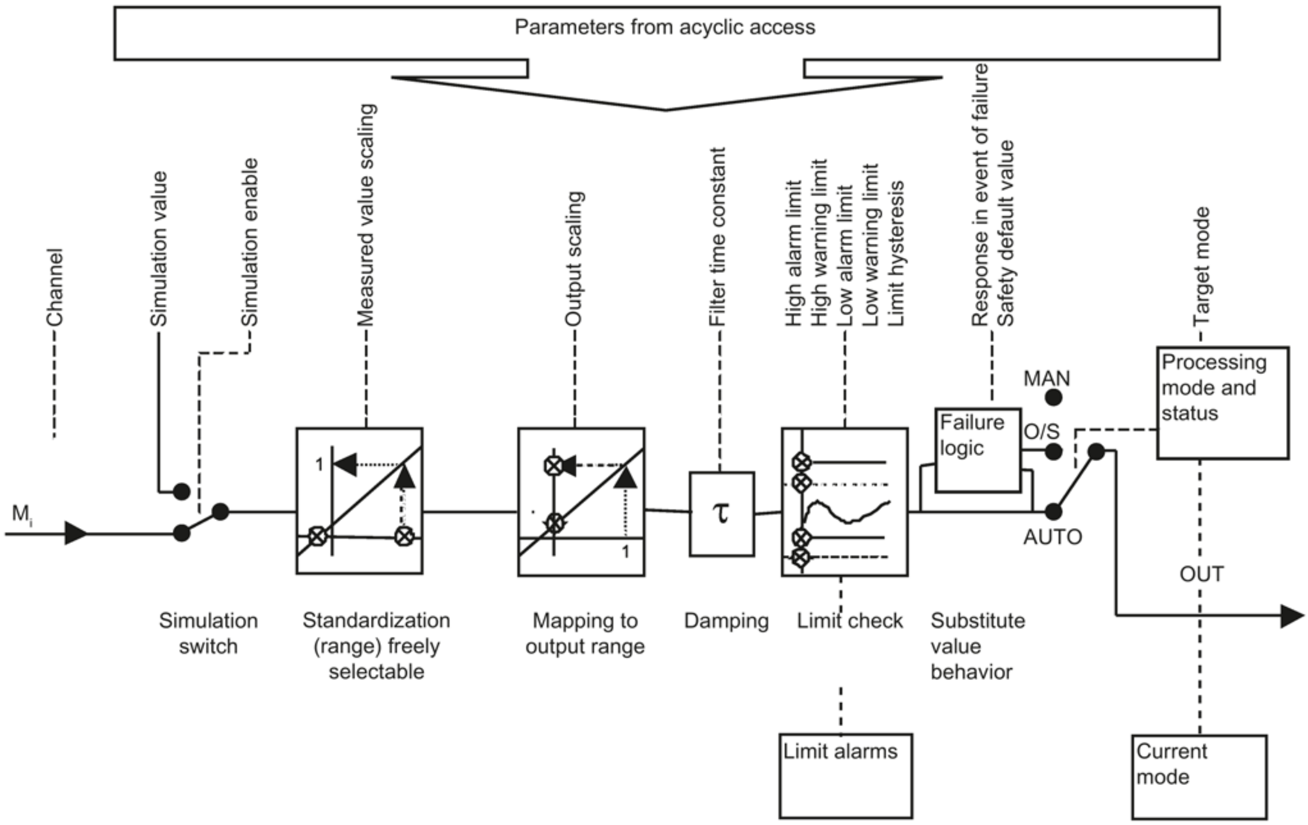


Image 7-5 Function groups of the analog input function block

M_i	Incoming measured value from the transducer for pressure	MAN	Manual
		O/S	Out of Service
OUT	Output (value, status)	AUTO	Automatically

Operating principle

The **incoming measurement value from the pressure transducer block** - or a **simulated value** prescribed through the **simulation switch** - is subject to another **normalization** (measured value scaling) and a **projection onto the output range** through output scaling (application-specific measured value).

Afterwards, the signal is **filtered** (damping) and check for being within preset **limit values**. An **upper and lower warning and alarm limit** is always available.

If the measured value has the status "Bad", the **shutdown logic** can output a **safety preset value**: This may be the last usable measured value or a preset substitute value.

Using the **target mode** selected in **Mode and status processing**, you can choose between output of the automatically acquired measured value (AUTO setting) or a manually set simulation value (MAN setting). If the function block is out of order (O/S setting) then the safety preset value is always output.

The analog input function block handles the numerical value separately from the physical unit. This allows you to set 1000 predefined units.

See also

Unit (Page 84)

7.1.6 Totalizer function block

The totalizer function block belongs to the standard functions of pressure transmitters. The function block is used in flow measurement. The following figure shows the processing of the measured values through to the output values.

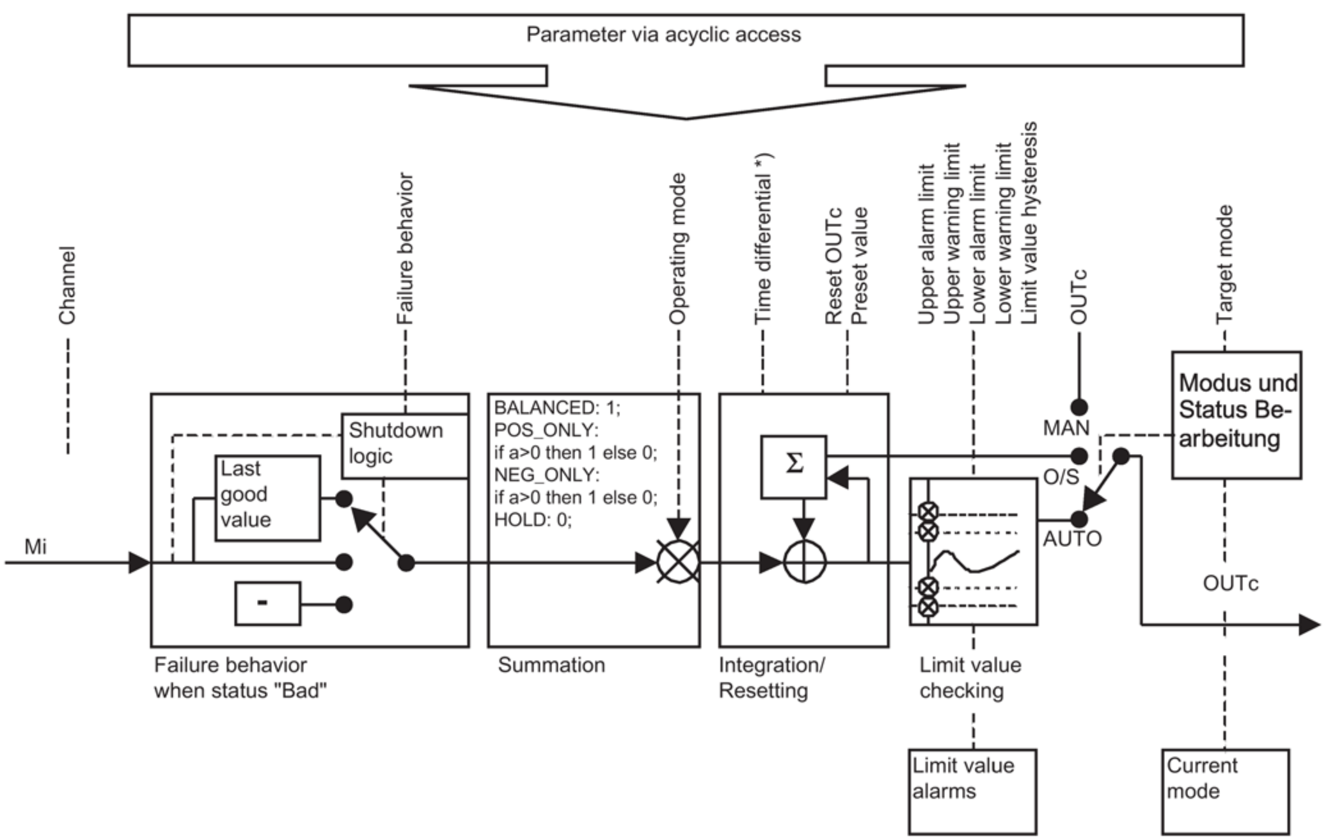


Image 7-6 Function groups of the totalizer function block

M_i	Incoming measured value from the transducer for pressure	MAN	Manual
		O/S	Out of Service

OUT	Output (value, status)	AUTO	Automatically

Operating principle

The function block processes the **measured values from the transducer for pressure**. If the status of the measured values is "bad", the setting of the **failure behavior** decides whether this value or the last "good" value is forwarded for totalizing.

The measured value now pass through the specified **summation direction**. The measured values are fed to a forward flow, reverse flow or net counting function.

The measured values are then **integrated** over time so that the flow can be calculated for a specified time segment. Adherence to the limit values is also checked. Here, it is also possible to **reset** the counted total to a preload value.

You can reset or initialize the totalizer function block not only with acyclic services. You can configure the totalizer function block so that you can reset or initialize it from the user program in cyclic data traffic.

In the **Mode and status processing**, select **Target mode**. Using the target mode, you can choose between output of the automatically acquired measured value (AUTO setting) or a manually set simulation value (MAN setting).

The possible units correspond to the volume and mass values of the transducer for pressure.

See also

Configuration of user data (Page 165)

Units of the pressure transducer block (Page 102)

7.2 Overview of operating functions

A PC software program like SIMATIC PDM is necessary for operation over PROFIBUS PA. How to do this is explained in the corresponding user manual and the online help. The full functionality of the pressure transmitter is available via PROFIBUS PA communication.

7.3 Measurement

In measurement mode, measurement values such as pressure, fill level or flow are available on the PROFIBUS-PA interface. PROFIBUS PA communication is signaled by the communication symbol "o" on the display.

See also

Display elements (Page 73)

7.4 Settings

7.4.1 Overview of settings

The pressure transducer can handle numerous measurement tasks. You only have to make the following settings:

- Settings with a configuration tool, for example STEP 7 or HW Config: Here, you choose the desired configuration with which the cyclically transmitted user data will be structured.
- Settings with SIMATIC PDM: Here you set the parameters that also influence the cyclic user data.

See also

Configuration of user data (Page 165)

7.4.2 Settings

If you set a new device, select the measurement type, for example pressure or fill level. As a result, you will see the appropriate default parameter settings in the SIMATIC PDM user interface. The following sections will introduce only those which you will still have to set.

Procedure

To read out the settings, proceed as follows:

1. Start the "Download to PG/PC" function.

   The current settings are downloaded to the device.
2. Check the current settings.
3. Change the necessary settings.
4. Load the parameter settings into the device.
5. Save the parameter settings offline.

7.4.3 Pressure measurement

Procedure

To select pressure measurement, proceed as follows:

1. Start SIMATIC Manager.
2. Create a device with the desired measurement type.
3. To open SIMATIC PDM, double-click on the device you have created.

7.4.4 Level measurement

Procedure

To set fill level measurement, proceed as follows:

1. Start SIMATIC Manager.
2. Create a device with measurement type "Fill level".
3. To open SIMATIC PDM, double-click on the device you have created.

Depending on whether you want to measure a height, a volume, or a mass, set the following values.

Height measurement

To select height measurement, proceed as follows:

- Start SIMATIC PDM. Create an assignment between the pressure to be measured (measurement range) and the fill level to be recorded (working range), by setting these parameters:

```
>    Input
>    >    Transducer block 1
          Transmitter type:    Level
>    >    >    Measuring range
               Start of scale value
               Full scale value
>    >    >    Working range
               Unit:                Unit of length [m, cm, mm, ft, in, yd]
               Start of scale value
               Full scale value
```

- Create an assignment between the measured level value and the output value by setting these parameters:

```
>    Output
>    >    Function block 1 - analog input
          Channel:             Measured value (primary variable)
>    >    >    Measured value scaling
               Start of scale value: as in "working range"
               Full scale value:     as in "working range"
>    >    >    Output scaling
               Unit:                 as in "working range"
               Start of scale value: as in "working range"
               Full scale value:     as in "working range"
```

You can also adjust the output to another process value. Assign the required unit to the parameters under the rubric output scaling. Assign the start of scale and full scale values according to the measured value scaling.

Volume measurement

- Start SIMATIC PDM. Create an assignment between the pressure to be measured (measurement range) and the volume to be recorded (working range), by setting these parameters:

> Input
> > Transducer block 1
Transmitter type: Volume
> > > Measuring range
Start of scale value
Full scale value
> > > Working range
Unit: Unit of volume [m^3, dm^3, cm^3, mm^3, l ...]
Start of scale value
Full scale value

- If there is no linear relationship between level and volume in your container, you can also define a characteristic curve:

> Input
> > Transducer block 1
Transmitter type: Volume
> > > Characteristic curve
Characteristic curve type: User-defined table
> > > Nodes
New number of nodes: max. 31
x[n] measurement range: Pressure value
y[n] working range: Corresponding volume value

- Create an assignment between the measured volume value and the output value by setting these parameters:

> Output
> > Function block 1 - analog input
Channel: Measured value (primary variable)
> > > Measured value scaling

Start of scale value: as in "working range"

Full scale value: as in "working range"

> > > Output scaling

Unit: as in "working range"

Start of scale value: as in "working range"

Full scale value: as in "working range"

You can also adjust the output to another process value. Assign the required unit to the parameters under the rubric output scaling. Assign the start of scale and full scale values according to the measured value scaling.

Mass measurement

- Start SIMATIC PDM. The measurement of mass is calculated from the volume and density. Therefore create an assignment between the pressure to be measured (measuring range) and the volume to be recorded (working range) by setting the following parameters:

> Input

> > Transducer block 1

Transmitter type: Volume

> > > Measuring range

Start of scale value

Full scale value

> > > Working range

Unit: Unit of volume [m^3, dm^3, cm^3, mm^3, l ...]

Start of scale value

Full scale value

- If there is no linear relationship between level and volume in your container, you can also define a characteristic curve:

> Input

> > Transducer block 1

Transmitter type: Volume

> > > Characteristic curve

Characteristic curve type: User-defined table

> > > Nodes

New number of nodes: max. 31

x[n] measurement range: Pressure value

y[n] working range: Corresponding volume value

- Create an assignment between the measured mass value and the output value by setting these parameters:

> Output
> > Function block 1 - analog input
Channel: Measured value (primary variable)
> > > Measured value scaling
Start of scale value: as in "working range"
Full scale value: as in "working range"
> > > Output scaling
Unit: Unit of mass [kg, g, t ...]
Start of scale value: as "measured value scaling" * density
Full scale value: as "measured value scaling" * density

You can also adjust the output to another process value. Assign the required unit to the parameters under the rubric output scaling. Assign the start of scale and full scale values according to the measured value scaling.

See also

Adjusting to a desired process value (Page 114)

7.4.5 Flow measurement

- Select the required configuration with the configuration tool:

Table 7- 6 Desired configuration for flow measurement

Desired configuration	Measurement type
Output	Current flow/time
Totalizer output	Volume or mass that has flowed over a time segment
Output, totalizer output	Current flow/time, volume or mass that has flowed over a time segment, reset totalizer output (with SIMATIC PDM)
Output, totalizer output, reset totalizer output	Current flow/time, volume or mass that has flowed over a time segment, Dosing

Desired configuration	Measurement type
Output, reset totalizer output, mode	Current flow/time, volume or mass that has flowed over a time segment, Dosing, Controlling the mode of the totalizer from the user program: Net, forward flow, reverse flow, hold totalizer count
Totalizer output, reset totalizer output	Volume or mass that has flowed over a time segment, Dosing
Totalizer output, reset totalizer output, mode	Volume or mass that has flowed over a time segment, Dosing, Controlling the mode of the totalizer from the user program: Net, forward flow, reverse flow, hold totalizer count

- Create a device with measurement type "Flow".
- Start SIMATIC PDM. Create an assignment between the pressure to be measured (measurement range) and the volume or mass flow to be recorded (working range), by setting these parameters:

> Input
> > Transducer Block 1
Transmitter type: Flow
> > > Measuring range
Start-of-scale value: 0
Final value
> > > Working area
Unit: Volume unit/time unit [m3/s, m3/h, l/s, ...]
Mass unit/time unit [kg/s, t/min, ...]
Start-of-scale value 0
Final value
> > > Characteristic curve
Characteristic curve type: Root extracted

- To acquire the current flow, use "Function Block 1 – Analog Input". Create an assignment between the measured flow value and the output value by setting these parameters:

> Output
> > Function Block 1 - Analog Input

Channel: Measurement value (primary variable)

> > > Measured value scaling

Start-of-scale value: as in "working range"

Final value: as in "working range"

> > > Output scaling

Unit: as in "working range"

Start value: as in "working range"

Final value: as in "working range"

- To acquire an amount that has flowed (mass or volume), use the totalizer function block.

> Output

> > Totalizer function block

Channel: Measurement value (primary variable)

Unit (totalizer)

- If your desired configuration does not include the mode settings (reset totalizer or mode), set the following parameters as well with SIMATIC PDM:

> Output

> > Totalizer function block

> > > Operating mode

Operating mode: [Pos. and neg. values | only positive values]

Totalizer output: Count

Application point of the root function, creep quantity suppression

If you want to suppress the error that occurs at low flow quantities, you have two options that you can also combine:

- The application point of the root function determines the point below which the root function becomes linear.
- Creep quantity suppression sets the measured flow quantity to 0, when the value falls below the preset limit.

Enter the application point as a % of the operating range (volume flow).

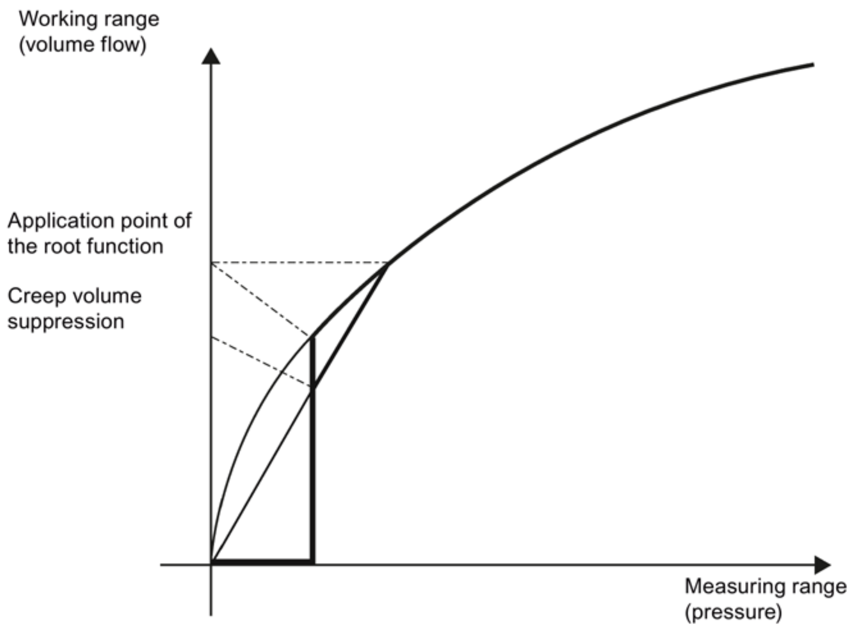


Image 7-7 Application point of the root function and creep quantity suppression

Flow measurement correction

If you want to carry out a correction in your application (for example to take account of the flow coefficient α and the expansion coefficient ε), select:

- Characteristic curve type: Root extracted and characteristic curve
- Nodes: For a maximum of 31 nodes, enter an input value (measured volume flow) and an output value (corrected volume flow).

See also

Configuration of user data (Page 165)

7.4.6 Adjusting to a desired process value

The analog input function block has the purpose of mapping the measured value to the process value. In general, you want to direct the measured value straight to the bus: Then the input and output range is taken from the working range.

If the measured pressure or the fill level has an indirect but linear relation to the process value, however, assign the start and final values of the input range to start and final values for the output range. The following examples illustrate this:

Procedure

The **procedure** is shown by means of two concrete application examples.

Example 1

You want to assign the input range 1 to 4 Pa to the output range 0 to 100%.

1. Set measurement type "Pressure".
2. Set the following parameters:

>	Pressure transducer block	
	Unit for measured value (primary variable):	Pa
>	Analog input function block	
	Input starting value:	1.0
	Input final value:	4.0
	Output starting value:	0.0
	Output final value:	100.0
	Unit (output):	%

Note

The display can only show a part of the ASCII character set in both upper and lower case. If you enter lower-case letters f, g, j, p, q, t, x, y, z in SIMATIC PDM in the parameter "Unit text (output)", they will only be shown in upper case. The German letters ä, ö, ü, and ß, as well as any ASCII characters with codes higher than 125, are displayed with a block symbol with all segments on. Thus try to avoid language-specific characters.

Example 2

You want to convert the input range 0 to 400 m^3 to 200 l barrels. The output range, for instance, is 0 to 2000 barrels.

1. Set measurement type "Volume".
2. Set the following parameters:

>	Pressure transducer block	
	Unit for measured value (primary variable):	m^3
>	Analog input function block	
	Input for start-of-scale value:	0.0
	Input for final value:	400.0
	Output for start-of-scale value:	0.0
	Output for final value:	2000.0
	Unit (output):	Text
	Unit text (output):	Barrels

See also

Level measurement (Page 108)

Pressure measurement (Page 107)

7.5 Electrical damping (filter time constant)

You can set the time constant of electrical damping (filter time constant) to a point within a range of 0 to 100 seconds. It always applies to the "Pressure" device variable (DV0) and thus to the measured values derived from it.

See also

Setting/adjusting electrical damping (Page 79)

7.6 Key lock and write protection

You can set operation blocks according to the following table.

Table 7- 7 Keypad locks

Lock	Effect	Switching on/off	Display
Keypad and function block (hardware write protection)	Parameter changes with SIMATIC PDM and setting changes made locally are blocked. Independent of other operating locks.	Local Mode 10	L
Write block	Write block for parameterization using SIMATIC PDM. Local operation is possible. With PROFIsafe devices, password protection can be set for parameter modifications via bus. Refer to Write protection (Page 150).	SIMATIC PDM	LC
Local operation	If local operation is not enabled, no access is possible using the keypad. Regardless of the setting of this parameter, local operation is automatically enabled 30 seconds after loss of communication. After communication is restored, the "Local operation permitted" parameter is restored to its original setting in the device.	SIMATIC PDM	LA
Combination of write blocking and no enabling of local operation	Acts like an active keypad block. Changes to parameters (except for keypad block) are not possible either with local operation or using SIMATIC PDM.	SIMATIC PDM	LL

Blocks can also be combined:

Table 7- 8 Combined blocks

Lock	Write block for parameter changes over the bus	Release of local operation over SIMATIC PDM	Display
On	On or off	Released or blocked	L
Off	Off	Blocked	LA
Off	Off	Released	- -
Off	On	Blocked	LL
Off	On	Released	LC

See also

Locking of buttons and functions (Page 81)

7.7 Warning and alarm limits

The analog input function blocks each have high and low warning and alarm limits for the output. In order to avoid unstable display of warnings and alarms, specify a hysteresis.

In the analog input function blocks, set the following parameters according to process requirements:

- Limit value hysteresis
- High warning limit
- High alarm limit
- Low warning limit
- Low alarm limit

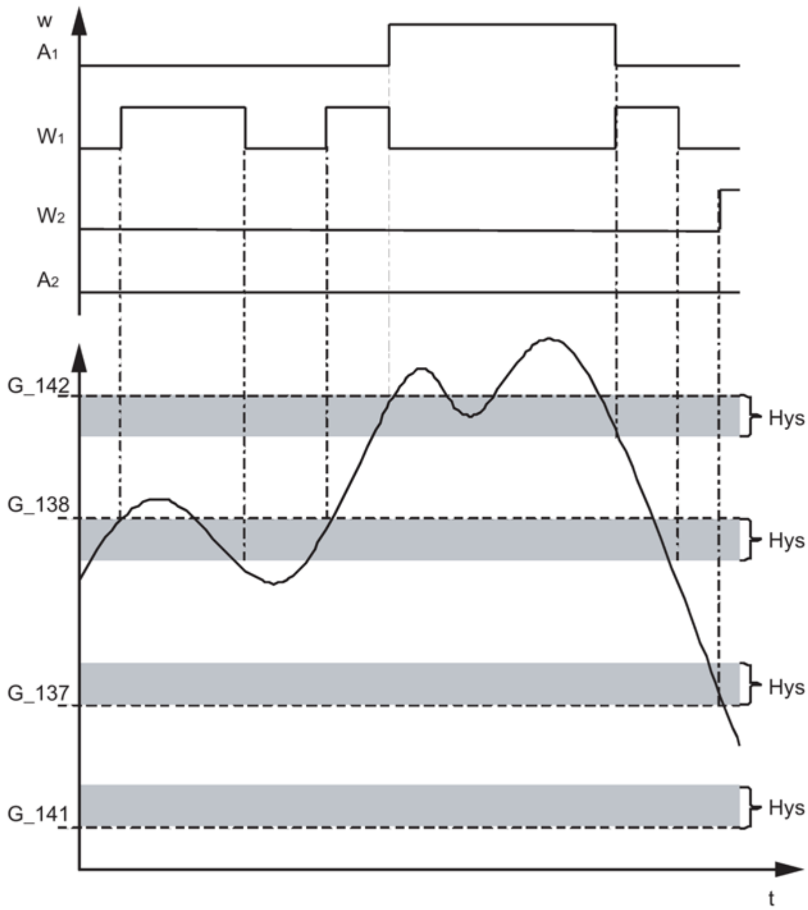
Status

If limits are violated, the output is accompanied by a status which you can evaluate in your application program:

Table 7- 9 Limits and status displays

Status Display	Status Hex	Violation
G_137	89	Low warning limit
G_138	8A	High warning limit
G_141	8D	Low alarm limit
G_142	8E	High alarm limit

Example



G_137	Low warning limit	A_1	High alarm
G_138	High warning limit	A_2	Low alarm
G_141	Low alarm limit	W_1	High warning limit
G_142	High alarm limit	W_2	Low warning limit
		Hys	Hysteresis
t	Time	w	Measured value

Image 7-8 Warning and alarm limits

7.8 Failure behavior

7.8.1 Overview of failure behavior

If the transducer block fails, the analog input and totalizer function blocks can adopt a value preset by the user. If the output variables of the transducer block have the status "Bad" due to an error, activate the failure behavior for the function blocks. The status "Unsure" then accompanies the output or the totalizer output.

7.8.2 Output

Set the failure behavior in the analog input function block:

Table 7- 10 Failure behavior of the analog input function block

Failure behavior	Description	Status code
The output value is set to the replacement value.	The predefined safety preset value is output.	U_075
Saving of the last valid output value.	The last valid output value is output.	U_071
The incorrectly calculated measured value is on the output (shutdown logic turned off).	The bad output value is accompanied by the status assigned to it by the transducer block.	B_0xx

To narrow down the cause of failure after the shutdown logic engages, read the measured value (primary variables) or secondary variables including the status from SIMATIC PDM.

7.8.3 Totalizer output

Set the failure behavior in the totalizer function block:

Table 7- 11 Failure behavior of the totalizer function block

Failure behavior	Description	Status code
Stop	Counting is stopped if there are input values with the "Bad" status.	U_075
Safe operation	Counting continues with the last input value that had the "Good" status prior to the failure.	U_072
Operation	The bad measured value is accompanied by the status assigned to it by the transducer block.	B_0xx

7.9 Diagnostics functions

7.9.1 Operating hours counter

You can read out one operating hours counter for the electronics and one for the sensor. They are activated upon first commissioning of the pressure transmitter.

7.9.2 Calibration interval and service interval

There are two timers in the pressure transmitter:

- A timer for the calibration interval, which ensures regular calibration of the electronics.
- A timer for the service interval, which draws attention to any necessary service for the sensor cell and its connections.

The interval is selectable. The timers can monitor on two levels, first giving a warning, then an alarm.

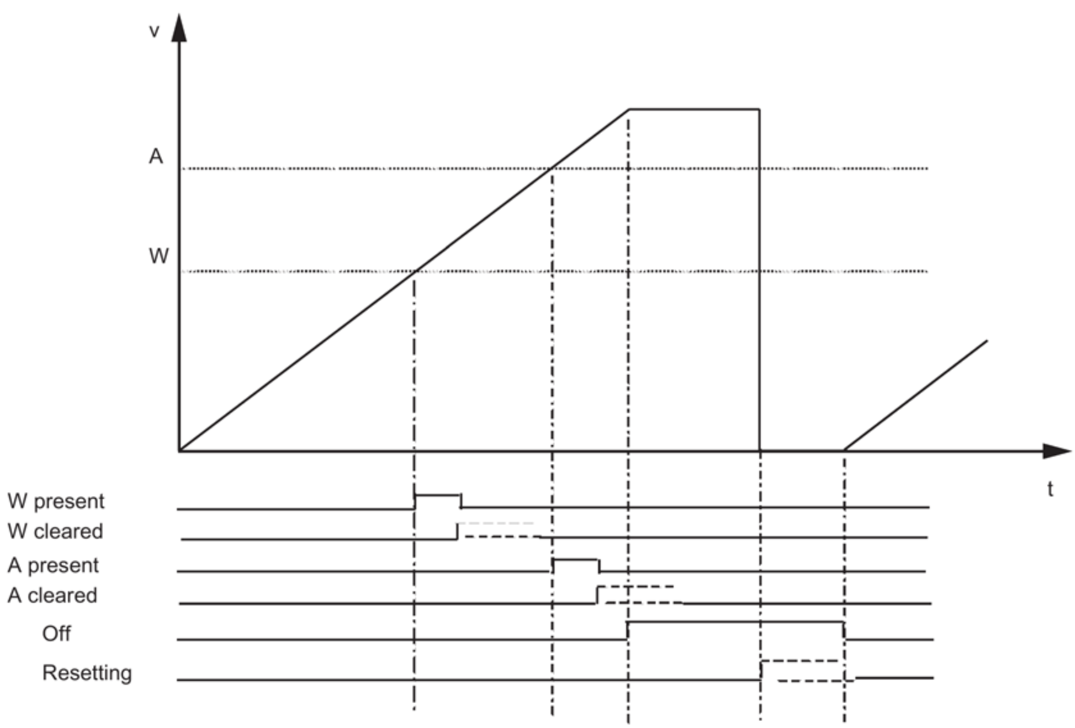


Image 7-9 Calibration and service intervals

v	Timer value	t	Time
A	Interrupt	W	Warning

Procedure

To adjust the calibration and service interval, proceed as follows:

1. Set the parameter for warning/alarm.
2. Give the time interval after which a warning is output.
3. Give the additional time interval after which an alarm is output.

7.9.3 Clearing warning

As soon as the warning interval is past, the first monitoring level emits a warning. Measured values have the status "Good, Maintenance request". The "Maintenance request" diagnostics alarm is also displayed. SIMATIC PDM can also display the status for calibration or service and the value of the timer.

Procedure

To clear a warning, proceed as follows:

1. Clear the warning.

   The diagnostic message is deleted and the status set back to "Good".
2. Perform the calibration or service.
3. Reset the timer.

7.9.4 Clearing the alarm

If you don't perform calibration or service on time, the second monitoring level emits an alarm which again draws attention to the urgent need for service. Measured values are accompanied by the status "Unsure, value inexact" and the diagnostic message "Service required" is displayed.

Procedure

To clear an alarm, proceed as follows:

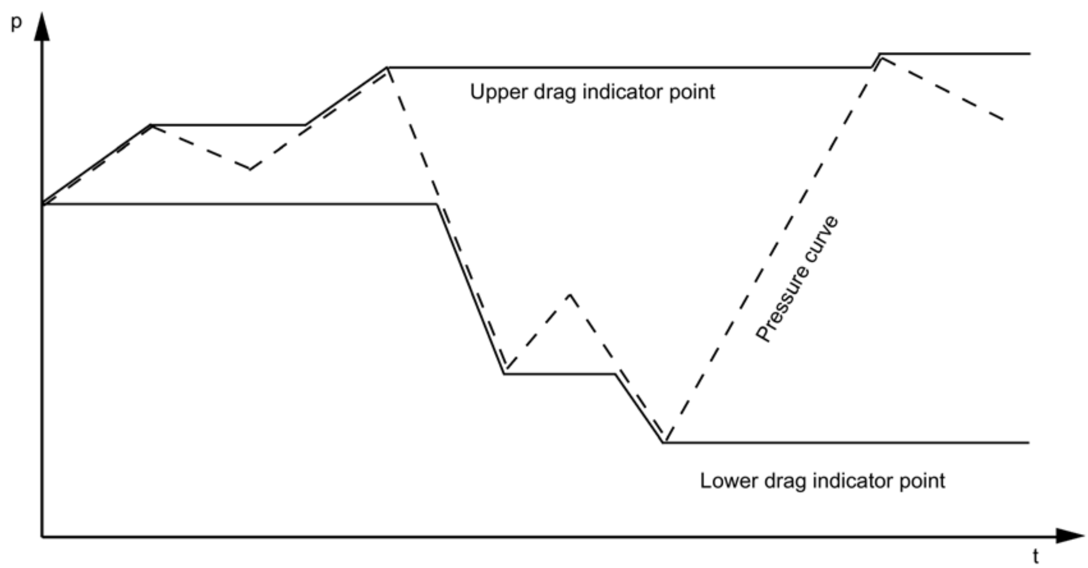
1. Clear the alarm.

   The diagnostic message is deleted and the status set back to "Good".
2. Perform the calibration or service.
3. Reset the timer.

7.9.5 Min/max indicator

Description

The pressure transmitter has three pairs of min/max pointers which you can use to monitor the three measured variables pressure, sensor temperature, and electronics temperature for negative and positive peak values. For each measured value, a resettable min/max pointer saves the maximum and minimum peak values in long-term storage in the two non-volatile memories. Consequently, the values are available even after the device is restarted. The min/max pointers are also updated during a simulation.



p Pressure

Image 7-10 Basic representation of min/max pointers

See also

Simulating the pressure sensor (Page 124)

Simulating sensor and electronics temperature (Page 125)

7.10 Simulation

7.10.1 Overview of simulation

Simulation functions help you when commissioning parts of the system and the pressure transmitter. You can generate process values without recording real measured values. The value range of simulated process values can be tested fully: This makes the simulation of errors possible.

From the output of the pressure transmitter, you can get ever closer to the sensor and check the measurement and function blocks.

The display indicates active simulation with an "Si" in the mode display.

7.10.2 Simulating output

By simulating the output, you can make process values available at the output of the pressure transmitter for cyclic data transmissions using acyclic write access. This allows you to test the process value processing in the automation program.

Procedure

To simulate the output, make the following settings:

1. Select output simulation.
2. Set the target mode to manual (MAN).
3. Enter the desired output value, the quality, and the status.
4. Transmit the settings from the program into the pressure transmitter.

The behavior of the output can be observed, e.g. in SIMATIC PDM or using a variable table (VAT component).

To return to normal operation afterwards, set the target mode to AUTO.

7.10.3 Simulating input

By simulating the input, you can check the following functions:

- Adaptation of the measured value to the required process variable
- Monitoring of the process limits you have set
- Electrical damping
- Response to failure

Procedure

To simulate the input, make the following settings:

1. Select input simulation.
2. Set the target mode to AUTO.
3. Select the simulation mode "Released".
4. Enter the desired input value, the quality, and the status.
5. Transmit the settings from the program into the pressure transmitter.

You can observe the behavior of the input in e.g. SIMATIC PDM.

To return to normal operation afterwards, you must switch off the simulation.

7.10.4 Simulating the pressure sensor

By simulating the pressure sensor as a fixed value or a parameterizable ramp, you can check the following functions:

- Trim
- Check the zero-point adjustment
- Reaction to violation of sensor limits
- Linearization
- Projection onto the working range

You can make the simulation value dynamic with a parameterizable ramp. The simulation value then goes from a start value (v_1) in a step function to a full-scale value (v_2), staying at each level for the given step interval (t_v). At the full-scale value, the direction reverses.

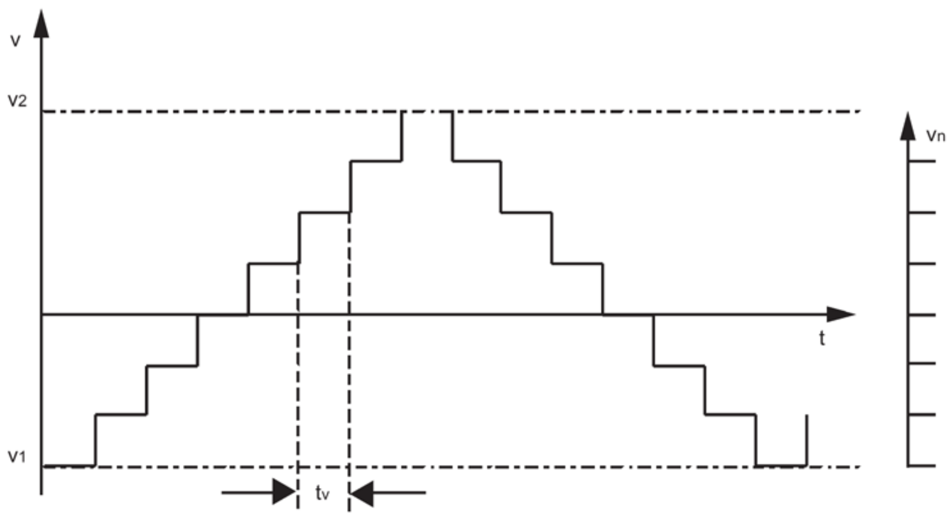


Image 7-11 Parameterizable ramp

v	Value	t	Time
v_1	Start value	t_v	Step interval
v_2	Full-scale value	v_n	Number of steps

Procedure

To simulate the pressure sensor, make the following settings:

1. Select pressure sensor simulation.
2. Set the simulation mode and the parameters:
   – Simulation mode "Fixed" and parameter pressure value
   – Simulation mode "Ramp" and ramp parameters
3. Transmit the settings from the program into the pressure transmitter.

The behavior of the measured value (primary variable), the secondary variables 1, 2, and 3, and of the output, can be observed in SIMATIC PDM.

To return to normal operation afterwards, you must switch off the simulation.

7.10.5 Simulating sensor and electronics temperature

By simulating the sensor and electronics temperature you can, for instance, check the influence of excessive temperature on the measurement results:

Procedure

To simulate the sensor and electronics temperature, make the following settings:

1. Select the simulation of sensor or of the electronics temperature.
2. Set the simulation mode and the parameters:
   – Simulation mode "Fixed" and parameter pressure value
   – Simulation mode "Ramp" and ramp parameters
3. Transmit the settings from the program into the pressure transmitter.

The behavior of the measured value (primary variable), the secondary variables 1, 2, and 3, and of the output, can be observed in SIMATIC PDM.

To return to normal operation afterwards, you must switch off the simulation.

7.11 Calibrating the sensor

Sensor calibration enables you to calibrate the pressure transmitter. Analogous to modes 19 and 20 for local operation, you can change the slope of the characteristic curve of the pressure transmitter.

Using a lower and an upper trim point, you can determine the course of the characteristic curve.

Change the slope of the characteristic to a minimum of 0.9 and a maximum of 1.1. Any larger variation from a slope of 1.0 will prevent the respective trim point from being stored.

The lower trim point must be far enough from the upper trim point so that the smallest calibration span is included.

The smallest calibration span is displayed in the sensor calibration dialog and depends on the measurement range. If the calibration is smaller than the smallest span, the following status code accompanies the measured value:

"Bad, configuration error"

In this case, recalibration the lower or the upper sensor trim point with a sufficiently large calibration span.

Calibrating the lower point

To calibrate the lower point, proceed as follows:

1. Call up the dialog "Sensor Trim".
2. Apply the reference pressure for the lower sensor trim point.
3. Enter the value of the reference pressure in the field "Lower Sensor Trim Point".
4. Click on "Transfer".

In the field "Pressure cleaned raw value", observe the effect of the calibration. In the "Lower Sensor Trim Point" box, you can see whether the new trim point was applied.

Calibrating the upper point

To calibrate the upper point, proceed as follows:

1. Call up the dialog "Sensor Trim".
2. Switch to the "Upper Sensor Trim" tab.
3. Apply the reference pressure for the upper sensor trim point.
4. Enter the value of the reference pressure in the field "upper sensor trim point".
5. Click on "Transfer".

In the field "Pressure cleaned raw value", observe the effect of the calibration. In the "Upper Sensor Trim Point" box, you can see whether the new calibration point was applied.

After both points have been calibrated, the status of the measured value must be "Good". If the status "Bad, configuration error" is displayed, the calibration was smaller than the smallest calibration span. You must move the trim points away from one another by moving one of the two trim points.

See also

LO calibration (Page 91)

HI calibration (Page 92)

7.12 Correcting for positional error

External influences can affect the original zero point. External influences include:

- Mounting position
- Ambient temperature
- Installation-caused preset pressures, for instance fluid columns in the pressure line to the pressure transmitter
- The screw-mounting on the process plant, e.g. measuring ranges from 1 to 20 mbar (differential pressure), can respond more sensitively to the screw-mounting.

You can correct for these influences within the following limits.

Differential pressure	-100% to +100% of the rated measuring range
Pressure	-100%, but not more than -1 bar up to +100% of the nominal measurement range
Absolute pressure	Correction for positional error not possible

Procedure

To correct for positional error, proceed as follows:

1. Call up the dialog "Position correction".
2. Create a pressure calibration.
3. Click on "Transfer".

7.13 Reset

7.13.1 Resetting to delivery state

If the pressure transmitter is so maladjusted that it can no longer fulfill its measurement tasks, you can use this function to reset it to the factory settings. It resets all parameters to the factory settings, with a few exceptions.

The exceptions are:

- PROFIBUS address
- Device operation type
- Static version number
  - In Transducer Block 1
  - In the analog input function block

The reset is indicated by the diagnostic message "New start executed". The automation or control system reads the status "Unsure, initial value, value constant" until a measured value result is available.

See also

Resetting the PROFIBUS address (Page 128)

Device operation type (Page 88)

7.13.2 Warm start/restart

With a warm start, you cause the pressure transmitter to switch itself off and restart. This interrupts and then reestablishes communication.

You need this function, for example, if the PROFIBUS address is changed during running communication with a cyclical master.

This restart is indicated by the diagnostic message "Restart executed". The automation or control system reads the status "Unsure, initial value, value constant" until a measured value result is available.

7.13.3 Resetting the PROFIBUS address

If no other pressure sensor in your system has the preset address 126, you can add your pressure transmitter to the PROFIBUS strand during running operation of the automation or control system. You must subsequently change the address of the newly connected device to a different value.

If you remove the pressure transmitter from the PROFIBUS chain, reset its address to 126. This allows you to include the pressure transmitter in this or another system if necessary.

Functional safety 8

8.1 Safety function

The safety function of SITRANS P DS III with PROFIsafe protocol (ordering option -Z C21) is based on the measurement of pressure.

The pressure is converted to a digital measured value and transmitted via PROFIsafe communication. Fault tolerance allowances must be made, because the measured value transferred to the automation system by the pressure transmitter can deviate from the physical value. This fault tolerance is calculated as follows:

Total tolerance (safety function) = ± [application-specific measurement error + 2 % safety accuracy].

Pressure transmitter safety accuracy: the maximum effect of a non-critical individual error on the measured value.

The measured value is transferred along with the "Validity" and "Quality" status information.

The diagnostics function will respond within 60 seconds in the worst-case scenario.

The safety accuracy together with the application-specific measurement error allows the system operator to include a backup for process monitoring. Even if a random individual error occurs that is within the safety accuracy, the system can still be safely shut down.

As there is also always a possibility of dangerous faults occurring, these are categorized and listed in the manufacturer declaration for the device (SIL declaration of conformity, functional safety pursuant to IEC 61508 and IEC 61511).

Example:

A silo is to be securely monitored to check that the level does not exceed 10 meters.

Application-specific measurement error: 0.1%

Safety accuracy: 2.0%

Total tolerance: 2.1%

2.1% of 10 meters is 21 centimeters. If process monitoring is set to 9.79 meters, safe shutdown is guaranteed even in the event of a random individual error within the safety accuracy.

Note

Use of remote seals

If remote seals are used, the application-specific measurement error is the product of the pressure transmitter and remote seal measurement errors.

> **⚠ WARNING**
>
> **Disregarding conditions for fulfilling the safety function**
>
> Disregard can result in a malfunction of the process plant or application, e.g. process pressure too high, maximum level exceeded.
>
> The mandatory settings and conditions are listed in chapters "Settings (Page 132)" and "Safety-related characteristics (Page 132)".
>
> Please observe the applicable conditions to ensure the safety function.

Safety-instrumented system in single-channel operation (SIL 2)

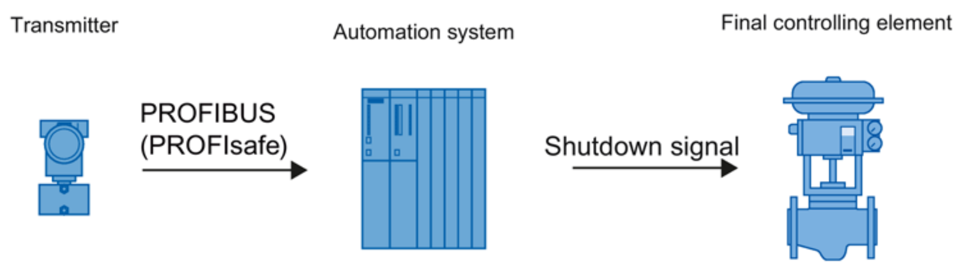


Image 8-1 Safety-related system for pressure transmitters in single-channel operation

The combination of pressure transmitter, automation system and final controlling element forms a safety-instrumented system that performs a safety function. The emphasis of this description is on the pressure transmitter. For information on requirements for the automation system or final controlling element, please refer to the corresponding standards.

The pressure transmitter generates a process-related measured value that is transferred to the automation system. The automation system monitors this measured value. If the measured value violates the high or low limit, the automation system generates a shutdown signal for the connected final controlling element, which switches the corresponding valve to the specified safety position.

Only one SITRANS P DS III device is required for single-channel operation for SIL 2.

8.2 Safety Integrity Level (SIL)

The international standard IEC 61508 defines four discrete Safety Integrity Levels (SIL) from SIL 1 to SIL 4. Every level corresponds to a probability range for the failure of a safety function.

Description

The following table shows the dependency of the SIL on the "average probability of dangerous failures of a safety function of the entire safety-instrumented system" (PFD_{AVG}). The table deals with "Low demand mode", i.e. the safety function is required a maximum of once per year on average.

Table 8- 1 Safety Integrity Level

SIL	**Interval**
4	$10^{-5} \leq PFD_{AVG} < 10^{-4}$
3	$10^{-4} \leq PFD_{AVG} < 10^{-3}$
2	$10^{-3} \leq PFD_{AVG} < 10^{-2}$
1	$10^{-2} \leq PFD_{AVG} < 10^{-1}$

The "average probability of dangerous failures of the entire safety-instrumented system" (PFD_{AVG}) is normally split between the following three components:

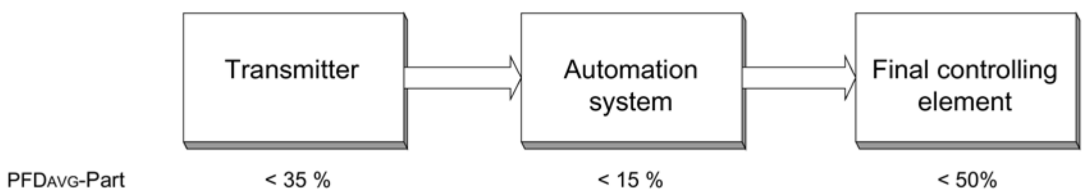


Image 8-2 PFD distribution

The following table shows the achievable Safety Integrity Level (SIL) for the entire safety-instrumented system for type B devices depending on the safe failure fraction (SFF) and the hardware fault tolerance (HFT).

- Type B devices include analog transmitters and shut-off valves **with** complex components, e.g. microprocessors (also see IEC 61508, Section 2).
- For detailed information on values and hardware/firmware versions for your device, refer to the manufacturer declaration for the device (Declaration of Conformity, Functional Safety according to IEC 61508 and IEC 61511): Certificates (http://www.siemens.com/processinstrumentation/certificates).

SFF	**HFT for type B devices**		
	0	**1 (0)** 1)	**2 (1)** 1)
< 60 %	Not permitted	SIL 1	SIL 2
60 to 90 %	SIL 1	SIL 2	SIL 3
90 to 99 %	SIL 2	SIL 3	SIL 4
> 99 %	SIL 3	SIL 4	SIL 4

1) Operational reliability in accordance with IEC 61511-1, Section 11.4.4

Operational reliability

According to IEC 61511-1, Section 11.4.4, the hardware fault tolerance (HFT) can be reduced by one (values in brackets) for transmitters and final controlling elements with complex components if the following conditions apply to the device:

- The device is proven in operation.
- The user can configure only the process-related parameters, e.g. control range, signal direction in case of a fault, limiting values, etc.
- The configuration level of the firmware is blocked against unauthorized operation.
- The function requires SIL of less than 4.

See also

General functional safety (http://www.siemens.com/safety)

Functional safety in process instrumentation (http://www.siemens.com/SIL)

8.3 Settings

Introduction

When using the device for functional safety, follow these steps:

Procedure

1. Setting safety-relevant parameters (Page 144)
2. Checking the safety function (Page 134)
3. Enabling write protection (Page 150)

8.4 Safety-related characteristics

The safety characteristics necessary for using the system are listed in the "SIL Declaration of Conformity". These values apply under the following conditions:

- SITRANS P DS III pressure transmitters are only used in applications with a low demand rate for the safety function (low demand mode).
- The safety-relevant parameters/settings were entered before the safety-instrumented operation via PROFIBUS communication. Check the safety-relevant parameters/settings by means of PDM; refer to chapter "PROFIsafe Configuration (Page 144)".
- The safety function test has been concluded successfully.
- The pressure transmitters are protected from accidental and unauthorized changes/operation.

- Fault rates are calculated on the basis of a mean time to repair (MTTR) of eight hours (order option C21).
- Only one SITRANS P DS III device is required for single-channel operation in accordance with SIL 2.
- Secure data transmission is only guaranteed when using a PROFIsafe master.

8.5 Maintenance/check

8.5.1 Overview

Checking safety

Check the safety function of the entire safety circuit on a regular basis in accordance with IEC 61508/61511. The test intervals are determined in the course of calculations for each safety circuit of a system (PFD_{AVG}).

Checking safety function/proof test

Runs this test to detect hidden serious faults of the pressure transmitter.

Hidden faults result in incorrect measurements and dangerous failures in your safety-related system.

If necessary, replace the pressure transmitter.

Enabling write protection

After parameter assignment/commissioning as well as after a proof test, perform the following steps:

1. Disable the write protection. For this purpose you have various options, which are described in the section "Write protection (Page 150)".
2. Protect the keys from unintended change in the parameters, e.g. by selecting the key lock or function lock (Mode 10).

Electronics and measuring cell

The safety function of the pressure transmitter is ensured only if you use the electronics, measuring cell, display and connection board delivered by the factory. These components cannot be replaced.

8.5.2 Checking safety function/proof test

Requirement

- You should preferably check the safety function while the device is installed. If this is not possible, you can also check the safety function when the device is not installed. Make sure that the pressure transmitter is mounted in the same position for testing as it is in the system.
- Observe the information in the section Write protection (Page 150).
- If you are using add-on parts, also see the tests in section Add-on parts (Page 140).

Procedure

1. Make sure that the test does not inadvertently result in an emergency shutdown of the system.
2. Make sure that there are no active warnings or error messages.
3. Check temperature sensors (Page 135).
4. Check response time of pressure transmitter (Page 135).
5. Conduct a two-point measurement:

   Two-point measurement ≥ 10% of the maximum measuring range. (Page 135)

   - or -

   Two-point measurement ≥ 50% of the maximum measuring range. (Page 138)
6. Make sure that the pressure transmitter is in measuring mode.
7. After the test, make sure that the emergency shutdown of the system is working again.
8. Disable the write protection.

Result

If you are conducting the test as described, you will detect dangerous faults to a certain degree that are not detected by runtime diagnostics:

- With two-point measurement ≥ 10% of the maximum measuring range: 89% of the faults are detected.
- With two-point measurement ≥ 50% of the maximum measuring range: 98% of the faults are detected.

Interval

- Check the pressure transmitter regularly for proper function (proof test) to detect influences which could reduce the functionality of the pressure transmitter in time.
- Select the interval according to the process and ambient conditions of the installation location of the pressure transmitter.

Note

For a safety-instrumented system, we recommend checking the device at regular intervals of one year.

8.5.2.1 Checking temperature sensors

Procedure

- Read the sensor temperature and the electronics temperature via communication.
- Check whether the measured sensor temperature is within the range of -50 °C to 120 °C.
- Check whether the measured electronics temperature is within the range of -50 °C to 90 °C.

If the measured temperatures are not within this range, the temperature sensor is defective.

8.5.2.2 Check response time of pressure transmitter.

Procedure

To check whether the response time of the pressure transmitter meets the requirements of the process plant, follow these steps:

- Change the pressure at the input abruptly from a base value by ≥ 10% of the maximum measuring range and check the measured values that result from this.

  Note that the set damping can affect the damping of the response time of the pressure transmitter.

8.5.2.3 Two-point measurement ≥ 10% of the maximum measuring range

General procedure

Requirement

The difference between the first input pressure and the second input pressure is ≥ 10% of the maximum measuring range.

Checking the measuring range

1. Apply an initial input pressure.
2. Check the transferred value.

3. Apply a second input pressure.
4. Check the transferred value.

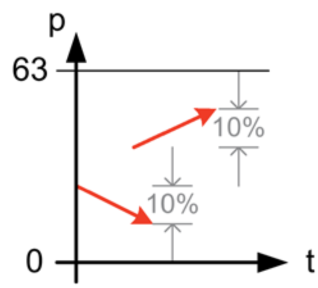
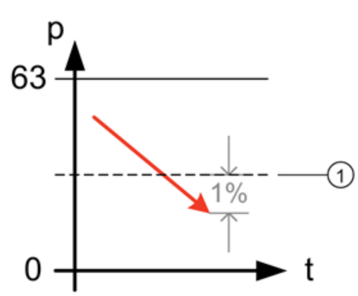


Image 8-3 Example of two-point measurement 10%

Procedure for monitoring a minimum pressure

Checking monitoring of a minimum pressure

1. Check the monitoring of the minimum pressure with the threshold defined in the system.
2. Apply an input pressure value that is above the threshold.
3. Apply an input pressure value that is ≥ 1% of the maximum measuring range below the threshold.



① Threshold

Image 8-4 Example of monitoring of a minimum pressure

Procedure for monitoring a maximum pressure

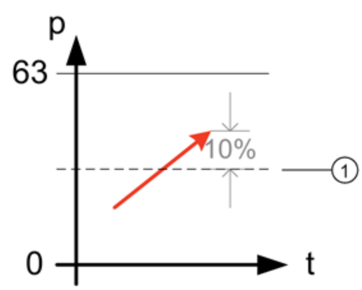
Checking monitoring of the maximum pressure

1. Check the monitoring of the maximum pressure with the threshold defined in the system.
2. Apply an input pressure value that is below the threshold.
3. Apply an input pressure value that is ≥ 10% of the maximum measuring range above the threshold.

Note

Step 3 can only be performed if the maximum limit value is ≥ 10% below the maximum full scale value. Otherwise, check only up to full scale value.

However, the test range must be ≥ 10% of the maximum measuring range.



① Threshold

Image 8-5 Example of monitoring of a maximum pressure

Result

The two-point measurements are successful when the deviation between input pressure and transferred value is ≤ 0.2%.

Negative measurement result

If the two-point measurements of the pressure transmitter were not successful, the SIL level is no longer guaranteed.

- Replace the pressure transmitter.

8.5.2.4 Two-point measurement ≥ 50% of the maximum measuring range

General procedure

Requirement

The difference between the first input pressure and the second input pressure is ≥ 50% of the maximum measuring range.

Checking monitoring of the maximum measuring range

1. Apply an initial input pressure.
2. Measure the transferred value.
3. Apply a second input pressure.
4. Measure the transferred value.

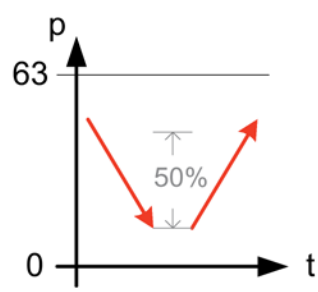
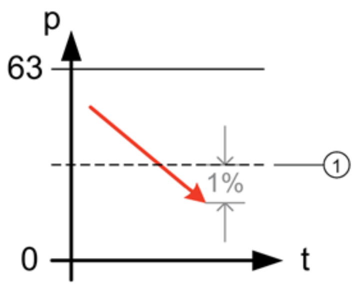


Image 8-6 Example of two-point measurement 50%

Procedure for monitoring a minimum pressure

Checking monitoring of a minimum pressure

1. Check the monitoring of the maximum pressure with the threshold defined in the system.
2. Apply an input pressure value that is above the threshold.
3. Apply an input pressure value that is ≥ 1% of the maximum measuring range below the threshold.



① Threshold

Image 8-7 Example of monitoring of a minimum pressure

Procedure for monitoring a maximum pressure

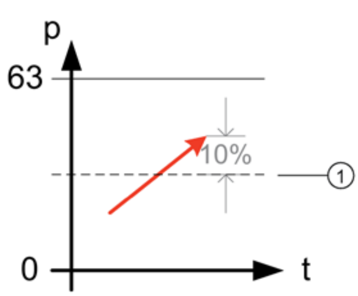
Checking monitoring of the maximum pressure

1. Check the monitoring of the maximum pressure with the threshold defined in the system.
2. Apply an input pressure value that is below the threshold.
3. Apply an input pressure value that is ≥ 10% of the maximum measuring range above the threshold.

Note

Step 3 can only be performed if the maximum limit value is ≥ 10% below the maximum full scale value. Otherwise, check only up to full scale value.

However, the test range must be 50% of the maximum measuring range.



① Threshold

Image 8-8 Example of monitoring of a maximum pressure

Result

The two-point measurements are successful when the deviation between input pressure and transferred value is ≤ 0.2%.

Negative measurement result

If the two-point measurements of the pressure transmitter were not successful, the SIL level is no longer guaranteed.

- Replace the pressure transmitter.

8.5.2.5 Checking pressure transmitter for external damage

- Make sure that the terminal compartment is dry.
- Make sure that the enclosure and the process connections do not have any leaks through which the filling oil or the process medium could escape.
- Check the enclosure for critical damages.
- Make sure that the connecting cable is plugged in correctly and that it is not damaged.

8.6 Add-on parts

This chapter contains safety information for add-on parts.

WARNING

Add-on parts unsuitable for process medium

Danger of injury or damage to device.

If the process medium is not suitable for the parts which come into contact with it, hot and/or toxic or corrosive substances could be released.

- Refer to the information in the chapter "Technical data (Page 193)".
- Make sure that the add-on parts are suitable for the corresponding application with regard to materials, temperature of process medium, and pressure.

8.6.1 Checking a device with add-on pneumatic block

Procedure

1. Check the connection between the pressure transmitter and pneumatic block and between the pneumatic block and pipelines in the plant for leaks.
2. Observe the safety information and specifications in chapter Installing / mounting (Page 39).

3. Check the following valves for correct positioning and absence of leaks:
   – Process valves
   – Stabilizing valve
   – Vent valves
   – Blowout valves or plugs
4. Observe the safety information and specifications in chapter Commissioning (Page 171).

8.6.2 Checking a device with add-on remote seal

Procedure

1. Check the connection between the pressure transmitter and remote seal and between the remote seal and the plant for leaks.
2. Observe the safety information and specifications in chapter Installing / mounting (Page 39).

8.7 PROFIsafe

8.7.1 Introduction

PROFIsafe enables safe communication by detecting and reporting all communication errors. Data security is continuously monitored on the PROFIBUS in the process.

8.7.2 Technical advantages of PROFIsafe

The main advantage of PROFIsafe is that the PROFIBUS communication channel becomes secured by a protocol in a transparent way. Thus incorrect values cannot be transferred to the master without being discovered. The user does not need any special network components. All the user needs is the standard network components of PROFIBUS. However, the CPU must be suitable for safety applications.

In the following example, you see that PROFIsafe and PROFIBUS devices can be operated simultaneously on a PROFIBUS network.

Note

PROFIsafe devices can only be operated with the S7 F Systems V6.1 configuration software in combination with S7-400H.

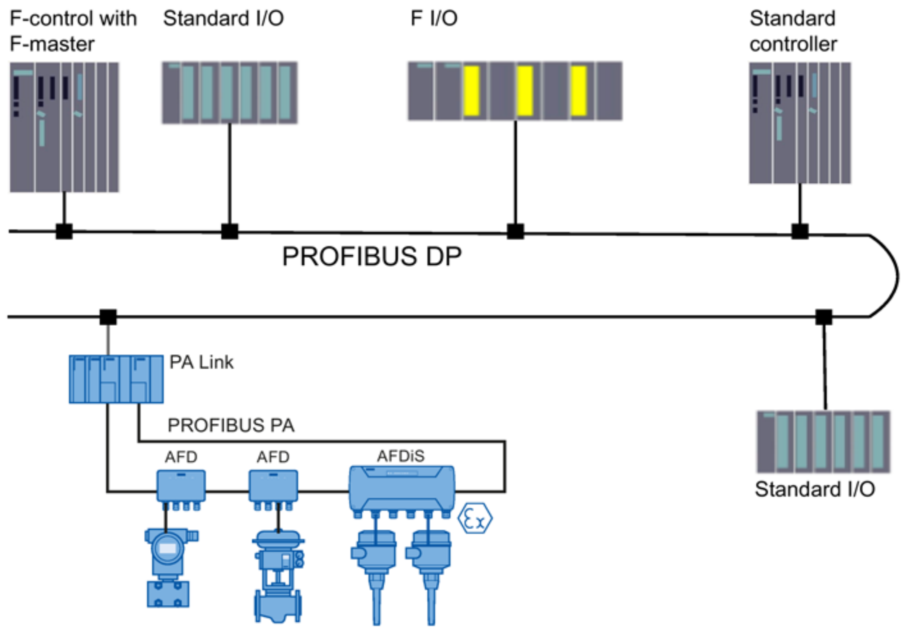


Image 8-9 Example of PROFIsafe communication

See also

PI PROFIBUS - PROFINET (http://www.profibus.com/home/)

8.7.3 Further information

Standards

The PROFIsafe protocol was developed while taking the international standard IEC 61508 into account. The IEC 61508 governs the requirements for the functional safety of products and systems. The use of the IEC 61508 in the process industry is described in the application-specific standard IEC 61511.

Safety levels

The device meets the requirements of Safety Integrity Level 2 (SIL).

Note

You will find more information on safety engineering and installing PROFIsafe in the document "Safety Engineering in SIMATIC S7".

See also

General functional safety (http://www.siemens.com/safety)

Functional safety in process instrumentation (http://www.siemens.com/SIL)

Product information on SITRANS P in the Internet (http://www.siemens.com/sitransp)

8.7.4 Preconditions

CPU

The CPU must be capable of operating in fail-safe mode to be able to communicate with PROFIsafe devices.

These F-CPUs are contained in the catalog ST 70, SIMATIC S7.

Electronic Device Description (EDD):

Operate your application in conjunction with the EDD and GSD of SITRANS P, series DSIII PA PROFIsafe in the following system environment:

- with EDD version 01.02.01-53 with GSD "SI0180A6.GSD revision 1.03"
  - PCS 7 V7.0 and F systems V5.2SP4 with library Failsafe Blocks (V1_2) or
  - PCS 7 V7.0 and F systems V6.0 with library Failsafe Blocks (V1_2) or
- EDD version 01.02.02 or higher with GSD "SI0180A6.GSD revision 1.04" with PCS 7 V7.0 SP1 and F systems V6.0 with library S7 F Systems Lib V1_3
- EDD version 01.02.03 or higher with GSD "SIEM8170.GSD revision 1.0" with PCS7 V7.1 SP3 and F systems V6.1 with libraryS7 F Systems Lib V1_4

Note

With this EDD, the "PROFIBUS Ident number" parameter can be set to manufacturer-specific (3.01), PROFIsafe V1/V2

PROFIsafe device

For safety reasons, the PROFIsafe device ships with default settings. This means PROFIsafe is deactivated. You activate PROFIsafe with the PROFIsafe commissioning.

Technical requirements for PROFIsafe:

- SIMATIC PDM HF1
- EDD from 01.02.01
- Firmware from 301.02.01

8.7.5 PROFIsafe Configuration

For safety reasons, the PROFIsafe device ships with default settings.

Requirement

Before you commission the PROFIsafe device, configure it, for example in STEP 7.

Process

8.7.5.1 Import EDD with SIMATIC PDM

To import the EDD, click on "SIMATIC PDM" > "Manage Device Catalog".

8.7.5.2 Configure CPU with HW Config

The relevant settings for fail-safe of the CPU are located in the CPU-specific documentation.

Procedure

If your CPU is a SIMATIC CPU, proceed as follows:

1. Double click on the CPU.
2. You are now in the "Properties" dialog box on the "Protection" tab. Activate the following checkboxes:
   - Protection level "1"
   - "Removable with password"
   - "CPU contains safety program"

8.7.5.3 Configure device with HW Config

Procedure

1. You are in the "Catalog" view with the "standard" profile. Go to the device in the catalog:
   - "PROFIBUS-PA > Sensors > Pressure > SIEMENS > SITRANS P DSIII PROFIsafe" valid for firmware 0301.02.01 and 0301.02.02
   - "PROFIBUS-PA > Sensors > Pressure > SIEMENS > SITRANS P DSIII PROFIsafe V2"
     valid as of firmware 0301.02.03

   Note

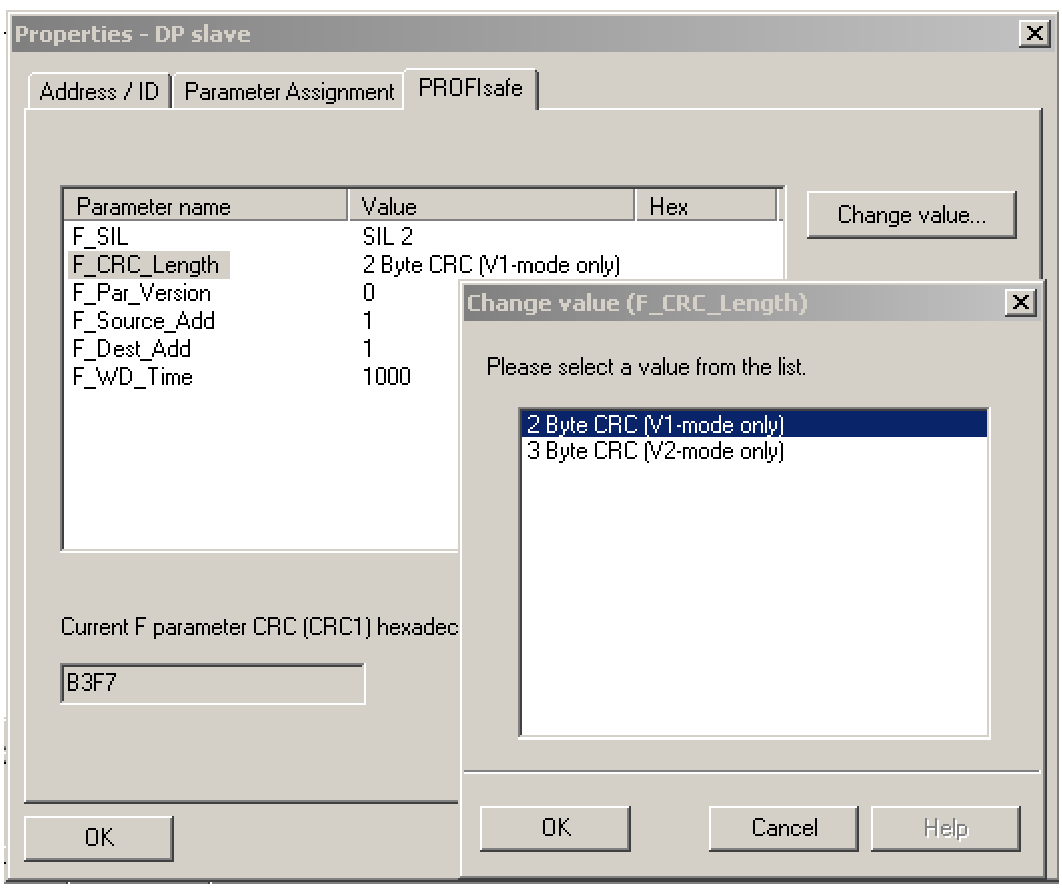
   You will find the valid firmware version on the label and can then select the correct GSD file for your version.

2. Pull the following device onto "PA Master System" with Drag & Drop.
   The "Properties" dialog then opens.

3. Set the PROFIBUS address.
   The device is displayed in HW Config with the default configurations.
4. Delete the default module of the device at Slot 1.
5. You are now in the "Catalog" view. For the PROFIsafe device, select the fail-safe-compliant configuration "F:Pressure\Level\Flow\Temp".
6. Drag the F-module to slot 1.
7. Open the "PROFIsafe" tab in the "Properties - DP slave" dialog of the catalog.
8. Check the PROFIsafe address, parameter "F_Dest_ADD".

   Note:

   You must set the PROFIsafe address, parameter "F_Dest_ADD" to the same value later using the PDM table in the device.
9. Valid as of firmware 0301.02.03:
   Select the PROFIsafe protocol version V1 or V2 with which the device will work.
   - crc length = 3, F-Par-Version = 1 → V2 PROFIsafe protocol
   - crc length = 2, F-Par-Version = 0 → V1 PROFIsafe protocol



10. Adapt the value of the "F_WD_Time" parameter to the number of PROFIBUS devices connected to the PROFIBUS-PA bus. The default value for this parameter is 1 second.

11.Close the "Properties - DP slave" dialog of the catalog.

12.Click the "Save and compile" button.

13.Press the "Download to module" button.

Note

F-CPUs for PROFIsafe V2 communication

With F-CPUs, if you set "F_Par_Version" to "1" for a device, a communications error occurs in the case of safety-oriented communication with the device because PROFIsafe V2 communication does not support this setting. One of the following diagnostic events will then be entered in the diagnostic buffer of the F-CPU:

- "F-I/O passivated": Cyclic redundancy check error/sequence number error.
- "F-I/O passivated": F-monitoring time for safety frame exceeded.

To make sure that PROFIsafe V2 communication works correctly, use only F-CPUs approved for this purpose.

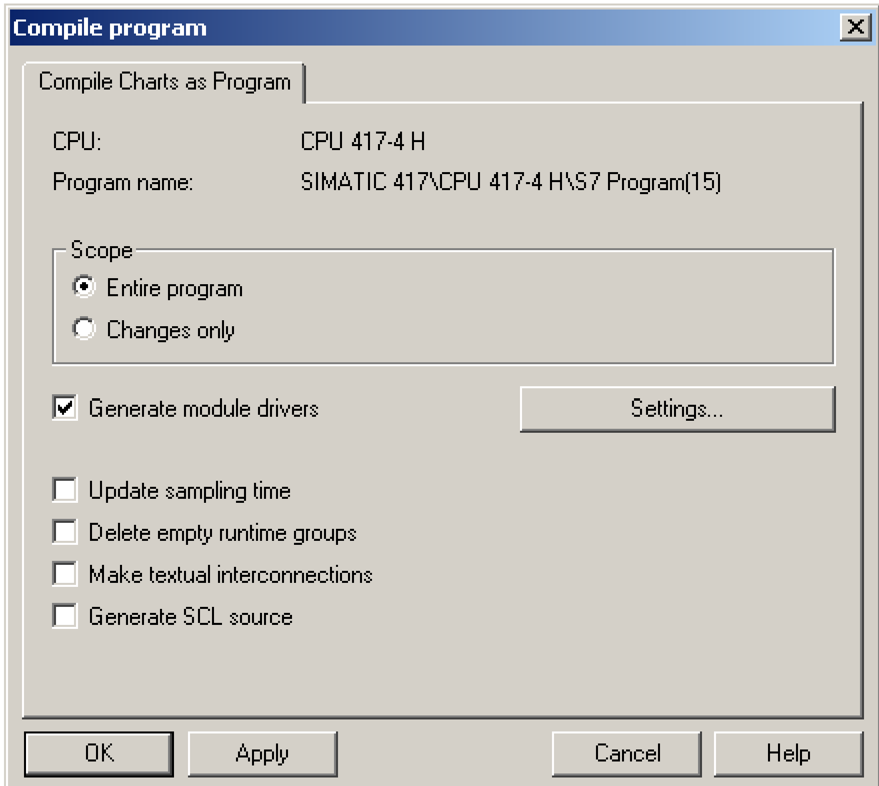
8.7.5.4 Configure CFC

Procedure

1. You are in the "Catalog" window, "Libraries" tab.
2. Locate the block "F_PA_AI [FB356] in the "Failsafe Blocks" library.
3. Pull the block into the plan with Drag & Drop.
4. Set the parameter "Value", value type "Real" in the block "F_PA_AI" as follows:
   - Click this parameter with the right mouse button.
   - Select "Connect to Operand..." in the context menu.

     A selection list of transfer rates is displayed.
   - Connect the parameter value of the block "F_PA_AI" with the real value of the configured device.
5. Click the "Compile program" button.

6. Select the "Generate module drivers" check box.



7. Click the "OK" button.

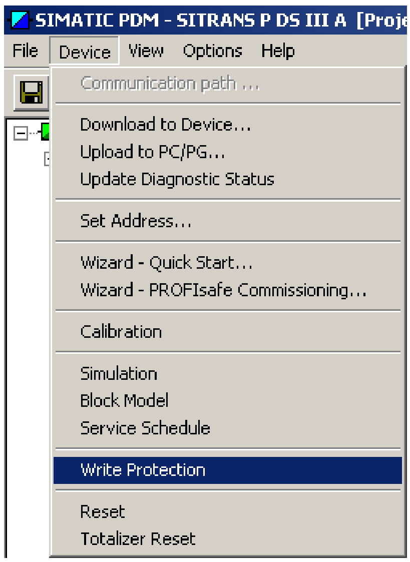
   The parameters are connected.

Note

Until PROFIsafe commissioning is completed, the device displays the error "B_60: Bad function check". This has no effect on the operation of the device. The error message lets you know that the device is not yet in "S4".

8.7.6 Write protection

8.7.6.1 Overview



Write protection

The following write-protection options are available:

- Lock or unlock device

  The dialog box shows the current write protection. If you have activated write protection with PIN, you can lock or unlock the device with the PIN here.

  Default PIN: 2457

- Change stored PIN

  The dialog box shows the current write protection. In addition, you enter your desired PIN here.

- Enter Super PIN

  If you have forgotten your PIN, it is possible to deactivate the write protection by entering the super PIN. The device resets the PIN to the default value.

  Super PIN: G73KMQ2W

See also

Activate write protection using PIN in SIMATIC PDM (Page 151)

Activate and parameterize PROFIsafe with SIMATIC PDM (Page 152)

Disable write protection using PIN in SIMATIC PDM (Page 160)

8.7.6.2 Activate write protection using PIN in SIMATIC PDM

Requirement

The device is in the PROFIsafe commissioning status "S1".

Procedure for creating user-defined PIN

1. In the "Device" menu, select the "Write protection" command.
2. Click the "Change PIN" button.
   An additional dialog opens.
3. Enter the desired PIN.
4. Click "OK".
   The dialog closes.
5. Click the "ON" button.
6. Click the "Close" button.

Create default PIN

1. In the "Device" menu, select the "Write protection" command.
2. Click the "ON" button.

Result

The "Write protection" dialog is closed.

A user-defined PIN has been created for the write protection.

8.7.7 PROFIsafe Commissioning

Requirement

Before you commission the PROFIsafe device, configure it, for example in STEP 7.

Process

Activate and parameterize PROFIsafe with SIMATIC PDM (Page 152)

Commission PROFIsafe with SIMATIC PDM (Page 153)

Check write protection with SIMATIC PDM (Page 158)

8.7.7.1 Activate and parameterize PROFIsafe with SIMATIC PDM

Procedure

1. Click the "Upload to PC" button.

   SIMATIC PDM reads in the parameters from the device.
2. Under ">> PROFIsafe", set the "PROFIsafe activation" parameter to "Yes".
3. Set the "F_Dest_ADD" parameter so that it has the same value as in HW Config.
4. If you must change other parameters, then parameterize them.
5. Press the "Download to device" button.

Result

The device has activated the PROFIsafe functionality. The relevant menus for PROFIsafe commissioning are active in SIMATIC PDM.

Note

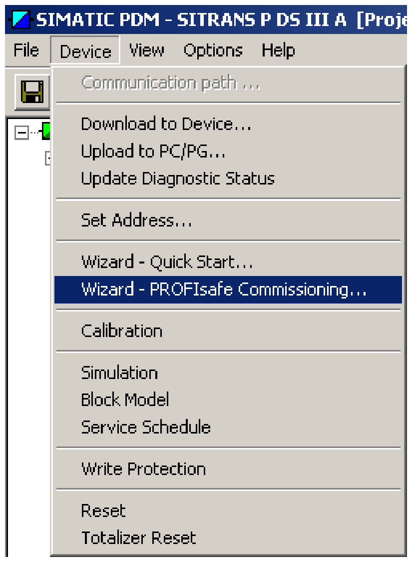
If you want to change the "F_Dest_ADD" parameter later, reset the device.

Resetting the device (Page 159)

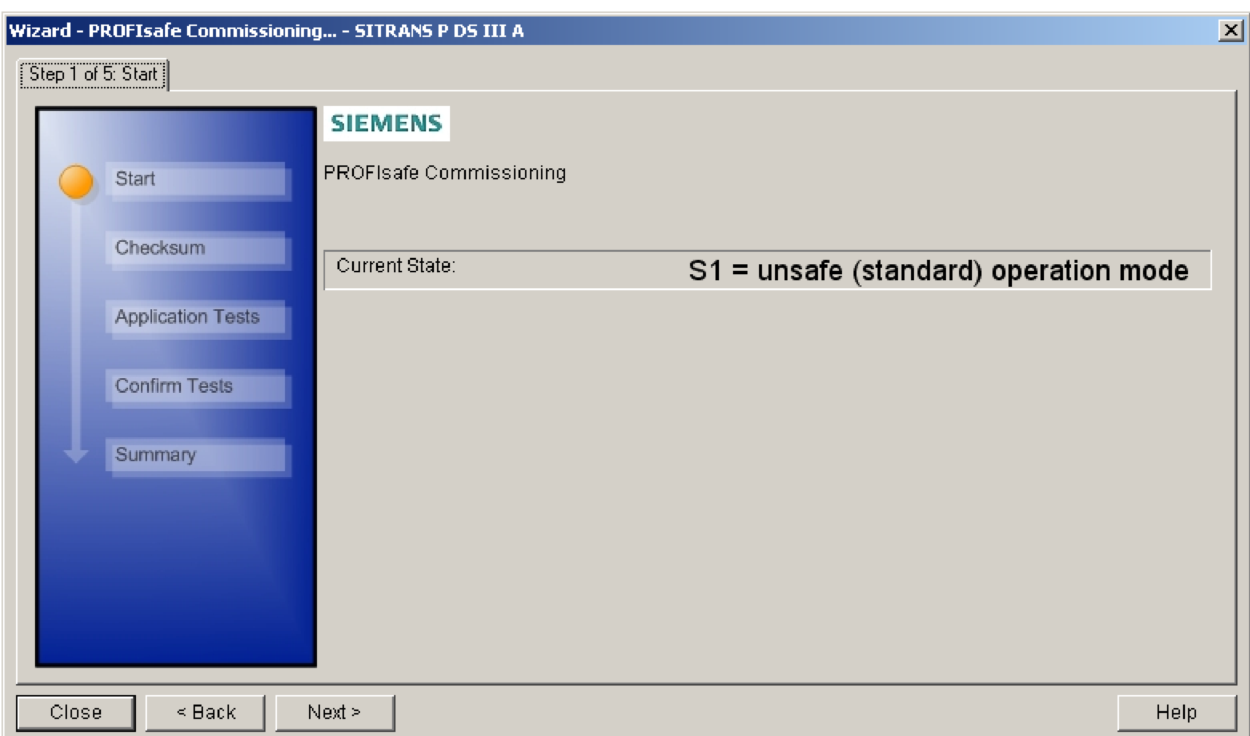
8.7.7.2 Commission PROFIsafe with SIMATIC PDM

Start PROFIsafe commissioning

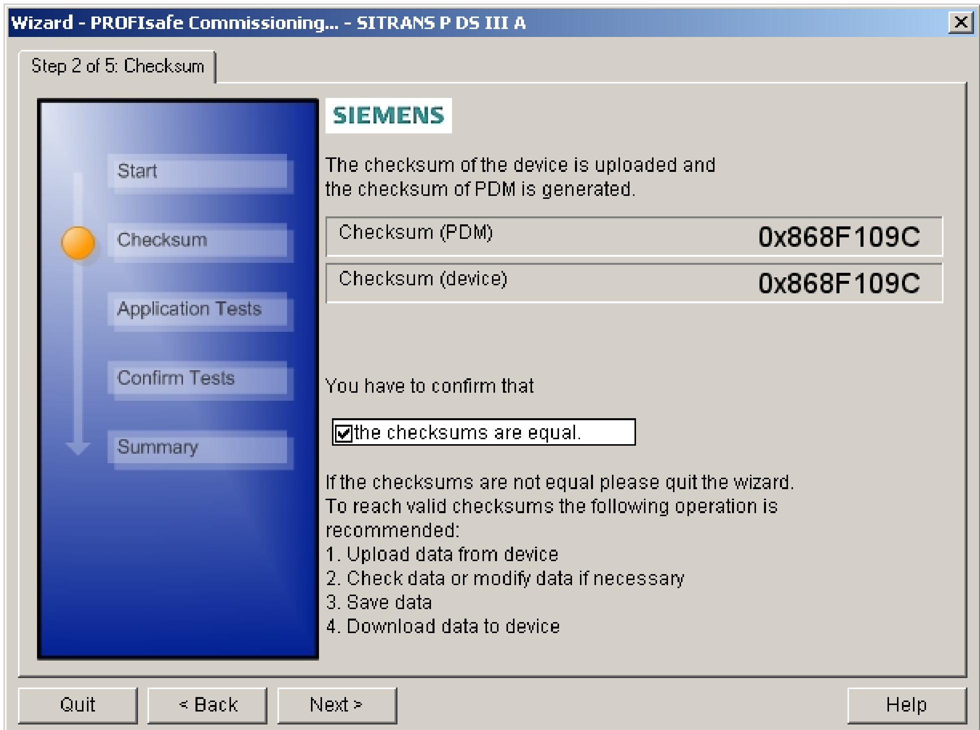
1. In the "Device" menu, select the "Wizard - PROFIsafe commissioning" command.



The "Wizard - PROFIsafe commissioning" dialog box is opened.

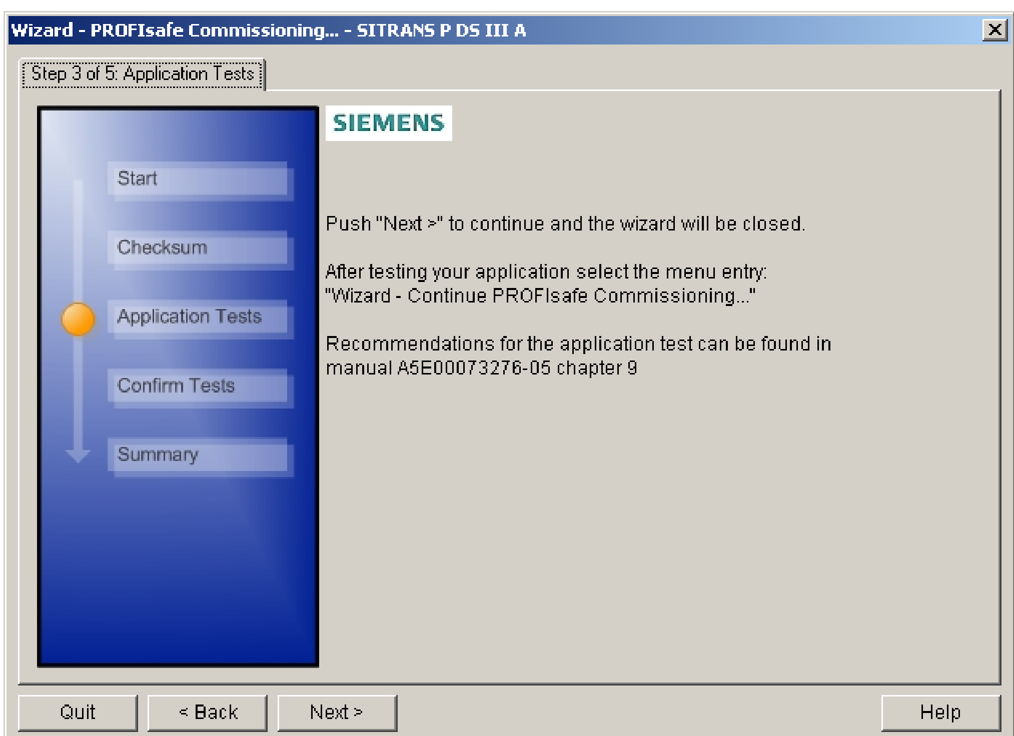


2. Click "Next".



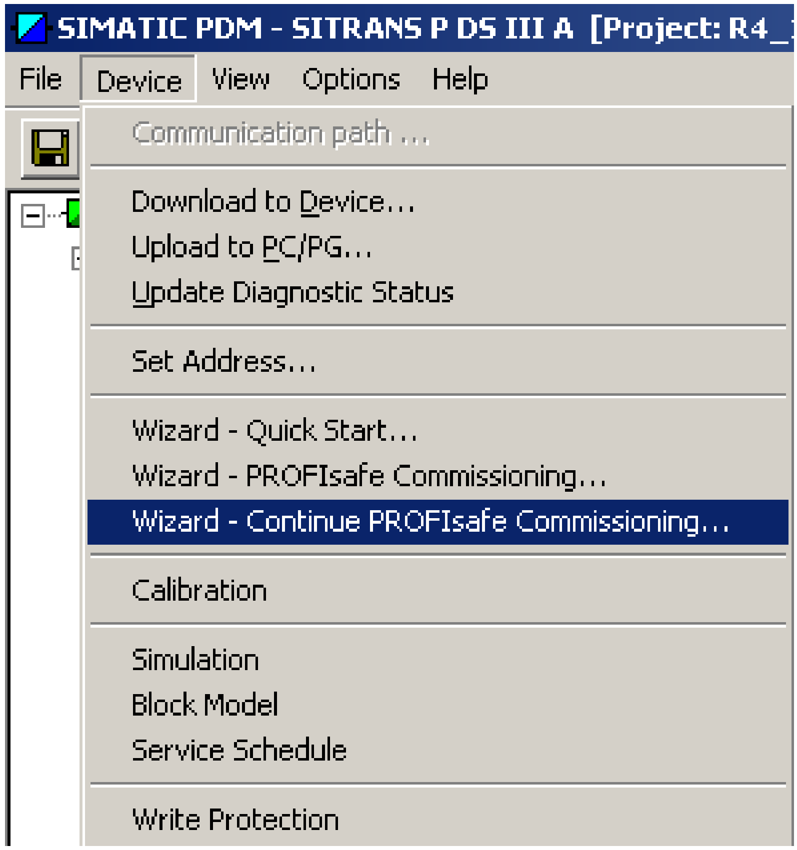
3. If the checksums are the same, select the checkbox.

   You obtain further information.

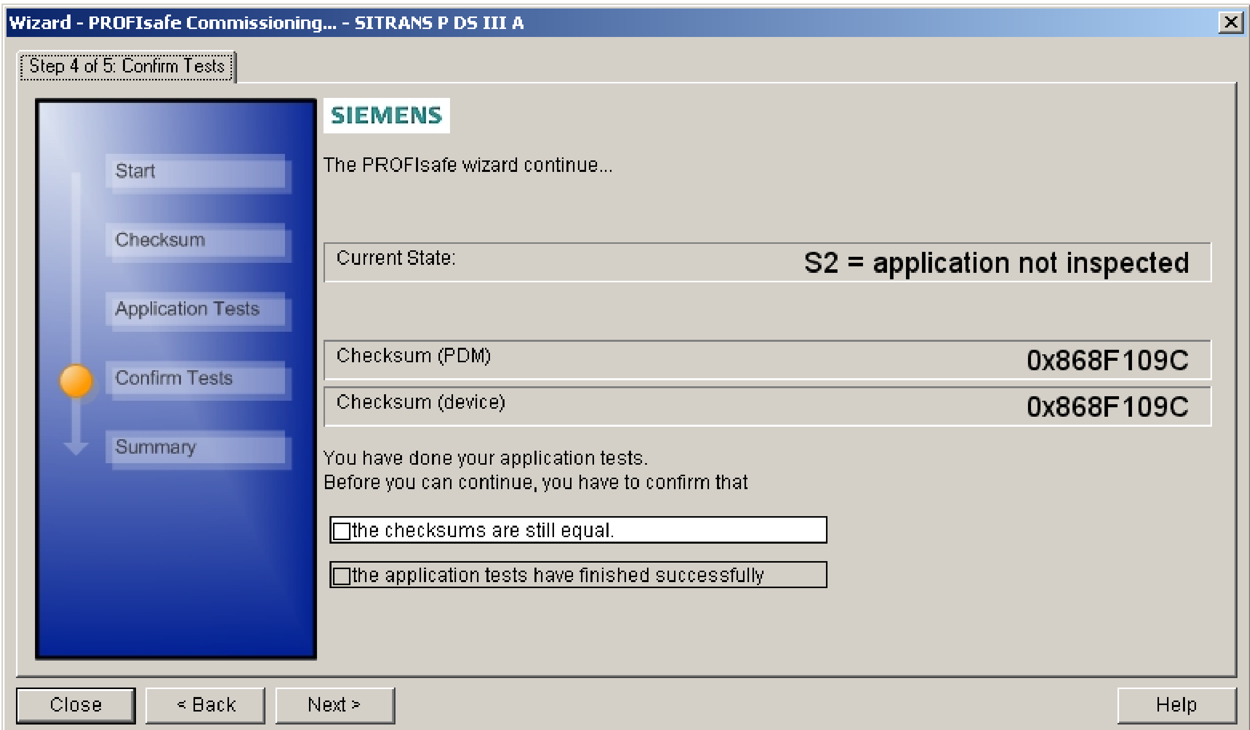


4. Click "Next".
5. Click "OK" to confirm the message that follows.

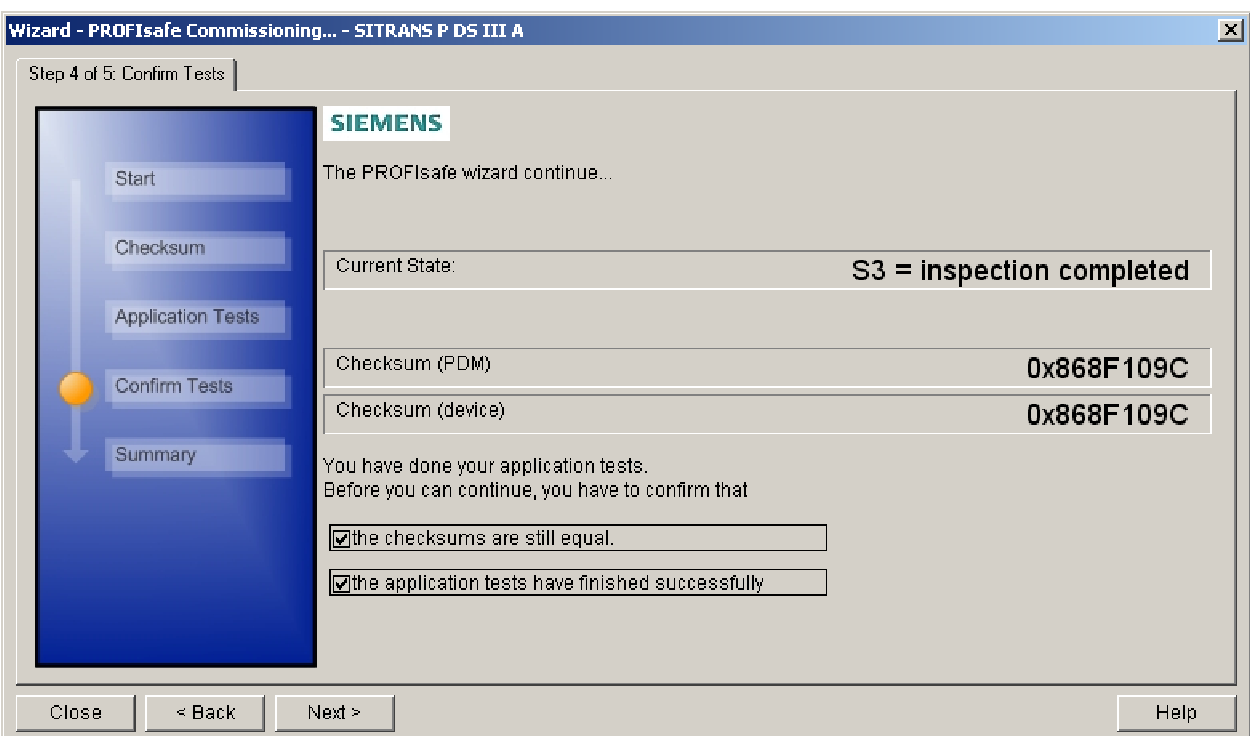
6. In the "Device" menu, select the "Wizard - continue PROFIsafe commissioning" command.



The "Wizard - PROFIsafe commissioning" dialog box is opened again.



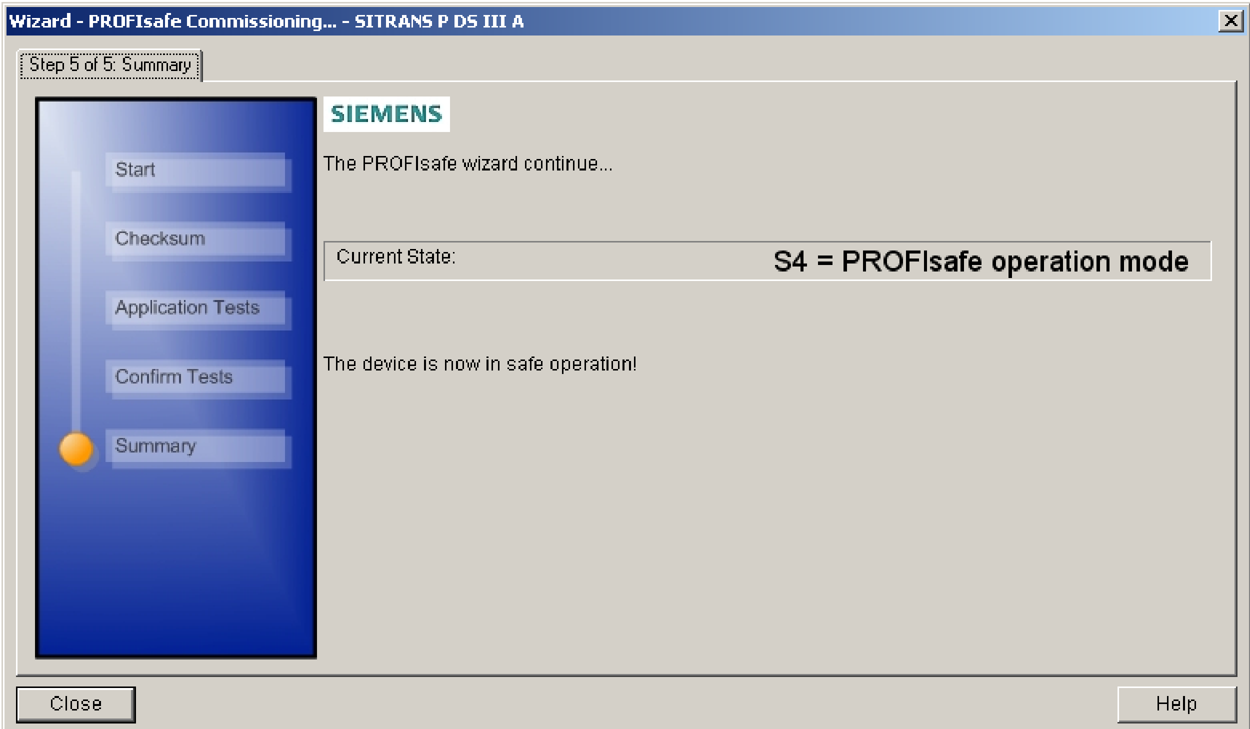
The PROFIsafe commissioning status shows the following: "S2 = application not inspected".



7. If the checksums are still the same, select the checkboxes.

   The PROFIsafe commissioning status shows the following: "S3 = inspection completed".

8. Click "Next".



The PROFIsafe commissioning status shows the following: "S4 = PROFIsafe operation mode"

9. Click the "Close" button.

Result

The "Wizard - PROFIsafe commissioning" dialog box is closed.

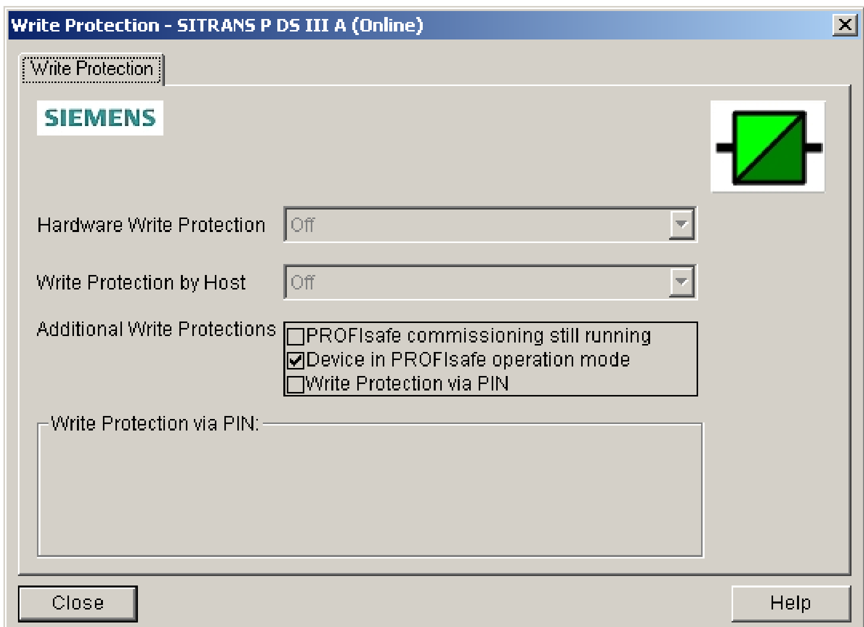
The PROFIsafe device is in "S4" and is write protected accordingly.

8.7.7.3 Check write protection with SIMATIC PDM

Procedure

To check the write protection in the PROFIsafe Commissioning State, e.g. "S4", proceed as follows:

1. In the "Device" menu, select the "Write protection" command.
2. Make sure that the second option checkbox is active.



Note

Local operation

The write protection in the PROFIsafe Commissioning State "S4" restricts local operation. The parameters that affect the local appearance of the display can be adjusted.

Note

SIMATIC PDM operation

The write protection in the PROFIsafe commissioning status "S4" allows the maintenance timer to be changed, for example for the calibrating interval of the electronics and for the servicing interval of the sensor.

Note

Additional write protection by HOST

The additional write protection by HOST is set in Continuous Function Chart (CFC) in the F_PA_AI function block, I_PAR_EN parameter.

Note

If you need a user-defined PIN write protection, you will find it in the appropriate chapter.

See also

Overview (Page 150)

Activate write protection using PIN in SIMATIC PDM (Page 151)

8.7.7.4 Speeding up the commissioning process

Parameter setting

During PROFIsafe commissioning you only have 60 seconds for confirmation between steps S3 and S4.

Proceed as follows to speed up commissioning of the device:

1. Insert the blocks from the library into the CFC and interconnect them.
   Show the properties of the "F_PA_AI" block.
2. Go to the folder "Connections" and change the preselection of the "IPAR_EN" connection from hidden to visible.
3. Close the "Properties" menu.
   The input "IPAR_EN" is now visible at the "F_PA_AI" block.
4. Assign this input with "1."
   Write protection of the host is now cancelled.
5. Now go to the PDM table of SITRANS P DSIII PA PROFIsafe
6. Set the "Service Diagnostics" parameter to locked under "Performance > Status/Diagnostics add-on."
7. Save this setting before commissioning.
8. Once you have concluded commissioning, unlock the "Service Diagnostics" parameter once again to receive all diagnostics information of the device.

8.7.7.5 Resetting the device

The following procedure no longer belongs to standard commissioning. Take the following steps only when necessary.

Procedure

1. Select the "Master Reset" command in the "Device" menu.
   The "Master Reset - ..." dialog opens.
2. Click the "Warm restart" button.

Note

Procedure when subsequently changing the F parameter

1. Carry out a change to an F parameter using HW Config or PDM.
2. Select the "Reset" command in the "Device" menu.
   The "Reset - ..." dialog opens.
3. Click the "Warm restart" button.
   As a result of the warm restart, the change to the F parameter is included in the cyclic communication procedure.

8.7.8 Quit PROFIsafe commissioning

8.7.8.1 Preparations for maintenance and service

Procedure

Before you perform maintenance on a PROFIsafe device, proceed as follows:

1. Deactivate "PROFIsafe Commissioning".
2. Disable the write protection.

8.7.8.2 Deactivating PROFIsafe commissioning in SIMATIC PDM

Procedure

1. In the "Device" menu, select the "Wizard - PROFIsafe commissioning" command.
2. Click the "Change to unsafe mode" button.
3. Click the "Close" button.

8.7.8.3 Disable write protection using PIN in SIMATIC PDM

Procedure

1. In the "Device" menu, select the "Write protection" command.
2. Click on the "OFF" button.
3. Enter the user-defined PIN, the default PIN, or the super PIN.

See also

Overview (Page 150)

8.7.9 Replacing a device

Replacing a PROFIsafe device with firmware <= 0301.02.02 or a PROFIBUS device with a PROFIsafe device with firmware 0301.02.03 or higher

When shipped, PROFIsafe is disabled on the replacement device.

Requirement

Import the PROFIsafe EDD as of version 01.02.03 to the device catalog of SIMATIC PDM.

Process

1. Replace the device.
2. Configure the device. You have two options:
   - Making settings locally
   - Host system

The EDD of the new device must be reassigned to that of the replaced PDM object. Making the reassignment in the "Process Devices - Network View" of the SIMATIC Manager.

8.7.9.1 Making settings locally

Procedure

1. Set mode 16.
2. Set the device mode [129] with the [↑] and [↓] keys.
3. Save with the [M] key.

Device modes

Display	Meaning
[0]:	Profile-compliant: Exchangeable for pressure transmitters with PROFIBUS PA Profile 3.0, with analog input function block (without totalizer) (as standard device only)
[1]:	State as shipped Profile-compliant with expansions: Full range of functions of the SITRANS P, series DS III PROFIsafe with: • Analog input function block • Safe analog input • Totalizer PROFIsafe communication in mode V1 or V2 possible
[2]:	Can be replaced by the predecessor device SITRANS P, series DS III PA (only as standard device)
[128]:	Profile-compliant: Exchangeable for pressure transmitters with PROFIBUS PA Profile 3.0 (as standard device only) • Analog input function block • Totalizer
[129]:	• Can be replaced by SITRANS P, series DS III PROFIsafe with PROFIsafe communication only possible in V1 mode. • In this device operating mode a SITRANS P, DS III PA series (standard device with Profibus Profile 3.00 or 3.01) can be replaced by a SITRANS P, DS III PROFIsafe series (firmware version 0301.02.03 or higher).

A specific Generic Station Description (GSD) file is assigned to each device mode:

Display	File name
[0]:	pa_29700.gsd or pa_39700.gsd
[1]:	siem8170.gsd
[2]:	sip1804B.gsd
[128]:	pa_29740.gsd or pa_39740.gsd
[129]:	SI0180A6.gsd or SIEM80A6.gsd or SI0280A6.gsd

8.7.9.2 Configuration with host system

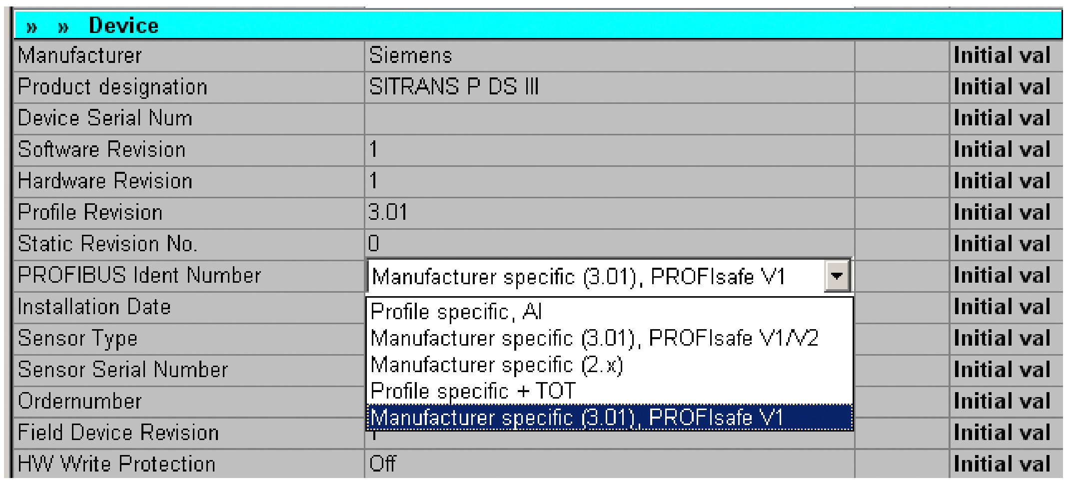
Note

Generic Station Description (GSD)

The generic station description file in HW Config remains the same: **SI0180A6.gsd.**

Procedure

1. Using the EDD, change the "PROFIBUS Ident Number" parameter from manufacturer specific (3.01), PROFIsafe V1/V2 to manufacturer specific (3.01), PROFIsafe V1, if you want to operate your devices with PROFIsafe V1.



Note

Write protection

Check whether or not write protection is disabled. If write protection is enabled, no further configuration is possible, If write protection is enabled, disable it.

---

2. Commission PROFIsafe as described in section PROFIsafe Commissioning (Page 151) .

Result

After downloading the data to the device, cyclic communication with the device is once again possible.

See also

Activate and parameterize PROFIsafe with SIMATIC PDM (Page 152)

Commission PROFIsafe with SIMATIC PDM (Page 153)

Configuration/project engineering 9

9.1 Cyclical data transfer

Cyclical data transmission is used to transfer user data relevant for process automation between the control or automation system (class 1 master) and the pressure transmitter.

Setting the PROFIBUS address

The PROFIBUS is set to 126 at the factory. You set it at the device or using a parameterization tool through the bus, e.g.:

- SIMATIC PDM
- HW Config

The new address will take effect either after the first warm start or when the device is disconnected temporarily from the bus.

9.2 Configuring

9.2.1 Overview of configuration

General

Information on the input and output range as well as the consistency of cyclically transmitted data is defined in the device master data file (GSD file). Using the configuration packet, it is checked by the device and declared valid. During projection it must be determined which data will be transmitted in cyclical operation. This allows the optimization of the data quantity to be transmitted. In the Siemens control system, the GSD files of all the usual devices are already available, and they are also available on the Internet and can be imported later.

Reference

http://www.ad.siemens.de/csi_e/gsd

9.2.2 Configuration of user data

The user data which are provided through the PROFIBUS to the control system are based on the selected target configuration. User data is generated by the function blocks and assembled in the following order:

Analog input function block

The *Analog input function block* provides the content of the "Output" parameter. The *Totalizer function block* provides the content of the "Totalizer output" parameter. You can select in the configuration which function block is used to generate the output data:

- Output
- Totalizer output

In the "Totalizer output" parameter you can insert the following additional functions:

- Reset totalizer output
- Operating mode

Using "Reset totalizer output" you can reset the integrator from the application program, and with "Operating mode" you can determine its function.

Note

For STEP 7, the configuration tool is HW Config.

For STEP 5, the configuration tool is COM_PROFIBUS.

User data

Table 9- 1 User data dependent on the selected function block

Function block / parameter	Byte	User data, sent to master	User data, sent from master	Meaning, depending on parameter
Analog input/output	1-4	Measured value	---	Pressure, height, volume, mass flow, volume flow, sensor temperature, electronics temperature
	5.	Status		
Totalizer / totalizer output	6-9	Measured value	---	Mass or volume
	5	Status		

Table 9- 2 User data, dependent on selected additional function in the totalizer output function block

Additional function	Byte	User data, sent to master	User data, sent from master	Meaning	
Reset totalizer output	1	---	Reset totalizer output	Totalizer reset function	
				0	Normal operation of totalizer Integration running.
				1	Step integration and reset integrator back to 0.
				2	Stop integration and load integrator with preset value.

Additional function	Byte	User data, sent to master	User data, sent from master	Meaning	
Operating mode	2	---	Operating mode	Operating mode of totalizer	
				0	Net counter - count up and down.
				1	Ascending counter
				2	Descending counter
				3	Hold count.

See also

Analog input function block (Page 104)

Flow measurement (Page 111)

9.2.3 Transmission of user data over PROFIBUS

User data is continually updated via PROFIBUS cyclical data transmission.

Table 9- 3 IEEE standard floating point representation of the measured value

Bits	7	6	5	4	3	2	1	0
Byte 1	VZ	E 2^7	E 2^6	E 2^5	E 2^4	E 2^3	E 2^2	E 2^1
Byte 2	E 2^0	E 2^{-1}	M 2^{-2}	M 2^{-3}	M 2^{-4}	M 2^{-5}	M 2^{-6}	M 2^{-7}
Byte 3	M 2^{-8}	M 2^{-9}	M 2^{-10}	M 2^{-11}	M 2^{-12}	M 2^{-13}	M 2^{-14}	M 2^{-15}
Byte 4	M 2^{-16}	M 2^{-17}	M 2^{-18}	M 2^{-19}	M 2^{-20}	M 2^{-21}	M 2^{-22}	M 2^{-23}

VZ Sign
- 0 positive
- 1 negative

M mantissa

E exponent

9.2.4 Status

The status provides information on:

- Usability of the measured value in the application program
- Device status, e.g. self-diagnosis or system diagnostic
- Additional process information, for instance process alarms

The status code consists of one letter and a three-digit number. The letter stands for:

G	Good
U	Unsure
B	Bad

Table 9- 4 Example status code

Digital display	Hex	Configured measured value source	PDM display	Cause	Measure
G_141	8D	Electronics tempera-ture, output	Good, lower alarm limit violated	Lower configured alarm limit violated.	Correct error through user program.
U_071	47	Output	Unsure, last usable value, value constant	Input condition "fail safe" is fulfilled, the parameterized safety setting is set to "keep last valid value".	Check the data meas-urement.
B_011	0B	Secondary variable 3	Bad, not connected, value constant	Variable is not calculated,	Correct the "transmitter type" setting.

See also

Overview of status codes (Page 189)

9.2.5 Diagnosis

Besides status information, the device can also actively send information about its own state. Diagnostics are important information which an automation system can use to initiate corrective measures.

To transmit diagnostic information, the standard mechanisms of the PROFIBUS DP are used and messages are actively sent to the class 1 master. PROFIBUS DP provides a protocol to transmit information to the class 1 master with a higher priority than the user data.

Messages

The content of the "Device state" parameter from the physical block is sent, along with information about whether a state change (event incoming/event sent) has occurred.

The diagnostic object consists of four bytes. For the pressure transmitter, only the first two bytes are relevant.

Table 9- 5 Diagnostics messages

Byte	Bit	Meaning of "1"	Cause	Measure
Byte 0	0			
	1			

Byte	Bit	Meaning of "1"	Cause	Measure
	2			
	3	Electronics temperature too high	The transmitter monitors the temperature of the transmitter electronics. If this exceeds 85 °C, this message is generated.	Reduce the ambient temperature to the permitted range.
	4	Memory errors	During operation, the memory of the cells and the electronics is continually checked for checksum errors and read/write errors. In case of error, this message is generated.	Replace the electronics and, if necessary, the sensor.
	5	Error recording measured value	In case of a sensor failure or the violation of control limits (< -20 % or > +20 % of the nominal measurement range)	Have a service technician check the sensor.
	6			
	7			
Byte 0	0			
	1			
	2			
	3	Restart executed (goes to "0" after 10 seconds)	Power was applied to the device, or a warm start was performed using SIMATIC PDM, or the internal watchdog triggered.	Check the wiring and the supply voltage.
	4	Restart Goes to "0" after 10 seconds	The device was reset to the factory settings.	
	5	Service necessary	A calibration or service interval has run out.	Perform the calibration or service and clear the message and reset the messages using SIMATIC PDM.
	6			
	7	Ident number changed	You changed the parameter "PROFIBUS Ident Number" during cyclical operation. The device signals the change to the ident number and shows a shutdown warning. In case of a restart, the device will no longer participate in cyclic user data exchange unless the system configuration is changed.	Make a change to the configuration data (change the GSD file) so that it matches the ident number configured in the device.

Note

The device state can be simulated using SIMATIC PDM. This allows you to check the reaction of the automation system to an error.

9.3 Acyclic data transfer

Acyclic data transmission is used primarily for the transmission of parameters:

- During commissioning
- During service
- In batch processes
- To display additional measurement data which is not sent during cyclic user data transmission, e.g. raw pressure value

The data traffic between a class 2 master and the field device occurs over a so-called C2 connection. So that multiple class 2 masters can access the same pressure transmitter at the same time, the device supports up to four C2 connections. However, you must ensure that the same data is not being written.

Commissioning 10

10.1 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.

- Before venting ensure that there are no toxic gases or liquids in the device, or take the appropriate safety measures.

WARNING

Improper commissioning in hazardous areas

Device failure or danger of explosion in hazardous areas.

- Do not commission the device until it has been mounted completely and connected in accordance with the information in Chapter "Technical data (Page 193)".
- Before commissioning take the effect on other devices in the system into account.

WARNING

Opening device in energized state

Danger of explosion in areas subject to explosion hazard.

- 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.

10.2 Introduction to commissioning

Following commissioning, the pressure transmitter is immediately ready for use.

To obtain stable measured values, the pressure transmitter needs to be allowed to warm up for around 5 minutes after the power supply is switched on. When it starts up, the pressure transmitter goes through an initialization routine (display at the end: "Init done"). If the pressure transmitter does not complete the initialization routine, check the auxiliary power.

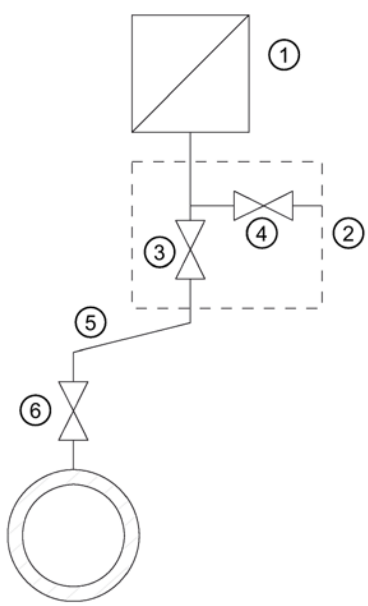
The operating data must correspond to the values specified on the nameplate. If you switch on the auxiliary power, the pressure transmitter is in operation.

The following commissioning cases are typical examples. Configurations different from those listed here may be meaningful depending on the system configuration.

10.3 Gauge pressure, absolute pressure from differential pressure series, and absolute pressure from gauge pressure series

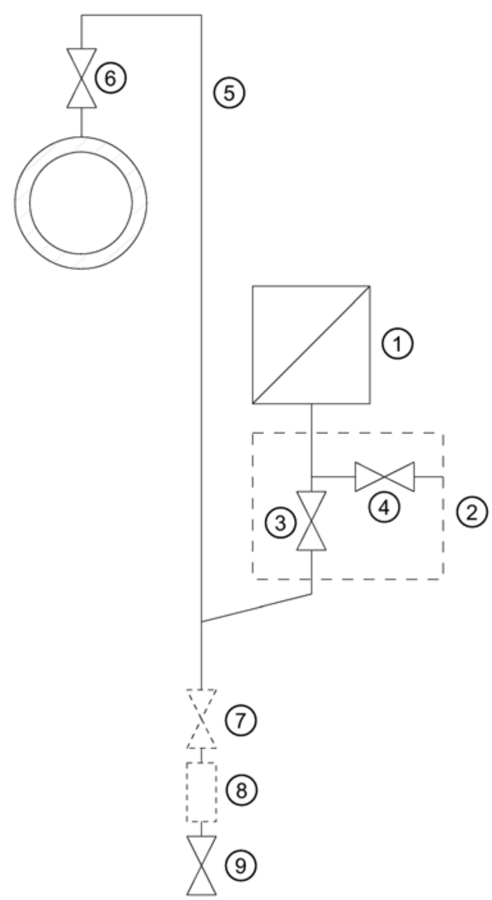
10.3.1 Commissioning for gases

Usual arrangement



Measuring gases above the pressure tapping point

Special arrangement



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	Drain valve

Requirement

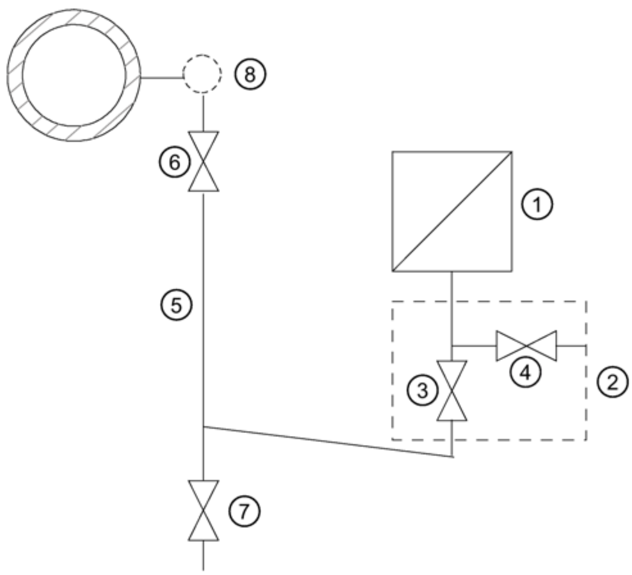
All valves are closed.

Procedure

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 ①.
3. Check the start of scale value.
4. If the start of scale value differs from the value desired, correct it.
5. Close the shut-off valve for the test connection ④.
6. Open the shut-off valve ⑥ at the pressure tapping point.
7. Open the shut-off valve for the process ③.

10.3.2 Commissioning with steam or liquid



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 Blow-out valve
⑧ Compensation vessel (steam only)

Image 10-1 Measuring steam

Requirement

All valves are closed.

Procedure

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 ①.
3. Check the start of scale value.
4. If the start of scale value differs from the value desired, correct it.
5. Close the shut-off valve for the test connection ④.

6. Open the shut-off valve ⑥ at the pressure tapping point.
7. Open the shut-off valve for the process ③.

10.4 Differential pressure and flow rate

10.4.1 Safety notes for commissioning with differential pressure and flow rate

WARNING

Incorrect or improper operation

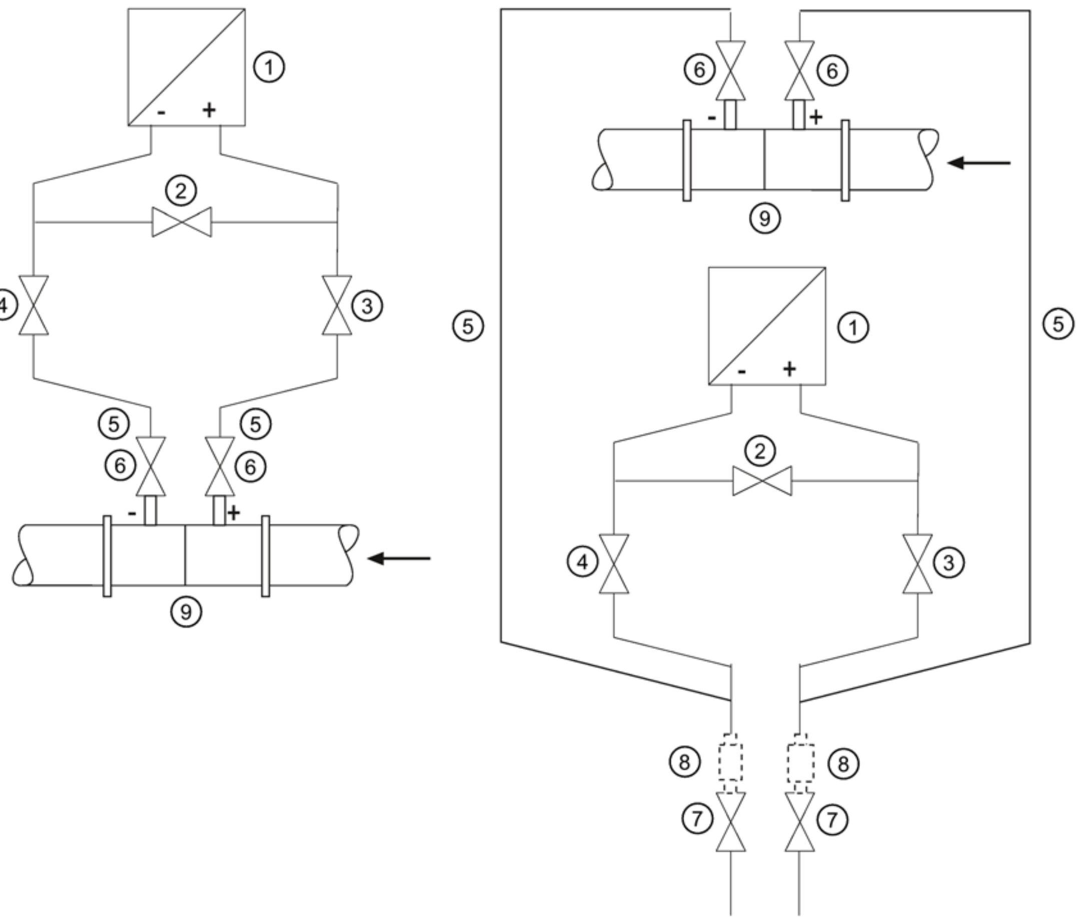
If the lock screws are missing or are not sufficiently tight, and/or if the valves are operated incorrectly or improperly, it could lead to serious physical injuries or considerable damage to property.

Measure

- Make sure the locking screw and/or the vent valve are screwed in and tightened.
- Ensure that the valves are operated correctly and properly.

10.4.2 Commissioning in gaseous environments

Usual arrangement | Special arrangement



Pressure transmitter **above** the differential pressure transducer

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
⑦	Blow-out valve
⑧	Condensation vessels (optional)
⑨	Differential pressure transducer

Requirement

All shut-off valves are closed.

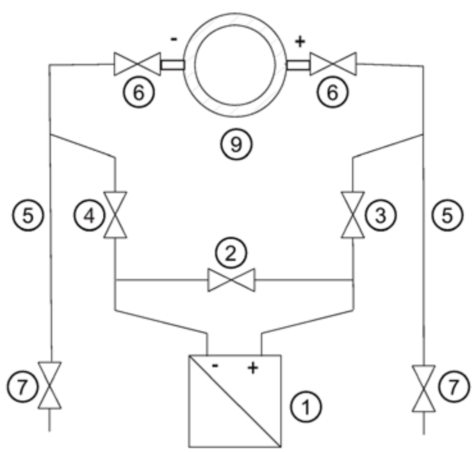
Procedure

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

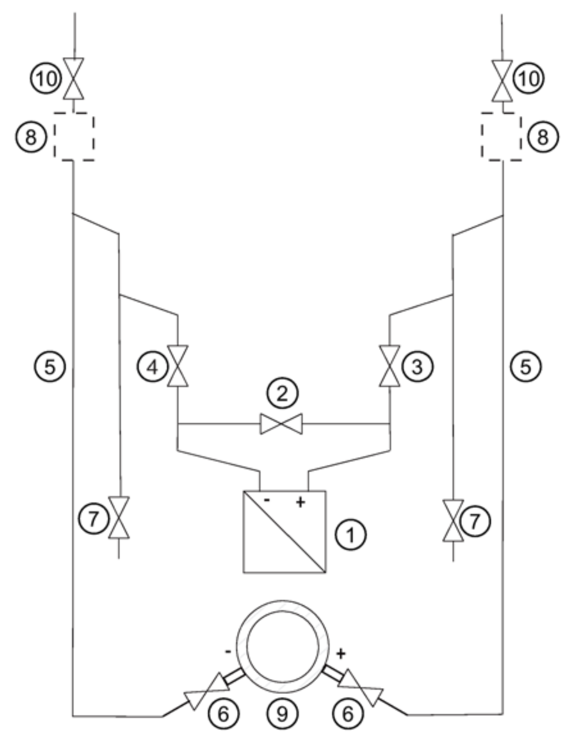
10.4.3 Commissioning for liquids

Usual arrangement



Pressure transmitter **below** the differential pressure transducer

Special arrangement



Pressure transmitter **above** the differential pressure transducer

①	Pressure transmitter	⑦	Drain valve
②	Stabilizing valve	⑧	Gas collector vessels (optional)
③, ④	Differential pressure valves	⑨	Differential pressure transducer

⑤	Differential pressure lines	⑩	Vent valves
⑥	Shut-off valves		

Requirement

All valves are closed.

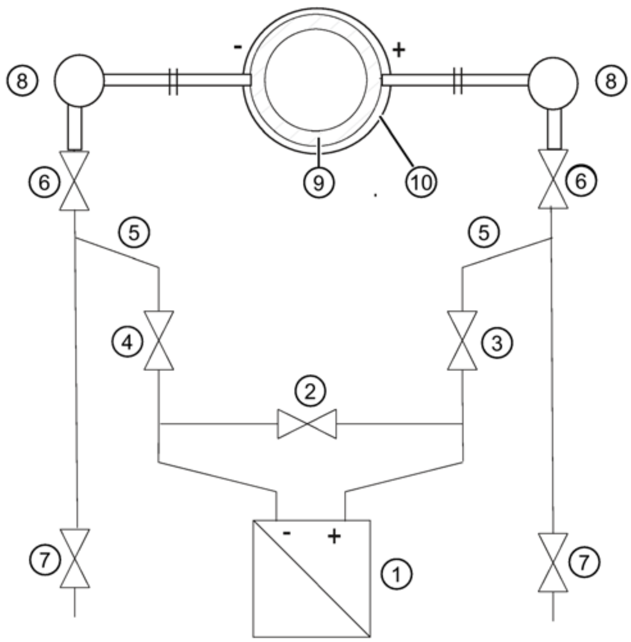
Procedure

> **⚠ 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.
>
> - Before venting, make sure there is no liquid in the device or take the necessary safety precautions.

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**, open both drain valves one after the other ⑦ until the liquid emerges without bubbles.
   In the case of a **pressure transmitter above the differential pressure transducer**, open both vent valves one after the other ⑩ until the liquid emerges without bubbles.
4. Close both drain valves ⑦ or vent valves ⑩.
5. Open the differential pressure valve ③ and the vent valve on the positive side of the pressure transmitter ① slightly, until fluid escapes without bubbles.
6. Close the vent valve.
7. Open the vent valve on the negative side of the pressure transmitter ① slightly, until fluid escapes without bubbles.
8. Close the differential pressure valve ③.
9. Open the differential pressure valve ④ until the liquid emerges and then close it.
10. Close the vent valve on the negative side of the pressure transmitter ①.
11. Open the differential pressure valve ③ by rotating it in half a turn.
12. Check and if required correct the zero point when the start of scale value is 0 kPa.
13. Close the stabilizing valve ②.
14. Open the differential pressure valves (③ and ④) completely.

10.4.4 Commissioning with vapor



①	Pressure transmitter	⑦	Drain valve
②	Stabilizing valve	⑧	Condensate pots
③, ④	Differential pressure valves	⑨	Differential pressure transducer
⑤	Differential pressure lines	⑩	Insulation
⑥	Shut-off valves		

Image 10-2 Measuring steam

Requirement

All valves are closed.

Procedure

> **WARNING**
>
> **Hot vapor**
>
> Danger of injury or damage to device.
>
> If the shutoff 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.
>
> - 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.

- Only open the drain valves ⑦ briefly, and close them again before vapor escapes.

Note

Incorrect measurement results

The measurement result is only free of errors if the differential pressure lines ④ have equally high condensate columns with the same temperature. The zero calibration must be repeated, if required, if these conditions are fulfilled.

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 till the vapor in the differential pressure lines ⑤ and in the condensate pots ⑧ condenses.
4. Open the differential pressure valve ③ and the vent valve on the positive side of the pressure transmitter ① slightly, until condensate escapes without bubbles.
5. Close the vent valve.
6. Open the vent valve on the negative side of the pressure transmitter ① slightly, until condensate escapes without bubbles.
7. Close the differential pressure valve ③.
8. Open the differential pressure valve ④ till the air-free condensate goes out and then close it.
9. Close the vent valve on the negative side ①.
10. Open the differential pressure valve ③ by rotating it in half a turn.
11. Check and if required correct the zero point when the start of scale value is 0 kPa.
12. Close the stabilizing valve ②.
13. Open the differential pressure valve ③ and ④ completely.
14. You can briefly open the blow-out valves ⑦ to clean the line. Close before steam starts to leak.

11 Repair and maintenance

11.1 Basic safety instructions

> **⚠ WARNING**
>
> **Impermissible repair of explosion protected devices**
>
> Danger of explosion in areas subject to explosion hazard.
>
> - Repair must be carried out by Siemens authorized personnel only.

> **⚠ WARNING**
>
> **Impermissible accessories and spare parts**
>
> Danger of explosion in areas subject to explosion hazard.
>
> - 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**
>
> **Use of incorrect device parts in potentially explosive environments**
>
> Devices and their associated device parts are either approved for different types of protection or they do not have explosion protection. There is a danger of explosion if device parts (such as covers) are used for devices with explosion protection that are not expressly suited for this type of protection. If you do not adhere to these guidelines, the test certificates and the manufacturer warranty will become null and void.
>
> - Use only device parts that have been approved for the respective type of protection in the potentially explosive environment. Covers that are not suited for the "explosion-proof" type of protection are identified as such by a notice label attached to the inside of the cover with "Not Ex d Not SIL".
> - Do not swap device parts unless the manufacturer specifically ensures compatibility of these parts.

WARNING

Maintenance during continued operation in a hazardous area

There is a danger of explosion when carrying out repairs and maintenance on the device in a hazardous area.

- Isolate the device from power.

- or -

- Ensure that the atmosphere is explosion-free (hot work permit).

WARNING

Commissioning and operation with pending error

If an error message appears, correct operation in the process is no longer guaranteed.

- Check the gravity of the error.
- Correct the error.
- If the error still exists:
  - Take the device out of operation.
  - Prevent renewed commissioning.

See also

Display in case of a fault (Page 185)

WARNING

Hot, toxic or corrosive process media

Danger of injury during maintenance work.

When working on the process connection, hot, toxic or corrosive process media could be released.

- 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

Danger of explosion in areas subject to explosion hazard.

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

Refer to Chapter "Connecting up (Page 63)".

WARNING

Use of a computer in a hazardous area

If the interface to the computer is used in the hazardous area, there is a danger of explosion.

- Ensure that the atmosphere is explosion-free (hot work permit).

CAUTION

Releasing key lock

Improper modification of parameters could influence process safety.

- Make sure that only authorized personnel may cancel the key locking of devices for safety-related applications.

CAUTION

Hot surfaces

Danger 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.

WARNING

Hazardous voltage with open device in versions with 4-conductor extension

Danger of electrocution when the enclosure is opened or enclosure parts are removed.

- Disconnect the device before you open the enclosure or remove enclosure parts.
- Observe the special precautionary measures if maintenance is required while the device is live. Have maintenance work carried out by qualified personnel.

NOTICE
Electrostatic-sensitive devices The device contains electrostatic-sensitive devices (ESD). ESD can be destroyed by voltages far too low to be detected by humans. These voltages can occur if you simply touch a component part or the electrical connections of a module without being electrostatically discharged. The damage to a module caused by overvoltage cannot normally be detected immediately; it only becomes apparent after a longer period of operating time has elapsed. Protective measures against the discharge of static electricity: • Make sure that no power is applied. • Before working with modules, make sure that you discharge static from your body, for example by touching a grounded object. • Devices and tools used must be free of static charge. • Hold modules only by their edges. • Do not touch connector pins or conductor tracks on a module with the ESD notice.

11.2 Maintenance and repair work

11.2.1 Defining the maintenance interval

⚠ WARNING
No maintenance interval has been defined Device failure, device damage, and risk of injury. • 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.

11.2.2 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 Siemens.

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 Siemens.

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1. Clean the enclosure and seals.
2. Check the enclosure and seals for cracks and damage.
3. Grease the seals if necessary.
   - or -
4. Replace the seals.

11.2.3 Display in case of a fault

Check the start of scale value of the device from time to time.

Differentiate between the following in case of a fault:

- The internal self test has detected a fault, e.g. sensor break, hardware fault/Firmware fault.

  Displays:

  – Display: display "ERROR"

  – PROFIBUS: B_016: sensor error
  diagnostics in measured-value recording

- Grave hardware faults, the processor is not functioning.

  Displays:

  – Display: no defined display

  – PROFIBUS: slave not available

In case of defect, you can replace the electronic unit by following the warning notes and the provided instruction manual.

See also

Error display (Page 74)

11.2.4 Changing the measuring cell and application electronics

Related

Each of the individual components "Measuring cell" and "Electronics" has a non-volatile memory (EEPROM).

Measuring cell data (e.g.: measuring range, measuring cell material, oil filling) and application-specific electronics data (e.g.: downscaling, additional electrical damping) are located in the measuring cell EEPROM. Application-specific data is lost when the measuring cell is changed. Application-specific data is not lost when the application electronics is changed.

You can backup application-specific data before changing the measuring cell and reload it afterwards. Use an input device which supports the PROFIBUS protocol (e.g. PROFIBUS communicator, PC with PROFIBUS modem and PROFIBUS software or PC with PROFIBUS modem and PDM software). Factory settings will be used if application-specific data is not backed up before the measuring cell is changed.

Technical developments enable advanced functions to be implemented in the firmware of the measuring cell or application electronics. Further technical developments are indicated by modified firmware statuses (FW). The firmware status does not affect whether the modules can be replaced. However, the scope of functions is limited to the function of existing components.

If a combination of certain firmware versions of measuring cell and application electronics is not possible for technical reasons, the device will identify this problem and go into "Fault current" mode. This information is also provided over the PROFIBUS interface.

11.3 Cleaning

⚠ WARNING

Dust layers above 5 mm

Danger of explosion in hazardous areas. Device may overheat due to dust build up.

- Remove dust layers in excess of 5 mm.

NOTICE
Penetration of moisture into the device
Device damage.
• Make sure when carrying out cleaning and maintenance work that no moisture penetrates the inside of the device.

Cleaning the enclosure

- Clean the outside of the enclosure and the display window using a cloth moistened with water or a mild detergent.
- Do not use aggressive cleaning agents or solvents. Plastic components or painted surfaces could be damaged.

⚠ WARNING
Electrostatic charge
Danger of explosion in hazardous areas if electrostatic charges develop, for example, when cleaning plastic surfaces with a dry cloth.
• Prevent electrostatic charging in hazardous areas.

11.3.1 Servicing the remote seal measuring system

The remote seal measuring system usually does not need servicing.

If the mediums are contaminated, viscous or crystallized, it could be necessary to clean the diaphragm from time to time. Use only a suitable solvent to remove the deposits from the diaphragm. Do not use corrosive cleaning agents. Prevent the diaphragm from getting damaged due to sharp-edged tools.

NOTICE
Improper cleaning of diaphragm
Device damage. The diaphragm can be damaged.
• Do not use sharp or hard objects to clean the diaphragm.

11.4 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 goods delivery note (http://www.siemens.com/processinstrumentation/returngoodsnote)

  with the following information:

  – Product (item description)

  – Number of returned devices/replacement parts

  – Reason for returning the item(s)
- Decontamination declaration (http://www.siemens.com/sc/declarationofdecontamination)

  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.

The forms can be found on the Internet as well as in the documentation which comes with the device.

11.5 Disposal

Devices identified by this symbol may not be disposed of in the municipal waste disposal services under observance of the Directive 2002/96/EC on waste electronic and electrical equipment (WEEE).

They can be returned to the supplier within the EC or to a locally approved disposal service. Observe the specific regulations valid in your country.

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.

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12 Interrupts, error and system alarms

12.1 Overview of status codes

Table 12- 1 Status code

Display	Hex	configured measured value source	PDM display	Cause	Measure
	80	Electronics temperature, sensor temperature, raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output, totalizer output	---	Normal operation	---
G_132	84	Electronics temperature, sensor temperature, raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output, totalizer output	Good, update.event	A parameter relevant to the behavior of the slave was changed. The display goes off after 10 sec.	Note to the control system.
G_137	89	Output, totalizer output	Good, warning limit exceeded	Configured low warning limit violated.	Correct error through user program.
G_138	8A	Output, totalizer output	Good, warning limit exceeded	High configured warning limit violated.	Correct error through user program.
G_141	8D	Electronics temperature, output, totalizer output	Good, alarm limit violated	Configured low alarm limit violated.	Correct error through user program.
G_142	8E	Electronics temperature, output, totalizer output	Good, alarm limit violated	High configured alarm limit violated.	Correct error through user program.
G_164	A4	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output, totalizer output	Good, Service required	Service interval expired: Calibrate or service.	Service, calibration of the electronics, or service of the sensor cell is necessary.
U_071	47	Output	Unsure, Last usable value, value constant	Input condition "fail safe" is fulfilled, the parameterized safety setting is set to "keep last valid value".	Check the data measurement.

Display	Hex	configured measured value source	PDM display	Cause	Measure
U_072	48	Totalizer output	Unsure, Replacement value	Use of the totalizer block if the measured value status is "Bad" and the parameterized safety setting is "Safe operation". The summed value changes. Failure behavior = safe operation.	Check the data measurement.
U_075	4B	Output, totalizer output	Unsure, Replacement value, value constant	Value is not an automatic measurement value. A parameterizable, static replacement value or preset value is marked in this manner.	Check the data measurement.
U_079	4F	Output, totalizer output	Unsure, Initial value, value constant	An initial value is written to the device memory after startup.	Throw away the value in the application program.
U_080	50	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output, totalizer output	Unsure, Value inexact	Impermissible operating parameter or service alarm.	Check the operating parameters, e.g. the permissible ambient temperature. Immediate service required.
U_081	51	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output, totalizer output	Unsure, Value inexact, limit value violated	Low nominal range measurement limit violated (<0%).	Increase the pressure in the positive direction.
U_082	52	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output, totalizer output	Unsure, Value inexact, limit value violated	High nominal range measurement limit violated (>100%).	Reduce the pressure.
B_000	00	Output (cyclical data only), totalizer output (cyclical data only)	Bad	Used if no other information is available. Device does not exist or cyclical connection is interrupted.	-
B_004	04	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output 1), totalizer output 2)	Bad, Configuration error	Calibration span too small.	Repeat the calibration procedure with pressure values which are farther apart.
B_011	0B	Secondary variable 3	Bad, not connected, value constant	Variable is not calculated	Correct the "transmitter type" setting.

Display	Hex	configured measured value source	PDM display	Cause	Measure
B_012	0C	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output 1), totalizer output 2)	Bad, Device error	Device has an irreparable error	Replace the electronics.
B_015	0F	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output 1), totalizer output 2)	Bad, Device error, value constant	Device has an irreparable error	Replace the electronics.
B_016	10	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output 1), totalizer output 2)	Bad, Sensor error	Sensor indicates an error.	Have a service technician check the sensor.
B_017	11	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output 1), totalizer output 2)	Bad, Sensor error, limit value violated	Negative pressure too high. Low control limit violated (<-20% of nominal measurement range).	Increase the pressure in the positive direction.
B_018	12	Raw pressure value, secondary variable 1, secondary variable 2, measured value (primary variable), secondary variable 3, output 1), totalizer output 2)	Bad, Sensor error, limit value violated	Positive pressure too high. High control limit violated (>120% of nominal measurement range).	Reduce the pressure.
B_031	1F	Output, totalizer output	Bad, Out of service, value constant	Function block was placed out of service with a target mode command. A parameterized safety value is output.	For normal operation, reset the target mode to AUTO.
B_060	3C	Output	Bad; configuration error	Device is not yet in safe state.	Complete PROFIsafe commissioning.

1) Only if the failure behavior of the analog input function block is set to "The incorrectly calculated measured value is on output".

2) Only if the failure behavior of the totalizer function block has been set to "Operation".

See also

Error display (Page 74)

Status display (Page 76)

Status (Page 167)

12.2 Errors

Errors and error correction

Errors	Cause	Measure
Measured value		
Measured value shows up on the display but is not displayed in the control system.	• Mode 15	• Check whether the bus address on the device matches the bus address in the control system. If it does not match, correct the bus address.
	• Mode 16	• Set "ident" in mode 16.

Table 12- 2 Error message

Display	PDM display	Cause	Measure
F_001	-	Local operation blocked.	Remove write protection.
F_003	-	Changes to the bus address and device operating type are not possible, since the device is in communication with a class 1 master.	End communication with class 1 master.
F_004	-	Display overflow.	Check settings of physical unit and position of decimal point, and adjust to the current measured value.
F_005	-	Value is read-only.	-
F_006	-	Correction not successful.	Check calibration span and repeat procedure.
F_007	-	After zero-point calibration, measurements no longer possible in entire measurement range.	Check measurement range, decrease correction if necessary.
F_008	-	Local operation blocked by SIMATIC PDM.	Use SIMATIC PDM to set the "Local operation" parameter to "released".

See also

Status (Page 167)

Technical data 13

13.1 Overview of technical data

Introduction

The following overview of technical data provides you with a quick and easy access to relevant data and characteristic numbers.

Remember that tables in part contain the data of the three communication types HART, PROFIBUS and FOUNDATIONTM Fieldbus. This data deviates in many cases. Therefore, adhere to the communication type used by you when using the technical data.

Contents of the chapter

13.2 SITRANS P DS III input

Gauge pressure input			
Measured variable	Gauge pressure		
Span continuously adjustable) or measuring range, max. operating pressure (in accordance with 97/23/EC 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)	Span [1]	Maximum operating pressure MAWP (PS)	Maximum test pressure
	8.3 … 250 mbar	4 bar	6 bar
	0.83 ... 25 kPa	400 kPa	0.6 MPa
	0.12 … 3.6 psi	58 psi	87 psi
	0.01 … 1 bar	4 bar	6 bar
	1 ... 100 kPa	400 kPa	0.6 MPa
	0.15 … 14.5 psi	58 psi	87 psi
	0.04 … 4 bar	7 bar	10 bar
	4 ... 400 kPa	0.7 MPa	1 MPa
	0.58 … 58 psi	102 psi	145 psi
	0.16 … 16 bar	21 bar	32 bar
	16 ... 1600 kPa	2.1 MPa	3.2 MPa
	2.3 … 232 psi	305 psi	464 psi
	0.63 … 63 bar	67 bar	100 bar
	63 ... 6300 kPa	6.7 MPa	10 MPa
	9.1 … 914 psi	972 psi	1450 psi
	1.6 … 160 bar	167 bar	250 bar
	0.16 ... 16 MPa	16.7 MPa	2.5 MPa
	23 … 2321 psi	2422 psi	3626 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
Low measuring limit[2]			
• Measuring cell with silicone oil filling	30 mbar a/3 kPa a/0.44 psi a		
• Measuring cell with inert liquid	30 mbar a/3 kPa a/0.44 psi a		
Upper measuring limit	100 % of max. span (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/process temperature)		
Start of scale value	Between the measuring limits (fully adjustable)		

1) Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

2) With 250mbar/25 kPa/3.6 psi measuring cells, the lower 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.

gauge pressure input, with flush mounted diaphragm			
Measured variable	Gauge pressure		
Span (continuously adjustable) or measuring range, max. operating pressure and max. test pressure	Span [1]	Maximum operating pressure MAWP (PS)	Maximum test pressure
	0.01 … 1 bar	4 bar	6 bar
	1 ... 100 kPa	400 kPa	0.6 MPa
	0.15 … 14.5 psi	58 psi	87 psi
	0.04 … 4 bar	7 bar	10 bar
	4 ... 400 kPa	0.7 MPa	1 MPa
	0.58 … 58 psi	102 psi	145 psi
	0.16 … 16 bar	21 bar	32 bar
	0.06 ... 1600 kPa	2.1 MPa	3.2 MPa
	2.3 … 232 psi	305 psi	464 psi
	0.6 … 63 bar	67 bar	100 bar
	0.06 ... 6.3 MPa	6.7 MPa	10 MPa
	9.1 … 914 psi	972 psi	1450 psi
Lower measuring limit			
• Measuring cell with silicone oil filling	100 mbar a/10 kPa a/1.45 psi a		
• Measuring cell with inert liquid	100 mbar a/10 kPa a/1.45 psi a		
• Measuring cell with neobee	100 mbar a/10 kPa a/1.45 psi a		
Upper measuring limit	100% of maximum span		

[1] Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

Absolute pressure input, with flush-mounted diaphragm			
Measured variable	Absolute pressure		
Span (continuously adjustable) or measuring range, max. operating pressure and max. test pressure	Span [1]	Maximum operating pressure MAWP (PS)	Maximum test pressure
	43 … 1300 mbar a	2.6 bar a	10 bar a
	4.3 ... 130 kPa a	260 kPa a	1 MPa a
	17 … 525 inH_2O a	37.7 psi a	145 psi a
	160 … 5000 mbar a	10 bar a	30 bar a
	16 ... 500 kPa a	1 MPa a	3 MPa a
	2.32 … 72.5 psi a	145 psi a	435 psi a
	1 … 30 bar a	45 bar a	100 bar a
	0.1 ... 3 MPa a	4.5 MPa	10 MPa a
	14.5 … 435 psi a	653 psi a	1450 psi a
	Depending on the process connection, the span may differ from these values		
Lower measuring limit	0 mbar a/kPa a/psi a		
Upper measuring limit	100% of maximum span		

[1] Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

Input pressure transmitter with PMC connection			
Measured variable	Gauge pressure		
Span (continuously adjustable) or measuring range, max. operating pressure and max. test pressure	Span[1) 2)]	Maximum operating pressure MAWP (PS)	Maximum test pressure
	0.01 … 1 bar	4 bar	6 bar
	1 ... 100 kPa	400 kPa	600 kPa
	0.15 … 14.5 psi	58 psi	87 psi
	0.04 … 4 bar	7 bar	10 bar
	4 ... 400 kPa	700 kPa	1 MPa
	0.58 … 58 psi	102 psi	145 psi
	0.16 … 16 bar	21 bar	32 bar
	0.016... 1.6 MPa	2.1 MPa	3.2 MPa
	2.3 … 232 psi	305 psi	464 psi
Lower measuring limit			
• Measuring cell with silicone oil filling [2)]	100 mbar a/10 kPa a/1.45 psi a		
• Measuring cell with inert liquid [2)]	100 mbar a/10 kPa a/1.45 psi a		
• Measuring cell with neobee [2)]	100 mbar a/10 kPa a/1.45 psi a		
Upper measuring limit	100% of maximum span		

1) Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

2) For PMC-Style Minibolt, the span should not be less than 500 mbar

Absolute pressure input (from the gauge pressure series)			
Measured variable	Absolute pressure		
Span (continuously adjustable) or measuring range, maximum operating pressure (as per 97/23/EC pressure device guideline) and maximum test pressure (as per DIN 16086)	Span [1)]	Maximum operating pressure MAWP (PS)	Maximum test pressure
	8.3 … 250 mbar a	1.5 bar a	6 bar a
	0.83 ... 25 kPa a	150 kPa a	600 kPa a
	3 … 100 inH₂O a	21.8 psi a	87 psi a
	43 … 1300 mbar a	2.6 bar a	10 bar a
	4.3 ... 130 kPa a	260 kPa a	1 MPa a
	17 … 525 inH₂O a	37.7 psi a	145 psi a
	160 … 5000 mbar a	10 bar a	30 bar a
	16 ... 500 kPa a	1 MPa a	3 MPa a
	2.32 … 72.5 psi a	145 psi a	435 psi a
	1 … 30 bar a	45 bar a	100 bar a
	0.1 ... 3 MPa a	4.5 MPa a	10 MPa a
	14.5 … 435 psi a	653 psi a	1450 psi a
Lower measuring limit			
• Measuring cell with silicone oil filling	0 mbar a/kPa a/psi a		
• Measuring cell with inert liquid			

Absolute pressure input (from the gauge pressure series)	
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 - 108 °F)/°F
Upper measuring limit	100 % of max. span (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/process temperature)
Start of scale value	Between the measuring limits (fully adjustable)

[1] Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

Absolute pressure input (from the differential pressure series)		
Measured variable	Absolute pressure	
Span (continuously adjustable) or measuring range and max. operating pressure (in accordance with 97/23/EC Pressure Equipment Directive)	Span [1]	Maximum operating pressure MAWP (PS)
	8.3 … 250 mbar a	32 bar a
	0.83 ... 25 kPa a	3.2 MPa a
	3 … 100 inH$_2$O a	464 psi a
	43 … 1300 mbar a	32 bar a
	4.3 ... 130 kPa a	3.2 MPa a
	17 … 525 inH$_2$O a	464 psi a
	160 … 5000 mbar a	32 bar a
	16 ... 500 kPa a	3.2 MPa a
	2.32 … 72.5 psi a	464 psi a
	1 … 30 bar a	160 bar a
	0.1 ... 3 MPa a	16 MPa a
	14.5 … 435 psi a	2320 psi a
	5.3 … 100 bar a	160 bar a
	0.5 ... 10 MPa a	16 MPa a
	76.9 … 1450 psi a	2320 psi a
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	
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 - 108 °F)/°F	

Absolute pressure input (from the differential pressure series)	
Upper measuring limit	100 % of max. span (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/process temperature)
Start of scale value	Between the measuring limits (fully adjustable)

1) Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

Differential pressure and flow rate input		
Measured variable	Differential pressure and flow rate	
Span (continuously adjustable) or measuring range and max. operating pressure (in accordance with 97/23/EC Pressure Equipment Directive)	Span [1]	Maximum operating pressure MAWP (PS)
	1 ... 20 mbar 0.1 ... 2 kPa 0.4015 … 8.031 inH_2O	32 bar 3.2 MPa 464 psi
	1 ... 60 mbar 0.1 ... 6 kPa 0.4015 … 24.09 inH_2O	160 bar 16 MPa 2320 psi
	2.5 … 250 mbar 0.2 ... 25 kPa 1.004 … 100.4 inH_2O	160 bar 16 MPa 2320 psi
	6 … 600 mbar 0.6 ... 60 kPa 2.409 … 240.9 inH_2O	160 bar 16 MPa 2320 psi
	16 … 1600 mbar 1.6 ... 160 kPa 6.424 … 642.4 inH_2O	160 bar 16 MPa 2320 psi
	50 … 5000 mbar 5 ... 500 kPa 20.08 … 2008 inH_2O	160 bar 16 MPa 2320 psi
	0.3 … 30 bar 0.03 ... 3 MPa 4.35 … 435 psi	160 bar 16 MPa 2320 psi
	2.5 … 250 mbar 0.25 ... 25 kPa 1.004 … 100.4 inH_2O	420 bar 42 MPa 6091 psi
	6 … 600 mbar 0.6 ... 60 kPa 2.409 … 240.9 inH_2O	420 bar 42 MPa 6091 psi
	16 … 1600 mbar 1.6 ... 160 kPa 6.424 … 642.4 inH_2O	420 bar 42 MPa 6091 psi

Differential pressure and flow rate input		
	50 … 5000 mbar 5 ... 500 kPa 20.08 … 2008 inH_2O	420 bar 42 MPa 6091 psi
	0.3 … 30 bar 0.03 ... 3 MPa 4.35 … 435 psi	420 bar 42 MPa 6091 psi
Lower measuring limit		
• Measuring cell with silicone oil filling	-100% of max. measuring range (-33 % for 30 bar /3 MPa /435 psi measuring cell) or 30 mbar a /3 kPa a /0.44 psi a	
• Measuring cell with inert liquid		
for process temperature -20°C < ϑ ≤ 60°C (-4°F < ϑ ≤ +140°F)	-100 % of max. measuring range (-33 % for 30 bar/3 MPa/435 psi measuring cell) or 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))	• -100% of max. measuring range (-33% for 30 bar/3 kPa/435 psi measuring cell) • 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 - 108 °F)/°F	
Upper measuring limit	100 % of max. span (for oxygen measurement: max. 100 bar/10 MPa/1450 psi and 60 °C ambient temperature/process temperature)	
Start of scale value	Between the measuring limits (fully adjustable)	

1) Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

Level input		
Measured variable	Level	
Span (continuously adjustable) or measuring range and max. operating pressure (in accordance with 97/23/EC Pressure Equipment Directive)	Span 1)	Maximum operating pressure MAWP (PS)
	25 … 250 mbar 2.5 ... 25 kPa 10 … 100 inH_2O	see the mounting flange
	25 … 600 mbar 2.5 ... 60 kPa 10 … 240 inH_2O	
	53 … 1600 mbar 5.3 ... 160 kPa 021 … 640 inH_2O	
	160 … 5000 mbar 16 ... 500 kPa 2.32 … 72.5 psi	

Level input	
Lower measuring limit	
• Measuring cell with silicone oil filling	-100% of max. measuring range or 30 mbar a/3 kPa a/0.44 psi a depending on the mounting flange
• Measuring cell with inert liquid	-100% of max. measuring range or 30 mbar a/3 kPa a/0.44 psi a depending on the mounting flange
Upper measuring limit	100% of maximum span
Start of scale value	between the measuring limits continuously adjustable

1) Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

13.3 SITRANS P410 input

Gauge pressure input			
Measured variable	Gauge pressure		
Span (continuously adjustable) or measuring range, max. operating pressure (in accordance with 97/23/EC Pressure Equipment Directive) and max. test pressure (in accordance with DIN 16086).	Span 1)	Maximum operating pressure MAWP (PS)	Maximum test pressure
	0.01 … 1 bar	4 bar	6 bar
	1 ... 100 kPa	400 kPa	0.6 MPa
	0.15 … 14.5 psi	58 psi	87 psi
	0.04 … 4 bar	7 bar	10 bar
	4 ... 400 kPa	0.7 MPa	1 MPa
	0.58 … 58 psi	102 psi	145 psi
	0.16 … 16 bar	21 bar	32 bar
	16 ... 1600 kPa	2.1 MPa	3.2 MPa
	2.3 … 232 psi	305 psi	464 psi
	0.63 … 63 bar	67 bar	100 bar
	63 ... 6300 kPa	6.7 MPa	10 MPa
	9.1 … 914 psi	972 psi	1450 psi
	1.6 … 160 bar	167 bar	250 bar
	0.16 ... 16 MPa	16.7 MPa	2.5 MPa
	23 … 2321 psi	2422 psi	3626 psi
Lower measuring limit			
• Measuring cell with silicone oil filling	30 mbar a/3 kPa a/0.44 psi a		
Upper measuring limit	100% of maximum span		
Start of scale value	Between the measuring limits (fully adjustable)		

1) Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

Differential pressure and flow rate input		
Measured variable	Differential pressure and flow rate	
Span (continuously adjustable) or measuring range and max. operating pressure (in accordance with 97/23/EC Pressure Equipment Directive)	Span [1]	Maximum operating pressure MAWP (PS)
	2.5 … 250 mbar 0.2 ... 25 kPa 1.004 … 100.4 inH_2O	160 bar 16 MPa 2320 psi
	6 … 600 mbar 0.6 ... 60 kPa 2.409 … 240.9 inH_2O	160 bar 16 MPa 2320 psi
	16 … 1600 mbar 1.6 ... 160 kPa 6.424 … 642.4 inH_2O	160 bar 16 MPa 2320 psi
	50 … 5000 mbar 5 ... 500 kPa 20.08 … 2008 inH_2O	160 bar 16 MPa 2320 psi
	0.3 … 30 bar 0.03 ... 3 MPa 4.35 … 435 psi	160 bar 16 MPa 2320 psi
	6 … 600 mbar 0.6 ... 60 kPa 2.409 … 240.9 inH_2O	420 bar 42 MPa 6091 psi
	16 … 1600 mbar 1.6 ... 160 kPa 6.424 … 642.4 inH_2O	420 bar 42 MPa 6091 psi
	50 … 5000 mbar 5 ... 500 kPa 20.08 … 2008 inH_2O	420 bar 42 MPa 6091 psi
	0.3 … 30 bar 0.03 ... 3 MPa 4.35 … 435 psi	420 bar 42 MPa 6091 psi
Lower measuring limit		
• Measuring cell with silicone oil filling	-100 % of max. measuring range (-33 % for 30 bar/3 MPa/435 psi measuring cell) or 30 mbar a/3 kPa a/0.44 psi a	
Upper measuring limit	100% of maximum span	
Start of scale value	Between the measuring limits (fully adjustable)	

[1] Order the nominal measuring range with the order option Y01 for PROFIBUS PA or FOUNDATION Fieldbus.

13.4 Output

Output		
	HART	**PROFIBUS PA and FOUNDATION Fieldbus**
Output signal	4 … 20 mA	Digital PROFIBUS PA or FOUNDATION™ Fieldbus signal
• Low saturation limit (fully adjustable)	3.55 mA, set to 3.84 mA in the factory	–
• High saturation limit (fully adjustable)	23 mA, set to 20.5 mA or optionally 22.0 mA in the factory	–
• Ripple (without HART communication)	I_{SS} ≤ 0.5 % of the max. output current	–
adjustable time constants damping coefficient	0 … 100 s, continuously adjustable	0 … 100 s, continuously adjustable
Adjustable time constants (T63) with local operation	0 … 100 s, in steps of 0.1 s Factory-set to 2 s	0 … 100 s, in steps of 0.1 s Factory-set to 2 s
• Current transmitter	3.55 … 23 mA	–
• Failure signal	3.55 … 23 mA	–
Load	Resistor R [Ω]	–
• Without HART communication	$R = \frac{U_H - 10,5\ V}{23\ mA}$	–
	U_H Power supply in V	
• With HART communication		–
HART communicator (Handheld)	R =230 … 1100 Ω	–
SIMATIC PDM	R =230 … 500 Ω	–
Characteristic curve	• Linearly increasing or linearly decreasing • Linear increase or decrease or root extraction increase (only for differential pressure and flow rate)	
Bus physics	–	IEC 61158-2
Polarity-independent	–	Yes

13.5 Measuring accuracy of SITRANS P DS III

Measuring accuracy (as per EN 60770-1) gauge pressure			
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)		
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range		
Conformity error at limit point setting, including hysteresis and repeatability			
• 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 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	≤ 0.065%		≤ (0.004 • r + 0.045) %
• Linear characteristic curve	r ≤ 3	3 < r ≤ 10	10 < r ≤ 100
400 bar/40 MPa/5802 psi 700 bar/70 MPa/10152 psi	≤ 0.075%	≤ (0.0029 • r + 0.071) %	≤ (0.005 • r + 0.05) %
Effect of ambient temperature	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 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	≤ (0.025 • r + 0.125) %		
• 700 bar/70 MPa/10152 psi	≤ (0.08 • r + 0.16) %		
Long-term stability at ±30 °C (±54 °F)			
• 250 mbar/25 kPa/3.6 psi	Per year ≤ (0.25 • r) %		
• 1 bar/100 kPa/14.5 psi 4 bar/400 kPa/58 psi	In 5 years ≤ (0.25 • r) %		

Measuring accuracy (as per EN 60770-1) gauge pressure	
• 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	In 5 years ≤ (0.125 • r) %
• 700 bar/70 MPa/10152 psi	In 5 years ≤ (0.25 • r) %
Step response time T_{63} (without electrical damping)	Approx. 0.15 s
Effect of mounting position	≤ 0.05 mbar/0.005 kPa/0.000725 psi per 10° incline (zero-point correction is possible with position error compensation)
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured value resolution for PROFIBUS PA or FOUNDATION Fieldbus	$3 \cdot 10^{-5}$ of the nominal measuring range

Gauge pressure measuring accuracy, with flush mounted diaphragm	
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range
Conformity error at limit point setting, including hysteresis and repeatability	
• Linear characteristic curve	
r ≤ 5	≤ 0.075 %
5 < r ≤ 100	≤ (0.005 • r + 0.05) %
Effect of ambient temperature	
In percent per 28 °C (50 °F)	≤ (0.08 • r + 0.16)
Effect of process temperature	In pressure per temperature change
• Temperature difference between medium temperature and ambient temperature	3 mbar per 10 K 0.3 kPa per 10 K 0.04 psi per 10 K
Long-term stability at ±30 °C (±54 °F)	In 5 years ≤ (0.25 • r) %
Step response time T_{63} without electrical damping	Approx. 0.2 s
Effect of mounting position	In pressure per change of angle 0.4 mbar/0.04 kPa/0.006 psi per 10° incline (zero-point correction is possible with position error compensation)

Gauge pressure measuring accuracy, with flush mounted diaphragm	
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured value resolution for PROFIBUS PA or FOUNDATION Fieldbus	3 • 10^{-5} of the nominal measuring range

Absolute pressure measuring accuracy with flush diaphragm	
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range
Conformity error at limit point setting, including hysteresis and repeatability	
• Linear characteristic curve	
r ≤ 10	≤ 0.2%
10 < r ≤ 30	≤ 0.4%
Effect of ambient temperature	
In percent per 28 °C (50 °F)	≤ (0.16 • r + 0.24)
Effect of process temperature	In pressure per temperature change
• Temperature difference between medium temperature and ambient temperature	3 mbar per 10 K 0.3 kPa per 10 K 0.04 psi per 10 K
Long-term stability at ±30 °C (±54 °F)	In 5 years ≤ (0.25 • r) %
Step response time T_{63} without electrical damping	Approx. 0.2 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)
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured-value resolution for PROFIBUS PA or FOUNDATION Fieldbus	3 • 10^{-5} of the nominal measuring range

Measuring accuracy (according to EN 60770-1) of pressure transmitter with PMC connection	
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range
Conformity error at limit point setting, including hysteresis and repeatability	
• Linear characteristic curve	
$r \leq 5$	≤ 0.075 %
$5 < r \leq 100$	≤ (0.005 • r + 0.05) %
Effect of ambient temperature	
In percent per 28 °C (50 °F)	≤ (0.08 • r + 0.16)
Effect of process temperature	In pressure per temperature change
• Temperature difference between medium temperature and ambient temperature	3 mbar per 10 K 0.3 kPa per 10 K 0.04 psi per 10 K
Long-term stability at ±30 °C (±54 °F)	In 5 years ≤ (0.25 • r) %
Step response time T_{63} without electrical damping	Approx. 0.2 s
Effect of mounting position	In pressure per change of angle ≤ 0.1 mbar/0.01 kPa/0.00145 psi per 10° incline (zero point correction is possible with position error compensation)
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured-value resolution for PROFIBUS PA or FOUNDATION Fieldbus	$3 \cdot 10^{-5}$ of the nominal measuring range

Absolute pressure measuring accuracy (from gauge and differential pressure series)	
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range
Conformity error at limit point setting, including hysteresis and repeatability	

Absolute pressure measuring accuracy (from gauge and differential pressure series)	
• Linear characteristic curve	
r ≤ 10	≤ 0.1%
10 < r ≤ 30	≤ 0.2%
• Effect of ambient temperature	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 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	≤ (0.08 • r + 0.16)
Long-term stability at ±30 °C (±54 °F)	In 5 years ≤ (0.25 • r) %
Step response time T_{63} without electrical damping	Approx. 0.2 s
Effect of mounting position	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 with position error compensation)
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured value resolution for PROFIBUS PA or FOUNDATION Fieldbus	$3 \cdot 10^{-5}$ of the nominal measuring range

Differential pressure and flow rate measuring accuracy	
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range
Conformity error at limit point setting, including hysteresis and repeatability	

Differential pressure and flow rate measuring accuracy			
• Linear characteristic curve	r ≤ 5	5 < r ≤ 10	10 < r ≤ 20
20 mbar/2 kPa/0.29 psi	≤ 0.075 %	≤ (0.0029 • r + 0.071) %	≤ (0.0045 • r + 0.071) %
• 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 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	≤ 0.065%		≤ (0.004 • r + 0.045) %
• Root extraction characteristic			
Flow > 50 %	r ≤ 5	5 < r ≤ 10	10 < r ≤ 20
• 20 mbar/2 kPa/0.29 psi	≤ 0.075 %	≤ (0.0029 • r + 0.071) %	≤ (0.0045 • r + 0.071) %
• Root extraction characteristic			
Flow > 50 %	r ≤ 5		5 < r ≤ 60
• 60 mbar/6 kPa/0.87 psi	≤ 0.075 %		≤ (0.005 • r + 0.05) %
• Root extraction characteristic			
Flow > 50 %	r ≤ 5		5 < r ≤ 100
• 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	≤ 0.065%		≤ (0.004 • r + 0.045) %
• Root extraction characteristic			
Flow 25 ... 50%	r ≤ 5	5 < r ≤10	10 < r ≤ 20
• 20 mbar/2 kPa/0.29 psi	≤ 0.15 %	≤ (0.0058 • r + 0.142) %	≤ (0.009 • r + 0.142) %
• Root extraction characteristic			
Flow 25 ... 50%	r ≤ 5		5 < r ≤ 60
• 60 mbar/6 kPa/0.87 psi	≤ 0.15 %		≤ (0.01 • r + 0.1) %
• Root extraction characteristic	r ≤ 5		5 < r ≤ 100
• 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	≤ 0.13%		≤ (0.008 • r + 0.9) %
Effect of ambient temperature	In percent per 28 °C (50 °F)		

Differential pressure and flow rate measuring accuracy	
• 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 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	≤ (0.025 • r + 0.125) %
Effect of static pressure	
• At the start of scale value	
20 mbar/2 kPa/0.29 psi	≤ (0.15 • r) % per 32 bar (zero-point correction is possible with position error compensation)
60 mbar/6 kPa/0.87 psi 250 mbar/25 kPa/3.63 psi 600 mbar/60 kPa/8.70 psi 1600 mbar/160 kPa/23.21 psi	≤ (0.1 • r) % per 70 bar (zero-point correction is possible with position error compensation)
5 bar/500 kPa/72.52 psi 30 bar/3 MPa/435.11 psi	≤ (0.2 • 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 32 bar
60 mbar/6 kPa/0.87 psi 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	≤ 0.14 % per 70 bar
Long-term stability at ±30 °C (±54 °F)	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 30 bar/3 MPa/435.11 psi	In 5 years ≤ (0.25 • r) %
• 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	In 5 years ≤ (0.125 • r) %
Step response time T_{63} without electrical damping	
• 20 mbar/2 kPa/0.29 psi 60 mbar/6 kPa/0.87 psi	Approx. 0.3 s
• 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	Approx. 0.2 s

Differential pressure and flow rate measuring accuracy	
Effect of mounting position	In pressure per change of angle ≤ 0.7 mbar/0.07 kPa/0.028 inH_2O per 10° incline (zero-point correction is possible with position error compensation)
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured-value resolution for PROFIBUS PA or FOUNDATION Fieldbus	$3 \cdot 10^{-5}$ of the nominal measuring range

Level measuring accuracy				
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)			
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range			
Conformity error at limit point setting, including hysteresis and repeatability				
• Linear characteristic curve	r ≤ 5	5 < r ≤ 10	5 < r ≤ 25	5 < r ≤ 30
250 mbar/25 kPa/3.63 psi	≤ 0.125%	≤ (0.007 • r + 0.09) %		
600 mbar/60 kPa/8.70 psi	≤ 0.125%		≤ (0.007 • r + 0.09) %	
1600 mbar/160 kPa/23.21 psi	≤ 0.125%			≤ (0.007 • r + 0.09) %
5 bar/500 kPa/72.52 psi	≤ 0.125%			≤ (0.007 • r + 0.09) %
Effect of ambient temperature	In percent per 28 °C (50 °F)			
• 250 mbar/25 kPa/3.63 psi	≤ (0.4 • r + 0.16) %			
• 600 mbar/60 kPa/8.70 psi	≤ (0.24 • r + 0.16) %			
• 1600 mbar/160 kPa/23.21 psi 5 bar/500 kPa/72.52 psi	≤ (0.2 • r + 0.16) %			
Effect of static pressure				
• At the start of scale value				
Measuring cell 250 mbar/25 kPa/3.63 psi	≤ (0.3 • r) % per nominal pressure			
Measuring cell 600 mbar/60 kPa/8.70 psi	≤ (0.15 • r) % per nominal pressure			

Level measuring accuracy	
Measuring cell 1600 mbar/160 kPa/23.21 psi Measuring cell 5 bar/500 kPa/72.52 psi	≤ (0.1 • r) % per nominal pressure
• On the measuring span	≤ (0.1 • r) % per nominal pressure
Long-term stability at ±30 °C (±54 °F)	in 5 years ≤ (0.25 • r) % static pressure max. 70 bar/7 MPa/1015 psi
Step response time T_{63} without electrical damping	Approx. 0.2 s
Effect of mounting position	depending on the fill fluid in the mounting flange
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured value resolution for PROFIBUS PA or FOUNDATION Fieldbus	3 • 10^{-5} of the nominal measuring range

13.6 Measuring accuracy of SITRANS P410

Measuring accuracy (as per EN 60770-1) gauge pressure		
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)	
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
Conformity error at limit point setting, including hysteresis and repeatability		
• Linear characteristic curve	r ≤ 5	5 < r ≤ 100
1 bar/100 kPa/14.5 psi 4 bar400 kPa/58 psi 16 bar/1.6 MPa/232 psi 63 bar/6.3 MPa/914 psi 160 bar/16 MPa/2321 psi	≤ 0.04%	≤ (0.004 • r + 0.045) %
Effect of ambient temperature	In percent per 28 °C (50 °F)	
• 1 bar/100 kPa/14.5 psi	≤ (0.05 • r + 0.1) %	
• 4 bar/400 kPa/58 psi 16 bar/1.6 MPa/232 psi 63 bar/6.3 MPa/914 psi 160 bar/16 MPa/2321 psi	≤ (0.025 • r + 0.125) %	

Measuring accuracy (as per EN 60770-1) gauge pressure	
Long-term stability at ±30 °C (±54 °F)	
• 1 bar/100 kPa/14.5 psi 4 bar/400 kPa/58 psi	In 5 years ≤ (0.25 • r) %
• 16 bar/1.6 MPa/232 psi 63 bar/6.3 MPa/914 psi 160 bar/16 MPa/2321 psi	In 5 years ≤ (0.125 • r) %
Step response time T_{63} (without electrical damping)	Approx. 0.15 s
Effect of mounting position	≤ 0.05 mbar/0.005 kPa/0.02 inH_2O per 10° incline (zero point correction is possible with position error compensation)
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured value resolution for PROFIBUS PA or FOUNDATION Fieldbus	$3 \cdot 10^{-5}$ of the nominal measuring range

Differential pressure and flow rate measuring accuracy		
Reference conditions	• Rising characteristic curve • Start of scale value 0 bar/kPa/psi • Seal diaphragm stainless steel • Measuring cell with silicone oil filling • Room temperature 25 °C (77 °F)	
Measuring span ratio r (spread, Turn-Down)	r = max. measuring span/set measuring span and nominal measuring range	
Conformity error at limit point setting, including hysteresis and repeatability		
• Linear characteristic curve	r ≤ 5	5 < r ≤ 100
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	≤ 0.04%	≤ (0.004 • r + 0.045) %
• Root extraction characteristic		
Flow > 50 %	r ≤ 5	5 < r ≤ 30
• 250 mbar/25 kPa/3.63 psi 600 mbar/60 kPa/8.70 psi 1600 mbar/160 kPa/23.21 ps i 5 bar/500 kPa/72.52 psi 30 bar/3 MPa/435.11 psi	≤ 0.04%	≤ (0.004 • r + 0.045) %
Flow 25 ... 50%	r ≤ 5	5 < r ≤ 30

Differential pressure and flow rate measuring accuracy		
• 250 mbar/25 kPa/3.63 psi 600 mbar/60 kPa/8.70 psi 1600 mbar/160 kPa/23.21 ps i 5 bar/500 kPa/72.52 psi 30 bar/3 MPa/435.11 psi	≤ 0.08%	≤ (0.008 • r + 0.09) %
Effect of ambient temperature	In percent per 28 °C (50 °F)	
• 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	≤ (0.025 • r + 0.125) %	
Effect of static pressure		
• At the start of scale value		
250 mbar/25 kPa/3.63 psi 600 mbar/60 kPa/8.70 psi 1600 mbar/160 kPa/23.21 psi	≤ (0.1 • r) % per 70 bar (zero-point correction is possible with position error compensation)	
5 bar/500 kPa/72.52 psi 30 bar/3 MPa/435.11 psi	≤ (0.2 • r) % per 70 bar (zero-point correction is possible with position error compensation)	
• On the measuring span		
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	≤ 0.14 % per 70 bar	
Long-term stability at ±30 °C (±54 °F)	Static pressure max. 70 bar/7 MPa/1015 psi	
• 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	In 5 years ≤ (0.125 • r) %	
• 30 bar/3 MPa/435.11 psi	In 5 years ≤ (0.25 • r) %	
Step response time T_{63} without electrical damping		
• 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	Approx. 0.2 s	
Effect of mounting position	In pressure per change of angle ≤ 0.7 mbar/0.07 kPa/0.001015 psi per 10° incline (zero-point correction is possible with position error compensation)	

Differential pressure and flow rate measuring accuracy	
Effect of auxiliary power supply	In percent per change in voltage 0.005 % per 1 V
Measured value resolution for PROFIBUS PA or FOUNDATION Fieldbus	3 • 10^{-5} of the nominal measuring range

13.7 Operating conditions

Rated conditions for gauge pressure and absolute pressure (from the gauge pressure series)		
Installation conditions		
Ambient conditions		
• Ambient temperature		
Note	Observe the temperature class in hazardous areas.	
Measuring cell with silicone oil filling	-40 … +100 °C (-40 … +212 °F)	
Measuring cell with inert liquid	-20 … +85 °C (-4 … +185 °F)	
Measuring cell with inert filling liquid for gauge pressure measuring cells 1, 4, 16 and 63 bar	-40 ... +85°C (-40...+185°F)	
Display	-30 … +85 °C (-22 … +185 °F)	
Storage temperature	-50 … +85 °C (-58 … +185 °F)	
• Climate class		
Condensation	Permitted	
• Degree of protection in accordance with EN 60529	IP66, IP68	
• Degree of protection in accordance with NEMA 250	NEMA 4X	
• Electromagnetic compatibility		
Interference emission and interference immunity	In accordance with EN 61326 and NAMUR NE 21	
Process medium conditions		
• Process temperature		
Cell	*Pressure*	*Temperature range*
Measuring cell with silicone oil filling		-40 … +100 °C (-40 … +212 °F)

Rated conditions for gauge pressure and absolute pressure (from the gauge pressure series)		
Measuring cell with inert liquid	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)
With extension to Zone 0		-20 … +60 °C (-4 … +140 °F)

Conditions of use for gauge pressure and absolute pressure with flush-mounted diaphragm		
Installation conditions		
Ambient temperature		
Note	Observe the temperature class in hazardous areas.	
• Measuring cell with silicone oil filling	-40 … +85 °C (-40 … +185 °F)	
• Measuring cell with inert liquid (various 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 Neobee (FDA-compliant)	-10 … +85 °C (14 … 185 °F)	
• Display	-30 … +85 °C (-22 … +185 °F)	
• Storage temperature	-50 … +85 °C (-58 … +185 °F) (with Neobee: -20 ... + 85 °C (-4 ... +185 °F)) (with high-temperature oil: -10 ... + 85 °C (14 ... 185 °F))	
Climate class		
Condensation	Permitted	
• Degree of protection in accordance with EN 60 529	IP66, IP68	
• Degree of protection in accordance with NEMA 250	NEMA 4X	
Electromagnetic compatibility		

Conditions of use for gauge pressure and absolute pressure with flush-mounted diaphragm	
• Interference emission and interference immunity	In accordance with EN 61326 and NAMUR NE 21
Process medium conditions	
Process temperature[1)]	
• 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 liquid	-20 … +100 °C (-4 … +212 °F) -20 … +200°C (-4 … +392 °F) with cooling extension
• Measuring cell with Neobee (FDA-compliant)	-10 … +150°C (14 … 302 °F) -10 … +200°C (14 … 392 °F) with cooling extension
• Measuring cell with high-temperature oil filling	-10 ... +250 °C (14 ... 482 °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.

Conditions of use for pressure transmitter with PMC connection	
Installation conditions	
Ambient temperature	
Note	Observe the temperature class in hazardous areas.
• Measuring cell with silicone oil filling	-40 … +85 °C (-40 … +185 °F)
• Display	-30 … +85 °C (-22 … +185 °F)
• Storage temperature	-50 … +85 °C (-58 … +185 °F)
Climate class	
Condensation	Permitted
• Degree of protection in accordance with EN 60529	IP66, IP68
• Degree of protection in accordance with NEMA 250	NEMA 4X
Electromagnetic compatibility	
• Interference emission and interference immunity	In accordance with EN 61326 and NAMUR NE 21
Process medium conditions	
• Process temperature	-40 … +100 °C (-40 … +212 °F)

Rated conditions for 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.
Measuring cell with silicone oil filling	-40 … +85 °C (-40 … +185 °F)
• Measuring cell 30 bar (435 psi)	• -20 … +85 °C (-4 … +185 °F) • For flow: -20 … +85 °C (-4 … +185 °F)
Measuring cell with inert liquid	-20 … +85 °C (-4 … +185 °F)
Display	-30 … +85 °C (-22 … +185 °F)
Storage temperature	-50 … +85 °C (-58 … +185 °F)
• Climate class	
Condensation	Permitted
• Degree of protection in accordance with EN 60529	IP66, IP68
• Degree of protection in accordance with NEMA 250	NEMA 4X
• Electromagnetic compatibility	
Interference emission and interference immunity	In accordance with EN 61326 and NAMUR NE 21
Process medium conditions	
• Process temperature	
Measuring cell with silicone oil filling	-40 … +100 °C (-40 … +212 °F)
• Measuring cell 30 bar (435 psi)	-20 … +85 °C (-4 … +185 °F)
Measuring cell with inert liquid	-20 … +100 °C (-4 … +212 °F)
• Measuring cell 30 bar (435 psi)	-20 … +85 °C (-4 … +185 °F)
In conjunction with dust explosion protection	-20 … +60°C (-4 … +140°F)

Rated conditions for level	
Installation conditions	
• Installation instruction	specified through the flange
Ambient conditions	
• Ambient temperature	

Rated conditions for level	
Note	Observe the allocation of the max. permissible operating temperature to the max. permissible operating pressure of the relevant flange connection.
Measuring cell with silicone oil filling	-40 … +85 °C (-40 … +185 °F)
Display	-30 … +85 °C (-22 … +185 °F)
Storage temperature	-50 … +85 °C (-58 … +185 °F)
• Climate class	
Condensation	Permitted
• Degree of protection in accordance with EN 60529	IP66
• Degree of protection in accordance with NEMA 250	NEMA 4X
• Electromagnetic compatibility	
Interference emission and interference immunity	In accordance with EN 61326 and NAMUR NE 21
Process medium conditions	
• Process temperature	
Measuring cell with silicone oil filling	• Plus side: See mounting flange • Low-pressure side: -40 … +100 °C (-40 … +212 °F)

13.8 Construction

Construction for gauge pressure and absolute pressure (from the gauge pressure series)	
Weight	Approx. 1.5 kg (3.3 lb) for aluminum enclosure
Material	
• Wetted parts materials	
Process connection	Stainless steel, mat. no. 1.4404/316L or Hastelloy C4, mat. no. 2.4610
Oval flange	Stainless steel, mat. no. 1.4404/316L
Seal diaphragm	Stainless steel, material no. 1.4404/316L or Hastelloy C276, material no. 2.4819
• Non-wetted parts materials	
Electronics housing	• Copper-free die cast aluminum GD-AlSi 12 or stainless steel precision casting, mat. no. 1.4408 • Standard: Powder coating with polyurethane Option: 2 coats: Coat 1: epoxy-based; coat 2: polyurethane • Stainless steel nameplate
Mounting bracket	Steel or stainless steel

Construction for gauge pressure and absolute pressure (from the gauge pressure series)	
Measuring cell filling	• Silicone oil • Neobee M20 • Inert liquid (max. 120 bar g (2320 psi g) for oxygen measurement)
Process connection	G1/2B connection pin in accordance with DIN EN 837-1; female thread 1/2-14 NPT or oval flange (PN 160 (MAWP 2320 psi g)) with M10 fastening screw thread in accordance with DIN 19213 or 7/16-20 UNF in accordance with EN 61518. Male thread M20 x 1.5 and 1/2-14 NPT
Electrical connection	Cable inlet using the following cable glands: • Pg 13.5 • M20 x 1.5 and ½-14 NPT or Han 7D/Han 8D connector[1)] – Cable diameter: 6 to 12 mm; types of protection "nA" and "ic" (Zone 2): 8 to 12 mm or a suitable cable gland for smaller diameters • M12 connector
Degree of protection for Han and M12 connectors	IP65

1) Han 8D is identical to Han 8U.

Construction for gauge pressure, with flush mounted diaphragm	
Weight	Approx 1.5 … 13.5 kg (3.3 … 30 lb) with aluminum enclosure
Material	
• Wetted parts materials	
Process connection	Stainless steel, mat. no. 1.4404/316L
Seal diaphragm	Stainless steel, mat. no. 1.4404/316L
• Non-wetted parts materials	
Electronics housing	• Non-copper aluminum die casting GD-AlSi 12 or stainless steel precision cast-ing, mat. no. 1.4408 • Standard: Powder coating with polyurethane Option: 2 coats: Coat 1: epoxy-based; coat 2: polyurethane • Stainless steel nameplate
Mounting bracket	Steel or stainless steel
Measuring cell filling	• Silicone oil • Neobee M20 • Inert liquid
Process connection	• Flanges as per EN and ASME • F&B and Pharma flange, clamp and threaded connectors • NEUMO BioConnect/BioControl • PMC connections for the paper industry

Construction for gauge pressure, with flush mounted diaphragm	
Electrical connection	Cable inlet using the following cable glands: • Pg 13.5 • M20x1.5 • ½-14 NPT • Han 7D/Han 8D plug[1)] • M12 connector
Degree of protection for Han and M12 connectors	IP65

1) Han 8D is identical to Han 8U.

Construction of pressure transmitter with PMC connection	
Weight	Approx. 1.5 kg (3.3 lb) for aluminum enclosure
Material	
• Wetted parts materials	
Gasket (standard)	PTFE flat gasket
O-ring (minibolt)	• FPM (Viton) • FFPM or NBR (optional)
Seal diaphragm	Hastelloy C276, mat. No. 2.4819
• Non-wetted parts materials	
Electronics housing	• Non-copper aluminum die casting GD-AlSi 12 or stainless steel precision casting, mat. no. 1.4408 • Standard: Powder coating with polyurethane Option: 2 coats: Coat 1: epoxy-based; coat 2: polyurethane • Stainless steel nameplate
Mounting bracket	Steel or stainless steel
Measuring cell filling	• Silicone oil • Inert liquid
Process connection	
• Standard	• Flush mounted • 1$^1/_2$" • PMC Standard design
• Minibolt	• Flush mounted • 1" • PMC Minibolt design

Construction of pressure transmitter with PMC connection	
Electrical connection	Cable inlet using the following cable glands: • Pg 13.5 • M20 x 1.5 • ½-14 NPT • Han 7D/Han 8D plug[1)] • M12 connector
Degree of protection for Han and M12 connectors	IP65

[1)] Han 8D is identical to Han 8U.

Design for absolute pressure (from the differential pressure series), differential pressure and flow rate	
Weight	Approx. 4.5 kg (9.9 lb) for aluminum enclosure
Material	
• Wetted parts materials	
Seal diaphragm	Stainless steel, mat. no. 1.4404/316L, Hastelloy C276, mat. no. 2.4819, Monel, mat. no. 2.4360, tantalum or gold
Pressure caps and locking screw	Stainless steel, mat. no. 1.4408 to PN 160, mat. no. 1.4571/316Ti for PN 420, Hastelloy C4, 2.4610 or Monel, mat. no. 2.4360
O-ring	FPM (Viton) or optionally: PTFE, FEP, FEPM and NBR
• Non-wetted parts materials	
Electronics housing	• Non-copper aluminum die casting GD-AlSi 12 or stainless steel precision casting, mat. no. 1.4408 • Standard: Powder coating with polyurethane Option: 2 coats: Coat 1: epoxy-based; coat 2: polyurethane • Stainless steel nameplate
Pressure cap screws	Stainless steel
Mounting bracket	Steel or stainless steel
Measuring cell filling	• Silicone oil • Neobee M20 • Inert liquid (max. 120 bar g (2320 psi g) for oxygen measurement)
Process connection	$^{1}/_{4}$-18 NPT female thread and flat 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))

Design for absolute pressure (from the differential pressure series), differential pressure and flow rate	
Electrical connection	Screw terminals Cable inlet using the following cable glands: • Pg 13.5 • M20 x 1.5 • ½-14 NPT or Han 7D/Han 8D connector[1)] • M12 connector
Degree of protection for Han and M12 connectors	IP65

1) Han 8D is identical to Han 8U.

Construction for level	
Weight	
• as per EN (pressure transmitter with mounting flange, without tube)	approx 11 … 13 kg (24.2 … 28.7 lb)
• as per ASME (pressure transmitter with mounting flange, without tube)	approx 11 … 18 kg (24.2 … 39.7 lb)
Material	
• Wetted parts materials	
Plus side	
• Seal diaphragm on the mounting flange	Stainless steel, mat. no. 1.4404/316L, Monel 400, mat. no. 2.4360, Hastelloy B2, mat. no. 2.4617, Hastelloy C276, mat. no. 2.4819, Hastelloy C4, mat. no. 2.4610, tantalum, PTFE, ECTFE
• Sealing surface	smooth as per EN 1092-1, form B1 or ASME B16.5 RF 125 … 250 AA for stainless steel 316L, EN 2092-1 form B2 or ASME B16.5 RFSF for the remaining materials
Sealing material in the pressure caps	
• for standard applications	Viton
• for underpressure applications on the mounting flange	Copper
Minus side	
• Seal diaphragm	Stainless steel, mat. no. 1.4404/316L
• Pressure caps and locking screws	Stainless steel, mat. no. 1.4408
• O-ring	FPM (Viton)
• Non-wetted parts materials	

Construction for level	
Electronics housing	• Non-copper aluminum die casting GD-AlSi 12 or stainless steel precision casting, mat. no. 1.4408 • Standard: Powder coating with polyurethane Option: 2 coats: Coat 1: epoxy-based; coat 2: polyurethane • Stainless steel nameplate
Pressure cap screws	Stainless steel
Measuring cell filling	Silicone oil
• Mounting flange fill fluid	Silicon oil or a different design
Process connection	
• Plus side	Flange as per EN and ASME
• Minus side	$^{1}/_{4}$-18 NPT female thread and flat connection with M10 fastening screw thread in accordance with DIN 19213 (M12 for PN 420 (MAWP 6092 psi)) or $^{7}/_{16}$-20 UNF in accordance with EN 61518
Electrical connection	Screw terminals Cable inlet using the following cable glands: • Pg 13.5 • M20 x 1.5 • ½-14 NPT or Han 7D/Han 8D connector[1)] • M12 connector
Degree of protection for Han and M12 connectors	IP65

1) Han 8D is identical to Han 8U.

Torques	
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)
• Screw-in torque for NPT gland in the NPT adapter NOTE: To avoid damage to the device, the NPT adapter must be held in place while the NPT gland is screwed into the NPT adapter.	68 Nm (50 ft lb)
• Tightening torque for union nut made of plastic	2.5 Nm (1.8 ft lb)

Torques	
• Tightening torque for union nut made of metal/stainless steel	4 Nm (3 ft lb)

13.9 Display, keyboard and auxiliary power

Display and user interface	
Keys	3 for on-site programming directly at the device
Display	• With or without integrated display (optional) • Cover with inspection window (optional)

Auxiliary power U_H		
	HART	**PROFIBUS PA or Foundation Fieldbus**
Terminal voltage on pressure transmitter	• DC 10.5 V … 45 V • In the case of intrinsically safe operation 10.5 V … 30 V DC	–
Ripple	U_{SS} ≤ 0.2 V (47 … 125 Hz)	–
Noise	U_{eff} ≤ 1.2 mV (0.5 … 10 kHz)	–
Auxiliary power	–	Bus-powered
Separate supply voltage	–	Not necessary
Bus voltage		
• Not Ex	–	9 … 32 V
• For intrinsically safe operation	–	9 … 24 V
Current consumption		
• Max. basic current	–	12.5 mA
• Starting current ≤ basic current	–	Yes
• Max. current in event of fault	–	15.5 mA
Error shut-down electronics (FDE) present	–	Yes

13.10 Certificates and approvals

Certificates and approvals		
	HART	**PROFIBUS PA and FOUNDATION Fieldbus**
Classification according to Pressure Equipment Directive (PED 97/23/EC)	• for gases of Fluid Group 1 and liquids of Fluid Group 1; meets requirements of Article 3 Para. 3 (good 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	In preparation	
Explosion protection		
• Intrinsic safety "i"		
Designation	Ⓔx II 1/2 G Ex ia/ib IIC T4/T5/T6 Ga/Gb	
Permissible ambient temperature	-40 … +85 °C (-40 … +185 °F) temperature class T4 -40 … +70 °C (-40 … +158 °F) temperature class T5 -40 … +60 °C (-40 … +140 °F) temperature class T6	
Connection	To a certified intrinsically safe circuit with the max. values: U_i = 30 V, I_i = 100 mA, P_i = 750 mW, R_i = 300 Ω	FISCO supply unit U_0 = 17.5 V, I_0 = 380 mA, P_0 = 5.32 W Linear barrier U_0 = 24 V, I_0 = 174 mA, P_0 = 1 W
Effective inner capacitance	C_i = 6 nF	C_i = 1.1 nF
Effective inner inductance	L_i = 0.4 mH	L_i = 7 µH
• Flameproof enclosure encapsulation "d"		
Designation	Ⓔx II 1/2 G Ex d IIC T4, T6 Ga/Gb	
Permissible ambient temperature	-40 … +85 °C (-40 … +185 °F) temperature class T4 -40 … +60 °C (-40 … +140 °F) temperature class T6	
Connection	To a circuit with the operating values: U_H = 10.5 … 45 V DC	To a circuit with the operating values: U_H = 9 … 32 V DC
• Dust explosion protection for Zone 20 and 20/21		
Designation	Ⓔx II 1 D Ex ta IIIC IP65 T120°C Da, Ⓔx II 1/2 D Ex ta/tb IIIC IP65 T120°C Da/Db	
Permissible ambient temperature	-40 ... +85 °C (-40 ... +185 °F)	
max. surface temperature	120°C (248°F)	
Connection	To a certified intrinsically safe circuit with the max. values: U_i = 30 V, I_i = 100 mA, P_i = 750 mW, R_i = 300 Ω	FISCO supply unit U_0 = 17.5 V, I_0 = 380 mA, P_0 = 5.32 W Linear barrier U_0 = 24 V, I_0 = 250 mA, P_0 = 1.2 W
Effective inner capacitance	C_i = 6 nF	C_i = 1.1 nF
Effective inner inductance	L_i = 0.4 mH	L_i = 7 µH

Certificates and approvals		
	HART	**PROFIBUS PA and FOUNDATION Fieldbus**
• Dust explosion protection for Zone 22		
Designation	II 2 D Ex tb IIIC IP65 T120°C Db	
Connection	To a circuit with the operating values: U_H = 10.5 … 45 V DC; P_{max} = 1.2 W	To a circuit with the operating values: U_H = DC 9 … 32 V; P_{max} = 1.2 W
• Type of protection "n" (Zone 2)		
Designation	II 2/3 G Ex nA II T4/T5/T6 Gc II 2/3 G Ex ic IIC T4/T5/T6 Gc	
Connection "nA"	U_n = 45 V	U_m = 32 V
Connection "ic"	To a circuit with the operating values: U_i = 45 V	FISCO supply unit U_O =17.5 V, I_O = 570 mA Linear barrier U_0 = 32 V, I_0 = 132 mA, P_0 = 1 W
Effective inner capacitance	C_i = 6 nF	C_i = 1.1 nF
Effective inner inductance	L_i = 0.4 mH	L_i = 7 µH
• Explosion protection in accordance with FM	Certificate of Compliance 3008490	
Designation (XP/DIP) or IS; NI; S	CL I, DIV 1, GP ABCD T4 ... T6; CL II, DIV 1, GP EFG; CL III; CL I, ZN 0/1 AEx ia IIC T4 ... T6; CL I, DIV 2, GP ABCD T4 ... T6; CL II, DIV 2, GP FG; CL III	
Permissible ambient temperature	T_a = T4: -40 ... +85 °C (-40 ... +185 °F) T_a = T5: -40 ... +70 °C (-40 ... +158 °F) T_a = T6: -40 ... +60 °C (-40 ... +140 °F)	
Entity parameters	As per "control drawing" A5E00072770A: U_i = 30 V, I_i = 100 mA, P_i = 750 mW, R_i = 300 Ω, C_i = 6 nF, L_i = 0.4 mH	As per "control drawing" A5E00072770A: U_{max} = 17.5 V, I_{max} = 380 mA, P_{max} = 5.32 W, C_{max} = 6 nF, L_{max} = 0.4 mH
• Explosion protection as per CSA	Certificate of Compliance 1153651	
Designation (XP/DIP) or (IS)	CL I, DIV 1, GP ABCD T4 ... T6; CL II, DIV 1, GP EFG; CL III; Ex ia IIC T4 ... T6: CL I, DIV 2, GP ABCD T4 ... T6; CL II, DIV 2, GP FG; CL III	
Permissible ambient temperature	T_a = T4: -40 ... +85 °C (-40 ... +185 °F) T_a = T5: -40 ... +70 °C (-40 ... +158 °F) T_a = T6: -40 ... +60 °C (-40 ... +140 °F)	
Entity parameters	As per "control drawing" A5E00072770A: U_i = 30 V, I_i = 100 mA, P_i = 750 mW, R_i = 300 Ω, L_i = 0.4 mH, C_i = 6 nF	

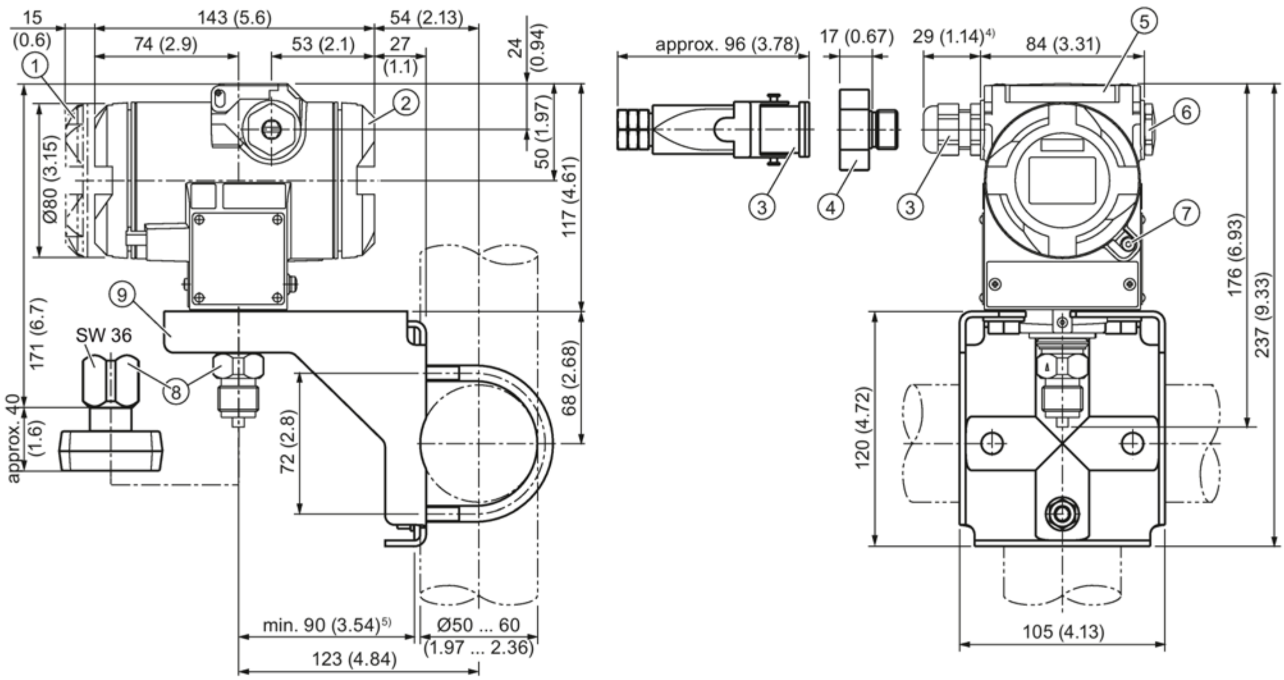
13.11 PROFIBUS communication

PROFIBUS PA communication	
Simultaneous communication with master Class 2	Max. 4
Setting of address possible using	• Configuration tool • Local operation (standard setting is address 126)
Cyclic user data	
• Output byte	• One measured value: 5 bytes • Two measured values: 10 bytes
• Input byte	• Totalizer mode: 0, 1 or 2 bytes • Reset function because of injection: 1 byte (totalizer mode and reset function because of injection)
Internal preprocessing	
Device profile	PROFIBUS PA Profile for Process Control Devices Version 3.0, Class B
Function blocks	2
• Analog input	
Adaptation to user-specific process variable	Yes, linearly rising or falling characteristic
Adjustable electrical damping	0 ... 100 s
Simulation function	Output/input
Failure response	Can be parameterized: • Last good value • Substitute value • Faulty value
Limit monitoring	Upper and lower warning and alarm limits
• Totalizer	• Can be reset and preset • Selectable counting direction • Simulation function of totalizer output
Failure response	Can be parameterized: • Addition with last good value • Stop addition • Addition with faulty value
Limit monitoring	Upper and lower warning and alarm limits
• Physical block	1
Transducer blocks	2
• Transducer block "Pressure"	
Calibration by applying two pressures	Yes

PROFIBUS PA communication	
Monitoring of sensor limits	Yes
Input of a container characteristic	With max. 30 interpolation points
Characteristic curve	• Linear • Square-root Not for gauge and absolute pressures
Low-flow cut-off and starting point of square-rooting Not for gauge and absolute pressures	Parameterizable
Simulation function	
• Pressure measurement	• Constant value • Parameterizable ramp function
• Sensor temperature	• Constant value • Parameterizable ramp function
• Transducer block "Electronics temperature"	
Simulation function	
• Pressure measurement	• Constant value • Parameterizable ramp function
• Electronics temperature	• Constant value • Parameterizable ramp function

Dimension drawings 14

14.1 SITRANS P, DS III/P410 for gauge pressure and absolute pressure from the gauge pressure series



① Electronics side, display
(longer for cover with inspection window)1)

② Connection side1)

③ Electrical connection:
- Pg 13.5 gland (adapter)2)3)
- M20 x 1.5 gland3)
- ½-14 NPT gland
- Han 7D/Han 8D plug2) 3)

④ Harting adapter

⑤ Protective cap of the operating buttons

⑥ Blanking plug

⑦ Safety catch
(only for flameproof encapsulation, not shown in the drawing)

⑧ Process connection: G½B connection pin or oval flange

⑨ Mounting bracket (optional)

1) Take an additional 20 mm (0.79 inches) thread length into account

2) Not with "flameproof enclosure" type of protection

[3)] Not for "FM + CSA [is + XP]" type of protection

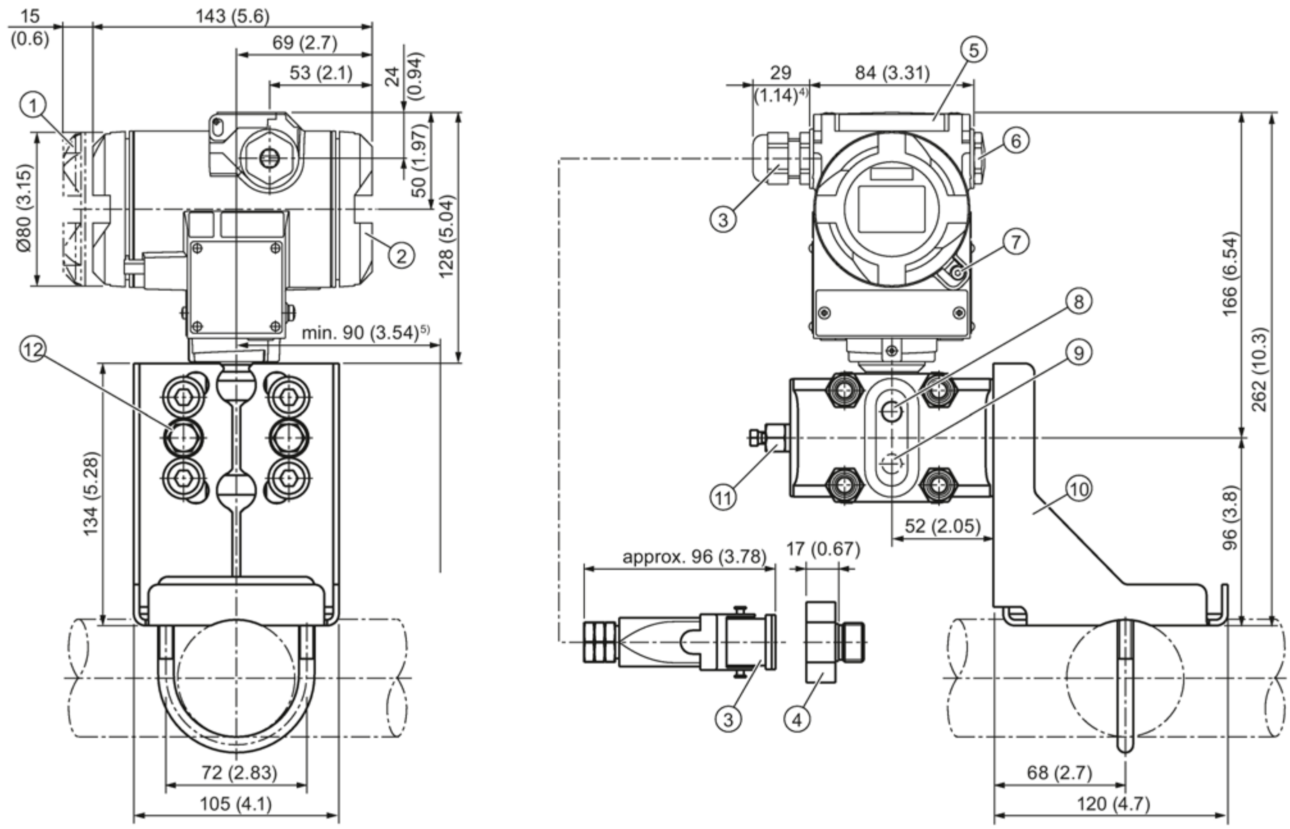
[4)] For Pg 13.5 with adapter, approx 45 mm (1.77 inches)

[5)] Minimum distance for rotating

[6)] SITRANS P410 is only available as gauge pressure and differential pressure version.

Image 14-1 Pressure transmitter SITRANS P DS III/P410 for absolute pressure, from the gauge pressure series, dimensions in mm (inches)

14.2 SITRANS P DS III/P410 for differential pressure, flow rate and absolute pressure from the differential pressure series



① Electronics side, display
(longer for cover with inspection window)1)

② Connection side1)

③ Electrical connection:
- Pg 13.5 gland (adapter)2)3)
- M20 x 1.5 gland
- ½-14 NPT gland
- Han 7D/Han 8D plug2)3

④ Harting adapter

⑤ Protective cap of the operating buttons

⑥ Blanking plug

⑦ Safety catch
(only for "flameproof enclosure" type of protection, not shown in the drawing)

⑧ Lateral ventilation for liquid measurement (standard)

⑨ Lateral ventilation for gas measurement (addition H02)

⑩ Mounting bracket (optional)

⑪ Sealing plug, with valve (optional)

⑫ Process connection: 1/4-18 NPT (EN 61518)

1) Take an additional 20 mm (0.79 inches) thread length into account

2) Not with "flameproof enclosure" type of protection

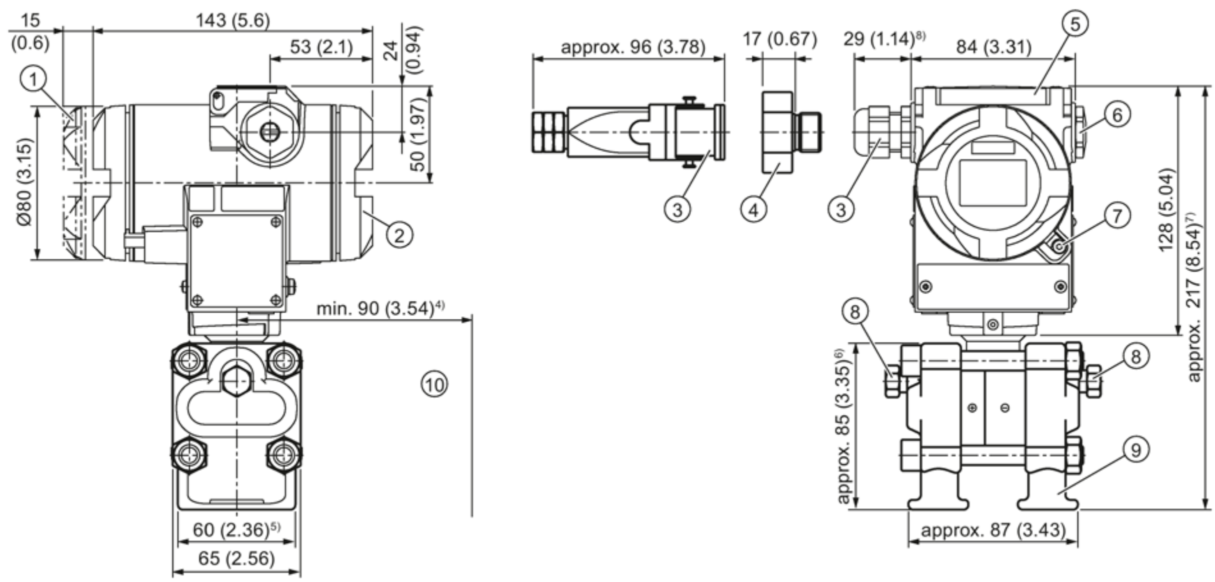
3) Not for "FM + CSA [IS + XP]" type of protection

4) For Pg 13.5 with adapter, approx 45 mm (1.77 inches)

5) 92 mm (3.62 inch) minimum distance for rotating the pointer

6) SITRANS P410 is only available as gauge pressure and differential pressure version.

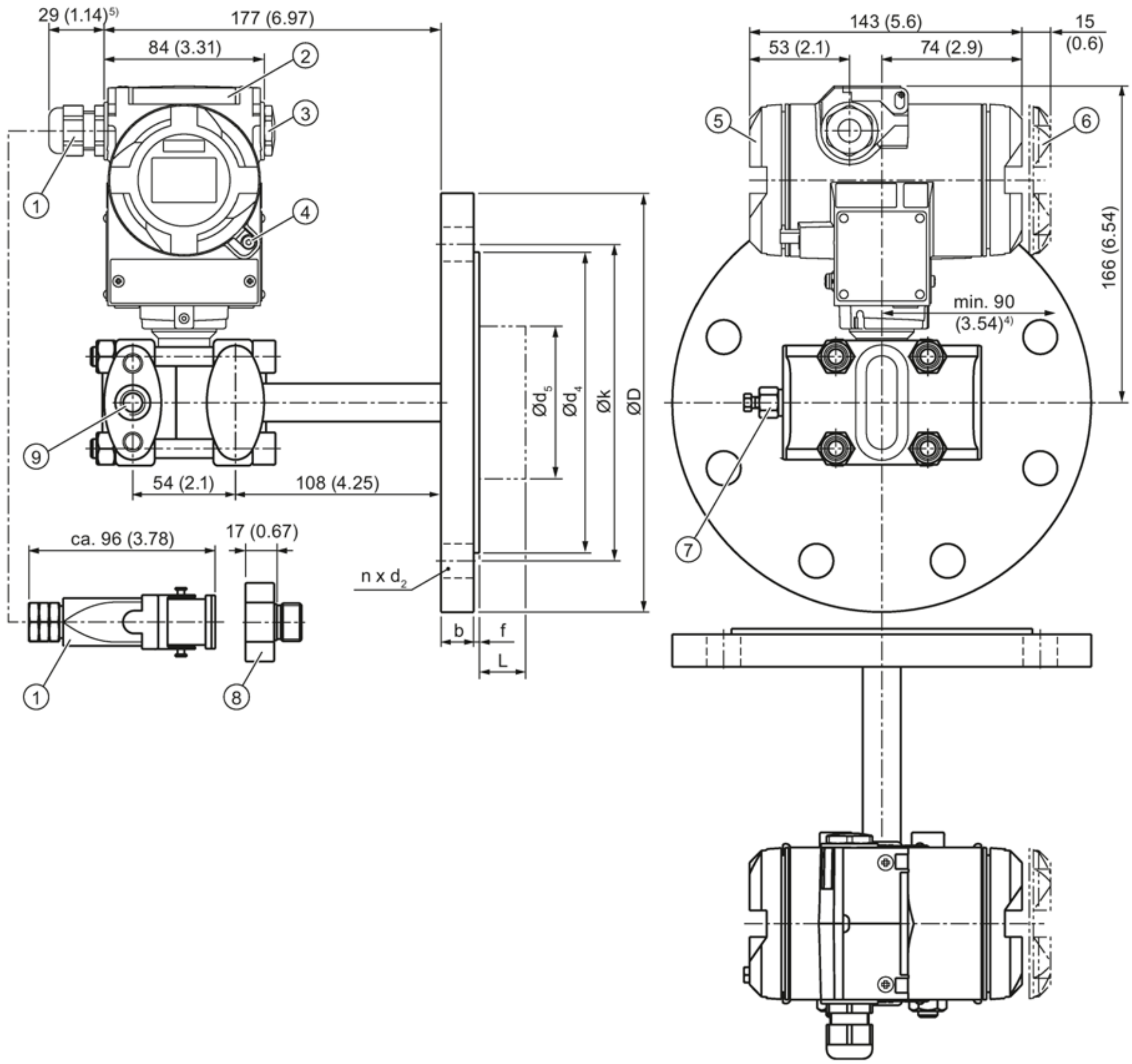
Image 14-2 Pressure transmitter SITRANS P DS III/P410 for differential pressure and flow rate, dimensions in mm (inches)



①	Electronics side, display (longer for cover with inspection window)[1]
②	Connection end
③	Electrical connection: • Pg 13.5 gland (adapter)[2,3] • M20 x 1.5 gland • ½-14 NPT gland • Han 7D/Han 8D plug[2,3]
④	Harting adapter
⑤	Protective cap of the operating buttons
⑥	Blanking plug
⑦	Safety catch (only for "flameproof enclosure" type of protection, not shown in the drawing)
⑧	Sealing plug, with valve (optional)
⑨	Process connection: ¼-18 NPT (IEC 61518)
⑩	Clearance for rotating the enclosure
1)	Take an additional 20 mm (0.79 inches) thread length into account
2)	Not with "flameproof enclosure" type of protection
3)	Not for "FM + CSA [is + XP]" type of protection
4)	92 mm (3.6 inch) minimum distance for rotating the pointer
5)	74 mm (2.9 inch) for PN ≥ 420 (MAWP ≥ 6092 psi)
6)	91 mm (3.6 inch) for PN ≥ 420 (MAWP ≥ 6092 psi)
7)	219 mm (8.62 inch) for PN ≥ 420 (MAWP ≥ 6092 psi)
8)	For Pg 13.5 with adapter approx. 45 mm (1.77 inches)
9)	SITRANS P410 is only available as gauge pressure and differential pressure version.

Image 14-3 Pressure transmitter SITRANS P DS III/P410 for differential pressure and flow rate with caps for vertical differential pressure lines, dimensions in mm (inches)

14.3 SITRANS P DS III/P410 for level



① Electrical connection:
- Pg 13.5 gland (adapter)2)3)
- M20 x 1.5 gland
- ½-14 NPT gland
- Han 7D/Han 8D plug2) 3)

② Protective cap of the operating buttons

③ Blanking plug

④ Safety catch (only for "flameproof enclosure" type of protection, not shown in the drawing)

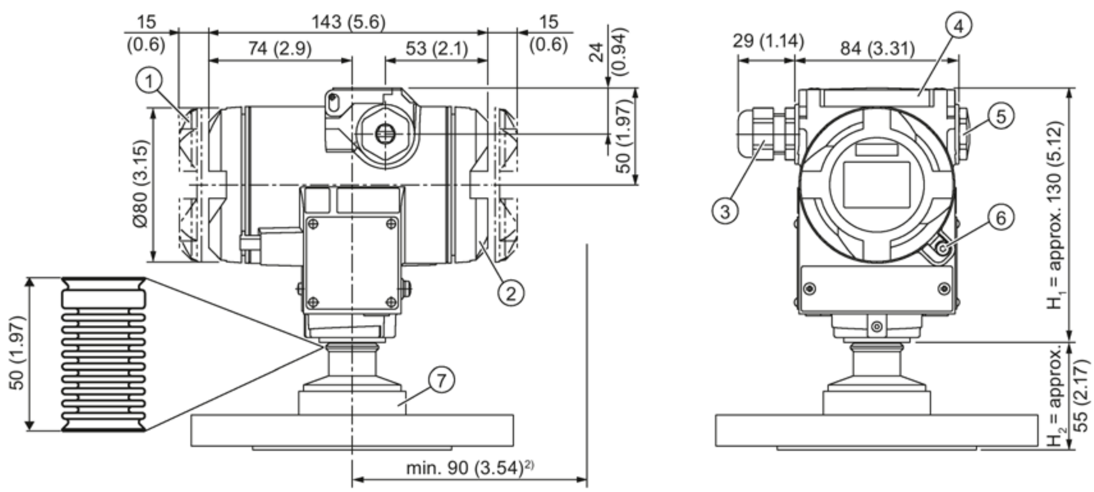
⑤ Connection side1)

⑥ Electronics side, display (longer for cover with inspection window)1)

⑦	Locking screw with valve (option)
⑧	Harting adapter
⑨	Process connection: Minus side ¼-18 NPT (IEC 61518)
1)	Take an additional 20 mm (0.79 inches) thread length into account
2)	Not with "flameproof enclosure" type of protection
3)	Not for "FM + CSA [is + XP]" type of protection
4)	92 mm (3.62 inches) minimum distance for rotating the enclosure with pointer
5)	For Pg 13.5 with adapter, approx 45 mm (1.77 inches)
6)	SITRANS P410 is only available as gauge pressure and differential pressure version.

Image 14-4 Pressure transmitter SITRANS P DS III/P410 for level, including mounting flange, dimensions in mm (inches)

14.4 SITRANS P DS III (flush-mounted)



①	Electronics side, display (longer for cover with inspection window)1)
②	Connection side1)
③	Electrical connection: • M20 x 1.5 gland • ½-14 NPT gland • M12 connector
④	Protective cap of the operating buttons
⑤	Blanking plug
⑥	Safety catch (only for "flameproof enclosure" type of protection, not shown in the drawing)
⑦	Process connection: see Flange table
1)	In addition, allow approx. 20 mm (0.79 inch) for the thread length
2)	92 mm (3.6 inches) minimum distance for rotating the enclosure with display
3)	SITRANS P410 is only available as gauge pressure and differential pressure version.

Image 14-5 SITRANS P DS III/P410 (flush mounted)

14.4.1 Note 3A and EHDG

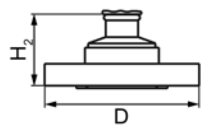
Note

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.

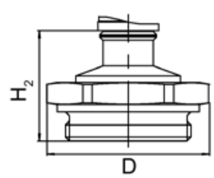
14.4.2 Connections as per EN and ASME

Flange as per EN



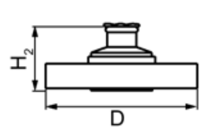
EN 1092-1				
	DN	PN	⌀D	H_2
	25	40	115 mm (4.5")	Approx. 52 mm (2")
	25	100	140 mm (5.5")	
	40	40	150 mm (5.9")	
	40	100	170 mm (6.7")	
	50	16	165 mm (6.5")	
	50	40	165 mm (6.5")	
	80	16	200 mm (7.9")	
	80	40	200 mm (7.9")	

Threaded connections



G3/4", G1" and G2" In accordance with DIN 3852				
	DN	PN	⌀D	H_2
	¾"	63	37 mm (1.5")	Approx. 45 mm (1.8")
	1"	63	48 mm (1.9")	Approx. 47 mm (1.9")
	2"	63	78 mm (3.1")	Approx. 52 mm (2")

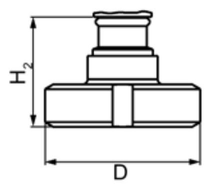
Flanges as per ASME



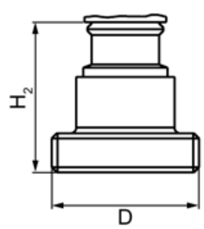
ASME B 16.5				
	DN	CLASS	⌀D	H_2
	1"	150	110 mm (4.3")	Approx. 52 mm (2")
	1"	300	125 mm (4.9")	
	1½"	150	130 mm (5.1")	
	1½"	300	155 mm (6.1")	
	2"	150	150 mm (5.9")	
	2"	300	165 mm (6.5")	
	3"	150	190 mm (7.5")	
	3"	300	210 mm (8.1")	
	4"	150	230 mm (9.1")	
	4"	300	255 mm (10.0")	

14.4.3 F&B and pharma flange

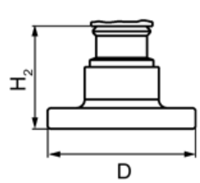
Connections as per DIN



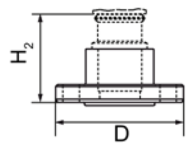
DIN 11851				
	DN	PN	⌀D	H_2
	50	25	92 mm (3.6")	Approx. 52 mm (2")
	80	25	127 mm (5.0")	

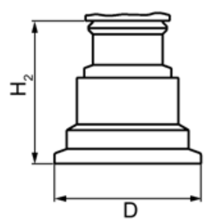


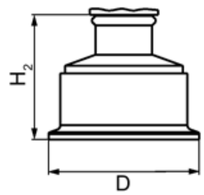
DIN 11864-1 Form A - sterile threaded sockets				
	DN	PN	⌀D	H_2
	25	40	52 mm (2")	Approx. 52 mm (2")
	40	40	65 mm (2.6")	
	50	40	78 mm (3.1")	
	100	40	130 mm (5.1")	
Approvals	EHEDG			



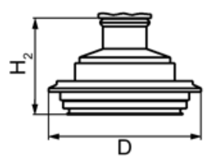
DIN 11864-2 Form A - sterile collar flange				
	DN	PN	⌀D	H_2
	50	16	94 mm (3.7")	Approx. 52 mm (2")
	65	16	113 mm (4.4")	
	80	16	133 mm (5.2")	
	100	16	159 mm (6.3")	
Approvals	EHEDG			

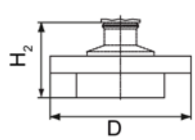
DIN 11864-2 Form A - sterile groove flange				
	DN	**PN**	**⌀D**	**H_2**
	50	16	94 mm (3.7")	Approx. 52 mm (2")
	65	16	113 mm (4.4")	
	80	16	133 mm (5.2")	
	100	16	159 mm (6.3")	
Approvals	EHEDG			

DIN 11864-3 Form A - sterile collar sockets				
	DN	**PN**	**⌀D**	**H_2**
	50	25	77.5 mm (3.1")	Approx. 52 mm (2")
	65	25	91 mm (3.6")	
	80	16	106 mm (4.2")	
	100	16	130 mm (5.1")	
Approvals	EHEDG			

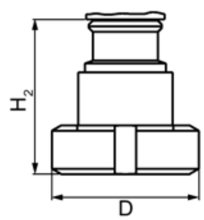
Tri-Clamp as per DIN 32676				
	DN	PN	⊘D	H_2
	50	16	64 mm (2.5")	Approx. 52 mm (2")
	65	16	91 mm (3.6")	

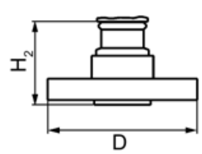
Other connections

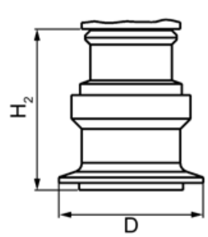
Varivent® connector				
	DN	PN	⊘D	H_2
	40-125	40	84 mm (3.3")	Approx. 52 mm (2")
Approvals	EHEDG			

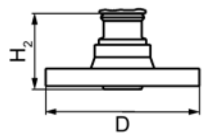
Connection in accordance with DRD				
	DN	PN	⊘D	H_2
	65	40	105 mm (4.1")	Approx. 52 mm (2")

BioConnect™ connectors

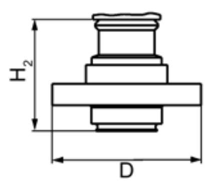
BioConnect™ screwed joint				
	DN	PN	⌀D	H_2
	50	16	82 mm (3.2")	Approx. 52 mm (2")
	65	16	105 mm (4.1")	
	80	16	115 mm (4.5")	
	100	16	145 mm (5.7")	
	2"	16	82 mm (3.2")	
	2½"	16	105 mm (4.1")	
	3"	16	105 mm (4.1")	
	4"	16	145 mm (5.7")	
Approvals	EHEDG			

BioConnect™ flange connector				
	DN	PN	⌀D	H_2
	50	16	110 mm (4.3")	Approx. 52 mm (2")
	65	16	140 mm (5.5")	
	80	16	150 mm (5.9")	
	100	16	175 mm (6.9")	
	2"	16	100 mm (3.9")	
	2½"	16	110 mm (4.3")	
	3"	16	140 mm (5.5")	
	4"	16	175 mm (6.9")	
Approvals	EHEDG			

BioConnect™ clamp connector				
	DN	PN	⌀D	H_2
	50	16	77.4 mm (3.0")	Approx. 52 mm (2")
	65	10	90.9 mm (3.6")	
	80	10	106 mm (4.2")	
	100	10	119 mm (4.7")	
	2"	16	64 mm (2.5")	
	2½"	16	77.4 mm (3.0")	
	3"	10	90.9 mm (3.6")	
	4"	10	119 mm (4.7")	
Approvals	EHEDG			

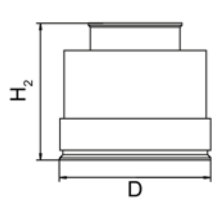
Connect S™ flanged joint				
	DN	**PN**	**⌀D**	**H_2**
	50	16	125 mm (4.9")	Approx. 52 mm (2")
	65	10	145 mm (5.7")	
	80	10	155 mm (6.1")	
	100	10	180 mm (7.1")	
	2"	16	125 mm (4.9")	
	2½"	10	135 mm (5.3")	
	3"	10	145 mm (5.7")	
	4"	10	180 mm (7.1")	
Approvals	EHEDG			

Other connections

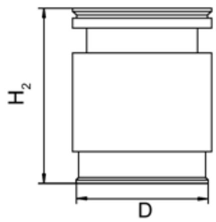
BioControl™ connector				
	DN	**PN**	**⌀D**	**H_2**
	50	16	90 mm (3.5")	Approx. 52 mm (2")
	65	16	120 mm (4.7")	
Approvals	EHEDG			

14.4.4 PMC Style

Connections for the paper industry

PMC Style Standard				
	DN	**PN**	**⌀D**	**H_2**
	–	–	40.9 mm (1.6")	Approx. 36.8 mm (1.4")
	M44x1.25 cap nut			

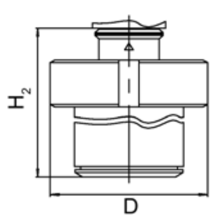
PMC-Style Minibolt

	DN	PN	⌀D	H_2
	–	–	26.3 mm (1.0")	Approx. 33.1 mm (1.3")

14.4.5 Special connections

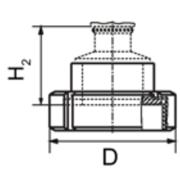
Tank connection

TG52/50 and TG52/150

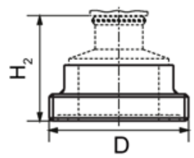
	DN	PN	⌀D	H_2
	TG52/50			
	43.5 mm	10	63 mm (2.5")	Approx. 63 mm (2.5")
	TG52/150			
	43.5 mm	10	63 mm (2.5")	Approx. 170 mm (6.7")

SMS connectors

SMS sockets with union nut

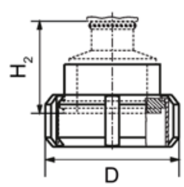
	DN	PN	⌀D	H_2
	2"	25	84 mm (3.3")	Approx. 52 mm (2.1")
	2½"	25	100 mm (3.9")	
	3"	25	114 mm (4.5")	

SMS threaded sockets

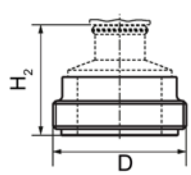
	DN	PN	⌀D	H_2
	2"	25	70 x 1/6 mm (2.8")	Approx. 52 mm (2.1")
	2½"	25	85 x 1/6 mm (3.3")	
	3"	25	98 x 1/6 mm (3.9")	

IDF connectors

IDF sockets with union nut

	DN	PN	⌀D	H_2
	2"	25	77 mm (3.0")	Approx. 52 mm (2.1")
	2½"	25	91 mm (3.6")	
	3"	25	106 mm (4.2")	

IDF threaded sockets

	DN	PN	⌀D	H_2
	2"	25	64 mm (2.5")	Approx. 52 mm (2.1")
	2½"	25	77.5 mm (3.1")	
	3"	25	91 mm (3.6")	

Spare parts / accessories 15

15.1 Order data

In order to ensure that the ordering data you are using is not outdated, the latest ordering data is always available on the Internet:

Catalog process instrumentation (http://www.siemens.com/processinstrumentation/catalogs)

Selection and order data	Order no.
CD "sitrans p - pressure transmitters" with documentation in German/English/French/Spanish/Italian, etc.	A5E00090345
HART modem	
• With USB interface	7MF4997-1DB[1) D)]
Weld-in support for PMC connection	
For Series SITRANS P DS III and SITRANS P300	
• PMC Style Standard: Thread 1½"	7MF4997-2HA
• PMC-Style Minibolt: flush mounted 1"	7MF4997-2HB
Gaskets for PMC connection, (1 set = 5 pieces)	
• PTFE gasket for PMC Style Standard: Thread 1½"	7MF4997-2HC
• Viton gasket for PMC Style Minibolt: flush mounted 1"	7MF4997-2HD
Weld-in adapter for PMC connection	
For connection of weld-in support delay during welding for:	
• PMC Style Standard: Thread 1½"	7MF4997-2HE
• PMC-Style Minibolt: flush mounted 1"	7MF4997-2HF

1) Available from stock

D) Subject to export regulations AL: N, ECCN, EAR99H

15.2 Spare parts/accessories for SITRANS P DS III

Selection and order data	Order no.
Mounting bracket and fastening parts	
For SITRANS P DS III, DS III PA and DS III FF	
For gauge pressure transmitter (7MF403.-.....-..C.)	
For absolute pressure transmitter (7MF423.-.....-..C.)	
• Made of steel	7MF4997-1AB

Selection and order data		Order no.
• Made of stainless steel		7MF4997-1AH
Mounting bracket and fastening parts		
For SITRANS P DS III, DS III PA and DS III FF		
For gauge pressure transmitter (7MF403.-.....-..A., -..B. and -..D.)		
For absolute pressure transmitter (7MF423.-.....-..A., -..B. and -..D.)		
• Made of steel		7MF4997-1AC
• Made of stainless steel		7MF4997-1AJ
Mounting bracket and fastening parts		
For SITRANS P DS III, DS III PA and DS III FF		
Differential pressure transmitter with flange thread		
• Made of steel		
	For thread M10 (7MF433.-... and 7MF443.-...)	7MF4997-1AD
	For thread M12 (7MF453.-...)	7MF4997-1AE
• Made of stainless steel		
	For thread M10 (7MF433.-... and 7MF443.-...)	7MF4997-1AK
	For thread M12 (7MF453.-...)	7MF4997-1AL
Mounting bracket and fastening parts		
For SITRANS P DS III, DS III PA and DS III FF		
Differential and absolute pressure transmitter with flange thread 7/16-20 UNF (7MF433.-..., 7MF443.-... and 7MF453.-...)		
• Made of steel		7MF4997-1AF
• Made of stainless steel		7MF4997-1AM
Cover		
For SITRANS P DS III, DS III PA and DS III FF		
• Made of aluminum die casting, including gasket		
	Without inspection window	7MF4997-1BB
	With inspection window	7MF4997-1BE
• Made of stainless steel, including gasket		
	Without inspection window	7MF4997-1BC
	With inspection window	7MF4997-1BF
Digital display		
For SITRANS P DS III, DS III PA and DS III FF		
Including the fastening material		7MF4997-1BR
Measuring point label		
• not labeled (five pieces)		7MF4997-1CA
• labeled (1 unit) Specifications as per Y01 or Y02, Y15 and Y16 (refer to SITRANS P pressure transmitter)		7MF4997-1CB-Z Y..: ....

Selection and order data	Order no.
Fastening screws, 50 pieces for: • Measuring point label • Earthing and connecting terminals • Digital display	7MF4997-1CD
Locking screws, (1 set = 2 pieces) for pressure cap	
• Made of stainless steel	7MF4997-1CG
• Made of Hastelloy	7MF4997-1CH
Vent valves, complete (1 set = 2 pieces)	
• Made of stainless steel	7MF4997-1CP
• Made of Hastelloy	7MF4997-1CQ
Electronics	
• For SITRANS P DS III	7MF4997-1DK
• For SITRANS P DS III PA	7MF4997-1DL
• For SITRANS P DS III FF	7MF4997-1DM
Network card	
• For SITRANS P DS III	7MF4997-1DN
• For SITRANS P DS III PA and DS III FF	7MF4997-1DP
Sealing rings for pressure caps made of	
• FPM (Viton)	7MF4997-2DA
• PTFE (Teflon)	7MF4997-2DB
• FEP (with silicon core, suitable for food)	7MF4997-2DC
• FFPM (Kalrez, Compound 4079)	7MF4997-2DD
• NBR (Buna N)	7MF4997-2DE

15.3 Order data for SIMATIC PDM

You can find ordering data in the Catalog FI 01 "Field devices for process automation in the Chapter "Communication and software > Software > SIMATIC PDM - Process Device Manager".

See also

Catalog process instrumentation (http://www.siemens.com/processinstrumentation/catalogs)

15.4 Ordering data for PROFIBUS accessories

In the Industrial Communication catalog (IK PI) you can find additional accessories that are required for communication with our devices and PROFIBUS.

For the latest updates to this catalog, please visit the Industry Mall (https://mall.industry.siemens.com/).

Appendix

A

A.1 Certificate

The certificates can be found on the enclosed CD and on the Internet under:

Certificates (http://www.siemens.com/processinstrumentation/certificates)

A.2 Certificates (China)

Additional information for China

The product is based on the standards QDSSC 001-2013, QDSSC 002-2013, QDSSC 003-2013 and meets the requirements of CMC and CPA.

CMC

辽制 02000001 号

CPA

中华人民共和国

计量器具型式批准证书

西门子传感器与通讯有限公司：

根据中华人民共和国计量法第十三条和中华人民共和国计量法实施细则有关规定，对你单位申请型式批准的计量器具新产品经审查合格，现予批准，并可使用以下标志和编号：

CPA

07F208-21

批准日期：2007.6.21

批准人签名：

经批准的计量器具新产品（名称、类别、型号）：

名　称：　压力变送器

型　号：　7MF4033 系列

名　称：　压力变送器

型　号：　7MF4034 系列

其技术指标为：

最大允许误差：±0.075%FS

最大允许误差：±0.075%FS

批准部门

（盖章）

中华人民共和国

计量器具型式批准证书

西门子传感器与通讯有限公司：

根据中华人民共和国计量法第十三条和中华人民共和国计量法实施细则有关规定，对你单位申请型式批准的计量器具新产品经审查合格，现予批准，并可使用以下标志和编号：

CPA

07F209-21

批准日期：2007.6.21

批准人签名：

经批准的计量器具新产品（名称、类别、型号）：

名　称：　绝压变送器
型　号：　7MF4233 系列
　　　　　7MF4333 系列
名　称：　绝压变送器
型　号：　7MF4234 系列
　　　　　7MF4334 系列

其技术指标为：

最大允许误差：±0.075%FS
最大允许误差：±0.075%FS

批准部门
（盖章）

中华人民共和国

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CPA

07F210-21

批准日期：2007.6.21

批准人签名：

经批准的计量器具新产品（名称、类别、型号）：

名　称：差压变送器

型　号：7MF4433 系列

7MF4533 系列

名　称：差压变送器

型　号：7MF4434 系列

7MF4534 系列

其技术指标为：

最大允许误差：±0.075%FS

最大允许误差：±0.075%FS

批准部门

（盖章）

中华人民共和国

计量器具型式批准证书

西门子传感器与通讯有限公司：

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CPA

07F211-21

批准日期：

批准人签名：

经批准的计量器具新产品（名称、类别、型号）：

名　称：液位差压变送器
型　号：7MF4633 系列

名　称：液位差压变送器
型　号：7MF4634 系列

其技术指标为：

基本误差：±0.15%FS
基本误差：±0.15%FS

批准部门
（盖章）

A.3 Literature and standards

No.	Standard	Description
/1/	IEC 61508 Section 1-7	Functional safety of following systems: • Safety-instrumented • Electrical • Electronic • Programmable Target group: Manufacturers and suppliers of equipment
/2/	IEC 61511 Section 1-3	Functional safety - Safety systems for the process industry Target group: Planners, constructors and users

A.4 Technical support

Technical Support

If this documentation does not provide complete answers to any technical questions you may have, contact Technical Support at:

- Support request (http://www.siemens.com/automation/support-request)
- More information about our Technical Support is available at Technical support (http://www.siemens.com/automation/csi/service)

Internet Service & Support

In addition to our documentation, Siemens provides a comprehensive support solution at:

- Service&Support (http://www.siemens.com/automation/service&support) where you will find support news, support documents including EDDs and software, and also support from experts.

Additional Support

If you have additional questions about the device, please contact your local Siemens representative.

Find your local contact partner at:

- Partner (http://www.automation.siemens.com/partner)

Documentation for various products and systems is available at:

- Instructions and manuals (http://www.siemens.com/processinstrumentation/documentation)

See also

Product information on SITRANS P in the Internet (http://www.siemens.com/sitransp)

Process instrumentation catalog (http://www.siemens.com/processinstrumentation/catalogs)

E-mail (mailto:support.automation@siemens.com)

List of abbreviations/acronyms

B

B.1 Pressure transmitter

List of abbreviations

Table B- 1 Tags

Abbreviation	In full	Meaning
OUT	Output	
PRIM	Primary variable	
SEC	Secondary variable	
SENS	Raw pressure value	
TMP E	Electronics temperature	
TMP S	Sensor temperature	
TOTAL	Totalizer output	

Table B- 2 Units

Abbreviation	In full	Meaning
bar a	Bar absolute	Pressure unit for absolute pressure
bar g	Bar gauge	Pressure unit for gauge pressure
lb	Pound	Unit of weight
psi a	psi absolute	Pressure unit for absolute pressure
psi g	psi gauge	Pressure unit for gauge pressure
mbar	Millibar	Unit for pressure
Pa	Pascal	Unit for pressure
hPa	Hectopascal	Unit for pressure
psi	Pound per square inch	Unit for pressure
g/cm^2	Gram per square centimeter	Unit for pressure
kg/cm^2	Kilogram per square centimeter	Unit for pressure
mmH_2O	Millimeter water column	Unit for pressure
inH_2O	Inch water column	Unit for pressure
ftH2O	Foot water column	Unit for pressure
mmHg	Millimeter mercury [column]	Unit for pressure
inHg	Inch mercury [column]	Unit for pressure
l	Liter	Unit for volume
norml	Standard liter	Unit for volume
m^3	Cubic meter	Unit for volume
$normm^3$	Standard cubic meter	Unit for volume
Hl	Hectoliter	Unit for volume
$inch^3$	Cubic inch	Unit for volume

Abbreviation	In full	Meaning
$stdft^3$	Standard cubic foot	Unit for volume
ft^3	Cubic foot	Unit for volume
yd^3	Cubic yard	Unit for volume
gal	Gallon (USA)	Unit for volume
Imp. gallon	Imperial gallon	Unit for volume
Bushel	Bushel	Unit for volume
bl	Barrel	Unit for volume
Barrel liquid	Barrel liquid	Unit for volume
s	Second	Unit for time
min	Minute	Unit for time
h	Hour	Unit for time
d	Day	Unit for time
K	Kelvin	Temperature unit
°C	degrees Celsius	Temperature unit
°F	degrees Fahrenheit	Temperature unit
°R	degrees Rankine	Temperature unit

Table B- 3 Other abbreviations

Abbreviation	In full	Meaning
CLASS		Term for nominal pressure measured in psi
PED	Pressure Equipment Directive	
DN	Diameter Nominal	Nominal diameter measured in mm
DP	Distributed I/O	Protocol for the transmission of information between field device and automation system over PROFIBUS.
FDE	Fault disconnection electronics	
FISCO	Fieldbus Intrinsically Safety Concept	
GSD	Device master data	
HART	Highway Addressable Remote Transducer	Standard protocol for the transmission of information between field device and automation system.
F&B	Food and beverage industry	
PA	Process automation	Protocol for the transmission of information between field device and automation system over PROFIBUS.
PDM	Process Device Manager	
PN	Pressure Nominal	Nominal pressure measured in bar
PNO	PROFIBUS User Organization	
PROFIBUS	Process Field Bus	Manufacturer-independent standard for the networking of field devices, e.g. PLC, drives, or sensors. PROFIBUS can be used with the DP and PA protocols.
SELV	Safety extra-low voltage Safety extra-low-voltage	

B.2 Functional safety

Abbreviation	Full term in English	Meaning
CFC	Continuous Function Chart	Software package for graphical, technology-oriented configuration of automation tasks
FIT	Failure in Time	Frequency of failure Number of faults withing 10^9 hours
HFT	Hardware Fault Tolerance	Hardware fault tolerance: Capability of a function unit to continue executing a required function in the presence of faults or deviations.
MooN	"M out of N" voting	Classification and description of the safety-instrumented system in terms of redundancy and the selection procedures used. A safety-instrumented system or part that consists of "N" independent channels. The channels are connected to each other in such a way that "M" channels are in each case sufficient for the device to perform the safety instrumented function. Example: Pressure measurement: 1oo2 architecture. A safety-instrumented system decides that a specified pressure limit has been exceeded if one out of two pressure sensors reaches this limit. In a 1oo1 architecture, there is only one pressure sensor.
MTBF	Mean Time Between Failures	Average period between two failures
MTTR	Mean Time To Restoration	Average period between the occurrence of a fault in a device or system and restoration of functionality
PFD	Probability of Dangerous Failure on Demand	Probability of dangerous failures of a safety function on demand
PFD_{AVG}	Average Probability of Dangerous Failure on Demand	Average probability of dangerous failures of a safety function on demand
SFF	Safe Failure Fraction	Proportion of safe failures: Proportion of failures without the potential to bring the safety-instrumented system into a dangerous or non-permissible functional status.
SIL	Safety Integrity Level	The international standard IEC 61508 defines four discrete Safety Integrity Levels (SIL 1 to SIL 4). Each level corresponds to a range of probability for failure of a safety function. The higher the Safety Integrity Level of the safety-instrumented system, the lower the probability that it will not execute the required safety functions.
SIS	Safety Instrumented System	A safety-instrumented system (SIS) executes the safety functions that are required to achieve or maintain a safe status in a system. It consists of a sensor, logic unit/control system and final controlling element.

Glossary

Coupler

connects the DP and PA segments in PROFIBUS. It has a fixed transmission speed. The transmission speed is 45.45 kbps (DP) to 31.25 kbps (PA).

Dangerous failure

Failure with the potential to switch a safety-instrumented system to a hazardous or non-functioning safety status.

Diameter nominal

The diameter nominal is specified according to DIN EN ISO 6708 by the term DN followed by a dimensionless number approximating the inner diameter in millimeters. According to DIN 2440 (medium-weight threaded pipe), a DN 50 pipe, for example, identifies a pipe with an outer diameter of 60.3 mm and a wall thickness of 3.65 mm (inner diameter therefore 53 mm).

EEPROM

EEPROM (Electrically Erasable Programmable Read-Only Memory) is a non-volatile, electronic memory chip.

EEPROM are often used when individual data bytes change over long intervals and need to be stored and retained if there is a network failure, for example configuration data or operating hours counters.

Failure/Fault

Failure:
A resource is no longer capable of executing a required function.

Fault:
Undesired state of a resource indicated by the incapability of executing a required function.

Fault

→ *Failure/Fault*

Fault tolerance

Fault tolerance N means that a device can execute the intended task even when N faults exist. The device fails to execute the intended function in the case of N+1 faults.

Final controlling element

Converter that converts electric signals into mechanical or other non-electric variables.

Firmware

Firmware is a type of software that is embedded in a chip in electronic devices in contrast to software proper that is stored on hard disks or other media. Today, firmware is usually stored in a flash memory or EEPROM.

The firmware usually contains elementary functions for controlling the device or input and output routines.

Frequency shift keying

Frequency shift keying is a simple modulation method in which the digital values 0 and 1 are represented by two different frequencies.

Frequency shift keying (FSK)

→ *Frequency shift keying*

Function block

A named block consisting of one or more inputs, outputs, and included parameters.

Function blocks represent the basic automation functions executed by an application in a way as independent as possible from the details of I/O devices and the network. Each function block processes input parameters using a specified algorithm and a set of internally stored parameters. They produce output parameters which are available for use inside the same function block application or by other function block applications.

Generic Station Description

The generic station description (GSD) contains the information necessary for the control system to establish communication.

GSD

→ *Generic Station Description*

Link

is a coupler with a variable transmission speed. The transmission speed is a maximum of 12 Mbps (DP) to 31.25 kbps (PA).

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 status of the system by taking a defined hazardous incident into account.

Example:
Limit pressure monitoring

Safety Integrity Level

→ *SIL*

Safety-instrumented system

A safety-instrumented system (SIS) executes the safety functions that are required to achieve or maintain a safe status in a system. It consists of a sensor, logic unit/control system and final controlling element.

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 electric signals.

SIL

The international standard IEC 61508 defines four discrete safety integrity levels (SIL) from SIL 1 to SIL 4. Every level corresponds to a probability range for the failure of a safety function. The higher the SIL of the safety-instrumented system, the higher the probability that the required safety function works.

The achievable SIL is determined by the following safety-instrumented characteristics:

- Average probability of failure on demand (PFD_{AVG})
- Hardware fault tolerance (HFT)
- Safe failure fraction (SFF)

srli2

→ *srlin2*

srlin2

"srli2" or "srlin2" is a type of square root extracting characteristic curve for the output current. This characteristic curve type is proportional to the flow rate, linear in two levels up to the application point and has a pre-defined application point of 10%.

"srli2" or "srlin2" are synonymous and technically there is no difference between them. The abbreviation "srli2" is used in sections that refer to the on-site operation of the pressure transmitter. The reason for the abbreviation is that the pressure transmitter display is restricted to five characters. The abbreviation "srlin2" is used for HART operation.

Zero point adjustment

After the following functions, the measuring range will have changed:

- Zero point calibration
- LO calibration
- HI calibration

If you have used one of these functions, the measuring range will have changed. This changed, remaining measuring range is called the zero point offset.

Refer to the **Operation** section for the corresponding modes of these functions.

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