SIEMENS

SITRANS® P
pressure transmitter, DS series (Smart)

7MF4032

Operating Instructions       Order No.: C73000—B5676—C82—1
SIEMENS

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pressure transmitter, DS series (Smart)

7MF4032

Operating Instructions

C73000-B5676-C82
Note

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency that may arise during installation, operation or maintenance.

Should further information be desired or should particular problems arise that are not covered sufficiently for the Purchaser’s purposes, the matter should be referred to the local Siemens Sales Office.

The contents of this instruction manual shall not become part of or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained herein do not create new warranties or modify the existing warranty.

WARNING

This equipment should only be installed and operated after qualified personnel have ensured that suitable power supplies are available. These personnel must ensure that the equipment is not subjected to any hazardous voltages during normal operation or when a defect occurs in the system.

This equipment may be used under high pressure and with aggressive media. Improper use of this equipment may therefore result in severe personal injury or extensive damage to property.

The successful and safe operation of this equipment is dependent upon its proper handling, installation, operation and maintenance.

Qualified person

For the purposes of this manual, a qualified person is one who is familiar with the installation, commissioning and operation of this equipment. In addition, the person must be:

- Trained and authorised to operate and service equipment/systems in accordance with established safety practices relating to electrical circuits, high pressures and aggressive media.
- Trained in the proper care and use of protective equipment in accordance with established safety practices.
- Trained in rendering first aid.
1 Technical description

1.1 Application
The Smart version of the SITRANS P transmitter measures the pressure of non-aggressive and aggressive gases, vapours and liquids. Measuring spans of between 0.03 and 400 bar are possible. The output signal is a load-independent direct current 4 to 20 mA, linearly proportional to the measured pressure.

Transmitters conforming to protection type "Intrinsic safety" and "Flame-proof enclosure" may be installed within potentially explosive areas (zone 1). The conformance certificates correspond to the European standard (CENELEC).

Transmitters fitted with various types of chemical seal are available for special applications, e.g. measuring highly viscous media.

1.2 How it works
Pressure is transmitted to a silicone pressure sensor (4, see Figure 1.1) through a diaphragm (2) and a liquid filling (3). The pressure causes the sensor's measuring diaphragm to distort. The resistance of four doped piezo-resistors in a bridge circuit in the measuring diaphragm changes. This change in resistance generates an output voltage in the bridge circuit that is proportional to the measured pressure. This voltage is converted into a periodic signal in amplifier (11) in a voltage/frequency converter (12). A microcontroller (13) evaluates the signal, corrects it with respect to linearity and temperature before passing it on to a digital/analogue converter, which converts it into a 4 – 20 mA output current.

Data specific to the measuring cell and transmitter parameters are stored in non-volatile memory (EEPROM).

Transmitters with a measuring span of ≤63 bar measure pressure against atmosphere, those with spans of 160 bar and 400 bar against vacuum.

The cable termination point and the electronics are arranged opposite one another.

Calibration of the transmitter is performed using a PC/laptop or HART® Communicator. The PC/Laptop is connected to the two-wire circuit of the transmitter through a HART® modem. The communication signals required by revision 5.1 of the HART® protocol are superimposed on the output current by the FSK (Frequency Shift Keying) method.

The following parameters can be set or their current settings interrogated:
- measuring point number
- measuring point description
- text
- upper limits of output signal
- limits of measuring range
  - transmitter design (e.g. type of material)
  - measuring range*
  - engineering unit*
  - measured value in mA, % or engineering units*
  - damping*
  - "loop check" function*
  - output current when errors occur*
  - disabling of pushbuttons and/or functions*

As well as calibrating the transmitter from a PC/laptop or HART® Communicator, the start of scale and full scale values can also be set directly on the transmitter by three pushbuttons. By means of a digital indicator (optional) the parameters marked by * can be adjusted directly on the transmitter without opening the housing.
Figure 1.1 SITRANS P pressure transmitter, function diagram

Figure 1.2 Communication between PC/laptop or HART® Communicator and SITRANS P transmitter
1.3 Technical data

Functional data

Measuring spans and overrange limits

<table>
<thead>
<tr>
<th>Variable measuring spans</th>
<th>Overrange limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.03 to 1 bar / 3 to 100 kPa</td>
<td>Lower 6 bar Upper 1 bar</td>
</tr>
<tr>
<td>0.13 to 4 bar / 13 to 400 kPa</td>
<td>Lower 10 bar Upper 1 bar</td>
</tr>
<tr>
<td>0.53 to 16 bar / 0.05 to 1.6 MPa</td>
<td>Lower 32 bar Upper 1 bar</td>
</tr>
<tr>
<td>2.1 to 63 bar / 0.21 to 6.3 MPa</td>
<td>Lower 100 bar Upper 1 bar</td>
</tr>
<tr>
<td>5.3 to 180 bar / 0.53 to 16 MPa</td>
<td>Lower 250 bar Upper 1 bar</td>
</tr>
<tr>
<td>13.3 to 400 bar / 1.33 to 40 MPa</td>
<td>Lower 600 bar Upper 1 bar</td>
</tr>
</tbody>
</table>

Lower measuring limit
- Measuring cell
  - silicone oil filling
  - fluorolube filling
- Upper measuring limit
  - 30 mbar (absolute)
  - atmospheric pressure
- Shift of scale
  - 100% of max. measuring span
- Auxillary power
  - terminal voltage on transmitter
    - ripple
      - noise
    - Output signal
      - lower limit
        - 3.84 mA
      - upper limit
        - 20.0 to 22.0 mA
    - in error situation
      - ripple
        - Ip < 0.5% of maximum output current
    - Load
      - \( R \leq \frac{V_i - 11 V}{0.023 \: A} \) in \( \Omega \)
      - \( V_i \): auxiliary power in V
      - 230 to 500 \( \Omega \) for communication with PC/Laptop
      - 230 to 1100 \( \Omega \) for communication with HART® Communicator

Electrical damping
- variable time constant
  - 0 to 100 s
- current source
  - adjustable, 3.6 mA to 22.8 mA

Ambient temperature
- Measuring cell filled with silicone oil
  - -40 °C to +85 °C
- fluorolube
  - -10 °C to +85 °C
- Digital indicator (optional)
  - -20 °C to +85 °C

Temperature of medium
- Measuring cell filled with silicone oil
  - -40 °C to +100 °C
- fluorolube
  - -10 °C to +100 °C
- with oxygen measurement
  - -10 °C to +85 °C
- Storage temperature
  - -50 °C to +85 °C
- Condensation
  - permitted
- Installation
  - process connection pointing vertically down

1) With oxygen measurement 80 bar max.
2) Adjustable with PC/laptop or HART® Communicator. The factory setting is 20.5 mA.
Response characteristic
Start of scale 0 bar and filling of silicone oil.
All figures relate to the output span.

Measurement error when calibrating fixed point
(incl. hysteresis and repeatability)
Time constant T90 at 20 °C (incl. electrical damping)
Long-term drift
Effect of ambient temperature
Effect of scale
Effect of auxiliary power
Presence of magnetic compatibility
Effect of installation from vertical

Instrument design
Electrical connection

Degree of protection to EN 60529
Process connection

Material of components that come into contact with the medium
connecting shank
diaphragm

Measuring cell filling
Housing for electronics

Mounting bracket (optional)
Indicator (optional)

Weight

---
3) Double this value if selected measuring span < 10 % of max. measuring span
4) Not available for protection type "Flame-proof enclosure"
5) Not available for protection type FM exp/CSA exp
Explosion protection to DIN EN 50 014, DIN EN 50 018 and DIN EN 50 020 (CENELEC)

Intrinsic safety "I"
Identification

Conformance certificate
PTB Nr. Ex—94.C.2090

Max. ambient temperature
+85 °C (temperature class T4)
+75 °C (temperature class T5)
+60 °C (temperature class T6)

Connection
to certified intrinsically safe circuits with the following maximum values:

Effective internal inductance
\( L_i \leq 0.6 \text{ mH} \)

Effective internal capacitance
\( C_i \leq 8 \text{ nF} \)

Flame—proof enclosure "d"
Identification

Conformance certificate
PTB Nr. Ex—94.C.1021

Max. ambient temperature
+65 °C (temperature class T5)
+75 °C (temperature class T6)

Communication (PC/laptop or HART® Communicator to SITRANS P transmitter)

Load, with connection of
HART® Modem
230 to 500 Ω
230 to 1100 Ω

HART® Communicator

Cable
screened 2—core: \( \leq 3.0 \text{ km} \)
screened multicore: \( \leq 1.5 \text{ km} \)

Protocol
HART®, revision 5.1

PC/laptop requirements
IBM or compatible
\( \geq 4 \) MByte memory
Hard disk
RS—232—C interface
VGA graphics

Software
Windows 3.1 and SIPROM P
# 1.4 Ordering data

<table>
<thead>
<tr>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intrinsic pressure transmitter, PS series</td>
<td>7MF4032-</td>
</tr>
<tr>
<td>Measuring cell filling</td>
<td>Cleaning of measuring cell</td>
</tr>
<tr>
<td>Measuring cell material</td>
<td>Normal Greasefree</td>
</tr>
<tr>
<td>Connection pressure</td>
<td>B C D E F G</td>
</tr>
<tr>
<td>0 to 1 bar</td>
<td>1 bar 2</td>
</tr>
<tr>
<td>0 to 4 bar</td>
<td>3 bar 2</td>
</tr>
<tr>
<td>0 to 16 bar</td>
<td>4 bar 2</td>
</tr>
<tr>
<td>0 to 160 bar</td>
<td>5 bar 2</td>
</tr>
<tr>
<td>0 to 400 bar</td>
<td>6 bar 2</td>
</tr>
<tr>
<td>Safety components that come into contact with the medium</td>
<td>Connecting shank</td>
</tr>
<tr>
<td>Connection type</td>
<td>Stainless steel</td>
</tr>
<tr>
<td>Fitting material</td>
<td>A B</td>
</tr>
<tr>
<td>With chemical seal</td>
<td>Y</td>
</tr>
<tr>
<td>Option protection</td>
<td>0-120 A</td>
</tr>
<tr>
<td>Option protection panel</td>
<td>1/2-14 NPT</td>
</tr>
<tr>
<td>Option protection panel</td>
<td>A B C D</td>
</tr>
<tr>
<td>Panel 0 to 120 A</td>
<td>E F G</td>
</tr>
<tr>
<td>Panel 1/2-14 NPT</td>
<td>H I J</td>
</tr>
<tr>
<td>Connection/cable type</td>
<td>A B C D</td>
</tr>
<tr>
<td>Male thread M20 x 1.5</td>
<td>E F G</td>
</tr>
<tr>
<td>Female thread 1/2-14 NPT</td>
<td>H I J</td>
</tr>
<tr>
<td>Conduit connector G 1/2</td>
<td>K L</td>
</tr>
<tr>
<td>Indicator</td>
<td>A B C D</td>
</tr>
<tr>
<td>None</td>
<td>E F G</td>
</tr>
<tr>
<td>With analogue indicator</td>
<td>H I J</td>
</tr>
<tr>
<td>- scale 0 to 100% linear</td>
<td>K L</td>
</tr>
<tr>
<td>- scale as specified (Y20 code required)</td>
<td>M N</td>
</tr>
<tr>
<td>With digital indicator</td>
<td>O P Q</td>
</tr>
</tbody>
</table>

1 With oxygen measurement B12 bar max.
2 Not available for protection type “Flame–proof enclosure”
3 Not available for protection type FM exp/CSA exp
### Technical Description

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitter with mounting bracket of steel</td>
<td>A01</td>
</tr>
<tr>
<td>Transmitter with mounting bracket of stainless steel</td>
<td>A02</td>
</tr>
<tr>
<td>Operating instructions and description of the plate</td>
<td></td>
</tr>
<tr>
<td>(German by default)</td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>B11</td>
</tr>
<tr>
<td>French</td>
<td>B12</td>
</tr>
<tr>
<td>Spanish</td>
<td>B13</td>
</tr>
<tr>
<td>Italian</td>
<td>B14</td>
</tr>
<tr>
<td>Manufacturer’s test certificate M as specified in DIN 53350, Part 18 and ISO 8402</td>
<td>C11</td>
</tr>
<tr>
<td>Acceptance certificate B as specified in DIN 50049, section 5.1, and EN 10294</td>
<td>C12</td>
</tr>
</tbody>
</table>

### Additional Information

<table>
<thead>
<tr>
<th>Description</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required measuring range (max. 26 characters), specify in plain text:</td>
<td></td>
</tr>
<tr>
<td>Y01: ... to ... mbar, bar, kPa, MPa, ...</td>
<td>Y01</td>
</tr>
<tr>
<td>Measuring point identification: number of measuring point (max. 16 characters), specify in plain text:</td>
<td></td>
</tr>
<tr>
<td>Y15: ..................................</td>
<td>Y15</td>
</tr>
<tr>
<td>Description of measuring point (max. 27 characters), specify in plain text:</td>
<td></td>
</tr>
<tr>
<td>Y16: ..................................</td>
<td>Y16</td>
</tr>
<tr>
<td>Customer specified scale for analogue indicator (max. 20 characters), specify in plain text:</td>
<td></td>
</tr>
<tr>
<td>Y20: ... to ... mbar, bar, kPa, MPa, ...</td>
<td>Y20</td>
</tr>
</tbody>
</table>

### Accessories

<table>
<thead>
<tr>
<th>Description</th>
<th>Order No</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT® modem and SIRIM P software</td>
<td></td>
</tr>
<tr>
<td>German</td>
<td>7MF4998-8DD</td>
</tr>
<tr>
<td>English</td>
<td>7MF4998-8DE</td>
</tr>
<tr>
<td>French</td>
<td>7MF4998-8DF</td>
</tr>
<tr>
<td>HART® Communicator with a accumulator, battery charger for 230 V AC and case:</td>
<td></td>
</tr>
<tr>
<td>Type of protection intrinsically safe EEx ia II C T4</td>
<td></td>
</tr>
<tr>
<td>German</td>
<td>7MF4998-8KF</td>
</tr>
<tr>
<td>English</td>
<td>7MF4998-8KT</td>
</tr>
</tbody>
</table>
1.5 Dimensions

1. Process connection female thread 1/2 - 14 NPT or G 1/2 A connection Shank (with adapter)
2. Terminal side, analogue indicator (optional)
3. Electronics side, digital indicator (optional)
4. Rotation reference mark (see section 2.1.2)
5. Permitted range of rotation, hatched in drawing (see section 2.1.2)
6. Locking screw (see section 2.1.2)
7. Safety angle for housing cover, not displayed in drawing (only with protection type "Flame-proof enclosure")
8. Blanking plug (only with Pg 13.5 and Han 7D)
9. Protective cover for keys
10. Electrical connection:
   - Pg 13.5 compression gland or
   - Female thread M20 x 1.5 or
   - Female thread 1/2 - 14 NPT or
   - Han 7 D Connector

1) Take into consideration the addition of about 20 mm for thread length
2) Not available for protection type "Flame-proof enclosure"
3) Not available for protection type FM exp/CSA exp

Figure 1.3 SITRANS P pressure transmitter, dimensions
2 Installation

2.1 Where to install

The transmitter can be installed above or below the pressure tapping point. When measuring gases, we recommend the transmitter be installed above the pressure tapping point and the pressure pipe be laid so it runs down to the pressure tap. This will permit any condensation in the pipe to drain off and not affect the measurement.

When measuring liquids, the transmitter should be installed below the pressure tapping point and the pipe laid so it rises up to the pressure tap, thus enabling any gas in the pipe to be dispersed.

The point of installation should be easily accessible, preferably close to the measuring point and free from vibration. The permitted ambient temperature limits must not be violated. Protect the transmitter from direct heat sources.

Before installing the transmitter, compare the process data against the data on the rating plate. Keep the transmitter closed during the installation process.

2.1.1 Fixing with a mounting bracket

The mounting bracket is fixed to either

- a wall or mounting frame using 2 screws,
- or to a vertical or horizontal mounting pipe (50 to 60 mm in diameter) using a U-bolt.

The transmitter is fastened to the mounting bracket using the two enclosed M8 x 20 screws.

Figure 2.1 Fixing the SITRANS P transmitter using a mounting bracket
2.1.2 Rotating the measuring unit in relation to the housing

If required, the measuring unit of the transmitter SITRANS P can be rotated in relation to the electronics housing (with digital indicator) to a visible position.

Only a limited rotation is permitted!

The range of rotation (7) is marked at the bottom of the electronics housing. At the neck of the electronics housing there is a reverence mark which must always be within the marked range when rotated.

- undo the locking screw (8)
- rotate the housing within the marked range (7)
- tighten locking screw (torque 3.4±0.2 Nm)
2.2 Electrical connection

**WARNING**

Observe the relevant regulations during the electrical installation; in hazardous areas, pay particular attention to:

- the regulations governing electrical systems in hazardous areas (Ex e V)
- the specifications regarding the installation of electrical systems in hazardous areas (VDE 0165) and
- the conformance certificate

Check that the auxiliary power supply matches that specified on the rating plate.

The transmitter should be powered from a SELV (safety extra-low voltage) source. If other power sources are to be used, we recommend that the transmitter housing be earthed. The earth terminal in the terminal housing is connected to the external earth terminal.

- The sealing caps in the cable entries have to be replaced by relevant cable glands or blanking plugs which must be certified when using transmitters conforming to protection type "Flame-proof enclosure".
- The terminal strip (Fig. 2.3) can be screwed on to four different positions (±90° or ±180° rotation possible). Please notice that the rotation is limited to ±150° (proceeding from the fixed position as on delivery).
- The following general guidelines apply when laying terminal (max. cross section 1.5 mm²/signal cables):
  - lay the signal cable separately from cables carrying voltages > 60 V
  - use twisted-pair cables
  - do not lay the cables close to large electrical systems, or use screened cables
  - full specifications in accordance with HART® 5.1 only with screened cable

Connection to screw-type terminals

- remove housing cover of the electronics side (marked "FIELD TERMINALS" on housing)
- remove analogue indicator (if fitted)
- feed cable in through cable gland
- connect to "+" and "−" terminals, observing polarity!
- replace analogue indicator (if applicable)
- replace housing cover

Note: With transmitters conforming to protection type "Flame-proof enclosure" the housing cover has to be secured with the safety angle.

Connection using a plug connector (not available for protection type "Flame-proof enclosure")

The contacts for the connector are supplied in a bag with the instrument.

- slide sleeve and gland on to the cable
- remove about 8 mm of insulation from the end of the cable
- crimp or solder the contacts to the cable ends
- assemble connector

![Figure 2.2 Connection using plug connector](image_url)

**Figure 2.2 Connection using plug connector**

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A faultless communication requires at least a load of 230 Ω within the signal circuit (see Fig. 2.3), when using power supply isolators for Smart transmitters, e.g., Siemens 7NG4021, a load has already been assembled (see Fig. 2.4). The power supply isolator with intrinsic safe input circuit (transmitter circuit) also separates safely between intrinsically safe and not—intrinsically safe circuit. The HART® modem or the HART® Communicator can be connected to the jacks marked HK (see Fig. 2.4).

**WARNING**

The HART® modem must not be installed in hazardous locations and not connected to intrinsically safe circuits.
2.3 Installing the analogue indicator
- Remove the housing cover of the terminal side (marked "FIELD TERMINALS" on housing)
- Plug analogue indicator into the test sockets
  Depending on the transmitter position the analogue indicator can be plugged—in to four different positions
  (±90° or ±180° rotation possible).
- Replace cover with viewing window

2.4 Installing the digital indicator
- Remove the housing cover of the electronics side
- Plug—in the digital indicator
  Depending on the transmitter position the LCD can be plugged—in to four different positions
  (±90° or ±180° rotation possible).
- Replace cover with viewing window
3 Commissioning

The process data must correspond to that on the rating plate. The transmitter functions as soon as the power is turned on.

WARNING
Severe personal injury or damage to property may result if the valves are improperly or incorrectly operated.

Measuring gases
The isolating valves should be operated in the following sequence:

Initial setting: all valves closed
- Open isolating valve (2B),
- Apply a pressure corresponding to the start of scale to the transmitter (1) using the test connection of isolating valve (2),
- Check the start of scale and correct if necessary,
- Close isolating valve (2B),
- Open isolating valve (4) at pressure tapping point,
- Open isolating valve (2A).

Figure 3.1 Measuring gases
**Measuring liquids**

The isolating valves should be operated in the following sequence:

- **Initial setting**: all valves closed
  - Open isolating valve (2B),
  - Apply a pressure corresponding to the start of scale to the transmitter (1) using the test connection of isolating valve (2),
  - Check the start of scale and correct if necessary,
  - Close isolating valve (2B),
  - Open isolating valve (4) at pressure tapping point,
  - Open isolating valve (2A).

![Diagram of Measuring liquids](image)

*Figure 3.2 Measuring liquids*
Measuring steam

The isolating valves should be operated in the following sequence:

Initial setting: all valves closed
- Open isolating valve (2B),
- Apply a pressure corresponding to the start of scale to the transmitter (1) using the test connection of isolating valve (2),
- Check the start of scale and correct if necessary,
- Close isolating valve (2B),
- Open isolating valve (4) at pressure tapping point,
- Open isolating valve (2A).

Figure 3.3 Measuring steam
4 Operation

4.1 Operating from a PC/Laptop
For the parametrization of the SITRANS P transmitter with the PC/laptop the software SIPROM P is necessary (see also technical data, section 1.3).
Please take service notes from the software description.

4.2 Operating from a HART® Communicator
The HART® Communicator must be connected to the transmitter (see Fig. 2.3 and 2.4).

Action keys
Use the key to turn the HART® Communicator on and off. When the communicator is turned on the communication with the transmitter starts automatically. The online menu appears on the display.
Turning off the HART® Communicator is not possible in certain operations (e.g. when essential parameters have not been sent to the transmitter). In this case a message will be put out on the display.

Use the key to move the cursor up through a menu. The selected menuname will be marked.

Use the key to move the cursor down through a menu. The selected menuname will be marked.

Use the key to move the cursor to the right or to select menu options. The name of the selected menu will be displayed at the top.

Use the key to move the cursor to the left or to back out of a menu.

Use the key (hot key) to call—in directly the menu zero or span, also with turned off HART® Communicator.

Function keys
Below the LCD there are the function keys F1 to F4. The different function of the keys depend on the menus and will be displayed at the bottom of the LCD.

Alphanumeric and shift keys
These keys are used for data entry. The function as a number—or letter key depends on the respective menu. Letters are selected when the relevant shift key is used before.

Please take all other information for operating and technical data from the operating instructions of the HART® Communicator.
4.3 Operation on the transmitter

4.3.1 General

The SITRANS P pressure transmitter can also be adjusted in the field by three pushbuttons, located on the outside of the instrument, with which the start of scale and full scale values are "set" or adjusted. By means of the digital indicator (optional) additional parameters can be adjusted. The pushbuttons can be accessed by undoing the two screws holding the protective cover in place, which can then be moved out of the way.

![Digital indicator and pushbuttons](image)

*Figure 4.2 SITRANS P transmitter controls and displays*

With the fitted digital indicator as an option all functions of table 4.1 are selected using the \[ \text{[A]} \] key. When pressing the \[ \text{[M]} \] key (Modus) 2 appears bottom left on the LCD. Every additional key press increases the mode by one. The parameters, the current value or the engineering unit can be modified using the \[ \text{[A]} \] and \[ \text{[C]} \] keys. In the case of error messages \text{Error} is displayed on the LCD, (see section 4.3.3.6). The transmitter changes to function "Measured value", if mode 14 is passed by pressing the \[ \text{[M]} \] key or if 2 minutes elapse without a key being pressed (except in mode 8: loop check).

**Note:**
- If there is an LCD overflow then "####" appears (with small engineering units like e.g. Pa).
- If an L is displayed on the LCD, then the transmitter parameters are protected against overwriting (see section 4.4) and the keys are locked.
- If a C is displayed on the LCD, the transmitter, operating with a PC/laptop or HART® Communicator, works in the "loop check" function mode or multidrop operation. The output current is independent of the applied pressure. The keys are locked.
- It applies to all modes (except 7 and 8): A set new value is only stored, when the mode has been changed or when the transmitter reverts automatically to the "Measured value" function approximately 2 minutes after last pressing the keys.
4.3.2 Setting start of scale and full scale without LCD

**Note**
- The start of scale and measuring span are non-interactive.
  (Measuring span = full scale minus start of scale)
- Pushbuttons may be disabled! (see Section 4.4)
  - Undo the two screws holding the protective cover in place, which can then be moved out of the way.

**Set start of scale (4 mA) and full scale (20 mA)**
Assuming the pushbuttons are pressed as described below, the transmitter sets the start of scale to 4 mA and the full scale to 20 mA. An ammeter is not required.

- **Start of scale**
  - Apply a pressure corresponding to the start of scale to the transmitter. When the start of scale is 0 bar, compensate the pressure for atmosphere when the start of scale is 0 bar.
  - Press \( \uparrow \) and \( \downarrow \) keys together for about 2 s

- **Full scale**
  - Apply a pressure corresponding to the full scale to the transmitter.
  - Press all three keys, making sure you press the \( \rightarrow \) key first, hold it, and press both the other.
Calibrate start of scale and full scale
If the output current is not to be set but freely adjusted:
- Connect a DC meter to the output circuit or the test sockets (see Fig. 2.4)

⚠️ **WARNING**

* For intrinsic safe current circuits only certified current meters are permitted.
* It is forbidden to screw off the transmitter cover when working in hazardous locations and using transmitters conforming to protection type "Flame-proof enclosure" (Explosion-proof).

Measuring at test sockets:
- Clean the transmitter to prevent the ingress of dirt
- Open the housing cover of the terminal side
- Remove the analogue indicator (if fitted)
- Connect DC meter

☐ Start of scale
- Apply a pressure corresponding to the start of scale to the transmitter
- Set the output current for start of scale using the [-] and [+] keys

☐ Full scale
- Apply a pressure corresponding to the full scale to the transmitter
- Set the output current for full scale using the [M] key and the [-] key or the [M] key and the [+] key. Always press the [M] key first, hold it, and press either the [-] key or the [+] key.

- On completion of calibration
  - Replace the analogue indicator (if applicable)
  - Screw housing cover back on
  - Replace protective cover and tighten both screws
<table>
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| Electrical damping       | 4       | increase decrease | Time constant $T_{E}$ in s  
Range: 0.1 to 100.0                                                                   | 4.3.3.4 |
| Start of scale "blind" calculation | 5       | increase decrease | set to start of scale 2)                                                              | 4.3.3.2 |
| Full scale "blind" calculation | 6       | increase decrease | set to upper range limit 2)                                                            | 4.3.3.2 |
| Set zero point "blind" calculation | 7       | --      | --                                      | execute | Calibrate pressure to atmosphere  
(Start of scale does not change)  
Measuring value in engineering units                              | 4.3.3.3 |
| "Loop check" function    | 8       | increase decrease | initiate  
Constant output current in mA  
3.6 4.0 12.0 20.0 22.8                                                                 | 4.3.3.5 |
| Output current in error situation | 9       | toggles between the two values | Selected output current  
Either 22.8 or 3.6 mA                                                                  | 4.3.5.6 |
| Disable pushbuttons and/or functions | 10      | toggles between the four functions | $D = \text{none}$  
$L = \text{locked all}$  
$L = \text{locked at accept start of scale}$  
$L = \text{locked at accept start of scale and full scale}$ | 4.3.3.7 |
| -- --                    | 11      | --      | Not relevant (only $\Delta p$)                                                        | --      |
| -- --                    | 12      | --      | Not relevant (only $\Delta p$)                                                        | --      |
| Measured value display   | 13      | change | Engineering units (input variable) or output current in mA or %                      | 4.3.3.8 |
| Engineering units        | 14      | change | Engineering units                                                                     | 4.3.3.9 |

1) If an $L$ is displayed on the LCD, then the transmitter parameters are protected against overwriting (see section 4.4) and the keys are locked.  
If a $L$ is displayed on the LCD, the transmitter, operating with a PC/laptop or HART Communicator, works in the "loop check" function mode or multidrop operation. The output current is independent of the applied pressure. The keys are locked.

2) Press $<$ and $>$ keys simultaneously for about 2 s. The display goes blank and the current value is displayed after about 2 s.

3) If the sign $<$ is displayed at the left, the measuring range limits have been violated.

Table 4.1 SITRANS P transmitter functions
4.3.3 Operation with LCD

**Note:**
- The start of scale and measuring span are non-interactive.
  (Measuring span = full scale minus start of scale)
  - Pushbuttons and/or functions may be disabled!
  - See table 4.1, mode 10, section 4.3.3.7 and 4.4
  - Depending on the transmitter position the LCD can be plugged—in to four different positions.
    - Undo the two screws holding the protective cover in place, which can then be moved out of the way.
- On completion of calibration
  - Replace protective cover and tighten both screws

### 4.3.3.1 Setting start of scale and full scale

**Note:** If no pressure source is available,
- the start of scale can be set in mode 5 and
- the full scale in mode 6.
- Both are specified in the selected engineering unit, see section 4.3.3.2.

- **Set start of scale**
  - Apply a pressure corresponding to the start of scale to the transmitter. When the start of scale is 0 bar, compensate the pressure for atmosphere when the start of scale is 0 bar.
  - Select mode 2 using the [ ] key.
  - Set the output current corresponding to the start of scale using the [ ] and [ ] keys.
  - Set output current to 4 mA:
    - Press the [ ] and [ ] keys simultaneously for about 2 s.
  - If the sign [ ] is displayed at the left, the measuring range limits have been violated. The original value remains unchanged.

- **Set full scale**
  - Apply a pressure corresponding to the full scale to the transmitter.
  - Select mode 3 using the [ ] key.
  - Set the output current corresponding to full scale using the [ ] and [ ] keys.
  - Set output current to 20 mA:
    - Press the [ ] and [ ] keys simultaneously for about 2 s.
  - If the sign [ ] is displayed at the left, the measuring range limits have been violated. The original value remains unchanged.
  - If the sign [ ] [ ] is displayed the selected measuring span is more than twice the maximum measuring span. When pressing [ ] and [ ] keys simultaneously for about 2 s the full scale is set to 0.0000.
4.3.3.2 Setting start of scale and full scale without a pressure source

It is possible to set the start of scale and full scale of the SITRANS P transmitter even if there is no pressure line connected or pressure source available ("blind" calibration).

☐ To set start of scale
  - Select mode 14 using the [M] key.
  - Use the [H] or [L] key to select engineering unit
  - Select mode 5 using the [M] key.
  - Use the [H] or [L] key to set the start of scale in the selected engineering unit
  - When pressing both [H] and [L] keys simultaneously for about 2 s, the start of scale is set to zero
    (in the selected engineering unit)

☐ To set the full scale
  - Select mode 6 using the [M] key.
  - Use the [H] or [L] key to set the full scale in the selected engineering unit
  - When pressing both [H] and [L] keys simultaneously for about 2 s, the full scale is set to the upper measuring
    limit (in the selected engineering unit)

Example 1

A transmitter with a maximum measuring span of 4 bar is to be calibrated to a measuring range of 0 to 3.52 bar
 to correspond to 4 to 20 mA.
  - Select engineering unit "bar" in mode 14
  - For the start of scale, set the value "0.0000" in mode 5.
  - For the full scale, set the value "3.5200" in mode 6.

Example 2

A transmitter with a maximum measuring span of 1 bar is to be calibrated to a measuring range of
+456.70 to −123.40 mm Hg to correspond to 4 to 20 mA.
  - Select engineering unit "mm Hg" in mode 14
  - For the start of scale, set the value "+456.7" in mode 5.
  - For the full scale, set the value "−123.4" in mode 6.

Example 3

A transmitter with a maximum measuring span of 1 bar is calibrated for a measuring range of 0 to 800 mbar to corre-
 spond to 4 to 20 mA.
The measuring range is to be changed to a setting of 400 to 960 mbar.
  - For the start of scale, set the value "400.0" in mode 5.
  - Select mode 6 using [M] key; the full scale "1200.0 mbar" is displayed
  - When trying to decrease the value using the [L] key, the error note " " is displayed additionally to the
    (not changeable) value
    (Explanation: if the start of scale is changed the measuring span remains unchanged. The full scale
    1200 mbar violates the measuring range limits.)
  - Press the [H] and [L] keys simultaneously for about 2 s. Then the full scale is set to 1000.0 mbar.
  - Use the [L] key to set the full scale to 960.0 mbar.
4.3.3.3 Correction of zero point

If the transmitter is installed and operational, external influences such as angle of installation, ambient temperature, or installation dependent pressure effects (e.g. head of liquid in the impulse pipe line to the transmitter) may cause an offset in the transmitter’s zero point. This offset (max. 5% of the max. measuring span) can be corrected in the SITRANS P transmitter without modifying the start of scale and full scale settings in modes 5 and 6 (correction of zero point).

- Compensate the pressure for atmosphere when the start of scale is 0 bar (see section 4.3.3.1)
- Select mode 7 using the [4] key.

The value 0 or 0.0 etc. to 0.0000 is displayed on the LCD, depending on the maximum measuring span of the transmitter and the selected engineering unit.

Example

A transmitter with a maximum measuring span of 1 bar is calibrated for a measuring range of 200 to 800 mbar (4 to 20 mA), i.e. start of scale 200 (mbar) in mode 5, full scale 800 (mbar) in mode 6 and engineering unit "mbar" in mode 14. The transmitter is, however, being used in hotter conditions, which is causing an offset (200.3 mbar) in the original zero point.

This offset is to be corrected.
- Compensate the pressure for atmosphere.
- Press the [2] and [3] keys simultaneously for about 2 s in mode 7. The value of "0.0 mbar" is displayed.
- Apply the original differential pressure; "200.0 mbar" is displayed

The start of scale and full scale of 200 (mbar) and 800 (mbar) set in modes 5 and 6 respectively remain unchanged.

4.3.3.4 Setting electrical damping

Note: The time response of the SITRANS P transmitter is determined by the dead time, the time constant T63 (see section 1.3), and the electrical damping value.

The SITRANS P transmitter is supplied with a damping value of 0.1 s. Values of 0.1 to 100.0 s in increments of 0.1 s are permitted.

- Select mode 4 using the [4] key.

3.3.5 "Loop check" function

The following output current constants can be set to check the output signal loop, e.g. during commissioning, irrespective of the pressure:

3.6 mA  4.0 mA  12.0 mA  20.0 mA  22.8 mA

- Select mode 8 using the [4] key.
- Press the [2] and [3] keys simultaneously for about 2 s. This activates the "loop check" function. An output current of 4.0 mA is displayed.

Changing the mode disables the "loop check" function.
4.3.3.6 Output current in error situations

The pressure sensor and electronics are monitored continuously. If a defect occurs Error is displayed. The output current is set to 3.6 mA or 22.8 mA, neither of which are possible under normal conditions. The value set is determined using mode 9. The factory setting is 22.8 mA.

- Select mode 9 using the M key.
- Use the + or - key to select either 3.6 mA or 22.8 mA.

Changing the mode causes the selected value to be stored.

4.3.3.7 Disable pushbuttons and/or functions

The pushbuttons located under the protective cover can be protected together with their functions against accidental or unauthorised use.

- Select mode 10 using the M key.
- Use the + or - key to select one out of four functions

D → no pushbuttons or functions disabled (operation see section 4.3.3)
L R → all pushbuttons and functions disabled
L D → all functions disabled except start of scale (to set or adjust start of scale see section 4.3.2)
L S → all functions disabled except start of scale and full scale (to set or adjust start of scale or full scale see section 4.3.2)

Changing the mode causes the selected locking to be stored. The disabling of pushbuttons and/or functions is displayed. It is cancelled when the M key is pressed more than 5 s.

Note:
- When selecting lock L D or L S the measured value display current in mA or % should be chosen beforehand in mode 13 (see section 4.3.3.8). Otherwise a change of the output value is not noticeable when the + and - keys are pressed.
- If an L is displayed on the LCD, then the transmitter parameters are protected against overwriting (see section 4.4)

4.3.3.8 Select display (current, %, pressure)

It can be displayed either the input variable pressure in the selected unit in mode 14 or the output variable current in mA or %.

- Select mode 13 using the M key
- Use the + or - key to select the required variable

4.3.3.9 Select engineering units

The following engineering units can be chosen from:

bar mbar in H₂O°° in Hg ft H₂O°° mm H₂O°° mm Hg psi Pa kPa MPa

- Select mode 14 using the M key
- Use the + or - key to select the engineering units

Note:
- If there is an LCD overflow then 9999.99 appears (with small engineering units like e.g. Pa)

* Reference temperature 20 °C
4.4 Write protection for HART® Communication

The transmitter parameters can be protected against accidental or unauthorised overwriting. The write protection prevents changing the parameters using the keys or PC/laptop or HART® Communicator. But they can be read out by PC/Laptop or HART® Communicator.

- Clean the transmitter before opening it to prevent the ingress of dirt
- Switch off the voltage for transmitters conforming to protection type "Flame-proof enclosure" when using in hazardous location, undo the screw holding the safety angle on the electronics side (if fitted)
- Move angle out of the way
- Screw off housing cover of the electronics side
- Pull off jumper.
- On the LCD (optional) is displayed the letter L
- Secure jumper against losing: push jumper horizontal\(^1\) on the right jumper pin

\begin{center}
\includegraphics[width=0.5\textwidth]{diagram.png}
\end{center}

- Screw on housing cover
- Fix safety angle (if applicable) and switch on the voltage

\(^{1}\) Proceeding from the normal position (see Fig. 1.3 and note 4.3.3)
5 Maintenance

The transmitter requires no maintenance.
Check the transmitter's start of scale value occasionally.
If an error occurs:

- the output current is set to 22.8 mA or 3.6 mA, depending on selection (see section 4.3.3.6)
- using EEPROM an appropriate message is displayed in the "Measured values" field
- Error is displayed on LCD (optional)
6 Conformance Certificates

Physikalisch-Technische Bundesanstalt

KONFORMITÄTSBEScheinigung

PTB Nr. E-In.C.1021

(1) Diese Bescheinigung gilt für das elektrische Bauteil/gerät:

Reihenform: SITRAMS P Typ 7646491
dreiadrig, Typ "a".

(2) der Firma

Elektro AG

(3) Die Bauart dieses elektrischen Bauteils/geräts und die entsprechende zulässige Ausführung sind

in der Anlage zu dieser Konformitätbescheinigung festgelegt.

(4) Das Physikalisch-Technische Bundesamt betrachtet die Prüfung nach Anhang 1 zur Bekanntmachung

des Rates der Europäischen Gemeinschaften vom 19. Dezember 1975 (75/117/EWG) zur Durchfüh-

rung dieses elektrischen Bauteils/geräts in den einheitlichen Europäischen Handelsraum.

Elektrische Betriebssicherheit für eupäspezifische Betriebe

EN 60 334-1777 + A1 + (E) 0367/8171 Teil 11 (2,42) Allgemeine Bestimmungen
EN 50 389/1777 + A1 + (E) 0367/8171 Teil 11 (2,4) Eigenschaften "H*

nach der Bekanntmachung mit E-085 unterzeichnen untergeben wurde. Die Ergebnisse dieser

Prüfung werden in einem zuständigen Industrieblatt veröffentlicht.

(5) Das Bauwerk mit der folgenden Kennzeichnung zu versehen:

EEC d IC 56 bzw. EEC d IC 64

(6) Die Hersteller ist dafti verpflichtet, keine abgelaufenen Prüfungen nach einer Bauart

der Anlage zu einem der Bescheinigung zulassigen Prüfzeichen abzuschaffen.