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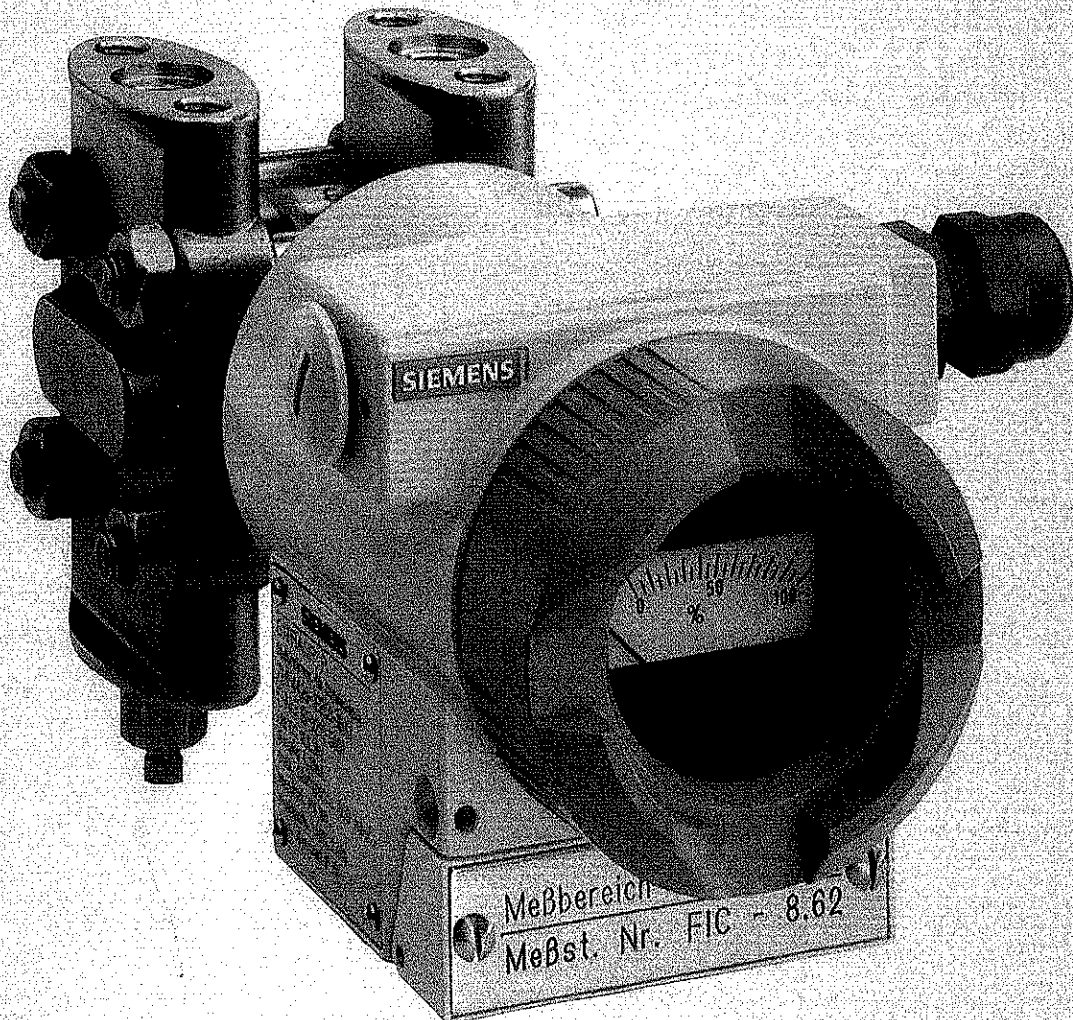
SITRANS® P

Differential pressure and flow transmitter

7MF4420 and 7MF4520

Operating Instructions

Order No.: C73000—B5676—C75—5



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**SITRANS P**

Differential pressure and flow transmitter

 **7MF4420 and 7MF4520**

**Operating Instructions**

 **C73000-B5676-C75**

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### Note

These instructions do not claim 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 procedures 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 SITRANS P transmitter measures

- the differential pressure, e.g. effective pressure,
  - small positive and negative gauge pressures
- or
- the rate of flow  $q \sim \sqrt{\Delta p}$  (in conjunction with a restrictor)

of non-aggressive and aggressive gases, steam and liquids.

Measuring spans of between 1 mbar and 30 bar are possible.

The output signal is a load-independent direct current 4 to 20 mA. A linear (proportional to the differential pressure) or square-root (proportional to rate of flow) characteristic can be selected.

Transmitters of "intrinsically safe" design can be installed within hazardous areas (zone 1). The conformance certificate conforms 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

Differential pressure is transmitted to a silicone pressure sensor (4, see Figure 1.1) through a diaphragm (6) and a liquid filling (7). If the pressure is too high, the overload diaphragm (5) is distorted until one of the diaphragms touches the body of the measuring cell (3), thus protecting the sensor (4) from overloads.

The differential pressure causes the sensor's measuring diaphragm to distort. The resistance of four 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 differential pressure. This voltage is converted into a periodic signal by an amplifier (11) into 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 (14), which converts it into a 4 – 20 mA output signal.

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

Calibration of the transmitter is performed using three pushbuttons located on the outside of the housing. Settings are displayed on an LCD display inside the instrument.

When the instrument is closed, start of scale and full scale can be set using a pressure source and the pushbuttons.

When the instrument is open, and the LCD visible, the following functions are available:

- set start of scale and full scale using pressure source
- set start of scale and measuring span without pressure source ("blind" calibration)
- select characteristic (linear or square-root)
- select where to apply square-root characteristic
- electrical damping
- "loop check" function
- specify output current when errors occur
- disabling of pushbuttons when instrument is closed

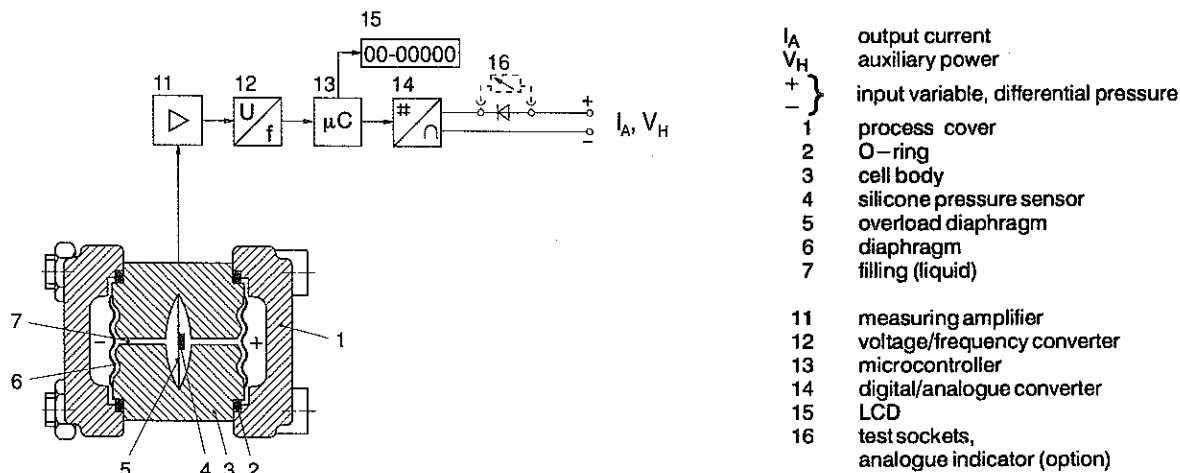


Figure 1.1 SITRANS P differential pressure and flow transmitter, function diagram

### 1.3 Technical data

#### Functional data

#### Rated pressure and measuring spans

Rated pressure	Variable measuring spans			
PN 32	1 to	20 mbar /	0.1 to	2 kPa
PN 160	6 to	60 mbar /	0.6 to	6 kPa
PN 160 or PN 420	25 to	250 mbar /	2.5 to	25 kPa
	60 to	600 mbar /	6 to	60 kPa
	160 to	1600 mbar /	16 to	160 kPa
	500 to	5000 mbar /	50 to	500 kPa
	3000 to	30000 mbar /	300 to	3000 kPa

#### Minimum static pressure

Measuring cell  
 silicone oil filling 30 mbar (absolute)  
 fluorolube filling atmospheric pressure

Overrange limits applied to one side -1 bar and rated pressure

#### Measuring limits

Differential pressure -100 and +100 % of measuring span;  
 30 bar measuring cell  
 -33 and 100 % of max. measuring span;  
 0 and 100 % of max. measuring span

#### Start of scale

Differential pressure anywhere between the measuring limits  
 Flow 0 mbar

#### Auxiliary power

terminal voltage on transmitter 11 to 45 V DC,  
 11 to 30 V DC safe mode intrinsically

### 1.4 Ordering data

Description		Order no.
SITRANS P differential pressure and flow transmitter PN 32 and PN 160 2-wire system		7MF4420 - <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> - 1 <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Measuring cell filling	Cleaning of measuring cell	↑ ↑ ↑ ↑ 1 3 B C D E F G H
Silicone oil Fluorolube	Normal Grease-free	
Rated pressure	Measuring span	
PN 32	1 mbar to 20 mbar	
PN 160	6 mbar to 60 mbar	
	25 mbar to 250 mbar	
	60 mbar to 600 mbar	
	160 mbar to 1600 mbar	
	500 mbar to 5000 mbar	
	3000 mbar to 30000 mbar	
<u>Material of components that come into contact with the medium</u>		
Diaphragm	Parts of measuring cell	Process covers
Stainless steel	Stainless steel	Stainless steel
Hastelloy	Stainless steel	Stainless steel
Version with chemical seal		Y
<u>Process connection</u>		
Female thread 1/4-18 NPT and Flange connection to DIN 19 213 with thread M 10 7/16 - 20 UNF		0 2
<u>Material of components that do not come into contact with the medium</u>		
Screws of process covers	Electronics housing	
Steel	Die-cast aluminium	0
Stainless steel	Die-cast aluminium	2
<u>Explosion protection</u>		
none		
intrinsically safe		A B
<u>Electrical connection/cable inlets</u>		
Pg 13.5 compression gland Female thread M20 x 1.5 Female thread 1/2-14 NPT Han 7 D connector		A B C D
<u>Indicator</u>		
none		1
with analogue indicator		
scale 0 to 100 %, linear		3
scale as specified (Y20 code required)		5

Other versions  
Add "-Z" suffix and code to order no.

Description	Code
Transmitter with mounting bracket of steel	A01
stainless steel	A02
O-ring for process covers from PTFE (FPM by default)	A20
-----	
Language for rating plate (German by default)	
English	B11
French	B12
Spanish	B13
Italian	B14
-----	
Manufacturer's test certificate M as specified in DIN 55350, Part 18 and ISO 8402	C11
Acceptance certificate B as specified in DIN 50049, section 3.1, and EN 10204	C12

Additional information  
Add "-Z" suffix and code to order no. and specify in writing

Description	Code
Required measuring range, specify in writing, max. 26 characters, With linear characteristic: Y01: ... to ... mbar, bar, kPa, MPa, ... with square root characteristic: Y02: ... to ... mbar, bar, kPa, MPa, ...	Y01 Y02
Measuring range for level measurement without chemical seal: The measuring range (Δp) has to be calculated. When ordering, complete and return the "Hydrostatic level measurement" questionnaire.	Y06
Measuring point identification: Number of measuring point, specify in writing, max. 16 characters: Y11: .....	Y11
Description of measuring point, specify in writing, max. 26 characters: Y12: .....	Y12
Customer specified scale for analogue indicator, specify in writing, max. 26 characters: Y20: ... to ... mbar, bar, kPa, MPa, ...	Y20



Output signal	4 to 20 mA
lower limit	3.84 mA
upper limit	22 mA
in error situation	3.6 mA or 22.8 mA
ripple	$I_{pp} \leq 0.5\%$ of maximum output current
Characteristic	rising linear, falling linear or square root (cut-off point of square root characteristic anywhere between 5 % and 15 % of max. flow, linear below this point)
Load	$R \leq \frac{V_H - 11 V}{0.023 A}$ in $\Omega$ , $V_H$ : auxiliary power in V

Electrical damping	0 to 2 s in steps of 0.1 s
variable time constant	2 to 100 s in steps of 1 s

Current source 3.6 mA, 4.0 mA, 12.0 mA, 20.0 mA or 22.8 mA

Ambient temperature

Measuring cell for measuring span filled with silicone oil Fluorolube	$\leq 5$ bar	30 bar
	-40 °C to +85 °C	-20 °C to +85 °C
	-10 °C to +85 °C	-10 °C to +85 °C

observe temperature classes in hazardous areas

Temperature of medium

Measuring cell for measuring span filled with silicone oil Fluorolube	$\leq 5$ bar	30 bar
	-40 °C to +100 °C	-20 °C to +85 °C
	-10 °C to +100 °C	-10 °C to +85 °C

Storage temperature -50 °C to +85 °C

Condensation permitted

Installation process connection pointing vertically down

Output characteristic

linear rising, 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)  $\leq 0.1\%$  (with square root characteristic where  $q > 50\%$ ,  $\leq 0.2\%$  where  $10\% \leq q \leq 50\%$ )

Time constant  $T_{63}$  at 20 °C (no electrical damping) approx. 0.2 s  
approx. 0.3 s with 20 mbar and 60 mbar measuring cell

Long-term drift  $\leq 0.1\%$  every 6 months at max. measuring span;  
20 mbar measuring cell: double this value

Effect of ambient temperature

on start of scale  
from -10 °C to +60 °C  $\leq 0.05\%/10$  K at max. measuring span  
from -40 °C to -10 °C  
and +60 °C to +85 °C  $\leq 0.1\%/10$  K at max. measuring span;  
20 mbar measuring cell: double these values

on measuring span  
from -10 °C to +60 °C  $\leq 0.1\%/10$  K  
from -40 °C to -10 °C  
and +60 °C to +85 °C  $\leq 0.15\%/10$  K;  
20 mbar measuring cell: double these values

Effect of static pressure on start of scale	$\leq 0.15\%$ per 100 bar at max. measuring span; 20 mbar measuring cell: per 32 bar
on the measuring span	$\leq 0.2\%/100$ bar; 20 mbar measuring cell: per 32 bar
Effect of auxiliary power	$\leq 0.005\%$ for each 1 V change in voltage
Electro-magnetic compatibility	conforms to IEC 801/NAMUR recommendations
Effect of installation from vertical	$\leq 0.7$ mbar up to $10^\circ$ of deviation
<b>Instrument design</b>	
Electrical connection	screw-type terminals or Han 7 D connector Cable inlet in the case of screw-type terminals via Pg 13.5 compression gland or M20 $\times$ 1.5 female thread or $1/2 - 14$ NPT female thread
Degree of protection to EN 60529	IP65
Process connection	$1/4 - 18$ NPT female thread and flange connection to DIN 19213 with M10 thread ( $PN \leq 160$ ), M12 ( $PN 420$ ) or $7/16 - 20$ UNF
Material of components that come into contact with the medium	
diaphragm	stainless steel, material no. 1.4404 or Hastelloy C276, material no. 2.4819
process covers	stainless steel, material no. 1.4408
vent valve	stainless steel, material no. 1.4401
parts of measuring cell	stainless steel, material no. 1.4401
O-ring	FPM(Viton) or PTFE (Teflon)
Measuring cell filling	silicone oil or fluorolube (PN32 and PN160 only)
Housing for electronics	die-cast aluminium with low copper content GD-AISI 12, polyester based lacquer, stainless steel rating plate
Screws for process covers	galvanised, yellow-passivated steel, or stainless steel
Mounting bracket (optional)	galvanised, yellow-passivated steel, or stainless steel
Analogue indicator (optional)	linear scale 0 to 100 % or to customer's specification
Weight	approx. 4 kg (without options)
<b>Explosion protection</b> to DIN EN 50 014 and DIN EN 50 020 (CENELEC)	
Type of protection	intrinsically safe "i" EEx ia IIC T4 or T5 or T6
Conformance certificate	PTB Nr. Ex-92.C.2146
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: $V_o = 30$ V, $I_k = 100$ mA, $P = 750$ mW
Effective internal inductance	$L_i \leq 0.6$ mH
Effective internal capacitance	$C_i \leq 6$ nF

Description		Order no.
SITRANS P differential pressure and flow transmitter PN 420 *) 2-wire system		7MF4520 - 1□□□□ - 1□□□
Rated pressure PN 420 %*)	Measuring span	
	25 mbar to 250 mbar	
	60 mbar to 600 mbar	
	160 mbar to 1600 mbar	
	500 mbar to 5000 mbar	
	3000 mbar to 30000 mbar	
<b>Material of components that come into contact with the medium</b>		
Diaphragm	Parts of measuring cell	Process covers
Stainless steel	Stainless steel	Stainless steel
Hastelloy	Stainless steel	Stainless steel
<b>Process connection</b>		
Female thread 1/4-18 NPT and Flange connection to DIN 19 213 with thread M 12 7/16 - 20 UNF		1 3
<b>Material of components that do not come into contact with the medium</b>		
Screws of process covers	Electronics housing	
Steel	Die-cast aluminium	
Stainless steel *)	Die-cast aluminium	
0 2		
<b>Explosion protection</b>		
none intrinsically safe		A B
<b>Electrical connection/cable inlets</b>		
Pg 13.5 compression gland female thread M20 x 1.5 female thread 1/2-14 NPT Han 7 D connection		A B C D
<b>Indicator</b>		
none		1
with analogue indicator		
scale 0 to 100 %, linear		3
scale as specified (Y20 code required)		5

Other versions  
Add "-Z" suffix and code to order no.

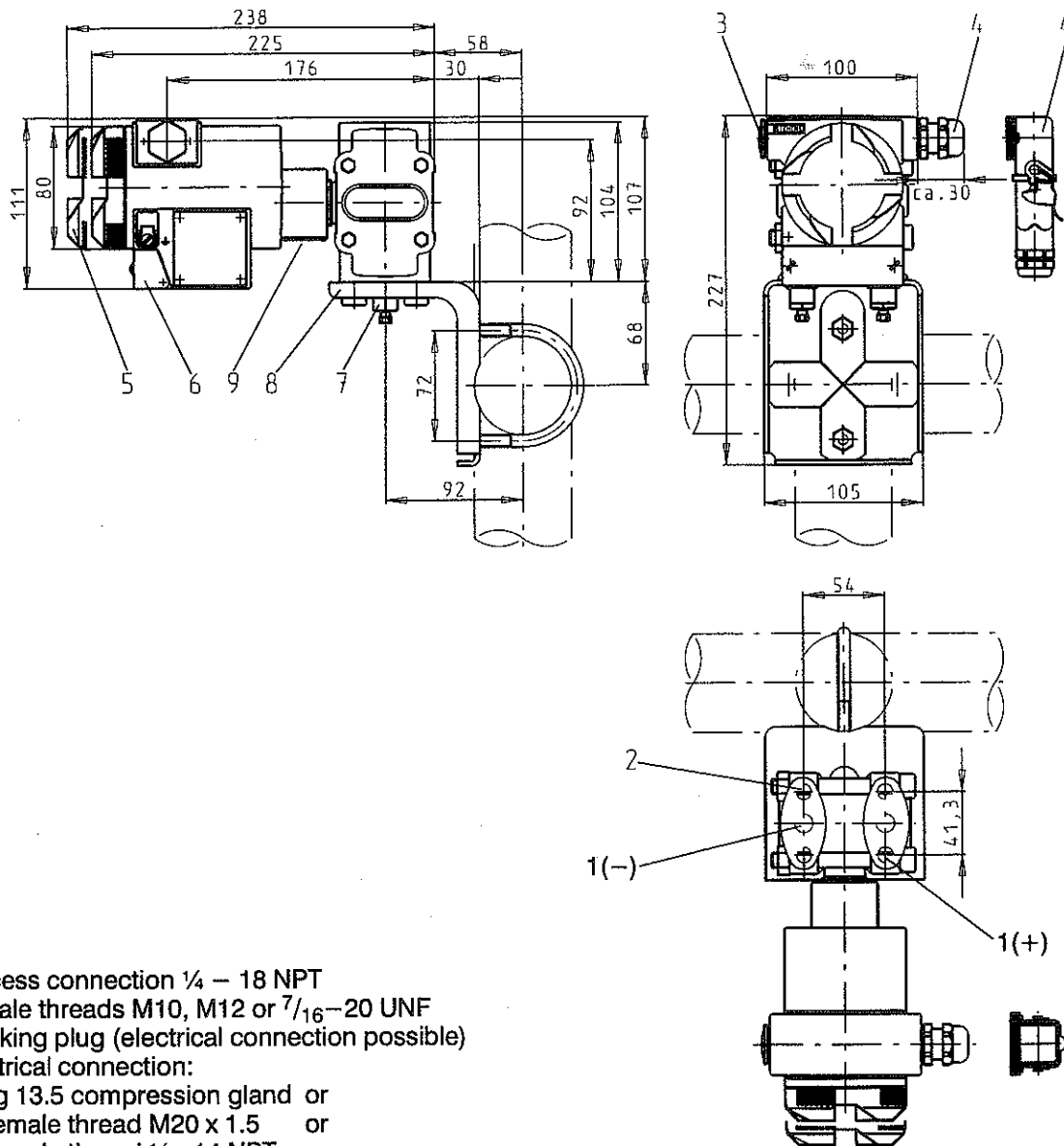
Description	Code
Transmitter with mounting bracket of steel stainless steel	A01 A02
Language for rating plate (German by default)	
English	B11
French	B12
Spanish	B13
Italian	B14
Manufacturer's test certificate M as specified in DIN 55350, Part 18 and ISO 8402	C11
Acceptance certificate B as specified in DIN 50049, section 3.1, and EN 10204	C12

Additional information  
Add "-Z" suffix and code to order no. and specify in writing

Description	Code
Required measuring range, specify in writing, max. 26 characters, With linear characteristic: Y01: ... to ... mbar, bar, kPa, MPa, ... with square root characteristic: Y02: ... to ... mbar, bar, kPa, MPa, ...	Y01 Y02
Measuring range for level measurement without chemical seal: The measuring range (Δp) has to be calculated. When ordering, complete and return the "Hydrostatic level measurement" questionnaire..	Y06
Measuring point identification: Number of measuring point, specify in writing, max. 16 characters: Y11: .....	Y11
Description of measuring point, specify in writing, max. 28 characters: Y12: .....	Y12
Customer specified scale for analogue indicator, specify in writing, max. 26 characters: Y20: ... to ... mbar, bar, kPa, MPa, ...	Y20

\*) For the version with process covers screws of stainless steel (7MF4520-1..2-1...), PN 315 only

### 1.5 Dimensions



- 1 Process connection 1/4 – 18 NPT
- 2 Female threads M10, M12 or 7/16–20 UNF
- 3 Blanking plug (electrical connection possible)
- 4 Electrical connection:  
Pg 13.5 compression gland or  
Female thread M20 x 1.5 or  
Female thread 1/2–14 NPT or  
Han 7D connector
- 5 Indicator (optional)
- 6 Protective cover for keyboard
- 7 Outlet valves
- 8 Mounting bracket (optional), with U–bolt for fixing  
to vertical or horizontal pipe  
(50 to 60 mm in diameter)
- 9 Locking screw

Figure 1.2 SITRANS P differential pressure and flow transmitter, Dimension

## 2 Installation

### 2.1 Where to install

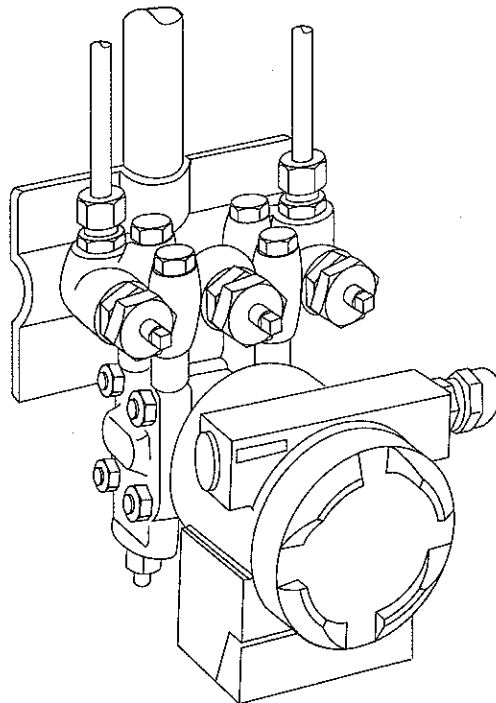
The transmitter can be installed above or below the pressure tapping point. When measuring gases, we recommend the transmitter be installed above the pressure tapping point and the pressure pipe be laid so it runs down to the pressure tap. This will permit any condensation in the pipe to drain off and 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.

The transmitter can be fitted directly to the valve manifold or secured with a mounting bracket.

#### 2.1.1 Fixing to the valve manifold

In the installation example in Figure 2.1, the SITRANS P transmitter is flanged onto a three-way valve manifold. The valve manifold is fixed to a wall, a frame or pipe using a mounting plate.



*Figure 2.1 Fixing SITRANS P to a three-way valve manifold*

### 2.1.2 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 four screws supplied.

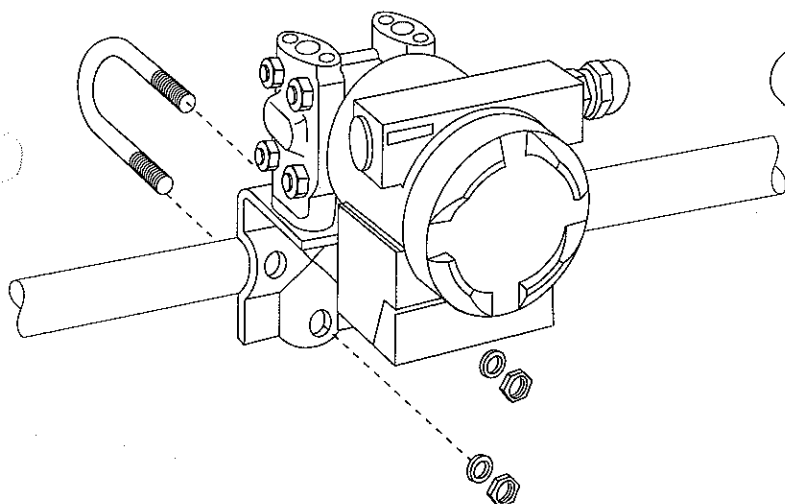


Figure 2.2

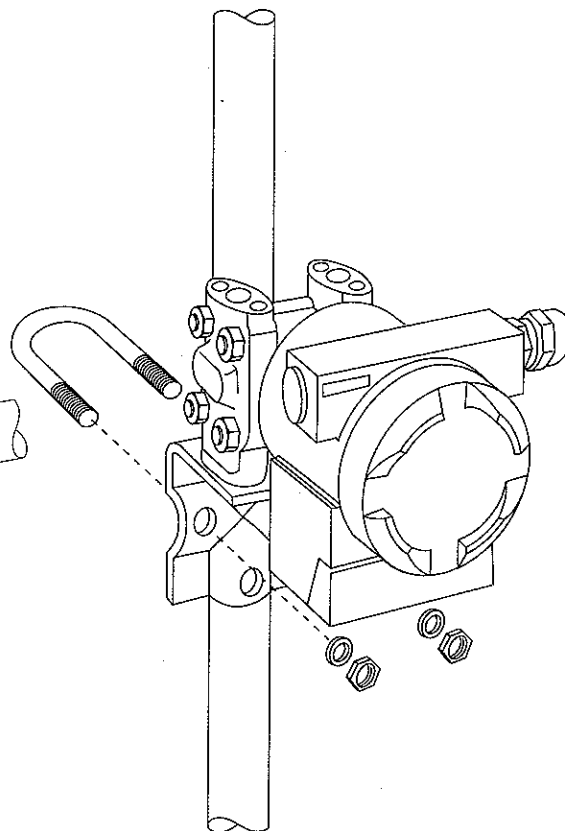


Figure 2.3

*Fixing the SITRANS P transmitter using a mounting bracket*

### 2.1.3 Reversing the process terminals

If required, the process terminals of the SITRANS P transmitter can be reversed by rotating the measuring cell by a maximum of  $\pm 180^\circ$  in relation to the electronics housing.

- open the electronics housing, see section 4.1: General notes
- remove the protective lacquer of the locking screw (hexagonal bolt 9, Figure 1.2)
- undo the locking screw
- disconnect electrical supply to the electronics module
- undo both fixing screws, see section 4, Figure 4.1
- carefully remove the electronics module
- rotate the measuring cell by a maximum of  $180^\circ$  in relation to the housing. Make sure that the ribbon cable is not twisted by more than  $180^\circ$
- carefully replace the electronics module
- tighten both screws
- tighten locking screw
- apply protective lacquer
- restore electrical supply to the transmitter.

## 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 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 galvanically connected to the external earth terminal.

☐ The following general guidelines apply when laying terminal/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 cable

☐ Connection to screw-type terminals

- remove housing cover
- remove analogue indicator (if fitted)
- feed cable in through cable gland
- connect to "+" and "-" terminals, observing polarity!
- replace analogue indicator (if applicable)
- replace transmitter cover

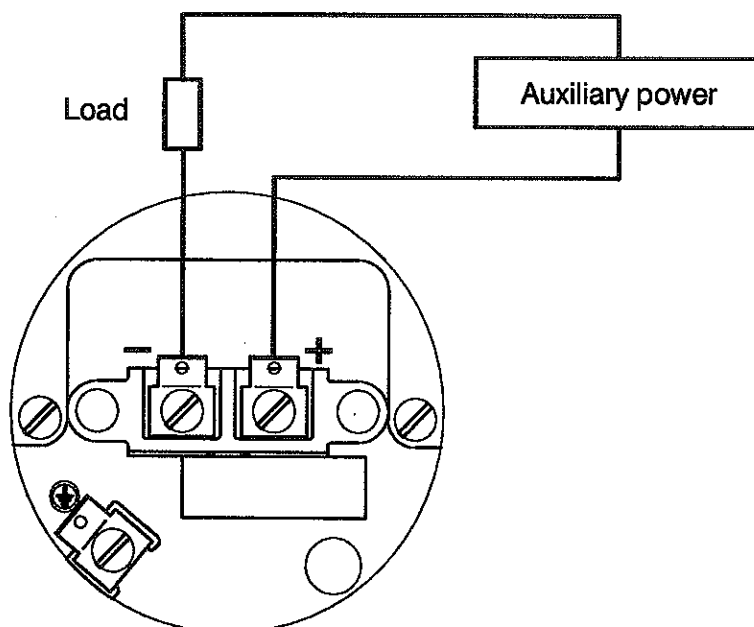


Figure 2.4 Electrical connection schematic

Connection using a plug connector

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

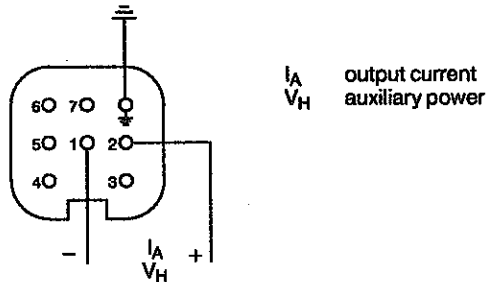


Figure 2.5 Connection using plug connector

## 2.3 Installing the analogue indicator

- Remove transmitter cover
- Plug analogue indicator into the test sockets
- Replace cover and viewing window



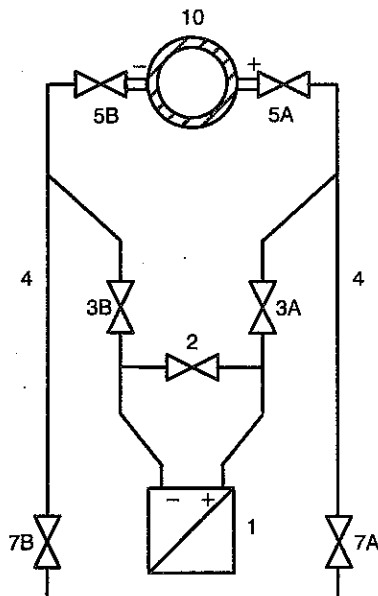
Measuring liquids

The isolating valves should be operated in the following sequence:

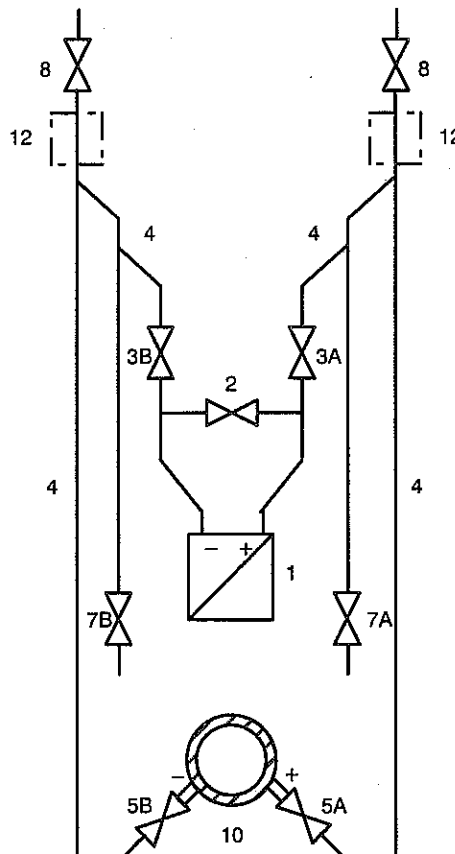
Initial setting: all valves closed

- Open both isolating valves (5) at the pressure tapping points
- Open the equalizing valve (2).
- If the transmitter is below the pressure source:  
open both outlet valves (7) slightly, one after the other, until no more air escapes.
- If the transmitter is above the pressure source:  
open both venting valves (8) slightly, one after the other, until no more air escapes.
- Close both outlet (7) or venting valves (8).
- Open the pressure inlet valve (3A) and venting valve on the positive leg of the transmitter (1) slightly until no more air escapes.
- Close the venting valve.
- Open the venting valve on the negative leg of the transmitter slightly until no more air escapes.
- Close pressure inlet valve (3A).
- Open the pressure inlet valve (3B) slightly until no more air escapes, close after.
- Close the venting valve on the negative leg of the transmitter (1).
- Open the pressure inlet valve (3A) ½ a rotation.
- Check the zero point (4 mA) against start of scale 0 and correct if necessary.
- Close equalizing valve (2).
- Open pressure inlet valves (3A and 3B) fully.

- 1 Transmitter
- 2 Equalizing valve
- 3 Pressure inlet valves
- 4 Impulse lines
- 5 Isolating valves
- 7 Outlet valves
- 8 Venting valves
- 10 Pressure source
- 12 Gas trap



Transmitter below pressure source (normal configuration)



Transmitter above pressure source (non-standard)

Figure 3.2 Measuring liquids

**Measuring steam**

The isolating valves should be operated in the following sequence:

Initial setting: all valves closed

- Open both isolating valves (5) at the pressure tapping points
- Open the equalizing valve (2).
- Wait until the steam in the impulse line (4) and in the condensate reservoirs (13) has condensed.
- Open the pressure inlet valve (3A) and venting valve on the positive leg of the transmitter slightly until no more air escapes.
- Close the venting valve.
- Open the venting valve on the negative leg of the transmitter slightly until no more air escapes.
- Close pressure inlet valve (3A).
- Open the pressure inlet valve (3B) slightly until no more air escapes.
- Close the venting valve on the negative leg of the transmitter.
- Open the pressure inlet valve (3A) ½ a rotation.
- Check the zero point (4 mA) against start of scale 0 and correct if necessary.
- Close equalizing valve (2).
- Open pressure inlet valves (3A and 3B) fully.

**Caution!**

The result will only be correct when the impulse lines (4) contain an identical head of condensate at identical temperatures. Zero point calibration should be repeated, if necessary, when this condition is satisfied.

The flow of steam may damage the transmitter if the equalizing valve (2) is opened when both the isolating valves (5) and pressure inlet valves (3) are open!

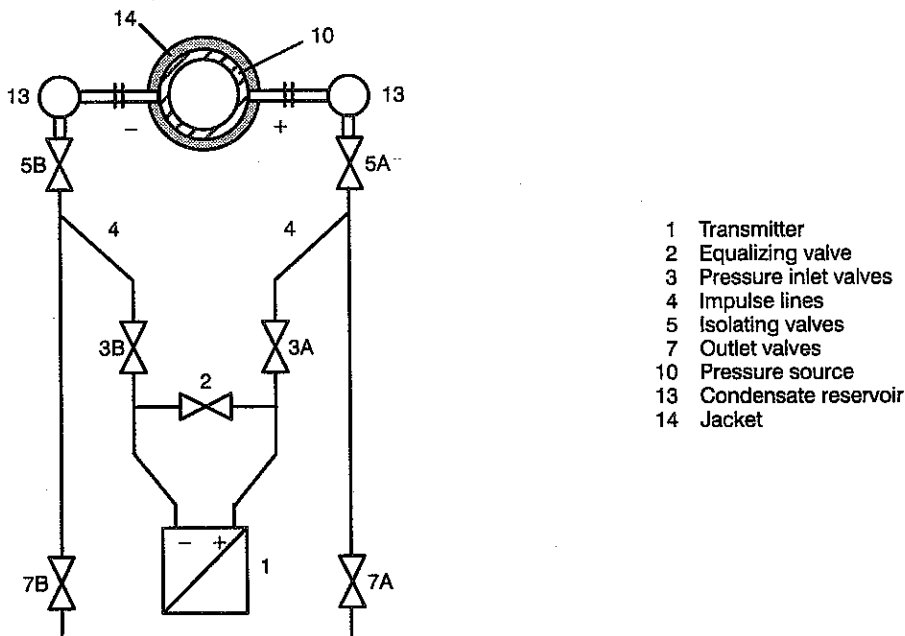


Figure 3.3 Measuring steam

## 4 Operation

### 4.1 General

The SITRANS P differential pressure and flow transmitter is easily parameterised in the field without having to use auxiliary instruments, such as a hand-held terminal.

The transmitter is operated by three pushbuttons located on the outside of the instrument. Settings are displayed on an LCD located inside the housing. 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.

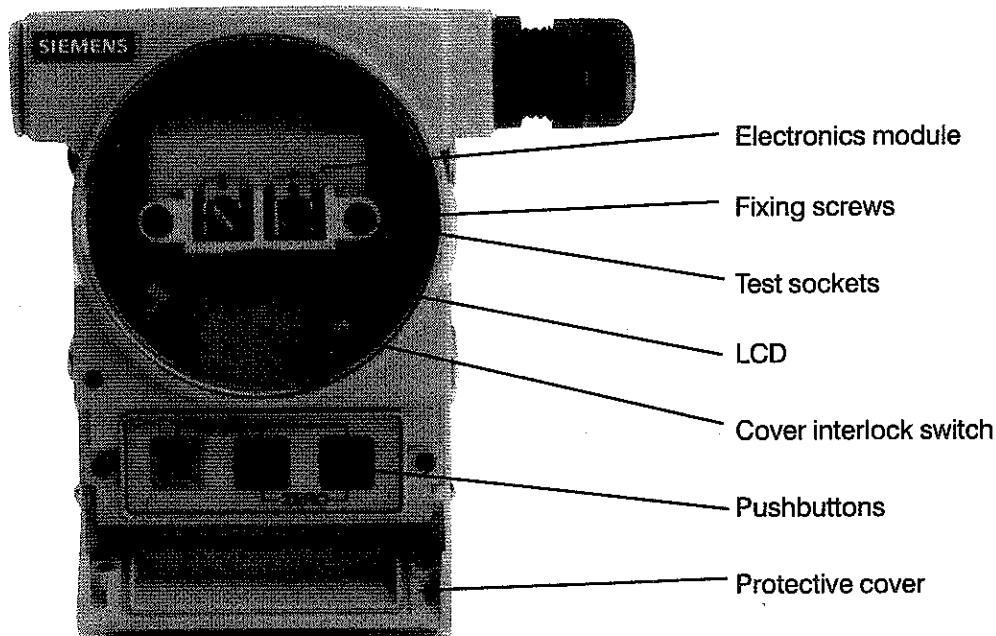


Figure 4.1 SITRANS P transmitter controls and displays

There are two ways of operating the transmitter:

- **With the transmitter closed**  
Only able to set start of scale and full scale
- **With the transmitter open**  
All functions available (see Table 4.1)

With the transmitter open, functions are selected using the **[M]** key and indicated by a mode number on the LCD. The mode number can be modified using the **[↑]** and **[↓]** keys. The LCD always displays the current value.

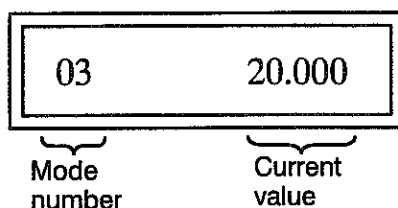


Figure 4.2 Liquid Crystal Display

General notes

- Clean the transmitter before opening it to prevent the ingress of dirt
- Remove the analogue indicator (if fitted) to view the LCD
- The transmitter reverts to the "Measured value" function:
  - if mode 12 is passed by pressing the **[M]** key
  - if 2 minutes elapse without a key being pressed (except in mode 08: "loop check")
  - if the cover interlock switch is pressed
  - when the transmitter is closed
- On completion of calibration
  - replace the analogue indicator in the test sockets (if applicable)
  - screw cover back on
  - replace protective cover and tighten both screws

Function	Mode	Key			Display, Description	Section
		↑	↓	↑ a. ↓ <sup>1)</sup>		
Measured value					Output current in mA 3.84 to 22	
	E				Output current 22.8 or 3.6 mA "E" indicates error	
Status	01				0 : OK ≠ 0 : Error	
Start of scale	02	increase	decrease	set to 4 mA <sup>2)</sup>	Output current in mA	4.2.2
Full scale	03	increase	decrease	set to 20 mA <sup>2)</sup>	Output current in mA	4.2.2
Electrical damping	04	increase	decrease		Time constant T <sub>63</sub> in s Range: 0.0 to 1.9; 2 to 100	4.5
Start of scale "blind" calibration	05	increase	decrease		Start of scale as percentage of max. measuring span	4.3
Measuring span "blind" calibration	06	increase	decrease		Measuring span as percentage of max. measuring span, negativ if falling characteristic	4.3
Set zero point "blind" calibration	07	--	--	execute	Compensate pressure between positive and negative leg. The calibrated value will be displayed as percentage of the max. measuring span (Start of scale does not change).	4.4
"Loop check" function	08	increase	decrease	initiate	Constant output current in mA 3.6 4.0 12.0 20.0 22.8 Terminate using <b>[M]</b> key or cover interlock switch	4.6
Output current in error situation	09	toggles between the two values			Selected output current Either 22.8 or 3.6 mA	4.7
Disable pushbuttons	10	increase	decrease		Pushbutton operation with transmitter closed 0 = start of scale and full scale 1 = start of scale only 2 = none	4.8
Characteristic	11	toggles between the two values			0 = linear 1 = square-root	4.9
Transition point of square-root characteristic	12	increase	decrease		Flow q                      Setting (p = q <sup>2</sup> ) 5 %                              0.25 ⋮                                    ⋮ 15 %                             2.25	4.10

1) Press **[↑]** and **[↓]** keys simultaneously for about 2 s. The display goes blank and the current value is displayed after about 2 s.

2) If **┌---** or **└---** is displayed, the measuring range limits have been violated.

Table 4.1 SITRANS P transmitter functions

## 4.2 Setting start of scale and full scale

There are two ways of setting the start of scale and full scale values:

- with the transmitter closed
- with the transmitter open

**Note:** The start of scale and measuring span are non-interactive.  
(Measuring span = full scale minus start of scale)

### 4.2.1 Transmitter closed



**Note:** Pushbuttons may be disabled! (See section 4.8 and table 4.1, mode 10.)

- 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 differential pressure corresponding to the start of scale to the transmitter. When the start of scale is 0 bar, compensate the pressure between positive and negative leg of the transmitter.
- Press  and  keys together for about 2 s

##### Full scale

- Apply a differential pressure corresponding to the full scale to the transmitter.
- Press all three keys, making sure you press the  key first and release it last, otherwise the start of scale may be incorrect; set start of scale and full scale again if necessary.

#### Calibrate start of scale and full scale

If the output current is going to be variable rather than fixed:



- connect a DC meter to the output circuit








## WARNING

If the transmitter is installed in a Zone 1 hazardous area, use a passive DC meter only.

##### Start of scale

- Apply a differential pressure corresponding to the start of scale to the transmitter. When the start of scale is 0 bar, compensate the pressure between positive and negative leg of the transmitter.
- Set the output current for start of scale using the  and  keys.

##### Full scale

- Apply a differential pressure corresponding to the full scale to the transmitter.
- Set the output current for full scale using the  key and the  key or the  key and the  key. Always press the  key first and release it last, otherwise the start of scale may be incorrect; set start of scale and full scale again if necessary and recalibrate.

## 4.2.2 Transmitter open

Read the general notes in section 4.1.

**Note:** If no pressure source is available,

the start of scale can be set in mode 05 and the measuring span in mode 06.

Both are specified as a percentage of the maximum measuring span, see section 4.3.

### Set start of scale

- Apply a differential pressure corresponding to the start of scale to the transmitter. When the start of scale is 0 bar, compensate the pressure between positive and negative leg of the transmitter.
- Select mode 02 using the **[M]** key.
- Set the output current corresponding to the start of scale using the **[↑]** and **[↓]** keys.

or

Set output current to 4 mA:

Press the **[↑]** and **[↓]** keys simultaneously for about 2 s.

If **┌ \_ \_ \_** or **└ \_ \_ \_** is displayed, the measuring range limits have been violated. The original value remains unchanged.

### Set full scale

- Apply a differential pressure corresponding to the full scale to the transmitter.
- Select mode 03 using the **[M]** key.
- Set the output current corresponding to full scale using the **[↑]** and **[↓]** keys.

or

Set output current to 20 mA:

Press the **[↑]** and **[↓]** keys simultaneously for about 2 s.

If **┌ \_ \_ \_** or **└ \_ \_ \_** is displayed, the measuring range limits have been violated. The original value remains unchanged.

### 4.3 Setting start of scale and measuring span without a pressure source

Performed with transmitter open, observe the general notes in section 4.1.

It is possible to set the start of scale and measuring span 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 05 using the **[M]** key.
- Use the **[↑]** or **[↓]** key to set the start of scale as a percentage of the maximum measuring span

To set the measuring span

- Select mode 06 using the **[M]** key.
- Use the **[↑]** or **[↓]** key to set the measuring span as a percentage of the maximum measuring span

#### Example 1

A transmitter with a maximum measuring span of 5 bar is to be calibrated to a measuring range of 0 to 3.75 bar to correspond to 4 to 20 mA.

The start of scale 0 bar corresponds to 0% of the measuring span and the measuring span 3.75 bar to 75% of the maximum measuring span.

- For the start of scale, set the value "0.00" in mode 05.
- For the measuring span, set the value "75.00" in mode 06.

#### Example 2

A transmitter with a maximum measuring span of 250 mbar is to be calibrated to a measuring range of –25 to +100 mbar to correspond to 4 to 20 mA.

The start of scale –25 mbar corresponds to –10% of the measuring span and the measuring span (full scale minus start of scale) 125 mbar to 50% of the maximum measuring span.

- For the start of scale, set the value "–10.00" in mode 05.
- For the measuring span, set the value "50.00" in mode 06.

#### Example 3

A transmitter with a maximum measuring span of 600 mbar is to be calibrated to a measuring range of 400 to 0 mbar to correspond to 4 to 20 mA.

The start of scale 400 mbar corresponds to 66.67% of the measuring span and the measuring span (full scale minus start of scale) –400 mbar to –66.67% of the maximum measuring span.

- For the start of scale, set the value "66.67" in mode 05.
- For the measuring span, set the value "–66.67" in mode 06.



## 4.4 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 can be corrected in the SITRANS P transmitter without modifying the start of scale and span settings in modes 05 and 06 (correction of zero point).

- Compensate the pressure (see section 4.2.2)
- Select mode 07 using the **[M]** key.
- Press the **[↑]** and **[↓]** keys simultaneously for about 2 s.

The zero point correction is displayed as a percentage of the maximum measuring span.

### Example

A transmitter with a maximum measuring span of 600 mbar is calibrated for a measuring range of 120 to 480 mbar (4 to 20 mA), i.e. start of scale 20% ( $\hat{=}$  120 mbar) in mode 05, measuring span 60% ( $\hat{=}$  360 mbar) in mode 06. The transmitter is, however, being used in hotter conditions, which is causing an offset in the original zero point.

This offset is to be corrected.

- Compensate the pressure.
- Press the **[↑]** and **[↓]** keys simultaneously for about 2 s in mode 07. A value of "-0.22", for example, is displayed, which means that the zero point has been corrected by -0.22%.

The start of scale and measuring span of 20% and 60% set in modes 05 and 06 respectively remain unchanged.

## 4.5 Setting electrical damping

Performed with transmitter open, observe the general notes in section 4.1.

**Note:** The time response of the SITRANS P transmitter is determined by the time constant  $T_{63}$  (see section 1.3) and the electrical damping value.

The SITRANS P transmitter is supplied with a damping value of 0.0 s. Values of 0.0 to 2 s in increments of 0.1 s and 2 to 100 s in increments of 1 s are permitted.

- Select mode 04 using the **[M]** key.
- Use the **[↑]** and **[↓]** keys to change the damping value.

## 4.6 "Loop check" function

Performed with transmitter open, observe the general notes in section 4.1.

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 08 using the **[M]** key.
- Press the **[↑]** and **[↓]** keys simultaneously for about 2 s. This activates the "loop check" function. An output current of 4.0 mA is displayed.
- Use the **[↑]** and **[↓]** keys to select the required current.

Changing the mode or pressing the cover interlock switch or closing the transmitter disables the "loop check" function.

## 4.7 Output current in error situations

Performed with transmitter open, observe the general notes in section 4.1.

The pressure sensor and electronics are monitored continuously. If a defect occurs, the output current is displayed as 3.6 or 22.8 mA, neither of which are possible under normal conditions. Which value is displayed is determined using mode 09. The factory setting is 22.8 mA.

- Select mode 09 using the **[M]** key.
- Use the **[↑]** or **[↓]** key to select either 3.6 mA or 22.8 mA.

Changing the mode or pressing the cover interlock switch or closing the transmitter causes the selected value to be stored.

## 4.8 Disable pushbuttons

Performed with transmitter open, observe the general notes in section 4.1.

The pushbuttons located under the protective cover can be protected against accidental or unauthorised use **when the transmitter is closed.**

- Select mode 10 using the **[M]** key.
- Use the **[↑]** or **[↓]** key to select either 0, 1 or 2.
- 0 → start of scale and full scale can be altered
- 1 → start of scale only can be altered
- 2 → all pushbuttons disabled

Changing the mode or pressing the cover interlock switch or closing the transmitter causes the selected value to be stored.

## 4.9 Select characteristic (linear/square–root)

Performed with transmitter open, observe the general notes in section 4.1!

The output characteristic is selected as follows:

- linear (proportional to differential pressure)
- square–root (proportional to rate of flow)
- Select mode 11 using the **[M]** key.
- Use the **[↑]** or **[↓]** key to select either:
  - 0 for linear characteristic
  - 1 for square–root characteristic

Changing the mode, operating the cover interlock switch or closing the transmitter causes the selected characteristic to be stored.

In the case of a square–root characteristic, the transition point can also be specified (see section 4.10).

## 4.10 Setting transition point of square–root characteristic

Performed with transmitter open, observe the general notes in section 4.11

When measuring rate of flow with a pressure source, the transition point of the square–root characteristic can be set between 5 % and 15 % of the rate of flow. The output characteristic is linear below this point.

- Select mode 12 using the **[M]** key.
- Use the **[↑]** or **[↓]** key to select the transition point of the square–root characteristic.

In order to determine the transition point of the square–root characteristic, set the appropriate differential pressure for the required flow. The relation between differential pressure and flow is given by  $\Delta p \sim q^2$ . The factory setting is 0.94 %.

Flow q	Setting ( $\Delta p$ in % )
5%	0.25
6%	0.36
7%	0.49
8%	0.64
9%	0.81
9.7%	0.94
10%	1.00
12%	1.44
15%	2.25

Changing the mode, operating the cover interlock switch or closing the transmitter causes the selected transition point to be stored.

**Note:** The transition point selected in mode 12 only takes effect if a square–root characteristic was selected in mode 11 (see section 4.9).

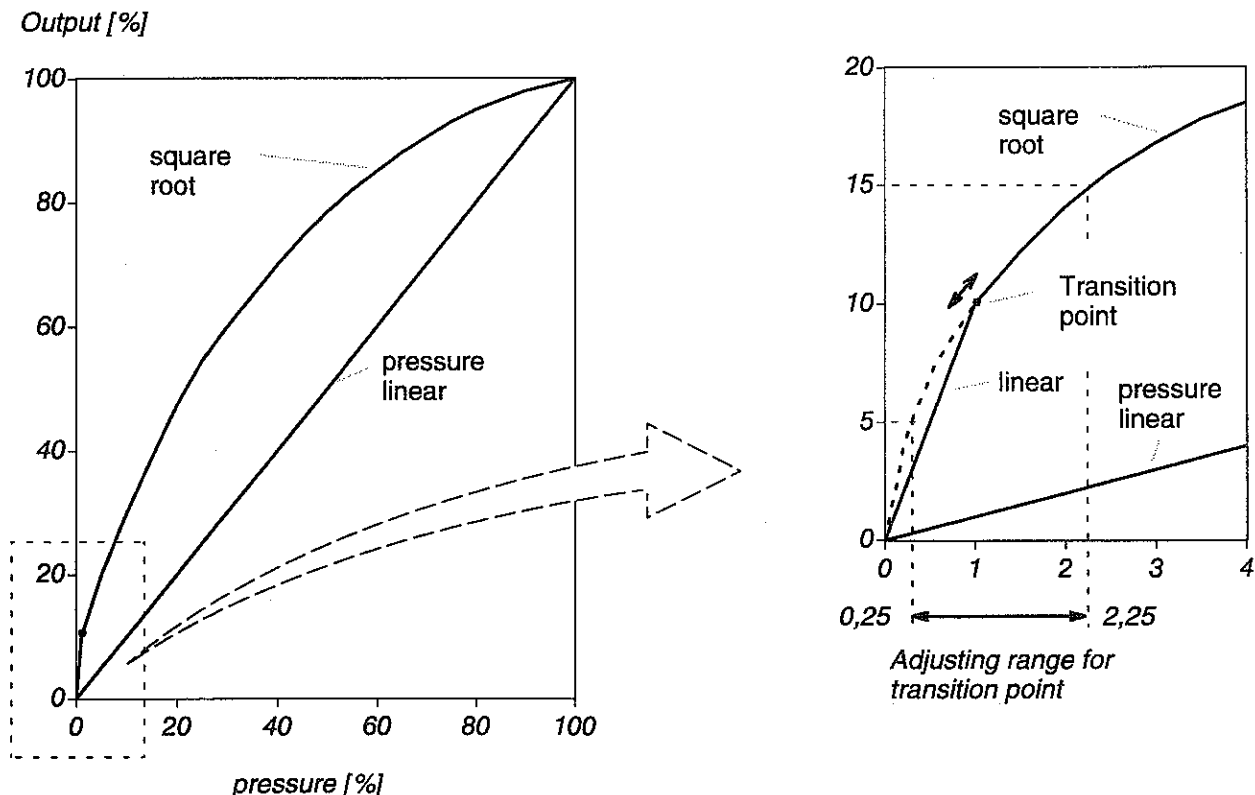



Figure 4.2 Transition point of square–root characteristic

# 6 Conformance Certificate

**Physikalisch-Technische Bundesanstalt**



**KONFORMITÄTSBESCHEINIGUNG**  
PTB Nr. Ex-92.C.2146

(1) Diese Bescheinigung gilt für das elektrische Betriebsmittel

(2) Meßumformer SITRANS P Typ 7MF4\*\*\*-A+\*\*\*-1B+\*

(3) der Firma Siemens AG, 800 Kapfenberg

(4) Die Bauart dieses elektrischen Betriebsmittels sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Konformitätsbescheinigung festgelegt.

(5) Die Physikalisch-Technische Bundesanstalt bescheinigt als Prüfstelle nach Artikel 14 der Richtlinie des Rates der Europäischen Gemeinschaften vom 18. Dezember 1975 (76/117/EWG) die Übereinstimmung des elektrischen Betriebsmittels mit den harmonisierten Europäischen Normen

**Elektrische Betriebsmittel für explosionsgefährdete Bereiche**

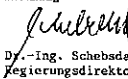
EN 50014:1977 + A2 (VDE 0170/0171 Teil 1) Allgemeine Bestimmungen  
EN 50020:1977 + A2 (VDE 0170/0171 Teil 2) Eigensicherheit

nachdem das Betriebsmittel Erfolg einer Bauartprüfung erlangt hat. Die Ergebnisse dieser Bauartprüfung sind in einem Protokoll festgelegt.


(7) Das Betriebsmittel ist mit dem folgenden Kennzeichen zu versehen:  
**EEx ia IIC T6**

(8) Der Hersteller ist dafür verantwortlich, daß jedes derart gekennzeichnete Betriebsmittel in seiner Bauart mit den in der Anlage zu dieser Konformitätsbescheinigung festgelegten übereinstimmt und daß die vorgeschriebenen Stöcknummern eingetragen sind.

(9) Das elektrische Betriebsmittel darf mit dem hier abgedruckten gemeinschaftlichen Unterscheidungszeichen gemäß Anhang II der Richtlinie des Rates vom 6. Februar 1979 (79/196/EWG) gekennzeichnet werden.

Im Auftrag  
  
Dr.-Ing. Schebsdat  
Regierungsdirektor

Braunschweig, 12.01.1993



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Die Bescheinigungen dürfen nur unverändert weitervertrieben werden.  
Ausgabe oder Änderungen bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt, Bundesallee 100, Postfach 33 45, D-3300 Braunschweig

**Physikalisch-Technische Bundesanstalt**

A N L A G E  
zur Konformitätsbescheinigung PTB Nr. Ex-92.C.2146

Der Meßumformer SITRANS P Typ 7MF4\*\*\*-A+\*\*\*-1B+\* dient in seinen verschiedenen Ausführungen zur Messung von Druck, Absolutdruck, Differenzdruck, Durchfluß oder Füllstand von Flüssigkeiten, Gasen oder Dämpfen.

Die höchstzulässige Umgebungstemperatur in Abhängigkeit von der Temperaturklasse ist der folgenden Tabelle zu entnehmen:

Temperaturklasse	Umgebungstemperatur
T6	60°C
T5	75°C
T4	85°C

**Elektrische Daten**

Hilfsenergie-/Ausgangssignalstromkreis (Anschluß: +, -) in Zündschutzart Eigensicherheit EEx ia IIC nur zum Anschluß an bescheinigte eigensichere Stromkreise mit folgenden Höchstwerten:  
 $U_0 = 30 \text{ V}$   
 $I_K = 100 \text{ mA}$   
 $P = 750 \text{ mW}$

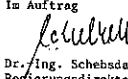
wirksame innere Induktivität  $L_i = 0,6 \text{ mH}$   
wirksame innere Kapazität  $C_i = 6 \text{ nF}$

Kontrollenzeigerstromkreis (Anschluß: Testbuchsen) in Zündschutzart Eigensicherheit EEx ia IIC nur zum Anschluß an erdfreie Anzeiger oder Prüfgeräte ohne eigene Stromversorgung (Batterie, Netz) und ohne Fremdstromkreise  
Höchstwerte:  $U_0 = 30 \text{ V}$   
 $I_K = 100 \text{ mA}$


höchstzulässige äußere Induktivität  $L_A = 0,6 \text{ mH}$   
höchstzulässige äußere Kapazität  $C_A = 7 \text{ nF}$

**Prüfungsunterlagen** unterschrieben am:

1. Beschreibung (15 Blatt)	07.09.1992
2. Zeichnung Nr. C73451-A400-X100-26	
Blatt 0, 1, 4, 6	12.10.1992
Blatt 2, 3, 5, 7-15	07.09.1992

Im Auftrag  
  
Dr.-Ing. Schebsdat  
Regierungsdirektor

Braunschweig, 12.01.1993



Blatt 1/1

## 5 Maintenance

The transmitter requires no maintenance.

Check the transmitter's start of scale value occasionally (see section 4.2 or 4.3).

The output current is displayed on the LCD. If an error has occurred, the character "E" is displayed in the first position.

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Siemens Aktiengesellschaft

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