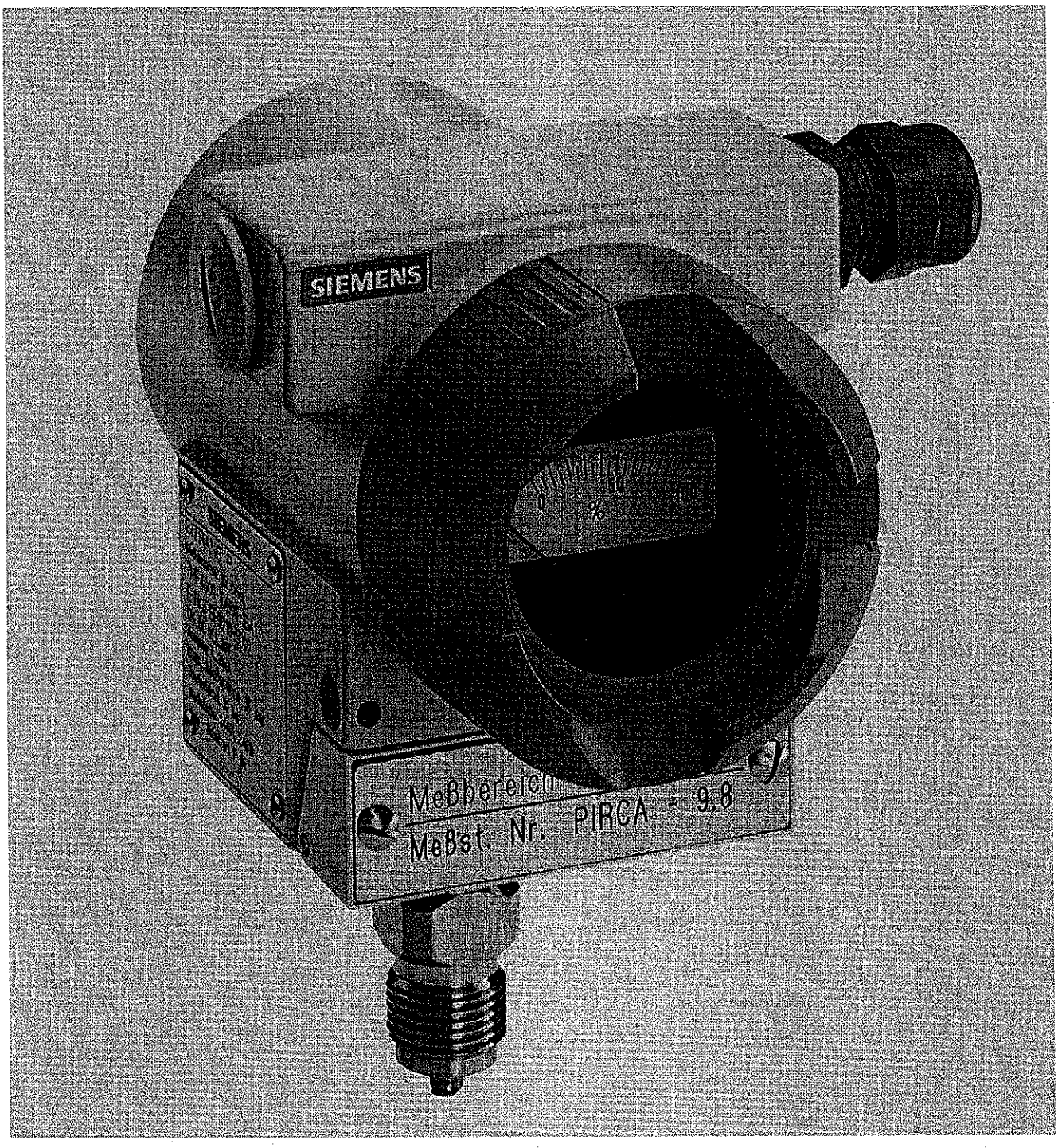
SIEMENS

SITRANS® P

pressure transmitter, MK series

7MF4000

Operating Instructions Order No.: C73000–B5676–C70–1



SIEMENS

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pressure transmitter, MK series

7MF4000

Operating Instructions

C73000–B5676–C70

Contents

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 SITRANS P transmitter measures the pressure of non–aggressive and aggressive gases, vapours and liquids. Measuring spans of between 0.16 and 160 bar are possible.

The output signal is a 4 to 20 mA DC signal, linearly proportional to the measured pressure.

The transmitter is of "intrinsically safe" design and 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.

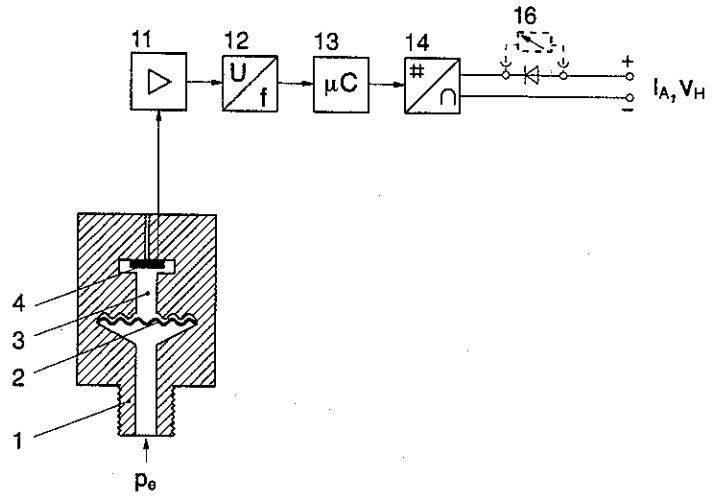
1.2 How it works

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 by an 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 signal.

Data specific to the measuring cell are stored in non–volatile memory (EEPROM).

Transmitters with a measuring span of $\leq$ 63 bar measure pressure against atmosphere, those with spans of 160 bar against vacuum.

Start of scale and full scale are set using three pushbuttons located on the outside of the instrument.



I_A	output current
V_H	auxiliary power
p_e	measured pressure
1	process connection
2	diaphragm
3	filling (liquid)
4	silicone pressure sensor
11	measuring amplifier
12	voltage/frequency converter
13	microcontroller
14	digital/analog converter
16	test sockets
	analogue indicator (option)

Figure 1.1 SITRANS P pressure transmitter, function diagram

1.3 Technical data

Functional data

Measuring spans and overrange limits

Variable measuring spans								Overrange limits	
								Lower	Upper
0.16	to	1	bar	/ 16	to	100	kPa	−1 bar	6 bar
0.63	to	4	bar	/ 63	to	400	kPa	−1 bar	10 bar
2.5	to	16	bar	/ 0.25	to	1.6	MPa	−1 bar	32 bar
10	to	63	bar	/ 1	to	6.3	MPa	−1 bar	100 bar
25	to	160	bar	/ 2.5	to	16	MPa	−1 bar	250 bar

Lower measuring limit	30 mbar (absolute) at ambient temperature below 60 °C
Upper measuring limit	100% of max. measuring span
Start of scale	anywhere between the measuring limits
Auxiliary power terminal voltage on transmitter	 11 to 45 V DC, 11 to 30 V DC in intrinsically – safe mode
Output signal lower limit upper limit in error situation ripple	4 to 20 mA 3.84 mA 22 mA 3.6 mA or 22.8 mA $I_{ss} \leq 0.5\%$ of maximum output current
Load	$R \leq \frac{V_H - 11\ V}{0.02\ A}\ in\ \Omega$, V_H: auxiliary power in V
Ambient temperature	−40 °C to +85 °C, observe temperature classes in hazardous areas
Temperature of medium	−40 °C to +100 °C
Storage temperature	−50 °C to +85 °C
Condensation	permitted
Installation	process connection pointing vertically down

Response characteristic
with rising characteristic, start of scale 0 bar.
All figures relate to the output span.

Measurement error when calibrating fixed point (incl. hysteresis and repeatability)	≤ 0.25 %
Time constant T_{63}	approx. 0.2 s
Long–term drift	≤ 0.2 % every 6 months at max. measuring span
Effect of ambient temperature	
on start of scale	≤0.15 %/10 K at max. measuring span
on measuring span	≤0.15 %/10 K
Effect of auxiliary power	≤0.005 % for each 1 V change in voltage
Electro–magnetic compatibility	conforms to IEC 801/NAMUR recommendations
Effect of installation from vertical	≤0.05 mbar / 10° of angle

Instrument design

Electrical connection	screw–type terminals or Han 7D connector Cable inlet in the case of screw–type terminals via Pg 13.5 compression gland or M20 x1.5 female thread
Degree of protection to EN 60529	IP65
Process connection	connecting shank G ½A conforming to DIN 16288 or ½ – 14 NPT female thread
Material of components that come into contact with the medium	
connecting shank	stainless steel, material no. 1.4401
diaphragm	stainless steel, material no. 1.4404 or Hastelloy C276, material no. 2.4819
Measuring cell filling	silicone oil
Housing for electronics	die–cast aluminium with low copper content GD–AlSi 12, polyester based lacquer, stainless steel rating plate
Mounting bracket (optional)	galvanised, yellow–passivated steel, or stainless steel
Analog indicator (optional)	linear scale 0 to 100% or to customer's specification
Weight	approx. 1.5 kg (without options)

Explosion protection
to DIN EN 50014 and DIN EN 50020 (CENELEC)

Type of protection	"intrinsically safe i" EEx ia IIC T4 or T5 or T6
Conformance certificate	PTB 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, IK = 100 mA, P = 750 mW
Effective internal inductance	$L_i \leq$ 0.6 mH
Effective internal capacitance	$C_i \leq$ 6 nF

1.4 Ordering data

Description	Order no.
SITRANS P pressure transmitter 2-wire system	7MF4000 – 1□□□□ – 1□□□
Measuring span	
0.16 bar to 1 bar	B
0.63 bar to 4 bar	C
2.5 bar to 16 bar	D
10 bar to 63 bar	E
25 bar to 160 bar	F
Material of components that come into contact with the medium	
Stainless steel / Connecting shank	
Edelstahl / Stainless steel	A
Hastelloy / Stainless steel	B
Version with chemical seal	Y
Process connection	
Connecting shank G $^1/_2$ A	0 0
Female thread $^1/_2$–14 NPT	1 0
Explosion protection	
none	A
"intrinsically safe"	B
Electrical connection/cable inlets	
Pg 13.5 compression gland	A
Female thread M20 x 1.5	B
Han 7D connector	D
Indicator	
none	1
with analog indicator	
scale 0 to 100%, linear	3
scale as specified (Y20 code required)	5

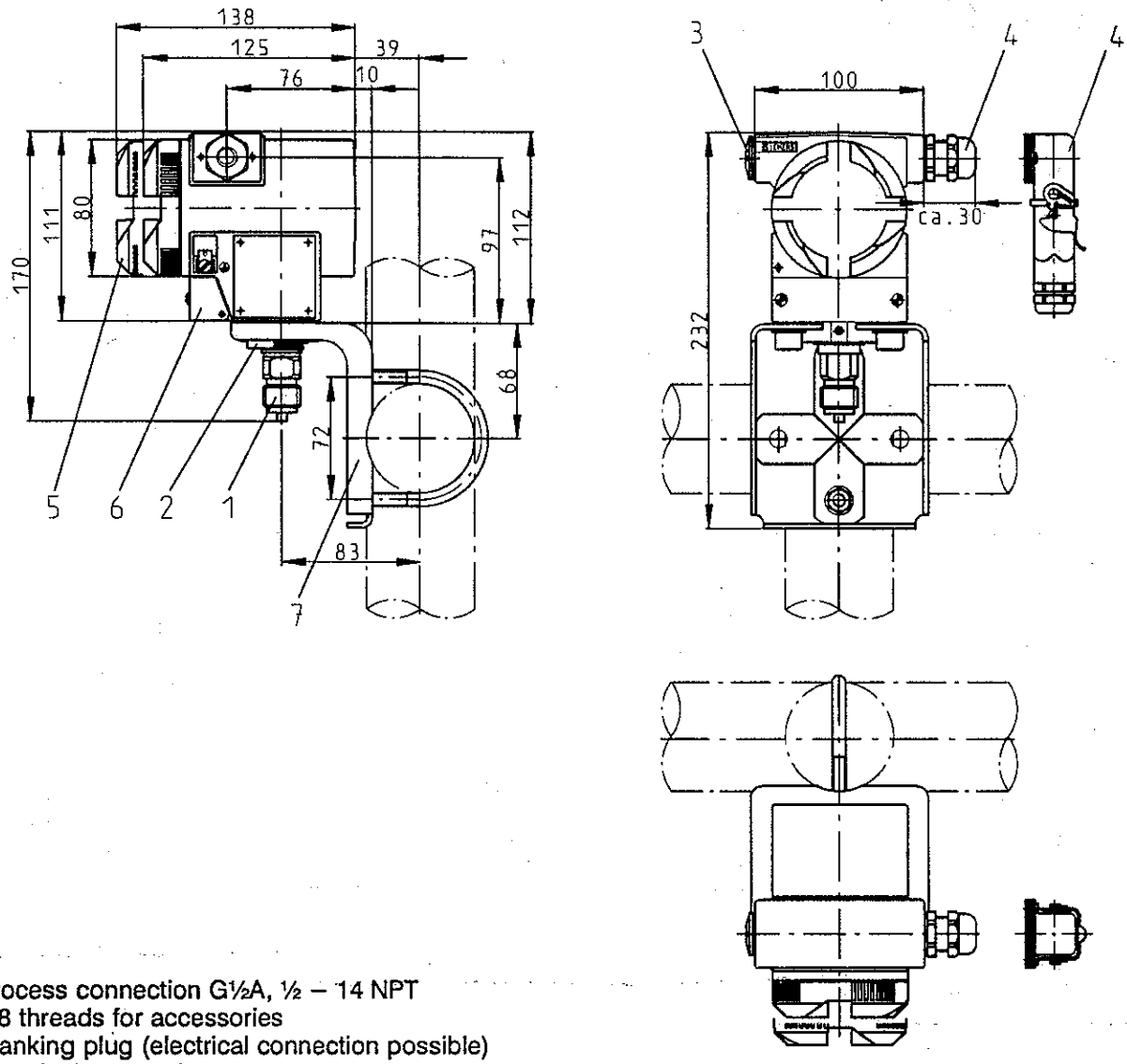
Other versions
Add "–Z" suffix and code to order no.

Description	Code
Transmitter with mounting bracket	
of steel	A01
stainless steel	A02
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

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: **Y01: ... to ... mbar, bar, kPa, MPa, ...**	**Y01**
Measuring point id. 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 analog indicator, specify in writing, max. 26 characters: **Y20: ... to ... mbar, bar, kPa, MPa, ...**	**Y20**

1.5 Dimensions



1 Process connection G½A, ½ – 14 NPT
2 M8 threads for accessories
3 Blanking plug (electrical connection possible)
4 Electrical connection:
  Pg 13.5 compression gland or
  Female thread M20 x 1.5 or
  Han 7D connector
5 Indicator (optional)
6 Protective cover for keyboard
7 Mounting bracket (optional), with U–bolt for fixing to vertical or horizontal pipe (50 to 60 mm in diameter)

Figure 1.2 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.

The transmitter can be fixed to the isolating valve or secured with the mounting plate, depending on the type of process connection.

Note: The measuring cell must not be rotated within the electronics housing!

2.1.1 Fixing to the isolating valve

In the installation example in Figure 2.1, the SITRANS P transmitter is screwed onto a DIN 16720 model B isolating valve. The isolating valve is fixed to a wall or pipe by a clamp.

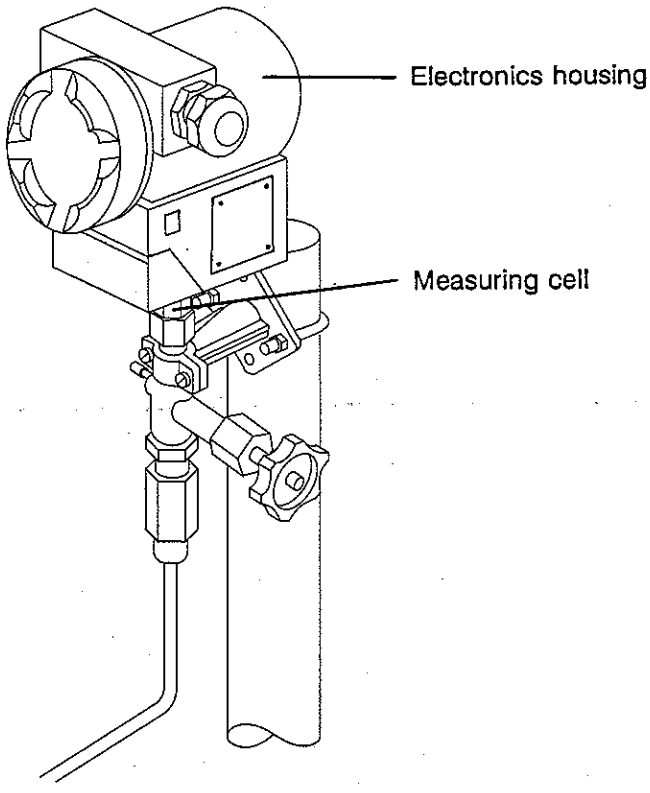


Figure 2.1

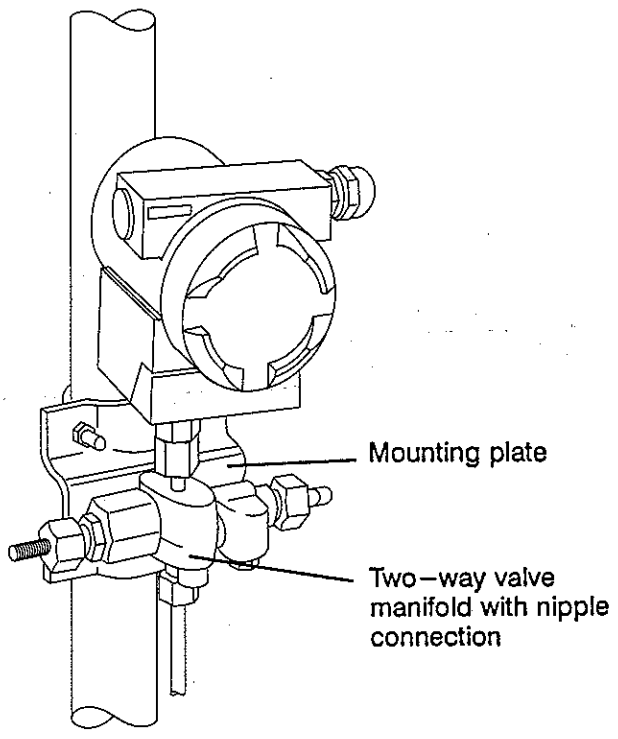


Figure 2.2

Fixing SITRANS P to a isolating valve using G½A connecting shank

Figure 2.2 shows SITRANS P screwed to a two–way valve manifold with a welded nipple connection. The two–way valve manifold is fastened using a mounting plate.

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 two enclosed M8 x 20 screws.

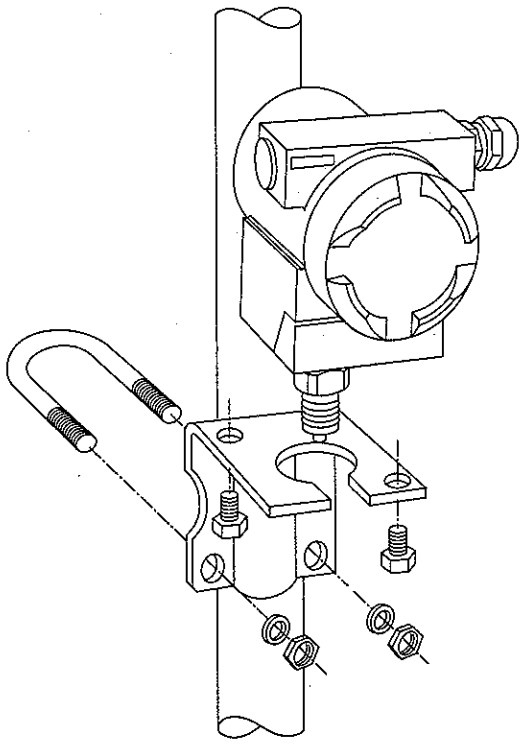


Figure 2.3 Fixing the SITRANS P transmitter using a mounting bracket

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

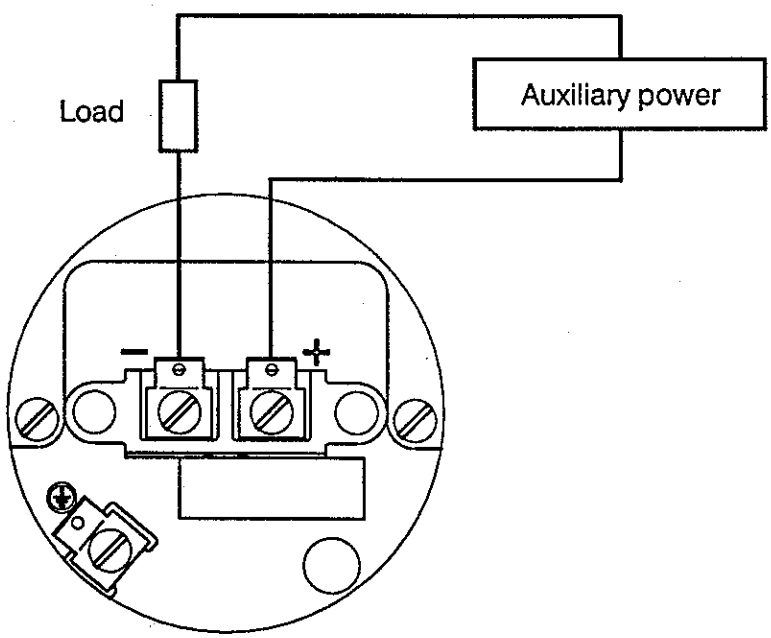


Figure 2.4 Electrical connection schematic

❑ 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

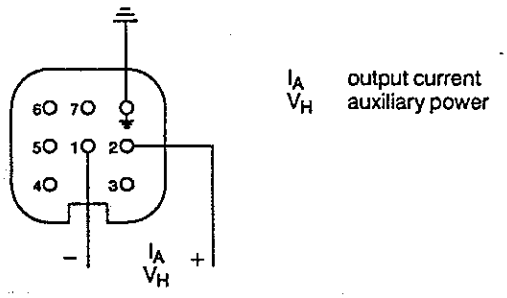


Figure 2.5 Connection using plug connector

2.3 Installing the analogue indicator

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

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 (see section 4),
- Close isolating valve (2B),
- Open isolating valve (4) at pressure tapping point,
- Open isolating valve (2A).

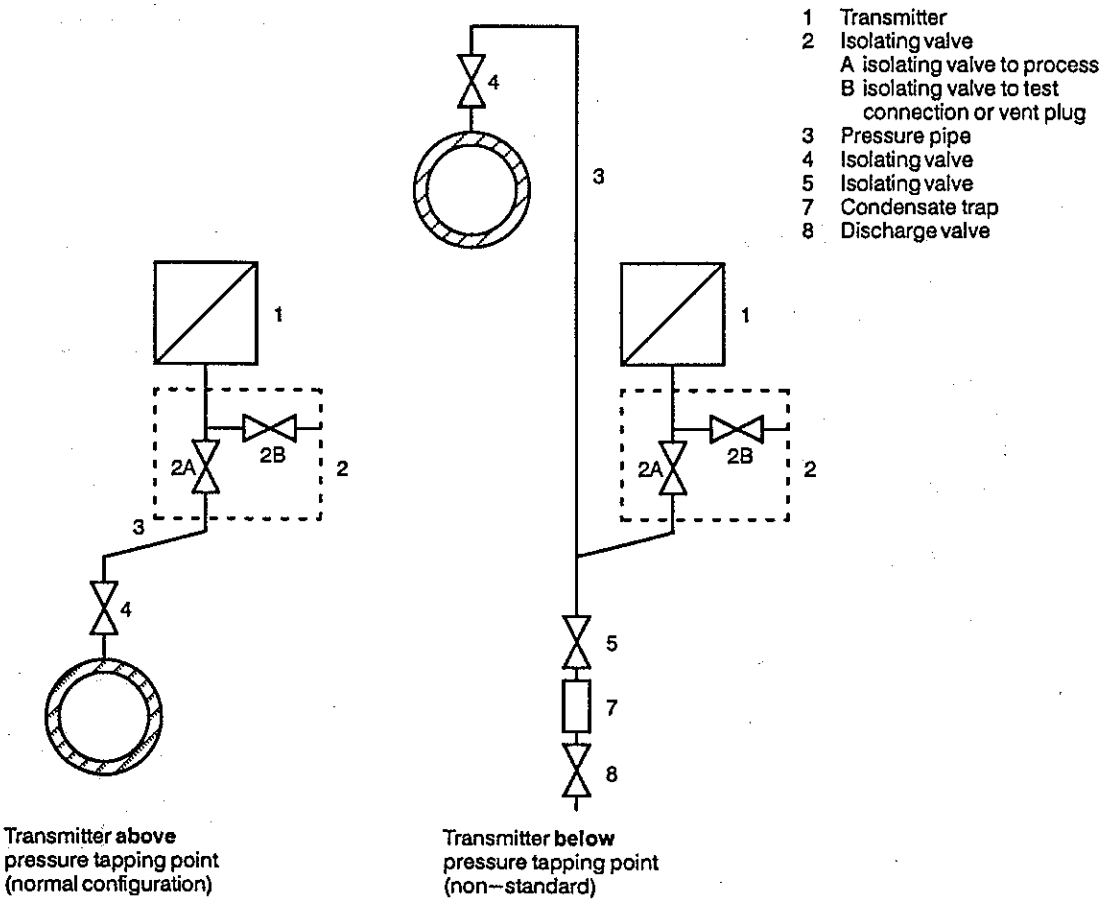


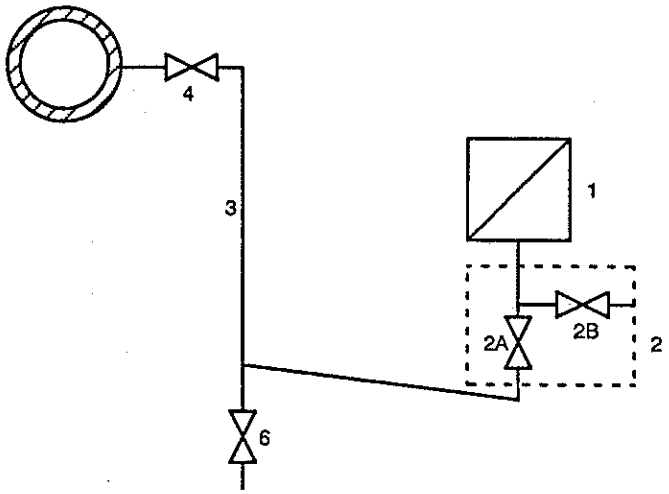
Figure 3.1 Measuring gases

❑ 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 (see section 4),
- Close isolating valve (2B),
- Open isolating valve (4) at pressure tapping point,
- Open isolating valve (2A).



1 Transmitter
2 Isolating valve
A isolating valve to process
B isolating valve to test connection or vent plug
3 Pressure pipe
4 Isolating valve
6 Outlet valve

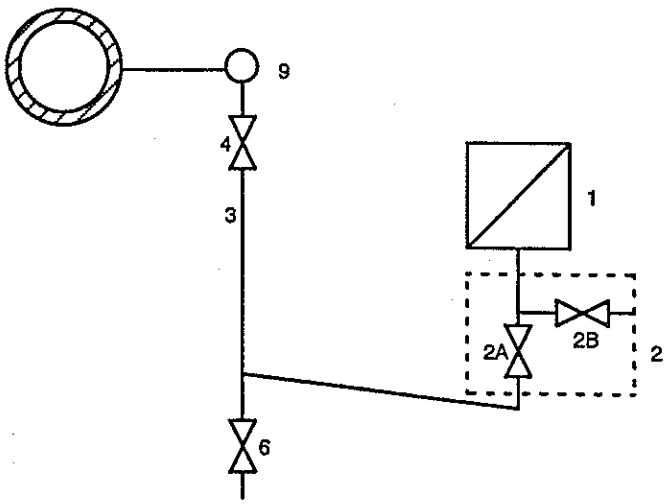
Figure 3.2 Measuring liquids

❑ 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 (see section 4),
- Close isolating valve (2B),
- Open isolating valve (4) at pressure tapping point,
- Open isolating valve (2A).



1 Transmitter
2 Isolating valve
A isolating valve to process
B isolating valve to test connection or vent plug
3 Pressure pipe
4 Isolating valve
6 Outlet valve
9 Condensate reservoir

Figure 3.3 Measuring steam

4 Operation

The transmitter is operated by three pushbuttons, located on the outside of the instrument, with which the start of scale and full scale are set. 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.

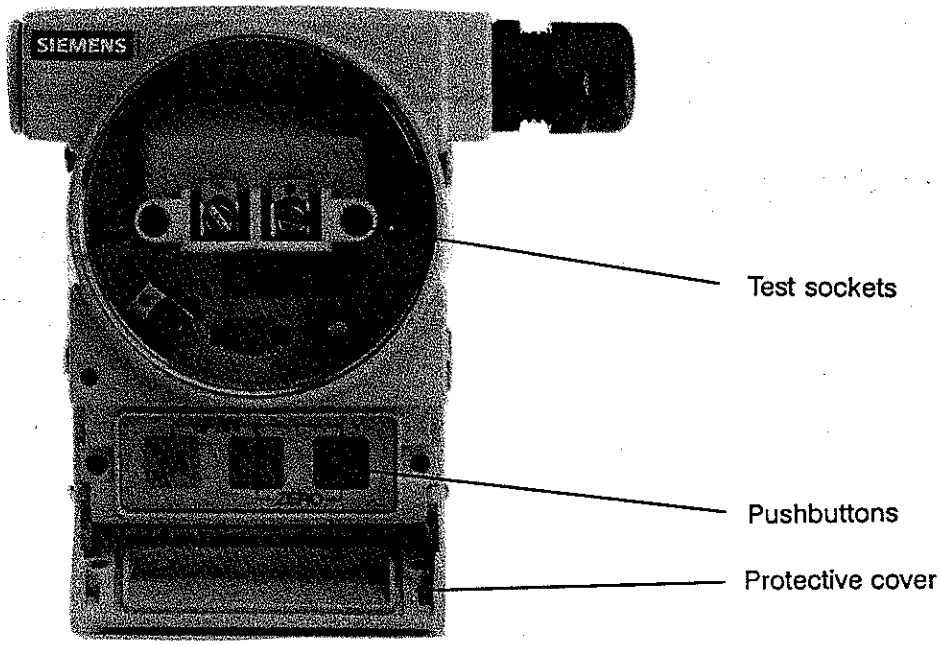


Figure 4.1 SITRANS P transmitter controls and displays

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, ensure the measuring chamber is equal to atmospheric pressure.
- Press [↓] and [↑] keys together for about 2 s

❑ Full scale

- Apply a pressure corresponding to the full scale to the transmitter. (Observe the measuring limits)
- Press all three keys, making sure you press the [M] 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 or the test sockets

  ☞ Connection to test sockets

  - Clean the transmitter before opening it to prevent the ingress of dirt
  - Remove transmitter cover
  - Remove the analogue indicator (if fitted)

WARNING

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

☐ Start of scale

- Apply a pressure corresponding to the start of scale to the transmitter. When the start of scale is 0 bar, ensure the measuring chamber is equal to atmospheric pressure.
- 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 and release it last, otherwise the start of scale may be incorrect; set start of scale and full scale again if necessary and recalibrate.

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

On completion of calibration

- replace the analogue indicator in the test sockets (if applicable)
- screw cover back on (if applicable)
- replace protective cover and tighten both screws

5 Maintenance

The transmitter requires no maintenance.

Check the transmitter's start of scale value occasionally (see section 4).

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

6 Conformance Certificate

Physikalisch-Technische Bundesanstalt

(1) KONFORMITÄTSBESCHEINIGUNG

PTB Nr. Ex-92.C.2146

(2)

(3) Diese Bescheinigung gilt für ...
Meßumformer SITRANS P Typ 7MF4***-*++**-1B**

(4) der Firma Siemens AG
...00 Karlsruhe

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

(6) 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 dieses elektrischen Betriebsmittels mit den harmonisierten Europäischen Normen

Elektrische Betriebsmittel für explosionsgefährdete Bereiche

EN 50014:1977 + A1 ... A5 (VDE 0170/0171 Teil 1) Allgemeine Bestimmungen
EN 50020:1977 + A1 ... A2 (VDE 0170/0171 Teil ...) Eigensicherheit

nachdem die Übereinstimmung mit den Anforderungen auf Erfolg einer Bauartprüfung festgestellt wurde. Die Ergebnisse dieser Bauartprüfung sind in einem Prüfprotokoll 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 Bescheinigung beschriebenen Bauarten übereinstimmt und daß die vorgeschriebenen Stückprüfungen durchgeführt werden.

(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

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 24

Prüfbescheinigungen ohne Unterschrift und ohne Dienstsiegel haben keine Gültigkeit.
Die Bescheinigungen dürfen nur unverändert weiterverbreitet werden.
Auszüge oder Änderungen bedürfen der Genehmigung der Physikalisch-Technischen Bundesanstalt, Bundesallee 100, Postfach 33 45, 0-3300 Braunschweig.

V 13-755 32007 - i.90

Physikalisch-Technische Bundesanstalt

ANLAGE

zur Konformitätsbescheinigung PTB Nr. Ex-92.C.2146

Der Meßumformer SITRANS P Typ 7MF4***-*++**-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_o= 30 V, I_k=100 mA, P =750 mW wirksame innere Induktivität L_i=0,6 mH wirksame innere Kapazität C_i= 6 nF
Kontrollanzeigerstromkreis (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_o= 30 V, I_k=100 mA höchstzulässige äußere Induktivität L_a=0,6 mH höchstzulässige äußere Kapazität C_a= 7 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

PHYSIKALISCH-TECHNISCHE BUNDESANSTALT 24

Blatt 1/1

V 13-755 320 17-6.88

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