SIEMENS

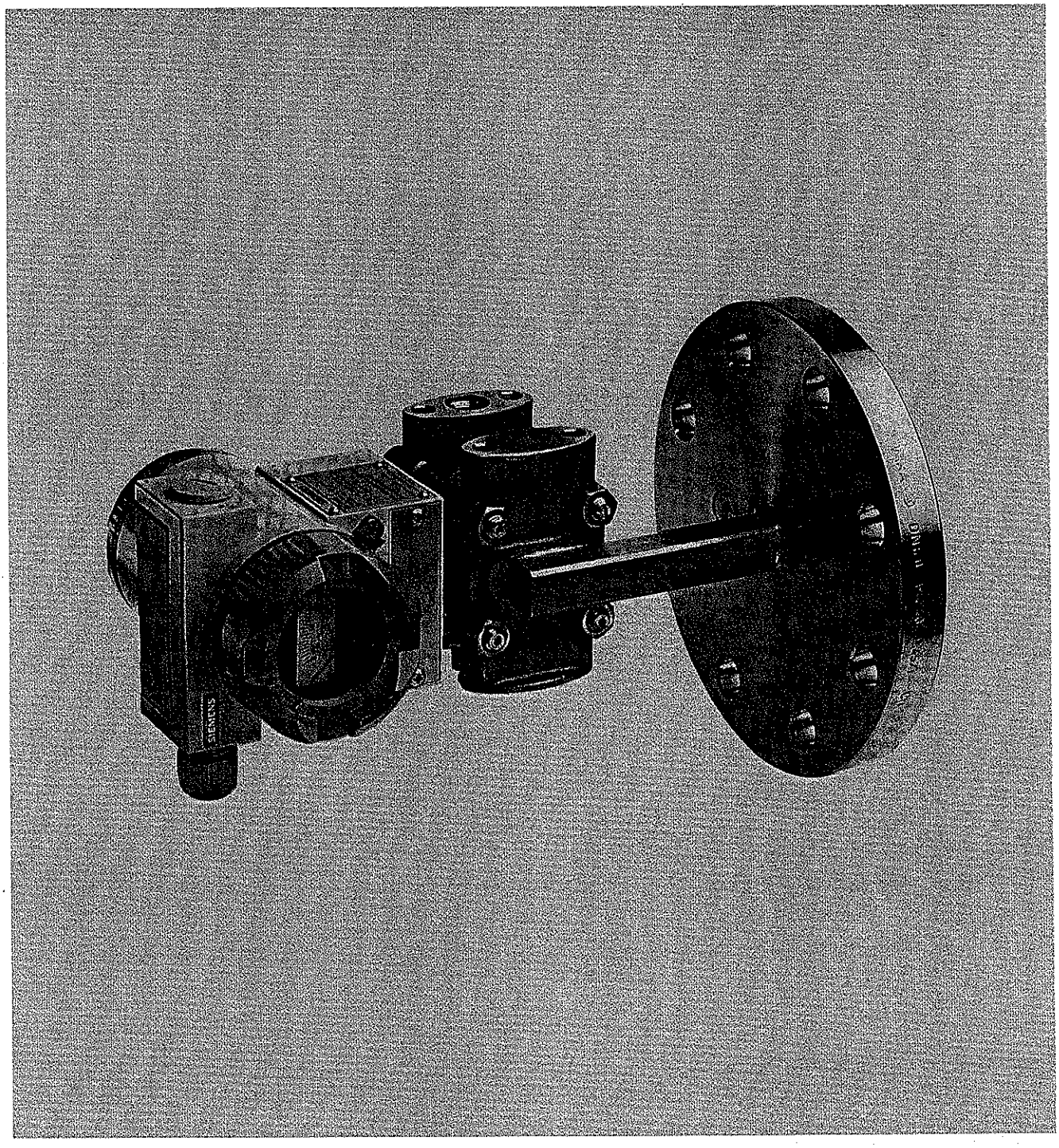
Archivexemplar

SITRANS® P

Level transmitter, DS series (Smart)

7MF4632

Operating Instructions Order No.: C73000–B5676–C88–1



SIEMENS

SITRANS P

Level transmitter, DS series (Smart)

7MF4632

Operating Instructions

C73000–B5676–C88

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 Smart version of the SITRANS P transmitter with mounting flange are used to measure the level of non–aggressive and aggressive liquids in open and closed containers.
Measuring spans of between 25 mbar and 5 bar are possible. The nominal size of the mounting flange is DN 80 or DN 100 (or 3 or 4 inch).

When measuring level in an open container, the negative connection of the measuring cell remains open (measurement taken "against atmosphere"): in the case of closed containers, this terminal must be connected to the container in order to compensate for static pressure.

The wetted parts are made from a variety of materials depending on the level of corrosion resistance required (see "Technical Data").

The output signal is a load–independent direct current 4 to 20 mA, lineary proportional to the level (hydrostatic 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).

1.2 How it works

The input pressure (hydrostatic pressure) exerts a pressure on the measuring cell via the isolating diaphragm (10, see Figure 1.1) on the mounting flange. The differential pressure is transmitted to a silicone pressure sensor (4) through the diaphragms (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.

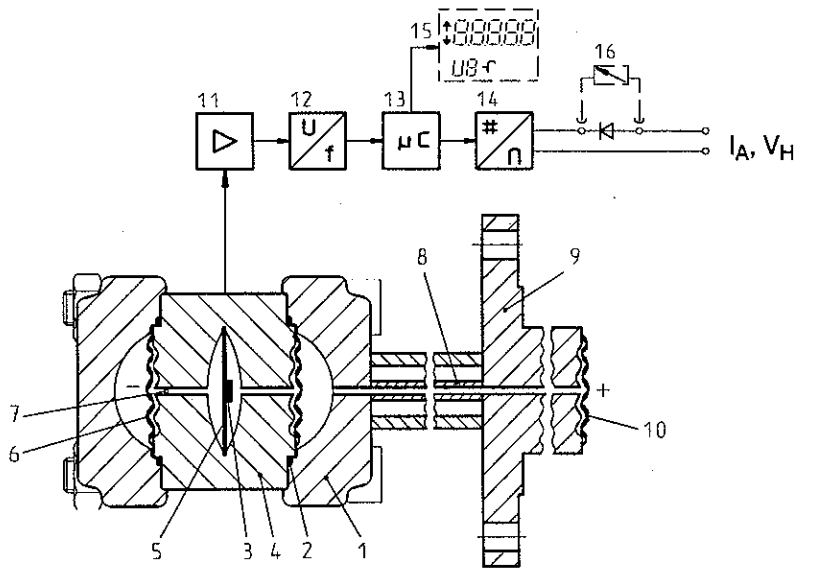
The differential pressure causes the sensor's measuring diaphragm to distort. The resistance of four piezo–resistors in a bridge circuit in the measuring diaphragm changes. This change in resistance generates an output voltage in the bridge circuit that is proportional to the differential pressure. This 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 current.

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

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 erros 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.



I_A	output current
V_H	auxiliary power
+ }	input variable, differential pressure
− }	
1	process cover
2	O−ring
3	cell body
4	silicone pressure sensor
5	overload diaphragm
6	isolating diaphragm on the measuring cell
7	Liquid filling in measuring cell
8	Capillary tube containing liquid filling for mounting flange
9	Flange with extension tube
10	Isolating diaphragm on mounting flange
11	measuring amplifier
12	voltage/frequency converter
13	microcontroller
14	digital/analogue converter
15	digital indicator (optional)
16	analogue indicator (optional)

Figure 1.1 SITRANS P level transmitter, function diagram

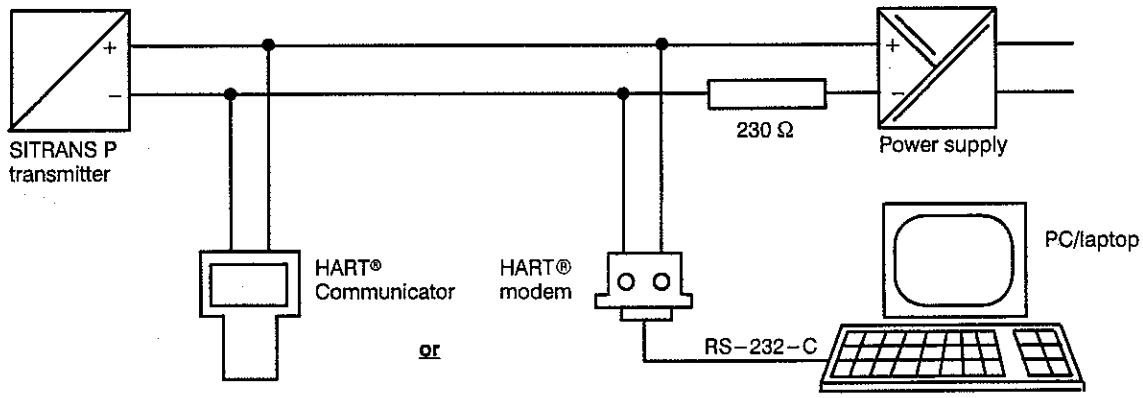


Figure 1.2 Communication between PC/laptop or HART® Communicator and SITRANS P transmitter

1.3 Technical data

Functional data

Rated pressure and measuring spans

Rated pressure	Variable measuring spans
PN 16	25 to 250 mbar / 2.5 to 25 kPa
or	25 to 600 mbar / 2.5 to 60 kPa
PN 40	53 to 1600 mbar / 5.3 to 160 kPa
	160 to 5000 mbar / 16 to 500 kPa

Minimum static pressure	30 mbar (absolute)
Overrange limit	rated pressure
Measuring limits	−100 and +100 % of 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 certified intrinsic safety
ripple	$U_{pp} \leq 0.2$ V (47 to 125 Hz)
noise	$U_{eff} \leq 1.2$ mV (0.5 to 10 kHz)
Output signal	4 to 20 mA
lower limit	3.84 mA
upper limit	20.0 to 22.0 mA [1]
in error situation	3.6 mA or 22.8 mA
ripple	$I_{pp} \leq 0.5$ % of maximum output current
Load	$R \leq \frac{V_H - 11\ V}{0.023\ A}\ in\ \Omega$, V_H: auxiliary power in V 230 to 500 Ω for communication with PC/laptop 230 to 1100 Ω for communication with HART® Communicator
Electrical damping	
variable time constant (for tube length L = 0)	0 to 100 s
Current source	Adjustable, 3.6 mA to 22.8 mA
Ambient temperature	−40 °C to +85 °C
Digital indicator	−20 °C to +85 °C observe temperature classes in hazardous areas!
Temperature of medium	
where $p_{abs} \geq 1$ bar	−40 °C to +175 °C
where $p_{abs} < 1$ bar	−40 °C to +80 °C
Storage temperature	−50 °C to +85 °C
Condensation	permitted

1) Adjustable with PC/laptop or HART® Communicator. The factory setting ist 20.5 mA.

Output characteristic
rising caracteristic, start of scale 0 bar and mounting flange with no extension tube
All figures relate to the output span.

Measurement error when calibrating fixed point (incl. hysteresis and repeatability)	≤0.15 % [2]
Time constant T_{63} at 20 °C (no electrical damping)	approx. 0.2 s
Long–term drift	≤0.1 % every 6 months at max. measuring span;
Effect of ambient temperature (transmitter and mounting flange at same temperature)	
on start of scale	
250 mbar cell	≤0.25 %/10 K at max. measuring span
600 mbar cell	≤0.15 %/10 K at max. measuring span
1600 mbar cell	≤0.10 %/10 K at max. measuring span
5000 mbar cell	≤0.07 %/10 K at max. measuring span
on measuring span	≤0.1 % [2]/10 K
Effect of static pressure	
on start of scale	≤0.1 % per rated pressure at max. measuring span
on the measuring span	≤0.1 % per rated pressure at max. measuring span
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 deviation

Instrument design

Electrical connection	screw–type terminals or Han 7 D connector[3] [4] Cable inlet in the case of screw–type terminals via Pg 13.5 compression gland[3] [4] or M20 × 1.5 female thread[4] or $^1/_2$ – 14 NPT female thread
Degree of protection to EN 60529	IP65
Process connection	
Positive side	DIN or ANSI flange
Negative side	$^1/_4$ – 18 NPT female thread and flange connection to DIN 19213 with M10 thread or $^7/_{16}$ –20 UNF
Material of components that come into contact with the medium	
Positive side	
Isolating diaphragm on mounting flange	Stainless steel, 316 Ti Monel 400 Hastelloy B2 Hastelloy C276 Hastelloy C4 Tantalum Titanium
Negative side	
diaphragm	stainless steel, 316L
process cover	stainless steel, 316
vent valve	stainless steel, 316
parts of measuring cell	stainless steel, 316
O–ring	FPM(Viton)

2) Double this value if selected measuring span <10 % of max. measuring span
3) Not available for protection type "Flame–proof enclosure"
4) Not available for protection type FM exp/CSA exp

Filling liquid	
of the measuring cell	silicone oil
of the mounting flange	silicone oil M5
Housing for electronics	die–cast aluminium with low copper content GD–AlSi 12, polyester based lacquer, stainless steel rating plate
Screws for process covers	galvanised, yellow–passivated steel, or stainless steel
Indicator (optional)	analogue indicator with linear scale 0 to 100% or to customer's specification or digital indicator
Weight	
Transmitter with mounting flange	
DIN	approx. 11 kg to 13 kg
ANSI	approx. 11 kg to 18 kg without extension tube in both cases

Explosion protection
to DIN EN 50 014, DIN EN 50 018 and DIN EN 50 020 (CENELEC)

Intrinsic safety "i"	
Identification	EEx ia IIC T4 or T5 or T6
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 maxium values: V_o = 30 V, I_k = 100 mA, P = 750 mW
Effective internal inductance	$L_i \leq$ 0.6 mH
Effective internal capacitance	$C_i \leq$ 8 nF
Flame–proof enclosure "d"	
Identification	EEx d IIC T5 or T6
Conformance certificate	PTB Nr. Ex–94.C.1021
Max. ambient temperature	+85 °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
HART® Communicator	230 to 1100 Ω
Cable	screened 2–core: $\leq$ 3.0 km screened multicore: $\leq$ 1.5 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

Description	Order no.
SITRANS P level transmitter (converter section) two–wire system, Smart version Order mounting flange 7MF4912 separately	**7MF4632 – 1□Y□□ – 1□□□**
Measuring span 25 mbar to 250 mbar 25 mbar to 600 mbar 53 mbar to 1600 mbar 160 mbar to 5000 mbar	D E F G
Process connection on negative side Female thread $^1/_4$–18 NPT and Flange connection to DIN 19 213 with thread M 10 $^7/_{16}$ – 20 UNF	0 2
Material of components that do not come into contact with the medium Screws of process covers / Electronics housing Steel / Die–cast aluminium Stainless steel / Die–cast aluminium	0 2
Explosion protection None CENELEC Intrinsic safety CENELEC Flame–proof enclosure FM is (intrinsic safety) (applied for) FM exp (explosion–proof) (applied for) CSA is (intrinsic safety) (applied for) CSA exp (explosion–proof) (applied for)	A B D F G J K
Electrical connection/cable inlets Pg 13.5 compression gland [1) 2)] Female thread M20 x 1.5 [2)] Female thread ½–14 NPT Han 7D connector [1) 2)]	A B C D
Indicator None With analogue indicator scale 0 to 100%, linear scale as specified (Y20 code required) With digital indicator	1 3 5 6
Mounting flange directly mounted on SITRANS P transmitter (transmitter section) for level	**7MF4912 – 2□□□1**
Flange / Nominal diameter / Nominal pressure Connection to DIN 2501 / DN 80 / PN 40 DN 100 / PN 16 PN 40 Connection to ANSI B16.5 / 3 inches / 150 lb/sq.in. 300 lb/sq.in. 4 inches / 150 lb/sq.in. 300 lb/sq.in.	D G H Q R T U
Material of parts in contact with medium Stainless steel, 316 Ti Monel 400 Hastelloy B2 Hastelloy C276 Hastelloy C4 Tantalum Titanium	A G H J U K L
Sealing surface smooth to DIN 2526, form D	
Tube length 0 mm 50 mm 100 mm 150 mm 200 mm	0 1 2 3 4

Mounting flange with other nominal diameter, made of another material, with another sealing surface and another filling liquid on request.

1) Not available for protection type "Explosion–proof enclosure"
2) Not available for protection type FM exp/CSA exp

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

Description	Code
Operating instructions and description of the 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

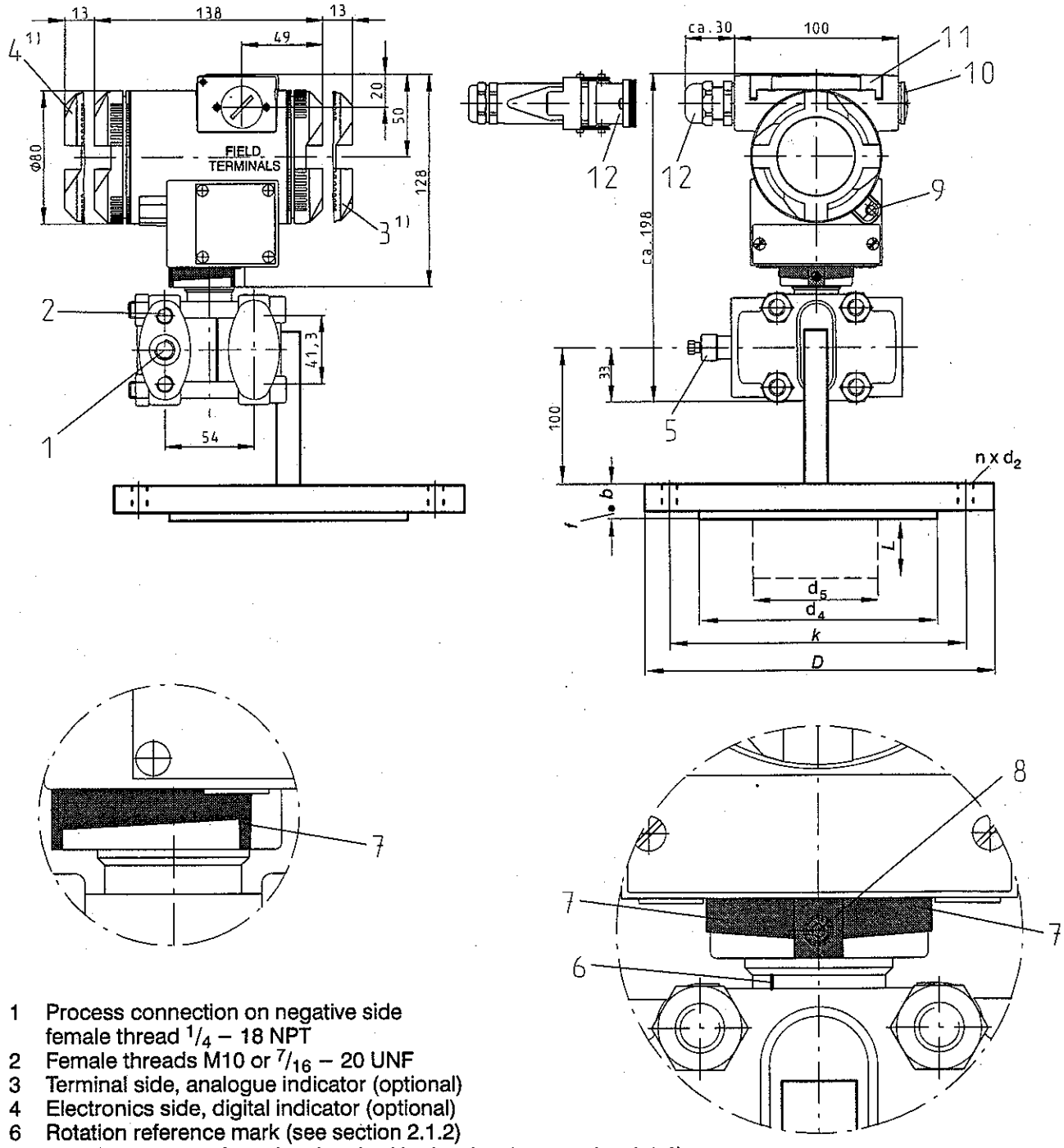
Description	Code
Required measuring range (max. 26 characters), specify in plain text:	
Y01: ... to ... mbar, bar, kPa, MPa, ...	**Y01**
Measuring point identification: Number of measuring point (max. 16 characters), specify in plain text:	
Y15:	**Y15**
Description of measuring point (max. 27 characters), specify in plain text:	
Y16:	**Y16**
Customer specified scale for analogue indicator (max. 26 characters), specify in plain text:	
Y20: ... to ... mbar, bar, kPa, MPa, ...	**Y20**

Ordering note 1st Order position: 7MF4632 transmitter
2d Order position: 7MF4912 mounting flange

Accessories

Description	Order No.
HART® modem and SIPROM P software	
German	**7MF4998–8DD**
English	**7MF4998–8DE**
French	**7MF4998–8DF**
HART® Communicator with a accumulator, battery charger for 230 V AC and case, Type of protection intrinsically safe EEX ia II C T4	
German	**7MF4998–8KF**
English	**7MF4998–8KT**

1.5 Dimensions



1 Process connection on negative side female thread $^1/_4$ – 18 NPT
2 Female threads M10 or $^7/_{16}$ – 20 UNF
3 Terminal side, analogue indicator (optional)
4 Electronics side, digital indicator (optional)
6 Rotation reference mark (see section 2.1.2)
7 Permitted range of rotation, hatched in drawing (see section 2.1.2)
8 Locking screw (see section 2.1.2)
9 Safety angle for housing cover, not displayed in drawing (only with protection type "Flame–proof enclosure")
10 Blanking plug (only with Pg 13,5 and Han 7D)
11 Protective cover for keys
12 Electrical connection:
Pg 13.5 compression gland[2) 3)] or
Female thread M20 x 1.5[3)] or
Female thread $^1/_2$ – 14 NPT or
Han 7 D Connector[2) 3)]

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 level transmitter, dimensions

DIN 2501 connection

DN	PN	b	D	d	d_2	d_4	d_5	d_M	f	k	n	L
80	40	24	200	90	18	138	75.5	72[1)]	3	160	8	0, 50, 100, 150 or 200
100	16	20	220	115	18	158	94	89	3	180	8	
	40	24	235	115	22	162	94	89	3	190	8	

ANSI B16.5

DN inch	PN lb/sq.in.	b inch (mm)	D inch (mm)	d_2 inch (mm)	d_4 inch (mm)	d_5 inch (mm)	d_M inch (mm)	f inch (mm)	k inch (mm)	n	L inch (mm)
3	150	$^{15}/_{16}$ (23.8)	$7^{1}/_{2}$ (190.5)	$^{3}/_{4}$ (19.0)	5 (127)	3 (75.5)	$2^{13}/_{16}$[1)] (72)	$^{1}/_{16}$ (1.6)	6 (152.4)	4	0, 2, $3^{15}/_{16}$, $5^{15}/_{16}$, or $7^{1}/_{8}$ (0, 50, 100, 150 or 200)
	300	$1^{1}/_{8}$ (28.6)	$8^{1}/_{4}$ (209.5)	$^{7}/_{8}$ (22.2)	5 (127)	3 (75.5)	$2^{13}/_{18}$[1)] (72)	$^{1}/_{16}$ (1.6)	$6^{5}/_{8}$ (168.3)	8	
4	150	$^{15}/_{16}$ (23.8)	9 (228.6)	$^{3}/_{4}$ (19.0)	$6^{3}/_{16}$ (157.2)	$3^{11}/_{16}$ (94)	$3^{1}/_{2}$ (89)	$^{1}/_{16}$ (1.6)	$7^{1}/_{2}$ (190.5)	8	
	300	$1^{1}/_{4}$ (31.7)	10 (254)	$^{7}/_{8}$ (22.2)	$6^{3}/_{16}$ (157.2)	$3^{11}/_{16}$ (94)	$3^{1}/_{2}$ (89)	$^{1}/_{16}$ (1.6)	$7^{7}/_{8}$ (200)	8	

d Inside diameter of seal according to DIN 2690

d_M Effective diameter of diaphragm

1) 89 mm ≈ 3½ inch with extension tube length L = 0

2 Installation

2.1 Where to install

2.1.1 Fixing the transmitter

Before installing the transmitter, check that it tis configured in line with the requirements of the application (material, length of sensor, measuring span).

The point of installation should be easily accessible and free from vibration. The permitted ambient temperature limits must not be violated. Protect the transmitter from direct heat sources, rapid changes in temperature, dirt and try not to damage it.

The container flange to which the transmitter is to be connected must be positioned so that it is always below the lowest level of the liquid being measured. The lowest level at which the liquid can still be measured is level with the upper edge of the flange.

- Place a seal (e.g. DIN 2690 flat seal) on the flange of the transmitter (see Figure 1.3) and screw the flange to the mating flange on the container (seals and screws are not supplied). The seal must be positioned centrally and should in no way affect the fexibility of the isolating diaphragm in the flange.
- Check the mounting position carefully!

2.1.2 Connecting the negative impulse line

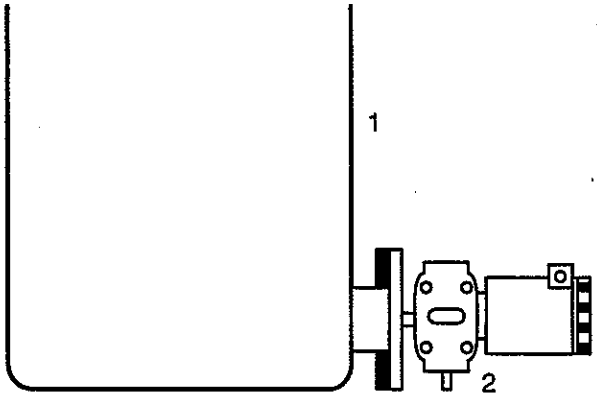
This line is not required in the case of open containers (Figure 2.1) as the negative chamber is open to atmosphere. The opening to the connector should be pointing down to prevent the ingress of dirt.

Where measurements are being taken from closed containers that produce no or only very little condensation (Figure 2.2), the negative impulse line will not be filled up; a condensate trap should nevertheless be included. The line should be laid such that condensate cannot accumulate anywhere.

Where measurements are being taken from closed containers that produce large amounts of condensation (Figure 2.3), the negative impulse line must be filled (usually with condensation from the liquid being measured) and a condensate reservoir fitted. The instrument can be isolated, for example, using the two/way valve manifold 7MF9001–2.

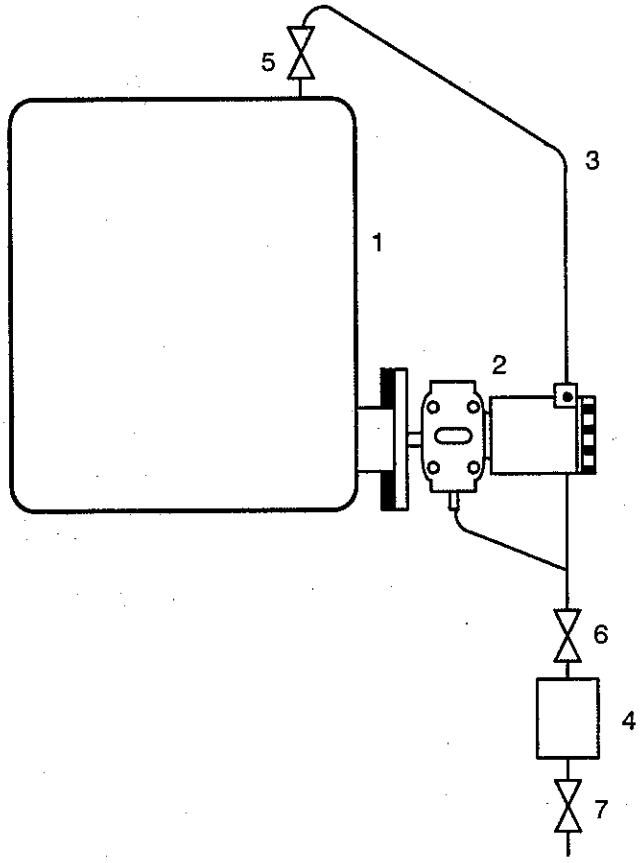
The process connection on the negative side is a $^1/_4$–18 NPT female thread or an oval flange.

Use a weldless steel tube 12 mm x 15 mm for the negative impulse line. See Figures 2.2 and 2.3 for details of the Isolationg valves.



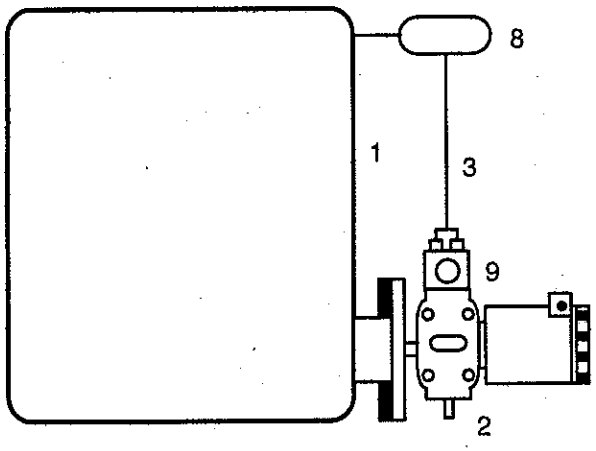
1 Container
2 Transmitter, process connection of the negative chamber open, pointing down

Figure 2.1 Measuring on an open container



1 Container
2 Transmitter
3 Empty negative impulse line, descending from the highest point to the condensate trap
4 Condensate trap
5, 6, 7 Isolating valves

Figure 2.2 Measuring on a closed container (no or very little condensation)



1 Container
2 Transmitter
3 Full negative impulse line
8 Condensate reservoir
9 Two-way valve manifold

Figure 2.3 Measuring on a closed container (large amounts of condensation)

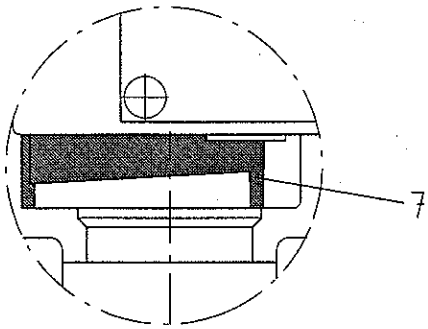
2.1.3 Rotating the measuring unit in relation to the housing

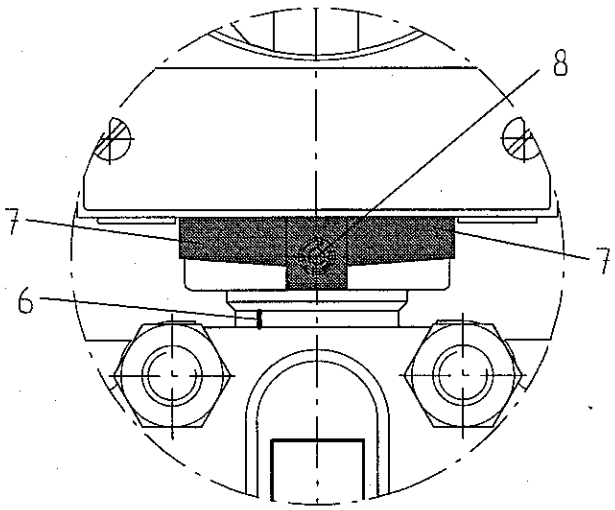
If required, the measuring unit of the transmitter SITRANS P can be rotated in relation to the electronics housing (with digital indicator) to a visible position.

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 (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 connected to the external earth terminal.

Note

- 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. 2.5) can be screwed on to four different positions (±90° or ±180° rotation possible). Please notice that the rotation is limited to ±180° (proceeding from the fixed positon as on delivery).
- The following general guidelines apply when laying terminal (max. cross section 1.5 mm^2)/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
  - 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

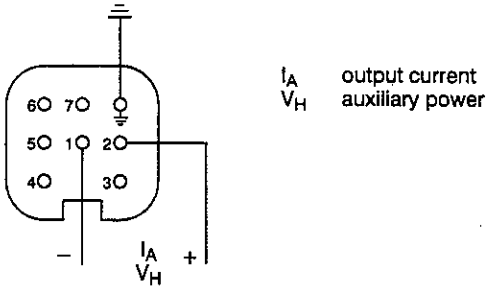
Note

- 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



I_A output current
V_H auxiliary power

Figure 2.4 Connection using plug connector

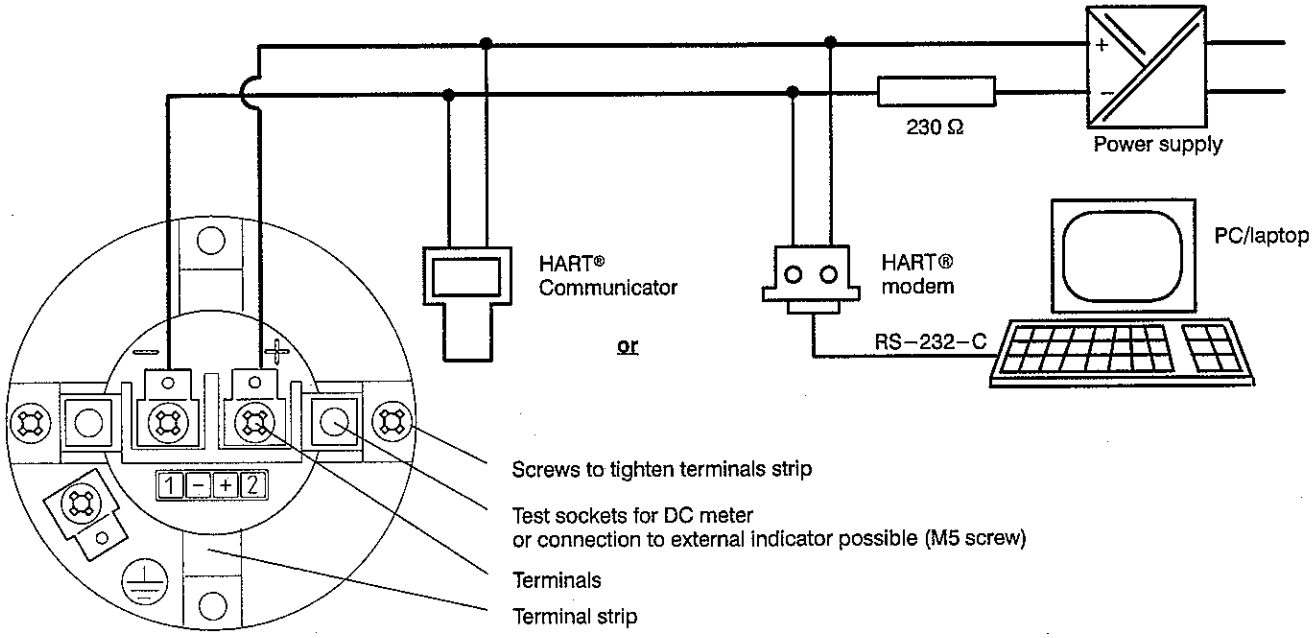


Figure 2.5 Electrical connection schematic

A faultless communication requires at least a load of 230 Ω within the signal circuit (see Fig. 2.5), when using power supply isolators for Smart transmitters, e.g. Siemens 7NG4021, a load has already been assembled (see Fig. 2.6). 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. 2.6).

WARNING

☞ The HART® modem must not be installed in hazardous locations and not connected to intrinsically safe circuits.

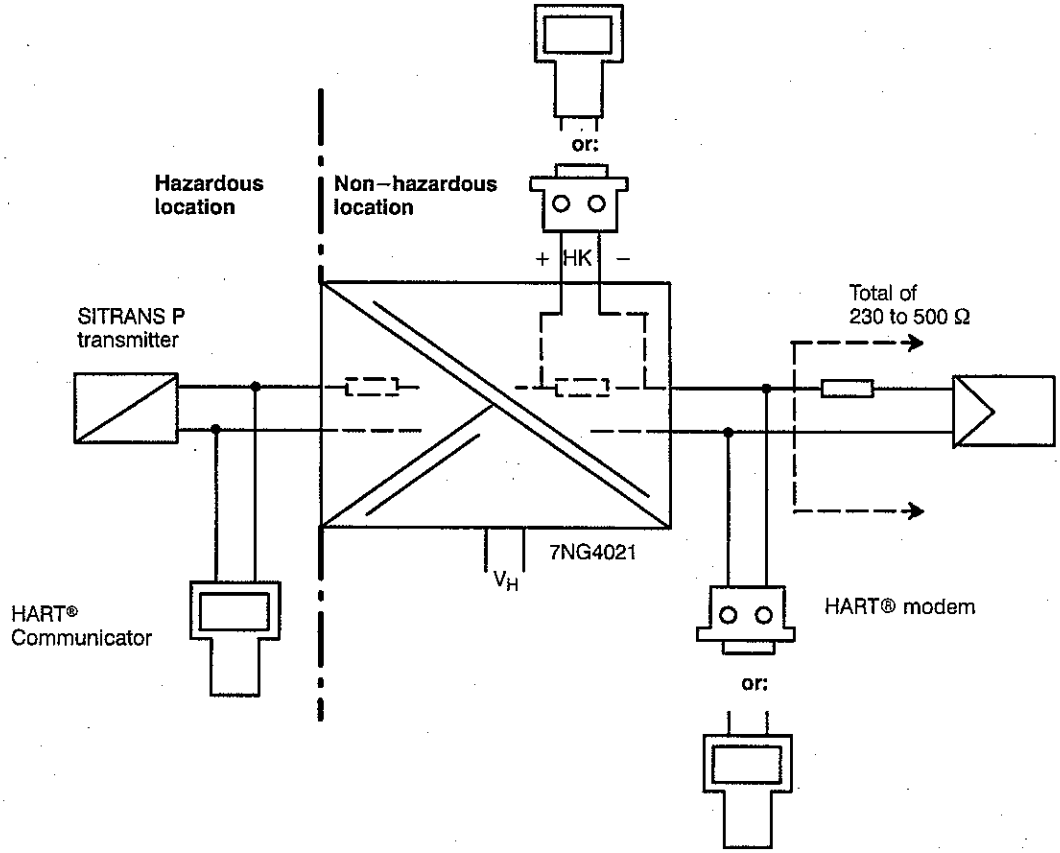


Figure 2.6 Electrical connection with power supply isolator for Smart transmitters

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

Before starting work with the transmitter or at the pipes it is necessary to check which special properties the medium possesses and which respective regulations are in operation. This is important especially for poisonous and radioactive media.

Severe personal injury or damage to property may result if

- ☞ the venting valve and/or the screw plug are missing or not fitted properly and/or
- ☞ the valves are improperly or incorrectly operated.

When working with a hot medium, the individual steps described below must be performed in quick succession, otherwise the valves and transmitter may overheat and be damaged.

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. 2.5 and 2.6).

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 menuline will be marked.

Use the key to move the cursor down through a menu. The selected menuline 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.

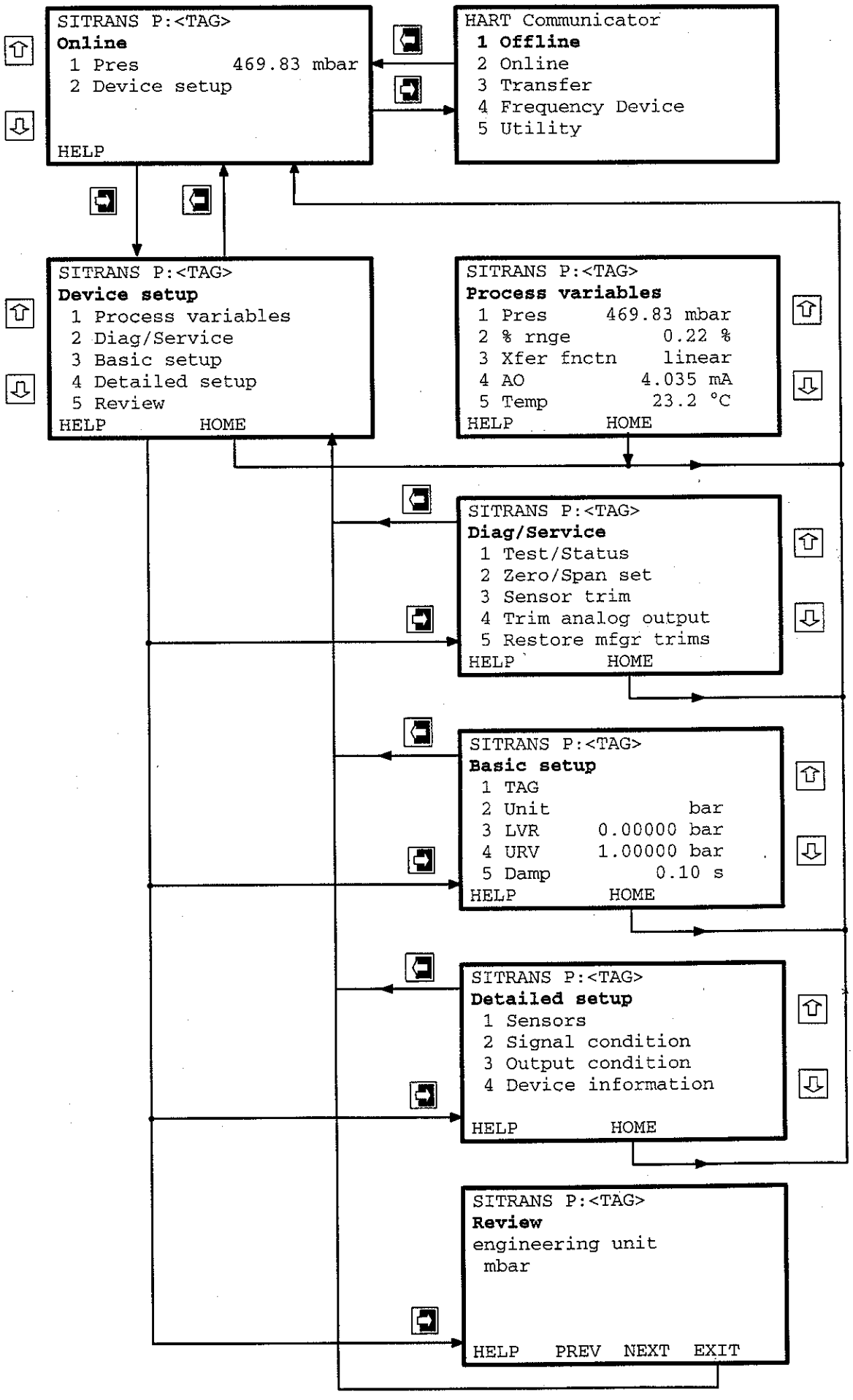


Figure 4.1 Menu

4.3 Operation on the transmitter

4.3.1 General

The SITRANS P level 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.

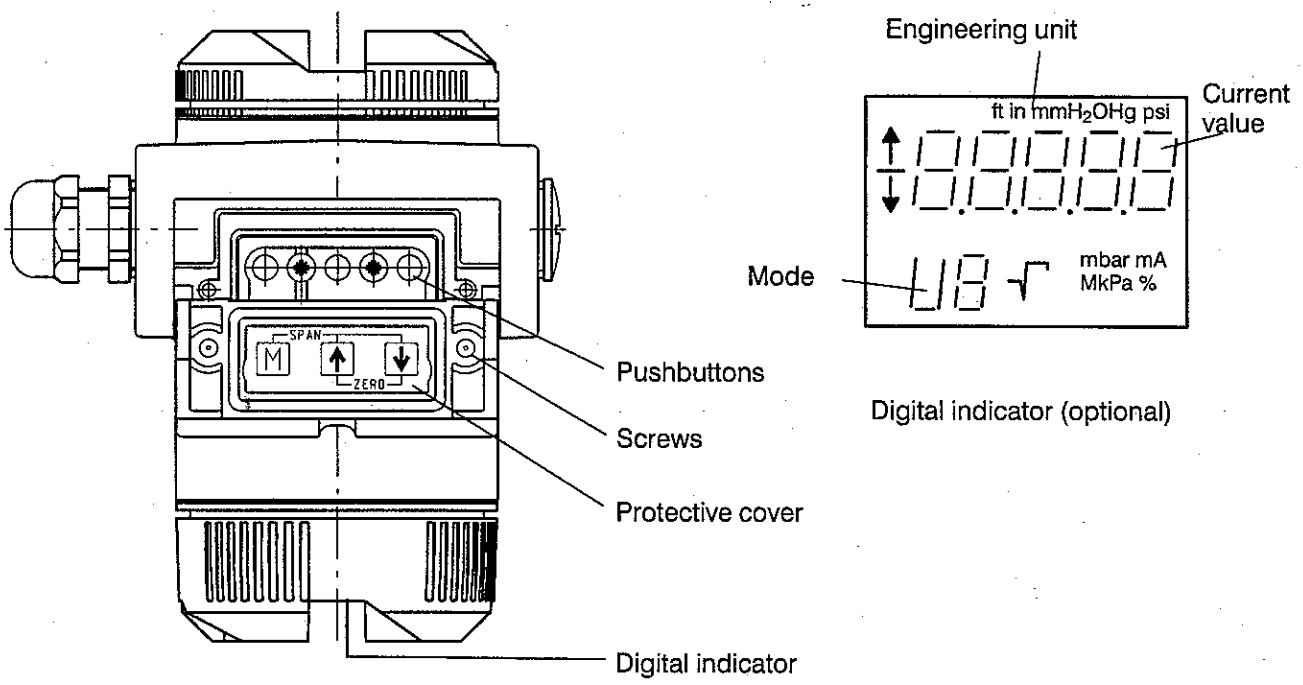


Figure 4.2 SITRANS P transmitter controls and displays

With the fitted digital indicator as an option all functions of table 4.1 are selected using the [M] key. When pressing the [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 [↑] and [↓] keys. In the case of error situations *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 [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 9.9.9.9.9 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

– Press [↑] and [↓] 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 [M] 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. 2.5)

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

Function	Mode [1]	Key [1] ↑	Key [1] ↓	Key [1] ↑ a. ↓ [2]	Display, Description	Section
Measured value					Output current in mA or % or input pressure in engineering units	4.3.3.8
Error display					Error, when transmitter is disturbed	4.3.3.6
Start of scale	2	increase	decrease	set to 4 mA [2]	Output current in mA	4.3.3.1
Full scale	3	increase	decrease	set to 20 mA [2]	Output current in mA	4.3.3.1
Electrical damping	4	increase	decrease		Time constant T_{63} in s Range: 0.1 to 100.0	4.3.3.4
Start of scale "blind" calibration	5	increase	decrease	set to start of scale [2]	Start of scale in selected engineering units	4.3.3.2
Full scale "blind" calibration	6	increase	decrease	set to upper range limit [2]	Full scale in selected engineering units	4.3.3.2
Set zero point "blind" calibration	7	--	--	execute	Compensate pressure between positive and negative leg. (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 Terminate using M key	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	4.3.3.6
Disable pushbuttons and/or functions	10	toggles between the four functions			0 = none LA = locked all L0 = locked all accept start of scale L5 = locked all accept start of scale and full scale	4.3.3.7
---	11	---			Not relevant (only Δp)	---
---	12	---			Not relevant (only Δp)	---
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 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.

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.

– Select mode 2 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 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 [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 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 [↑] or [↓] key to select engineering unit
- Select mode 5 using the [M] key
- Use the [↑] or [↓] key to set the start of scale in the selected engineering unit
- When pressing both [↑] and [↓] 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 [↑] or [↓] key to set the full scale in the selected engineering unit
- When pressing both [↑] and [↓] 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 5 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 1,6 bar is to be calibrated to a measuring range of 456.7 to 123.4 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 250 mbar is calibrated for a measuring range of 0 to 200 mbar to correspond to 4 to 20 mA.
The measuring range is to be changed to a setting of 100 to 240 mbar.

- For the start of scale, set the value "100.00" in mode 5.
- Select mode 6 using [M] key; the full scale "300.00 mbar" is displayed
- When trying to decrease the value using the [↓] 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 300 mbar violates the measuring range limits.)
- Press the [↑] and [↓] keys simultaneously for about 2 s. Then the full scale is set to 250.00 mbar.
- Use the [↓] key to set the full scale to 240.00 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 (see section 4.3.3.1)
- Select mode 7 using the [M] key
- Press the [↑] and [↓] keys simultaneously for about 2 s

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
- Press the [↑] and [↓] 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 T_{63} (see section1.3), 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 [M] key
- Use the [↑] and [↓] keys to change the damping value

4.3.3.5 "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 [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 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 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

0 → no pushbuttons or functions disabled (operation see section 4.3.3)

LA → all pushbuttons and functions disabled

L0 → all functions disabled except start of scale (to set or adjust start of scale see section 4.3.2)

L5 → 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 *L0* or *L5* 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 H_2O*) in Hg ft H_2O*) mm H_2O*) mm Hg psi Pa kPa MPa

- Select mode 14 using the [M] key
- Use the [↑] or [↓] key to select the engineering units

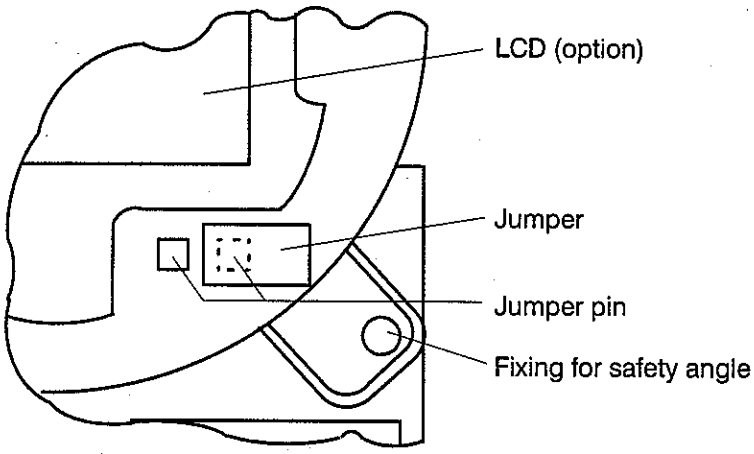
Note:
- If there is an LCD overflow then *9.9.9.9.9* appears (with small engineering units like e.g. Pa)

*) 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*) on the right jumper pin



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

*) 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 SIPROM P an appropriate message is displayed in the "Measured values" field
- *Error* is displayed on LCD (optional)

6 Conformance Certificates

Physikalisch-Technische Bundesanstalt

(1) KONFORMITÄTSBESCHEINIGUNG

(2) **PTB Nr. Ex-94.C.1021**

(3) Diese Bescheinigung gilt für das elektrische Betriebsmittel

Meßumformer SITRANS P Typen 7MF4***.*++**.*D+*

(4) der Firma Siemens AG
D-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 50 014:1977 + A1...A5 (VDE 0170/0171 Teil 1/1.87) Allgemeine Bestimmungen
EN 50 018:1977 + A1...A3 (VDE 0170/0171 Teil 5/1.87) Druckfeste Kapselung "d"

nachdem das Betriebsmittel mit Erfolg einer Bauartprüfung unterzogen wurde. Die Ergebnisse dieser Bauartprüfung sind in einem vertraulichen Prüfprotokoll festgelegt.

(7) Das Betriebsmittel ist mit dem folgenden Kennzeichen zu versehen:

EEx d IIC T5 bzw. EEx d IIC T6

(8) Der Hersteller ist dafür verantwortlich, daß jedes derart gekennzeichnete Betriebsmittel in seiner Bauart mit den in der Anlage zu dieser Bescheinigung aufgeführten Prüfungsunterlagen übereinstimmt und daß die vorgeschriebenen Stückprüfungen erfolgreich durchgeführt wurden.

(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

Dipl.-Ing. R. [illegible]

Braunschweig, 25.04.1994

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, D-3300 Braunschweig.

V 15 - 329007 - 7.85

Physikalisch-Technische Bundesanstalt

(1) KONFORMITÄTSBESCHEINIGUNG

(2) **PTB Nr. Ex-94.C.2090**

(3) Diese Bescheinigung gilt für das elektrische Betriebsmittel

Meßumformer SITRANS P Typ 7MF4*3*-*++**-*B+*

(4) der Firma Siemens AG
D-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 50 014:1977 + A1...A5 (VDE 0170/0171 Teil 1/1.87) Allgemeine Bestimmungen
EN 50 020:1977 + A1...A2 (VDE 0170/0171 Teil 7/1.87) Eigensicherheit "i"

nachdem das Betriebsmittel mit Erfolg einer Bauartprüfung unterzogen wurde. Die Ergebnisse dieser Bauartprüfung sind in einem vertraulichen 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 aufgeführten Prüfungsunterlagen übereinstimmt und daß die vorgeschriebenen Stückprüfungen erfolgreich durchgeführt wurden.

(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

Dipl.-Ing. [illegible]

Braunschweig, 15.08.1994

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, D-3300 Braunschweig.

V 15 - 329007 - 7.85

Siemens AG
Bereich Automatisierungstechnik
Geschäftsgebiet
Meß- und Prüftechnik, Prozeßautomatisierung
D-76181 Karlsruhe

Siemens Aktiengesellschaft

Order No. C73000-B5676-C88-1
Available from: MWB
Printed in the Federal Republic of Germany
AG 1094 0.3 OR 36 En

Progress
in Automation.
Siemens