

Operating Manual



MHPS

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- Operating manual MHPS-M (this document)

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● Safety instructions

Used icons



Warning!

A non-observance can cause injuries to persons or lead to demolition of the device.



Attention!

A non-observance can cause a faulty operation of the device.



Information!

A non-observance can have influence on the operation of the device or cause unintentional reactions of the device.

Mounting, putting into operation



The MHPS is a pressure transmitter for level and pressure measuring. The manufacturer of the device is not liable for defects, which are resulted from incorrect use or use other than that designated.

The pressure transmitter meets the state of the art with taking into account the relevant regulations and EC standards. When the use is not appropriate or in accordance with the requirement, from the device can start application-related dangers, eg an escape of fluid when mounted or adjusted wrong.

A non-observance of the valid safety regulations for this case of application may cause serious injuries and/or damages. Only personnel with the needed qualification, who is authorised by the operator, is allowed to carry out mounting, electrical connection, putting into operation, operation and maintenance of the pressure transmitter.

The specialist staff must have read and understood this operating manual. Instructions, which are included in this manual, have to be followed. As well the specification and notices of the type plates have to receive attention.

Modifications and repairs to the device are permissible only when they are allowed expressly in this documentation.

● Mounting

Before mounting:

Acceptance

- When receiving the goods check the packaging and the contents for damage
- Check the goods for completeness (eg compare delivery note with order data)

Storage

- The device has to be stored in a dry, clean area and protected against damage from impact
- Storage temperature: -40...+85 °C

Identification

- The type plate shows the maximum working pressure (P_{\max} = MWP = maximum working pressure). This value refers to a reference temperature of 20 °C.
- The allowed pressure values at higher temperatures can be found in the relevant standards.
- The test pressure of the device is corresponding with the overload pressure (see table on page 14).
- The used abbreviation PS in the Pressure Equipment Directive (97/23/EG) corresponds to the MWP (Maximum working pressure = P_{\max}) of this device.

Details on the type plates (these details can vary)

Type: name of the device = MHPS

TAG-No: identification number within the installation

Date: date of completion

P_{\max} : = MWP = maximum working pressure)

Input: kind of pressure (eg relative pressure)

Supply: voltage supply = 15...45 VDC

Output: output signal = 4...20 mA HART

Range: measuring range (adjusted)

Order number / item number: 200-xxxxx (x = variable)

SN: serial number

Degree of protection: IP65

● **Mounting (continued)**

Scope of delivery

The delivery includes:

- differential pressure transmitter MHPS
- accessories (option)

Supplied documents:

- this operating manual MHPS-M
- option: final inspection and test report
- option: factory calibration form
- option: operating manual for programming software

Mounting

- Assembly dimensions see page 14

Notes for installation

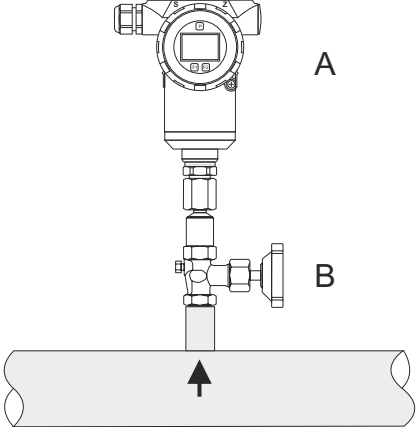
- Due to the fitting position of the MHPS there may be a zero offset. Example: Although the storage basin is empty the measured value not 0 (zero). It is possible to correct this zero point shift directly on the device by using the keys for configuration or externally by means of software for configuration. See page 11...13 in this manual or in the manual for the software.
- When using a valve, the mounting, putting into operation and maintenance can be done without interrupting the process.
- When laying the pressure pipes outside, take care of an adequate antifreezing protection, eg with a parallel pipe heating.
- You can take from relevant standards (national or international) recommendations about laying of pressure pipes (eg DIN 19210).
- Tubes for pressure drop have to be laid with a constant gradient of at least 10%.
- The enclosure of the electronics can be turned up to 360°. In this way the display of the electronic insert is readable very well. See on page 8, too.

● Mounting

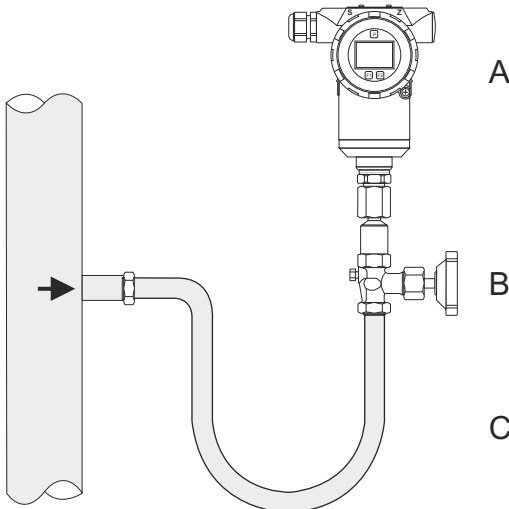
Hinweis

- The modular pressure transmitter is mounted as a manometer. It can be proceeded according the same directives.
- The orientation of the device depends on the application (see examples).
- Valves (shut off) and siphons (if necessary) are recommended.
- Do not damage the diaphragm through mechanical effect (eg when cleaning).

Pressure measurement in gases

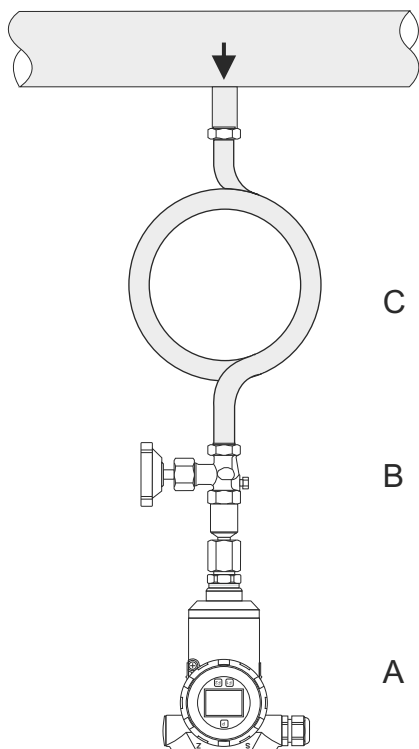
	<p>To make the condensate to flow into the process mount the MHPS above the tapping point. (Recommendation: use a valve)</p> <p>A: MHPS B: Valve</p>
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Pressure measurement in steams (example 1)

	<p>Mount MHPS in that way that the siphon is below the tapping point. The siphon reduces the temperature at the MHPS to almost the ambient temperature. Fill the siphon with fluid before setting into operation.</p> <p>A: MHPS B: Valve C: Siphon (U-shaped)</p>
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● Mounting (continued)

Pressure measurement in steams (example 2)



Mount MHPS in that way that the siphon is below the tapping point.

The siphon reduces the temperature at the MHPS to almost the ambient temperature.

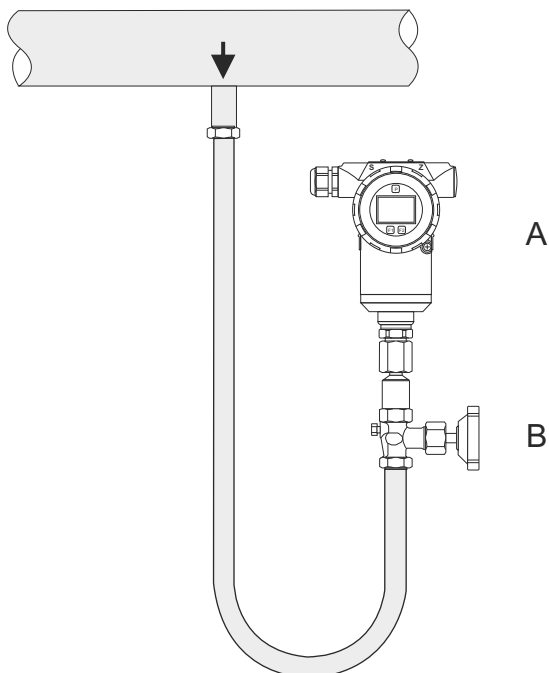
Fill the siphon with fluid before setting into operation.

A: MHPS

B: Valve

C: Siphon (circular)

Pressure measurement in liquids

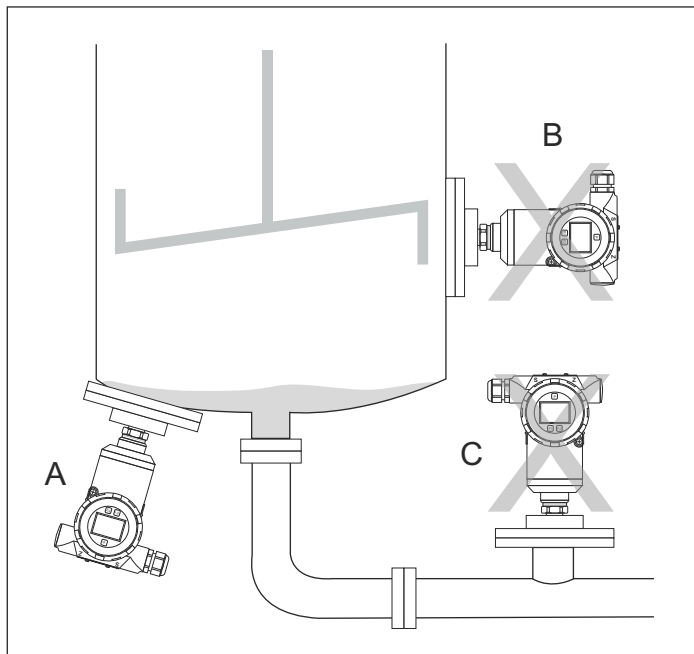


Mount the MHPS in that way that it is below or at the same level as the tapping point.
(Recommendation: use a valve)

A: MHPS

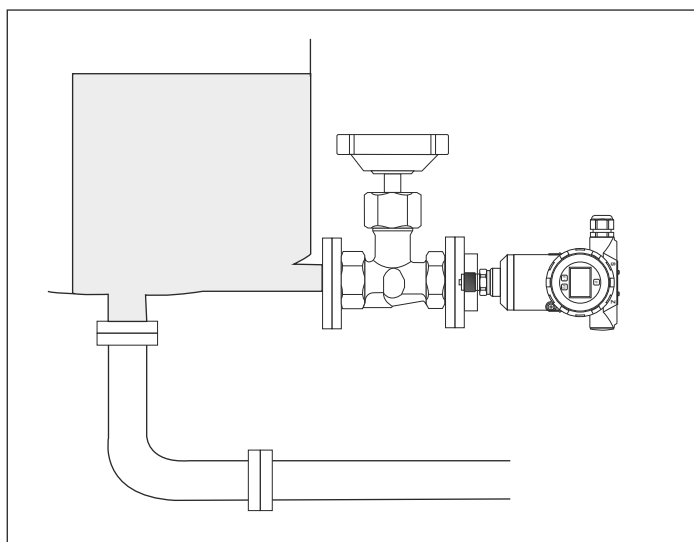
B: Valve

Level measuring



- A: If possible mount the MHPS below the lowest measuring point
- B: Do not mount the MHPS in a position where pressure pulses of an agitator are possible.
- C: Do not mount the MHPS in the fill flow or tank outlet.

Level measuring (Preferred mounting)

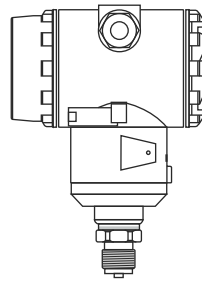
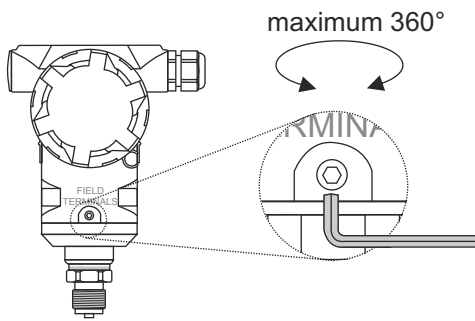


For the use of the MHPS the mounting of a valve is recommended. In that way it is easier to adjust and test.

● **Turning of enclosure**

After unscrewing the M6 Allen screw the enclosure can be rotated up to 360°.

- release the screw with a 3 mm hexagon key
- turn enclosure (up to 360°)
- drive in screw again



Example: turning 90°

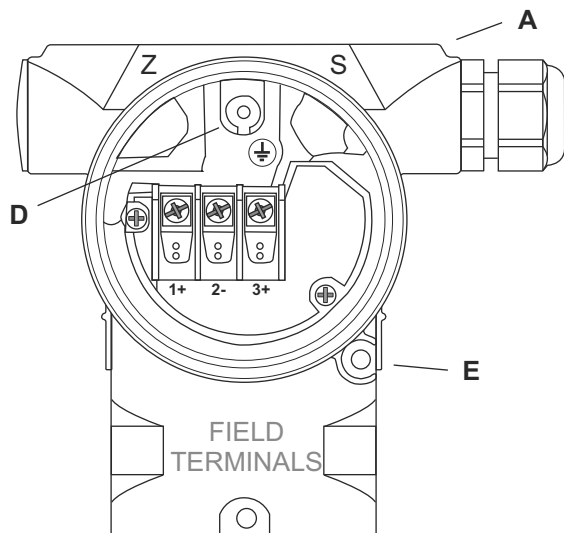
● **Check the mounting**

After mounting of the transmitter carry out the following check:

- Check if all screws are screwed down tight
- Check if the screwed covers are screwed up
- Check if screw plugs / ventilating valves are screwed down tight

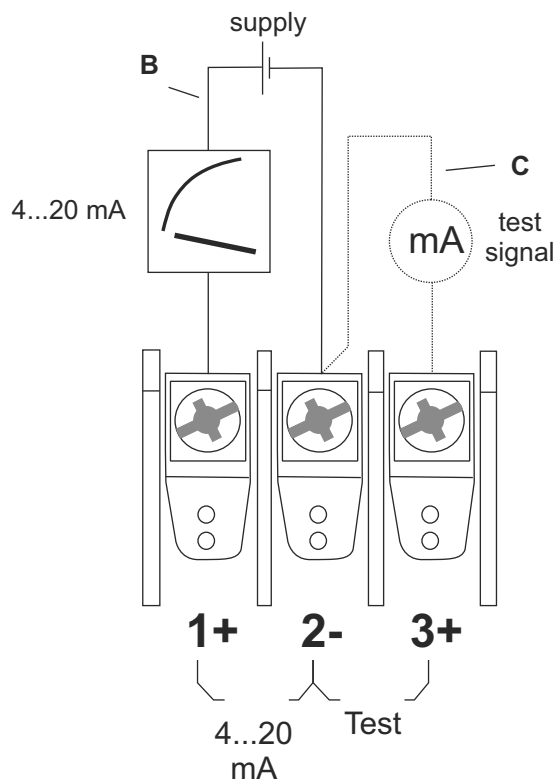
● **Electrical connection**

- The supply voltage has to match the power supply which is given on the type plate.
See also on page 3: identification
- Before connecting the device, switch off the power supply.
- Screw off the screwed cover of the terminal compartment.
- Insert the cable via screwed cable gland (specification see below).
- Carry out the connection according the illustration below.
- Screw up screwed cover.
- Switch on power supply.



Electrical connection 4...20 mA HART

- A: Enclosure
 B: Voltage supply 15...45 VDC (terminal 1(+)) / terminal 2 (-))
 C: 4...20 mA test signal between 2- and test point 3+
 D: Internal earthing
 E: External earthing



The device has a protective system against overvoltage peaks, RF interferences and wrong polarity.

Voltage supply: between 1545 VDC

Cable entry: screwed cable gland M20x1,5 (metal)

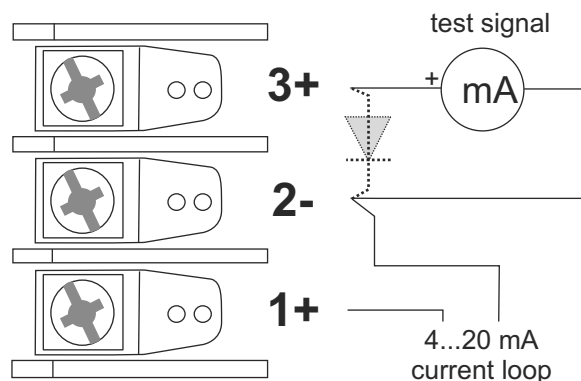
Cabel: outer diameter: 6...12 mm
 cross-sectional area: 0,5...1,5 mm²
 shielded and twisted 2-wire cable (recommended)

Residual ripple: no influence on mA-signal up to 5% within nominal voltage range

● **Tapping the 4...20 mA test signal**

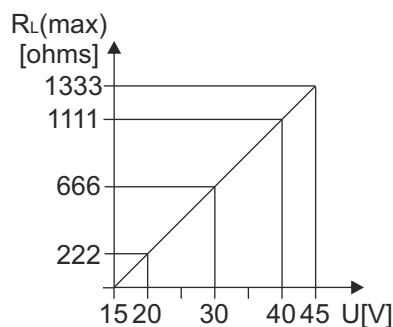
The 4...20 mA test can be measured without interruption of the low-potential circuit between terminal 3(+) and terminal 2(-). The output current is measured with an ammeter for mA across a diode in the output circuit.

The internal resistance of the ammeter should be less than 0,7 ohms to keep the error of measurement below 0,1%.



● Output (working resistance)

Load: $R_{Lmax} = (U - 15 \text{ V}) / 0,0228 \text{ A}$



Voltage supply: 15...45 VDC

R_{Lmax} : maximum load resistance

U: Voltage supply



Please note: When using communication via a HART modem, a communication resistance of minimum 250 ohms has to be taken into account.

Resolution: current output: 16 bit
indication: adjustable (factory setting: 0...100%)

Read cycle time: HART commands all 200 ms.

Damping: continuously adjustable from 0 to 160 μA via electronic insert inside the device, hand-held equipment or PC-software. Factory configuration: 0 μA

● Screening and equipotential bonding

An optimal screening against disturbances is to achieve if the screening is connected on both sides (on the device and in the cabinet). If there are potential equalisation currents possible in the plant, only earth screening on one side, preferably the transmitter side. Installation of potential matching is not necessary.

● Check electrical connection

After completion of the electrical installation carry out the following check:

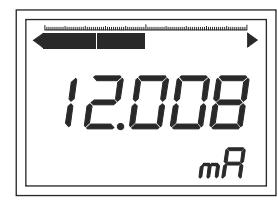
- Check if the power supply matches the details of the type plates.
- Check if the device is connected as shown on page 8.
- Check if all screws are screwed down tight.
- Check if the screwed covers are screwed up.

When switching on the power supply the backlighting of the display in the electronic insert illuminates.

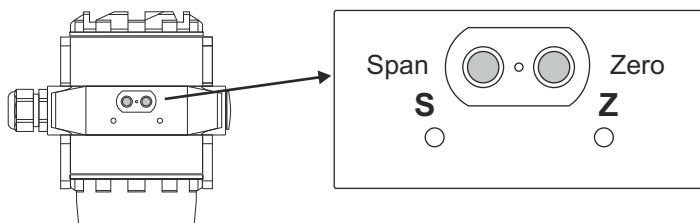
● On-site display

The on-site display is a 3-line display (LCD). Indicated are measured values and dialog texts.

Functions: 5-digit measured value display (including sign and decimal point), indication of unit and a bargraph for indication of current.

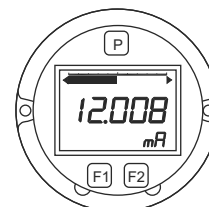


● Operating elements



Below the type plate there are 2 key button for easy configuration of zero, span, zero offset compensation and reset of the device.

The layout of the 2 keys is marked on the enclosure with "S" and "Z"



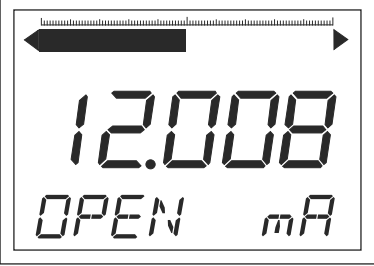



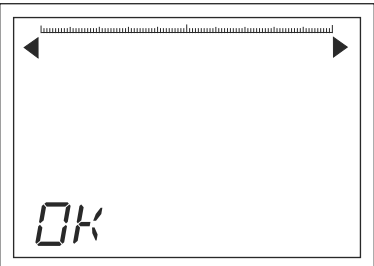
The electronic insert with the display has 3 keys (P, F1, F2) for the configuration of the transmitter. The keys are approachable after screwing off the screwed cover.

● On-site operation with external keys

Below the type plate there are 2 key keys for easy configuration. Configurable are:

- Zero (lower range value)
- Span (upper range value)
- Zero offset compensation
- Reset of the device

The position of the keys is marked on the enclosure with “S” and “Z”.

 The LCD screen displays a numerical value '12.008' in large digits, with 'mA' to its right. Below this, the word 'OPEN' is displayed in a smaller font, followed by 'mA'. Above the main display is a horizontal bar with a left-pointing arrow and a right-pointing arrow.	<p>Open the lock</p> <p>Press the keys S and Z for 5 seconds simultaneously. The LCD screen is showing OPEN when the lock is opened.</p>
 The LCD screen displays a numerical value '4.000' in large digits, with 'mA' to its right. Below this, the word 'LSET' is displayed in a smaller font, followed by 'mA'. Above the main display is a horizontal bar with a left-pointing arrow and a right-pointing arrow.	<p>Input pressure for 4 mA (zero) output</p> <p>Set the input pressure to zero reference level. Press key Z for 2 seconds and the output of the transmitter is 4,000 mA. The LCD screen is showing LSET.</p>
 The LCD screen displays a numerical value '20.000' in large digits, with 'mA' to its right. Below this, the word 'HSET' is displayed in a smaller font, followed by 'mA'. Above the main display is a horizontal bar with a left-pointing arrow and a right-pointing arrow.	<p>Input pressure for 20 mA (span) output</p> <p>Set the input pressure to span reference level. Press key S for 2 seconds and the output of the transmitter is 20,000 mA. The LCD screen is showing HSET.</p>
 The LCD screen displays a numerical value '4.000' in large digits, with 'mA' to its right. Below this, the text 'PV=0' is displayed in a smaller font, followed by 'mA'. Above the main display is a horizontal bar with a left-pointing arrow and a right-pointing arrow.	<p>Zero offset compensation (compensation of position)</p> <p>Set the input pressure level to zero (pressure value = 0 = atmosphere). Press keys S and Z for 2 seconds simultaneously and the output of the transmitter is 4,000 mA. The LCD screen is showing PV=0.</p> <p>Note: If pressure value / pressure range is >0,5, the zero offset compensation is not possible. The LCD screen is showing PVER.</p>
 The LCD screen displays the text 'OK' in large digits. Above the main display is a horizontal bar with a left-pointing arrow and a right-pointing arrow.	<p>Reset</p> <p>Switch off the power of the device. Press keys Z and switch on the power supply again. Go on to press key Z for another 5 seconds. The LCD screen is showing OK when the transmitter is reset.</p> <p>Note: If pressure value / pressure range is >0,5, the zero offset compensation is not possible. The LCD screen is showing PVER.</p>

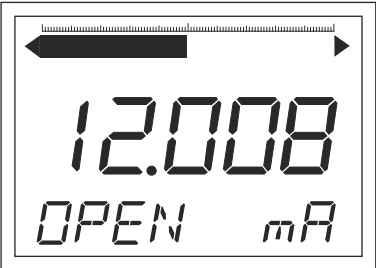
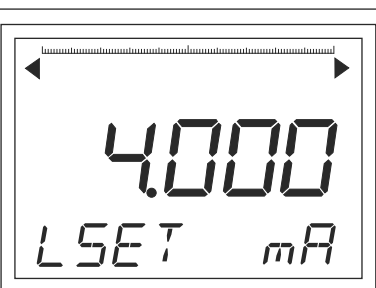
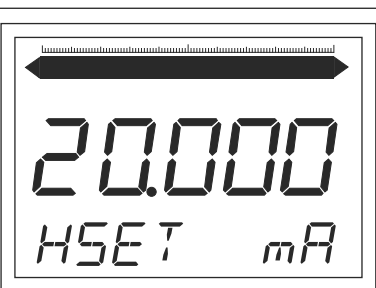
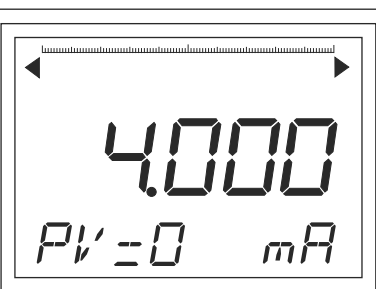
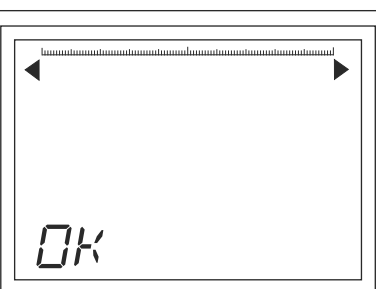
● On-site operation with keys on display

The display is rotatable for approx. 330°

The electronic insert has 3 keys for configuration.

Configurable are:

- lower range value
- Zero offset compensation (compensation of position)
- Reranging starting measuring value
- Damping
- Fixed current output
- upper range value
- Reset
- Reranging final measuring value
- Unit (mA, mbar, %)

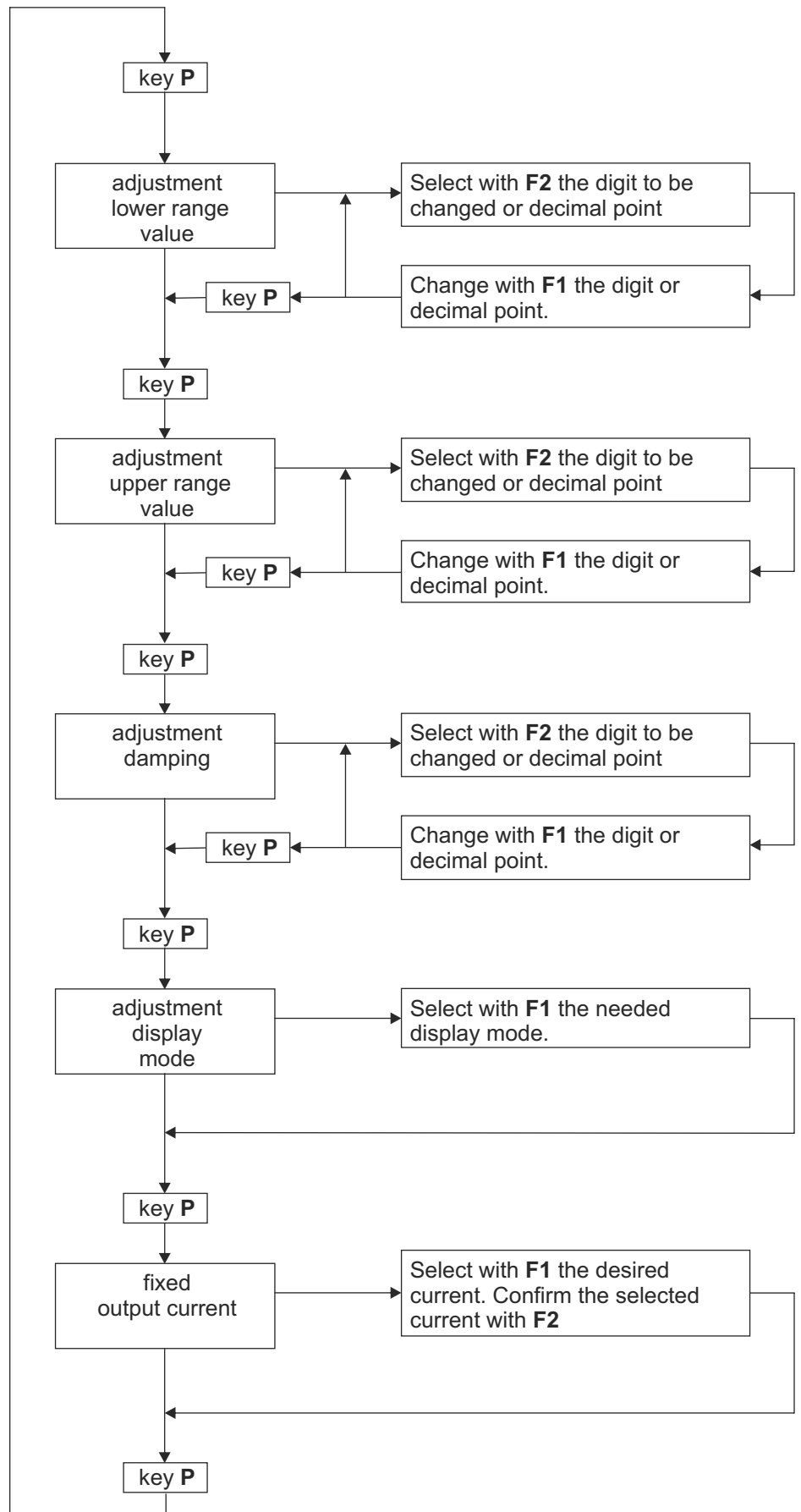
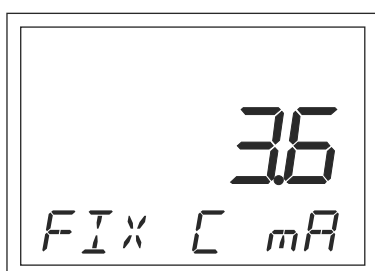
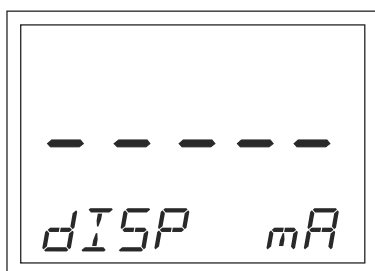
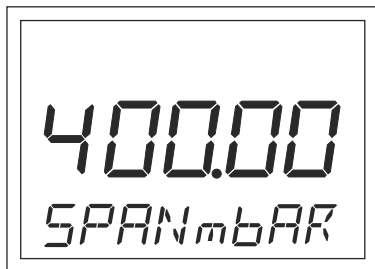
 <p>The LCD display shows a horizontal bar at the top. Below it, the number 12.008 is displayed in large digits, with mA below it. At the bottom, the word OPEN is displayed.</p>	<p>Open the lock</p> <p>Press the keys F1 and F2 for 5 seconds simultaneously. The LCD screen is showing OPEN when the lock is opened.</p>
 <p>The LCD display shows a horizontal bar at the top. Below it, the number 4.000 is displayed in large digits, with mA below it. At the bottom, the word LSET is displayed.</p>	<p>Input pressure for 4 mA (zero) output</p> <p>Set the input pressure to zero reference level. Press key F2 for 2 seconds and the output of the transmitter is 4,000 mA. The LCD screen is showing LSET.</p>
 <p>The LCD display shows a horizontal bar at the top. Below it, the number 20.000 is displayed in large digits, with mA below it. At the bottom, the word HSET is displayed.</p>	<p>Input pressure for 20 mA (span) output</p> <p>Set the input pressure to span reference level. Press key F1 for 2 seconds and the output of the transmitter is 20,000 mA. The LCD screen is showing HSET.</p>
 <p>The LCD display shows a horizontal bar at the top. Below it, the number 4.000 is displayed in large digits, with mA below it. At the bottom, the text PV=0 is displayed.</p>	<p>Zero offset compensation (compensation of position)</p> <p>Set the input pressure level to zero (pressure value = 0 = atmosphere). Press keys F1 and F2 for 2 seconds simultaneously and the output of the transmitter is 4,000 mA. The LCD screen is showing PV=0.</p> <p>Note: If pressure value / pressure range is >0,5, the zero offset compensation is not possible. The LCD screen is showing PVER.</p>
 <p>The LCD display shows a horizontal bar at the top. Below it, the word OK is displayed.</p>	<p>Reset</p> <p>Switch off the power of the device. Press keys F2 and switch on the power supply again. Go on to press key F2 for another 5 seconds. The LCD screen is showing OK when the transmitter is reset.</p> <p>Note: If pressure value / pressure range is >0,5, the zero offset compensation is not possible. The LCD screen is showing PVER.</p>

● **On-site operation with keys on display (continued)**

Function of the keys: P: select function / store adjusted value

F1: change digit or decimal point / select characteristic

F2: select digit to be changed or decimal point / confirm selected characteristic



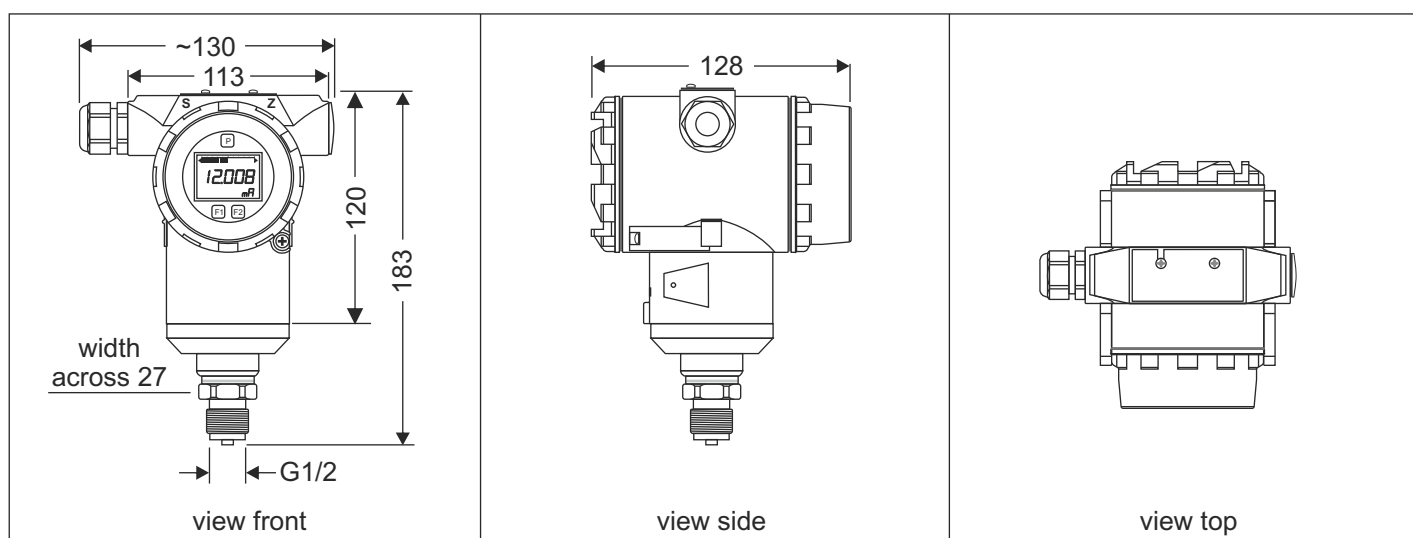
● Input

Measurand: overpressure (positive, negative), absolute pressure
derived from this: level (level, volume, mass)

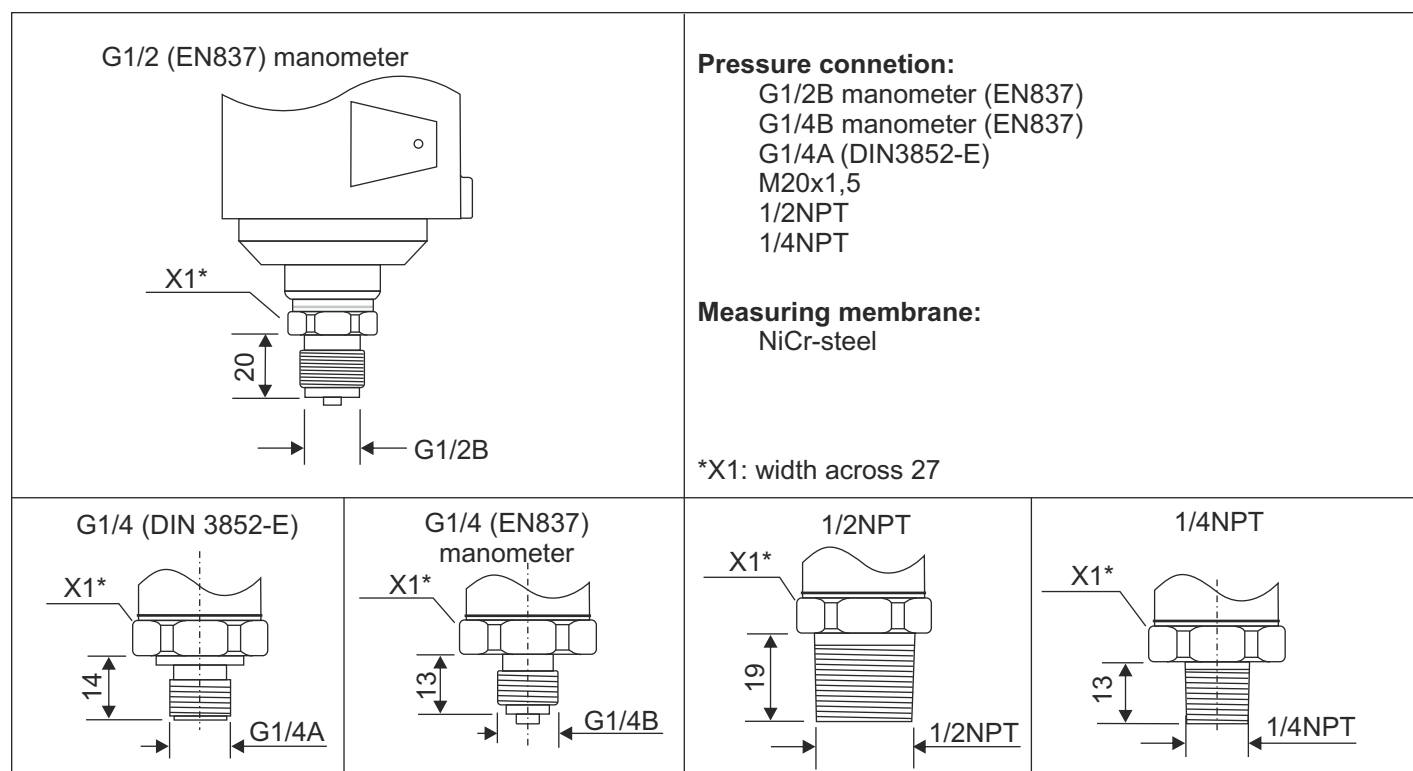
Measuring ranges: 0,1 bar up to 1000 bar

Pressure range	0,1	0,16	0,25	0,4	0,6	1	1,6	2,5
Over pressure safety	1	1,5	2	2	4	5	10	10
Burst pressure	2	2	2,4	2,4	4,8	6	12	12
Pressure range	4	6	10	16	25	40	60	100
Over pressure safety	17	35	35	50	50	80	120	200
Burst pressure	20,5	42	42	96	96	400	550	800
Pressure range	160	250	400	600	1000			
Over pressure safety	320	500	800	1200	1500			
Burst pressure	800	1250	1300	1800	3000			

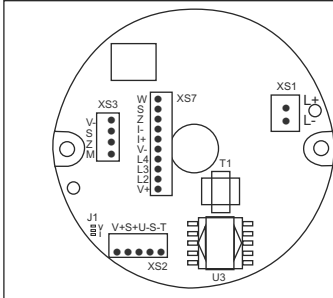
● Dimensions (in mm)



● Process connection



● Electronics



- XS1 voltage supply 15...45 V
- XS2 connection sensor
- XS3 external keys
- XS7 display
- J1 solder bridge to select sensor supply

● HART Communication

HART tool:

The HART-Tool is a graphical user interface for the MH series with menu-driven program for configuration. It can be used for putting into operation, configuration, analysis of signals, data backup and documentation of the device. Operating systems: Windows 2000, Windows XP

Functions:

- Configuration of the devices in on-line operation
- Loading and storing the devices data (upload / download)
- Linearization of characteristic curve
- Documentation of the measuring point

Possible HART devices to use:

- HART interface (modem) with serial interface of a PC
- HART interface (modem) with USB interface of a PC
- Hand-held HART communicator

● Configuration with software via HART communication

The following settings are possible:

- | | |
|--|-----------------------------------|
| - Adjustment of output current | - Simulation of output current |
| - Configurable characteristic values:
limits of measuring range
filter function
linear / square root output signal for flow | unit for display
decimal-place |
| - HART address | - HART TAG number |
| - 2-point calibration (start and end of value) | - 6-point calibration |

● Technical data

Input

Overpressure:	0,1 / 0,16 / 0,25 / 0,4 / 0,6 / 1 / 2,5 / 4 / 6 / 10 / 16 / 25 / 40 / 60 / 100 / 250 / 400 / 600 / 1000 bar
Absolute pressure:	0,25 / 0,4 / 0,6 / 1 / 2,5 / 4 / 6 / 10 / 16 / 25 bar

Output

Analog:	4...20 mA, 2-wire, with superimposed communication signal (HART-protocol)
Signal range:	3,6...22,8 mA (on failure: 3,6 mA)
Option:	additionally with limit value contacts / PROFIBUS / EtherCat / Modbus / PWM

Performance

Accuracy:	<0,25% of sensor range (up to 0,25 bar: <0,5% of sensor range)
According BFSL:	<0,125% of sensor range (up to 0,25 bar: <0,25% of sensor range) including non-linearity, hysteresis, non-repeatability, zero point and full scale error (according to IEC 61298-2)
Influences:	supply: <0,005% of nominal range/1V vibration: <0,01% of nominal range/g at 200 Hz
Response time 10...90%:	<1ms (<10 ms at medium temperature <-30°C for nominal ranges up to 25 bar)
Non-linearity:	<0,2% of nominal range (BFSL) according IEC 61298-2
Non-repeatability:	<0,1% of nominal range
Stability:	<0,2% of span (1 year, at reference conditions)
Temperature range:	0...80°C (compensated, pressure sensor)
Temperature coefficient:	within compensated range
Mean TC of zero:	<0,2% of nominal range / 10 K (<0,4% for ranges <0,25 bar)
Mean TC of range:	<0,2% of nominal range / 10 K

Settings

Rise-delay time:	5 s
Cycle time, update:	0,25 s
Damping:	200 ms (without consideration of electronic damping)
Filter adjustment:	0...160µA

Display

Visible range:	32,5x22,5 mm
Indication:	5-digits 7-segments, 8 mm / 8-digits 14-segments, 5 mm / bargraph with resolution 2%
Range:	-19999...99999

Supply

Voltage:	15...45 VDC (current loop)
Insulation resistance:	>250 MOhm
Short circuit-proof:	permanent
Reverse battery protection:	yes (no destruction, no funtion)
Overvoltage protection:	500V

Environmental conditions

Temperature:	Operating: -20...70°C / Ambient: -20...70°C / Storing: -40...+85°C Medium: -30...100°C / -40...125°C
Humidity:	5...98% relative humidity
Shock resistance:	1000 g according IEC 60068-2-27 (mechanical shock)
Vibration resistance:	20 g according IEC 60068-2-6 (vibration at resonance)

Mechanics

Material:	Enclosure electronics: diecast aluminium
	Enclosure pressure sensor: CrNi steel
	Wetted parts: CrNi steel
	Type plate: stainless steel 1.4301
	Viewing glass: laminated glass
	Internal transmission fluid: syntetic oil
Process connection:	G1/2B / G1/4B / G1/4A / 1/2NPT / 1/4NPT / M20x1,5
Dimensions:	see page 7
Protection:	degree IP 65
Weight:	approx. 1,7 kg
Connection:	terminal screw (maximum 1,5 mm ²), via srewed cable gland M20x1,5
Standards:	IEC 61000-4-3 / Pressure equipment directive 97/23/EG