

# Operating Manual



MHPS

## Overview Documents

- Data sheet MHPS
- Operating manual MHPS-M (this document)

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## ● **Safety Instructions**

### Used Signs



#### **Warning!**

Non-compliance can cause injuries or device demolition.



#### **Attention!**

Non-compliance can cause faulty device operation.



#### **Information!**

Non-compliance can influence device operation or cause unintentional device reactions.

### Mounting, Start-Up



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 EU standards. When the use is not appropriate or in accordance with the requirement, from the device can start application-related dangers, e. g. a fluid leakage when mounted or adjusted wrong.

Non-compliance of safety regulations valid for this application may cause serious injuries and/or damages. Only qualified personnel authorised by the operator is allowed to carry out mounting, electrical connection, start-up, operation and maintenance of the pressure transmitter.

Qualified personnel must have read and understood this operating manual. The instructions included in this manual have to be complied with.

Only conduct modifications and repairs when this documentation expressly allows it.

## ● **Mounting**

### **Before Mounting:**

#### **Acceptance**

- Check packaging and contents for damage when receiving goods.
- Check delivery for completeness (e. g. compare delivery note with order)

#### **Storage**

- Store the device in a dry and clean area. Protect the device against damage from impact
- Storage temperature: -40...+85 °C

#### **Identification**

- The product label shows the maximum working pressure ( $P_{max} = MWP =$  maximum working pressure). This value refers to a reference temperature of 20 °C.
- Allowed pressure values at higher temperatures can be found in the relevant standards.
- The test pressure of the device is corresponding to the overload pressure (see table on page 14).
- The used abbreviation PS in the Pressure Equipment Directive (2014/68/EU) corresponds to the MWP (Maximum working pressure =  $P_{max}$ ) of this device.

Product label details (these details may 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

Protection class: IP65

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## ● **Mounting (Continued)**

### **Scope of Delivery**

The delivery includes:

- 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**

- Mounting dimensions see page 14

### **Notes for Mounting**

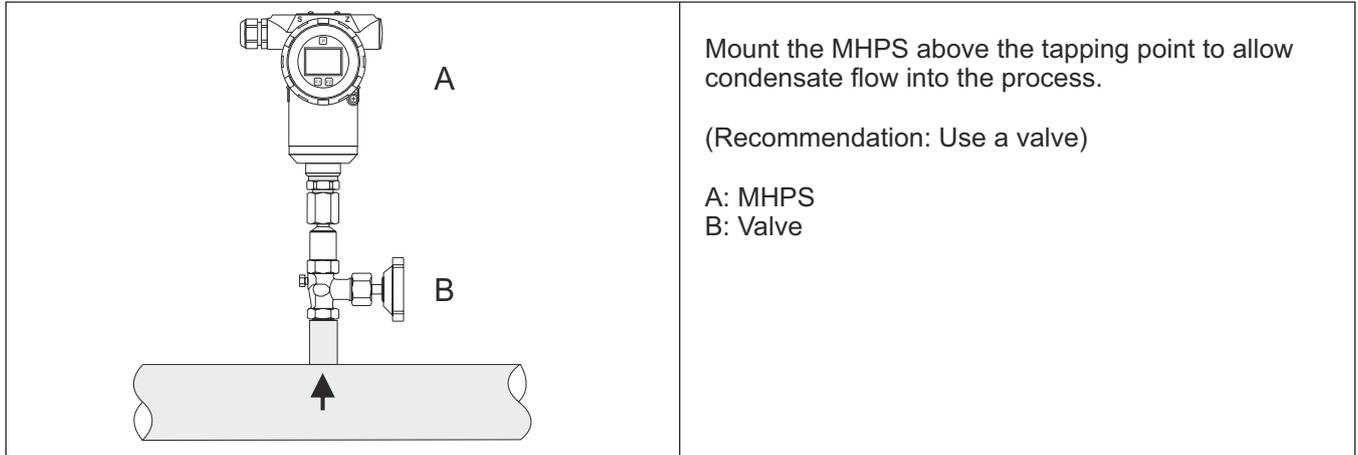
- The fitting position of the MHPS may cause a zero point offset. E. g. with an empty container, the measured value will not be 0 (zero). This can be corrected by shifting the zero point directly with the configuration keys on the device or by using the external configuration software. See page 11...13 or programming software manual.
- Usage of a stop valve allows for mounting, start-up and maintenance without process interruption.
- When laying pressure pipes outside, provide for appropriate frost protection, e. g. by using parallel pipe heating.
- The relevant standards (national or international) can give recommendations for the laying of pressure pipes (e. g. DIN 19210).
- Pressure pipes with a constant drop have to be laid with a constant gradient of at least 10%.
- The electronics casing can be rotated up to 360°. This makes the display of the electronic insert very readable. See also page 8.

## ● Mounting (Continued)

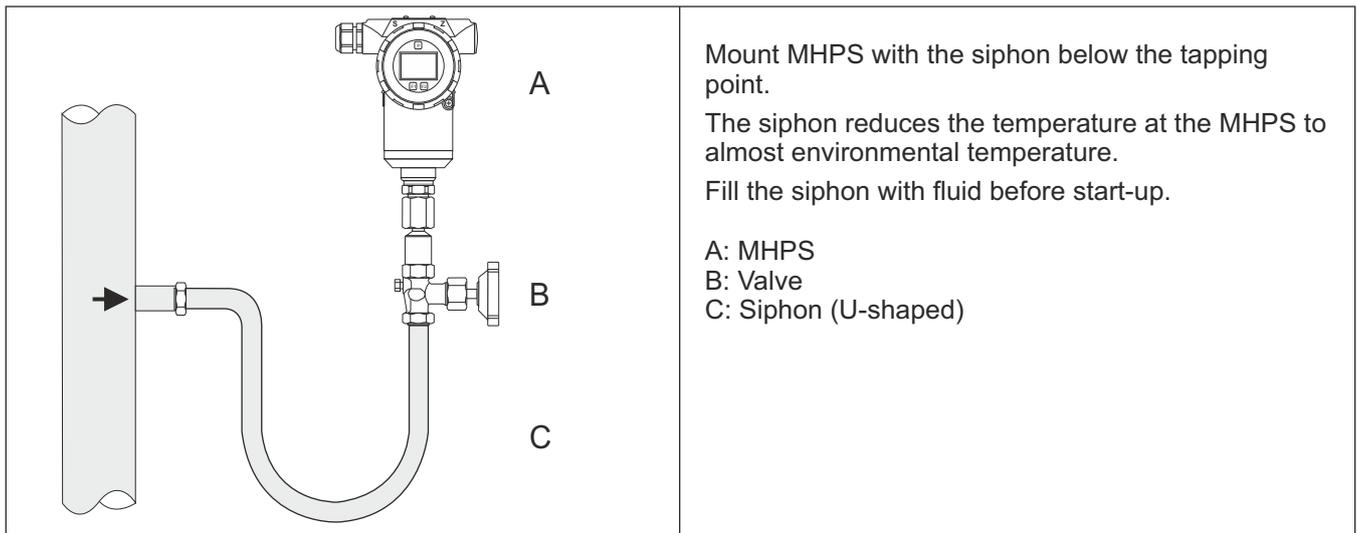
### Notes for Mounting (Continued)

- The modular pressure transmitter is mounted as a manometer. The same guidelines can be applied.
- The device orientation depends on application (see examples).
- Stop valves and siphons (if necessary) are recommended.
- Do not damage the diaphragm through mechanical effect (e. g. when cleaning).

### Mounting for Pressure Measurement in Gases

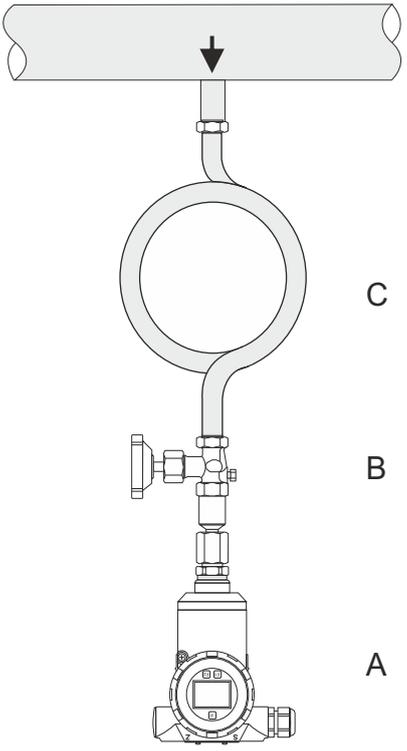


### Mounting for Pressure Measurement in Steam (Example 1)

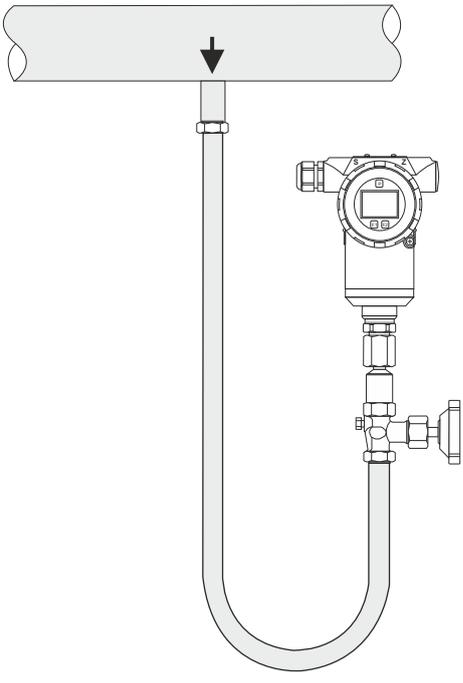


● **Mounting (Continued)**

**Mounting for Pressure Measurement in Steam (Example 2)**

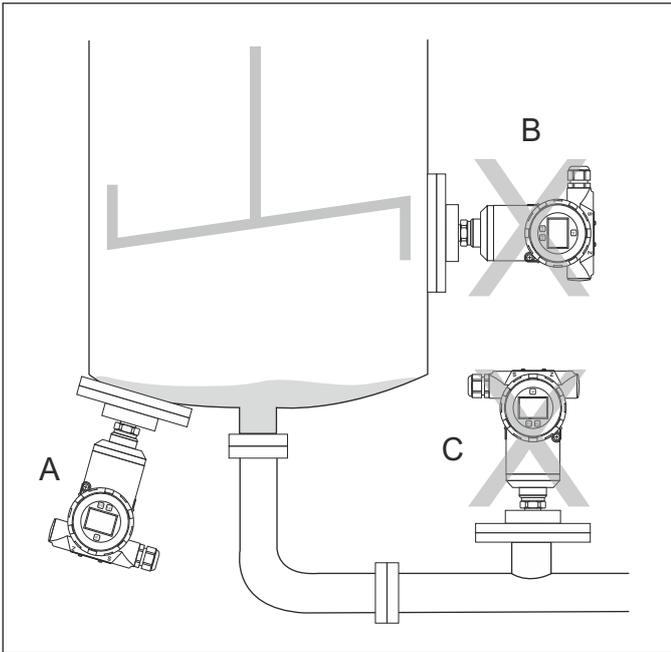
 <p>The diagram shows a vertical pipe with a downward arrow indicating steam flow. A circular siphon (labeled C) is connected to the pipe, with its top edge below the tapping point. Below the siphon is a valve (labeled B), and at the bottom is the Modular Pressure Transmitter (labeled A).</p>	<p>Mount MHPS in a way that the siphon is below the tapping point. The siphon reduces the temperature at the MHPS to almost environmental temperature. Fill the siphon with fluid before start-up.</p> <p>A: MHPS B: Valve C: Siphon (circular)</p>
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**Mounting for Pressure Measurement in Fluids**

 <p>The diagram shows a vertical pipe with a downward arrow indicating fluid flow. A U-tube siphon is connected to the pipe, with its top edge at the same level as the tapping point. The Modular Pressure Transmitter (labeled A) is mounted on the right side of the siphon, and a valve (labeled B) is located below it.</p>	<p>Mount MHPS in a way that the siphon is below or at the same level as the tapping point. (Recommendation: Use a valve)</p> <p>A: MHPS B: Valve</p>
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● **Mounting (Continued)**

**Mounting for Level Measurement**

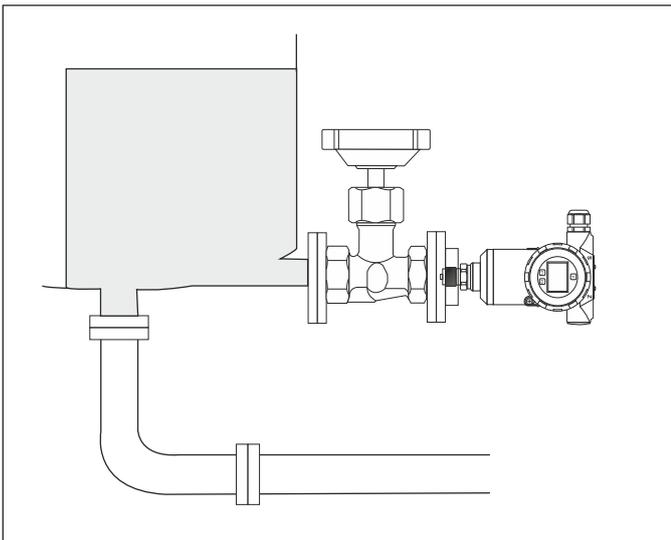


A: If possible mount the MHPS below the lowest measuring point

B: Do not mount the MHPS in a position where agitator pressure pulses are possible.

C: Do not mount the MHPS in the fill flow or tank outlet.

**Mounting for Level Measurement (Preferred Mounting)**

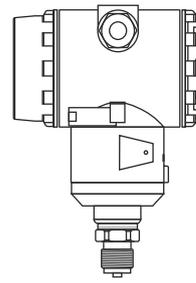
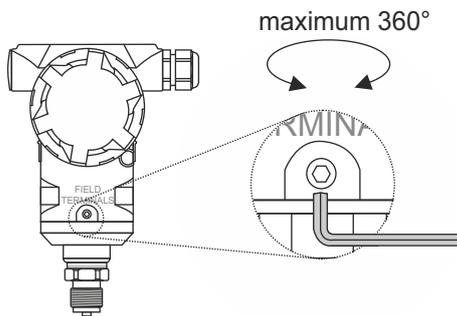


For ease of use of the MHPS, mounting a valve is recommended. It allows easier adjusting and testing.

## ● **Casing Rotation**

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

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



Example: turning 90°

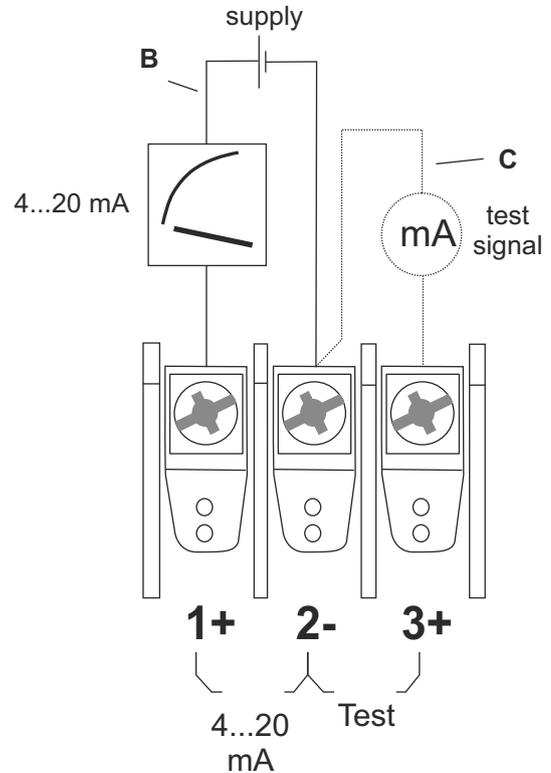
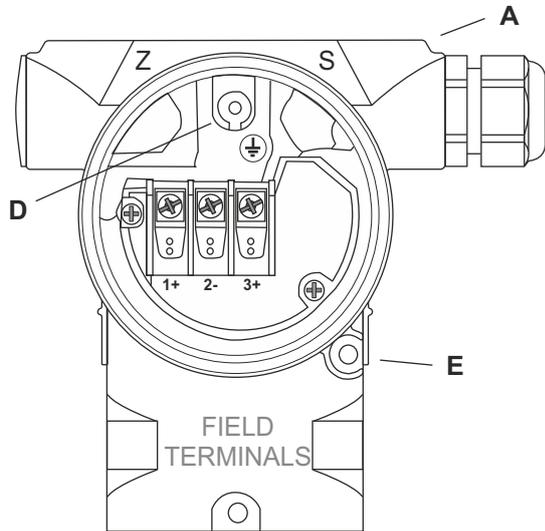
## ● **Mounting Control**

After mounting the transmitter, carry out the following checks:

- Check if all screws are tightened firmly.
- Check if transmitter covers are screwed in.
- Check if screw plugs / vent valves are tightened firmly.

## ● Electrical Connection

- The supply voltage has to match the voltage supply given on the product label.  
See also page 3: Identification
- Switch off the power supply before connecting the device.
- Unscrew the connection compartment cover.
- Insert the cable through the gland (see below for specification).
- Make the connection as per the diagram below.
- Screw cover on.
- Switch on supply voltage.



Electrical connection 4...20 mA HART

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

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

Voltage supply: between 15 ...45 VDC

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

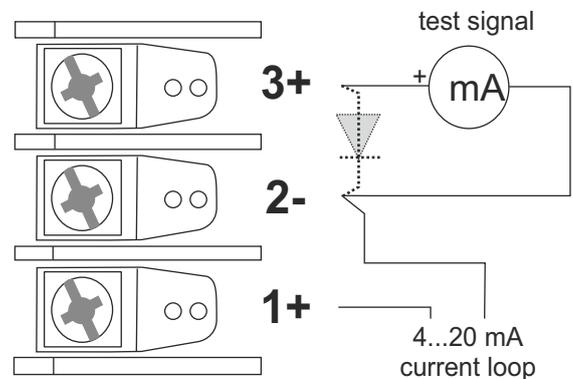
Cabel: outer diameter: 6...12 mm  
cross-sectional area: 0,5...1,5 mm<sup>2</sup>  
shielded and twisted 2-wire cable (recommended)

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

## ● 4...20 mA Test Signal

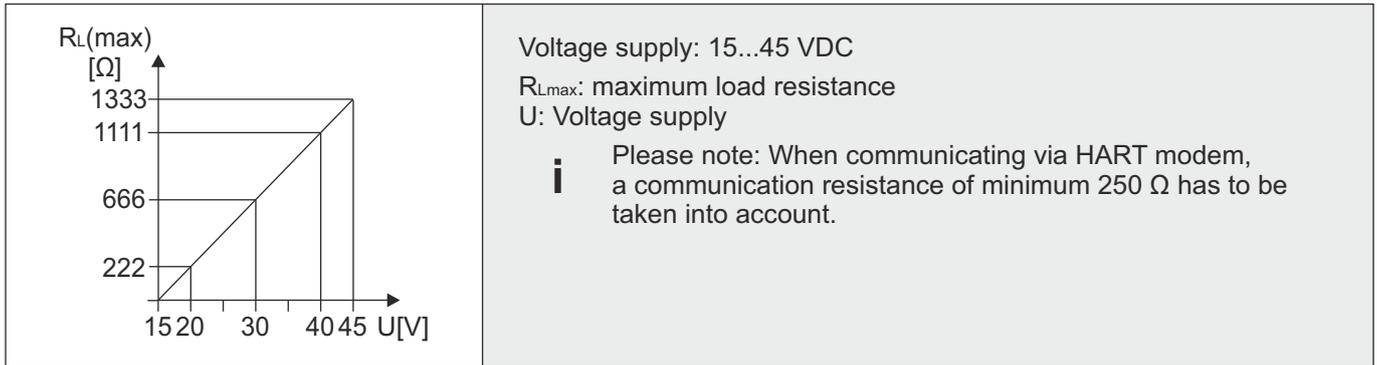
The 4...20 mA test can be measured without interruption of the low-potential circuit between terminal 3(+) and terminal 2(-). The output current is measured with an ammeter for mA across a diode in the output circuit.

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



## ● Output (Load)

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



**Resolution:** Current output: 16 bit  
 Indication: Adjustable (factory setting: 0...100%)

**Read cycle:** HART commands every 200 ms.

**Damping:** Continuously adjustable from 0 to 160  $\mu\text{A}$  via electronic insert inside the device, hand-held equipment or PC-software. Factory configuration: 0  $\mu\text{A}$

## ● Shielding and Potential Equalization

An optimal shielding against disturbing actions is achievable by connecting cable shielding on both sides (transmitter and switch cabinet). If potential equalization currents can occur in the plant, ground the shielding only on one side, preferably at transmitter side. An installation of potential equalization is not necessary.

## ● Connection Check

After completion of the electrical installation conduct the following checks:

- Check if the power supply matches the details on the product label.
- Check if the device is connected as per page 8.
- Check if all screws are tightened firmly.
- Check if the cover is screwed on tight.

After switching on the supply voltage, the backlighting of the electronics insert will light up.

## ● On-Site Display

A 3-line display (LCD) serves as on-site display. It can display measured values and dialog texts.

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



## ● Operating Elements

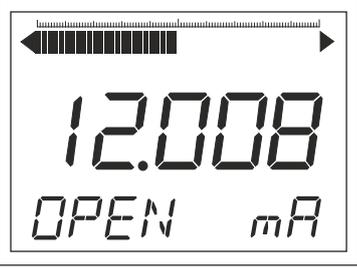
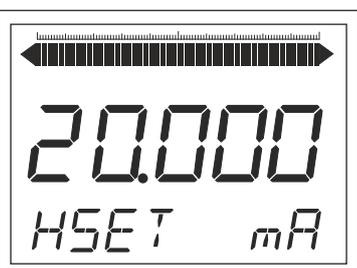
<p>There are 2 key buttons below the product label for easy configuration of zero point, span, zero point offset compensation and device reset. The key layout of the 2 keys is marked on the casing with <b>S</b> and <b>Z</b>.</p>	<p>The electronics insert with display has 3 keys (P, F1, F2) for transmitter configuration. The keys are accessible after unscrewing the cover.</p>

## ● On-Site Operation (External Keys)

Below the product label you can find 2 external keys for easy configuration. Configurable are:

- Zero point (lower range value)
- Span (upper range value)
- Zero point offset compensation
- Reset

The key layout is marked with **S** and **Z** on the casing.

 <p>The LCD screen displays a horizontal bar at the top. Below it, the number '12.008' is shown in large digits, with 'mA' to its right. Below that, the word 'OPEN' is displayed in a smaller font, followed by 'mA'.</p>	<p><b>Open Programming Lock</b></p> <p>Press the keys <b>S</b> and <b>Z</b> at the same time and hold them down for 5 seconds. When the lock is open, the LCD screen will display <b>OPEN</b>.</p>
 <p>The LCD screen displays a horizontal bar at the top. Below it, the number '4.000' is shown in large digits, with 'mA' to its right. Below that, the word 'LSET' is displayed in a smaller font, followed by 'mA'.</p>	<p><b>Input Pressure for 4 mA Output Signal (Zero Point)</b></p> <p>Set the input pressure to zero reference level. Press key <b>Z</b> for 2 seconds and the output of the transmitter is 4,000 mA. The LCD screen is showing <b>LSET</b>.</p>
 <p>The LCD screen displays a horizontal bar at the top. Below it, the number '20.000' is shown in large digits, with 'mA' to its right. Below that, the word 'HSET' is displayed in a smaller font, followed by 'mA'.</p>	<p><b>Input Pressure for 20 mA Output Signal (Span)</b></p> <p>Set the input pressure to span reference level. Press key <b>S</b> for 2 seconds and the output of the transmitter is 20,000 mA. The LCD screen will show <b>HSET</b>.</p>
 <p>The LCD screen displays a horizontal bar at the top. Below it, the number '4.000' is shown in large digits, with 'mA' to its right. Below that, 'PV=0' is displayed in a smaller font, followed by 'mA'.</p>	<p><b>Zero Point Offset Compensation (Position Compensation)</b></p> <p>Set the input pressure level to zero (pressure value = 0 = atmosphere). Press keys <b>S</b> and <b>Z</b> for 2 seconds simultaneously and the output of the transmitter is 4,000 mA. The LCD screen will show <b>PV=0</b>.</p> <p>Note: If pressure value / pressure range is &gt;0,5, the zero point offset compensation is not possible. The LCD screen will show <b>PVER</b>.</p>
 <p>The LCD screen displays a horizontal bar at the top. Below it, the word 'OK' is shown in large, bold letters.</p>	<p><b>Reset</b></p> <p>Switch off supply. Press key <b>Z</b> and switch on supply again. Hold key <b>Z</b> for another 5 seconds. When the transmitter has been reset, the LCD screen will show <b>OK</b>.</p>

## ● On-Site Operation (Internal Keys)

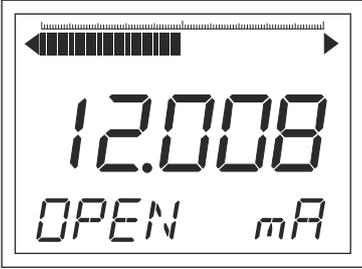
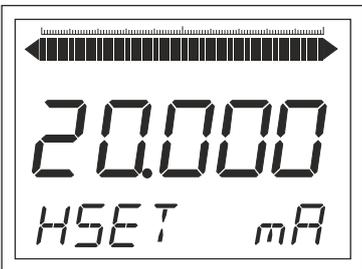
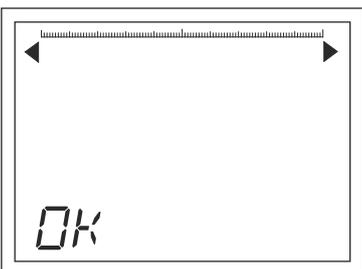
The display is rotatable by approx. 330°.

The electronics inserts has 3 keys for configuration.

Configurable are:

- Zero point (lower range value)
- Zero point offset compensation (position compensation)
- Rescaling lower range value
- Damping
- Fixed current output
- Span (upper range value)
- Reset
- Rescaling upper range value
- Unit (mA, bar, %)

To adjust settings, unscrew and remove cover.

 <p>The LCD display shows a numerical value '12.008' in the center, with 'OPEN mA' below it. Above the number is a horizontal bar with a left-pointing arrow and a right-pointing arrow, indicating a range or scale.</p>	<p><b>Open Programming Lock</b></p> <p>Press the keys <b>F1</b> and <b>F2</b> at the same time and hold them down for 5 seconds. When the lock is open, the LCD screen will display <b>OPEN</b>.</p>
 <p>The LCD display shows a numerical value '4.000' in the center, with 'LSET mA' below it. Above the number is a horizontal bar with a left-pointing arrow and a right-pointing arrow, indicating a range or scale.</p>	<p><b>Input Pressure for 4 mA Output Signal (Zero Point)</b></p> <p>Set the input pressure to zero reference level. Press key <b>F2</b> for 2 seconds and the output of the transmitter is 4,000 mA. The LCD screen is showing <b>LSET</b>.</p>
 <p>The LCD display shows a numerical value '20.000' in the center, with 'HSET mA' below it. Above the number is a horizontal bar with a left-pointing arrow and a right-pointing arrow, indicating a range or scale.</p>	<p><b>Input Pressure for 20 mA Output Signal (Span)</b></p> <p>Set the input pressure to span reference level. Press key <b>F1</b> for 2 seconds and the output of the transmitter is 20,000 mA. The LCD screen will show <b>HSET</b>.</p>
 <p>The LCD display shows a numerical value '4.000' in the center, with 'PV=0 mA' below it. Above the number is a horizontal bar with a left-pointing arrow and a right-pointing arrow, indicating a range or scale.</p>	<p><b>Zero Point Offset Compensation (Position Compensation)</b></p> <p>Set the input pressure level to zero (pressure value = 0 = atmosphere). Press keys <b>F1</b> and <b>F2</b> for 2 seconds simultaneously and the output of the transmitter is 4,000 mA. The LCD screen will show <b>PV=0</b>.</p> <p>Note: If pressure value / pressure range is &gt;0,5, the zero point offset compensation is not possible. The LCD screen will show <b>PVER</b>.</p>
 <p>The LCD display shows the text 'OK' in the center.</p>	<p><b>Reset</b></p> <p>Switch off supply. Press key <b>F2</b> and switch on supply again. Hold key <b>F2</b> for another 5 seconds. When the transmitter has been reset, the LCD screen will show <b>OK</b>.</p>

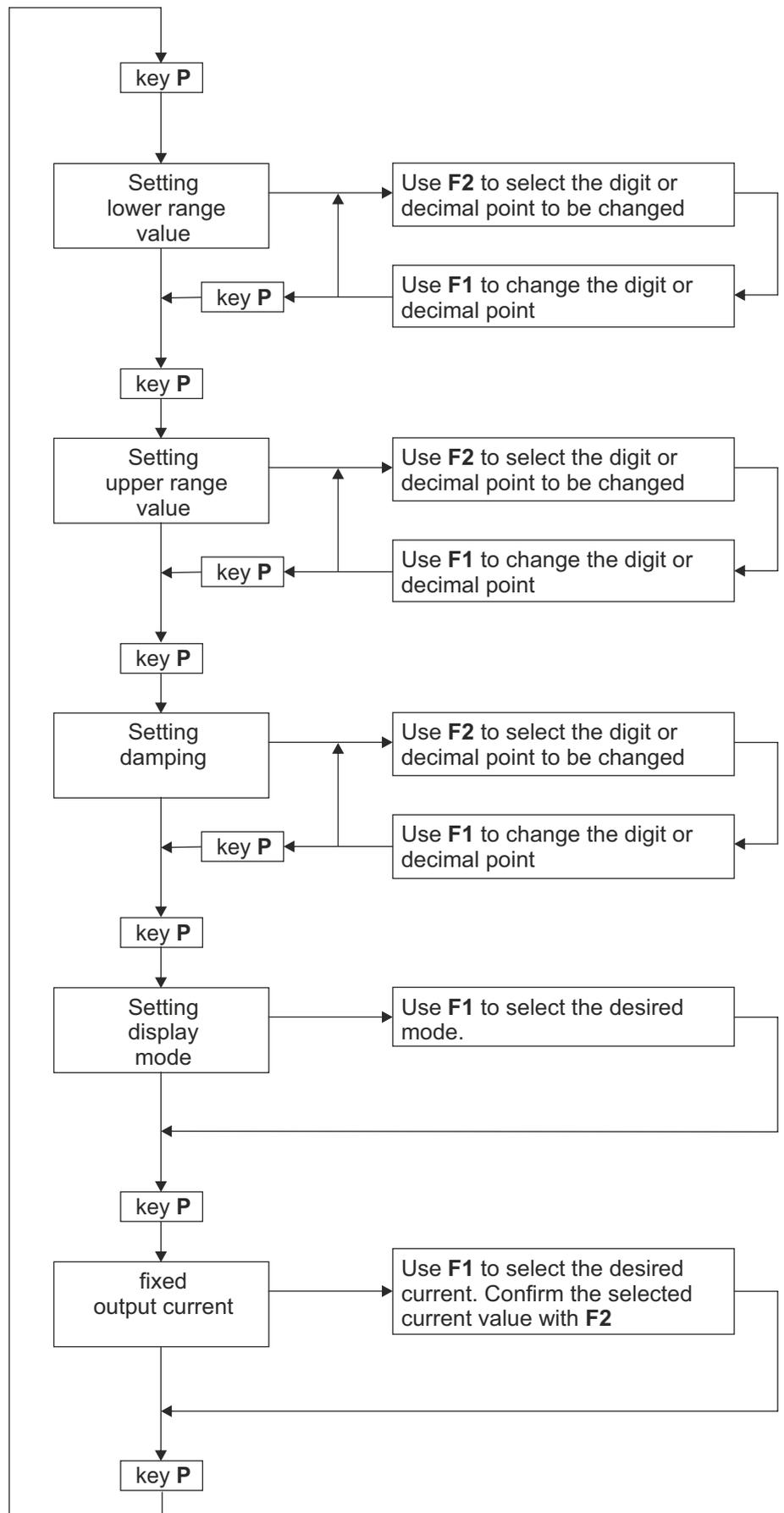
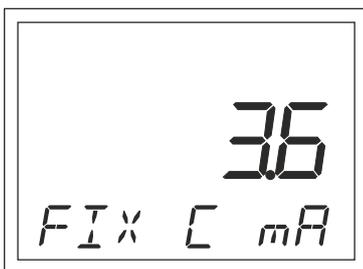
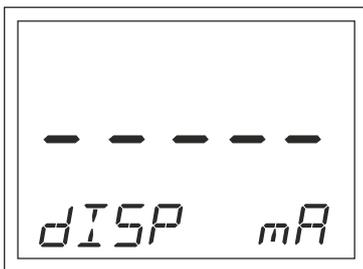
● **On-Site Operation (Internal Keys) Continued**

**Key functions:**

**P:** Select function / store adjusted value

**F1:** Change digit or decimal point / select characteristic

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



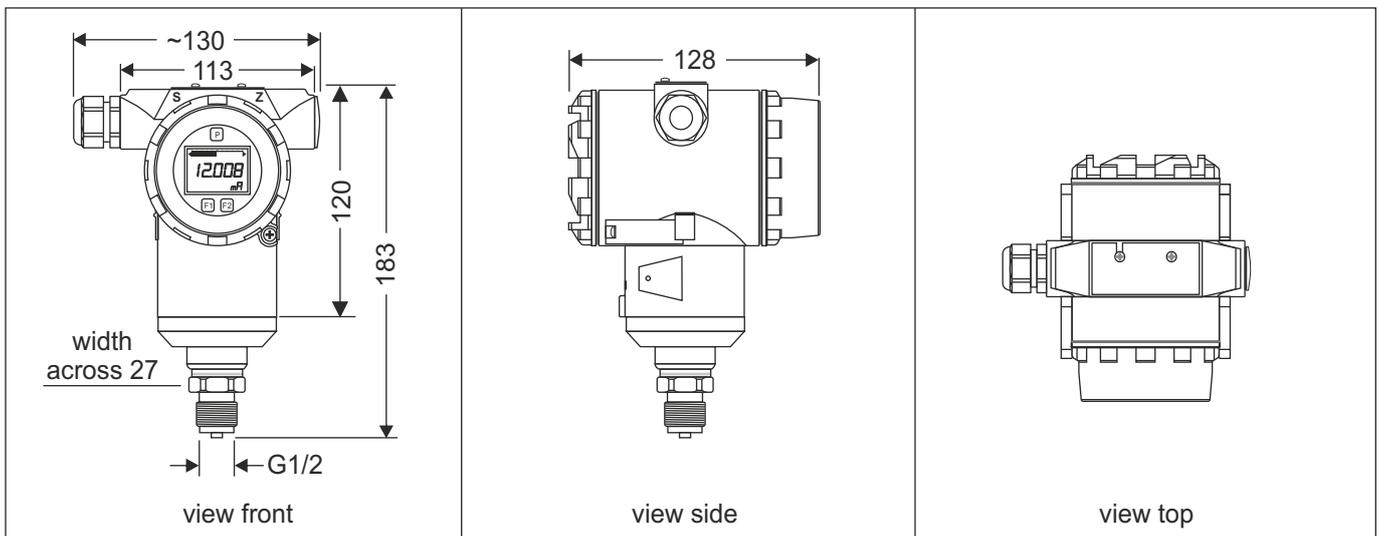
## ● Input

**Measurand:** Overpressure (positive, negative), absolute pressure  
derived from this: Level (level, volume, mass)

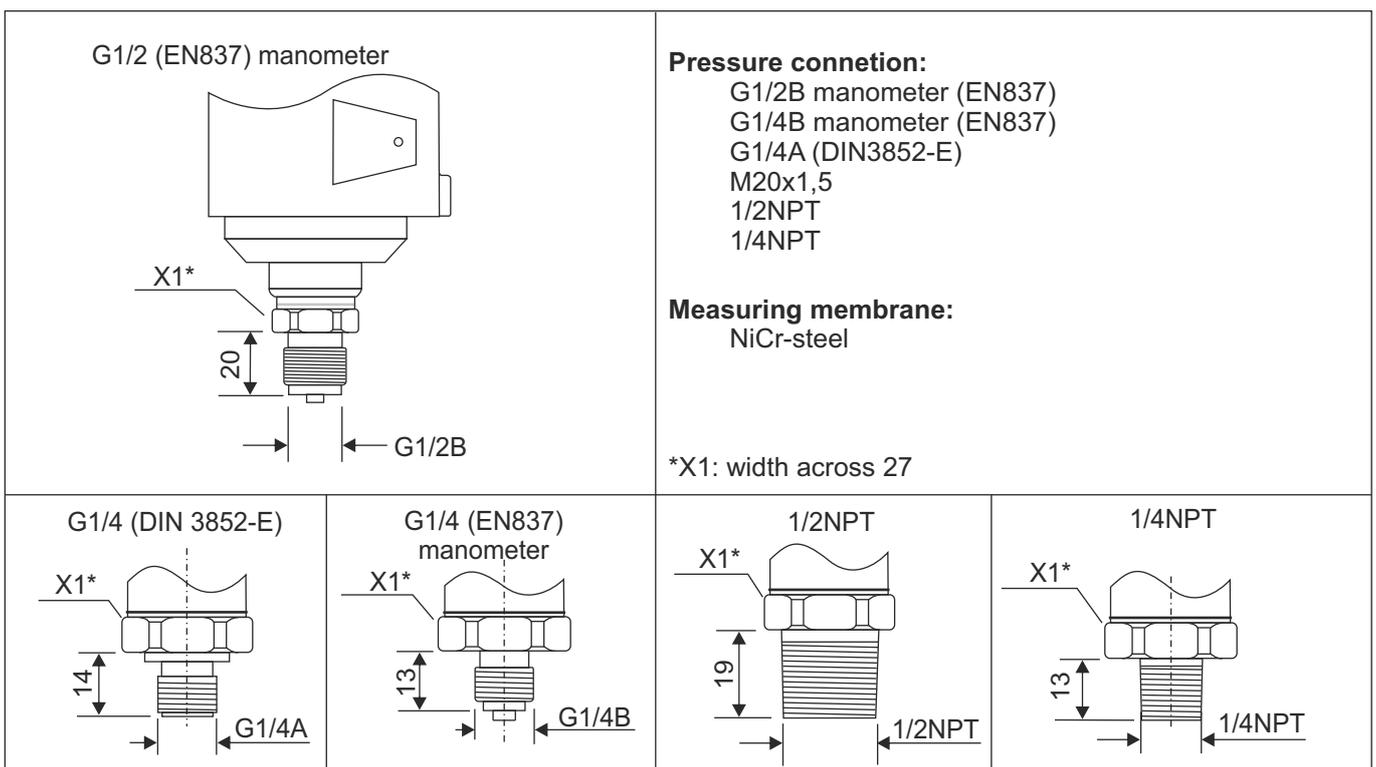
**Measuring ranges:** 0,1 bar up to 1000 bar

Pressure range	0,1	0,16	0,25	0,4	0,6	1	1,6	2,5
Overpressure 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
Overpressure 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			
Overpressure safety	320	500	800	1200	1500			
Burst pressure	800	1250	1300	1800	3000			

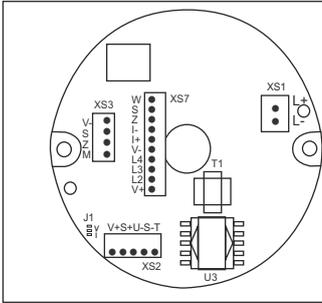
## ● Dimensions (in mm)



## ● Process Connection



● **Electronics**



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

● **HART Communication**

**HART Tool:**

The HART tool is a graphical user interface for the MH series with a menu-driven program for configuration. It can be used for start-up, configuration, signal analysis, data backup and device documentation. Operating systems: Windows 2000, Windows XP, Windows 7, 8.1 and 10.

**Functions:**

- Device configuration during online-operation
- Loading and storing of device data (upload / download)
- Linearization of the curve
- Measuring point documentation

**Connection Options:**

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

● **Software Configuration via HART Communication**

The following settings are available:

- Adjustment of output current	- Simulation of output current
- Configurable parameters: 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 contacts

### 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

Switch-on delay:	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 MΩ
Short circuit resistance:	permanent
Reverse voltage protection:	yes (no function, no damage)
Overvoltage protection:	500 V

### 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:	Casing electronics:	diecast aluminum
	Casing pressure sensor:	CrNi steel
	Wetted parts:	CrNi steel
	Product label:	stainless steel 1.4301
	Viewing glass:	laminated glass
	Internal transmission fluid:	synthetic oil
Process connection:	G1/2B / G1/4B / G1/4A / 1/2NPT / 1/4NPT / M20x1,5	
Dimensions:	see page 14	
Protection class:	IP65	
Weight:	approx. 1,7 kg	
Connection:	terminal screw (maximum 1,5 mm <sup>2</sup> ), via screwed cable gland M20x1,5	
Standards:	IEC 61000-4-3 /	Pressure equipment directive 2014/68/EU