Technical documentation

MHPS

● *Table of content*

● *Characteristics*

Input:	overpressure (0,1 bar up to 1000 bar) / absolute pressure (0,25 bar up to 25 bar)
Output:	4...20 mA current loop (15...45 VDC), HART-protocol
Option:	additionally with limit value contacts / PROFIBUS / EtherCat / Modbus / PWM
Turn down:	up to 100:1
Accuracy:	<0,25% of sensor range (up to 0,25 bar: <0,5% of sensor range)
Indication:	LCD-display with backlighting
Configuration:	with keys and/or software
Enclosure for electronics:	diecast aluminium (degree of protection: IP65)
Process connection:	G1/2B / G1/4B / G1/4A / 1/2NPT / 1/4NPT / M20x1,5 (pressurized parts: NiCr steel)

● *Applications*

The pressure sensor is suitable to measure overpressure (negative, positive) and absolute pressure. From overpressure can be derived: level (level, volume, mass). Typical areas of use are chemical industry and process engineering.

● *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 concideration 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)

● Technical data (continued)

Mechanics

Material:	Enclosure ektronics: 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 mm²), via srewed cable gland M20x1,5
Standards:	IEC 61000-4-3 / Pressure equipment directive 97/23/EG

● 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			

● Output

Output signal: 4...20 mA, 2-wire connection
with superimposed communication signal for HART protocol

Signal range: 3,6...22,8 mA

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

Voltage supply: 15...45 VDC

R_{Lmax}: maximum load resistance
U: Voltage supply

Please note: When using communication via a HART modem, a comunication resistance of minimum 250 ohms has to be taken into account.
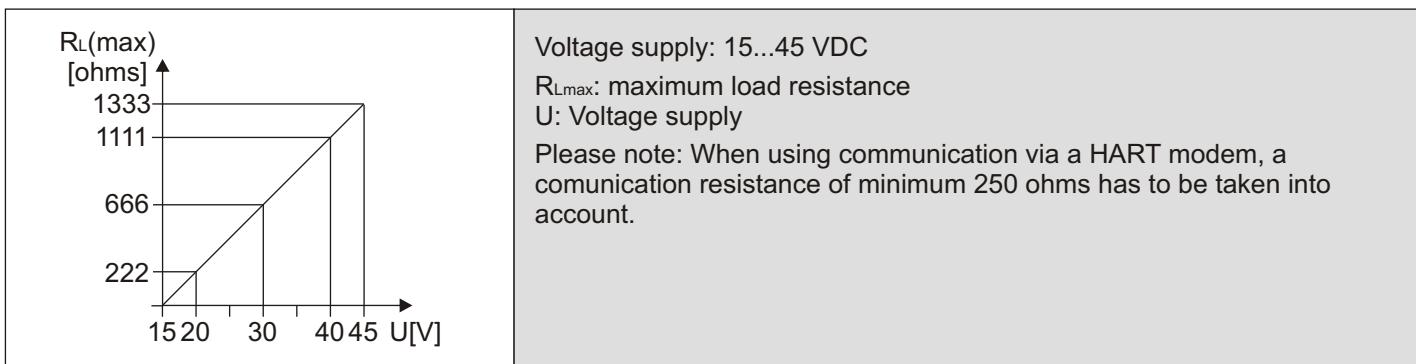
Resolution: current output: 16 bit
indication: adjustable (factory setting: 0...100%)

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

● *Electrical connection*
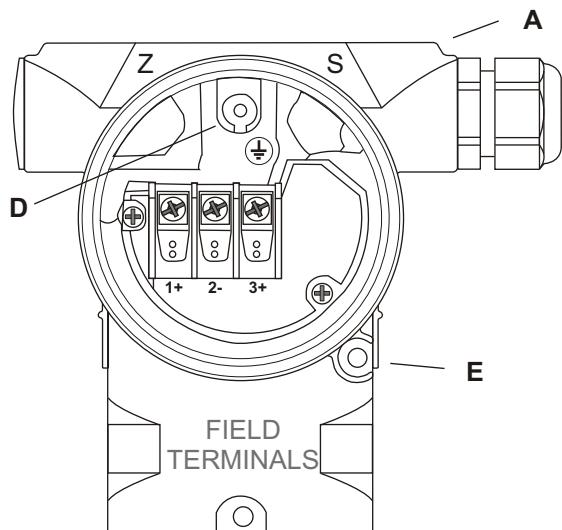
Electrical connection 4...20 mA HART

A: Enclosure

B: Voltage supply 15...45 VDC (1+ / 2-)

C: 4...20 mA test signal between 2- and test point 3+

D: Internal earthing

E: External earthing
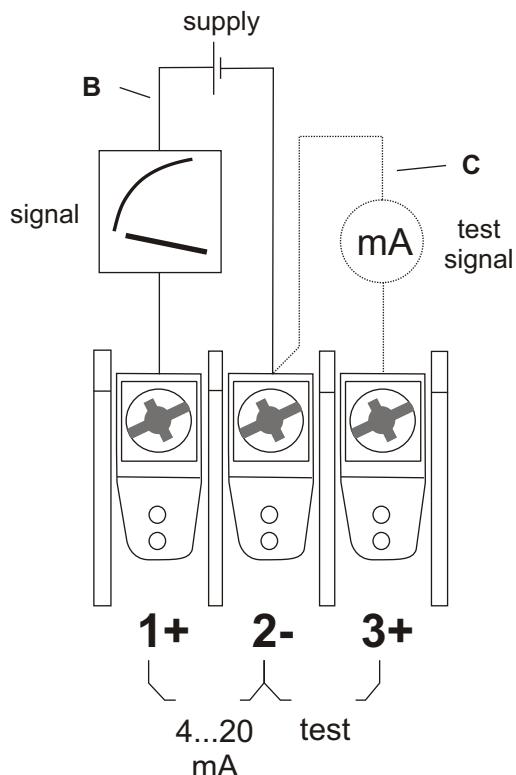
The device has a protective system against overvoltage peaks, RF interferences and wrong polarity.
Voltage supply: between 15 ....45 VDC
Cable entry: screwed cable gland M20x1,5 (metal)
Cable: outer diameter: 6...12 mm
                cross-sectional area: 0,5...1,5 mm²
                shielded and twisted 2-wire cable (recommended)
Residual ripple: no influence on mA-signal up to 5% within nominal voltage range
Influence supplied power: <0,005% of nominal range / 1V

● *Process connection*

G1/2 (EN837) manometer

X1*

20
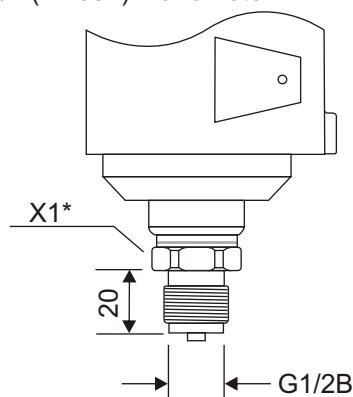
G1/2B

Pressure connetion:
   G1/2B manometer (EN837)
   G1/4B manometer (EN837)
   G1/4A (DIN3852-E)
   M20x1,5
   1/2NPT
   1/4NPT

Measuring membrane:
   NiCr-steel

*X1: width across 27

G1/4 (DIN 3852-E)
X1*
14
G1/4A

G1/4 (EN837) manometer
X1*
13
G1/4B
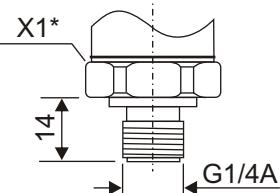
1/2NPT
X1*
19
1/2NPT
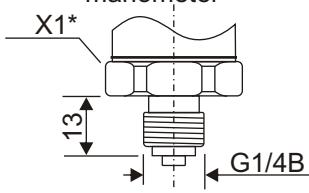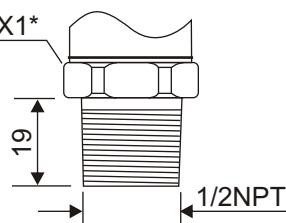
1/4NPT
X1*
13
1/4NPT

● *4...20 mA test signal*

test signal

3+

2-

1+
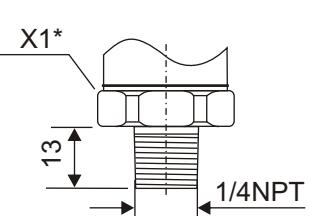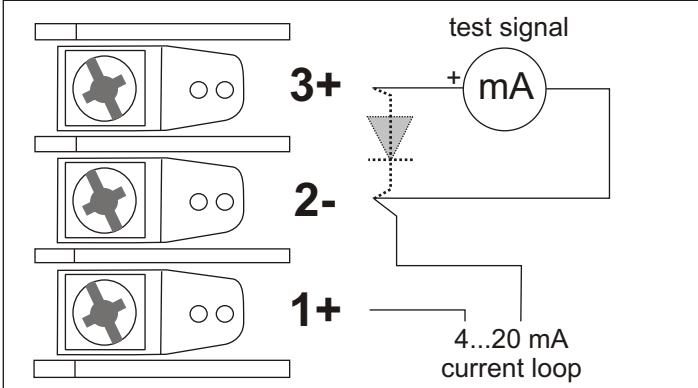
4...20 mA
current loop

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.

● *External operator's control*

Span ● ● Zero
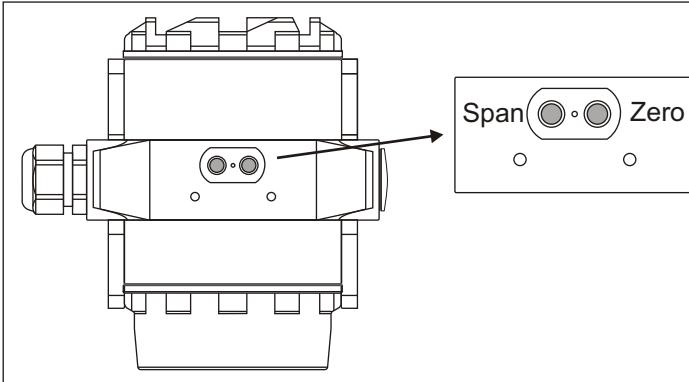
Below the type plate there are 2 key button for easy configuration of zero and span. The keys are Hall effect devices and are completely seperated from other parts of the enclosure.

Advatages:
 - Protection against environmental influence
 - without wear
 - ease of operation

● *Rotating of enclosure*

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

Advatages:
Good reading of the display
Operator's controls of the device are easy approachable

maximum 360°

FIELD
TERMINALS

Example: turning 90°
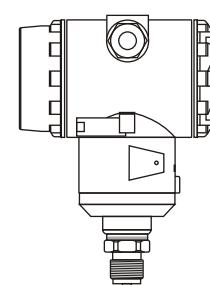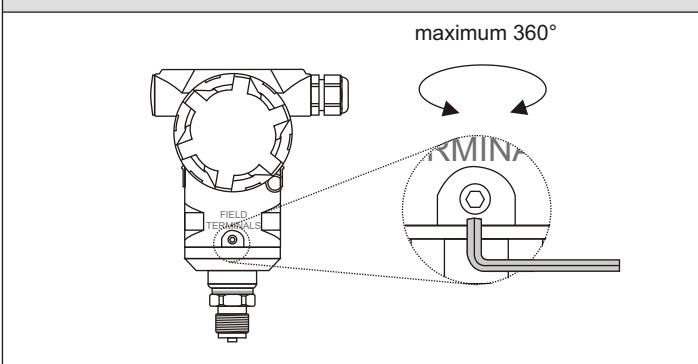
● *Electronic insert with display*

Display with key buttons for configuration

	The display is rotatable for approx. 330°
	With 3 operator's keys is configurable:
	  - Starting measuring value (reference pressure has to be supplied)
	  - Final measuring value (reference pressure has to be supplied)
	  - Zero offset compensation (compensation of position)
	  - Reset
	  - Starting measuring value (reranging without reference pressure)
	  - Final measuring value (reranging without reference pressure)
	  - Damping
	  - Unit (mA, mbar, %)
	  - Fixed current output

Display
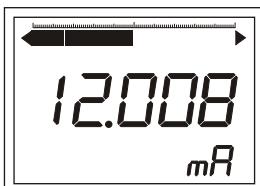
	- Visible range 32,5x22,5 mm - 5-digits 7-segment line, 8 mm high (-19999...99999) - 8-digits 14-segment line, 5 mm high - Bargraph with resolution 2%

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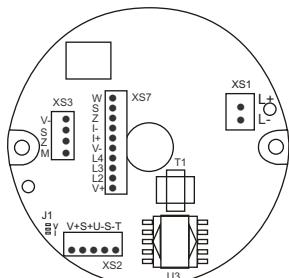
|	
	- XS1 voltage supply 15...45 V - XS2 connection sensor - XS3 external keys - XS7 display - J1 solder bridge to select sensor supply

● *HART Communication*

HART tool:

The HART-Tool is a graphical user interface for the MH series with menu-driven progam 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

● *Dimensions (in mm)*

| view front | view side | view top |
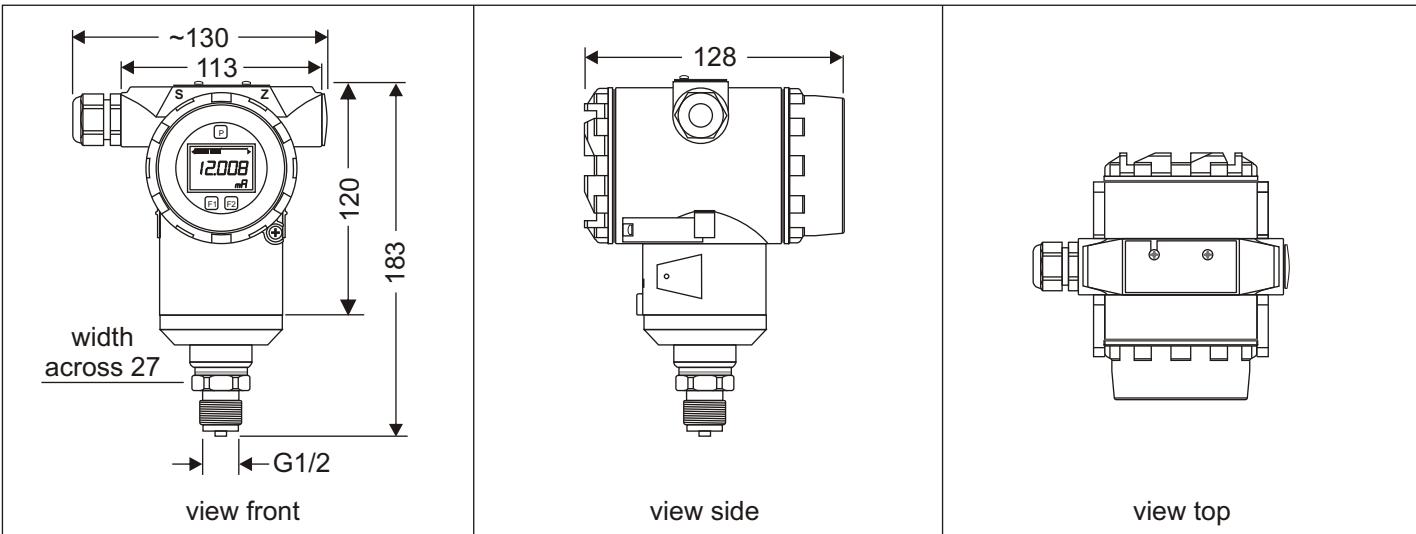
● *Definitions*

LRL: lower range limit
LRV: lower range value
TD: turn down

URL: upper range limit
URV: upper range value

Example 1

LRL = LRV   URV   URL

0 bar   0,6 bar   +1 bar

adjusted working range

sensor range / nominal range
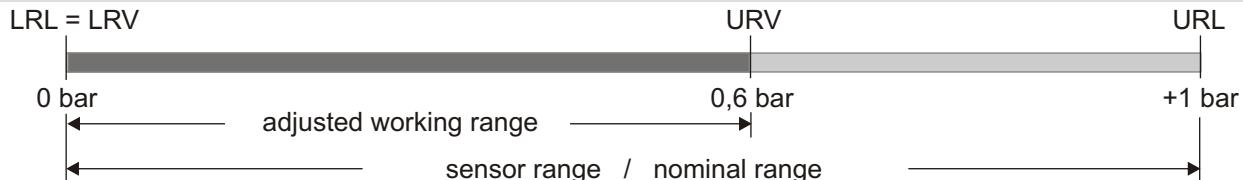
$	LRV	<	URV	$:	lower range value (LRV) = 0 bar	upper range value (URV) = 0,6 bar
	upper range limit (URL) = 1 bar	
Turn down:	URL / $	URV	$ = 1 bar / 0,6 bar	Turn down = 1,66 : 1
Set span:	URV - LRV = 0,6 bar - 0 bar	set span = 0,6 bar
(adjusted)	(The span is based on the zero point)	

Example 2

LRL   LRV   URV   URL

-1 bar   0 bar   0,8 bar   +1 bar

adjusted working range
nominal range

sensor range
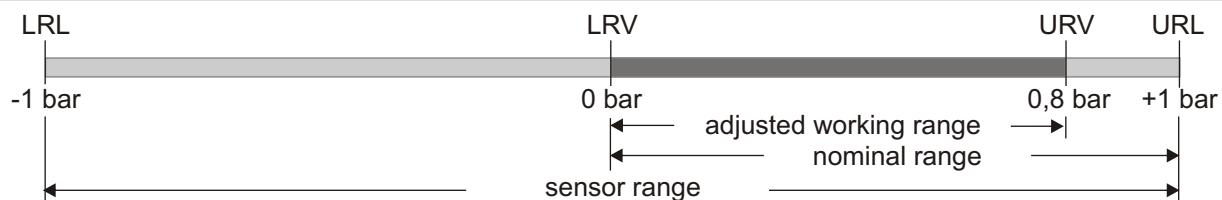
$	LRV	<	URV	$	lower range value (LRV) = 0 bar	upper range value (URV) = 0,8 bar
	upper range limit (URL) = 1 bar mbar	
Turn down:	URL / $	LRV	$ = 1 bar / 0,8 bar	Turn down = 1,25 : 1
Set span:	URV - LRV = 0,8 bar - 0 bar	set span = 0,8 bar
(adjusted)	(The span is based on the zero point)	

Example 3

LRL   LRV   URV   URL

-1 bar   -0,7 bar   0 bar   +1 bar

adjusted working range

nominal range

sensor range
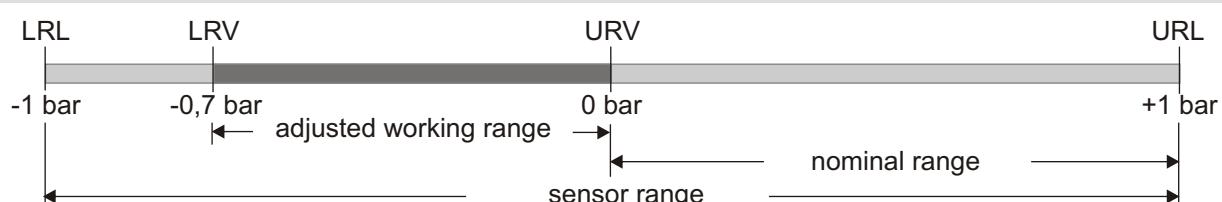
$	LRV	>	URV	$	lower range value (LRV) = -0,7 bar	upper range value (URV) = 0 bar
	upper range limit (URL) = 1 bar	
Turn down:	URL / $	LRV	$ = 1 bar / 0,7 bar	Turn down = 1,43 : 1
Set span	URV - LRV = 0 bar - (-0,7 bar)	set span = 0,7 bar
(adjusted)	(The span is based on zero point)	

● *Ordering code*

H	P	X	X	X	X	X	X	-	X	X	X

Output:		
	4...20 mA (HART)	0
	4...20 mA (HART), electronical limit contacts[1]	1
	4...20 mA (HART), limit contacts relays[1]	2
	4...20 mA (HART), PROFIBUS[1]	3
	4...20 mA (HART), Modbus[1]	4
	4...20 mA (HART), EtherCat[1]	5
	4...20 mA (HART), PWM[1]	6

Kind of pressure:[2]		
	relative	0
	absolute	1
	relative (±)	2

Pressure range:[3]	(please indicate)	X

Process connection:		
	G 1/2 (EN 837), manometer	0
	G 1/4 (EN 837), manometer	1
	G 1/4 (DIN 3852 E)	2
	1/2 NPT	3
	1/4 NPT	4
	M20x1,5	5

Material process connection:[4]	1/4-18 NPT 1.4435 (316L)	0

Temperature medium:		
	-30...+100 °C	0
	-40...+125 °C	1

Enclosure / connection:	diecast aluminium with screwed cable gland M20x1,5	0

Configuration:		
	factory configuration[5]	0
	customized configuration (please indicate)[6]	1

Other / accessories:		
	special model	0
	HART Interface, USB, software	1i
	HART iInterface, RS232, software	2

1) For more details see the corresponding data sheet:
   - MH-LVE for electronical limit value contacts
   - MH-PRO for interface PROFIBUS
   - MH-ETH for interface EtherCat
   - MH-LVR for limit value contacts with relays
   - MH-MOD for interface Modbus
   - MH-PWM for interface pulse-width modulation (PWM)

2) relative: positive overpressure, negative overpressure (subatmospheric pressure)
   relative (±): above and below the prevailing atmospheric pressure

3) Coding for X (pressure ranges), given in bar:
   relative pressure: 0 = 0...0,1 / 1 = 0...0,16 / 2 = =...0,25 / 3 = 0...0,4 / 4 = 0...0,6 / 5 = 0...1 / 6 = 0...1,6 /
   7 = 0...2,5 / 8 = 0...4 / 9 = 0...6 / A = 0...10 / B = 0...16 / C = 0...25 / D = 0...40 / E = 0...60 / F = 0...100 /
   G = 0...160 / H = 0...250 / I = 0...400 / J = 0...600 / K = 0...1000 / L = -1...0
   absolute pressure: 2 = =...0,25 / 3 = 0...0,4 / 4 = 0...0,6 / 5 = 0...1 / 6 = 0...1,6 / 7 = 0...2,5 / 8 = 0...4 /
   9 = 0...6 / A = 0...10 / B = 0...16 / C = 0...25 /
   relative pressure (±): M = -1...+1

4) Material in contact with medium: CrNi steel

5) zero: 4,000 mA / span: 20,000 mA / zero offset compensation: without / turn down: without /
   calibration points: 2 / damping: without / display mode: 100% / output on alarm: 3,6 mA / fixed output: without

6) the possibilities of the technical data can be selected. In case of not given values the details of factory-set are
   used.