

MDM3051S-DP

Intelligent Pressure Transmitter



Introduction

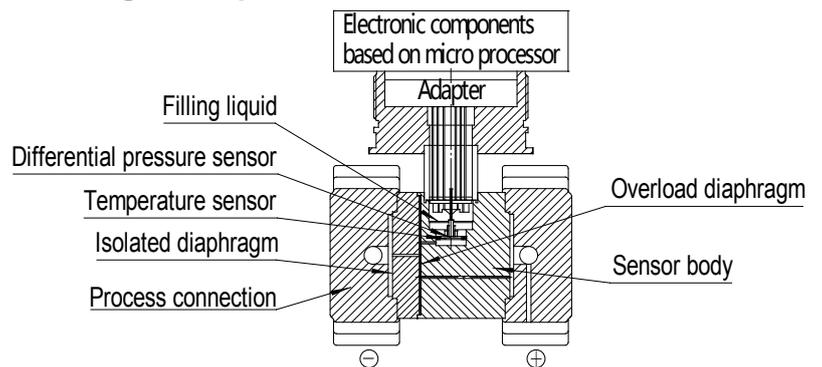
Differential Pressure Transmitter (DP)

- Measured media: gas, steam, liquid
- Measured range(with no shift):
0mbar~1mbar...30bar
- Basic error: $\pm 0.075\%$
- Diaphragm contacting with liquid: Stainless Steel 316L, Hast-alloy C

Features

- The central sensing element of transmitter uses the world's leading high- Accuracy silicon sensor technology, Basic error is $\pm 0.075\%$
- Working pressure of transmitter has three levels--160bar, 250bar and 400bar, the highest one-way overpressure is 400bar
- Excellent static pressure performance, optimal static pressure error $\leq \pm 0.1\%/100\text{bar}$
- The inner of pressure sensor integrates high sensitive temperature sensor
- Excellent temperature performance, optimum $\pm (0.20 \times \text{TD} + 0.10)\% \times \text{Span}$ /-20°C ~65°C
- All stainless steel 316L, silicone oil filling with welded sealing construction
- Stable and reliable, optimal long-term drift performance: $\pm 0.1\%/year$, 5-year maintenance-free
- Wide measured range: 1mbar~30bar
- Max. 100:1 pressure range proportion adjustable
- EMC conforms to GB/T 18268.1-2008 standard

Working Principle



Differential pressure transmitter includes two functional units:

*Main unit

*Auxiliary unit

Main unit includes sensor and process connection, working principle as followed:

The sensor module uses whole welded technology, in which has a compact overload diaphragm, a differential pressure sensor and a temperature sensor. The temperature is taken as a reference for temperature compensation. The positive end of the differential pressure sensor is connected with high pressure chamber of sensor capsule; the negative end is connected with low pressure chamber of sensor capsule. Through the isolated diaphragm and filling liquid, the differential pressure is transmitted to silicon die in the inner of differential pressure sensor, which makes the resistor of sensor die change. So the detection system outputs different voltage. The output voltage is in proportion to the pressure variation, and then it is transmitted to standard output by adapter and amplifier.

Differential Pressure Transmitter (DP)

MDM3051S-DP Differential Pressure Transmitter is used for level, density, pressure and flow measurement of liquid, gas and steam. Then it will output 4mA~20mA DC HART signal and also it could be connected to MS-HART375 hand communicator or RSM295 Modem to do the specification setting and process control.

Standard Specification

(Standard zero as the reference calibration range, Stainless steel 316L diaphragm, filling liquid is silicone oil)

Performance Specification

Reference Basic error for range calibration(including linearity, hysteresis and repeatability from zero):

$\pm 0.075\%$

If $TD > 10$ ($TD = \text{Max. Pressure range/calibration range}$), the Basic error is $\pm(0.0075 \times TD)\%$

The Basic error of square root output is 1.5 times of above reference Basic error.

Environmental Temperature Effect

| Range Code | -20°C ~65°C Total effect value |
|------------|---|
| A | $\pm(0.45 \times TD + 0.25)\% \times \text{Span}$ |
| B | $\pm(0.30 \times TD + 0.20)\% \times \text{Span}$ |
| C/D/F | $\pm(0.20 \times TD + 0.10)\% \times \text{Span}$ |

| Range Code | -40~-20°C , 65°C ~85°C Total effect value |
|------------|---|
| A | $\pm(0.45 \times TD + 0.25)\% \times \text{Span}$ |
| B | $\pm(0.30 \times TD + 0.20)\% \times \text{Span}$ |
| C/D/F | $\pm(0.20 \times TD + 0.10)\% \times \text{Span}$ |

Over range effect: $\pm 0.075\% \times \text{Span}$

Static pressure effect

| Range Code | Effect value |
|------------|--|
| A | $\pm(0.5\% \text{Span})/40\text{bar}$ |
| B | $\pm(0.3\% \text{Span})/100\text{bar}$ |
| C/D/F | $\pm(0.1\% \text{Span})/100\text{bar}$ |

Overpressure effect

| Range Code | Effect value |
|------------|--|
| A | $\pm 0.5\% \times \text{Span}/40\text{bar}$ |
| B | $\pm 0.2\% \times \text{Span}/160\text{bar}$ |
| C/D/F | $\pm 0.1\% \times \text{Span}/160\text{bar}$ |

Long-term stability

| Range Code | Effect value |
|------------|---|
| A | $\pm 0.5\% \times \text{Span}/1 \text{ year}$ |
| B | $\pm 0.2\% \times \text{Span}/1 \text{ year}$ |
| C/D/F | $\pm 0.1\% \times \text{Span}/1 \text{ year}$ |

Power effect $\pm 0.001\% / 10V$ (12V~42V DC), negligible.

Functional Specification

Standard Specification

| Range/Limits | | mbar |
|--------------|--------|-------------|
| A | range | 1~10 |
| | limits | -10~10 |
| B | range | 2~60 |
| | limits | -60~60 |
| C | range | 4~400 |
| | limits | -400~400 |
| D | range | 25~2500 |
| | limits | -2500~2500 |
| F | range | 300~30000 |
| | limits | -5000~30000 |

Pressure range limit

The pressure is adjustable within the upper and lower limit;

It is recommended to choose the range code with the lowest pressure range proportion to optimize the performance specification;

Zero setting

The zero and pressure range could be adjusted to any value within the measured rang in the table, only the calibrated range \geq Min. Range is valid;

Mounting position effect

The change of mounting position parallel to diaphragm could not influence the zero drift. If the angle between mounting position and diaphragm is over 90° , the zero drift is $<4\text{mbar}$ which could be calibrated by zero setting. No other effect on pressure range;

Output

2- wire, 4mA~20mA DC, HART communication protocol, linearity or square root output optional.

Output signal limit: $I_{\min}=3.9\text{mA}$, $I_{\max}=20.5\text{mA}$;

Response time

The damping constant of amplifier parts is 0.1s, time constant of sensor is 0.1s~1.6s, which is decided by the pressure range and pressure range ratio. The additional adjustable time constant is 0.1s~60s. The non-linearity output(eg. Square root output) is influenced by this function and could be calculated by it;

Warm-up time

$<15\text{s}$

Environmental temperature

$-40^\circ\text{C} \sim 85^\circ\text{C}$

With LCD display and viton sealing ring, the temperature is $-20^\circ\text{C} \sim 65^\circ\text{C}$;

Storage temperature/ transportation temperature

$-50^\circ\text{C} \sim 85^\circ\text{C}$;with LCD display: $-40^\circ\text{C} \sim 85^\circ\text{C}$;

Working pressure

Rated working pressure: 160bar, 250bar, 400bar

Static pressure limit

From 35mbar absolute pressure to rated pressure, protection pressure can be pressurized to both high and low side of transmitter; and it can be higher than 1.5 times of rated pressure.

One-way overpressure limit

One-way overpressure could reach the rated pressure

EMC

Please refer to next page "EMC table"

Installation

Power and load condition

Power supply:

24V DC, $R \leq (U_s - 12V) / I_{\max}$ (k Ω) $I_{\max}=23\text{mA}$

Max. Voltage supply: 42V DC

Min. Voltage supply: 12V DC, 15V DC(Backlit LCD display)

Digital communication load resistance range: 250 Ω ~600 Ω

Electrical Connection

M20 \times 1.5 cable sealing buckle, terminals are suitable for (0.5~2.5)mm 2 wire.

Process connection

NPT 1/4 and UNF 7/16" female at both sides of process connection flange

Physical Specification

Material

Measuring capsule: Stainless Steel 316L
 Diaphragm: Stainless Steel 316L, Hast-alloy C
 Process flange: Stainless steel 304
 Nut and bolt: Stainless steel(A4)
 Filling liquid: silicone oil
 Sealing ring: NBR, FKM, PTFE
 Transmitter housing: Aluminum alloy material, epoxy resin glue sprays on the surface
 Housing sealing ring: NBR
 Nameplate: Stainless steel 304

Weight

3.3kg(not including LCD display, mounting support and process connection)

Housing protection

IP67

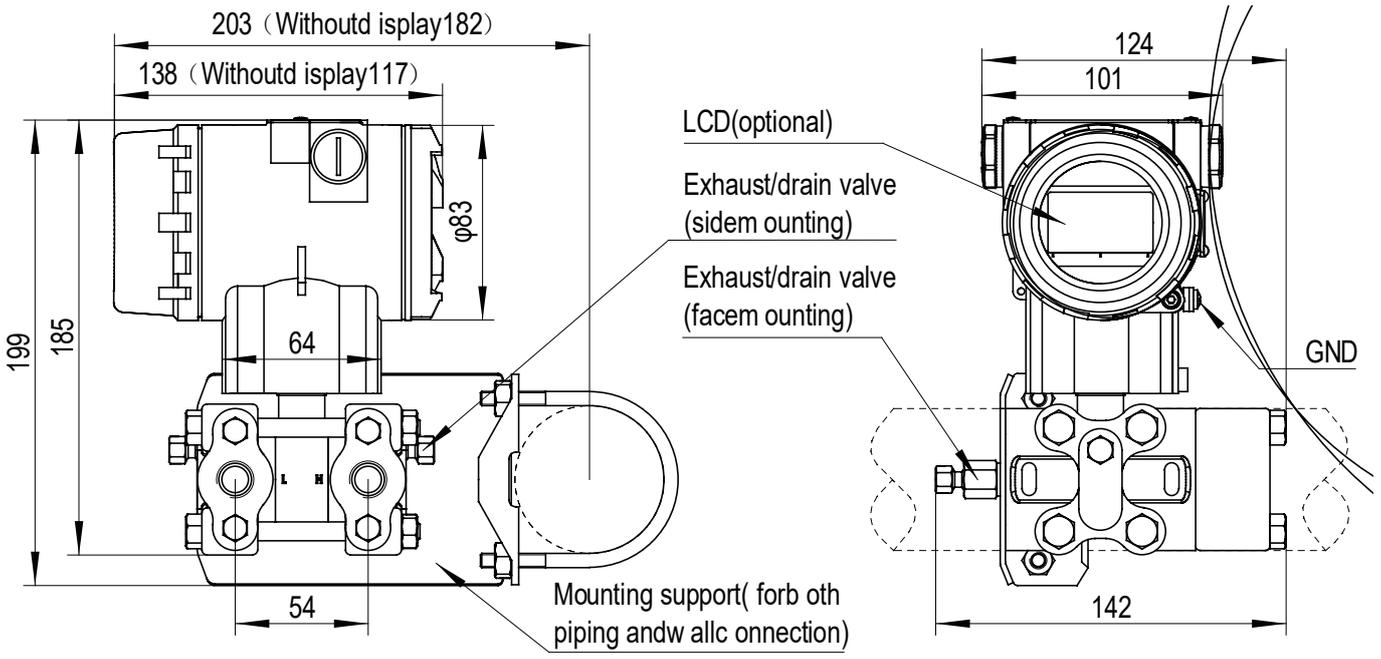
EMC Table

| Code | Test terms | Standard | Test condition | Performance degree |
|------|---|-----------------------|-----------------------|--------------------|
| 1 | Radiated interference(housing) | GB/T 9254-2008 table5 | 30MHz~1000MHz | qualified |
| 2 | Transmission interference (DC power port) | GB/T 9254-2008 table1 | 0.15MHz~30MHz | qualified |
| 3 | ESD immunity | GB/T 17626.2-2006 | 4kV(contact) 8kV(air) | B |
| 4 | Radiofrequency electromagnetic field immunity | GB/T 17626.3-2006 | 10V/m (80MHz~1GHz) | A |
| 5 | Power frequency magnetic field immunity | GB/T 17626.8-2006 | 30A/m | A |
| 6 | EFT immunity | GB/T 17626.4-2008 | 2kV(5/50ns,5kHz) | B |

Notes:

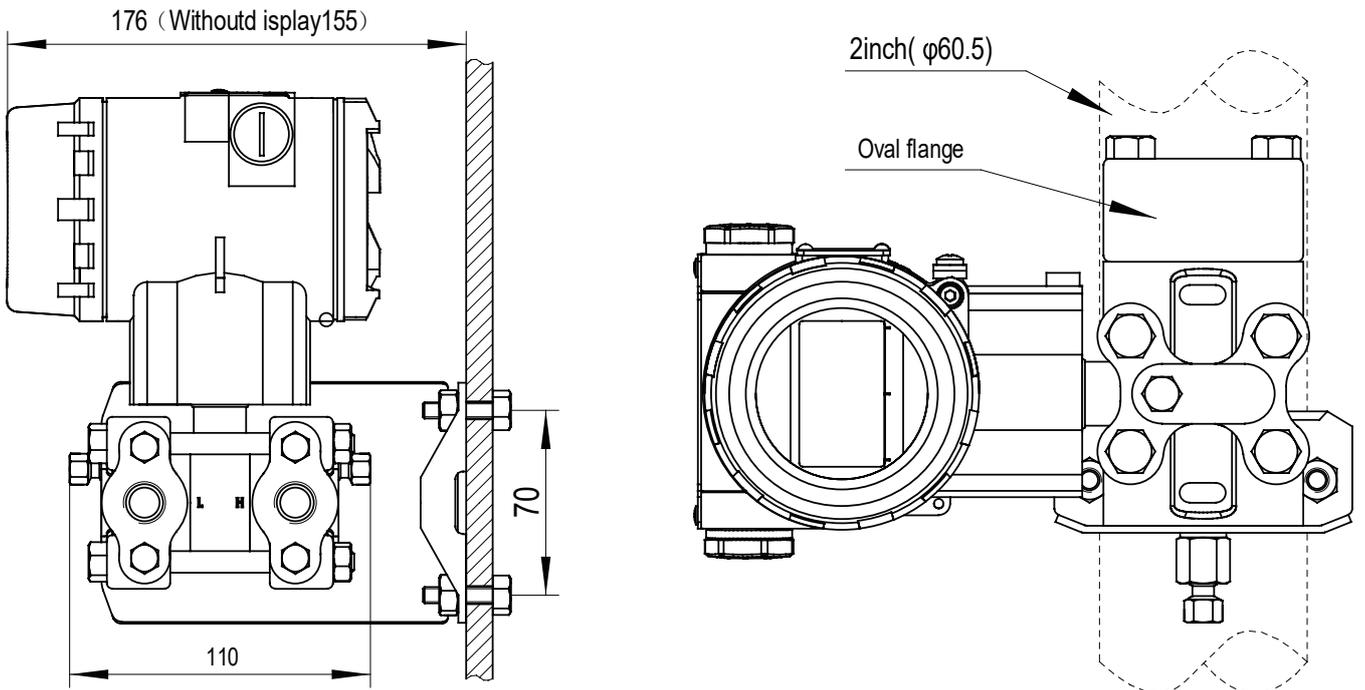
1. A degree: Performance is normal within the technical standard range during testing.
2. B degree: During, the function or performance is lowered or lost temporarily, but it could be recovered by itself. Actual operation state, storage and data will keep the same.

Outline Dimension(Unit: mm)



Horizontal Piping Installation (side view)

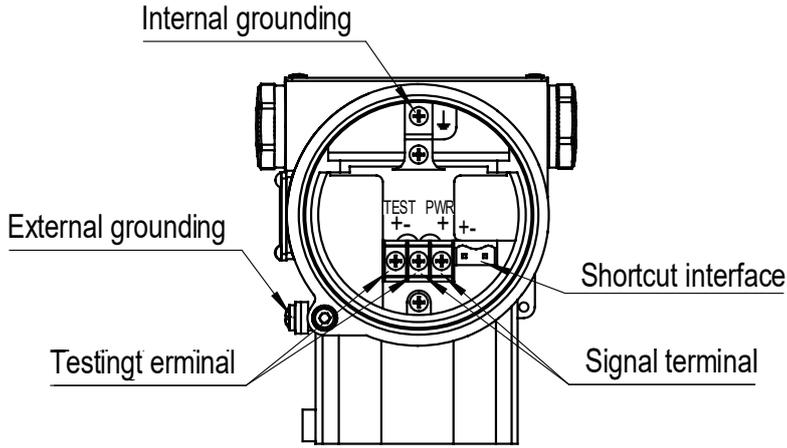
Horizontal Piping Installation (front view)



Wall Installation

Vertical Piping Installation

Electrical connection

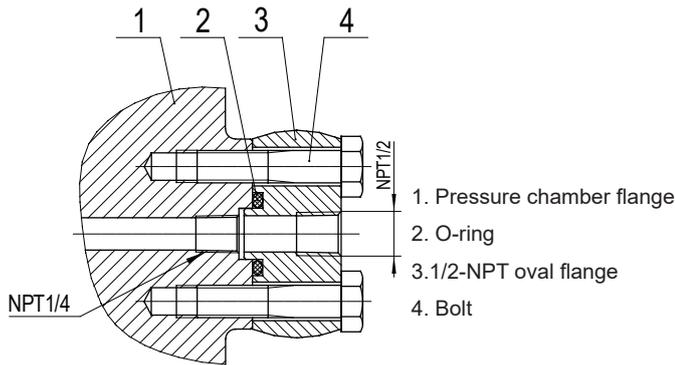


Note: the function of shortcut interface is equal to signal terminal.

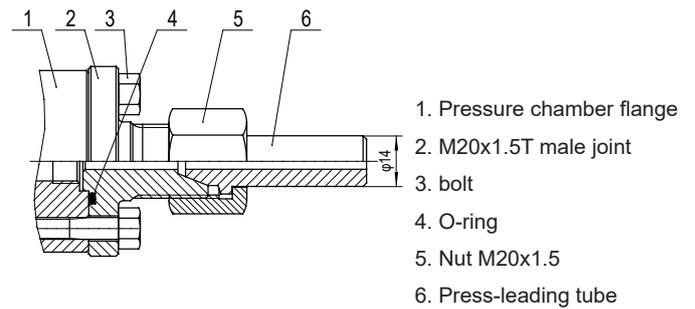
Process connection instruction

Process flange joint

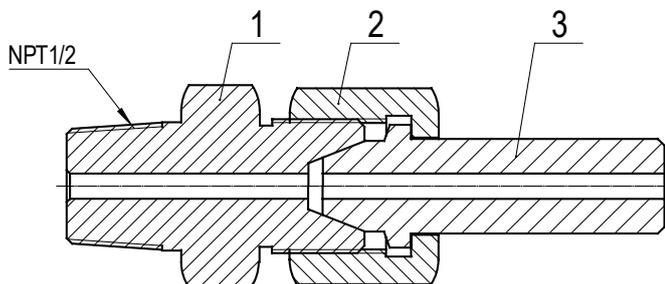
NPT1/2 Stainless steel oval flange(Code1)



M20x1.5 Stainless steel T joint(Code2)



NPT1/2 male with bolts and pressure tube, SS304(Code3)



- 1. NPT1/2 and core connection joint
- 2. Nut M20x1.5
- 3. Pressure leading tube, welded, SS304

Order Guide

| MDM3051S-DP | | Intelligent Pressure Transmitter | | | | | | | | | | |
|-------------|--|----------------------------------|---|---|---|---|---|---|---|---|---|-----------------|
| Code | Output | | | | | | | | | | | |
| H | 4mA~20mA DC with HART | | | | | | | | | | | |
| Code | Pressure Range | | | | | | | | | | | |
| A | 0mmH ₂ O~10mmH ₂ O...100 mmH ₂ O/ (0mbar~1mbar...10mbar) | | | | | | | | | | | |
| B | 0mmH ₂ O~20mmH ₂ O...600 mmH ₂ O/ (0mbar~2mbar...60mbar) | | | | | | | | | | | |
| C | 0mmH ₂ O~40mmH ₂ O...4000 mmH ₂ O/ (0mbar~20mbar...400mbar) | | | | | | | | | | | |
| D | 0mH ₂ O~0.25mH ₂ O...25 mH ₂ O/ (0mbar~25mbar...2500mbar) | | | | | | | | | | | |
| F | 0mH ₂ O~3mH ₂ O...300 mH ₂ O/ (0bar~0.3bar...30bar) | | | | | | | | | | | |
| Code | Diaphragm material | Filling | | | | | | | | | | |
| A | Stainless steel316L | silicone oil | | | | | | | | | | |
| C | Hastelloy C | silicone oil | | | | | | | | | | |
| Code | Rated working pressure | | | | | | | | | | | |
| 0 | 2bar (only for range A) | | | | | | | | | | | |
| 7 | 70bar (only for range A) | | | | | | | | | | | |
| 1 | 160bar | | | | | | | | | | | |
| 2 | 250bar | | | | | | | | | | | |
| 3 | 400bar | | | | | | | | | | | |
| Code | Process connection | | | | | | | | | | | |
| N | 1/4 NPT and 7/16 UNF thread hole without release valve | | | | | | | | | | | |
| B | 1/4 NPT and 7/16 UNF thread hole, release valve mounting in the end-face of flange back | | | | | | | | | | | |
| U | 1/4 NPT and 7/16 UNF thread hole, release valve mounting in upper flange side | | | | | | | | | | | |
| D | 1/4 NPT and 7/16 UNF thread hole, release valve mounting in lower flange side | | | | | | | | | | | |
| Code | Sealing materials contacting with liquid | | | | | | | | | | | |
| N | NBR | | | | | | | | | | | |
| F | FKM | | | | | | | | | | | |
| P | PTFE | | | | | | | | | | | |
| Code | Additional function | | | | | | | | | | | |
| N | None | | | | | | | | | | | |
| F | Square root output | | | | | | | | | | | |
| O | No oil processing (For oxygen measurement: fluorocarbon oil filling, viton sealing ring, <60bar, <60°C) | | | | | | | | | | | |
| Code | Mounting bracket | | | | | | | | | | | |
| N | None | | | | | | | | | | | |
| 1 | Stainless steel | | | | | | | | | | | |
| 2 | Galvanized Carbon Steel | | | | | | | | | | | |
| Code | Process connection parts | | | | | | | | | | | |
| N | None | | | | | | | | | | | |
| 1 | 1/2 NPT Female with stainless steel oval flange | | | | | | | | | | | |
| 2 | M20×1.5 male with stainless steel T joint | | | | | | | | | | | |
| 3 | 1/2-14NPT guiding pressure transition joint and rear welding guiding pressure tube (SS) | | | | | | | | | | | |
| Code | Display | | | | | | | | | | | |
| N | None | | | | | | | | | | | |
| 1 | LCD with back-light | | | | | | | | | | | |
| Code | Others | | | | | | | | | | | |
| N | None | | | | | | | | | | | |
| A | Intrinsic safe | | | | | | | | | | | |
| D | Exd version with Explosion-proof cable joint | | | | | | | | | | | |
| S | Stainless steel 316 plate | | | | | | | | | | | |
| T | Ship-use | | | | | | | | | | | |
| MDM3051S-DP | H | [0~0.2]bar | A | 1 | B | N | F | 1 | 1 | 1 | A | The whole spec. |