

# MDM3051S-DP Intelligent Pressure Transmitter



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## Brief Introduction

### Differential Pressure Transmitter (DP)

Measured media: gas, steam, liquid

Measured range(with no shift): 0Pa~100Pa...3MPa

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--16MPa, 25MPa and 40MPa, the highest one-way overpressure is 40MPa;

※ Excellent static pressure performance, optimal static pressure error  $\leq \pm 0.1\%/10\text{MPa}$ ;

※ The inner of pressure sensor integrates high sensitive temperature sensor.

※ Excellent temperature performance, optimum  $\leq \pm (0.20 \times \text{TD} + 0.10)\% \times \text{Span}$  /  $-20^\circ\text{C} \sim 65^\circ\text{C}$ ;

※ All stainless steel 316L, silicone oil filling with welded sealing construction;

※ Low gauge /absolute pressure transmitter uses the world's leading die resistance to high overload protection. 6kPa: one-way overpressure and protection pressure is 300kPa; 40kPa: one-way overpressure and protection pressure is 1MPa. The max. Pressure is 50 times of full span pressure.

※ Stable and reliable, optimal long-term drift performance:  $\pm 0.1\%$ /year, 5-year maintenance-free;

※ Wide measured range: 100Pa~60MPa;

※ Max. 100:1 pressure range proportion adjustable;

※ EMC conforms to GB/T 18268.1-2008 standard;

## Working Principle

### 1 Differential Pressure Transmitter (DP)

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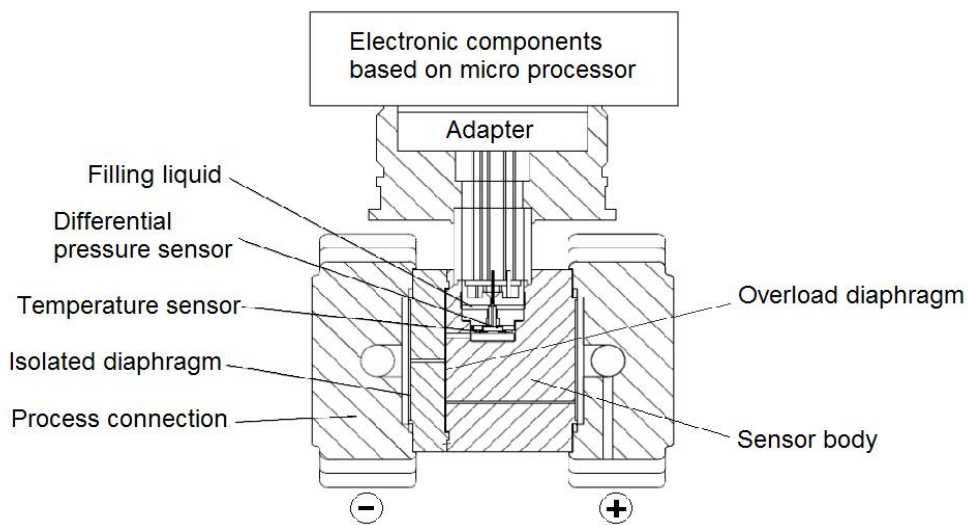


Chart 1 Differential Pressure Transmitter (DP)

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.

MDM3051S-DP Differential Pressure Transmitter is used for level, density, pressure and flow measurement of liquid, gas and steam. Then it will outputs 4mA~20mA DC HART signal and also it could be connected to RST375 hand communicator or RSM100 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)

#### 1 Performance Specification

Reference Basic error for range calibration(including linearity, hysteresis and repeatability from zero):  $\pm 0.075\%$

If  $TD > 10$  ( $TD = \text{Max. Pressure range} / \text{calibration range}$ ), 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.

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**Environmental Temperature Effect**

Range Code	-20℃~65℃ Total effect value	Range Code	-40℃~-20℃和 65℃~85℃ Total effect value
A	$\pm(0.45 \times TD + 0.25)\% \times \text{Span}$	A	$\pm(0.45 \times TD + 0.25)\% \times \text{Span}$
B	$\pm(0.30 \times TD + 0.20)\% \times \text{Span}$	B	$\pm(0.30 \times TD + 0.20)\% \times \text{Span}$
C/D/F	$\pm(0.20 \times TD + 0.10)\% \times \text{Span}$	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	$\pm(0.5\% \text{Span})/4\text{MPa}$
B	$\pm(0.3\% \text{Span})/10\text{MPa}$
C/D/F	$\pm(0.1\% \text{Span})/10\text{MPa}$

**Overpressure effect**

Range Code	Effect value
A	$\pm 0.5\% \times \text{Span}/4\text{MPa}$
B	$\pm 0.2\% \times \text{Span}/16\text{MPa}$
C/D/F	$\pm 0.1\% \times \text{Span}/16\text{MPa}$

**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  $\pm 0.001\% / 10\text{V}$  (12V~42V DC), negligible.

**2 Functional Specification**
**Pressure range and limits**

range/limits		kPa	mbar
A	range	0.1~1	1~10
	limits	-1~1	-10~10
B	range	0.2~6	2~60
	limits	-6~6	-60~60

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C	range	0.4~40	4~400
	limits	-40~40	-400~400
D	range	2.5~250	25~2500
	limits	-250~250	-2500~2500
F	range	30~3000	0.3~30 bar
	limits	-500~3000	-5~30 bar

**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 range 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  $90^\circ$ , the zero drift is  $< 0.4\text{kPa}$  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:  $I_{\min}=3.9\text{mA}$ ,  $I_{\max}=20.5\text{mA}$

**Alarm Current**

Low alarm mode(min.): 3.7mA

High alarm mode(max.): 21mA

No alarm mode(holding): holding the active current value before failure

Standard alarm current mode: High alarm mode

**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**

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-40°C~85°C

With LCD display and viton sealing ring, the temperature is -20°C~65°C.

**Storage temperature/ transportation temperature**

-50°C~85°C; with LCD display: -40°C~85°C

**Working pressure**

Rated working pressure: 16MPa, 25MPa, 40MPa

**Static pressure limit**

From 3.5kPa 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"

### 3 Installation

**Power and load condition**

Power supply: 24V DC,  $R \leq (U_s - 12V) / I_{max}$  (kΩ)

$I_{max} = 23\text{mA}$

Max. Voltage supply: 42V DC

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

Digital communication load resistance range: 250Ω~600Ω

**Electric Connection**

M20×1.5 cable sealing buckle, terminals are suitable for (0.5~2.5)mm<sup>2</sup> wire.

**Process connection**

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

### 4 Physical Specification

**Material**

Measuring capsule: Stainless Steel 316L

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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

**Note:** (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

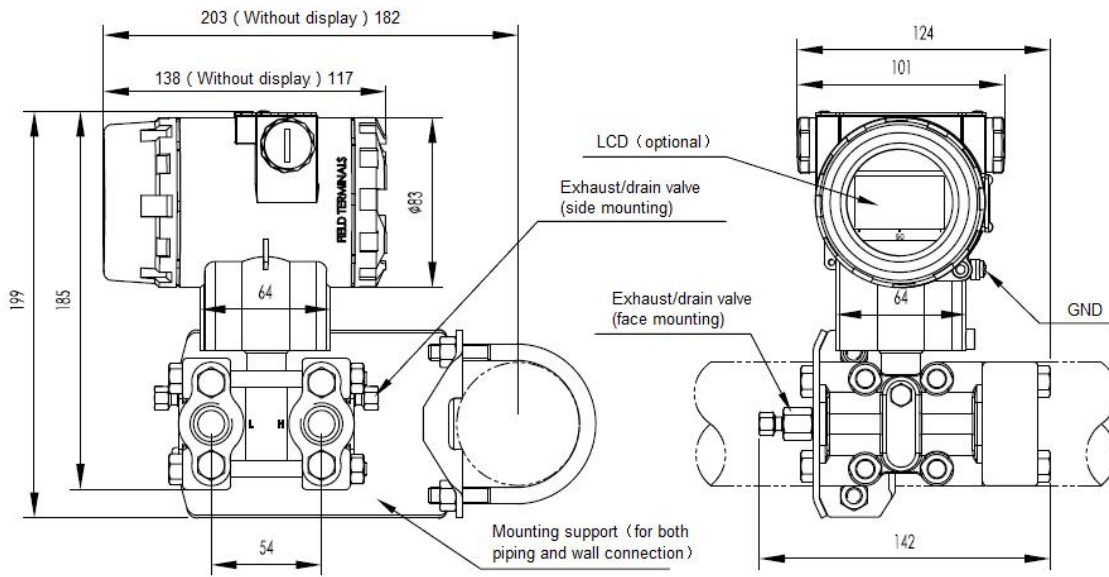
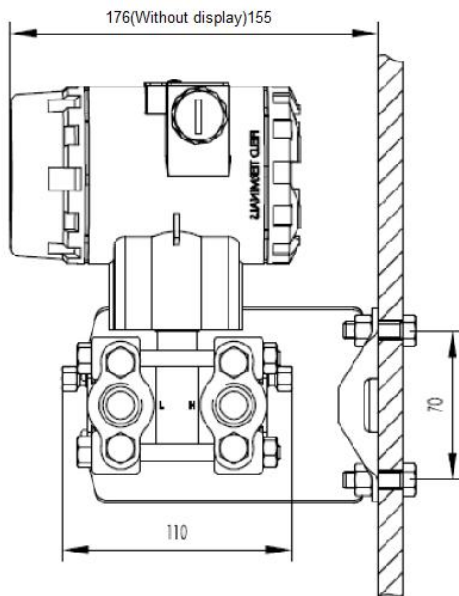
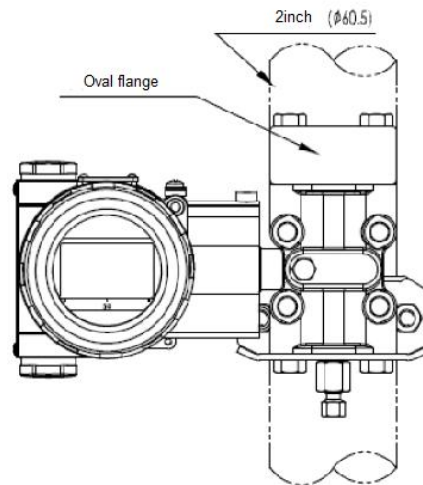
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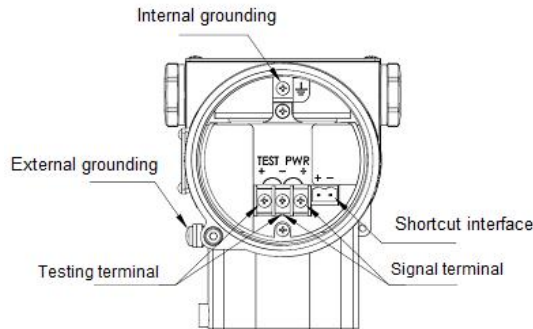
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**Horizontal Piping Installation (side view)**
**Horizontal Piping Installation (front view)**

**Wall Installation**

**Vertical Piping Installation**

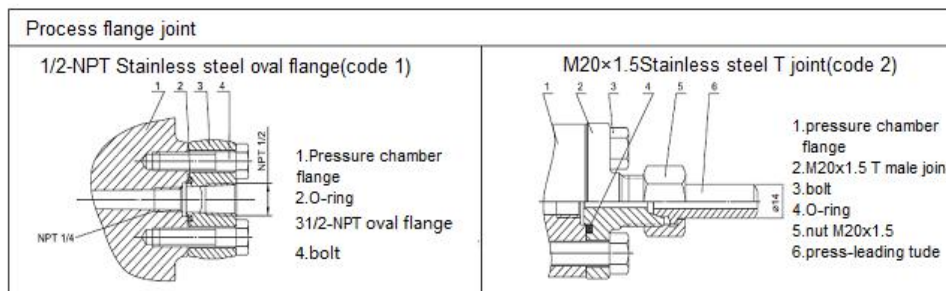
**5 Electric connection chart**



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

**6 Process connection instruction**

**7.Basic micro**



**error**

**differential pressure range**

- A. range is - 100 pa ~ 199 pa, the basic error of plus or minus 1%;
- B. range is - 200 pa ~ 499 pa, the basic error of plus or minus 0.5%;
- C. range is - 500 pa ~ 999 pa, the basic error of plus or minus 0.2%;
- D. range is 1000 pa range (i.e., 1 kpa) or more, the basic error of plus or minus 0.075%.

**8. Model and Specification Code Table**

MDM3051S-DP	Intelligent Differential Pressure Transmitter	
	Code	Output
	H	4mA ~ 20mA DC with HART
	N	4mA ~ 20mA DC analog output
	Code	Pressure range
	A	0Pa...100Pa~1kPa (0mm...10mm~100 mm H <sub>2</sub> O) /(0mbar...1mbar ~10mbar)
	B	0Pa...200Pa~6kPa (0mm...20mm~600 mm H <sub>2</sub> O) /(0mbar...2mbar ~60mbar)
	C	0Pa...400Pa~40kPa (0mm...40mm~4000 mm H <sub>2</sub> O) /(0mbar...20mbar ~400mbar)

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D	0kPa...2.5kPa~250kPa (0m...0.25m~25 m H <sub>2</sub> O) / (0mbar...25mbar ~2500mbar)	
F	0kPa...30kPa~3MPa (0m...3m~300 m H <sub>2</sub> O) / (0bar...0.3bar~30bar)	
	Code	Diaphragm material      Filling
	A	Stainless steel316L      silicone oil
	C	Hastelloy C      silicone oil
	Code	Rated working pressure
	0	0.2MPa (only for range A)
	7	7MPa (only for range A)
	1	16MPa
	2	25MPa
	3	40MPa
	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 、 <6MPa 、 <60℃)
	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	M20X1.5 male with stainless steel T joint
	3	1/2-14NPT guiding pressure transition joint and rear welding guiding pressure tube (SS)
	Code	Display
	1	LCD
	2	LCD with back-light

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	Code	Others
	N	None
	A	Intrinsic safe
	D	Exd
	E	Exd version with Explosion-proof cable joint
	S	Stainless steel 316 plate

MDM3051S-DP	H	C	A	1	B	N	F	1	1	1	N	The whole spec
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