

# 工作原理

## Working Principle

### 一、传感器原理

差压变送器包括两个功能单元：

①主单元，②辅助单元。

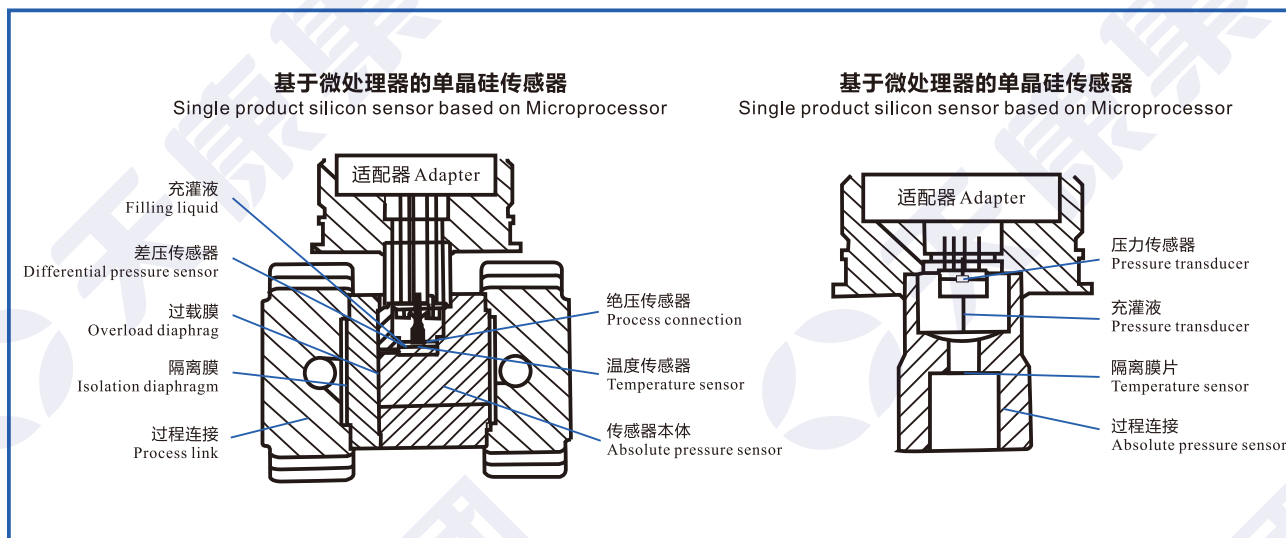
主单元包括传感器和过程连接，工作原理如下：传感器模块采用全焊接技术，内部拥有一个整体化的过载膜片，一个绝对压力传感器、一个温度传感器和一个差压传感器。绝压传感器只装在传感器膜盒的高压侧，做为静压测量和补偿的参考价值。温度传感器做为温度补偿的参考值，差压传感器的负压侧与传感器膜盒的低压腔相连，差压通过隔离膜片和填充液，传递给差压传感器的硅芯片，使差压传感器的芯片的阻值发生变化，从而导致检测系统输出电压变化，该输出电压与压力变化成正比，再由适配单元和放大器转化成以标准化信号输出。

### Sensor principle

The differential pressure transmitter consists of two functional units:

Main unit, Auxiliary unit.

The main unit comprises a sensor and process links, the working principle is as follows: the sensor module adopts the welding technology, has an integrated overload diaphragm, an absolute pressure sensor, a temperature sensor and a pressure sensor. The pressure sensor is installed on the high pressure side of the sensor box, which is the reference value of static pressure measurement and compensation. As the temperature sensor for temperature compensation of the reference value, the low pressure chamber side and negative pressure sensor diaphragm differential pressure sensor is connected to the differential pressure measurement through the diaphragm and liquid filling, transfer to the silicon chip differential pressure sensor, the differential pressure sensor chip resistance changes, resulting in the detection system of the change of output voltage, the output voltage changes with pressure the signal is proportional to the output of the amplifier adapter unit and transformed into a standard.



压力变送器包括两个功能单元：

主单元，辅助单元。

主单元包括传感器的过程连接，工作原理如下：过程介质通过柔性、抗腐蚀性的隔离膜片以及填充液的压力传感器测量膜片上施加压力，压力传感器测量膜片的另一端接大气（用于表压测量）或真空（用于绝压测量）。从而使传感器硅芯片的阻值发生变化，导致检测系统输出电压变化。该输出电压与压力变化成正比。再由适配单元和放大器转化成一标准化信号输出。

The pressure transmitter consists of two functional units:

Main unit, Auxiliary unit

The main unit comprises a sensor process link, the working principle is as follows: the pressure diaphragm process through the medium of flexibility, corrosion resistance and pressure sensor diaphragm of filling liquid, the other end is connected with the atmospheric pressure sensor (for measuring diaphragm gauge pressure (or vacuum) for absolute pressure measurement). Therefore, the resistance of the silicon chip of the sensor changes, which results in the change of the output voltage. The output voltage is proportional to the pressure change. And then converted into a standard signal output by the adapter unit and amplifier.

## 二、技术优势

- 差压变送器中心传感单元采用国内外领先的高精度单晶硅传感器技术，最高可达 $\pm 0.05\%$ 的高精度；
- 微差压送器采用全球领先的双过载保护膜片专利技术，最高可达 $\pm 0.075\%$ 的高精度；
- 差压变送器工作压力分别为16MPa、25MPa和40MPa三档，单向过载压力最高到40MPa；
- 差压变送器可选封装静压传感器，可用于现场工作静压的测量和显示，也可应用于静压补偿，静压性能极佳，静压误差最优 $\leq \pm 0.05\%/10\text{MPa}$ ；
- 传感器内部集成高灵敏度传感器，变送器温度性能极佳，最优 $\leq \pm 0.04\%/10\text{K}$ ；
- 全不锈钢316L硅油充灌焊接密封性结构；
- 微量程表压/绝压变送器采用全球领先的无传压损耗过载保护膜片专利技术，单向过压最高达7MPa，即满量程的1166倍；
- 稳定可靠，长期漂移为 $\pm 0.1\%/3$ 年，5年免维护；
- 极宽的测量范围100Pa~40MPa（最高可扩展至60MPa）；
- 最高100:1的可调量程比；
- EMC符合GB/T 18268, 1-2008标准要求。

## 三、主要特点

- 采用先进的单晶硅传感器技术及电容传感技术；
  - 高稳定性、高可靠性、高抗干扰性；
  - 多种调试方法：就地按钮、手操器、通信软件；
  - 就地按钮与LCD表头可实现变送器的功能组态；
  - 可选防雷保护（耐瞬变电压）功能；
  - 可选不锈钢电子外壳
- 液位、远传变送器：形式、隔离膜片、灌装液选择丰富；
- 测量介质：液体、蒸汽和气体；
  - 基本误差： $\pm 0.05\% \sim \pm 0.1\%$ ；
  - 最大量程比：100:1；
  - 测量范围（未迁移时）  
差压范围：0-50Pa~1MPa；  
压力范围：0-1kPa~40MPa；  
绝压范围：0-10kPa~3MPa；
  - 环境温度： $-40 \sim +85\text{C}$ （防爆、防雷）  
 $40\text{C} + 60\text{C}$ （带LCD表头、充氟油： $-20\text{C} \sim +60\text{C}$ ）；
  - 被测介质温度： $-40\text{C} \sim +315\text{C}$ ；
  - 温度影响  
 $-20\text{C} + 65\text{C}$ 时： $\pm (0.03\% \text{URL} + 0.05\% \text{Span}) / 20\text{C}$ ；  
 $-40\text{C} \sim +85\text{C}$ 时： $\pm (0.1\% \text{URL} + 0.1\% \text{Span}) / 120\text{C}$ ；
  - 静压等级：16MPa、25MPa、40MPa；
  - 静压影响  
 $\pm 0.05\% \text{URL} / 10\text{MPa}$  \* 长期漂移： $0.10\% \text{URL} / 3$ 年。

## Technical advantage

The center sensor unit of the differential pressure transmitter adopts the leading high-precision single product silicon sensor technology at home and abroad, which can reach up to  $\pm 0.05\%$  high precision;

Micro differential pressure transmitter using the world's leading double overload protection diaphragm patented technology, up to  $\pm 0.075\%$  high precision;

The transmitter pressure differential pressure were 16MPa, 25MPa and 40MPa gear, one-way overload pressure up to 40MPa;

Differential pressure transmitter optional static pressure sensor package, can be used to measure the static pressure field work and display, but also can be applied to static compensation, excellent static; performance, static optimal error less than  $0.05\% / 10\text{MPa}$ ;

The sensor integrated sensor with high sensitivity, excellent performance of optimal temperature transmitter, less than  $0.04\% / 10\text{K}$ ;

Full stainless steel 316L silicone oil filling welding sealing structure;

Micro range gauge / absolute pressure transmitter with no loss of pressure overload protective membrane patent technology leading, one-way overvoltage of up to 7MPa, which is the full range of 1166 times;

Stable and reliable, long-term drift of  $+ 0.1\% / 3$  years, 5 years free maintenance;

Very wide measurement range 100Pa~40MPa (up to 60MPa);  
Adjustable range of maximum 100:1;  
EMC comply with GB/T 18268, 1-2008 standard requirements;

## Main features

- advanced single crystal silicon sensor technology and capacitive sensing technology
- High stability, high reliability, high anti-interference

A variety of debugging methods: on the spot button, hand operator, communications software

- the local button and the LCD header can realize the transmitter function configuration
- optional lightning protection (transient voltage resistance) function optional stainless steel electronic case

Liquid level, remote transmitter: form, isolation diaphragm, filling fluid selection rich

Measuring medium: liquid, steam and gas

- basic error:  $+ 0.05\% \sim + 0.1\%$

Maximum range ratio: 100:1

- measuring range (no migration)

Differential pressure range: 0-50Pa~1MPa pressure range: 0-1kPa ~ 40MPa absolute pressure range: 0-10kPa ~ 3MPa

Ambient temperature:  $-40 \sim +85\text{C}$  (explosion-proof, lightning protection:  $-40 \text{ degrees C} \sim +60 \text{ degrees C}$ ) (with LCD header, fluorine oil:  $-20 \text{ degrees C} \sim +60 \text{ degrees C}$ )

- measured medium temperature:  $-40 \text{ degrees C} \sim +315 \text{ degrees C}$
- temperature affect  $-20 \text{ C} \sim +65$ . (when):  
Shi ( $0.03\% \text{URL} + 0.05\% \text{Span}$ ) /  $20 \text{ C} - 40 \text{ DEG C} \sim +85 \text{ DEG C}$ :  
Soil ( $0.1\% \text{URL} + 0.1\% \text{Span}$ ) /  $120\text{C}$

Static pressure level: 16MPa, 25MPa, 40MPa

Static pressure effects:  $+0.05\% \text{URL} / 10\text{MPa}$  \* long drift:  $+0.10\% \text{URL} / 3$  years

- 防爆标志：Ex d IIC T4~T6 > Exia IIC T4-T6；
- 输出通信协议：HART、PROFIBUS-PA、FF；
- 输出功能：线形、平方根等；
- 电磁兼容性：符合EN 61326-1：2006；
- 快速的动态响应；
- 防护等级：IP67
- 灌充液：硅油、氟油、高温硅油等；
- 基型表隔离膜片：316L、哈氏合金C等；
- LCD表头：显示工程单位、百分数、电流值等；
- 远传形式：平法兰式、插入筒式、对夹式、法兰安装式、螺纹安装式、夹持式、耦合式、微型等；
- 液位、远传隔离膜片：316L、哈氏合金C、钽、PFA涂层、F46覆膜、镀金等。

TK-3051系列产品仍保留基于传统金属电容式差压压力传感器的应用。其高性价比可满足用户的需求。

- Explosion proof mark: Ex D T4~T6 > Ex IA IIC IIC T4-T6
  - Reference output communication protocol: HART, PROFIBUS-PA, FF
  - Output function: linear, square root isoparametric
  - electromagnetic compatibility: EN 61326-1:2006
  - Fast dynamic response
  - Protection level: Ip67
  - Filling fluid: silicone oil, fluorine oil, high temperature silicone oil, etc.
  - Base type isolation diaphragm: 316L, Hastelloy C, etc.
  - LCD header: display engineering units, percentage, current value, etc.
  - Remote form: flat flange, tube insertion of the clip, flange mounted, screw type, clamp type, coupling type, micro - level, remote diaphragm: 316L, Hastelloy C, tantalum, PFA coating, F46 coating, plating etc.
- TK-3051 series products are still based on the traditional metal capacitive differential pressure sensor applications. Its high performance price ratio can meet the needs of different users.