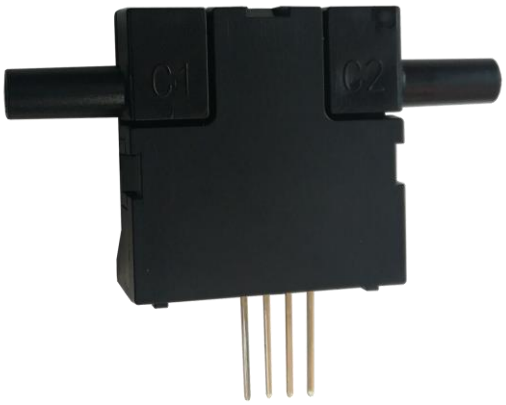
ASAIR®

Micro Flow Sensor

Product Manual

AFS01IA



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characteristic

- 5V supply voltage
- Operating temperature range -25℃～85℃
- Completely calibrated
- I^2C interface communication
- Low power consumption: less than 50mW
- Can be used for non-corrosive gases
- Long service in lifetime
- High frequency
- Low hysteresis error
- Easy installation interface

product description

AFS01IA is an ultra-high response speed, long-term stable output, high precision, fully calibrated gas micro-flow sensor. The modern production process ensures that the products have extremely high reliability and excellent long-term stability. The micro-flow sensor is a product that uses the sensor chip developed and produced by the company and uses the heat transfer principle to measure the gas flow and integrates digital processing. Inside is connected by a thermal sensor chip detection sensor and a high-performance integrated 24-bit AD acquisition CMOS microprocessor. The product has the advantages of excellent quality, ultra-fast response, strong anti-interference ability, and high-cost performance. The high integration of the whole machine is very suitable for the requirements of high quality and large-scale production. It is an ideal choice for users and is convenient for OEM applications of cooperative manufacturers.

AFS01IA communication mode adopts I2C digital communication mode, ultra-small size, and extremely low power consumption, making it the best choice for various application fields

of Seiko gas applications. The working voltage of AFS01IA is 5V. The module product can provide low cost and low power consumption advantages for various common application scenarios. The micro-flow sensors are all factory-calibrated in a high-precision gas standard production laboratory, and directly output the detected flow output. The user does not need to perform secondary signal processing to obtain accurate flow information, reduce the user's cost of use, facilitate the application of user`s product solutions, and reduce cumbersome secondary development.

Application range

Flow sensor control, gas flow monitoring of medical physiotherapy application instruments, special effect technology smoke, fragrance gas ratio control, industrial packaging inflation, and food anti-corrosion, electronic SMT production, and semiconductor chemical electronic equipment, intelligent automatic switches and machinery, industrial development experiments Room application, etc.

OEM industry customization and solutions

Our company is devoted to the research and development of various sensors. We have professional R&D laboratories and instruments and equipment and support a variety of simulation environment experimental conditions to create high-quality product production and inspection processes. The flow sensor chip is one of the chips independently developed and manufactured by our company. It can customize the flow range and design an independent air duct structure according to the application site and customer needs, and professionally provide customers with a complete set of application solutions.

目录

1、Sensor performance

Table 1: AFS01IA accuracy condition performance table

Parameter	Type	Unit
Measuring range	0～200	Sccm
Accuracy	±3	%reading
Repeatability	±5	%reading
The sampling period	0.5	second
Calibration method	Factory calibrated	

2、Sensor electrical characteristics

Electrical characteristics, such as sleep power consumption, measured power consumption, etc., all depend on the power supply. Table 2 details the electrical characteristics of AFS01IA. If not marked, it means that the supply voltage is 5V.

Parameter	Condition	MIN	TYP	MAX	Unit
communication			I2C		
Supply voltage	VDD	4.75	5	5.25	V
I2C Working level	High level	4	-	VDD	V
	Low level	GND	-	0.8	V
The sampling period		500			ms
Power consumption	measuring		7.5	10	mA
I2C Communication rate			100	400	Kb/s
Operating temperature		-25		+85	℃
storage temperature		-25		+90	℃

Table 2： AFS01IA Electrical characteristics parameter table

3、Sensor limit rating

Table 3： Parameter limit

Parameter	Condition	MIN	TYP	MAX	Unit
Altitude		0		2000	Km
voltage	VDD	-0.3		5.5	V

Note: The working range should be within the above parameter environment as much as possible, otherwise it will cause a certain degree of precision value influence and irreversible damage to the equipment.

4、Sensor communication

The AFS01IA sensor uses a standard I2C communication protocol to adapt to a variety of devices. The protocol uses two data lines: serial data bus (SDA) and serial time bus (SCL). The two data lines need to be connected to pull-up resistors to VDD. Multiple sensor devices can share the bus; but only one host device can appear on the bus, the sensor I2C address is 0x15, the I2C read command is 0x2B, and the I2C write command is 0x2A.

If the SCL and DATA signal lines are parallel and very close to each other, it may cause signal crosstalk and communication failure. The solution is to place VDD or GND power signals between the two signal lines, separate the signal lines or use shielded cables Wait. Also, by reducing the SCL frequency may improve the integrity of signal transmission. The sensor needs to be led out, then a 100nF decoupling capacitor should be added between the positive and negative power supply pins for filtering. This capacitor should be as close as possible to the sensor.

4.1 I2C communication interface characteristics and timing

In the I2C bus, the AFS01IA sensor as a slave device supports a communication rate of up to 400kHz bit rate. When the host sends a start signal (low level), the sensor starts to communicate. When the host sends a stop signal (high level), when the communication ends, the start and end signals are only valid when the SCL is high.

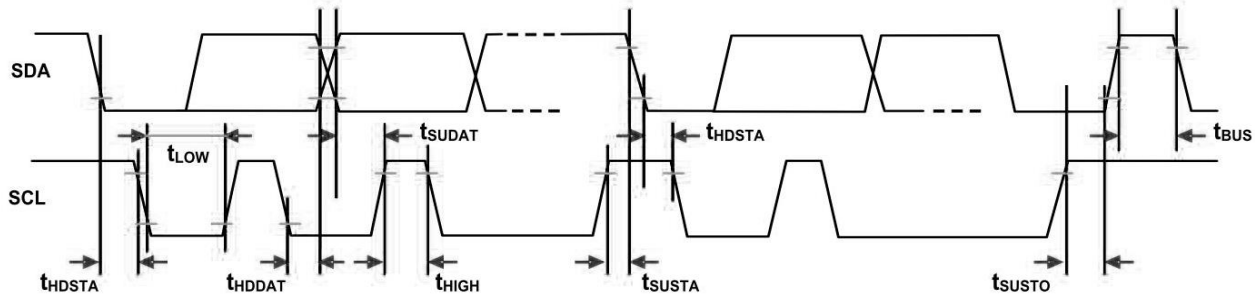


Figure 1: I²C Timing

Table 4: I²C Parameter

Parameter	Condition	MIN	TYP	MAX	Unit
I2C Clock frequency	f_{SCL}	10		400	KHz
Start signal time	t_{HDSTA}	0.8			μs

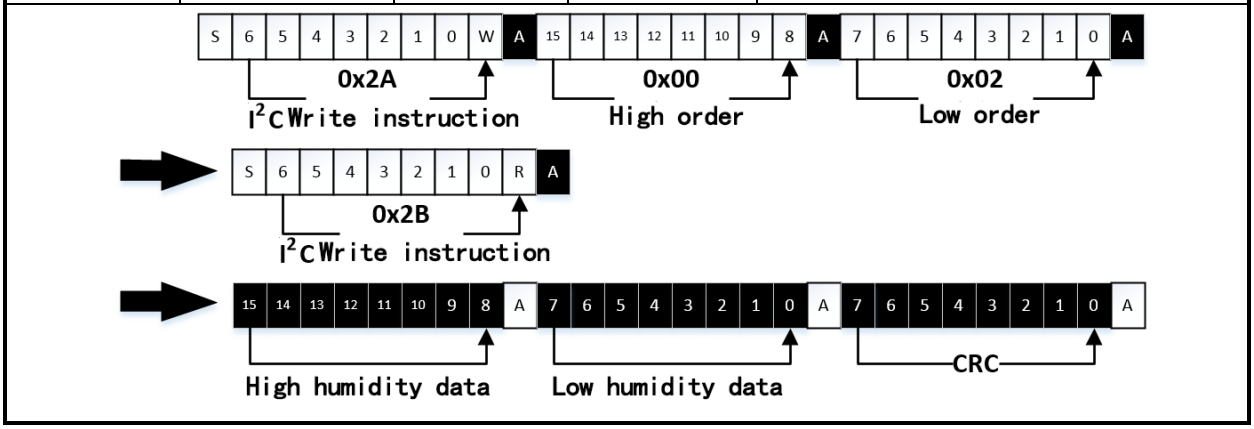
SCL Clock high level width	t_{HIGH}	0.6			μs
SCL Clock low width	t_{LOW}	0.6			μs
Set time relative to SCL edge start condition	t_{SUSTA}	0.1			μs
Data retention time relative to SCL SDA edge	t_{HDDAT}	0		0.5	μs
Data setup time relative to SCL SDA edge	t_{SUDAT}	1			μs
Set time at SCL stop condition	t_{SUSTO}	0.1			μs
Bus idle time between stop condition and start condition	t_{BUS}	1			μs

4.2 Sensor data collection

After the self-test of the AFS01IA sensor, data will be collected in 500ms cycles. At the end of a measurement cycle, the data output register will be refreshed. Users can collect flow data through flow collection instructions. The data unit is sccm, and the instructions are defined as follows:

Table 5 Sensor module self-test instructions

command	Condition	Hex code	Position	Definition
Flow collection	High order	0x00	Bit15:8	Sensor data high
	Low order	0x02	Bit7:0	Sensor data low



4.3 AFS01IA Microflow sensor CRC calculation routine

AFS01IA sensor CRC verification uses CRC8, the initial value is 0XFF, the polynomial is 0x31 (x8 + x5 + x4 + 1), please see the code below for details

```
//**************************************************************
//Function name: Calc_CRC8
//Features    : CRC8 calculation, initial value: 0xFF, polynomial: 0x31(x8 + x5 + x4 +1 )
//Parameter    : u8 *data: CRCCheck the first number; u8 Num: CRC check data length
//Return    : crc: The calculated value of
crc8//**************************************************************
u8 Calc_CRC8(u8 *data, u8 Num)
{
  u8 bit,byte,crc=0xFF;
  for(byte=0; byte<Num; byte++)
  {
    crc^=(data[byte]);
    for(bit=8;bit>0;--bit)
    {
      if(crc&0x80) crc=(crc<<1)^0x31;
      else crc=(crc<<1);
    }
  }
    return crc;
}
```

5、Pin definition

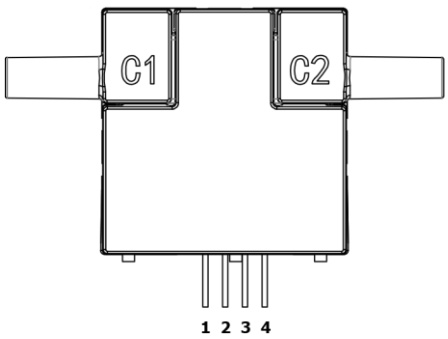


Figure 2：Sensor pinout

Table 6：Pin function description

Pin	name	Type	Description
1	+5V	VDD	Power supply pin
2	SDA	IN/OUT	I2C Digital communication data pin, built-in 4.7K pull-up resistor
3	GND	/	Power ground
4	SCL	IN	I2C Digital communication clock pin, built-in 4.7K pull-up resistor

6、Sensor typical circuit

6.1 Typical circuit Pin connection

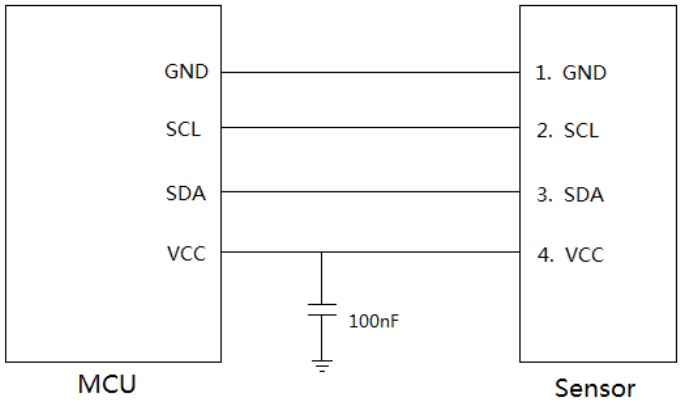


Figure 3：Typical circuit diagram

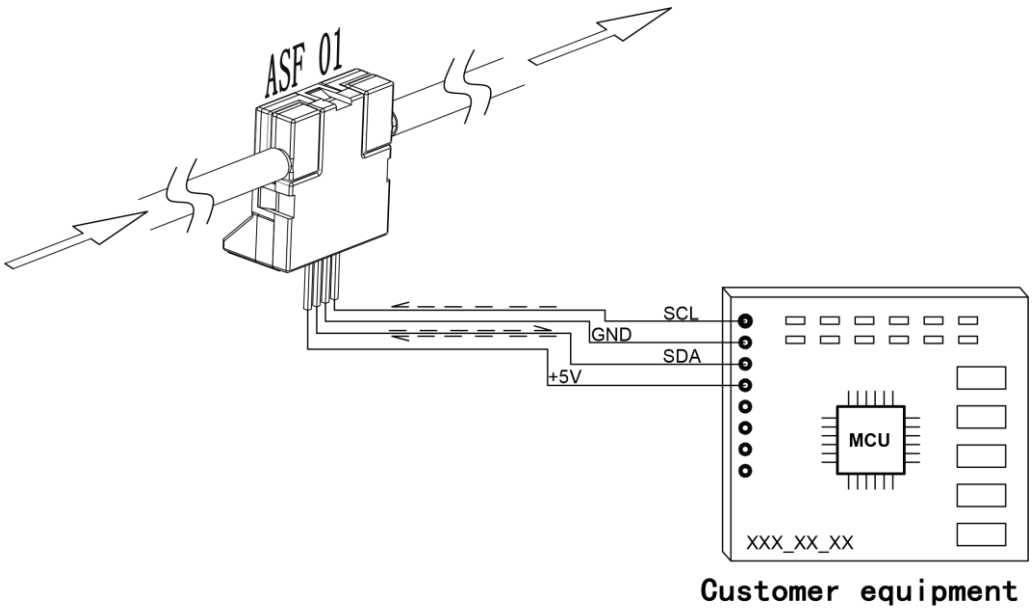


Figure 4：Wiring communication diagram

6.2 Valve control component connection

AFS01IA products are precision measuring instruments, with rich application scenarios and small size. If the user's application scenario requires a gas valve for gas control, the electrical valve assembly should be installed at the gas input, and then connected to the AFS01IA to make it more airtight.

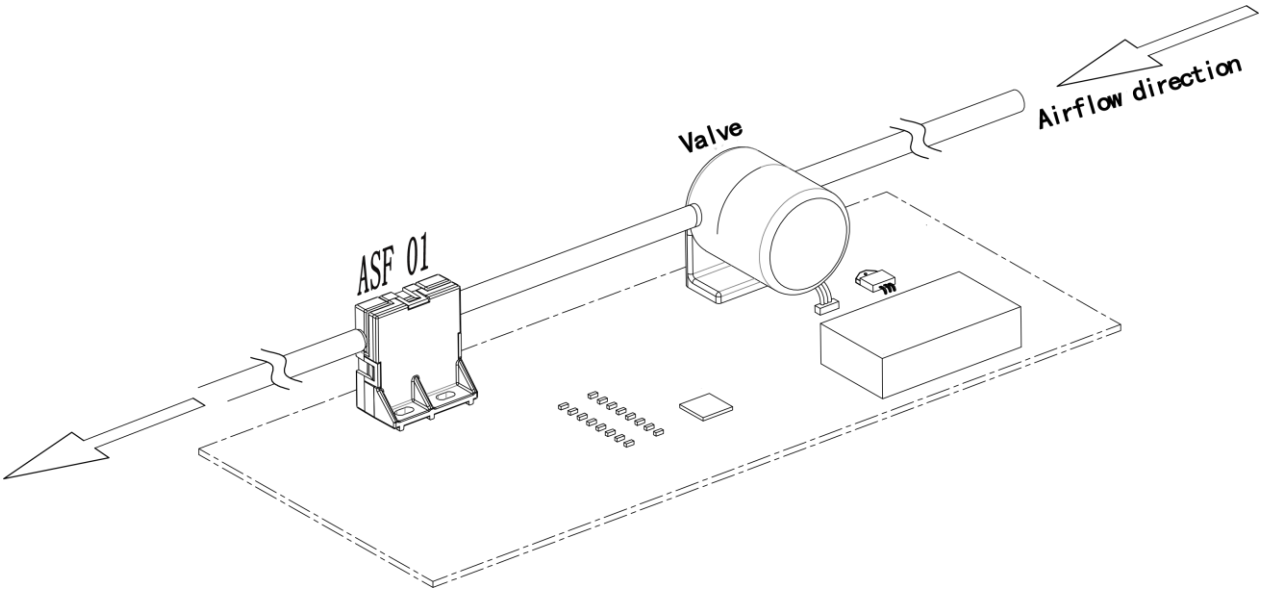


Figure5：Valve-controlled electrical diagram

6.3 Application Case

AFS01IA has a wide range of application fields, for example: in electronic manufacturing, pharmaceutical production equipment, industrial filling precision dispensing, product vacuum packaging, etc.; AFS01IA runs in a fixed installation state as high speed as possible in instruments and equipment, and maintains a straight pipe of more than 10CM Intake air to ensure that the product works in the best condition.

The following picture is the application case of the product in the SMT equipment of precision manufacturing in the electronics industry. The operating state is controlled by the central control CPU to drive the suction device, electric valve group, and functional cylinder. The CPU senses the airflow information of the high-speed rod nozzle through AFS01IA, and coordinates the overall equipment for precision production work.

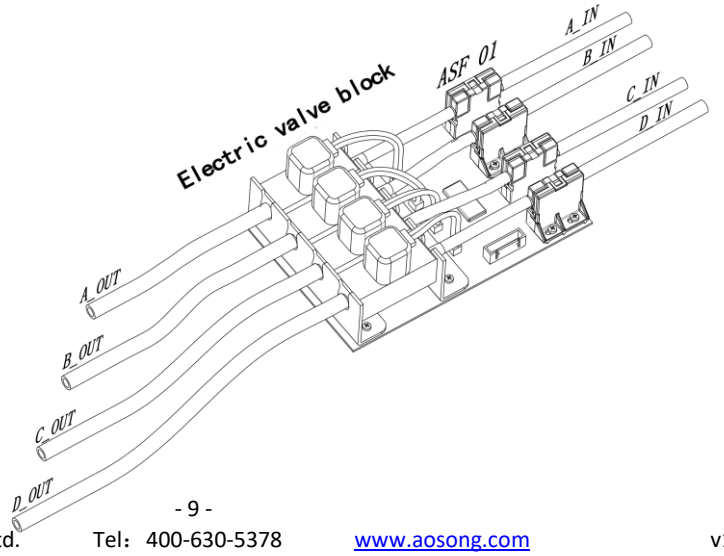


Figure6： AFS01IA Schematic diagram of flow control components

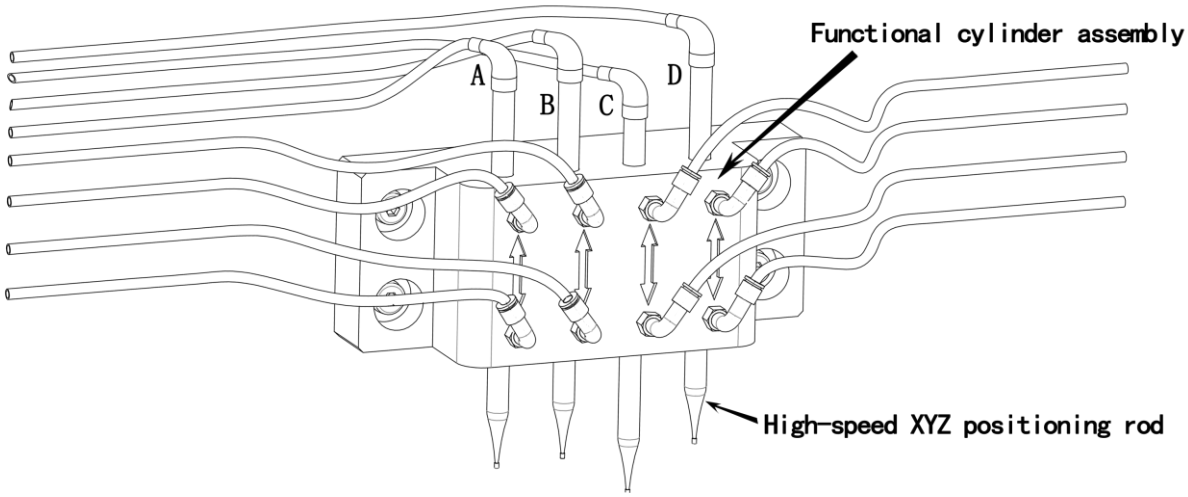
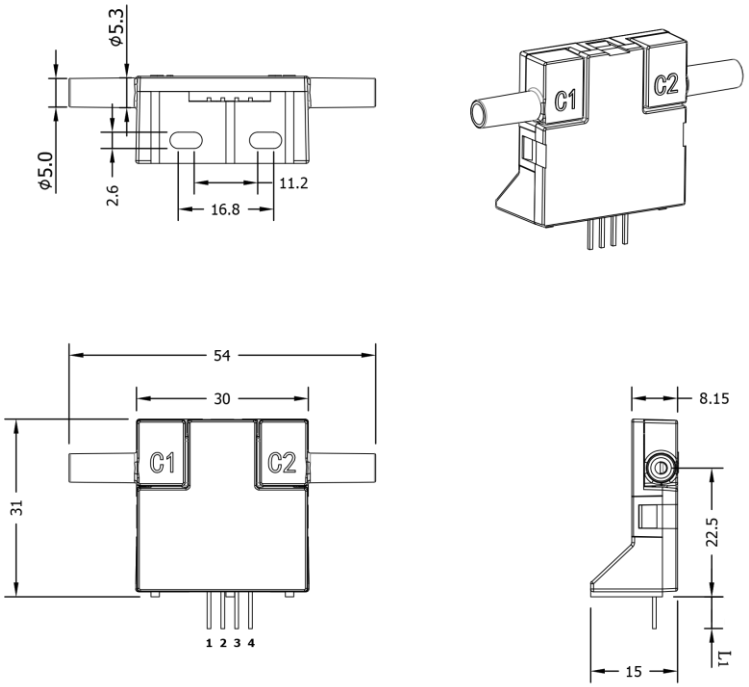


Figure7： Schematic diagram of high-speed precision parts

7、Dimensions (Unit：mm)



L1: Custom length of straight plug terminal is about 5mm～10mm

Figure8： Flow sensor size

8、NOTE

8.1 Standard of the pipeline connection end

To provide more stable measurement conditions, the installation location of the sensor needs to be paid attention to. The sensor should avoid excessive intake pipe twists, otherwise, it will affect the accuracy of the sensor. As shown in the installation diagram of the product pipeline in Figure 10, try to fix it as a straight line when the airflow enters and exits State; and keep the length of L1, L2 greater than 10CM; AFS01IA is a one-way gas input, C1 is the gas input end, C2 is the gas output end;

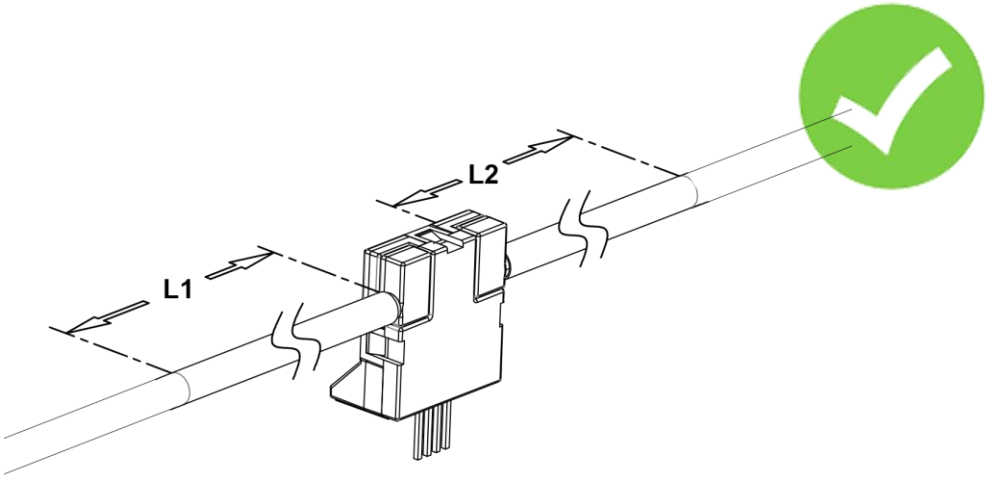


Figure 9： Schematic diagram of correct pipeline connection

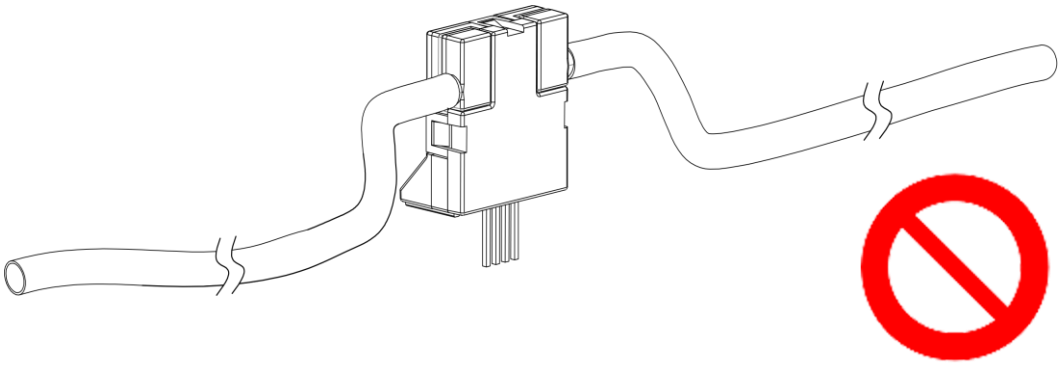


Figure 10： Schematic diagram of error pipeline

8.2 ESD

AFS01IA Exposure to sunlight or strong ultraviolet radiation for a long time will reduce the performance, and the casing will be aging.

AFS01IA Meet the following anti-static standards:

- AEC-Q-100-002 (4kV HBM)
- AEC-Q-100-003 (200V MM)

Although the sensor meets these specifications, it does not mean that the sensor itself is immune to ESD. When installing the sensor, please place it in an anti-static tray to prevent electrostatic discharge. To avoid damage to the sensor, personnel need to wear an electrostatic bracelet or wear insulated gloves before touching the sensor.

8.3 I2C communication

The I2C wiring from the sensor to the processor needs to be shortened as much as possible. The maximum recommended length is no more than 30cm. If the lead exceeds 10cm, you need to widen the data line when designing the circuit board to ensure the normal connection of the data.

9. Accuracy statement

AFS01IA sensor is measured and calibrated strictly by the AS-WI-RD3370 precision measurement guidance document. The performance of the sensor under other test conditions is not guaranteed and cannot be used as part of the sensor's performance. Especially for the specific occasions requested by users, no commitment is made.

10. License Agreement

11. Warning and personal injury

Do not apply this product to safety protection devices or emergency stop equipment, and any other applications that may cause personal injury due to the failure of this product. Do not apply this product unless there is a special purpose or authorization to use it. Before installing, handling, using, or maintaining the product, refer to the product datasheet and application guide. If you do not comply with this recommendation, the company will not be liable for all compensation for the resulting personal injury or death and will be exempted from company managers and employees and affiliated agents, distribution Any claims that may be incurred by businesses, etc., including various costs, compensation costs, lawyer fees, etc.

12.Quality assurance

The company provides a 12-month (one-year) quality guarantee for its direct purchasers of products (calculated from the date of shipment). The technical specifications of the product's data manual published by the company shall prevail. If the quality of the product is proved to be defective within the warranty period, the company will provide free repair or replacement. Users need to meet the following conditions:
① The product shall notify the company in writing within 14 days of finding the defect;
②The product should be sent back to the company by the buyer;
③ The product should be within the warranty period.

The company is only responsible for those products that are defective when applied to meet the technical conditions of the product. The company does not make any guarantees, guarantees, or written statements about the application of its products in those special applications. At the same time, the company does not make any commitment to the reliability of its products applied to products or circuits.