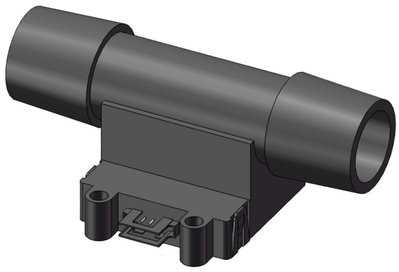
XGZF4000 AIR FLOW SENSOR

FEATURES



- MEMS mass gas flow technology
- Wide range from 5 to 500SLM
- Analog or Digital output optional
- Unidirectional and bidirectional flow optional
- Low working voltage optional
- Fast Response
- High sensitivity&accuracy
- Reliable and stable performance

APPLICATIONS

- Portable Ventilator, Household Oxygen Generator
- CPAP Device
- Anesthesia for childbirth
- Critical care equipment
- HVAC
- Air purifier
- Environmental climate monitoring
- Fuel cell control and
- More applications for air flow control and measurement

INTRODUCTION

The XGZF4000 series measures the flow of gases in flow channels according to the thermodynamic principle and is capable of measuring non-corrosive gases such as air, oxygen and nitrogen with high accuracy. The built-in MEMS thermal sensor chip and high performance CMOS microprocessor, combined with a unique calibration program, can output real-time accurate flow signals.

ELECTRONIC PERFORMANCE

Unless otherwise specified, measurements were taken with a supply voltage of (8～24)VDC (Default: 12 VDC) at a temperature of 0±1℃ and humidity ranging from 40％～60％RH

Specifications		Min.	Typ.	Max	Unit
Accuracy	≤100SLM	-	-	±1.5	%FS
	＞100SLM&≤200SLM	-	-	±2.5	
	＞200SLM≤500SLM	-	-	±3.5	
Offset Drift		-	0.2	-	%FS
Resolution		-	0.1	-	%FS
Range①		0~5/12/20/35/50/100/150/200/300/450/500			SLM
Analog Output②		0.5		4.5	V
Response Time②	Standard Version		50		ms
	Fast Version		10		ms
I2C Interface	Clock Pulse Frequency③		-	100	KHz
	Input Voltage(Low Level)	-	-	0.5	
	Input Voltage(High	4	-	5.5	
	Output Voltage(Low	-	-	0.5	
	Output Voltage(High	4	-		
Working Voltage	Standard Version	8	12	24	V
	Low Voltage	4.75	5	5.25	V
Working Current		5	15	30	mA
Working Pressure		-	-	0.2	Mpa
Compensation Temp.		0	-	50	℃
Working Temp.		0	-	50	℃
Storage Temp.		-20	-	85	℃
Electronic Interface		2.54mm -5 PIN			
Materials		Silicon, epoxy resin, nylon resin (PA66) + glass fibre (GF), FR4			℃

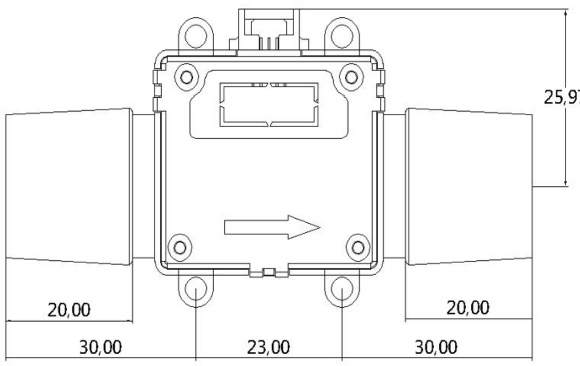
① Range 0 - (5 to 500SLM) customizable

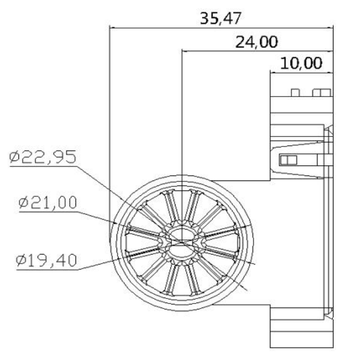
② This specification is for analogue output only, other output voltages(eg.1-5V) are available on request

③ This specification is for digital output only

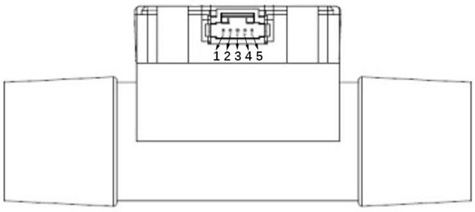
④ The SDA/SCL is internally pulled up to 5V, no external pull-up resistor is required.

DIMENSION (Unit:mm Unspecified Tolerances:±0.25mm)





PIN CONNECTION&DEFINITION



2.54mm 5 Pin Dubond Latch Connector

Analog Output PIN Definition

1	2	3	4	5
Vout	VDD	GND	NC	NC

Digital Output PIN Definition

1	2	3	4	5
NC	VDD	GND	SDA	SCL

ORDER GUIDE

XGZ F 4 200 F L B - A0545 - A

XGZ	Company Product Part Code
F	Flow Sensor
4	4000 Series
200	Range: 200SCL
F	Default: Standard Version; F: Fast Response Version
L	Default: 8V ~24Vdc Power Supply; L: 5V±0.01Vdc Power Supply
B	Default: Unidirectional; B:Bidirectional
A0545	Output Type A0545：Analog,0.5 ~4.5V; A1050: Analog 1.0 ~5.0V; D: Digital(I2C)
A	Media A ： Air N: Nitrogen O:O2

RANGE EXAMPLE

Test Condition：VIN=12±0.01VDC，Ta=25℃; RH: 40%<RH<60% Max. Working Temp. Range: -25℃ to +85℃

P/N	Range	Unit
XGZF4005	0-5	SLM
XGZF4012	0-12	SLM
XGZF4020	0-20	SLM
XGZF4035	0-35	SLM
XGZF4050	0-50	SLM
XGZF4100	0-100	SLM
XGZF4150	0-150	SLM
XGZF4200	0-200	SLM
XGZF4300	0-300	SLM
XGZF4450	0-450	SLM
XGZF4500	0-500	SLM

FLOW CALCULATION

Analog Output

XGZF4200-A-A@0.5~4.5 V(Unidirectional)

Flow rate = [(Vout - 0.5 V)/4 V] x full scale flow rate

For example: XGZF4200-A-A, when reading the output voltage of 2.5V,

The Instantaneous flow rate is [(2.5V - 0.5V)/4V x 200 SLM] = 100 SLM

XGZF4200-B-A-A@0.5~4.5 V(Bidirectional)

Flow rate = [(Vout - 0.5 V)/2V] x full scale flow rate

For example: XGZF4200-B-A-A, when reading the output voltage of 1.0V,

The Instantaneous flow rate is [(1.0V - 2.5V)/2V x 200 SLM] = -150 SLM

Digital Output

XGZF4200-D-A

Flow rate = [I2C output reading]/proportionality factor K

Example: XGZF4200-D-A, when reading output 11055

Instantaneous flow rate is [11055]/100 = 110.55 SLM

K Full Scale Range	K
10SLM≤ flow rate < 50SLM	1000
50SLM≤ flow rate≤300SLM	100
300SLM < flow rate≤500SLM	10

XGZF4020-B-D-A

Flow rate = [I2C output reading]/proportionality factor K

Example: XGZF4200-B-D-A, when reading output 13040

Instantaneous flow rate is [13040]/1000 = 13.04 SLM

K Full Scale Range	K
10SLM≤ flow rate < 30SLM	1000
30SLM≤ flow rate≤300SLM	100
300SLM < flow rate≤500SLM	10

I2C PROTOCOL

The I2C protocol is a standard protocol for the exchange of information between integrated circuits or functional units; the I2C bus uses a data line (SDA), plus a clock line (SCL) to complete the transmission of data and the expansion of peripheral devices. the I2C bus has three data transmission speeds: standard, fast mode and high speed mode. The standard is 100 Kbps and the fast mode is 400 Kbps (this sensor only supports the standard mode transmission speed). The addressing of the individual nodes is soft addressing, which saves on chip select lines. The standard addressing byte SLAM is 7 bits and can address 127 units. The default I2C address is **0x50**

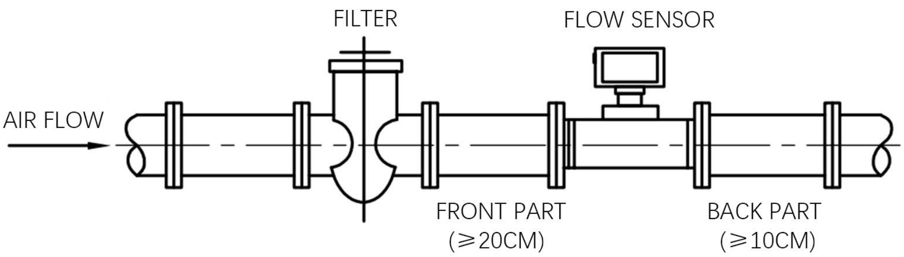
I2C Read FLOW Data Communication Format

<table>
<tr><td colspan="29">7 BIT SLAVE ADDRESS FOLLOWED BY 2 BYTES OF FLOW DATA (READ MODE)</td></tr>
<tr><td colspan="29">READ FLOW DATA</td></tr>
<tr><td>S</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>R</td><td>A</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td>A</td><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>N</td><td>S</td></tr>
<tr><td></td><td colspan="7">I2C SLAVE ADD</td><td></td><td></td><td colspan="8">FLOW HIGH BYTE(8 BIT)</td><td></td><td colspan="8">FLOW LOW BYTE(8 BIT)</td><td></td><td></td></tr>
<tr><td></td><td>1</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td></td><td></td><td colspan="8">1ST</td><td></td><td colspan="8">2ND</td><td></td><td></td></tr>
</table>

- S : START Condition
- 6 : SLAVE Address Bit
- R : READ Bit(Read=1)
- A : ACK from SLAVE
- 15 : Date Bit
- A : ACK from Master
- N : NACK from Master
- S : STOP Condition

The flow data is divided into 2 bytes, the first byte is the high byte of the flow data, the second byte is the low byte of the flow data, the flow data is K (see airflow calculation formula) times the actual flow rate. The default unit of flow data is L/M (litres/minute), for example, when K=100, read the hexadecimal data as 03E8, then convert to decimal current actual flow rate is 10.00L/M, if you need the flow rate unit is M3/H (cubic metres/hour), then the following formula can be calculated (M is cubic metres/hour flow rate, L is litres/minute flow rate): M=L/ 1000*60, which is calculated when the flow rate is 0.6M3/H.

INSTALLATION NOTES



For XGZF4000 series installation, as above show, the recommended pipe length is the first 10 and 5, that is, the inlet pipe length is 10 times the product diameter, and the outlet pipe length is 5 times the diameter; the product is installed concentrically, which is reliable and firm; the airflow direction is consistent with the product indication direction; The pin connection needs to correspond to the product pin definition to ensure correct operation after power on.

OPERATION NOTES

1. The product can be used normally only when it is suitable for the environment defined in this specification
2. Pay attention to the gas flow direction sign during installation, and the connection and leak detection should be carried out in accordance with the corresponding regulations.
3. During the use of the product, it is prohibited to install pipelines, clean pipelines or other improper operations that introduce a large amount of impurities at the same time; it may cause damage to the product.
4. If the gas medium contains water vapor and impurities, it may cause the sensor's sensitivity characteristics to decrease or damage.
5. Pay attention to the positive and negative poles of the power supply. If the positive and negative poles are connected reversely, the internal circuit of the sensor may be burned out and the normal use of the product will be affected.

【 SAFETY NOTES 】

Using these sensors products may malfunction due to external interference and surges, therefore, please confirm the performance and quality in actual use. Just in case, please make a safety design on the device (fuse, circuit breaker, such as the installation of protection circuits, multiple devices, etc.), so it would not harm life, body, property, etc even a malfunction occurs.

To prevent injuries and accidents, please be sure to observe the following items:

●The driving current and voltage should be used below the rated value.

● Please follow the terminal connection diagram for wiring. Especially for the reverse connection of the power supply, it will cause an accident due to circuit damage such as heat, smoke, fire, etc.

●In order to ensure safety, especially for important uses, please be sure to consider double safety circuit configuration.

●Do not apply flow above the maximum applied flow. In addition, please be careful not to mix foreign matter into the flow medium. Otherwise, the sensor will be discarded, or cause an accident.

●Be careful when fixing the product and connecting the gas inlet. Otherwise, accidents may occur due to sensor scattering and the blowing out of the media.

●Because the sensor PIN is sharp, please be careful not to hurt your body when using it.

【 WARRANTY 】

The information in this sheet has been carefully reviewed and is believed to be accurate; however, no responsibility is assumed for inaccuracies. Furthermore, this information does not convey to the purchaser of such devices any license under the patent rights to the manufacturer. CFSensor reserves the right to make changes without further notice to any product herein. CFSensor makes no warranty, representation or guarantee regarding the suitability of its product for any particular purpose, nor does CFSensor assume any liability arising out of the application or use of any product or circuit and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Typical parameters can and do vary in different applications. All operating parameters must be validated for each customer application by customer’s technical experts. CFSensor does not convey any license under its patent rights nor the rights of others.

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CODE：Digital output for reading flow sensor module standard programs

```
//Read flow sensor code example

//SDA，SCL corresponds to IO interface of Microcontrollers respectively

//Master send 0xA1 to Slave，Slave send back 2 bytes to Master


#include"IIC_Master.h"
#define SDA PA0
#define SCL PA1
Unsigned int IIC_RX_Buf[2];
bit ErrorBit;
void I2C_Init(void)
{
   SDA_INPUT=0; //Program initialization sets the SDA pin to output
   SCL_INPUT=0; //Program initialization sets the SCL   pin to output
   SDA=1;
   SCL=1;
}
Void I2C_Start(void)
{
   SDA=1;
   Delay_Us(20);
   SCL=1;
   Delay_Us(20);
   SDA=0;
   Delay_Us(20);
   SCL=0;
   Delay_Us(20);
}




//-----------------------------------------------------------------------------
void I2C_Stop(void)
{
   SCL=0;
   Delay_Us(20);
   SDA=0;
   Delay_Us(20);
```

```
    SCL=1;
    Delay_Us(20);
    SDA=1;
    Delay_Us(20);

}
//---------------------------------------------------------------------------
-
void I2C_ACK(void)
{
    SDA=0;
    Delay_Us(20);
    SCL=1;
    Delay_Us(20);
    SCL=0;
    Delay_Us(20);
}
//---------------------------------------------------------------------------
-
void I2C_NoAck(void)
{
    SDA=1;
    Delay_Us(20);
    SCL=1;
    Delay_Us(20);
    SCL=0;
    Delay_Us(20);
}
//---------------------------------------------------------------------------
-
Unsigned int I2C_ReadByte(void)
{
    Unsigned int ucValue=0;
    Unsigned int ucIndex;

    SDA=1;
    Delay_Us(20);
    SDA_INPUT=1; // Set SDA PIN as input
    Delay_Us(20);
    for ( ucIndex = 0; ucIndex < 8; ucIndex++ )
    {
        ucValue <<= 1;
        SCL=0;
        Delay_Us(20);
```

```
    SCL=1;
    Delay_Us(20);
    if(IIC_DAT==1) // IIC_DAT, to read the level of the SDA pin after setting the SDA as an input
    { ucValue = ucValue |0x01;}
    else
    { ucValue = ucValue & 0xfe;}
    Delay_Us(20);
    SCL=0;
    Delay_Us(20);
  }
  SDA_INPUT=0; //Set SDA as output
  Delay_Us(20);
  return ucValue;
}
//-----------------------------------------------------------------------------
void I2C_WriteByte( unsigned int ucData )
{
  u8 i;
  for( i = 0; i < 8; i++ )
  {
    SCL=0;
    Delay_Us(20);
    if((ucData & 0x80) == 0x80)
    {
      SDA=1;
      Delay_Us(20);
    }
    else
    {
      SDA=0;
      Delay_Us(20);
    }

    SCL=1;
    Delay_Us(20);

    SCL=0;
    Delay_Us(20);
    ucData <<= 1;

  }
  SCL=1;
  Delay_Us(20);
  ErrorBit = IIC_DAT;
```

```
    Delay_Us(20);
    SCL=0;
    Delay_Us(20);
}

void iic_master_proc(void)
{
    Unsigned int count=2,i;
    I2C_Init() ;
    I2C_Start();
    I2C_WriteByte(0xa1); //write address 0xA1
    for(i = 0;i < count;i++)
    {
        IIC_RX_Buf[i] = I2C_ReadByte();
        if(i < (count -1)) I2C_ACK();
        else                I2C_NoAck();
    }
    I2C_Stop();

}
```