ASAIR®

Absolute Humidity Sensor

product manual

AHS01IB

For more detail please check：www.aosong.com

Features

- Working power voltage:+5V
- Operating temperature: -5 to +200℃

（Humidity detection part）

- fully calibrated
- I2C digital interface communication
- Power consumption:120mW(maximum)
- Zero-free drift
- Very long operation life
- High resistance to pollution
- Low humidity lag error

Description

AHS01IB is an absolute humidity sensor with ultra-high response speed, high temperature resistance, high accuracy and fully calibration. Modern manufacturing process ensures high reliability and excellent long-term stability. The sensor includes a humidity detection sensor connected to a CMOS microprocessor with a high performance integrated 24bitAD.The product has the advantages of excellent quality, ultra-high response speed, strong anti-interference ability and very high cost effective. With high integration performance, it is perfectly meet the requirements for high-quality mass production.

AHS01IB has I2C digital interface with very small size and very low power consumption. The working voltage for AHS01IB is 5 Volt supply voltage, it could be used to all kinds of common application scenario provides low cost and very low power consumption advantages. AHS01IB has been calibrated in high accuracy constant temperature and humidity chamber from our factory, the output is the real value of environmental humidity, users can get the accurate humidity value directly without any signal processing, which help customers to save the costs and make the further job much easier.

Applications

Microwave Humidity Control, Dryer Humidity Detection, Oven Smart Control, Industrial Measurement, Air Conditioning and Moisture Control, Physical and Chemical Instruments, Steam Bath, etc.

1.Sensor Accuracy

1.1 Accuracy parameters

Table1: AHS01IB performance table

Parameter	Condition	TYP	Units
Operating Range	1atm	0～∞	actual value
Typical output	+60℃,30%～+60℃,60%	900~1300	actual value
Accuracy	1atm	±200	actual value
Repeatability	1atm	±5%	actual value
Stabilization time	Power on	8±5	second
Humidity response	90% response	12±5	second

1.2 Sensor material characteristics

Table2: Sensibility and materials

Parameter	Condition	TYP
Sensibility to gas （at 1000ppm）	Carbon dioxide	-60
	Ethyl alcohol	-60
	Isobutane	-60
RoHS	——	RoHS compliant
Wire for sensor	——	high temperature resistant shielded wire

1.3 Temperature and humidity conditions

Table3: AHS01IB Temperature and humidity conditions

Parameter	Condition	TYP	Units
Operating Temperature Range	Tsensor	-5～+200	℃
CPU Temperature Range	Twork	-20～+85	℃
Storage Temperature	Tstor	-20～+85	℃
Storage humidity	Hstor	20%～60%	RH

2. Sensor Electrical Characteristics

Electrical characteristics depend on the power supply. Table 4 shows the electrical characteristics of AHS01IB. If not indicated, the power supply voltage is 5v.

Table4: AHS01IB Electrical characteristics

Parameter	Condition	MIN	TYP	MAX	Units
Communication			I2C		
Supply Voltage	VDD	4.75	5	5.25	V
I2C Level	High	4	-	VDD	V
	Low	GND	-	0.8	V
Sampling period		0.5	1		second
Power consumption	normal		23	30	mA
	standby		1		mA
I2C speed			100	400	Kb/s

3.Sensor parameters limit value

Table5: Parameters Limit Value

Parameter	Condition	MIN	TYP	MAX	Units
Supply Voltage	VDD	-0.3		5.5	V
Storage Temperature Range	TSTOR	-20		85	℃

Note: AHT20 works beyond the above parameters, can cause a certain degree of irreversible damage to itself.

4. Sensor communication

4.1 Overview of I2C bus

AHS01IB sensor adopts standard I2C communication protocol, which is applicable to a variety of devices. Two data cables are used in the protocol: serial data bus (SDA) and serial time bus (SCL), and two data cables need to be connected to the 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 instruction is 0x2B, and the I2C write instruction is 0x2A.

If the SCL and DATA signal lines are parallel and very close to each other, signal crosstalk and communication may fail. The solution is to place VDD or GND power signals between the two signal lines, separate the signal lines for processing or use the shield cable.In addition, the integrity of signal transmission may be improved by reducing the frequency of SCL.The sensor needs to be wired out, so a 100nF de-coupling capacitance should be added between the pins of the positive and negative power supply for filtering.The capacitance should be as close to the sensor as possible.

4.2 I2C communication interface features and timing

AHS01IB sensor is used as a slave device to support the communication rate up to 400kHz bit rate.When the host sends the start signal (low level), the sensor starts communication. When the host sends the stop signal (high level), when the secondary communication ends, the start and end signals are only valid when the SCL is high power.

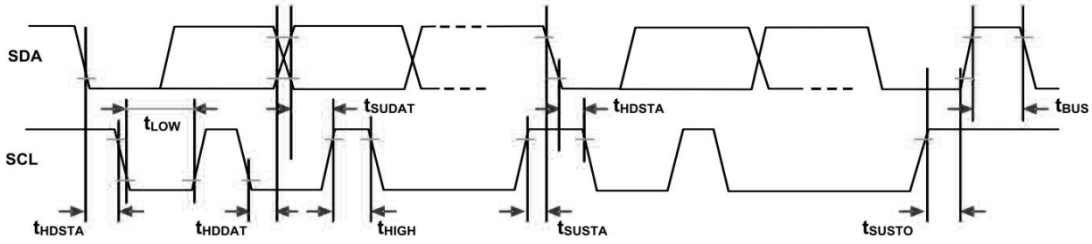


Table 6 features and timing

Parameter	Condition	MIN	TYP	MAX	Units
I2C clock frequency	f_{SCL}	10		400	KHz
Start time	t_{HDSTA}	0.8			μs
SCL clock high level width	t_{HIGH}	0.6			μs
SCL clock low level width	t_{LOW}	0.6			μs
Set time relative to SCL edge start condition	t_{SUSTA}	0.1			μs
Data save time relative to the SCL SDA edge	t_{HDDAT}	0		0.5	μs
The data setting time is relative to the SCL SDA edge	t_{SUDAT}	1			μs
Stop condition setting time in SCL	t_{SUSTO}	0.1			μs
Bus free time between stop and start conditions	t_{BUS}	1			μs

4.3 I2C communication

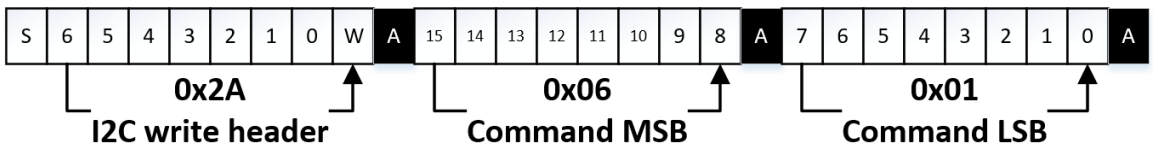
When the host initiates the start signal, and the operation mode of the SCL bus satisfies the above time parameter conditions, the sensor will start communication, and the command or data will always be sent when the SCL is rising, until the sensor receives the stop signal sent by the host and ends the communication.
After the initial signal is sent, the host sends an 8-bit read/write instruction, which contains a high 7-bit address, plus the 8-bit read (1)/ write (0), which will directly determine the direction of data transmission.When the read instruction 0X2B is sent, it means that the host reads the slave data and when the write instruction 0X2A is sent, it means that the host writes the sensor data.
The communication unit for reading and writing data of subsequent sensors includes 8 bit data bits, and 1 bit response bits; when the response bit is 0(low level), it is ACK(data response) for communication; and when the response bit is 1(high level), it is NACK(data no response).When an ACK signal is received from the machine to the host, the next data unit will be sent, or when the host sends a stop signal, the communication will be terminated.

4.4 Start of measurement instruction

AHS01IB has been in the state of waiting for the host to send the start command for measurement and collection.The CPU inside the sensor can now parse the rest of the instructions, but the rest can't start the data collection.
After the host sends the start command for collection, it can wake up AHS01IB for self-inspection and collect data periodically. The start instruction for measurement is defined as follows:

Table 7 Start of measurement instruction

Command	Conditions	Hexadecimal code
Start of measurement instruction	Command MSB	0x06
	Command LSB	0x01

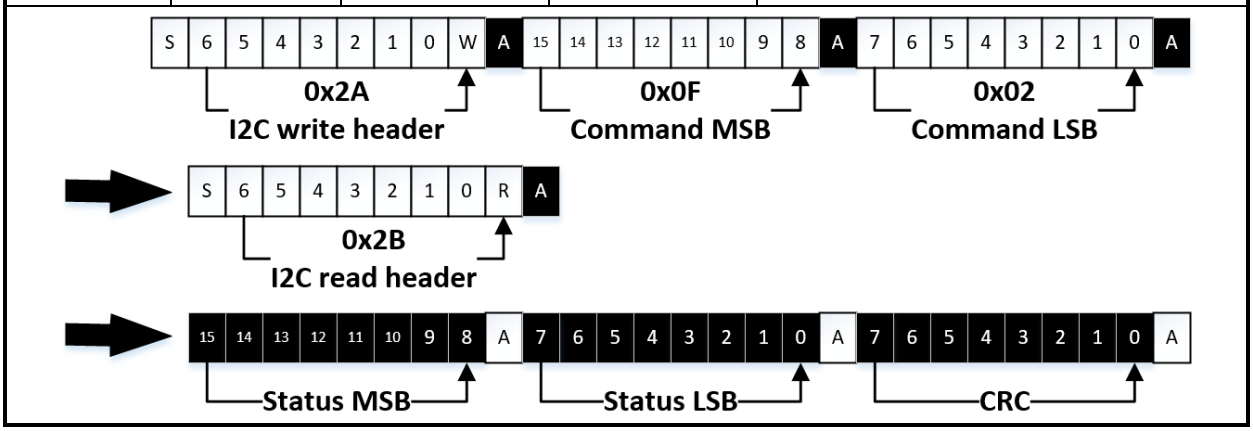


4.5 Sensor status register

The status register contains the sensor status bit (bit15:14) and the reserved data bit (bit13:0), as defined below.

Table 8 description of sensor status register

Command	Conditions	Hexadecimal code	Bit	Field description
Query sensor status	Command MSB	0x0F	Bit15:14	00: Sensor to be tested 01: Sensor passed the test 10: Sensor problem
	Command LSB	0x02	Bit13:0	Reserved



When receiving the start instruction of measurement, the module will empty the status register of the Sensor, automatically open part of the Sensor power supply, and start the self-check of the Sensor. After the self-check, the self-check result of the Sensor will be written into the status register of the Sensor.

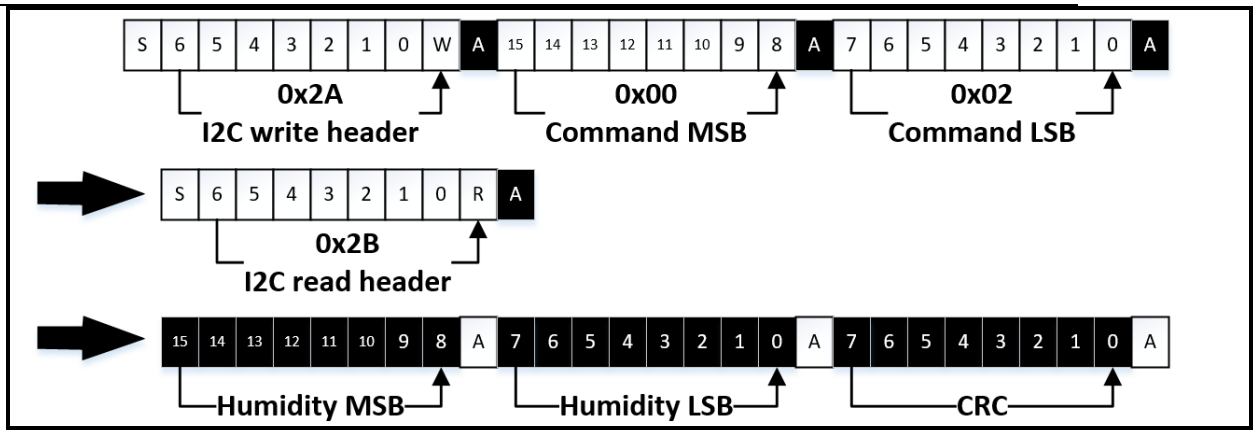
After completion of self-inspection, if the sensor is normal, the module will conduct zero alignment automatically and start periodic sensor data collection automatically.

4.6 Humidity data collection

After self-inspection of the absolute humidity sensor module, the data will be collected at a period of 500ms. At the end of the measurement cycle, the data output register will be refreshed.Humidity collection instruction is defined as follows

Table 9 instructions of data collection

Command	Conditions	Hexadecimal code	Bit	Field description
Humidity acquisition	Command MSB	0x00	Bit15:8	Humidity MSB
	Command LSB	0x02	Bit7:0	Humidity LSB



4.7 End of measurement instruction

When the user does not need the module to work, the sensor power can be cut off by the end of measurement instruction, and the CPU will stop the collection of humidity and enter the low-power waiting mode.Humidity collection instruction is defined as follows

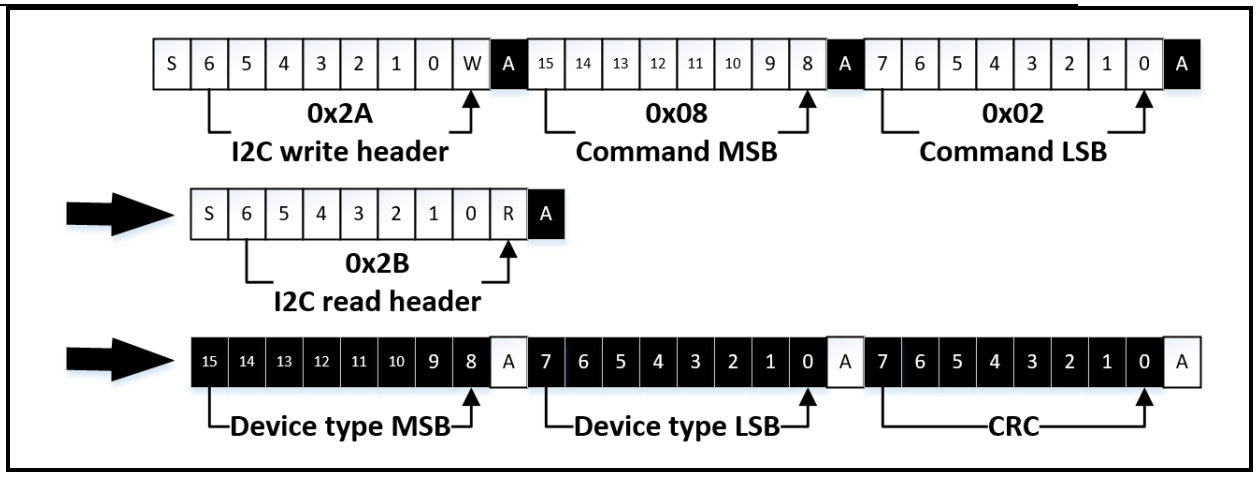
Table 10 instructions for end of measurement

Command	Conditions	Hexadecimal code
End of measurement instruction	Command MSB	0x07
	Command LSB	0x01

4.8 Read device type

Table 11 instructions for device model reading

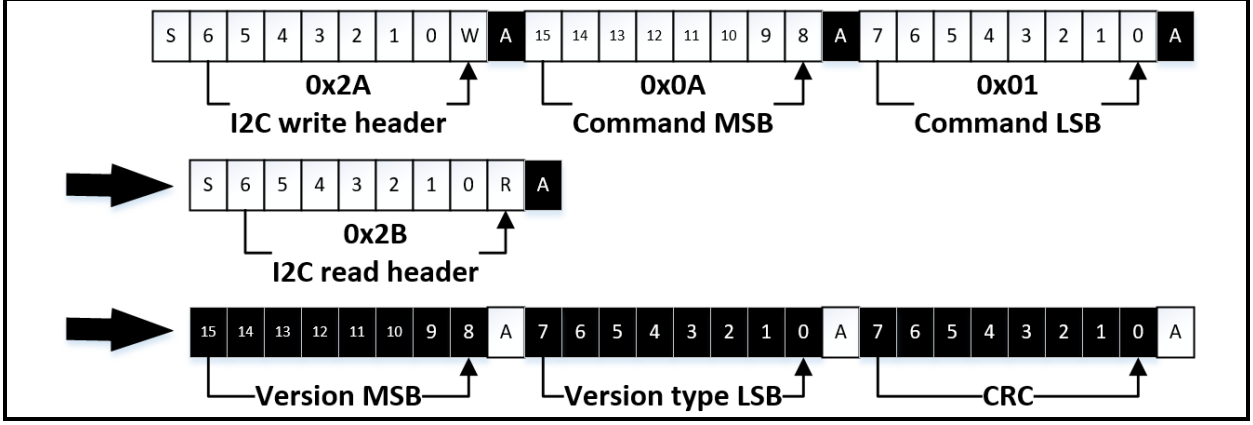
Command	Conditions	Hexadecimal code
Read device type	Command MSB	0x08
	Command LSB	0x02



4.9 Read the module version

Table 12 version number reads the description

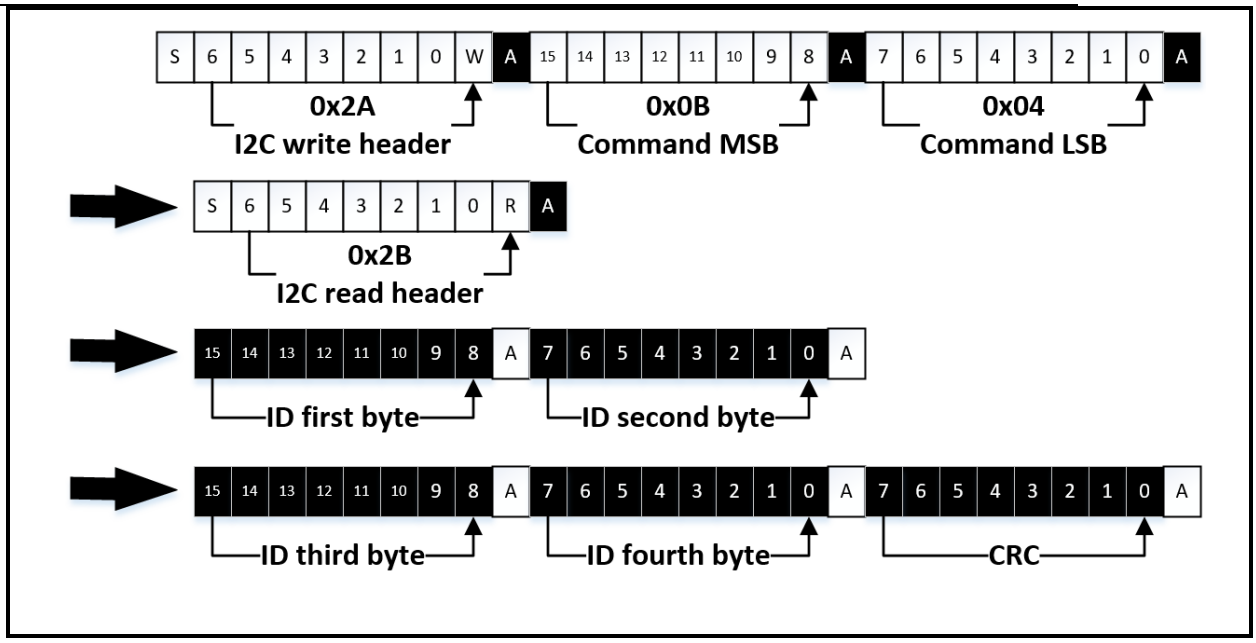
Command	Conditions	Hexadecimal code
Read the module version	Command MSB	0x0A
	Command LSB	0x01



4.10 Read device ID

Table 13. Description of the query instruction with ID number

Command	Conditions	Hexadecimal code	Bit	Field description
Read device ID	Command MSB	0x0B	Bit31:24	**ID first byte**
			Bit23:16	**ID second byte**
	Command MSB	0x04	Bit15:8	**ID third byte**
			Bit7:0	**ID fourth byte**



4.11 AHS01IB sensor I2C register definition

Table 14 general table of register

Read sensor frame format: host frame format: (SLA+W)+ start address + register number +(SLA+R)+delay+ return data +CRC8							
Write sensor frame format: host frame format: (SLA+W)+ start address + register number +(SLA+W)+ write data +CRC8							
List of sensor registers:							
Register	Adr	Description	Adr	Description	Adr	Description	Adr
Humidity MSB	0x00	device type MSB	0x08	Status LSB	0x10	Reserved	0x18
Humidity LSB	0x01	device type LSB	0x09	Reserved	0x11	Reserved	0x19
Reserved	0x02	version	0x0A	Reserved	0x12	Reserved	0x1A
Reserved	0x03	ID(24-31) Bit	0x0B	Reserved	0x13	Reserved	0x1B
Reserved	0x04	ID(16-23) Bit	0x0C	Reserved	0x14	Reserved	0x1C
Reserved	0x05	ID(8 - 15) Bit	0x0D	Reserved	0x15	Reserved	0x1D
Start CMD	0x06	ID(0 - 7) Bit	0x0E	Reserved	0x16	Reserved	0x1E
End CMD	0x07	Status MSB	0x0F	Reserved	0x17	Reserved	0x1F

4.12 AHS01IB sensor CRC sample program

AHS01IB sensor CRC validation USES CRC8 with initial value of 0XFF and polynomial of 0x31 (x8 + x5 + x4 + 1). Please see the code below for details

```
//**********************************************************
//Function name: Calc_CRC8
//Function: CRC8 calculation, initial value: 0xFF, polynomial: 0x31(x8 + x5 + x4 +1)
//Parameter: u8 *data: the first number of the CRC calibration;U8 Num: CRC calibration data length
//Return: CRC: value of calculated 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 1: Pin Assignments

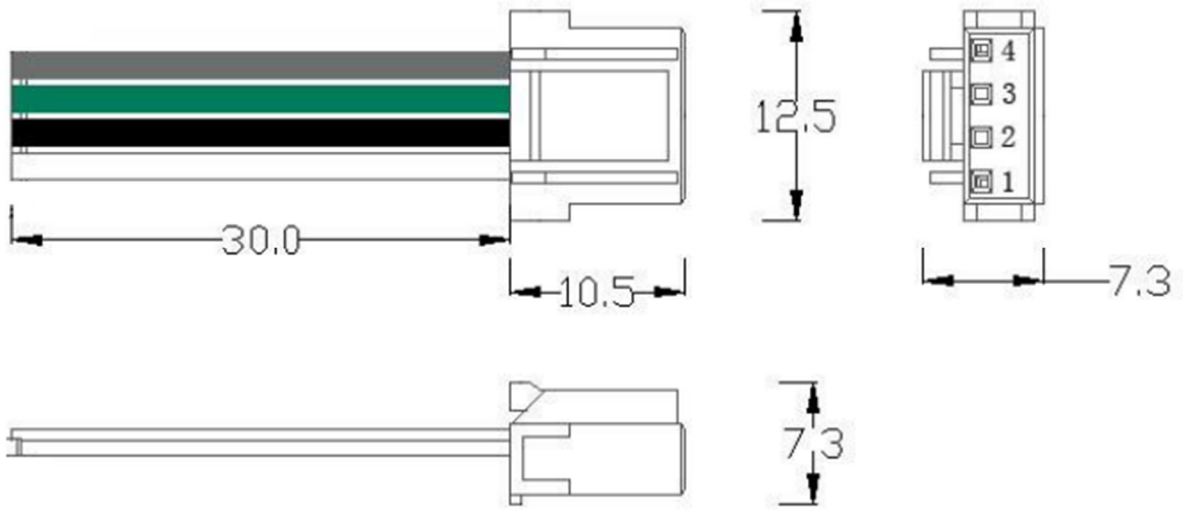
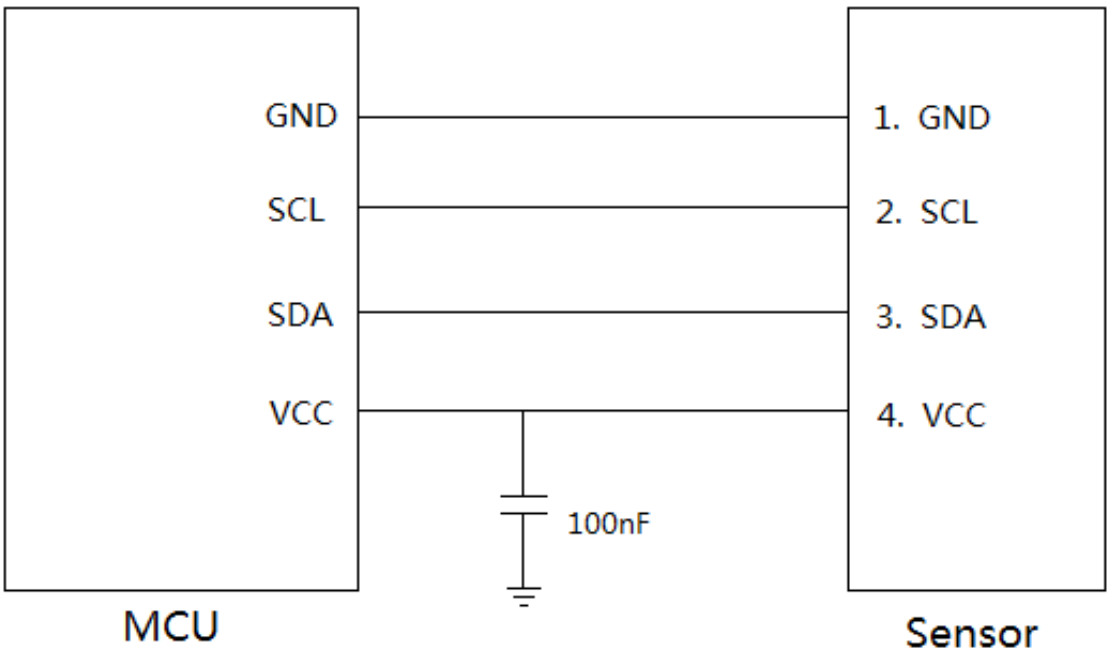


Table 15 Pin Descriptions

Pin Number	Name	Type	Description
1	GND		Ground
2	SCL	IN	I2C SCL
3	SDA	IN/OUT	I2C SDA
4	VDD		Supply voltage

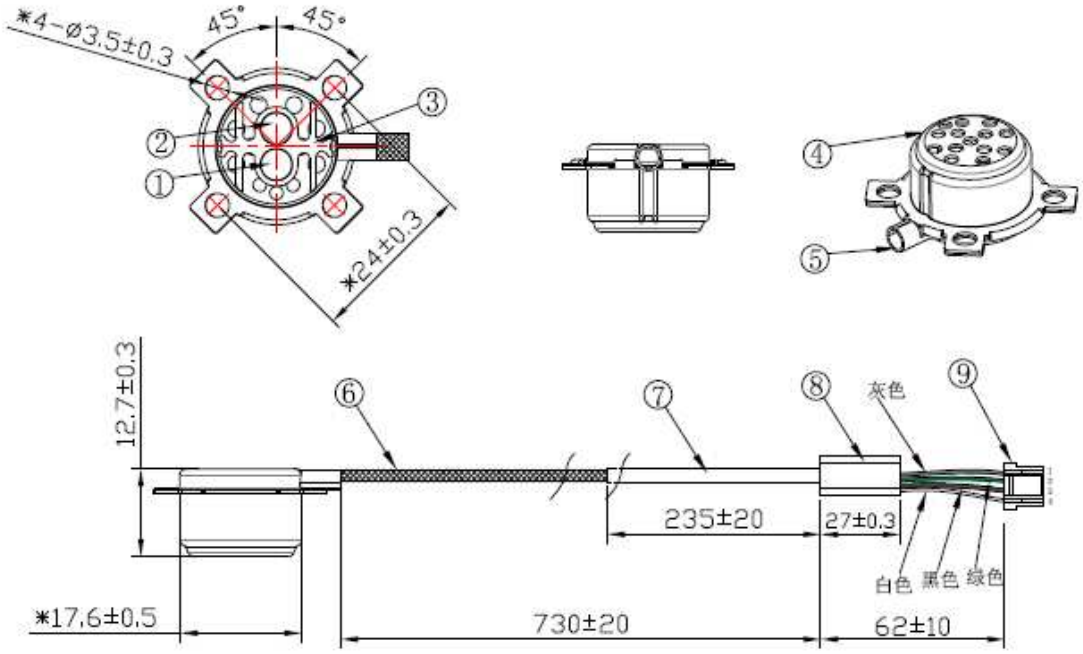
6. Sensor Typical Circuit

Figure 2: Typical Circuit



Note: Rp recommended resistance is 2.2k

7.Mechanical specifications（Unit：mm）



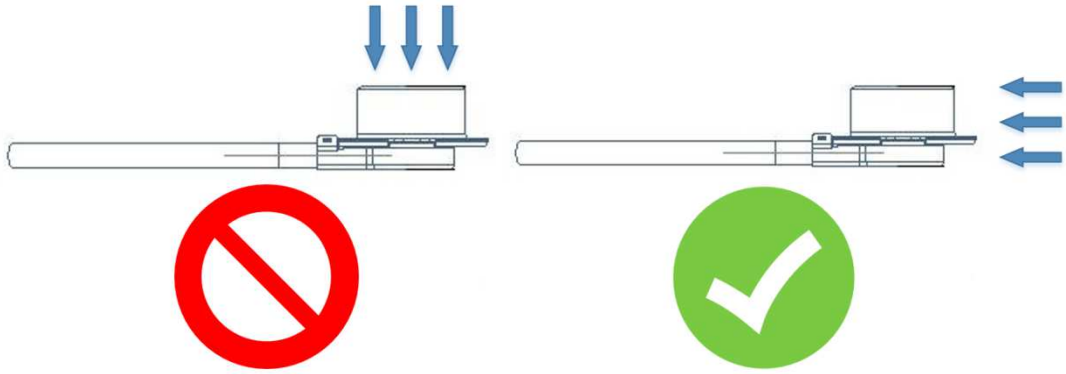
8.Application Note

8.1. power on

After the sensor reaches the internal temperature balance state, the normal measurement can be started, and the user shall reserve enough stable time when power on.

8.2. Sensor installation position

In order to provide more stable measurement, the sensor needs to avoid the fan from the front, otherwise it will affect the accuracy of the sensor, resulting in unstable output results.



8.3. Temperature compensation

Since the sensor is linear output at each temperature segment, no temperature compensation is required.

8.4. ESD

Exposure of AHS01IB to sunlight or intense ultraviolet radiation for a long time will degrade performance and aging of the housing
AHS01IB meets the following anti-static standards:
- AEC-Q-100-002 (4kV HBM)
- AEC-Q-100-003 (200V MM)
Although the sensor complies with these standards, it does not mean the sensor is immune against ESD. The sensor is shipped in an antistatic tray to prevent electrostatic discharge. To avoid damage to the sensor, using a grounding strap or by touching a grounded object before touching the sensor. Furthermore, store the parts in an antistatic package when not in use.

8.5. I2C Interface

The serial connection line 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 serial port lead exceeds 10cm, you need to widen the data line during the circuit board design to ensure the normal data connection.

9. Accuracy statement

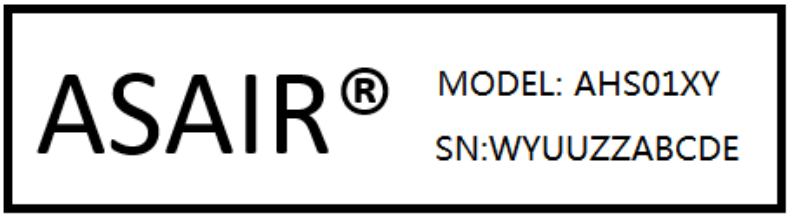
If the sensor is used in equipment or machinery, make sure that the sensor used for the measurement and the sensor used for the accuracy reference sense the temperature and humidity under the same conditions. If the sensor is placed inside the device, the reaction

time will be prolonged, so it is necessary to ensure sufficient measurement time in the program design.

The AHS01IB sensor is calibrated in strict accordance with AS-WI-RD3370 Accuracy 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. In particular, no commitment is made to the specific occasion requested by the user.

10. Traceability

All AHS01IB sensors are imprinted with unique laser markers to facilitate identification and improve traceability.

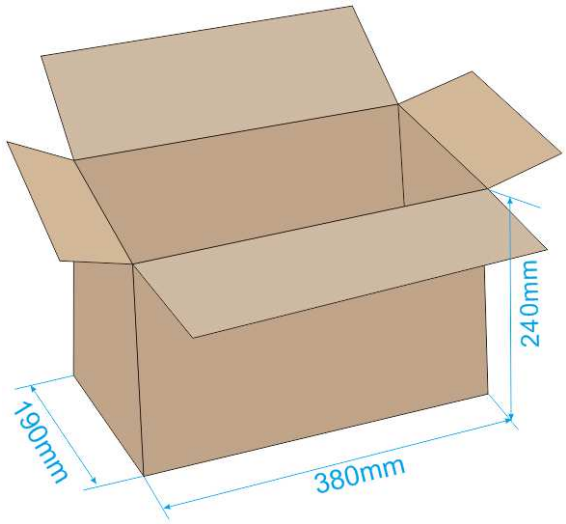


Sensor first line ASAIR ® registered trademark for the company.

The second line AHS01XY is the product model, consisting of 7 letters and Numbers, in which "A" is the company code: ASAIR, "HS" is the product type code: absolute humidity sensor, "01" is the specific product model, "X" is the output mode of the product, such as “I” is I2C signal output; "Y" is the product version number, and "A" is the first version.

Third line laser tag for the product serial number, including "WYUUZZ" specify the batch code for the company, "ABCDE" for five serial number, this code can be from the choice of raw materials to the delivery of the goods process all-the-way tracking, you can find the process of production processing sensor and its related spare parts information, such as man, machine, material, method, ring, measurement, logistics, customer code elements such as state, able to quickly identify quality problems cause and inform the customer accordingly.

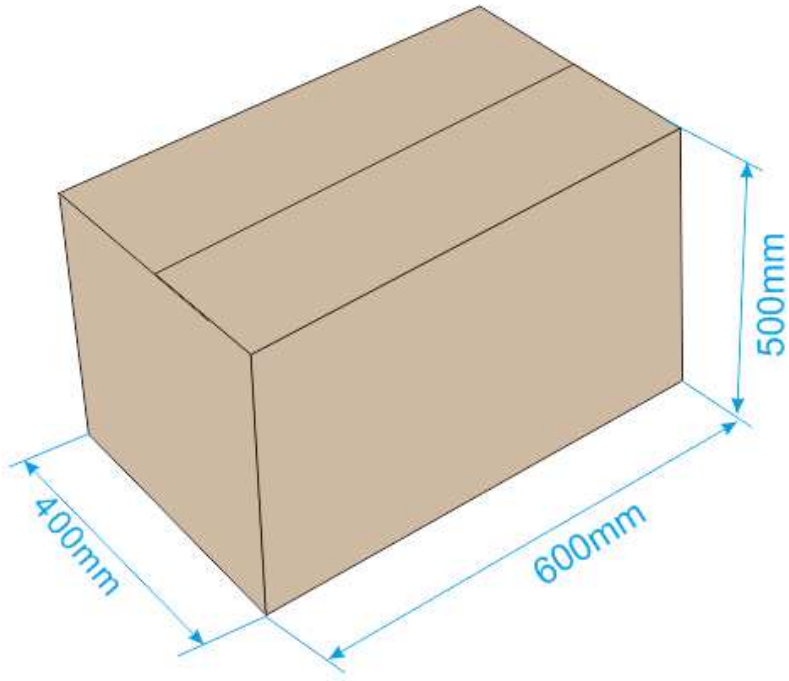
11.Packing specification



Inner box size： 380mm * 190mm * 240mm

Gross weight：2.8kg

Quantity of products：10*12=120 pcs



Outer box size：600mm * 400mm *500mm

Gross weight：18.1kg

Quantity of products：120*6=720 pcs

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The purchaser must comply with the following conditions:

- Send the written notice to company in 14 days when you find defects.
- Undertake the fee that that be costed to mail the product to the company.
- It does not exceed the shelf life.

The company is only responsible for products that have defects that are used in applications that meet the technical conditions of the product. The company does not make any guarantees, guarantees or written statements about its products for those special applications. At the same time, the company makes no commitment to the reliability of its products applied to products or circuits.