Digital Temperature & Humidity Module

CM2122 User Manual

1. Dimensions

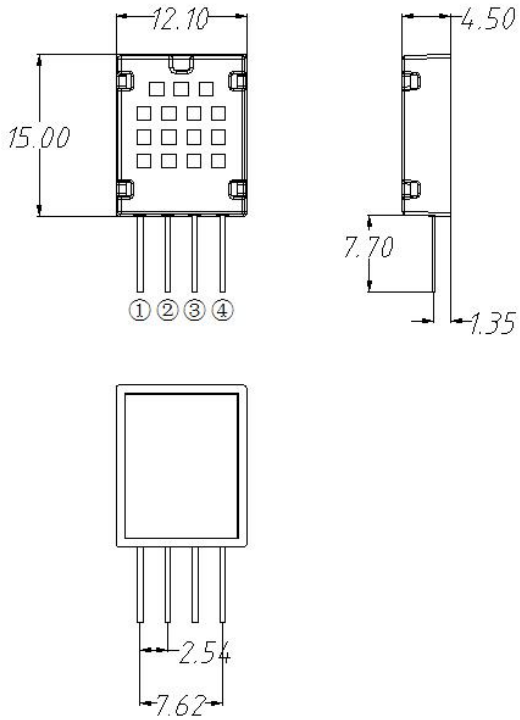

Figure 1 Dimension (Units: mm)

Pins 1 VDD 2 SDA 3 GND 4 NC

2. Sensor Performance

2.1 Relative Humidity(RH%)

Parameter	condition	min	typ.	max	units
Resolution			0.1		%RH
Measuring range		0		99.9	%RH
Accuracy[1]	25℃		±2		%RH
Repeat-ability			±0.1		%RH
Interchangeability		Completely interchangeable			
Response time[2]	1/e(63%)		<5		Sec
Hysteresis			±0.3		%RH
Drift[3]	Typical		<0.5		%RH/yr

2.2 Temperature(℃)

Parameter	condition	min	typ.	max	units
Resolution			0.1		℃
			16		bit
Measuring range		-40		80	℃
Accuracy		25℃	±0.3		℃
Repeat-ability			±0.2		℃
Interchangeability		Completely interchangeable			
Response time	1/e(63%)		<5		Sec
Drift			±0.1		℃/yr

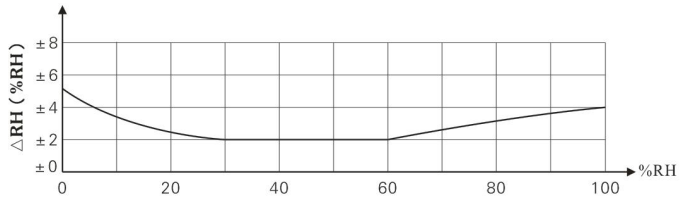

Figure 2 Typical RH% Accuracy at 25℃

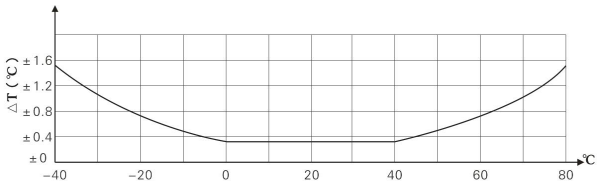

Figure 3 Typical Temperature Accuracy

3. Electrical Specification

Electrical specification, such as energy consumption, high and low level, input and output voltage, etc., depend on the power supply. Table 1 illustrates the electrical specification of the sensor in detail. If not indicated, the power supply voltage is 5V. To get the best results from the sensor, please design it in strict accordance with the conditions of table below.

Table 1 CM2122 sensor direct-current characteristic

Parameter	Condition	min	typ	max	units
Supply Voltage		3.3	5	5.5	V
Power consumption[4]	Sleep	8	10		μA
	measuring		1.5		mA
	Average		750		μA
Low level output voltage	I_{OL}[5]	0		300	mV
High level output voltage	Rp<25 kΩ	90%		100%	VDD
Low level input voltage	Decline	0		30%	VDD
High level input voltage	Rise	70%		100%	VDD
Rpu[6]	VDD = 5V VIN = VSS	3	4.7	100	kΩ
Output current	Open		8		mA
	Tri-state（turn off）	10	20		μA
Sampling period		2			S

Note:

1 *Accuracy measured at 25 ℃, 5.0V.*

2 Measured at 25 ℃,1m/sec airflow for achieving 63% of time.

3 In volatile organic compounds, values may be higher.

4 Average value measured at 25 ° C, 5.0V , 2S / times.

5 Low level output current.

6 Represents a pull-up resistor.

4. Pin Definitions

4.1 Pin Assignment

Pin-No	Name	Description
1	VDD	Power Supply (3.3V-5.5V)
2	SDA	Serial data, two-way port
3	GND	Ground supply
4	NC	No Connection

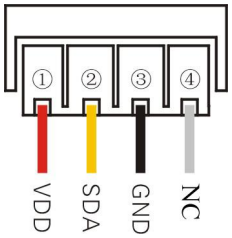

Figure 4 CM2122 Wiring Diagram

4.2 Power Pin（VDD）

Supply voltage is from 3.3V to 5.5V.

4.3 Serial Data Pin（SDA）

The SDA pin is a three state structure that is used to read and write sensor data. Further information about timing and communication between the sensor and micro controller is explained in the detailed description of the communication protocol.

5. Single Bus Communication Protocol

CM2122 serial interface has been optimized to read signal and reduce power loss. The sensor is output by single bus communication, and the single bus is fully compatible with the single bus communication of other products of our company. When reading the CM2122 sensor, please follow the protocol of communication in a timely manner. Specific communication protocol is shows as follow.

5.1 One-Wire Bus Protocol

5.1.1 Block Diagram

The block diagram of figure 5 shows the typical application circuitry of the CM2122 with micro-controller. In one-wire communication mode, the SDA is connected to the I/O port of the microprocessor after it is pulled up.

Note:

1.Cable length shorter than 30 meters with 4.7K pull-up resistor proposed in the typical application circuit, more than 30 meters according to the actual situation of lower pull resistance.

2.When using 3.3V voltage supply, the length of connection wire shall not be greater than

1m. Otherwise, the line pressure drop will cause insufficient sensor power supply, resulting in measurement errors.

3.Read the sensor minimum every 2 seconds, If the reading interval is less than 2 seconds, may lead to temperature or humidity is not allowed or communication is not successful.

4.In fact, the readings are last measured value each time. In order to get real-time data, continuously read two times, or read sensors continuously several times and the reading interval is greater than 2 seconds .

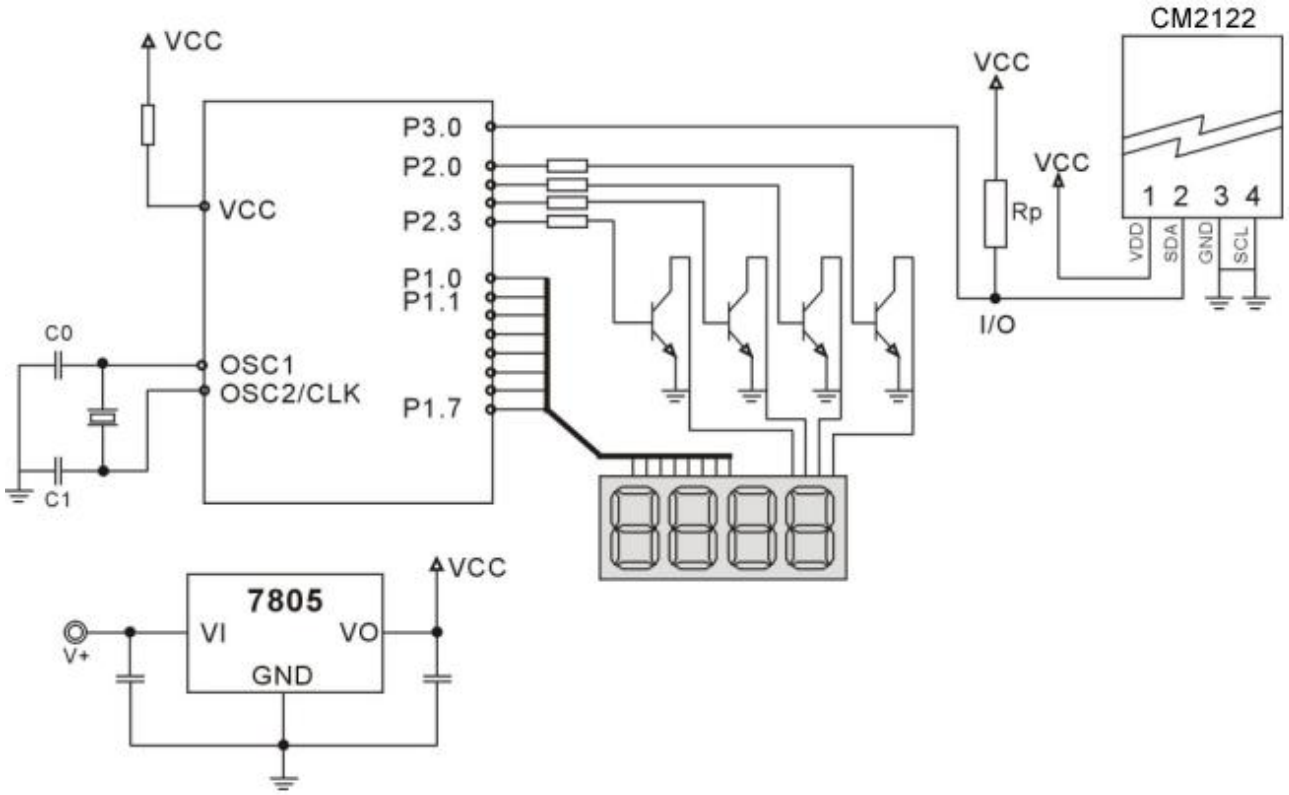

Figure 4 CM2122 One-Wire Application Circuitry

5.2 One-Wire Communication Agreement

◎Descriptions

The CM2122 uses simplified single bus communication, the 1-wire bus has only one data line, and the data exchange and control in the system are completed by the data line. The micro-controller is connected to the data line via a drain open circuit or a three state port, allows the device to release the bus without sending data, let other devices use the bus. A single bus usually requires an external pull up resistor of about 4.7k, thus, when the bus is idle, the state is high. Because they are the principal and subordinate structure, only the host

call sensor, the sensor can response, so the host access sensor must strictly follow the single bus sequence, if the sequence of chaos, sensor will not respond to host.

◎One-Wire Bus Data Definition

SDA is used for communication and synchronization between micro controller and CM2122, and uses single bus data format to transmit 40 bit data at one time. The specific communication sequence is shown in Figure 6, and the communication format specification is shown in Table 2.

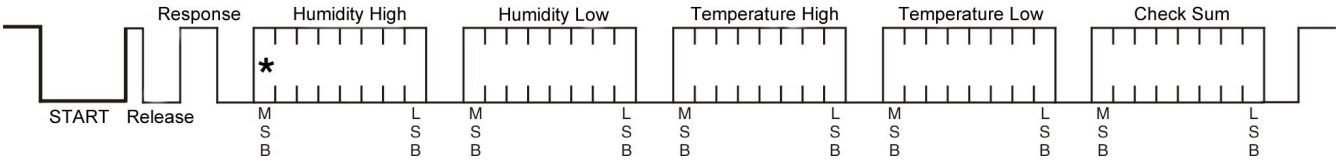

Figure 5 CM2122 Single Bus Communication Protocol

Table 2 CM2122 Communication format description

Name	Single bus format definition
START	The microprocessor pulls the data bus (SDA) down for a period of time (at least 800μs), informing the sensor to prepare the data.
Response	The sensor pulls the data bus (SDA) low by 80μs and pills up by 80μs in response to the host's start signal.
Data format	Once receipted from the host start signal, the sensor collects 40 bits of data from the data bus (SDA) at one time, High first out.
Humidity	Humidity resolution is 16Bit, high bit in the former; sensor string out the humidity value is 10 times the actual humidity value.
Temperature	Temperature resolution is 16Bit, high in the former; sensor string out of the temperature value is 10 times the actual temperature; The highest temperature (Bit15) is equal to 1 for negative temperature, the highest temperature bit (Bit15) is equal to 0 for positive temperature;Temperature in addition to the most significant bit (Bit14 ~ Bit0) that the temperature value.
Check Sum	Check Sum＝Humidity high bit+Humidity low bit+Temperature high bit+Temperature low bit

◎Examples for Single bus data calculation

Example 1 Received 40 bit data is

0000 0010	1001 0010	0000 0001	0000 1101	1010 0010
Humidity High	Humidity Low	Temperature High	Temperature High	Check Sum

Calculation

0000 0010+1001 0010 +0000 0001+0000 1101= 1010 0010（Check Sum）

So

Received data is correct.

Humidity 0000 0010 1001 0010 = 0292H (Hexadecimal)= 2×256 + 9×16 + 2 = 658

=> Humidity = 65.8%RH

Temperature：0000 0001 0000 1101 = 10DH(Hexadecimal) = 1×256 + 0×16 + 13 = 269

=> Temperature = 26.9℃

◎**Special Instructions**

When the temperature is below 0 ° C, the highest bit of the temperature data is 1。

Example： -10.1 ℃ => 1 000 0000 0110 0101

Temperature: 0000 0000 0110 0101 = 0065H(Hexadecimal)＝ 6×16 +5 = 101

=> Temperature ＝ -10.1℃

Example 2 received 40 bit data is

0000 0010	1001 0010	0000 0001	0000 1101	1011 0010
Humidity high 8bit	Humidity low 8bit	Temperature high 8bit	Temperature high 8bit	Check bit

Calculation：

0000 0010+1001 0010 +0000 0001+0000 1101= 1010 0010 ≠ 1011 0010

（Check error）

The data received this time is not correct. Give up and re-receive data.

5.3 Single Bus Communication Timing

The CM2122 switches from Sleep to High Speed mode when the user host (MCU) sends a start signal (pulls the data bus SDA low by at least 800μs). After the host start signal is completed, the CM2122 sends a response signal and sends 40Bit from the data bus SDA serially. The high bit of the data is sent first. The data sent is: the high bits of humidity, the low bits of humidity, the high bits of temperature, the low bits of temperature, the check digit. The information is collected after sending data ends and the sensor is automatically transferred to the sleep mode until the next A communication comes.

Detailed timing signal characteristics shown in Table 10, single bus communication timing diagram shown in Figure 7.

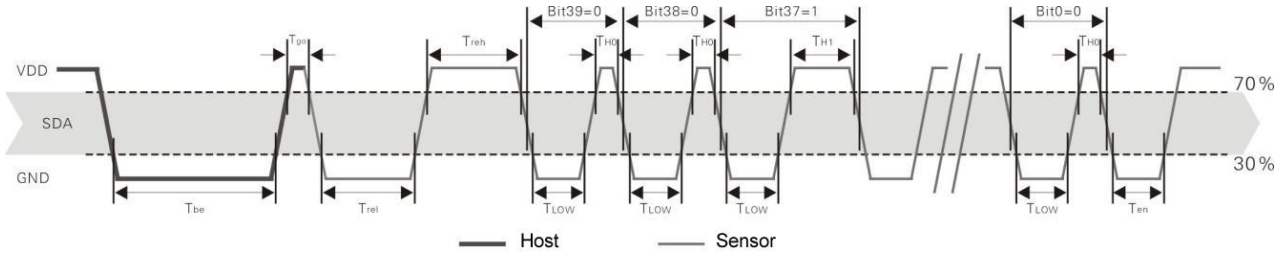

Figure 6 CM2122 Single bus communication timing

Note: The temperature and humidity data the host read from the CM2122 is always the previous measurement. If the two measurement interval is very long, please read twice and use the second measurement value as the value of real-time temperature and humidity values. While reading ,make sure the minimum interval between two measurement is 2 Second.

Table 3 Single bus signal characteristics

Symbol	Parameter	min	type	max	Units
T_{be}	Time of the host start signal is pulled low	0.8	1	20	mS
T_{go}	Time of the host releases the bus	10	20	200	μS
T_{rel}	Time to response low level	75	80	85	μS
T_{reh}	Time to response high level	75	80	85	μS
T_{LOW}	Signal“0”“1”low level time	48	50	55	μS
T_{H0}	Signal“0”high level time	22	26	30	μS
T_{H1}	Signal “1”high level time	68	70	75	μS
T_{en}	Time of the sensor releases the bus	45	50	55	μS

Note: To ensure accurate communication of the sensor, please strictly in accordance with parameters and timing design of Table 10 and Figure 7 when reading the sensors.

5.4 Peripheral Read Step Example

Communication between the host and the sensor can complete by the following three steps.

Step 1

After the CM2122 is powered on (the CM2122 will wait 2S to go beyond the unstable state, during which time the device can not send any instructions), test the environment temperature and humidity data, and record the data, then the sensor automatically goes to sleep. CM2122 SDA data line pulled up by the pull-up resistor and then would keep high, at this state, CM2122 is detect the external signal continuously, and its SDA pin in the input state.

Step 2

The I / O of the microprocessor is set to output and the output is low, and the low hold time

can not be less than 800us. The typical value is pulled down 1MS. Then the microprocessor's I / O is set to the input state, the bus is released. Due to pull-up resistor, the microprocessor's I / O that CM2122 SDA data line also will become high. when the host release bus, CM2122 send a response signal, that is, 80ms low output as a response signal. After that an 80ms high output to inform the peripherals ready to receive data, the signal transmission shown in Figure 8.

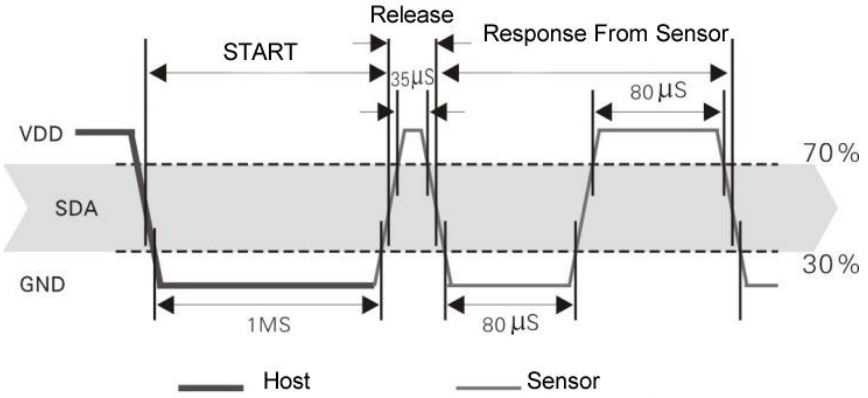

Figure 7 Single Bus Decomposition Timing Diagram

Step 3

CM2122 sends the response, followed by the data bus SDA continue serial output 40-bit data, the microprocessor receive 40-bit data according to the I / O level changes

The format of the bit data "0" is: 50 ms low level plus 26-28 ms high level;

The format of the bit data "1" is: 50 ms low level plus 70 ms high leve;

The format of the bit data "0", bit data "1" are shown in Figure 9.

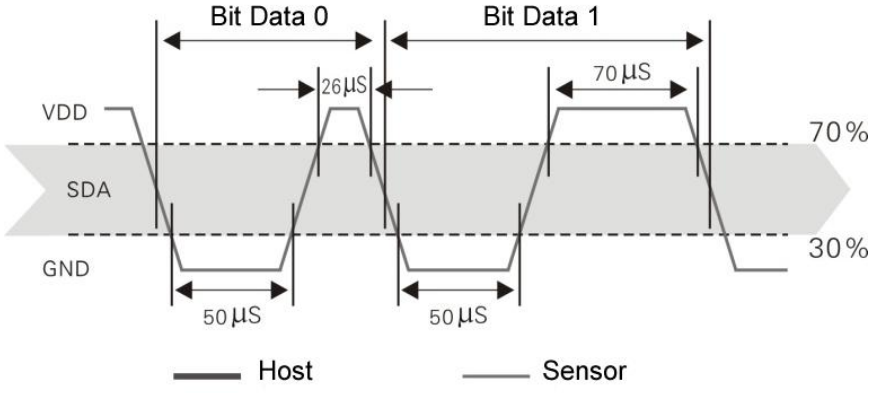

Figure 8 Single Bus Decomposition Sequence Diagram

5.5 Peripheral read flow chart

Flow chart of CM2122 sensor read bus schematic diagram is shown as below:

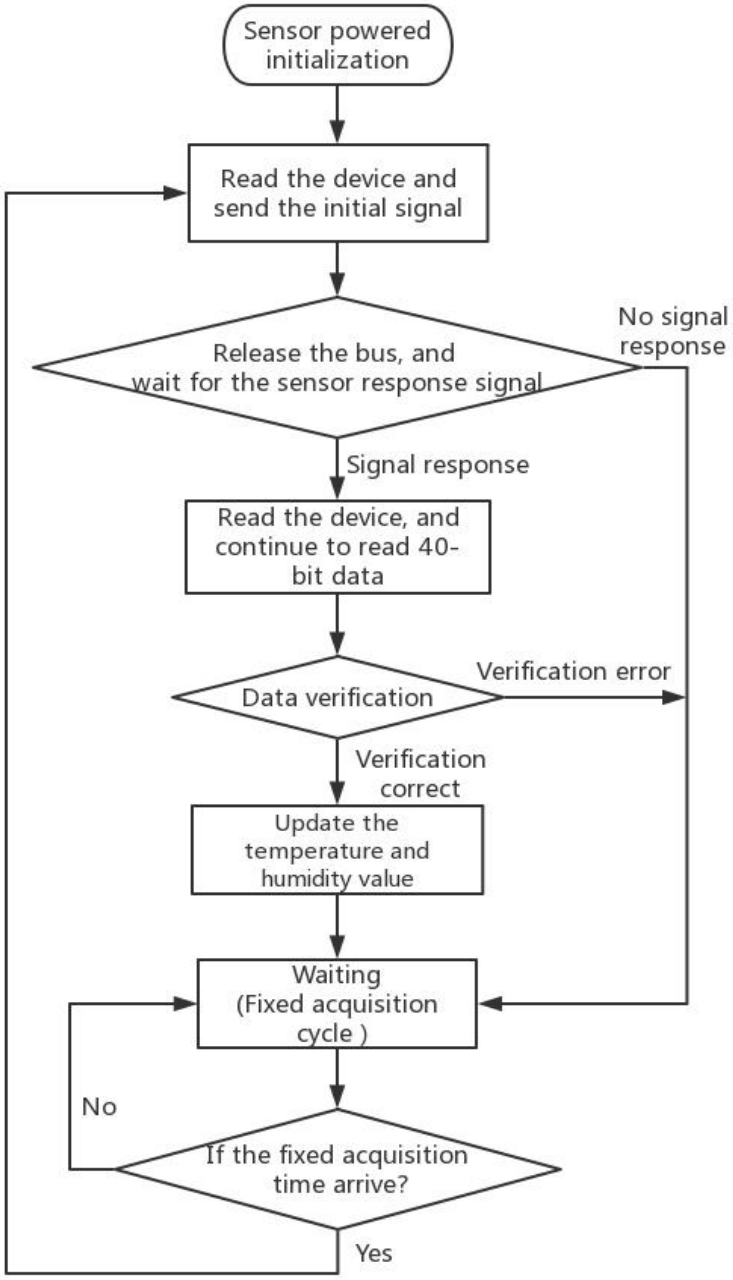

Figure 9 The Single Bus Read Flow Chart

6. Application information

6.1 Working and storage conditions

Beyond the recommended range of work, the sensor may cause temporary drift signals up to 3%RH. After returning to normal operating condition, the sensor will slowly return to the calibration state. To speed up the recovery process, see “recovery processing". Long hours

working under abnormal working conditions will accelerate the aging of the product.

Avoid placing components in the dew and dry environment for long periods of time and the following circumstances:

A. Salt fog

B. Acid or oxidizing gas, such as sulfur dioxide, hydrochloric acid

Recommended storage environment

Temperature: 10~40℃., humidity: 60%RH below

6.2 Exposure to Chemicals

The sensing layer of capacitive humidity sensor will be disturbed by chemical vapor, and the diffusion of chemical in the induction layer may lead to drift of measurement value and decrease of sensitivity. In a clean environment, pollutants will slowly release. The recovery process described below will accelerate the process. High levels of chemical contamination, such as ethanol, can cause complete damage to the sensing layer of the sensor.

6.3 Temperature Influence

The relative humidity of gases depends largely on temperature. Therefore, when measuring humidity, humidity sensors should work at the same temperature as far as possible. If a printed circuit board is shared with the heat releasing electronic component, the sensor shall be kept away from the electronic component as far as possible. The humidity sensors should be installed below the heat source, while keeping the enclosure well ventilated. To reduce thermal conductivity, the sensor and the copper plating on the other part of the printed circuit board should be as minimal as possible and leave a gap between the two.

6.4 Light Effects

Exposure to sunlight or intense ultraviolet radiation for a long time will cause performance degradation.

6.5 Recovery Processing

Sensors operating under extreme operating conditions or chemical vapors can be restored to calibration state by following procedures: At 45℃ and <10%RH humidity for 2 hours (drying), then at 20-30℃ and >70%RH humidity for more than 5 hours.

6.6 Wiring Notes

The quality of signal wire will affect the quality of voltage output, recommended to use high quality shielding wire.

6.7 Welding Information

For manual welding, at a maximum temperature of 300℃, the contact time shall be less than 3 seconds.

6.8 Product Upgrade

Please consult the Aosong electronic technology sector.

7. License Agreement

1) Without the written permission of the company, it shall not copy or disseminate the content of this specification in any form, nor shall it be disclosed to a third party.
2) The company and the third party have the ownership of the software, and the user can only use it after signing the contract or obtaining the software license.
3) The contents of this instruction manual are subject to change without prior notice.