Intelligent Infrared CO_2 Gas Sensor

(Model: MH-711A)

Manual

Version: 3.3

Valid from: May 1st, 2014

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MH-711A Infrared CO2 Gas Sensor

1. Product Description

MH-711A is a universal type intelligent sensor to detect CO_2 in air taking advantages of non-dispersive infrared (NDIR) principle. With high selectivity, no oxygen dependence, high performance and long lifespan features, MH-711A also has built-in temperature compensation feature. MH-711A is a compact and high-performance sensor based on infrared absorption of gas detection technology, micro-machining and sophisticated circuit design.

2. Characteristics

- Long lifespan
- High Sensitivity and resolution
- 5V constant power supply, low power consumption
- Output method: UART, analog voltage signal, etc.
- Quick response & Resume
- Temperature compensation, excellent linear output
- Anti-poisons, anti-vapor interference
- Detect combustible gas concentration matching with flame-proof marked detector in area 1&2 explosive environments which mix of ⅡA, ⅡB, ⅡC and T1-T6 flammable gases, vapors and air

3. Application

Widely used for industrial field instrumentation, industrial-process control and safety protection

4. Technical Parameters

Product Model	MH-711A
Target Gas	CO2
Working Voltage	4.5 V ~ 5.5V DC
Average Current	< 100mA
Interface Level	3.3V
Measurement Range	0~30%VOL optional (view table 2)
Output Signal	IIC
	0.4-2V DC
Warm-up Time	3min
Response Time	$T_{90} < 30s$
Working Temp.	-40℃ ~ 70℃
Working Humidity	0 to 95%RH, Non-condensing
Dimension	Φ44×61mm
Weight	350g
Lifespan	>5 years
Ex-marking	Ex dⅡC T6 Gb
Protected Class	IP65

Table 1 Technical Index

Detected Gas	Measurement Range	Accuracy	Remarks
Carbon Dioxide (CO2 gas)	0~2000ppm	±50ppm +/-5% reading	Temperature compensation
	0~6000ppm		Temperature compensation
	0~1%VOL		Temperature compensation
	0~3%VOL		Temperature compensation
	0~5%VOL		Temperature compensation
	0~10%VOL		Temperature compensation
	0-30%VOL	±15% reading	Temperature compensation

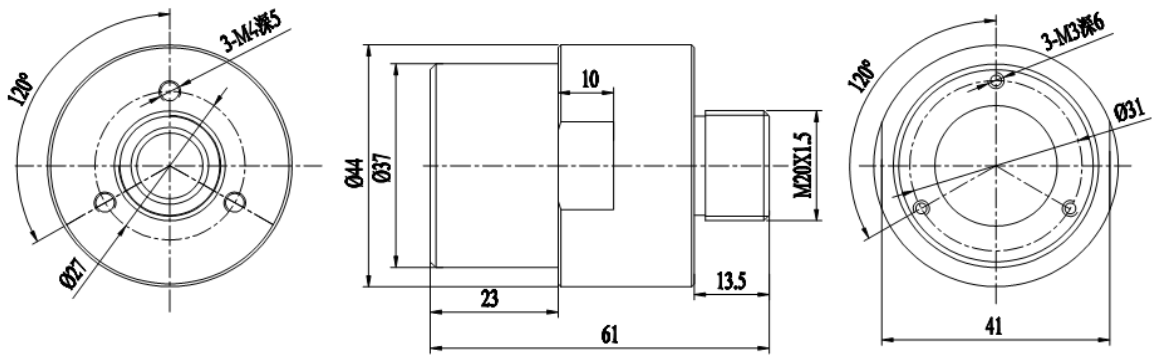Table 2: Measurement Range and Accuracy

5. Structural Drawing
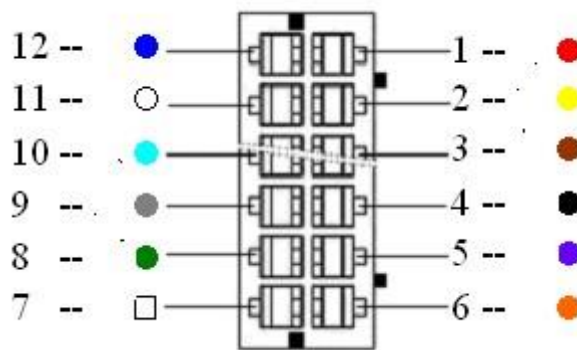

Figure 1 Structural Drawing of Sensor

Figure 2: Pin Definition

Pin	Description
Pad1	Vin (input voltage 4.5V～5.5V)
Pad4	GND
Pad5	Vout (0.4～2V)
Pad2	IIC(SCL)　clock
Pad3	IIC(SDA)　data

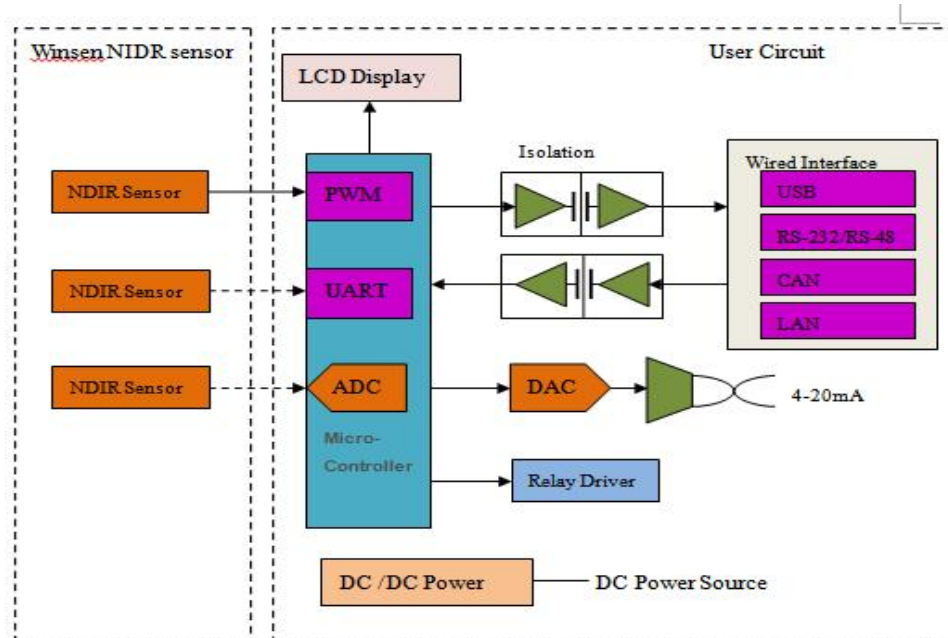|	
Pad6, Pad7, Pad8 Pad10, Pad11, Pad12	Reserved, do not connect

Table 3: Definition of Pin

6. Application Circuit

Figure 3 Application Circuit

Explanations:

6.1: Analogue Voltage Output

Voltage output range 0.4 to 2V, relatively stands for 0 to F.S.

Pad1 connect with 5V supply, Pad4 connect with VSS and Pad5 connect with input side of ADC. Then warm-up the sensor, the Vout will show a voltage value which stands for the gas concentration.   If the sensor malfunctions, the output voltage is 0V.
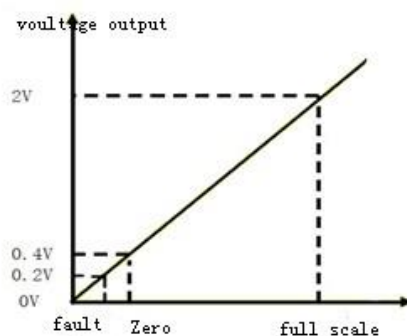
Figure 4 Analogue Voltage Output

6.2 Digital Output

Pad1 connect with 5V supply, Pad4 connect with VSS.

Customer's CLK connects with sensor CLK; SDA connect sensor SDA.

The detector can read the value of gas concentration directly through the IIC of the sensor (The pull-up resistor of user's SCL and SDA signal lines must be less than 10k to ensure the normal work of the communication interface), no need to calculate the gas concentration.

6.2.1 Communication Protocol

MH-711A is communicated through IIC bus. The module works basing IIC slave mode and can connects to external MCU,module address: 0x55, write operation address: 0xAA, read operation address: 0xAB. Every frame number data contains 10 bytes. Different host orders lead to different data and the last byte of data is the proof test value. The SCL clock frequency is recommend less than 10K.

1) Device Address

Address format: Highest seven digits are the module add of the sensor(0x55)，the least significant digit is SDIR, 0 stand for Reading, 1 stand for Writing.

A7	A6	A5	A4	A3	A2	A1	W/R
1	0	1	0	1	0	1	0/1

Table 4: Address Format

IIC communication

Write address: 0xAA,   Read address: 0xAB

2) Bus Description

IIC interface protocol is a special bus signal protocol, is composed of 3 parts - Start(S), Stop(P) and binary data, as shown below.At start,SCL is high,SDA is at falling edge.Aftter that,send the slave add.After the seven add digits is the control read&write digits,choose the read&write operation as above picWhen the slave device recognizes the corresponding add information,it sends a responsive signal to main device and SDA is pulled down at the ninth clock cycle.At stop,SCL keeps high level,SDA is at rising edge.
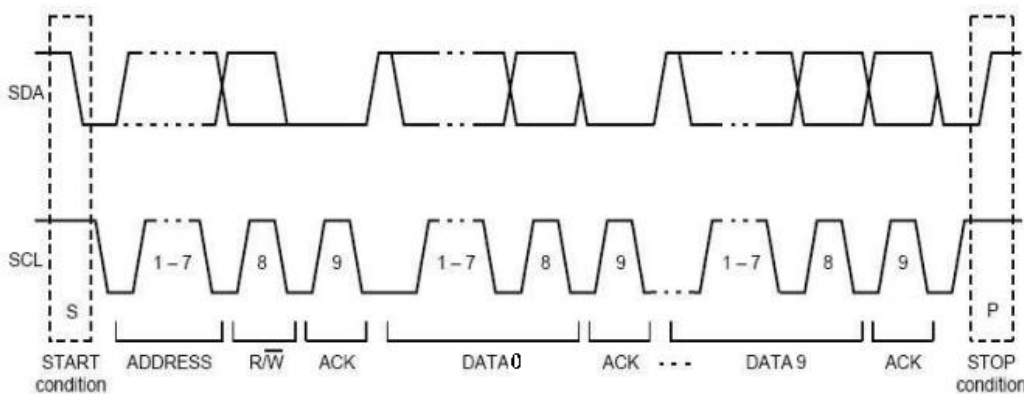

Figure 5 IIC Sequence Chart

3) Command

Every frame number data of IIC communication command contains 10 bytes. Different host orders lead to different data and the last byte of data is the proof test value.

Table 5 Command List

0x96	Gas Concentration
0xA0	Calibrate zero point（ZERO）
0xAA	Calibrate span point（SPAN）

Gas Concentration Reading

1	0x96	**Gas Concentration Reading**								
Send		0	1	2	3	4	5	6	7	8	9
		Command	--	--	--	--	--	--	--	--	Check Code
		0x96	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x6A
EXP.	96 00 00 00 00 00 00 00 00 6A										
Return		0	1	2	3	4	5	6	7	8	9
		Module Status					High Density	Low Density	High Range	Low Range	Check Code
EXP.	Return										

Gas concentration= high density *256 + low density

Calibrate Zero

1	0xA0	**Gas Concentration Reading**								
Send		0	1	2	3	4	5	6	7	8	9
		Command	--	--	--	--	--	--	--	--	Check Code
		0xa0	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x60
EXP.	A0 00 00 00 00 00 00 00 00 60										
Return		0	1	2	3	4	5	6	7	8	9
		--	--	--	--	--	--	--	--	--	
		--	--	--	--	--	--	--	--	--	
EXP.	No value return										

Calibrate Span

1	0xAA	**Gas Concentration Reading**								
Send		0	1	2	3	4	5	6	7	8	9
		Command	SPAN Value		--	--	--	--	--	--	Check Code
		0xaa	High Byte	Low Byte	0x00	0x00	0x00	0x00	0x00	0x00	0xbb
EXP.	AA 13 88 00 00 00 00 00 00 BB （Eg. calibrate 5000ppm, HEX：0x1388）										
Return		0	1	2	3	4	5	6	7	8	9
		--	--	--	--	--	--	--	--	--	
		--	--	--	--	--	--	--	--	--	
EXP.	No value return										

6.2.2 Calibrate and Calculate

The checksum = (invert (byte0 +... + 8)) + 1

For example, Gas Concentration Reading

	Command Sent								
Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8	Byte9
Command	-	-	-	-	-	-	-	-	Check Value
0x96	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x6A

A. Add all the bytes together except byte 0

   0x96 + 0 + 0 + 0 + 0 + 0 + 0 + 0 + 0 = 0x96

B. Get the value from step A, then invert it.

   0xff – 0x96 = 0x69

C. Plus one based on the value of step B

   0x69 + 0x01 = 0x6A

6.2.3 Example Program

C Language Calibrate & Calculate and Routine

```c
char getCheckSum(char *packet)
{
    char i, checksum;
    for( i = 1; i < 9; i++)
    {
        checksum += packet[i];
    }
    checksum = 0xff – checksum;
    checksum += 1;
    return checksum;
}
```

7. Notes For Maintenance

7.1 The sensor should be calibrated regularly. Recommended cycle time is once per 6 months.

7.2 Do not use the sensor in the high dusty environment for long time.

7.3 Please use the sensor with correct power supply.