



# Intelligent Infrared Methane Gas Sensor

(Model: MH-741A)

## Manual

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Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD.

# MH-741A Infrared CH4 Gas Sensor

## 1. Product Description

MH-741A is a universal type intelligent sensor to detect CH4 gas, taking advantage of non-dispersive infrared (NDIR) principle. With high selectivity, no oxygen dependence, high performance and long lifespan features, MH-741A also has built-in temperature compensation feature. MH-741A is a compact and high-performance sensor based on infrared absorption of gas detection technology, micro-machining and sophisticated circuit design.



## 2. Features

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

## 3. Application

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

## 4. Specification Table 1 Technical Index

|                     |                                   |
|---------------------|-----------------------------------|
| Product Model       | MH-741A                           |
| Gas Detected        | Flammable Gas                     |
| Working Voltage     | 4.5 V ~ 5.5V DC                   |
| Average Current     | < 100mA                           |
| Interface Level     | 3.3V                              |
| Measurement Range   | 0~100%VOL optional (view table 2) |
| Output Signal       | IIC                               |
|                     | 0.4-2V DC                         |
| Warm-up Time        | 3min                              |
| Response Time       | T <sub>90</sub> < 30s             |
| Working Temperature | -40℃ ~ 70℃                        |
| Working Humidity    | 0 to 95%RH, non-condensing        |
| Dimension           | Φ44×61mm                          |
| Weight              | 350g                              |
| Lifespan            | >5 years                          |
| Ex-marking          | Ex d II C T6 Gb                   |
| Protected Class     | IP65                              |

Table 2 Measurement Range and Accuracy

| Detected Gas              | Measurement Range | Accuracy | Remark                   |
|---------------------------|-------------------|----------|--------------------------|
| Methane(CH <sub>4</sub> ) | 0~5%VOL           | 0.01%VOL | Temperature compensation |
| Methane(CH <sub>4</sub> ) | 0~10%VOL          | 0.01%VOL | Temperature compensation |
| Methane(CH <sub>4</sub> ) | 0~100%VOL         | 0.1%VOL  | Temperature compensation |

## 5. Structural Drawing

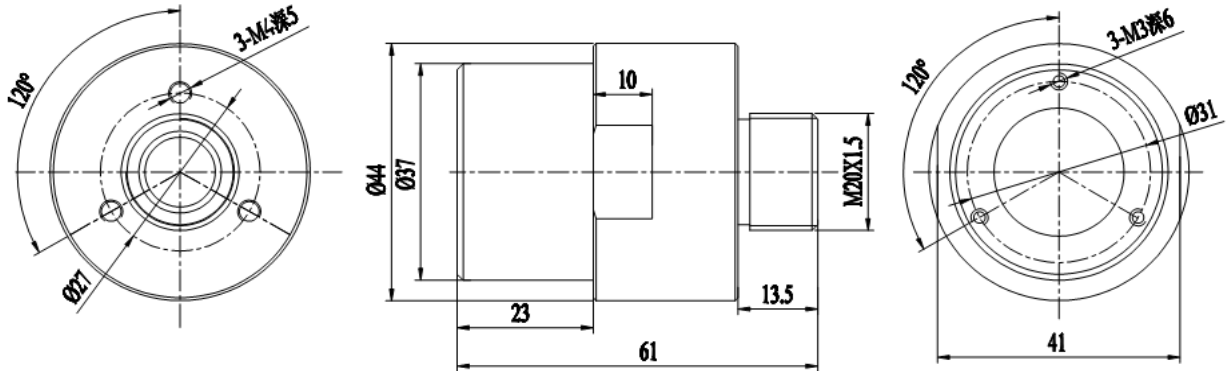


Figure 1 Structural Drawing of Sensor

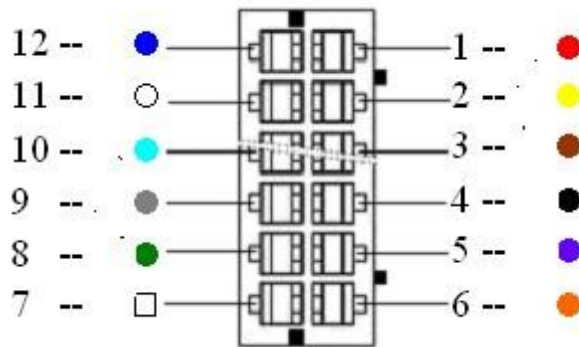


Figure 2 Pin Definition

| Pin                                     | Description                    |
|---|--------------------------------|
| Pad1                                    | V in (input voltage 4.5V~5.5V) |
| Pad4                                    | GND                            |
| Pad5                                    | V out (0.4~2V)                 |
| Pad2                                    | IIC(SCL) clock                 |
| Pad3                                    | IIC(SDA) data                  |
| Pad6, Pad7, Pad8<br>Pad10, Pad11, Pad12 | Reserved, do not connect       |

Table 3 Definition of Pin

## 6. Application Circuit

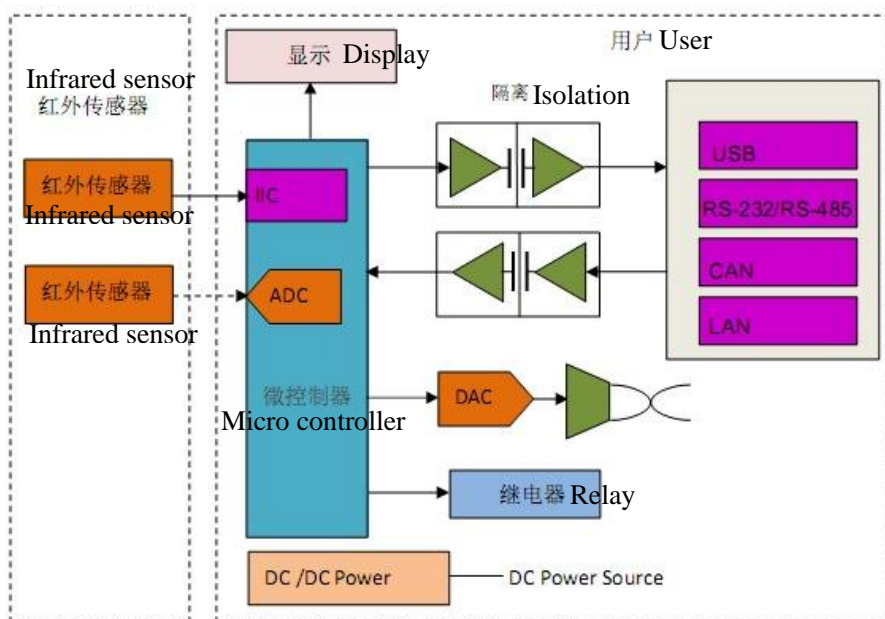


Figure 3 Application Circuit

## 7. Explanation

### 7.1 Analogue Voltage Output

Input 5V voltage to Win Pin, GND Pin connect power ground and Vout Pin connect input side of ADC, then warm-up the sensor, the Vout side will output a voltage value which stands for the gas concentration, while output voltage range 0.4V~2V stands for gas concentration 0~FS. If it found in trouble in self-inspection process, the output voltage of sensor is 0V.

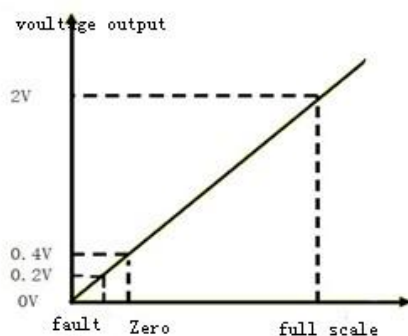


Figure 4 Analogue Voltage Output

### 7.2 Digital Output

Input 5V voltage to Win Pin, GND Pin connect power ground, CLK side of user's communication interface connect CLK side of detector while SDA side connect SDA side of detector, then the detector will 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 no more than 10k to ensure the normal work of the communication interface), no need to calculate.

#### 7.2.1 Communication Protocol

MH-741A 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.After 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.

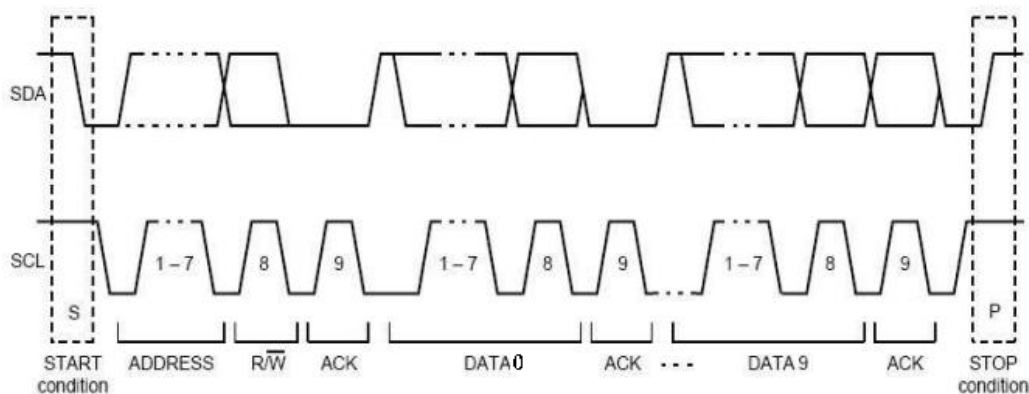


Figure 5 IIC Sequence Chart

### 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                             | <b>Gas Concentration Reading</b> |      |      |      |              |             |            |           |            |
| 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 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                             | <b>Gas Concentration Reading</b> |      |      |      |      |      |      |      |            |
| 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 00 60 |                                  |      |      |      |      |      |      |      |            |
| Return | 0                                | 1                                | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9          |
|        | --                               | --                               | --   | --   | --   | --   | --   | --   | --   |            |
|        | --                               | --                               | --   | --   | --   | --   | --   | --   | --   |            |
| EXP.   | No value return                  |                                  |      |      |      |      |      |      |      |            |

**Calibrate Span**

|        |  |                                  |          |      |      |      |      |      |      |            |
|--------|--|----------------------------------|----------|------|------|------|------|------|------|------------|
| 1      | 0xAA   | <b>Gas Concentration Reading</b> |          |      |      |      |      |      |      |            |
| 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  |                                  |          |      |      |      |      |      |      |            |

### 7.2.2 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

$$0x69 + 0x01 = 0x6A$$

### 7.2.3 Example Program

#### C Language Calibrate & Calculate and Routine

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

## 8. Notes For Maintenance

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

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

8.3 Please use the sensor with correct power supply.

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