AGS3871 **Instructions**

Carbon Monoxide Sensor

• High sensitivity

• Low power

consumption •

Quick response • Strong

anti-interference ability •

Excellent long-term stability • Long service life

Product Description

The carbon monoxide sensor (hereinafter referred to as the sensor) is a sensor based on the MEMS principle and is used to monitor the concentration of carbon monoxide gas in real time.

The sensor has a built-in high-performance semiconductor silicon-based resistive sensor chip, and uses dedicated digital module acquisition technology and gas induction sensing

technology to ensure that the product has extremely high reliability and excellent long-term stability. It has the characteristics of low power consumption, high sensitivity, low cost, and simple driving c

The sensors have been fully calibrated and tested before leaving the factory to meet the needs of customers' large-scale applications.

Application

Sensors have a wide range of applications in home security, automotive industry, air conditioning and HVAC industry, and industrial safety.

It can be used to monitor the concentration of carbon monoxide gas in equipment such as water heaters, gas stoves, automobile exhaust and air conditioners.

Figure 1. **Product image**

1. Working Principle

The sensor uses advanced MEMS technology to make a micro hot plate on a silicon substrate. The gas-sensitive material used is an electric

Metal oxide semiconductor materials with low conductivity. When the sensor works in an air environment, the conductivity of the gas-sensitive material changes with the detected

The conductivity of the gas-sensitive material changes with the concentration of the gas being detected. The higher the concentration of the gas being detected, the higher the conductivity of the gas-sensitive material.

Using a dedicated integrated circuit, the change in conductivity is converted into an output signal corresponding to the gas concentration.

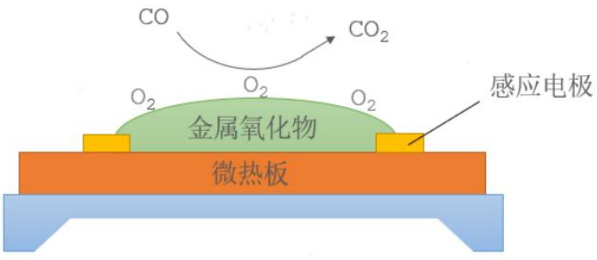


Figure 2. **Schematic diagram**

2. Sensor characteristics

Table 1 **Sensor characteristics**

Operating voltage	4.75ÿ5.25VDC
Working current	24±4mA
Sampling period	ÿ2s
Measuring range	50ÿ1000ppm
Output Interface	I 2C
Typical Accuracy ÿ25ÿ/50%RHÿ	±(50ppm+40%RD)
Warm-up time	ÿ120s
Response characteristics	When the gas concentration is 1000ppm, the response time does not exceed 30 seconds
Operating temperature	-25ÿ60ÿ
Working	20ÿ95%RH (no condensation)
humidity size (Length x Width x	12mm ×12mm ×16.5mm
Height) Weight	About 1.5g
life	More than 10 years (25°C, clean air)

3. **Interface definition**

Figure 3. **Pin diagram**

Table 2 **Pin definition table**

Pinout	name	describe
1	VCC	Power supply (5VDC)
2	SDA	Communication data
3	GND	Power Ground
4	SCL	Communication clock

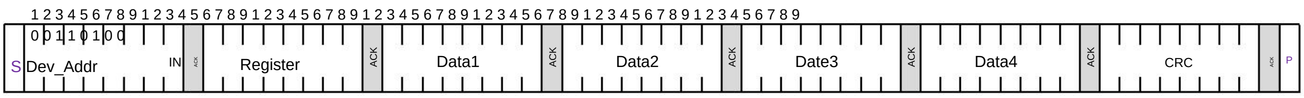
4. **Communication Protocol**

The sensor uses the standard I2C communication protocol and is suitable for a variety of devices. The physical interface of I2C includes a serial data signal (SDA) and a serial Line clock signal (SCL). Both interfaces need to be pulled up to VCC through 1kÿ~10kÿ resistors. SDA is used to read and write sensor data. SCL must be kept high when powered on until I2C communication starts, otherwise it will cause poor I2C communication. When I2C communication occurs, SCL is used by the host to Synchronize communication with sensors. Multiple I2C devices can share the bus, but only one master device can appear on the bus.

The sensor I2C device address is 0 1 (7-bit), the write command is 0 34, and the read command is 0 35. The communication rate is no higher than 100kHz.

4.1 **I2C communication protocol command format**

The host write command format is as follows:



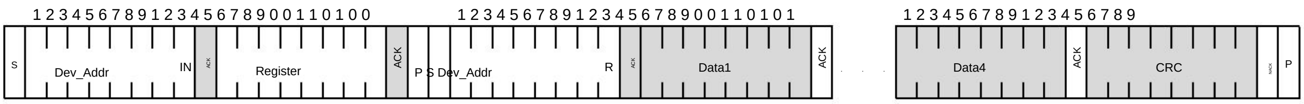
According to the I2C transmission protocol: high bit first, low bit last;

Master signal Slave signal S: Start signal P: Stop signal ACK: Acknowledge signal NACK: Non-acknowledge signal

Register: register address of the operation

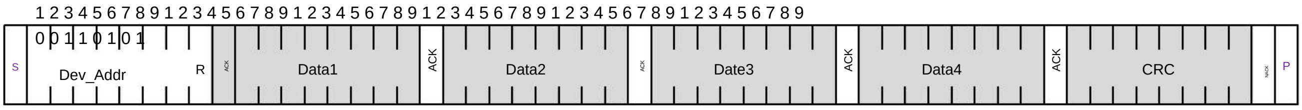
CRC: The verification result from Data1 to Data4. For the calculation method, please refer to the "CRC Calculation" section below.

Host read command format:



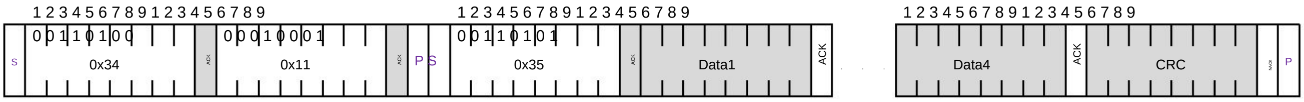
The host simplified read command format is as follows:

Read the last operation register Register address, the power-on default Register = 0 00

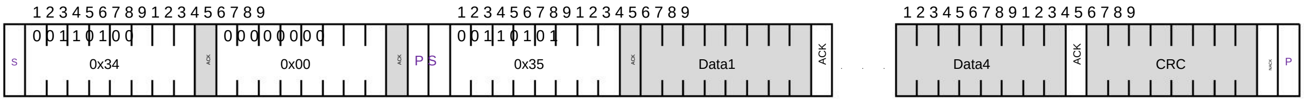


4.2 **Read the version number**

The sensor version number can be obtained through the following command.



4.3 **Reading concentration data**



Data1~Data4 are described in detail as follows:

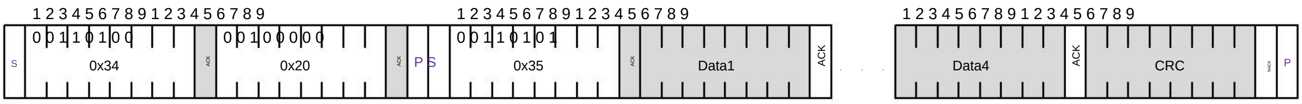
Data1	Data2	Date3	Data4	CRC
Status	Conc			CRC
7 6 5 4 3 2 1 0	23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0			
R.D.Y.				

Status is described in detail as follows:

Bit7ÿBit1 Reserved **bits, always** 0	
Bit0	RDY **data ready bit; RDY = 0, data has been updated; RDY = 1, data has not been updated or is being preheated**

4.4 **Read the current resistance value**

The current resistance value of the sensor can be obtained through the following command.



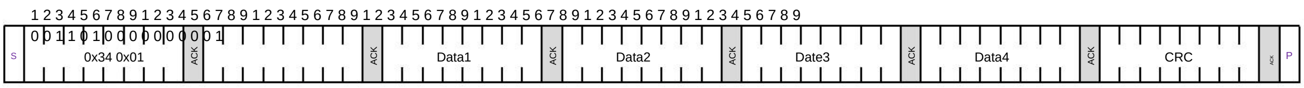
The resistance values are described as follows:

Data1	Data2	Date3	Data4	CRC
Res				CRC
23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0 7 6 5 4 3 2 1 0				

Actual resistance = **× 10, unit ÿ**

4.5 **Zero point calibration (reserved)**

The sensor has been zero-point calibrated before leaving the factory. Users can recalibrate the zero point as needed during use. The calibration data is not The data will be saved and lost after power failure. Place the sensor in fresh air and power it on for 5 minutes, then send the following calibration command to complete the zero point calibration. calibration.



Data1 and Data2 are fixed to 0 00 and 0 0.

Data3 Data4	describe
0 0	Restore to factory zero resistance value
0 00 0 00	Get the current sensor resistance as the zero point
0 0	Enter the specified resistance value 0 as the zero point (actual resistance value/10)

4.6 Calculation of CRC

The sensor uses CRC8 verification, the initial value is 0, and the polynomial is 0 31 (8 +^{5} + ^{4} + 1), the code is as follows:

```
//********************************************************************* //Function name: Calc_CRC8 // Function : CRC8 calculation,
initial value: 0xFF, polynomial:
0x31 (x8 + x5 + x4 + 1) // Parameter : unsigned char *dat: the first address of the data to be
verified;
                        unsigned char Num: CRC check data length
// // Return : crc: calculated checksum value
//********************************************************************* unsigned char Calc_CRC8(unsigned char *dat, unsigned
char Num) {

          unsigned char i, byte, crc=0xFF;

          for(byte=0; byte<Num; byte++) {

                    crc^=(dat[byte]); for(i=0;i<8;i+
                    +) {

                              if(crc & 0x80)
                                        crc=(crc<<1)^0x31; else

                                        crc=(crc<<1);
                    }
          }
          return crc;
}
```

5. **Product size diagram**

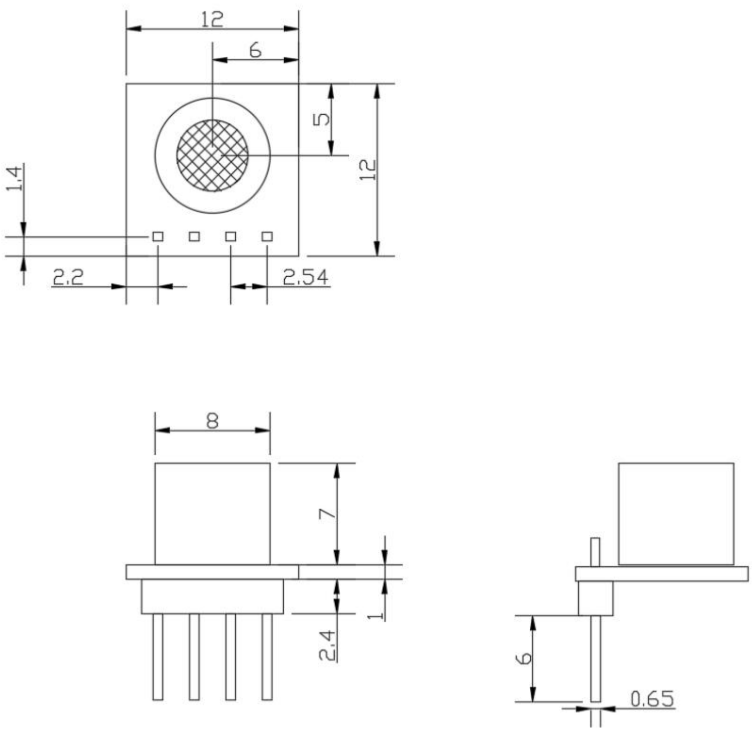


Figure 4. **Product dimensions (unit: mm)**

Tolerances see table below

Table 3 Dimension tolerance table

Size range D/mm	Dimensional tolerance T/
0.5ÿDÿ3	mm ±0.2
3ÿDÿ6	±0.3
6ÿDÿ30	±0.5

6. Notes

6.1 Water environment

(1) Splashing water onto the sensor or immersing the sensor in water will cause the sensor performance to deteriorate or even damage the sensor.

(2) If water condenses on the surface of the gas-sensitive material and remains there for a period of time, the performance of the sensor will deteriorate.

(3) Ice on the sensor surface will cause the sensor material layer to break and lose its sensitive properties.

6.2 High concentration VOC gas

(1) Regardless of whether the sensor is powered on or not, long-term operation in high-concentration VOC gas will affect the sensor performance.
Blowing butane from a lighter directly toward the sensor will cause great damage to the sensor; or placing the sensor in a high concentration of hydrocarbons for a long time,
Gases such as hydrogen will damage the sensor.

(2) When the CO_2 gas concentration is too high, it will have a slight impact on the sensor's measurement accuracy.

6.3 Excessive airflow or direct airflow

Avoid placing the sensor in places with excessive airflow or direct airflow, such as at a vent or with a fan blowing directly from the front, as this may cause measurement errors.
inaccurate.

6.4 High Voltage and Polarity Reversal

(1) When the voltage applied to the sensor is too high, for example, the voltage applied exceeds 5.5V, it will cause permanent damage to the sensor.

(2) When the positive and negative polarities of the sensor are connected in reverse, it will cause permanent damage to the sensor circuit.

6.5 Alkaline, acidic environments and pollution from halogenated substances

(1) When the sensor is contaminated by alkaline or acidic liquid spray, or exposed to halogen-containing substances, the sensor performance will be degraded.

(2) When the sensor is exposed to high concentrations of corrosive gases (such as H_2S, SO_2, Cl_2, HCl, etc.), it will not only cause the sensor to
Corrosion or destruction of the pipeline can also cause irreversible damage to the gas-sensitive materials.

6.6 Exposure to volatile silicon vapors

The sensor should be kept away from exposure to silicone adhesives, hair spray, silicone rubber, putty or other places where volatile silicone compounds exist.
If the surface of the sensor is adsorbed with silicon compound vapor, the sensitive material of the sensor will be covered, inhibiting the sensitivity of the sensor and failing to
Recoverable.

6.7 Long-term power outage

When the sensor is not powered for a long time, its resistance will produce a reversible drift, which is related to the environment in which the sensor is located.
Sensors that have been powered off for a long time need to be powered on for a longer time before use to reach a stable state.
The recommended timing lengths are shown in Table 4.

Table 4 Power-off duration and recommended power-on stabilization time

Power outage duration	Recommended power-on stabilization time
Less than 1 week	No less than 30 minutes
More than 1 week	No less than 60 minutes

6.8 Long-term exposure to extreme environments

Regardless of whether the sensor is powered on or not, if it is exposed to extreme conditions for a long time, such as high humidity, high temperature or high pollution, the sensor Performance will be severely affected and unrecoverable.

6.9 Vibration

Frequent and excessive vibration may cause the solder joints of the sensor's internal leads to fall off. Use a pneumatic screwdriver or Ultrasonic welders create these vibrations.

6.10 Impact

Strong impact (such as falling) can cause sensor components to loosen and lead wires to fall off.

6.11 Welding and Cleaning

(1) For sensors, manual soldering is the most ideal soldering method. The recommended soldering conditions are as follows: Flux: chlorine-free resin flux; Soldering temperature: temperature less than 250°C, time less than 5 seconds.

(2) When using liquids such as alcohol or washing water for cleaning, do not allow the liquid to flow into or splash into the sensor to prevent the sensor performance from being affected.

(3) In the instrument, the sensor detection hole should be exposed to the external airflow as much as possible to avoid interference with the measurement accuracy caused by the flux inside the instrument.

6.12 Wiring

The quality of the signal cable will affect the communication distance and quality. It is recommended to use high-quality shielded cables.

7. Common fault guide

7.1 The sensor is powered on for the first time and the measured value is too high

When the sensor is powered on for the first time or after the user has powered off the sensor for a long time, it is necessary to perform a power-on stabilization test according to the power-on stabilization time recommended in Table 4. The sensor readings will return to normal levels.

7.2 After powering on according to the power-on stabilization time recommended in Table 4 , the sensor measurement value is still too high

(1) The sensor may be in a polluted environment. If you place the sensor outdoors or in fresh air, the value will return to normal. (2) The sensor may be in a high temperature and high humidity environment. It is recommended to avoid using it in a high temperature and high humidity environment.

7.3 The sensor measurement value is too low

The sensor is placed in an environment with convection or there are obstacles blocking the sensor's air holes.

7.4 Host cannot communicate with sensor

(1) Hardware problem: The sensor SDA and SCL are not connected to pull-up resistors or the power supply voltage is less than 5V. (2) Software problem: The slave address sent by the host is incorrect (the initial value is 0 1); the CRC check code sent by the host is incorrect; the register address (Register) sent by the host is incorrect; the communication speed is greater than 100kHz.

7.5 Using intermittent power supply mode leads to inaccurate measurement values (too high/too low)

When continuous measurement is required, continuous power supply is required. Using intermittent power supply will result in inaccurate measurement values.

Warning and Personal Injury

Do not use this product in safety protection devices or emergency stop devices, or in any other applications where personal injury may occur due to failure of this product. This product may not be used in any other application unless it is specifically intended or authorized for use.

Please refer to the product data sheet and instructions before using the product. Failure to follow the recommendations may result in death or serious personal injury. assume all compensation for personal injury and death resulting from this, and exempt the company's officers, employees, affiliated agents, Any claims that may be made by distributors, etc., including: various costs, claim expenses, attorney fees, etc.

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Warranty period description

Product Categories	Shelf life
Carbon Monoxide Sensor	12 months

The company is only responsible for products that are defective when used in situations that meet the technical requirements of the product. We do not provide any warranty for use in special scenarios other than those recommended. Reliability does not make any promises.

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