

CO Sensor User Manual

GR-0001
CM-0205 (USB Devkit)

Manual Version 3.2, Revised 12 August 2015



Summary

This pipeline-type infrared gas detection module uses the principle of infrared absorption (NDIR) to detect the contents of carbon monoxide in a gas. The module adopts imported high precision infrared detector and industrial-grade high stability of single chip microcomputer, the product has long life, low cost, high accuracy, and good long-term stability.

Serial communication baud rate is 9600, the data bits for 8, 1 stop bit, parity checking. Its output interface is: 4 ~ 20 ma output current, 0.4 ~ 2 v, output voltage, RS485 output signal, and TTL level signal.

Application

This sensor can be widely installed for home networks, ventilation systems, industrial controllers, public wall hangings, pipeline gas detection, environment monitoring etc.

Performance Parameters

1. Testing environment: atmosphere pressure: 1020 hpa, temperature: 25°C gas flow rate: 300ml/min
2. Detect gas: the content of specific gas in the gas CO
3. Operation principle: NDIR
4. Warm-up time: < 2 minutes (20 min the best measurement condition)
5. Response time: < 5 seconds
6. T90: 15 second (300ml/Min)
7. Recovery time: 25 seconds
8. Test flow rate: 200--400 mL/Min
9. Resolution: depends on different test range
10. Repeatability: $\leq \pm 1\%$ FS
11. Linear error: $\leq \pm 1\%$ FS
12. Zero temperature draft: $\leq \pm 0.1\%$ FS/°C
13. Test temperature draft: $\leq \pm 0.2\%$ FS/°C
14. Operating voltage: 12V DC (+/-5 %)
15. Operating current: max current 50ma, Average current 20 ma
16. Operating power: < 600 mW
17. Output signal: 4-20mA current
 - a. 0.4-2V voltage
 - b. Modbus RS485 digital
 - c. Modbus TTL digital
18. Air intake mouth: M5*3; air outlet mouth: M4*2.5
19. Operating temperature: -10°C--50°C
20. Storage temperature: -20°C--60°C
21. Operating humidity: 0%—95%RH (non-condensation)
22. Operating pressure: 1 ± 0.2 ↑ atmosphere pressure
23. Dimensions: 65mm * 35mm * 20mm (L*W*H)

Schematic Diagram

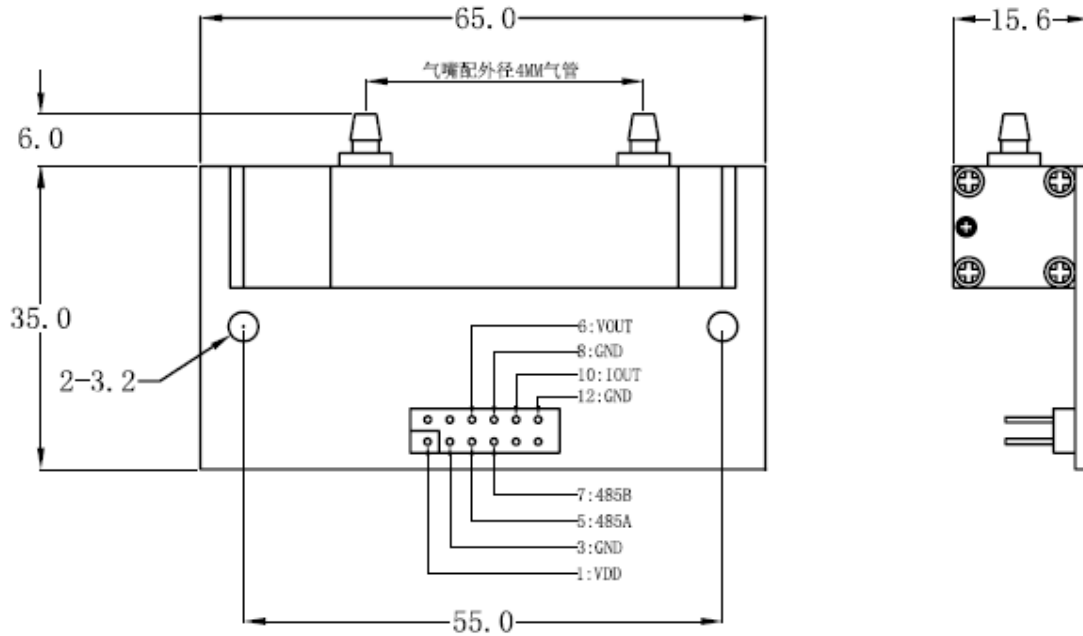


Figure (1) schematic diagram of pipeline type module structure.

Note: the smaller port is the inlet.

Wiring Diagram



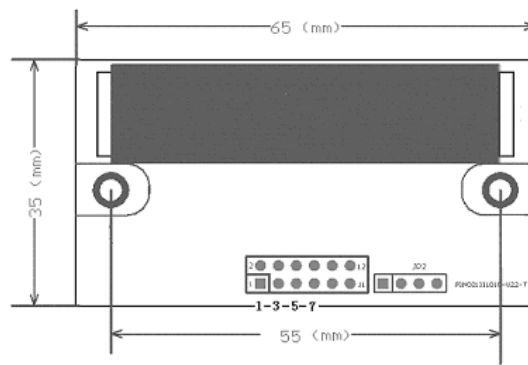


Figure (2) wire diagram of pipeline type infrared detection module

Interface pin definition (See figure 2)

Name	input/output	Pin number	description
VDD	I	1	Operating voltage 12V
GND	I	3	Power and signal ground
485 Aor URXD	I/O	5	485A or module TTL level receiving end(optional)
485 Bor UTXD	I/O	7	485Bor TTL level send end (optional)
VOUT	O	6	Voltage output 0.4~2V
GND	O	8	Signal ground
IOUT	O	10	Current output 4~20mA
GND	O	12	Signal ground

Communication Protocols

1. Format for Universal RS485 bus.

Adpot universal RS485 bus.

All of the control board is connected to a RS485 bus

Communication is universal asynchronous receiver / transmitter (UART), buad rate 9600, 8 data bits, 1 stop bit, even parity

A complete message contains an address byte, a command byte, a data byte length, N data bytes and two parity bytes

Format is as follows:

start	address	command	Data length	data	check	over
4 T	1 byte	1 byte	1 byte	N bytes	2 byte	4 T

A. Start/end

Send each message frame need more than 3.5 character time (recommended more than five characters time) pause interval begins; such as baud rate of 9600, which a character time $T = 1/9600 * 10 = 1.04\text{ms}$, therefore when the system detects that the current byte of the byte interval is greater than about $3.5 T$ at 3.5ms, automatically the byte as a message frame's start (proposed sends two messages frame interval above 5ms) When receiving the first byte (address), each device decodes to determine whether destined for their own. After the last transmitted character, the same at least more than 3.5 character times (recommend more than five character times) pause interval to indicate the end of a frame message. A new message can begin after this pause.

The entire message frame must be continuously sent. If there is more than 3.5 character times pause time before finish frame two bytes, the receiving device flushes the incomplete message and assumes that the next byte is the address field of a new message (recommended frames sent between two bytes before the completion of the message in the same frame two bytes within the interval should be controlled within 1.5 character times). Likewise, if a new message in front of less than then began receiving device will consider it a continuation of the previous message in the 3.5 character times. This will result in a communication error, because the value is definitely wrong when check.

B. Address

Slave address, a byte, range: 1-255 (0xFF). Host will be contacted via the address from the machine into the address field of the message to the slave strobe. When slave sending response messages, it put his address in response to the address field in order to let master know which one device to respond. Address 0 is used as a broadcast address, so that all can be received from the device.

C. Command

That command is function code, a byte, range is 1-255. When the message is sent from the host to the slave, the function code will let slave to know what specific tasks it need to perform.

For a different command, the slave will make different responses; If done correctly, the nature of the query command, the machine will return a message with the specified information; the nature of the operating instruction, the slave will return an empty data (ie, data length byte 0) message to the host to confirm the success of the operation after the completion of the specified operation, ; If a communication error, the slave will return an exception response codes, including including abnormal.

Function code specific definition as show in figure 1.

D. Data length

A byte, means the number of bytes of data range of the message frame, if the value is 0 indicates there is no data

E. Date

Data range including. What you need slave to perform the action or the returned message by the slave adpot. This information can be a value, the reference address etc. If data range is multi-byte, then the low byte first, high byte later. For different slave, address and data information are not the same.

F Check

Master or slave can use check code to discriminate whether the receiving information is wrong; calibration method for the 16-bit cyclic redundancy code (CRC16), calibration object includes all bytes of the message frame (except for the two checksum byte itself).

CRC16 contains two-byte, low byte first, high byte later. CRC16 code calculated by the sending device, placed in the tail of the sent information. The Equipment to receive information and then recalculate the information received CRC16 code, comparing the calculated CRC16 code whether matches the received, if they do not match, then the error.

C language example which calculated by CRC16 code is as following:

```
//CRC16 code directly calculation method
/*pSendBuf first byte:finger
//nEnd: data check length
unsigned int GetCheck(unsigned char *pSendBuf,unsigned char nEnd)
{
    unsigned char i,j;
    unsigned int wCrc = (unsigned int)(0xffff);
    for(i = 0;i<nEnd;i++)
    {
        wCrc ^= (unsigned int)(pSendBuf[i]);
        for(j = 0;j<8;j++)
        {
            if(wCrc&0x01)
            {
                wCrc >>=1;
                wCrc ^= 0xA001;
            }
            else wCrc >>=1;
        }
    }
    return wCrc;
}
```

Instructions

Instruction set as shown in figure 1. Detailed instruction format is as follows (assuming these slave address are 0x01), the data in the following table are in hexadecimal. If only one module on the network and send 0x01 command no return then can use address broadcast address 0x00, you can know how much the current module address.

1. Read mode number

Host send format:

Address	Command	Data length	Check lower	Check high
01	01	00	21	90

Instruction: The slave which read address is 01

The slave return format:

Address	Command	Data length	Data lower	Data high	Check lower	Check high
01	01	02	71	17	DD	A2

Instruction: address is 01 of the slave mode number is 6001(0x1771);

2. Read Type

Host send format:

address	Command	Data length	Check lower	Check high
01	04	00	22	C0

Instruction: The measurement type of read address 01 slave;

Slave return format:

Address	Command	Data length	Data	Check lower	Check high
01	04	01	16	C0	47

The measurement type of read address 01 slave is (see figure 2, indicates CO)

3. Read test range

Host send format:

Address	Command	Data length	Check lower	Check high
01	05	00	23	50

Instruction: the measurement test range of read address 01 slave;

Slave return format:

Address	Command	Data length	Data lower	Data high	Check lower	Check high
01	05	02	10	27	F5	16

Instruction: (Assume the measurement unit of address 01 slave is 2 as show figure3, indicate ppm),

decimal 1, then the test range of address 01 slave is 1000.0ppm(0x2710=10000);

Remarks: This command get data must be combined measurement unit and decimal place two parameter to get the final test range value;

4. Read unit

Host send format:

Address	Command	Data length	Check lower	Check high
01	06	00	23	A0

Instruction: the measurement unit of the read address 01 slave;

Slave return format:

address	command	Data length	data	Check lower	Check high
01	06	01	02	61	88

Instruction: the measurement unit of address 01 slave is 02 as show figure 3, indicate ppm);

Remarks: This parameter is valid to all concentration value, including test range value, measurement value and each alarm value;

5. Read decimal place

Host send format:

address	Command	Data length	Check lower	Check high
01	07	00	22	30

Instruction: the decimal number of the read address 01 slave data value

Slave return format:

address	command	Data length	data	Check lower	Check high
01	07	01	01	70	49

Instruction: the decimal place of address 01 slave is 1, if no decimal place then return value is 0. ;

Remarks: This parameter is valid to all concentration value, including test range value, measurement value and each alarm value;

6. Change address

Host send format:

address	command	Data length	data	Check lower	Check high
00	10	01	01	C1	B1

Instruction: change all of the slave address on net to 01.

If change successful, (new address is valid), the slave return format:

address	Command	Data length	Check lower	Check high

01	10	00	2D	C0
----	----	----	----	----

Remark: cannot change the new address to broadcast address 00.

7. Read measurement value

Host send format:

Address	command	Data length	Check lower	Check high
01	20	00	39	C0

or

address	command	Data length	Check lower	Check high
00	20	00	68	00

Instruction: the concentration measurement value of the read address 01 slave;

The slave return format:

address	command	Data length	Data lower	Data high	Check lower	Check high
01	20	02	EA	04	FD	63

Instruction: Assure the measurement unit of address 01 slave is 2 (see figure 3 , means ppm), decimal place is 1, then the measurement value of the address 01 slave is 125.8ppm(0x04EA=1258);

remark: This command get data must combine measurement unit and decimal place two parameter to get final measurement value.

8. Restore factory calibration data

Host send format:

address	command	Data length	Check lower	Check high
01	31	00	35	90

Instruction: restore factory calibration data for address 01 slave, if customer calibrate the zero point and standard value make wrong, then can use this command to restore factory calibration data.

if change successful, the slave return format:

address	Command	Data length	Check lower	Check high
01	31	00	35	90

9. Check ZERO

Host send format:

address	command	Data length	Check lower	Check high
01	38	00	33	C0

instruction: correct the current measurement value of read address 01 slave to new zero point (general use pure nitrogen), after correction, please power off first, then power on to observe data .

If correction success, the slave return format:

address	command	Data length	Check lower	Check high
01	38	00	33	C0

10. Check SPAN

Host send format:

address	command	Data length	Data lower	Data high	Check lower	Check high
01	39	02	64	00	9E	5C

Instruction: calibrate the current measurement value of the read address 01 slave to a standard value (determined as the standard gas concentration, related with decimal places). As an example of the standard gas of 10.01% of CO₂ (assuming that the slave unit of measure is%, a decimal, it means that the calibration gas value corresponding data in decimal 100 = 0X0064; assume that the unit of measurement for the slave is %, 2 decimal places, it means that the calibration gas value corresponding data in decimal 1001 = 0X03E9; assumes that the slave unit of measurement of% decimal places to 0, it means that the calibration gas value corresponding data decimal 10 = 0X000A); please power off first and then power on to observe data after calibration is complete.

If calibration is successful, the slave returns the format:

address	command	Data length	Check lower	Check high
01	39	00	32	50

Glossary

Figure 1: function code definition

code	name	Sending data	Response data	Function	remark
0x01	Read model	0 byte	2 byte	Read the model number of selected slave	
0x04	Read type	0 byte	1 byte	Read the measurement type of specific slave	Figure 2
0x05	Read test range	0 byte	2 byte	Read the measurement range of selected slave	
0x06	Read unit	0 byte	1 byte	Read the measurement unit of selected slave	Figure 3
0x07	Read decimal place	0 byte	1 byte	Read the decimal place of the selected slave	
0x10	Chang address	1 byte	0 byte	Modify the communication address of the selected slave	
0x20	Read measurement value	0 byte	2 byte	Read the measurement result of selected slave	
0x31	Remove zero adjusted value	0 byte	0 byte	remove the specific calibration value of the selected slave (restore factory set)	
0X38	Regulate zero	0 byte	0 byte	regulate the current vale of the selected slave to zero	
0X39	Regulate SPAN	2 byte	0 byte	calibrate the current value of the selected slave to given calibration values	

Figure 2: infrared gas type definition

number	Name	Chemical formula	remarks	Serial number	Name	Chemical formula	remark
01	Carbon monoxide	CO					
05	NO2	NO ₂					
06	NOM	NO					
07	Sulfur dioxide	SO ₂					
09	ammonia	NH ₃					
22	Carbon dioxide	CO ₂					
23	Sulfur hexafluoride	SF ₆					
25	methane	CH ₄					
26	hydrocarbon	HC(standard gas C3H8)					
27	N2O	N ₂ O					
28	R123a	R123a					

Figure 3: Unit definition

code	0	1	2	3	4	5	6	7	8	...
mark	PPM	PPB	PPM	‰	%	%LE L	%VO L	Mg/m3	Mg/L	...

Support

The quickest way to obtain technical support is via email. Please send all support inquiries to support@co2meter.com.

Please include a clear, concise definition of the problem and any relevant troubleshooting information or steps taken so far, so we can duplicate the problem and quickly respond to your inquiry.

Warranty

This sensor comes with a 90 day (warranty period) limited manufacturer’s warranty, starting from the date the sensor was shipped to the buyer.

During this period of time, CO2Meter.com warrants our products to be free from defects in materials and workmanship when used for their intended purpose and agrees to fix or replace (at our discretion) any part or product that fails under normal use. To take advantage of this warranty, the product must be returned to CO2Meter.com at your expense. If, after examination, we determine the product is defective, we will repair or replace it at no additional cost to you.

This warranty does not cover any products that have been subjected to misuse, neglect, accident, modifications or repairs by you or by a third party. No employee or reseller of CO2Meter.com’s products may alter this warranty verbally or in writing.

Liability

All liabilities under this agreement shall be limited to the actual cost of the product paid to CO2Meter.com. In no event shall CO2Meter.com be liable for any incidental or consequential damages, lost profits, loss of time, lost sales or loss or damage to data, injury to person or personal property or any other indirect damages as the result of use of our products.

Returns

If the product fails under normal use during the warranty period, a RMA (Return Material Authorization) number must be obtained from CO2Meter.com. After the item is received CO2Meter.com will repair or replace the item at our discretion.

To obtain a RMA number, call us at or email us at (386) 256-4910 support@co2meter.com. When requesting a RMA please provide reason for return and original order number.


If we determine that the product failed because of improper use (water damage, dropping, tampering, electrical damage etc.), or if it is beyond the warranty date, we will inform you of the cost to fix or replace the product. For more information visit our website: www.CO2Meter.com/pages/faq


Contact Us

We are here to help!

For information or technical support, please contact us.

 support@co2meter.com

 (386) 256-4910 (Technical Support)

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