Product Data Sheet

NDIR CO2 SENSOR MODULE (4CO2-5000) (PN: 096-0100-000)

• Description

This infrared sensor functions based on the NDIR principle for monitoring carbon dioxide (CO2) presence. It features a highly accurate optical system equipped with a durable light source and a temperature-compensated infrared detector with dual channels. The electronic circuit includes a microprocessor with embedded intelligent software, which handles signal acquisition, processing, and output. Furthermore, it simultaneously performs environmental temperature compensation, rectifies response non-linearity, and offers multiple output options.

• Performance Characteristics

Output Mode:	UART
	Analog (0.4 ~ 2.0 V)
Number of Channel:	Dual
Dimension:	Industrial standard 4-series

• Environmental

Storage Temperature:	-20°C ~ 50°C
Working Temperature:	-40°C ~ 70°C
Working Humidity:	0% ~ 95% RH non-condensing

• Pinout

Pin 1 - VCC	Pin 4 - RX
Pin 2 - GND	Pin 5 - DA
Pin 3 - TX	

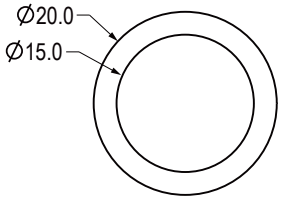
• Life Time

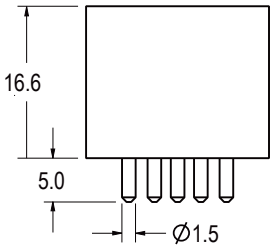
Expected Operating Life:	6 years in clean air
Warranty:	24 months

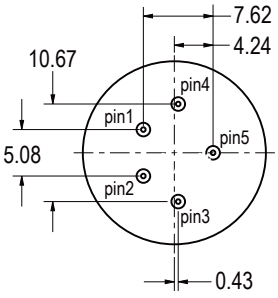
• Technical Data

Detection Range	0 ~ 5,000 (customizable) ppm
Detection Accuracy	±(50 ppm + 5% of reading)
Response Time (T90)	< 30s @ 20°C ambient
Warm-Up Time	Start to work < 30s @ 20°C ambient
	Precision reached < 5min @ 20°C ambient
Working Voltage	3.0 ~ 5.5 VDC
Working Current	I_{avg}: 45 / I_{peak}: 74 mA
Resolution	1% of measuring range
Zero Repeatability	±500 ppm @ 20°C ambient
Span Repeatability	±500 ppm @ 20°C ambient
Long Term Zero Drift	±500 ppm / month @ 20°C ambient

• Product Dimensions







All dimensions in mm
All tolerances ±0.20mm unless otherwise stated

• Note

All the above performance parameters are measured in a standard test environment. Please contact us if you need more details.

• UART Protocol

Baud rate: 9600bps (settable), 8-bit data, 1-bit stop bit, no check bit.

1. Active upload mode

The sensor actively uploads the concentration value and outputs the data in ASCII format as follows:

32	32	x	x	x	x	x	32	p	p	m	\r	\n

Where 32 is the ASCII code of the space, and the output ends with a new line character.

For example: output of 12345 ppm:

		1	2	3	4	5		p	p	m
0x20,	0x20,	0x31,	0x32,	0x33,	0x34,	0x35,	0x20,	0x70,	0x70,	0x6d,

2. Passive upload mode

The sensor will automatically switch to passive mode after receiving any of the passive commands.

2.1 Passive Command Format:

(**The format of each communication frame is as follows**)

Header	Device Code	Function Code	Starting Address	Data Length	Data	Check Bit
H	ID	F	A	N	D	CRC16

H: 1Byte, fixed as 0x3A

ID: 1Byte, fixed as 0x10

F: 1Byte, e.g. 0x03

A: 2Bytes, e.g. 0x0001

N: 1Byte, e.g. 0x01

D: N*2Bytes, high byte first, e.g.(MSB LSB)defined as a signed short integer.

CRC16: Check data from first byte to data bit, 2Bytes, using MODBUS_CRC16 checking algorithm. (see Appendix 1 for details)

2.2 Sensor Type Reading

Request from host devise

Header	Device Code	Function Code	Starting Address	Check Bit
0x3A	0x10	0x01	0x00	0x0C A9

Module receiving the correct data reply

Header	Device Code	Function Code	Data	Check Bit
0x3A	0x10	0x01	D (1byte)	CRC16

D data definition: 0A: CO2 0B: CH4

e.g., 3A 10 01 0A 8C AE Read data D as 0x0A and module as CO2 module.

2.3 Gas Concentration Reading

Request from host devise

Header	Device Code	Function Code	Starting Address	Data Length	Data	Check Bit
0x3A	0x10	0x03	0x0000	0x01	0x00	0xC6 03

Module receiving the correct data reply

Header	Device Code	Function Code	Starting Address	Data Length	Data	Check Bit
0x3A	0x10	0x03	0x0000	0x01	D	CRC16

D: Received data, 4Bytes, high byte first

e.g., 3A 10 03 00 00 01 00 00 03 09 20 3B

Concentration(ppm): 00 00 03 09 i.e., 777ppm

2.4 Calibration Instruction

Request from host devise

Header	Device Code	Function Code	Starting Address	Data	Check Bit
0x3A	0x10	0x07	0x00	D	CRC16

e.g., 2Bytes, high byte first

send 3A 10 07 00 01 90 C4 0A D is 0x01*256+0x90, for calibration of the 400 ppm concentration

send 3A 10 07 00 00 00 C5 F6 D is 0x00*256+0x00, for calibration of the 0 ppm concentration

Module response (data bit 0x00 indicates successful calibration, 0x01 indicates failed calibration)

Header	Device Code	Function Code	Data	Check Bit
0x3A	0x10	0x07	0x00/0x01	0x0F 09

Note: It is necessary to place the sensor module in a stable environment for at least 10 minutes before calibration. Calibration is complete when the calibration receives a response.

2.5 Factory Default Setting

Request from host devise

Header	Device Code	Function Code	Data	Check Bit
0x3A	0x10	0x09	0x00	0x0B 69

Module receiving the correct data reply

Header	Device Code	Function Code	Data	Check Bit
0x3A	0x10	0x09	0x00	0x0B 69

Note: The Restore Factory Settings command restores the calibrated settings in 2.4 to the manufacturer default settings.

2.6 Modification of baud rate

Request from host devise

Header	Device Code	Function Code	Starting Address	Data	Check Bit
0x3A	0x10	0x05	0x01 1C	D	CRC16

D: 1Byte data, 0x00 i.e., baud rate =9600bps

0x01 i.e., baud rate =19200bps

0x02 i.e., baud rate =38400bps

e.g., 3A 10 05 01 1C 00 9D 4E (baud rate =9600bps)

3A 10 05 01 1C 01 5C 8E (baud rate =19200bps)

3A 10 05 01 1C 02 1C 8F (baud rate =8400bps)

Module response (data bit 0x00 indicates successful calibration, 0x01 indicates failed calibration)

Header	Device Code	Function Code	Starting Address	Data	Check Bit
0x3A	0x10	0x05	0x01 1C	D	CRC16

Appendix1: MODBUS CRC16 algorithm

```
unsigned short modbus_CRC16(unsigned char *ptr, unsigned char len)
{
unsigned short wcrc=0XFFFF; / /
int i=0, j=0;
for (i=0; i<len; i++)
{
wcrc^=*prt++;
        for ( j=0; j<8; j++)
        {
            if (wcrc&0X0001)
            {
                wcrc=wcrc>>1^0XA001;
            }
        else
        {
            wcrc>>=1;
        }
}
}
return wcrc<<8| wcrc>>8; // low byte first, then high byte
}
```