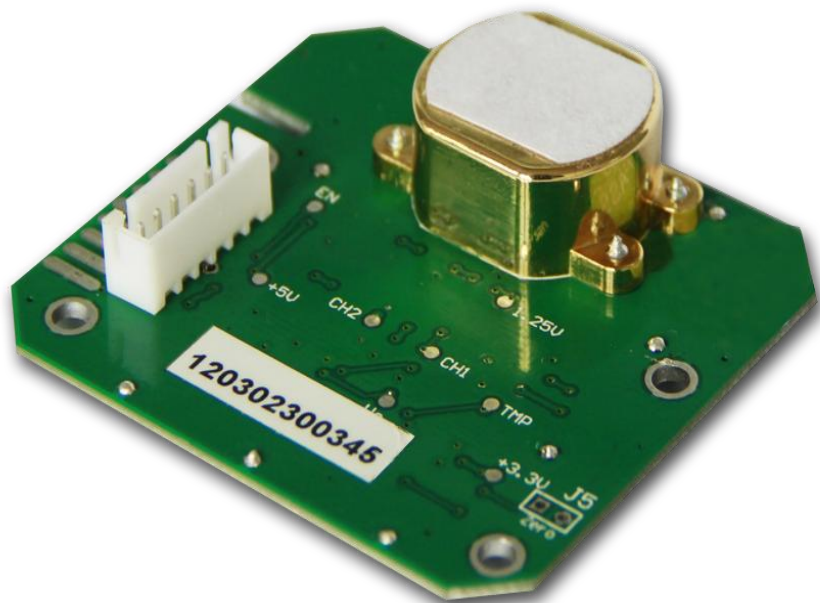# USERS MANUAL

Infrared Carbon Dioxide Module

CM1102 SERIES（Dual Beam）

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1.   Briefing

Welcome to use infrared carbon dioxide gas sensor module CM1101 series. It adopts advanced non-dispersive infrared technology (NDIR) a, which can be integrated in safety and alarming devices, able to be used for CO2 concentration detecting, air quality monitoring, HVAC, buildings, schools, medical, air conditioning, environmental monitoring, mushroom farming, fireplace CO2 gas control etc .

2. Working principle

CO2 gas is composed of different types of atoms have absorption spectrum in infrared range. Absorption intensity abides by Lamber-Beer's Law. Basic working principle of NDIR sensor is as below,
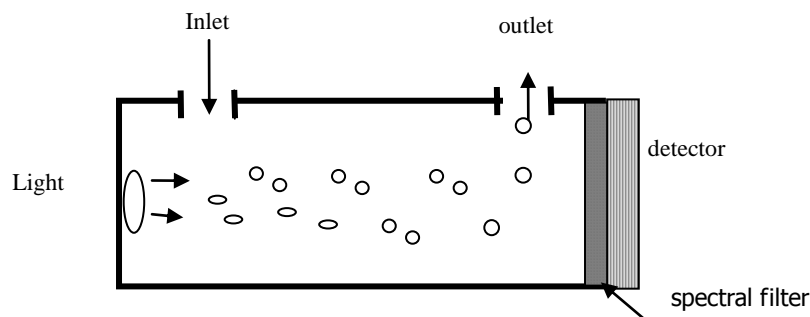
Basic mathematical model：A majority of both organic and inorganic polyatomic gas have specific absorptive wavelength in infrared region. It observes Lambert-Beer Law formula $I=I_0e^{-kpl}$ when infrared light is coming through. Light absorption intensity "i" can be described as $i=I_0-I=I_0(1-e^{-kpl})$. I_0: intensity of incoming ray. I: transmitting beams. l :thickness of gaseous medium. p: gas concentration. k: absorption coefficient.

3.   Specifications

Infrared CO2 gas module	
Technology	NDIR
Range	0-2000ppm,0-5000ppm, 0-10000ppm
Max drift	+/-2% FS
Resolution	10ppm
Temperature influent	＜0.5% FS per℃
Accuracy	±（40ppm+2%） readings
Response time T90	30s
Repeatability	<2%
Sampling method	Diffusion

Power supply/Consumption	DC 5V±5%/Pmax 0.6w
Working current	Average 70mA, max 120mA
Voltage output	PWM,RS232-TTL, 0-4 V DC
Digital output UART	Data bit:8; Stop bit: 1; Check bit: null
Standard baud rate	9600bps
Working temperature	0℃- 50 ℃
Relative humility	0-95% no condensing
Lifespan	≥10years
Dimension	57*62*14.3mm(L*W*H)

## 4. Dimensions & I/O definitions

4.1 Dimensions
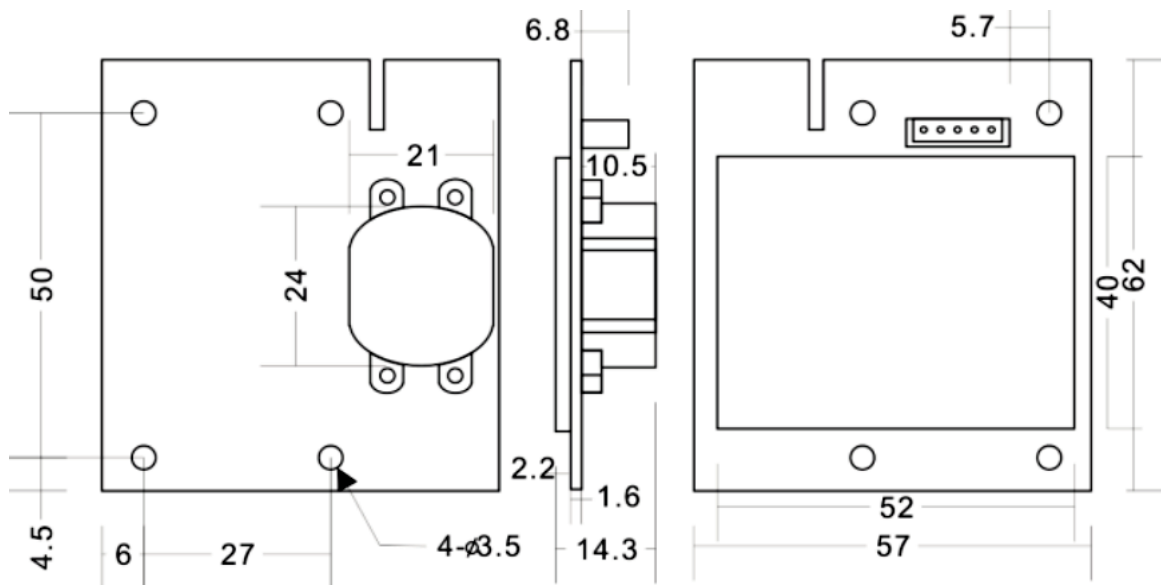
4.2 I/O definitions
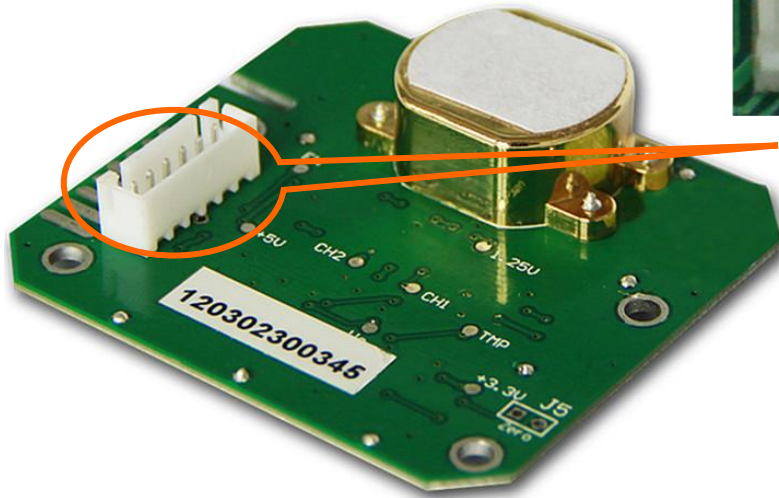
| Pins	Items	Definitions
1	TX	UART TX（SENDING）
2	RX	UART RX（RECEIVING）
3	+5V	POWER SUPPLY INPUT（+5V）
4	GND	POWER SUPPLY INPUT（GND）
5	PWM	PULSE WIDTH MODEM (OPTIONAL)
6	UO	VOLTAGE OUTPUT

Note：Pin1 and Pin2 are RS232 communication terminals on the board. RS232 TTL on the board is 0-3.3V, able to be compatible with 5V SCM. It should convert TTL if connecting to the computer via RS232. For example: Using transferred IC ADM3202.

RS232 communication reference diagram:
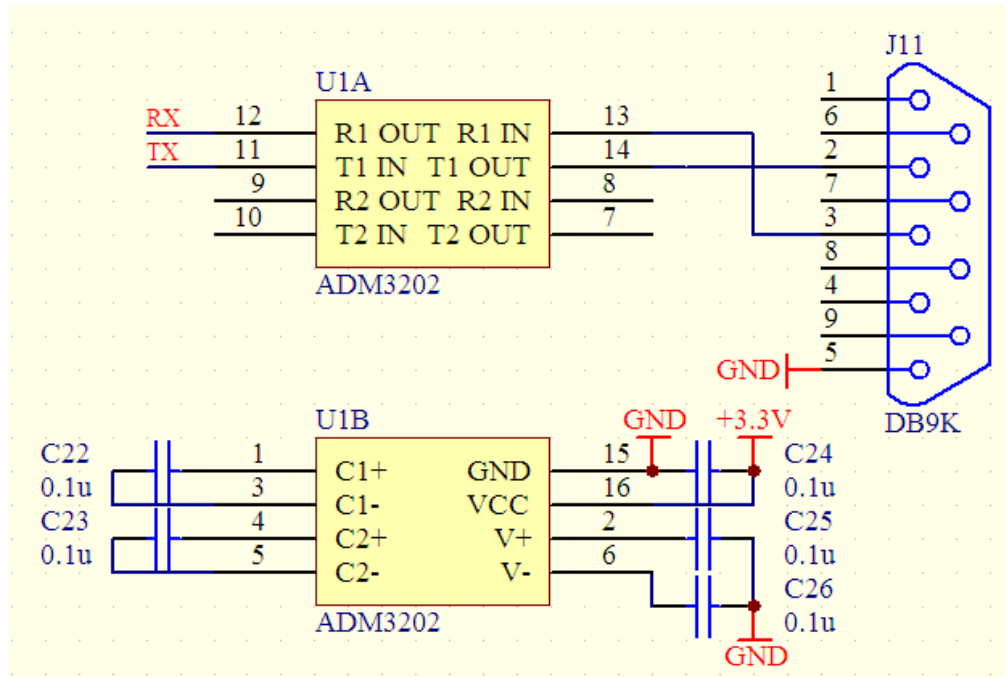
5. Relationship between concentration and voltage output

Relationship between concentration and voltage output is linearity: $Y = U/4 * FS$
Y is the CO_2 concentration (ppm); U is voltage, units of V; FS is full scale, unit of ppm (2000ppm or 5000ppm).
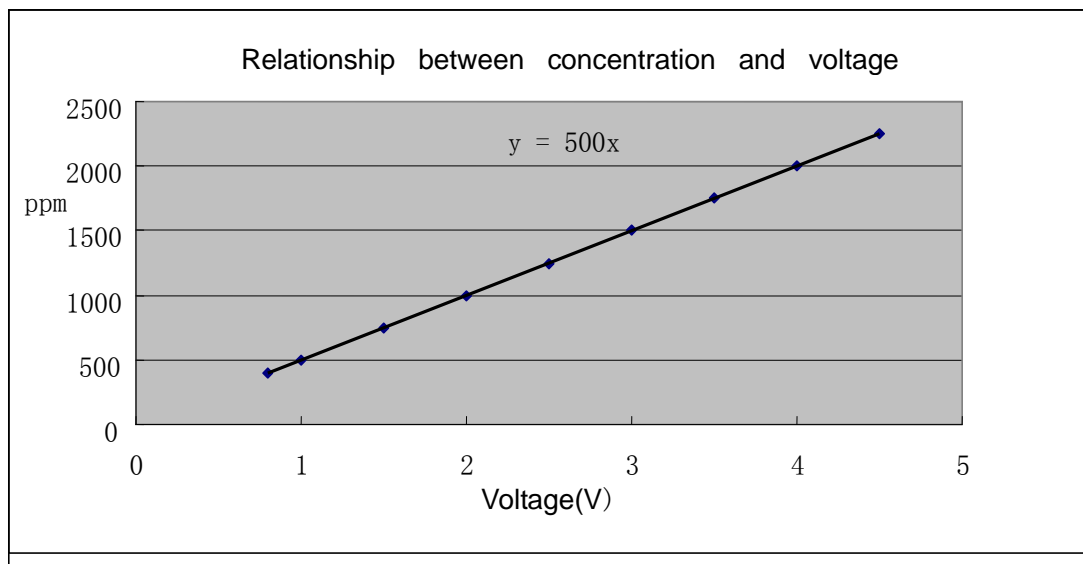
6. Zeroing

Make J5 short cut for 3 seconds, the NDIR CO_2 sensor will automatically zero to 400ppm.

Note: please do it in the fresh air with good ventilation.

7.   UART Communication protocol

Baud rate：9600bps   Data bit：8   Stop bit：1   Check bit：null

Summary:

1. The data in the explanation are all hex data. Such as 46 is decimal [70]
2. [xx] is single byte data(no symbol,0-255) ;(xx) is double byte data, signed integer (-32768 to +32767),the top one is ahead. "—— " followed by explanation;
3. All the data are integer. It has (100, 10, and 1) times relationship with true data. For example, if an instrument of four components SO2, CO2, CO, O2, show as 899PPM, 2.000%, 010.0%, 20.80%, then the instrument return data are divided by 1,1000,10,100 as the instrument display data.
4. The length of command byte is [LB]+3.

Command Format:

Send：   [IP] [LB] [CMD] [DF] [CS]
[IP]   address（fixed as 11）。
[LB]   byte length followed does not include CS
[CMD]   command
[DF]   parameter items with command, optional
[CS]   CS= －（IP +LB+CMD +DF）

Response：
a．When the command is implemented correctly, it responses
[ACK] [LB] [CMD] [DF] [CS]
[ACK]=0X16 right command
[LB]   byte length followed does not include CS
[CMD]   command
[DF]   parameter items with command, optional
[CS]   CS=－（ACK +LB+CMD+DF）

b．When the command is not implemented correctly, it responses
[NAK] [LB] [CMD] [EC] [CS]
[NAK]=0X06   Command is not implemented correctly
[LB]=2   byte length followed does not include CS
[CMD]   command
[EC]   the error code that command is not implemented correctly
[CS]   CS= －（NAK +LB+CMD+DF）

[EC]
01   Order length is wrong
02   The command is not correct
03   Can't implement this command under current status.

Function list

No	Function	CMD	Description
1.	**measuring results check**	0x01	Besides measuring data, it also has status information
2.	**measuring results check**	0x02	Measurement results of each component
3.	**software version check**	0x1E	
4.	**sensor serial No. check**	0x1F	

Detail description

1. Look up measurement result

Send：11 01 01 ED

Response：[ACK] 05 01 [DF1] [DF2] [ST1] [ST2] [CS]

Function：Look up measurement result.

Remarks：

1).Gas 1 concentration = （DF1*256+ DF2）/ (ppm)

2).[ST] means status of system, which give the information of working status of it. For example: to check whether it needs zeroing, sampling signal is correct, user's options.

2. Look up voltage result

Send：11 02 02 [TVM] EB

Response：[ACK] 0A 02 [TVM] [FV1] [FV2] [FV3] [FV4] (refVpp) (testVpp) [CS]

Function：Look up voltage result.

Remarks：

1). [TVM] gas measurement voltage. 00 is the first component,01 is the second component,(this place only has the first component)

2). [FV1] [FV2] [FV3] [FV4] to calculate voltage. Four bytes consist of floating type

3). (refVpp) is referred voltage peak, its range is about 0-4 or 5 k

4). (testVpp) is measurement voltage peak

5). For example,there is an instrument consist two component,CO+CO2,which has know as the first component was CO,now take CO to measure voltage,should sent"11 02 02 00 EB",then take the second component of CO2 to send"11 02 02 01 EA"

3.Software version check

Send：11 01 1E D0

Response ：[ACK] 0C 1E [CH1] [CH2] [CH3] [CO2] [CH5] [CH6] [CH7] [CH8][CH9][CH10][CH11][CH12] [CS]

Function： to check software version

Remark：

Out put the version code. [CHx] is ASCLL II code.

4.Series number check

Send：11 01 1F CF

Response：ACK] 0B 1F（SN1）（SN2）（SN3）（SN4）（SN5）[CS]

Function：

Remark：

Output the series number of software. SNn is from 0-9999, three integer consists of 12 bits series number

After-sales services and consultancy

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