



Electrochemical Gas Detection Module

User's Manual V3.1
(Model: TE03)

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Taiyuan Tengxing sensor technology Co., Ltd

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Electrochemical Detection Module TEI

TE03 is a general-purpose and high-performance electrochemical module. It uses three electrodes, electrochemical gas sensor and high-performance micro-processor. By installing different gas sensor, the module could detect relevant gas. It has the digital output and analog voltage output at the same time which facilitates the usage and calibration and shorten the development period. It is a combination of mature electrochemical detection principle and sophisticated circuit design, to meet customers' different detection needs.

Features

High sensitivity & high resolution
Small size and low power consumption
UART and analog voltage output
Good stability and excellent anti-interference ability

Main Application

Portable and fixed gas detector, various gas detection equipment and occasion.

Technical Parameters

Model No.	TE03
Target Gas	CO, O ₂ , NH ₃ , H ₂ S, NO ₂ , O ₃ , SO ₂ , CL ₂ , HF, H ₂ , PH ₃ , HCL etc
Measurement Range	Refer table 2.
Working Voltage	DC 5±0.1V
Working Current	< 10 mA
Output Data	UART Output (TTL electrical level,3V)
	Analog Voltage (refer table2. for sensor original amplifying signal)
Working Life	2 years (in clean air)
Operating Environment	Temp.: -20~50°C
	Humidity.: 15%~90%RH (no condensation)
Storage Environment	Temp.: -20~50°C
	Humidity.: 15%~90%RH (no condensation)
Size	∅23.3mm*31.2mm(diameter*height)
Weight	O ₂ : <25g Others: <15g

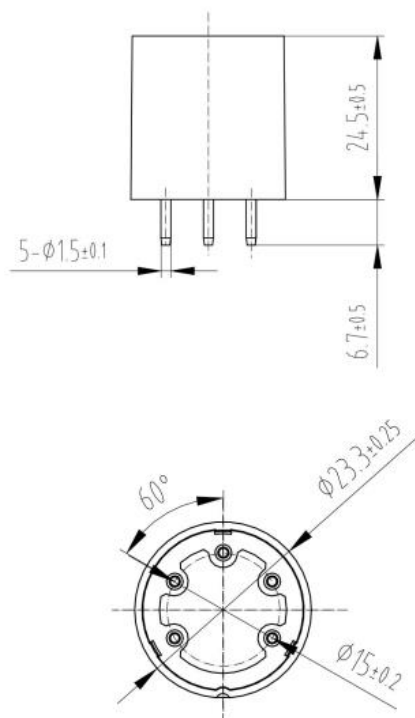


Fig1. Structure view from side and bottom

(unit is mm)

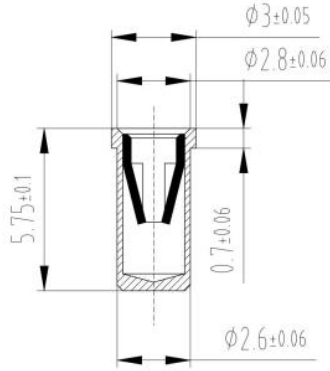


Fig2. Socket size for module (from side, unit is mm)

Detection range and signal output Table 2

No.	Gas Code	Detected Gas	Range	Resolution	Voltage output range	Response time(T90)
1	0x02	NH3	(0-100)ppm	1ppm	(0.6-3) V	≤150S
2	0x03	H2S	(0-100)ppm	1ppm	(0.6-3) V	≤30S
3	0x04	CO	(0-1000)ppm	1ppm	(0.6-3) V	≤30S
4	0x05	O2	(0-25) %VOL	0.1 %VOL	(1.5-0) V	≤15S
5	0x06	H2	(0-1000)ppm	1ppm	(0.6-3) V	≤120S
6	0x08	C2H4	(0-100)ppm	0.1ppm	(0.6-3) V	≤120S
7	0x17	HCHO	(0-50)ppm	0.1ppm	(0.6-3) V	≤120S
8	0x2A	O3	(0-10) ppm	0.1ppm	(2-0) V	≤120S
9	0x2B	SO2	(0-20) ppm	0.1ppm	(0.6-3) V	≤30S
10	0x2C	NO2	(0-20) ppm	0.1ppm	(2-0) V	≤30S
11	0x2E	HCL	(0-10)ppm	0.1ppm	(2-0) V	≤60S
12	0x2F	HCN	(0-100)ppm	0.1ppm	(0.6-3) V	≤120S
13	0x31	CL2	(0-20) ppm	0.1ppm	(2-0) V	≤60S
14	0x33	HF	(0-10)ppm	0.1ppm	(2-0) V	≤60S
15	0x34	ETO/VOC	(0-100)ppm	0.1ppm	(0.6-3) V	≤120S
16	0x45	PH3	(0-1000)ppm	0.1ppm	(0.6-3) V	≤30S
17	0x46	DG01 (odor)	(0-50) ppm	0.01ppm	(0.6-3) V	≤120S

NOTE. 1.Table2 shows the normal detection range, other ranges could be customized.

2.Left side value of detection range (zero point) is corresponding to left side value of voltage output range. BUT right side value of detection(max detection value) is **NOT** corresponding to the right side value of voltage output range.

Take TE03-O2 (0-25%vol) as an example: 0%vol is corresponding to 1.5V, but the corresponding value of 25%vol is not the fixed value of 0V, it may be other values like 0.1V or 0.2V.

Pin definition table3.

GND	Ground
VCC	Power supply
VO	Original Voltage output
RXD	Series port input
TXD	Series port output

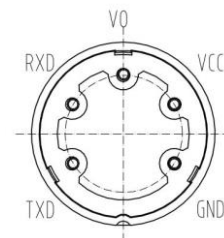


Fig3.Bottom view

Take TE03-CO for example: zero voltage $V_{out0} = 0.6\text{ V}$, its corresponding concentration $N_1 = 0\text{ ppm}$; in 200 ppm CO gas, $V_{out1} = 0.9\text{ V}$, its corresponding concentration $N_2 = 200\text{ ppm}$, If the current voltage $V_{outx} = 1.2\text{ V}$, then the current CO concentration:

Communication Protocol

Baud Rate	9600
Data Bits	8
Stop Bits	1
Parity	None

The default communication type is active upload and it sends gas concentration once every other second (the concentration is 16 hexadecimal). If you want to switch to Q&A mode, please send 0x78 command, to change communication mode to 0x04(Q&A mode), then current concentration will be returned by module after it receiving 0x86 command (reading concentration), suggested communication cycle is 1s.

The default mode is active upload mode, the sensor will send gas concentration actively as follow without sending any command by users. **Table5.**

$$\text{gas concentration} = (\text{High byte} * 256 + \text{Low byte}) * \text{resolution}.$$

If number of decimal is 0, resolution is 1ppm; number of decimal is 1, resolution is 0.1ppm; number of decimal is 2, resolution is 0.01ppm.

	0x78	To change communication mode							
Send	0	1	2	3	4	5	6	7	8
	Start Byte	Address	Command	Communication Mode	reserved	reserved	reserved	reserved	Check sum
	0xFF	0x01	0x78	0x04	0x00	0x00	0x00	0x00	0x83
EXP.	FF 01 78 04 00 00 00 00 83 (send this command to switch to Q&A mode)								

Receive	0	1	2	3	4	5	6	7	8
	Start Byte	Command	Return	reserved	reserved	reserved	reserved	reserved	Check sum
	0xFF	0x78	Success: 0x01 Failure: 0x00	0	0	0	0	0	0x87 0x88
EXP.	FF 78 01 00 00 00 00 87 (If users received the data, it means switch successfully)								

If users want to switch to active upload mode, send FF 01 78 **03** 00 00 00 00 84(hexadecimal).

0x86 — To read the concentration value (This command is needed just under Q&A mode.) Table7.

1	0x86	To read concentration							
Send	0	1	2	3	4	5	6	7	8
	Start Byte	Address	Command	reserved	reserved	reserved	reserved	reserved	Checksum
	0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	0x79
EXP.	FF 01 86 00 00 00 00 79								
Receive	0	1	2	3	4	5	6	7	8
	Start Byte	Command	Concentration High byte	Concentration Low byte	Gas No.	number of decimal	reserved	reserved	Checksum
	0xFF	0x86	0x00	0xD1	0x05	0x01	0x00	0x00	0xA3
EXP.	FF 86 00 D1 05 01 00 00 A3 (Take O2 for example, its concentration is 20.9%vol in air)								

gas concentration=(High byte*256+Low byte)*resolution

Please note that in the calculation formula, the High byte and Low byte means the decimalism value changed from hexadecimal.

4.Checksum and calculation

/******

* Function Name: ucharFucCheckSum (uchar *i,uchar ln)

* Functional description: checksum 【Non(sending/receiving commend

Byte1+Byte2+...Byte7) +1】

*Function instruction: add from first digit to penult and then do negation and plus one(number of digits must >2)

*****/

unsigned char FucCheckSum(unsigned char *i,unsigned char ln)

{

 unsigned char j,tempq=0;

 i+=1;

 for(j=0;j<(ln-2);j++)

 {

 tempq+=*i;

 i++;

 }

```
tempq=(~tempq)+1;  
return(tempq);  
}
```

Cautions

1. Please do not take away or plug the sensor in the module.
 2. It is prohibited to weld the pins of the module. The matched sockets could be welded.
 3. Sensor shall avoid organic solvent, coatings, medicine, oil and high concentration gases.
 4. Excessive impact or vibration should be avoided.
 5. Please keep the modules warming up for at least 5 minutes when first using. 24 hours aging time are suggested if power off for long time.
 6. Please do not use the modules in systems which related to human being's safety.
 7. Please do not use the modules in strong air convection environment.
 8. Please do not expose the modules in high concentration organic gas for a long time.
 9. Returned data of module serial port is real-time concentration of current target gas in environment, If you don't have standard gas, please do not use standard command, for it will cause calibrated data is clear away and returned data of serial port is not accurate.
 10. To judge whether module communication is normal, it is advisable to use tools that can change USB to TTL(communication level 3V), debug assistant software via serial port, and determine it by communication protocol.
 11. When choosing module, users should choose products of different applications and ranges. If there is no special requirement, products will use conventional range.
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