Electrochemical Gas

Detection Module

User's Manual V2.8

（Model：ZE03）

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Zhengzhou Winsen Electronics Technology Co., Ltd

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Zhengzhou Winsen Electronics Technology CO., LTD

Electrochemical Detection Module ZE03

ZE03 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 is with built-in temperature sensor to make temperature compensation, which makes it could detect the gas concentration accurately. It has the digital output and analog voltage output at the same time which facilities 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 & resolution
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.	ZE03	
Target Gas	CO, O2, NH3, H2S, NO2, O3, SO2, CL2, HF, H2, PH3, HCL etc	
Measurement Range	Refer stable 2.(can be customized also)	
Working Voltage	DC 5±0.1V	
Working Current	＜ 5 mA	
Output Data	UART Output (TTL electrical level,3V)	
	Analog Voltage (refer stable2. for sensor original amplifying signal)	
Working Life	2 years	
Operating Environment	Temp.: -20～50℃	
	Humidity.: 15%-90％RH (no condensation)	
Storage Environment	Temp.: −20～50℃	
	Hum.: 15%RH-90％RH	
Size	Ø23.5mm*24.5mm	
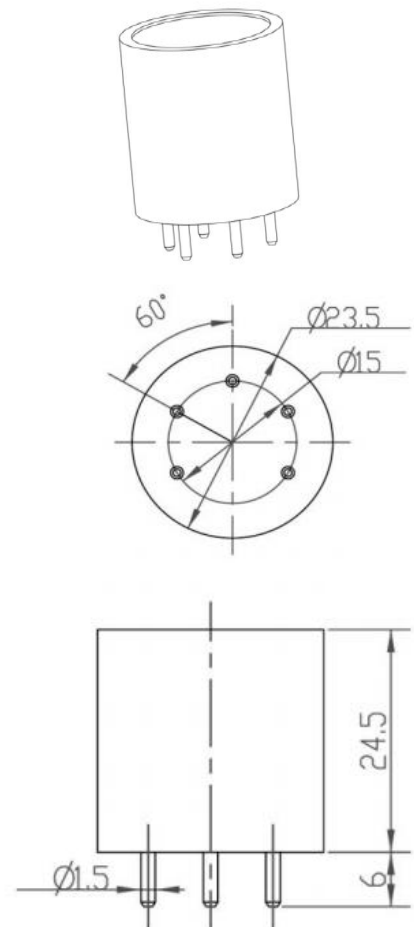
Fig1. Structure(tolerance ±0.25mm)
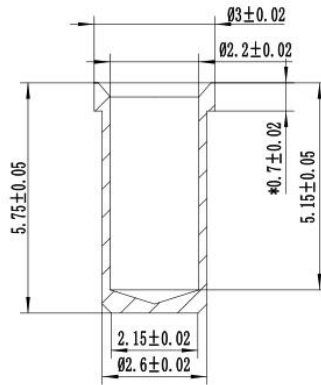
Fig2. Socket size for module (mm)

Detection range and signal output   Table 2

Detection gas	CO	O2	NH3	H2S	SO2	DG01	VOC
Detection range	(0-1000)ppm	(0-25) %VOL	(0-100)ppm	(0-100)ppm	(0-20) ppm	(0-50)ppm	(0-100)ppm
Resolution	1ppm	0.1 %VOL	1ppm	1ppm	0.1ppm	0.01ppm	0.1ppm
VO Voltage output Range	(0.6-3) V	(1.5-0) V	(0.6-3) V	(0.6-3) V	(0.6-3) V	(0.6-3)V	(0.6-3) V
Response Time(T90)	≤30S	≤15S	≤150S	≤30S	≤30S	≤120S	≤120S

Detection gas	H2	PH3	NO2	O3	CL2	HCL	HF
Detection range	(0-1000)ppm	(0-1000)ppm	(0-20) ppm	(0-10) ppm	(0-20) ppm	(0-10)ppm	(0-10)ppm
Resolution	1ppm	0.1ppm	0.1ppm	0.1ppm	0.1ppm	0.1ppm	0.1ppm
VO Voltage output Range	(0.6-3) V	(0.6-3) V	(2-0) V	(2-0) V	(2-0) V	(2-0) V	(2-0) V
Response Time(T90)	≤120S	≤30S	≤30S	≤120S	≤60S	≤60S	≤60S

Detection gas	C2H4	ETO	CH2O				
Detection range	(0-100)ppm	(0-100)ppm	(0-50)ppm				
Resolution	0.1ppm	0.1ppm	0.1ppm				
VO Voltage output Range	(0.6-3)V	(0.6-3)V	(0.6-3)V				
Response Time(T90)	≤30S	≤120S	≤30S				

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 ZE03-O2 (0-25%vol) as an example: 0%vol is corresponding to 1.5V, but the corresponding value of 25%vol should subject to inspection report, not 0V, other values like 0.1V or 0.2V are possible.

Pin definition stable3.

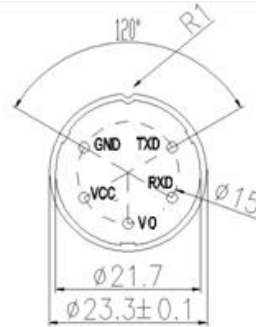|	
GND	Ground
VCC	Power supply
VO	Original Voltage output
RXD	Series port input
TXD	Series port output

Fig3.Bottom view

The meaning of VO (Vout) : It means original voltage (linear) after amplifying circuit, rather than concentration value of current target gas in environment. If choose this pin test, users need to know when purchase, the zero voltage Vout0 and test voltage Vout1 can be shown in the inspection report delivered to customer with the modules together. Users can calculate gas concentration of current target gas in environment based on Vout0 and Vout1.

Take ZE03-CO for example: zero voltage Vout0 = 0.6 V; in 200ppm CO gas,Vout1=0.9V,

If the current voltage Voutx=1.2V, then the CO concentration:

$$N= \frac{200}{Vout1 - Vout0} * (Voutx - Vout0) = 400ppm.$$

Name rules
Model name: ZE03-X-X-X
"Z" means module, "E " means electrochemical type sensor, "03" means version, the first X means detected gas, the second X means detection range, the third X means output way.
Eg. "ZE03-CO-(0-1000)ppm-UART/VDC","ZE03-O2-(0-25)%VOL-UART/VDC".
"UART/VDC" means the output way is series port and analog voltage (non standard voltage, refer to stable2.)

Communication Protocol

1.General Settings

Baud Rate	9600
Data Bits	8
Stop Bits	1
Parity	None

2.Communication Specification
The default communication type is active upload and it sends gas concentration once every 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 sent by module after it receiving 0x86 command (reading concentration), suggested communication cycle is 1s.

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

Receive	0	1	2	3	4	5	6	7	8
	Start byte	Command	**Gas concentration**		Gas No	number of decimal	reserved	reserved	Checksum
	0xFF	0x86	**High byte**	**Low byte**	0x2B	0x01	0	0	4E
EXP.	FF 86 **00 00** 2B 01 00 00 4E (Take SO2 for example, the concentration is 0)								

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

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

Number of decimal is 0, resolution is 1ppm, number of decimal is1, resolution is 0.1ppm, number of decimal is 2, resolution is 0.01ppm.

0X78—To modify the communication mode (0x03 is active upload mode, 0x04 is Q&A mode)

1	0x78	To change communication mode							
Send	0	1	2	3	4	5	6	7	8
	Start Byte	Address	Command	Communication Type	--	--	--	--	Checksum
	0XFF	0X01	0x78	0x04	0	0	0	0	0x83
EXP.	FF 01 78 04 00 00 00 00 83 (to switch to Q&A mode)								
Receive	0	1	2	3	4	5	6	7	8
	Start Byte	Command	Return	--	--	--	--	--	Checksum
	0XFF	0X78	Success: 1 Failure: 0	0	0	0	0	0	0x87 0x88
EXP	FF 78 01 00 00 00 00 00 87								

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.)

1	0x86	To read concentration							
Send	0	1	2	3	4	5	6	7	8
	Start Byte	Address	Command	--	--	--	--	--	Checksum
	0XFF	0X01	0x86	0	0	0	0	0	0x79
EXP.	FF 01 86 00 00 00 00 00 79								
Receive	0	1	**2**	**3**	4	5	6	7	8
	Start Byte	Command	**Gas Concentration**		Gas No.	number of decimal	reserved	reserved	Checksum
	0XFF	0X86	**High byte**	**Low byte**	0x2B	0x01	0	0	4E
EXP.	FF 86 **00 00** 2B 01 00 00 4E (Take SO2 for example, the concentration is 0)								

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.

Instruction for Gas No.

No.	0x02	0x03	0x04	0x05	0x06	0x08	0x17	0x2A	0x2B
Gas	NH3	H2S	CO	O2	H2	C2H4	CH2O	O3	SO2
No.	0x2C	0x2E	0x2F	0x31	0x32	0x34	0x3B	0x45	0x46
Gas	NO2	HCL	HCN	CL2	HF	VOC	C2H3CL	PH3	DG01(NH3)

4.Checksum and calculation

```
/*****************************************************************

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

* Functional description: checksum【Non(sending/receiving commend
Byte1+Byte2+…Byte7) +1】


*****************************************************************/

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 socket 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.
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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