Electrochemical Gas Detection Module

User's Manual V2.3

（Model：ZE11）

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Zhengzhou Winsen Electronics Technology Co., Ltd

Statement

Thanks for purchasing our product. In order to let customers use it better and reduce the faults caused by misuse, please read the manual carefully and operate it correctly in accordance with the instructions. If users disobey the terms or remove, disassemble, change the components inside of the sensor, we shall not be responsible for the loss.

The specific such as color, appearance, sizes …etc., please in kind prevail.

We are devoting ourselves to products development and technical innovation, so we reserve the right to improve the products without notice. Please confirm it is the valid version before using this manual. At the same time, users' comments on optimized using way are welcome.

Please keep the manual properly, in order to get help if you have questions during the usage in the future.

Zhengzhou Winsen Electronics Technology CO., LTD

Electrochemical Detection Module ZE11

ZE11 is a general-purpose and high-performance electrochemical module. It can detect the ethylene, ethanol, formaldehyde, benzene, toluene, vinyl chloride and other VOC gases based on electrochemical principle, it has good selectivity and stability. A temperature sensor is built-in for temperature compensation. 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 & long working life
UART and analog voltage output
Good stability and excellent anti-interference ability
Temperature compensation and excellent linear output

Main Application

Petroleum and chemical industry, environment protection filed, detection of ethylene, ethanol, formaldehyde, benzene, toluene, vinyl chloride and other VOC gases

Technical Parameters

Table 1.

Model No.	ZE11
Target Gas	ethanol, formaldehyde, benzene, toluene, vinyl chloride and other VOC gas
Preheat time	≤3 Min
Response time	≤180 Sec
Measurement range	0-100ppm
Resolution	0.1 ppm
Working Voltage	DC 5.0V±0.1V
Output Data	DAC(0.4～2V) standard voltage signal
	UART Output (TTL 3V compatible 5V)
	Sensor amplified voltage signal
Operating Environment	Temp.: -20～50℃
	Humidity.: 15%RH-90%RH (no condensation)
Storage Environment	Recommend Temp.: -20～50℃
Dimension	Ø32mm*32.6mm (D*H)
Working Life	2 years （in air）
Weight	＜45g
● Other resolutions and ranges can be customized	

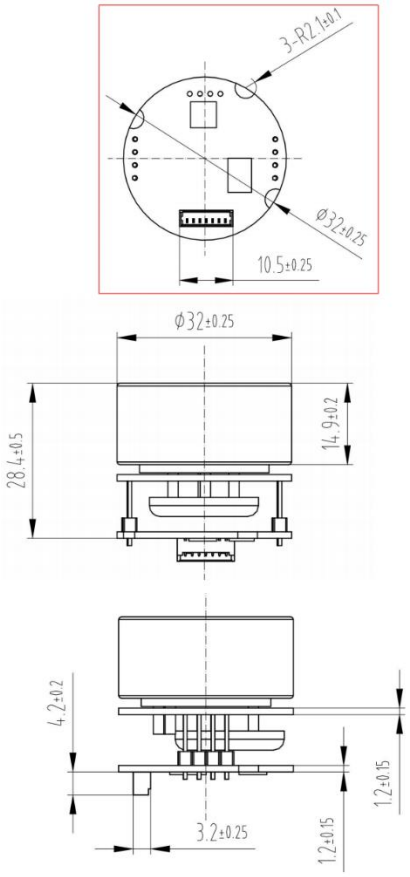

Figure 1: Module structure diagram (Unit: mm)

Pin definition Table2.

Pin1	NC (No connection)
Pin2	DAC (0.4~2V for 0~full measurement)
Pin3	GND
Pin4	Vin (voltage input 5.0±0.1V)
Pin5	UART(RXD) data input
Pin6	UART(TXD) data output
Pin7	Sensor amplified voltage (Non-standard signal)

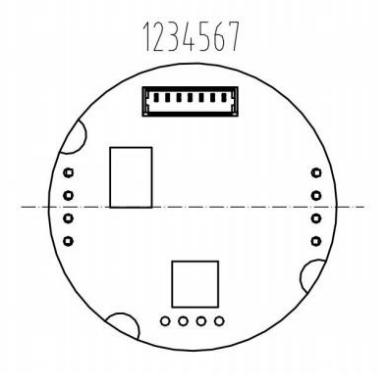

Figure 2: Module pin diagram (bottom view)

Gas Code Description Table 3.

Gas Code	0x08	0x15	0x17	0x1B	0x1C	0x34	0x3B	…
Detection gas	ethylene	ethanol	formaldehyde	benzene	toluene	VOC	vinyl chloride	…

Communication Protocol

1. General Settings Table 4.

Baud Rate	9600
Data Bits	8 bytes
Stop Bits	1 byte
Check Bits	Null

2. Communication Specification

The default communication mode is active upload and query & answer mode.

Active upload by default, it sends gas concentration every one second.

For example, if detect ethylene, The module return value format is as below Table 5:

0	1	2	3	4	5	6	7	8
Start bit	Gas Code	Unit ppm	Decimal digits	Gas concentration high order	Gas concentration low order	Full scale high order	Full scale low order	Check value
0xFF	0x08	0x03	0x01	0x02	0xE3	0x03	0xE8	0x24
For example: FF 08 03 01 02 E3 03 E8 24 (using the ethylene module, the reading concentration value is 73.9ppm, the range is 100.0ppm as an example)								

Gas concentration value=(concentration high order*256+concentration low order)* Resolution

Note: If the number of Decimal digits is 0x00, the resolution is 1ppm. If the number of Decimal digits is 0x01, the resolution is 0.1ppm.

For example, the above return value format shows that the module is ethylene module (0x08), the concentration unit is ppm (0x03), the resolution is 0.1ppm (0x01),

The ethylene gas concentration value =(0x02*256+0xE3)*0.1= (2*256+227)*0.1= 73.9ppm.
Detection Range =(0x03*256+0xE8)*0.1=(3*256+232)*0.1=100.0ppm.

Shift to query and answer mode, command line format as below (Table 6)

0	1	2	3	4	5	6	7	8
Start bit	Reserve	Switch command	Query and answer	reserve	reserve	reserve	reserve	Check value
0xFF	0x01	0x78	0x41	0x00	0x00	0x00	0x00	0X46
Query and answer mode command is **FF 01 78 41 00 00 00 00 46**								

In query and answer mode, read the concentration command line format as below (Table 7).

0	1	2	3	4	5	6	7	8
Start bit	Reserve	Command	reserve	reserve	reserve	reserve	reserve	Check value
0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	0X79
In query and answer mode, read the concentration command is **FF 01 86 00 00 00 00 00 79**								

Sensor returned value format as below (Table 8).

0	1	2	3	4	5	6	7	8
Start bit	Command	Gas concentration high order (mg/m3)	Gas concentration low order (mg/m3)	reserve	Decimal digits	Gas concentration high order(ppm)	Gas concentration low order(ppm)	Check value
0xFF	0x86	0x05	0xC6	0x00	0x01	0x02	0xE3	0xC9
Sensor return value: FF 86 05 C6 00 01 02 E3 C9 (Take the return value of a sensor at a time of read concentration in Query and answer mode as an example)								

Gas concentration value=(concentration high order*256+concentration low order)* Resolution

Note: If the number of Decimal digits is 0x00, the resolution is 1ppm. If the number of Decimal digits is 0x01, the resolution is 0.1ppm.

For example: the above gas concentration value = (0x05*256+0xC6) *0.1= (5*256+198) *0.1=147.8mg/m3 (the 2nd and 3rd byte mg/m3 concentration value);

Or the above gas concentration value =(0x02*256+0xE3)*0.1= (2*256+227)*0.1=73.9ppm
(the 6th and 7th byte ppm concentration value).

(Note: the conversion relationship between unit mg/m3 and ppm in the return value: 2mg/m3=1ppm, the coefficient is calculated on behalf of ethylene oxide. Due to the different coefficients of different gas types, it is recommended to take the ppm concentration value of the 6th and 7th bytes as the standard.)

Switch to active upload , command line format as below (Table 9).

0	1	2	3	4	5	6	7	8
Start bit	Reserve	Switch command	Active upload	reserve	reserve	reserve	reserve	Check value
0xFF	0x01	0x78	0x40	0x00	0x00	0x00	0x00	0X47
Active mode instruction: FF 01 78 40 00 00 00 00 47								
The format of sensor return values is shown in Table 5.								

3.Checksum and calculation

```
/************************************************************************
* Function Name: unsigned char FucCheckSum(uchar *i,ucharln)
* Functional description: Sum check【Take the sum of 1\2\3\4\5\6\7 of the sending and receiving protocols and take the inverse +1】
* * Function declaration: array[n]    NOT { Sum （array[1]~array[n-1]）}+1
（number of array must be larger than2）
************************************************************************/
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

- Sensor shall avoid organic solvent, coatings, medicine, oil and high concentration gases
- Do not disassemble the sensor at will. Otherwise, the sensor electrolyte may leak and cause damage..
- Cannot be fully packaged by resin material, cannot be immersed in oxygen-free environment, or it may impact the performance of sensor.
- Cannot be used in corrosive gas for long time, corrosive gas will damaged sensor.
- Disclosing and damaging waterproof and breathable cover is prohibited
- Sensor gas inlet side cannot be blocked and polluted.
- Excessive impact or vibration should be avoided.
- Please keep the modules warming up for more than 24 hours when first using.
- Please do not use the modules in systems which related to human being's safety.
- Please do not use the modules in strong air convection environment.
- Please do not expose the modules in high concentration organic gas for a long time, Long-term placement will cause sensor zero drift.

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