# Electrochemical Gas Detection Module

# User's Manual V1.0

# （Model：ZE03-DG）

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Zhengzhou Winsen Electronics Technology Co., Ltd

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# Electrochemical Detection Module ZE03-DG

The ZE03-DG electrochemical module adopts electrochemical gas sensor and high-performance micro-processor. By installing ME-DG gas sensor to measure the odor concentration.  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

It is widely used in portable and fixed gas detectors and occasions and equipment for detecting odors in public toilets and farms.

## Technical Parameters

| Model No. | ZE03-DG |
|---|---|
| Target Gas | peculiar smell |
| 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 ) |
| Zero point drift | ≤ 1% FS |
| Working Life | 2 years |
| Operating Environment | Temp.: -20～50℃ |
| | Humidity.: 15%-90％RH(no condensation) |
| Storage Environment | Temp.: 20～25℃ |
| | Hum.: 30%RH-70％RH |
| Size | Ø23.5mm*24.5mm |
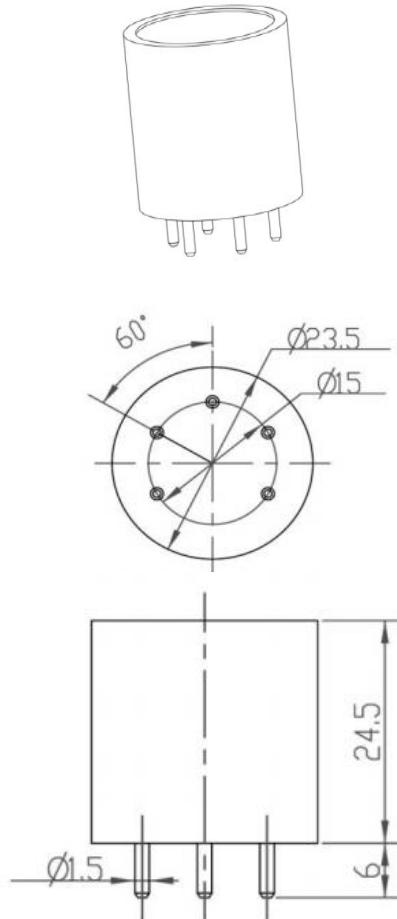
Fig1. Structure( tolerance ±0.25mm )

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## Detection range and signal output  stable2.

| Detection gas | peculiar smell |
|---|---|
| Detection range | (0-50)ppm |
| Resolution | 0.01ppm |
| VO Voltage output Range | (0.6-3) V |
| Response Time(T90) | ≤90S |

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.  0ppm is corresponding  to 0.6V, but the corresponding value of 50ppm should subject to the measured data on inspection report or the provided EXCEL form, not 3V.

## Pin definition  stable3.

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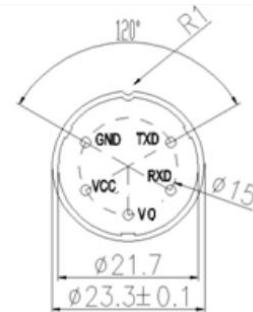


Fig2.Bottom view

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 keep us informed when purchase, thus 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.  For example: zero voltage  Vout0 = 0.6 V; in 50ppm gas,Vout1=2.5V, If the current voltage Voutx=1.2V, then the gas concentration:

$$N = \frac{50}{Vout1 - Vout0} * (Voutx - Vout0) = 15.79\text{ppm}$$

## Communication Protocol

### 1.General Settings

| Baud Rate | 9600 |
|---|---|
| Data Bits | 8 bytes |
| Stop Bits | 1 byte |
| check bits | Null |

### 2.Communication Specification

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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** | | -- | -- | -- | -- | Checksum |
| | 0xFF | 0x86 | **High byte** | **Low byte** | 0 | 0 | 0 | 0 | 7A |
| EXP. | FF 86 **00 00** 00 00 00 00 7A (concentration is 0) | | | | | | | | |

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

**0X78—to switch the communicate 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 | Demand | Communication Type | -- | -- | -- | -- | Checksum |
| | 0XFF | 0X01 | 0x78 | 0x03 | 0 | 0 | 0 | 0 | 0x84 |
| EXP. | FF 01 78 03 00 00 00 00 84 (switch to active upload type) | | | | | | | | |
| Receive | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| | Start Byte | Command | Return calibration | -- | -- | -- | -- | -- | Checksum |
| | 0XFF | 0X78 | Success: 1 Failure: 0 | 0 | 0 | 0 | 0 | 0 | 0x87 |
| EXP | FF 78 01 00 00 00 00 00 87 | | | | | | | | |

If switch to Q&A mode, send FF 01 78 **04** 00 00 00 00 83(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** | | -- | -- | -- | -- | Checksum |
| | 0XFF | 0X86 | **High byte** | **Low byte** | 0 | 0 | 0 | 0 | 7A |
| EXP. | FF 86 **00 00** 00 00 00 00 7A (concentration value is 0) | | | | | | | | |

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

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**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,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.

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11. When choosing module, users should choose products of different applications and ranges. If there is no special requirement, products will use conventional range.