All-in-one module communication protocol

（Model：ZEHS04）

Version：1.1

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Zhengzhou Winsen Electronic Technology Co., Ltd

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ZEHS04 communication protocol

1. General Settings

Table 1

Baud Rate	9600
Data Byte	8 bits
Stop Byte	1 bit
Check Byte	Null

2.Communication Commands

Communication is divided into active upload type and question and answer type (currently RS485 output supports active upload type and question and answer type, serial output only supports active upload type), the factory default is active upload, and the concentration value is sent every 1S. The format of the concentration value is as follows:

Table 2

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8	Byte9	Byte10
Start Byte	Mixed Gas	Unit (ug/m3)	CO (High Byte)	CO (Low Byte)	SO2 (High Byte)	SO2 (Low Byte)	O3 (High Byte)	O3 (Low Byte)	NO2 (High Byte)	NO2 (Low Byte)
0xFF	0x40	0x14	0x03	0xC8	0x00	0x22	0x00	0x78	0x00	0x37

Byte11	Byte12	Byte13	Byte14	Byte15	Byte16	Byte17	Byte18	Byte19	Byte20	Byte21
PM2.5 (High Byte)	PM2.5 (Low Byte)	PM10 (High Byte)	PM10 (Low Byte)	reserved (High Byte)	reserved (Low Byte)	Temp. (High Byte)	Temp. (Low Byte)	Humid. (High Byte)	Humid. (Low Byte)	Check Byte
0x00	0x18	0x00	0x20	0x00	0x00	0x02	0xA2	0x01	0x65	0xCE

Remarks:
（1）**Before performing the following calculations, first convert the hexadecimal to decimal**
（2）**The resolution of different modules is different. Please refer to Table 2 of ZEHS04 all-in-one module manual for specific resolution.**
gas concentration value = high gas concentration * 256 + low gas concentration.

Temperature value = (high temperature value*256+low temperature value-500)/10.

Humidity value = (high humidity value*256+low humidity value)/10.

For example, the data in Table 2:

CO concentration value=0x03*256+0xC8=3*256+200=968ug/m3;

PM2.5 concentration value=0x00*256+0x18=0*256+24=24ug/m3;

Vocs concentration value=(0x07*256+0xD0)*0.001=(7*256+208)*0.001=2.000ppm

Temperature value=(0x02*256+0xA2-500)/10=(2*256+162-500)/10=17.4℃;

Humidity value=(0x01*256+0x65)/10=(1*256+101) /10=35.7%RH.

To switch the question and answer mode, the command line format is as follows:

Table 3

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Reserved	switch command	Q&A	Reserved	Reserved	Reserved	Reserved	Check value
0xFF	0x01	0x78	0x41	0x00	0x00	0x00	0x00	0x46
For example	FF 01 78 41 00 00 00 00 46							

The command format of reading gas concentration value in question and answer mode is as follows:

Table 4

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Reserved	Command	Reserved	Reserved	Reserved	Reserved	Reserved	Check value
0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	0x79
For example	FF 01 86 00 00 00 00 00 79							
The format of the returned concentration value is shown in Table 3								

Switch to active upload, the command line format is as follows:

Table 5

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Reserved	switch command	active upload	Reserved	Reserved	Reserved	Reserved	Check value
0xFF	0x01	0x78	0x40	0x00	0x00	0x00	0x00	0x47
For example	FF 01 78 40 00 00 00 00 47							
The format of the returned concentration value is shown in Table 3								

If pumping function is added, the pump is activated by default. The command format for shutting down the pump is as following:

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Table 6

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Reserved	command	Shut down	Reserved	Reserved	Reserved	Reserved	Check value
0xFF	0x01	0x96	0x41	0x00	0x00	0x00	0x00	0x28
For example	FF 01 96 41 00 00 00 00 28							

To open the pumping function:

Table 7

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start Byte	Reserved	Command	Open	Reserved	Reserved	Reserved	Reserved	Check value
0xFF	0x01	0x96	0x40	0x00	0x00	0x00	0x00	0x29
For example	FF 01 96 40 00 00 00 00 29							

3. Unit Conversion

Table 8

	CO	SO2	O3	NO2
Gas code	0x04	0x2B	0x2A	0x2C
Unit conversion factor N	1.25	2.857	2.143	2.054

Note: The conversion factor N is the relative molecular mass of the test gas divided by the gas molar volume under standard conditions.

Example: The relative molecular mass of CO is 28, and the gas molar volume is 22.4 under standard conditions, then N=28/22.4=1.25.

Unit conversion formula: ug/m3=N*ppb

Example: The current concentration of CO is 500ppb, then the conversion to ug/m3 is 1.25*500=625ug/m3.

The returned value unit is explained as follows:

Table 10

CO	SO2	O3	NO2	PM2.5	PM10	Reserved	TM	RH
Ug/m^3	Ug/m^3	Ug/m^3	Ug/m^3	Ug/m^3	Ug/m^3	According to the actual module output unit	℃	%RH

4.Checksum and calculation

```
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);
}
```

The calculation example of the calibration value is as follows:

Example 1: The calibration value in Table 2

Step 1: Summation.

0x40+0x14+0x03+0xC8+0x00+0x22+0x78+0x00+0x37+0x00+0x18+0x00+0x20+0x07+0xD0+0x02+0xA2+0x01+0x65=0x69

(only lower 8 bits reserved)

Step 2 Negate. 0x09 is negated as 0xF6.

Step 3: Increment 1. 0xF6 plus 1 is 0xF7. 0xF7 is the check value.

Example 2: Check values in Table 3:

Step 1: Sum. 0x01+0x78+0x41+0x00+0x00+0x00+0x00=0xBA (only the lower 8 bits are reserved)

Step 2: Negate. The negation of 0xBA is 0x45.

Step 3: Add 1. 0x45 plus 1 is 0x46. 0x46 is the check value.

Zhengzhou Winsen Electronics Technology Co., Ltd
Add: No.299, Jinsuo Road, National Hi-Tech Zone, Zhengzhou 450001 China
Tel:+86-371-67169097/67169670
Fax: +86-371-60932988
E-mail: sales@winsensor.com
Website:www.winsen-sensor.com