Manual of Formaldehyde detection module

（Model：RM-HCHO）

1. Product description

RM-HCHO detection module is the latest masterpiece of Relations, adopt international advanced fuel battery technology and combined with advanced micro detection technology directly transform the HCHO concentration in the environment into measurable ppm value, standard digital output, easy for customers to integrate. This module has passed strict factory calibration and can be directly used to portable detector, air quality monitoring equipment, air purifier and intelligent home equipment, etc..

2. Module features

High sensitivity, high resolution, low power consumption, long service life
Provide standardized digital output to facilitate customer develop two times
High stability, excellent anti-interference ability, excellent linear output
Exclusive features: the core of the internal use of imported chemicals and breathable membrane.

3. Application area

Portable detector, air quality monitoring equipment, air purifier, fresh air ventilation system, air conditioning, smart home equipment and other places

3.1 Technical index

Model	RM-HCHO
Measure principle	Fuel battery
Detect gas	HCHO
Range	0-2ppm
Maximum Overload	50ppm
Supply voltage	5-7V
Preheating time	<3min
Response time	<40S
recovery time	<60S
Resolution	0.01ppm
Working temperature	-20℃～50℃
Working humidity	10%－90%RH（non condensation）
Storage lifetime	Six months

Storage temperature	$0 \sim 20℃$
Service life	Three years
Warranty	18 months
Weight	4g

3.2 Pin definition

Pin name	Pin description
Pin1	Vin(5V)
Pin2	GND
Pin3	RXD
Pin4	TXD
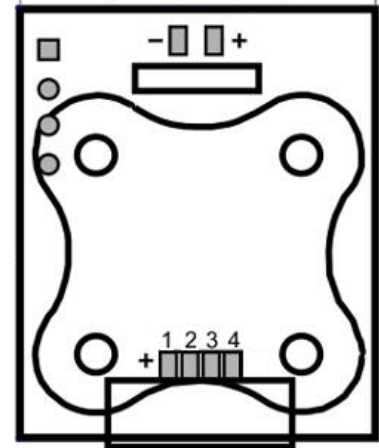
Note：Pin1--Pin4 are customer use port; Pin5--Pin8 are Program debug port.

4. Communication protocol

4.1 General settings

Sensor module uses serial communication, communication configuration parameters are as follows:

baud rate	9600
Data bit	8 bit
Stop bit	1 bit
Check bit	no

4.2 Communication command

Communication is divided into active upload and Q & A（question and answer） type, factory default active upload, send concentration value Interval seconds send a concentration value, command line format is as follows:

0	1	2	3	4	5	6	7	8
Start bit	Gas name	Unit	decimal digits	Gas concentration	Gas concentration	Full range	Full range	Check value
	CH2O	ppb	no	High bit	Low bit	High bit	Low bit	
0XFF	0X17	0X04	0X00	0X00	0X25	0X13	0X88	0X25

Gas concentration value= gas concentration of high bit *256+ gas concentration of low bit

Switch to Q & A type, the command line format is as follows:

Sheet 5

0	1	2	3	4	5	6	7	8
Start bit	Reserve	Switch command	Q&A	Reserve	Reserve	Reserve	Reserve	Check value
0XFF	0X01	0X78	0X41	0X00	0X00	0X00	0X00	0X46

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

Sheet 6

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

Read the gas concentration values are as follows:

Sheet 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

The return value of the sensor is as follows:

0	1	2	3	4	5	6	7	8
Start bit	Command	gas concentration（ug/m3）	gas concentration（ug/m3）	Reserve	Reserve	gas concentration of high bit （ppb）	gas concentration of low bit（ppb）	Check value
0XFF	0X86	0X00	0X2A	0X00	0X00	0X00	0X20	0X30

Gas concentration value= gas concentration of high bit *256+ gas concentration of low bit

4.3 check and calculate

```
/************************************************************************
* function name: unsigned char FucCheckSum(uchar *i,ucharln)
* Function description: summation check（sum the send protocol 1\2\3\4\5\6\7 bit , and then
  invert 1+, sum the receive protocol 1\2\3\4\5\6\7 bit   and then invert +1）
* Function description: get the reciprocal of array element 1-, and add together with the second
  element, and then invert +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);
}
```

Attached: unit conversion
The usual unit of formaldehyde is mg/m3 or ppm
Ppm: Volume concentration method, the volume of pollutants in one million volumes of air;
mg/m3: Mass concentration method for the pollutants quantity in per cubic meter air ;

the conversion between concentration unit ppm and mg/m3：

Calculate according to the following formula：

mg/m3=M /22.4 ppm {273/(273+T)]*（Ba /101325）

M mean : (Gas molecular weight), T mean Gas temperature, Ba mean pressure

In 25℃和 one atmospheric pressure：（formaldehyde molecular weight 30）

Namely：
mg/m3 = ppm*M /22.4　→ mg/m3≈ppm*1.3392857≈ppb*0.0013392857
ppm =　mg/m3×22.4/M → ppm≈　mg/m3×0.74666

5．Matters needing attention：

1. The module need to avoid contact with organic solvents（Including silicone and other adhesives），

paint, oil and other high concentration gas
2. Modules are not subject to violent impact or vibration.
3. Module circuit and sensor parts can not be squeezed by hand or touch.
4. The module is used for the first time to preheat more than 5 minutes.
5. Do not allow modules to be used in systems involving personal safety.
6. Do not install the module in a strong air convection system.
7. Do not place the sensor in a high concentration organic gas, long-term placement will lead to zero drift.