



# Multi-in-One Sensor Module

(Model: ZPHS01B)

# Manual

Version: 1.3

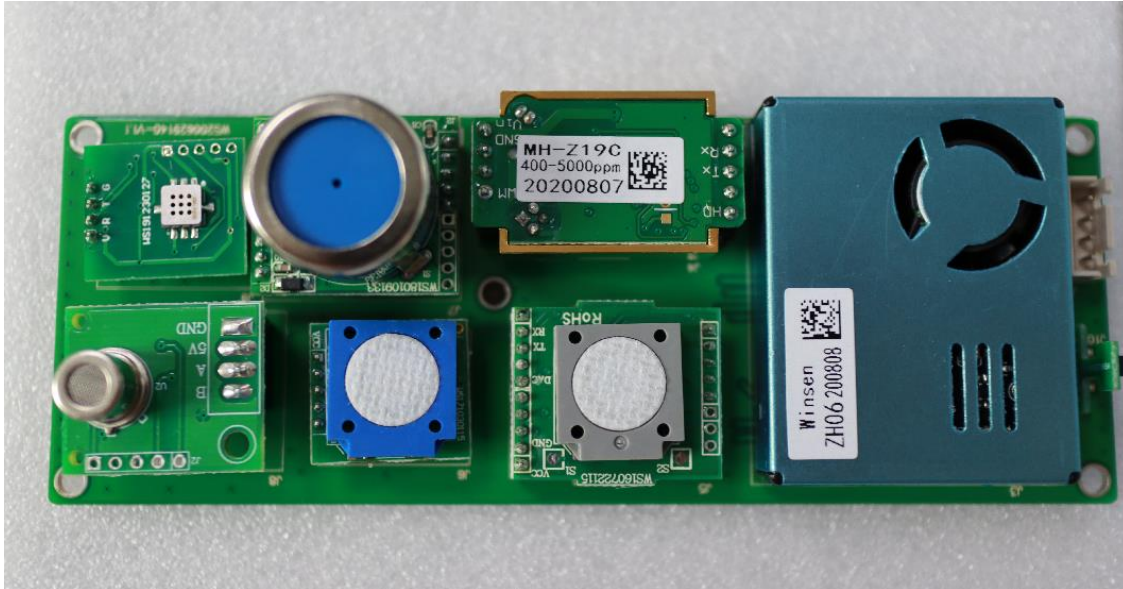
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## Multi-in-One ZPHS01B Sensor Module

### Profile

ZPHS01B is a multi-in-one air quality module, integrating laser dust sensor, infrared carbon dioxide sensor, electrochemical formaldehyde sensor, electrochemical ozone sensor, electrochemical carbon monoxide sensor, VOC sensor, NO2 sensor and temperature and humidity sensor. It can accurately measure the concentration of various gases in the air, with UART (TTL level) communication interface.



### Application

- Gas detector
- Air purifier
- Air conditioner
- HVAC system
- Air quality monitoring
- Smart home

### Specification

Model	ZPHS01B	
Target Gas	CO2. PM2.5. CH2O. O3. CO. TVOC. NO2. Temperature. Humidity	
Working voltage	5V (DC)	
Average Current	< 300 mA	
Peak Current	< 500 mA	
Physical interface	XH2.54-4P	
Interface level	3V(compatible with 3.3V)	
Output signal	UART (TTL)	
PM2.5	Range	0~1000 $\mu\text{g}/\text{m}^3$
	Particle size range	0.3-10 $\mu\text{m}$ (PM1.0, PM2.5, PM10)
	Accuracy	$\pm 15 \text{ ug}/\text{m}^3$ (when concentration is $\leq 100\text{ug}/\text{m}^3$ ); $\pm 15\%$ (when concentration is $>100\text{ug}/\text{m}^3$ )
	Response time	T90 < 45s

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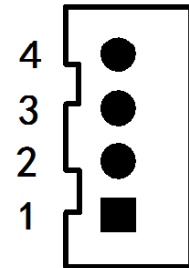
	Sampling method	Fan extraction
	MTTF	Continuous uninterrupted > 10000h
CO <sub>2</sub>	Range	0~5000 ppm
	Accuracy	±(50ppm+5% of reading value)
	Warm-up time	3min
	Response time	T90 < 120s
	Sampling method	Diffuse
	Lifespan	> 5 years
CH <sub>2</sub> O	range	0~6.250 mg/m <sup>3</sup>
	accuracy	± 0.03 mg/m <sup>3</sup> (when concentration is ≤ 0.2mg/m <sup>3</sup> ); ± 20% reading value (when concentration is >0.2mg/m <sup>3</sup> )
	Warm-up	≤ 3min
	Response time	≤ 60s
	Recovery time	≤ 60s
	Sampling method	Diffuse
	Life span	5 years (18~25°C in clean air)
TVOC	Range	0~3 grades
	Warm-up	≤3min
	Response time	≤20s
	Recovery time	≤60s
	Sampling method	Diffuse
	Sensitivity attenuation	≤1% /year
O <sub>3</sub>	Range	0~10 ppm
	Resolution	0.01 ppm
	Accuracy	± 0.1ppm, when the concentration is ≤1ppm; ±20% full range, when the concentration is over 1ppm;
	Warm-up	≤3min
	Response time	≤90s
	Recovery time	≤90s
	Sampling method	Diffuse
	Life span	2 years(18~25°C in clean air)
CO	Range	0~500 ppm
	Resolution	0.1 ppm
	Accuracy	± 10% reading value
	Warm-up	≤30s
	Response time	≤30s
	Recovery time	≤30s
	Sampling method	Diffuse
	Life span	3~5 years (in air)
NO <sub>2</sub>	Range	0.1~10 ppm
	Resolution	0.05ppm
	Warm-up	≤3min

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	Response time	≤120s
	Recovery time	≤90s
Temperature	Range	-20~65℃
	Accuracy	±0.5℃(0-65℃)
Humidity	Range	0~100%RH
	Accuracy	±3%RH
Working temperature		-10~50℃
Working humidity		15~80% RH (no condensing)
Storage temperature(recommend)		0~25℃
Storage humidity (recommend)		0~80% RH
Dimensions		135 x 50 x 26.2mm (L x W x H)

### Pin Definition

PIN	Definition
PIN1	GND
PIN2	+5V
PIN3	RXD (UART input)
PIN4	TXD (UART output)



### Serial communication protocol format

#### 1. Communication parameter

Baud rate	9600bps
Data bit	8bit
Stop bit	1bit
Check digit	None

#### 2. Communication command

The communication between the host and module, adopts question and answer mode.

The command format to read the module concentration is as following:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start bit	Reserved	Command	Reserved	Reserved	Reserved	Reserved	Reserved	Check value
0xFF	0x01	0x86	0x00	0x00	0x00	0x00	0x00	0x79

The command format which the module returns the concentration value is as following:

Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7	Byte8
Start bit	Command	PM1.0		PM2.5		PM10		CO2
0xFF	0x86	0x00	0x65	0x00	0x36	0x00	0x96	0x01

Byte9	Byte10	Byte11	Byte12	Byte13	Byte14	Byte15	Byte16	Byte17
CO2	VOC	Temperature		Humidity		CH2O		CO
0x9A	0x00	0x02	0xFD	0x00	0x28	0x00	0x28	0x00
Byte18	Byte19	Byte20	Byte21	Byte22	Byte23	Byte24	Byte25	
CO	O3		NO2		Reserved	Reserved	Check sum	
0x05	0x00	0x20	0x00	0x50	0x00	0x00	0xEA	

Note:

Item	Unit	Concentration
PM1.0	Ug/m3	(Byte2*256+Byte3) ug/m3= 101ug/m3
PM2.5	Ug/m3	(Byte4*256+Byte5) ug/m3= 54ug/m3
PM10	Ug/m3	(Byte6*256+Byte7) ug/m3= 150ug/m3
CO2	ppm	(Byte8*256+Byte9) ppm=410ppm
VOC	0~3 grade	
Temperature	0.1℃	$((\text{Byte11} * 256 + \text{Byte12}) - 500) * 0.1 \text{℃} = 26.5 \text{℃}$ For example (negative temperature): byte11=0x01, byte12=0x59 $((\text{Byte11} * 256 + \text{Byte12}) - 500) * 0.1 \text{℃} = -15.5 \text{℃}$
Humidity	%RH	(Byte13*256+Byte14)%RH=40%RH
CH2O	0.001mg/m3	(Byte15*256+Byte16)*0.001mg/m3=0.040mg/m3
CO	0.1ppm	(Byte17*256+Byte18)*0.1ppm=0.5ppm
O3	0.01ppm	(Byte19*256+Byte20)*0.01ppm=0.32ppm
NO2	0.01ppm	(Byte21*256+Byte22)*0.01ppm=0.80ppm

### 3. Checksum calculation

Check value=(invert( Byte1+Byte2+...+Byte7))+1

Or

Check value=(invert( Byte1+Byte2+...+Byte24))+1

### Note:

- PM2.5 sensor collection hole is the internal airflow inlet, which needs to maintain good contact with the outside air; the fan installation position is the internal airflow outlet of the sensor. When the sensor is installed, please avoid strong airflow around the sensor; if it cannot be avoided, try to keep the direction of the external airflow perpendicular to the direction of the internal airflow of the sensor.
- When designing the detection chamber of the whole detector, the effective area of the PM2.5 sensor sampling port must be fully considered to ensure the smoothness of the sampling gas path as much as possible. A small sampling area and excessive air resistance will seriously affect the accuracy of the sensor data.
- Excessive impact or vibration will affect the sensor accuracy and life span, so the sensor should be protected from falling or vibration during installation and use.

4. The PM2.5 sensor on this module is suitable for the detection of dust particles in ordinary indoor environments. The actual use environment should try to avoid soot environment, excessive dust particles, high humidity environment, such as: kitchen, bathroom, smoking room, outdoor, etc. If used in such an environment, appropriate protective measures should be added to prevent viscous particles or large particles from entering the sensor, forming a buildup inside the sensor, and affecting the sensor's performance.
5. The module should avoid contact with organic solvents (including silica gel and other adhesives), coatings, pharmaceuticals, oils and high-concentration gases.
6. The module cannot be completely encapsulated with resin material, and it cannot be immersed in an oxygen-free environment, otherwise the performance of the sensor will be damaged.
7. The module cannot be used in the environment containing corrosive gas for a long time. Corrosive gas will damage the sensor.
8. The module needs to be warmed up for more than 3 minutes when it is powered on for the first time.
9. Do not use this module in systems involving personal safety.
10. Do not install the module in a strong convection air environment.
11. Do not place the module in high-concentration organic gas for a long time. Long-term placement will cause the sensor zero point drift and slow recovery.
12. It is prohibited to use hot-melt adhesive or sealant to seal the module with a curing temperature higher than 80°C.
13. The sensor should be away from the heat source, and avoid direct sunlight or other heat radiation.