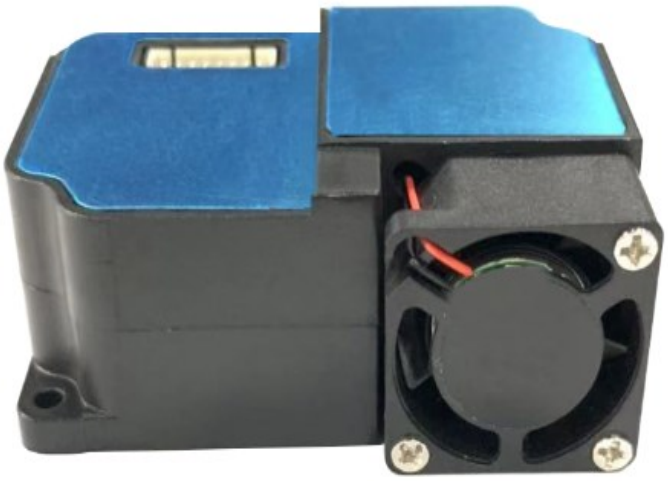
D3 laser grain

Particulate Matter

detection pass sensor



Product Description:

The D3 Particle Detection Sensor is a cutting-edge digital sensor designed based on laser scattering principles. Its primary function is to provide real-time measurement of current particle concentrations, covering a particle size range from 0.3μm to 10μm. Equipped with a variety of digital output interfaces and a unique power-on self-calibration feature, this sensor boasts excellent consistency and stability. Its versatility allows seamless integration into various instruments or equipment related to particle concentration, delivering timely and precise data.

Main Features:

✧ Laser scattering principle for precise measurements

✧ Real-time responsiveness with continuous data collection support

✧ Minimum resolution for particle size: 0.3μm

✧ Dual-frequency data acquisition technology

✧ Unique laser self-calibration technology

✧ Compact dimensions: 503620mm

✧ Robust metal shielding shell for excellent anti-interference performance

✧ Customizable air outlet direction for a wide range of applications

✧ Standard serial port digital output with PWM pulse width output support

Working Principle:

The sensor operates on the laser scattering principle. As air passes through the measurement cavity, suspended particles scatter the laser, and the collected scattered light intensity forms a curve with respect to time. Utilizing the Mie (MIE) theory, the microprocessor calculates the equivalent particle size and the number of particles of different sizes per unit volume. The functional parts of the sensor are illustrated in the block diagram shown in Figure 1.

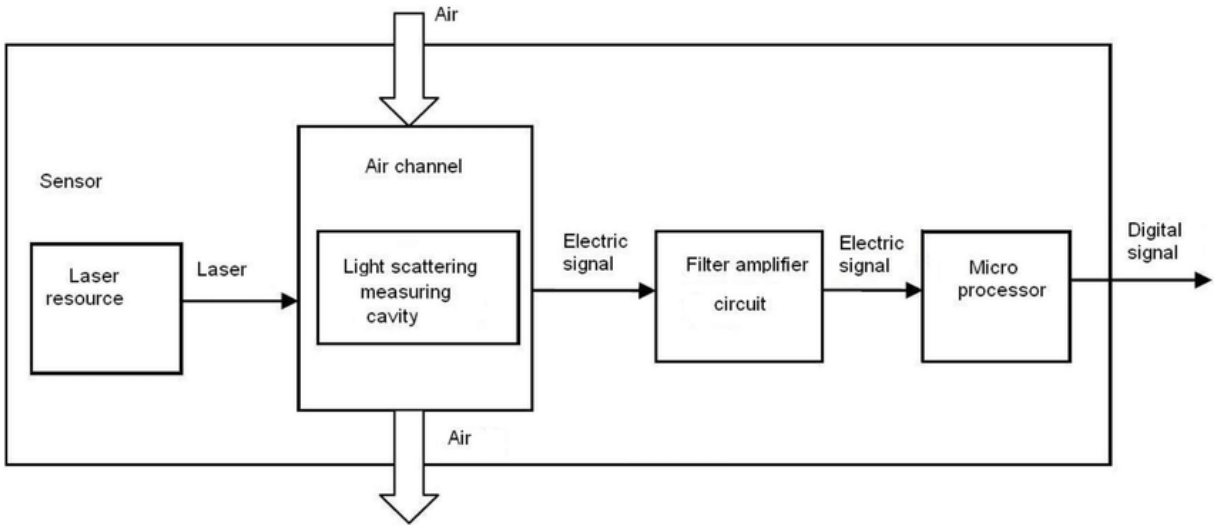
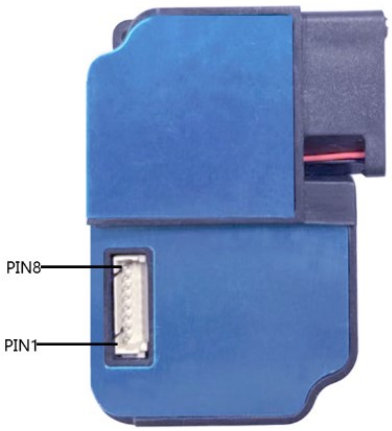



*Figure 1 sensor functional block diagram architecture*

## Technical indicators

| parameter | smallest | typical | max | unit |
|---|---|---|---|---|
| Measuring range | 0.3 | 2.5 | 10 | μm micron |
| Effective range of particulate matter mass concentration | 0 | 700 | - | μg/m3 microgram/cubic meter |
| Particulate matter concentration maximum range | ≥1000 | | | μg/m3 microgram/cubic meter |
| Particulate matter concentration maximum range (PWM) | 996 | | | μg/m3 microgram/cubic meter |
| Particulate matter mass concentration resolution | - | 1 | - | μg/m3 microgram/cubic meter |
| Weigh the accurate volume | - | 0.1 | - | L liter |
| Particulate matter quantity range | 0 | - | 65535 | pieces/0.1L |
| DC supply voltage | 4.90 | 5 | 5.10 | V volts |
| Interface level | 2.7 | 3.3 | 3.6 | V volts |
| Maximum working current | - | - | 70 | mA milliampere |
| Response time | 0 | 1 | 10 | S seconds |
| Operating temperature | -10 | 25 | 60 | ℃ degrees Celsius |
| Storage temperature | -30 | 25 | 80 | ℃ degrees Celsius |
| Working humidity (non-condensing) | 5% | 40% | 80% | RH |
| Storage humidity (non-condensing) | 0% | 40% | 95% | RH |
| Particulate matter mass concentration consistency (0~100 ug/m3) | - | ±10 | - | ug/m3 micrograms/cubic meter |
| Particulate matter mass concentration consistency (≥100 ug/m3) | - | ±10% | - | ug/m3 micrograms/cubic meter |

| | | |
|---|---|---|
| PIN1 | VCC | power supply 5V |
| PIN2 | GND | power ground |
| PIN3 | NC | NC |
| PIN4 | RXD | Serial port receiving pin (3.3Vlevel) |
| PIN5 | TxD | Serial port transmit pin (3.3Vlevel) |
| PIN6 | RESET | Leave empty when in use. Connecting it low will disable the module. |
| PIN7 | NC | NC |
| PIN8 | PWM | PWM Pulse width signal output pin (3.3Vlevel) |



## Communication Interface

Notice:

1. PWM The output simply connect PIN1(+5V) ,PIN2(GND) & PIN8(PWM)

| | | | |
|---|---|---|---|
| PIN 5 | UART | Default output | 3.3V interface level |
| PIN 8 | PWM | Default output | 3.3V interface level |

Note: The UART interface level is 3.3V. If the MCU end operates at 5V, it is advisable to incorporate a level conversion mechanism. Alternatively, a 200-ohm resistor can be connected from MCU TXD to this network. This connection is optional but may be left unaltered if not needed.

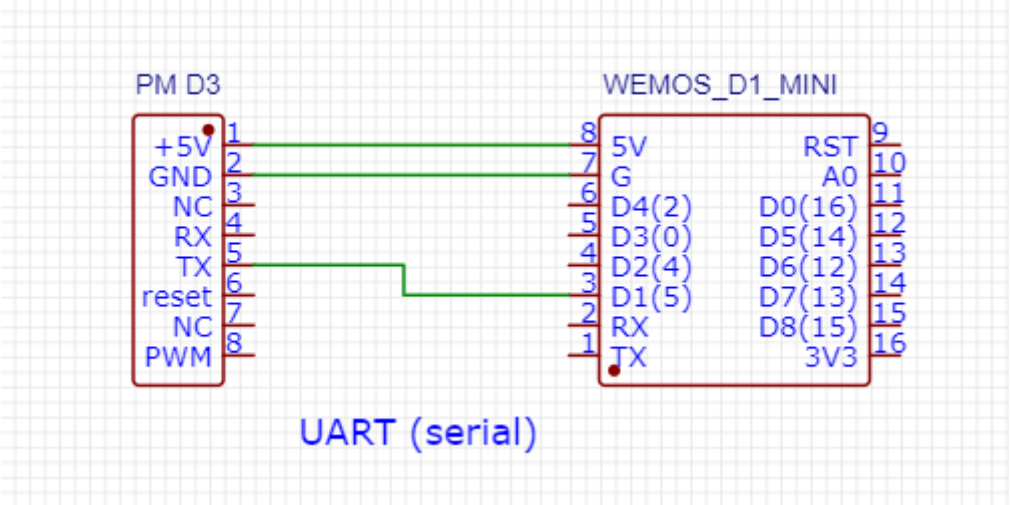
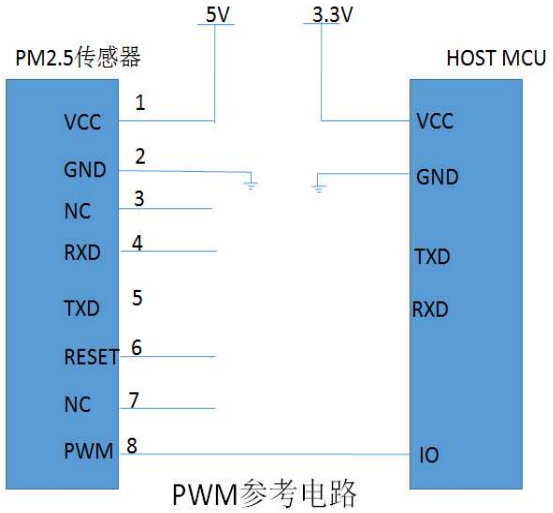



*Figure 2 For serial communication connect PIN1(+5V) ,PIN2(GND) & PIN5(TX)*



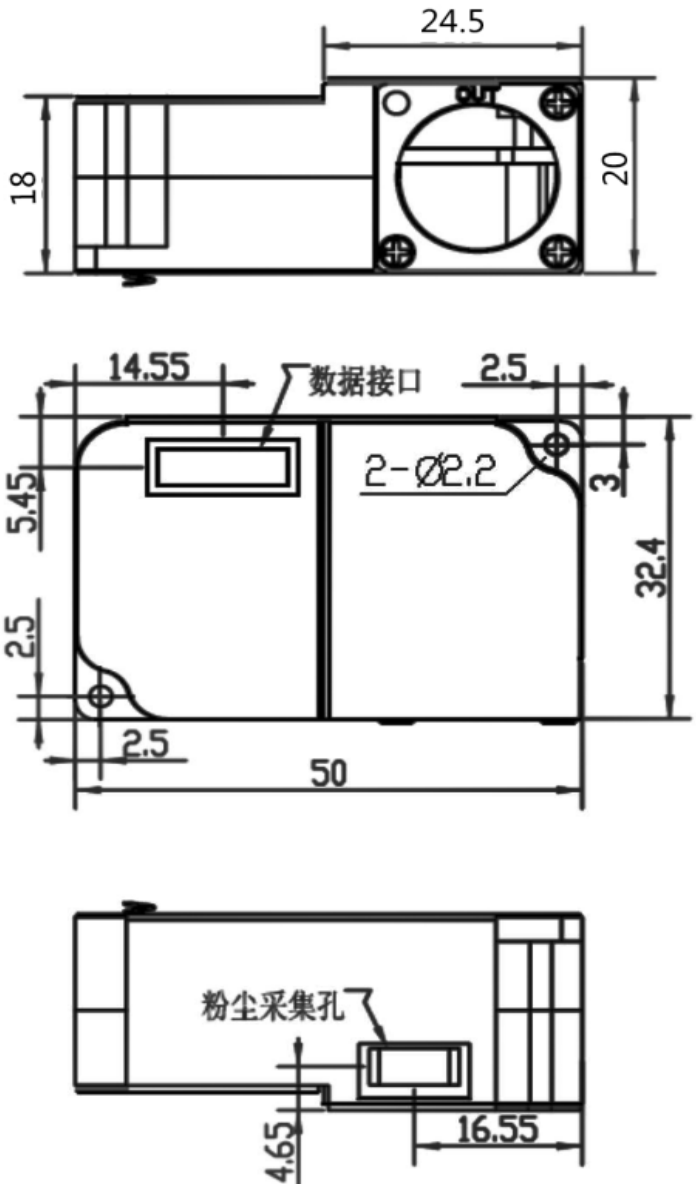
Packet length: 32byte(8BIT)

The data string is as follows:

| | | | |
|---|---|---|---|
| BYTE0 | Starter1 | 0x42 | (fixed) |
| BYTE1 | Starter2 | 0x4d | (fixed) |
| BYTE2 | The upper eight bits of the frame length | | Frame length=2×13+2(data+Check Digit) |
| BYTE3 | Frame length lower eight bits | … | |
| BYTE4 | PM1.0 High eight digits | … | expressPM1.0concentration(0.3um~1.0um), unit μg/m3(standard particulate matter) |
| BYTE5 | PM1.0 Lower eight bits | … | |
| BYTE6 | PM2.5 High eight digits | … | expressPM2.5concentration(0.3um~2.5um), unit μg/m3(standard particulate matter) |
| BYTE7 | PM2.5 Lower eight bits | … | |
| BYTE8 | PM10 High eight digits | … | expressPM10concentration(0.3um~10um), unit μg/m3(standard particulate matter) |
| BYTE9 | PM10 lower eight digits | … | |
| BYTE10 | PM1.0 High eight digits | … | expressPM1.0concentration(0.3um~1.0um), unit μg/m3(under atmospheric environment) |
| BYTE11 | PM1.0 Lower eight bits | … | |
| BYTE12 | PM2.5 High eight digits | … | expressPM2.5concentration(0.3um~2.5um), unit μg/m3(under atmospheric environment) |
| BYTE13 | PM2.5 Lower eight bits | … | |
| BYTE14 | PM10 High eight digits | … | expressPM10concentration(0.3um~10um), unit μg/m3(under atmospheric environment) |
| BYTE15 | PM10 lower eight digits | … | |
| BYTE16 | High number of particles | … | express0.1The diameter in the air is 0.3um The number of particles above (Already blocked, special request is required) |
| BYTE17 | Low number of particles | … | |
| BYTE18 | High number of particles | … | express0.1The diameter in the air is 0.5um The number of particles above (Already blocked, special request is required) |
| BYTE19 | Low number of particles | … | |
| BYTE20 | High number of particles | … | express0.1The diameter in the air is 1.0um The following number of particles (Already blocked, special request is required) |
| BYTE21 | Low number of particles | … | |
| BYTE22 | High number of particles | … | express0.1The diameter in the air is 2.5um The following number of particles (Already blocked, special request is required) |
| BYTE23 | Low number of particles | … | |
| BYTE24 | High number of particles | … | express0.1The diameter in the air is 5.0um The number of particles above (Already blocked, special request is required) |
| BYTE25 | Low number of particles | … | |
| BYTE26 | High number of particles | … | express0.1The diameter in the air is 10um The following number of particles (Already blocked, special request is required) |
| BYTE27 | Low number of particles | … | |
| BYTE28 | | … | Reserve (ignore) |
| BYTE29 | | … | |
| BYTE30 | Inspection and high position | … | Check code=(BYTE0+BYTE1+…+BYTE29). The sum of the previous 30 BYTEs. |
| BYTE31 | checksum low | … | |

Precautions:

1. Ensure the metal casing and the sensor's internal power ground are connected, avoiding short-circuits with external circuits or the chassis shell.
2. For optimal installation, place the sensor's air inlet and outlet plane near the air holes on the user's machine's inner wall, ensuring a 2cm clearance and no obstructions. Maintain air flow isolation between the inlet and outlet to prevent reverse airflow.
3. The equipment's air inlet and outlet openings should not be smaller than the sensor inlet size.
4. When using the sensor in purifier products, avoid direct placement in the purifier's air duct. Design an independent structural space for the sensor within the air duct to prevent contamination from the purifier's airflow.
5. Install the sensor at a position 15-20cm above the ground to prevent ground dust, floating objects, or large dust particles from hindering fan rotation. Consider using pre-filtration in dusty environments.
6. Never disassemble the sensor, including the metal shielding shell, to prevent irreversible damage.
7. Ensure data consistency by not using third-party testing instruments or data as a comparison standard. If aligning with third-party testing equipment is necessary, perform data fitting based on actual collection results for calibration.
8. The sensor is suitable for ordinary indoor environments. In extreme conditions, such as excessive dust accumulation, oil build-up, or water intrusion, data consistency may be compromised. Avoid use in environments where:
    a) Annual dust concentration exceeds 300 micrograms/cubic meters for more than 50% of the time or exceeds 500 micrograms/cubic meters for more than 20% of the time.
    b) Oil fume is present.
    c) High water mist is present. d) Outdoor use.


24.5
18
20
OUT
14.55
数据接口
2.5
2-Ø2.2
3
5.45
32.4
2.5
2.5
50
粉尘采集孔
4.65
16.55

Checksum calculation

| | | |
|---|---|---|
| Byte 1: 0b01000010 | 0x42 | 66 |
| Byte 2: 0b01001101 | 0x4D | 77 |
| Byte 3: 0b00000000 | 0x00 | 0 |
| Byte 4: 0b00011100 | 0x1C | 28 |
| Byte 5: 0b00000000 | 0x00 | 0 |
| Byte 6: 0b00000110 | 0x06 | 6 |
| Byte 7: 0b00000000 | 0x00 | 0 |
| Byte 8: 0b00001010 | 0x0A | 10 |
| Byte 9: 0b00000000 | 0x00 | 0 |
| Byte 10: 0b00001100 | 0x0C | 12 |
| Byte 11: 0b00000000 | 0x00 | 0 |
| Byte 12: 0b00000110 | 0x06 | 6 |
| Byte 13: 0b00000000 | 0x00 | 0 |
| Byte 14: 0b00001010 | 0x0A | 10 |
| Byte 15: 0b00000000 | 0x00 | 0 |
| Byte 16: 0b00001100 | 0x0C | 12 |
| Byte 17: 0b00000000 | 0x00 | 0 |
| Byte 18: 0b00000000 | 0x00 | 0 |
| Byte 19: 0b00000000 | 0x00 | 0 |
| Byte 20: 0b00000000 | 0x00 | 0 |
| Byte 21: 0b00000000 | 0x00 | 0 |
| Byte 22: 0b00000000 | 0x00 | 0 |
| Byte 23: 0b00000000 | 0x00 | 0 |
| Byte 24: 0b00000000 | 0x00 | 0 |
| Byte 25: 0b00000000 | 0x00 | 0 |
| Byte 26: 0b00000000 | 0x00 | 0 |
| Byte 27: 0b00000000 | 0x00 | 0 |
| Byte 28: 0b00000000 | 0x00 | 0 |
| Byte 29: 0b00000000 | 0x00 | 0 |
| Byte 30: 0b00000000 | 0x00 | 0 |
| Byte 31: 0b00000000 | 0x00 | 0 |
| Byte 32: 0b11100011 | 0xE3 | 227 |
| Checksum is 00E3 | 00E3 | 227 |

Sample code Arduino

https://github.com/ltvanderkrogt/Particulate-Matter-sensor-D3/tree/main