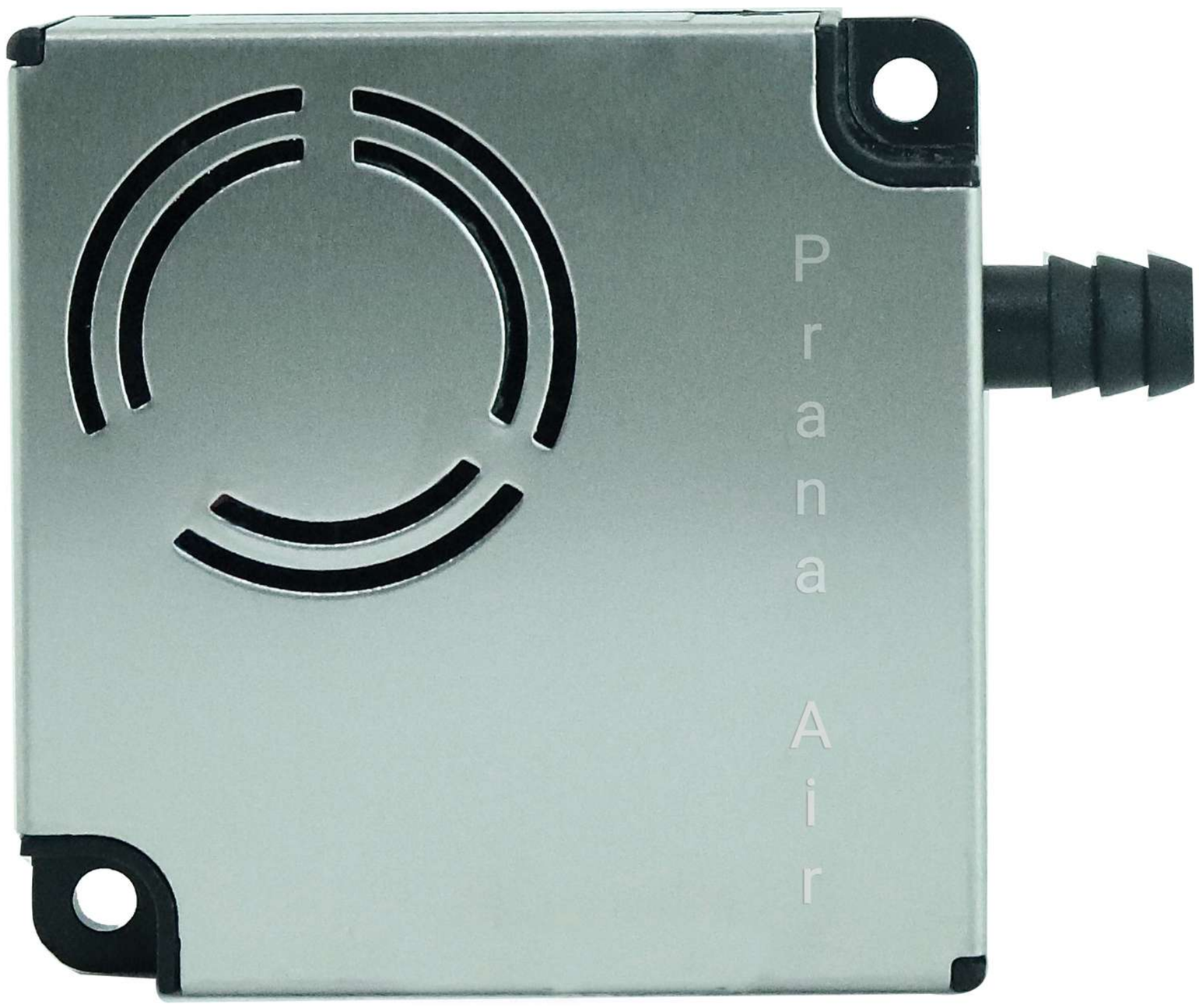
Prana Air

Outdoor PM
Laser Dust Sensor

PAS-OUT-01



Connector Information

■ Recommended installation method

The recommended installation method is: install the air inlet vertically upward according to the gravity direction.

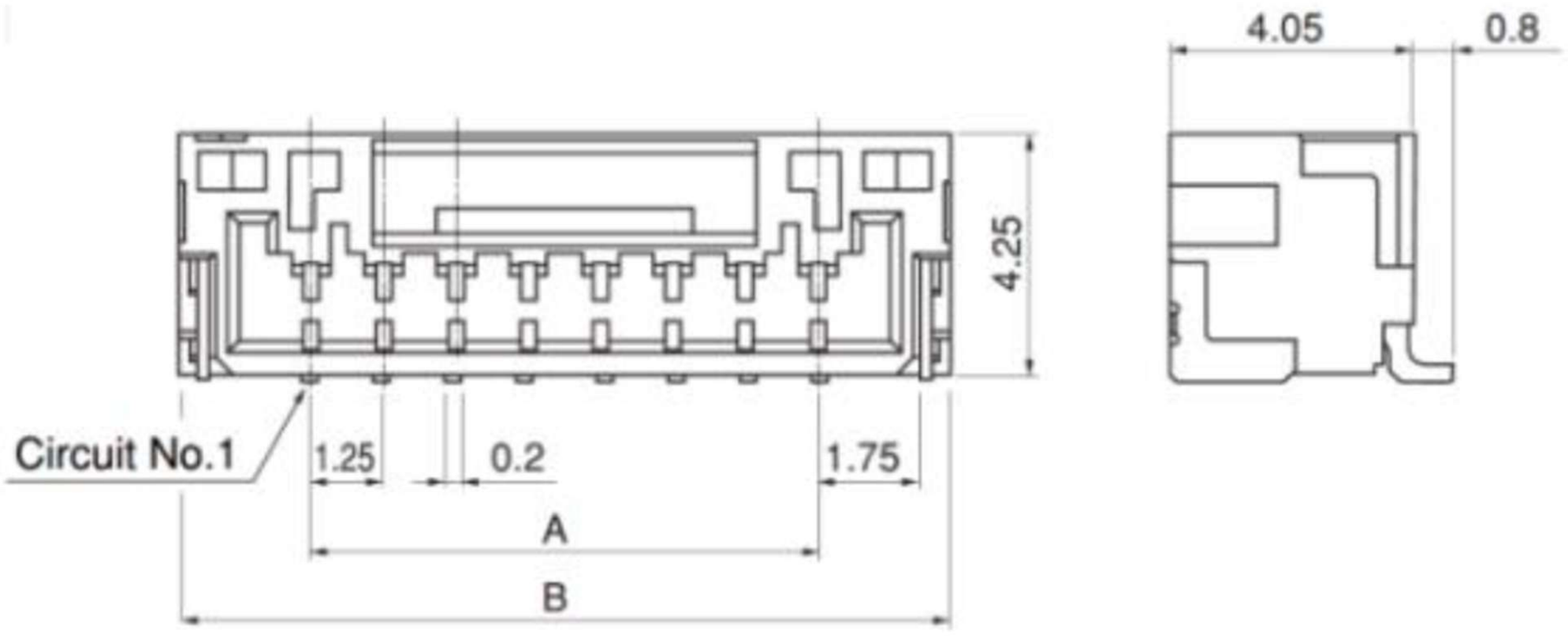


Figure 2 pin definition of connector

■ Output pin definition

The sensor interface is a 10 pin socket with a spacing of 1.25 mm. The model is SM10B-GHS-TB, with **A** value of 11.25 mm and **B** value of 15.75 mm. Pin definition as shown in the figure.

Table 1. Definition of output pin

Pin number	pin assignment	describe
1	VCC	+5V power input
2	GND	Power ground
3	SET	Set pin / TTL level @ 3.3V, high level or suspended is normal working state, low level is off state
4	RXD	Serial port reception (3.3V level)
5	TXD	Serial port transmission (3.3V level)
6		retain
7		retain
8	RESET	Module reset signal / TTL level @ 3.3V, low reset
9		retain
10		retain

Note: the input power of the sensor is 5V, and the data communication (RXD, TXD) and control pins (set, reset) are 3.3V. If the communication level of external main board MCU is 5V, level conversion chip or circuit shall be added to the communication line and control pin.

Table 2. Technical indicators of sensors

Parameter name	Index
Rated voltage	5V
Rated current	70mA
Communication port level	3.3 V
working temperature	-20～70℃
Storage temperature	-20～85℃
Working humidity	0～99%RH(No condensation)
Particle size resolution	0.3 um
PM2.5 effective range of mass concentration	0～31000ug/m^3
Effective range of PM10 mass concentration	0～31000ug/m^3
Mass concentration data resolution	1ug/m3
PM2.5 consistency of mass concentration	± 10% or ± 10ug, whichever is greater
Consistency of PM10 mass concentration	± 15% or ± 15ug, whichever is greater
Mean time between failures	⩾ 30000 hours

Note: the above indexes are tested at 25 ℃ and 50% RH.

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Communication Protocol

The sensor adopts UART, and the communication interface is configured as follows:

Baud rate	9600
Data bits	8 bits
Stop bit	1bit
Parity bit	no

There are two communication modes: Q&A mode and continuous mode. The default mode is Q&A mode.

In Q&A mode, communication is carried out in frames. The command frame format is fixed, and each frame is composed of 9 bytes. When the external device sends the command frame to the sensor, the sensor will reply to the corresponding response frame of the external device.

In continuous mode, the sensor sends a frame of data at a fixed interval (1s by default), each frame of data is composed of 32 bytes.

Table 3 command frame format

Frame head	Frame command	Frame content	Checksum	Frame tail
Byte 1 (0xAA)	Byte 2	Byte 3 to byte 6	Byte 7 to byte 8	Byte 9 (0xBB)

Table 4 specific agreement of Q&A mode

Function description			Command frame	Reply frame
Object of operation	R/W	Frame command	Frame content	Frame content
Boot up	N/A	0x01	0x00000000	0x00004F4B
Read PM2.5 and PM10 mass concentration	R	0x02	0x00000000	Byte 3 (PM10 high byte) Byte 4 (PM10 low byte) Byte 5 (PM2.5 high byte) Byte 6 (PM2.5 low byte)
Shut down	N/A	0x03	0x00000000	0x00004F4B
Reading 2.5um-10um and 0.3um-2.5um Number of particles	R	0x04	0x00000000	Byte 3 (high byte of 2.5um-10um particles) Byte 4 (low byte of 2.5um-10um particles) Byte 5 (high byte of 0.3um-2.5um particles) Byte 6 (0.3um-2.5um particles high byte)

Read 32 bytes of measurement data	R	0x05	0x00000000	See Table 5 for the specific response frame format
Start to send 32 bytes of measurement data continuously	W	0x06	0x00000000	See Table 5 for specific response frame format
Stop sending 32 bytes of measurement data continuously	W	0x07	0x00000000	0x00004F4B
Send 32 bytes of measurement data continuously	W	0x08	0x00000000	0x00000001
Release continuous sending of measurement data	W	0x09	0x00000000	0x00000000
Read current operating mode	R	0x0A	0x00000000	0x00000000 is Q&A mode; 0x00000001 is 32 bytes continuous transmission mode;

Table 5 32 byte measurement data frame format

Byte 1	Start character 1	0x42
Byte 2	Start 2	0x4D
Byte 3	Frame length high octet	0x00
Byte 4	Frame length low octet	0x1C
Byte 5	Data 1 high octet	Data 1 represents PM1.0 concentration
Byte 6	Data 1 low octet	
Byte 7	Data 2 high octet	Data 2 represents PM2.5 concentration
Byte 8	Data 2 low octet	
Byte 9	Data 3 high octet	Data 3 represents PM10 Concentration
Byte 10	Data 3 low octet	
Byte 11	Data 4 high octet	reserve
Byte 12	Data 4 low octet	reserve
Byte 13	Data 5 high octet	reserve

Byte 17	Data 7 high octet	Data 7 indicates the number of particles with an equivalent diameter of more than 0.3um in 0.1L air
Byte 18	Data 7 low octet	
Byte 19	Data 8 high octet	Data 8 indicates the number of particles with an equivalent diameter of more than 0.5um in 0.1L air
Byte 20	Data 8 low octet	
Byte 21	Data 9 high octet	Data 9 indicates the number of particles with an equivalent diameter of more than 1.0um in 0.1L air
Byte 22	Data 9 low octet	
Byte 23	Data 10 low octet	Data 10 indicates the number of particles with an equivalent diameter of more than 2.5um in 0.1L air
Byte 24	Data 10 high octet	
Byte 25	Data 11 low octet	Data 11 indicates the number of particles with an equivalent diameter of more than 5.0um in 0.1L air
Byte 26	Data 11 high octet	
Byte 27	Data 12 low octet	Data 12 indicates the number of particles with an equivalent diameter of more than 10um in 0.1L air
Byte 28	Data 12 high octet	
Byte 29	Data 13 low octet	reserve
Byte 30	Data 13 low octet	reserve
Byte 31	Data and check high octet	Check code = start character 1 + start character 2 +……+Data 13 low octet
Byte 32	Data and check low octet	

Attention:

1. PM2.5 and PM10 concentrations are strictly calibrated; PM1.0 concentration output is experience reference data, if accurate calibration is required, please consult the sales personnel;
2. The number of particles is output as reference data.

Communication example: read PM2.5 and PM10 test data

Table 6 specific content of command frame sent by external equipment to sensor:

Frame head	Frame command	Frame content	Checksum	Frame tail
0xAA	0x02	0x00000000	0x0167	0xBB

Table 7 the specific content of the response frame of the sensor to the external device:

Frame head	Frame command	Frame content	Checksum	Frame tail
0xAA	0x02	0x01310123	0x01BD	0xBB

Calculate the PM2.5 mass concentration value: (byte 5 * 256 + (byte 6)) = 0x01 * 256 + 0x23 = 291 (ug/m^3)

Calculate the PM10 mass concentration value: (byte 3 * 256 + (byte 4) = 0x01 * 256 + 0x31 = 305 (ug/m^3)

Calculation byte and check:

(Byte 1) + (byte 2) + (byte 3) + (byte 4) + (byte 5) + (byte 6) + (byte 9) = (byte 7) * 256 + (byte 8) that is 0xAA + 0x02 + 0x01 + 0x31 + 0x01 + 0x23 + 0xbb = 0x01*256 + 0xBD.