JDS COMPANY KOREA
02-3491-5217
www.jdscompany.co.kr

SPECIFICATION

Product Name: Laser Particle Sensor Module

Item No.: PM2012

Version: V0.1

Date: March 1, 2019

Writer	Audit	Approved
Mei Yang		

Revision

No.	Version	Content	Reviser	Date

Laser Particle Sensor Module

PM2012

Applications

- Air purifier
- Air quality monitor
- Air conditioner
- Ventilation system
- Consumer electronic products

Description

PM2012 is a laser particle sensor module which uses light scattering principle. It measures and calculates the suspending particle number which is within unit volume on the air exactly and output particle mass concentration ug/m^3 directly via mathematical algorithm and scientific calibration.

Features

- The smallest size of available measurement: 0.3um
- Real-time output particle mass concentration in ug/m^3 available
- High accuracy, highly sensitive and quick response (≤8sec)
- Small size, compact structure, easy to install

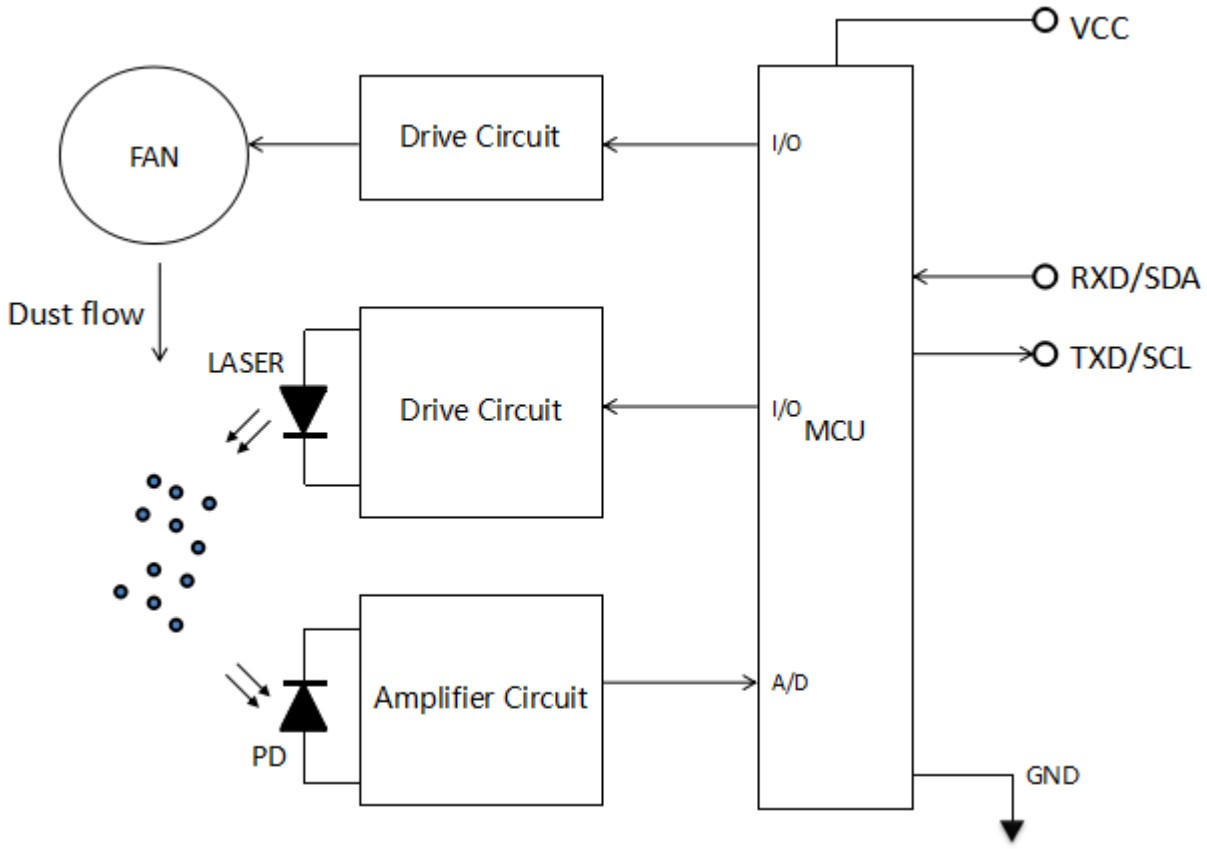
Working Principle

- Sampling by the internal pressure which occurs by a fan, when sampling particles pass through light beam (laser), there will be a light scattering phenomenon. Scattered light will be converted into an electrical signal (pulse) via a photoelectric transformer.
- The bigger particles will obtain a stronger pulse signal (peak value).
- Through peak value and pulse value quantity concentration of particles in each size can be calculated.
- Thus, real-time measured data is obtained by measuring the quantity and strength of scattered light.

Specifications

Laser Particle Sensor Specification	
Operating principle	Laser scattering
Measured particle range	0.3um ~ 10um
Measurement range	0 ~ 1,000ug/m³
Resolution	1ug/m³
Working condition	-10°C ~ 60°C, 0 ~ 95%RH (Non-condensing)
Storage condition	-30°C ~ 70°C, 0 ~ 95%RH (Non-condensing)
Maximum consistency error for PM1.0&PM2.5	0 ~ 100ug/m³, ±10ug/m³ 101 ~ 1,000ug/m³, ±10% reading Condition: 25 ±2°C, 50±10%RH, Reference instrument: TSI 8530
Response time	1sec
Time to first reading	≤ 8 seconds
Power supply	DC 5V±0.1V, ripple wave＜50mV
Working current	⩽100mA
Standby current	⩽200uA
Dimensions	W38 * H35 * D12 mm
Digital output 1 (default)	UART / I2C: 3.3V / 5V(Level)
MTTF	37,297 hrs (continuous turn on)

Internal Architecture Description

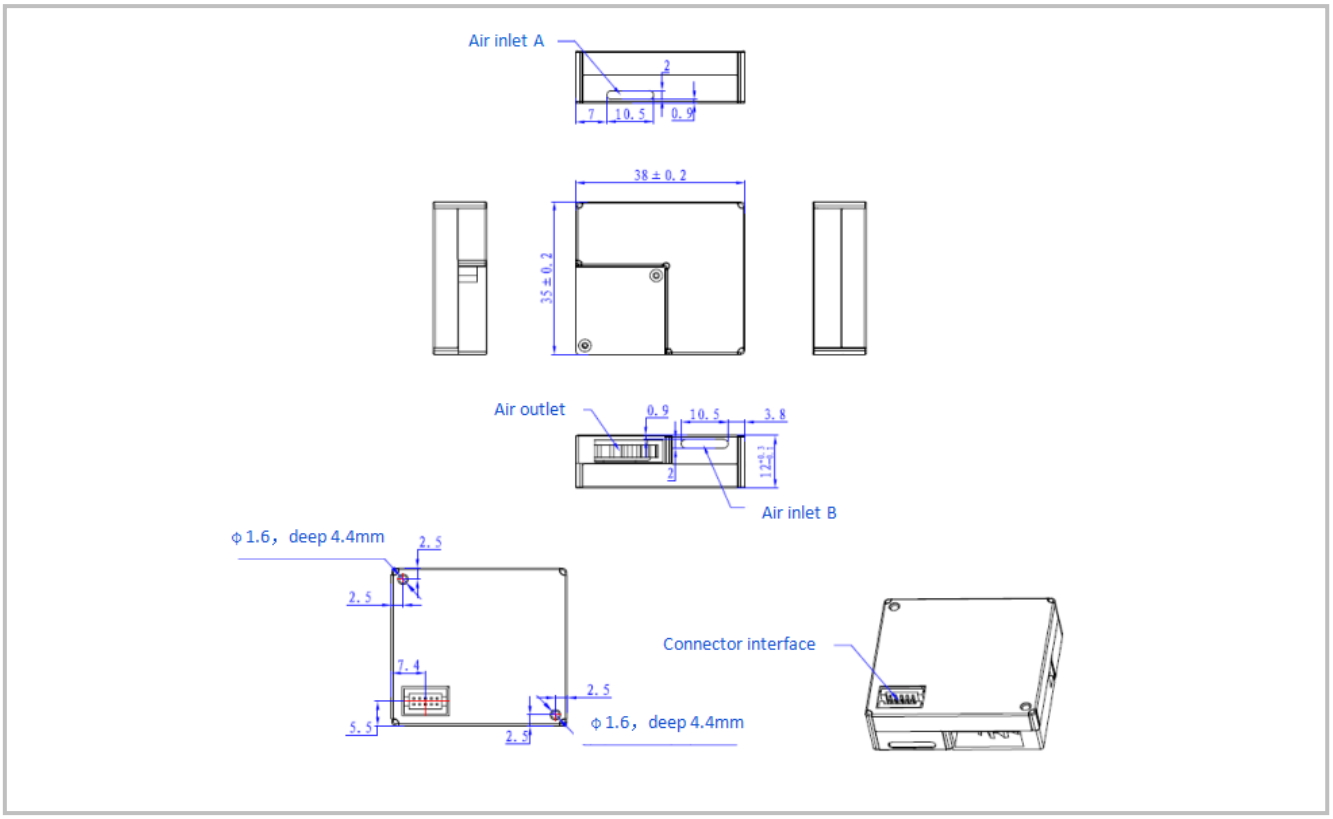


According to the above figure, the light source part of PM2012 is composed of a laser tube and a driving circuit. The detection part of the sensor is composed of a light-sensitive part which receives reflected light and amplifying circuit. Data processing and communication output are completed by the microprocessor.

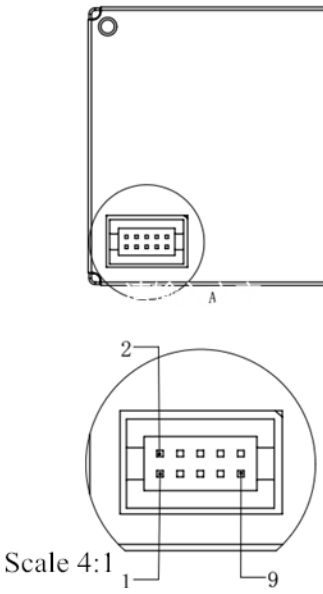
The gas flows into the module through the fan, when sampling particles pass through light beam (laser), there will be light scattering phenomenon, scattered light will be converted into an electrical signal (pulse) via light-sensitive part. Electrical signal will be transformed into digital signals after amplifying circuit, smoothing and MCU processed.

Dimensions and Connector

1. Dimensions (Unit mm, tolerance ±0.2 mm)



2. I/O Connector Pin out



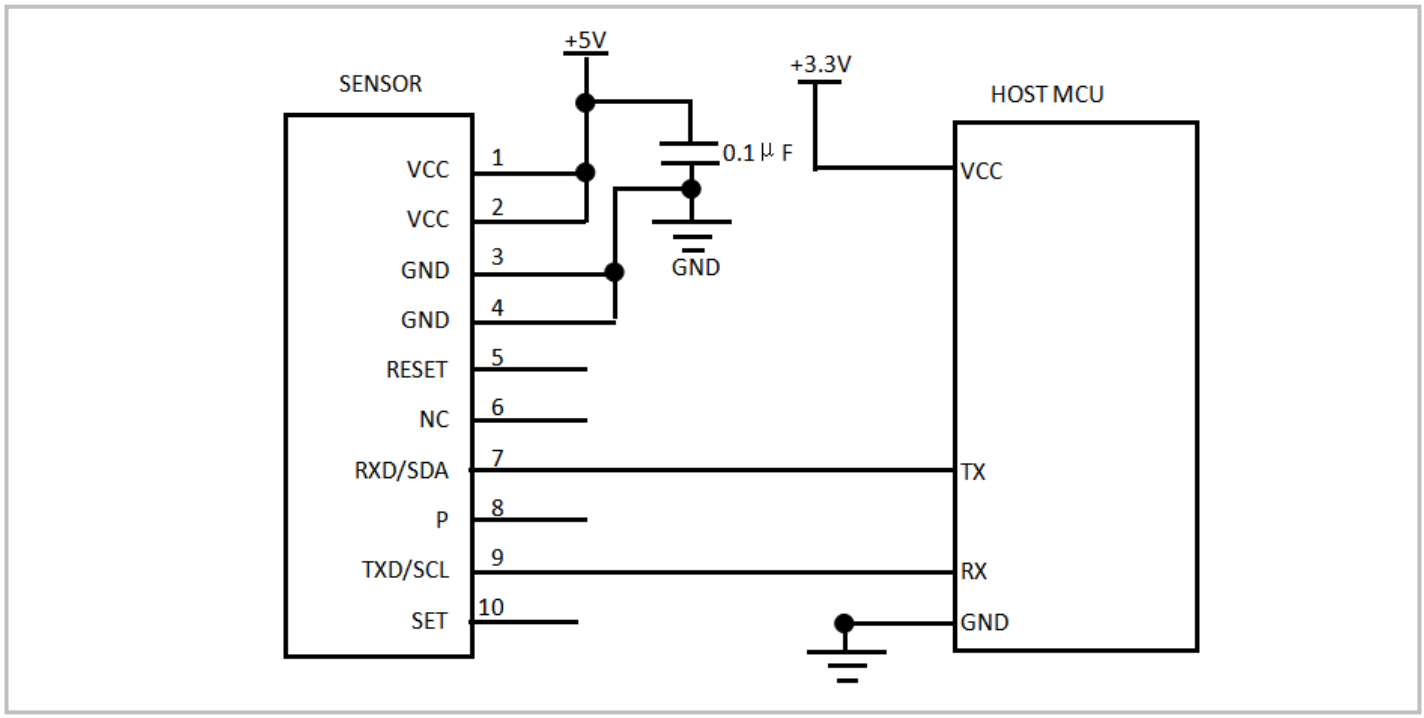
No	Pin	Description
1	VCC	Power input (+5V)
2	VCC	Power input (+5V)
3	GND	Power input (ground terminal)
4	GND	Power input (ground terminal)
5	Reset	Reset (Low level is reset, floating is default)
6	NC	NC
7	RXD/SDA	UART receiving / I2C data
8	P	Output mode exchange TTL level @3.3V High level or floating is UART communication mode, low level is I2C communication mode
9	TXD/SCL	UART sending / I2C clock
10	Set	Set (TTL level @3.3V, high level or floating is normal working status, while low level is sleeping mode）

3. Connector and Cables (Connector can be customized)

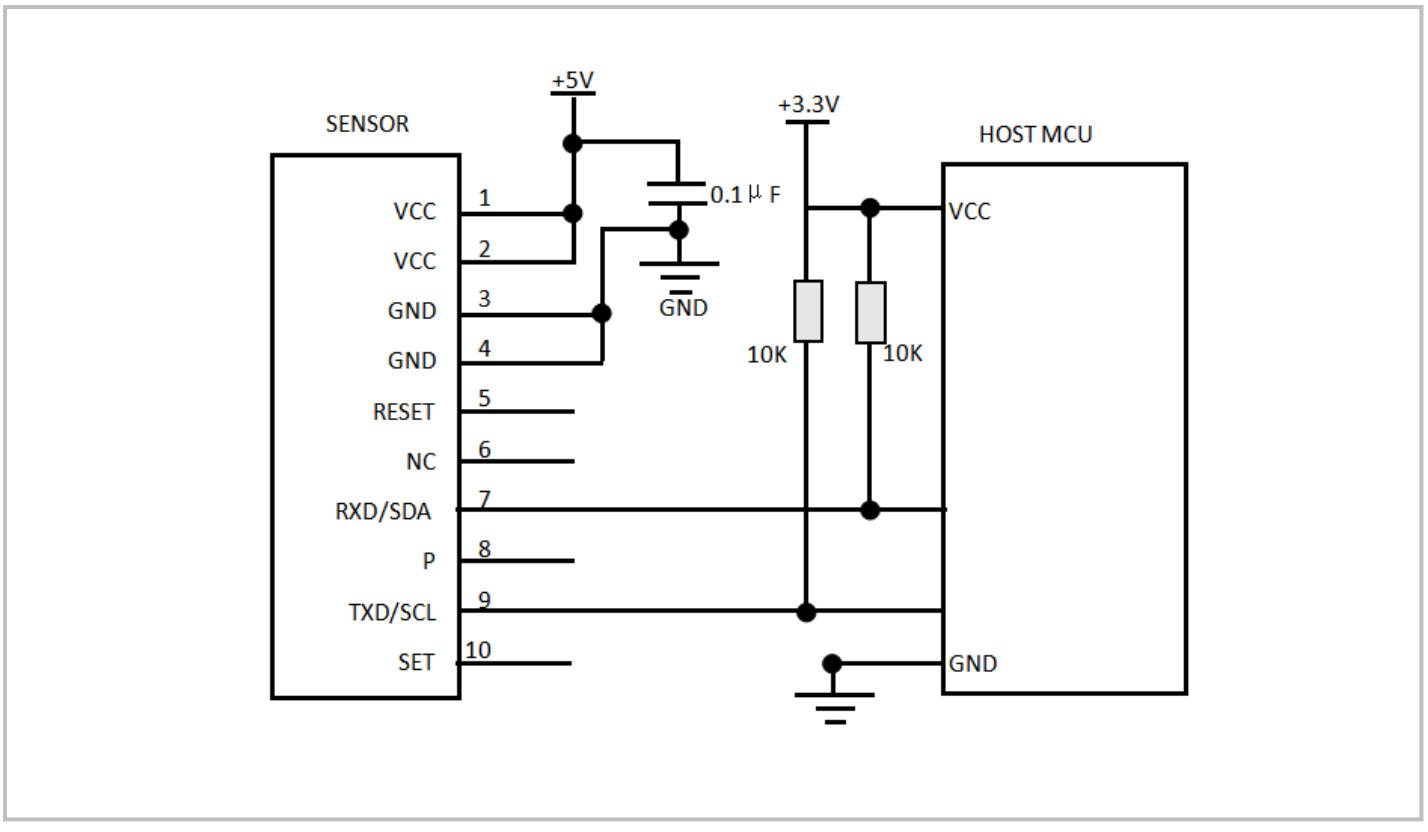
Item	Part Number	Pitch
Connector	JSD-BH-312-002	1.25 mm

Typical Application Circuit

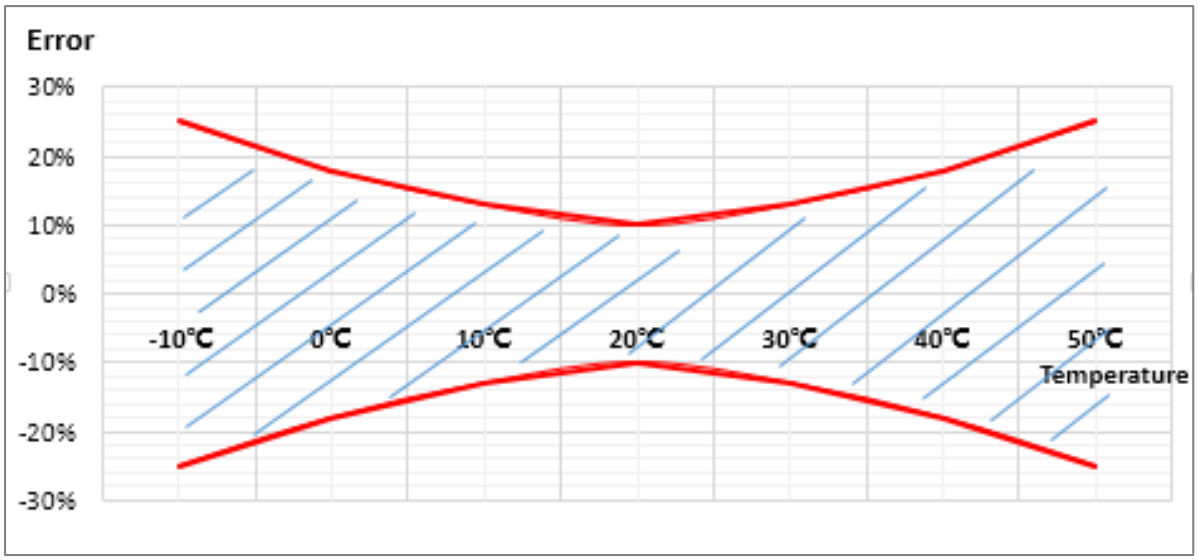
Case 1. UART Application



Case 2. I²C Application



Temperature Influence

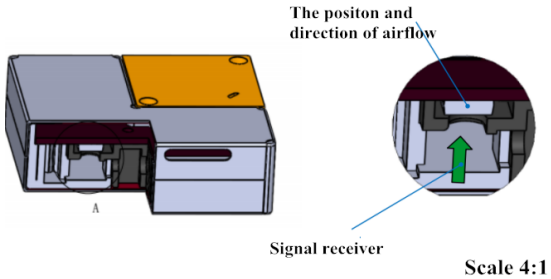


Particle measured error: under 25 ±2°C, 50 ±10%RH, 0 ~ 1,000ug/m³, consistency and accuracy of PM1.0/PM2.5 is ±10% reading or ±10ug/m³, use the biggest one (TSI-8530, Cigarette)

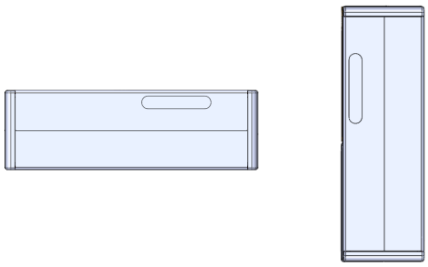
Temperature influence coefficient: 0.5%/°C ~ 1%/°C or 0.5ug/m³/°C ~ 1ug/m³/°C, use the biggest one.

User Attention

▪ It is for household electronics products. For the application of medical, mining, disaster preparedness, which needs high security and high dependence, this sensor is not suitable.
▪ Please do not use it in a bad dusty environment and close sampling port.
▪ Avoid using the sensor under situation with strong magnetic, such as situated close to the stereo speaker, microwave oven, induction cooking.
▪ When installing to the system, make sure the inlet and outlet are unobstructed, and cannot be touched against by large air stream. There are two sides cannot be put downwards (As below pictures), In case of dust deposition on the surface of the sensor device, dust deposition will affect the accuracy of the sensor.

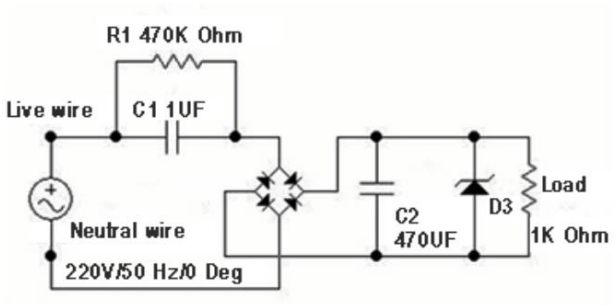


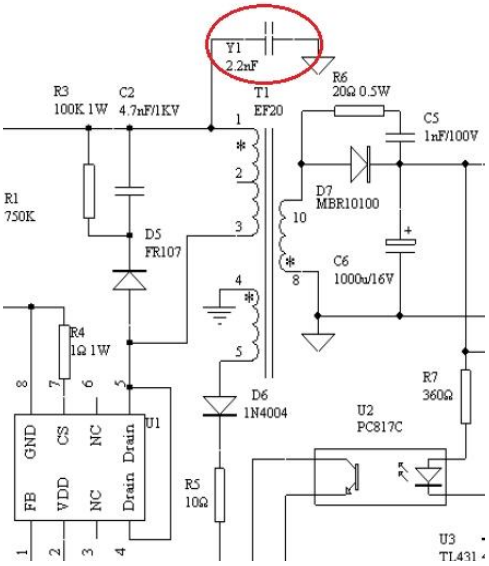
Inner crossing section drawn



Recommend installation

▪ The metal case of sensor connects with the DC ground of inner circuit directly, which will cause safety problem if touching with DC ground. To avoid this problem, Sensor should be internally installed and no permit for touching sensor before powering off.
▪ There is no high-pressure transient protection circuit of the sensor. The power supply of the sensor should be stable 5V and low noise. Please refer to the working current in the specification table.
▪ If using RC decrease voltage, the metal case will contact the fringe line or null line of 220VAC, special protection is needed.





▪ If isolated switch power supply is adapted to obtain DC power, please control the capacitance between the DC ground and the AC ground below 2.2nF and withstand voltage reaches to 3KV.
▪ The sensor itself is safe to use. What you should be cautious is the safety of power supply and structure design on the sensor.
▪ This product is defined as a 3R laser product according to《GB7247.1-2012 laser product safety》with laser radiation inside. Please avoid direct illumination on the eye. The warning label is as above.

UART Communication Protocol

1. General Statement

1) Default Baud rate: 9,600bps; Stop Bits: 1; Parity: No.

2) Whole length: 32 bits

Start Character 1	0x42 (Fixation)	
Start Character 2	0x4d (Fixation)	
Frame length high 8 bit	…	Frame length= 2 * 13 + 2 (Data + check bit)
Frame length low 8 bit	…	
Data 1 high 8 bit	…	Data 1 refers to concentration of PM1.0 Unit: ug/m³
Data 1 low 8 bit	…	
Data 2 high 8 bit	…	Data 2 refers to concentration of PM2.5 Unit: ug/m³
Data 2 low 8 bit	…	
Data 3 high 8 bit	…	Data 3 refers to concentration of PM10 Unit: ug/m³
Data 3 low 8 bit	…	
Data 4 high 8 bit	…	Reserved
Data 4 low 8 bit	…	
Data 5 high 8 bit	…	Reserved
Data 5 low 8 bit	…	
Data 6 high 8 bit	…	Reserved
Data 6 low 8 bit	…	
Data 7 high 8 bit	…	Particle counter ＞0.3um, Unit: pcs/0.1L
Data 7 low 8 bit	…	
Data 8 high 8 bit	…	Particle counter ＞0.5um, Unit: pcs/0.1L
Data 8 low 8 bit	…	
Data 9 high 8 bit	…	Particle counter ＞1.0um, Unit: pcs/0.1L
Data 9 low 8 bit	…	
Data 10 high 8 bit	…	Particle counter ＞2.5um, Unit: pcs/0.1L
Data 10 low 8 bit	…	
Data 11 high 8 bit	…	Particle counter ＞5.0um, Unit: pcs/0.1L
Data 11 low 8 bit	…	
Data 12 high 8 bit	…	Particle counter ＞10um, Unit: pcs/0.1L
Data 12 low 8 bit	…	
Data 13 high 8 bit	…	Version number
Data 13 low 8 bit	…	Error code
Data and check bit high 8 bit	…	Check sum= start character 1 + start character 2+…..+ data 13 low 8 bit
Data and check bit low 8 bit	…	

2. Slave extending command

2.1 Communication protocol format of master

Character bit 1	Character bit 2	Command bit	Status bit1	Status bit2	Check bit 1	Check bit 2
0x42	0x4d	CMD	DATAH	DATAL	LRCH	LRCL

2.2 Definition of command and character bits

CMD	DATAH	DATAL	Description
0xe2	X	X	Passive reading
0xe1	X	00H: Passive 01H: Positive	Status exchange
0xe4	X	00H: Standby 01H: Normal	Status exchange

2.3 Command response

0xe2: Response 32 bits, the same as protocol in last page.

2.4 Check bit generate

All the cumulative sum from character bit.

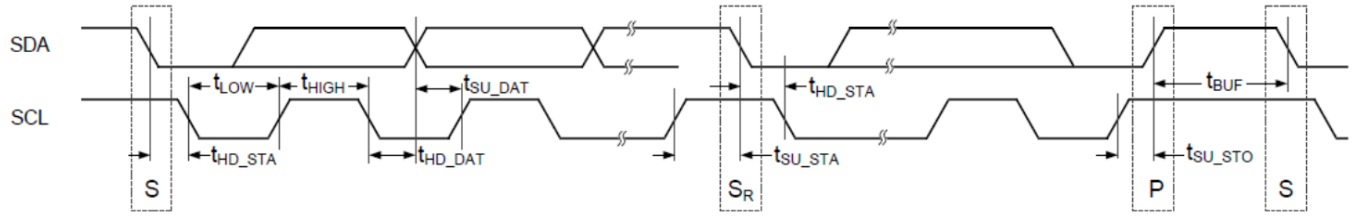
2.5 Error code

Data 13 low 8 bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Alarm definition					1: low working temperature	1: high working temperature	1: Fan at low revolving speed	1: Fan at high revolving speed

I²C Communication Protocol

1. 100Ksps standard NXP EEPROM instruction protocol. Sensor data is placed in registers for mainframe extraction.

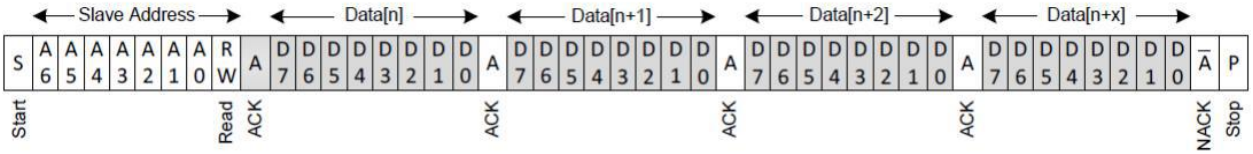
2. Basic Sequence Diagram



parameter	tHD_STA	tLOW	tHIGH	tHD_DAT	tSU_DAT	tSU_STA	tSU_STO	tBUF
min value	4.0	4.7	4.0	5.0	250	4.7	4.0	4.7
unit	μs	μs	μs	μs	ns	μs	μs	μs

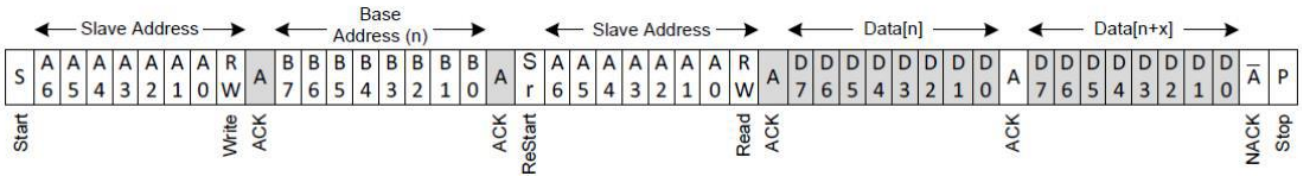
3. Instruction Communication Sequence

3.1 Host continuously reads data to the slave



Note: white is the host operation, gray is the slave operation

3.2 the host reads data from the specified register to the slave



Note: white is the host operation, gray is the slave operation

4. I2C Address Setting:

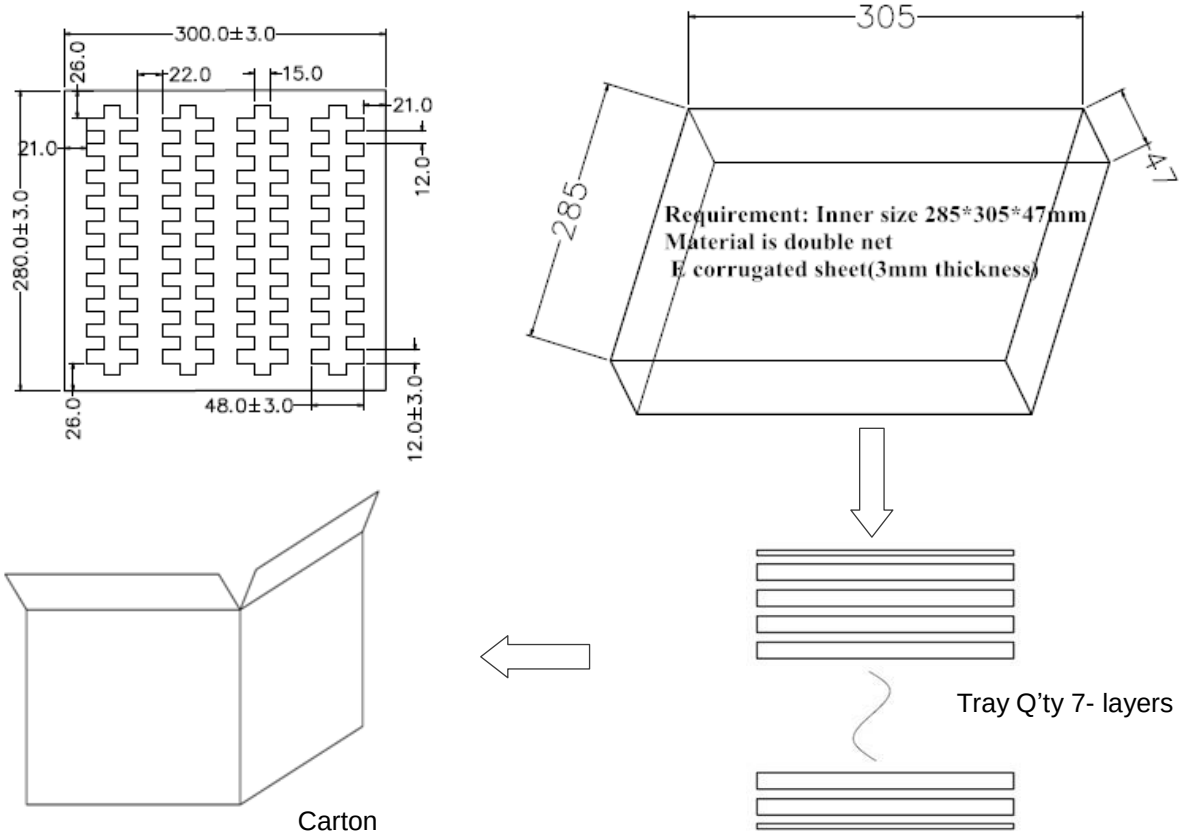
Slave address:0x12

5 . Register Data Definition

Register	Definition	Data	
0x00	start character 1	0x42 (fixation)	
0x01	start character 2	0x4d (fixation)	
0x02	Frame length, high byte	...	Frame length= 2 * 13 + 2(data + check bit)
0x03	Frame length, low byte	...	
0x04	Data 1, high byte	...	Data 2 show PM1.0 concentration, unit: ug/m³
0x05	Data 1, low byte	...	
0x06	Data 2, high byte	...	Data 2 show PM2.5 concentration, unit: ug/m³
0x07	Data 2, low byte		
0x08	Data 3, high byte	...	Data 3 show PM10 concentration, unit: ug/m³
0x09	Data 3, low byte	...	
0x0a	Data 4, high byte	...	Reserved
0x0b	Data 4, low byte		
0x0c	Data 5, high byte	...	Reserved
0x0d	Data 5, low byte		
0x0e	Data 6, high byte	...	Reserved
0x0f	Data 6. low byte	...	
0x10	Data 7, high byte	...	Number of 0.3um, unit: pcs/0.1L
0x11	Data 7, low byte	...	
0x12	Data 8, high byte	...	Number of 0.5um, unit: pcs/0.1L
0x13	Data 8, low byte		
0x14	Data 9, high byte	...	Number of 1.0um, unit: pcs/0.1L
0x15	Data 9, low byte	...	
0x16	Data 10, high byte	...	Number of 2.5um, unit: pcs/0.1L
0x17	Data 10, low byte	...	
0x18	Data 11, high byte	...	Number of 5.0um, unit: pcs/0.1L
0x19	Data 11, low byte	...	
0x1a	Data 12, high byte	...	Number of 10.0um, unit: pcs/0.1L
0x1b	Data 12, low byte	...	
0x1c	Data 13, high byte	...	Version number
0x1d	Data 13, low byte	...	Error code
0x1e	Data and verify, high byte	...	Check code= start character 1+start character 2+.... +data 13, lower 8 byte
0x1f	Data and verify, low byte	...	

Package Information

Tray Size



Sensor per Tray	Tray Qty	Sensor per Carton	Carton Dimensions	Packing Material
40 pcs	7 layers	280 pcs	395*310*330 mm	Red anti-static EPE

JDS COMPANY KOREA
02-3491-5217
www.jdscompany.co.kr

After-Sales Services and Consultancy

Wuhan Cubic Optoelectronics Co., Ltd.
Tel: +86 (0)27 81628827 Fax: +86 (0)27 81628821
Add: Fenghuang No.3 Road, Fenghuang Industrial Park, Eastlake Hi-tech Development Zone, Wuhan 430205, China
E-mail: info@gassensor.com.cn