P760/P710 Particle & Gas Sensor Module Datasheet

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Contents

Module Features

1. Uses laser light and Mie scattering principle to measure PM1, PM2.5 & PM10.
2. The smallest particle size measured is: 0.3μm.
3. Uses miniature Air Pump to save power, reduce noise, reduce EMI, and provide long life.
4. Fast, accurate, stable, and reliable measurement.
5. Slim, minimal design for portable and wearable applications (size : 28.85X28.85X7.2mm).
6. Thermal protection: Auto-change to reduced sampling mode when PCB temperature > 60^0C.
7. Includes a BOSCH BME688 Environmental Sensor which adds gas related index for air quality & pressure (P760 only).

Module Applications

1. Mobile phone
2. Watch/ smart wristband
3. Wearable devices
4. Air purifier
5. Air quality monitoring
6. Air conditioning system
7. Auxiliary function expansion of consumer electronics

Product Principles and Descriptions

P760/P710 Particle Sensor Module uses laser light and Mie scattering principle to measure PM1, PM2.5 & PM10 particulate matter in the air, and report environmental index for air quality. It uses an Air Pump to draw outside air, pass it through a laser beam. With light scattering off passing particle, it measures intensity to get PM1, PM2.5 & PM10 mass concentration. In addition, for model P760, it obtains index for air quality from BME688. Measurement is taken in real time and sent out using I^2C interface. A system block diagram is shown in Fig.1。Module' s air inlet and outlet are shown in Fig.2.

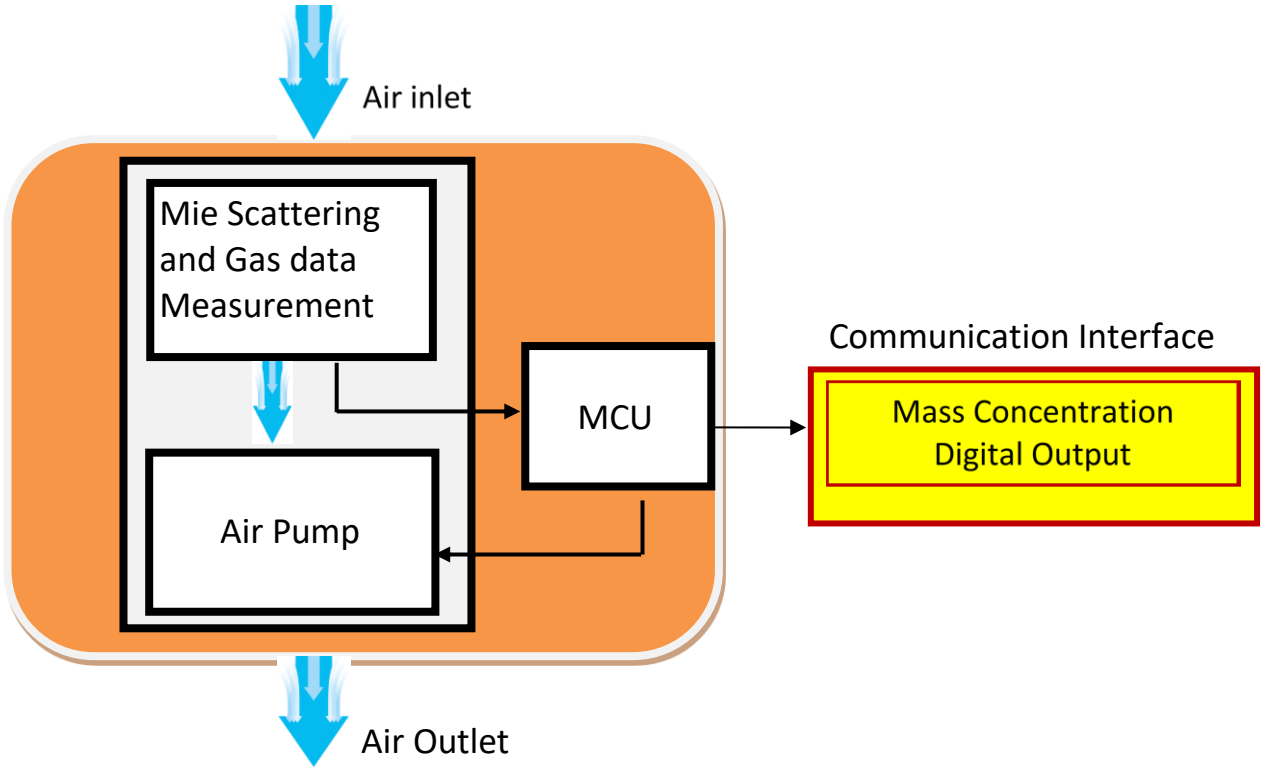


Fig.1: System Context Diagram

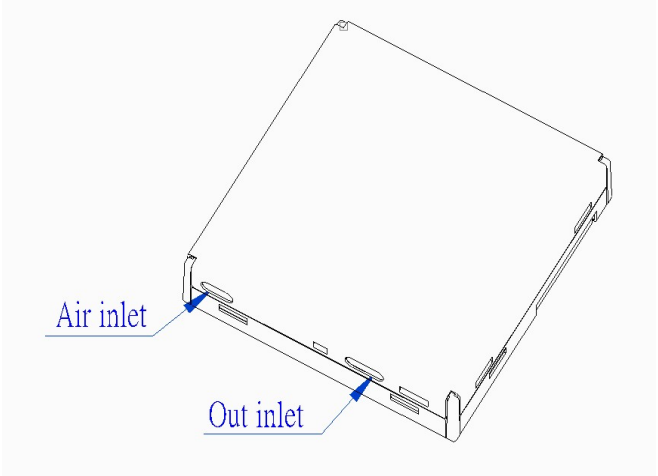


Fig.2: Dimesion:28.85X28.85X7.2mm

Module Specifications

P760/P710 Parameters	Value	unit
Mass concentration range (PM 2.5/10) **(PM 1)**	0-1000 0-150	μg/m^3
Mass concentration resolution	1	μg/m^3
Mass concentration accuracy (PM2.5)	±15% @251-500 ug/m3 ±10%@101~250 μg/m3 ±5%±5@21~100μg/m3 ±5%±3@0~20μg/m3 (25±50C · 50±5R.H.%)	
Mode	Continuous/ Interval	
Sampling interval	1(Continuous mode) 60(Interval mode)	sec
Stand-up time	30(high precision)	sec
Working environment	Temperature: 10~40^{0}C Humidity: 20~80%	
Lifetime	≧3 years at 60 seconds mode (It depends on the using environment and working period)	
P760 only： **Index for Air Quality (IAQ) (VOC Index)**	0-500	1

IAQ for P760

● Pressure Sensor for P760

RMS Noise	0.12 Pa (equiv. to 1.7 cm)
Sensitivity Error	±0.25 % (equiv. to 1 m at 400 m height change)
Temperature coefficient offset	±1.3 Pa/K (equiv. to ±10.9 cm at 1°C temperature change)

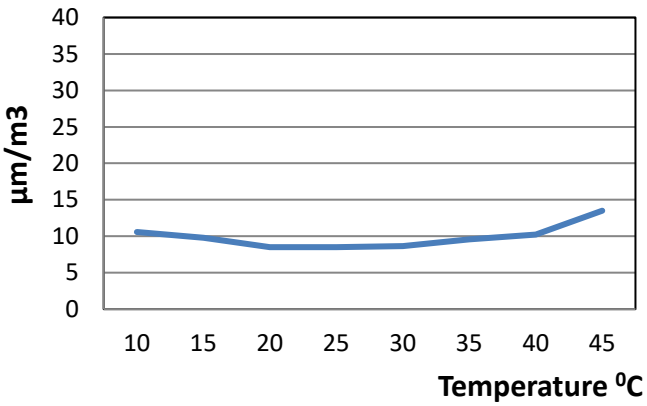
P760/P710

- module provides 2 operation modes：

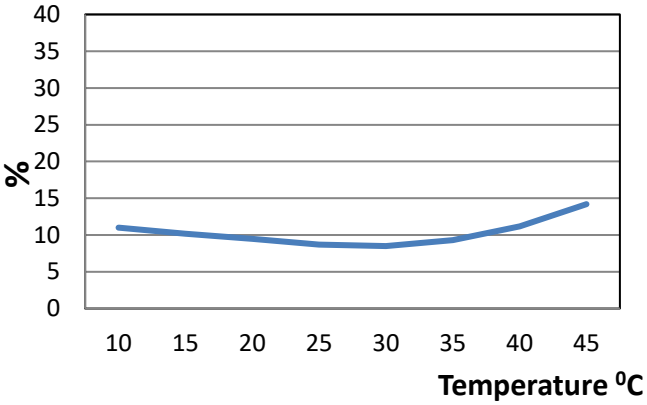
  A. Continuous mass concentration output once per 1 sec.

  B. Interval mass concentration output once per 1min.

- module needs 30 secs for data collection to provide stable and accurate mass concentration output.
- Accuracy over Temperature



Accuracy for PM2.5 < 100 µm/m^3



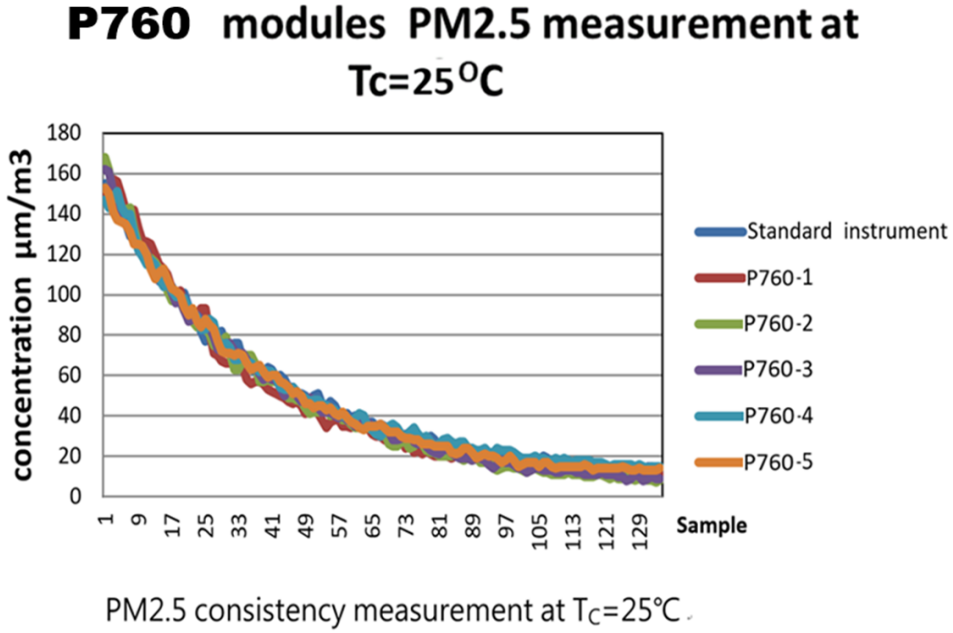
Accuracy for PM2.5 > 100 µm/m^3

Module Electrical Specifications

Parameter	Value	unit
Power supply	5±0.5	V_{DC}
Working current	10-65	mA
Average current	65(Continuous mode) 32(Interval mode 1min)	mA
Standby current	200	μA
Input high level voltage (V_{IH})	>2.31	V
Input low level voltage (V_{IL})	<0.99	V
Output high level voltage (V_{OH})	>2.9	V
Output high level voltage (V_{OL})	<0.4	V

- Environment parameters: Temperature: 25℃, Humidity：60%

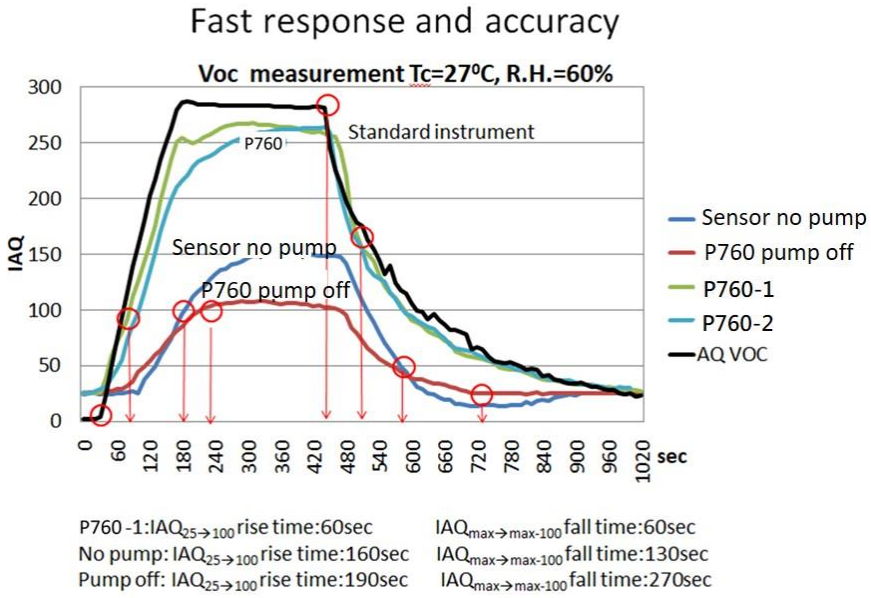
Unit-to-unit Variations over Range of PM2.5 (also represented with P710)



PM2.5 consistency measurement at T_C=25℃.

*The standard instrument is GRIMM 11-D, R.H=60%.

Gas Index for air quality (IAQ) response time and accuracy



P760 -1:$IAQ_{25\rightarrow100}$ rise time:60sec
No pump: $IAQ_{25\rightarrow100}$ rise time:160sec
Pump off: $IAQ_{25\rightarrow100}$ rise time:190sec

$IAQ_{max\rightarrow max-100}$ fall time:60sec
$IAQ_{max\rightarrow max-100}$ fall time:130sec
$IAQ_{max\rightarrow max-100}$ fall time:270sec

Measurement condition:

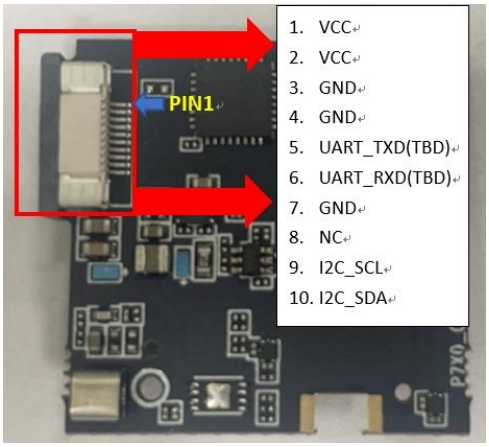
1. Chamber: 50*40*20cm
2. Test gas: Isobutyl (C_4H_8)
3. Standard Instrument: AQVOC device

Communication Interface

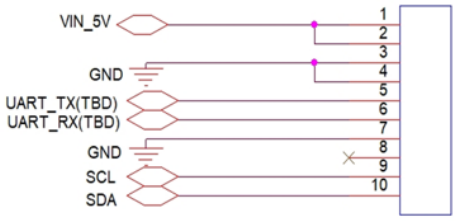
Pin Descriptions

NO	Pin	Description
1	VCC	Power input (DC 5V)
2	VCC	Power input (DC 5V)
3	GND	Ground
4	GND	Ground
5	UART_TX(TBD)	UART transmit
6	UART_RX(TBD)	UART receive
7	GND	Ground
8	(reserved)	
9	SCL	I^2C clock
10	SDA	I^2C data

FFC connector descriptions：



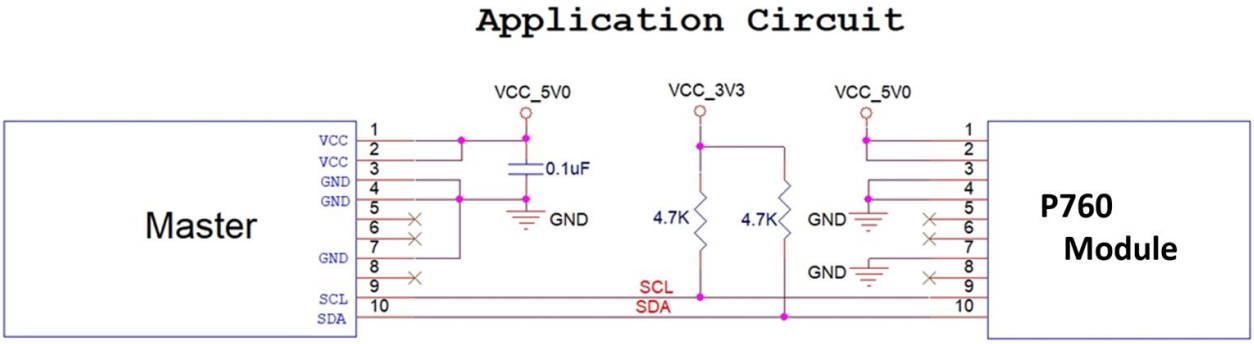
0.5PH-10PIN



※ Drawer Down Connector 10P 0.5mm Pitch

P: pin interval Pt: full pin interval S1: pin length
Cw: pin width M: edge width W: FFC width

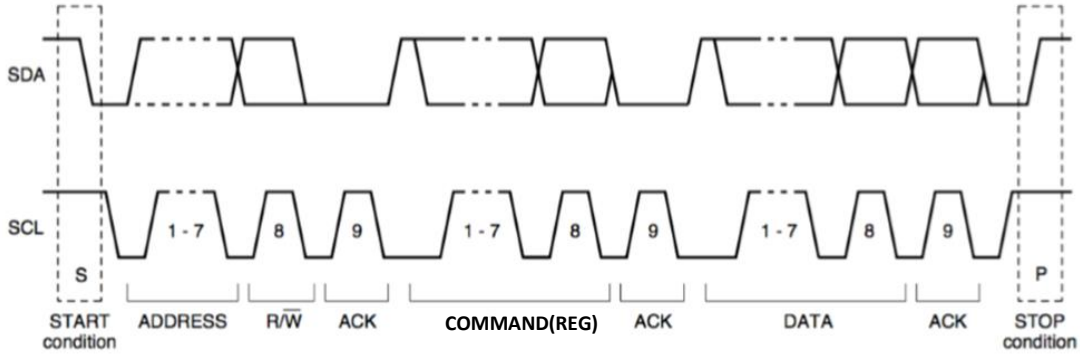
Application Circuit (also represented with P710)



Air pump and P760 module is supplied 5VDC, but I2C interface is 3.3VDC

I²C Communication Protocol

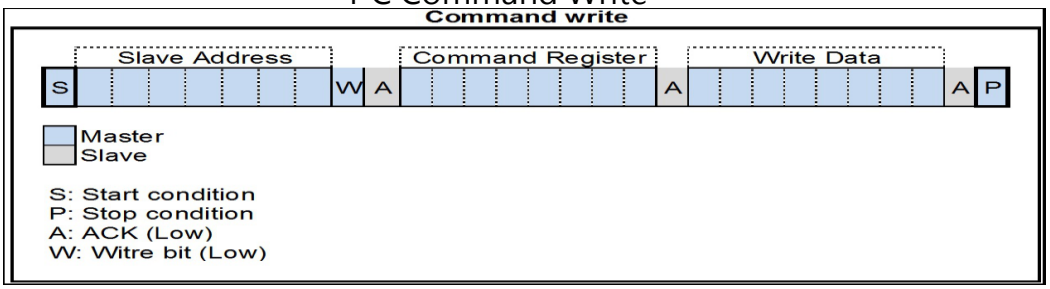
I²C Bus



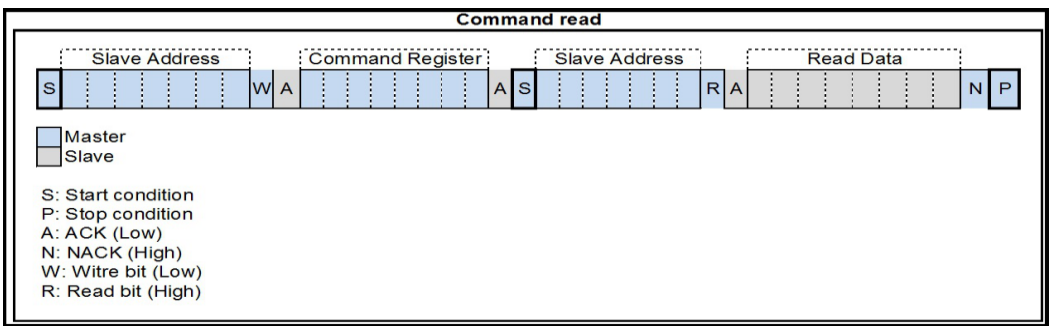
The physical I²C interface consists of the serial clock (SCL) and serial data (SDA) lines. Both SDA and SCL lines must be connected to Vcc_3V3 through a pull-up resistor. I²C communication with this device is initiated by the master sending a START condition and terminated by the master sending a STOP condition. A high-to-low transition on the SDA line while the SCL is high defines a START condition. A low-to-high transition on the SDA line while the SCL is high defines a STOP condition. · The 1-7 bits of first byte is I²C address, and the 8th bit is R/ $\overline{W}$ setting in SDA. The second byte is command Register. The next bytes are transfer data. Each byte of data (including the address byte) is followed by one ACK bit from the receiver. The ACK bit allows the receiver to communicate to the transmitter that the byte was successfully received and another byte may be sent.

P760 module I²C address：0x12 · Max speed:100K bit/s 。

I²C Command Write



I²C Command Read



P760/P710 I^2C R/$\overline{W}$ and Command Register setting:

I^2C Command Register：

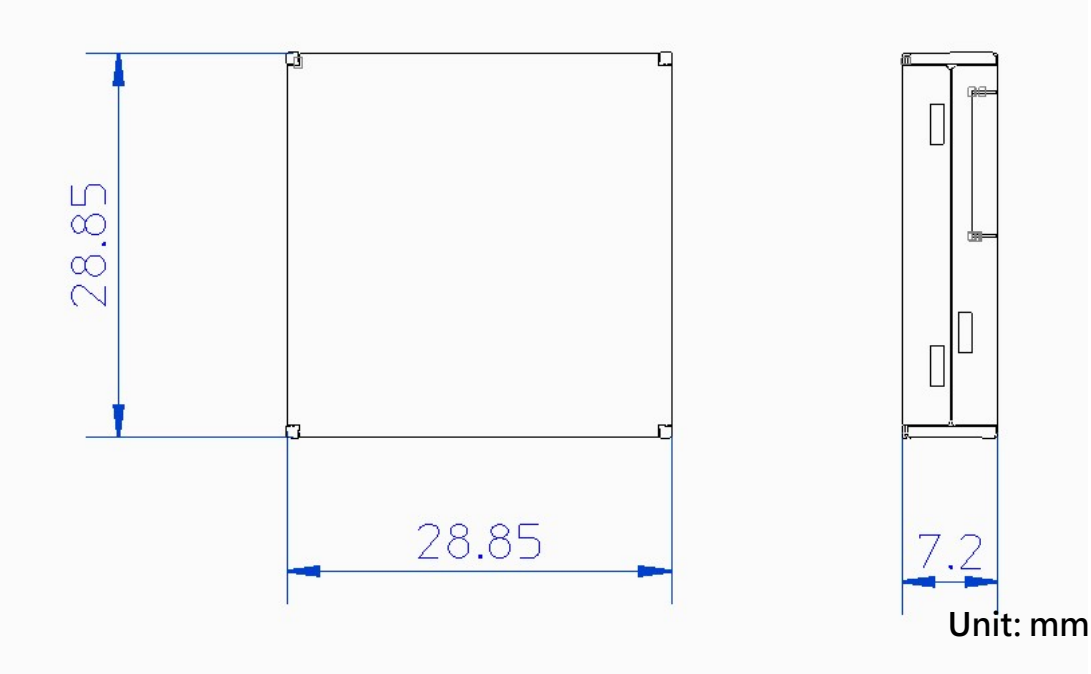
Reg Number (Hex)	Register Name	Type	Default (Hex)	Description
0x00 2-4-6 bytes	PM1_H	R	0x00	PM1 mass concentration (μg/m^3) Note: 6 consecutive bytes can be read to obtain PM1 thru PM10 in one operation
	PM1_L	R	0x00	
0x02 **2 bytes**	PM2P5_H	R	0x00	PM2.5mass concentration (μg/m^3)
	PM2P5_L	R	0x00	
0x04 **2 bytes**	PM10_H	R	0x00	PM10 mass concentration (μg/m^3)
	PM10_L	R	0x00	
0x06	MODE	R/W	0x01	"0" continuous ; " 1" 60 seconds
The IAQ & Air pressure data of the P760 is starting from 0X20 To read 12 bytes(value[0]~value[11]) of valid data. IAQ= value[0]<<8+value[1]				
0x20 **2 bytes**	IAQ_H	R	0x00	index for air quality (IAQ)
	IAQ_L	R	0x00	
Air Pressure = value[9]<<16+value[10]<<8+value[11]				
3 bytes	AIR_PRESSURE _H	R	0x00	(10^{-5}atm)
	AIR_PRESSURE _M	R		
	AIR_PRESSURE_L	R		

0x2E	BOSCH_ON_OFF_ADDR	R/W	0x01	0x01 Bosch ON 0x00 Bosch OFF
0x70 4 bytes	FW_VER_NUM1	R		Version
	FW_VER_NUM2	R		Year
	FW_VER_NUM3	R		Month
	FW_VER_NUM4	R		Day
0x81 **4 bytes**	MODEL_1	R	0x50	Model name 1 (ASCII)
	MODEL_2	R	0x37	Model name 2
	MODEL_3	R	0x36	Model name 3
	MODEL_4	R	0x30	Model name 4
0xB6	PM25_STOP	R/W	0x00	0x01 PM25 Stop 0x00 PM25 Start

Product code:

P	8	0X
Measuring particle classifying P: Particle sensor	Module size classifying Ex: 8: Normal size 7: Small size	Vision code: 0X: Version code of Particle Module

Module Appearance and Size

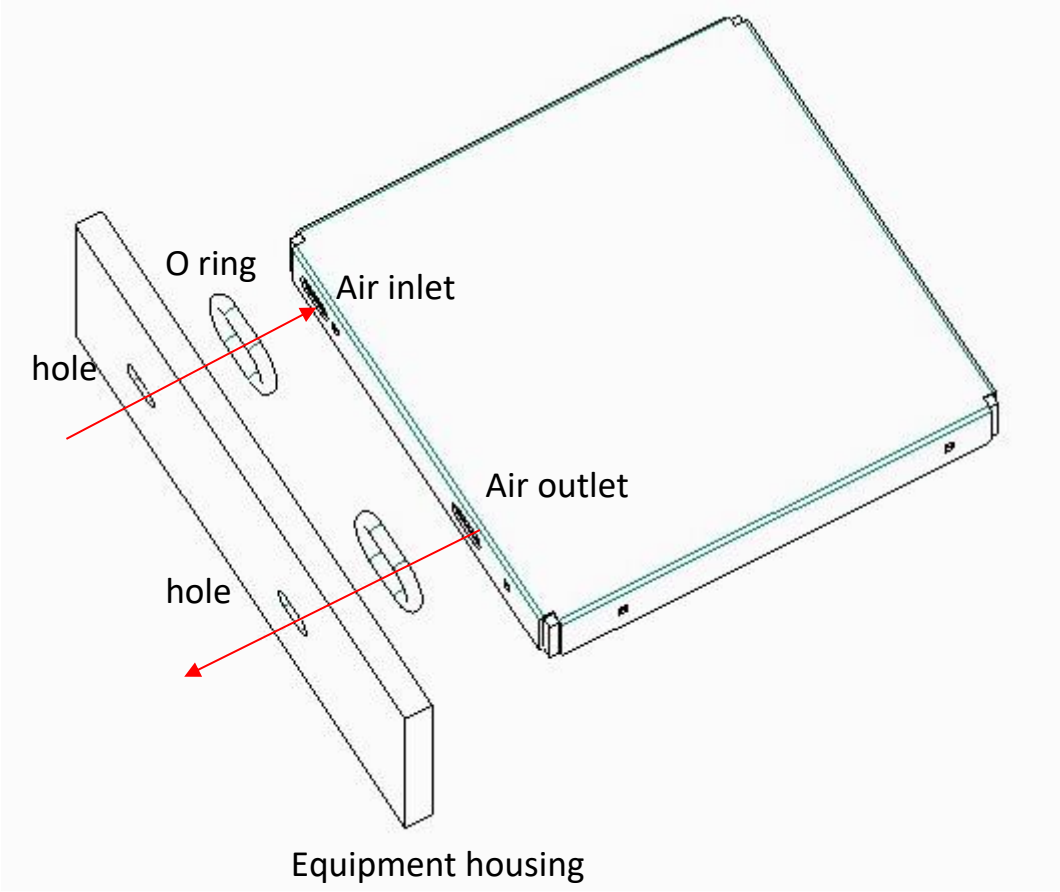


Unit: mm

Notes

- P760/P710 is suited to measure particulate matter in general environment. Do not used in prolonged high-pollution environment such as smoking rooms, kitchens, Buddhist temples, bathrooms, dust industry factories, etc. Module will age and its accuracy will decline.
- P760/P710 is sealed in the factory. Do not disassemble. There is no serviceable part inside. Warranty is void if unit is opened.
- The metal shells of module are connected to logic ground. Do not connect to active circuit or use it as an earth ground.
- To avoid air recirculation, add O rings or rubber seal at the interface of Module as shown below.

Installation example



Reversion history

Date	Version	Description
20241105	V241105	First version
20241202	V241202	Add new digital algorithm/calculation
20241220	V241220	Add particle SIZE from 0.3-10 commands
20250519	V250519	Temperature revised of working environment
20250826	V250826	Delete eCO2, BVOC, temperature, humidity. Revise IAQ definition as (Index for Air quality)
20250903	V250903	Revise PM1 range 0-300
20260122	V260122	1.Revise PM1 range 0-150 2.Revise PM2.5 accuracy
20260213	V260213	Modify and include P710