

NO.	
DATE	2021.07.07
REV.	07

APPROVAL SHEET

ITEM : DUST SENSOR

CODE No. : UPD-M010UA

CUSTOMER			
WRITTEN BY	CHECKED BY		APPROVED BY

MANUFACTURER			
WRITTEN BY	CHECKED BY		APPROVED BY
최민지	김영준		

DONG IL TECHNOLOGY LTD.

Code No.:	REVISION REPORT		DOC No.
Customer		Description	DUST SENSOR

Rev.	Date	Page	Contents	
01		10	Initial Release	
02	2019.11.26	10	Packing Specification Description	
03	2020.03.13	10	Reliability Test Description	
04	2020.04.06	13	Notice revise	
05	2020.12.30	14	Sensor Install Guide	
06	2021.03.10	14	PM DATA Read Command Change	
07	2021.07.07	14	Output Interface Change	

Content

1. UPD-M010UA Overview	3
2. Sensor Performance	4
3. Block Diagram & Pin Assignment	4
4. Electrical Specifications	6
5. Interface Specifications	7
6. Product Dimension	10
7. Reliability Test	11
8. Packing Information	12
9. Notices	13
10. Contact	13

UPD-M010UA

PM1.0/PM2.5/PM10 Fine Particulate Sensor

Applications

Air Conditioner, Air Purifier, Air Monitor
Ventilation System, Fan Control
IAQ Monitoring & Control System
Smoke Detector



Key Features

Detecting particles such as dust, pollen and smoke down to $0.3\mu\text{m}$
Internal APC block for operating LD
Internal dust signal processing unit
Wide sensing range : $0\sim 1,000\ \mu\text{g}/\text{m}^3$
Compact and Lightweight Package
Lead-free, RoHS compliant

Product Summary

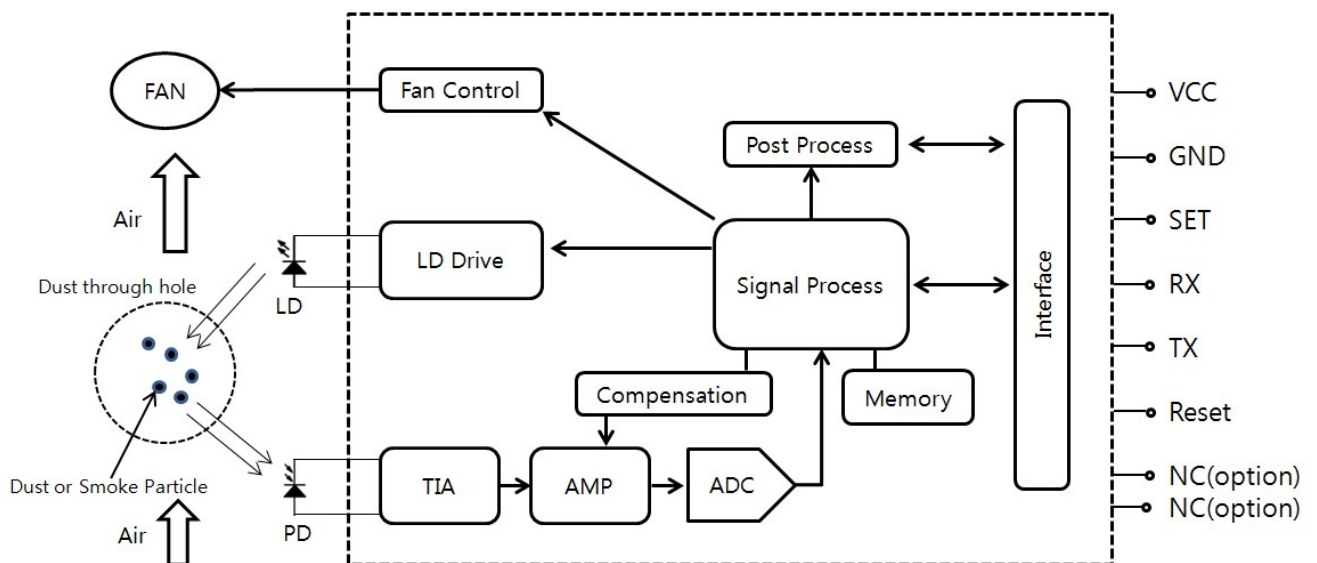
The UPD-M010UA particle sensor module is based on light scattering method. This product is designed for detect particle concentration, it can distinguish between $0.3\mu\text{m}$ to $10\mu\text{m}$ size particles in the air. The UPD-M010UA's ROIC that is composed Internal APC circuit and dust signal processing unit make possible more smaller and lightweight product. So this product is suitable to application where size is important product.

1. Sensor Performance

Parameter	Value	note
Measuring Principle	Light Scattering	Laser Diode($\lambda=650\text{ nm}$) & Photo Diode
Measuring Data	PM1.0, PM2.5, PM10	Standard Particle : Aerosol KCl Comparing Instrument : Grimm Model *.*** Condition: $25\pm 2^{\circ}\text{C}$, $50\pm 10\%\text{RH}$
Measuring Range	Max $1,000\text{ }\mu\text{g}/\text{m}^3$	
Detection Accuracy *1	$\pm 10\% @ 100\sim 500\text{ }\mu\text{g}/\text{m}^3$ $\pm 10\text{ }\mu\text{g}/\text{m}^3 @ 0\sim 100\text{ }\mu\text{g}/\text{m}^3$	
Resolution	$1\text{ }\mu\text{g}/\text{m}^3$	
Response Time	<1sec	Time to First reading < 30s
Module Weight	17g	
Module Dimension	41 x 36 x 11.6 mm	
Output Interface	UART_TTL_3.3V	

2. Block Diagram & Pin Assignment

2.1 Block Diagram



< DIT Dust Sensor Block Diagram >

2.2 Pin Assignment



Pin	Name	note
①	VCC	Power Supply (+5V)
②	GND	Ground
③	SET	High Level(3.3V) or Open : Normal Mode. Low level : Sleep Mode.
④	RXD	Serial port receiving pin (3.3V_TTL)
⑤	TXD	Serial port sending pin (3.3V_TTL)
⑥	RESET	High Level(3.3V_TTL) or Open : Normal Mode. Low Level : Module Reset
⑦	N.C	-
⑧	N.C	-

* Wafer

- Maker : Yeonho Electronics (Korea)
- Model : 12505WR-08
- (Pitch : 1.25 mm, Number of Pins: 8, Right-angle type Wafer)

3. Electrical Specifications

3.1 Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Supply Voltage	V _{CC}	5±0.25	V
Power Consumption	P _o	<500	mW
Operating Current	I _o	<100	mA
Standby Current	I _o	<5	mA
¹⁾ Operating Temperature Range	T _{opr}	-10 ~ 60	°C
Storage Temperature Range	T _{stg}	-40 ~ 80	°C
²⁾ Operating Humidity Range	RH	< 95	%RH

¹⁾The sensor shows best performance when operated within recommended temperature and humidity range of 10 - 40°C and 20 - 80%RH, respectively.

²⁾The module is susceptible to the influence of the humidity. If it is possible, please avoid the place that is moisturized.

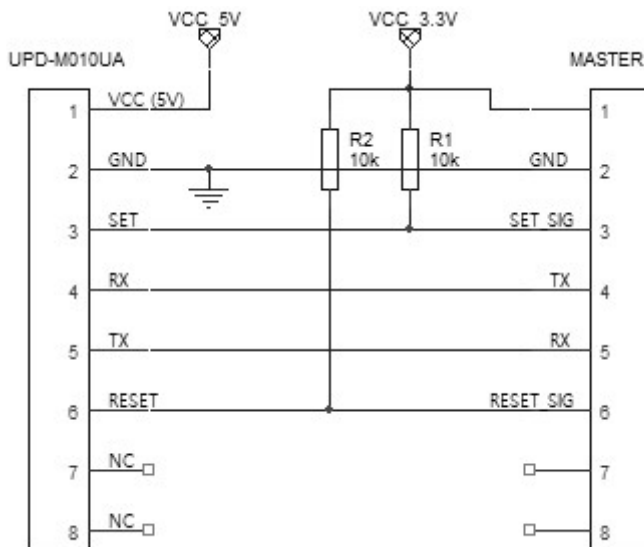
*The above statements in table are operating conditions. The result could be changed by the condition

3.2 Electrical Specifications

Item	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage	V _{CC}	4.75	5	5.25	V
Operating Current	I _o			90	mA
High Output Voltage Level	V _{OH}	2.54			V
Low Output Voltage Level	V _{OL}			0.76	V
High Input Trigger Level	V _{IH}	2.41			V
Low Input Trigger Level	V _{IL}			0.89	V

4. Interface Specifications

4.1 UART Interface

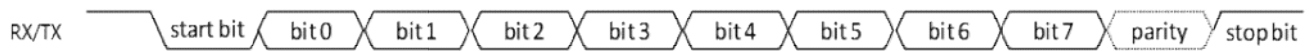


- 1) Operating Power is $5V \pm 5\%$
- 2) The SET and RESET pins are recommended that they are connected external pull-up resistors ($R1 \ \& \ R2 = 10k\Omega$) in order to correctly operation.
- 3) PIN7 & PIN8 should not be connected
- 4) If the product is wake up from the sleep mode, it is necessary about 30 seconds time to acquire the correct PM DATA.

4.2 UART Communication

This Module supports standard UART Interface for data transmission to client MCU.

- Standard UART Interface : Rx, Tx 2pin
- Data Length : 8bit
- Data Order : LSB first
- Parity : none (Parity bit is not applied by default, but it is possible to be applied if you want)

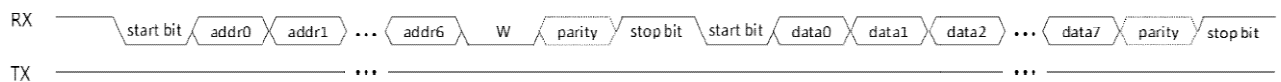


UART timing diagram

- MSB of address byte (bit7) is used as a value for distinguishing READ/WRITE.
(WRITE = 0, READ = 1)

- Write Operation

First, a command to distinguish the READ/WRITE (bit7) with the 7 bit address(bit0-bit6) is constructed and the write operation is performed. In the case of WRITE, 8-bit data should be consecutively transmitted after address command. See following Figure



UART Write Operation

- Read Operation

In case of READ operation, a command with the READ/WRITE flag set to '1' is configured with 7 bit address and transmitted, and then waits to receive 8-bit data.



UART READ Operation

- Baud Rate

Default speed is 9.6kbps.

UART standard baud rate supported

Bit rate (Baud rate)	Time per bit	Supported
9,600 bit/s	104.2 μ S	Yes

- Booting Sequence

This module needs to perform the following procedure during power-on.

Seq.	RD/WR	Address	Data	Account	Example
①	RD	0x7C	0xC0	Reading Chip ID(=0XC0) if different data is read, please do seq.① again.	0xC0(RD)
②	WR	0x08	0x2E	Initial setting for precise PM data read process	
③	WR	0x5A	0xB9		

- To achieve the proper data from the sensor, the procedure which is called "booting sequence" should be conducted at the initial booting system.

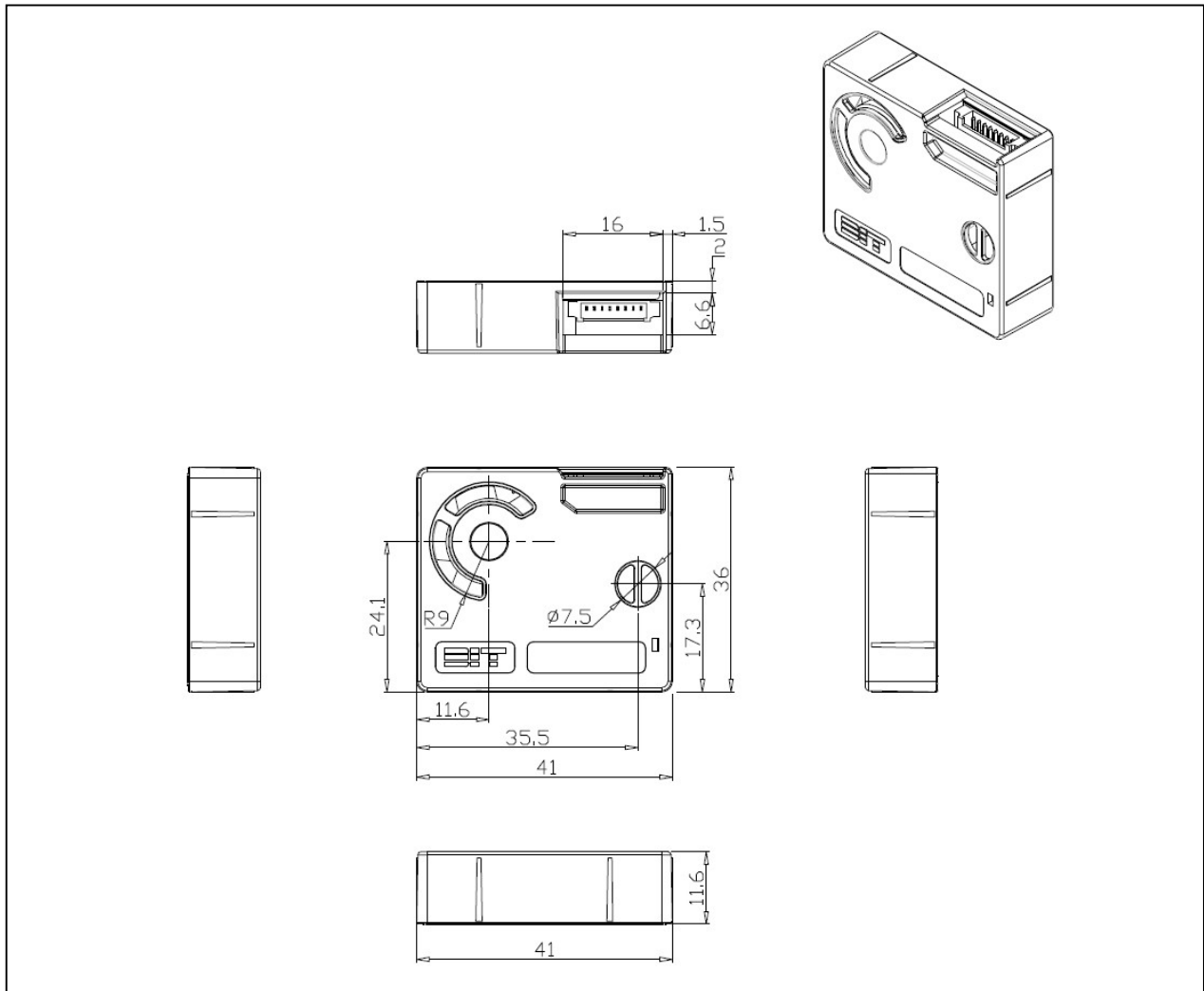
- Read PM Data

This module needs to perform the following procedure to receive the PM data.

Seq.	RD/WR	Address	Data	Account	Example
①	RD	0x7C	0xC0	Reading Chip ID(=0XC0) if different data is read, please do seq.① again.	0xC0(RD)
②	WR	0x08	0x2E	Initial setting for precise PM data read process	
③	WR	0x5A	0xB9		
④	WR	0x00		Latching PM Data	
⑤	RD	0x01		Requesting PM1.0 High Data	PM1.0 DATA
⑥	RD	0x02		Requesting PM1.0 Low Data	
⑦	RD	0x03		Requesting PM2.5 High Data	PM2.5 DATA
⑧	RD	0x04		Requesting PM2.5 Low Data	
⑨	RD	0x05		Requesting PM10 High Data	PM10 DATA
⑩	RD	0x06		Requesting PM10 Low Data	

- PM Data (PM1.0, PM2.5, PM10) is updated at every 500ms into sensor internal register.
- Master needs to achieve the data every 500ms for real time data.
- To be sure that master should send the latching sequence to the sensor before achieving data.

5. Dimensions

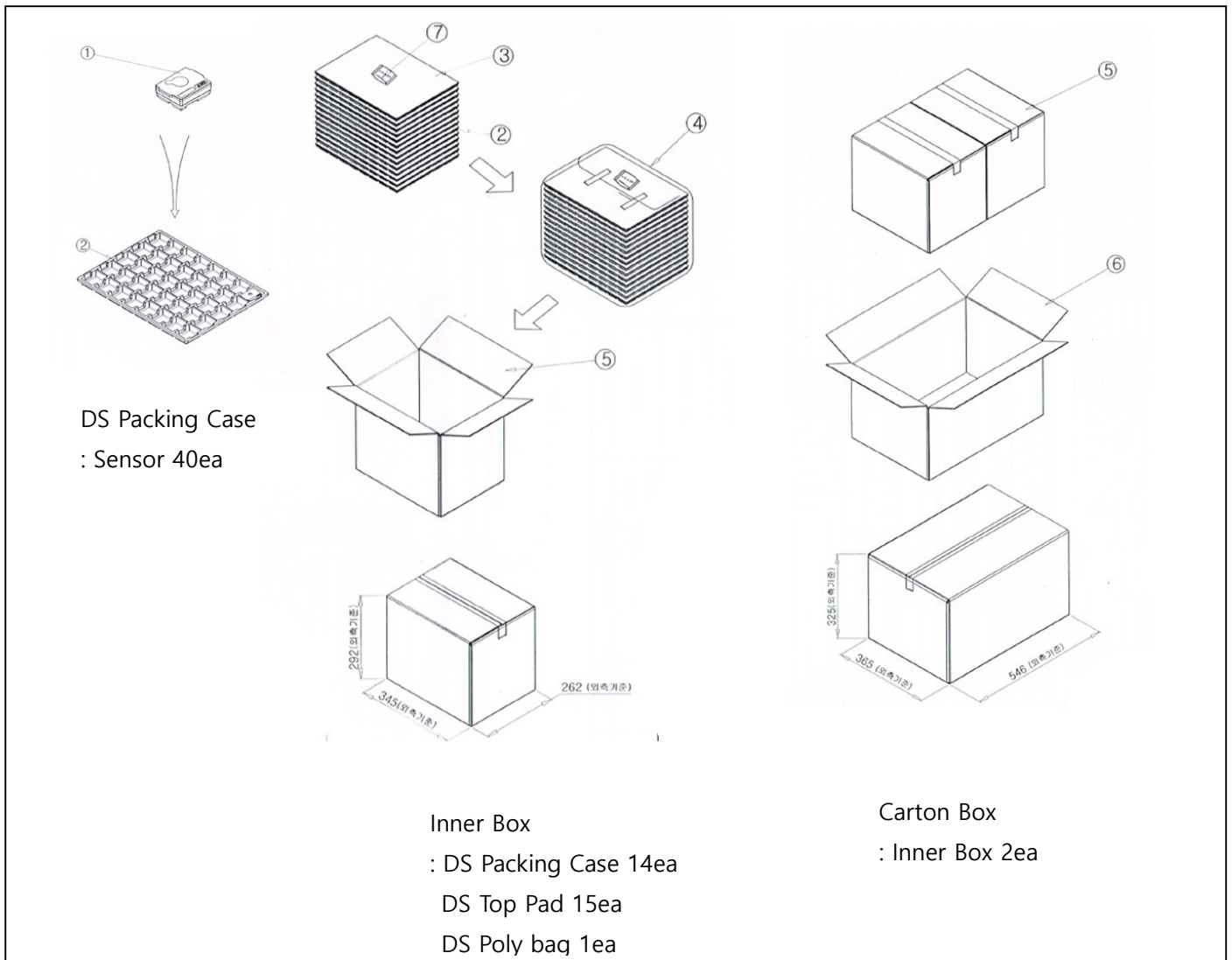


<UPD-M010UA Dimensions>

6. Reliability Test

No	Test Item	Test Condition	Standard	Sample quantity : N Defective quantity : C
1	High temp. Storage	Leave the sensor in the ambient of 80°C, keep for 72 hours.	No Damage No Breakage Output within $\pm 30\%$ of the initial value (at 50 $\mu\text{g}/\text{m}^3$ PM2.5)	N = 5 C = 0
2	Low temp. Storage	Leave the sensor in the ambient of -30°C, keep for 72 hours.		N = 5 C = 0
3	High temp & High humidity. Storage	Leave the sensor in the ambient of 70°C and 95%RH, keep for 72 hours.		N = 5 C = 0
4	Power On-Off Cycle	Operation the sensor in the ambient of 25°C and 45%RH, VCC=5V, ON : 10sec, OFF : 5sec Repeat 20,000 times		N = 5 C = 0
5	Thermal Cycle	Leave the sensor in the ambient of 25°C for 1 hour Raise the temperature to 80°C for 1 hour Leave the sensor in the ambient of 80°C for 4 hours Lower the temperature to -25°C for 2 hours Leave the sensor in the ambient of -25°C for 4 hours Raise the temperature to 25°C for 1 hour Repeat 20 times		N = 5 C = 0
6	Thermal Shock	Leave the sensor in the ambient of 25°C for 1 hour Move it to ambient of 80°C for 1 hour Move it to ambient of -20°C for 1 hour Repeat 24 times		N = 5 C = 0
7	Drop Test	Drop the sensor from 70 height down to the hard wooden board three times at random diretion		N = 5 C = 0
8	Mechanical Shock	Frequency 5 ~ 55 ~ 5Hz (1min) Overall amplitude 1.5mm Direction X, Y, Z for 2 hours		N = 5 C = 0

7. Packing Information

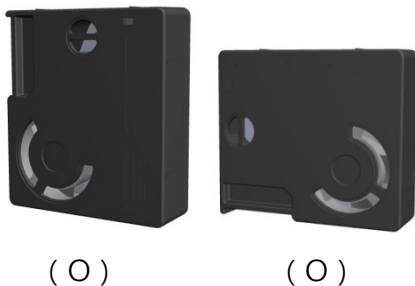


<UPD-M010UA Tray, Inner ,Carton>

Num	Part Name	Q'ty(ea)	Spec	Remark
1	Dust Sensor	1120	-	-
2	DS Packing Case	14	PET 0.4T	1 Packing tray = 40 ea
3	DS TOP Pad	15	SKSB/B골	14Sheets/1 Inner Box
4	DS Poly Bag	2	PE 0.05T	1 Poly bag = 560 ea
5	Inner Box (Sensor)	2	SKSA/B골(345*262*292)	1 Inner Box = 560 ea
6	Carton Box (Sensor)	1	SK3SA or 2종 or 1종 (365*546*325)	1 Carton Box=1,120 ea
7	Silica gel	2	2.5g	2.5g/1ea

8. Notices

- ① Metal Case is connected to the GND of the sensor.
Don't connect or short the other circuit except GND.
- ② Main power is DC 5V. But the data level is 3.3V. So if user product is using 5V data level, it is needed level shift unit.
- ③ In order to good performance, make the surface of air inlet and outlet of the sensor clings to the air vent in the inner wall of the user device.
- ④ The sensor should be installed above 20cm higher than floor to avoid contamination of large dust particles entering the sensor.
- ⑤ The sensor is designed for indoor environments. If using in outdoor, the sensor should be protected from dust storms, rain, snow, etc.,
- ⑥ Do not use the sensor other purpose that is not intended for it. It is not proper to use the sensor for safety or emergency devices such as fire alarm.
- ⑦ The components of the sensor is sensitive to electrostatic discharge, so should be not disassemble metal case from the sensor.
- ⑧ Stable data is acquired after the sensor is operating at least 30 seconds because of the fan's performance and the ROIC's LPF setting.
- ⑨ Do not break up the sensor.
- ⑩ When installing to system, make sure the inlet and outlet is unobstructed, and cannot be touched by large air stream. There are two ways to installing sensor (As below pictures), In case of dust deposition on the surface of sensitive device, dust deposition will affect accuracy of sensor.



9. Contact

DONG IL TECHNOLOGY LTD.

Tel : +82 031-299-5500

FAX : +82 031-357-2610

ADD : 28, Namyang-ro 930beon-gil, Hwaseong-si, Gyeonggi-do, KOREA
445-040