

INSTRUCTION MANUAL

FOR

Separate Type Air Dust Monitor

TYPE
PFM-AD12S

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※An operator should read carefully this instruction manual and conduct correct handling.

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Safety precautions

- Be sure to thoroughly read the instruction manual before using the products.
- Keep the instruction manual in a safe, convenient location for future reference.
- All or part of the contents described in this manual may be changed without any notice.
- Due to our constant striving for further improvement of products, parts or products that differ from those described in this manual may be substituted.



WARNING (Failure to observe this WARNING may cause a fatal or serious injury.)

- Be sure to confirm that any peripheral equipment does not move before installation work. In addition, observe safety requirements for installation work where high-place work is expected.
- Be sure to turn off the power source before wiring, mounting and transportation work. (Failure to observe this WARNING may result in an electric shock/ injury or equipment damage due to short-circuit.)
- Carry out wiring work correctly with reference to a proper drawing.
- Never disassemble the equipment. (Failure to observe this WARNING may result in an electric shock.)
- Do not open the cover under an explosive environmental condition when power is entered. (Failure to observe this WARNING may result in an injury or equipment damage.)
- Do not place or store the equipment in any hostile environmental place where it will be subjected to direct sunlight, rain, water droplet, hazardous gas/water, etc.



CAUTION (Failure to observe this CAUTION may cause a moderate injury or equipment damage.)

- Do not use the equipment for any purpose other than the original purpose of use.
- Be sure to confirm the specification of equipment and use the equipment within the range of specification. (Mounting conditions such as temperature, power source, frequency, etc.)
- Make sure a correct wiring before applying power source.
- Do not have a shock or strong impact to the equipment. (Failure to observe this CAUTION may result in equipment damage.)
- Be sure to connect necessary terminals (grounding, etc.).
- Remove all wiring to the equipment before doing electrical welding work near the equipment.
- Do not forcibly bend or pull the lead wire also do not use unnecessarily long wire.
- Tighten the cover, lead outlet, etc. properly so that dust, rainwater, etc. do not enter inside the equipment.
- Do not use the equipment under a corrosive condition (NH₃, SO₂, Cl₂, etc.).
- Be sure to tighten the cable gland so that outer air does not enter inside the equipment.
- When applying piping connection such as conduit, etc. instead of cable gland, apply putty or equivalents on the cable entry so that outer air does not enter inside the equipment.
- Do not directly touch the probe with hands regardless of power ON or OFF. If you unavoidably have to touch the probe with hands when installation or maintenance process, be sure to turn OFF the power and use non-conductive gloves such as rubber gloves during the process.
*Touching the probe with hand directly may cause a failure due to static electricity charge in a human body.
- **MAINTENANCE:** When you clean the probe, be sure to turn OFF the power, put on non-conductive gloves such as rubber gloves to clean the probe with moist cloth.*Touching the probe with hand directly may cause a failure due to static electricity charge in a human body. Cleaning the probe with dry cloth may also cause a failure due to friction charge generated between the cloth and probe.



IMPORTANT (indicates notes or information to help customers.)

Limitations of Warranty:

- Warranty period shall be one year from the date of delivery (ex-factory).
- Any damage of any other products that have occurred for use of the equipment is not covered by this warranty. Also any loss induced by failure or malfunction of the equipment is not covered by this warranty.
- Failure or malfunction caused by following are not covered by this warranty:
 - a. Modification or repair by a party other than MATSUSHIMA's authorized personnel, or replacement of parts not recommended by MATSUSHIMA.
 - b. Inadequate storage, installation, use, inspection or maintenance that does not comply with specifications.
 - c. Cause for any peripheral equipment or device.
 - d. Accident beyond control and force majeure (fire, earthquake, flood, riots, etc.).

Lack of instructions to MATSUSHIMA for information or safety requirements that can be predicted only by customers' side.

This warranty conditions do not limit customers' legal right.

Price for the equipment does not include any charge for services such as commissioning, supervising, etc.

1. Summary

Air Dust Monitor monitors the flying dust concentration for 24 hrs.

After automatically taking in the air including dusts from the air inlet, the dust solid particles in the air make a transfer of electric charge to the electrode by touching with or passing near the probe of Air Dust Monitor.

This transfer of electric charge is widely known as triboelectricity or contact charging.

This product will output a 4 to 20mA signal in proportion to the dust amount and some contact signals, through filtering and amplifying the transfer amount of electric charge.



Important: Dust concentration measurement of triboelectric type Dust Monitor

The triboelectric type Dust Monitor will change an output value in its measurement principle, corresponding to a variety of environmental factors such as “kind of particle”, “particle diameter”, “specific gravity” and “flow velocity”.

However, obviously the linearity under a fixed environment will not change.

Regarding the concentration of the triboelectric type dust monitor, as mentioned above, it is required to consider the effect of physical property change and it is not necessarily corresponding to the specified concentration.

2. Specifications

1.	Power supply		AC100V -15%/+10% 50/60Hz (specified separately in case of AC 220V)		
2.	Object to be measured		Floating dust		
3.	Particulate material		All solid particles		
4.	Particle size		≥ 0.3μm		
5.	Particle concentration		0.1mg/m ³ to 1000mg/m ³		
6.	Measuring system		Triboelectric system		
7.	Circumstances				
	7-1.	Temperature	-10°C to +50°C * If using at Sensitivity +10°C to +40°C		
	7-2.	Humidity	Max. 95%RH * If using at Sensitivity Max. 85%RH		
8.	Output signal				
	8-1.	Analog output	DC4-20mA (Max. 23.3mA/Isolated output/Load resistance: Max. 500Ω) (* Be sure to use a shielded cable)		
	8-2.	Contact output	Fault alarm: x1 (AC250V, 2A/DC30V, 2A)		
Upper limit: x2 (AC250V, 2A/DC30V, 2A)					
9.	Detection sensitivity level		1(Low sensitivity) to 9(High sensitivity) [9 ranges switching]		
10.	Fan sound pressure		approx. 53dB		
11.	Detection unit specifications				
	10-1.	Wiring distance	Exclusive use cable 10m Max. 20m		
	10-2.	Inhaling range of dust	Within approximate 10cm from the edge of the cover intake		
	10-3.	Dust conditions	≥ 0.3μm (* only case of airborne dust)		
			* Max. particle size dependent on specific gravity		
	10-4.	Mounting	≤ 40vol%		
Pole mounting U-Bolt mounting: (50A~90A) x 2					
		Wall mounting Screw mounting: M8 screw x 4			
12.	Converter unit specifications				
	12-1.	Connection method	Power line Terminal block connection Screw size: M3.5		
			Signal line Terminal block connection Screw size: M3		
	12-2.	Mounting	Wall mounting or put on the floor		
	12-3.	Protection	IP54		

3. Outline (rough drawing)

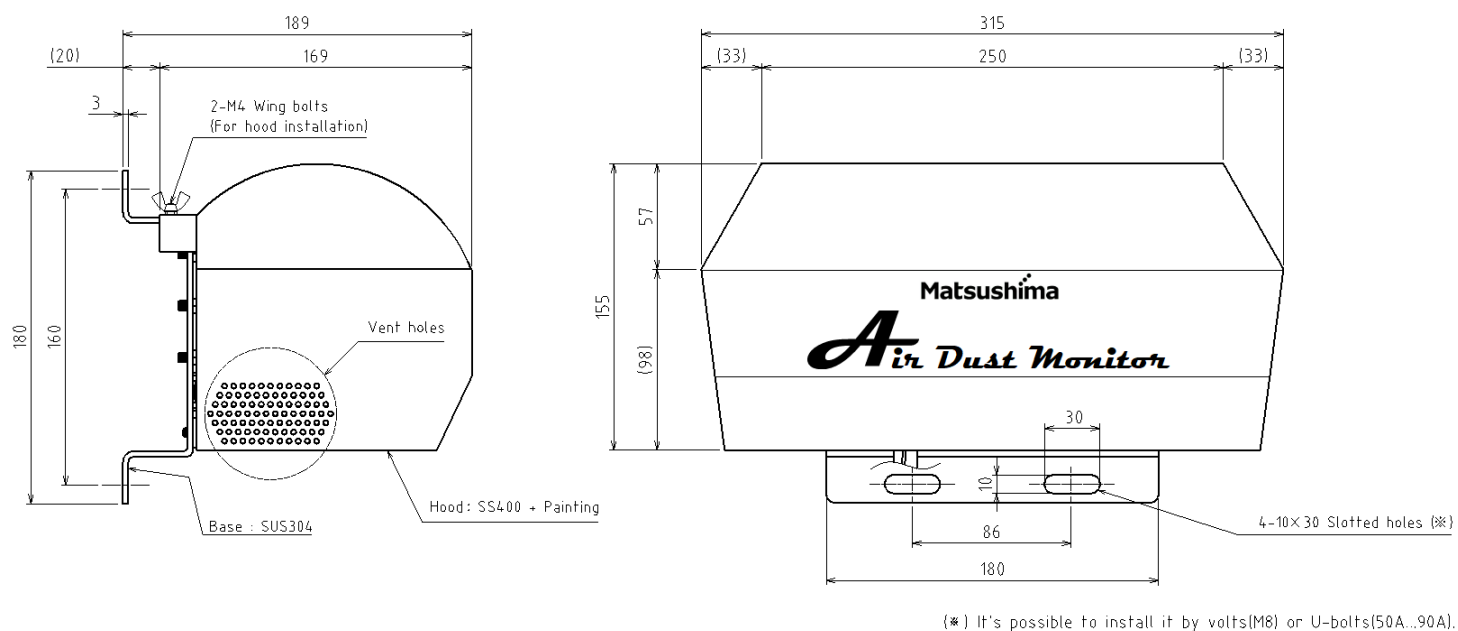


Fig. 1. Outline of Detection unit

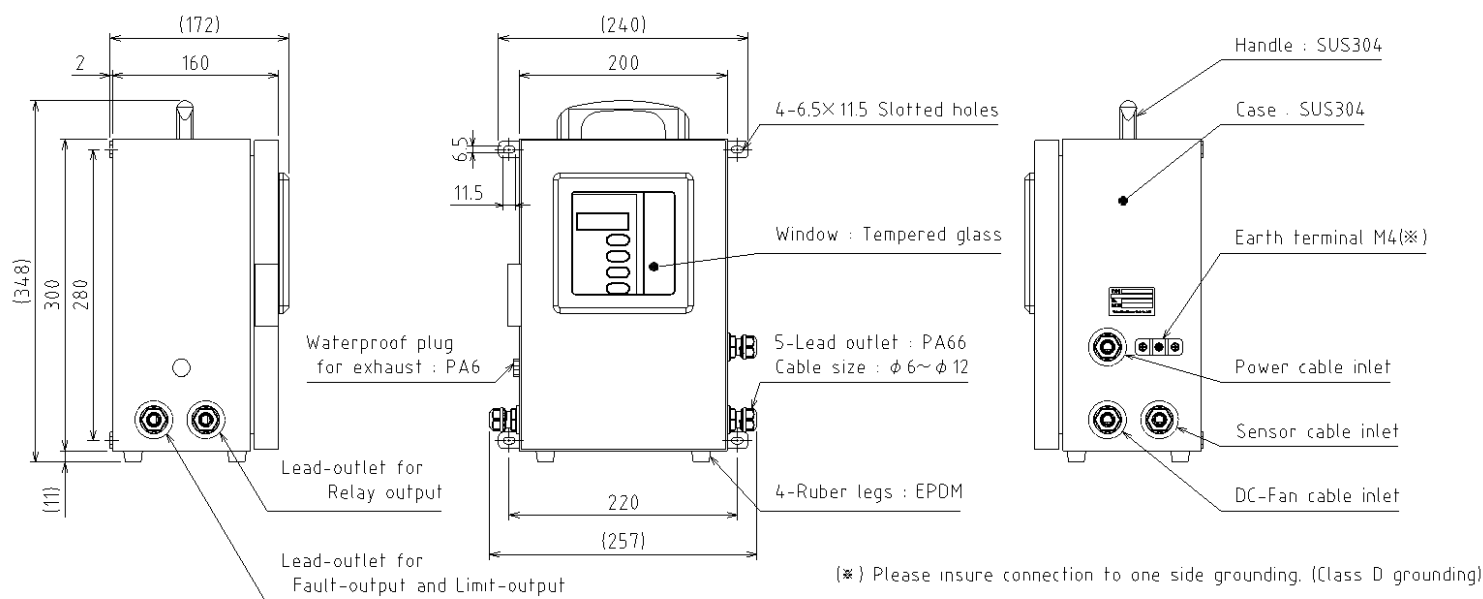


Fig. 2. Outline of Converter unit

- + *1) Make sure to connect the earth terminal.
- + *2) Make sure to tighten the lead outlet to prevent the outer air into Case.
For other connections like a conduit instead of our lead outlet plug, make sure to prevent outer air from coming into the body by using putty etc. on the inlet lead wiring.

4. Mounting

This product is designed for wall-mounting or setting on floor.

4-1. Mounting Method

Please try to set pole-mounted with U-shape bolts sizing 50A to 90A, or wall-mounted with the type M6 screws on the sensing station.

In case of wall-mounting converter component, use type M6 screws in 4 mounting holes. If floor-setting, keep setting on a horizontal floor.

* Plastics attaching on the case door will be protective layers for sponge packing during transportation.

Please remove them if using the product.



Warning: Not including U-shape bolts and screws for mounting.



Caution: Under any measuring environment and conditions outside the scope of specifications, some malfunction may occur.



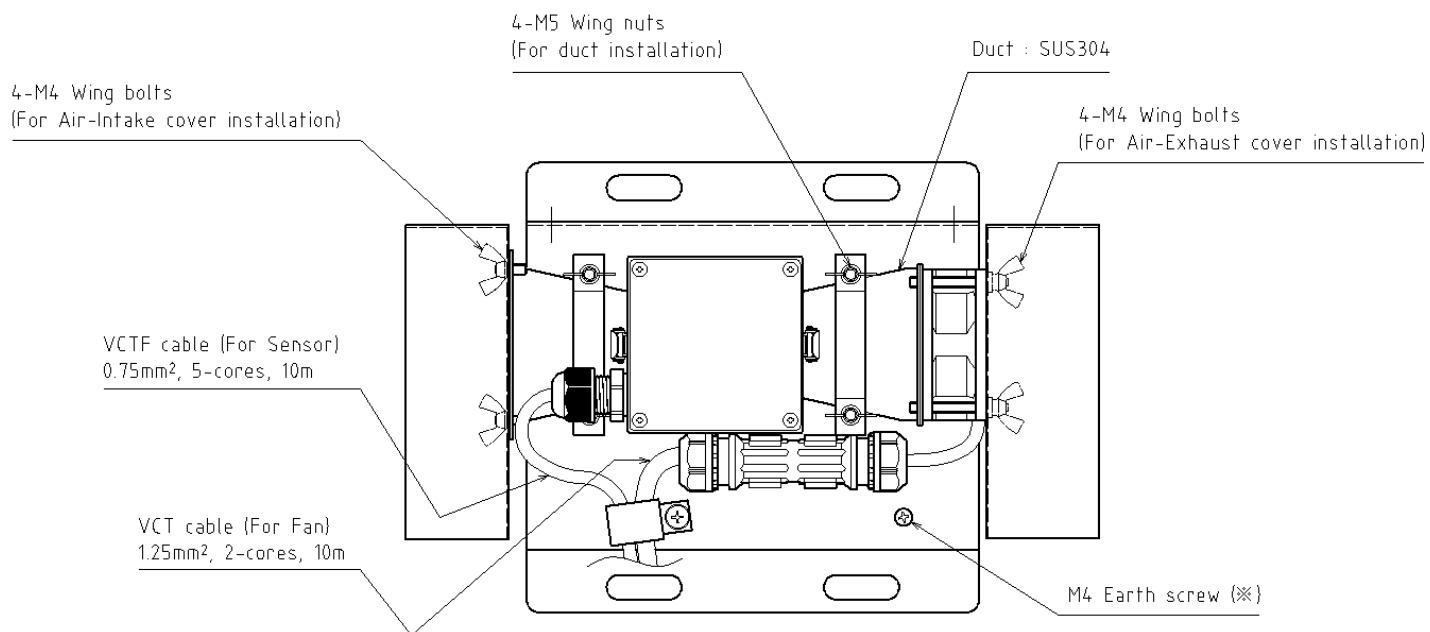
Important: In case of the sensing station under heavy rain more than 100mm, instrument reading may be changed due to false detection by rain. If concerning false detection by rain, set a roof to protect rain drops on the sensing station.



Caution: Keep the circuit protector to be OFF, if wiring.

5. Connecting

Detection unit internal device layout



(※) Please insure connection to one side grounding. (Class D grounding)

Fig. 3. Detection unit internal device layout

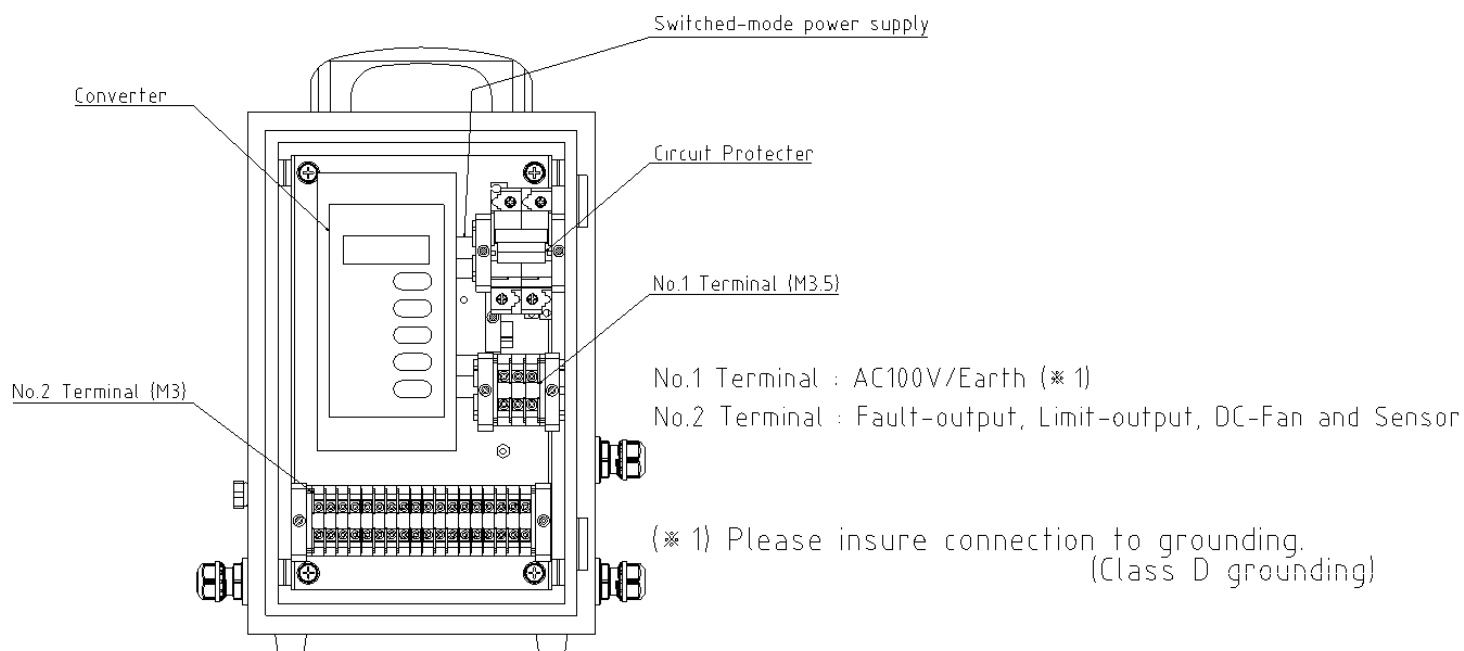
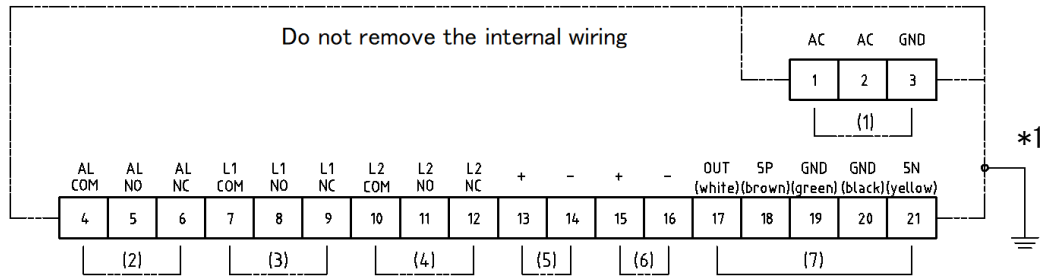


Fig. 4. Converter unit internal device layout

How to connect



(1) Power source

AC110V -15% / +10%

or AC220V -15% / +10%

(For AC220V, specify separately)

(2) Fault alarm output (SPDT)

(3) Limit 1 output (SPDT)

(4) Limit 2 output (SPDT)

(5) Analog output (DC4 to 20mA output)

(6) Power supply for DC-Fan (DC24V output)

(7) Connection terminal for the sensor

*1 Make sure the Class D grounding.

Wire connecting terminal:
Max. 1.5mm²

Fig. 5. Connection diagram



Caution: Keep the circuit protector to be OFF, if wiring.



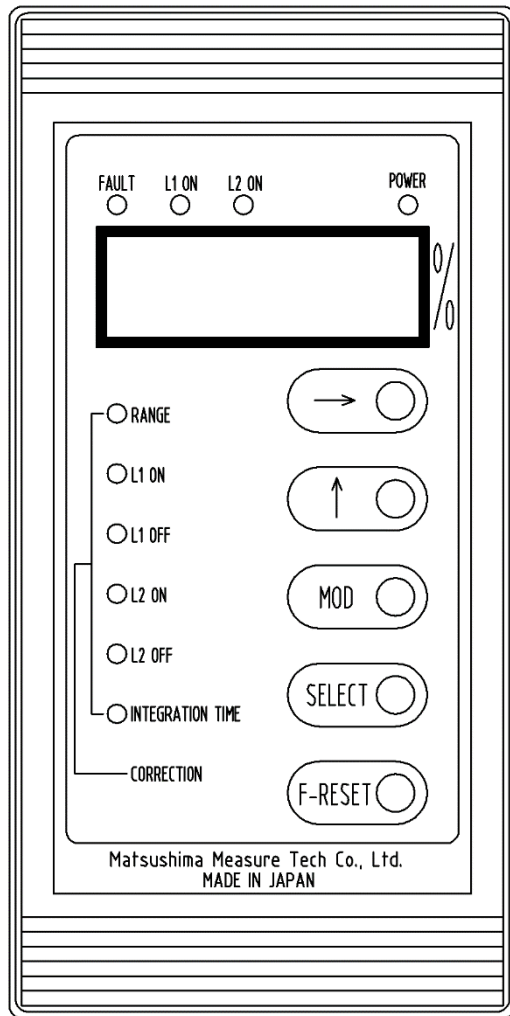
Important: Wiring power and signal individually.



Caution: Make sure to tighten the lead outlet to prevent outer air into the body.

For other connections like a conduit instead of our lead outlet plug, make sure to prevent outer air from coming into the body by using putty etc. on the inlet of lead wiring.

6. Part names and functions



【for indication】

POWER LED: Light on as power on

FAULT LED: CPU on when abnormal

L1 ON LED: Light on over limit 1set

L2 ON LED: Light on over limit 1set

4 beams indicate LED: detection density will indicate per 0-100% complying with setup.

【for button】

→: use when changing beam of number/value.

↑: use when increasing number/value.

MOD: use when switching parameter set mode and measure mode.

Pushing after set change will memorize parameter and return to measure mode.

SELECT: Use when switching set items.

F-RESET: Use when setting measure again.

Fig. 6. Front panel of Output unit

(1) RANGE: measure range(1, 2, 3, 4, 5, 6, 7, 8, 9)set

(2) L1 ON: set ON point of limit 1 (set range : 0-100%)

(3) L1 OFF: set OFF point of limit 1(set range : 0-100%)

(4) L2 ON: set ON point of limit 2 (set range : 0-100%)

(5) L2 OFF: set OFF point of limit 2(set range : 0-100%)

(Minimum range of Hysteresis is still 1%.)

(6) INTEGRATION TIME: Integral time set (set range: 0-30 seconds)

(7) CORRECTION : Compensation value set (set range: 0.1-2.0)

7. Start up

7-1. Warm up operation

Dust Monitor requires warm up operation for about 1 hour after switch on.

7-2. Measure range set

Nine levels of measure range are provided, ranging from 1 (low sensitivity) to 9 (high sensitivity).

If the display on the transducer is too close to the upper limit, increase the measure range.

7-3. Integral set

Integration will even off measure signal per time fixed number up to maximum 30 seconds. (optional set)

7-4. Limit set

Limit set can be done 2 different upper limits (alarm) in the range of 4-20mA (signal level 0-100%)

In case signal change gets severe however, chattering might rise often.

In such case you may be recommended to use integral function or delay function at/from higher position (Customers expertise) respectively.

[Limit 1, 2 and action chart of trouble alarm]

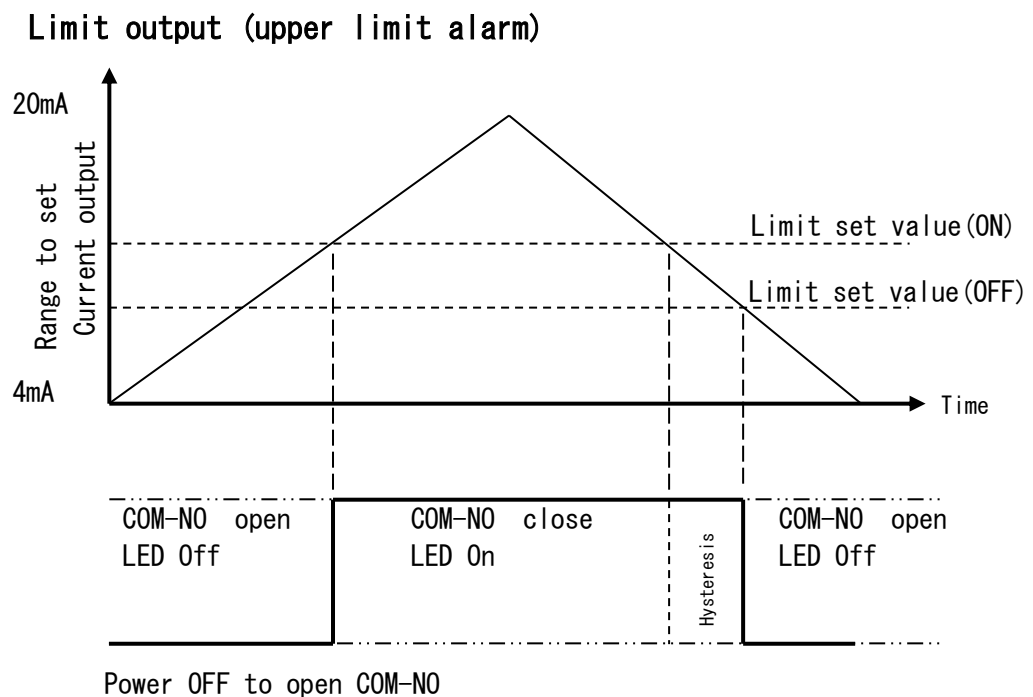


Fig. 7. Operation chart (upper limit alarm)

Trouble alarm

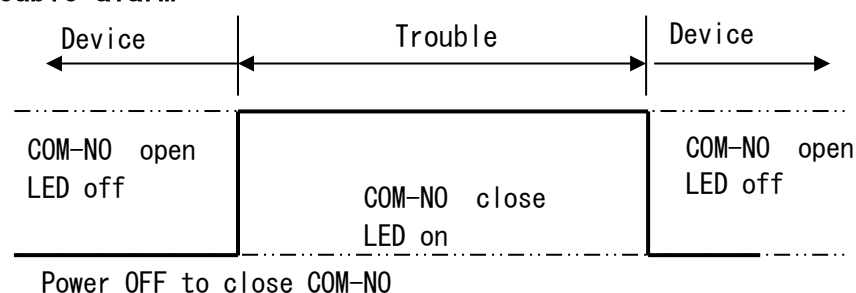
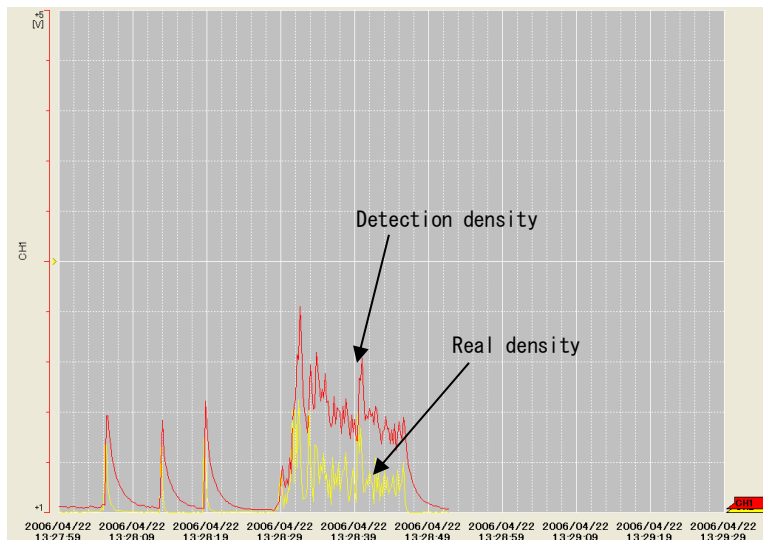


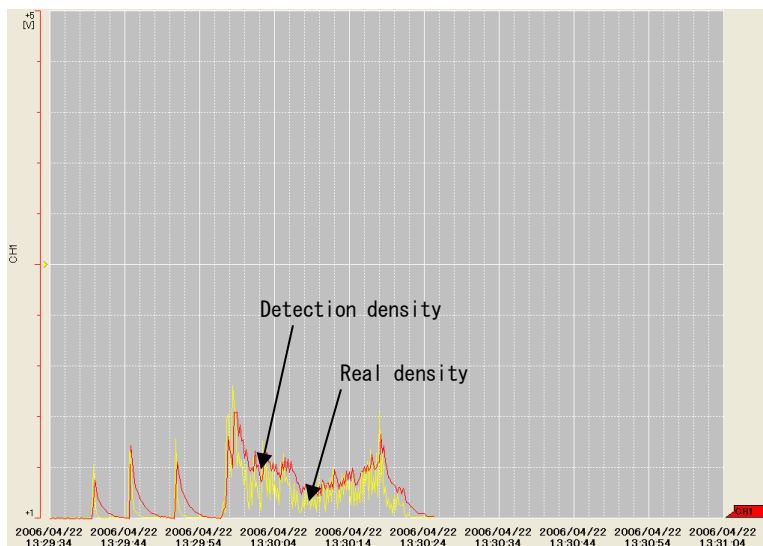
Fig. 8. Operation chart (Trouble alarm)

7-5. Compensation value set

Compensation value can output in a range of 0.1–2.0 (double) as compensation coefficient. In such case as output is too high or too low for actual density when standard coefficient is 1.0, this function can output nearest density to actual density by multiplying output. Utilizing this function, output can be compensated as shown hereunder.



Compensation value 1.0 trend
For actual density,
detect density outputs high.



Compensation value 0.5 trend
For actual density,
Detect density outputs almost
all alike and understood
compensation is effective.

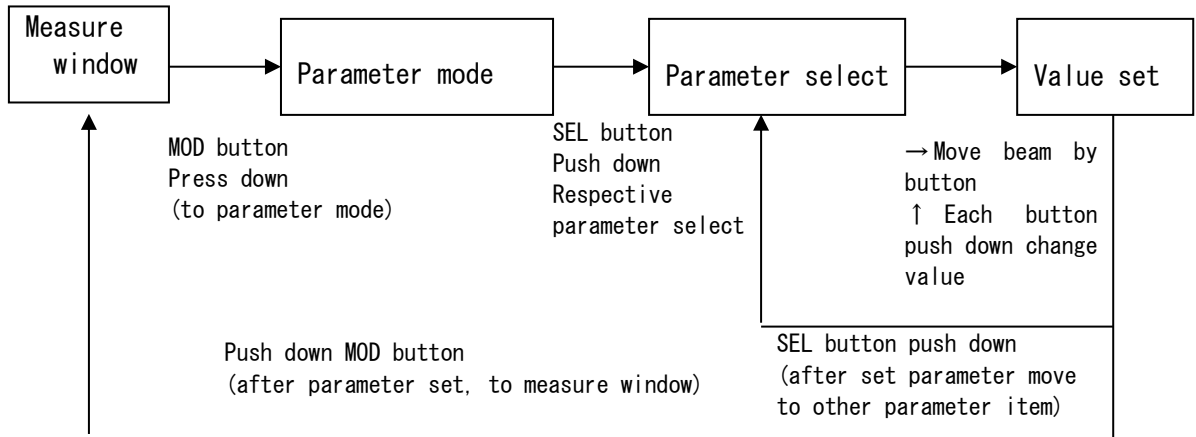
Fig. 9. Compensation value

This function is 0.1 in increments of input in the range of 0.1–2.0 (default is 1.0). If management is only for trend of dust exhaust, you can do without using this function (=set value 1.0). In case management requires the nearest value to actual density, you seize actual density such as counter wash pulse time, etc. by manual analysis first and then set counter wash pulse shown by device very much close to value of manual analysis.

8. Set example of parameter

8-1. Flow of parameter set

Parameter should set according to the flow as shown hereunder.



*** In case setting up value over input range exceeding specification, setup value of parameter will indicate [ERR] on indication LED, let you know setup value is wrong and do not accept next operation.**

*** In this case, please change to correct set value again.**

8-2. Example of parameter set

Following is a set example to set integral time at 15 second.
(Providing that set value was 0 second before change.)

- (1) Push "MOD" button 1 time..... move to parameter window and LED (orange).
written Range on the left will light on.
- (2) Push "SEL" button 5 time..... LED (orange) lit goes down in turn
and INTEGRATION TIME LED will light.
- (3) By using both → button and ↑ button,
set Indication LED at "15" .
- (4) Push "MOD" button 1 time..... return to measure window and start
measure again at integral 15 second.

You operate other parameters with same procedure, please.

In case setting other parameters continuously, at (4) above instead of "MOD" you push "SEL" and can perform both setting parameter and moving to plural items at the same time.

Reference: Parameter and light up of corresponding LED

RANGE	: only RANGE LED light up
L1 ON	: only L1 ON LED light up
L1 OFF	: only L1 OFF LED light up
L2 ON	: only L2 ON LED light up
L2 OFF	: only L2 OFF LED light up
INTEGRATION TIME	: only INTEGRATION TIME LED light up
CORRECTION	: both RANGE LED and CORRECTION LED light up same time

9. Maintenance

Updating for maintenance will be significantly changed because of environmental situations and concentration of dust vacuuming.

Please try to decide the updating for maintenance at your side, after checking the points to be maintained every day for the initial one month.

Keep the power to be OFF during maintenance.

Warning: Do not remove the earth wire during even maintenance because it may cause breakdown. And please do not touch the probe on the sensor.

Important: If lacking any maintenance, low detection sensitivity or off the scale of detection value may occur. Surely perform a routine maintenance to keep normal detection sensitivity.

Please remove the butterfly bolt on the housing and take off the cover.

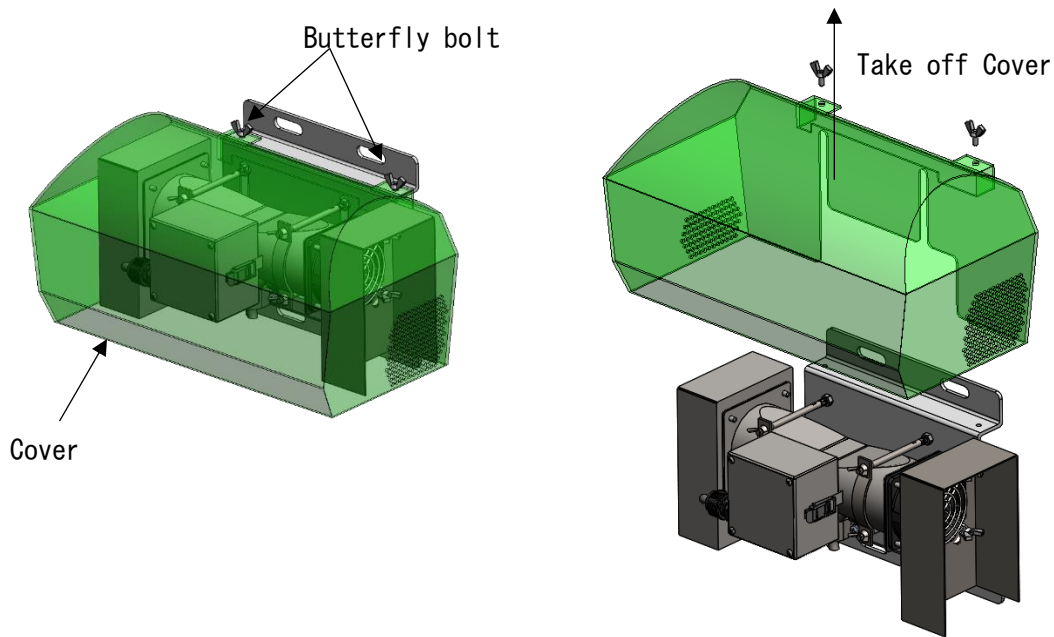


Fig. 10. Take off Cover

9-1. Maintenance of Probe

Release 2 patching locks fixing the sensor and take off the sensor in duct.

* Please do not remove the connecting wire between the sensor and the converter.

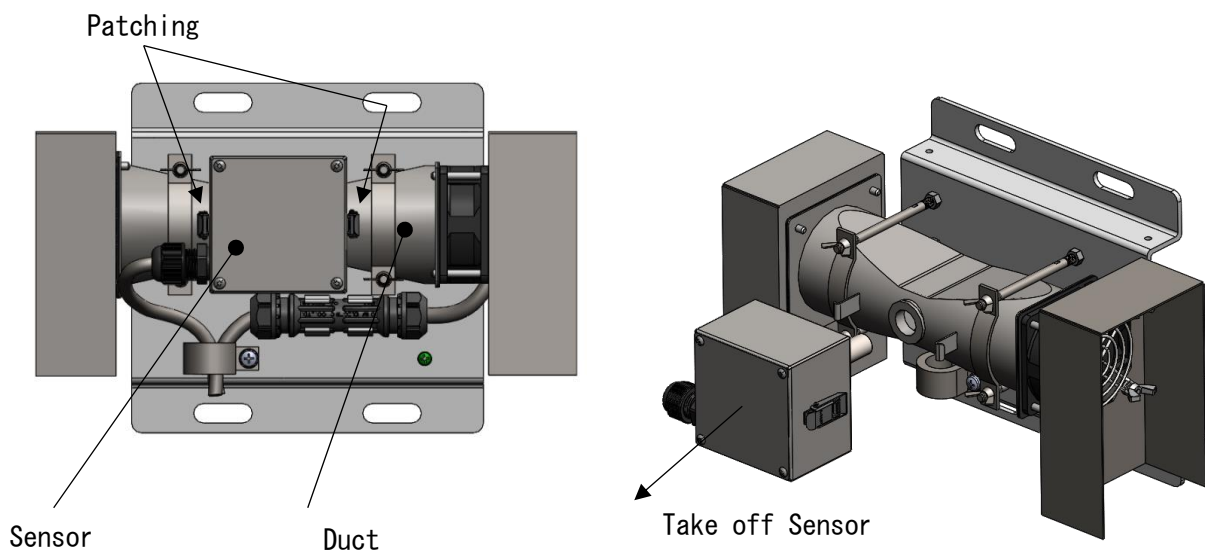


Fig. 11. Take off Sensor

Wipe the probe on the sensor with some wet waste cloth.
If oily fouling, use some liquid to remove oil.

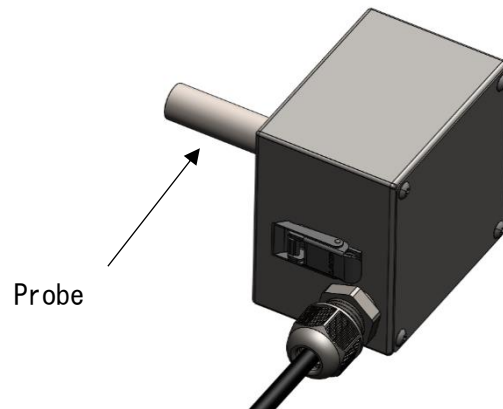


Fig. 12. Sensor

9-2. Maintenance of Duct

Remove the wingnuts on the housing without the sensor and take off the duct.

* Please do not remove the connecting wire between the sensor and the converter.

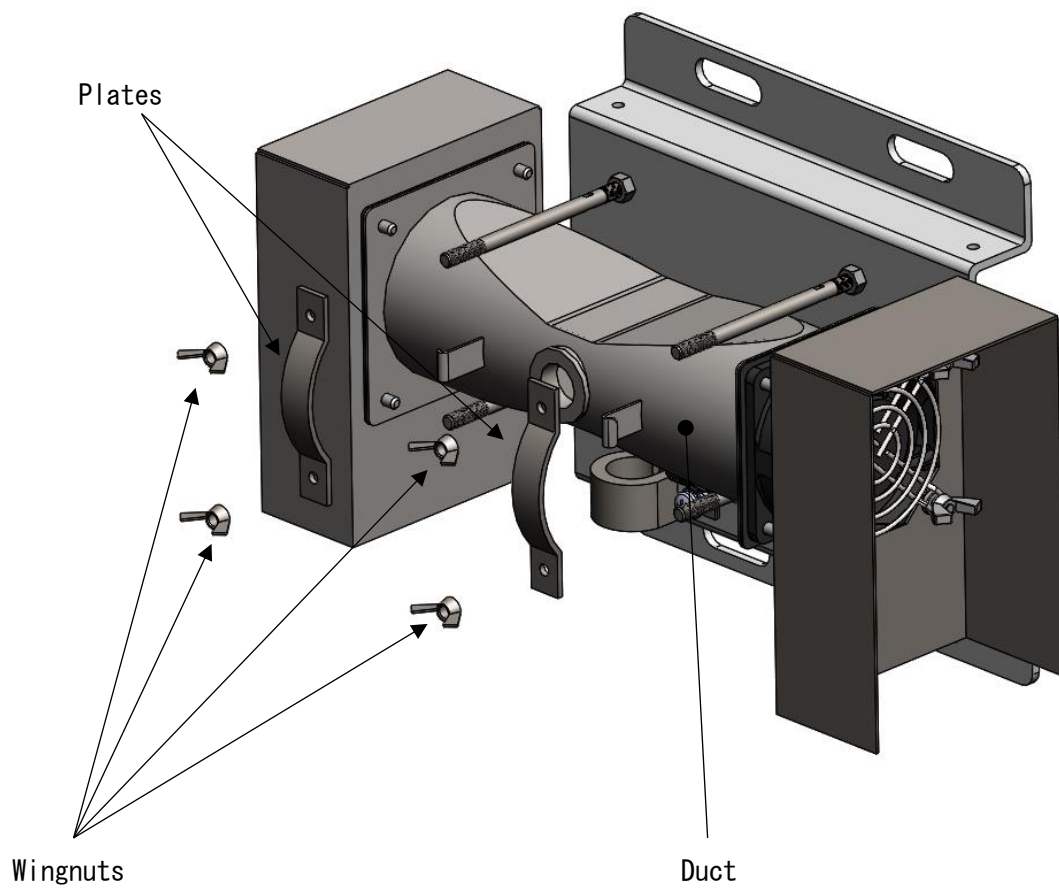


Fig. 13. Take off Duct

Next, please take off the air intake plate and the DC fan after removing the butterfly bolts. Loosen the butterfly bolts (type M4) at 8 points to take off.

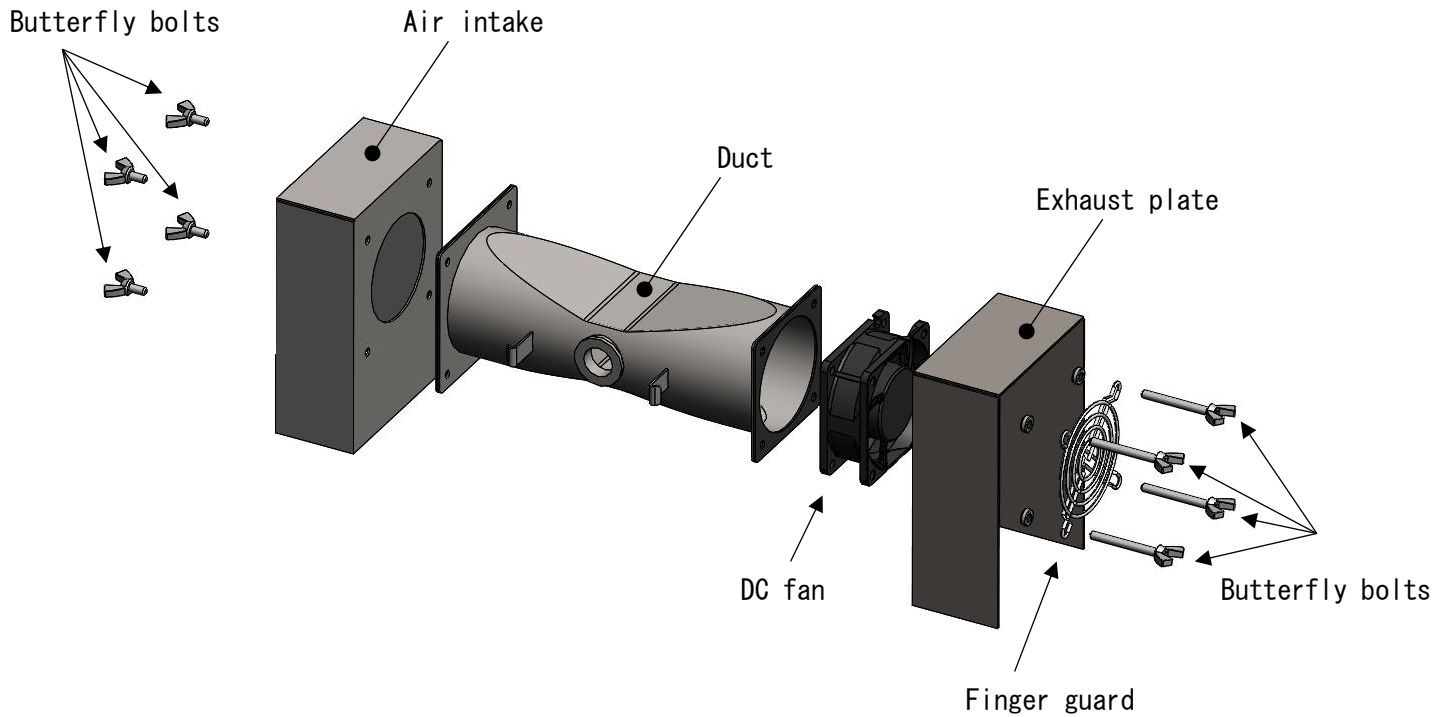


Fig. 14. Take off Duct

Wipe inside of the duct with air blower or waste cloth after taking off as below Fig. 15. If unable to clean up, please try brushing.

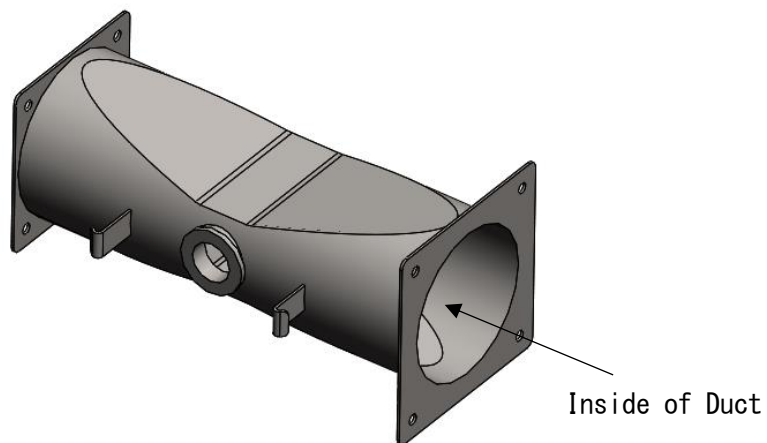


Fig. 15. Individual Duct (after took out)

After cleaning, please set on the sensor by inverse process.

9-3. Maintenance of DC Fan

⚠ Warning: The DC Fan is a suggested part of replacement by each 5 years to keep flow rate.

⚠ Warning: 5 years will be recommendable replacement term, not guarantee for operation.

Please take off the DC Fan according to Fig. 14 in 9-2.

Wipe inside of the DC fan removed from the duct with air blower or waste cloth.

If unable to clean up, please try brushing.

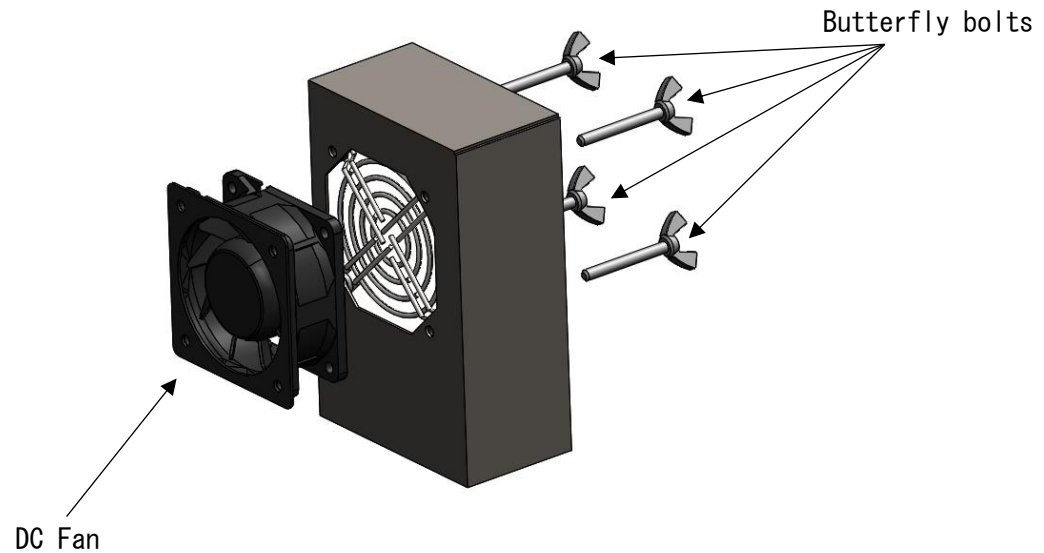


Fig. 16. Individual DC Fan (after took off)

10. Troubleshooting

If the product can not recover by the below countermeasures, contact with us.

Table 1. Troubleshooting

Problem	Presumable cause	Confirmation
No light on power LED and other LEDs	<ul style="list-style-type: none"> Power not supplied Power specification is changed from the ordered specification. Circuit protector is OFF. CPU abnormal. 	<ul style="list-style-type: none"> Confirm power supply voltage on Circuit protector terminal base. Confirm the voltage on name plate of Transducer is the same as the supplied power. If it is different, return us Transducer, then the power spec. will be changed at out site. Switch Circuit protector to ON. Power OFF, then ON.
Instable output indication	<ul style="list-style-type: none"> Warm up operation after setup is not complete. Unconnected between Sensor and Converter The wiring between Sensor and Transducer is either off or wrong. Material sticking on Probe electrode. Condensation on electrode Micro amount solid particles flying. 	<ul style="list-style-type: none"> Make warm up operation for 1 hour and check output again. Confirm cable connection between sensor part and converter. If unconnected, please contact us. Confirm wiring of exclusive cable. (See Page 5-6, 5.Connecting.) If wiring is wrong, rewire correctly. Remove Sensor and check if any sticking on Probe electrode. If yes, power off and wipe them off with moist cloth. (See NOTE) Remove sensor and confirm electrode. If condensation on electrode, wipe off with a wet rag after power-OFF. (See NOTE) Change measuring sensitivity or integration setting.
Output indication off-scale and no return	<ul style="list-style-type: none"> Duct or pipe is short-circuited with Probe electrode due to the sticking material. Condensation on electrode Device is in trouble. Too many solid particles in gas CPU abnormal. 	<ul style="list-style-type: none"> Remove Sensor and check if any sticking on Probe electrode. If yes, power off and wipe them off with moist cloth. (See NOTE) Remove sensor and confirm electrode. If condensation on electrode, wipe off with a wet rag after power-OFF. (See NOTE) Consult with Sales Dept. to check the soundness of Device. Change measuring sensitivity. Power OFF, then ON.
No change on indication	<ul style="list-style-type: none"> Power not supplied The wiring between Sensor and Transducer is either off or wrong. Material sticking on Probe electrode. Device is in trouble. No intake/exhaust of air CPU abnormal. 	<ul style="list-style-type: none"> Confirm power supply voltage on Circuit protector terminal base. Confirm wiring of exclusive cable. (See Page 5-6, 5.Connecting.) Remove Sensor and check if any sticking on Probe electrode. If yes, power off and wipe them off with moist cloth. (See NOTE) Consult with Sales Dept. to check the soundness of Device. Confirm that DC fan connector is connected. If not, connect it. Power OFF, then ON.

Fault LED is lighted.	<ul style="list-style-type: none"> •Wiring is wrong. •The supplied power supply is out of allowable range. •CPU abnormal. 	<ul style="list-style-type: none"> •Check wiring of power/output signal lines, exclusive cable. (See Page 5-6, 5.Connecting.) If wiring is wrong, rewire correctly. •Check power supply with a Tester etc. If it is out of the allowable range, apply the one within the range. •Power OFF, then ON.
Fan does not turn.	<ul style="list-style-type: none"> •No power supplied. •Circuit protector is OFF. •Connector is unconnected. 	<ul style="list-style-type: none"> •Confirm power supply wire to connect to Terminal No.AC. Confirm power supply voltage on Circuit protector terminal base. If power is not supplied, supply power. •Switch Circuit protector to ON. •Connect DC fan connector.

Note: After cleaning, make sure to tighten securely when mounting.

11. Maintenance item

The recommended items for periodical maintenance are in the below Table 2.

Table 2. Maintenance item list

Maintenance item	Type	Performance	Frequency
Duct unit	PFM-AD12-D	Replacement	Every 5 years
Packing set	PFM-AD12-P	Replacement	Every 3 years