

INSTRUCTION MANUAL
FOR
Air Dust Monitor

TYPE
PFM-AD12

Contents

Safety Precautions	1
1. Summary	2
2. Specifications	3
3. Outline	4
4. Mounting	4
5. Connecting	5-7
6. Part names and functions	8
7. Start up	9-10
8. Set example of parameter	11
9. Maintenance	12-14
10. Troubleshooting	15-16
11. Maintenance item	16

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

Matsushima Measure Tech Co.,Ltd.

1-8-18 Norimatsu-Higashi, Yahatanishi-ku, Kitakyushu 807-0837 Japan
Phone No. (8193) 691-3731 Fax No. (8193) 691-3735
<http://www.matsushima-m-tech.com>
E-mail sales@matsushima-m-tech.com

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 grand so that outer air does not enter inside the equipment.
- When applying piping connection such as conduit, etc. instead of cable grand, 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

This product 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

2-1. Power supply	
2-1-1. Voltage	AC 110V or 220V -15%/+10% (specify on demand) 50/60Hz
2-1-2. Power consumption	15VA
2-2. Measuring object	Flying dust
2-3. Particle material	All solid particles
2-4. Particle size	0.3μm or more (Max. particle size dependent on specific gravity)
2-5. Particle concentration	0.1mg/m ³ to 1000mg/m ³
2-6. Measuring system	Triboelectric system
2-7. Circumstances	
2-7-1. Temperature	-10 to 50°C or less *1
2-7-2. Humidity	95%RH or less *1
2-8. Output signal	
2-8-1. Analog output	DC4 to 20mA (Isolated output/Load resistance: 500Ω) (Max. 23.3mA)
2-8-2. Contact output	Fault alarm output x 1 (AC250V, 2A/DC30V, 2A) Upper limit output x 2 (AC250V, 2A/DC30V, 2A)
2-9. Fan sound pressure	approx. 53dB
2-10. Sensing unit specifications	
2-10-1. Inducing capacity	Inhaling air volume approx. 0.5m ³ /min
2-10-2. Inhaling hood	360° turning mechanism
2-10-3. Inhaling range of dust	within approx. 70mm in direction of a hood inlet (from an open hood edge)
2-10-4. Dust conditions	Humidity 40vol% or less
2-11. Mounting	Wall-mounting or on floor
2-12. Switching sensitivity	9 levels switchable Sensitivity 1 (lowest) to Sensitivity to 9 (highest) For each range (sensitive), 0.1 ~ 2.0 double output compensation can do
2-13. Protection	IP54 (only for the control part) When the cover and the lead outlet are tightly closed *2

*1) If using at measure range 9, +40°C / 85%RH.

*2) Under the conditions that the case cover is closed and the lead outlet is tightened.

3. Outline (rough drawing)

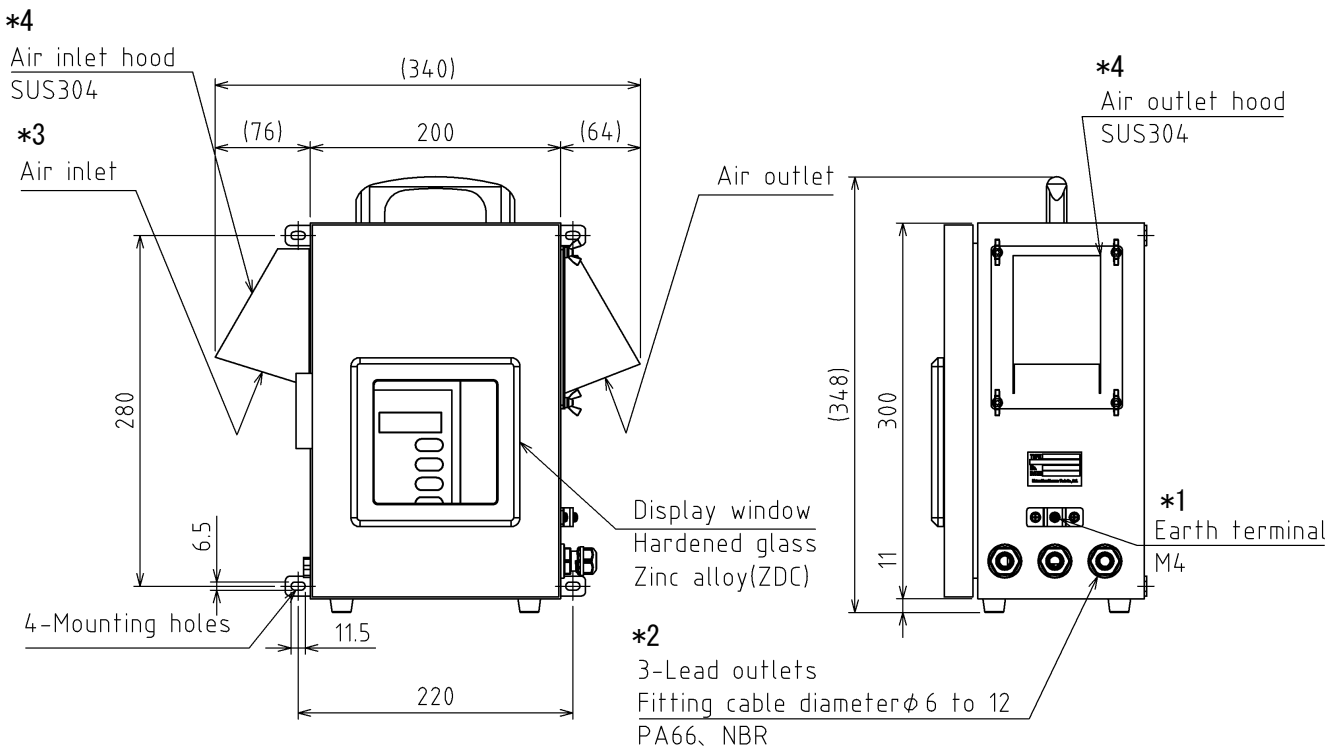


Fig.1 Outline

- *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.
- *3) The air inlet hood can be rotated and changed in any direction.
- *4) For indoor use, the air inlet and outlet hoods can be removed.
Removing the hood makes it easier to inhale and exhale, improving sensitivity.
When using outdoors, the air inlet should face downwards.
If the probe comes into contact with raindrops entering from the air inlet, the indicated value may become unstable.

4. Mounting

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

If mounting on wall, tighten with M6 screws at four mounting holes previously provided.

If setting on floor, place it on the flat floor.

* Resins (Plastics) attached on the case cover are protective layers during transportation for securing the sponge packing. Please remove these when use the product, because these are unnecessary.

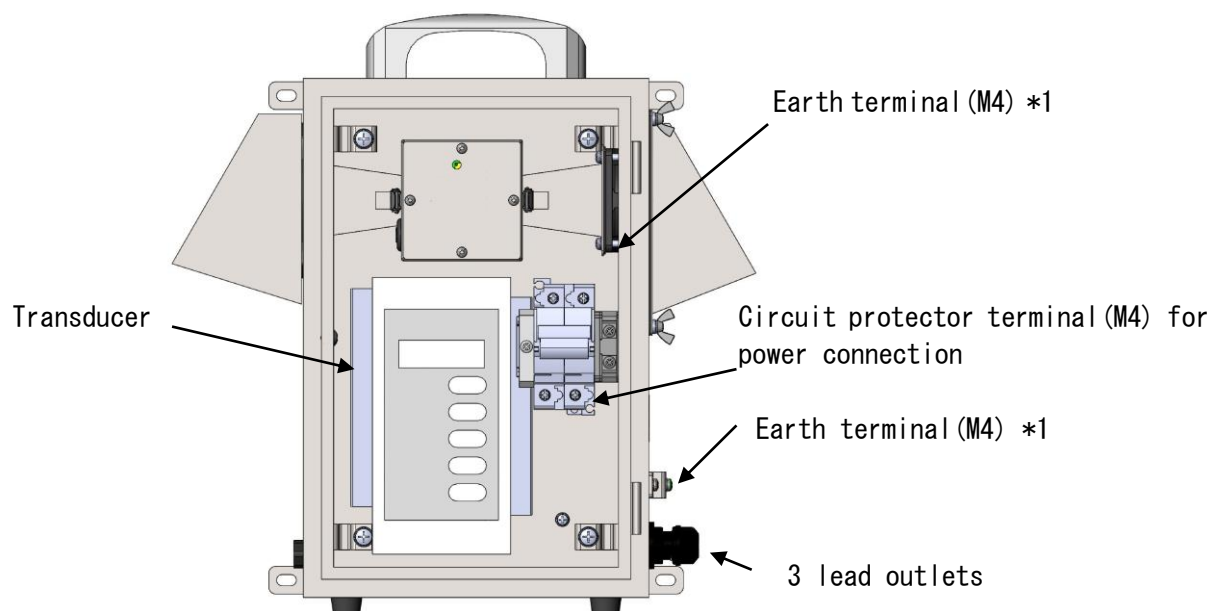


Caution: Under any measuring environment and conditions outside the scope of specifications, some malfunction may occur.



Important: If this product is exposed to heavy rainfall exceeding 30 mm/h, the indicated value may change due to false detection of rain.
When using the product outdoors, install a roof to prevent it from being exposed to rain.

5. Connecting



*1) Make sure to ground either one of two.

Fig. 2. Inside Layout

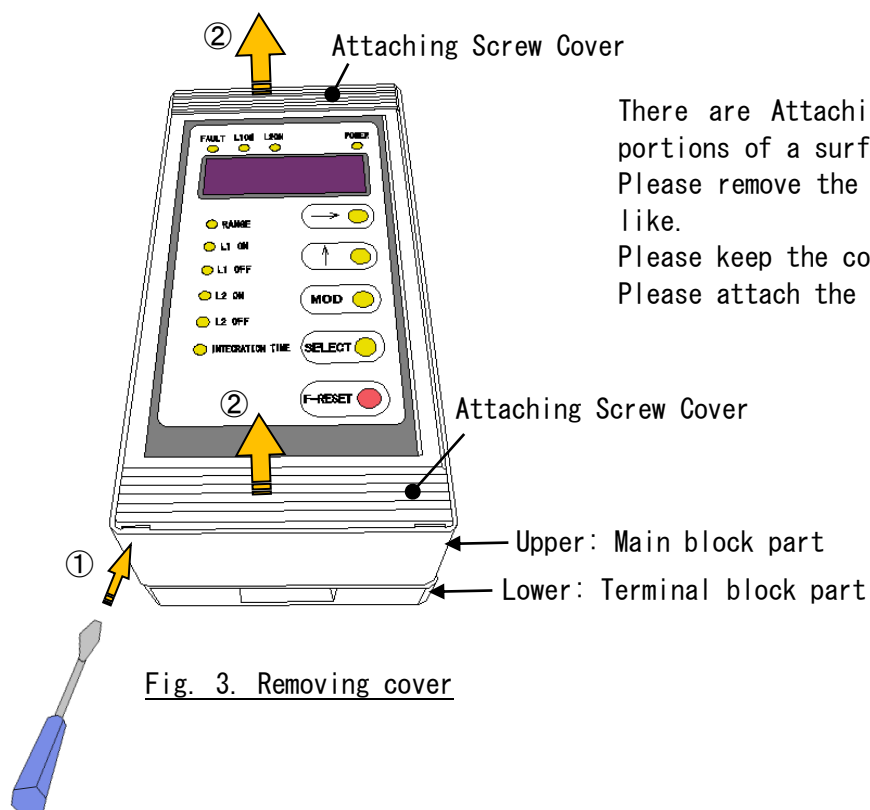
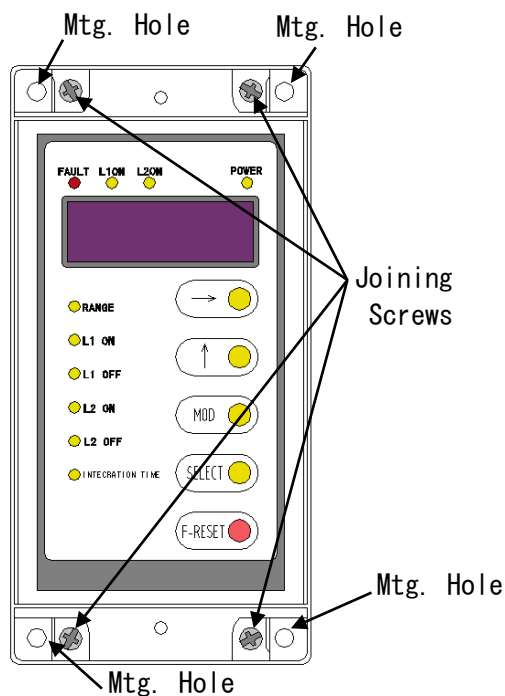
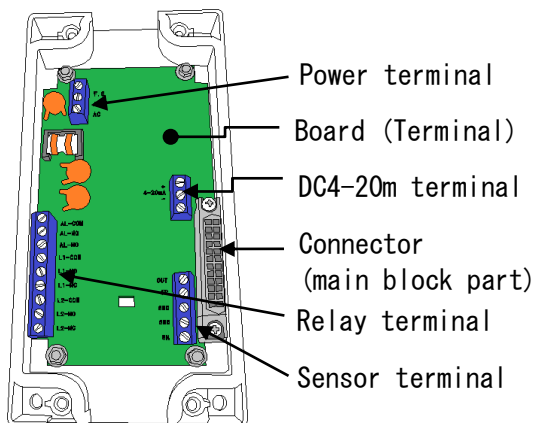


Fig. 3. Removing cover



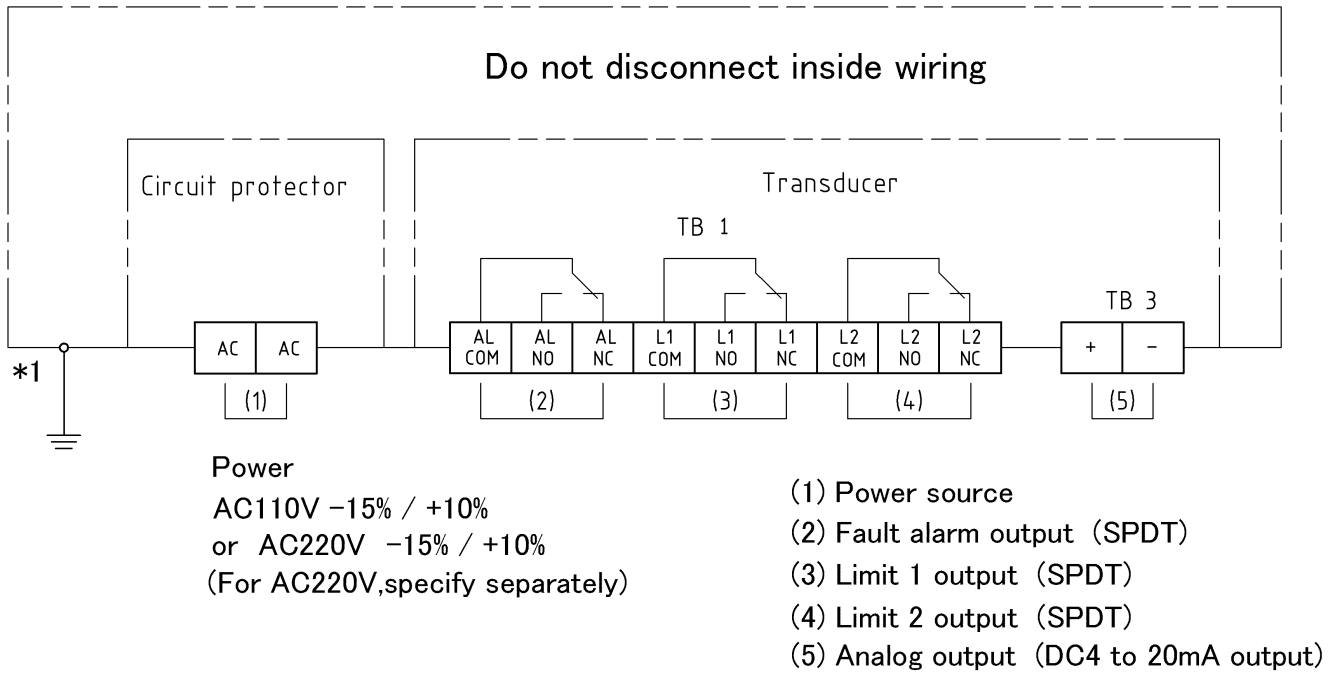
A terminal block part is joined to a main block part with four points of screws and connectors. You can see a screw joining to the terminal block part under holes for Transducer attaching when you remove the attaching screw covers. Please loosen these joining screws of the terminal block part with a Phillips driver. You can see the terminal block of the Transducer when you remove the main block part from the terminal block part after having loosened these Joining Screws.

Fig. 4. Joining screws of terminal and main block part



When you wire the terminal block of the converter, you must not make any false wiring. After wiring, please attach the main block part with the procedure the reverse of how to remove the main block part.

Fig. 5. Terminal part



*1) Make sure the Class D grounding.

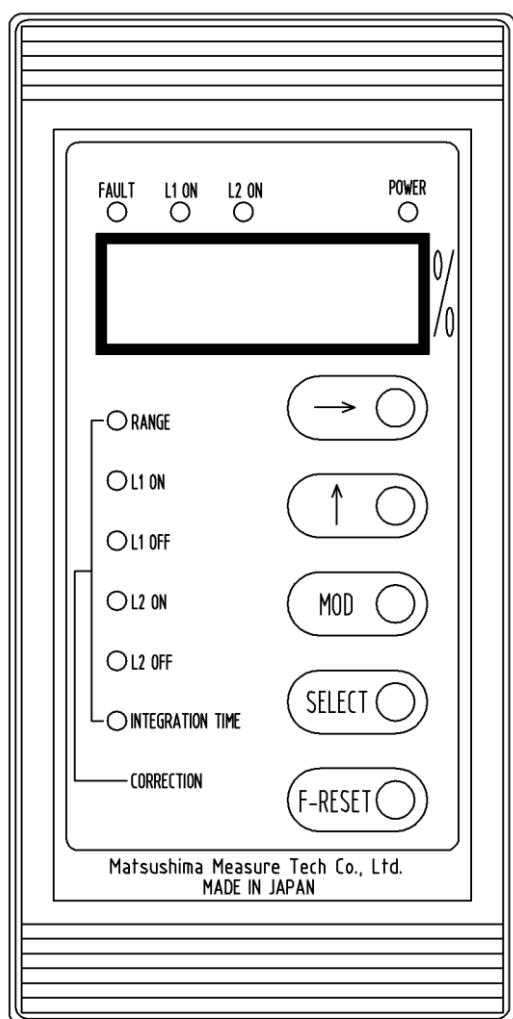
Wire connecting terminal:
Max. 1.5mm²

Fig. 6. Wiring Diagram

! 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. 7. 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 switching 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, decrease 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]

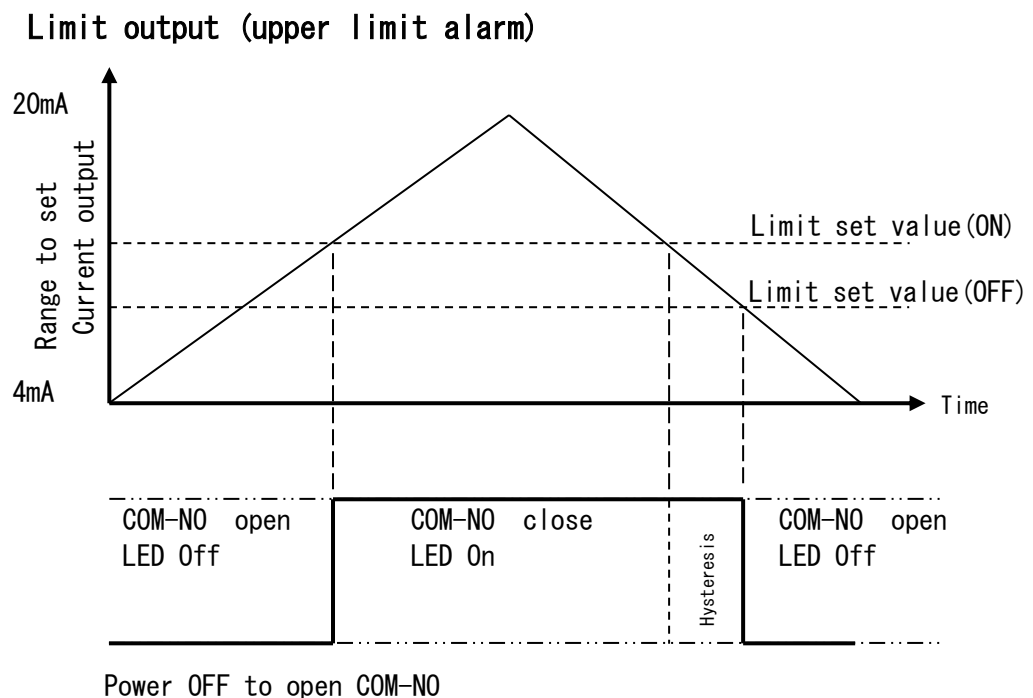


Fig. 8. Operation chart (upper limit alarm)

Trouble alarm

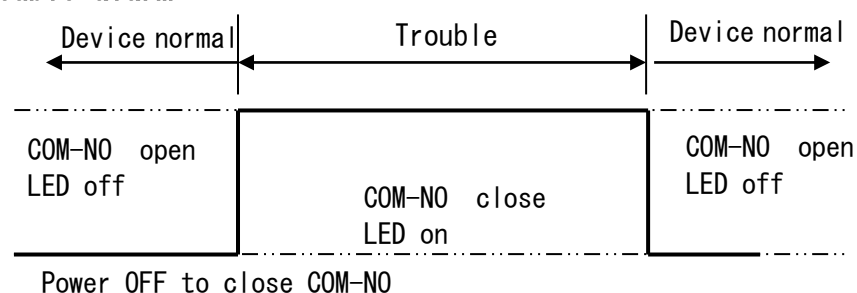
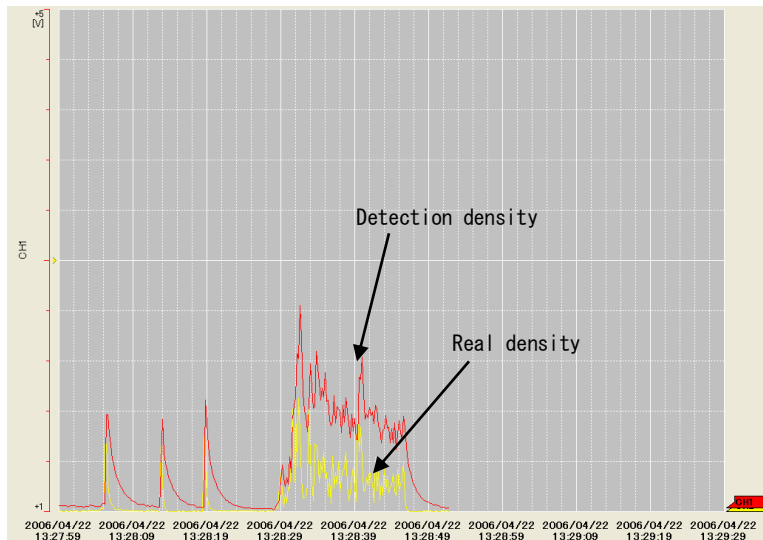


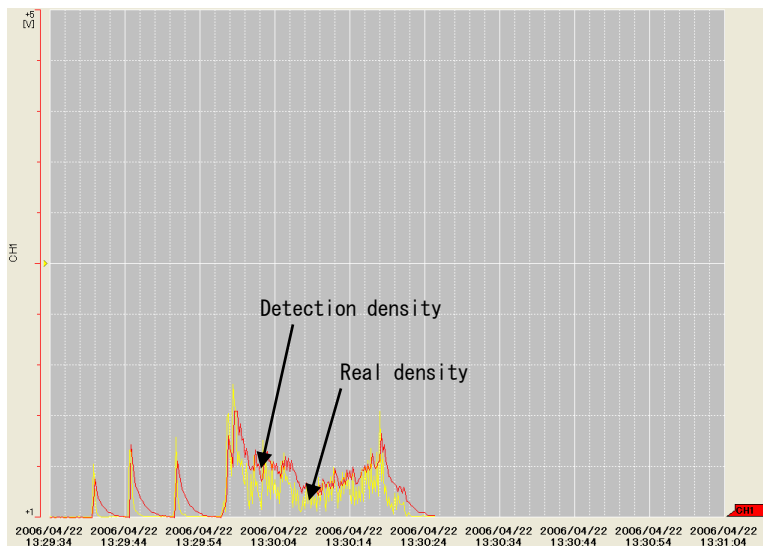
Fig. 9. Operation chart (Trouble alarm)

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.

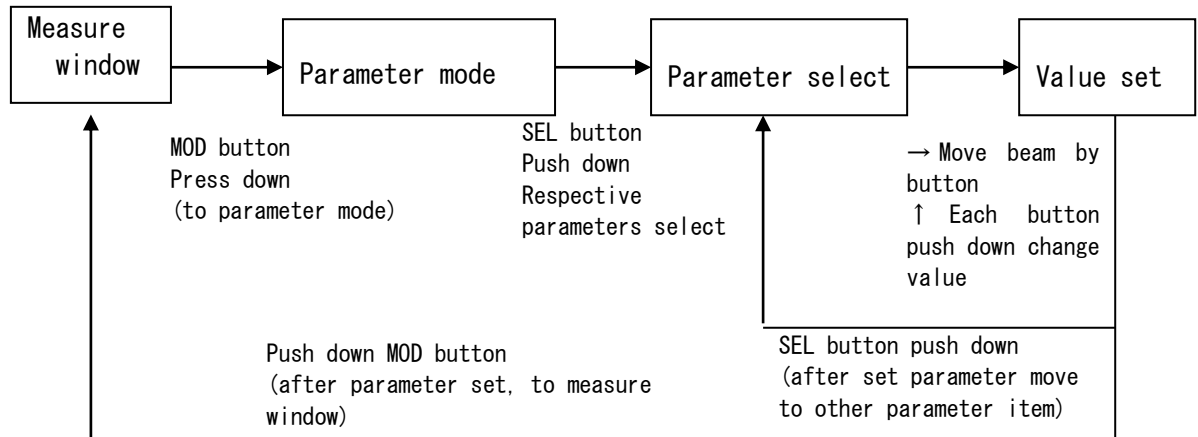
Fig. 10. Compensation value

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 up.
- (2) Push "SEL" button 5 times..... 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.



Caution: Do not disconnect the earth wire during maintenance to avoid malfunction.

Further do not touch the probe directly by hand.



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.

9-1. Maintenance of the probe

Unlock the two draw-latch fixed the sensor part and remove the sensor part from the duct.

* Please do not disconnect the wire between the sensor part and the converter.

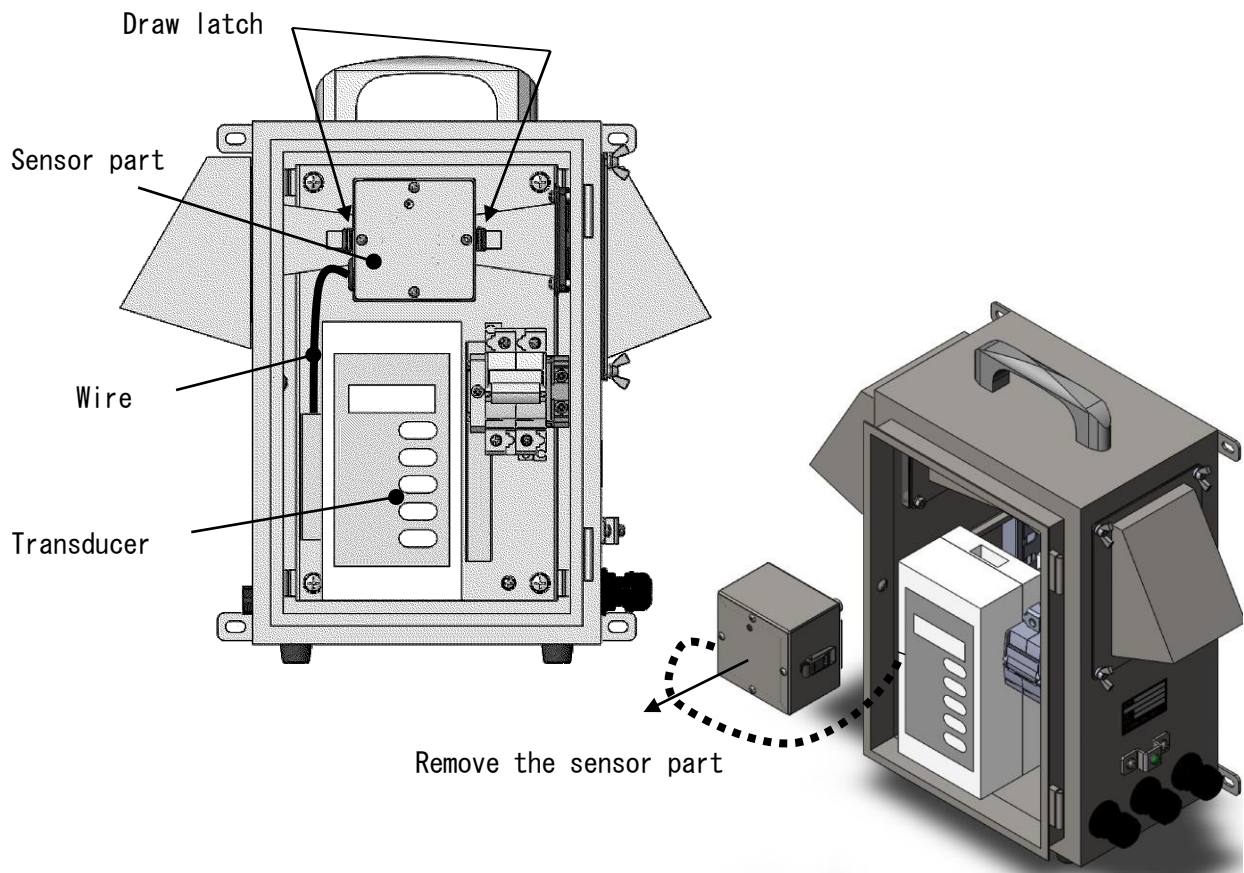


Fig. 11. Removing the sensor part

Clean the probe of the sensor part with the tightly wrung rag.
Also clean up with any liquid which can remove oil if oil is included in the build-up material.

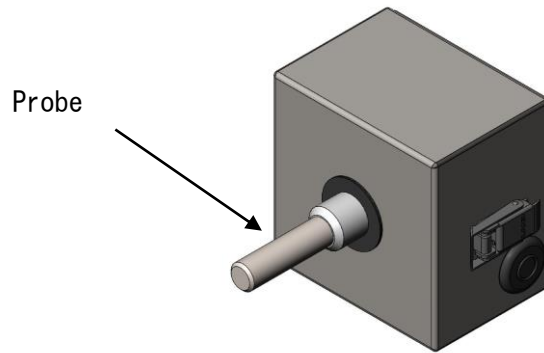


Fig. 12. Sensor part

9-2. Maintenance for duct



Caution: Duct unit is recommended to replace in every 5 years for keeping a flow velocity.

Remove the sensor part and loosen the locknut of Hood and take off the unit with Hood.

* Please do not disconnect the wire between the sensor part and the converter.

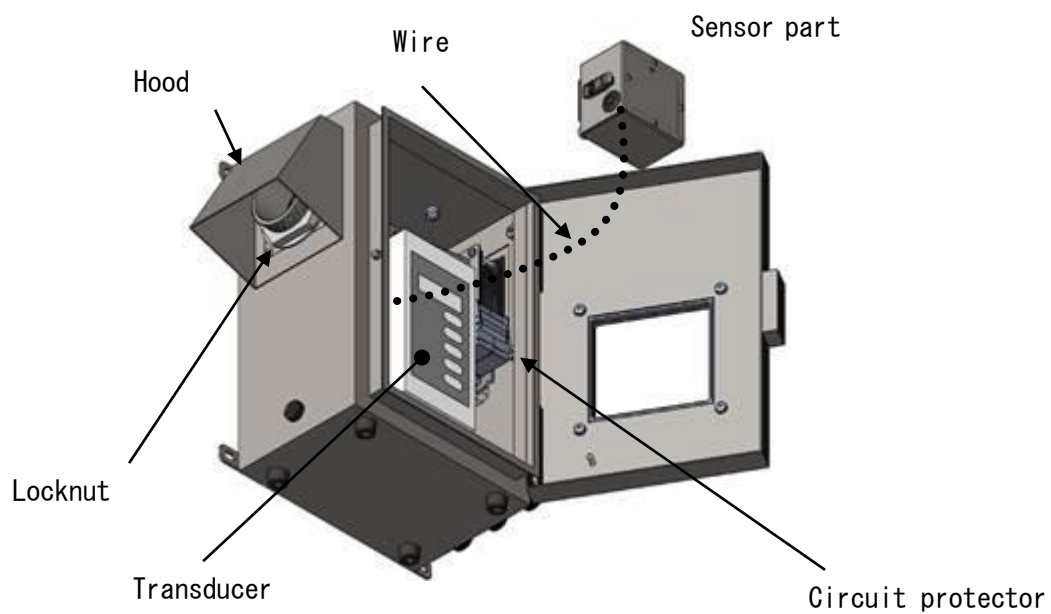


Fig. 13. Removing Hood

Next remove the connector of DC fan near the circuit protector and loosen 4 butterfly bolts (M5), then Duct can be removed out in the arrow direction of the below figure.

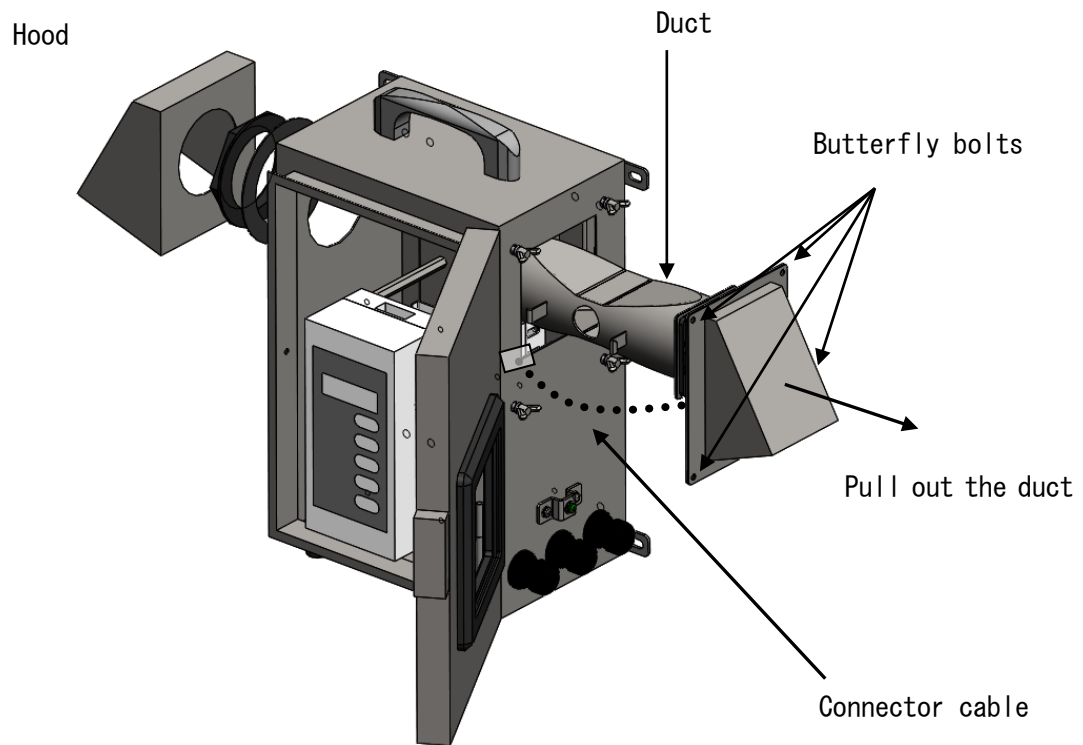


Fig. 14. Removing Duct

As Duct can be removed as the below figure, make sure to clean the inside of Duct with an air blow or rag.

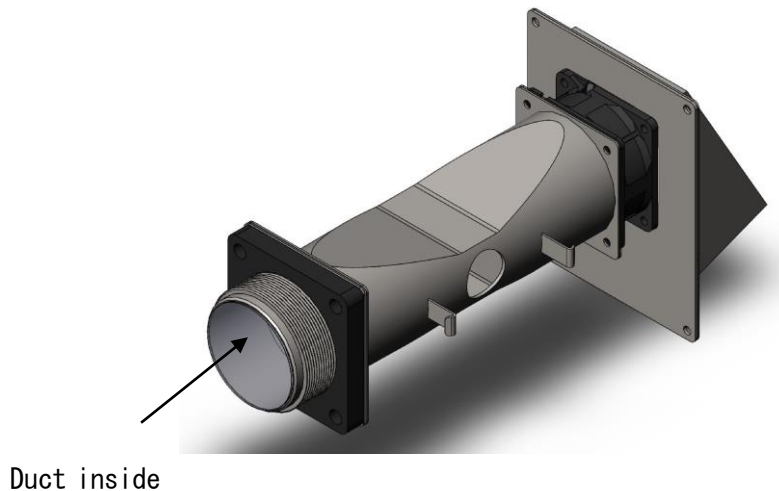


Fig. 15. Removed duct

After cleaning, in reverse process, set the duct and the sensor part, and connect the DC fan connector.

* Please be care of watching the DC fan connector cables when pull out or push in the duct unit.

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. Grounding is not provided. The wiring between Sensor and Transducer is either off or wrong. Material sticking on Probe electrode. Condensation on Probe electrode. Micro amount solid particles flying. 	<ul style="list-style-type: none"> Make warm up operation for 1 hour and check output again. Confirm D class grounding (100ohm or less) is done. Confirm wiring of exclusive cable. If wiring is wrong, please contact us. 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 4, 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, "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