CODE 080000-6311
080000-6312
080000-6313

DIGITAL DUST INDICATOR

AP-632TL / AP-632TM / AP-632TH

Operation Manual

Thank you for purchasing this product.
Be sure to read this operation manual before use.
Handle this product in accordance with the explanations described in this manual.
After reading this operation manual, keep it with the warranty in a safe place.
If you find any unclear points in this manual, please contact your Sibata agent.

SIBATA SCIENTIFIC TECHNOLOGY LTD.

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Using the Product Correctly and Safely

To ensure correct use, read this operation manual thoroughly before handling this product. In addition, keep this manual in an easily accessible location.

Before Using the Product

(Be sure to read this, and handle this product with due care.)

- Install this product horizontally at a stable location.
- Be sure to connect the power cord grounding wire.
- This product is not explosion-proofed, so do not use it in the vicinity of combustible or flammable substances.
- [Modifications and Repairs Are Prohibited] Never disassemble or modify this product, as doing so will void the warranty with Sibata. Doing so may also result in unforeseen faults and accidents.
- If a fault occurs, request repairs immediately. Never leave the fault as is, or attempt your own repairs, as subsequent use may result in unforeseen accidents.
- If the product becomes dirty, wipe away the dirt with a soft cloth (soaked in detergent if there is significant dirt).
- If the product emits smoke, becomes very hot, or the product makes a strange noise, stop using it immediately. Turn OFF the power switch, remove the power plug from the power outlet, and request repairs.
- When removing the power plug from the outlet, hold the cord by the power plug to avoid pulling on the power cord. Be sure your hands are dry before handling the power cord. Otherwise, there is a risk of electric shocks.
- Do not bend, stretch, or twist the cord. Do not connect it to a different cord.
- If you notice that the cord has become damaged, or broken, or the plug does not connect properly, stop using it immediately, and request repairs.

1 Overview

The typical method used for determining the concentration of airborne particulate matter involves using suction to collect particles directly onto a paper filter and then weighing the filter. However, that method requires sophisticated measurement technology, complicated operations, and, for low concentrations, long sampling times. Furthermore, the method cannot be used for continuous measurements of spatiotemporally instantaneous values.
In such cases, there is an interactive relationship between the airborne particulate matter and, furthermore, it is probably more appropriate to measure easily-measurable physical quantities. The light scattering-based detector is designed as a dust concentration indicator for applications such as atmospheric monitoring and other concentration measurements, for measuring the effectiveness of filters and other dust removal devices, for controlling concentration levels in dust exposure and animal inhalation tests, and for evaluating the performance of ventilation and air purification equipment.
It is intended for use in combination with various display devices and data processing equipment.

2 Measurement Principle

The dust indicator is based on the principle that when light is shone on airborne particulate matter in a dark room, the amount of light that is scattered by the matter is proportional to the mass concentration of the matter, provided the particulate matter has the same physical properties (such as reflectance, size, shape, specific weight, and color). The actual system passes the air sample through a stabilized light beam inside a dark compartment. The light scattered by the airborne particulate matter enters a photomultiplier tube located in a thermostatic chamber, which converts the light to a photoelectric current. When the photoelectric current output multiplied by time becomes a constant value, a circuit that integrates the photometric current for one pulse is used to convert the photometric current into a pulse that is proportional to the amount of light scattering. Therefore, the relative mass concentration of airborne particulate matter can be determined by adding up the number of pulses per unit time.
Values measured using this method are referred to as relative concentration values. Since the values measured by the digital dust indicator have sensitivity values specified in units of mass concentration ($\mu g/m^3$), it is unnecessary to measure the absolute quantity of air tested.

3 Sensitivity

Structurally two types of detectors are available (the AP-632T detector connects via tubes, whereas the AP-632F connects via flanges). These are used in three models (L, M, and H) with different sensitivity levels.
The standard particles used to determine mass sensitivity values are calibrated based on filtration collection of monodispersed stearic acid particles with a mean 0.3 μm diameter.

Model		Sensitivity
AP-632T (F)	L	1CPM = 10 $\mu g/m^3$
AP-632T (F)	M	1CPM = 1 $\mu g/m^3$
AP-632T (F)	H	1CPM = 0.1 $\mu g/m^3$

(CPM = counts per minute)

The sensitivity of the instrument is determined based on stearic acid particles with a mean diameter of 0.3 μm, but instrument sensitivity is routinely maintained by approximation using an optical attenuator for relative sensitivity adjustments (hereinafter a "standard scattering plate").
However, it is recommended that the device be calibrated about once a year, due to unavoidable changes resulting from vibration, changes in the standard scattering plate over time, or other factors.

4 Measurement Values

Due to characteristics of the light scattering method, relative concentration measurement values must be corrected if measurements for particulate matter other than standard particles (stearic acid particles with a mean diameter of 0.3 μm) are used to evaluate mass concentration. There are many factors such as differences in substances to be measured and differences in particle size distribution in order to obtain correction coefficients for all particles in advance.

The best and most efficient method for evaluating the mass concentration of actual particulate matter being measured is the relative concentration measurement method, which involves weighing the filter in combination with using the digital dust indicator and then determining the correction factor for the actual measurement site based on comparison data. It is also helpful to first determine the correction factor before generating test powders for dust experiments or controlling the dust concentration for testing the filtering efficiency of filter materials, the collection efficiency of dust collectors, or the dust resistance of parts.

5 Specifications

Detection Sensitivity	1CPM =0.1 to 10 μg/m^3 (criterion of stearic acid particles with a mean diameter of 0.3 μm)
Measurement Range	10 to 10^5 CPM
Measurement Accuracy	Max. ±10 % (criterion of stearic acid particles)
Ambient Temperature	- 10 to 40 °C
Intake Rate	About 35 L/min through a 18 mm I.D. x 5 m long sampling hose
Output	Open collector (sink current max. 10 mA at 30 V) Transmission pulse output via max. 2 km wired connection Data recorder output min. 100 kΩ at 0 to 10 mV
Power Supply	100 VAC ±10 V, 50/60 Hz
Power Consumption	About 70 VA
Dimensions	270(W)×390(D)×250(H)mm
Weight	About 15 kg

Note) Shape, dimensions, specifications, and other product information are subject to change without notice in the interest of product improvement to the extent that product functions and applications will not be impaired.

6 System Configuration

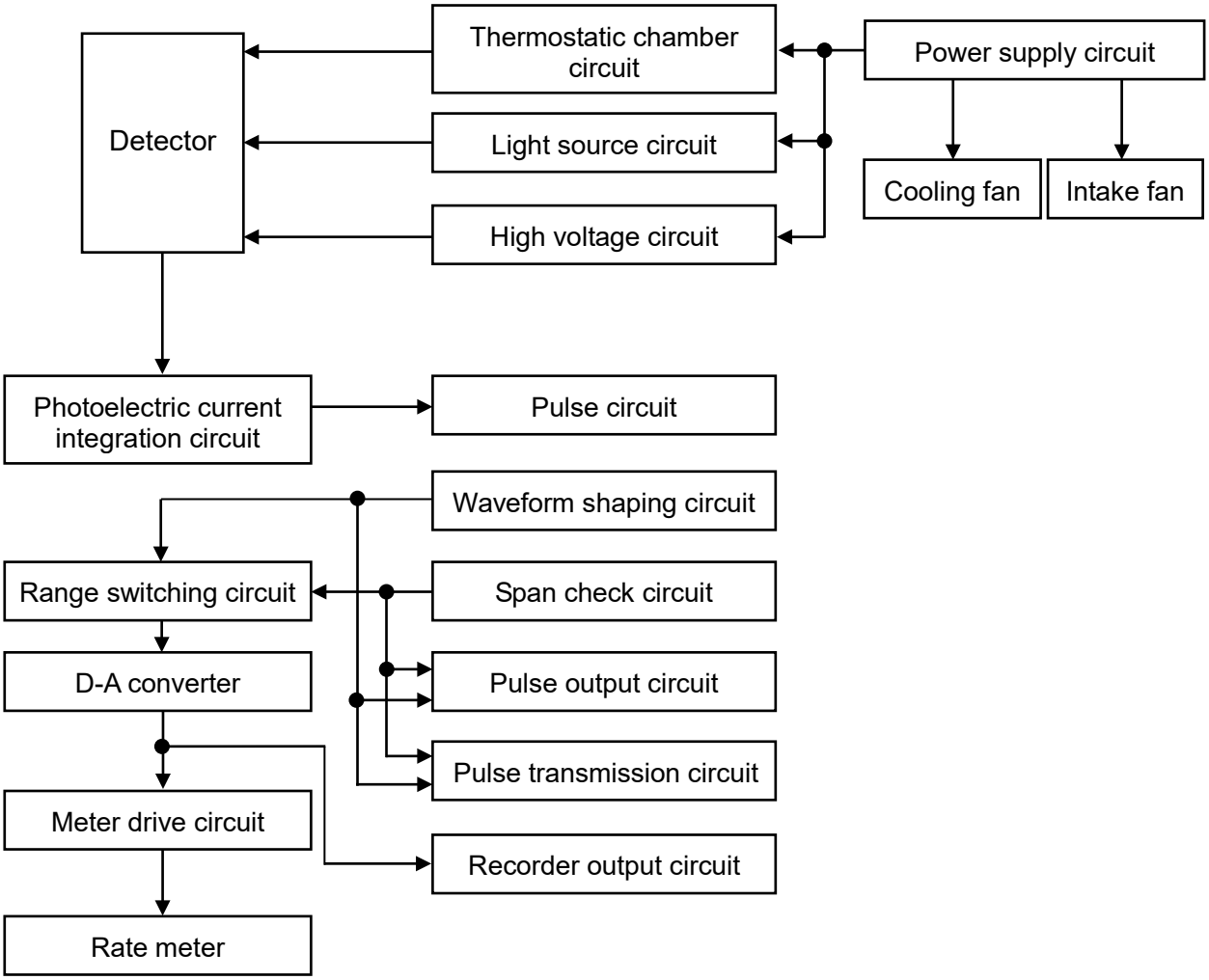
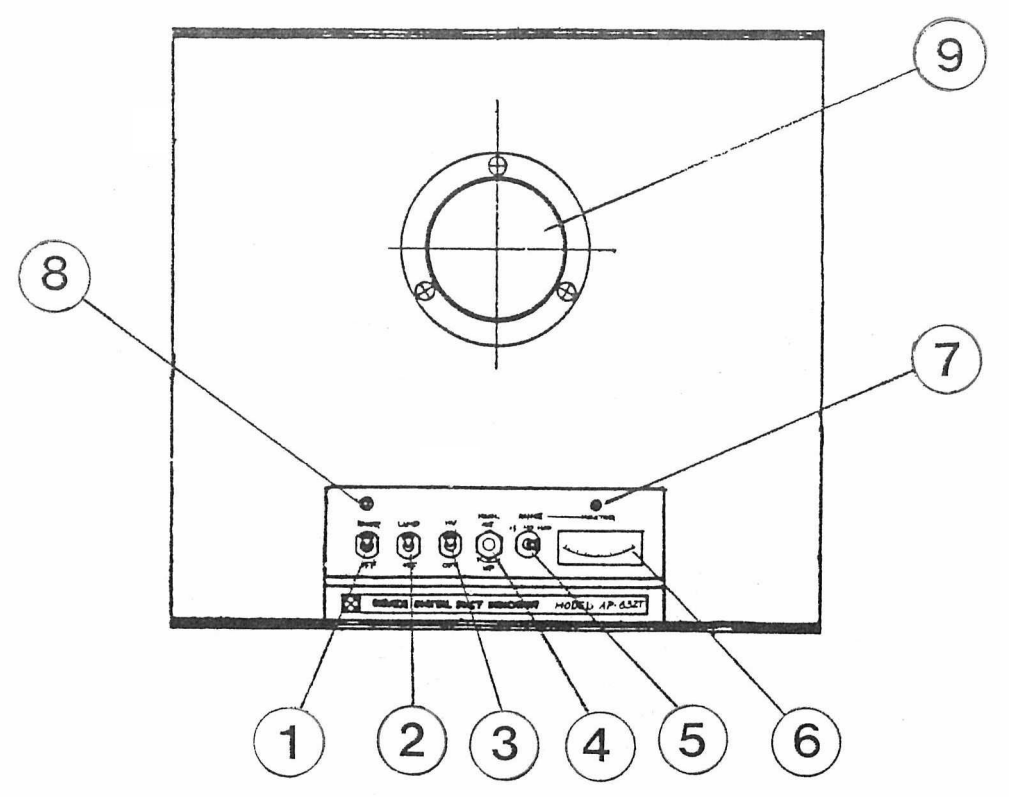


Fig.1

The detector unit uses the photoelectric current integration circuit to convert the light scattering that corresponds to airborne dust concentration into a pulse signal.

To prevent relative sensitivity fluctuations due to temperature variations, a thermostatic chamber controls the temperature of the photomultiplier tube to within 40 ±1 °C. The waveform of the output from the photoelectric current integration circuit is shaped and then converted to a direct reader signal, counter pulse, and transmission pulse. A differential-type 3-core twisted cable (optional) is used to minimize noise and enable transmission for up to 2 km.

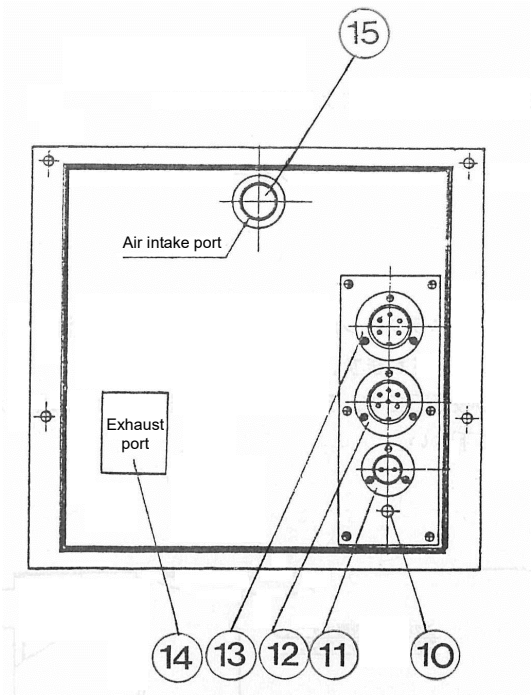
7 Description of Parts



[1] Front Panel

(1) POWER	Switches the power ON or OFF.
(2) LAMP	Switches light source ON or OFF and the switch also serves as the switch for the cooling propeller fan.
(3) H.V	Switches the high voltage circuit ON or OFF.
(4) SENSI.ADJ	This multi-rotational variable resistor can be rotated 10 revolutions to make fine adjustments to sensitivity (changes sensitivity by about 10 % per revolution).
(5) RANGE	Switches between three ranges for the monitor meter, either 1x, 10x, or 100x for 0 to 1000 cpm.
(6) MONITOR	The scale indicated on the direct reader used to display instantaneous values is from 0 to 1000 cpm, where by switching between the three ranges it can be used to directly read values up to 10^5 cpm.
(7) ZERO RESET	This screw adjusts the zero point for the monitor meter.
(8) PILOT LAMP	This illuminates to indicate the power is ON.
(9) LIGHT TRAP	This cap is removed to mount a standard scattering plate for adjusting sensitivity using a light trap. Normally, it is used to absorb the light beam from the light source.

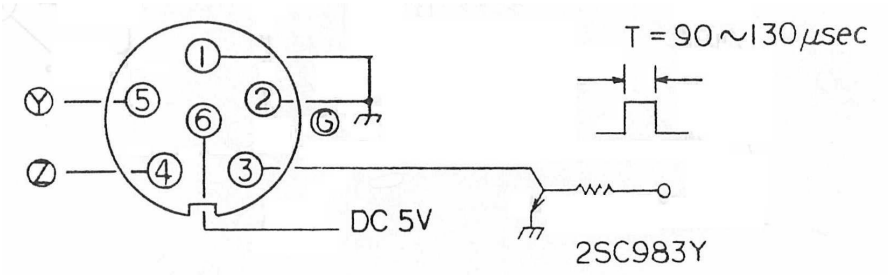
[2] Rear Panel



(10) Ground terminal : To prevent electric shock and minimize noise, always connect this terminal to ground.

(11) Power supply connector : Use the power cord to connect this connector to a 100 V AC power supply.

(12) Output connector (6-pin) : Internal wire connections are indicated below.

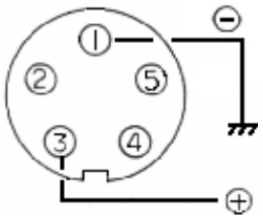


(1) and (3) : Open collector output

(2), (4), and (5) : Wired transmission output for max. 2 km

(6) : 5 V DC power supply for driving the external photocoupler

(13) Output connector (5-pin)



(1) and (3) : 0 to 10 mV output
Min. 100 kΩ load resistance

Note: Data cannot be transmitted over long distances.

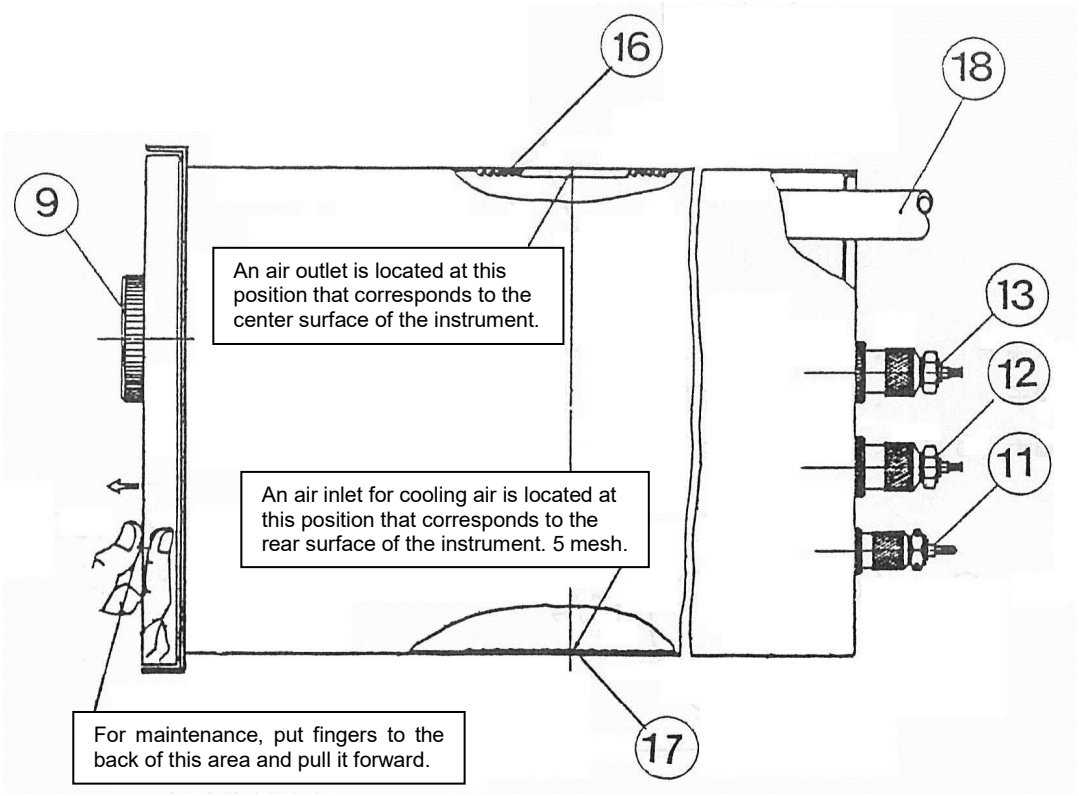
(14) Exhaust port : Sampled air is discharged via this port.

(15) Air intake port : Includes an adapter for connecting the air intake hose.

[3] Side Exterior

(16) Cooling exhaust port : The internal propeller fan blows heat from the detector light source, amplifier, and other components out this port.

(17) Cooling intake port : This port takes in air for cooling. Be careful to prevent blocking this port, such as when placing the unit on a rack.



[4] Internal Structure

(18) Air Tube : Air tube connected from the air intake port to the detector.

(19) Thermostatic chamber : This thermostatic chamber for the photomultiplier tube is controlled to a setting of 40 ±1 °C to stabilize the dark current and prevent condensation from forming on the scattered light input surface.

(20) Temperature gauge : Used to monitor the temperature in the thermostatic chamber.

(21) Photomultiplier tube : Used to convert scattered light into an electrical signal, it features an input surface on the side and nine secondary electron amplification electrodes.

(22) Circuit board case : The subchassis houses the printed circuit board that contains all circuits.

(23) Light source lamp socket : The lamp and socket are fabricated as a single unit, which is fastened with two specialized screws.

(24) Guide rails : Used to slide out the interior of the instrument for maintenance, the instrument can be removed from the case by unscrewing four screws from the rear side of the instrument.

(25) Detector : Air drawn in from outside the instrument passes through this area, where the amount of dust in the air is converted to a corresponding amount of scattered light. The measurement angle is 135 degrees.

(26) Exhaust duct : After passing past the detector, the air flows through this duct and is discharged outside the instrument.

(27) Filter holder : To prevent dust from the contaminating the scattered light input area, lower pressure inside the detector is used to generate clean air and send it into the light input area.

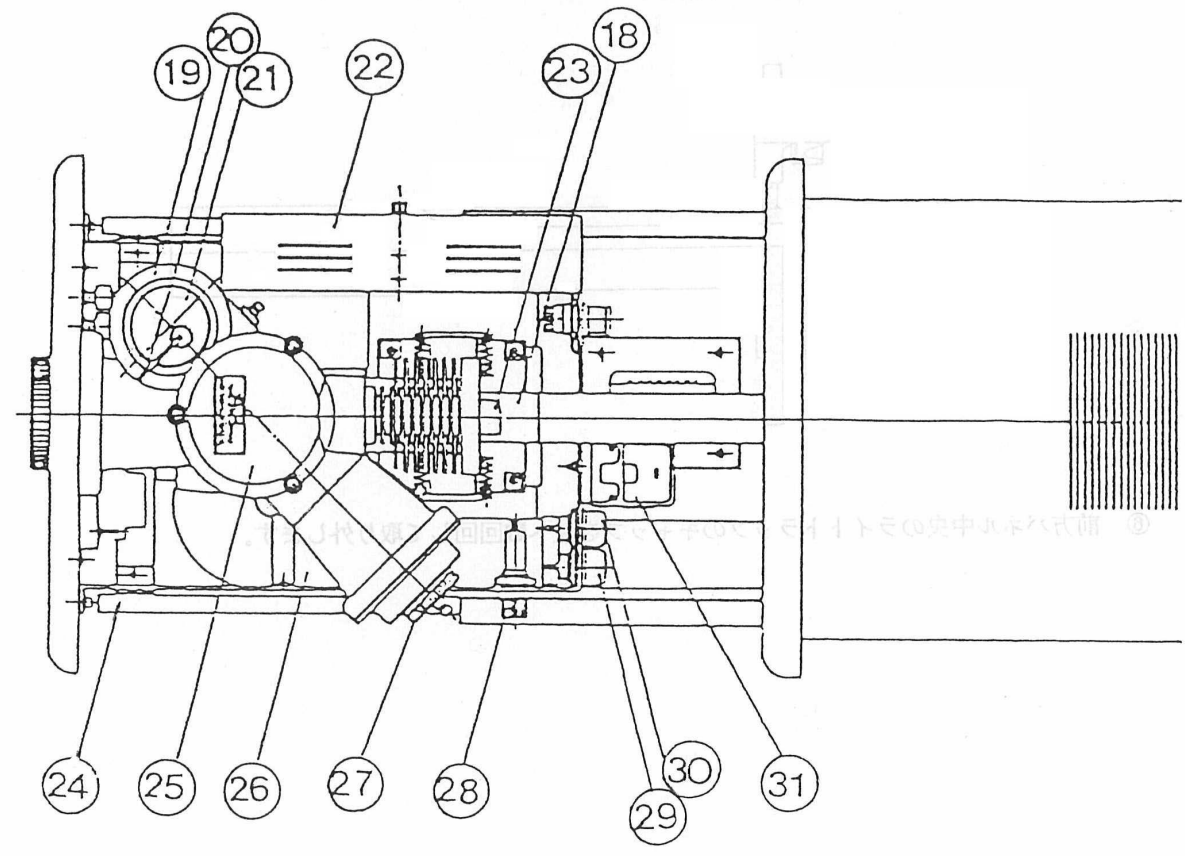
(28) Fuse : The instrument uses a 2 A tube fuse.

(29) Air intake fan connector : Connects to the centrifugal fan installed below the detector.

Note: For systems designed to take in external air, the centrifugal fan is removed and connected to the exhaust duct via a flange and glass tube.

(30) Cooling fan connector : Connects to the forced-air propeller cooling fan for the light source lamp and other power supply circuit.

(31) Power connector : Connects between the output terminal strip and the components mounted on the guide rails.



8 Measurement Method

Prepare the tubing joints, intake pump, flow meter, and other components to be used for the given application. Similarly, connect the display unit using the provided cable that is appropriate for the given application.

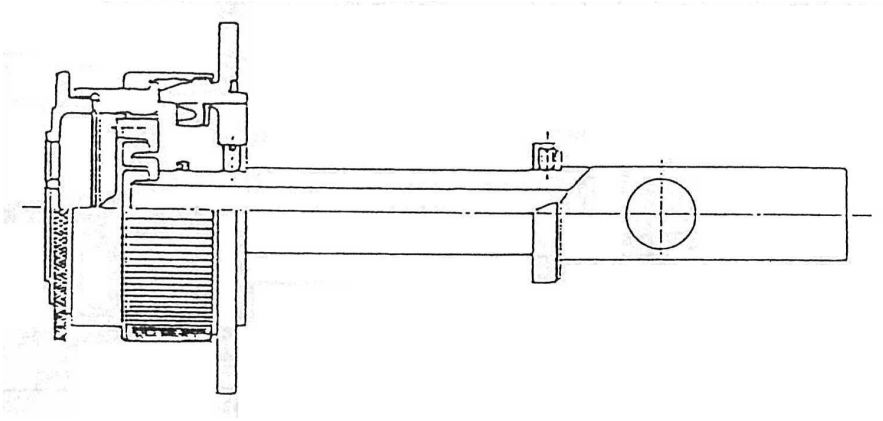
(1) Connect the power cord to a 100 V AC power supply and turn the power switch ON.
The pilot lamp illuminates.

(2) Turn the lamp switch ON. The air intake centrifugal fan and the cooling fan start rotating.

(3) Turn the high voltage switch ON.
After the above steps, the system is operational, but requires about three hours to fully stabilize. Sensitivity will fluctuate by about 5 % until stabilized.

(4) Adjust the sensitivity.
In this case, sensitivity refers to the relative sensitivity of the instrument to measure the mass concentration of standard dust. To maintain consistent sensitivity, sensitivity is adjusted by installing a standard scattering plate to the detector.

(5) Remove the standard scattering plate from the provided storage box and remove the protective case.



(6) Remove the cap from the light trap in the center of the front panel by rotating it several times to the left. Align the 3 mm diameter set screw on the standard scattering plate with the groove in the detector flange and screw it all the way in to secure the plate.

(7) Set the meter range to [x10] and use the provided screwdriver to adjust the sensitivity while watching the value indicated on the monitor meter until the indicated value is approximately the same as the value indicated on the standard scattering plate.

(8) Depending on the application, the standard scattering plate does not need to be adjusted accurately to within a few counts, but perform a one-minute measurement repeatedly several times and adjust it to within ±5 % of the indicated value.

Note: If used to monitor the environment, the mass conversion factor must be determined for the given location by measuring standard dust in parallel with a low-volume air sampler for the corresponding sensitivity criterion value. Two detectors are used for applications such as generating a test powder for evaluating filtering efficiency. However, even if they have some levels of different sensitivity, typical test requires determining a blank value (a correction value for sensitivity differences), so it is more important to confirm their stability than to accurately match their sensitivity levels.

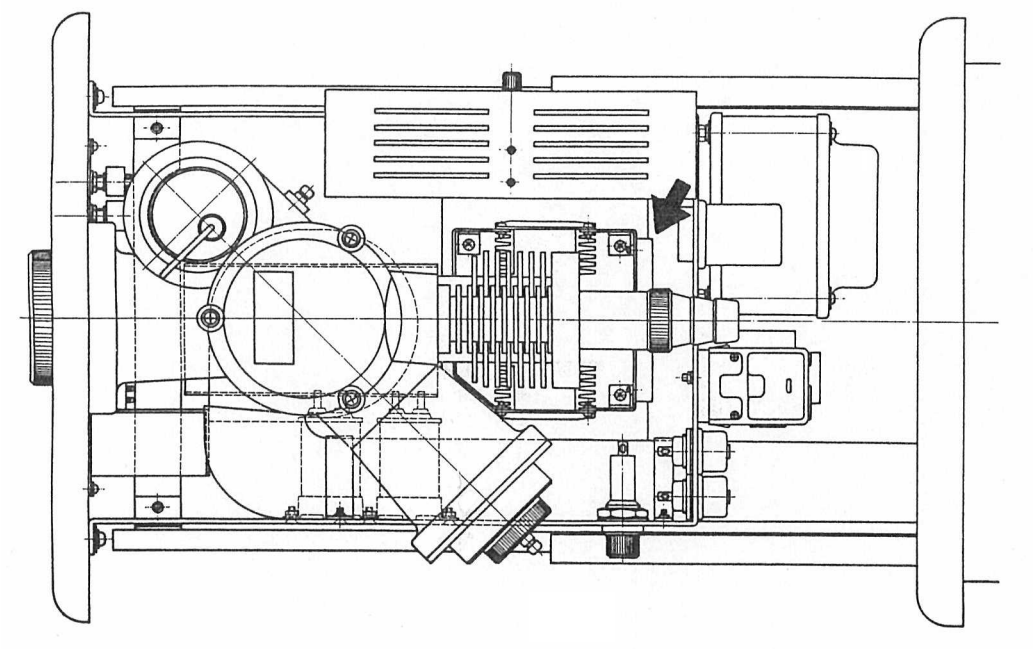
(9) After matching the sensitivity levels, remove the standard scattering plate and screw in the cap. If the cap is difficult to rotate, apply a small amount of the provided grease to the threads and O-ring.

9 Maintenance, Inspection, and Precautions

(1) The filter inside the standard scattering plate is for preventing dust from contaminating internal mechanisms by utilizing the lower pressure inside the detector unit to supply clean air. For normal operating environments, replacing the filter once a year should be sufficient, but replace the filter whenever it become dirty. Remove the screw at the front edge of the standard scattering plate and replace the filter with a 47 mm diameter glass fiber filter provided.

(2) Always attach the protective case before storing the standard scattering plate in the storage box. Handle it with particular care. Occasionally clean the light input surface and white scattering plate surface on the scattering plate with gauze or other means.
Scattering plate values may fluctuate or change over time if dropped or after extensive use.
To calibrate the sensitivity, contact a Sibata representative.

(3) Replace the light source lamp as follows.



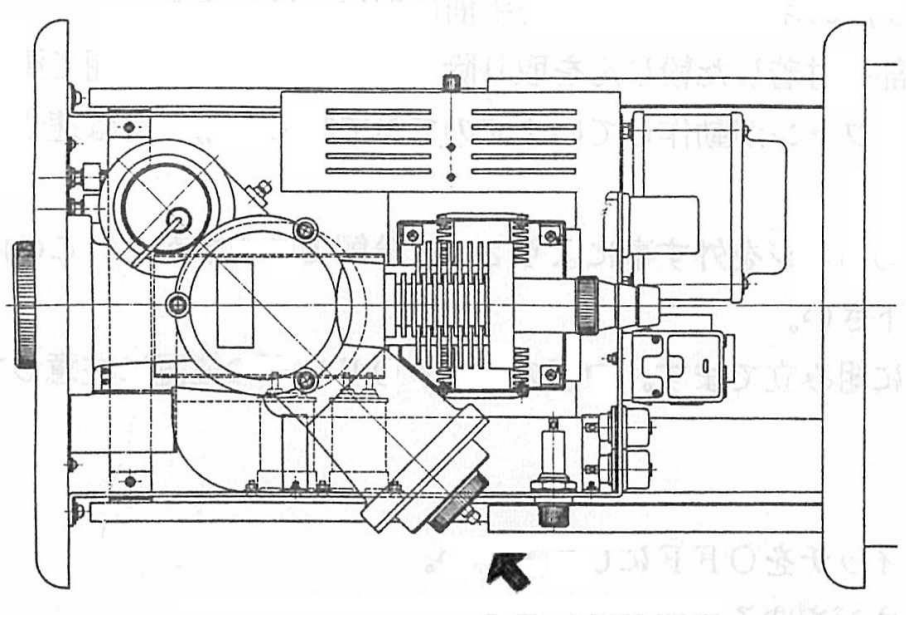
The light source lamp must be replaced after six months of continuous operation. After replacing the lamp, simply use the two fastening screws to fasten the light source lamp to the specialized socket. Not optical axis or focus adjustments are necessary.

a. Clean the glass surface of the provided spare lamp with gauze or other means, and then remove it by loosening the two screws on the cover, as indicated with an arrow. Disconnect the two socket lead wires from the terminal block.

b. Next, use a screwdriver to loosen the two screws that fasten the light source lamp socket and then rotate them by hand. There is no polarity involved. Reinstall the cover that was removed earlier.

c. Turn the lamp switch ON and wait for about 10 minutes to stabilize. Then adjust the sensitivity according to the sensitivity adjustment method described earlier.

(4) Replace the filter as described below.



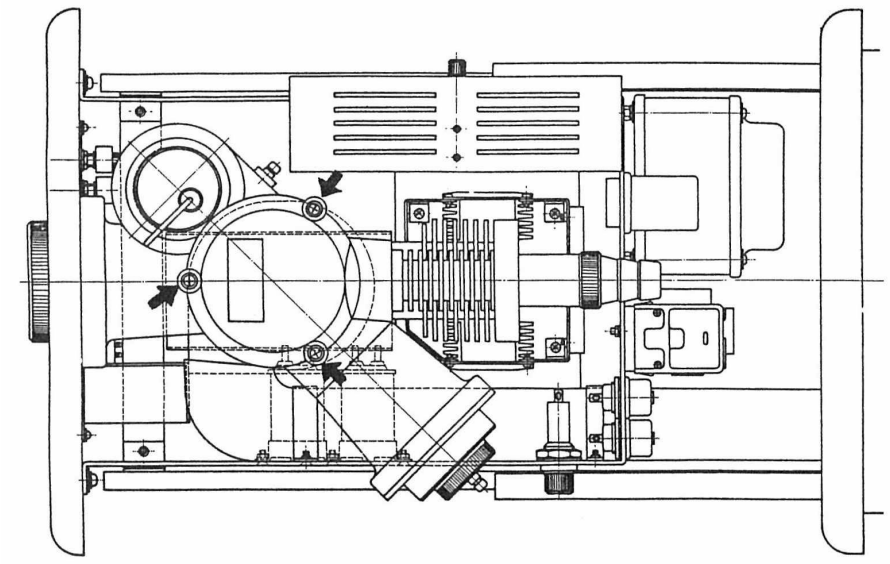
To prevent contamination from dust flowing past the detector input surface, a filter (indicated with an arrow) uses the lower pressure inside the detector to continuously generate and supply clean air to the light input area.
Therefore, for environmental monitoring, this filter must be replaced when dirty or at least once a year.

a. Rotate the portion indicated with the arrow toward the left and then remove the filter with tweezers.

b. Replace the old filter with one provided 47 mm diameter glass fiber filter. The filter may be oriented with either side facing outward.

c. Place the donut-shaped ring on the filter and then firmly screw in the filter holder.
That completes the filter replacement process.

(5) Clean the detector as follows.



a. Turn the high voltage switch OFF.

b. Remove the three screws indicated with arrows and then remove the top cover by pulling it forward.

c. Scrape off any dust accumulations inside using the brush tool provided. Clean those areas that can be reached with the brush. Dislodged dust will be quickly discharged outside the instrument by the air intake fan, which is running during this process.

d. Remove the screw in the center of the cover to separate the unit into two parts and then remove the dust inside the exposed areas.

e. Reassemble the cover as it was previously. Make sure the cover orientation and O-ring position are correct.

(6) Clean the circuit board as follows.

a. Turn the power switch OFF.

b. Loosen the screw on the circuit board case and remove the screw.

c. Pull out the printed circuit board and thoroughly clean off any dust from the front and back sides of the board, using the brush tool provided. Also clean the dust from inside the case.

d. Insert the circuit board securely all the way into the case and close the cover.

10 List of Accessories

1. A standard scattering plate (with protective case)……1
2. Spare lamps (with specialized socket) ……2
3. Filters (GB-100R 47-mm dia.) ……100 pcs
4. 5-pin connector……1
5. 6-pin connector……1
6. Power cord …… 3 m
7. Grounding wires (green) …… 3 m
8. Fuse (2 A tube fuse)……2
9. Screwdrivers (one large and one small) …… 1 each
10. Tweezers……1
11. Plastic tubing (19 mm dia. x 23 mm dia.)…… 5 m
12. Grease……1
13. Accessories storage box……1
14. Brush……1
15. Thumb screws, 4x10 (for securing main unit) ……2

11 Warranty

If a Sibata product fails within one year from date of purchase, it will be repaired free of charge.
To request repairs, contact your Sibata representative.
Be sure to provide the item code, product name, model number, serial number, a description of the problem, and other relevant information.
The warranty excludes consumable parts included with the product, products without the purchase date or distributor information recorded, and products for which warranty information was revised.
The warranty excludes any problems resulting from any of the following causes. Such repairs are subject to normal service fees.

(1) Faults or damage due to improper usage

(2) Faults or damage resulting from repairs or modifications implemented by parties other than Sibata

(3) Faults caused by abuse or inadequate maintenance

(4) Faults or damage resulting from fires or natural disasters, such as earthquakes

(5) Faults or damage occurring after purchase due to relocation, movement, falling, or vibration

(6) Faults or damage resulting from the use of consumable items not specified by Sibata

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