Manual No.3011E R6

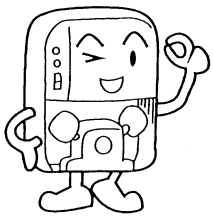
INSTRUCTION MANUAL
FOR
DUST DENSITOMETER
MODEL ISS-101

KV-610014-J

ENERGY SUPPORT CORPORATION

1. General description

1.1 Introduction



This Dust densitometer model ISS-101 is a relative dust concentration meter, which utilizes the light scattering method and can be used to continuously monitor the dust concentration for an extended period of time. The analyzer is directly connected to the flume and has a simple sampling piping system, ensuring easy maintenance.

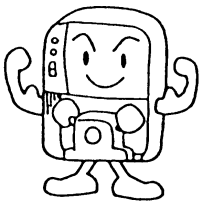
By supplying the clean air to the optical system, lowering of the sensitivity due to contamination of the optical system is prevented.

Therefore, the analyzer can measure from the high concentration to low concentration without effects of load fluctuations and does not require any maintenance for an extended period of time.

This instruction manual describes how to install, operate, and inspect the Dust densitometer model ISS-101. Before starting installation of this analyzer, thoroughly read this instruction manual to fully understand its contents and operate the analyzer in correct manner.

1.2 Guarantee of product

IMPORTANT



The guarantee period of this product is stated in the final document. If the delivery drawings are not provided, the guarantee period is determined as one year after delivery.

(1) Conditions

The product shall be stored and installed properly until the trial-run adjustment is started. If any defect due to faulty design, defective materials, and/or poor workmanship is found during the guarantee period, Energy Support corp. shall repair or replace defective item free of charge.

The proper operating conditions include the following terms.

① The operating conditions and installation conditions specified in this instruction manual shall be satisfied.

② Excessive mechanical shock and impact shall not be applied to the sampling probe.

③ The Dust densitometer shall be calibrated and consumable parts shall be replaced periodically.

④ The confirmation and maintenance of the Dust densitometer operation status shall be performed correctly.

⑤ The suction and exhaust valves shall be closed not to suck the sample gas until the warm-up time of the transmitter has elapsed.

⑥ The optical system shall be cleaned and clogging of the probe shall be inspected and cleaned periodically.

This guarantee does not include defects arising from the following conditions even during the guarantee period.

- Defects arising from improper handling (improper operation not stated in this instruction manual)
- Defects arising from repair, modification, or overhaul cleaning made by personnel other than those authorized by Energy Support corp.
- Defects arising from fire, natural disaster, or improper maintenance (storage in a place where high temperature and high humidity exist, or mold occurs.)

Note: Replacement of consumable and/or similar parts is not included in the guarantee coverage.

(2) Guarantee coverage

This guarantee covers only products manufactured and delivered by Energy Support corp. Incidental and consequential damages (damage and loss caused by controlled and recorded results by the product delivered by Energy Support corp. and damage and loss of the equipment, in which Energy's product is installed) resulting from malfunction of the product manufactured by Energy Support corp. are not included.

(3) Remarks

① It is difficult to remove the slug dust by purging. It is absolutely necessary to perform the maintenance and replacement work with the probe removed.

② This instrument is a Dust densitometer that utilizes the light scattering method. When measuring the dust actually, a difference between the indication value on the Dust densitometer and weight concentration value of the actual dust may be produced by influences of the color, shape, and grain size of the dust.

Therefore, the customer needs to perform the manual analysis and add the compensation value from the following weight conversion coefficient to make the indication value on the Dust densitometer matched with the weight concentration value.

$$\text{Weight conversion coefficient} = \frac{\text{(Actual dust weight concentration value (mg/m}^3\text{N)}}{\text{(Average of indication value on the Dust densitometer (mg/m}^3\text{N))}}$$

This compensation is similar to the standard gas calibration of the gas analyzer.

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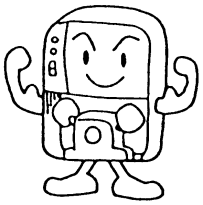
1.4 Safety precautions

IMPORTANT



⚠WARNING

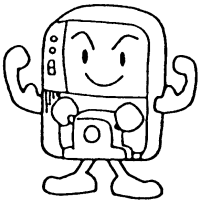
1. Before starting the wiring work to the terminal block, always shut-down the power. Failure to do so may cause an electrical shock. Additionally, before starting the maintenance work of electrical parts, always shut-down the power.
2. To prevent an electrical shock accident, connect the grounding cable to the grounding terminal firmly.

⚠CAUTION

1. To prevent dew condensation, the transmitter main body becomes hot. Before starting the cleaning and maintenance work of the piping in the optical system, trap, and ejector, always wear heat-resistant gloves.
2. Before attaching and detaching the cap to/from the span port, always wear heat-resistant gloves since the span port is hot.
3. If the suction and exhaust valves are not closed fully when starting the maintenance work while the furnace is being operated, the sample gas may spout out.To prevent such troubles, always close the suction and exhaust valves fully.
4. Before installing or removing the Dust densitometer, make sure that the furnace operation is stopped completely.
   If it is strongly required to install or remove the Dust densitometer while the furnace is being operated, pay special attention to the following cautions.
   (1) Since the part close to the mounting seat is hot, always wear heat-resistant gloves.
   (2) If the positive pressure exists inside the furnace, the sample gas may spout out
   from the opening. Never get access to the opening.
   (3) Additionally, the dust and soot in the sample gas may also spout out. Always wear dust-proof glasses to prevent dust and soot from entering your eyes.

1.5 Cautions for operation

IMPORTANT

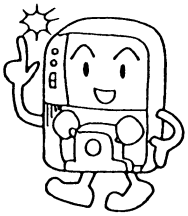


⚠ CAUTION

The following cautions must be strictly observed to prevent corrosion and clogging of dust caused by dew condensation. Always operate the Dust densitometer correctly while carefully referring to the following operations.

1. Close the suction and exhaust valves if the HEAT lamp on the controller does not flash or if the warm-up operation is not performed for 60 min.
2. If the power to the transmitter is shut-down due to power failure, immediately close the suction and exhaust valves.
3. Perform the heat retention (heat insulation) work on the sample gas flowing pipes between the furnace wall (guide pipe) and transmitter.
4. The dust concentration inside the furnace becomes high during a period of approximately 2 hrs. After stopping or starting the furnace operation, causing the optical system of the Dust densitometer to be contaminated. Therefore, close the suction and exhaust valves for approximately 2 hrs. after stopping or starting the furnace operation in order to prevent the dust from entering the analyzer.
5. Open and close the suction and exhaust valves periodically (once a month). If the valves are not operated for an extended period of time, dust may stick to the valves, causing the valves not to be opened or closed.

1.6 Overview of Dust densitometer



[Measuring principle]

This Energy's Dust densitometer is a light scattering type Dust densitometer that utilizes the correlation between the dust weight concentration and scattering intensity.

The light scattering intensity ($I\theta$) is expressed by the following formula.

$$I\theta = \frac{\lambda^2}{8\pi^2\pi^2}\ \alpha^6 \left| \frac{m^2 - 1}{m^2 + 1} \right|^2 (1 + \cos^2\theta)$$

θ: Scattering angle, λ: Wavelength, α: Grain diameter parameter ($2\pi a/\lambda$), a: Radius of grain, R: Distance from grain, m: Index of refraction of light in grain/Index of refraction of light in medium

When the physical property of the grain (shape, size, composition, color, etc.) is almost constant, the scattering intensity is parallel to the dust weight concentration.

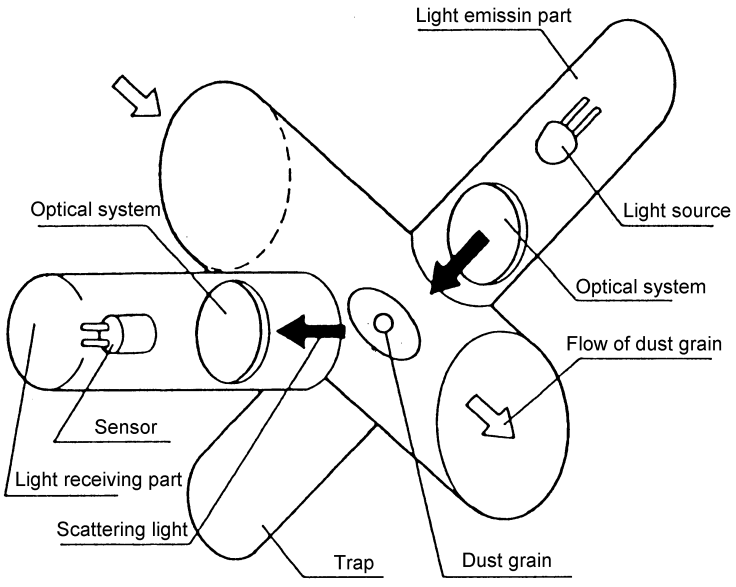
An infrared ray LED lamp with an emission light waveform of 875 nm is used as light source.

When this light is intermittently emitted to the dust passing through the detection area of the detector, the scattering light occurs at any angle to the dust.

A light receiving sensor is located at 70° forward to the light axis between the light source and trap. This sensor receives the infrared ray coming from the light source and converts it into the electrical signals.

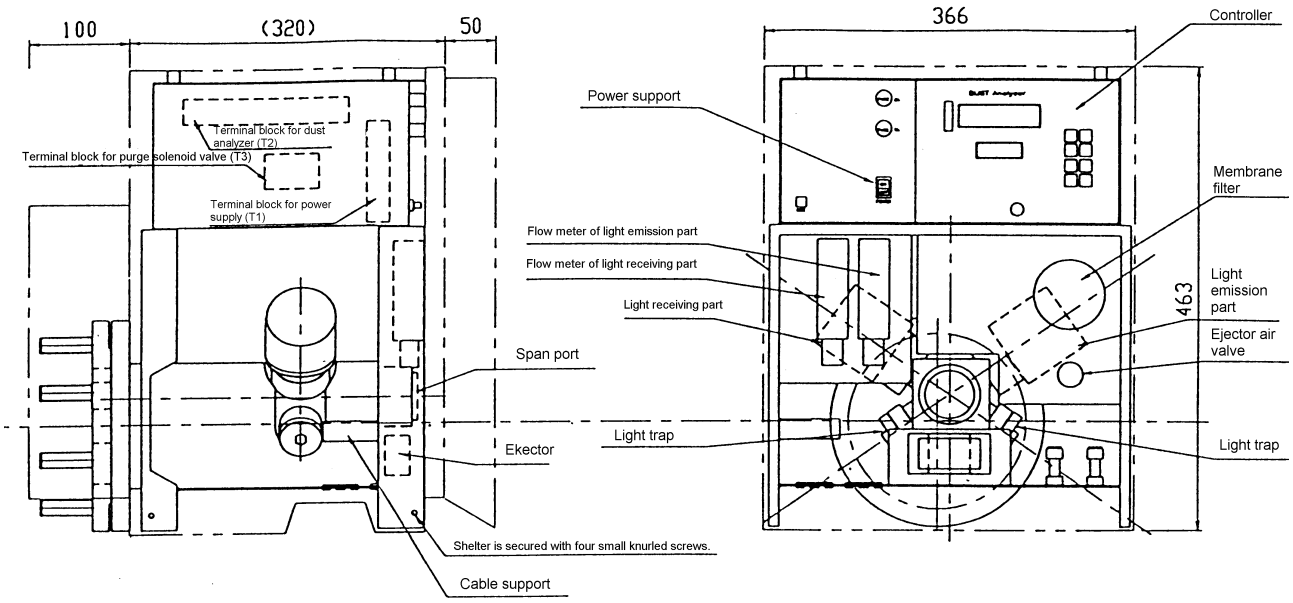
These electrical signals are processed to measure the relative dust concentration at real-time.

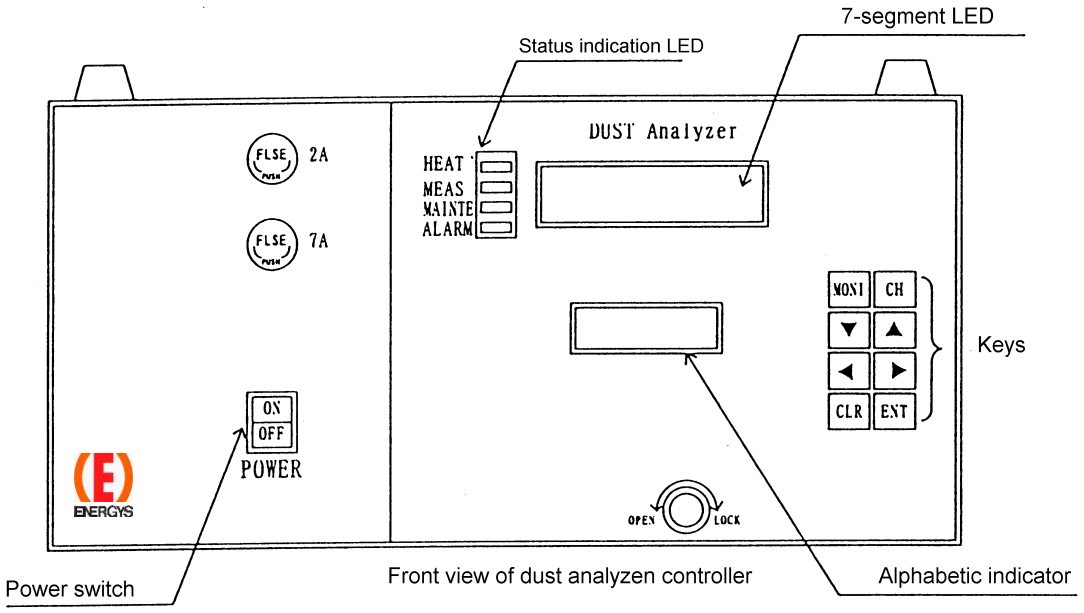
Using the standard grain, scales are put on this Dust densitometer. When measuring the exhaust gas, it is possible to perform the continuous measurement by calculating the weight conversion coefficient based on the measurement in conformity with JIS Z 8808.



1.7 Part names and functions

1) Outside view of Dust densitometer



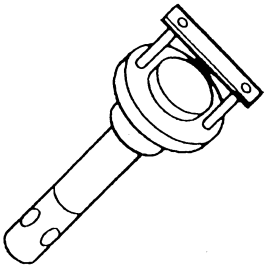


2) Part names and functions of Dust densitometer

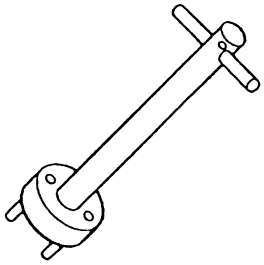
No.	Name	Function
1	Controller	Processes the signals inside the Dust densitometer.
2	Power switch	ON/OFF switch for the power to the Dust densitometer
3	HEAT LED	Pilot lamp of the heater for the Dust densitometer. Lit during temperature rise and flashes during control.
4	MEAS LED	Lit during measurement.
5	MAINTE LED	Lit during measurement.
6	ALARM LED	Lights up if a fault occurs.
7	7-segment LED	Indicates the dust concentration and error No.
8	Alphabetic indicator	Indicates the measuring range and status, such as CAL or PURGE.
9	Fuse 2A	Fuse for the electronics circuit.
	Fuse 7A	Fuse for the heater of the Dust densitometer
10	Flow meter of light emission part	Flow meter for clean air of the light emission part
11	Flow meter of light receiving part	Flow meter for clean air of the light receiving part
12	Ejector air valve	Flow regulation valve for driving of the ejector
13	Span port	Span rod is inserted into this port for span calibration. Cleaning port for cleaning of the suction side
14	Ejector	Ejector nozzle for suction of the sample gas When cleaning the exhaust side, remove this ejector and clean it.
15	Filter membrane	Filter for clean air
16	Light emission part	Infrared LED light source built-in unit
17	Light receiving part	Light sensor and amplifier built-in unit used to detect the scattering light.
18	Light trap	Absorbs the stray light.
19	Suction/exhaust nozzle	Nozzle used to suck/exhaust the sample gas.
20	Suction/exhaust valve	Valve used to shut-down the sample gas during calibration.
21	Terminal block for power supply (T1)	Terminal block for power supply to the Dust densitometer
22	Terminal block for Dust densitometer (T2)	Terminal block for signals to the Dust densitometer
23	Terminal block for purge solenoid valve (T3)	Terminal block for driving of the purge solenoid valve for the Dust densitometer

2. After unpacking

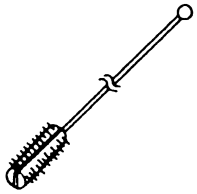
2.1 Checking of accessories



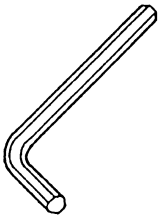
Span calibration rod



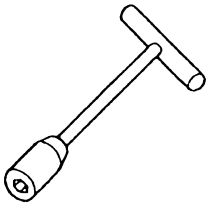
Optical system jig



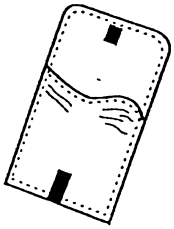
Cleaning brush



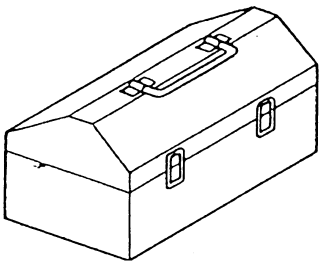
Allen wrench
(width across flats:3)



T-wrench

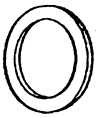


Span calibration
rod storage bag



Accessory storage box
(box master)

Stop plug 1/8B



Flange packing

Nut Washer Spring washer

List of products and accessories

Name	Part No.	Q'ty	Remarks
Dust densitometer model ISS-101	KV-610014-J	1	With case (shelter)
Suction nozzle	KV-620212-L	1	L = Specified length (mm)
Exhaust nozzle	KV-620212-L	1	L = Specified length (mm)
Span calibration rod	KV-610402-A	1	
Optical system jig	KV-650105	1	
Cleaning brush	KV-650106	1	
T-wrench	KV-650132	1	
Span calibration rod storage bag		1	L size
Accessory storage box		1	B-54
Stop plug	PG3041/8B	1	Used to stop the air inlet of the ejector nozzle when the ejector is not in use.
Stop plug	PG3161B	1	Supplied with the Dust densitometer main unit
Allen wrench		1	Width across flats: 3
Nut		8	For M16
Washer		8	For M16
Spring washer		8	For M16
Flange packing	T1995K10A100RF3T	1	

2.2 Temporary storage of product

CAUTION

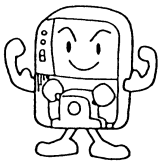
This Dust densitometer must be stored under original packing conditions in an indoor place (temperature: -5 – 50°C, humidity: 90%RH or less) until the installation work is started.
Do not store the Dust densitometer in an outdoor place (exposed to the rain) or a place where high temperature or high humidity exists, or mechanical vibration exists. Doing so may cause the Dust densitometer to malfunction.

When the Dust densitometer is installed, close the door and cure the Dust densitometer so that rain water and dust does not enter the inside through the piping port or wiring port. In the same manner, cure the probe and transmitter.

3. Installation

3.1 Installation conditions

IMPORTANT



This section describes how to carry out the installation, piping, and wiring work of the Dust densitometer model ISS-101.

If the installation place is selected incorrectly or the installation work is performed incorrectly, an unexpected trouble may occur later or the performance of the analyzer cannot be maintained, causing damage to the units. Thoroughly read the following description to fully understand its contents before staring the installation work.

If it is difficult to install the Dust densitometer under the conditions specified below, contact Energy Support corp. Before installing the Dust densitometer, determine or prepare the following items.

① Determine the gas sampling position (Dust densitometer installation position)
② Determine the storage panel (purge unit) installation place.

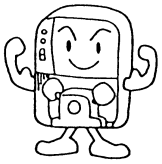
⚠

Cautions for installation work (CAUTION)

1) Before installing or removing the Dust densitometer, make sure that the furnace operation is stopped completely.
   If it is strongly required to install or remove the Dust densitometer while the furnace is being operated, pay special attention to the following cautions.
   (1) Since the part close to the mounting seat is hot, always wear heat-resistant gloves.
   (2) If the positive pressure exists inside the furnace, the sample gas may spout out from the opening. Never get access to the opening.
   (3) Additionally, the dust and soot in the sample gas may also spout out. Always wear dust-proof glasses to prevent dust and soot from entering your eyes.
2) Make sure that the suction and exhaust valves are closed fully.
   If these valves are not closed fully, this may cause dust clogging or corrosion.
3) Attach the flange packing (accessory) so that it does not deviate.
4) Apply the burn prevention agent (mori-coat) to the hexagon bolts and tighten the hexagon bolts and nuts (accessories) evenly.

3.1 Installation conditions

IMPORTANT



① Selection of gas sampling position

When selecting the gas sampling position, that is, Dust densitometer installation position, always take the place satisfying the following conditions into consideration.

1) Place where the typical dust value can be measured.
2) Place where the dust concentration does not vary rapidly.
3) Place where is close to the manual analysis seat.
4) Place where the gas temperature is 500°C or less.
5) Place where the sample gas forms an even laminar air flow.
   (It is not appropriate to install the Dust densitometer at a corner where the turbulent flow occurs easily.)
6) Place where the mechanical vibration and impact are minimized.
7) Place where the maintenance work can be carried out easily.
   Keep the maintenance area satisfying the following conditions.
   a. Place where is approximately 1000 mm above the center and both sides of the mounting seat. (It is necessary to attach and detach the shelter.)
   b. Place where is located 1000 mm + overall length of the nozzle after the mounting seat.
8) Place where the outdoor temperature is –10 - 50°C.

② Selection of storage panel (purge unit) installation place

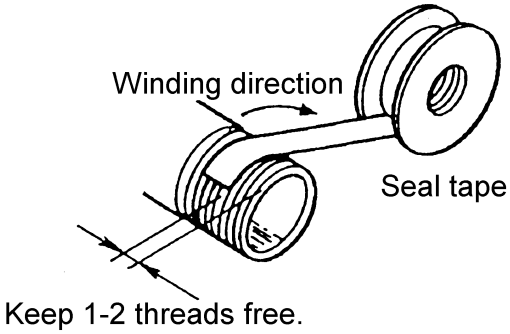
When selecting the storage panel installation place, always take the following conditions into consideration.

1) Place where the outdoor temperature is 0 - 50°C and variation in temperature is 15°C or less during daytime.
2) Place where the corrosive gas is minimized.
3) Place where the mechanical vibration and impact are minimized.
4) Place where the Dust densitometer is not exposed to the steam or hot air.
5) Place where the Dust densitometer is not exposed to the direct sunlight.
6) Place where the electro-magnetic induction is minimized.
   (Pay special attention to this caution for wiring place.)
7) Place at a distance of 50 m or less from the transmitter.
   (To reduce the piping and wiring construction costs and suppress increase in piping resistance, the above distance shall be made as short as possible.)
8) Place where maintenance space to allow opening and closing of the door of the storage panel can be kept.

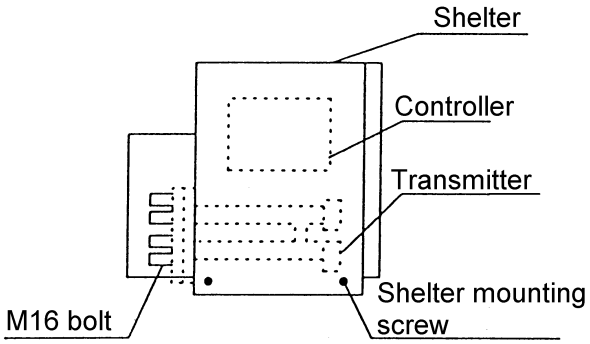
3.2 Installation

1) Preparations

① Wind a seal tape on the screw parts (R 3/4 male-screw) of the suction and exhaust nozzles.

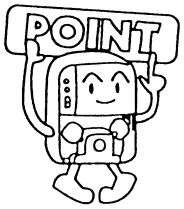


② Remove four shelter mounting screws from the Dust densitometer. Raise the shelter to remove it. Apply the burn prevention agent (mori-coat, etc.) to eight M16 bolts welded to the flange of the Dust densitometer.



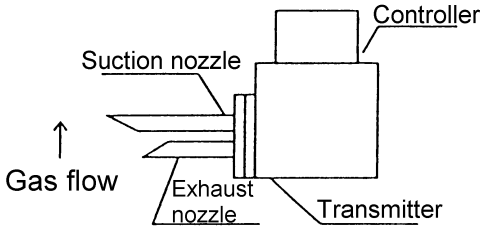
2) Procedures

① Screw the suction and exhaust nozzles into the flange.

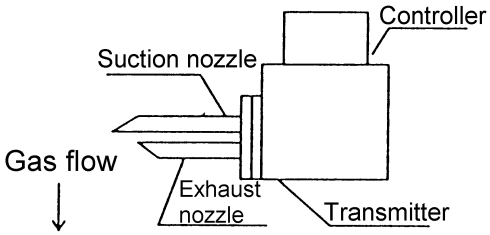


Make the opening of the suction nozzle faced toward the gas flow and the opening of the exhaust nozzle faced against the gas flow as shown in the following.

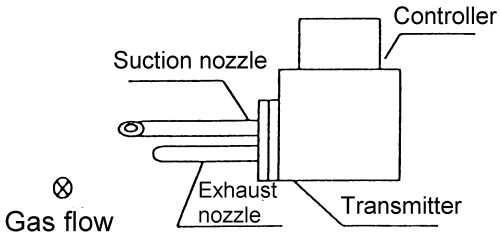
a. Gas flows from the bottom to the top.



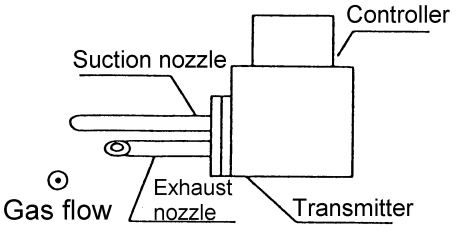
b. Gas flows from the top to the bottom.



c. Gas flow from the front side to the far side.

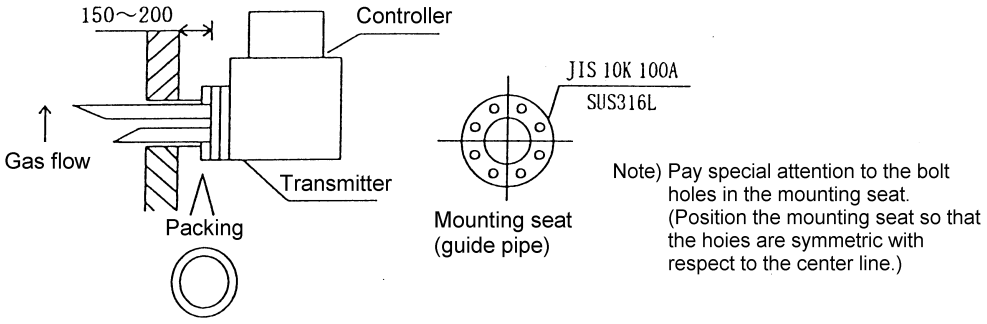


d. Gas flow from the far side to the front side.



To screw-in the suction and exhaust nozzles, first turn the nozzles manually, and then retighten them with a pipe wrench.
(If the nozzles are not retightened with a pipe wrench, the nozzle may fall down during operation.)
(If the nozzles cannot be positioned as shown in the Fig. above after the nozzles have been screwed in, adjust the positions by increasing or decreasing the seal tape winding amount.)

② Insert the M16 bolt of the Dust densitometer into the mounting seat (guide pipe), attach the M16 washer, spring washer, and hexagon nut in that order, and then tighten the nut.
(At this time, check that the suction and exhaust valves are closed fully.)



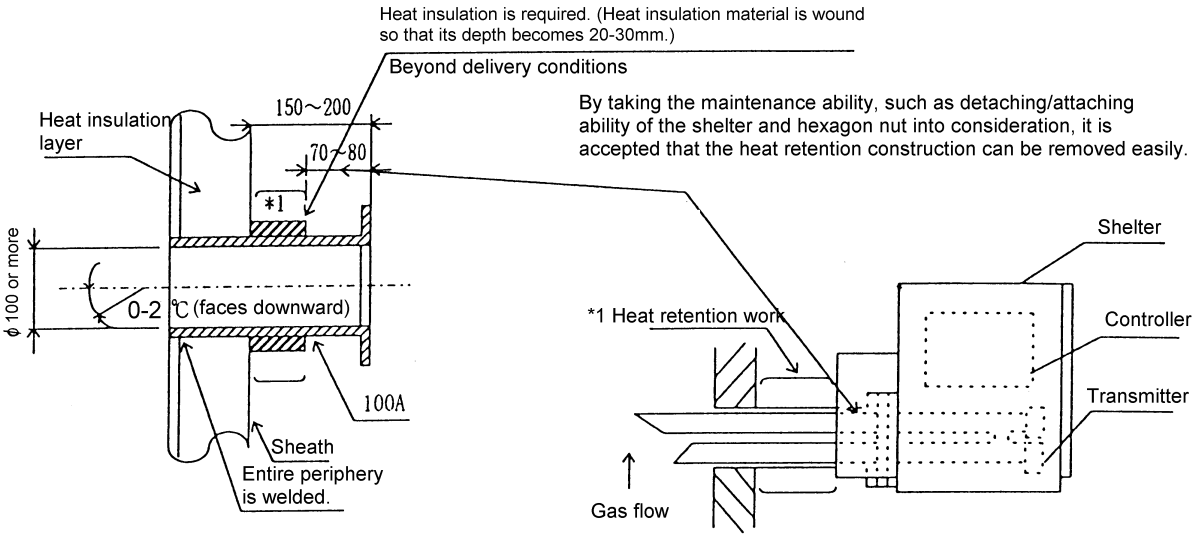
In the above assembly, always attach the flange packing (T1995-10K100RF3T).

CAUTION

Since the weight of the Dust densitometer is approximately 40 kg, always carry out the installation work by two or more personnel.

③ Carry out the heat retention work of the mounting seat (guide pipe).

Dimensions of guide pipe work (beyond delivery conditions)
(Reference)



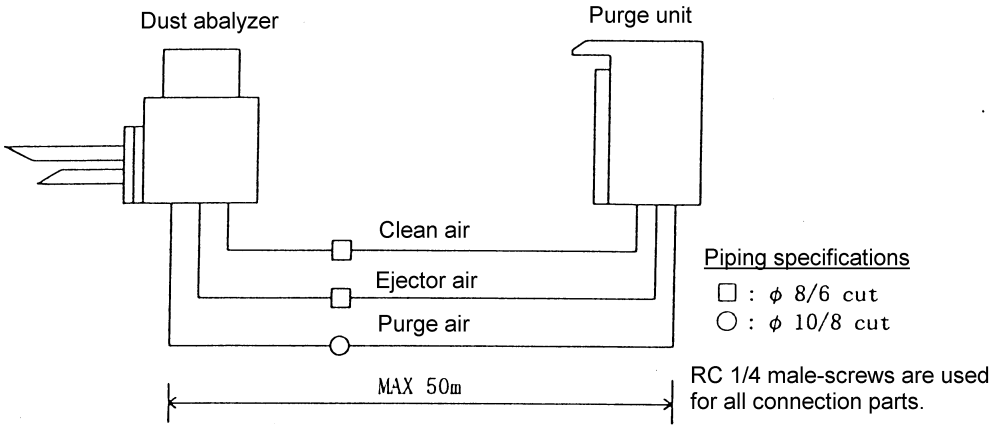
*1 Carry out the heat retention work of the guide pipe.

3.3 Piping and wiring

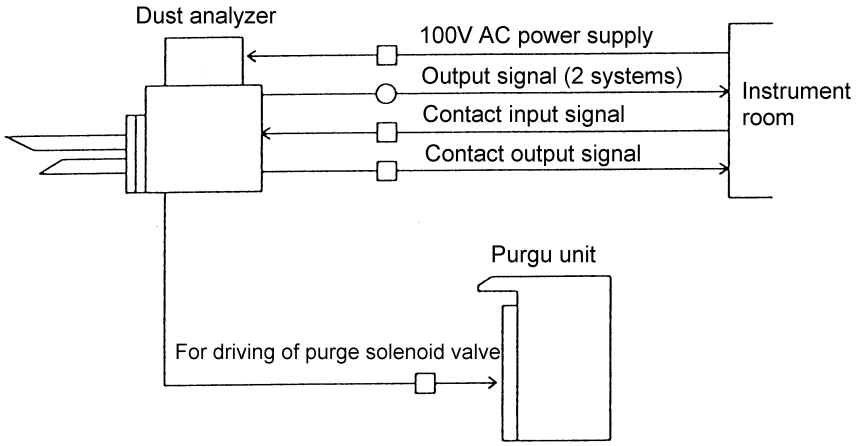
1) Piping

The air pipes are connected from the Dust densitometer to the purge unit.

The piping ports are located on the bottom surfaces of both the Dust densitometer and purge unit.



2) Wiring



Wiring materials

□ : CVV 2sq×2C

○ : CVV 2sq×2C (Signal line cables must be shielded.)

If the wiring temperature is 60°C or more, the heat-resistant wiring HCVV (-80°C) or KGB (-150°C) must be used.

The terminal blocks U, V, and E use M5 and other terminal blocks use M4.

Terminal pin assignments

The following shows the terminal pin assignments of the Dust densitometer. Always carefully connect the wires to their specified pins.

CAUTION

The wiring above the TC, TH, contact output 5, U1, V1, and purge solenoid valve drive terminal has been fixed by the manufacturer. Never touch these wiring lines.

Output signal 1 DC 4-20 mA
Output signal 2 DC 4-20 mA
O2 concentration signal input terminal DC 4-20 mA/0 – 25% O2
Thermocouple for the heat retention heater is connected.
Thermistor for cold-contact compensation of the thermocouple for the heat retention heater is connected.
Remote range contact (L range, M range, and H range) input terminals and bag filter bypass operation running contact input terminal
(These signals use the common terminal as common line and are activated by non-voltage contact inputs.)

Output 1 +	Output 2 +	O_2 +	TC +	TH +	H range	L range	COM	Contact output 1	Contact output 2	Contact output 3	Contact output 4	Contact output 5	Contact output 6

Terminal block T2

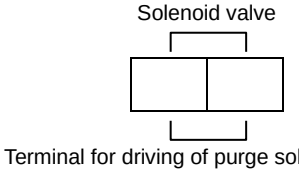
Output 1 -	Output 2 -	O_2 -	TC -	TH -	M range	Bypass	Contact output 1	Contact output 2	Contact output 3	Contact output 4	Contact output 5	Contact output 6

Select three points of the following four output modes and connect them to contact outputs 1 - 3.

① Turned ON (range echo back) when the High range is selected. (a-contact)
② Turned ON (range echo back) when the Medium range is selected. (a-contact)
③ Turned ON (range echo back) when the Low range is selected. (a-contact)
④ Turned ON when the maintenance range, manual/auto purge, bypass operation, manual calibration, semi-auto calibration, auto-zero reset, or purge/auto-zero recovery is selected. (a-contact)

Contact output 4: Turned ON when bypass operation is selected. (a-contact)
Contact output 5: Turned ON when solenoid valve for auto/manual purge is operated. (a-contact)
Contact output 6: Contact to be turned ON if the power failure or error No. E-01-16, or E-20 alarm occurs is output. (b-contact)

Contact capacity AC 250V, 5A, DC 30V, 5A

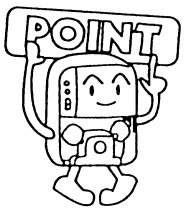


Terminal block T3

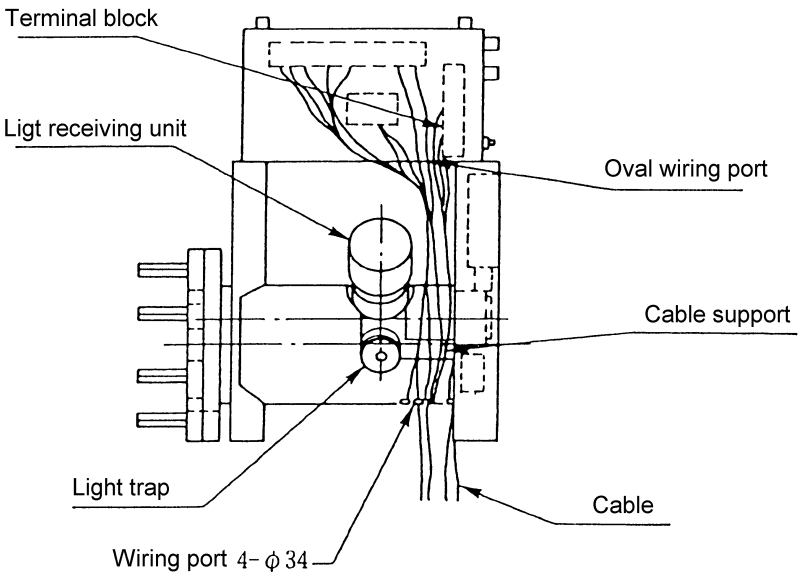
U1	Power supply terminals for driving of purge solenoid valve AC 100V
V1	
U	Power supply terminals AC 100V
V	
E	Grounding terminal

Power supply terminal block T1

Bundling of wiring cables



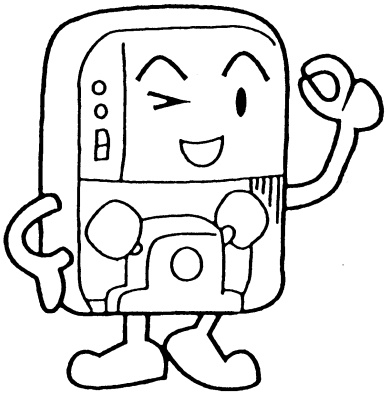
The wiring cables are inserted into the wiring ports (4-∅34) at the lower portion of the Dust densitometer.
Since the terminal blocks are located above the wiring ports, run the cables to these points.
The wiring cables are bundled and secured to the cable support and oval wiring port of the terminal block inlet using tie-bands.



Run the cables so that they do not lean against the light receiving unit and light trap.
If any cable leans against such unit, this may hinder the maintenance work of the light trap.

3.4 Inspection after installation

1) Make sure that the Dust densitometer has been installed and the heat retention work has been completed.
2) Make sure that the purge piping is ∅10/8.
3) Check the insulation resistance between each of the U and V terminals, and the E terminal with the main power 100V AC turned OFF.
   (Check using a DC500V Megger that the insulation resistance is 5 MΩ or more.)



4. Operation

CAUTION

CAUTIONS

(1) Before attaching and detaching the cap to/from the span port, always wear heat-resistant gloves since the span port is hot.

(2) If the cap is removed from the span port, the sample gas may spout out from the span port. Do not put your face close to the span port.

(3) If the cap of the span port is not tightened completely, the sample gas may leak, causing corrosion. If the cap is removed from the span port, always retighten the cap with the special tool.

(4) The span rod is very important to adjust the sensitivity. Always carefully handle the span rod so that the glass surface of the span rod is not damaged or the span rod is not fallen down.

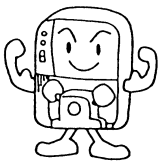
(5) Always close the suction and exhaust valves until a warm-up time of 60 min. has elapsed after the power has been turned ON.

4.1 Preparations for operation

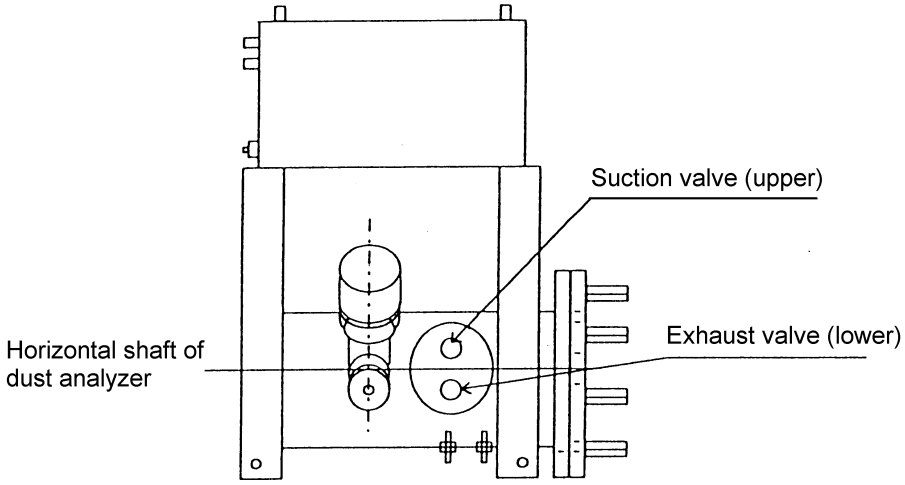
When the inspections after installation have been completed, follow the steps below to perform the preparations before operation.

1) Make sure that both the suction and exhaust valves are closed.

Operation of suction and exhaust valves — **IMPORTANT**

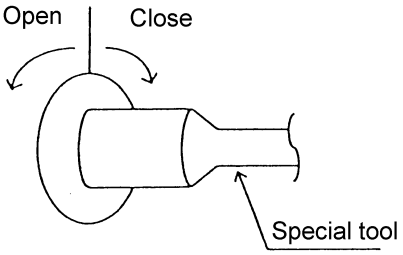


It is also accepted that only valve window on the right side of the shelter is opened (screws at four locations are removed).

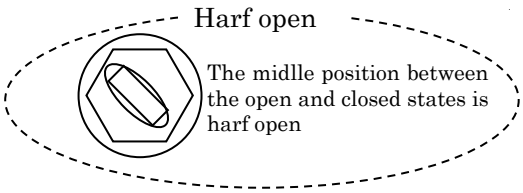


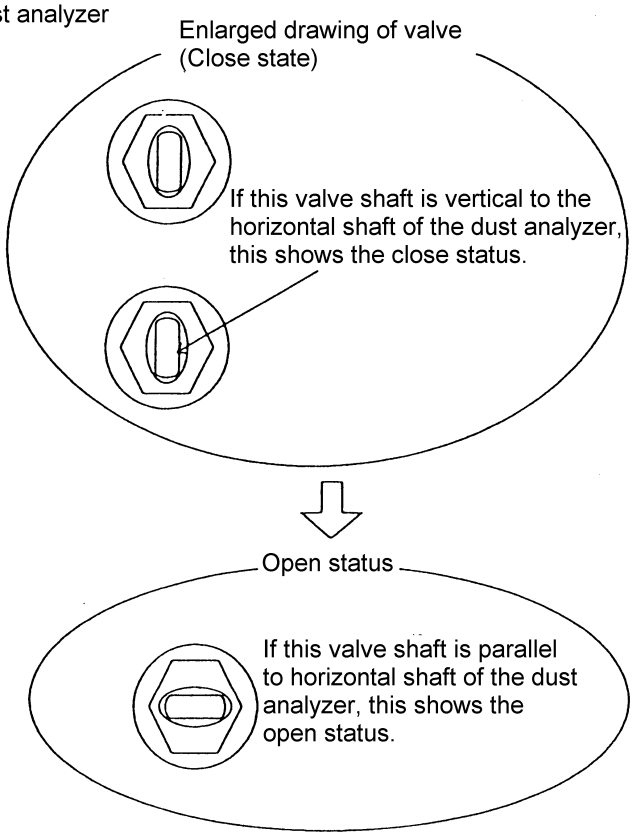
Left side view of dust analyzer

Use the special tool (T-wrench) supplied with the analyzer to open and close the valve.



It is possible to change open or close by turning the tool 1/4 rotation.

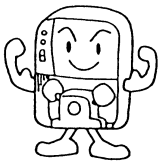


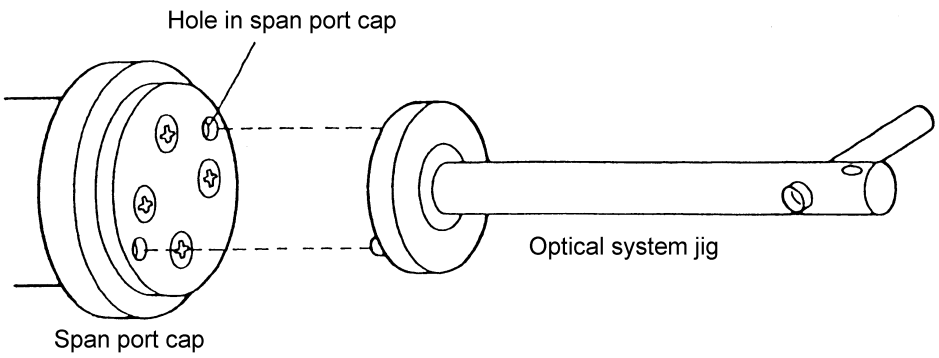


2) Detach the cap from the span port.

IMPORTANT

Attaching/detaching of cap to/from span port





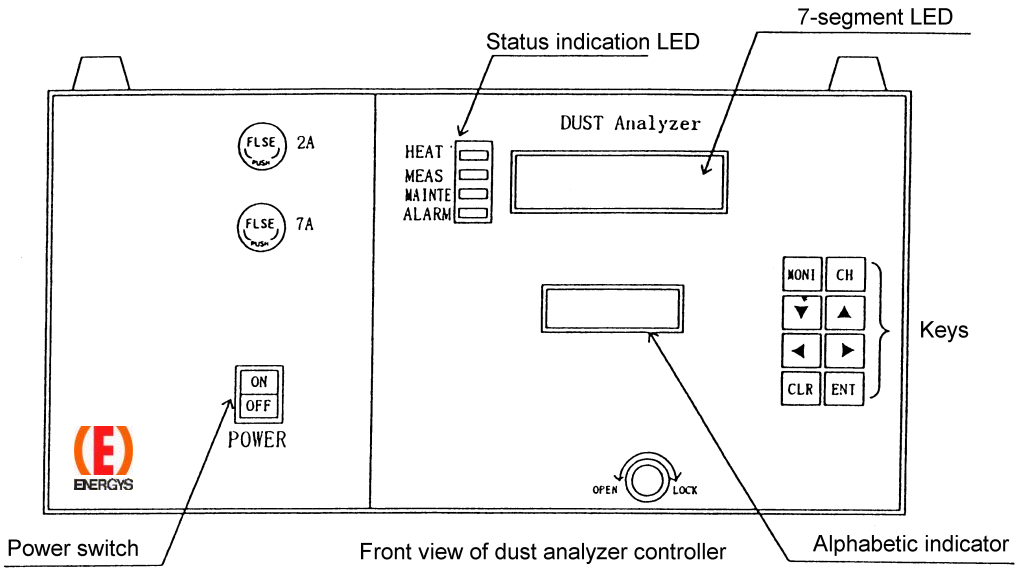
Insert the optical system jig into two holes in the span port cap. Turn the jig clockwise to tighten the span port cap while turn the jig counterclockwise to loosen it.

CAUTION

Always wear heat-resistant gloves since the span port cap is hot.

3) Open the ejector air valve (valve at the front right potion of the Dust densitometer) fully.
4) Adjust the pressure set on the pressure reducing valve with the filter (for clean air and ejector air main pressure) of the purge unit to 0.15 MPa. (To increase the purge effect, set as high pressure as possible in a range of 0.2 – 0.6 MPa.)
5) Adjust the flow meter valve so that the flow meters on the light emission and light receiving units show 8 liters/min. (8 - 9 liters/min.).
6) If the velocity of the measuring exhaust gas exceeds 5 m/sec., the ejector cannot be used. At this time, close the ejector air valve fully.

4.2 Key operation



The following describes the basic key operating procedures and the displays on the 7-segment LED and alphabetic indicator.
The operations are described assuming that the upper portion shows the 7-segment LED and lower portion shows the alphabetic indicator.

1) Turn ON the power switch to put the analyzer in the warm-up operation.

- - - - -
HT PD LD

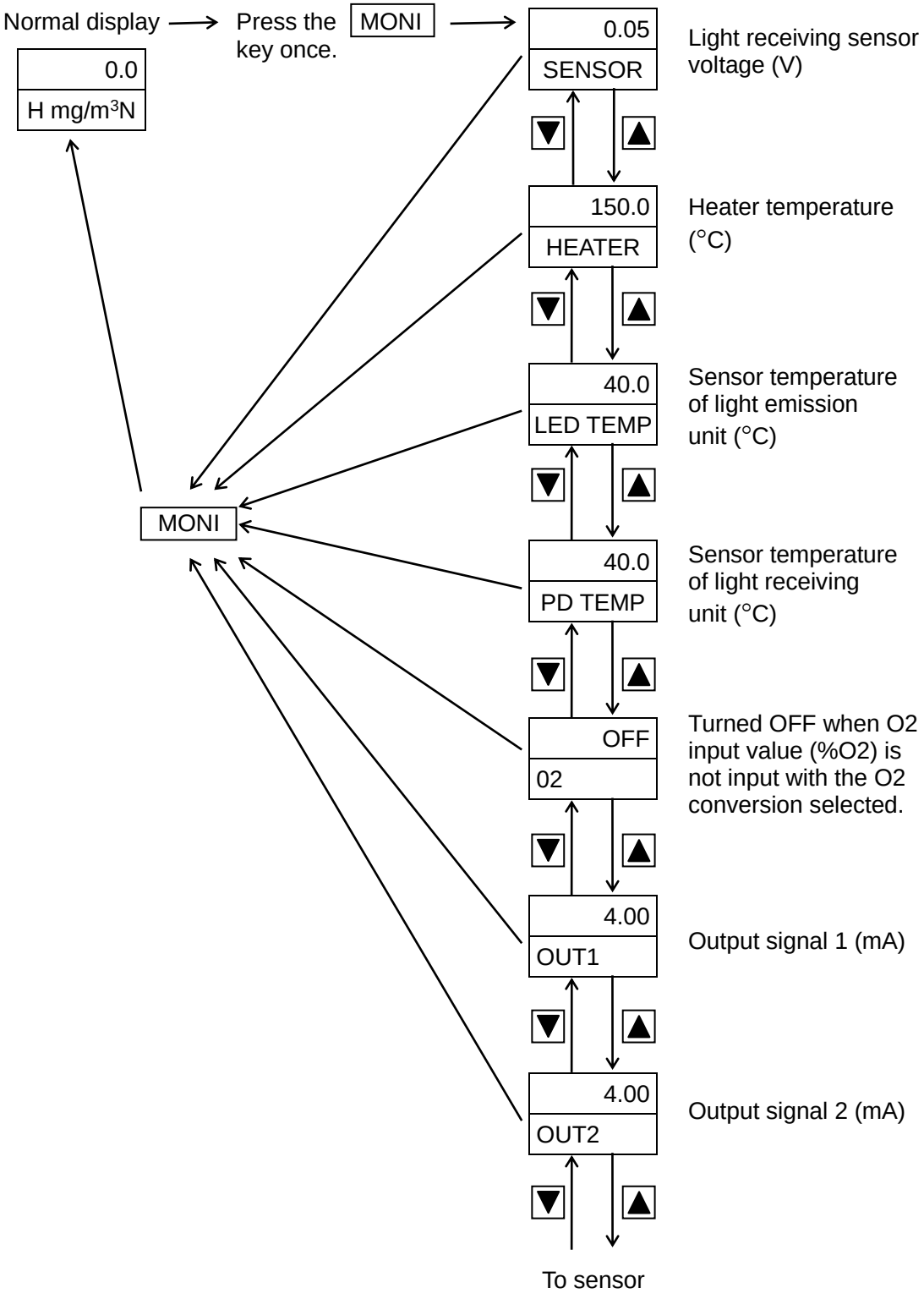
When the temperature reaches the set level, the indications HT, PD, and LD will disappear.
HT, PD, and LD show the heater, light receiving sensor, and light emission sensor, respectively.

2) When the warm-up operation is completed, the indicators show their normal displays.

0.0 ← Measured value
H mg/m^{3}N Hi range

3) Monitor operation

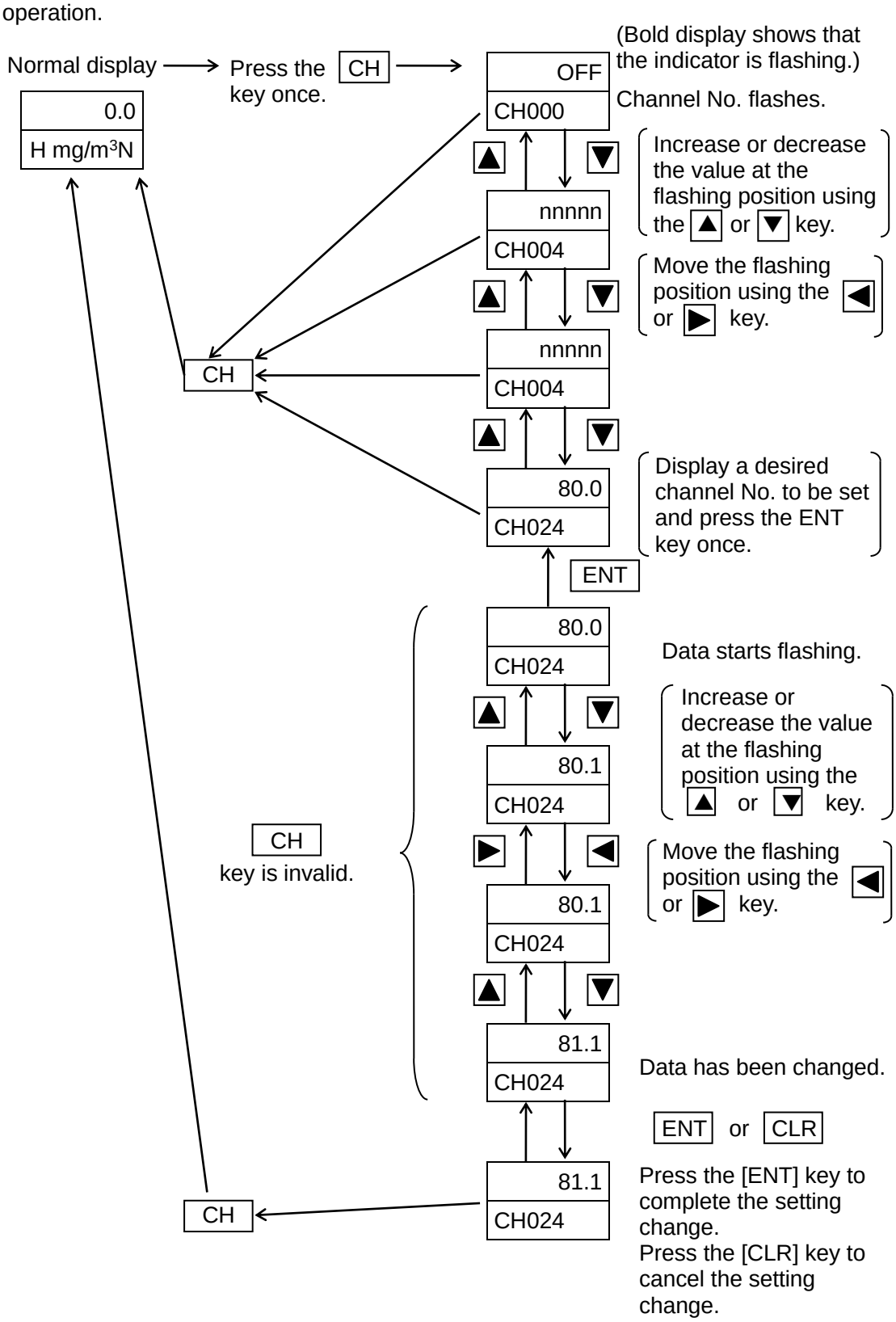
Press the [MONI] key while the normal display is shown to put the analyzer in the monitor operation.



Only the keys, [MONI] , [▼], and [▲] are valid in the above operation.

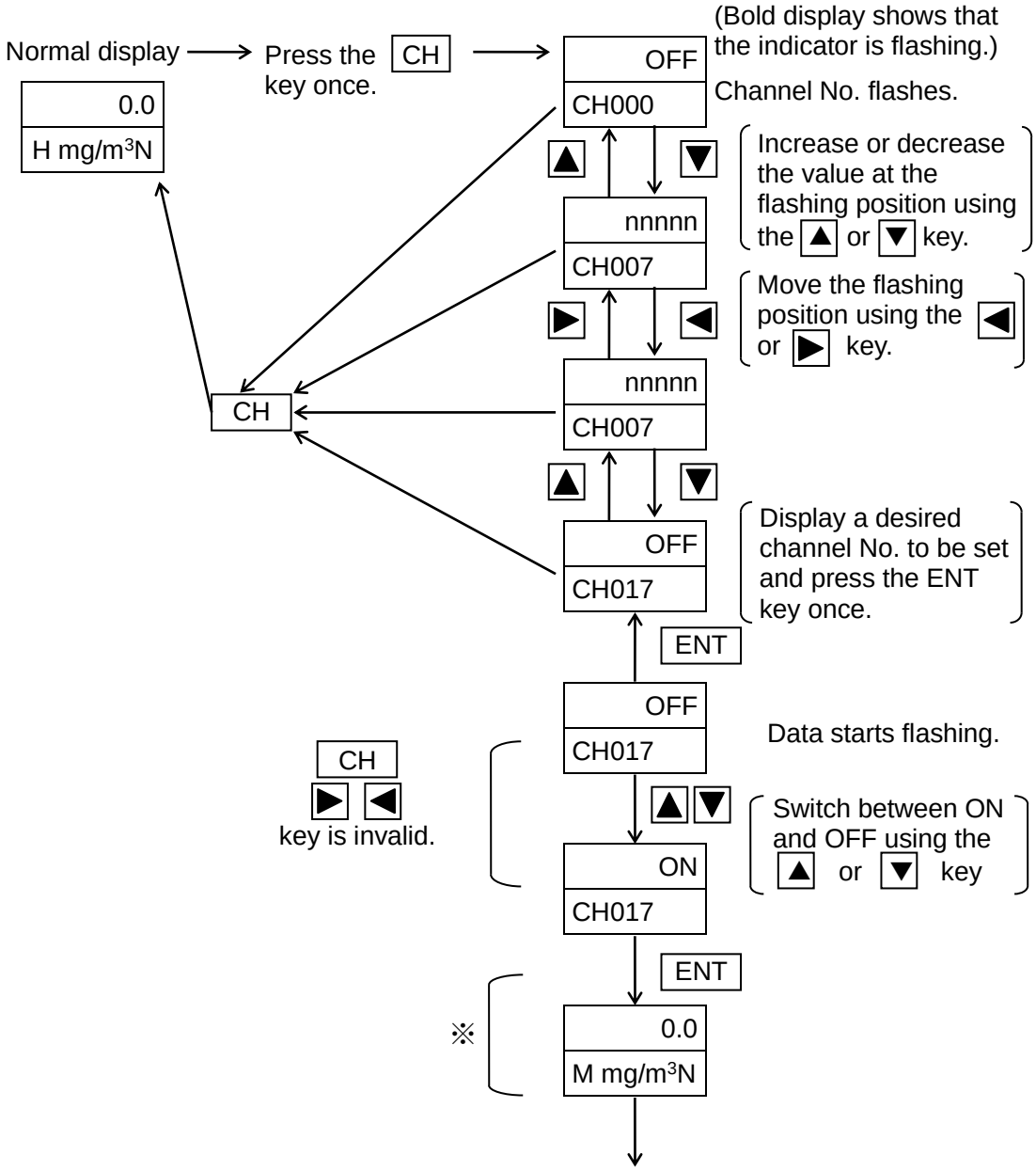
4) System data setting operation

Press the [CH] key while the normal display is shown to put the analyzer in the setting operation.



The keys, [CH], [▲], [▼], [◀], [▶], [ENT], and [CLR], are valid in the above operation.

5) System data setting operation (Data ON-OFF switching operation)

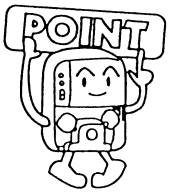


REFERENCE

※

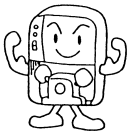
- To change the range of CH016 – 019, press the ENT key to return to the normal display. (CH000 - 003 are also included.)
- For manual start channel, such as CH026, 027, 037, and 042, press the ENT key to start.
- For ON-OFF selection setting channels other than those described above, press the ENT key to return to the channel No. flashing state.

To switch between OFF and ON, press the ▲ or ▼ key to change to a desired position after the OFF/ON is flashing, and then press the ENT key to register it.



IMPORTANT

4.3 List of functions



Item	Contents	Setting CH No.
Setting of desired measuring range	One of three measuring ranges, Low, Medium, and High, can be set. The minimum range (Low) is 0-10. The maximum range (High) is 0 – 100 mg/m^{3}N. In each range setup, set only the span side to a desired level with the zero side set at 0.	CH121-CH127
Changing of measuring range remote/local setting	Either remote or local operation can be performed.	CH120
Changing of measuring range	In the remote operation, the measuring range is changed by the contact input (changed by non-voltage contact). In the local operation, the measuring range is changed by the key operation.	CH16-19
Output signal calculation function	Two output signal systems, 4-20 mA DC, (set load resistance: 600 Ω or less, insulation output), are provided. The following settings can be made on each system individually. ・Non-conversion output, O2 conversion output, Weight conversion output, O2 and weight conversion output Moving average calculation (0 - 60 min. in steps of 1 min.) can be made on four kinds of dust concentration outputs. Additionally, the primary delay calculation function can be set commonly in two systems. (It is recommended to use the analyzer with an initial setting of 5 sec.)	CH60-63 CH68-71 CH72
O2 conversion	Dust concentration value after O2 conversion is output. (O2 concentration signal: DC 4 – 20 mA, It is necessary to supply 0-25% O2.)	CH144-146 CH74
Weight conversion	Dust concentration value after weight conversion of the manual analysis dust concentration value is output. (At this time, it is necessary to input the calculation coefficient.)	CH147 CH73
Output hold function	Output hold can be set individually on each of two output signal systems. If an alarm occurs, the output is held during maintenance. The hold value is the value immediately before the alarm occurs or the set value.	CH57-59 CH65-67
Output adjustment function	The zero and span values of the output signals of two system (4-20 mA) can be adjusted through the key operation.	CH56, 64
Calibration function	Manual calibration, semi-auto calibration, and auto zero reset functions are provided. Manual calibration: Value when the key operation is ON is taken as the calibration value. (Both zero and span calibrations) Semi-auto calibration: When the change in indication becomes the set value or less after the key operation is ON, the calibration value is taken automatically. (Both zero and span calibrations) Auto zero reset: Zero calibration and purge operation are synchronized to automatically perform the zero calibration.	CH24-27 CH40-43 CH152

Item	Contents	Setting CH No.
Dust concentration upper limit alarm	If the dust concentration upper limit value is set, the alarm is output. (The alarm is reset naturally. The alarm is output if the concentration value exceeds the upper limit for 5 sec. or longer.)	CH48, 49
Purge function	Auto or manual purge can be performed by optional synchronization. (Normally, operate the dialyzer with the auto purge.)	CH32-CH38
Purge function during bypass operation	Purge is performed while non-voltage contact is ON, which is turned ON during bypass operation of the bag filter.	CH151
Self-diagnostic function	Faulty part of the heater and light receiving/emission unit is detected automatically by the self-diagnostic function. If any fault is found, relevant error indication and alarm contact are output.	Value fixed by manufacturer
Contact input	Remote range change (three points) and bypass operation, that is, four points in total are provided. The common terminal is common to all points. The contact is activated when the contact (ON) is input.	Fixed by hardware
Contact output	Three points of four points (range echo back x 3 and maintenance) are connected to the contact output terminal blocks 1 - 3. Contact outputs 4 - 6 are output for bypass operation, purge solenoid valve, and alarm. (Contact outputs 4 - 6 are fixed.)	CH136-138

To set CH95 and later, it is necessary to operate the switch on the circuit board (turn ON S1-1).

4.4.1 List of system data (user data)

CH No.	Contents	Initial value	Data setting range	Remarks
000	Non-dust concentration conversion display	OFF	OFF/ON	Displayed by ON-ENT, a dust concentration value display change switch for the 7-segment LED. The data setting is valid only when the O2-weight conversion is selected.
001	Dust concentration O2 conversion display	OFF	OFF/ON	
002	Dust concentration weight conversion display	OFF	OFF/ON	
003	Dust concentration O2/weight conversion	OFF	OFF/ON	
016	High range selection	ON	OFF/ON	Local range change switch
017	Medium range selection	OFF	OFF/ON	
018	Low range selection	OFF	OFF/ON	
019	Maintenance range selection	OFF	OFF/ON	
024	Span calibration value	100.0	1.0 – 1000	
025	Calibration mode selection	0	0/1	0: Manual calibration 1: Semi-auto calibration
026	Zero calibration start	OFF	OFF/ON	
027	Span calibration start	OFF	OFF/ON	
032	Purge mode selection	1	0/1	0: Manual purge 1: Auto purge
033	Auto purge interval	01-00	00-01 – 99-23	** day - ** hr.
034	Purge solenoid valve ON time	10	1 – 99	Sec.
035	Purge solenoid valve OFF time	10	1 – 99	Sec.
036	Purge cycle (ON-OFF repetition)	3	1 – 99	Cycles
037	Manual purge start	OFF	OFF/ON	
038	Purge recovery time	1	1 – 99	Min.
040	Auto zero reset interval	3	1 – 99	Auto purge interval (cycle)/Auto zero reset interval
041	Auto zero reset time	3	1 – 99	Min.
042	Auto zero reset start	OFF	OFF/ON	
043	Auto zero reset recovery time	1	1 – 99	Min.
048	Dust concentration upper limit alarm selection	OFF	OFF/ON	
049	Dust concentration upper limit value	100	1 – 1000	
056	Output 1 adjustment	OFF	OFF/SPAN/ZERO	
057	Output 1 hold mode selection	0	0/1/2/3	0: No hold 1: Maintenance 2: Alarm occurs. 3: 1 + 2

CH No.	Contents	Initial value	Data setting range	Remarks
058	Output 1 hold signal selection	0	0/1	0: Previous value is held. 1: Set value is held.
059	Output 1 hold set value	0.0	0.0 – 100.0	mg
060	Output 1 O2 conversion output	OFF	OFF/ON	
061	Output 1 weight conversion output	OFF	OFF/ON	
062	Output 1 moving average selection	OFF	OFF/ON	
063	Output 1 moving average time	0	0 – 60	Min.
064	Output 2 adjustment	OFF	OFF/SPAN/ZERO	
065	Output 2 hold mode selection	0	0/1/2/3	0: No hold 1: Maintenance 2: Alarm occurs. 3: 1 + 2
066	Output 2 hold signal selection	0	0/1	0: Previous value is held. 1: Set value is held.
067	Output 2 hold set value	0.0	0.0 – 100.0	
068	Output 2 O2 conversion output	OFF	OFF/ON	
069	Output 2 weight conversion output	OFF	OFF/ON	
070	Output 2 moving average selection	OFF	OFF/ON	
071	Output 2 moving average time	0	0 – 60	
072	Primary delay calculation time constant	5	0 – 60	Sec.
073	Weight conversion coefficient	1.00	0.10 – 100.0	
074	Standard O2 concentration compensation value	10.0	0.0 – 25.0	%O2

CH004 – 015, 020 – 023, 028 – 031, 039, 044 – 047, 050 - 055, 075 – 095 are not used.

4.4.2 List of system data (manufacturer data)

To change the setting, it is necessary to operate the switch on the circuit board (turn ON S1-1).

CH No.	Contents	Initial value	Data setting range	Remarks
096	Manufacturer data	150	—	Do not change this value.
097	Manufacturer data	0.1	—	Do not change this value.
098	Manufacturer data	0	—	Do not change this value.
099	Manufacturer data	0	—	Do not change this value.
100	Manufacturer data	OFF	—	Do not change this value.
104	Manufacturer data	40.0	—	Do not change this value.
105	Manufacturer data	0.0	—	Do not change this value.
106	Manufacturer data	0	—	Do not change this value.
107	Manufacturer data	0	—	Do not change this value.
112	Manufacturer data	40.0	—	Do not change this value.
113	Manufacturer data	0.0	—	Do not change this value.
114	Manufacturer data	0	—	Do not change this value.
115	Manufacturer data	0	—	Do not change this value.
120	Range change mode	0	0/1	0: Field key operation 1: Remote contact input
121	High range zero point	0	—	Do not change this value.
122	High range span point	100	10 – 100	Set a value in a range of 10 – 100.
123	Medium zero point	0	—	Do not change this value.
124	Medium span point	25	10 – 100	Set a value in a range of 10 – 100.
125	Low range zero point	0	—	Do not change this value.
126	Low range span point	10	10 – 100	Set a value in a range of 10 – 100.
127	Maintenance range	0	0/1/2	0: H range, 1: M range. 2: L range
128	Temperature rise time	90	—	Min.
129	Heater temperature lower limit	80	—	°C
130	Heater temperature upper limit	230	—	°C
131	LED temperature lower limit	20.0	—	°C
132	LED temperature upper limit	70.0	—	°C
133	Optical sensor temperature lower limit	20.0	—	°C
134	Optical sensor temperature upper limit	70.0	—	°C
CH No.	Contents	Initial value	Data setting range	Remarks

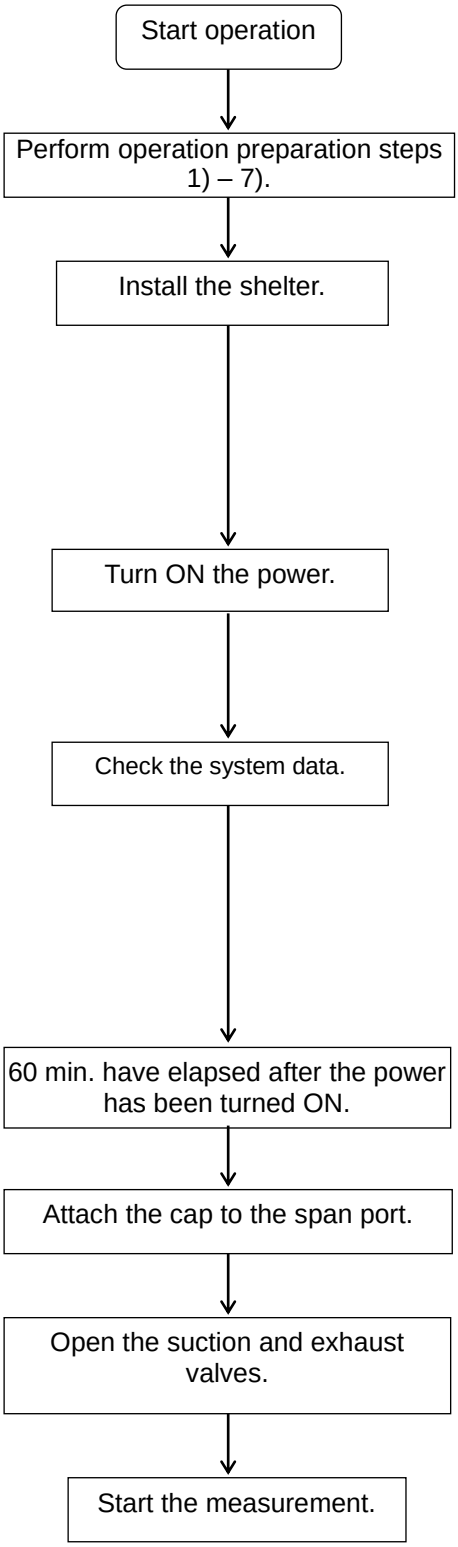
135	Allowable deviation value from previous zero calibration value	10.0	—	mg
136	Contact output 1 selection	0	0/1/2/3/4	0: Not used. 1: H range echo back 2: M range echo back 3: L range echo back 4: ON during maintenance
137	Contact output 2 selection	0	Same as above	Same as above
138	Contact output 3 selection	0	Same as above	Same as above
144	O2 conversion selection	OFF	OFF/ON	
145	O2 input zero point	0	—	Do not change this value.
146	O2 input span point	25	—	Do not change this value.
147	Weight conversion selection	OFF	OFF/ON	
148	Warning output setting	0	0～7	The details see below.
149	Manufacturer data	ON	—	Do not change this value.
150	Manufacturer data	ON	—	
151	Purge function selection during bypass operation	OFF	OFF/ON	
152	Auto zero reset function selection	OFF	OFF/ON	
153	Manufacturer data	2	—	Do not change this value.
154	Manufacturer data	1.00	—	Do not change this value.
155	Semi-auto zero calibration stable range	1.0	—	mg
156	Semi-auto span calibration stable range	5.0	—	mg
157	Semi-auto calibration limit time	10	—	Min.
158	Light receiving sensor voltage at previous zero calibration	—	—	Do not change this value.
159	Light receiving sensor voltage at previous span calibration	—	—	Do not change this value.
160	Manufacturer data	ON	—	Do not change this value.
161	Manufacturer data	ON	—	Do not change this value.
162	Manufacturer data	ON	—	Do not change this value.
168 or later	Hardware calibration value	—	—	Do not change this value.

CH101 – 103, 108 – 111, 116 – 119, 139 – 143, 148, 163 – 167, 174, 175, 182 – 183, 188 - 191 are not used.

Setting of the warning point of contact output by CH148 value

CH148 value	0	1	2	3	4	5	6	7
E-17	×	○	×	○	×	○	×	○
E-18	×	×	○	○	×	×	○	○
E-19	×	×	×	×	○	○	○	○

4.5 Starting operation



Put the shelter from the top and tighten the mounting screws at four locations.
Open the valve window on the right side of the shelter. (Remove four screws.)
Open the front door of the shelter. (Padlock is provided at two locations.)

When the power switch is turned ON, the temperature of the heater in the Dust densitometer starts rising. (It takes approximately 60 min. to complete the warm-up operation.)

Always check the data during trial operation.

Recheck the list of functions stated in section 4.3.
Check that desired functions are set correctly using the list of system data stated in section 4.4.

See section 4.2, key operation.

Return the display to the normal display.

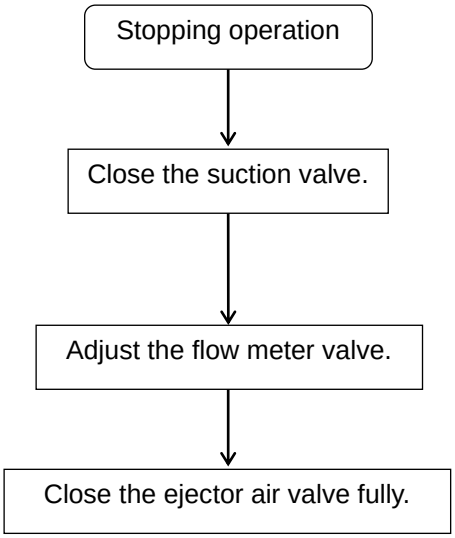
0.0
H mg/m^{3}N

Tighten the cap firmly with the special tool (optical system jig).

Open the valves with the special tool (T-wrench).
Mount the valve window on the right side of the shelter.

Change the measuring range to a desired range.

4.6 Stopping operation



Close the suction valve firmly with the special tool (T-wrench).
Keep the exhaust valve open.

Adjust the flow meter valve so that the flow meters of the light emission and light receiving units show 8 liters/min. (8 - 9 liters/min.).

Close the ejector air valve fully.

The stopping operation is then completed.

When the furnace is stopped for an extended period of time (one month or longer), carry out the following steps.

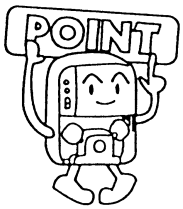
① lose the main valve for the instrument air to be supplied to the purge unit.
② lose both the suction and exhaust valves.
③ urn OFF the power switch.

4.7 Operation while analyzer is running

The following shows the operations to be carried out while the Dust densitometer is running.

－1 Measuring range change operation
－2 Calibration operation (manual calibration, semi-auto calibration, and auto-zero reset)
－3 Purge and bypass operation
－4 O2 and weight conversion operation
－5 Output signal calculation, hold, and output adjustment

4.7.1 Measuring range change operation



To change the measuring range, either remote (remote operation) or local (field operation) can be selected. The operation is set by setting the data, that is, CH120 is set at “1” (remote) or “0” (local).

① Changing of remote (remote operation) range

	H range	L range	COM	
	M range	Bypass		

Terminal block

- It is necessary to connect the wires to the H range, M range, L range, and COM terminals on the terminal block.
- The COM terminal is used as common line. The operation is performed by the contact (ON) input.
- Non-voltage contact is used and the contact is turned ON when the resistance is approximately 2 kΩ or less.
- If all range change inputs are ON or OFF at the same time, the Hi range is then selected.

② Changing of local (field operation) range
Only one data is selected from the system data CH016 - 019.
With key operation, a range, which is set at ON, is selected.

	Display on alphabetic indicator
CH016→High range	H mg/m^{3}N
CH017→Medium range	M mg/m^{3}N
CH018→Low range	L mg/m^{3}N
CH019→Maintenance range	Mainte

For details, see section 4.2, Key operation.

4.7.2 Calibration operation

[Zero calibration]

This operation is performed to compensate for drift of the zero level toward the positive side caused by dust sticking to the trap part or part close to the optical system.
It is possible to perform the manual, semi-auto, or auto zero reset.

[Span calibration]

This operation is performed to compensate for changes in sensitivity caused by dust sticking to the window or part close to the optical system.
It is possible to perform this calibration in the manual or semi-auto mode.

[Manual calibration]

Closing of the suction and harf open exhaust valves, and attaching of the standard scattering sample are performed manually.
After the indication value has become stable, turn ON the ZERO/SPAN CALIBRATION START key to load the currently measured value as calibration value.

[Semi-auto calibration]

It is necessary to manually close the suction and harf open exhaust valves, and to attach the standard scattering sample in the same manner as described for above step, Manual calibration.
When turning ON the ZERO/SPAN CALIBRATION START key, the measured value is automatically read as calibration value when the change in indication becomes the set value or less within a specified period of time.

[Auto-zero reset]

The zero calibration is performed automatically by synchronizing the zero calibration with the purge operation.
It is not necessary to close the suction and exhaust valves.
There are two kinds of zero rest methods, one is auto zero reset with key operation (purging is started automatically) and the other is that the auto-zero reset is performed by synchronizing with the auto purge cycle.
In either case, when the set period of auto zero reset time has elapsed, the value measured at that point is taken as calibration value.

① Manual zero calibration

・ Positive pressure exists inside the furnace.

Fully close the ejector air valve.

↓

Fully close the suction valve and harf open exhaust valve.

↓

Detach the cap from the span port and wait for 2 - 3 min.

↓

Fully close the flow meters on the light emission and light receiving units.

↓

Attach the cap to the span port. (Always use the special tool.)

・ Negative pressure exists inside the furnace.

Fully close the ejector air valve.

↓

Fully close only the suction valve.

(Keep the exhaust valve open.)

↓

Check that the flow meters on the light emission and light receiving units show 8 liters/min.

↓

Wait until the indication becomes stable.

If the indication value is 0.0 mg/m^{3}N after the indication value has become stable, the calibration is not needed.
If the indication value deviates, follow the steps below to perform the calibration.
Set CH025 (calibration mode) to 0 (manual calibration).

Display CH026.

↓

Change the setting to ON using the ▲ or ▼ key.

↓

Press the ENT key.

↓

When manual calibration is completed, the display returns to the normal display.

↓

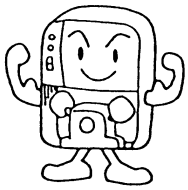
To manual span calibration.

OFF
CHO26
ON
CHO26
0.0
CAL ZERO
0.0
H mg/m^{3}N

The message, “CAL ZERO”, is displayed for approximately 1 sec. after the ENT key is pressed. After that, the display returns to the normal display.

② Manual span calibration

IMPORTANT



The span calibration is performed using the span rod having the same manufacture No. as that of the Dust densitometer.
If the calibration is performed using the span rod having the different No., this may cause an error. Never perform the calibration using the span rod having the different No.
Always carefully store the span rod.

Manual zero calibration is completed.
(Span calibration is started immediately after the zero calibration.)

↓

Detach the cap from the span port.

↓

Insert the span rod into the span port.

Insert the span rod with the groove on the span port matched with the span rod positioning mark.

↓

Tighten the cap.

Manually tighten the cap clockwise so that it does not become loose.

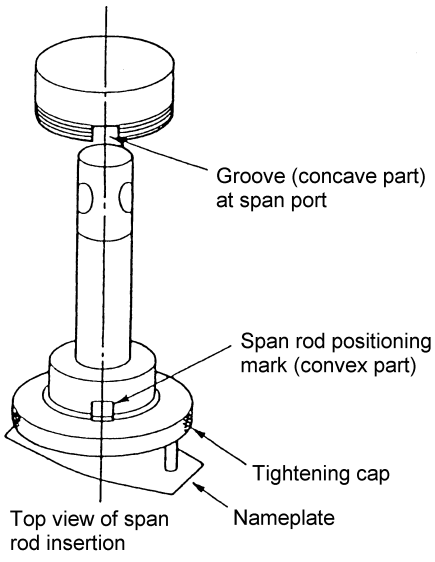
↓

Wait until the indication becomes stable.

After the span rod has been inserted, the indication value may change rapidly and the range-over or error E-04 may occur, but this is not a problem.

The indication becomes stable 90% or more within a few minutes. However, it takes about one hour to determine the final indication.

If there is a large difference between the span value on the span rod and indication value (±5% F.S or more) after the indication value has become stable, follow the steps below to perform the calibration.



Display CH024.

80.0
CHO24

↓

Check that the span value shown on the span rod is input.

If incorrect value is input, change the system data setting.

↓

Display CH027.

OFF
CHO27

↓

Change the setting to ON using the ▲ or ▼ key.

ON
CHO27

↓

Press the ENT key.

80.0
CAL SPAN

The message, “CAL SPAN”, is displayed for approximately 1 sec. after pressing the ENT key, and then the display returns to the normal display.

↓

When manual span calibration is completed, the display returns to the normal display.

80.0
H mg/m^{3}N

↓

Loosen the span rod tightening cap.

Turn the tightening cap counterclockwise.
At this time, never turn the nameplate on the span rod.

CAUTION

- Remove the span rod slowly (so that the span rod is not damaged).
- Since the span rod is hot, carefully handle it and return it to the storage bag immediately.

↓

Remove the span rod.

↓

Attach the cap to the span port.

(At this time, always use the special tool.)

↓

Adjust the flow rate on the flow meters of the light emission and light receiving units to 8 liters/min.

↓

Open the suction and exhaust valves.

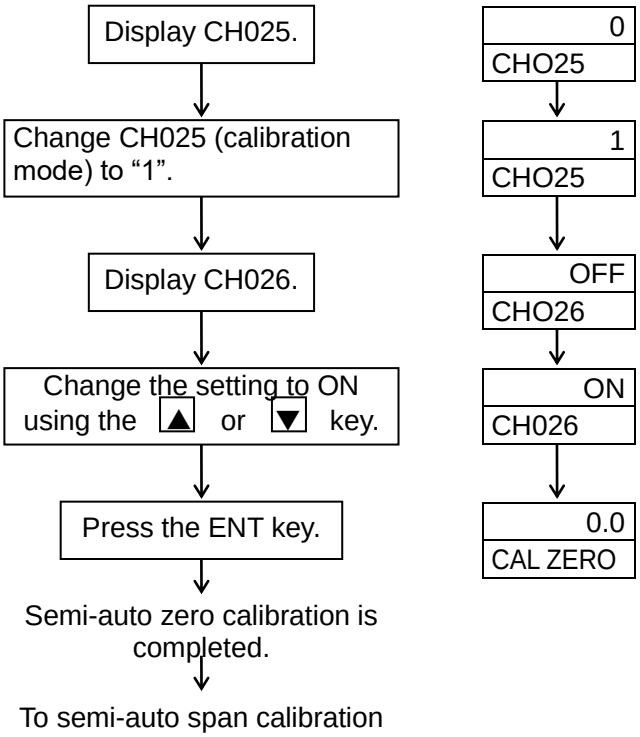
↓

Return the ejector valve to its previous position.

The manual zero span calibration is then completed.

③ Semi-auto zero calibration

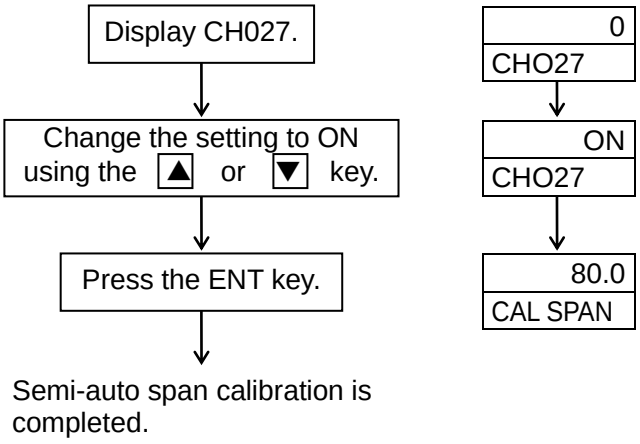
Perform the same operation steps from Fully open the ejector air valve to Wait until the indication becomes stable. as described for manual zero calibration



After the ENT key is pressed, the averaged value is taken at intervals of approximately 1 min.
When the indication value becomes stable, the measured value is taken as calibration value.

④ Semi-auto span calibration

Perform the same operation steps from Insert the span rod. to Wait until the indication becomes stable. and Check the span value. as described for manual span calibration.



After the ENT key is pressed, the averaged value is taken at intervals of approximately 1 min. When the indication value is stable, the averaged value is taken as calibration value.

Perform the same operation steps from Remove the span rod. to Return the ejector valve to its previous position. as described for manual calibration.

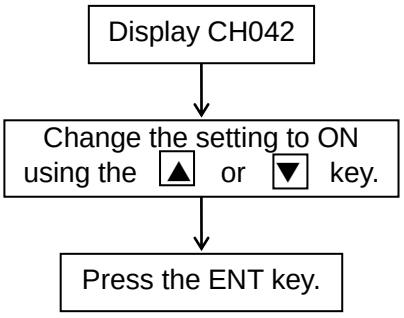
The semi-auto zero-span calibration is completed.

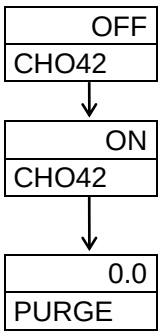
Note) When starting the span calibration (CH027) in the zero state or the zero calibration (CH026) in the span state, the calibration error (E-18 or E-19) occurs when starting the next calibration.
At this time, change the calibration mode selection (CH025) to manual (0) and perform the manual zero-span calibration (P4-19-21).

⑤ Auto zero reset

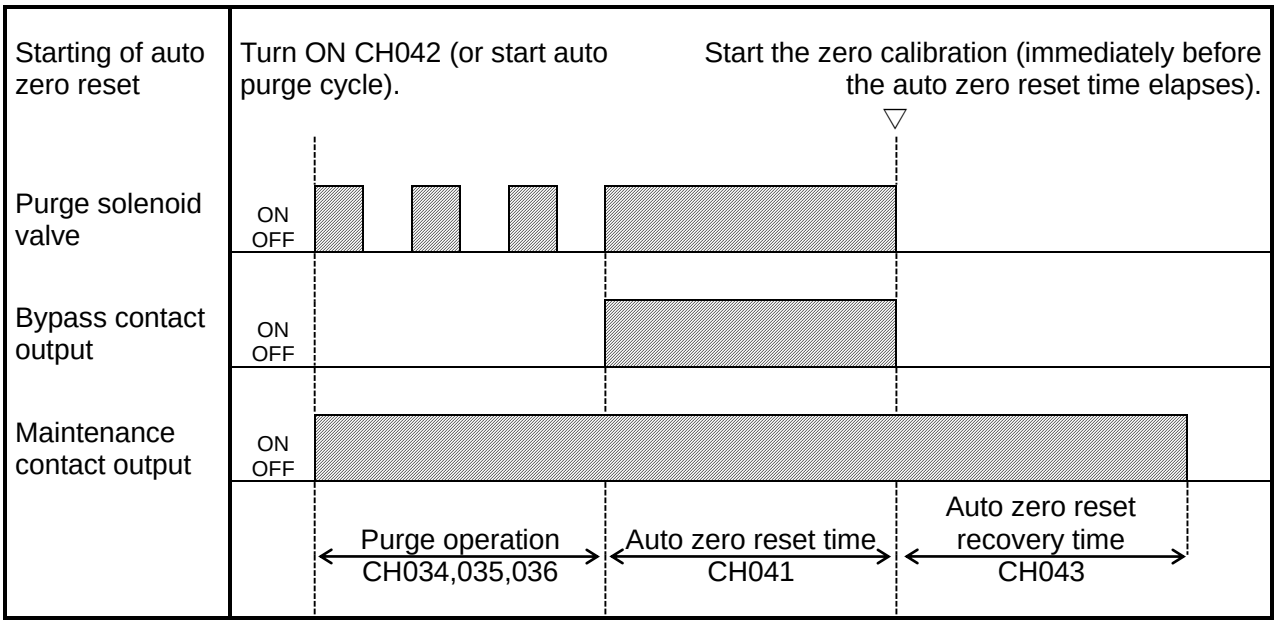
To use the auto zero reset function, it is necessary to change the CH152 setting to ON.

1) Starting of auto zero reset using key operation





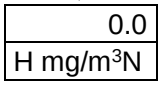
(The message, “PURGE”, is displayed on the alphabetic indicator until the recovery time elapses.)



Auto zero reset time chart

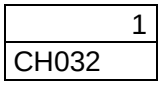
After auto reset recovery time has elapsed.

Normal display



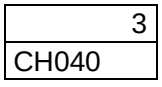
2) Auto zero reset by synchronizing with the auto purge cycle

Display CH032.



Check that the auto purge is selected.

Display CH040.

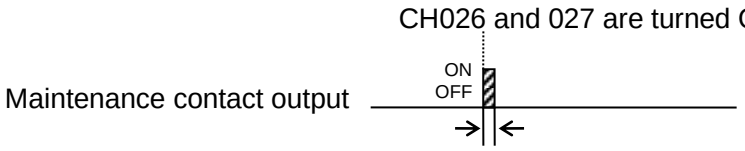


Check the auto zero reset cycle.

Example When the auto zero reset cycle is set at “3”, this means that the auto zero reset is performed once every 3 days (3 cycles) when the auto purge cycle is set at “1 day”. The auto zero reset operation is performed in the same manner as described in the above time chart.
After the system data, such as CH040 - 043 has been changed, reset the power to the analyzer.

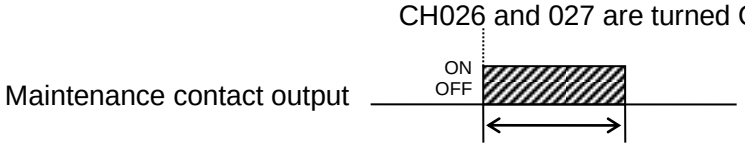
3) Maintenance contact output during calibration

Time chart of maintenance contact output during manual calibration



Contact output is turned ON only for approximately 1 sec. after CH026 and 027 are turned ON.

Time chart of maintenance contact output during semi-auto calibration

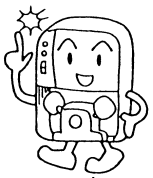


Contact output is turned ON only for approximately 1 min. – 10 min. (this period may vary depending on the stable time) after CH026 and 027 are turned ON until the calibration value is taken.

Time chart of maintenance contact output during auto zero reset

See the time chart of the auto zero reset on the previous page.
(Contact output is turned ON between purge operation and completion of auto zero reset recovery time.)

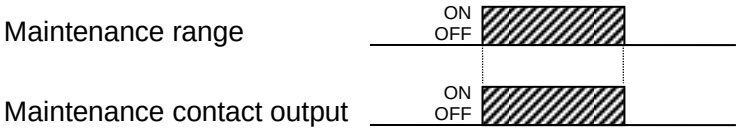
REFERENCE



During manual/semi-auto calibration

When starting the calibration operation after the maintenance range has been selected (CH019 is turned ON), the maintenance contact is turned ON while the maintenance range is ON.

Time chart of maintenance range and contact output



The message, “Mainte”, is displayed on the alphabetic indicator.

4.7.3 Purge and bypass operation

[Purge]

The purge operation is intended to periodically open or close the solenoid valve for a specified period of time and introduce a large amount of air to the suction and exhaust sides in order to prevent blocking of the sample gas dust.

[Manual purge]

With key operation, the MANUAL PURGE START switch is turned ON to start the manual purge.

[Auto purge]

The purge operation is performed at specified intervals after this system has been started.

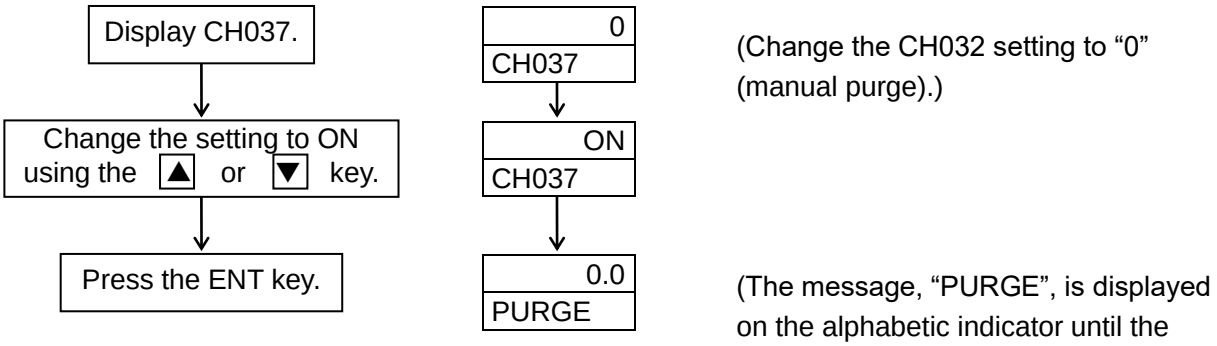
[Purge during bypass operation]

The purge operation is performed by non-voltage contact signal, which is turned ON during bypass operation of the bag filter.

- It is necessary to perform the piping and wiring between the Dust densitometer and purge unit.
- The contents of both manual and auto system data settings are performed for a period of time, which is common to both settings.

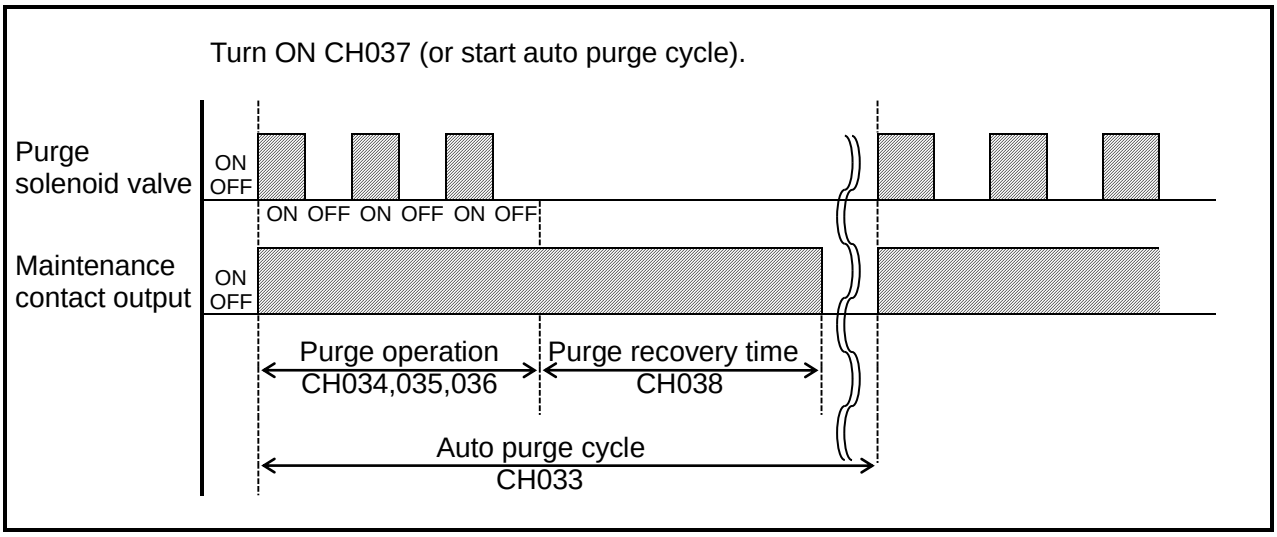
  CH034 Purge solenoid valve ON (open) time (sec.)
  CH035 Purge solenoid valve OFF (close) time (sec.)
  CH036 Number of purge cycles (ON-OFF is determined as one cycle.)
  CH038 Purge recovery time (min.)

① Manual purge



(Change the CH032 setting to “0” (manual purge).)

(The message, “PURGE”, is displayed on the alphabetic indicator until the recovery time elapses.)



Time chart of manual/auto purge

After the purge recovery time elapses.

↓

Display returns to the normal display.

↓

0.0
H mg/m^{3}N

② Auto purge

Display CH032.

↓

Reset the power.

1
CH032

Check that CH032 is set at “1”.

The purge operation is started after the period of time set in CH033 (auto purge cycle) has elapsed after starting up the system. The auto purge operation is the same as that shown in the above time chart.

After the system data, such as CH032 - 038 has been changed, reset the power to the analyzer.

The auto purge cycle data of CH033 is displayed in the format like 01day – 00hr.

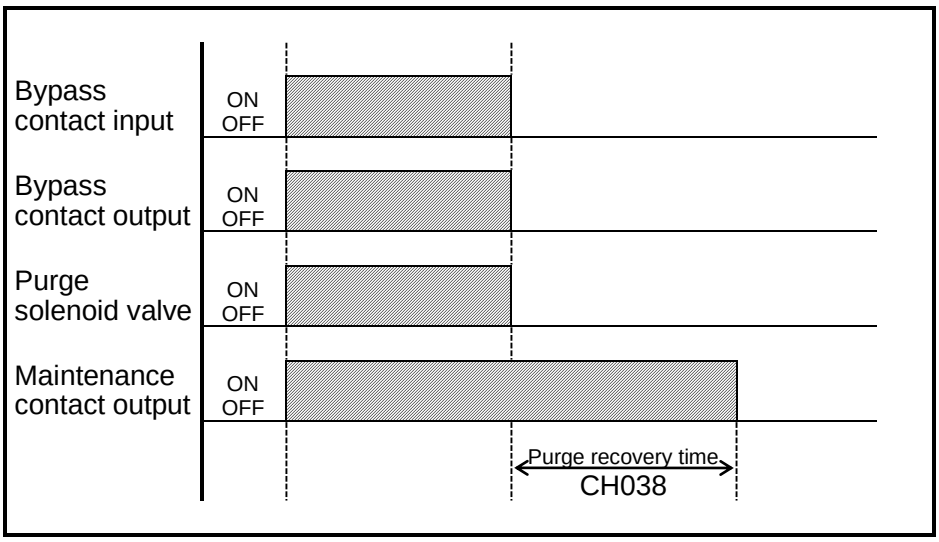
The minimum data is 00 day-01 hr. while the maximum data is 99 day- 23 hr.

To set the data to a value less than 01 day-00 hr., lower the first digit of the hour data like 00 day-23 hr. using the ▼ key.

③ Purge during bypass operation

To start the purge operation during bypass operation, it is necessary to set the CH151 setting to ON.

The purge operation is started by the contact input.



Time chart of bypass operation

The purge solenoid valve is turned ON (opened) between turning ON and OFF of the bypass contact input.

The message, BYPASS, is displayed on the alphabetic indicator.

The message, PURGE, is displayed on the alphabetic indicator during purge recovery time.

4.7.4 O2 conversion/weight conversion operation

[O2 conversion]

The dust concentration value is output after the data has been converted based on the following formula.

Dust concentration after conversion of O2 concentration (mg/m^{3}N)

$$C = \frac{21 - On}{21 - Os} \times Cs$$

Cs: Concentration of measuring dust (mg/m^{3}N)

Os: Concentration of oxygen in exhaust gas (%O2) (O2 concentration input signal)

On: Standard oxygen concentration compensation value (%O2)

① O2 conversion

To use the O2 conversion function, it is necessary to change the CH144 setting to ON.

Connect the O2 concentration input signals, DC4-20 mA/0-25% O2, to the O2+ and O2- terminals on the terminal block.

Set the standard oxygen concentration compensation value (%O2) in CH074.

To display the O2 conversion value, set CH001 to ON.

To display the O2 conversion on output-1 and output-2, set CH060 and CH068 to ON.

[Weight conversion]

The scale determined by Energy Support corp. with the standard grain size is put on the Dust densitometer.

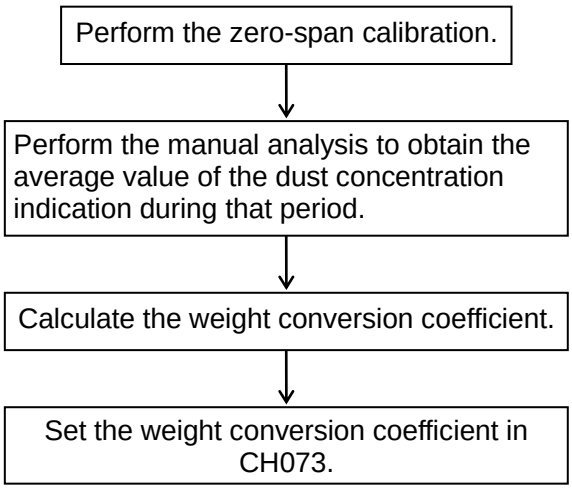
When measuring the dust actually, a difference between the indication value on this Dust densitometer and weight concentration of the actual dust is produced by influences of the color, shape, and grain size of the dust.

Therefore, the customer performs the manual analysis and needs to add the compensation based on the weight conversion coefficient from the following formula.

$$\text{Weight conversion coefficient} = \frac{\text{Actual dust weight concentration value (manual analysis value) mg/m}^3\text{N}}{\text{(Average value of indication value on Dust densitometer) mg/m}^3\text{N}}$$

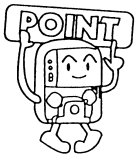
① Weight conversion

To use the weight conversion function, it is necessary to change the CH147 setting to ON.



To display the weight conversion value on the indicator, change the CH002 setting to ON.
To display the weight conversion on output-1 and output-2, set CH061 and CH069 to ON.

Do not change the span value stated on the span rod.



4.7.5 Output signal calculation/hold/output adjustment

① Output signal calculation

1) The contents of the following calculations can be set individually on each of two output signal systems.

Check and set the following CH No. data of the system data.

Contents of calculation	Output-1		Output-2	
	CH060	CH061	CH068	CH069
No conversion	OFF	OFF	OFF	OFF
O2 conversion output	ON	OFF	ON	OFF
Weight conversion output	OFF	ON	OFF	ON
O2 and weight conversion	ON	ON	ON	ON

2) The moving average (0 – 60 min. in steps of 1 min.) can be set individually on each of two output signal systems.

Contents of calculation	Output-1	Output-2
	CH062	CH070
Moving average	OFF	OFF
No moving average	ON	ON
Moving average time setting	Set in CH063.	Set in CH071.

3) The primary delay calculation can be made commonly in two output signal systems. A primary delay time constant (0 – 60 sec. in steps of 1 min.) can be set in CH072. It is recommended to operate the analyzer with the initial setting (5 sec.).

② Output hold

1) The output hold mode can be set individually on each of two output signal systems.

Output hold mode	Output-1	Output-2
	CH057	CH065
No hold	0	0
Hold during maintenance	1	1
Hold if alarm occurs.	2	2
Hold during maintenance and if alarm occurs.	3	3

No hold: Hold is not performed.

Hold during maintenance: Hold is performed when the maintenance range, auto/manual purge, bypass operation, manual/semi-auto calibration, auto zero reset, or purge/auto zero recovery is performed.

Hold if alarm occurs: Hold is performed if E-01 – E-16, or E-20 occurs.

* Regardless of the above settings (0, 1, 2, and 3), if E-04 or E-09 occurs, the value immediately before the error occurs is held.

2) When “hold” is set, select the hold signal.

Hold signal	Output-1	Output-2
	CH058	CH066
Value immediately before hold function is activated is held.	0	0
Previously set value is held.	1	1

3) When the setting is performed so that the previously set value is held, input a hold setting value.

Hold setting value	Output-1	Output-2
	CH059	CH067
Setting value (mg/m^{3}N)	0.0～100.0	0.0～100.0

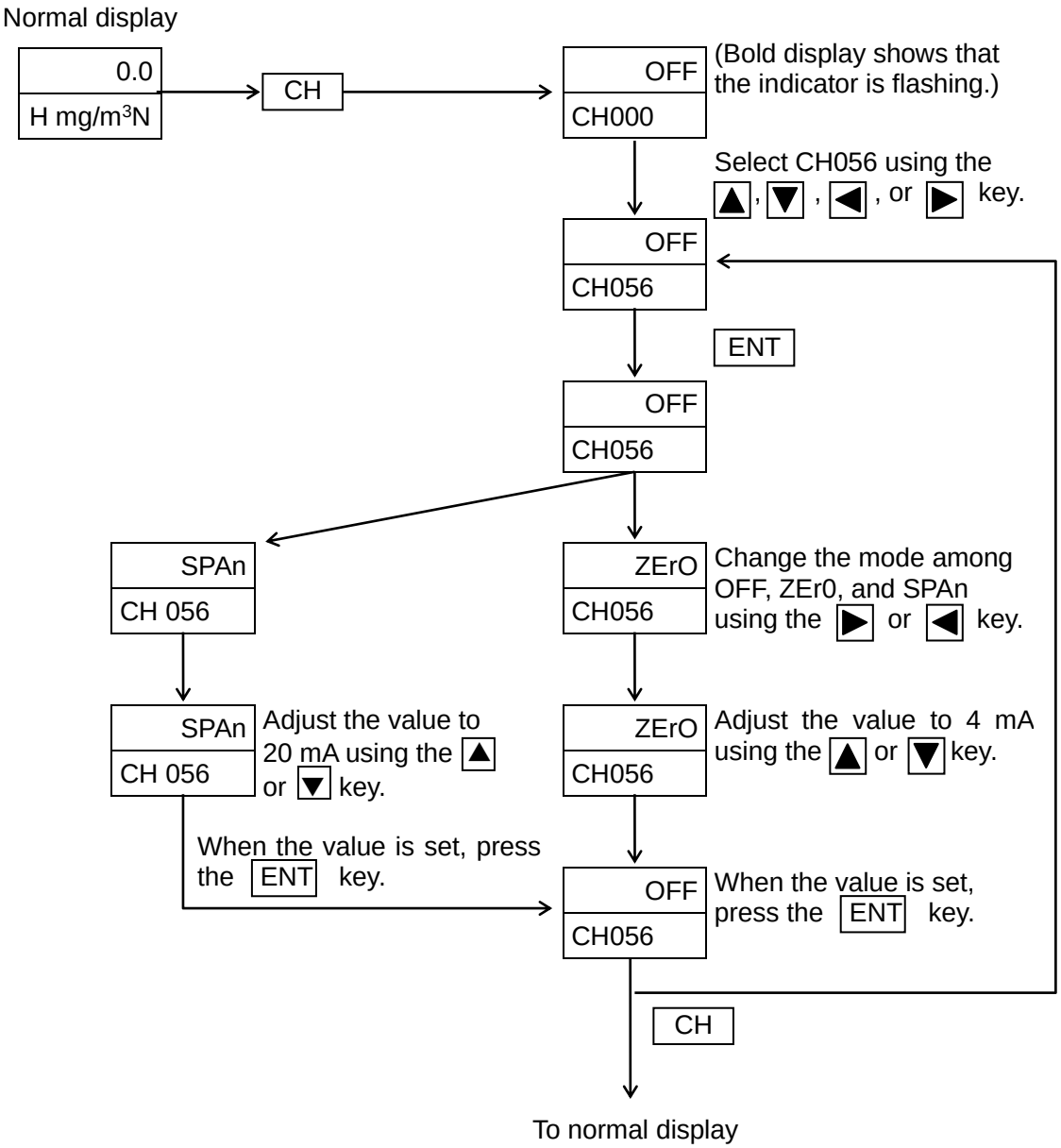
③ Output adjustment

The zero and span values can be adjusted individually in two output signal systems in a range of 4 – 20 mA using key operation.

Adjust the output using the CH Nos. as shown below.

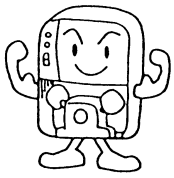
Output adjustment	Output-1	Output-2
	CH056	CH064

Operation Connect an ammeter to the output.



5. Maintenance

IMPORTANT



5.1 Cautions for maintenance ⚠CAUTION

(1) To prevent the dew condensation, the transmitter main body is hot. Therefore, always wear heat-resistant gloves before starting the cleaning and maintenance work of the piping in the optical system, trap, and ejector.

(2) Always wear heat-resistant gloves before attaching/detaching the cap to/from the span port since the span port is hot.

(3) If the suction and exhaust valves are not closed fully when starting the maintenance work while the furnace is being operated, the sample gas may spout out when opening the valve during maintenance. Always close the suction and exhaust valves fully.

(4) Before installing or removing the Dust densitometer, make sure that the furnace operation is stopped completely.
If it is strongly required to install or remove the Dust densitometer while the furnace is being operated, pay special attention to the following cautions.
   1) Since the part close to the mounting seat is hot, always wear heat-resistant gloves.
   2) If the positive pressure exists inside the furnace, the sample gas may spout out from the opening. Never get access to the opening.
   3) Additionally, the dust and soot in the sample gas may also spout out. Always wear dust-proof glasses to prevent dust and soot from entering your eyes.

(5) If the cap of the span port is not tightened completely, the sample gas may leak, causing corrosion. If the cap is removed from the span port, always retighten the cap with the special tool.

(6) Open and close the suction and exhaust valves periodically (once a month). If the valve is not opened and closed for an extended period of time, dust may stick to the valve, causing the valve not to be opened or closed.

(7) If the light emission or light receiving unit is fallen down, it may be damaged. Always carefully handle the units during maintenance.

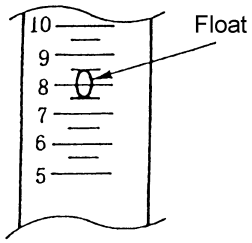
(8) The dust concentration in the furnace may increase during a period of 2 hrs. after stopping or starting the furnace operation, causing the optical system of the Dust densitometer to be contaminated.
Therefore, always close the suction and exhaust valves for approximately 2 hrs. after stopping or starting the furnace operation to prevent dust from entering the Dust densitometer.

5.2 Maintenance and inspection items

Unit name	Inspection location and inspection item	Inspection criteria and method	Recommended frequency	Remarks
Dust densitometer	Flow meter of light emission unit Flow meter of light receiving unit	8 liters/min.(8-9 liters/min.)	Once/week	
	Manual (or semi-manual) calibration	Perform the span calibration using the zero and span calibration rods with the air supplied.	Once/week – month	
	Auto zero reset	Check that the auto zero reset is performed once a week.	Once/week	
	Auto purge	Check that the auto purge is performed once a day.	Once/day	
	Membrane filter element	Replace the filter periodically or if the clean air is not flown at a set flow rate (8 – 9 liters/min.)	Once/month	
	Optical system and trap	Clean the optical system and light trap if the zero and span calibration cannot be performed.	Once/3 – 6 months	
	Ejector and inside of the base metallic pipe (exhaust side)	Clean the ejector and inside of the base metallic pipe if the dust is clogged or when cleaning the optical system and light trap.	Once/ 3 – 6 months	
	Output signal	Check that the output signal meets the indication value.	Once/year	
	O-ring	Replace the O-ring periodically.	Once/year	
	Suction and exhaust valves	Open and close the valves periodically. Apply the lubricant spray periodically.	Once/month Once/2 years	
	Flange packing	Replace the flange packing periodically.	Once/year	Replace the packing when the transmitter is removed from the mounting seat or when the analyzer is inspected by Energy Support corp.
Suction nozzle Exhaust nozzle	Inside of nozzle	Clean the inside of the nozzle if dust is clogged or if the furnace is cleaned periodically.	Once/3 – 6 months	
Purge unit	Pressure set on pressure reducing valve with filter	For ejector and clean air: 0.15 MPa Purge: 0.2 – 0.6 MPa *1	Once/week	*1 To increase the purge effect, set as high pressure as possible in a range of 0.2 –0. 6 MPa.
	Element for pressure reducing valve with filter	Replace the element periodically.	Once/year	
	Functional check	Check that purge operation functions correctly.	Once/year	

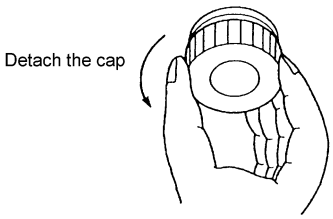
5.3 Maintenance and inspection

① Checking of flow meters on light emission and light receiving units



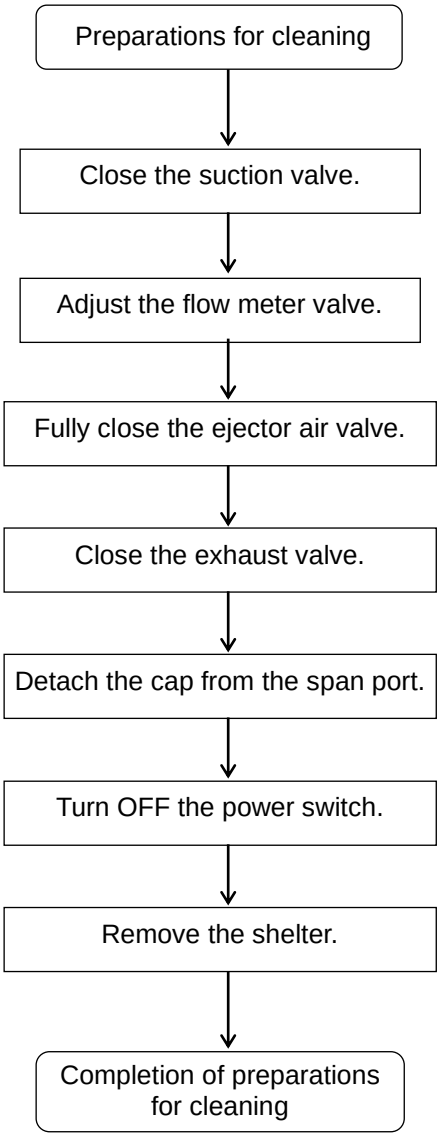
- Check that the center of the float is located at a position close to 8 – 9 liters/min.
- Gradually adjust the light emission and light receiving units alternately.

② Replacement of membrane filter element



1) Close the main valve for the instrument air on the purge unit.
2) Turn the membrane filter cap (transparent acrylic cap) counterclockwise to detach it.
3) Remove the filter element using tweezers.
4) Wipe off dirt from the body and support metal fitting, and set a new filter element.
5) If the grease on the O-ring has been dried, apply the grease.
6) Turn the filter cap clockwise and tighten it strongly by hand.
7) Open the main valve for the instrument air on the purge unit.
8) Check the flow rate on the flow meters of the light emission and light receiving units.

③ Cleaning of optical system and light trap



Use the special tool (T-wrench).

Adjust the flow meter valve.

Fully close the ejector air valve.

Use the special tool (T-wrench).

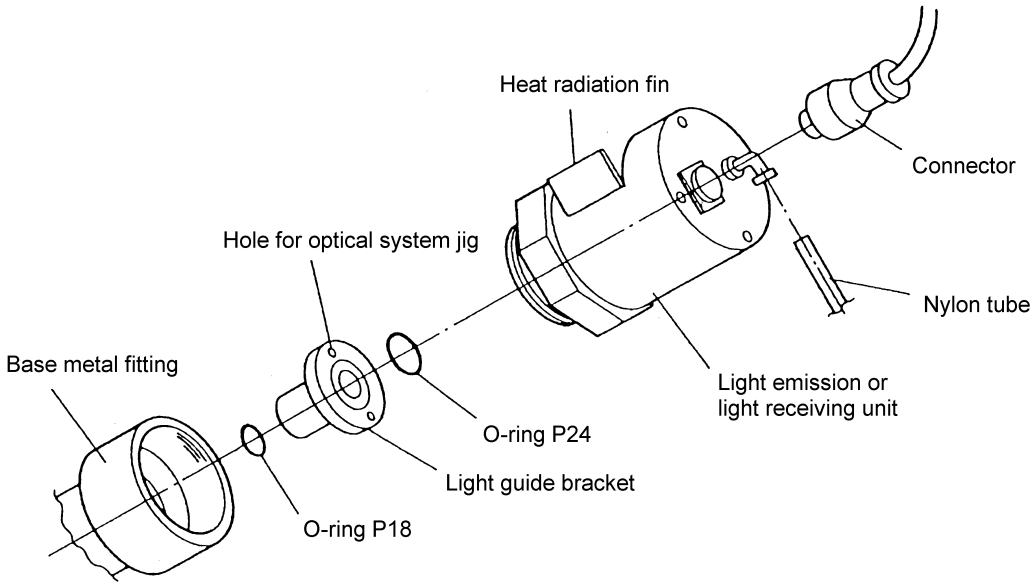
Use the special tool (optical system jig).

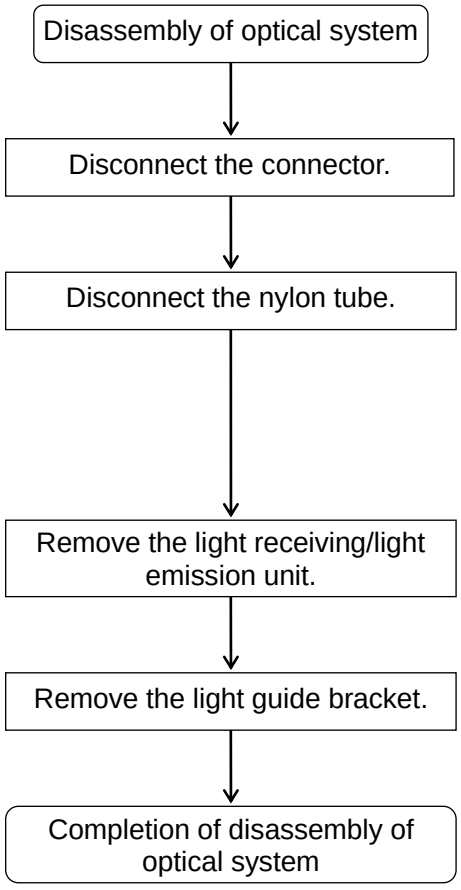
Turn OFF the power switch (POWER) on the controller.

Remove four shelter mounting screws and gradually raise the shelter to remove it.

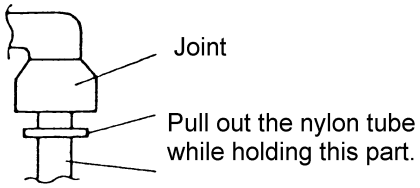
1) Disassembly of optical system

Both the light emission and light receiving units have the same structure.





Turn the knurled part of the connector and pull out the connector upward.

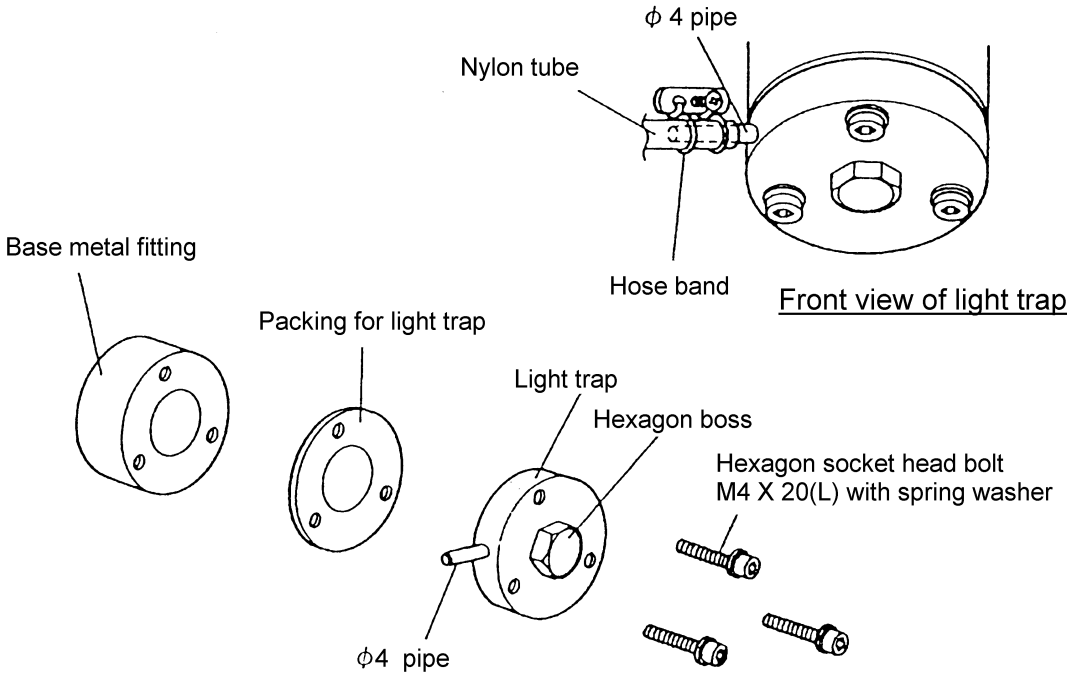


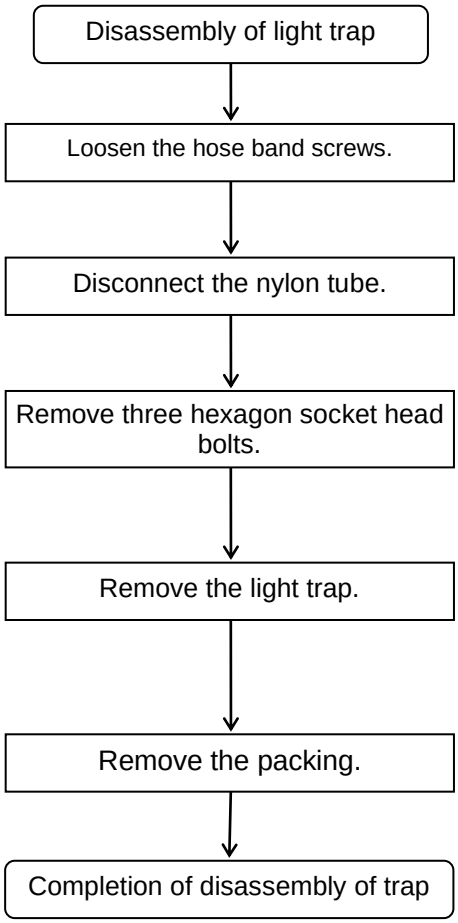
Turn the entire unit counterclockwise to remove it.

Insert the special jig (optical system jig) into the holes in the light guide bracket and turn it counterclockwise to remove it.

2) Disassembly of light trap

Both the light emission and light receiving units have the same structure.





Loosen the hose band screws with a Phillips screwdriver.

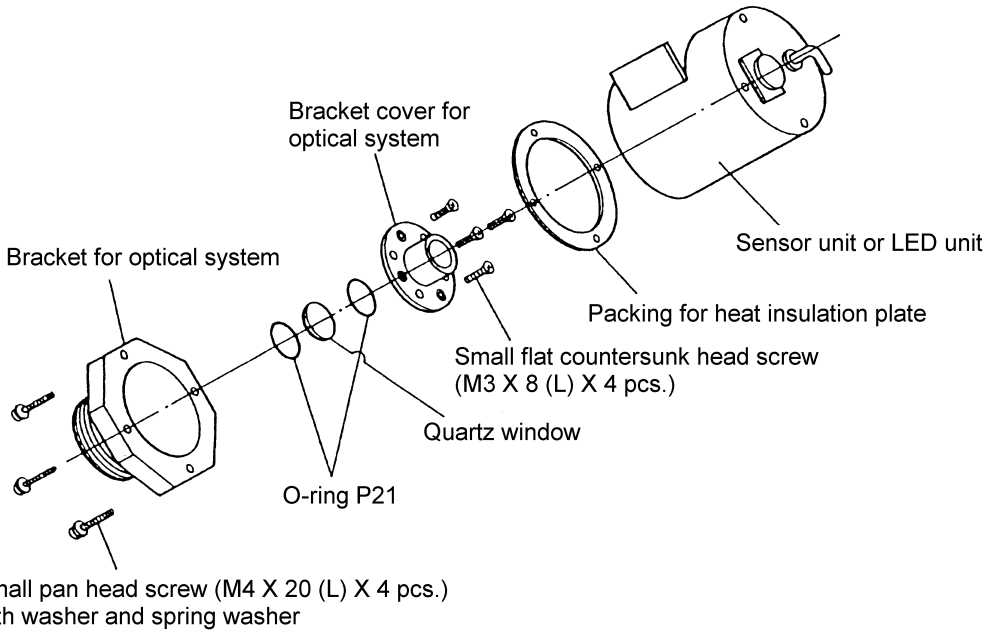
Fasten the ∅4 pipe welded to the light trap with long-nose pliers and raise the nylon tube in the direction opposite to the light trap to disconnect it.

Remove three hexagon socket head bolts completely with the Allen wrench (width across flats: 3) supplied with the analyzer.

Since the packing is attached and the light trap is secured to the base jig, fasten the hexagon boss part (width across flats: 13) of the light trap with a spanner and lay down either left or right part to remove the light trap.

Gradually remove the packing from the light trap or base metal fitting.
(If the hole opening of the packing is scratched and passed through, replace the packing with a new one.)

3) Disassembly of light receiving unit/light emission unit
Both the light emission and light receiving units have the same structure.



Disassembly of light receiving/light emission unit

↓

Remove the bracket for the optical system. — Remove four M4 small pan head screws.

↓

Remove the bracket cover for the optical system. — Remove four M3 small flat countersunk head screws.

↓

Remove the O-ring and quartz window. — The quartz window is sandwiched by two O-rings P21.

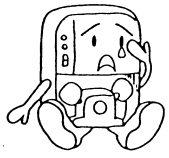
↓

Completion of disassembly of light receiving/light emission unit

Before removing the screws, put marks at the assembly positions between the bracket for the optical system and the sensor/LED unit. This ensures easy reassembly.

TROUBLE

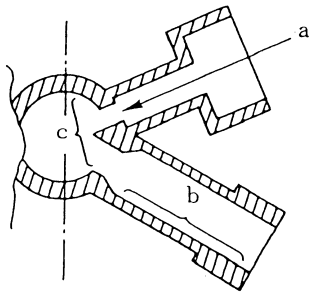
After the above disassembly has been completed, the inside of the sensor unit or LED unit can be seen. Always handle it carefully. Do not disassemble the sensor unit or LED unit further.



4) Cleaning of optical system, trap, and light receiving/light emission unit
Clean both the light emission and light receiving units in the same manner.

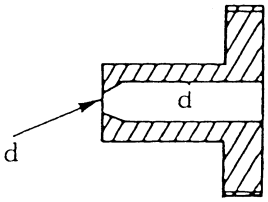
Cleaning of inside of base metallic pipe:

a. Remove the light guide bracket and wipe off the dirt sticking to the part close to the inlet hole inside the pipe (approximately ∅14).
b. Remove the light trap and wipe off the dirt sticking to the inside of the base metallic pipe to the light trap.
c. Remove the dirt sticking to parts close to two parts described above through the span port.



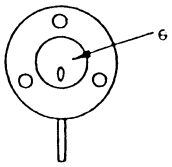
Cleaning of light guide bracket:

d. Remove the dirt sticking to the inlet and inside.



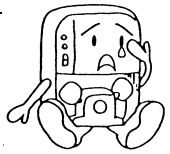
Cleaning of light trap:

e. Remove the dirt sticking to the inside.



TROUBLE

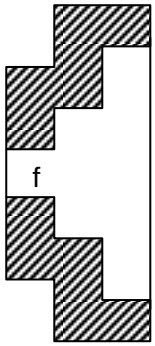
All above parts ***a*** to ***e*** are painted in black. If any part is scratched largely, this may affect the indication value. Always clean the parts carefully. (Blow the compressed air and wire off the dirt with a soft cloth rag.) Never use a sharp metallic object.



Cleaning of quartz window: Remove the dirt sticking to both surfaces.
Carefully clean the quartz window with soft gauze or cloth rag soaked in alcohol.

Cleaning of optical system bracket:

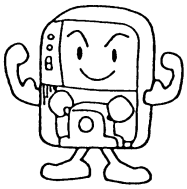
f. Remove the dirt sticking to the inlet and inside.



The cleaning work is then completed.

5) Cautions for reassembly after cleaning

IMPORTANT



- Do not handle the quartz window by contaminated hands.
- When reassembling the light receiving/light emission unit , make the heat radiation fin faced upward and secure it with fore M3 small pan head screws.
  If the heat radiation fin is not faced upward, remove four small pan head screws and shift the positional relationship between the optical system bracket and the light receiving/light emission unit 90° to adjust it.
- Always attach the O-rings (P18 and P24) to both sides of the light guide bracket.
- Mount the light trap so that it faces toward the span port of the ∅4 pipe.
- After the hexagon socket head bolts for the light trap are tightened manually, retighten them with the Allen wrench.
- Insert the nylon tube of the light trap to a position approximately 5 mm away from the root of the ∅4 pipe, and secure it with hose bands. (This keeps a space for fastening the nylon tube with long-nose pliers (5 mm).)

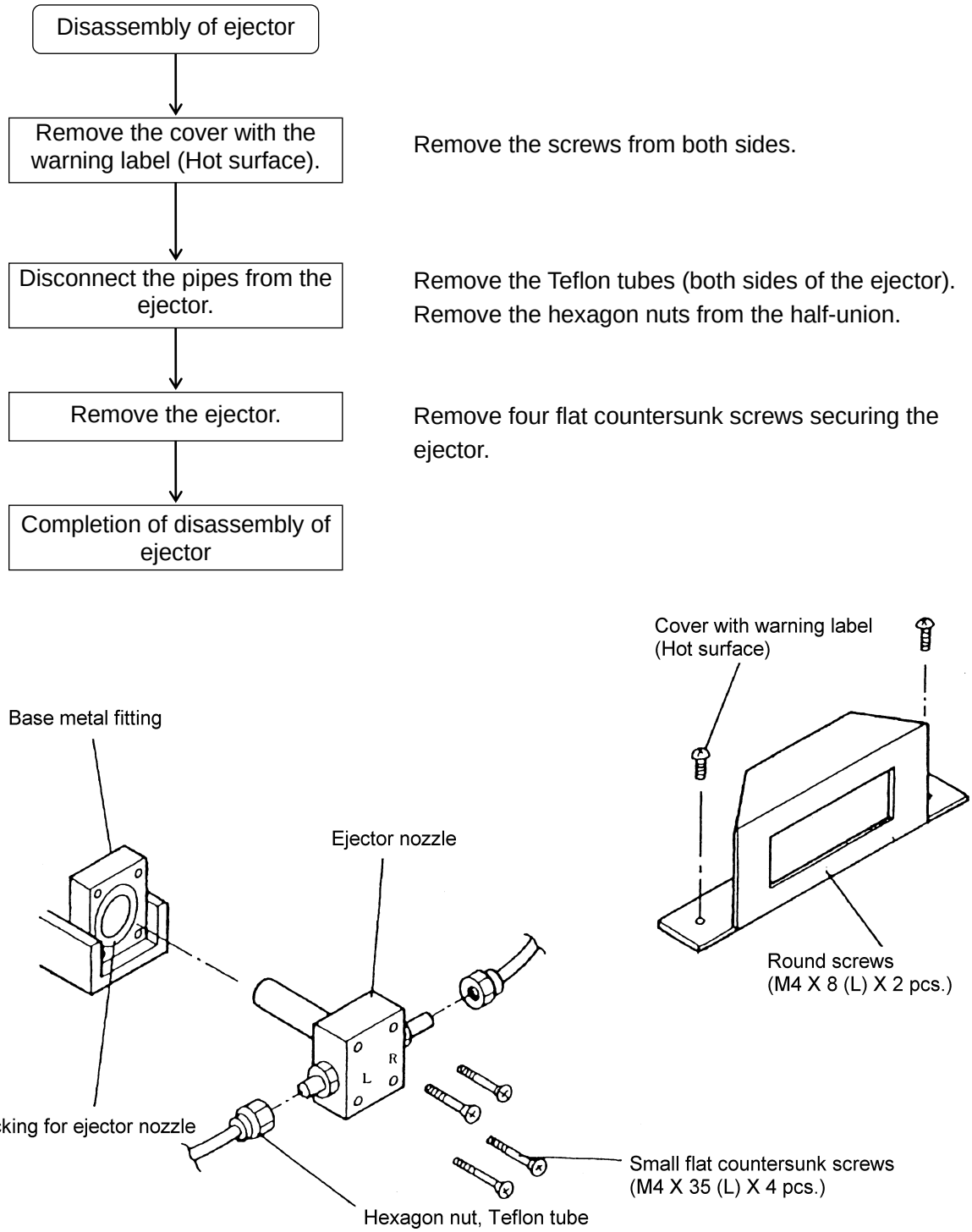
6) Starting of analyzer after cleaning and reassembling

- Start the Dust densitometer while referring to section 4.5, Starting operation.
- Perform the zero-span calibration while referring to section 4.7.2, Calibration operation.

④ Cleaning of ejector and inside of base metal fitting pipe (exhaust side)

Make the preparations for cleaning in the same manner as described in ③, Cleaning of optical system and trap.

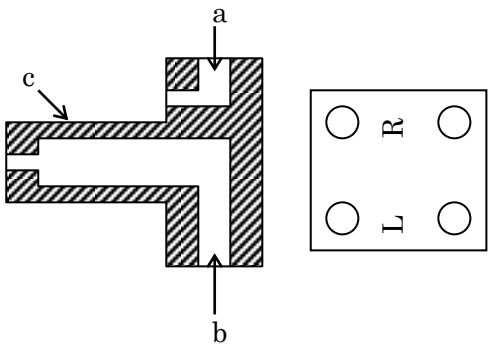
1) Disassembling procedure of ejector



2) Cleaning of ejector and inside of base metal fitting pipe (exhaust side)

Cleaning of ejector

a. Blow the compressed air to the purge air route to remove the blocked materials from the inside of the route.
b. Blow the compressed air to the ejector air route to remove the blocked materials from the inside of the route.
c. Wipe off the ejector nozzle surface with a cloth rag to remove the contamination.



Cleaning of inside of base metal fitting pipe (exhaust side)

The base metal fitting pipe is connected from the hole in the base fitting metal, from which the ejector has been removed, to the exhaust nozzle.
To clean the inside of the pipe, prepare the cleaning brush supplied with the analyzer.
Insert the cleaning brush and open only the exhaust valve. Move the brush back and forth to remove the blocked materials.

CAUTION

Carefully clean the inside of the base metal fitting pipe since the sample gas may spout out.
Pay special attention to burn hazard since the cleaning brush is hot.

3) Cautions for reassembly after cleaning

- If the packing for the ejector nozzle is scratched, replace it with a new one.
- Carefully check the L and R mounting positions of the ejector.
- Tighten the hexagon nuts of the half union so that they are not loose.

4) Starting after cleaning and reassembling

- Start the Dust densitometer while referring to section 4.5, Starting operation.
- Perform the zero-span calibration while referring to section 4.7.2, Calibration operation.

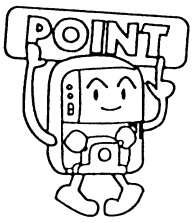
⑤ Replacement of O-ring

O-rings are used at the following locations.

Location	O-ring part No.	Q'ty	Remarks
Light guide bracket	FPM-P18	2 (Light emission and light receiving units)	Made of Biton. Application of the grease is not allowed.
	FPM-P24	2 (Light emission and light receiving units)	Made of Biton. Application of the grease is not allowed.
Quartz window	FPM-P21	2 x 2 (Light emission and light receiving units)	Made of Biton. Application of the grease is not allowed.
Span port cap	FPM-P26	1	Made of Biton.
Membrane filter	FPM-V55	1	Made of Biton or nitric rubber. Application of the grease is not allowed.

⑥ Suction and exhaust valves

- Open and close the suction and exhaust valves periodically (once/month).
  (If the suction and exhaust valves are not opened and closed for an extended period of time, dust may stick to the valves, causing the valves not to be opened or closed.)
- Apply the lubricant spray during periodic maintenance (when the Dust densitometer is removed from the furnace).



After the light receiving unit/light emission unit has been removed (see step (3)-1 in section 5.3), apply the lubricant spray to the suction and exhaust valves while opening or closing the valves.
Before remounting the light receiving unit/light emission unit, turn ON the power and flow the clean air after approximately 1 hour (valve is closed and span port cap is opened) to eliminate excessive spray oil contents.

⑦ Suction and exhaust valves

- For the exhaust nozzle, see the section, Cleaning of inside of base metal pipe (exhaust side).
- For the suction nozzle, remove the cap from the span port and open the suction valve. The pipe is connected to the suction nozzle.

Prepare the cleaning brush supplied with the machine.

The inside of the base metal fitting pipe (suction side) on the suction nozzle side is painted in black (see the section, Cleaning of optical system). Always carefully handle the cleaning brush when the top of the brush is located between the suction valve and span port. When the top of the brush reaches the suction nozzle, move the brush back and forth to remove the blocked materials.

5.4 Error display

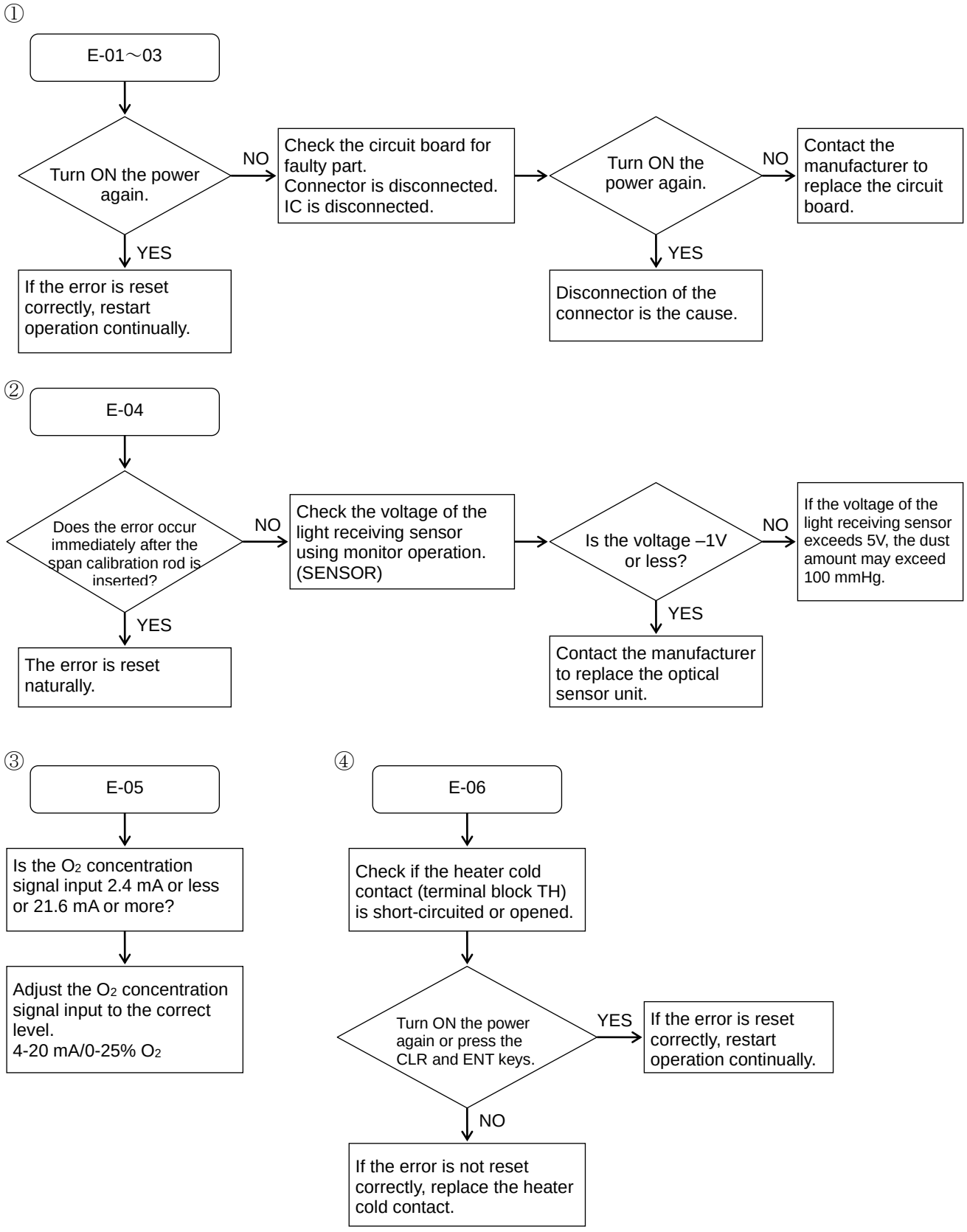
If an error occurs, relevant error No. is displayed on the 7-segment LED.
(Contact output 6 and power shut-down are turned ON if any of errors, E-01 – E-16, and E-20 occurs.)
Error Nos., E-01 – E-20, are provided. The following table shows the error Nos. and error contents.

Error No.	Contents	Error occurrence conditions	Retention or natural reset	Remarks
E-01	ROM error	Memory read/write is impossible.	Error is retained.	
E-02	RAM error	Memory read/write is impossible.	Error is retained.	
E-03	EEROM error	Memory read/write is impossible.	Error is retained.	
E-04	Optical sensor measurement voltage error	Voltage is beyond the measurement voltage upper/lower limit range.	Error is reset naturally if this error occurs by the upper limit. Error is retained if this error occurs by the lower limit.	
E-05	O2 input error	Input is 2.4 mA or less or 21.6 mA or more.	Error is retained.	This error occurs only when the O_2 conversion is used.
E-06	Heater cold contact error	Cold contact is short-circuited or opened.	Error is retained.	
E-07	Heater thermocouple error	Temperature is -30°C or less or 530°C or more.	Error is retained.	
E-08	Optical sensor thermistor error	Thermistor error contact is short-circuited or opened.	Error is retained.	
E-09	LED thermistor error		Error is retained.	
E-10	Temperature rise error (Heater, optical sensor, LED)	Temperature does not rise within the time set in CH128.	Error is retained.	
E-11	Heater temperature high error	Temperature is higher than that set in CH130.	Error is retained.	
E-12	Heater temperature low error	Temperature is lower than that set in CH129.	Error is retained.	
E-13	Optical sensor temperature high error	Optical sensor temperature is higher than that set in CH134.	Error is retained.	
E-14	Optical sensor temperature low error	Optical sensor temperature is lower than that set in CH133.	Error is retained.	
E-15	LED temperature high error	LED temperature is higher than that set in CH132.	Error is retained.	
E-16	LED temperature low error	LED temperature is lower than that set in CH131.	Error is retained.	
E-17	Zero calibration error (Auto zero-reset)	Calibration value deviates more than the value set in CH135 from the previously calibrated value.	Error is retained.	

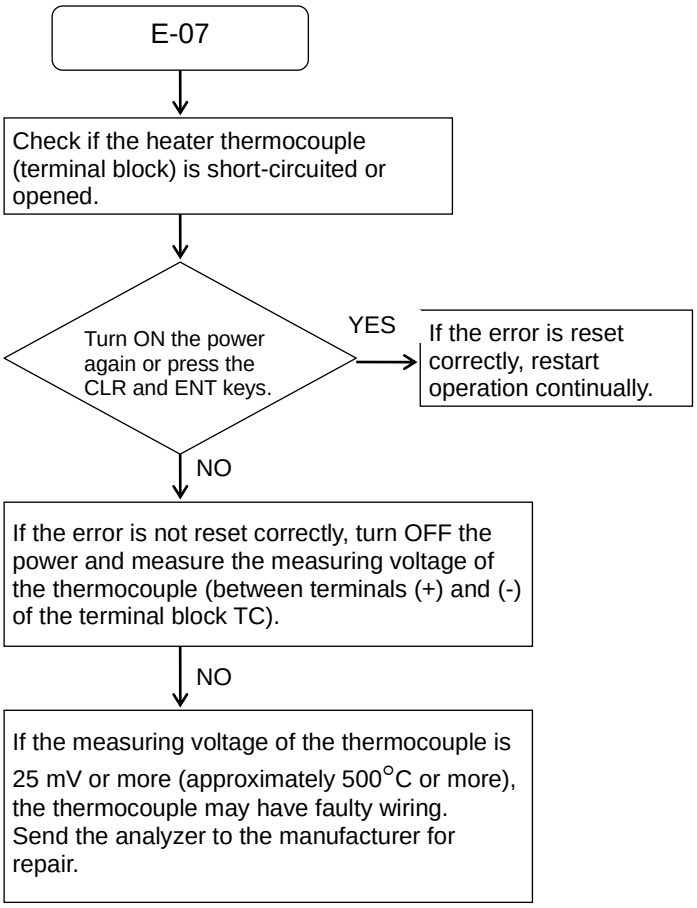
Error No.	Contents	Error occurrence conditions	Retention or natural reset	Remarks
E-18	Zero calibration error (Manual and semi-auto)	・Calibration value deviates more than the value set in CH135 from the previously calibrated value. ・Calibration does not enter the stable range set in CH155 within the time set in CH157 during semi-auto calibration. ・When starting the span calibration (CH027) in the zero state or when starting the zero calibration (CH026) in the span state, E-18 or E-19 occurs in the next calibration. If this occurs, change the calibration mode selection (CH025) to manual (0) and perform the manual zero-span calibration (P4-19-21).	Error is retained.	
E-19	Span calibration error (Manual, semi-auto)	・Calibration does not enter the stable range set in CH156 within the time set in CH157 during semi-auto calibration. ・When starting the span calibration (CH027) in the zero state or when starting the zero calibration (CH026) in the span state, E-18 or E-19 occurs in the next calibration. If this occurs, change the calibration mode selection (CH025) to manual (0) and perform the manual zero-span calibration (P4-19-21).	Error is retained.	
E-20	Dust concentration upper limit error	Dust concentration exceeds the upper limit value set in CH049.	Natural reset	This error is given only when CH048 is ON.

How to reset the error retention state: Turn ON the power again if E-01 – 03 occurs.
Press the CLR and ENT keys if other error occurs.
If the upper limit over error E-04 or E-20 occurs, it is reset naturally.

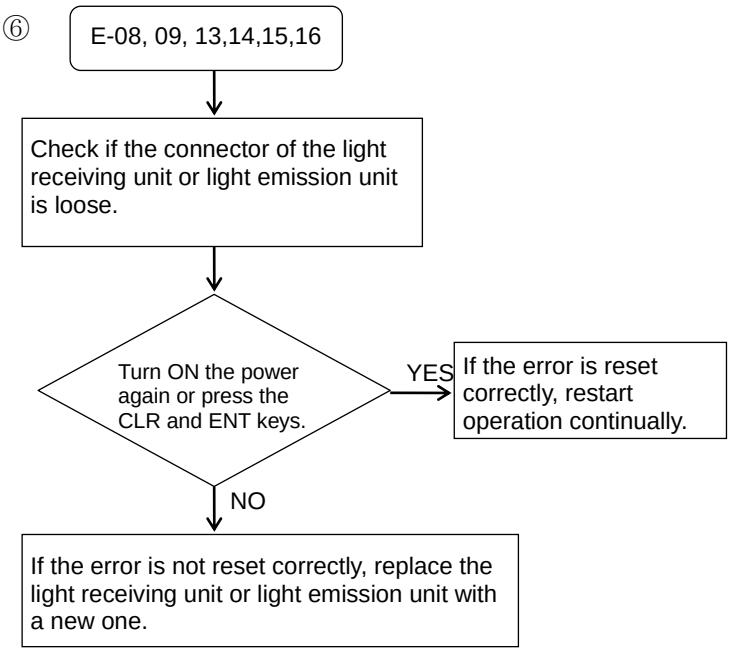
5.5 Troubleshooting



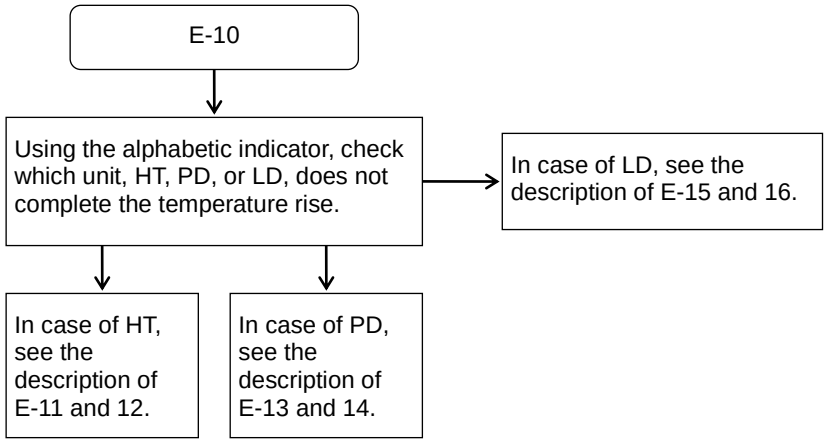
⑤


E-07
Check if the heater thermocouple (terminal block) is short-circuited or opened.
Turn ON the power again or press the CLR and ENT keys.
YES
If the error is reset correctly, restart operation continually.
NO
If the error is not reset correctly, turn OFF the power and measure the measuring voltage of the thermocouple (between terminals (+) and (-) of the terminal block TC).
NO
If the measuring voltage of the thermocouple is 25 mV or more (approximately 500°C or more), the thermocouple may have faulty wiring. Send the analyzer to the manufacturer for repair.

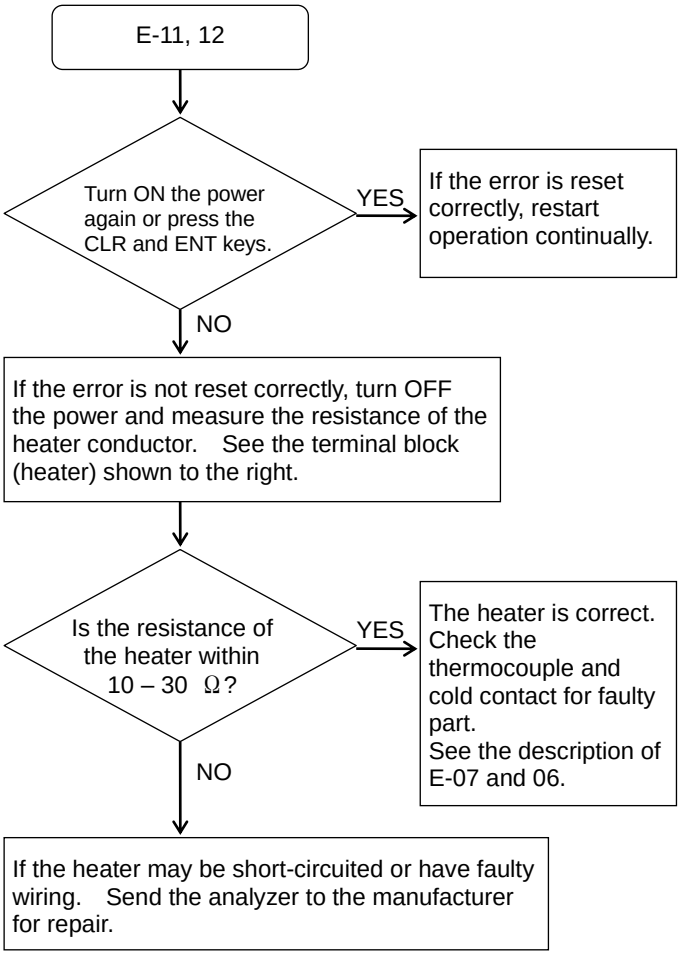
⑥

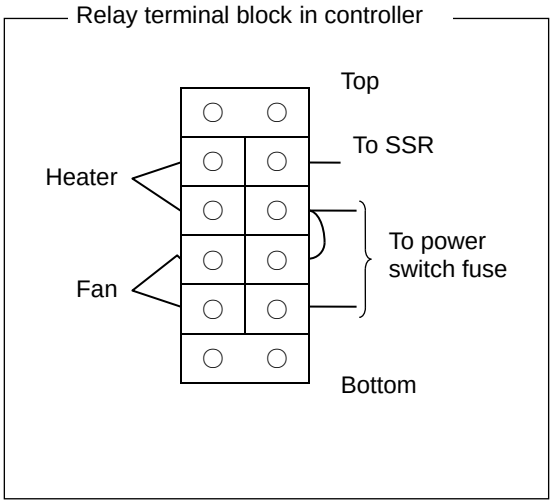

E-08, 09, 13,14,15,16
Check if the connector of the light receiving unit or light emission unit is loose.
Turn ON the power again or press the CLR and ENT keys.
YES
If the error is reset correctly, restart operation continually.
NO
If the error is not reset correctly, replace the light receiving unit or light emission unit with a new one.

⑦

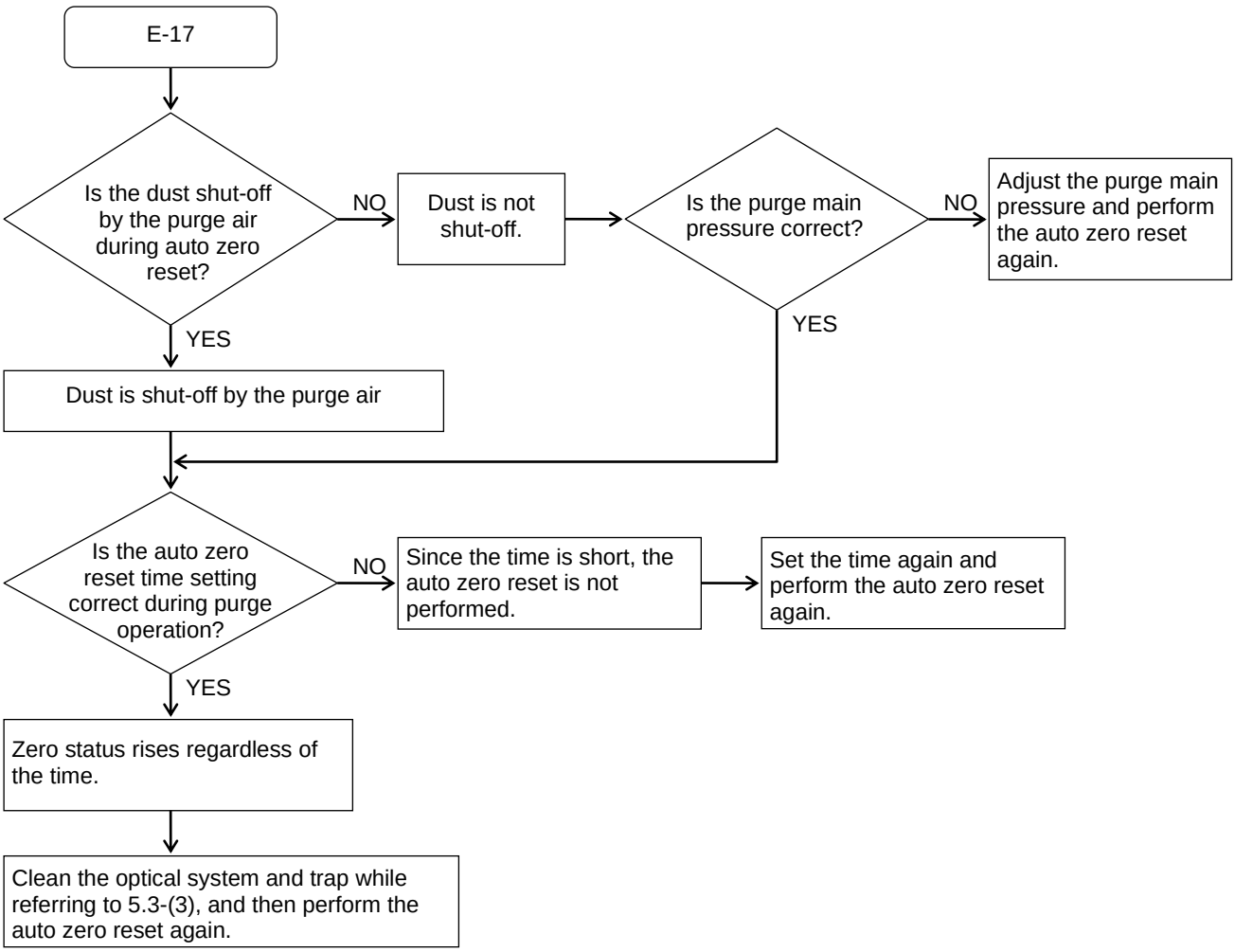

E-10
Using the alphabetic indicator, check which unit, HT, PD, or LD, does not complete the temperature rise.
In case of LD, see the description of E-15 and 16.
In case of HT, see the description of E-11 and 12.
In case of PD, see the description of E-13 and 14.

⑧

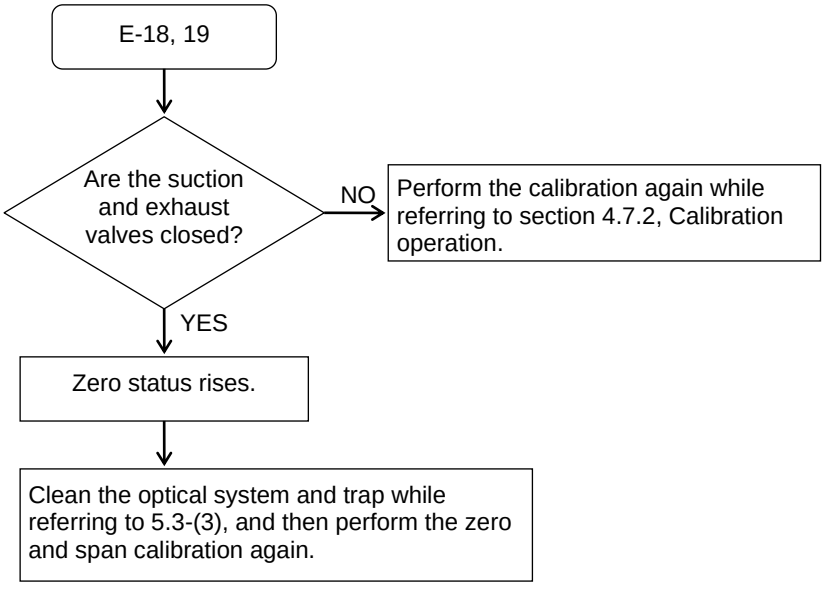

E-11, 12
Turn ON the power again or press the CLR and ENT keys.
YES
If the error is reset correctly, restart operation continually.
NO
If the error is not reset correctly, turn OFF the power and measure the resistance of the heater conductor. See the terminal block (heater) shown to the right.
Is the resistance of the heater within 10 – 30 Ω?
YES
The heater is correct. Check the thermocouple and cold contact for faulty part.
See the description of E-07 and 06.
NO
If the heater may be short-circuited or have faulty wiring. Send the analyzer to the manufacturer for repair.


Relay terminal block in controller
Top
To SSR
Heater
To power switch fuse
Fan
Bottom

⑨

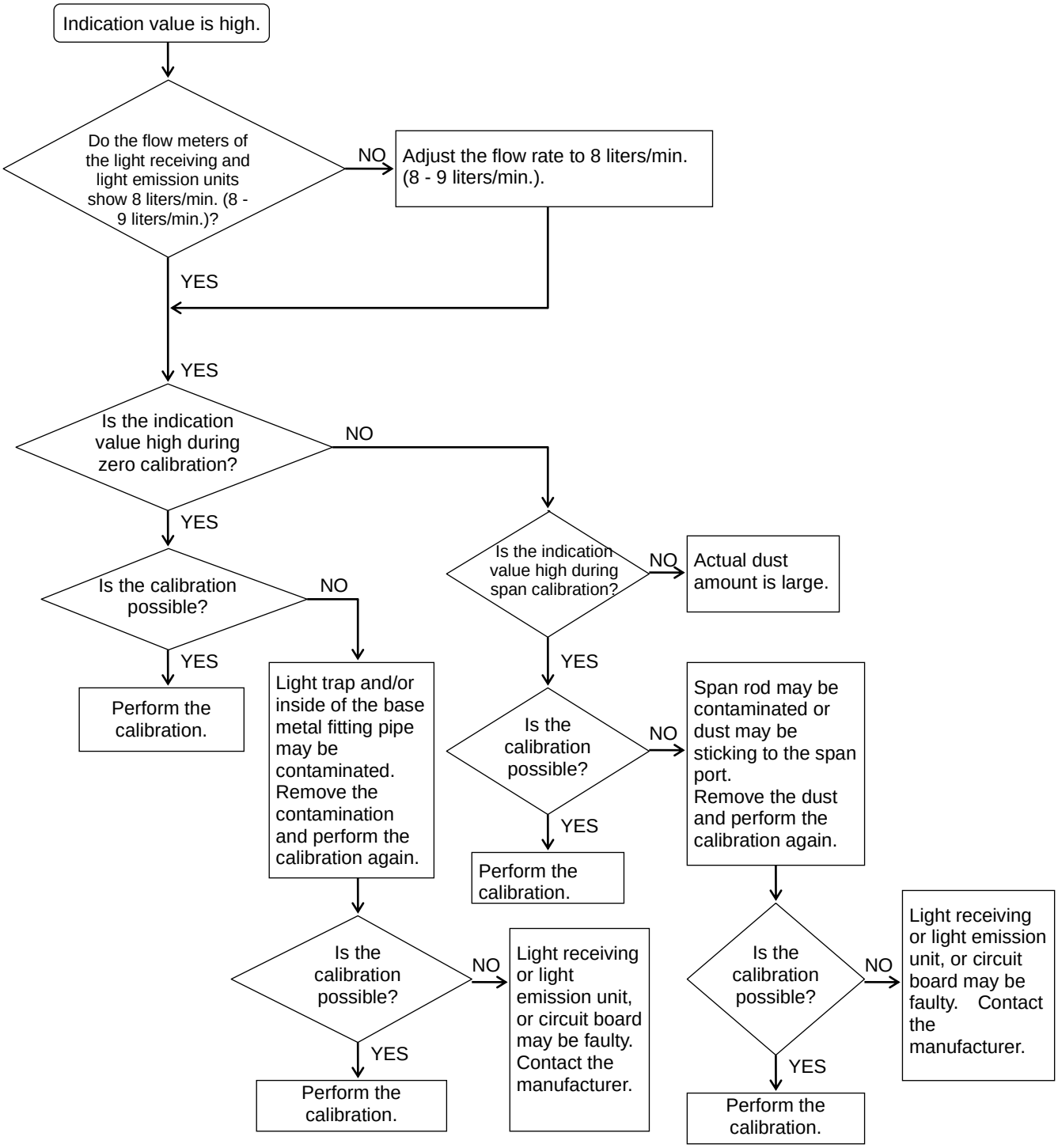

E-17
Is the dust shut-off by the purge air during auto zero reset?
NO
Dust is not shut-off.
Is the purge main pressure correct?
NO
Adjust the purge main pressure and perform the auto zero reset again.
YES
YES
Dust is shut-off by the purge air
Is the auto zero reset time setting correct during purge operation?
NO
Since the time is short, the auto zero reset is not performed.
Set the time again and perform the auto zero reset again.
YES
Zero status rises regardless of the time.
Clean the optical system and trap while referring to 5.3-(3), and then perform the auto zero reset again.

⑩


E-18, 19
Are the suction and exhaust valves closed?
NO
Perform the calibration again while referring to section 4.7.2, Calibration operation.
YES
Zero status rises.
Clean the optical system and trap while referring to 5.3-(3), and then perform the zero and span calibration again.

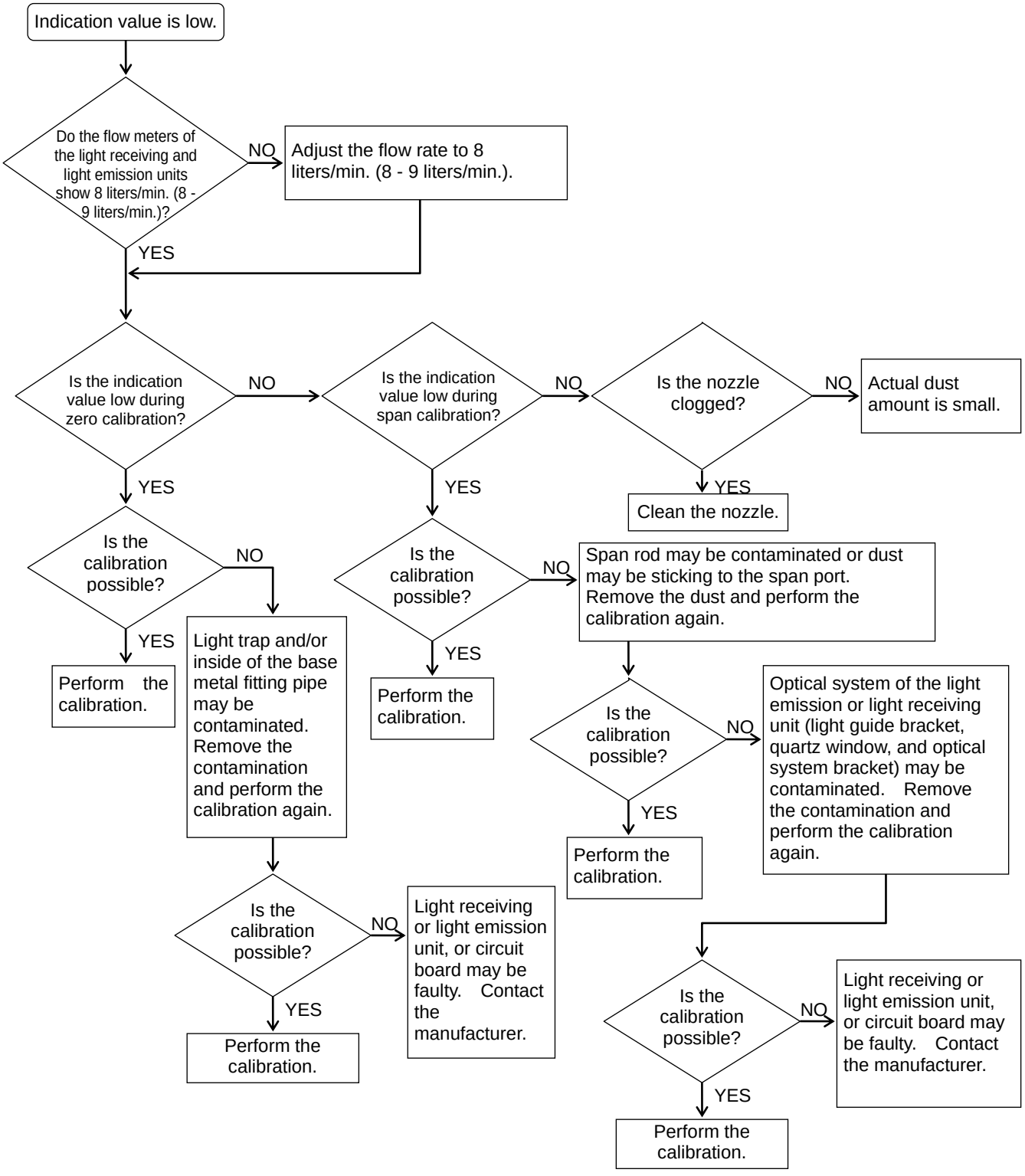
⑪ Indication value is high (higher than the initial indication value).

The main cause is that dust is sticking to the light trap and inside of the base metal fitting pipe, and the zero level drifts toward the positive side. This symptom may often occur immediately after starting the measurement of the initial sample or several weeks after cleaning the piping around the optical system.
If this occurs, perform the zero and span calibration to return the indication value to its initial value.

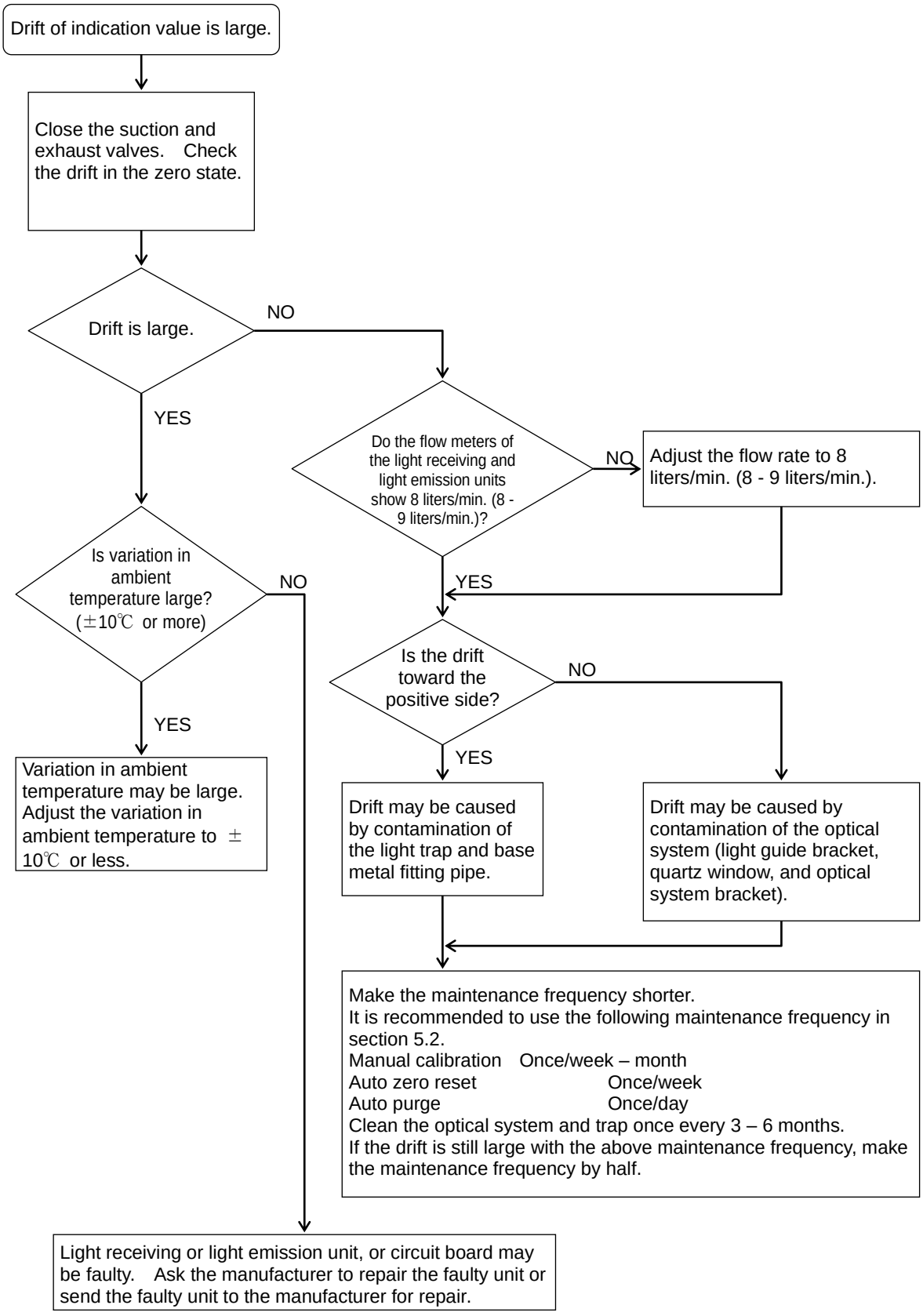


⑫ Indication value is low (lower than the initial indication value).

The main cause of low indication value is that the optical system (particularly, light guide bracket, quartz bracket, and optical system bracket) is contaminated and the light emission intensity from the light source to the sensor is lowered and the sensitivity is lowered.
If this occurs, perform the zero and span calibration to return the sensitivity to its initial value.

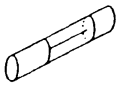
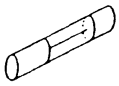
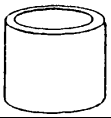
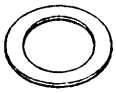
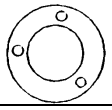
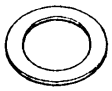
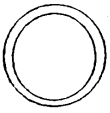


⑬ Drift of indication value is large (±5% FS or more/day).



5.6 Replacement parts

① Spare parts and consumable parts

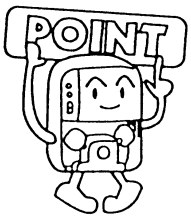
Part name	Part No.	Shape	Recommended replacement frequency	Remarks
Glass tube fuse	JIS-MF-51NR2A		Spare part	For circuit board power supply, 2A
Glass tube fuse	JIS-MF-51NR7A		Spare part	For heater, 7A
Membrane filter element	KS 288424		One month	For membrane filter
Filter element	AF30P-060S		One year	For pressure reducing valve with filter
Flange packing	T1995K10A100RF3T		One year (During periodic inspection or when the unit is removed.)	For mating flange for mounting
Packing for light trap	KV-610278		One year	
Packing for ejector nozzle	KV-610123-B		One year	
O-ring	FPM-P18		One year	For light guide bracket
	FPM-P21			For quartz window
	FPM-P24			For light guide bracket
	FPM-P26			For span port cap

② Other parts

Part name	Part No.	Replacement criteria	Remarks
Suction and exhaust nozzles	KV-620212-L	・If corrosion or damage is large. ・If blocked materials cannot be removed. ・Replace the nozzles every 2 – 3 years during preventive maintenance.	Length is specified by "L".
Heater and thermocouple	—	・If a trouble occurs and the heater is short-circuited or has faulty wiring, or thermocouple has faulty wiring.	Replacement at site is not allowed. Send the defective unit to the manufacturer for repair.
Span port cap	KV-610118	・If corrosion or damage is large.	
Ejector nozzle	KV-610129	・If corrosion or damage is large.	
Flow meter	RK200-VB-1/8AI-10	・If the drain or contaminated oil enters the air line. 〔In addition to replacement of the flow meter, membrane filter, and ejector air valve, it is necessary to replace the joint and clean the drain entry part.〕	
Membrane filter	KS-283042-A		
Ejector air valve (Miniature valve)	VH-6-2		

Part name	Part No.	Replacement criteria	Remarks
Light guide bracket	KV-610261	・If it is difficult to clean the sticking foreign matter. ・If corrosion or damage is large.	
Light trap	KV-610275	・If it is difficult to clean the sticking foreign matter. ・If corrosion or damage is large.	
Hose band	HB304D7	・If elasticity deteriorates.	
Optical system bracket	KV-610262	・If it is difficult to clean the sticking foreign matter. ・If corrosion or damage is large.	
Optical system bracket filter	KV-610263	・If damage is found during disassembly of the light receiving/light emission unit. ・If black painted part is damaged.	
Packing for heat insulation plate	KV-610265	・If damage is found during disassembly of the light receiving/light emission unit.	
Quartz window	NO3410	・If damage is found during disassembly of the light receiving/light emission unit. ・If black painted part is damaged.	
Sensor unit	—	・If a trouble occurs and the light receiving unit (or only the sensor unit) or the light emission unit (or only the LED unit) needs to be replaced.	Replacement at the customer's site is not allowed. Send the defective unit to the manufacturer for repair.
LED unit	—		
Light receiving unit	—		
Light emission unit	—		
CPU board Assy	KV-680096	・If a trouble occurs and the circuit board needs to be replaced.	Replacement at the customer's site is not allowed. Send the defective unit to the manufacturer for repair.
TMNL board Assy	KV-680092		
Display board Assy	KV-680094		
Span calibration rod	KV-610402-A	・If the span rod is fallen down and damaged.	Replacement at the customer's site is not allowed. Send the defective unit to the manufacturer for repair.

5.7 Replacement of parts



1. The heater, thermocouple, and base metal fitting cannot be replaced at the customer's site. It is necessary to send the defective unit to the manufacturer for repair.
   Two kinds of scaling (sensitivity adjustment) are needed after the light receiving unit (optical sensor), light emission unit (LED), or CPU board Assy has been replaced.
   1) A set of Dust densitometer is sent to the manufacturer and scaling is performed with the standard grain.
   2) Using the span rod supplied with the analyzer, the sensitivity is adjusted to the level before shipment from the factory. (This adjustment must be performed by the manufacturer's maintenance personnel.)

2. Two kinds of methods are provided to replace the span rod.
   1) A set of Dust densitometer is sent to the manufacturer. The scaling and making of the span rod are performed by the manufacturer.
   2) The scaling and making of the span rod are performed using the manufacturer's standard span.

   After above steps 1 and 2 have been performed, carry out the manual analysis again to set the weight conversion coefficients again.

Part name	Replacement procedure
Glass tube fuse	How to detach the fuse: Turn the fuse 1/4 rotation counterclockwise while keeping it pressed. How to attach the fuse: After replacing the glass tube fuse, turn the fuse 1/4 rotation clockwise while keeping it pressed.
Membrane filter element	See section 5.3-(2), Replacement of membrane filter element.
Filter element	Before detaching the case, release the pressure. Turn the lever at the center clockwise while keeping it lowered to detach the case. Turn the baffle counterclockwise to detach it. Pull down the filter element to detach it,
Flange packing, suction and exhaust nozzles	See section 3.2, Installation.
Light trap packing, light trap, and hose clip	See section 5.3-(3), Cleaning of optical system and trap
Packing for ejector nozzle and ejector nozzle main unit	See section 5.3-(4), Cleaning of ejector and inside of base metal fitting pipe (exhaust side).
Span port cap	See section 4.1-2), Attaching and detaching of span port cap.
Light guide bracket	See section 5.3-(3), Cleaning of optical system and trap.

Part name	Replacement procedure
Optical system bracket, optical system bracket cover, packing for heat insulation plate, and quartz window	See section 5.3-③, Cleaning of optical system and trap.

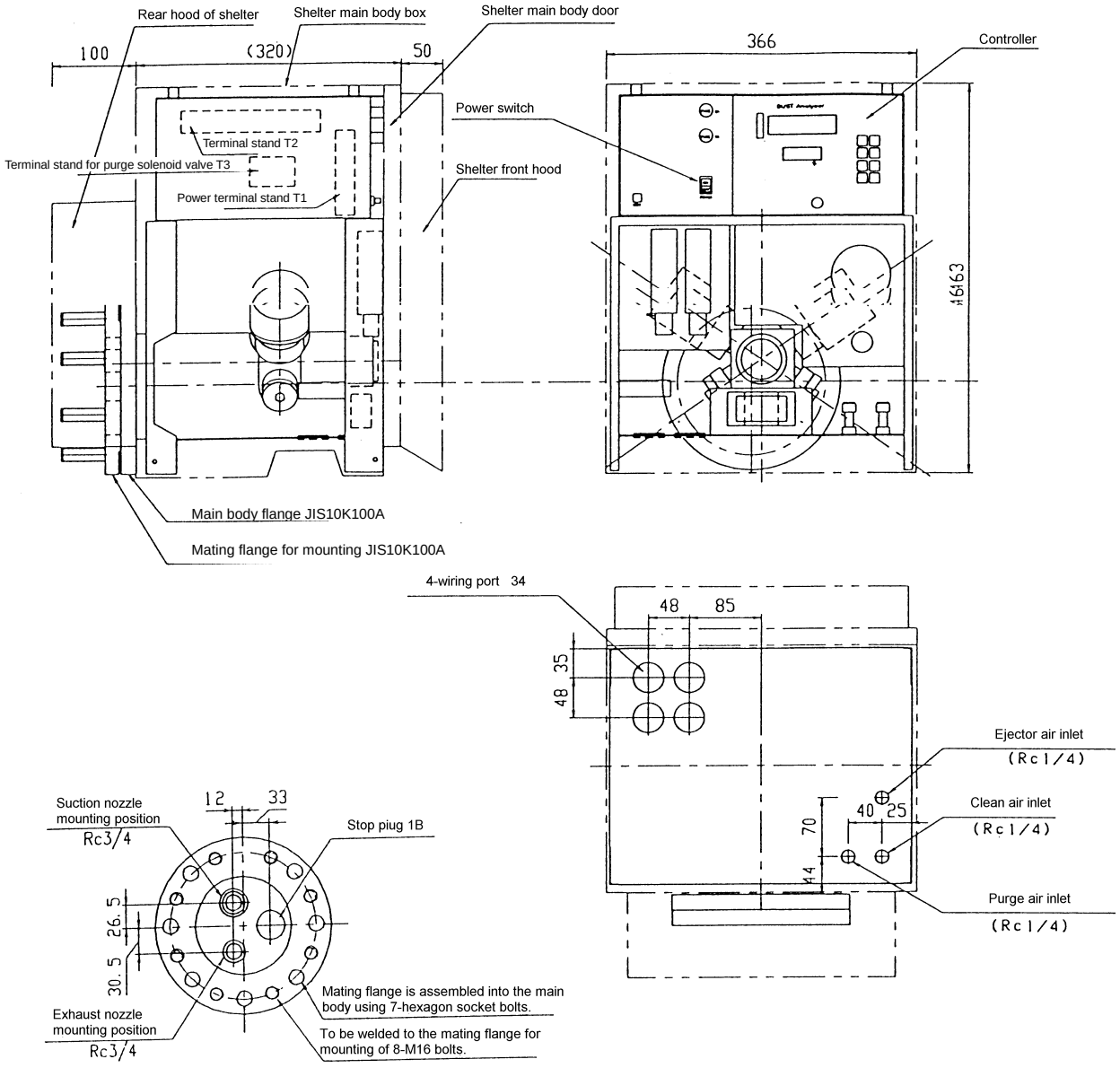
5.8 About this product

Please download the Safety Data Sheet (SDS) for IsoWool Bulk (artificial mineral fiber) used in this product from our homepage.

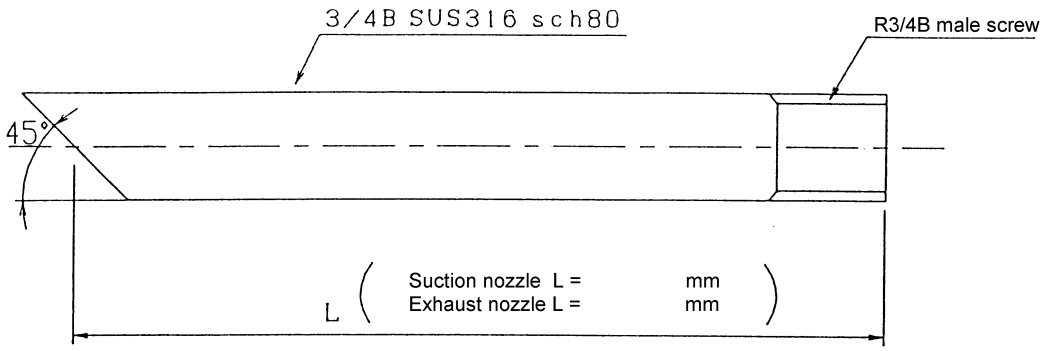
6. References

6.1 Outside view and dimensional drawing

1) Dust densitometer KV-610014-J



2) Suction and exhaust nozzles KV-620212

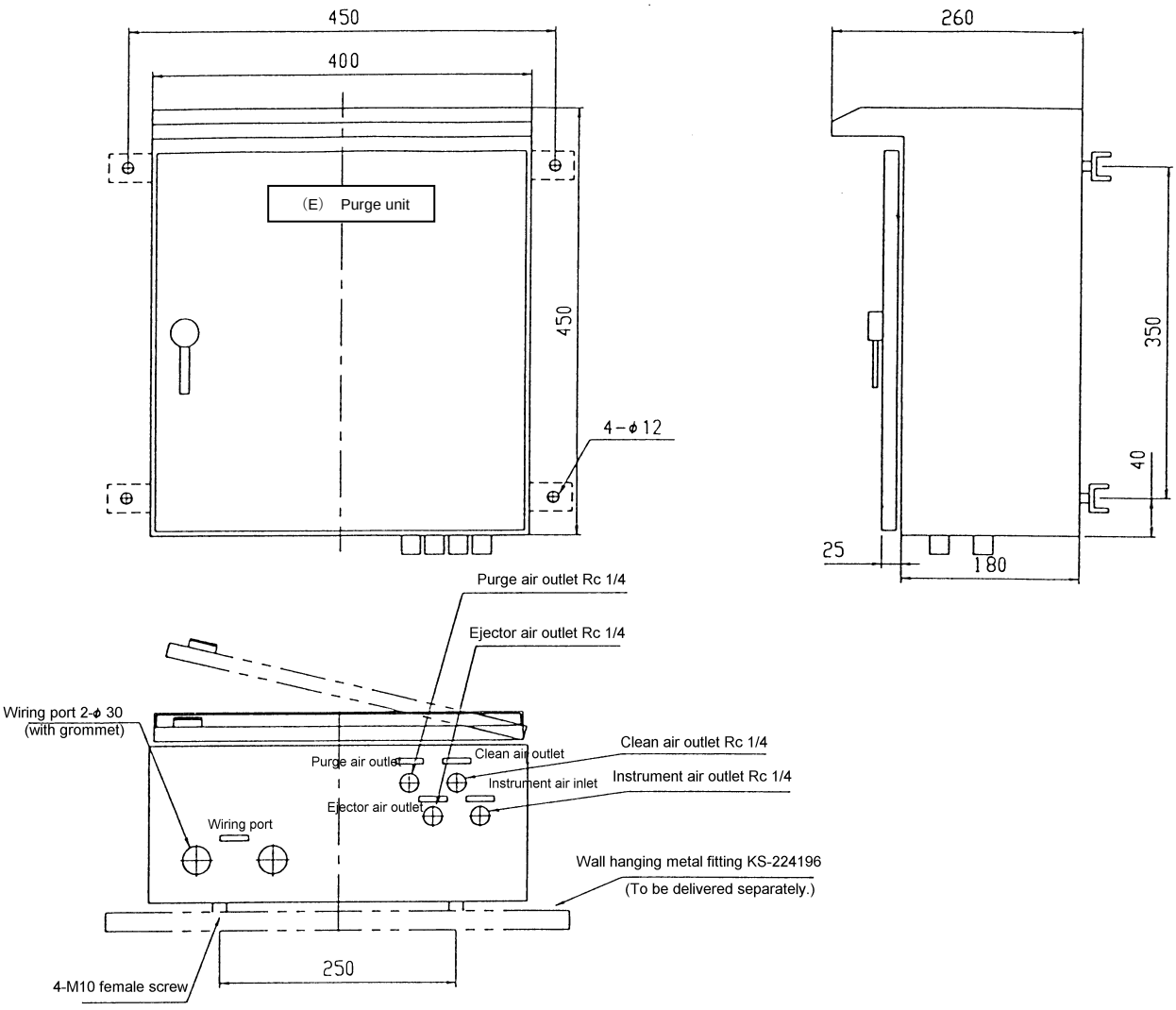


Specifications

Material: SUS316

Weight: Approximately 2.3 kg/1000 mm

3) Purge unit KV-634036-D



Specifications

Paint color:	Munsell 5Y7/1 (semi-glossy)
Structure:	Dust-proof, drip-proof, special stand or wall hanging
Weight:	Approximately 25 kg
Plate thickness:	1.6 (t)

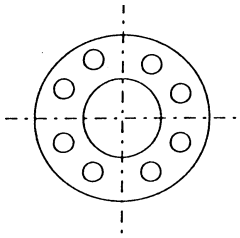
6.2 Standard specifications

Model: ISS-101
Measuring principle: Forward 70° light scattering method
Power supply: 100V AC ± 10%, 50/60 Hz, 700 VA
Measuring range: 0-10/0-25/0-100 mg/m^{3}N or equivalent
Output signal: 4 – 20 mA DC, (RL ≤ 600Ω insulation) x 2 systems
Compressed air supply: 0.2 – 0.7 MPa (instrument air or equivalent)

(Amount of fine particle: 0.1 mg/m^3 or less
Contaminated oil content: 1 ppm or less
Size of fine particle grain: 10 μm or less
Dew point at atmospheric pressure: -17°C or less)

When ejector is used: 20 Nliters/min. or less
(When the flow rate is 5 m/sec. or less or the sample point is disturbed, the ejector needs to be used.)
Purge: 150 Nliters/min. or more
Clean air: 16 Nliters/min.
The clean air is always supplied continuously at 16 Nliters/min. to prevent contamination of the optical system even though the furnace is stopped.
Note) If there is drain or contaminated oil, the measuring instrument does not function correctly. Additionally, if the air line is contaminated, it is necessary to replace the pipes and parts (flow meter and membrane filter, etc.).

Warm-up time: Approximately 60 min.
Ambient temperature range: -10 - 50°C
Mounting posture: Horizontal mounting
Note) Vertical mounting is not allowed.
Mounting flange: JIS10K100A



Pay special attention to the mounting seat bolt hole positions.

Weight: Approximately 40 kg
Paint color: Case SUS304 (except for bottom plate)
Bottom plate: Electro deposition black painting
Measuring gas conditions:
Temperature: Normal temperature – 500℃
Gas pressure: ±5 KPa
Water content: 0 – 55% (No over-saturation is allowed.)
(If over-saturation occurs, the light is scattered by water drop. As a result, higher indication value is shown.)
Dust concentration: 0 – 100 mg/m^{3}N NOx Max. 500 ppm
Flow rate: Max. 25 m/sec. SOx: Max. 150 ppm
HCl: Max. 400 ppm
Accuracy (repeatability): ±2% FS (To be measured with the standard scattering rod.)

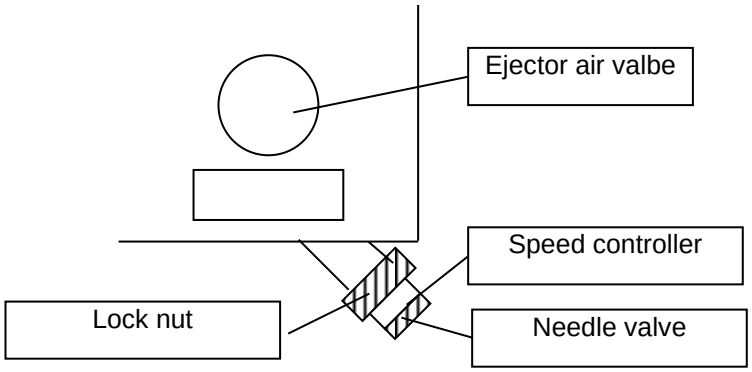
☐ Purge unit

Power supply:	None (Solenoid valve drive signals are connected from the Dust densitometer.)
Wiring port:	2- ϕ 30
Gas inlet:	Instrument air inlet RC1/4
Gas outlet:	Clean air outlet, ejector air outlet, purge air outlet, RC 1/4
Purge time setting:	By setting the data on the Dust densitometer.
Weight:	Approximately 25 kg
Paint color:	Munsell 5Y7/1 (semi-glossy)

Adjustment of the speed controller

・This dust densitometer gains the speed controller to do the flow quantity adjustment of the ejector.

・The position of the speed controller, please refer to the chart below.



From the front part of dust densitometer

・When no use ejector air, no need the adjustment. (please apply it in a shipment state)

・The ejector air is set at the time of the shipment to become about 3L/min. (in the case of ejector air pressure 0.2MPa)

＜Adjustment method＞

①Loosen the lock nut.

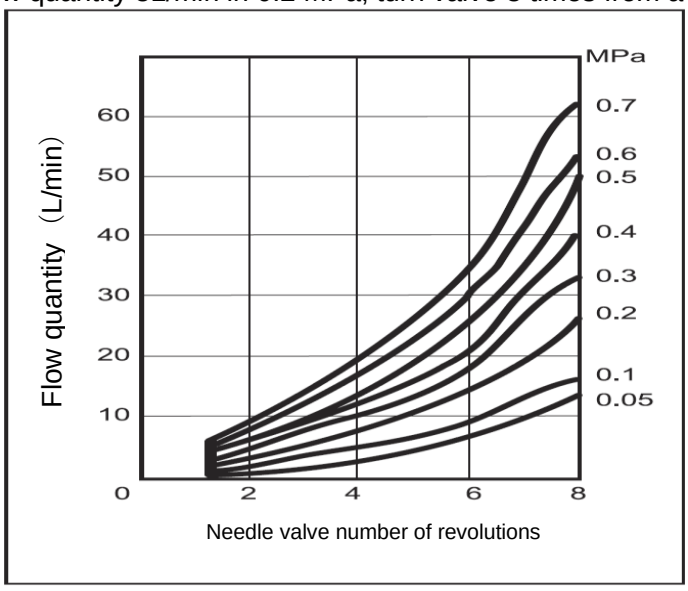
②Make a state to fully close the needle valve of the speed controller.

③Please regulate number of revolutions of the needle valve in reference to the following table to match the terms of use of the visitor.

④After adjustment, fix the needle valve by the lock nut.

＜Adjustment example＞

When need ejector flow quantity 5L/min in 0.2 MPa, turn valve 3 times from a state to fully close.



Relations of flow quantity and needle valve number of revolutions and the ejector air pressure

The contents of this manual are subject to change without notice for improvement.

ENERGY SUPPORT

For inquiries regarding product handling, please contact us or our distributors.
Inquiry form URL：https://www.energys.co.jp/english/inq/all.php
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