

3. How to Remove Radiation Protection Equipment (Details of radioactive contamination test are explained in Section 5: Method of Radioactivity Contamination Test.)

3.1. How to Remove Radiation Protection Equipment for Firefighters, Police and Medical Personnel

- Because the masks and protective clothing may be contaminated with radioactive materials, removed masks and clothing should be placed in the special container marked “Contaminated” to separate them from general waste.
- Remove the protective clothing slowly and gently to avoid radioactive contaminants on the clothing flying around.
- ☆ When clothing is removed in a room, remove shoe covers (Step ⑩) first before Step ①.
- ☆ When boots are used, remove the boots before Step ①.

① When work gloves are used over the rubber gloves, remove the work gloves first. Because radioactive materials are likely to be adhered to the outer surface of the work gloves, remove each glove so that it turns inside out.

② When a helmet is used, remove it first. Remove carefully because radioactive materials are likely to be adhered to the outer surface of the helmet.

③ Remove the adhesive tape over the rubber gloves and then remove the gloves. Because radioactive materials are likely to be adhered to the outer surface of the rubber gloves, remove each glove so that it turns inside out.

④ The surface of the mask should be tested for radioactive contamination*. By measuring the amount of radioactive materials caught by the surface of the mask, whether radioactive materials were inhaled can be estimated. If there are any contamination, never remove the mask by the final step of these procedure.

⑤ If there is no surface contamination on the mask, remove the hood of the protective clothing.

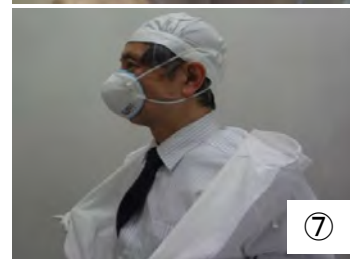
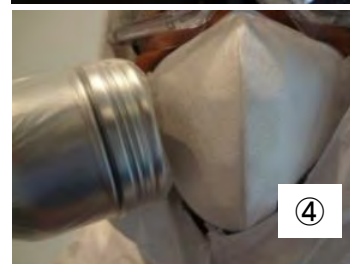
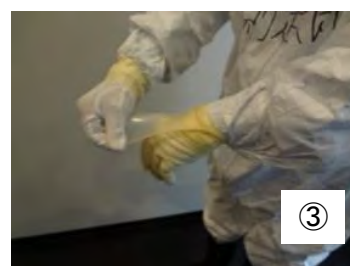
⑥ When goggles are used, remove them.

⑦ Remove the protective clothing. Because radioactive materials are likely to be adhered to the outer surface of the protective clothing, remove it slowly and gently so that it turns inside out.

⑧ Remove the mask. Remove it slowly and gently because the dust (radioactive materials) caught by the mask may be dispersed.

⑨ Remove the disposable cap.

* The purpose of the radioactive contamination test is to check whether radioactive materials are attached to the body. In measuring radioactivity, place the detector at a distance of about 1 cm from the measured surface so that the detector does not directly touch the surface.



⑩ Remove the shoe covers.

⑪ After the shoe covers are removed, radioactive contamination of the outer soles must be tested.



★ When boots are used

After Step ⑨, remove the special socks and check for radioactive contamination of the sole.

⑫ Remove the thin cotton gloves.



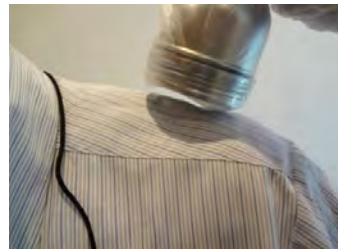
⑬ Check the palms and back of both hands for radioactive contamination.



⑭ Check the head and hair for radioactive contamination.

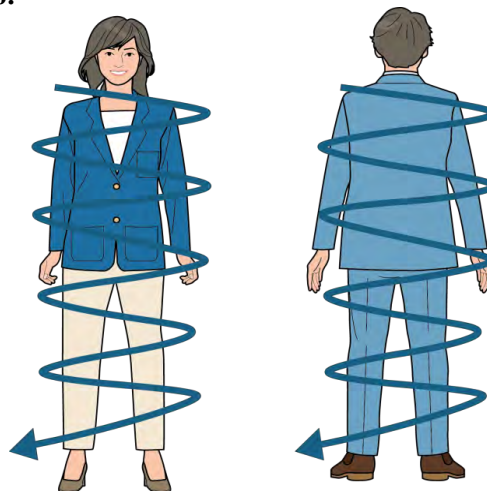


⑮ Check both shoulders for radioactive contamination.



⑯ Check the entire body for radioactive contamination by two steps, front and back.

Check front of the body, by moving the detector in a continuous zigzag pattern with face, front and side. And, check back of the body, too.



3.2. How to Remove Radiation Protection Equipment for workers inspecting and decontaminating evacuees

- Because the masks and protective clothing may be contaminated with radioactive materials, removed masks and clothing should be placed in the special container marked “Contaminated” to separate them from general waste.

- Remove the protective clothing slowly and gently to avoid radioactive contaminants on the clothing flying around.

☆ Remove the Protective Equipment in order of high possibility of contamination.

① Remove the adhesive tape over the rubber gloves and then remove the gloves. Because radioactive materials are likely to be adhered to the outer surface of the rubber gloves, remove each glove so that it turns inside out.



② The surface of the mask should be tested for radioactive contamination*. By measuring the amount of radioactive materials caught by the surface of the mask, whether radioactive materials were inhaled can be estimated. If there are any contamination, never remove the mask by the final step of these procedure.



③ Remove the isolation gowns.

Because radioactive materials are likely to be adhered to the outer surface of the Isolation gowns, remove it slowly and gently so that it turns inside out.



④ Remove the disposable cap.



⑤ Remove the mask. Remove it slowly and gently because the dust (radioactive materials) caught by the mask may be dispersed.



⑥ Remove the thin cotton gloves.



* The purpose of the radioactive contamination test is to check whether radioactive materials are attached to the body. In measuring radioactivity, place the detector at a distance of about 1 cm from the measured surface so that the detector does not directly touch the surface.

⑦ Remove the thin cotton gloves.



⑧ Check the palms and back of both hands for radioactive contamination.



⑨ Check the head and hair for radioactive contamination.

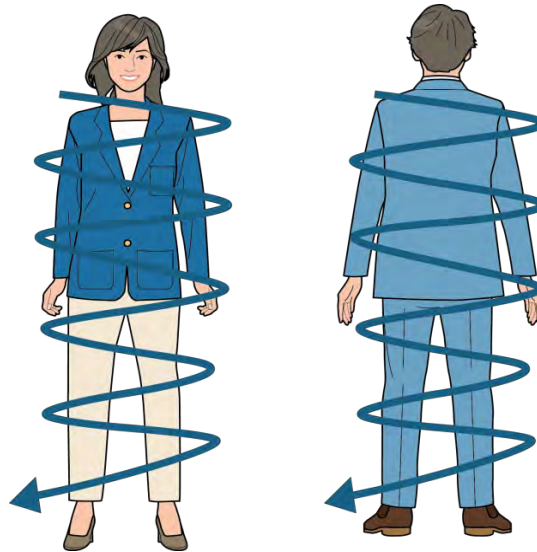


⑩ Check both shoulders for radioactive contamination.



⑪ Check the entire body for radioactive contamination by two steps, front and back.

Check front of the body, by moving the detector in a continuous zigzag pattern with face, front and side. And, check back of the body, too.



4. How to Use the Measuring Instruments

Operation of the instrument depends upon manufacturers so refer to the instruction manual of the instrument used.

Use the digital indicated value.

When the indicated value fluctuate greatly, read the median value of the fluctuation range.

(1) How to Use of Ambient Dose Rate Measuring Instrument (NaI Scintillation Survey Meter).

The ambient dose rate measuring instruments is used to measure gamma or X-ray radiation dose rate at a particular point, and the measurements are expressed in $\mu\text{Sv/h}$.

There are two types of instruments. One is the type whose indicated value is able to read as measurements. Another is the type whose indicated value should be multiplied by a calibration constant to obtain as measurements. Most instruments of the latter type are placed sticker which the calibration constant is written. On the other hand, instruments without the sticker are probably the former type.

Whether or not there is a calibration constant depends on the model and the content of regular inspections, so check it before use.

[How to obtain measurements]

When there is a calibration constant

$$\text{Measurements } (\mu\text{Sv/h}) = \text{Indicated Value } (\mu\text{Sv/h}) \times \text{Calibration Constant}$$

When there is not a calibration constant

$$\text{Measurements } (\mu\text{Sv/h}) = \text{Indicated Value } (\mu\text{Sv/h})$$

[The situation of measuring ambient dose rate]

The type of which the body and the detection unit are connected by a cable (Model: TCS-172B, NHC7)

• At the measurement point, keep the detector horizontally at a height of 1m (near the waist) from the ground. Measure in the same direction each time. At this time, keep the detector as distance from your body as possible.

• Set the time constant to 10 seconds, and after about 30 seconds (three times the time constant), read the indicated digital value. Refer p17 for the relationship between the indicated value and the time constant.



The type of that the body unit and the detection unit are integrated (Model: PRD-ERJ)

• At the measurement point, keep the instrument vertically at a height of 1m (near the waist) from the ground and measure after 16 seconds (longest response time).

• In response to the increasing measurements, the response time (three times the time constant) automatically switches.



[Example of usage. (When there is a calibration constant)]

★Model: TCS-172B (Manufacturer: Hitachi)

① Press and hold the power button for 2-3 seconds to power on the instrument.
 ※ When turning off the instrument, press and hold the power button.

② Press "Sv/h / S⁻¹" button to set the unit of measurement to "Sv/h".

③ Every time the "TIME CONST" button is pressed the time constant changes to 3-10-30 seconds each. Set the time constant to 10 seconds.

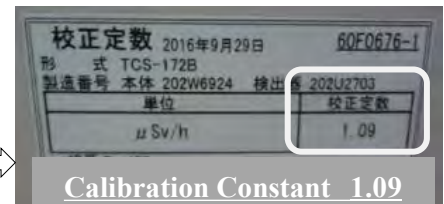
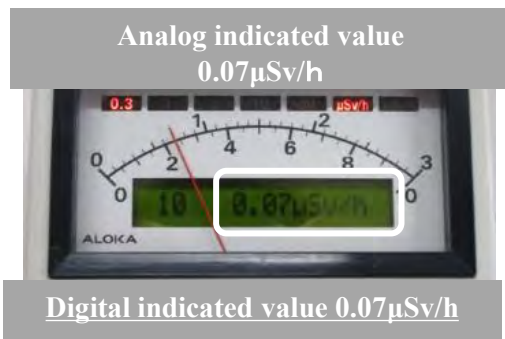
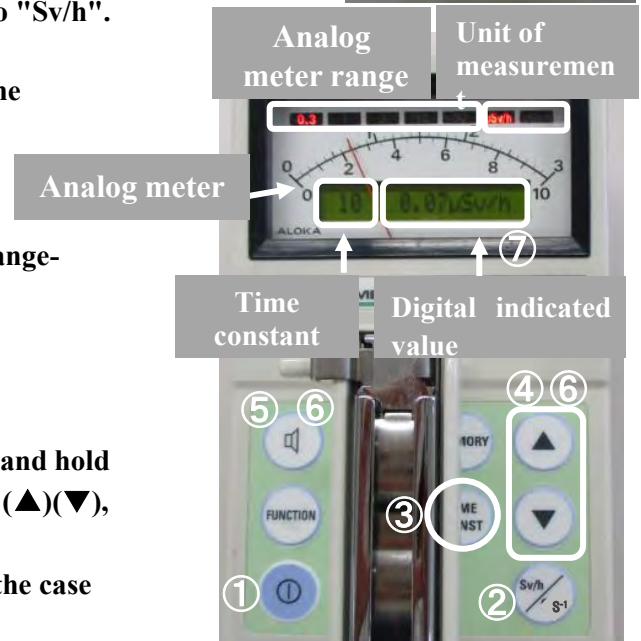
④ Set the range of the analog meter to 0.3 by pressing the range-up and range-down button (▲)(▼).

⑤ When turning off the speaker, press the speaker button.

⑥ When adjusting the contrast of the digital monitor, press and hold the speaker button and range-up and range-down button (▲)(▼), at the same time.
 In the case of pressing (▲), the display gets dark, and in the case of pressing (▼), it gets light.

⑦ The measurement is enabled. Read a digital indicated value.

⑧ Multiply the read digital indicated value by the calibration constant to obtain the measurements.



In the case of the above, the measurements are as follows.

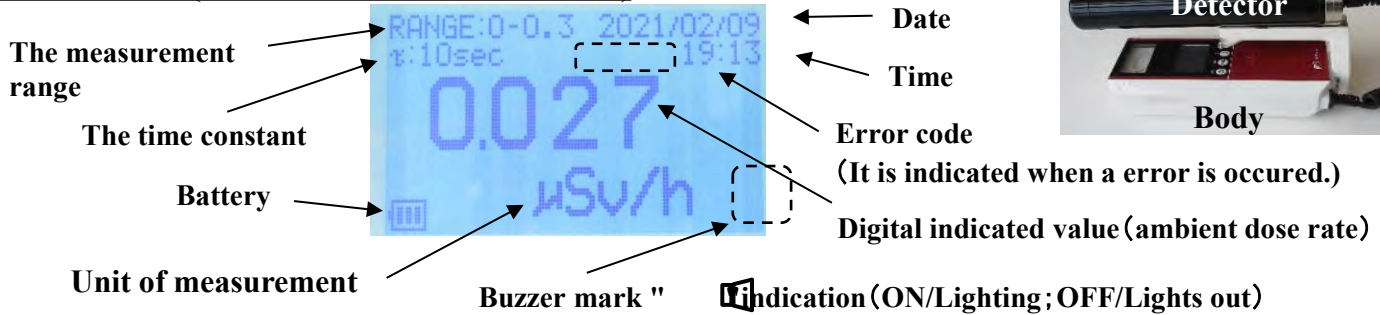
$$\begin{aligned} \text{Measurements} &= \text{Indicated Value}[0.07\mu\text{Sv/h}] \times \text{Calibration Constant}[1.09] \\ &= 0.08 \mu\text{Sv/h} \end{aligned}$$

【Indication and the measurement range of the analog meter range】

- ① In the case of 0.3: 0~0.3μSv/h ③ In the case of 3: 0~3.0μSv/h ⑤ In the case of 30: 0~30μSv/h
- ② In the case of 1: 0~1.0μSv/h ④ In the case of 10: 0~10μSv/h
- ※ When using range ①③⑤, read upper scale. When using range ②④, read lower scale.

[Example of usage. (When there is not a calibration constant)]

★Model: NHC7 (Manufacturer: FUJI ELECTRIC)



① Press and hold the "PWR" button for 5 seconds to power on the instrument.

※ When turning off the instrument, press and hold the "PWR" button for 5 seconds.

② Make sure that the unit of measurement is "μSv/h".

When the unit is not "μSv/h", the "FUNC" button should be pressed several times to adjust it to correct unit.

③ Set the time constant to 10 seconds.

When the time constant indicated on monitor is not 10 seconds, adjust it according to following procedure.

⇒ Press the "FUNC" button several times to display the "SCA2 ks⁻¹" monitor.

⇒ Press and hold the "FUNC" button for 3 seconds to display the "Date" monitor.

⇒ Press the "FUNC" button several times to display the "T.Const" monitor.


⇒ Press the ">" button once to blink the characters of the time constant.

⇒ Press the "∨" button several times to set the time constant to 10 seconds. ("1sec" → "3sec" → "10sec" → "30sec" → "AUTO")

⇒ Press and hold the "FUNC" button 3 seconds to blink the characters of the time constant.

⇒ Press the "FUNC" button several times to return to the initial "μSv/h" monitor.

⇒ Make sure that the time constant has changed to 10 seconds.

④ When turning off the speaker, press and hold the " > / ∨ " button for 3 seconds. Then, "  " mark will be not displayed on the monitor.

⑤ When the monitor should be brighten, press the "PWR" button to turn on the backlight.

⑥ The measurement is enabled.

The indicated value is the measurements.

In the case of the above, the measurements are as follows.

$$\text{Measurements} = \text{Indicated Value}[0.027\mu\text{Sv/h}] = 0.027 \mu\text{Sv/h}$$

[Indication and the measurement range of the analog meter range]

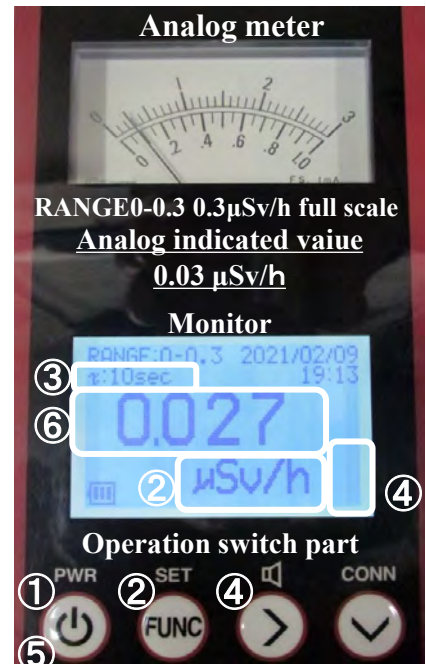
① (RANGE: 0-0.3): 0~0.3μSv/h ④ (RANGE: 0-10) : 0~10μSv/h

② (RANGE: 0-1.0): 0~1.0μSv/h ⑤ (RANGE: 0-30) : 0~30μSv/h

③ (RANGE: 0-3.0): 0~3.0μSv/h ⑥ (RANGE: 0-100) : 0~100μSv/h

※ The measurement range is automatically switched. When range ①③⑤ is indicated, read upper scale.

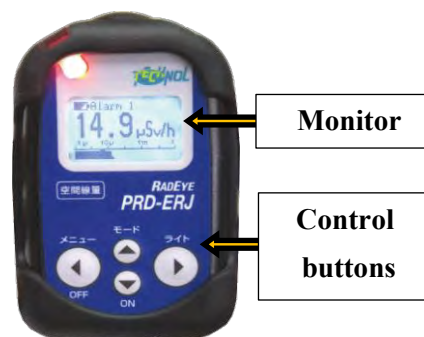
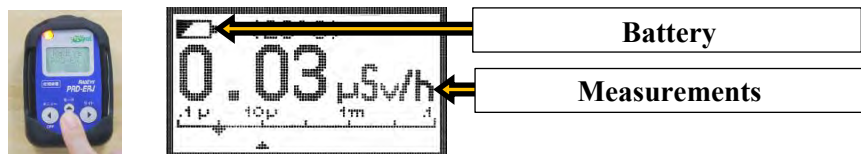
When range ②④⑥ is indicated, read lower scale.





★Model: PRD-ERJ (Manufacturer: Thermo Fisher Scientific, Distributor: Chiyoda Technol Corp.)

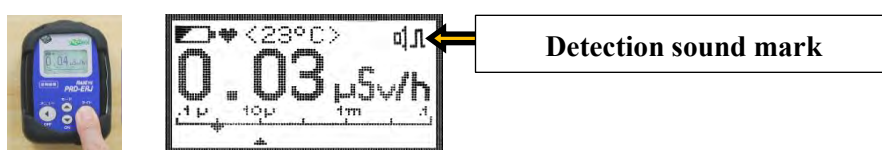
① Starting up the measuring instrument

Press and hold the "  " button for at least 1 second to power on the instrument.

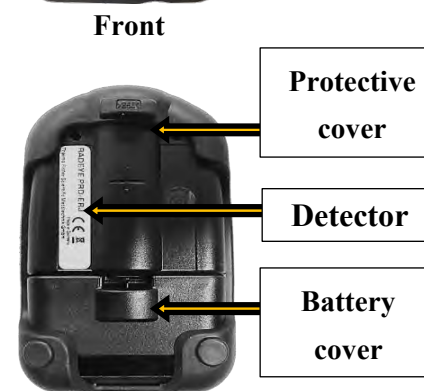


② Cancellation of the detection sound


When there is "  " (detection sound mark) in the initial monitor, press the "  " button twice.




※The detection sound is turned off during the evacuation inspection.



③ Cancellation of the alarm

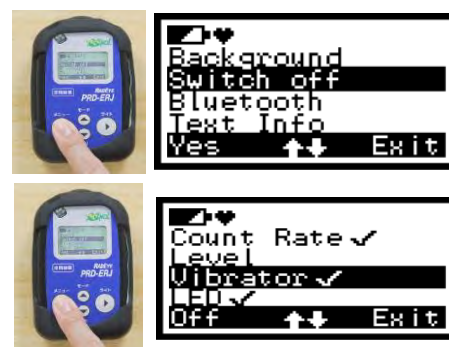
(1) Press the "  " button on the initial monitor to display the menu.

(2) Press the "  " or "  " buttons to scroll the monitor.

When there is a "✓" mark next to "Sound" and "Vibrator", press the "  " button to remove the "✓" mark.

(3) Press the "  " button twice to return to the initial monitor.

※The detection sound is turned off during the evacuation inspection.



④ Completion of start up to the instrument

The measurement is enabled. The indicated value is the measurements.


The unit of indicated value automatically switches according to the scale of the value (μSv/h ⇄ mSv/h).

In the case of the above, the measurements are as follows.

$$\begin{aligned} \text{Measurements} &= \text{Indicated Value} [0.03 \mu\text{Sv/h}] \\ &= 0.03 \mu\text{Sv/h} \end{aligned}$$

※In response to increasing measurements, the response time (three times the time constant) automatically switches.

⑤ Shutting down the instrument

Press the "  " button three times on the initial monitor to turn off the power.



(2) Use of the Surface Contamination Measuring Instrument (GM Survey Meter etc.)

The surface contamination measuring instrument is used to detect whether radioactive materials are present on the surface of the human body, clothing, and other objects. The unit of measurement is the number of beta ray counted per one minute ("cpm" or "min⁻¹": count per minute). The unit of measurement displayed may differ depending on the measuring device, but "cpm" and "min⁻¹" have the same meaning.

[Precaution for use]

Note that the measurement cannot be performed due to damage or contamination to the film of the detector window.

- There is a thin film inside of the protective material (mesh) of the detector surface.



Model: TGS-146B



Model: NHJ120



Model: B20J

[example of the usage]

★ Model: TGS-146B (Manufacturer: Hitachi)



- ① Press and hold the power button for 2-3 seconds to power on the instrument.
- ※ When turning off the instrument, press and hold the power button.

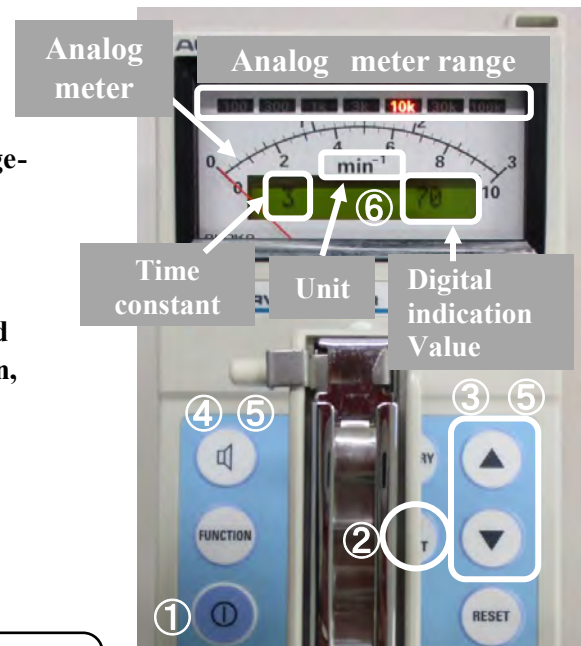
- ② Every time the "TIME CONST" button is pressed the time constant changes to 3-10-30 seconds each. Set the time constant to 3 seconds.

- ③ Set the range of the analog meter to 10k by pressing the range-up and range-down Button (▲)(▼).

- ④ When turning off the speaker, press the Speaker Button.

- ⑤ When adjusting the contrast of the digital monitor, press and hold the Speaker Button and range-up or range-down Button, at the same time (▲)(▼).
In the case of pressing (▲), the display gets dark, and in the case of pressing (▼), it gets light.

- ⑥ The measurement is enabled. Read a digital indicated value.
When indicated value exceeds 999 (min⁻¹), the value is automatically displayed in k (min⁻¹) units.



Measurements = Indicated Value (min⁻¹ = cpm)

【Indication and the measurement range of the analog meter range】

- ① In the case of 100: 0~100min⁻¹ ③ In the case of 1k: 0~1,000min⁻¹ ⑤ In the case of 10k: 0~10,000min⁻¹
- ② In the case of 300: 0~300min⁻¹ ④ In the case of 3k: 0~3,000min⁻¹ ⑥ In the case of 30k: 0~30,000min⁻¹
- ⑦ In the case of 100k: 0~100,000min⁻¹

※ When using range ②④⑥, read upper scale. When using range ①③⑤⑦, read lower scale.

★ Model: NHJ120 (Manufacturer: FUJI ELECTRIC)

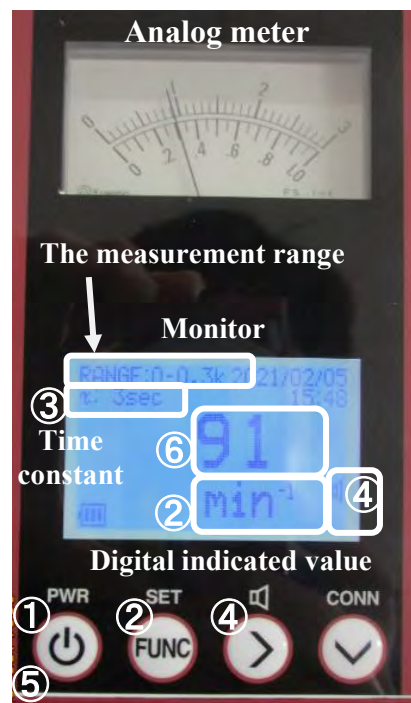
Detector window



- ① Press and hold the "PWR" button for 5 seconds to power on the instrument.
 ※ When turning off the instrument, press and hold the "PWR" button for 5 seconds.

- ② Make sure that the unit of measurement is "min⁻¹".
 When the unit is not "min⁻¹", the "FUNC" button should be pressed several times to adjust it to correct unit.

- ③ Set the time constant to 3 seconds.
 When the time constant indicated on monitor is not 3 seconds, adjust it according to following procedure.
 ⇒ Press the "FUNC" button several times to display the "Bq/cm²" monitor.
 ⇒ Press and hold the "FUNC" button for 3 seconds to display the "Date" monitor.
 ⇒ Press the "FUNC" button several times to display the "T.Const" monitor.
 ⇒ Press the ">" button once to blink the characters of the time constant.
 ⇒ Press the "√" button several times to set the time constant to 3 seconds. ("1sec" → "3sec" → "10sec" → "30sec" → "AUTO")
 ⇒ constant. Press and hold the "FUNC" button for 3 seconds to blink the characters of the time constant.
 ⇒ Press the "FUNC" button several times to return to the initial "min⁻¹" monitor.
 ⇒ Make sure that the time constant has changed to 3 seconds.



- ④ When turning off the speaker, press and hold the " > " button for 3 seconds.
 Then, " " mark will be not displayed on the monitor.

- ⑤ When the monitor should be brighten, press the "PWR" button to turn on the backlight.

- ⑥ The measurement is enabled. Read a digital indicated value.
 When indicated value exceeds 999 (min⁻¹), the value is automatically displayed in k (min⁻¹) units.

Measurements = Indicated Value (min⁻¹ = cpm)

【Indication and the measurement range of the analog meter range】

- ① (RANGE: 0-0.3k): 0~ 300min⁻¹ ④ (RANGE: 0-10k) : 0~ 10,000min⁻¹
 ② (RANGE: 0-1.0k): 0~1,000min⁻¹ ⑤ (RANGE: 0-30k) : 0~ 30,000min⁻¹
 ③ (RANGE: 0-3.0k): 0~3,000min⁻¹ ⑥ (RANGE: 0-100k): 0~100,000min⁻¹

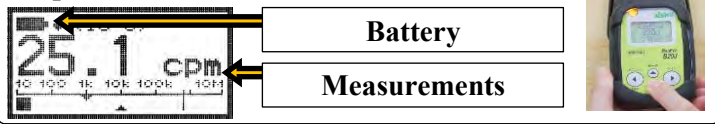
※ The measurement range is automatically switched.

When range ①③⑤ is indicated, read upper scale. When range ②④⑥ is indicated, read lower scale.



★Model: B20J (Manufacturer: Thermo Fisher Scientific, Distributor: Chiyoda Technol Corp.)

① Starting up the measuring instrument

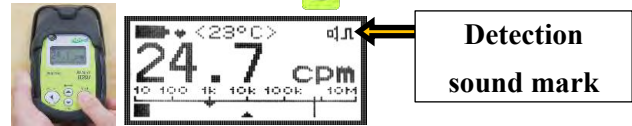
Press and hold the "  " button for at least 1 second to power on the instrument.









② Cancellation of the detection sound

When there is "  " (detection sound mark) in the initial monitor, press the "  " button twice.

※The detection sound is turned off during the evacuation inspection.









③ Cancellation of the alarm

- (1) Press the "  " button on the initial monitor to display the menu.
- (2) Press the "  " or "  " buttons to scroll the monitor.
And, choice "Alarm indication" and push the "  " button.
- (3) When there is a "✓" mark next to "Sound" and "Vibrator", press the "  " button to remove the "✓" mark.
- (4) Press the "  " button twice to return to the initial monitor.

※The alarm is turned off during the evacuation inspection.



④ Setting the response time

- (1) Press the "  " button on the initial monitor to display the menu.
- (2) Press the "  " and "  " buttons to scroll the monitor.
And, choice "Operation mode" and push the "  " button.
- (3) When there is not a "✓" mark next to "Ratemeter ADF", press "  " button to add the "✓" mark.
- (4) Press the "  " button twice to return to the initial monitor.




⑤ Completion of start up to the instrument

The measurement is enabled. Read a digital indicated value. The unit of indicated value automatically switches according to the scale of the value (cpm ⇄ kcpm).

※In response to increasing measurements, the response time (three times the time constant) automatically switches.

Measurements = Indicated Value
(cpm = min⁻¹)

⑥ Shutting down the instrument

Press the "  " button three times on the initial monitor to turn off the power.



【Reference(calculation method of the surface contamination density)】

If the ¹³⁷Cs surface contamination measured by B20J was 20,000 cpm, the surface contamination density would be about 120 Bq/cm² (equivalent to OIL4). For the calculation method, refer to p.19, "How to calculate surface contamination density (Bq/cm²) from measurements (cpm)"]".