

**Instructions in the Use of Radiation Protection
Equipment and Radiation Measuring Instruments by
Disaster Response Personnel in a Nuclear Emergency**

December 28,2022

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Cabinet Office, Nuclear Emergency Preparedness and Response

Purpose and Use of this Booklet

This booklet is intended to explain the radiation protection equipment and its use and the method of radiation contamination detection by disaster response personnel for protection from radiation in a nuclear emergency.

Actually, which the equipment is used depends on the operation in charge.

Please use this booklet in addition to the materials for basic training for a nuclear emergency.

1. Radiation Protection Equipment

1.1. Protective Equipment for Firefighters, Police and Medical Personnel

(1) Protective Mask

To prevent inhalation of radioactive materials

Wear a mask to prevent inhalation of radioactive materials from respiration.

A dust mask should be used for dusty radioactive materials.

The mask made of nonwoven fabric is disposable.



(2) Protective Clothing (Nonwoven fabric as protective clothing: Tyvek® etc.)

To prevent radioactive contamination of the skin and regular clothing

Wear disposable protective clothing over regular clothing, to prevent adhesion of radioactive materials on the skin and clothing.



(3) Gloves

To prevent radioactive contamination of hands

Disposable rubber gloves should be used over thin cotton gloves.

In order to prevent tearing of the rubber gloves, cloth work gloves should be used over the rubber gloves depending on the case.



(4) Shoe Covers

To prevent radioactive contamination of the shoes

Disposable shoe covers should be used if radioactive materials might adhere to shoes.



(5) Cap

To prevent radioactive contamination of the head and hair

Wear a disposable cap on the head.

The cap should be worn under the hood of protective clothing (nonwoven fabric as protective clothing: Tyvek® etc.).

When a helmet is used, wear it over the hood of the protective clothing.



1.2. Protective Equipment for workers inspecting and decontaminating evacuees

(This is for workers who may be contaminated by radioactive materials.)

(1) Surgical Mask

To prevent inhalation of radioactive materials

Wear a mask to prevent inhalation of radioactive materials from respiration.



Surgical Mask(Example)

(2) Isolation Gowns

To prevent radioactive contamination of the skin and regular clothing

Wear disposable Isolation gowns over regular clothing, to prevent adhesion of radioactive materials on the skin and clothing.



Isolation Gowns

(3) Gloves

To prevent radioactive contamination of hands

Disposable rubber gloves should be used over thin cotton gloves.

In order to prevent tearing of the rubber gloves, cloth work gloves should be used over the rubber gloves depending on the case.



Cotton Gloves



Rubber Gloves

(4) Cap

To prevent radioactive contamination of the head and hair

Wear a disposable cap on the head.



Cap(Example)

(6) Personal Dosimeter

To measure exposure dose

The personal dosimeter is a device to measure the individual radiation exposure dose.

There are two types of device to measure radiation exposure :
the electronic type and integrating type.



Electronic Personal Dosimeter (Example)

(i) Electronic Personal Dosimeter

The electronic personal dosimeter provides direct readings of individual radiation exposure doses.

There are two types of the personal electronic dosimeter: one is reset just by turning off the power switch;
the other is reset by holding down the power switch.

[Glass Badge]

[Quixcell Badge]



Integrating Personal Dosimeter(Example)

(ii) Integrating Personal Dosimeter

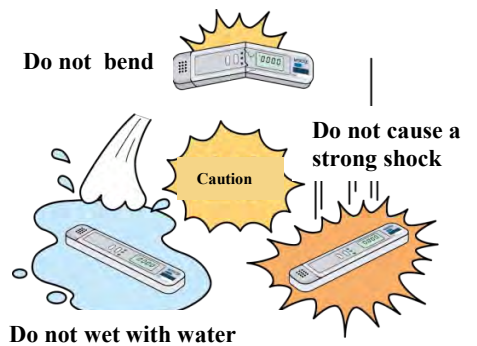
The integrating personal dosimeter measures the integrated exposure dose for every month or during the wearing period.

Then the dose vale is read using a dedicated device.

※Precautions for Use of Personal Dosimeter

Electromagnetic radiation emitted from a cellphone may induce malfunction to an electronic dosimeter, so never place it in a pocket with a cellphone.

Causing a strong shock, bending, or wetting with water must be avoided to either the electronic or integrating personal dosimeter.



(7) Radiation Measuring Instruments

(i) Ambient Dose Rate Measuring Instrument (NaI Scintillation Survey Meter)

The NaI scintillation survey meter can be used for measurement of the ambient dose rate from the natural background level with high sensitivity.



NaI Scintillation Survey Meter(Example)

(ii) Surface Contamination Measuring Instrument (GM Survey Meter etc.)

The GM survey meter can be used for the surface contamination measurement of radioactive materials on the body clothing, or surface of the object.

The GM survey meter is often used for surface contamination measurement. In addition, a plastic scintillator survey meter is also used.



GM Survey Meter(Example)

Measurement using the surface contamination measuring instrument should be kept a distance between the detector and the object surface at about 1 cm to avoid adhesion of radioactive materials on the GM tube surface.

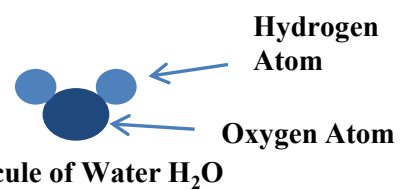
【Reference】 What is Becquerel (Bq)?

1Becquerel (Bq) is a unit of radioactivity.

Bq is defined as disintegration of atom per second.

An atom is the smallest unit that constitutes a substance.

For example, a molecule of water consists of two hydrogen atoms and one oxygen atom.



2. How to Wear Radiation Protection Equipment

2.1. How to wear the Protective Equipment for Firefighters, Police and Medical Personnel

(Put on the instrument and equipment as shown in the following order.)

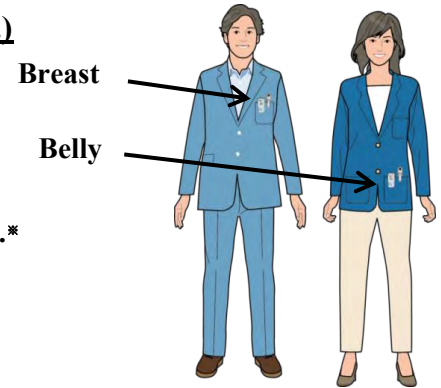
① Put on the personal dosimeter (Both the electronic personal dosimeter and the integrating personal dosimeter)

(A female who may be pregnant should place the device on the belly and other female and male should place the device on the breast.)

Place the electronic personal dosimeter with its display (LCD) facing the body.*

※ depending upon the dosimeter type.

Place the integrating personal dosimeter with your name facing outside.



② Put on the protective clothing. Pull up the zipper of the clothing all the way to the neck.

③ Put on the cap.

④ Wear thin cotton gloves.

⑤ Put shoe covers on both shoes.

⑥ Put on the dust mask.

Make sure that the dust mask is not upside down.

Do not place the string of the mask on your ears but around the back of your head.

Make sure the gap between the ridge of the nose (the foot of the nose between both eyes) and the mask is securely closed.

⑦ Wear rubber gloves.

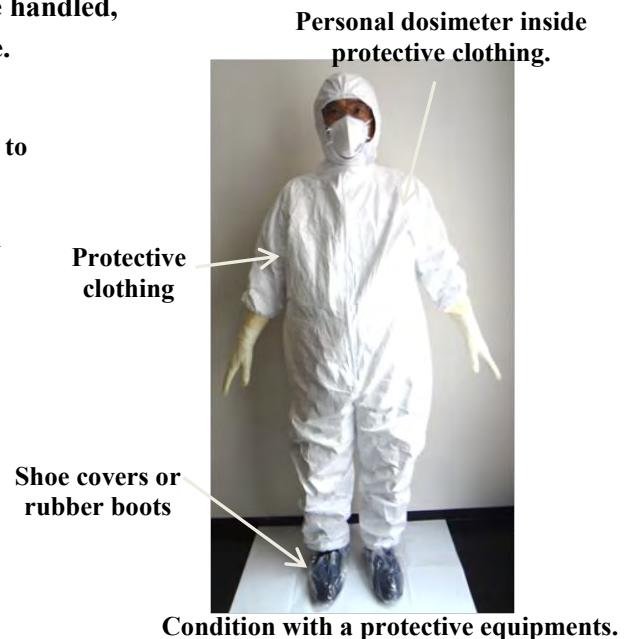
Seal the gap between the rubber glove and the cuff of the protective clothing using adhesive tape.

If the fender of a vehicle or other sharp object may possibly be handled, put on work gloves over the rubber gloves to prevent breakage.



The end of the adhesive tape (only one side) should be folded to form a triangle so that it can be easily removed. So, it will be difficult to peel off during work and easy to peel off when undressing.

⑧ Place the hood of the protective clothing over the cap.



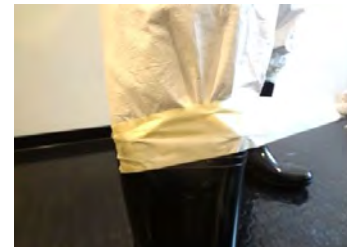
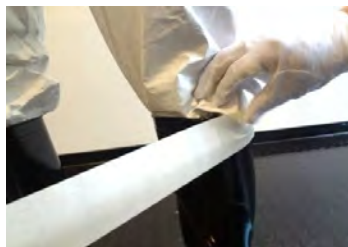
★ Measures for special situation ★

★ When boots are used:

When boots for contaminated areas are provided, use this.

Put the special socks over your personal socks.

Put the bottom of the protective clothing into the boot and seal the gap with adhesive tape.



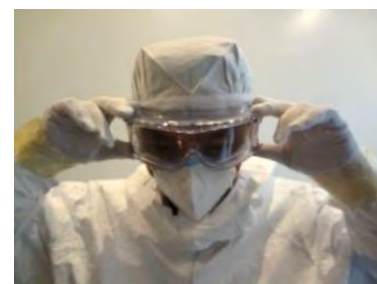
★ When a helmet is worn:

When the operation is made in an area of possible flying objects or under scaffolding, wear a helmet over the hood of the protective clothing and properly tighten the strap.



★ When goggles are worn:

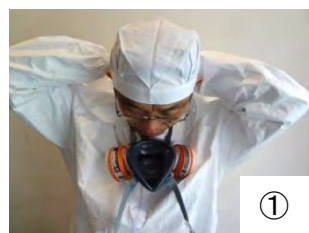
Wear goggles when the operation is made in dusty areas.



★ When a half mask with a charcoal filter is used:

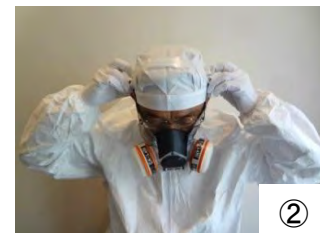
Wear a half mask with a charcoal filter when inhalation of radioactive iodine is likely to occur.

① Wrap the lower tightening string of the mask around your neck. Wrap the upper string around the back of your head.



② Pull the lower string to tighten.

Squeeze the upper string to tighten around the back of your head.



③ Make sure the mask is in tight contact with your face moving the face should move the mask up and down.

④ Inhale air with the canister of the mask blocked by your hand and to make sure there are no air leaks between the mask and your face.



⑤ If the mask is in close contact with your face when air is inhaled, the mask is properly placed without leakage of air.

2.2. How to wear the Protective Equipment for workers inspecting and decontaminating evacuees

(Put on the instrument and equipment as shown in the following order.)

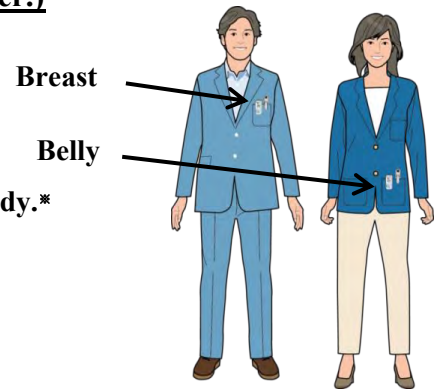
① Put on the personal dosimeter (Both the electronic personal dosimeter and the integrating personal dosimeter)

(A female who may be pregnant should place the device on the belly and other female and male should place the device on the breast.)

Place the electronic personal dosimeter with its display (LCD) facing the body.*

※depending upon the dosimeter type.

Place the integrating personal dosimeter with your name facing outside.



② Put on the isolation gowns.

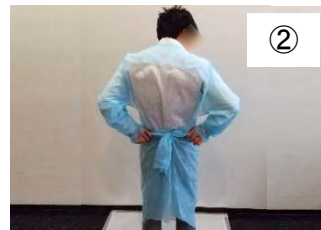
③ Put on the cap.

④ Wear thin cotton gloves.

⑥ Put on the surgical mask.

Make sure that the dust mask is not upside down.

Make sure the gap between the ridge of the nose (the foot of the nose between both eyes) and the mask is securely closed.



⑦ Wear rubber gloves.

Seal the gap between the rubber glove and the cuff of the protective closing using adhesive tape.



The end of the adhesive tape (only one side) should be folded to form a triangle so that it can be easily removed. So, it will be difficult to peel off during work and easy to peel off when undressing.

Personal dosimeter inside isolation gowns.

Isolation gowns



Condition with a protective equipments.

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.

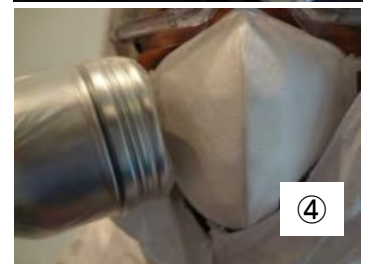
⑦ Remove the protective clothing.

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.



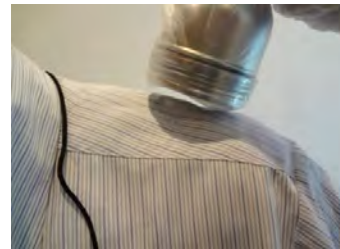
⑬ Check the palms and back of both hands for radioactive contamination.



⑭ Check the head and hair for radioactive contamination.

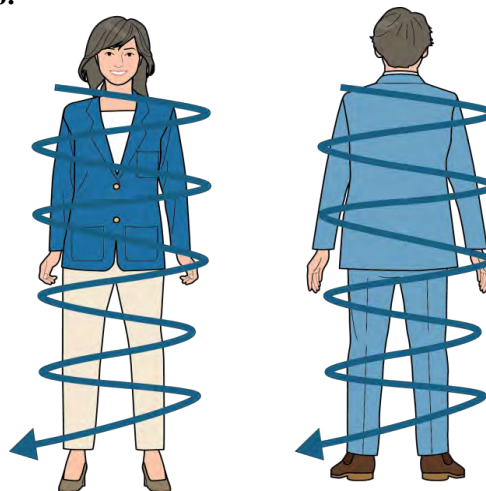


⑮ Check both shoulders for radioactive contamination.



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.

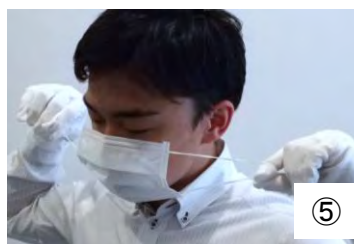
Because radioactive materials are likely to be adhered to the outer surface of the Isolation gowns, remove it slowly and gently so that it turns inside out.



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.

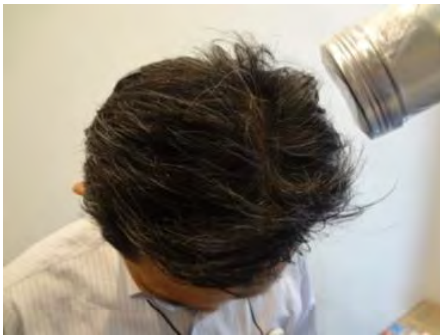
⑦ Remove the thin cotton gloves.



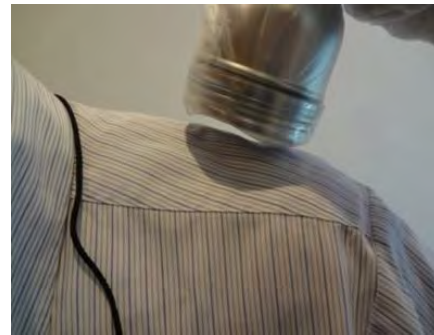
⑧ Check the palms and back of both hands for radioactive contamination.



⑨ Check the head and hair for radioactive contamination.

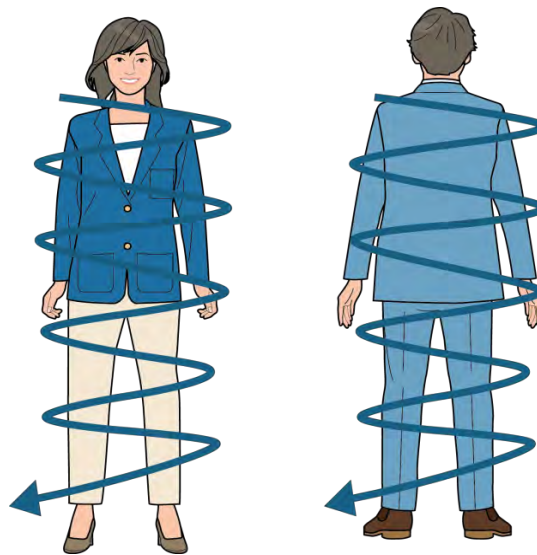


⑩ Check both shoulders for radioactive contamination.



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.

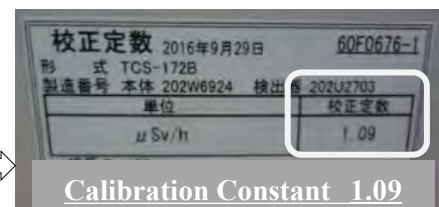
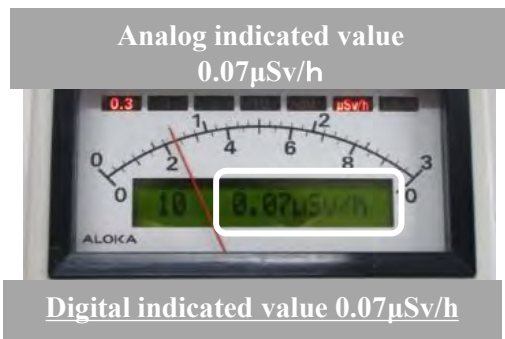
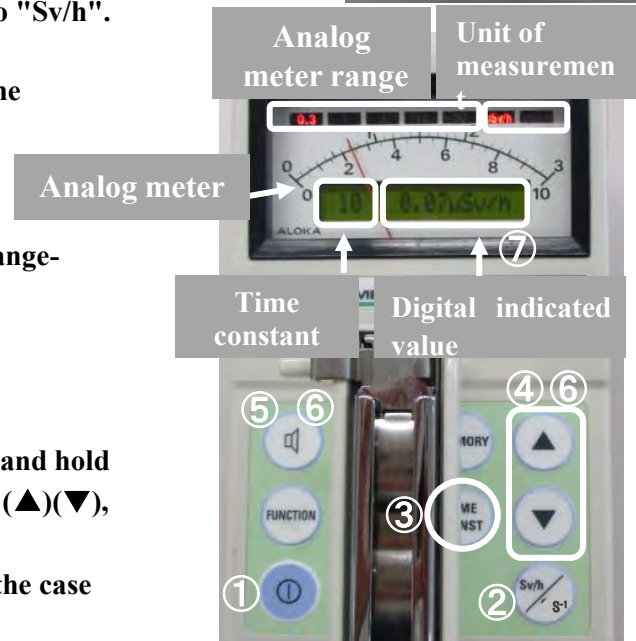
④ Set the range of the analog meter to 0.3 by pressing the range-up and range-down button (▲)(▼).

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.

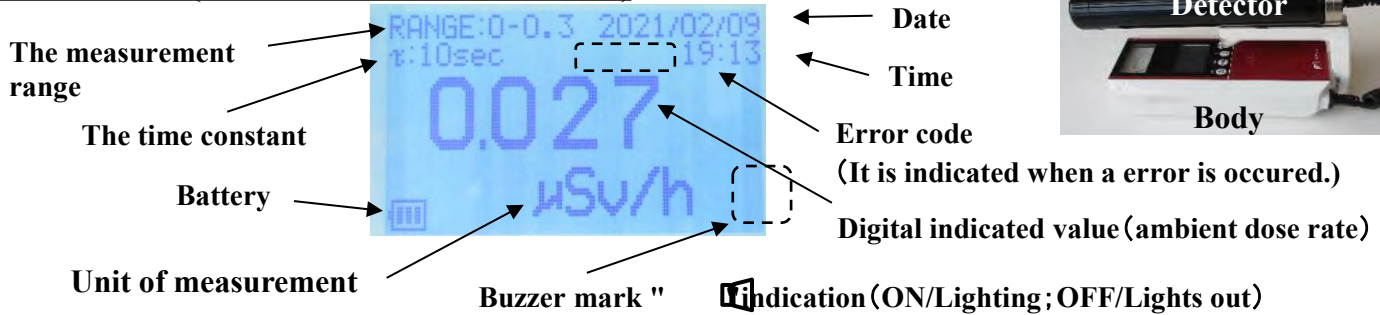
$$\begin{aligned} \text{Measurements} &= \text{Indicated Value}[0.07\mu\text{Sv/h}] \times \text{Calibration Constant}[1.09] \\ &= 0.08 \mu\text{Sv/h} \end{aligned}$$

【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.

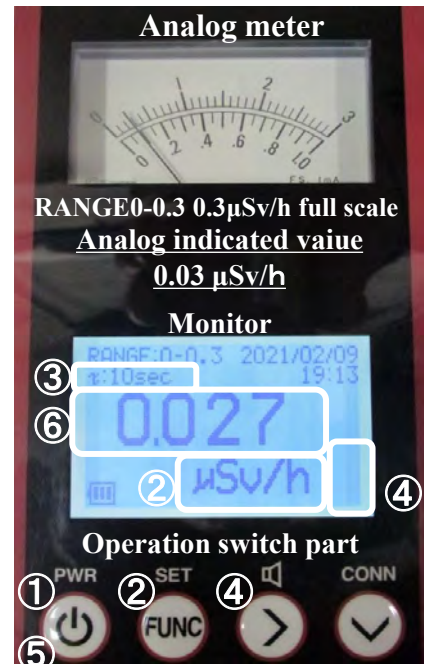
⇒ Make sure that the time constant has changed to 10 seconds.

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.

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

[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

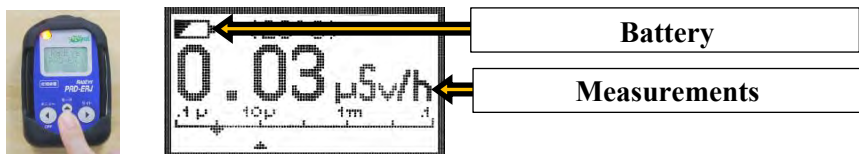
※ The measurement range is automatically switched. When range ①③⑤ is indicated, read upper scale.

When range ②④⑥ is indicated, read lower scale.



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

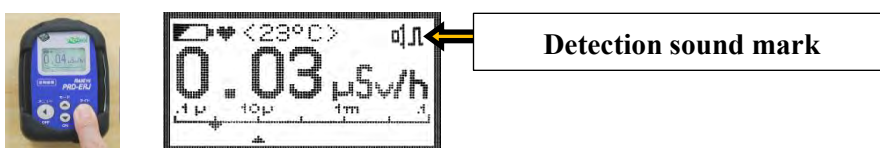
① Starting up the measuring instrument

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

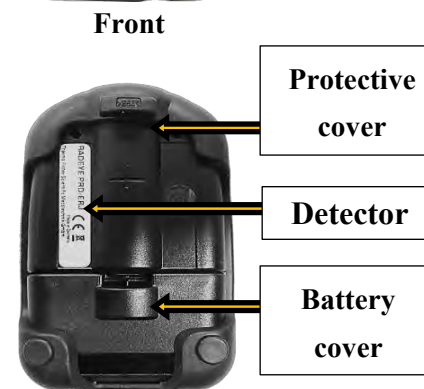


② Cancellation of the detection sound


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

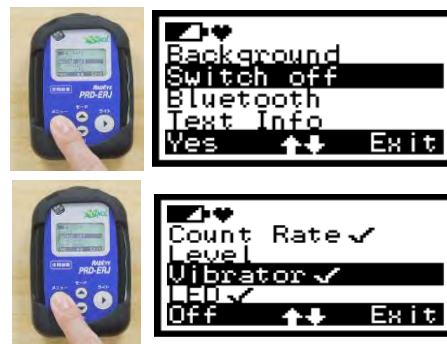
(1) Press the "  " button on the initial monitor to display the menu.

(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.

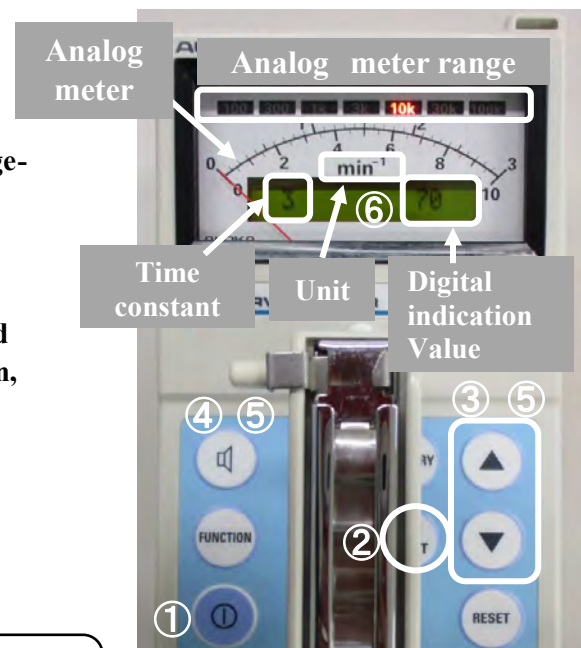
- ② Every time the "TIME CONST" button is pressed the time constant changes to 3-10-30 seconds each. Set the time constant to 3 seconds.

- 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)

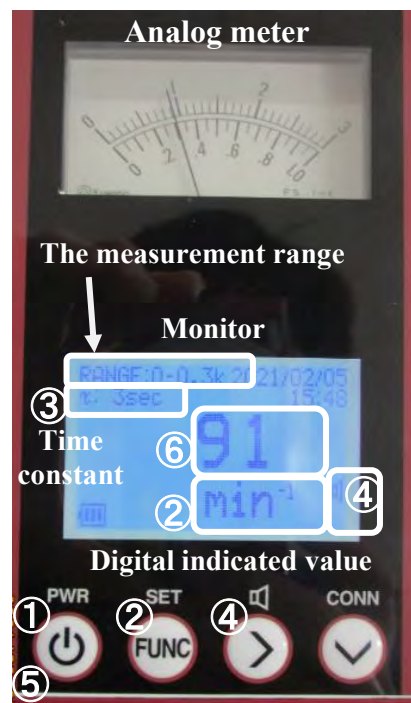
Detector window



- 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

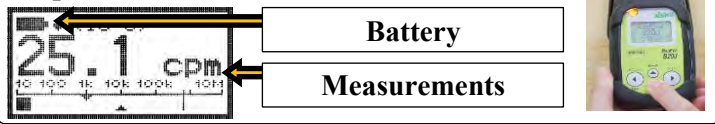
※ The measurement range is automatically switched.

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

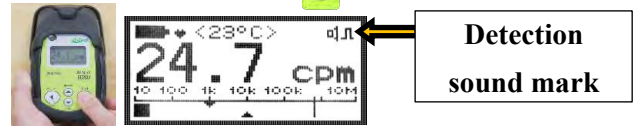
Press and hold the "  " button for at least 1 second to power on the instrument.









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)"]".

5. Method of Radioactivity Contamination Test

Radioactivity Contamination Test (Check of radioactive materials attached)

Use the Surface Contamination Measuring Instrument (GM Survey Meter, etc)

For details, refer to "4. How to Use the Measuring Instruments" and the instruction manual of each model.

[Preparations before testing]

- ① Place a PVC sheet etc. on the floor where contamination is checked to prevent contamination.
- ② Protect the surface contamination measuring instrument from radioactive contamination by wrapping the instrument and the GM tube with a thin PVC sheet or food packaging wrap.

When fixing with curing tape, etc., make sure that it does not cover the detection area window.



[Setup of the measuring instrument]

- ① Turn on the surface contamination measuring instrument.
 - ② Turn off the speaker during the evacuation inspection.
 - ③ Set the time constant to 3 (seconds).
 - ④ Set the measurement range to 10k (10,000cpm).
- ※Models with auto-switching measuring ranges do not need to be adjusted to 10k.

★ Setting standard of the measurement range (Model: in the case of use of TGS- 146B)

- 10k range (10,000min⁻¹) ➤ When measuring 6,000 cpm
- 30k range (30,000min⁻¹) ➤ When measuring 13,000cpm
- 100k range (100,000min⁻¹) ➤ When measuring 40,000cpm

[Contamination testing of residents, etc.]

★When using model: TGS-146B and NHJ120

- ① Move the GM Detector at a speed of about 10 cm/s to identify the spot where the needle of the analog meter swings abruptly.
When the needle swings out, adjust the measurement range.
- ② Move the GM Detector in a continuous zigzag pattern over the entire body at a distance of about 1 cm from the head and clothing and avoiding contact.
- ③ When the needle swings abruptly, move the detector slowly over the area at a speed of about 1 cm/s to identify the point where attachment of radioactive materials is concentrated.
When the point is identified, stop the detector and read the indicated digital value.
When the indicated value fluctuates greatly, read the median value of the fluctuation range.

★ When using model: B20J

- ① Move the detector window at a distance of about 1cm from the measurement target so that it does not touch the surface, and move it slowly in a continuous zigzag pattern to find a place where the measurements is high.
- ② Fix the instrument at a place where the measured value is high, and read the value after 10 seconds (the longest response time).



[Contamination testing of the carrying article]

In the evacuation inspection, articles carried in a bag or pouch can be measured from the outside of the bag or pouch. Measurement by opening the bag or pouch is not necessary.

[How to calculate surface contamination density (Bq/cm²) from measurements (cpm)]

An example of how to calculate the amount of radioactivity per square centimeter (Bq/cm²) from the measured values(cpm) is shown below.

There are differences in measurement efficiency (instrument efficiency) and detection area (incident window area) depending on the model of surface contamination measuring instrument used, so please check in advance.

Equation

Surface contamination density (Bq/cm²)

$$= \text{Measured Value (cpm)} \div 60 \text{ (s)} \div \text{Source Efficiency} \div \text{Measurement Efficiency} \div \text{Detection Area (cm}^2\text{)}$$

(When GM Survey Meter TGS-146B etc. is used)

When the measured value is 40,000 cpm in the condition where Source Efficiency is 0.5, Measurement Efficiency is 0.5, and the Detection Area of the detector is 20 cm², the radioactivity at that point is about 130 Becquerel (Bq).

Calculation

$$40,000 \text{ (cpm)} \div 60 \text{ (s)} \div 0.5 \text{ (Source Efficiency)} \div 0.5 \text{ (Measurement Efficiency)} \div 20 \text{ (Detection Area cm}^2\text{)} \doteq 130\text{Bq/cm}^2$$

6. Actions to be Taken when Contamination is Identified (Decontamination method)

When a hand is contaminated, the contamination should be removed with wet wipes.
 When handling a container of wet wipes, be careful not to contaminate the container.
 Move the wet wipe from the outside to the center to avoid spreading any contamination.

Always use the clean face of the wet wipe.



(Note)

Radioactive iodine may not be completely removed even when wiped with a wet wipe.

If the area is rubbed too hard with a wet wipe, the skin may be scratched and radioactive materials may enter the body, so cover the contaminated section of the body with food wrap to contain the contamination instead of rubbing too hard.

Wait until the contaminant is removed naturally over time.

If you feel anxious, consult a medical facility.



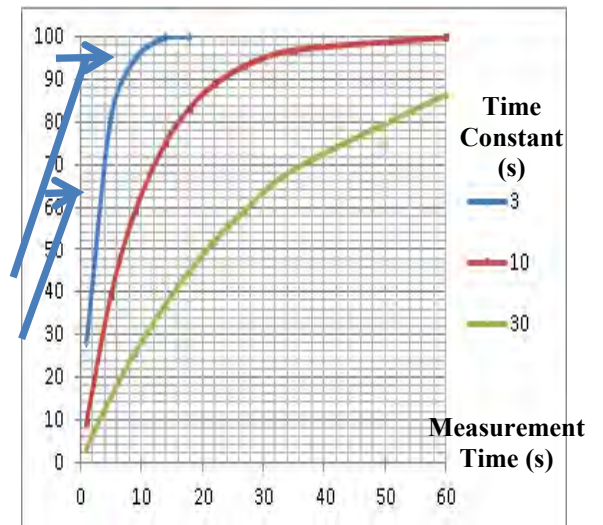
7. Precautions in Using the Instrument

① Relationship between Time Constant and the Indicated Value

In the measurement, read the indication of the meter after more than three times the time constant (seconds) has elapsed.
 The true value cannot be obtained unless more than three times the time constant has elapsed because of the relationship between the time constant and the indicated value.

95% or above at three times the time constant

63.2% at the time equal to the time constant

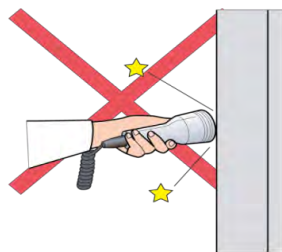


Relationship between Time Constant and the Indicated Value

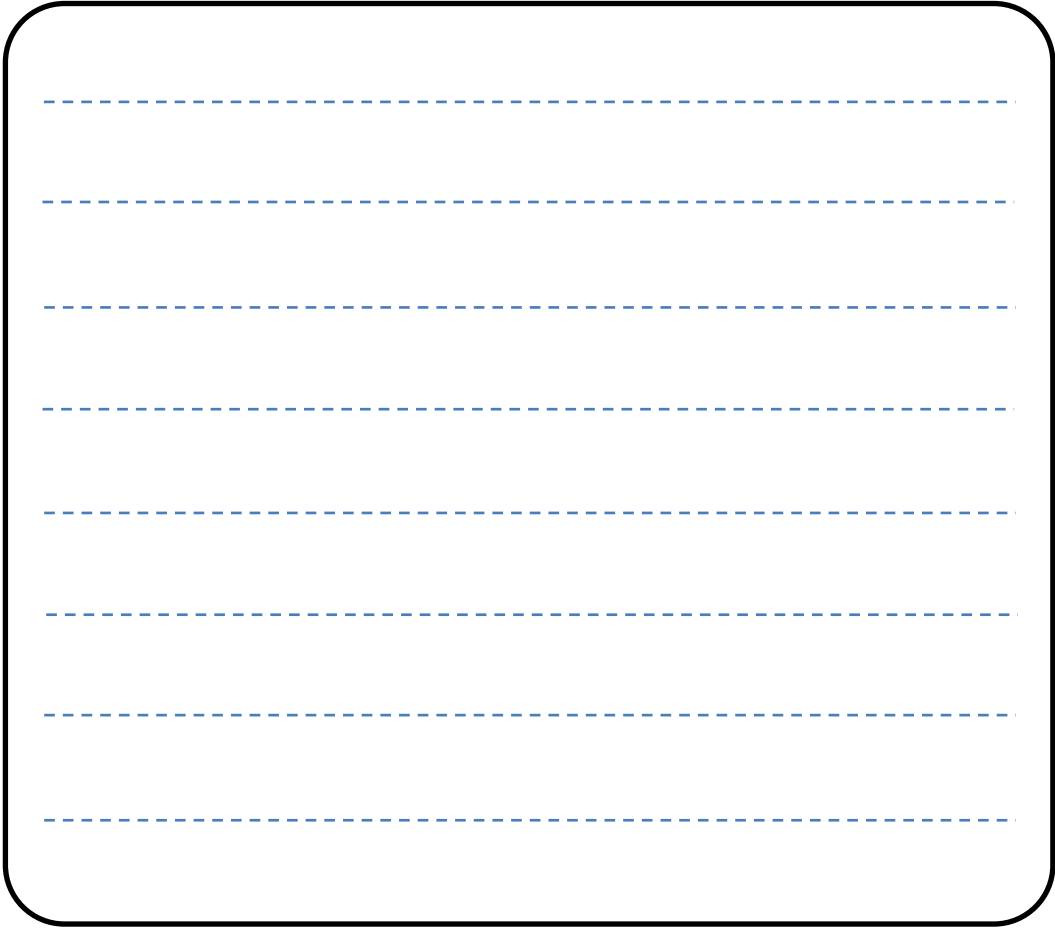
② Precautions in Using the Instrument

The instrument is a precision device.

Never expose the instrument to rain nor lift the device using the cable.



Memos



Contact Points

