

How to use and maintain survey meters and a personal digital dosimeter

- Materials for explaining
radiation measurement equipment and devices -

(English translation)

(Translated by the Red Cross Nuclear Disaster Resource Center)



日本赤十字社
Japanese Red Cross Society

(Deployed in FY 2013)

1. Survey meter for measuring air radiation dose
2. GM survey meter for body contamination screening
3. Personal digital dosimeter/(Protective suit)
4. Data reader

* *Japanese Red Cross Society*

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1. Survey meter for measuring air radiation dose
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1. Ionization chamber survey meter ICS-323C

For use of measuring air radiation dose
(1 $\mu\text{Sv/h}$ - 300m Sv/h)

Hitachi Aloka Medical, Ltd.

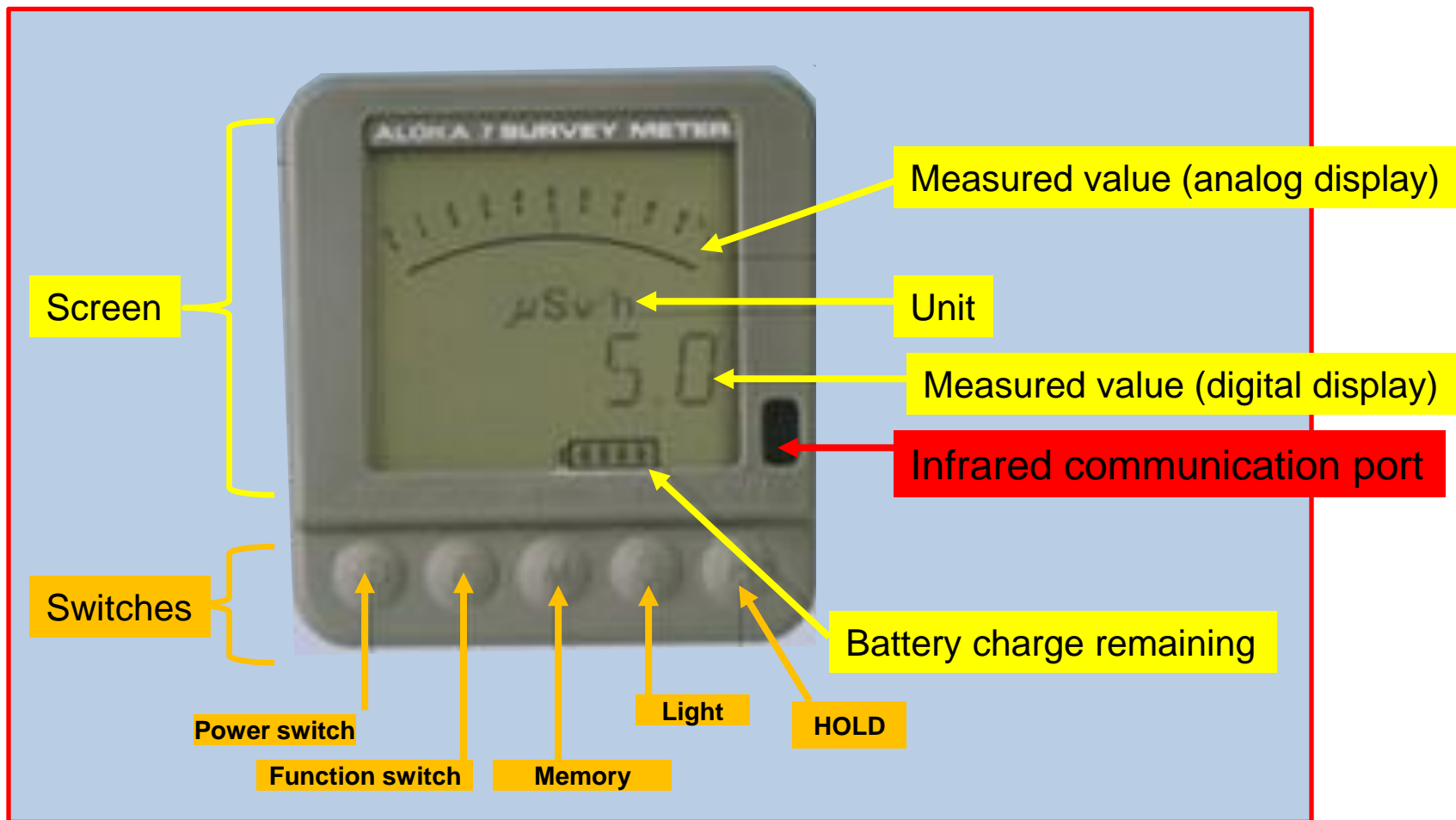
ICS-323C



Detector:	Ionization chamber
Radiation types to measure:	X-ray and γ -ray (β -ray)
Energy dependence:	30 keV - 2.0 MeV Within 15% relative to Cs-137
Measurement range:	1.0 $\mu\text{Sv/h}$ – 300 mSv/h 0.3 – 10 μSv

Note: Use of a scintillation survey meter (measurement range: 0.1 $\mu\text{Sv/h}$ – 30 $\mu\text{Sv/h}$) is appropriate to know correct air radiation doses in areas where the air radiation dose is expected to be low. However, it is not appropriate to use for the purpose of deciding on whether JRCS relief teams should continue their relief activities or estimating possible activity hours.

Part names (LC side)



(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

How to measure radiation dose:

1. Press the switch ① (for about 3 seconds).

* All display functions, time, HV and ZERO will be automatically adjusted and the device will be ready for measurement.

* Make sure to confirm that the display of $\mu\text{Sv/h}$ or μSv is shown on the screen.

2. When the above Procedure 1 is completed, the device is ready for measurement.

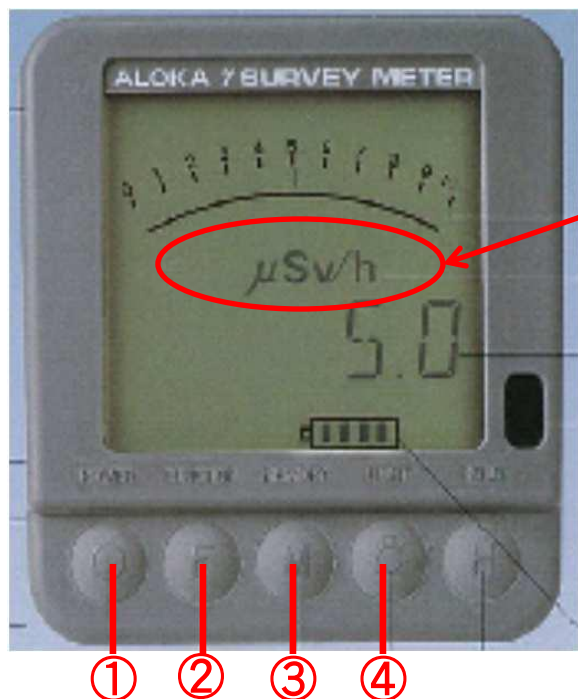
Once the survey meter reading is stable, read the indicated value.

3. To switch off the power, press the switch ① (for about 3 seconds).

To change the modes to/from $\mu\text{Sv/h}$ and μSv , press the switches in the order of:

②→③→④→③→②→②.

* To get it back to the previous mode, press the switches in the same order.

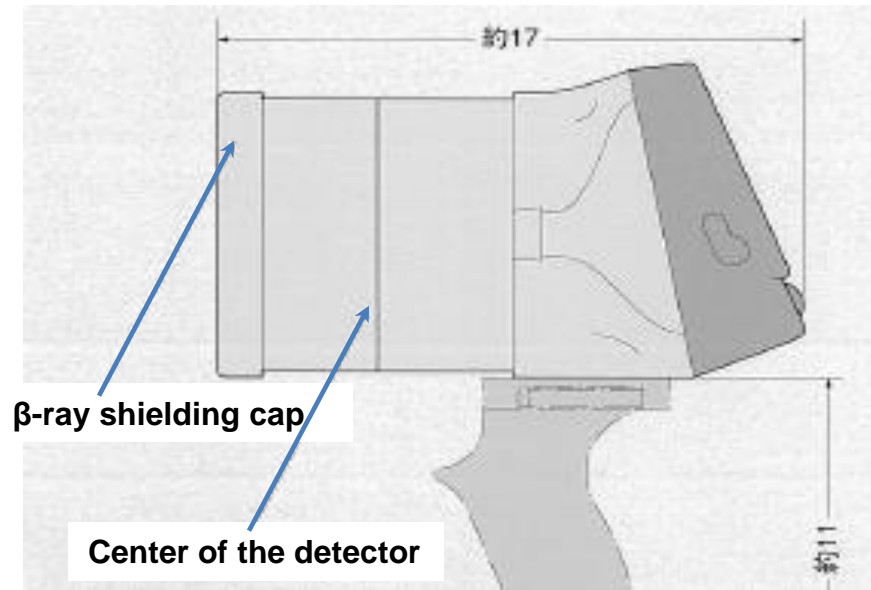


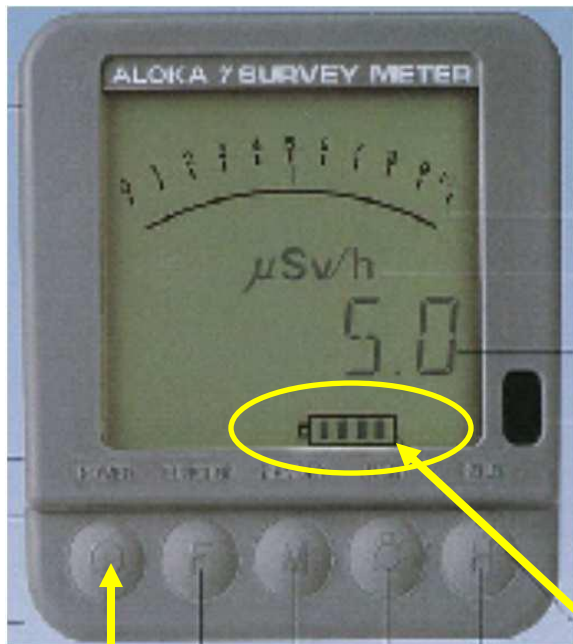
* It is preferable to conduct approx. 3 measurements and adopt the mean value.

* Make sure to measure a background value in a place of no effect from a space to be measured and subtract this background value from a measured value of the space.

(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

Face the survey meter toward
the object to be measured.





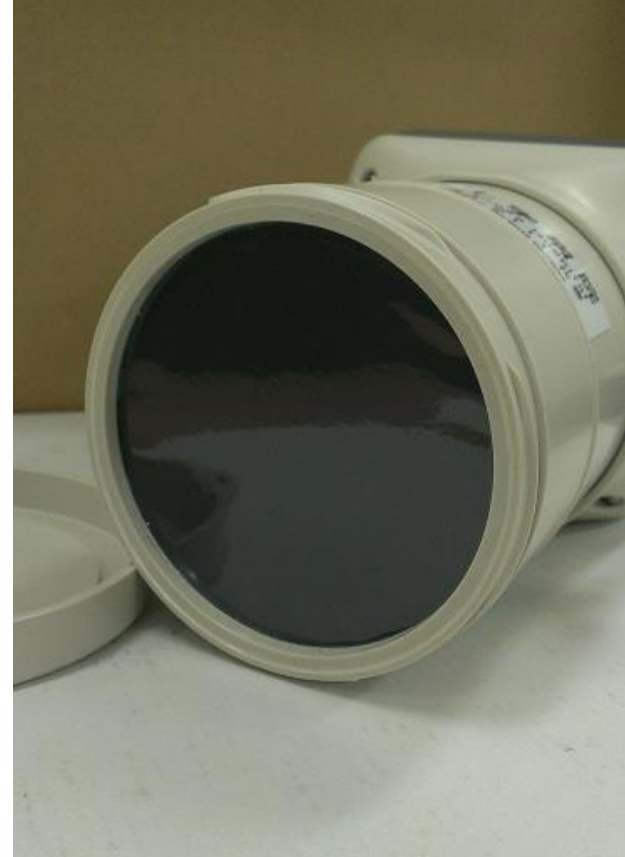
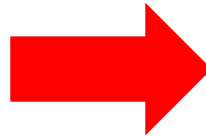
When the power is on, the self-check function starts to check the high voltage circuit and remaining battery charge, etc.

Confirm that there is no problem with the battery charge remaining, etc.

Power switch

Battery charge remaining

The survey meter has a cap on the top of it. Taking off the cap, you will see a thin membrane. Confirm that the membrane is not broken before using the meter.



- * If the survey meter is not going to be used for long periods, remove the battery and **store the survey meter in a dry space.** (Avoid humidity, direct sunshine, high/low temperature and dust.)
- * Be aware that high-intensity radio waves (e.g. use of mobile phone, high-power transceiver) cause value errors.
- * Wait **for 5 minutes** after turning on the switch **until the survey meter reading is stable** before measuring a radiation dose.
- * The survey meter reading rises during measuring a background radiation due to alpha particles including radon in the air. Therefore, wait for about tens of seconds until the reading is stable before measuring a radiation dose.
- * Do not grip the sides of the ionization chamber tight. (Otherwise, the reading will fluctuate.)

(Deployed in FY 2013)

1. Survey meter for measuring air radiation dose
2. GM survey meter for body contamination screening
3. Personal digital dosimeter/(Protective suit)
4. Data reader

2. GM survey meter TGS-146B

For use of body contamination screening

(0 - 100kmin⁻¹)

Hitachi Aloka Medical, Ltd.
TGS-146B



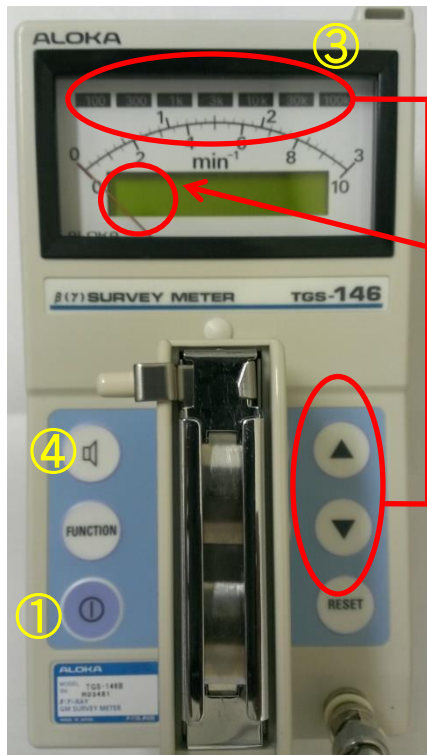
Detector:	GM tube
Radiation types to measure:	β -ray (γ -ray)
Measurement range:	0 - 100,000 min ⁻¹

Mechanism: Inactive gas is filled in the tube. The electrode is placed to the center to put high voltage on both positive and negative electrodes.



Attention to shocks/air pressure change!

- * Attention to **saturation** in an area of high count rate.
- * GM tube is a **consumable item**. (Replace it every 5 – 6 years.)



How to use the survey meter:

1. Press the switch ① (for about 3 seconds).

** Then time display, battery and HV will be automatically checked and the device will be ready for measurement.*

2. Get the detector closer to the object to be measured.

After seconds of 3 times the time constant, read the indicated value.

** The shorter the time constant is, the faster the response can be. However, there will be a wide margin of error with the shorter time constant.*

To change the time constant between 3 sec. → 10 sec. → 30 sec., press the switch ② “TIME CONST.”

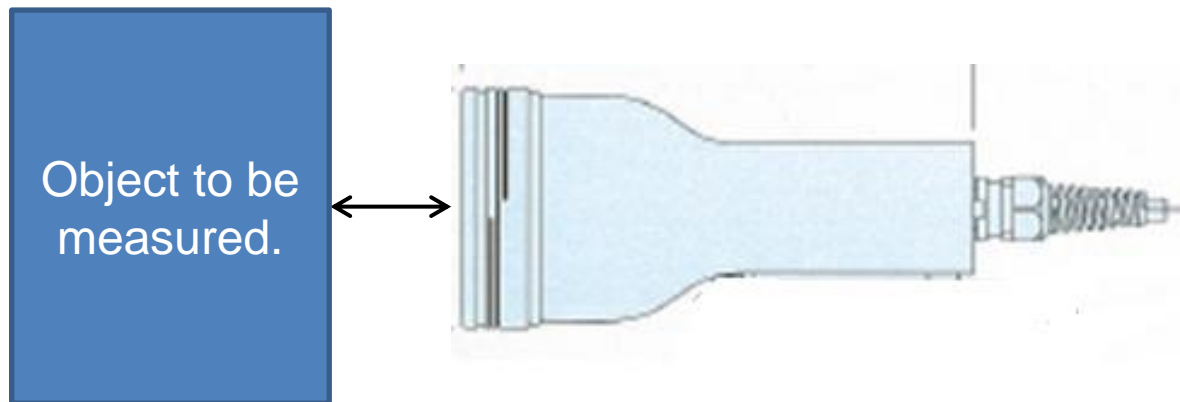
** When ③ is lighted, it shows a full scale of the analog display. The range can be changed with the switch ▲ or ▼. The measurement range should be usually started with a higher range and then down to lower ranges.*

** To turn on/off the count sound, press the switch ④.*

3. To switch off, press the switch ① (for about 3 seconds).

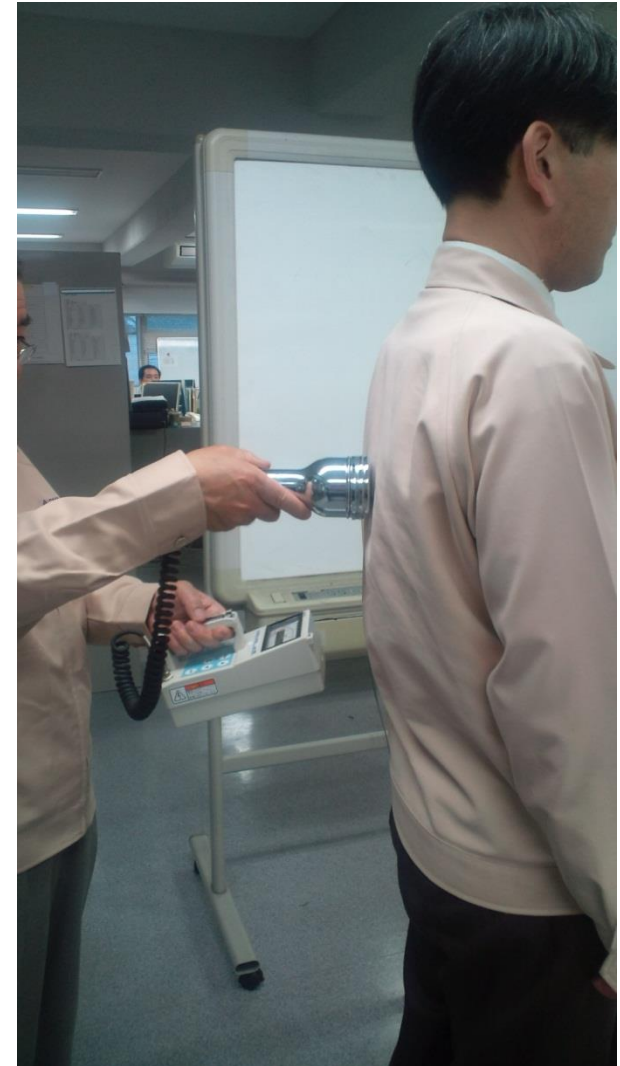


(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)



Place the survey meter at **about 1cm** from the object to be measured.

Attention: Do not place the survey meter too far from the object!



How to measure body surface contamination:

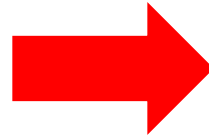
1. Cover the GM probe with a film or a thin plastic glove, etc.
(Turn off the sound switch.)
2. **Place the probe window at about 1 cm from the body surface.** Move the probe along the body surface slowly (**3 – 6 cm/s**) to look for a part of the body surface which shows the maximum count rate. Hold the GM probe at the part of the maximum count rate for about 30 seconds and then read the indicated value.
3. To avoid the indicator going too high or too low, select an appropriate measurement range with the COUNT RATE switch. (After changing the COUNT RATE, it will take a while until the indicator is stabilized.)
4. When the count rate is low and the indicator is not stabilized, set the time constant at 10 seconds or 30 seconds and read a median value of the swinging values.
5. The way to read the indicated values depends on the count rate. Make sure to check the value of the count rate.
6. Once the measurement is completed, turn off the switch.



During start-up, the self-check function automatically works to check the high voltage circuit and the remaining charge of the battery, etc.

Confirm that there is no problem with the remaining battery charge, etc. before using the survey meter.

The survey meter has a thin membrane at the top of the probe. Confirm that the membrane is not broken before using the meter.



- * Pay attention to the time constant (3 sec./10 sec./30 sec.)
Duration of **two or 3 times the time constant** is needed to read the indicated value.
- * Measurement of background:
Range: 100 min^{-1} (Set the display range at 100.)
 - Set the time constant with the TIME CONST switch at **10 seconds**. Read the indicated value **every 30 seconds**. Have approx. **10 readings** and the mean value should be adopted as the background value.
 - Measure the background in a space where effects from radiation can be ignored.

Note:

*Background: **About 60 min^{-1}** (Measured at the manufacturing plant.)*

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(Deployed in FY 2013)

1. Survey meter for measuring air radiation dose
2. GM survey meter for body contamination screening
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4. Data reader

3. Personal digital dosimeter PDM-222VB

(Radiation dose rate: 1 $\mu\text{Sv/h}$ – 1 Sv/h Accumulated dose: 1 μSv – 10 Sv)

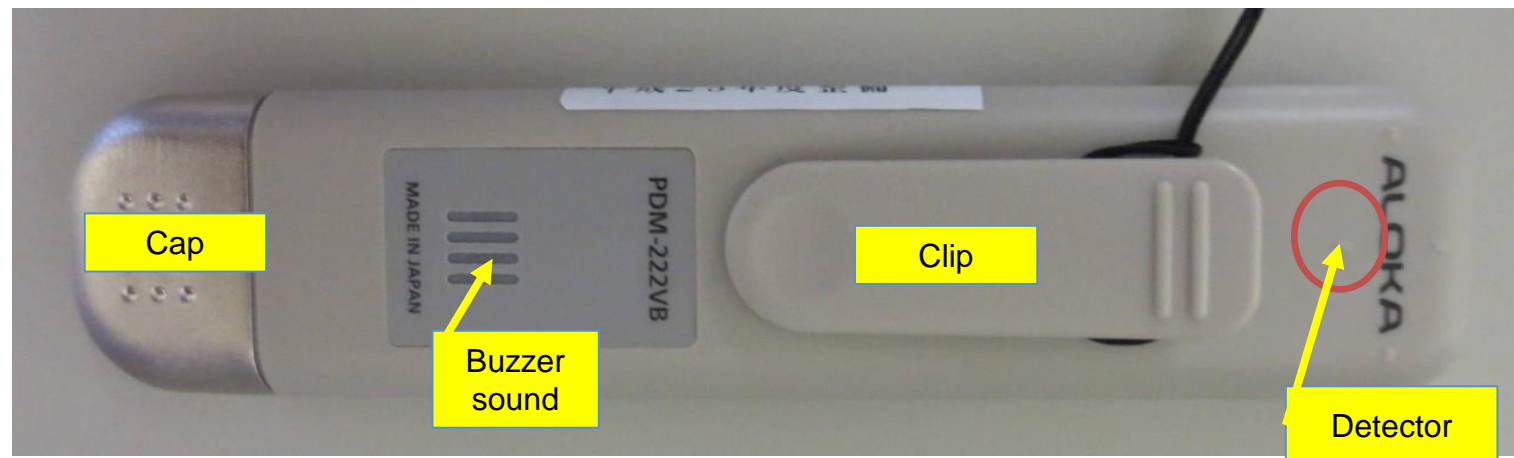
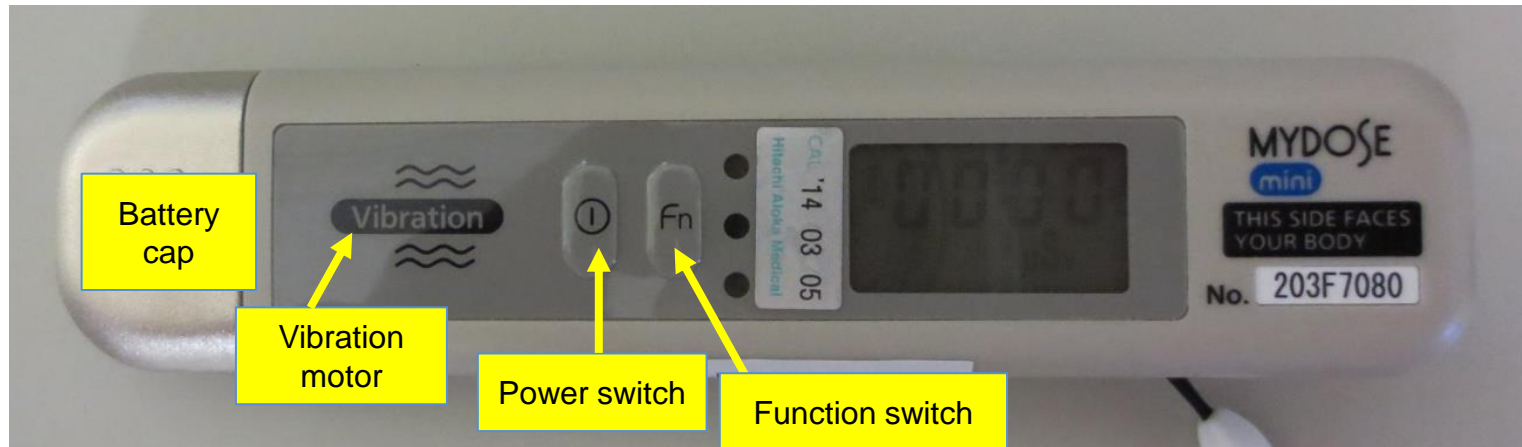
Hitachi Aloka Medical, Ltd.

PDM-222VB



Detector:	Silicon semiconductor
Radiation types to measure:	γ -ray (X-ray)
Energy dependence:	50 keV - 1.5 MeV $\pm 30\%$
Measurement range:	1 μSv – 10 Sv

Part names



(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

How to wear the dosimeter:

Put the dosimeter in a breast pocket using the clip.

* Make sure that the detector is pointed to the front.



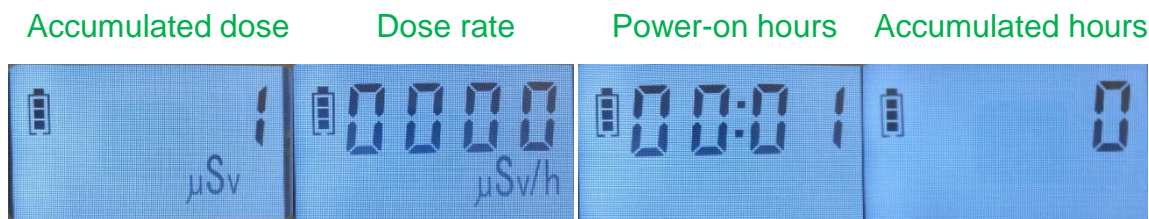
(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

How to use the dosimeter:

1. Press the power switch for about 3 seconds, and the power will turn on and the start-up process will begin.

(When “ μSv ” is displayed, the dosimeter is ready to use.)

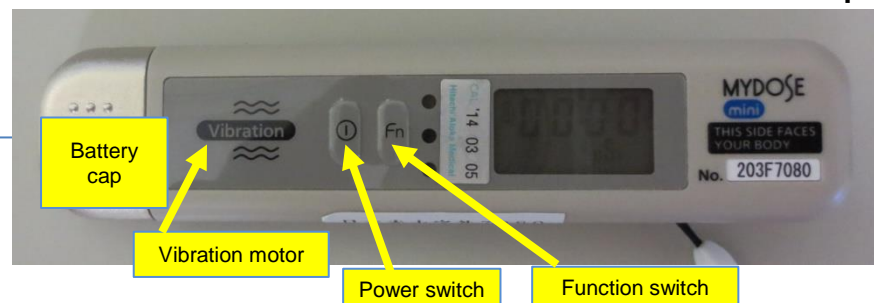
2. While the power is on, press the power switch and you can check various types of measured values.



Normally, set the display mode at “ μSv ” (Accumulated dose).

3. * Never touch the Fn switch.

If you have touched it by error, leave it alone for 10 seconds and then the display will return to the previous mode.



(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

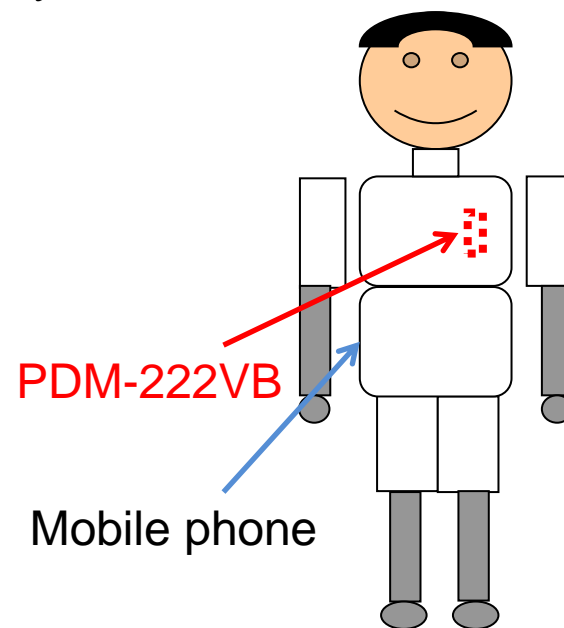
How to use the dosimeter (continued):

4. When the dosimeter detects the preset Warning/Caution dose value, you will see the alarm light on or hear an alarm sound. When this happens, immediately evacuate to any place of a lower dose rate.
(When a measured value falls below the preset value, the alarm light and sound will be cleared.)
5. When you want to manually stop the alarm sound or vibration, press the power switch for about 3 seconds.
 - * Preset Warning value for accumulated dose: 1.0 mSv
 - * Preset Warning value for dose rate: 10 mSv/hThe alarm will also go off when the measured accumulated dose or dose rate reaches above 50% of each preset Warning value, but the alarm sound will be cleared soon.
6. While the power is on, the dosimeter continues the measurement and the measured values are accumulated. After measurement is finished, take the dosimeter from your pocket and check the displayed value. Write the value on a daily report, etc.
7. Make sure to turn off the dosimeter after using it. (Press the power switch for about 3 seconds.)
Note: Make sure to leave the power on for 24 hours during your activity period. Turn off the dosimeter before leaving the affected area to return to your JRCS chapter.

(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

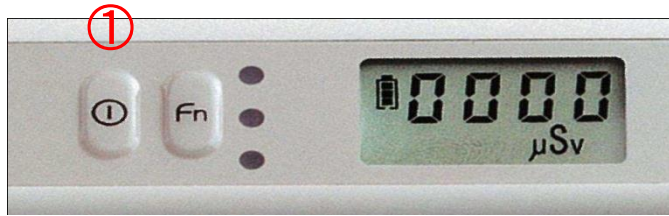
Considerations in handling the dosimeter:

- * Since this is a precision device, try to avoid shocks, dropping it onto the ground or shaking it. (**Use the clip and neck hanging strap.**)
- * If the dosimeter gets wet, wipe it off immediately.
- * To avoid malfunction, do not get the dosimeter close to electric field or magnetic field/objects.
Please remember not to put the dosimeter and other devices emitting high-intensity radio waves such as **mobile phones** in the same pocket.
- * While the power is on, never take out the battery. Otherwise, the measured values will not be saved.



(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

Considerations in handling the dosimeter:



To reset the accumulated dose; while the power is off, press the switch ① for about 15 seconds.

- * Measured value: Value totaling radiation dose from gamma ray and nature.
- * Even radiation from nature amounts to 1 μSv per day.
- * To accurately measure a radiation dose that you are exposed to during working hours, you should turn off your dosimeter after confirming the displayed value once you have finished working.
Note: Make sure to leave the power on for 24 hours during your activity period. Turn off the dosimeter before leaving the affected area to return to your JRCS chapter.
- * If the power is left on for about one month, the dosimeter will run out of battery.

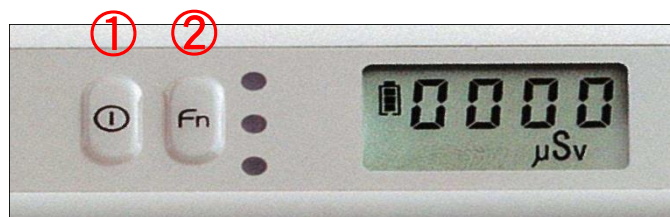
(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

How to preset values for Caution/Warning:

The preset values must be set by **an administrator**.

If the switch is not pressed for more than 10 seconds while the display is in presetting mode, the display will automatically return back to the measurement display (i.e. accumulated dose). Pay attention to this.

- Measurement display



1. How to change to presetting mode:

While the power is on, press the switch ② (for about 10 seconds). Once the display has changed to the presetting mode, take your finger off the switch.

- Display before changing to a preset value display



2. How to change a preset value:

When the left display appears, press the switch ② again. Then the preset alarm sound volume will be shown on the display.

(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

Preset value options:

* Sound volume: A - - 3 A-1 \Rightarrow A-2 \Rightarrow A-3 (Max.) \Rightarrow OFF
 \Rightarrow A-1

* Warning for accumulated dose: 1.000
mSv 10 μ \Rightarrow 20 μ \Rightarrow 50 μ \Rightarrow 100 μ \Rightarrow 200 μ \Rightarrow 500 μ \Rightarrow 1 m \Rightarrow 2 m \Rightarrow 5 m \Rightarrow 10 m \Rightarrow 20 m \Rightarrow 30 m \Rightarrow 40 m \Rightarrow 50 m \Rightarrow 100 m \Rightarrow _ _ _
 \Rightarrow OFF \Rightarrow 10 μ

(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

Preset value options:

* Caution for
accumulated
dose:

0.50

0.50 (50%) \Rightarrow 0.60 \Rightarrow 0.70 \Rightarrow
0.80 \Rightarrow 0.90 \Rightarrow _ _ _ \Rightarrow OFF
 \Rightarrow 0.50

* Warning for
air dose rate:

10.00
mSv/h

100 μ (Sv/h) \Rightarrow 200 μ \Rightarrow 500 μ
 \Rightarrow 1m \Rightarrow 2m \Rightarrow 5m \Rightarrow 10m
 \Rightarrow 20m \Rightarrow 50m \Rightarrow 100m \Rightarrow
200m \Rightarrow 500m \Rightarrow 1 \Rightarrow _ _
 \Rightarrow OFF \Rightarrow 100 μ

(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

Preset value options:

- * Caution for air dose rate: 0.50 0.50 (50%) \Rightarrow 0.60 \Rightarrow 0.70 \Rightarrow 0.80 \Rightarrow 0.90 \Rightarrow _ _ _ \Rightarrow OFF \Rightarrow 0.50
- * Warning for ON-time: oFF 00:10 (10 min.) \Rightarrow 00:20 \Rightarrow 00:30 \Rightarrow 00:40 \Rightarrow 00:50 \Rightarrow 01:00 \Rightarrow 02:00 \Rightarrow 03:00 \Rightarrow 04:00(4 hours) \Rightarrow _ _ \Rightarrow OFF \Rightarrow 00:10
- * Interval for data writing: For use of maintenance/check

(Cited from the user instruction by Hitachi Aloka Medical, Ltd. and edited by the Red Cross Nuclear Disaster Resource Center.)

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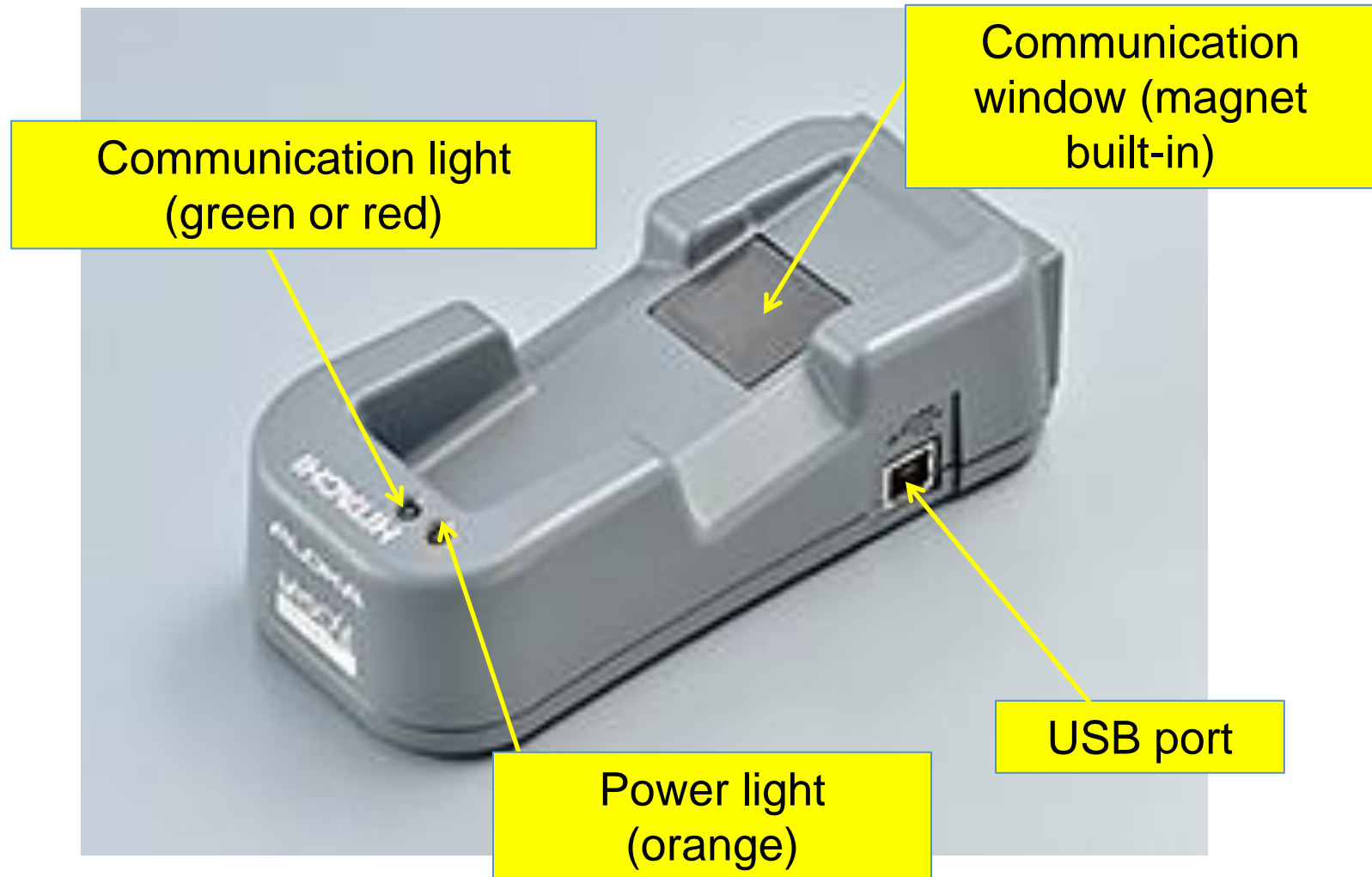
SDM-301



Connection to a computer with USB allows the data to be read through infrared communication; and be saved in a CSV file.

SDM-301

Part names:



What to do before using the reader:

Install the relevant software in a computer.



Install the USB driver.



Initialize the software.



Change the setting of the personal dosimeter (to make it readable).

Install the relevant software in a computer.

Check specifications of the computer:

Drive: The computer needs a built-in CD drive or can be connected to an external CD drive.

Disk size: More than 20GB.

Memory: More than 2GB.

OS: Windows 7 (Professional or Home Premium).

Other: Software for opening PDF files should be already installed. (Adobe Reader is recommended.)

SDM-301 Example of saved data

201410312009

ファイル

ホーム

挿入

ページレイアウト

数式

データ

校閲

表示

アドイン

MS Pゴシック

11

A⁺ A⁻

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折り返して全体を表示

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≡ ≡ ≡

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セルを結合して中央揃え

クリップボード

フォント

配置

A1

fx

Serial number

A

B

C

D

E

F

G

1

Serial number

Read Day

Read Time

Accumulate Unit

2

201 Q4410

2014/10/31

20:10:05

0 uSv

3

201 Q4410

2014/10/31

20:11:39

0 uSv

4

201 Q4410

2014/10/31

20:12:17

0 uSv

5

201 Q4410

2014/10/31

20:12:24

0 uSv

6

201 Q4410

2014/10/31

21:19:55

0 uSv

7

201 Q4410

2014/10/31

21:20:33

0 uSv

8

201 Q4410

2014/10/31

21:21:36

0 uSv

9

201 Q4410

2014/10/31

21:21:49

0 uSv

10

11

12

13