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Технические характеристики на измерители радиации с ионной камерой, ионометры 451B, RaySafe 452 компании **FLUKE BIOMEDICAL**



RaySafe 452

Radiation Survey

Meter

One device. Endless possibilities.

Spend more time on measurements and less time on settings. Just turn on the instrument and within a few seconds you are ready to measure. The RaySafe 452 does not require any corrections or manual settings, letting you focus on radiation protection rather than set-up.

The intuitive interface shows all parameters in one view. All measurement data is stored automatically, and the included PC software RaySafe View provides easy data transfer for further analysis and data storage.

One device for every situation means less to carry, learn and administrate. That equals less expense, more efficiency and time savings.

Key Features

- Broad application range
- Compliant with IEC 60846-1
- IP64 (dust proof and water resistant)
- Automatic data storage
- PC software connectivity
- USB charging
- Measures alpha, beta, gamma, X-ray
- Alarm threshold setting
- Built for indoor and outdoor applications



RaySafe 452 essentials

Large display

Intuitive user interface with easy to view parameters in bright daylight and dark environments. All parameters in one display for overview and easily accessible settings.

Fast response time

The dose sensitive Geiger-Müller pancake enables a fast response time even at very low dose rates while the silicon diodes provide accuracy and speed at higher dose rates.

Convenient data storage

The dose rate value is automatically saved every second providing comfort not to lose data and enabling measurement analysis at a later stage. The data can be transferred to PC with the software.

Sensitive, stable sensors

Silicon diodes combined with an energy compensated Geiger-Muller pancake provide high sensitivity and stability over a very wide energy and dose rate range.

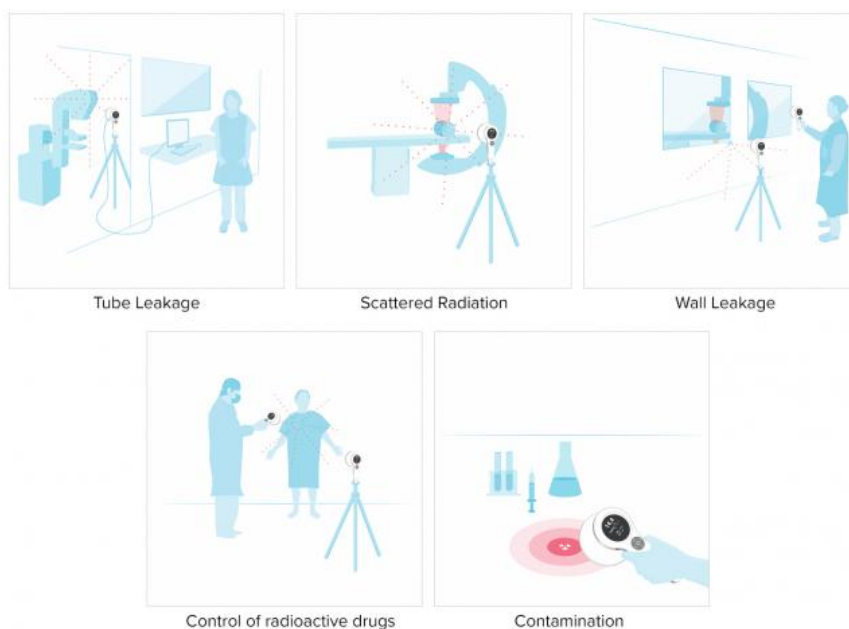
Worry free

Wipe the instrument with a wet cloth or wash under rinsing water thanks to the IP64 classification. The durability and wide temperature range also makes indoor and outdoor measurements possible without worrying about the instrument.

Typical applications

The RaySafe 452 Radiation Survey Meter can be used for many applications including these:

- X-ray tube leakage
- X-ray wall leakage
- Scattered room radiation
- Contamination measurements
- Environmental radiation
- Non-destructive testing





Technology

As versatile as you are

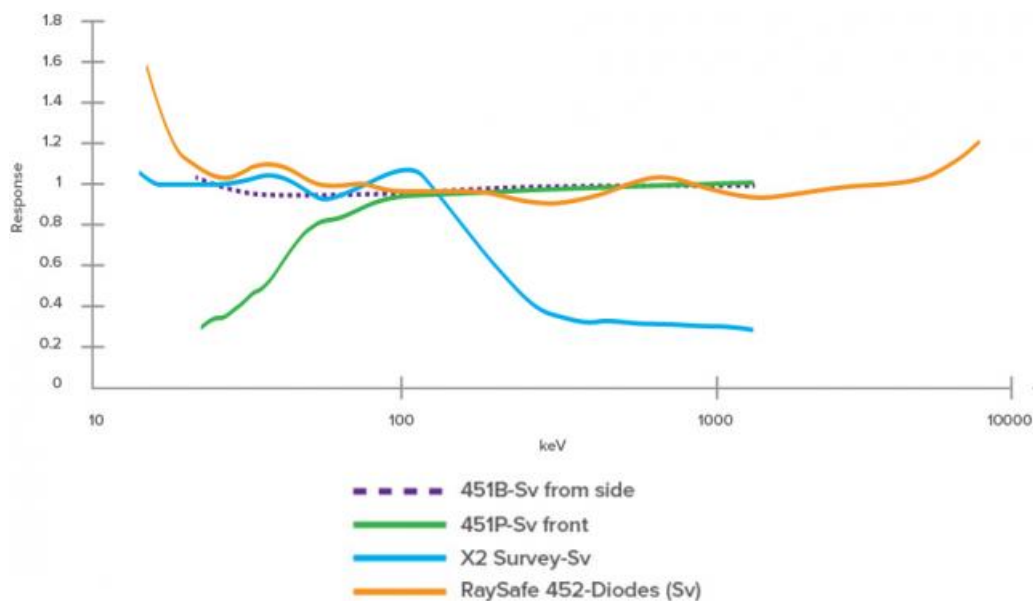
The measurement technology of the RaySafe 452 is based on a combination of a silicon sensor cluster and a Geiger-Müller pancake. The instrument has two interchangeable lids (depending on model) to switch between air kerma, ambient dose equivalent and counts. This design makes it a versatile instrument with a wide and flat energy response along with high sensitivity and a quick response time.

- Flat energy response
- Broad application range
- Compliant with IEC 60846-1
- Automatic data storage

Size

Convenient

The RaySafe 452 Radiation Survey Meter is about 30% lighter than the 451 making it easy to carry and use. It has a built-in integrated handle on the same level as the display so you are able to see the readings at all times. You won't cover the display with your hand which can be an issue with other models. The buttons are within easy reach of your thumb when holding the device.



Typical energy response

Most survey meters do not handle all photon energies equally but underestimate the rate at some energies, while others may be overestimated. The RaySafe 452 provides a flat wide energy response as well as high sensitivity.

- Flat energy response desired as it does not require adjusting the results
- There's almost always a spread of photon energies in the radiation beam, making it difficult to use correction factors

All RaySafe 452 Radiation Survey Meter products ship with:

- Instrument with mounted lids (depending on model).
- Power supply + plugs
- 5m USB cable
- Printed user manual and quick guide
- Calibration certificate
- Cardboard box with fitted foam.

Model Name	Part Number	Description
RaySafe 452 Ambient kit	5082288	This model is for ambient dose equivalent measurements. Corresponds closest with the 451P/B (Sv model). Measures in Sv, rem.

RaySafe 452 Air kerma kit	5082295	This model is specifically made for air kerma/ radiation measurements. Corresponds closest with the 451P/B (R models). Measures in R, Gy, rad.
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Model Name	Part Number	Description
RaySafe 452 kit	5082301	This is the most comprehensive version of the 452 models. It measures air kerma, ambient dose equivalent and can also detect alpha and beta radiation with its' GM tube. Its performance is a combination of the 451P (R and Sv), 451B (R and Sv) and the ASM-990. Measures in Sv, rem, R, Gy, rad, cps, cpm

General

Safety standard

Complies with IEC 61010-1:2010,
pollution degree²

Radiation meter standard

Complies with IEC 60846-1:2009, except EMC which complies with IEC 61326-1:2012, and except alarm sound level

Dimensions

250 x 127 x 83 mm (9.8 x 5.0 x 3.3 inches)

Weight

0.8 kg (1.7 pounds)

Display

240 x 400 pixel color LCD, sunlight readable, backlit

Rate alarm

65 dB(A) at 30 cm (12 inches)

Operating temperature

-20 – +50 °C (-4 – +122 °F) **Storage temperature**

-30 – +70 °C (-22 – +158 °F) **Battery charging temperature**

+10 – +40 °C (+50 – +104 °F)

Atmospheric pressure

70 – 107 kPa, altitude up to 3000 m (10,000 ft)

IP code

IP64 (dust proof and water resistant) according to IEC 60529:1989-2013, with lid mounted, seals intact and nothing connected to USB connector

Humidity, without lid

< 90 % relative humidity, non-condensing

Battery

Up to 100 h

Battery

Built-in rechargeable lithium-ion, 2550 mAh

Connector

USB micro (5 V DC, 1.3 A), for communication and charging

Mounting

Standard 1/4" tripod thread on handle

Data storage

4000 stored measurements and 10 days of dose rate log with 1 s resolution

Software

RaySafe View (for remote control, analysis and data export)

life

Radiology

Ambient dose equivalent, $H^*(10)$

Range

0 $\mu\text{Sv/h}$ – 1 Sv/h (0 $\mu\text{rem/h}$ – 100 rem/h)

Rate resolution

0.01 $\mu\text{Sv/h}$ (1 $\mu\text{rem/h}$) or 3 digits **Dose resolution**

0.1 nSv (0.01 μrem) or 3 digits **Energy range**

16 keV – 7 MeV

Energy response¹

> 20 $\mu\text{Sv/h}$ (2 mrem/h) and $T < 30$ $^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)	$\pm 15\%$, 20 keV – 5 MeV $\pm 25\%$, < 20 keV or > 5 MeV
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otherwise	$\pm 20\%$, 20 keV – 1 MeV –25 % – +150 %, < 20 keV or > 1 MeV
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otherwise

Minimum X-ray pulse length² 5 ms at $T < 30$ $^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)

Minimum linac frequency^{2,3} 100 Hz at $T < 30$ $^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)

Rate response time

~2 s to detect a step from 0.2 to 2 $\mu\text{Sv/h}$ (20 to 200 $\mu\text{rem/h}$)

IEC 60846-1 energy range⁴

20 keV – 2 MeV , angle of incidence $\pm 45^{\circ}$

IEC 60846-1 dose rate range⁴

1 $\mu\text{Sv/h}$ – 1 Sv/h (100 $\mu\text{rem/h}$ – 100 rem/h), non linearity $< \pm 10\%$

IEC 60846-1 dose range⁴

1 μSv – 24 Sv (100 μrem – 2.4 krem), coefficient of variation $< 3\%$

Units

Sv

rem (1 rem = 1/100 Sv)

Air kerma, K_{air}

Range

0 $\mu\text{Gy/h}$ – 1 Gy/h (0 $\mu\text{R/h}$ – 114 R/h)

Rate resolution

0.01 $\mu\text{Gy/h}$ (1 $\mu\text{R/h}$) or 3 digits

Dose resolution

0.1 nGy (0.01 μR) or 3 digits

Energy range

30 keV – 7 MeV

Energy response¹

> 20 $\mu\text{Gy/h}$ (2.3 mR/h) and $T < 30$ $^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)	$\pm 15\%$, 30 keV – 5 MeV $\pm 25\%$, 5 MeV – 7 MeV
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otherwise	$\pm 30\%$, 30 keV – 1 MeV –25 % – +120 %, 1 MeV – 7 MeV
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otherwise

Minimum X-ray pulse length²

5 ms at $T < 30^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)

Minimum linac frequency^{2,3}

100 Hz at $T < 30^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)

Rate response time

~2 s to detect a step from 0.2 to 2 $\mu\text{Gh/h}$ (23 to 230 $\mu\text{R/h}$)

Units

Gy

rad (1 rad = 1/100 Gy)

R (1 R = 1/114.1 Gy)

Mean photon energy, \bar{E}

Range

20 keV – 600 keV

Uncertainty

10 % at < 100 keV, 20 % otherwise

Defining standard

ISO 4037-1:2019

Minimum dose rate⁵

20 $\mu\text{Sv/h}$ (2 mrem/h) or 20 $\mu\text{Gy/h}$ (2.3 mR/h), at $T < 30^{\circ}\text{C}$ (86 $^{\circ}\text{F}$)

Counter (α , β , γ)

Detector type

Geiger-Müller pancake

Window

Mica, 1.5 – 2 mg/cm²

Sensitive area

15.55 cm², behind 79 % open steel grid

Range

0 cps – 20 kcps (0 cpm – 1.2 Mcpm)

Rate resolution

0.1 cps (1 cpm) or 3 digits

Counter resolution

1 count or 3 digits

Dead time correction Automatic, linearity within -10 %– +30 %

Typical background at 0.1 µSv/h

0.5 cps (30 cpm)

Typical gamma sensitivity, ¹³⁷Cs

6 cps / µGy/h (3000 cpm / mR/h)

Rate response time

~2 s to detect a step from 1 to 10 cps (60 to 600 cpm)

Units

cps

cpm (1 cpm = 1/60 cps)

2π emission sensitivity

Radionuclide	Decay (E _{max})	Typical efficiency
¹⁴ C	β ⁻ (0.16 MeV)	15 %
⁶⁰ Co	β ⁻ (0.32 MeV)	31 %
³⁶ Cl	β ⁻ (0.71 MeV)	43 %
⁹⁰ Sr / ⁹⁰ Y	β ⁻ (0.55 / 2.28 MeV)	49 %
²³⁹ Pu	α (5.16 MeV)	26 %
²⁴¹ Am	α (5.49 MeV)	26 %

Footnotes

1. The instrument uses a Geiger-Müller pancake at low rates and a cluster of solid-state sensors at high rates. The rate where the solid-state sensors are fully engaged gradually increase with temperature, for temperatures above 30 °C (86 °F).
2. Limit where the response is within ± 20 % of the response at continuous radiation. Above 30 °C (86 °F) the instrument's ability to handle low linac pulse rates and short X-ray pulses gradually declines with increasing temperature.
3. Refers to the microwave pulse repetition frequency of typical medical linear accelerators. Each pulse has a typical duration of a few μs .
4. Ranges where the instrument fulfills IEC 60846-1:2009.
5. Above 30 °C (86 °F) the minimum dose rate gradually increases with increasing temperature.
6. Measured at 3 mm distance between instrument housing (without lid) and wide area class 2 sources according to ISO 8769:2010.



451B Ion Chamber Survey Meter with Beta Slide

Get fast response time to radiation with the 451B's ionization chamber detector

The 451B's site surveying capabilities make it well-suited for a wide range of end users, and the ionization chamber detector allows for a fast response time to radiation from leakage, scatter beams and pinholes.

Key Features

- Measurement of rate and dose simultaneously, with the capability to record peak rate
- Beta slide for beta detection
- Auto-ranging and auto-zeroing
- RS-232 communications interface with optional Windows-based Excel add-in for data logging
- Ergonomic, anti-fatigue handle with replaceable grip, wrist strap and tripod mount
- Programmable flashing LCD display and audible alarm
- Available with dose equivalent energy response (SI units)
- CE tested. Meets applicable standards



451B Ionization Chamber Survey Meter with Beta Slide

The auto-ranging 451B ion chamber survey meter measures radiation rate and accumulated dose from beta, gamma and x-ray radiation sources. The 451B's site surveying capabilities make it well-suited for a wide range of end users, including police and fire departments, x-ray manufacturers, government agencies, state inspectors, emergency response and HAZMAT teams, nuclear medicine labs, hospital radiation safety officers, and nuclear power workers. Additionally, the low noise chamber bias supply provides for fast background settling time. A sliding beta shield serves as an equilibrium thickness for photon measurements and enables beta discrimination. The digital display features an analog bar graph, 2.5-digit digital readout, low battery and freeze ("peak hold") mode indicators, and an automatic backlight function. User controls consist of an ON/OFF button and a MODE button. The RS-232 interface can be connected directly to a computer for use with the Excel add-in for Windows (451EXL), enhancing the functionality of the instrument. This software allows for data retrieval, user parameter selection and provides a virtual instrument display with audible (requires sound card) and visual alarm indication.

Model Name	Part Number	Description
451B-RYR	2550217	Ion Chamber Survey Meter with Beta Slide (R and R/h)
451B-DE-SI-RYR	3267659	Ion Chamber Survey Meter with Beta Slide (Sv and Sv/h)

Get fast response time to radiation with the 451B's ionization chamber detector

451B ion chamber radiation survey meter

Dimensions:

4 (w) x 8 (d) x 6 in (h) (10 x 20 x 15 cm)

Weight:

2.5 lb (1.11 kg)

Radiation detected:

Alpha above 7.5 MeV, Beta above 100 keV, and Gamma above 7 keV

Operating ranges:

Röntgen (R)	Sievert (Sv) Model	Time
0 mR/h to 5 mR/h	0 to 50 μ Sv/h	8 sec
0 mR/h to 50 mR/h	0 to 500 μ Sv/h	2.5 sec
0 mR/h to 500 mR/h	0 to 5 mSv/h	2 sec
0 R/h to 5 R/h	0 to 50 mSv/h	2 sec
0 R/h to 50 R/h	0 to 500 mSv/h	2 sec

Accuracy:

Within 10% of reading between 10% and 100% of full-scale indication on any range, exclusive of energy response. Calibration source is Cs

Detector:

Chamber:

349 cc volume air ionization

Chamber wall:

246 mg/cm² thick phenolic

Chamber window:

6.6 mg/cm² Mylar, protected by steel mesh, 46 cm² detection area

Beta slide:

440 mg/cm²

451B-DE-SI:

In order to achieve energy response consistent with measurements of H*(10) as required by ICR4-47, aluminum has been added to the back wall, 38% of the side wall area, and to

the beta slide. With the Beta Shield open, the 451B can measure skin dose at 10* (0.07), and Deep Dose H* (10) with Beta shield closed.

Controls

ON/OFF and MODE

Automatic features

Auto-zeroing, auto-ranging, and auto-back

Typical Response time:

Röntgen (R)	Sievert (SI) Model	Time
0 mR/h to 5 mR/h	0 to 50 μSv/h	8 sec
0 mR/h to 50 mR/h	0 to 500 μSv/h	2.5 sec
0 mR/h to 500 mR/h	0 to 5 mSv/h	2 sec
0 R/h to 5 R/h	0 to 50 mSv/h	2 sec
0 R/h to 50 R/h	0 to 500 mSv/h	2 sec

Power requirements:

Two 9 V alkaline, 200 hours operation

Warm-up time:

One minute

Modes:

Integrate mode:

Operates continuously 30 seconds after the instrument has been turned on. Integration is performed even if the instrument is displaying in mR/h, R/h, μSv/h or mSv/h

Freeze mode:

Will place a tick mark on the bar graph display to hold on the peak displayed value. The unit will continue to read and display current radiation values

Display: LCD analog/digital with backlight

Analog:

100 element bar graph 6.4 cm long. Bar graph is divided into 5 major segments, each labeled with the appropriate value for the range of the instrument

Digital:

2.5 digit display is followed by a significant zero digit depending on the operating range of the instrument. The units of

measurement are indicated on the display at all times. Digits are 0.25 in (6.4 mm) high. Low battery and freeze indicators are also provided on the display

Environmental:

Temperature range

- 4° to + 158° F (- 20° to + 70° C

Relative humidity

0 to 100% (@140° F or + 60° C)

Geotropism:

Less than 1%

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