

Technical data

RaySafe 452 Radiation Survey Meter

One device. Endless possibilities.

**The RaySafe 452.
As versatile as you are.**

The RaySafe 452 is a powerful survey meter that measures ionizing radiation in a wide variety of applications, including finding spilled isotopes, and measuring scattered radiation from X-ray machines and linear accelerators.

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.



Technology

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.

Models

The RaySafe 452 comes in three different models.

	R / Gy / rad	Sv / rem	cps / cpm
RaySafe 452	•	•	•
RaySafe 452 Air Kerma	•		
RaySafe 452 Ambient		•	

Typical applications

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

Key features

- Broad application range
- Compliant with IEC 60846-1
- IP 64 (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



Technical specifications

General

Safety standard	Complies with IEC 61010-1:2010, pollution degree 2
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, backlight
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 life	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)

Radiology

Ambient dose equivalent, $H^*(10)$	
Range	0 μ Sv/h – 1 Sv/h (0 μ rem/h – 100 rem/h)
Rate resolution	0.01 μ Sv/h (1 μ rem/h) or 3 digits
Dose resolution	0.1 nSv (0.01 μ rem) or 3 digits
Energy range	16 keV – 7 MeV
Energy response ¹	> 20 μ Sv/h (2 mrem/h) \pm 15 %, 20 keV – 5 MeV and $T < 30$ °C (86 °F) \pm 25 %, < 20 keV or > 5 MeV otherwise \pm 20 %, 20 keV – 1 MeV –25 % – +150 %, < 20 keV or > 1 MeV
Minimum X-ray pulse length ²	5 ms at $T < 30$ °C (86 °F)
Minimum linac frequency ^{2,3}	100 Hz at $T < 30$ °C (86 °F)
Rate response time	\sim 2 s to detect a step from 0.2 to 2 μ Sv/h (20 to 200 μ rem/h)
IEC 60846-1 energy range ⁴	20 keV – 2 MeV, angle of incidence \pm 45°
IEC 60846-1 dose rate range ⁴	1 μ Sv/h – 1 Sv/h (100 μ rem/h – 100 rem/h), non linearity < \pm 10 %
IEC 60846-1 dose range ⁴	1 μ Sv – 24 Sv (100 μ rem – 2.4 krem), coefficient of variation < 3 %
Units	Sv rem (1 rem = 1/100 Sv)

Air kerma, K_{air}	
Range	0 μ Gy/h – 1 Gy/h (0 μ R/h – 114 R/h)
Rate resolution	0.01 μ Gy/h (1 μ R/h) or 3 digits
Dose resolution	0.1 nGy (0.01 μ R) or 3 digits
Energy range	30 keV – 7 MeV
Energy response ¹	> 20 μ Gy/h (2.3 mR/h) \pm 15 %, 30 keV – 5 MeV and $T < 30$ °C (86 °F) \pm 25 %, 5 MeV – 7 MeV otherwise \pm 30 %, 30 keV – 1 MeV –25 % – +120 %, 1 MeV – 7 MeV
Minimum X-ray pulse length ²	5 ms at $T < 30$ °C (86 °F)
Minimum linac frequency ^{2,3}	100 Hz at $T < 30$ °C (86 °F)
Rate response time	\sim 2 s to detect a step from 0.2 to 2 μ Gh/h (23 to 230 μ R/h)
Units	Gy rad (1 rad = 1/100 Gy) R (1 R = 1/114.1 Gy)

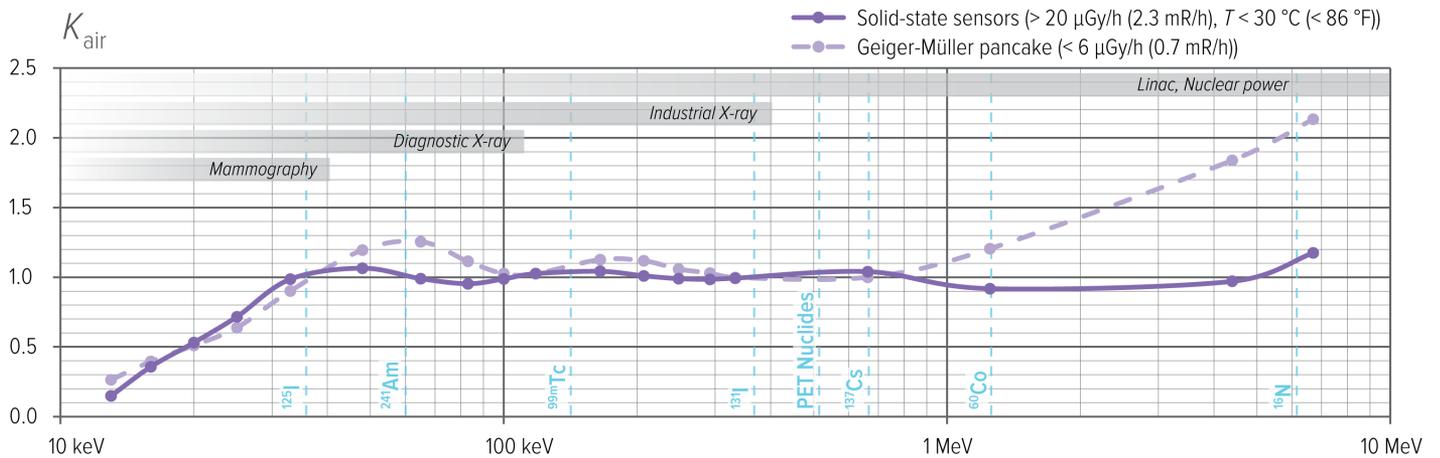
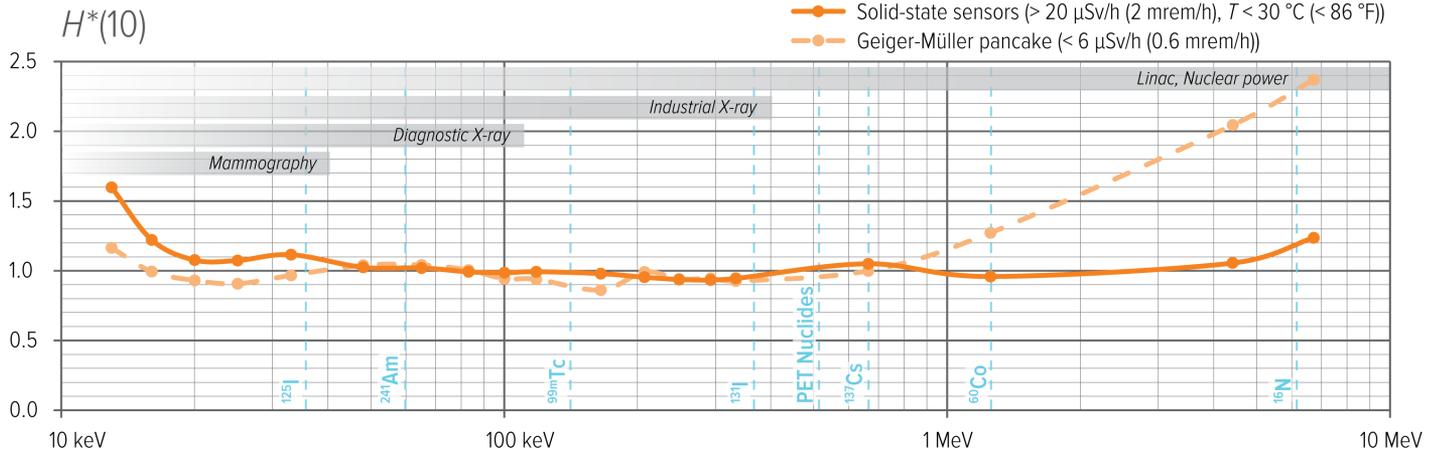
Mean photon energy, \bar{E}	
Range	20 keV – 600 keV
Uncertainty	10 % at < 100 keV, 20 % otherwise
Defining standard	ISO 4037-1:2019
Minimum dose rate ⁵	20 μ Sv/h (2 mrem/h) or 20 μ Gy/h (2.3 mR/h), at $T < 30$ °C (86 °F)

Counter (α, β, γ)			
Detector type	Geiger-Müller pancake		
Window	Mica, 1.5 – 2 mg/cm ²		
Sensitive area	15.55 cm ² , 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 μ Sv/h	0.5 cps (30 cpm)		
Typical gamma sensitivity, ¹³⁷ Cs	6 cps / μ Gy/h (3000 cpm / mR/h)		
Rate response time	\sim 2 s to detect a step from 1 to 10 cps (60 to 600 cpm)		
Units	cps cpm (1 cpm = 1/60 cps)		
2 π emission sensitivity ⁶	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

- 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).
- Limit where the response is within \pm 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.
- Refers to the microwave pulse repetition frequency of typical medical linear accelerators. Each pulse has a typical duration of a few μ s.
- Ranges where the instrument fulfills IEC 60846-1:2009.
- Above 30 °C (86 °F) the minimum dose rate gradually increases with increasing temperature.
- Measured at 3 mm distance between instrument housing (without lid) and wide area class 2 sources according to ISO 8769:2010.

Typical energy response



Ordering information

The system includes

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.

Optional accessories

- Heavy duty case with fitted foam

Visit raysafe.com or flukebiomedical.com for videos, user manual, RaySafe View software and other information.

Service Program

The RaySafe Service Program ensures a predictable, annual expense to keep your instrument performing and looking like new. This optional service program will keep your RaySafe 452 Survey Meter working accurately and efficiently through annual checks and calibrations and extends the instrument hardware warranty.

Fluke Biomedical regulatory commitment

As a medical test device manufacturer, we recognize and follow certain quality standards and certifications when developing our products. We are ISO 9001 and ISO 13485 medical device certified and our products are:

- CE certified, where required
- NIST and PTB traceable calibration
- UL, CSA, ETL certified, where required
- NRTL certified, where required. For example: UL, CSA, ETL, MET
- Environmental certified, where required. For example: RoHS, REACH



Fluke Biomedical.

Trusted for the measurements that matter.

Fluke Biomedical

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