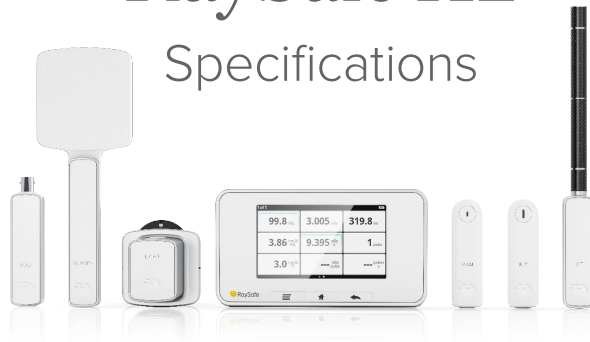


RaySafe X2

Specifications



X2 GENERAL

| | |
|------------------------------|--|
| EMC | According to IEC 61326-1 |
| SAFETY | According to IEC 61010-1 |
| X-RAY METERS STANDARD | Complies with IEC 61674 |
| EXPOSURES NEEDED | One |
| USB CABLES | 2 m (6.6 ft), 5 m (16.4 ft) and 5 m active extender |
| SIZE BASE UNIT | 34 x 85 x 154 mm (1.3 x 3.3 x 6.1 in) |
| WEIGHT BASE UNIT | 521 g (18.4 oz) |
| OPERATING TEMPERATURE | 15 – 35 °C (59 – 95 °F) |
| STORAGE TEMPERATURE | -25 – 70 °C (-13 – 158 °F) |
| POWER SOURCE | Rechargeable Li ion battery |
| BATTERY TIME | ~ 10 hours intensive usage |
| BATTERY TESTED | According to UN 38.3 |
| DISPLAY | 4.3" LCD with capacitive touch |
| MEMORY | ~ 10000 latest exposures |
| SOFTWARE | RaySafe View for data handling and analysis. Also exports data to Microsoft Excel. |
| PTB CERTIFICATE | DE-17-M-PTB-0053 |

X2 mAs

| | |
|--------------------|------------------|
| mAs | |
| RANGE | 0.001 – 9999 mAs |
| RESOLUTION | 0.001 mAs |
| UNCERTAINTY | 1 % |

| | |
|---------------------|---------------|
| mA | |
| RANGE (PEAK) | 0.1 – 1500 mA |
| RESOLUTION | 0.01 mA |
| UNCERTAINTY | 1 % |

| | |
|--------------------|--------------|
| TIME | |
| RANGE | 1 ms – 999 s |
| RESOLUTION | 0.1 ms |
| BANDWIDTH | 1 kHz |
| UNCERTAINTY | 0.5 % |

| | |
|-------------------|-----------------|
| PULSES | |
| RANGE | 1 – 9999 pulses |
| RESOLUTION | 1 pulse |

| | |
|-------------------|--------------------|
| PULSE RATE | |
| RANGE | 0.1 – 200 pulses/s |
| RESOLUTION | 0.1 pulse/s |

| | |
|--------------------|------------------|
| mAs/PULSE | |
| RANGE | 0.001 – 9999 mAs |
| RESOLUTION | 0.001 mAs |
| UNCERTAINTY | 1 % |

| | |
|-------------------|---------------------------|
| WAVEFORM | |
| RESOLUTION | 125 μ s ¹⁾ |
| BANDWIDTH | 1 kHz |

1) Automatically reduced for exposures longer than 3 s

RAYSAFE UNCERTAINTY DEFINITION

The expanded uncertainty is stated as the combined uncertainty of measurement multiplied by the coverage factor $k=2$, which assuming a normal distribution has a coverage probability of 95 % (complies with GUM by ISO (1995, ISBN 92-67-10188-9)).

Instrument specifications are subject to purchased configuration.
All specifications may change without notice.

X2 R/F SENSOR

| | |
|--|---|
| WEIGHT | 42 g (1.5 oz) |
| SIZE | 14 x 22 x 79 mm (0.5 x 0.9 x 3.1 in) |
| ACTIVE COMPENSATION | |
| Beam quality independent for the following ranges: | |
| DOSE/DOSE RATE | 40 – 150 kVp, 1 – 14 mm Al HVL |
| kVp | 40 – 150 kVp, up to 1 mm Cu |
| TF | 60 – 120 kVp, up to 1 mm Cu |
| DOSE | |
| RANGE | 1 nGy – 9999 Gy (0.1 µR – 9999 R) |
| UNCERTAINTY | 5 % or 5 nGy (0.5 µR) |
| DOSE RATE | |
| RANGE | 1 nGy/s – 500 mGy/s (5 µR/min – 3400 R/min) |
| RESOLUTION | 1 nGy/s (5 µR/min) |
| TRIG LEVEL | 50 nGy/s (340 µR/min) |
| UNCERTAINTY | 5 % or 10 nGy/s (70 µR/min) x duty cycle |
| kVp | |
| RANGE | 40 – 150 kVp |
| MINIMUM DOSE | 50 µGy (6 mR) |
| MINIMUM DOSE RATE (PEAK) | 10 µGy/s (70 mR/min) |
| UNCERTAINTY | 2 % |
| HVL | |
| RANGE | 1 – 14 mm Al |
| MINIMUM DOSE | 1 µGy (120 µR) |
| MINIMUM DOSE RATE (PEAK) | 0.5 µGy/s (3.5 mR/min) at > 70 kV 2.5 µGy/s (17 mR/min) at 50 kV |
| UNCERTAINTY | 10 % |

| | |
|---------------------------------|--|
| TOTAL FILTRATION | |
| RANGE | 1.5 – 35 mm Al |
| MINIMUM DOSE | 50 µGy (6 mR) |
| MINIMUM DOSE RATE (PEAK) | 10 µGy/s (70 mR/min) |
| UNCERTAINTY | 10 % or 0.3 mm Al |
| TIME | |
| RANGE | 1 ms – 999 s |
| RESOLUTION | 0.1 ms |
| BANDWIDTH | 4 Hz – 4 kHz ¹⁾ |
| UNCERTAINTY | 0.5 % |
| PULSES | |
| RANGE | 1 – 9999 pulses |
| MINIMUM DOSE RATE (PEAK) | 0.5 µGy/s (3.5 mR/min) |
| PULSE RATE | |
| RANGE | 0.1 – 200 pulses/s |
| MINIMUM DOSE RATE (PEAK) | 0.5 µGy/s (3.5 mR/min) |
| DOSE/PULSE | |
| RANGE | 1 nGy/pulse – 999 Gy/pulse (0.1 µR/pulse – 999 R/pulse) |
| MINIMUM DOSE RATE (PEAK) | 0.5 µGy/s (3.5 mR/min) |
| WAVEFORMS | |
| RESOLUTION | 62.5 µs ²⁾ |
| BANDWIDTH kV | 0.1 – 0.4 kHz ¹⁾ |
| BANDWIDTH DOSE RATE | 4 Hz – 4 kHz ¹⁾ |

1) Automatically adjusted depending on signal level

2) Automatically reduced for exposures longer than 1.5 s

X2 MAM SENSOR

| | |
|---------------|--------------------------------------|
| WEIGHT | 42 g (1.5 oz) |
| SIZE | 14 x 22 x 79 mm (0.5 x 0.9 x 3.1 in) |

ACTIVE COMPENSATION

Beam quality independent for the following ranges:

DOSE/DOSE RATE & HVL

No selections needed.

With or without paddle, with or without phantom.

| | |
|--|-------------|
| Mo/Mo, Mo/Rh | 20 – 40 kVp |
| Rh/Ag | 27 – 40 kVp |
| Mo/AI, W/Rh, W/Ag, W/AI, Rh/Rh, Rh/AI | 20 – 50 kVp |
| Mo/Cu, Rh/Cu, W/Cu, W/Ti | 40 – 50 kVp |

kVp

User selectable beam qualities.

Paddle compensation available when relevant.

| | |
|--------------------------|--|
| W/Ag | 20 – 40 kVp |
| W/AI | 20 – 50 kVp Measuring above 40 kVp requires an X2 R/F Sensor + 2 mm Al (incl.) |
| W/Rh | 18 – 40 kVp |
| Mo/Mo | 18 – 40 kVp |
| Mo/Rh | 32 – 40 kVp using + 2 mm Al (incl.) |
| Rh/Ag | 27 – 40 kVp |
| Mo/Cu, W/Cu, W/Ti | 40 – 50 kVp, using the X2 R/F Sensor |

DOSE

| | |
|--------------------|--|
| RANGE | 1 μ Gy – 9999 Gy (0.1 mR – 9999 R) |
| UNCERTAINTY | 5 % |

DOSE RATE

| | |
|--------------------|---|
| RANGE | 10 μ Gy/s – 300 mGy/s (70 mR/min – 2000 R/min) |
| UNCERTAINTY | 5 % |

kVp

| | |
|---------------------------------|--|
| RANGE | 18 – 50 kVp ¹⁾ Measuring above 40 kVp requires an X2 R/F Sensor and on W/AI +2 mm Al (incl.) |
| MINIMUM DOSE | 50 μ Gy (6 mR) |
| MINIMUM DOSE RATE (PEAK) | 10 μ Gy/s (70 mR/min) |
| UNCERTAINTY | 2 % or 0.5 kV (without paddle) 2 % or 0.7 kV (with paddle) |

HVL

| | |
|---------------------|------------------------------------|
| RANGE | 0.2 – 3.6 mm Al |
| MINIMUM DOSE | 1 μ Gy (0.1 mR) |
| UNCERTAINTY | 5 % above 25 kV 10% below 25 kV |

TIME

| | |
|--------------------|--------------|
| RANGE | 1 ms – 999 s |
| RESOLUTION | 0.1 ms |
| BANDWIDTH | 400 Hz |
| UNCERTAINTY | 0.5 % |

PULSES

| | |
|--------------|-----------------|
| RANGE | 1 – 9999 pulses |
|--------------|-----------------|

PULSE RATE

| | |
|--------------|--------------------|
| RANGE | 0.1 – 200 pulses/s |
|--------------|--------------------|

DOSE/PULSE

| | |
|--------------|---|
| RANGE | 1 μ Gy/pulse – 999 Gy/pulse (0.1 mR/pulse – 999 R/pulse) |
|--------------|---|

WAVEFORMS

| | |
|-------------------|----------------------------|
| RESOLUTION | 62.5 μ s ²⁾ |
| BANDWIDTH | 400 Hz |

1) Depending on beam quality, see active compensation

2) Automatically reduced for exposures longer than 1.5 s

X2 LIGHT SENSOR

| | |
|-----------------------|---|
| WEIGHT | 136 g (4.8 oz) |
| SIZE | 48 x 60 x 68 mm (1.9 x 2.4 x 2.7 in) |
| CLASSIFICATION | DIN 5032 part 7 class B |
| STANDARDS | Complies with relevant parts of AAPM TG18, IEC 62563-1 and IEC 61223-2-5. |

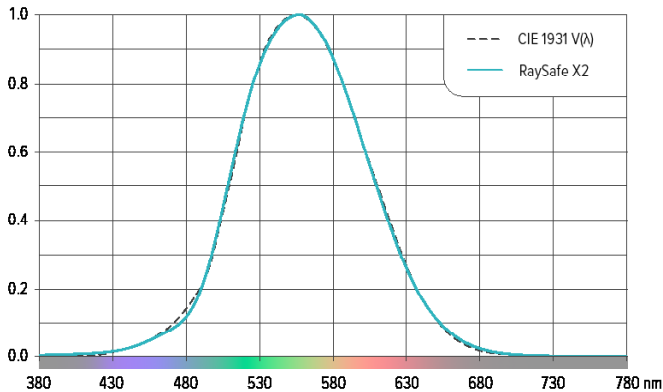
LUMINANCE

| | |
|---|---|
| RANGE | 0.01 – 10 000 cd/m ² (0.03 – 34 000 fL) |
| RESOLUTION | 0.001 cd/m ² (0.001 fL) |
| APERTURE ANGLE | 5° |
| MEASUREMENT AREA | ∅ 10 mm (0.4 in) |
| UNCERTAINTY ILLUMINANT A | 3% |
| DEVIATION FROM HUMAN EYE V(λ) (f₁') | < 3 % (see figure Photopic Response) |

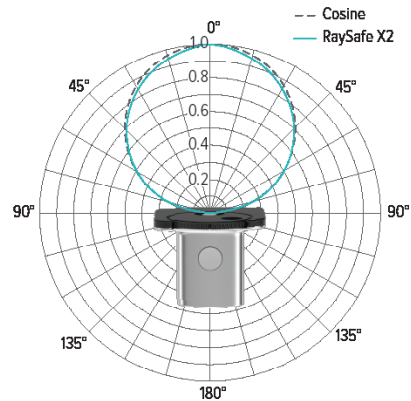
ILLUMINANCE

| | |
|---|---------------------------------------|
| RANGE | 0.1 – 100 000 lux (0.01 – 9000 fc) |
| RESOLUTION | 0.01 lux (0.001 fc) |
| UNCERTAINTY ILLUMINANT A | 3% |
| DEVIATION FROM HUMAN EYE V(λ) (f₁') | < 3 % (see figure Photopic Response) |
| COSINE DEVIATION (f₂) | < 3 % (see figure Cosine Response) |

Photopic Response



Cosine Response



X2 SURVEY SENSOR

| | |
|----------------------------|--|
| WEIGHT | 140 g (4.9 oz) |
| SIZE | 14 x 66 x 192 mm (0.5 x 2.6 x 7.6 in) |
| ACTIVE COMPENSATION | H*(10) – when selecting Sv Air kerma – when selecting Gy or R |

| | |
|-------------------|---|
| TRIG MODES | |
| MANUAL | Manual start and stop of measurement |
| AUTO | Trig level (N80): 10 µGy/h (1.2 mR/h) or 20 µSv/h |

| | |
|--------------------|----------------------------|
| H*(10) | |
| RANGE | 0 nSv – 9999 Sv |
| RESOLUTION | 1 nSv |
| UNCERTAINTY | 10 %, N-series 20 – 150 kV |

| | |
|--------------------|---|
| H*(10) RATE | |
| RANGE | 0 µSv/h – 150 mSv/h |
| UNCERTAINTY | 10 % or 0.3 µSv/h, N-series 20 – 150 kV |

| | |
|--------------------|--|
| AIR KERMA | |
| RANGE | 0 nGy – 9999 Gy (0 µR – 9999 R) |
| RESOLUTION | 1 nGy (0.1 µR) |
| UNCERTAINTY | 5 %, RQA 50 – 150 kV 10 %, N-series 40 – 150 kV |

| | |
|-----------------------|---|
| AIR KERMA RATE | |
| RANGE | 0 µGy/h – 100 mGy/h (0 mR/h – 10 R/h) |
| UNCERTAINTY | 5 % or 0.3 µGy/h (0.03 mR/h), RQA 50 – 150 kV 10% or 0.3 µGy/h (0.03 mR/h), N-series 40 – 150 kV |

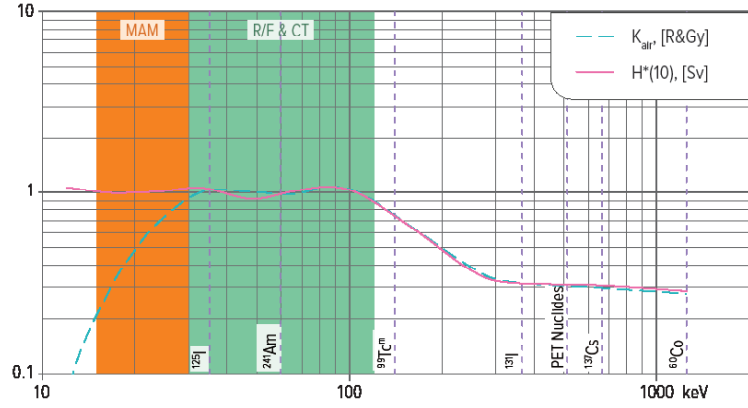
| | |
|--------------------------|-------------------------------|
| MEAN ENERGY | |
| RANGE | 30 – 120 keV |
| UNCERTAINTY | 10 % |
| MINIMUM DOSE RATE | 10 µSv/h or 10 µGy/h (1 mR/h) |
| DEFINING STANDARD | ISO 4037-1 |

| | |
|-------------------|--------------|
| TIME | |
| RANGE | 0.1 – 9999 s |
| RESOLUTION | 0.01 s |
| BANDWIDTH | 1 Hz |

| | |
|--------------------------|-------------------------------|
| WAVEFORM | |
| RESOLUTION | 10 ms ¹⁾ |
| BANDWIDTH | 1 Hz |
| MINIMUM DOSE RATE | 1 µSv/h or 1 µGy/h (0.1 mR/h) |

1) Automatically reduced for exposures longer than 4 min

Typical response



X2 CT SENSOR

| | |
|---|---|
| WEIGHT | 86 g (3.0 oz) |
| SIZE | 14 x 22 x 219 mm (0.5 x 0.9 x 8.6 in) |
| SIZE Ø | 12.0 mm (0.47 in) |
| STANDARD | For measurements in accordance with IEC 60601-2-44 |
| ACTIVE LENGTH | 100 mm (3.94 in) |
| ENERGY DEPENDENCE | < 5 % for 70 – 150 kV (RQR, RQA and RQT beam qualities) |
| AUTOMATIC ENVIRONMENTAL COMPENSATION | 55 – 110 kPa, 15 – 35 °C (59 – 95 °F) |
| DOSE | |
| RANGE | 10 µGy – 999 Gy (1 mR – 999 R) |
| UNCERTAINTY | 5 % |
| DOSE LENGTH PRODUCT | |
| RANGE | 100 µGycm – 9999 Gycm (10 mRcm – 9999 Rcm) |
| UNCERTAINTY | 5 % |
| DOSE RATE | |
| RANGE | 10 µGy/s – 250 mGy/s (70 mR/min – 1700 R/min) |
| UNCERTAINTY | 5 % |
| TIME | |
| RANGE | 10 ms – 999 s |
| RESOLUTION | 1 ms |
| BANDWIDTH | 10 Hz |
| UNCERTAINTY | 0.5 % |
| WAVEFORMS | |
| RESOLUTION | 1 ms ¹⁾ |
| BANDWIDTH | 10 Hz |

1) Automatically reduced for exposures longer than 24 s

X2 VOLT SENSOR

| | |
|-----------------------|--|
| WEIGHT | 55 g (1.9 oz) |
| SIZE | 17 x 23 x 93 mm (0.7 x 0.9 x 3.7 in) |
| INPUT TERMINAL | BNC connector, 1 MΩ input impedance (BNC-to-banana cable included) |
| VOLTAGE | |
| RANGE | ± 16 V |
| UNCERTAINTY | 1 % or 1 mV, whichever is greater |
| TRIG LEVEL | 50 mV (full bandwidth) or 2 mV (reduced bandwidth) |
| TIME | |
| RANGE | 5 ms – 999 s |
| RESOLUTION | 0.1 ms |
| UNCERTAINTY | 0.5 % |
| WAVEFORMS | |
| RESOLUTION | 42 µs ²⁾ |
| BANDWIDTH | 10 kHz (full) / 1.5 kHz (reduced) |

CONVERSIONS

The sensor calculates kV, or mA and mAs, from the measured voltage and selectable conversion factors:

| | | | |
|---------------------|-----------|----------|-----------|
| mA & mAs | 1 mA/V | 20 mA/V | 200 mA/V |
| | 5.06 mA/V | 50 mA/V | -200 mA/V |
| | 10 mA/V | 100 mA/V | 10 A/V |
| kV | 10 kV/V | 20 kV/V | 27 kV/V |
| | -10 kV/V | -20 kV/V | |

2) Automatically reduced for exposures longer than 1 s

RaySafe offers a variety of comprehensive solutions for radiographic imaging rooms. Our devices add value through the collection of radiation information and the ability to easily share results with relevant stakeholders.

User-friendly state of the art technology and maximum accuracy form the backbone of the RaySafe product range. All solutions meet the company's mission to reduce unnecessary radiation exposure and to establish a greater safety culture.

www.raysafe.com

