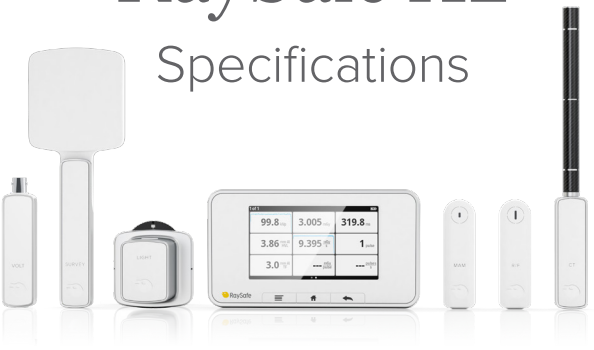
RaySafe X2

Specifications



RaySafe™

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 µs*
BANDWIDTH	1 kHz

* 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*
UNCERTAINTY	0.5 %

* automatically adjusted depending on signal level

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*
BANDWIDTH kV	0.1 – 0.4 kHz**
BANDWIDTH DOSE RATE	4 Hz – 4 kHz**

* automatically reduced for exposures longer than 1.5 s
** automatically adjusted depending on signal level

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/Al, W/Rh, W/Ag, W/Al, Rh/Rh, Rh/Al	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/Al	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 µGy – 9999 Gy (0.1 mR – 9999 R)
UNCERTAINTY	5 %

DOSE RATE

RANGE	10 µGy/s – 300 mGy/s (70 mR/min – 2000 R/min)
UNCERTAINTY	5 %

kVp

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

* depending on beam quality, see active compensation

HVL

RANGE	0.2 – 3.6 mm Al
MINIMUM DOSE	1 µGy (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 µGy/pulse – 999 Gy/pulse (0.1 mR/pulse – 999 R/pulse)

WAVEFORMS

RESOLUTION	62.5 µs**
BANDWIDTH	400 Hz

** 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.

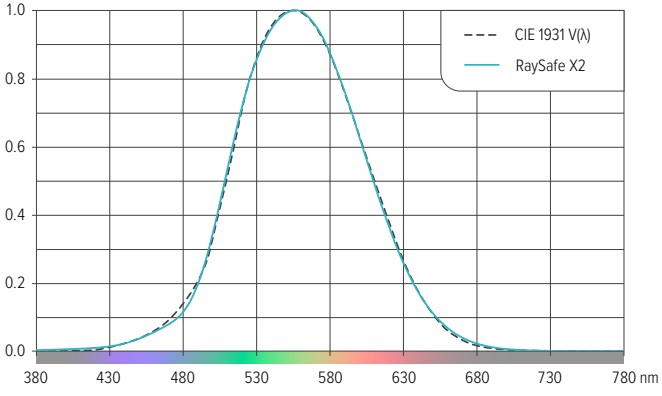
LUMINANCE

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	ø 10 mm (0.4 in)
UNCERTAINTY ILLUMINANT A	3%
DEVIATION FROM HUMAN EYE V(λ) (f_1')	< 3 % (see figure Photopic Response)

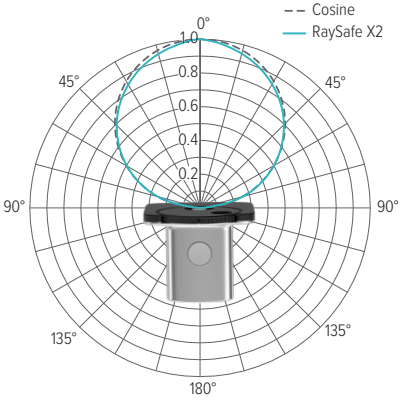
ILLUMINANCE

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) (f_1')	< 3 % (see figure Photopic Response)
COSINE DEVIATION (f_2)	< 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

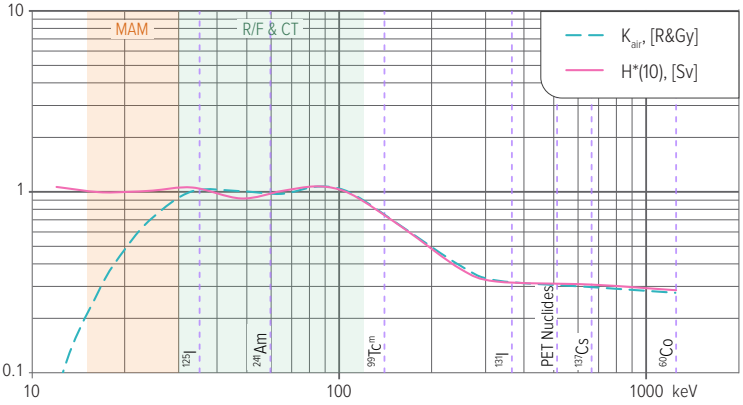
TIME

RANGE	0.1 – 9999 s
RESOLUTION	0.01 s
BANDWIDTH	1 Hz

WAVEFORM

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

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
BANDWIDTH	10 Hz

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*
BANDWIDTH	10 kHz (full) / 1.5 kHz (reduced)

* automatically reduced for exposures longer than 1 s

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	

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.

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