

RaySafe Xi versus RaySafe X2 – exposure time measurements

BACKGROUND

The RaySafe X2 measures time differently than the RaySafe Xi. This difference can result in slightly different measurement results depending upon the X-ray machine's radiation waveform, the RaySafe Xi's trig level setting, the RaySafe Xi's mode of operation, and the RaySafe X2's mode of operation.

The RaySafe Xi and RaySafe X2 can be used as stand-alone mAs meters. While using them as stand-alone mAs meters, exposure time can be measured using the mA waveform; however, the preferred method is to measure exposure time from the radiation waveform, so we recommend using the RaySafe Xi R/F or R/F + MAM detector or RaySafe X2 R/F or MAM sensor to measure exposure time.

Note: Whenever RaySafe Xi is mentioned in this application note, the information is also applicable for the RaySafe Solo.

RAYSAFE Xi EXPOSURE TIME MEASUREMENTS

The RaySafe Xi, by default, measures time from start trig until the signal falls below 25% of peak. After the first exposure, the trig level setting allows the start and end trig to be set to 25, 50, or 75% of the previous exposure's peak level. At low dose rates, about 1% of the max dose rate for the active sensor area, the 25% end level is changed to a low level which is about the lowest measurable dose rate for the active sensor area. If the radiation has a pulsed characteristic, the time is measured until the last pulse ends. The dead time interval between pulses must, however, be less than the Calc Delay time (0.5, 2, 4, 6 or 7s). The R/F low detector has an electrical bandwidth of 0.1 kHz (slower rising and falling slopes), causing the displayed exposure time to be a few milliseconds longer than for the R/F High sensor, which has a bandwidth of 2.5 kHz.

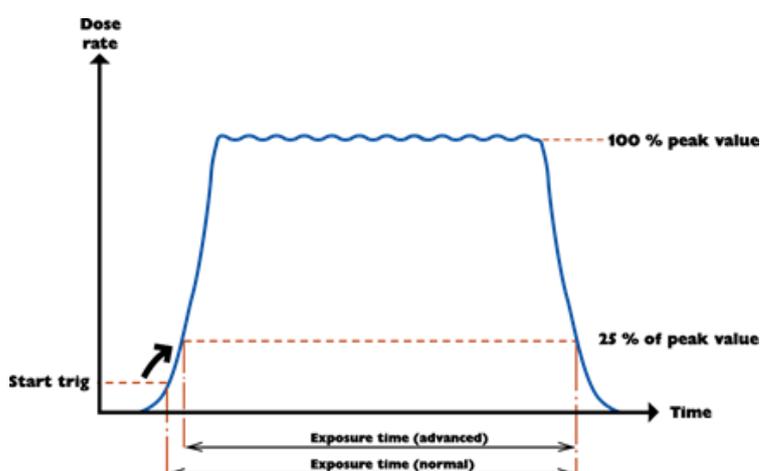


Figure 1. RaySafe Xi measures exposure time from start trig to 25 % of dose rate peak. The start trig can be delayed using Trig Level setting.

Figure 1 shows that the exposure time using a 25% Trig Level setting will be slightly shorter than if the Trig Level is set to its default "low" setting.

RAYSAFE X2 EXPOSURE TIME MEASUREMENTS

The RaySafe X2 measures exposure time by calculating the full width at half maximum (FWHM) on the dose rate waveform. In simpler terms, the RaySafe X2 starts to measure exposure time when the dose rate reaches 50% of peak, and ends the last time it drops below 50%. This is the generally accepted method for calculating exposure time¹ and is shown in Figure 2.

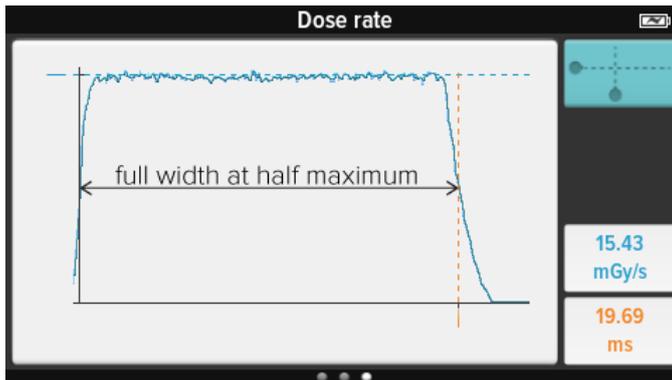


Figure 2. RaySafe X2 measures exposure time at 50 % of the dose rate peak.

COMPARISON

Assuming both systems are measuring exposure time from the same exposure, the RaySafe Xi with its Trig Level set to “low” will measure a longer exposure time than the RaySafe X2. This is because the RaySafe Xi will start to measure some time before the dose rate has exceeded 50% of its maximum and will not stop measuring until the dose rate drops below 25% of its maximum, whereas the RaySafe X2 will begin measuring when the dose rate exceeds 50% and stop measuring when the dose rate drops below 50% for the last time. The exact difference depends on the rise and fall time of the dose rate waveform.

If the RaySafe Xi’s Trig Level is set to 50%, the RaySafe Xi and RaySafe X2 will measure nearly equivalent exposure times. If the RaySafe Xi’s Trig Level is set to 75%, the RaySafe Xi will measure slightly shorter exposure time.

Because the RaySafe X2 can capture and analyze an exposure’s entire waveform, it uses the industry-preferred FWHM definition of exposure time. This allows the user to accurately measure exposure time without having to worry about the waveform, or making reference exposures and adjusting trig levels.

CONTACT

Please visit <http://www.raysafe.com> for more information.

¹ IEC standard 60601-2-65: 203.4.101.1 * IRRADIATION TIME

IRRADIATION TIME is measured as the time interval between the instant when the AIR KERMA RATE has risen for the first time to a value of 50 % of the peak value, and the instant when it finally drops below the same value.