

Measurements of X-ray tube current with RaySafe instruments – *mA* versus *mA avg*

INTRODUCTION

This application note demonstrates the RaySafe definitions of *mA* and *mA avg* for the RaySafe Xi (Xi), the RaySafe Solo (Solo), the RaySafe X2 (X2) and the RaySafe X2 Solo (X2 Solo).

Like most instruments on the market, the Xi and the Solo calculate X-ray tube current as an average over the exposure time, *mA avg*. The X2 and the X2 Solo calculates tube current in a different manner, denoted *mA*, that takes the waveform of the current into account. This approach is suitable for measurements on pulsed exposures and facilitates fine tuning of the tube current.

Table 1 summarizes the available settings for X-ray tube current measurements with the Xi, the Solo, the X2 and the X2 Solo. *Polarity independent* means that the instrument measures both positive and negative signals.

Table 1: X-ray tube current measurements - Available settings and properties.



	Xi & Solo	X2 & X2 Solo
<i>mA</i>	No	Yes (default)
<i>mA avg</i>	Yes	Yes (selectable)*
Polarity independent	No	Yes

*X2 Base Units with application version 2.11 or higher (Figure 3, last page) have a selection for *mA avg*, via *mA mode* (Figure 4, last page). If your base unit does not have the mA mode selection, you can calculate *mA avg* manually by dividing the mAs reading by the measured exposure time:

$$mA\ avg = \frac{charge\ (mAs)}{time\ (s)}$$

Note: The setting for *mA avg* will be added the next time your X2 Base Unit is sent for factory calibration and upgrade.

mA MEASUREMENTS

mA is the default option with the X2. *mA* is calculated from charge (mAs) measurements, as an average of all samples above 50% of peak*. Rush currents are automatically removed. As a result, the final reading reflects the average *mA* of the actual pulses, since the time between pulses is not part of the total time used for averaging.

Figure 1 illustrates the resulting *mA* reading from a pulsed exposure, as displayed on an X2 Base Unit (from the measurement screen, tap the *mA* value and swipe left to see the waveform). In this example, the RaySafe X2 reads 197.1 *mA*.



Figure 1: Illustration of an *mA* reading for a pulsed exposure. The dashed blue line shows the resulting reading of 197.1 *mA*.

mA avg MEASUREMENTS

mA avg is the only option with the Xi and selectable with the X2. *mA avg* is calculated from mAs measurements, as mAs divided by the total exposure time*. Figure 2 illustrates the resulting *mA avg* reading for the same exposure as in Figure 1. Here, the read value is 123.9 *mA*. Note the difference from Figure 1, where the resulting *mA* matches the level of the pulses, and gives a value of 197.1 *mA*.



Figure 2: Illustration of an *mA avg* reading for a pulsed exposure. The dashed blue line shows the resulting value of 123.9 *mA*.

* For details on calculations for long exposure times and live readings, see the respective User Manual.

SUMMARY

Due to the different definitions of mA and mA_{avg} , an X2 and an Xi instrument may give different current readings for the same exposure. We recommend measuring X-ray tube current as mA , especially for pulsed exposures. If you need to measure mA_{avg} , change the mA mode settings in the X2 Base Unit.

HOW TO FIND THE mAs APPLICATION VERSION

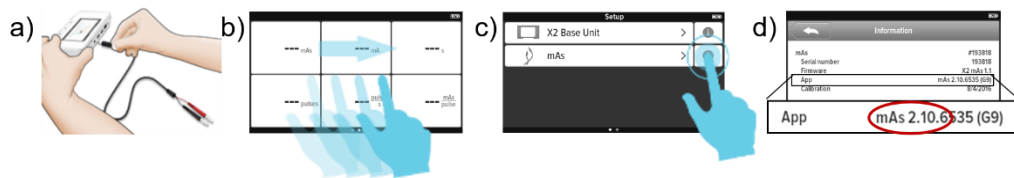


Figure 3: a) Connect the X2 mAs cable to the X2 Base Unit. b) Swipe right from the measurement screen. c) Tap the information sign for the mAs sensor. d) Find the app version (marked in red).

HOW TO FIND mA MODE SELECTIONS

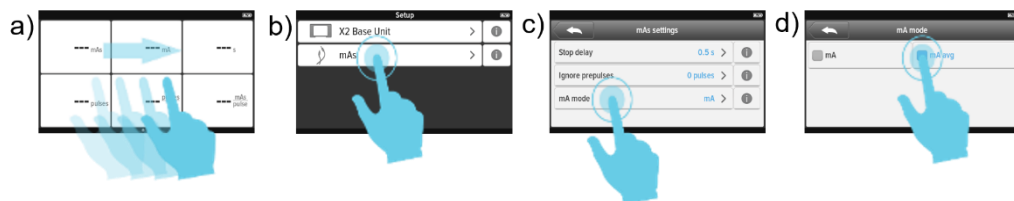


Figure 4: a) Swipe right from the measurement screen. b) Tap mAs . c) Tap mA mode. d) Select mA or mA_{avg}

CONTACT

Please visit www.raysafe.com for more information.