

Lab Experiment # 3

Setting Technical Factors: Time, mA, and mAs

Purpose

This lab is designed to give students hands-on experience with setting different mA (tube current), exposure times, and resulting mAs values on the x-ray control console.

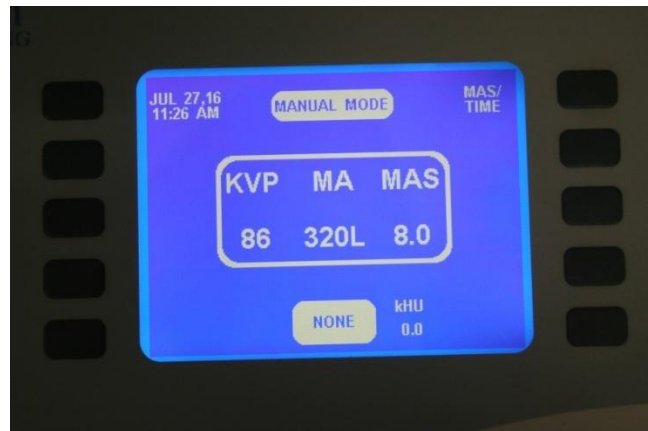
Learning Objectives

After completing this lab, you should be able to:

1. Use the laboratory equipment properly.
2. Set up the control console correctly.
3. Function effectively in group work.
4. Evaluate the effect of seconds and milliseconds on the exposure
5. Convert the exposure time from seconds to milliseconds.
6. Calculate the appropriate milliseconds to maintain image density.
7. Predict the effect of the change in seconds or milliseconds on image quality
8. Adjust mA and exposure time values on the console.
9. Calculate mAs and verify values against console readouts.
10. Recognize limitations in available increments for mA, time, and mAs.

Materials Needed

- High-frequency, digital control console



Pre-Lab Discussion

Units of Exposure Time

The exposure timers in use today vary with each X-ray machine. Most machines use seconds or milliseconds. Therefore, radiographers must be able to calculate and set the exposure time on the control console using seconds and milliseconds.

Relationship of Seconds to Milliseconds

Seconds (s)	Milliseconds (ms)
1.0	1000
0.8	800
0.75	750
0.667	667
0.6	600
0.5	500
0.4	400
0.333	333
0.25	250
0.2	200
0.167	167
0.1	100
0.05	50
0.017	17
0.008	* 8
0.004	4
0.002	2
0.001	** 1

* Shortest exposure time possible when using a *single-phase* imaging system

** Shortest exposure time possible when using a *triple-phase* or *high-frequency* imaging system

Millisecond Conversion

$$\text{milli} = \text{m} = 0.001$$

To change seconds to milliseconds – multiply by 1,000

$$\text{sec} \times 1,000 = \text{ms}$$

Example:

To convert 3 seconds to milliseconds:

$$3 \text{ sec} \times 1,000 = 3,000 \text{ ms}$$

Convert 0.04 seconds to milliseconds:



To change milliseconds to seconds – divide by 1,000

$$\frac{\text{ms}}{1,000} = \text{sec}$$

Example:

To convert 250 milliseconds to seconds:

$$\frac{250 \text{ ms}}{1,000} = 0.250 \text{ sec}$$

Convert 800 milliseconds to seconds:

Illustrated Thought Process

Here is a simple method for remembering the direction the decimal point must move.

To convert *seconds* to *milliseconds*, move the decimal point three places to the **RIGHT**.

Ex. 0.500 seconds = 500 milliseconds

A. Write the following visual aid.

s ← 3 → ms

B. Place the old time above the appropriate unit of measurement.

0.5
s ← 3 → ms

D. Move the decimal point three (**3**) places in the direction of the arrow and place the converted time above the new unit.

0.5 **500**
s ← 3 → ms

To convert *milliseconds* to *seconds*, move the decimal point three places to the **LEFT**.

Ex. 660 milliseconds = 0.660 seconds

A. Write the visual aid.

s ← 3 → ms

B. Place the old time above the appropriate unit of measurement.

660
s ← 3 → ms

C. Move the decimal point three (**3**) places in the direction of the arrow and place the converted time above the new unit.

0.660 660
s ← 3 → ms

Practice Drill – Illustrated Thought Process

1. A radiographic exposure requires 0.12 seconds.
What millisecond-equivalent timer setting should you use?

[_____]

s ←———— 3 —————→ ms

2. A radiographic exposure requires 300 milliseconds.
What decimal-equivalent timer setting should you use?

[_____]

s ←———— 3 —————→ ms

3. A radiographic exposure requires 0.044 seconds.
What millisecond-equivalent timer setting should you use?

[_____]

s ←———— 3 —————→ ms

4. A radiographic exposure requires 9 milliseconds.
What decimal-equivalent timer setting should you use?

[_____]

s ←———— 3 —————→ ms

To calculate **mAs (milliampere-seconds)** when you know the **mA (milliamperes)** and the **time (seconds)**:

$$mAs = mA \times Time$$

$$mA = mAs / Time \text{ (s)}$$

$$Time = mAs / mA$$

Example 1 – Calculate mAs (given mA and Time):

- mA = 400
- Time = 0.1 seconds

$$mAs = 400 \times 0.1 = 40 \text{ mAs}$$

Example 2 – Calculate mA (given mAs and Time):

- mAs = 200
- Time = 0.5 seconds

$$mA = \frac{mAs}{Time} = \frac{200}{0.5} = 400 \text{ mA}$$

Example 3 – Calculate Time (given mAs and mA):

- mAs = 120
- mA = 300

$$Time = \frac{mAs}{mA} = \frac{120}{300} = 0.4 \text{ seconds}$$

Setting the Control Console

Technique Worksheet

Direct Radiography Using TT technique

Worksheet 1

	SID	mA	Time	mAs
1	40"	100	0.05 s (50 ms)	?
2	40"	200	0.1 sec (100 ms)	?
3	40"	400	0.5 s (500ms)	?

Worksheet 2

	SID	mA	Time	mAs
1	40"	?	0.05 s (50 ms)	10
2	40"	?	0.1 sec (100 ms)	20
3	40"	?	0.5 s (500ms)	50

Worksheet 3

	SID	mA	Time	mAs
1	40"	100	?	20
2	40"	200	?	40
3	40"	400	?	80

Can all these techniques be set on the console of your X-ray unit?