

## Chapter 4: Ultrasonic Interference and Diffraction

### Overview:

In this experiment we will study interference and diffraction of ultrasonic waves. Interference and diffraction occur when waves from two sources superimpose in a region of space.

### Suggested Reading Assignment:

Chapters on “Interference” and “Diffraction” from an introductory physics book. Although these chapters focus primarily on light waves, the theory is the same for sound waves.

E.g., Chapters 36 and 37 of Halliday, Resnick, and Walker, 6<sup>th</sup> edition.

### Pre-lab Questions:

1. Under what conditions will two sources “interfere”?
2. Define “coherence”.
3. For two wave sources (see sketch below), find an equation for the intensity at any point  $x$  in the observation plane. Plot the intensity vs.  $x$ , and identify a few maxima and minima. Where is the 3<sup>rd</sup> maxima? The 12<sup>th</sup>?
4. For a single wave source of diameter  $a$ , find an equation for the intensity at any point  $x$  in the observation plane. Plot the intensity vs.  $x$ , and identify a few maxima and minima. Where is the 3<sup>rd</sup> minima? The 5<sup>th</sup>?
5. For two waves sources of diameter  $a$ , separated by a distance  $d$ , determine the intensity at any point  $x$  in the observation plane. Plot the intensity vs  $x$ . Suppose that  $a$  is somewhat smaller than  $d$ . How do changes in  $a$  or  $d$  affect the resulting intensity pattern?

