

15445 Wave Generator, Adjustable Phase

Purpose:

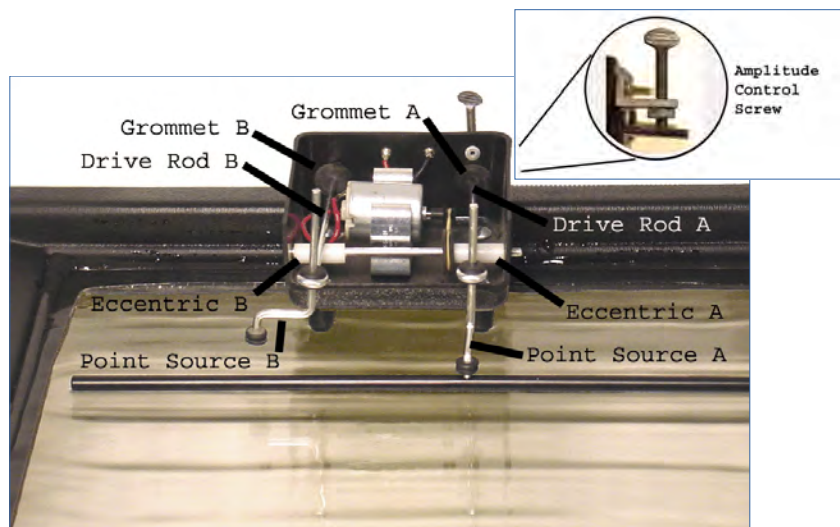
The Adjustable Phase Wave Generator is used to generate a number of different wave patterns in a ripple tank. By simple adjustments it can be made to produce circular waves from a single point source, interference patterns from two point sources in phase, interference patterns from two point sources out of phase, and straight waves.

Additional Required Materials:

- One (1) Complete Ripple Tank Setup
- One (1) Variable low voltage power supply
0-6 volt DC, 0-1 amp
or 1.5 volt #6 dry cell & rheostat.

Assembly:

Before starting the unit, check the motor mount in the chassis. If necessary, adjust the motor and the mount until the motor drive shaft is parallel to the chassis drive shaft.



Generating Circular Waves from a Single Point Source:

Insert the point source rod A into the rubber grommet at the hooked end of the drive rod A. Insert the drive rod A into the rubber grommet A until about 1 cm ($\frac{1}{2}$ inch) of the rod protrudes beyond the grommet. The amplitude control screw should not touch the drive rod. The drive rod must be touching the plastic eccentric A. Rotate the drive shaft manually until the vertical point source rod dips to its lowest position. Set the generator in the ripple tank. Adjust the point source rod until the point source depresses but does not break the surface of the water in the ripple tank. Connect the motor leads to the variable low voltage power supply. Turn on the power supply. Adjust the motor speed by controlling the power supply voltage until circular waves of the proper frequency are obtained.

Generating an Interference Pattern from two Point Sources in Phase:

Assemble side A as described above. Insert drive rod B through grommet B. Make certain that this drive rod touches eccentric B. Insert the point source rod B into the grommet at the hooked end of rod B. Turn on the power supply and adjust the power to its slowest speed. If the point source rods are moving in unison, they are said to be moving in phase with respect to each other. If the point source rods are not in phase, shut off the power supply. Manually rotate the drive shaft to determine if the point sources are now in phase. Turn on the power supply. Speed up the motor as needed to produce a clear image of the circular waves being generated. Adjust the motor speed until the nodal lines become clearly visible and the characteristics of the interference pattern can be observed on the viewing screen.

Generating Straight Waves:

Begin by setting up the wave generator as described above in “circular waves from a single point source”. Attach the straight wave bar to the point source rod A by turning the threaded portion of the point source into the threaded hole in the wave bar. Slide the grommet down so that it is snug against the wave bar to keep it from rotating. Adjust the height of the bar by moving the point source rod up or down in its grommet. The bottom edge of the bar must depress but not break the surface of the water. Be certain that the bar rests evenly along its length on the surface of the water. Tighten the amplitude control screw until the drive rod A no longer touches the eccentric. Turn on the power to low speed. Slowly loosening the amplitude control until the bar begins to generate smooth straight waves. Adjust the motor speed as necessary.

Note: At certain motor speeds the generator may exhibit some vibration that interferes with wave formation. Vibration can be minimized by placing a weight (a book or a brick) on top of the generator housing.

Operation:

The adjustable phase wave generator allows one to investigate wave patterns produced by two point sources in and out of phase. Assuming the sources are in phase, what will happen when the resultant waves overlap? Using the principle of superposition (adding the displacements of the individual waves) predict the resulting pattern. Using the generator, test your prediction. Sketch the pattern seen on

the screen. How do the waves in the pattern move? Follow a “double wave crest” (where two crests cross each other, a “double crest” will be formed. Such double crests will produce bright regions on the screen of a ripple tank). Are there regions where the waves from the two sources cancel each other at all times? These regions are the nodal lines. What happens to the nodal lines when the frequency of the motor is changed? Change the phase of the two point sources in small steps, from zero to one (one whole period). Using the in phase pattern as a reference, how does the position of the first nodal line change as you change the phase delay from zero to one? How does the position of the second nodal line change?

The adjustable phase wave generator can be used to produce circular wave patterns from a single source and straight wave patterns. The study of these waves is covered in the instruction sheet accompanying the Ripple Tank (#10-304, #15401, #15415, #15415A).

With the variable wave generator (#15490) the phase of the two point sources can be varied continuously, while the unit is operating.

Experiments using the wave generator can be found in all editions of the PSSC laboratory guide as well as other lab manuals featuring the use of a ripple tank.

Maintenance:

A drop of oil placed on each plastic eccentric at the point of contact with the drive rod will facilitate smoother operation. Should the drive belt (rubber band) break, additional belts are included. Using excess voltage (above 3 VDC) for a prolonged period of time may result in motor failure. If any difficulty develops, contact your science material distributor or Science First directly. Do not return this apparatus without the authorization of your supplier or the manufacturer.