

## INSTRUCTIONAL GUIDE

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- Ripple tank
- Water basin
- AC Adaptor
- 3 Dippers: Single point, double point, and plane wave
- 3 Barriers: Two L-shaped and one curved
- 3 Varied Lenses

#### Recommended for activities:

- [Strobe Frequency Counter \(P2-9020\)](#)



### Introduction

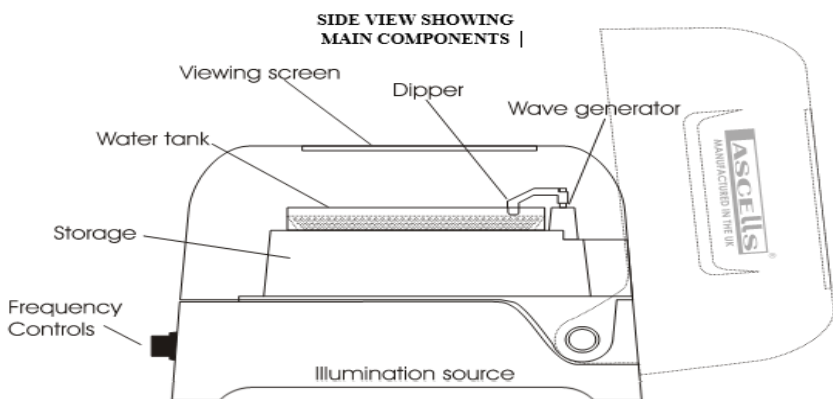
This apparatus provides a simple and effective method for students to investigate the properties of waves. The tank is completely self-contained, requiring no setting-up apart from the addition of water, and incorporates a built-in stroboscope to provide stationary or slowly moving images.

#### Applications:

- Properties of waves
- Diffraction, refraction, reflection and interference

### Background

Waves are generated in a small, rectangular basin which is placed on a raised shelf over the internal illumination source. The wave generator is built into the body of the unit and has an electronic drive circuit to vary the frequency which can also be synchronized to the light source. Dippers can be attached to the generator by simply pushing them onto the stem. A hinged lid is situated above the basin and images of the waves are projected on to this for study. When access to the basin is required, the lid is hinged out of the way. The sides of the tank are designed to absorb waves thus avoiding multiple reflections which could cause confused patterns.



## Set-Up

- Place the unit on a level bench and connect the power supply lead to the side socket. Plug the power unit into an outlet switch on.
- Set the wave generator and strobe switches to OFF.
- Lift the hinged lid to gain access to the wave generator and remove the accessories from the unit.
- Fill the tank half way with clean water (A small amount of surfactant can help to reduce the surface tension of the water).
- The dippers are a friction fit on the stem. Install a dipper onto the generator stem and adjust until the dipper just touches the surface of the water.
- Switch on the waves and strobe and adjust as required.

### **Illumination:**

The light source should be set to OFF for setting up purposes.

When set to SYNC the light flashes at the same frequency as the wave generator and produces perfectly stationary images.

When set to FREE the strobe frequency can be controlled independently of the waves. By choosing a frequency close to the wave frequency the wave patterns can be made to move slowly across the screen.

## Activities

The various accessories allow different wave effects to be studied. Higher frequencies give shorter wavelengths with the waves closer together. Since the patterns can be made stationary, a sheet of tracing paper or overhead film may be placed on the viewing screen and drawings made for subsequent analysis. In all cases certain wavelengths give the better results than others—adjust the wave frequency to best demonstrate the phenomenon in question.

### **Reflection:**

Use a plane wave dipper and metal L-plate in the tank. Observe the incident and reflected wave directions. Vary the plate angle to see the effect. The curved reflector can be used to demonstrate converging and diverging waves. A single point dipper generates circular waves and the reflection of these can also be studied.

### **Refraction:**

This effect relies on the different speeds of water waves in different depths of water. The effects are only seen when there is a significant difference in the depths. To achieve this, one of the transparent shapes is submerged in the tank and the level of the water is reduced until there is just a film over the shape (a syringe will prove invaluable throughout for this purpose). We then have about 0.5mm depth above the shape and 8mm depth elsewhere, i.e. a ratio of about 16:1.

1. Place the 5-sided block at the back of the tank so that it presents an angle to plane waves. As the waves slow down in the shallow water, they are refracted towards the normal.
2. Place the convex or concave lens shape in the tank. Again, adjust the water depth until there is a thin film over the shape. With plane waves there is a converging or diverging effect respectively.

**Diffraction:**

Use a plane wave dipper and metal L-plate parallel to the waves. Diffraction around and behind the plate will be seen. If two L-plates are used with a narrow gap between them, circular waves will be seen generated at the gap.

**Interference:**

Use the twin point dipper with nothing else in the tank. Constructive and destructive interference will be seen where the two sets of circular waves meet.

## Maintenance

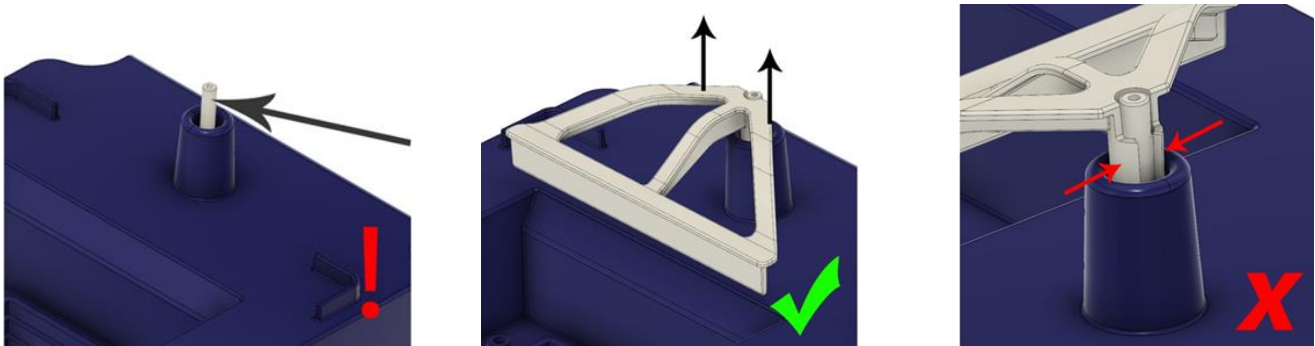
1. At the end of the session carefully lift the tank from the unit, pour away the water and dry the tank with a soft tissue. Use non-abrasive cloths to clean any of the tank surfaces.
2. The best waves are generated when the dipper just touches the water surface. This can be achieved by adjusting the dipper height or the water depth.

**Best Practices for Dipper Removal:**

The vibration/dipper post is a semi-delicate part of the instrument. Care should be taken at all times not to apply excessive forces to this post. Forcing this post upwards with more force than is necessary for normal dipper removal may result in damage to the internal vibration generator. Equipment used by students is at particular risk and teachers are advised to warn them beforehand.

After use and when changing dippers, they should be removed by gently pulling the dipper directly upwards by the arms near to the vibration post.

The dippers are attached and held in position on the vibration post by an integral spring clip. If squeezed during dipper removal it is possible to clamp this clip onto the vibration post and apply the excessive upward forces warned of above. Care should be taken not to squeeze the dipper/post interface while removing the dipper.



## Related Products

**Sound Wave Interference Kit (P7-7600)** Now you can get a complete economical solution for demonstrating wave interference on a classroom size scale. Kit includes signal generator and powered speakers, everything you need for this great demonstration.

**Mechanical Wave Complete Bundle (P7-1100)** The Arbor Scientific Mechanical Wave Complete Bundle makes harmonic and motion demonstrations affordable for ALL Physics classrooms.