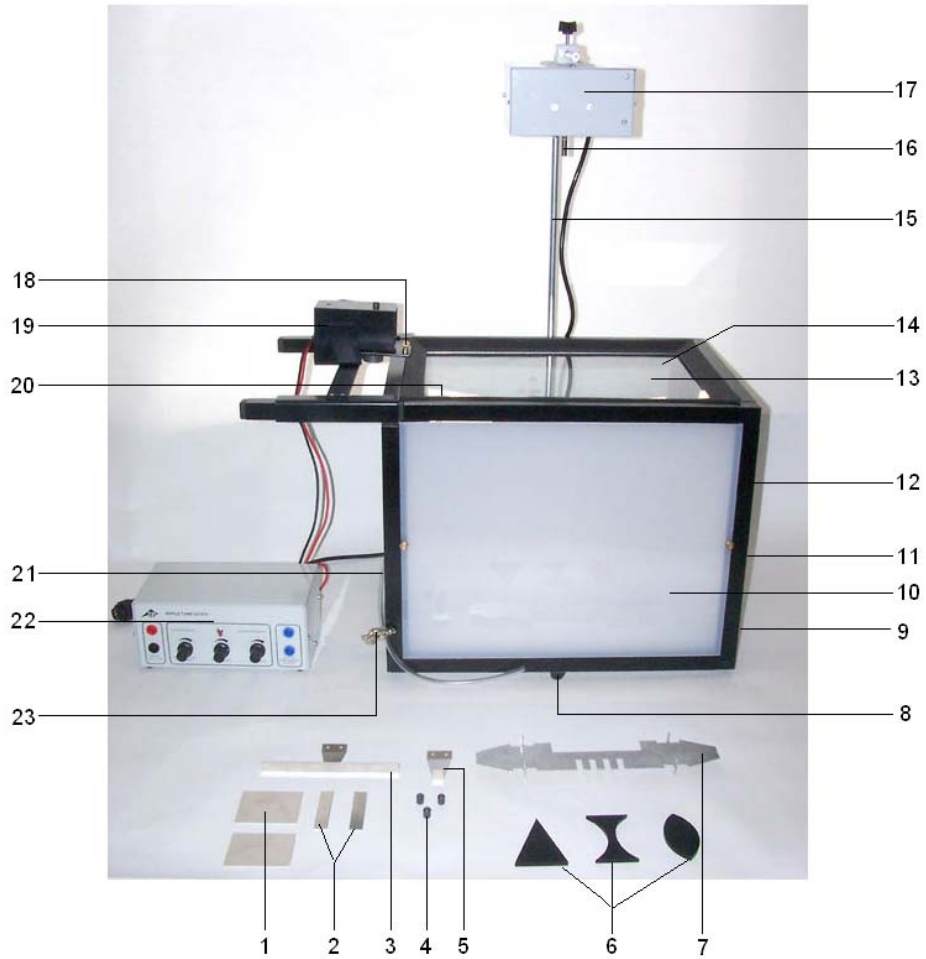
Ripple tank U21910

Instruction Sheet

03/09 Alf



1 1 Large covering plates
2 Small covering plates
3 Straight wave dipper
4 Dippers for exciting circular waves
5 Holder for dippers
6 Immersion bodies for experiments on refraction (prism, biconcave and biconvex lenses)
7 Obstacle with one large slit and 4 individual slits
8 Stand base
9 Spirit level (not shown)
10 Observation screen
11 Height-adjustable feet (not shown)
12 Frame
13 Glass plate
14 Projection mirror
15 Stand rod
16 Screw for turning stroboscope disc
17 Stroboscope
18 Knurled screw for fastening the wave generator
19 Vibrator
20 Drainage opening
21 Drainage hose
22 Control unit
23 Hose clamp

1. Safety instructions

Excessive voltages and currents can damage the control unit and the stroboscope lamp.

- Ensure that the operating parameters are kept within the specified ranges.

The glass components of the ripple tank can be broken if they are not handled properly.

- Do not subject the ripple tank to excessive mechanical forces.

Warning! The stroboscope becomes hot during operation.

- Do not touch the stroboscope lamp, and allow it to cool before putting the stroboscope away.
- When the ripple tank is moved, care must be taken to ensure that the mirror inside it does not fall out.

2. Description

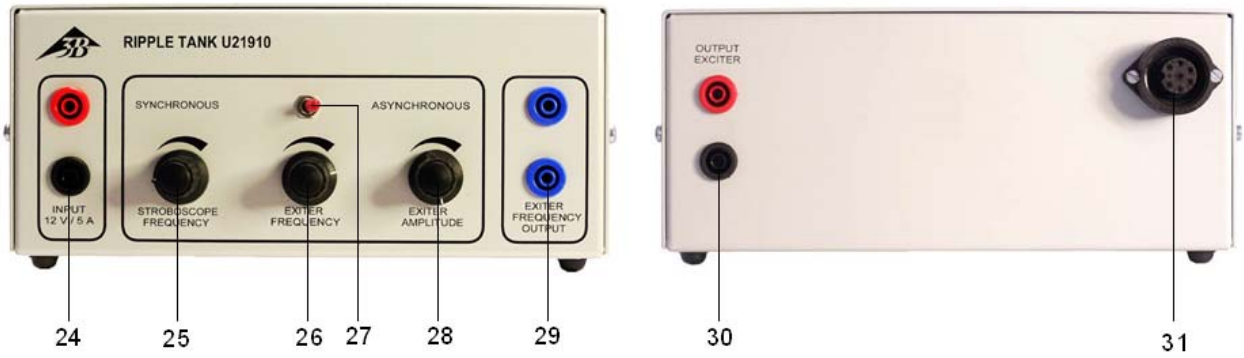
The purpose of the ripple tank is to provide clear demonstrations of basic wave phenomena in the form of ripples on water that can easily be made visible.

Experiment examples:

Reflection, Dispersion, Refraction, Interference, Diffraction, Doppler effect

The ripple tank consists of flat basin (13) set in an aluminium frame (12). In the glass floor, there is an opening (20) with a drainage hose (21) and a hose clip (23) to let out the water. For levelling purposes, the ripple tank is equipped with a spirit level (9) and two height-adjustable feet (11). Inside the frame, there is a removable mirror (14) inclined at an angle that allows the waves to be projected onto a frosted-glass pane. A halogen lamp with a stroboscope (17) connected in front of it illuminates the ripple tank from above. The generation of waves in water is carried out by transferring the oscillations of an electromagnetic vibrator (19) to the wave exciters (3, 4, 5) which are fixed with the help of two knurled screws (18).

An obstacle (7) and immersion bodies (6) are provided for conducting experiments. The covering plates (1, 2) can be used to construct grilles with slits of varying sizes and a wall to reflect waves. A control unit (22) is responsible for separately regulating both the frequency of the stroboscope and the frequency and amplitude of the vibrator. The stroboscope and the vibrator frequencies can be so that the stroboscope and vibrator operate synchronously or asynchronously. Two 4-mm safety connectors (29) are provided for connecting a counter to measure the frequency of the vibrator. The connection to the stroboscope is via a multi-pin connector (31) and the connection to the vibrator via 4-mm safety connectors (30), both of which are found on the rear end of the control unit.



2.1 Operating elements – control unit

24 4-mm safety connectors for connecting external power supply
25 Rotary knob for setting stroboscope frequency
26 Rotary knob for setting exciter frequency
27 Changeover switch for synchronous/asynchronous operation
28 Rotary knob for setting exciter amplitude
29 4-mm safety connectors for connecting an external frequency meter
30 4-mm safety connectors for connecting vibrator
31 Multi-pin connector for connecting stroboscope

3. Equipment supplied

1 Ripple tank
1 Projection mirror
1 Stand
1 Control unit for wave excitation unit and stroboscope
1 Stroboscope
1 Vibrator
1 Drainage hose
1 Hose clip
1 Exciter straight waves
3 Dippers for excitation of circular waves
1 Holder for dippers
3 Immersion bodies for experiments on refraction (prisms, biconcave and biconvex lenses)
1 Obstacle with large slit and 4 individual slits
2 Small covering plates
2 Large covering plates

4. Technical data

Dimensions:	
Tank:	345 x 250 x 10 mm³
Frame:	600 x 335 x 355 mm³
Frequency range:	continuous adjustment
Power supply:	9 V – 12 V DC via 4-mm safety connectors
Lighting:	Halogen lamp 12 V/35 W, GY6.35

5. Operation

For operation of the ripple tank an external DC power supply unit12 V, 5 A is additionally required.

It is recommended that the experiments be carried out using distilled water.

- Place the ripple tank upon a horizontal surface, making sure it is not subject to any shocks.
- Use the spirit level and two height-adjustable feet to align the ripple tank horizontally.
- Slide the projection mirror completely into the frame. The mirror is not fixed, it simply rests.
- Attach the drainage hose to the glass plate and close it off with the hose clip.
- Insert the stand into the frame and screw tight with the knurled screw.
- Screw the stroboscope onto the stand.
- Connect the control unit to the DC voltage supply unit and to the stroboscope.
- Limit the output voltage to 12 V and the output current to 5 A, and begin with the stroboscope frequency set to zero.
- Turn the stroboscope disc to provide maximum illumination and adjust the height and position of the stroboscope so that the ripple tank is fully illuminated.
- Mount the vibrator onto the frame of the ripple tank. Attach the accessories required for the appropriate experiments to the vibrator by means of the knurled screws.
- Connect the vibrator to the control unit.
- Fill the tank with distilled water. For experiments on refraction, fill the tank to approx. 1 mm over the level of the immersion bodies. For other experiments, fill to approx. 5 mm over the level of the immersion bodies.
- Use the drainage hose to empty the tank after the experiment.
- Thoroughly dry the apparatus to prevent forming of lime scale deposits.
- To construct a reflecting wall or grilles with varying slit widths, use a rubber band to fasten the covering slides to the obstacle plate.

6. Wave excitation

Water depth, depth of immersion of the wave exciters as well as frequency and amplitude of the vibrator must be carefully selected in order to present the optimum representation of the phenomena to be observed.

By synchronising the stroboscope frequency with that of the vibrator, the image of the waves can be made to appear stationary.

If the frequency is altered, it may require a readjustment of the amplitude in certain cases.

In some experiments, e.g. diffraction and reflection, it may be necessary to set certain ranges of the wave pattern to an enhanced resolution. This is done by modifying the amplitude accordingly.

6.1 Straight waves

- With the help of the knurled screw, attach the wave exciters to the vibrator.
- Set the depth of immersion by selecting the vibrator so that the lower edge of the exciter dipper touches the water surface in a straight line.
- On the control unit, set the desired frequency and amplitude.

On the viewing screen, a stationary or slowly moving wave pattern can be observed.

- Make fine adjustments using the rotary knob.

6.2 Circular waves

- Depending on the choice of the desired waves, press 1 to 3 dippers onto the edge of the wave exciter, pressing either briefly or for a lengthier period as required.
- With the help of the knurled screws, attach the wave exciters to the vibrator.
- Set the depth of immersion by setting the vibrator so that the lower edge of the exciter touches the water surface in a straight plane.
- On the control unit, set the desired frequency and amplitude.
- On the viewing screen, a stationary or slowly moving wave pattern can be observed. Make fine adjustments using the turning knob.

6.3 Determining the wavelength

When determining the wavelength, the magnification factor *b* must be taken into account.

Magnification factor *b* can be calculated by placing the biconcave lens onto the ripple tank for instance and checking the ratio of its actual size *A* to the size of its projection on the viewing screen *A*'.

$b = A'/A$

The actual wavelength λ can be calculated from the wavelength λ' measured on the viewing screen as follows.

$\lambda = \lambda'/b$

7. Storage and maintenance

- Store the ripple tank in a dust-free place.
- Thoroughly dry the ripple tank after use to prevent it developing water stains and lime scale deposits.