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Instructions for SL100 Sonoluminescence Kit

The control box of the SL100 System does not have a power switch, in order to turn the unit off unplug the power cord. When connecting or disconnecting any BNC cables from the control box or connecting or disconnecting the power cord **ALWAYS HAVE THE VOLUME CONTROL TURNED ALL THE WAY DOWN** The follwing instructions will guide you through the setup process once you have degassed the water. If you have not degassed the water refer to the instructions DEGASSING THE WATER.

In order to obtain SL one must first degass the water. This process takes about 90 minutes.

1. **Degassing the Water**

   - Fill flask with 900 ml of water (distilled if possible).
   - Place flask over hot plate and bring to boil for 10 minutes.
   - After water has boiled for 10 minutes place rubber stopper over flask with valve closed tightly and press stopper firmly in place providing a tight seal.
   - Place sealed flask into an ice bath for approx 90 minutes allowing water to cool with valve shut.
   - Remove flask from ice bath and very slowly open valve (you should hear the air leaking into the flask). Take care not to open valve too quickly as the water may regass.
   - Water is now degassed and ready to be poured carefully into SL cell.

2. **Setting the Function Generator Level**

- In order to prevent the amplifier from clipping the input signal from the function generator must be kept below 1 volt peak. First with no other connections to the BNC inputs on the control box and with the master volume on the control box all the way down connect the output of the function generator to the input **Input from Cell** (This is not the normal position for the function generator input and will only be used to set its maximum level.)
- Plug in the power cord of the control box thus turning it on and adjust the frequency of the function generator to approx 28 kHz. The pannel meter on the front of the control box will record the amplitude of the function generator output multiplied by a factor of 4. Adjust the amplitude of the function generator output until the pannel meter reads 4 volts.
- Disconnect the function generator input from the port **Input from Cell** and connect it to the port **Input from Function Generator**

3. **Setting up the Cell**

- Pour degased water into the cell holding the cell at an angle to prevent the water from churning. Fill to the level as marked by scribe on front face.
- Fasten horn with a flask holder at base of large round portion before taper. Connect other end of holder to an adjustable clamp mounted on a vertical rod.
- Adjust position of horn over the center of the filled cell such that the tip of the horn extends approx 5 mm below surface of water. Be sure that there is no bubble trapped beneath the horn tip or along any of the cell's walls.
- Connect BNC cable from the cell box to the input on the control box **Input from Cell**

4. **Setting up the Rest of the Control Box**

- Connect output of the control box **Output to Horn** to the horn. (Be careful not to connect this cable to any other input since it utilizes a floating ground and will short out.)
- Connect boiler filament to banana posts on back of control box labeled **Boiler Filament**. Make sure not to depress boiler button until filament is immersed in water otherwise filament will burn out. Place bend in wire approx 5 inches from filament and hang over cell (preferably over a corner) such that heating filament is just off the bottom.
- If you would like to view the output of the cell on an oscilloscope (optional) then connect a BNC cable from the output port **Output to Oscilloscope** to the input channel of an oscilloscope.

5. **Finding the Resonance Frequency**

- This cell works best in the (1,1,3) mode which corresponds to a frequency of $\sim$ 28kHz. The resonance frequency will change by roughly 500 Hz over several hours. Initially this resonance will be around 27-28 kHz.
- Initially set the function generator frequency to 27 kHz and the volume control on the control box near its midpoint. Slowly increment the frequency in 10 Hz steps and look at the response of the pannel. When the needle passes its maximum deflection you have just passed the resonance frequency. Set the frequency increment to its most sensitive setting (usually 1 Hz) and slowly adjust the frequency up or down to reposition the needle at this maximum.
- Once you have located the resonance adjust the master volume control to give a reading of 4-6 volts on the pannel(1-1.5 volts if viewed on oscilloscope).
- Briefly hit the boiler button to seed a bubble. You should hear a sharp zip as the water is boiled off and notice a momentary distortion of the pill signal as shown in Fig. (1). (If you are also viewing this on an oscilloscope it is best to look at the oscilloscope and look for a distortion of the sine wave.) When you have SL you should see a tiny blue light emminating from the lower portion of the cell

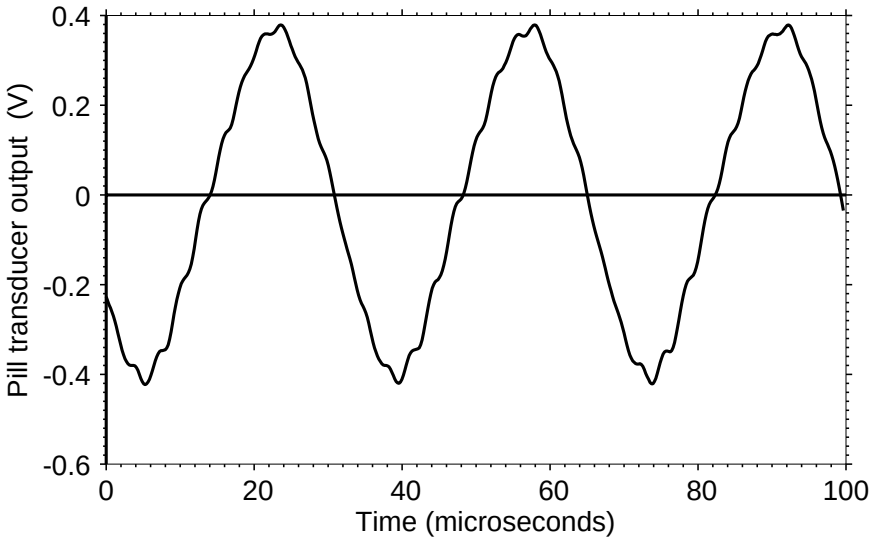

Figure 1: Distortion that appears on scope when SL is established. Note the relative magnitude of the distortion to the sine wave response of the pill

- If you hit the boiler several times and you get no SL try lowering the amplitude by 10 to 20%. If this does not produce SL try raising the amplitude by 10 to 20%. Initially as the water heats up you will have to adjust the frequency constantly to maintain resonance. The bubble will frequently go out simply hit the boiler and seed another one as this happens.