Saline Bucket Testing Platform Documentation

# Construction:

## Materials:

|  |  |
| --- | --- |
| Home Depot All Purpose Bucket  <https://www.homedepot.com/p/The-Home-Depot-5-Gal-Homer-Bucket-05GLHD2/100087613> | $3.25 |
| Salt (as pure as possible, with no anti-caking agents)  <https://www.amazon.com/Morton-Canning-Pickling-Salt-Box/dp/B00GZCEZ4O> | $9.47 |
| Distilled Water (approx. 3 gal) | Approx. $4.00 |
| Assorted Alligator Clips  <https://www.amazon.com/WGGE-WG-026-Pieces-Colors-Alligator/dp/B06XX25HFX> | $5.99 |
| BNC to Alligator clip cables (pack of two)  <https://www.amazon.com/Double-Alligator-Cable-Probe-Oscilloscope/dp/B00ORLGNVS/>  [one reviewer noted a possible impedance mismatch]  (look into that) | $7.89 |
| Siglent SDG2042X Function Generator  <https://www.amazon.com/Siglent-Technologies-SDG2042X-Arbitrary-Function-Generators/dp/B01410O55U#customerReviews> | $499.00 |
| Rigol DS1054Z Digital Oscilloscope  <https://www.amazon.com/Rigol-DS1054Z-Digital-Oscilloscopes-Bandwidth/dp/B012938E76> | $349.00 |
| 24”x24” Titanium Sheeting  <https://store.tmstitanium.com/products/199g/titanium-sheet-plate/cp-grade-2/0.020-thick-24.000-wide-24.000-long>  Or if building only one or two buckets:  <https://store.tmstitanium.com/products/198g/titanium-sheet-plate/cp-grade-2/0.020-thick-12.000-wide-24.000-long> | $65.00 |
| Total Cost: | $943.60 |

## Assembly:

1. Cut the titanium sheeting into 1” wide by 2’ long strips.
   1. This can be done with a bandsaw or metal shears, preferable electric metal shears for smoother cuts. These have worked well for us: <https://www.amazon.com/WEN-3650-4-0-Amp-Variable-Electric/dp/B01M5G99E7>.
   2. Each 24”x24” sheet of titanium is enough for 24 strips. Since each bucket only requires 3 or 4 strips, this is enough for 6-8 buckets. While it is always helpful to have spare titanium for electrode replacements, if the goal is only to build one bucket, purchasing the cheaper 12”x24” sheet is likely the best idea.
2. Create the saline solution.
   1. The optimum electrical impedance of this solution is 1000 ohms or 1kOhm. However, a range of around 100 ohms around this optimal value will suffice.
   2. Create a 0.9% weight by volume saline solution with the salt and the distilled water. You will want at least 1.5-2 gallons of water in the bucket. We recommend not going above 4 gallons to allow for an air gap at the top to reduce possible spillage. Calculate how much salt you need accordingly.
   3. Thoroughly mix the salt into the distilled water, making sure that all of it has dissolved.
   4. Take an impedance measurement of the saline solution. This can be done with an Activa PC+S and a DBS electrode, or with a multimeter (I think).
   5. If the impedance of the solution is too high, add a small amount of salt and measure again. If the impedance is too low, add a small amount of water and measure again.
3. Insert the electrodes.
   1. Insert each titanium strip into the tank such that the bottom of the strip touches the bottom of the bucket, and then bend the strip at the point where it exits the tank, such that the strip forms a narrow V with the point of the V resting on the lip of the bucket with one half of the strip inside the bucket, touching the bottom, and one half outside the bucket, ready for attachment of alligator clips.
4. Set up and attach devices to electrodes
   1. Unpack and plug in the two devices. They should both come pre-calibrated and work right out of the box.
   2. Connect one of the BNC-Alligator clip cables to Output #1 on the function generator. (connect the BNC end to the function generator). If the bucket is too far away from where the generator will be stored, BNC couplers can be purchased, and the BNC cables included with the function generator can be used as extensions.
   3. Clip the alligator cable ends of the BNC-Alligator cable to electrodes on opposite sides of the saline tank. If the cables are too short, other alligator clips or other wire can be used as extensions.
   4. Connect a voltage probe to the CH1 input on the oscilloscope.
   5. Using alligator clips, connect the tip of the voltage probe to an unused titanium strip. (The third one).
   6. Connect the ground plug of the voltage probe to a metal object, preferably a small piece of titanium sheet clamped to the lid of the bucket.
   7. Connect the negative output of the function generator to this small titanium plate, possibly using another alligator clip at a junction point, or connected directly to the function generator’s negative electrode.
   8. The small titanium ground plate provides an easy to access grounding point for devices under test that require it.

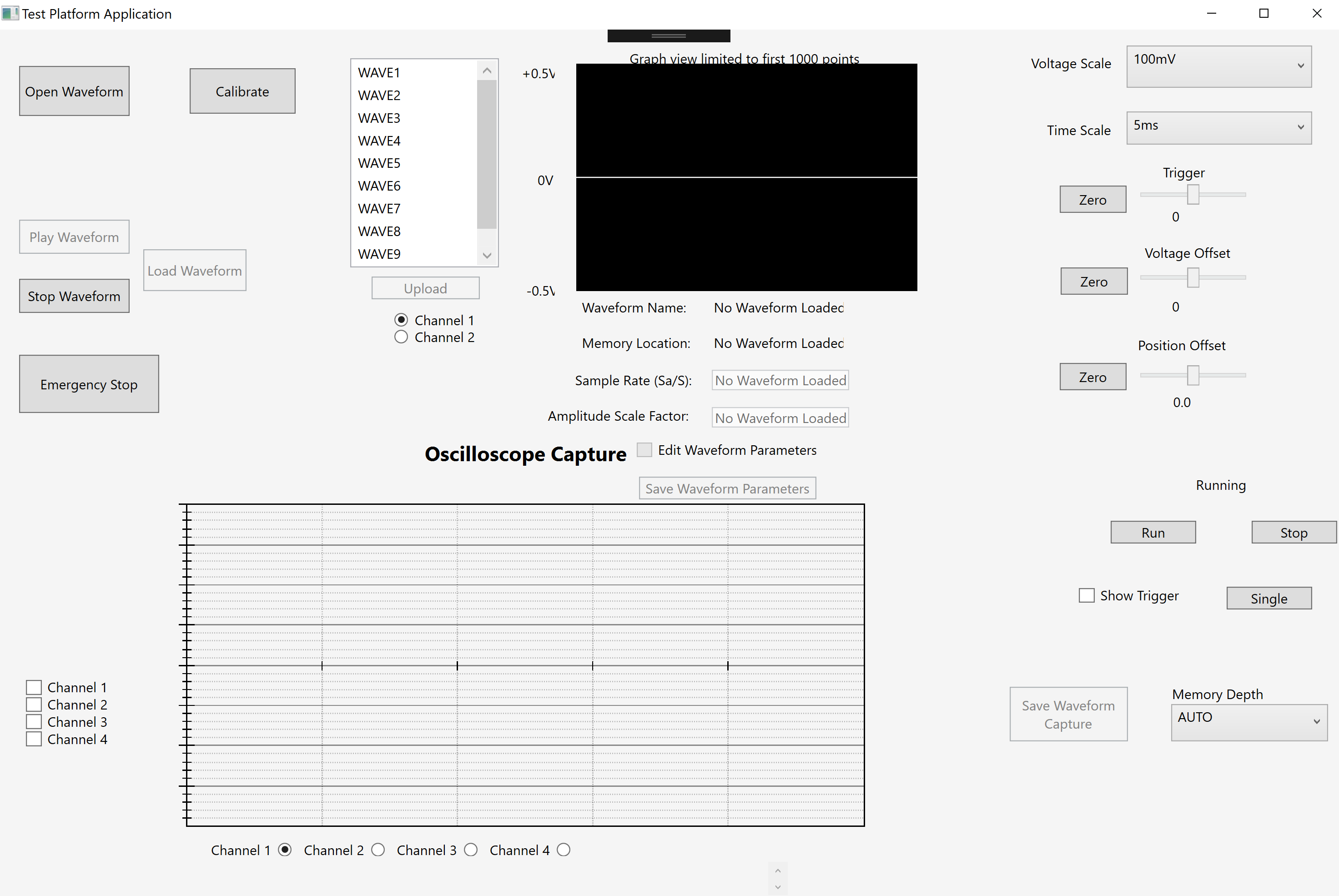
# Using the Software

## Installation:

1. Download the .exe file from the releases page on the GitHub. Make sure

TODO: Determine if NI-VISA must be installed on user computers in order to run the software, even with the DLL files

## UI Elements:



The UI elements marked in orange control the function generator part of the testing platform. (Ignore the “Oscilloscope Capture” header)

The UI elements marked in green control the oscilloscope part of the testing platform. (Again, ignore the “Oscilloscope Capture” header.)

## Waveform File Format:

Before we can begin talking about the function generator, we should mention the file format in which waveform files are stored. Waveforms that can be used with this program are stored as text files. The first line of the text file should be “samplerate=(your sample rate in Hz).” Setting the sample rate ensures accurate playback of the waveform. Each line following this should be a single decimal number, *preferably between -0.5 and 0.5*. For safety concerns, the maximum Vpp that a waveform can have is 1. If there is an error in capturing your data, and the resulting waveform has a slight DC offset, but the Vpp is still less than or equal to 1, the program will remove the DC offset for you when you open the file. If the Vpp of your waveform is greater than 1, the program will reject your waveform when you try to open it. Here is a screenshot of a waveform file opened in notepad.



As you can see, numbers in scientific notation format are allowed.

## Function Generator Usage:

The testing platform allows the user to upload recorded waveforms for playback with the function generator. Clicking the “Calibrate” button will play a 500 Hz 1Vpp sine wave on whichever function generator channel is selected.

The blue rectangle shows the function generator channel selector buttons. Whichever channel is selected is the channel that function generator operations will be done on.