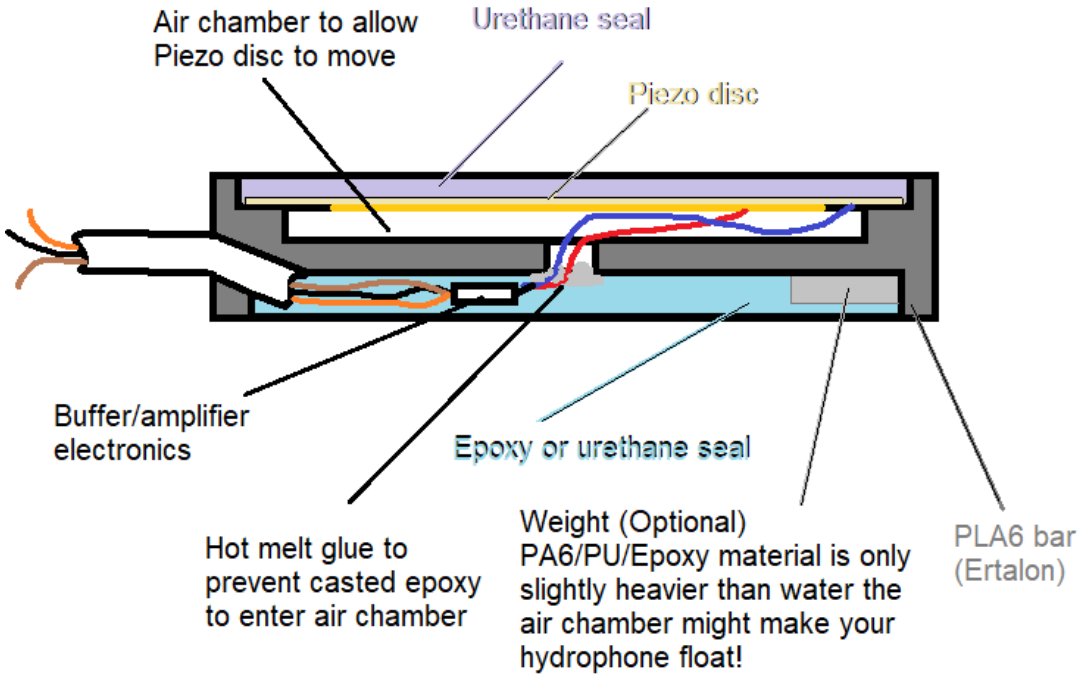
Hydrophone with Piezo disc.

To be able to pick up under water sounds, I built me a Hydrophone to connect to my bat detector.

I have been looking at https://www.instructables.com/Lets-Build-Some-World-Class-Hydrophones/, but it seems quite hard to get a Piezo ring, so I settled for a Piezo disc design.

COSEE TEK also uses a disc design, but I think it probably is better to have an air-space behind the disk than the compressible foam as used in the Cosee Tek design the foam makes for an easy build, but it could dampen the movement of the disc.
http://www.coseetek.net/resources/index.cfm?FuseAction=ShowResourceDetails&ResourceID=670

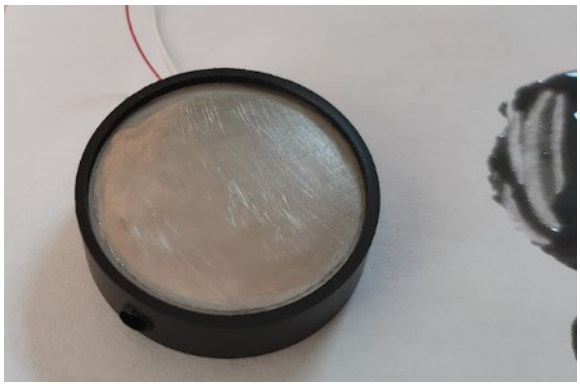
Since I do have access to a lathe I decided to turn a round housing form a piece op Polyamide material. It can hold the ceramic disc, has and air space behind the disc and some space for some electronics and a weight on the back side of the housing.



As you can see I still covered the Piezo disc with a small layer of 2-component casting urethane to have some extra protection.

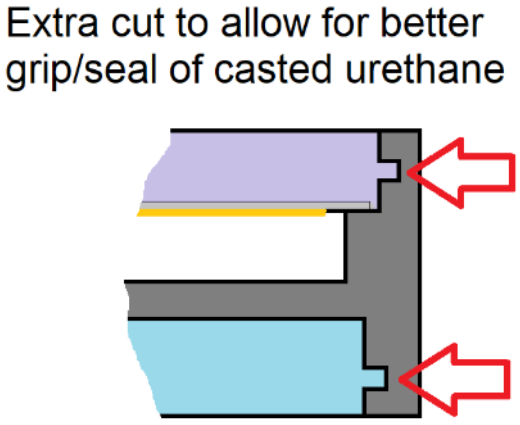
This is the end where I put the piezo disc, there is just enough space so the blobs of solder can not touch the back of the housing.

Diameters are made to fit the Piezo disc and the back inner diameter is to be able to fit an M16 washer.



I used some epoxy glue to hold the disk in place. After the epoxy glue is set I casted the urethane on top of it being careful it does touch the edges to seal it from the water.

To be sure I have a good seal there I made an extra cut as you can see in the detailed picture.

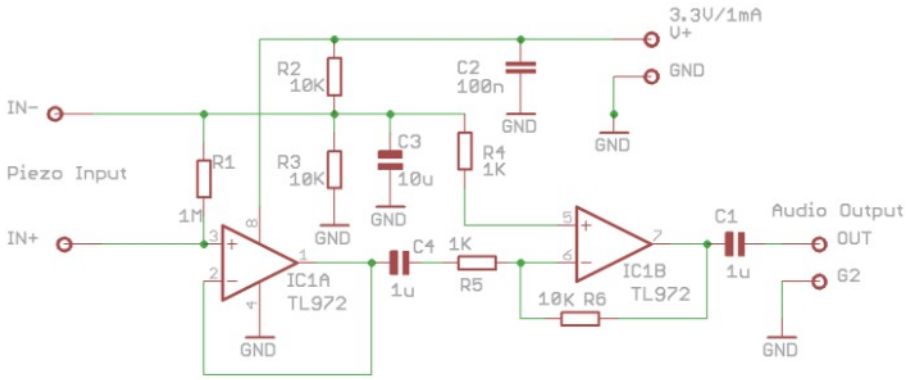


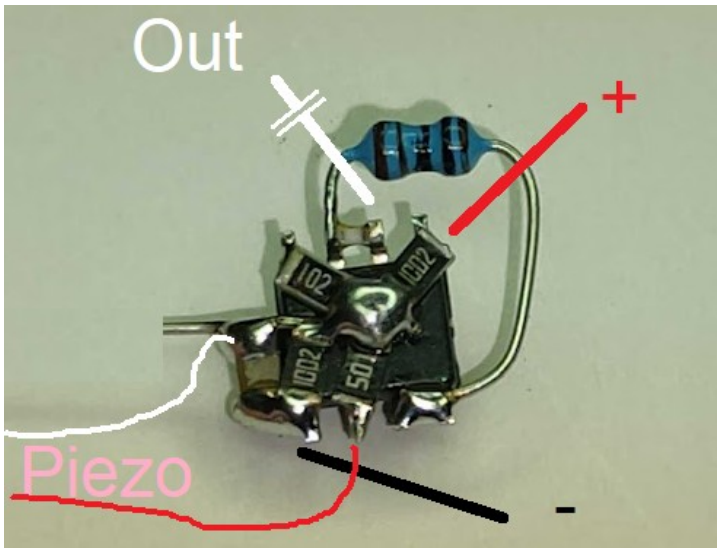
This a detailed image of the extra cut out I made Only a small cut of about 1*1mm is made here.

During casting I uses a cocktail-pick or toothpick to be sure the resin is filling this cut out ring properly.

These extra cut-outs are optional.

In the opposite end I made an op amp circuit to compensate for high impedance of the Piezo.





I soldeded my impedance buffer/ amplifier dead-bug style on an SMD TL972 dual operational amplifier.

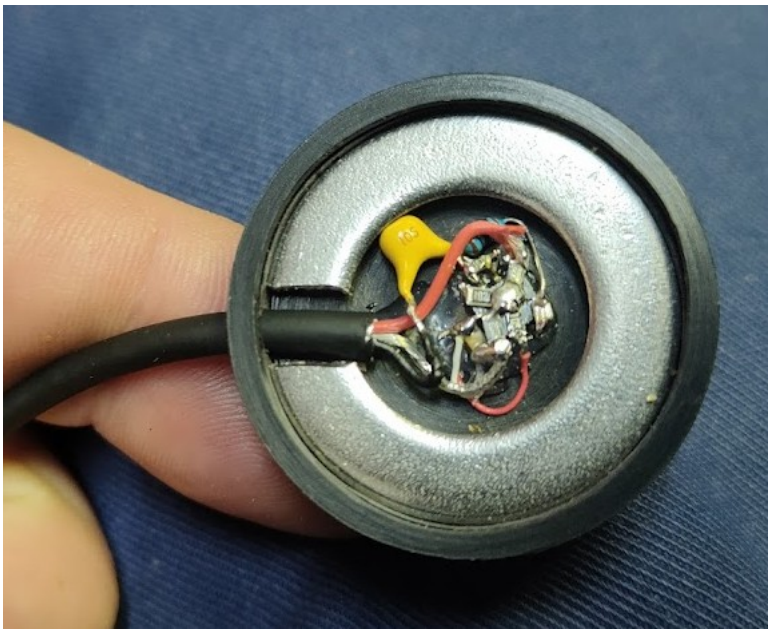
The sounds are already quite strong, the second stage might not be necessary.

When you do not need the amplification you can use C4 as output and R4,5,6 and C1 do not have to be mounted. Using a single op amp of terminating the second is recommend.

If the input of your recorder is not low impedance you can simply connect the Piezo disc directly.

The people that pay good attention will see that both C1 and C2 are missing in the picture above.

In the picture below you can see a “huge” C1 capacitor the decouples the audio to the recorder.



C2 is not visible in this picture. I used an M16 washer to add some weight. All though the air chamber is quit small I added the weight to be sure it will be sinking The Polyamide housing and Urethane is near the density of seawater.

Check for a good working hydrophone before casting the back end with resin. It should be able to pick up your voice and very sensitive to tapping and touching.

I use the hydrophone on my Teensybat detector the detector can be fitted with a 3.5mm stereo socket for external microphone. The tip contact is the 3.3V supply (drops a bit because of current limiting resistor) the ring is for the audio signal and the sleeve is GND.

Be sure to use a good shielded cable, use the shield as GND.