Capacitor Matching:

In designing the Ion Preamp it was found that two of the Capacitors of value 5pF (C1 and C2) must have the same value within 5%. Since the capacitors sent by the distributor cannot be dependably identical to this precision, we wanted to verify their values more exactly. Most of the meters that measure capacitance are not precise enough to detect a 5% difference in 5pF capacitors, so we used a very simple Wheatstone bridge to detect any variance between two capacitors.

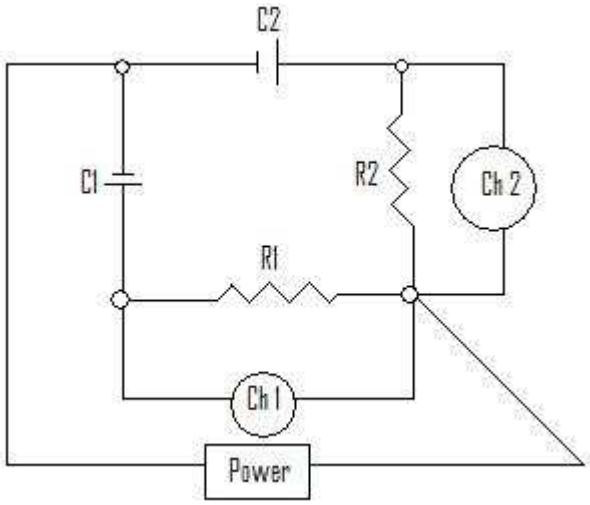

Fig. 1

Figure 1 is a rough circuit diagram of the Wheatstone bridge we used. R1 and R2 must be identical, and can be measured using a Fluke meter. They should have values between 50k and 100k Ohms. The easiest most secure way to build the bridge is using a piece of breadboard, three coaxial cables, and two sockets. The sockets are used so that capacitors can easily be switched in and out of the circuit. Be sure that the coaxial cable can plug into a function generator and scope. Below is a diagram of the breadboard circuit (Fig 2).

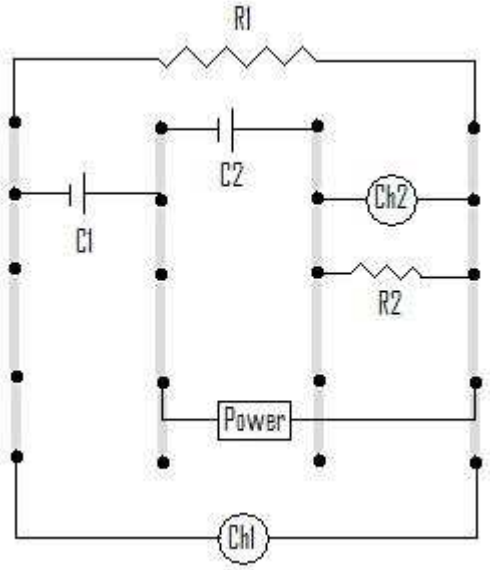

Fig. 2

This breadboard diagram is one of many possible configurations. First, place and solder the sockets, which are represented by C1 and C2, and then solder the resistors. Next strip some insulation off both ends of the three coaxial cables and separate the inner and outer layers. On one end, strip enough so that the two layers of the cable can span the distance between their respective holes on the board. On the other end, slide a piece of heatshrink wrap over the wire and solder it the connector. Shrink the wrap over the remaining exposed wire. Solder the three cables and the bridge is complete. If it is possible, you may want to tie down the cables using extra holes on the board and some wire.

The power source should be a function generator. It worked best to use a function generator, and we used sin waves at 1M Hz. The frequency should be as close to 1M Hz in order to observe any significance difference between C1 and C2. The simplest Wheatstone bridges use a galvanometer to detect any variance between the capacitors, but we use a larger scope to make sure that the variance is within 5%. Fig. 3 is a picture of the function generator and scope we used. On most scopes, you can look at both outputs at the same time. Fig. 4 is an example of the screen with both outputs observable at the same time. If these two sin waves are identical within 5% of each other, the capacitors are also matching.

Fig. 3

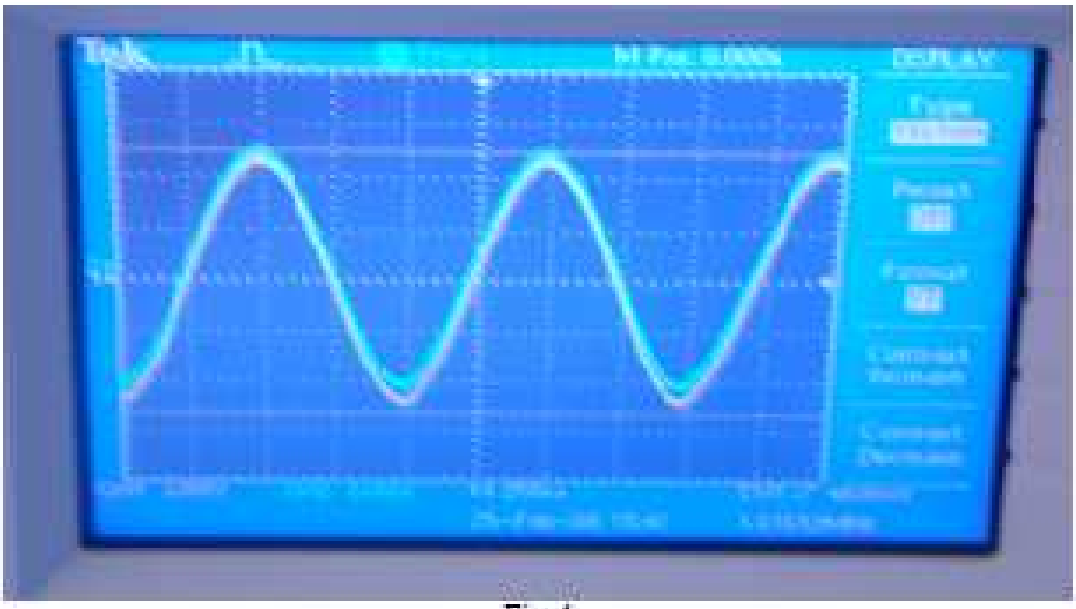

Fig. 4

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