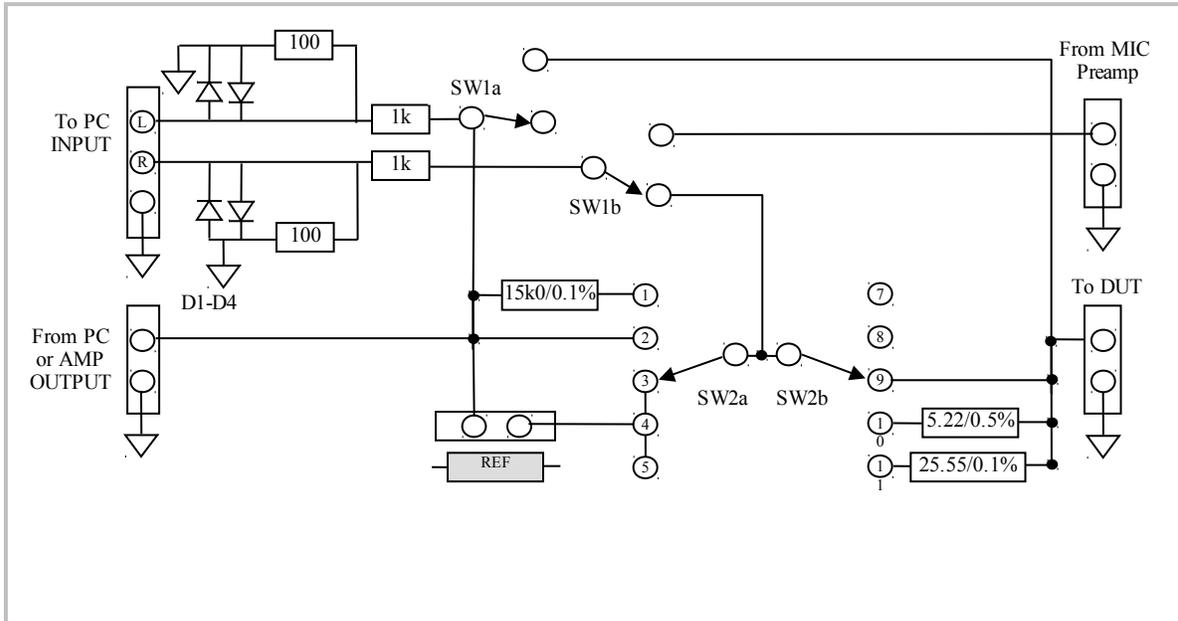


## Measurement Jig for Audua Speaker Workshop

### Schematic



### Explanations

The jig schematic includes a 10:1 voltage divider at the sound card input. Diodes D1-D4 are meant for protecting the input of the sound card against surges. With these diodes, the input at the sound card is clamped at about 0.65 volts peak (0.46VRMS for a sine wave), which corresponds to a voltage of 4.6VRMS before the voltage divider. During measurements, the signal level should be adjusted so that about 0.1-0.2VRMS is fed to the sound card which will provide sufficient signal level without causing the diodes to start conducting; this corresponds to a voltage of 1-2VRMS before the voltage divider.

It is not necessary that the voltage divider resistors be high precision; the sound card channel comparison test will calibrate the differences in these and, more importantly, any differences in the input impedances between left and right channels of the card.

The calibration procedures below are conducted without "telling" Speaker Workshop that there are voltage dividers. This approach allows us to include the effects of the dividers in the sound card calibration process, rather than have to manually account for their effect after the measurement. Put differently, we treat the voltage dividers as being a part of the sound card itself.

### Usage

In the above schematic, SW1 is shown in the DOWN position for conducting impedance measurements for the device under test (DUT). (The DUT may be a driver, resistor, capacitor, inductor etc.) When flipped to the UP position, the jig is used for acoustic measurements.

For impedance measurements for the DUT, the LEFT is the default reference channel. For acoustic measurements the default reference channel in Speaker Workshop is RIGHT; this must be flipped in the dialog boxes so that the LEFT is taken as the reference channel and the input from the microphone preamp is fed to the RIGHT channel.

In Speaker Workshop, go to **Options -> Preferences** where you see the *Impedance Jig Definition Box*. Clicking the Test button here shows the following instruction: "Use this wizard to accurately measure your impedance jig. This test will estimate and replace the REFERENCE resistor and SERIES resistance settings in Preferences. This process requires an impedance jig and at least two different KNOWN resistors." Therefore note that the external REFERENCE resistor value need *not* be precisely predetermined. (The name "REFERENCE" is thus potentially confusing.) It is determined using the KNOWN resistors which need to be of high precision. The values shown above are representative.

### ***Position 1: Sound Card Input Impedance (Right Channel)***

SW1 is in the DOWN position and SW2b is at position 7 for this test. Speaker Workshop uses the known value of the precision resistance 15.0k to determine the input resistance of the sound card channels. The output signal from the PC or amp is fed directly to the left channel of the sound card and via the 15.0k resistor to the right channel input of the sound card. Note that this test does not measure the Left channel input impedance; the impact of any difference between channels is taken care of indirectly by the channel difference test. Note that the reported sound card impedance includes the effect of the voltage divider; therefore the reported value must be entered as-is in the Speaker Workshop Impedance tab in Options ->Preferences. (Speaker Workshop Help assumes that you measure the input impedance without the voltage divider and advises you to accordingly calculate the net impedance to be entered here.)

### ***Position 2: Channel Difference/Acoustic Measurement***

SW1 in the DOWN position. The PC/Amp signal output is fed directly to both left and right channels, the latter via SW2. The DUT (speaker) does not get any signal. This is used for assessing the difference between the left and right channels of the sound card.

SW1 in the UP position. The PC / Amp signal output is fed to the left (reference) channel directly and to the DUT (speaker). The microphone preamp output is fed to the right channel of the sound card.

The REF resistor may be unplugged for these measurements.

### ***Position 3: Impedance Measurements***

SW1 is in the DOWN position and SW2b at position 9. The speaker or DUT is connected with the REF resistor plugged in place, for the actual impedance measurement. The REF resistor should be calibrated first.

### ***Position 4, 5: Calibration of SERIES and REFERENCE resistances***

SW1 is in the DOWN position and SW2b is at 10 (11 in Position 4). The speaker is replaced with a short at the end of the speaker cable. Speaker Workshop will then use the KNOWN resistor values 5.22 and 25.55 to calibrate the value of the external REF resistor (plugged in) AND the SERIES resistances *including* those of the cables leading to the speaker.

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## Parts List

### Item

D1-D4 - 1N4001

SW1-Toggle (DPDT)

SW2-Rotary (2P6W)

15k 0.1% precision resistor

26R1, 0.5% precision resistor (5)

*(Five in parallel required to achieve 5.22R)*

51R1, 0.1% precision resistor (2)

*(Two in parallel required to achieve 25.55R)*

Voltage divider resistors suggested - 100R/1K (values not critical)

Standard Banana sockets (3)

- *Input from PC or Amp*

- *REF*

- *To DUT*

Standard stereo jack

- *To PC Input*

Standard RCA socket

- *Input from Mic Preamp*

Rotary Knob to fit SW2

General-purpose PCB or Stripboard