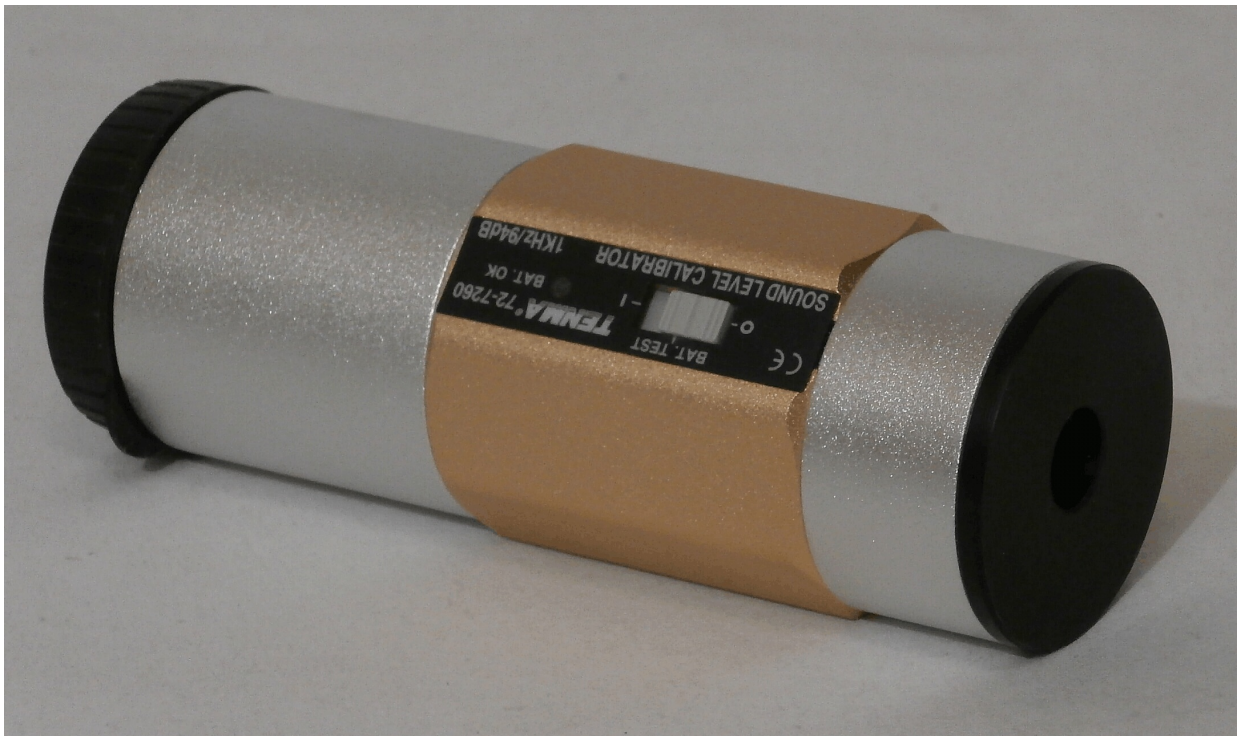
MATCHING WM-61A MICROPHONE CARTRIDGES

Ron Tipton – January 2018

As I mentioned in my DIY-HRTF article, it's necessary to match the Left and Right microphone cartridges for best performance. I used this cartridge in my TDL model 818 microphones and they all had very similar frequency responses from 20 Hz to 20 kHz. It's the sensitivities that must be matched, that is the output voltage at a particular frequency (usually 1,000 Hz) and a fixed sound pressure level, (usually 1 Pascal which is equal to 94 dB SPL).

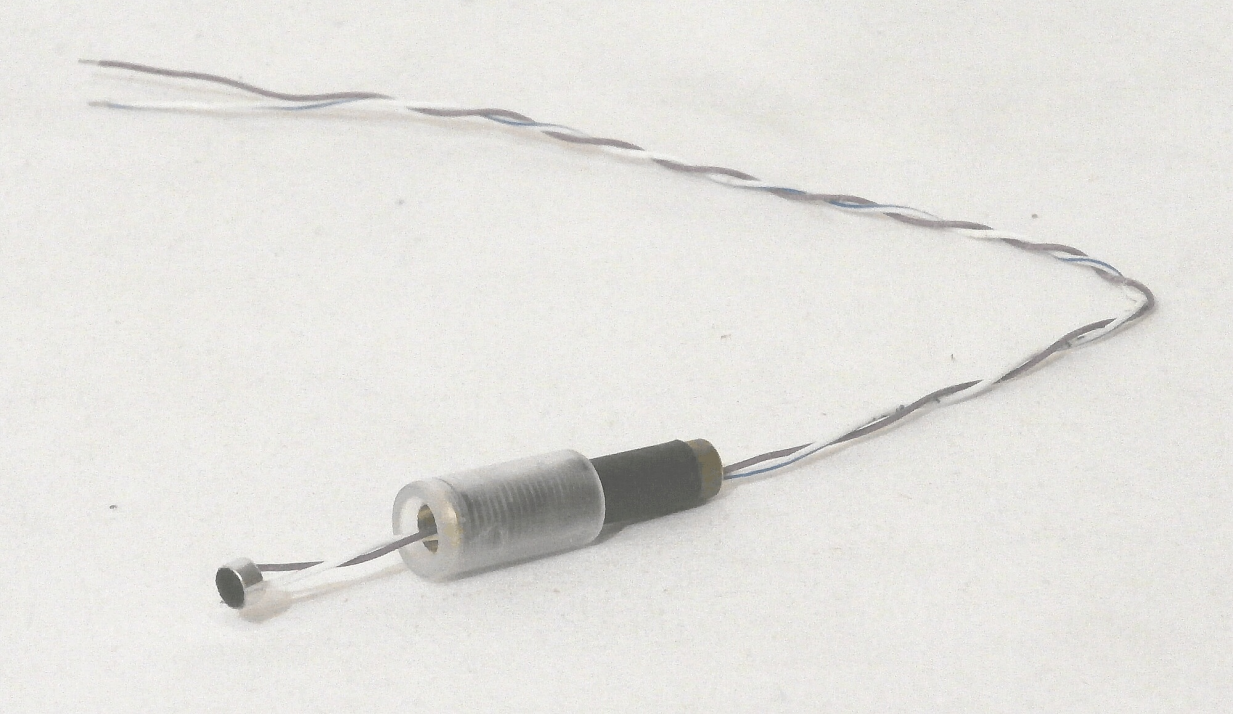
This matching can be accomplished by comparing each cartridge's output voltage to the output voltage of a reference microphone such as a Behringer ECM-8000 or Dayton Audio EMM-6. I have a step-by-step comparison description in my audioXpress article: "DIY Microphone Calibration," April 2009. (A pdf copy is included in this Supplementary Material file.)

But in my opinion, a more convenient method is a direct measurement using an inexpensive microphone calibrator such as the Tenma 72-7260 shown here.

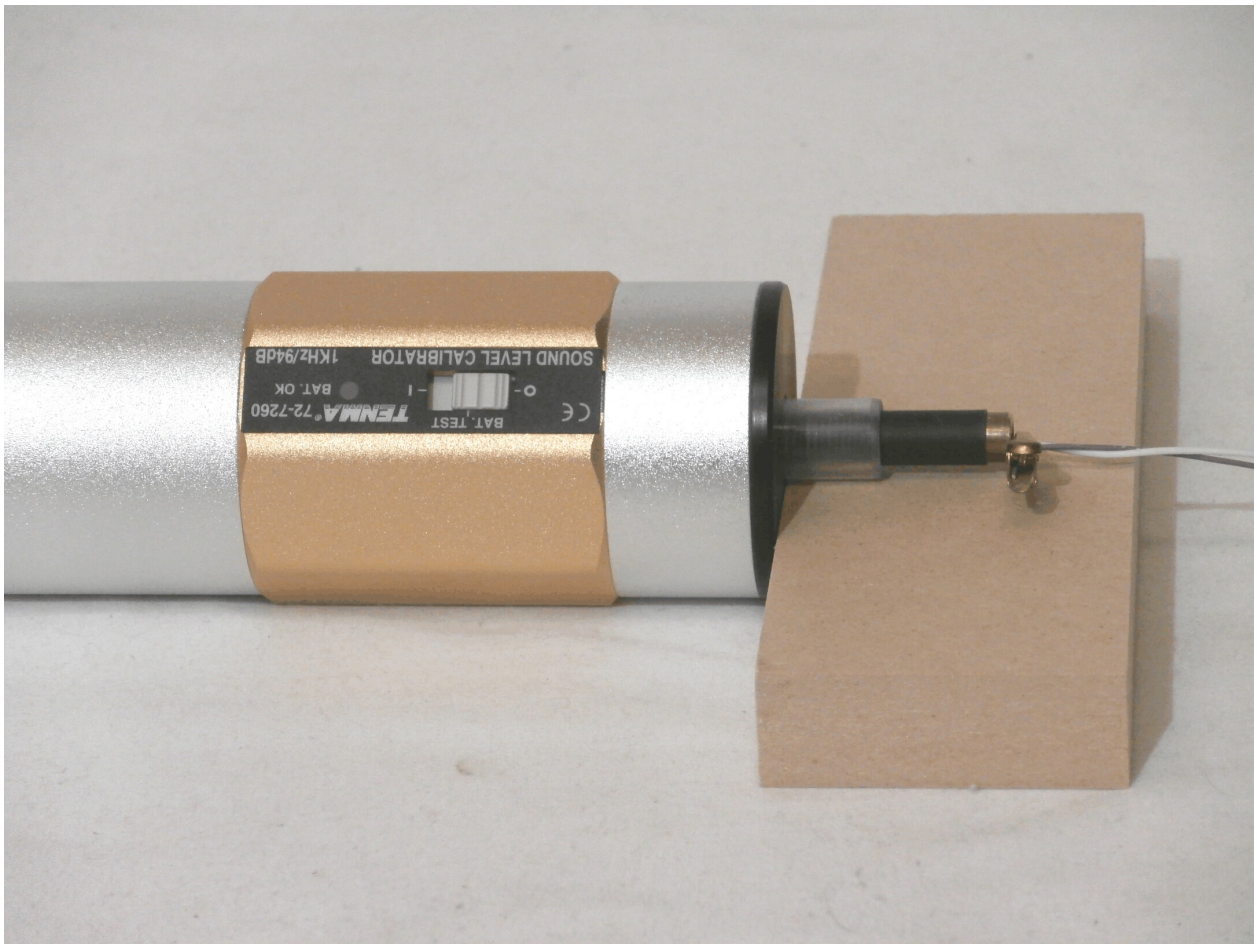


This calibrator generates a low-distortion 1,000 Hz sine wave at 94 dB SPL. The microphone to be calibrated is inserted into the ½" diameter well in the "business end" and the battery-powered unit is turned on. Both the above microphones have ½" barrels so they can be easily measured. But an adapter must be used for the smaller diameter of the WM-61A.

This next photo shows a WM-61A cartridge with attached 14" Teflon wires inserted into the adapter I constructed from a short length of 5/16" OD brass tubing and ½" OD polystyrene rod. The microphone has a 0.236" OD so the brass tube's bore must be increased to a "just slip fit" for the cartridge. A "B" drill bit has a nominal diameter of 0.238"so start with a "B" just deep enough so the cartridge face is flush with the brass tube's end. If the hole is too tight, enlarge it with a "C" bit which has a nominal 0.242" diameter. (The bit's actual sizes are somewhat dependent on the manufacturer.)



It’s difficult to get a properly snug fit between the bare brass tube and the plastic bushing so I covered the brass tube with a piece of shrink tubing to provide some “give.” This works well. The brass tube is inserted into the plastic bushing so the cartridge face is even with the bushing’s end. Then the bushing is inserted into the calibrator as shown in the next photo. A small alligator clip on the wires keeps the cartridge in place in its adapter and a small length of 3/4" thick MDF under the plastic bushing keeps the adapter level in the calibrator’s well – an important point for an accurate measurement.. .



The WM-61A needs a minimum 2 volts DC with a maximum of 10 volts. A microphone preamp with 5 volts is ideal. The preamp SHOULD have a switch to set the gain because it’s all too easy to slightly move a pot’s setting. For cartridge matching, the absolute gain is not important but it MUST remain constant for all the cartridges Connect an AC voltmeter (I prefer a digital meter) to the preamp’s output and start measuring!

SOME MATCHING RESULTS

As I mentioned earlier, I used the WM-61A cartridge in my TDL model 818 microphone so I measured a bunch of them. Here’s a list of 15 consecutive measurements for a random selection of

cartridges from a bag. (The mic spec sheet lists 12 mV/Pascal as the nominal sensitivity but none were that high.)

9.3 mV RMS
9.3
8.6
11.3
10.6
10.9
11.3
10.7
11.2
10.5
11.3
10.8
9.5
10.5
9.0

As you can see, there are several matched pairs in the list with several others close enough. Matching to within 1 dB is excellent with 2 dB maybe acceptable. (This is based on the generally accepted assumption that about 10 to 15% of the population can hear a 1 dB volume change, while most, maybe 90%, can hear a 2 dB change.)

Purchasing 10 cartridges should easily give you at lease one pair within the 1 dB range. The analysis is based on taking the base-10 log of the sensitivity ratio. For example:

11.3 / 11.3 = 1 and log 1 = 0 and 20 * 0 = 0 dB (but we knew that already)

10.5 / 9.5 = 1.105 and log 1.105 = 0.0435 and 20 * 0.0435 = 0.87 dB (very good)

10.5 / 9.0 = 1.167 and log 1.167 = 0.0669 and 20 * 0.0669 = 1.34 dB (okay, but try to do better)

11.3 / 8.6 = 1.314 and log 1.314 = 0.119 and 20 * 0.119 = 2.38 dB (not good enough)

Taking the ratio in the opposite order just makes the answer negative – for example:

9.5 / 10.5 = 0.9048 and log 0.9048 = -0.0435 and 20 * -0.0435 = -0.87 dB

SOURCES

WM-61A mic cartridge | ebay.com (typically one to two dollars each)

Tenma 72-7260 Microphone Calibrator | www. element14.com (it seems MCM Electronics has been absorbed by this division of Newark. The latest version of the 72-7260 has interchangeable “wells”

for both ½" and 1" microphones – at a somewhat higher price than I paid a few years back.

Behringer ECM-8000 | www.behringer.de

Dayton EMM-6 | www.parts-express.com

Brass tube and polystyrene rod | www.mcmaster.com or maybe a local hardware store

Letter size drill bits | maybe locally at Home Depot or Lowe's Home Improvement. Or online from www.travers.com or www.mcmaster.com.