The Science of Cable Design

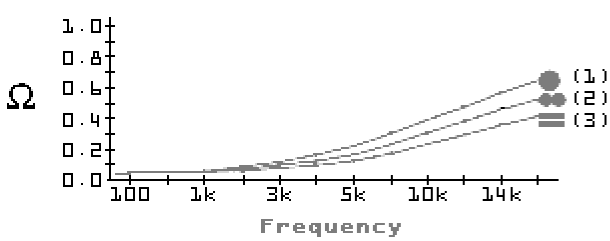
Part I

The following is the first in a series of articles by TARA Labs designer Matthew Bond.

Measuring Cable Performance & Correlating Results with the Listening Experience

There is an increased awareness among audiophiles as to the importance of cables in the sound of an audio system. It is a subject that has been surrounded by controversy, in part because many feel the differences to be either too subtle to be audible, or too system-dependent to hold any universal truth for buyers of audio equipment.

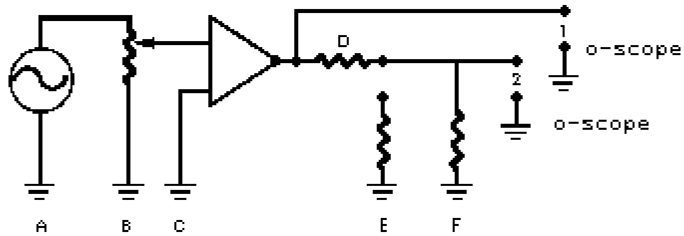
In fact, it is possible to make measurements of different audio cable conductor designs that will correlate with audible differences in the cables' performance. Moreover, with these measurements as a learning tool, one can begin to distinguish conductor designs which are linear and accurate as opposed to designs which soften, brighten or otherwise color the sound.



(1) = 1 x 2mm^2 round   (2) = 2 x 1mm^2 round   (3) = 2 x 1mm^2 rectangular

In 1988 TARA Labs developed Constant Current Impedance Testing (CCZT)™, a testing method which has been used in advanced university engineering studies to measure cable performance. These measurements provide reliable predictions about the sound to be heard from the changes of cable conductor design and configuration. With CCZT, we have been able to reliably and repeatably correlate the listening experience to the test-bench experience.[1]

Constant Current Impedance Testing



A. = Signal Source
B. = Signal level Control
C. = Amplifier
D. = Current Limiting Resistor
E. = Calibration Resistor
F. = R(Z) to be measured

CCZT measures impedance vs. frequency or linearity with frequency. This is both a necessary and important criterion of cable performance because it directly relates to rise time and phase coherency. These two elements, more than any other, correlate directly to one's perception of a cable's sound as either "live," or reproduced.

In CCZT testing we use conductor runs of equal mass (i.e. same D.C. resistance) but varying conductor shape and arrangement. They are set up in a test jig having the same parallel configuration between the send and return lines. This methodology accurately compares the design qualities of the conductors themselves while keeping all other factors identical.

The results of the tests are shown in the graph. Listening tests of the cables generate results as might be expected from examination of the graph.

Single 2mm (14 gauge) round conductor: Upper bass and mid-range are warm. Treble is soft and rolled off.

Two 1mm (14 gauge) round conductors: Upper bass and mid-range are cleaner, with better definition. Sound is more natural and coherent. Less roll-off in high frequencies.

Two 1mm (14 gauge) rectangular conductors: Upper bass and mid-range are more vivid, palpable and live sounding. The sound through the mid treble and upper frequencies is extremely coherent and natural. Overall, the natural harmonic structure of the music is more accurately revealed.

With even a rudimentary understanding of the principles of cable design it's possible to make good predictions about the sound of a cable just by examining its internal structure. In Part II, we'll examine why various conductor configurations yield the differences in frequency linearity (and therefore, sound) demonstrated here, and what to look for when comparing cable designs.

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[1]The testing methodology for CCZT is relatively simple to duplicate.