Audio Dummy Load Build

Figure 1 - CMS ADL-01 Audio Dummy Load

You know, every now and then it occurs that there is a piece of test equipment that would be nice to have, but either it is not readily available on the market or it is so cost-prohibitive that it might just as well not be available. That is when it is time to “roll your own” and solve the problem in true homebrew fashion. Right now, I am referring to an audio dummy load (Figure 1) – a device that can be used to place a proper load on an audio amplifier for both pre- and post-repair testing of that amplifier.

I thought about the idea for a while and then decided that I would design and build a load device that would offer several different load impedances, selectable via a front panel switch, across two audio channels and through several different input connector types. I also wanted to incorporate oscilloscope take-offs with variable attenuation to provide a means of observing the amplified waveforms from the amplifier.

I settled on four ohms, eight ohms, twelve ohms, sixteen ohms, and twenty-four ohms as the design impedances to be installed (refer to the unit schematic diagram in Figure 2). I also settled on 6.3mm (1/4-inch) monoaural jacks, 3.5mm (1/8-inch) monoaural jacks, RCA jacks, a 3.5mm (1/8-inch) stereo jack, and stripped-wire spring clips as the various input connectors to be installed. I chose 50 kilohms as the attenuation potentiometer value, and 50-ohm BNC jacks as the oscilloscope lead connectors. The enclosure selected is a 7-3/4-inch x 6-1/4-inch x 2-3/4-inch two-piece steel over aluminum unit with a white-painted body and a black cover. A two-pole six-position rotary switch was chosen as the selector switch.

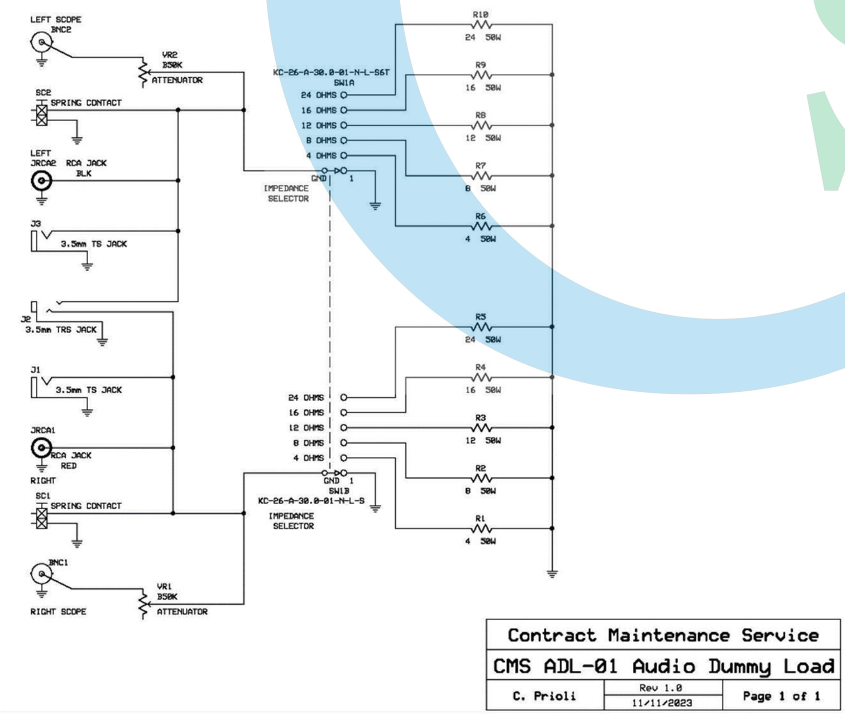

Figure 2 - ADL-01 schematic diagram

As a point of fact, the rotary switch selected is a variable-position two-pole switch. The number of positions to which the switch can be moved is determined by the position of a stopping ring that is installed at the bushing of the switch, underneath a toothed lock washer. The switch itself is actually a twelve-position switch with a thirty-degree index. It is the fact that it is a two-pole switch that makes six positions the maximum number of positions available for use. The specification of the “index” of a switch is a description of the number of degrees of rotation that the switch will move between each detent or position.

I had originally contemplated the installation of 2.5mm (3/32-inch) jacks, in monoaural for both left- and right-side inputs, and in stereo as a dual-channel input. After further thought, I decided to eliminate the 2.5mm jacks completely, both as a space-conscious decision and because that size is not very common in audio except for computer audio. I reasoned that if the need should arise to jack-in a 2.5mm connector, it could easily be accomplished through the use of an adapter or adapter cable, of which I have plenty on hand.

Front and rear panel labels were designed in CorelDraw! and then printed on a self-adhesive letter-size vinyl sheet. The labels were cut out of the sheet and then affixed to the front and rear panels of the lower half of the enclosure. Appropriately-sized holes were drilled at the various locations marked on the labels for that purpose, to provide for the installation of the various input connectors, selector switch, oscilloscope ports, and attenuator potentiometers.

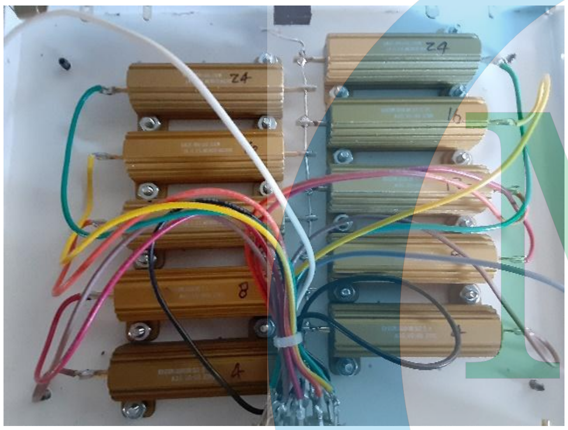

Figure 3 - Resistors installed in enclosure

Ten resistors rated fifty watts each were selected for the loads, each of them having a tolerance of one percent. The resistors were installed to the floor of the enclosure (Figure 3) using 4-40 x 3/8 machine screws with split lock washers and 4-40 hex nuts.

All of the input connectors were installed to the holes drilled into the rear panel, while the selector switch, the potentiometers, and the BNC jacks were installed to the holes drilled in the front panel. A single ground bus wire was run through all of the resistors at the center of the enclosure, with a tail left at the rear for attachment to the input ground string. The front end of that ground bus wire was tied to terminals one and seven of the selector switch. The outer end of each of the resistors was then wired to the appropriate switch terminals, with the four-ohm resistors connected to switch terminals two and eight, and the remaining resistors connected in sequence to the remaining terminal pairs in sequence. Switch terminals A and B were each supplied with a length of 22 AWG hookup wire, which were left standing as the input leads to the selector switch.

All of the rear panel input connector ground terminals were tied together (Figure 4) and connected to the tail of the resistor ground bus wire. The ground bus was extended to the front panel and connected to the ground lugs of the BNC switches (Figure 5).

Figure 4 - Rear panel wiring in place

Because I wanted the attenuation to increase as each control knob is turned clockwise, I wired the potentiometers using the center and high resistance side of each pot. I began by connecting the lead from terminal A of the selector switch to the center terminal of the right-side attenuator

Figure 5 - Front panel wiring in place

potentiometer. The high-resistance side of the right-side attenuator potentiometer was then wired to the center terminal of the right-side BNC jack. A bus was constructed that ties together all of the right-side isolated inputs, including the ring terminal of the stereo jack. This bus was then wired up to the center terminal of the right-side attenuator potentiometer. The same process was then followed to connect all of the left-side inputs, the tip terminal of the stereo jack, and the center terminal of the left-side attenuator potentiometer, tying in the wire lead that was soldered to terminal B of the selector switch. The high resistance side of the left-side attenuator potentiometer was wired to the center terminal of the left-side BNC jack.

For ease in future tracing of the circuit, I employed a standard electronics color-code sequence for the hookup wire, using BLK for the ground, BRN for four ohms, RED for eight ohms, ORN for twelve ohms, YEL for sixteen ohms, and GRN for twenty-four ohms. WHT was used for the right-side inputs, and GRY for the left-side inputs. This wire color scheme is evident in the illustration in Figure 3 and again in Figure 6. Bare wire was used for bus wire in several locations throughout the assembly.

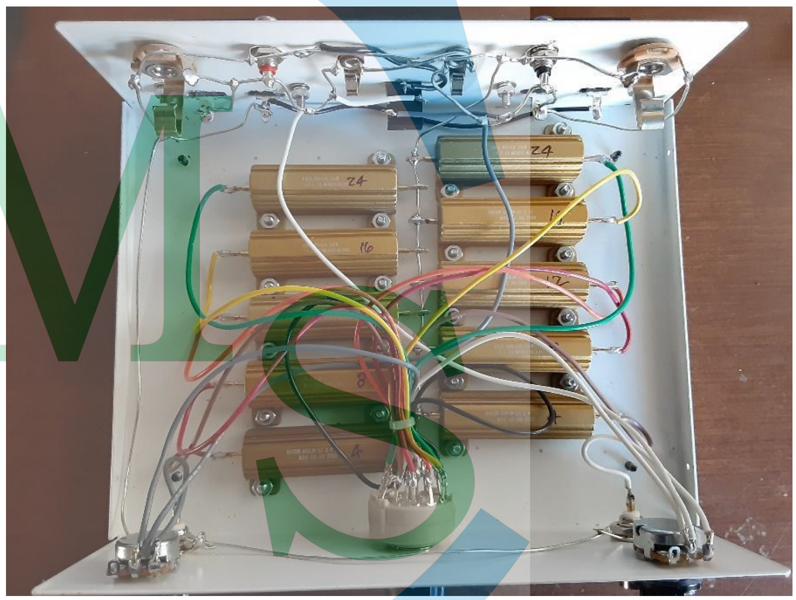

Figure 6 - Interior view of completed unit

This turned out to be a very simple build, and when tested, it operated flawlessly. Had there been any DC present in the unit, I would have included capacitors in the leads to the oscilloscope ports. This was not necessary as there is no DC present within the circuit at all.

The first position of the selector switch is a ground position, intended solely for use in bleeding off any charge that may be present on any output-connected capacitors within the amplifier under test. That selector switch position is *not* for use at all while the amplifier under test is operating, as it would be the equivalent of placing a direct short-circuit across the amplifier outputs. I have quickly developed the habit of leaving the selector switch in its eight-ohm position as a hedge against any undesirable outcomes.

The idea for this instrument was born in a climate of necessity, but it turned out to be just exactly what was needed. It seems that the way to solve a problem sometimes is to throw ideas at it and see what sticks. In this case, the idea stuck and bore fruit, and another effective piece of equipment was added to my test bench.