PRECISION 612 - REFURBISHING AND CALIBRATING

The precision model 612 is a combination tube and battery tester that, although employing only simple, straightforward (some would say "classic") vacuum tube emission testing circuitry is very well constructed of high quality components including a hefty, well-made power transformer and rugged, durable switches. Since even the best electronic components may eventually change in electrical value due to the accumulated effects of heat and moisture and the other ravages of time, better quality tube testers (such as the 612) incorporate calibration controls which provide compensation for such changes and help assure the continuation of a high level of measurement accuracy. In this article we will not concern ourselves with the battery testing function of the 612 but will concentrate exclusively on refurbishing and calibrating the tube testing circuits.

I am, by the way, indebted to Dave Haggard (Easy rider 8 on the Antique Radios Forum) for much good advice regarding tube tester repair and calibration.

First Things First

There is no point in trying to calibrate a tube tester that contains bad component parts, so our first step is to identify those parts that have to do with the tube testing (as opposed to battery testing) functions of the 612. We will then test and replace those parts as needed.

With the 612 lying on its back so the meter movement is in the normal position for testing tubes, you should be able to adjust the meter pointer to exactly zero on the meter scale using the mechanical zero set screw. If not and/or the pointer tends to stick, you have a meter movement problem. This article does not deal with meter movement repairs.

Referring to the schematic, we see that the 612 has only one capacitor, a .1mfd, 600 volt tubular type. I wouldn't bother to test it. Just replace it with a modern equivalent and be done with it.

Located toward the right hand side of the schematic, in a vertical configuration, we see a large group of sixteen resistors, numbered R6 at the top and R26 at the bottom. These are obviously load resistors for the various battery test ranges and play no part in testing tubes, so we will ignore these.

Continuing our search for components that may need checking we find the following resistors all associated with testing tubes: R7,R8,R9,R10,R11,R12,R13 and R3. In my 612, R3 appears to be a hand wound, high precision unit while the others are 10% tolerance carbon composition types. As a purely practical matter, you could no doubt replace any of them with modern, 5% tolerance deposited film resistors. If you lack access to an ohmmeter of known accuracy (a Known good DMM would be the ideal test instrument for this purpose) you could just replace all of them as cost is not terribly high. I would use three watt units in each case.

It is mandatory that you clean all tube socket contacts and controls except R1 and R5 (do not disturb those two for now, we will deal with them in due time) and all switches with your favorite contact cleaner. My 612 had been serviced previously, and had several suspicious looking solder joints which Ire-soldered.

If the 5Y3 is not up to snuff, that problems should show up later on when we do the actual calibration procedure. An open fuse or pilot lamp or bad neon short test bulb should be easy enough to detect and you should clean all the tube socket contacts, and examine and possibly replace the ac line cord.

What The Calibration Controls Do

The 612 employs two calibration controls; R1, a 40 ohm open construction rheostat and R5,a 6K ohm, sealed unit. The logic here is simple. Since proper filament voltage plays a major role in cathode emission, emission readings can only be meaningful when the correct filament voltage is being applied to the tube under test. Proper adjustment of R5 assures that the secondary of the power transformer is supplying accurate voltages to the various tube socket heater pins.

The function of R1 (in the "read meter" circuit) is to adjust cathode current flow through panel meter M-1, so that the meter needle will move upscale the appropriate distance for the particular tube being tested, based on the condition of that tube in terms of its ability to emit electrons from its cathode. So, if either R1 or R5 are out of adjustment emission readings will have little or no real meaning.

Final Steps Prior to Calibration

At this point we have replaced the capacitor, tested and replaced resistors and the ac line cord as needed and cleaned all tube sockets, switches and controls except R1 and R5. We now turn our attention to R1. Using a fine point felt marker pen, mark the position of R1's movable contact. You can draw that mark on top of R1's shaft and across it's mounting nut onto the chassis. Since R1 is of open construction it is possible that time and the natural elements may have caused the slider to freeze in place. In that case, any sudden movement of the slider could result in permanent damage to the winding. I like to handle this kind of potential problem by spraying a little contact cleaner into a small container (the cover of the spray cleaner can is fine) and using a flat 1/8"wide artist brush, apply the cleaner under the slider where it contacts the wire element. You will also need to apply cleaner to the shaft and bearing surfaces of R1, of course. Let the cleaner soak into R1 for a while and then try (gently, please!) rotating the shaft. In my 612, I had to use penetrating oil on the shaft and it took several applications to loosen it. I used Singer Sewing Machine oil as a final treatment on the shaft and bearing. If you are satisfied that R1 is now working smoothly, return it to the marked setting.

Now, mark the position of the shaft of R5, use your spray cleaner on it and then return it to the marked position. I like to open older rheostats and potentiometers and clean them from the inside out, and lube the shaft with fine oil and the wire wound element with Lubriplate, but not Everybody wants to go that route, so do as you feel is best.

Calibration Procedure Part One

We will begin calibration by plugging the 612 in and depressing the "Read Meter" switch just far enough to turn the instrument on. Set control "A" to any of the positions between 1 and 5. The settings of the other controls should not matter.

Allow at least ten minutes warm-up time and then connect an accurate ac voltmeter across the entire 300 volt secondary of the transformer. Referring to the schematic, the low volt end of the secondary connects to one end of the filament of the 5Y3 and the 300 volt tap connects to one end of R13, a 3K ohm, 2 watt resistor.

Now, set the Line Adjust control for exactly 300 volts on your voltmeter and adjust R-5 until the meter needle on the 612 is centered over the line adjust mark. You will probably find it necessary to work back and forth between the Line Adjustment control and R5 until you have accomplished the following goals:

a) The meter needle must be centered over the "Line Adjust" mark

b) Your voltmeter must indicate 300 volts

c) There must be no hum from the transformer

d) The pilot lamp must not appear to be overly bright

A too-bright lamp and/or humming noise from the transformer means you need to back off on the Line Adjustment and then re-adjust R5 to center the needle. We have now completed the first part of our calibration procedure.

The Final Step

As is usually true with emission testers, the 612 "sees" a tube as "average-good" if that tube has sufficient cathode emission to cause the meter pointer to indicate at about three quarters of full scale. So, our final calibration procedure consists of adjusting R1 to give a meter reading of about three quarters full scale with an average emission tube plugged into the 612. I used an average emission 6L6 to calibrate my 612, as I was taught to do it that way, but I don't know of any particular reason why you should not use another tube type.

One way to obtain the required tube would be to contact your Favorite tube seller and ask him to remove three new (not used) tubes from stock and sell you the one that falls midway between the other two in amount of emission. It may be necessary to test more than three in order to weed out any that read especially high or low. With your 612 set up to test your chosen calibration tube, run through the usual test procedure and when you get to the emission portion of the test, adjust R1 to give the desired three quarters of full scale reading.

Congratulations! You now own a calibrated tube tester!

Malcolm Leonard

Addenda:

I recently obtained the schematic for the precision model 10-12 tube tester and appears that the calibration procedure given here may work for the 10-12 also in spite of it's being a more complex tube tester. This may hold true for other precision models as well.

If you encounter a problem with the meter needle on your 612 refusing to move all the way to the three quarter scale position the 5Y3 may have inadequate emission or the meter movement may have lost part of its magnetic strength, or may be jammed with dirt or tiny metal particles.