THE PAT-4 BASS CONTROL

The tone controls in the PAT-4 are interesting in the Dynaco way. That is, they've made a little bit of stuff do a lot. The usual tone control solution would be the Baxandall tone controls. However, the Baxandall topology has two characteristics that might not be desirable[1]:

1. The input impedance changes as a function of bass and treble settings. Because of that, they should be preceded by a buffer, or realized with high impedances. However, if you use high impedances, the result is a bit noisy.
2. The Baxandall tone controls invert phase. I'm not sure that was a consideration for Dynaco in the 1960's, but purists on absolute phase should realize that so they might compensate appropriately.

By contrast, the Dynaco tone controls have largely constant and high input impedance, and do not invert the signal. That means that in typical Dynaco fashion, they've made less stuff do more. There is one penalty for that bit of optimization. It requires the use of completely non-standard tapers on the bass control potentiometer. A few days of searching has shown that replacement pots with that taper are no longer available. When you add the additional constraint of dual concentric shafts, the pot becomes even scarcer.

Bass Pot Electrical Measurements

I removed a bass control from a PAT-4 and measured the behavior of the resistance between its terminals. The pots have about 245 degrees of rotation. Fully counter clock wise is 0% rotation. Fully clockwise is 245 degrees, equal to 100% rotation. The maximum resistance (of the sample I measured) between the center terminal and either end was about 35 kOhms. This represents 100% resistance on the graph in Figure 2.

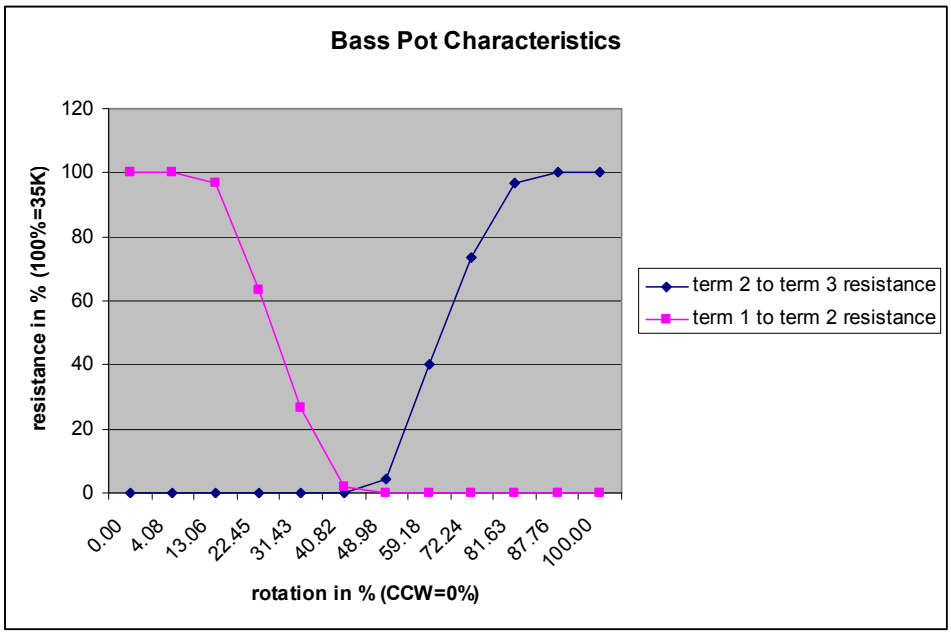


Figure 1 – Bass Control Potentiometer Characteristics

[1] A nice thing about the Baxandall topology is that it uses easy to find linear taper pots.

I verified this behavior by running a simulation with various positions of the bass pot. The simulation results supported the measurements.

Bass Pot Physical Measurements

Figure 2 – Physical dimensions of the PAT-4 bass control

Inner shaft length (silver colored shaft above brass colored outer shaft) – 0.25”
Outer shaft length (brass colored shaft above mounting threads – 3/16”
Mounting threads length – 0.25”
Overall length from body mounting flange to inner shaft end.- 0.75”

Centering the Bass Control

Understanding what we now do about the behavior of the bass control, it’s fairly easy to center the control, that is, to find the position where the bass response is flat. Measure the resistance from the center terminal to each end for various positions of the pot. There should be a range of positions near the center where both the terminal 1-2 and terminal 2-3 resistances will be low, a few Ohms or less.

Once you have found the center of that range for both sections of the bass control, loosen the setscrews on the knobs, and orient them at 12 O’clock (e.g. dead center). Tighten the set screws. The bass control is now set for flat frequency response.

What if my control doesn't measure like yours did?

If the maximum resistance is off by 10 or 20%, that's not a cause for alarm. If it's off by more than that when measured in circuit, particularly if it's on the low side, you may have a leaky capacitor (I'd suspect C16-C21). Still, you might just have to wait a bit more for the caps to charge to make an accurate in-circuit measurement.

To be sure about the measurement, you could remove two of the wires from the pot and repeat the measurements. If the result is still funny, you may have a problem.

Repairing the Most Common Problem with the Bass Control

The most common problem is a dirty control. You can repair this by spraying some contact/control cleaner and lubricant (I used some from Radio Shack) into the control. Spray each section of the control, followed by vigorous rotation of the control.

Warning: Make sure the power is off, and the PAT-4 is unplugged before you open it or service it. Further, allow some time for the power supply capacitors to discharge before working on the unit.

Figure 3 shows an extreme close-up of the bass control. The red tube is the extension tube on from the contact cleaner can. It is positioned to deliver contact cleaner to the insides of the control.

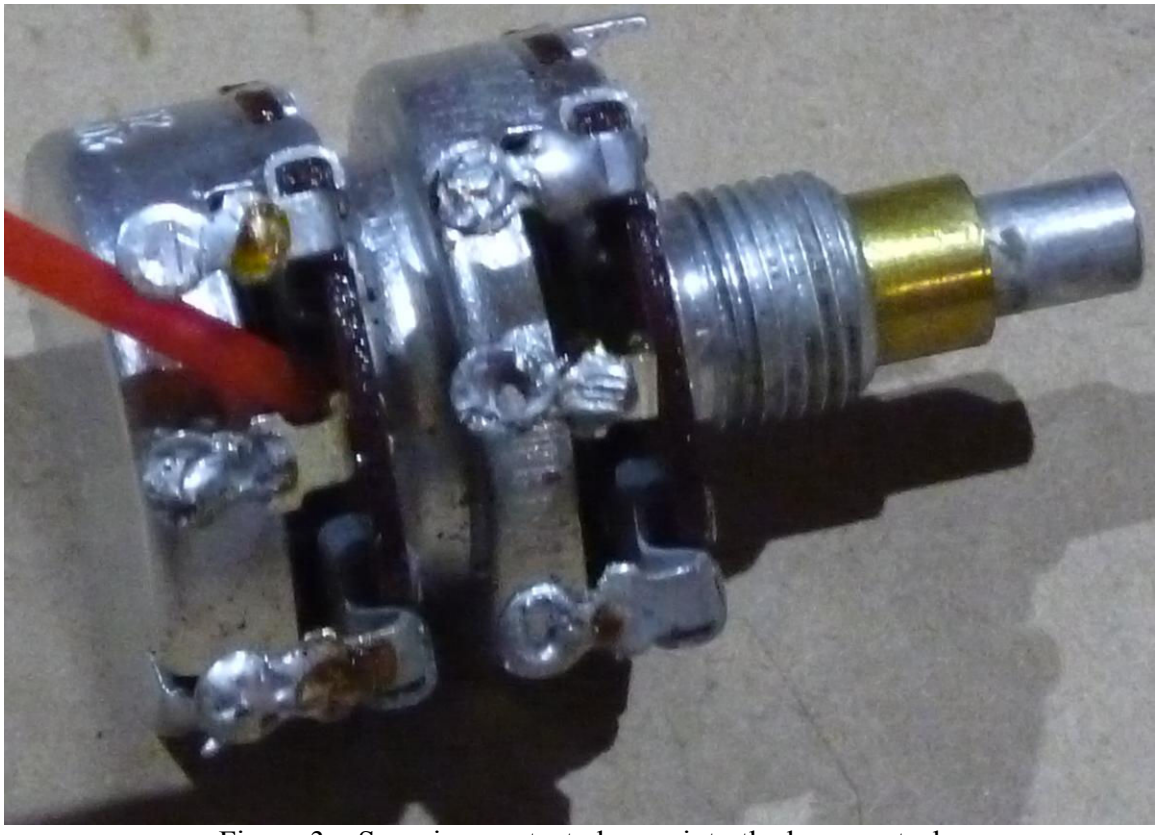
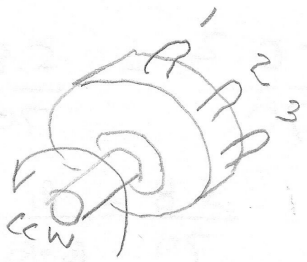


Figure 3 – Spraying contact cleaner into the bass control

APPENDIX – MEASUREMENT DATA

degrees rotation	resistance, term 1 to 2	resistance, term 2 to 3	rotation %	resistance term 1 to 2 as a %	resistance term 2 to 3 as a %
0	34740	1	0	100	0.002878526
10	34740	1	4.081633	100	0.002878526
32	33680	1	13.06122	96.94876223	0.002878526
55	22000	1.6	22.44898	63.32757628	0.004605642
77	9300	1.6	31.42857	26.77029361	0.004605642
100	727	1.6	40.81633	2.092688543	0.004605642
120	1.9	1579	48.97959	0.0054692	4.545192861
145	1.2	14000	59.18367	0.003454231	40.29936672
177	1.1	25620	72.2449	0.003166379	73.74784111
200	0.5	33700	81.63265	0.001439263	97.00633276
215	0.5	34740	87.7551	0.001439263	100
245	0.3	34740	100	0.000863558	100

Dynaco bass pot



		TERM 1-2	2-3	TERM 1-3
0 CCW	POS 1	34.74k		34.74k
10	2	34.74k		34.74k
32	3	33.68k		33.82k
55	4	22.00k	<1.6Ω	23.02k
77	5	9.30k		9.22k
100	6	0.727k	1.6Ω	760Ω
120	7	1.9Ω	1.579k	1.573k
145	8	1.2Ω	14.00k	13.20k
177	9	1.1Ω	25.62k	23.7k
200	10	0.5Ω	33.7k	34.07k
215	11	0.5	34.74k	34.74k
225 CW	12	0.3	34.74k	34.74k

Note: the control is a two-section control. The sketch shows only one of the sections.