Experiments with the Bottlehead Seduction tube phono preamp as a custom tube tape head preamp

last updated 6/20/08

"After nearly a two-month wait my Bottlehead Seduction tape amp finally arrived yesterday.

I'm using this with my Otari MX-5050 BIII via the direct head out RCA's I had added on. So the Otari is essentially now a transport and all of it's internal electronics are bypassed with the Seduction doing all the work.

Last night and today I've been comparing (in real-time with levels matched via remote) the differences between the internal electronics in the solid state Otari MX-5050 BIII and the external electronics of the tube Bottlehead Seduction.

After picking my jaw up off the floor at the staggering differences between the 2, I was able to summarize the differences in my mind. The Seduction is so much more relaxed, smoother, warmer, and has a much deeper soundstage. The Seduction also has MUCH better and deeper bass then the Otari. Such a fuller sound down low. The extreme top end (15-20kHz) is slightly rolled off compared to the Otari. In my system, this was a good thing and added to the richer presentation. I played with both the NAB and IEC switches on the Bottlehead as well. The IEC curve added a little sparkle on top that was missing from the NAB curve---this is no surprise and what it should do with a modern formulated tape.

*By **comparison**, the Otari electronics sound bright, brittle, thin, mechanical, forward, pinched, etched and sterile. It also has about 25% "less bass" then the Bottlehead, which was perhaps the largest difference between the 2. This is not to say the Otari sounds bad on its own, far from it: It was COMPARED to the Bottlehead I made those observations.*

Wow, and all this time I thought my Otari sounded really good on its own. I still feel it does, but the Bottlehead Seduction takes it to an all-new plateau. And it's not even burned in yet.....

I guess it is really not too much of a surprise that the Bottlehead sounds better then the solid state MOSFET amp inside the Otari, but what did surprise me was by HOW MUCH. I was expecting a subtle difference/improvement and instead I have an entirely different sounding machine now---for the better.

I recommend to anyone serious (I think you have to be serious and somewhat nuts if you go down this path!) about the best possible sound from your Otari or any other deck for that matter to check out the Bottlehead Seduction tape amp!

Now, if I could just get my Tape Project tapes soon I'll be all set!!!!!!"

Regards,
Joel

Yes, we can now build one for you. Contact us for pricing and availability.

Or you can buy a Seduction kit and modify it yourself.

Here's how:

by Doc B.

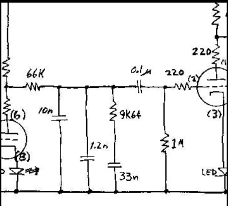
please note that this is discussion of a DIY project based on one of our kits, but that we do not sell a Seduction kit with the components specific to this application. The addition of a few dollars worth of trim pots to the stock kit and the use of an alignment tape are two additional elements which the DIYer must bring to the project for completion.

Oh, and since you're into tape, be sure to check out The Tape Project

I recently constructed a custom tube tape head preamplifier for a relatively rare Ampex 934 open reel tape transport that has no record or reproduce electronics and only a playback head. The head is a two channel quarter track head on a shifting mount that allows play of both half track and quarter track two channel tapes at 7.5 ips and 3.75 ips. The head is a high impedance model. The tape head preamp was constructed from a Bottlehead Seduction phono preamplifier kit, with minor modifications to the circuit to convert the stock passive RIAA equalization network to a passive NAB 1/4" 7.5/15ips equalization network.

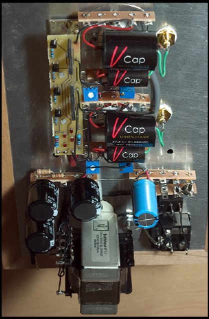
My showing this setup at RMAF has generated a surprising amount of interest from owners of various open reel transports who wish to modify them to use a similar tube tape head preamp. A basic explanation of the process is in order here, to help folks determine of such a project is within their skill set.

The Seduction phono preamp kit is a two stage preamplifier using the 6DJ8 family of tubes. Between the two stages there is a passive RIAA LP equalization network composed of a series resistor **R1** of 66Kohms, shunt capacitance **C2** a composite of a .01uF (10nF) and a .0012uF (1.2nF) capacitor in parallel, and a series-shunt network composed of **R2** and **C1**, 9.64Kohms and .033uF (33nF) respectively.



These components determine the time constants and hence corner frequencies of the RIAA curve in the low end, the midrange and the treble. Luckily for us the NAB tape equalization curves are similar and actually somewhat simpler to implement. I browsed the web for some insights, and found a nice website about the design of a tube preamp for a Tandberg tape transport by Mikkel Corydon Simonsens. This circuit employs passive NAB equalization along with some special tweaks specifically for the head in the Tandberg deck. A little study of this design made it evident that the Seduction EQ circuit could be modded to a similar configuration.

The process is fairly simple. **R1** is replaced with a 100K trim pot. **C2** is eliminated. **C1** remains the same at .033uF and **R2** is replaced by a 2K trimpot. The 47K input grid resistor attached to the input RCA jack (not shown above) is replaced with a 250K ohm trimpot. Below you can see the R1 (right) and R2 (left) trimpots along with a snug installation the very nice sounding V-Caps. The trimpots for the input grids are mounted under the C4S PC board. The extra observant will note that the stock 2N2907 transistors on the C4S board have been replaced with MPS4250 low noise resistors.



Some modeling yielded starting figures of 91K for R1 and 1.5K for R2. The RCA input trimpot was set to 100K. But this is only a starting point. The easiest way to accurately adjust this network is to use alignment tapes such as those provided by Magnetic Reference Lab. Once the alignment track of the tape has been used to properly adjust the head alignment for minimal phase differential one can proceed to trim the pots in the NAB EQ network for flattest response. In general R1 will determine the amount of relative bass boost and will also be useful in compensating for head bumps caused by fringing effects. It was found that R1 was about right at 75Kohms in the case of the Ampex 934. R2 will more or less determine the knee frequency and to some extent the slope of the high frequency end of the response. For the Ampex the optimum value was about 1.5K ohms. This was measured primarily with the test tones at 10kHz and below, as the Ampex head exhibited a rolloff above 12kHz that is typical of tape heads from that era. The final adjustment, of the input load resistor, will also affect high frequency response. It's value will be determined largely by the impedance of the playback head. The high impedance head of the Ampex 934 seemed to work best with a 250K load. Low impedance heads may want to see a lower impedance load. It is noted that one well known commercial tube tape head preamp offers an input load adjustment range of 4Kohms to 250K ohms. This may be indicative of the range of values one might find necessary with different heads. One may even find it necessary to employ an impedance matching transformer between the tape head and the preamp input in the case of very low impedance heads. This would be similar to implementing a step-up transformer between a low output moving coil phono cartridge and the stock Seduction in it's stock phono preamp guise.

Ampex 934,Seduction tape head preamp and a matching custom Bottlehead S.E.X. amp as a headphone monitor.

So that's how it's done. The rest of the Seduction circuitry stays stock. My prototype used Mullard gold pin 6922s out of convenience, and the excellent Teflon and tinfoil V-Caps for interstage and output coupling, out of the generosity of Chris VenHaus. If you want to try this out for yourself, what we can offer to you is the stock Seduction kit and the above information as a starting point. You will need to find out whether the heads in your transport are high or low impedance types, and you will need to figure out how to get the signal directly from the tape head to the input of the Seduction. Low capacitance cabling, most probably coax, in as short a length as possible will be critical to maintain high frequency response with high impedance heads. I used some Belden shielded coax of 17pF/ft. capacitance, in .5M lengths. Once again I will emphasize that the adjustment process by use of an alignment tape as outlined above is a necessary final step in the successful implementation of this circuit in any transport.

Thanks to Dave Dintenfass of Full Track Productions for his assistance in the alignment phase of this project. Thanks also to Paul Stubblebine for the fabulous master tapes we used to demonstrate the finished project. And thanks as always to Paul Joppa for such a versatile design.

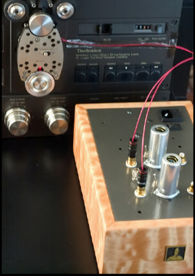
Doc B.

10/01/05 Project #2

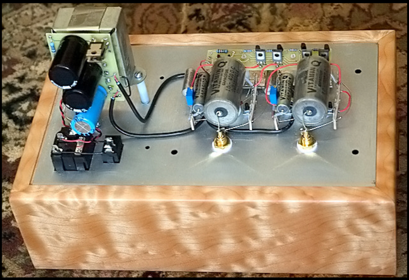
A tube tape head preamp for the Technics RS1500

"Folks, I've heard some mighty fine stereo systems over the years...But fed by the (Tape Project/Bottlehead) Technics tape deck and those Japanese oddball electronics from BA Labo, the Magico Model 6s reached a level of realism from full orchestra to solo voice that I've simply never heard matched."

- Jonathan Valin, Best of Show CES 2007,The Absolute Sound, April/May 2007



This project is a further evolution of the Seduction based tape head preamp. The same basic adjustable circuit was constructed, but this time the EQ was made switchable between the standard 7.5ips/15ips NAB EQ and Nagramaster 15ips EQ. You can see in the photo above that two small toggle switches have been added near the tubes on the Seduction to allow for switching the HF turnover time constant from NAB 7.5/15 50uS to Nagramaster 12.5 uS. You can also see here that a feed from the RS1500 headstack was kludged in from the front to avoid routing the coax past a couple of moving belts inside the transport. The wires leading from the 2-track/4-track playback head selector switch to the multi-pin plug that attaches the headstack to the chassis wiring harness were detached, and the fine coax wires were soldered to the selector switch contacts in their place.



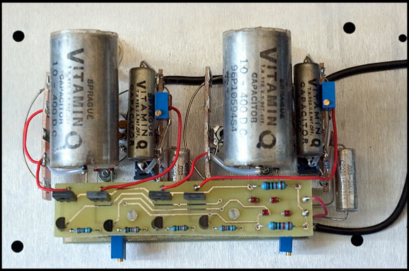
Here's the underside. Owners of Seduction phono stages will immediately notice the prototype PC board mounted power supply. This component is under evaluation for use in future products. The switch bodies are under the smaller Vitamin Q capacitors. The switch allows for a 50uS setting similar to the original tape head preamp, using a 1.5Kohm resistor for R2. When the switch is thrown to the 12.5uS Nagramaster setting a 500 ohm resistor is switched in parallel with the 1.5K ohm resistor to yield a value of 375 ohms for R2. Trimmers are again employed for R1 and the input grid resistor. As a starting point R1 was set to 75K ohms and the input grid resistor was set to 47K ohms. 47K was chosen because we have been informed that the inductance of the RS1500 playback heads is very similar to that of a Shure V15 phono cartridge at around 200uH. We have not had the chance to tweak the values with an alignment tape yet, but we'll report our results when we get the chance. *Update 10-9-05: a recent alignment indicates that 100K seems to be a more appropriate value for the input grid resistor.*

Update 2-7-06

I recently took some time to fine tune the RS1500 repro amp and here's my conclusions:

I actually tweaked each channel a few percent while using a calibration tape and a dual trace scope, so my values are just slightly different for each channel. But the starting value for R1 does work out to 75K ohms just like the calcs indicated, and 100K seems to be a good value for the input load trimmer. I'm now fairly confident that a person could use fixed resistor values of 75K for R1 and 1.5K for R2 for NAB EQ and get very good results. It might be worthwhile to keep a trimpot on the input if you plan to use the preamp with a variety of transports. I found a 100K input load to work well with the RS1500 heads and 250K to work better with the older Ampex heads. If you want to use a fixed value on the input, try starting with 250K ohms.

The last set of values I plan to cook up will be for the low impedance repro head on an Ampex ATR. I have yet to get the repro head, so it will be a while before I have any data. Meantime the above values should work for most prosumer type transports like Technics RS1500, Otari MX-5050, Revox A77/B77,G36, as well as older pro stuff like Ampex 351, etc., etc.



Here's a closeup view of the preamp circuit. Oil caps were used just for the fun of it. You can see the EQ switch just below the smaller Vitamin Q cap in each channel. MPS 4250s were used in place of 2N2907s for low noise.

The RS1500 is a very smooth sounding transport and seems to be quite a good match for the capabilities of the tape head preamp. The same circuit should be useable in an Otari MX-5050 as well as other prosumer grade transports.

added 7/5/06

Notes on rewiring the heads on an RS1500

by Stellavox, a.k.a. Charles King

There has been mention made of how to wire directly to the heads of these nice machines - but no accompanying words. I've just been in a 1520 twice and would like to offer the following guidance.

First - the easiest way to directly wire from the headblock would be "from the front" as it is a BEAR to wire out the back of the machine - more on this later. You remove the headblock by taking out three allen-head mounting bolts on the front. NOTE that there are 5 allen-head bolts on the top plate; the lowest two fasten the tape guides and should be LEFT ALONE. After loosening the correct 3 bolts, carefully pull the headblock foreward and remove it. Note that it plugs into two connectors on the back and when replacing it make sure that it correctly plugs into these connectors. Next, remove (And discard) the plastic back cover. You now have access to the back of the heads and can attach good quality shielded cable as necessary. Regarding the switch which selects the half-track or quarter-track playback heads - I disassembled it and found it to be of VERY high quality - silver plated with a positive "wipe". The silver contacts were tarnished which cleaned right up with Cramolin. If you do or want to listen to quarter-track as well as two-track stereo tapes I suggest that you retain the switch. You could now "somehow" bring the shielded cables out the side of the headblock but I couldn't see how to do it without getting in the way of the tape/tape path and elected to bring the cables out the back.

To do this, you have to lay the deck down on it's face. BEFORE DOING THIS make sure that you support the weight with some kind of spacers so that it is NOT resting directly on it's face. This is to keep the weight of the deck from possibly bending the reel spindles AND OFF of the 2 track/4 track switch lever which sticks out of the top of the headblock. I used scrap, short pieces of 2X4's. Take off the back cover and locate the capstan motor which you can't miss because it takes up the whole center part of the inside. It has to come out.

If you look around the "barrel" or circumference of the motor, you'll see 4 allen-head bolts which attach it to the frame. You'll also see a bunch of wires coming out the top of the motor. These wires go to a connector on the large PC board directly below the motor. Unfortunately on the unit I worked on, these wires were all bundled together and tie-wrapped with other wires. CAREFULLY cut the tie wraps and separate out the motor wires down to the connector and unplug it. I subsequently tie-wrapped the motor wires separately from the other wires. There was also a little PC board mounted right below the motor and in the way of its removal. Fortunately it was only held by a single screw which could be easily removed and the board pushed out of the way temporarily.

Now you can remove the motor by removing the four bolts and pulling the motor assembly CAREFULLY straight up - remember that the capstan shaft is on the other end and can be scratched.

Once the motor is removed you can almost see into where the bottom of the headblock attaches except that there is a thin shiny metal plate covering it held on by two screws. Make sure that you are not careful and drop one of the screws down into the rest of the mechanism so you can spend a back-wrenching, 15 minutes trying to shake it out.

With this access plate removed, you can now snake the new cables you've attached to the heads down into the back of the deck. It is not easy; I found that there was space at the top of the headblock/connector assembly. Is I wanted to run the new cables directly to the Seduction (not through a set of intervening jacks/plugs) I cut them to a length of 3 feet or so, snaked them through the front of the deck and was able to pull them from the back while pushing from the front. The last few inches were the toughest as you have to get the headblock into its correct orientation and the male connector pins correctly seated in the female sockets. If you don't you won't be able to record -(probably not a problem if this is to be a playback deck only) but you could lose the connection to the LED which illuminates the speed stobe.

Once the headblock is back on you can replace the little plate over the rear headblock connector (I was able to snake the new cables down and inside this) put the motor back in and insert it's connector. Don't forget to replace the other little PC board removed above. I was able to snake the cables out the existing ventilation holes on the back cover before re-attaching it. Then you put the RCA's on the other end of the cables and YOU'RE DONE. Time for that well-deserved cocktail.

Simple 3 hour job (if you're lucky)

Stellavox

Update 12-29-06

Tapping the headstack - An easier way

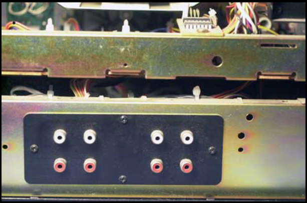
If you trace the black and gray cables that come off the half track/quarter track selector switch connections at the headblock socket, you will find that they end at a little plastic plug that connects to a PC board a ways to the right but not too far away from the RCA jacks on the back of the RS1500. On my latest RS1500 I just snipped those cables from the connector and reattached them to new RCA jacks that I installed in place of one pair of the original output jacks (after drilling out the PC board that the original jacks were mounted to). This should take about 2 hours off the procedure described above, although you are stuck using the stock cable rather than the latest hotrod audio cable to make the upgrade...

Doc B.

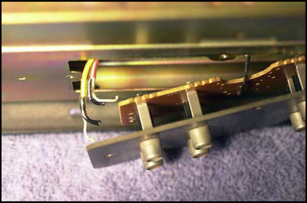
1-21-07

Photos of the easiest way

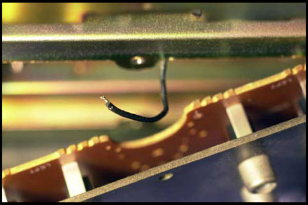
This sequence of photos shows basically the same procedure as I describe directly above, but simplified even more by the fact that I did not install upgraded RCA jacks, but rather used the existing jacks:



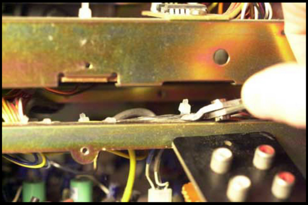
remove the back panel, then remove the four screws that hold the jack panel to the chassis.



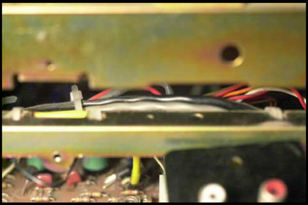
Snip the yellow and red cables free from the output rca jack end of the PC board attached to the back of the jack panel.



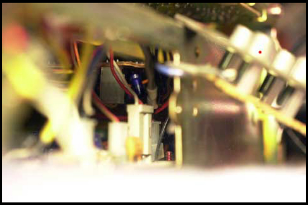
Desolder the black wire that is connected to the middle of the PC board. This will be reconnected later, but disconnecting it will allow access to the head cabling inside.



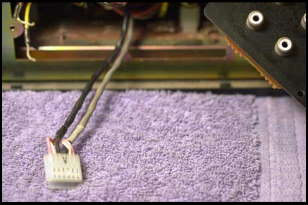
Cut the nylon cable tie that wraps around a gray and black cable as well as some other wires.



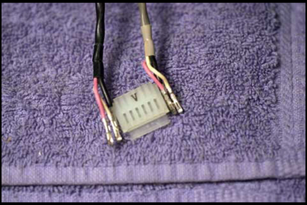
You should now be able to pull up and see the gray and black cables



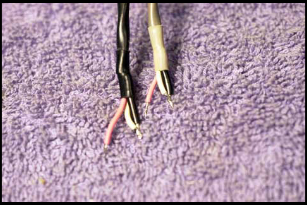
Looking in through the jack panel mounting hole in the chassis to the right you will see three nylon connectors. The farthest one (farthest to the right in this photo and a little shorter than the middle one) is the end of the gray and black cables. Use a long screwdriver to pry the connector, labeled V, off the PC board. Carefully route the gray and black cables out through the jack panel hole.



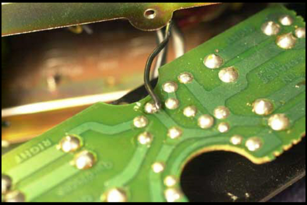
Here you can see the cables and the end connector, pulled out through the jack panel hole



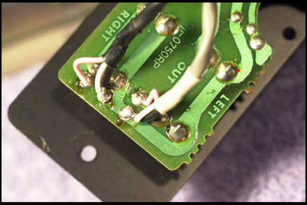
I use a tiny screwdriver to push the contacts out of the plug.



Clip off the connector pins. Strip the ends of the wires about 1/8" and twist the shield and the white wire together on each cable. Solder them.



Reattach the black wire to the center of the PC board. Note that I have soldered it to the pad on the exposed side rather than the same pad on the inside of the board - much easier.



Solder each pink wire to a center pin trace and the white/shield combination to the ground trace of each channel. Which is right and which is left? Damned if I can tell from the service manual. What I have done here, black cable to right, gray cable to left, is my SWAG and has a 50% chance of being correct. If anyone gets a definitive answer as to which is which before I do, please let me know and I will add the info here.

2-27-07

So I got my repro amp back from the studio yesterday and tried it with the machine shown above in the photos. Of course I got it backwards - it appears that the gray cable is right and the black cable is left - unless I did something else stupid...

10-23-06

IEC eq

One can set the Seduction up for a very usable approximation of the theoretical IEC eq curve. The theoretical curve for IEC tape eq is actually unattainable at the bottom end, as it calls for infinite gain at 0hz. So one must work out where the necessary bass rolloff will occur. We chose the same rolloff point as NAB for these Seds - 50Hz - to keep the gain of the preamp similar between the NAB and IEC settings. There's darn little info below 50Hz on anything but organ recordings anyway, and a lot are rolled off at more like 70Hz. On top of that there is a head bump at about 35Hz on RS1500s, MX-5050s and probably a lot of other decks with similar size heads. So the addition of that bump below the 50Hz corner frequency is likely to create a little lower rolloff point anyway. The difference on the top end EQ between NAB and IEC is a 3150 Hz corner frequency for NAB eq and a 4500Hz corner frequency for IEC eq. This shift in upper corner frequency difference between NAB and IEC eq is what the switch by each tube will effect.

For those who have built their own Sed tape head preamps and who will want to play our Tape Project 15 ips half track tapes done with IEC eq, you can make a switchable NAB/IEC eq similar to what I describe above for NAB and Nagramaster eqs. This is done by switching a 4.42K ohm resistor in parallel with the 1500 ohm resistor used in the NAB version, rather than the 500 ohm that was switched in for Nagramaster (see above). This parallel 4.42K/1.5K combo gets very close to the theoretical 1070 ohms needed for the 4500Hz corner frequency of the IEC curve. Oh, and bass sounds plentiful on the IEC setting, even with a 50Hz corner. If one can live with 6dB less output for the IEC eq setting one could change the value of C1 from .033 uF to .066uF and adjust R2 from 1070 ohms to a value of about 532 ohms. This will move the bass rolloff corner down to 25Hz, but it may make the playback output too low for some systems. Note that you will have to switch in both a parallel capacitor and a parallel resistor to do this and still retain the NAB eq setting, requiring a little more complex switching arrangement.

Doc B.

Tape Seduction: Finally

Posted by **xcortes** on January 28, 2008 at 07:57:48

I took me about 8 months since Eileen shipped me my Seduction but this weekend I finally put it together. Leaving aside a screw up when modifying the equalization curve that made me drill two more holes than needed to place the NAB/IEC switches and some desoldering and soldering back of two pair of resistors it all went smoothly. I used Auricaps for the coupling positions and C4S right from the start.

Yesterday I hooked the Seduction up to the heads of my Technics RS-1500 and played a tape of Pink Floyd DSOTM that I recorded on this deck from the lp. I don't recall the lp sounding this good! Actually I don't recall my system ever sounding so good.

I will let it break down a few hours but I'm ready to start playing my Tape Project tapes soon!