

# ANALOGUE ASSOCIATES, LLC

Acoustat X Servo Amp Specialists

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Analogue Associates is a group of individuals dedicated to the maintenance and upgrading of the Acoustat Direct Drive Servoamplifiers, the most inspired design for driving electrostatic speakers--and who cares about the rest--ever conceived. Our greatest respect goes to James Strickland, the original designer of these amplifiers. The farther along we get in these amps the longer this upgrade letter gets, so it may try your patience, but hopefully you will be able to slug your way through it. Hopefully you will find it to be worth the time. If nothing else it will serve as good sedative if you are having trouble sleeping.

We have been involved with Acoustat Servoamplifiers since 1977. All part changes have taken into consideration the function and operating conditions of each part in the circuit design. Everything discussed here has been done because we personally want the best sounding amplifiers and speakers in the world. We hope you share that desire.

These amps make Acoustat electrostatic speakers sound much better than any combination of conventional amplifier(s) with interfaces, no comparison. A frequent problem with these speakers is that often people don't like what they hear because Acoustat ESL's are extremely revealing. They tend to blame the speaker. The problems generally heard are with the front end. It sounds self-serving but experience has shown this to be true 90+% of the time. That is not to say the amplifiers don't have their sonic problems, but that is what we are addressing here.

You or a technician can do some of these modifications locally. We suggest that the more elaborate ones be done by us. This is primarily because our experience with the amplifiers has taught us quite a bit about how to deal with the high voltages involved. Furthermore that experience along with having the proper equipment required, makes maximizing performance and troubleshooting problems easier. The design of these amplifiers is unique enough that this experience is quite beneficial. Finally the traces on these amplifiers are very delicate and tend to break and pull off the board. This amplifier is not a common garden-variety device.

Sounds Like New, owned by Roy Esposito, will repair the Servos. He worked for Acoustat and is intimately familiar with these amps. If you are just interested in repair service on your Servoamplifiers, this is to whom we highly recommend you send your amps, Roy does professional work.

**NOTE** Recent experience has taught us a lesson. Because these amplifiers are mono and are EXTREMELY sensitive to a/c mains cables ALWAYS be sure that you use the exact same type a/c cord on both amps. If you are using the original cable captured in chassis cover this is not big issue We inadvertently used two different, but very close in appearance, garden variety cables and spent many frustrating hours tracking down a very significant difference between the sound of the two channels as heard through the speakers. It was the a/c cables. Sometimes even we make stupid mistakes with these amplifiers.

We suggest that you take steps to reject or bleed RF from the audio connections to these amplifiers. For audio purposes this requires that the cables from the preamplifier be shielded. Our experience also has led us to recommend you experiment with “audiophile” a/c mains cables where possible with these amplifiers. Most of these go to great lengths to shield the mains cables from rf. We have had good results with the Audience PowerCords. The Audience PowerCords do not seem to emphasize any particular area, but do reduce grunge and lower the noise floor when used with the Servoamplifiers. In order to use them you will have to drill out the rivets that hold the factory cable cover in place and replace the factory cable with your own **DO NOT OPERATE THESE AMPLIFIERS WITH THE CHASSIS CAGE OFF!** There are voltages in there that can bring a swift end to your listening career. Mr. Strickland’s safety cage works beautifully--don’t try to defeat it.

### **THE BASIC UPGRADES**

We have sourced a new quad IC for these amps, which has proven to be the best sounding one yet. This is obviously something you can install yourself. They run \$20.00 per matched pair. You will need to allow them to break in for about 3 weeks and after that you should reset the clipping symmetry. We would also suggest replacing the IC socket at the same time. We have found that replacing the IC socket often resolves a myriad of mysterious problems. Cleaning the old one is just not enough. We can supply one with solid milled and gold plated pin sockets, which effectively eliminates the need to ever replace them again. The parts are \$30, IC’s and sockets, and \$60 for installation for the pair. Included in this and all of the upgrades listed is adjusting the clipping symmetry of each amplifier.

Do your Servoamplifiers have tube standoffs? These are essential for circuit board life. At this time the most expensive repair is for severely burned circuit boards due to lack of tube standoffs. The early X’s did not have them, but many owners had them retrofitted. They run \$4 each, plus labor of \$90 to install all 8. With tube standoffs in place, the other components in close vicinity of the tubes survive much better. This also reduces arcing both on top of and underneath the circuit board due to carbonizing of the epoxy from overheating. The circuit board should always be examined for carbonizing and scrapped clean as necessary.

**REVISED** The next step to take is to improve the power supplies for the 150vt and 17vt sections. We replace the 4-22mf capacitors with matched higher voltage parts and replace all 12 of the zener diodes with higher rated parts. This results a more stable power supply and has some sonic benefits as well. Additionally we replace the 3-10mf capacitors with higher rated parts as well. Finally we replace all of the capacitors in the 17vt power supply with newer, better sounding parts. This improves the reliability of the Servo’s under stress and improves the overall sonics. The capacitors and diodes run about \$74.00, and the labor to install all of them is \$90 per pair of amplifiers.

It has been our experience that after the above modifications are made that these amplifiers become quieter and rock solid. To date we have not had a single failure of a modified amplifier that was not related to tube failure. The most critical aspect of the performance and reliability of the amplifier at that point becomes the tubes themselves. While we have had a tubes go for over three years in a pair of amplifiers that was used hard and still test well and sound good, it is critical that the tubes be tested periodically because tube failure becomes the single aspect the modifications cannot protect the amplifiers from. If you do not have access to a tube tester that can provide an emissions life test, we can check them for you at \$1 each plus shipping and return them to you.

This can extend the useful life of the tube without sacrificing reliability or sonics. Depending upon availability we sell NOS 6HB5's at \$22.50 each, tested, matched in quad sets as to tube style.

### **THE MAJOR UPGRADES**

WAKE UP!!! Now that I have your attention, two other modifications are bypassing the gain and hf balance pots. The gain bypass is fairly simple and results in quite a change in the sound of the amp. We bypass the rotary gain control with a high quality fixed resistor for each amp. This matches the gain between the amps. We have found that over time that using a single value produces the best results and we provide a Vishay for that purpose. The resistor runs about \$16 each. The installation labor is \$30 for the pair. The sound is quieter, yes truly quieter, and there is an obvious reduction in distortion.

We can also replace the high frequency carbon pots with a 12 position fixed resistor switch. It is nearly impossible to match each channel with the original carbon pots. This modification will allow you to change the hf balance readily and in predictable steps. This also results in a marked decrease in noise (distortion), increased high frequency purity and better image stability. We fabricate a stepped resistor switch with 12 values to allow steps of .2db at 10khz with a maximum variance of ~2.5db. The values we chose fall into the range of ~9 o'clock to 11 o'clock on the stock rheostats, the most commonly used positions. We have found that with discrete resistors lower values are typically desired due to the improvement in the high frequency signal. If you require a higher value we can provide a resistor that will allow you to do that without sacrificing the tight adjustment allowed by .2db steps. The cost to replace with a fixed resistor switch is \$90 for a pair of custom 12-position switches, including the price of the resistors. The labor to install them is \$20 per pair.

More complex but sonically very important is bypassing the automatic turn-on circuit. We put a manual turn-on switch in place of the auto-on circuit and remove the unnecessary components. This reduces the noise level and improves the sound of the amplifier throughout its frequency range. The cost of this change is \$150 per pair of amplifiers. The effect of this change cannot be overstated. It is one of the single most impressive sonic changes that we make to these amps. This is due to the fact that in the original design the turn-on circuit drives one quadrant of the IC into saturation the entire time the amplifier is playing music at a moderate level. This quadrant is not used for audio purposes but the sound of the IC is significantly impacted as a result. This does mean that you will have to manually turn the amplifiers on and off with a switch that replaces the gain control knob when the gain control is removed.

We can provide long runs of high voltage wire to allow the placement of the direct drive servoamplifiers closer to the preamplifier than to the speaker itself. The wire runs \$.44 a foot per lead with 3 leads per channel. This translates into a cost of \$1.32 per channel per foot. We use red, white and black. This allows you to use short, high quality interconnect between your preamplifier and the Servoamplifier. The secondary benefit of moving the Servoamps away from the panels, preferably into another room, is that the amps are subject to less microphonic stress and will sound noticeable cleaner and often will play louder. Just tap on the circuit board, while unplugged, if you want to see how much vibration is transmitted to all of the components. We recommend that you use a clear vinyl high voltage shield for each of the six high voltage leads to reduce the likelihood of the wire being punctured by spikes or teeth. It also has a sonic benefit that Acoustat recognized late in their production runs. You must realize that the voltage in the wire is as high as 2.5kv and while generally coming into contact with it is not lethal for adult humans, it will knock you off your feet and stun you. I speak from experience. It can be lethal to small animals. This is not recommended in an environment where the traffic is young children.

We have found a set of replacement transistors for the stock Motorola PNP and NPN transistors supplied by Acoustat. These new transistors are high-speed, high-resolution transistors which improve the sound significantly, especially the bass response, which now has more apparent deep bass, with improved low bass impact and definition. The level of noise and grit is also diminished. We remove the transistor sockets along with the transistors originally used by Acoustat and the new ones are soldered directly to the board. This change also improves the imaging with the traditional laid-back image of these speakers being brought to a point between the listener and the panels without impairing the overall sense of front to back imaging. It is like trading your tickets in row 20 for those in the middle of the row 8. The parts run \$40 and the labor to install them is \$35 per pair (when done with any other upgrade) of amplifiers. One of the most cost effective updates to date.

### **THE ULTIMATE UPGRADES**

We are now building a replacement for the quad IC opamp used in these amplifiers. These consist of two superb single opamps and the related circuitry being mounted onto a 14-pin adapter that allows it to be a direct plug in replacement for the existing quad IC. Note that these can only be used where the turn-on circuit has been modified by us as discussed above since there is no provision for the two remaining quadrants in this circuit and two of the pin positions are used by the new opamp circuitry. The sonic affect of these parts is pervasive in all aspects of the sound of the amps. While hard to describe, it is impossible to overlook. This circuit is a quantum leap in resolution and distortion reduction over the quad IC, even ours. The resulting music from this update defines **Palpable**. It isn't inexpensive at \$250 for a pair of these assemblies, but it is worth it. See further notes on this below.

**NEW** It has been apparent from the beginning that one place to make improvements was in the capacitors used in the low voltage signal path. The stock amplifiers came with a variety of types of capacitors, including the dreaded ceramic types, about the worst sounding capacitor for audio. In conversations with Mike Elliott he had encouraged me to replace all of the input capacitors from the beginning, but we were so involved in the output section we didn't have time. The more we looked at the schematic and examined the parts the more we were convinced that he was right (Duh?). So we asked our cap builders to take on the task to build to replace all of the low voltage capacitors. When the stock capacitors are replaced with these the bass becomes huge, deeeep and thunderous. Voices became clear, no straining to understand lyrics, and liquid. We are offering a complete set of custom capacitors to replace all of the capacitors in the low voltage audio circuit. Not all can be supplied by our dutiful cap builder, but the one that cannot are be is the best we can find for the job. The cost, not too bad, \$240 for the 32 capacitors. The labor is \$112 if we are doing any of the other upgrades at the same time, or \$157 if not, to install them in a pair of amplifiers.

We can replace for the high voltage resistors, the 500meg 4w, 6.8 Meg 5w, 680k 4w, 10K 15w and 10k 5w, using Caddock Ms and Mg series non-inductive resistors. We are now replacing all of the HV resistors in the amplifiers. The total cost for all 22 of the resistors is \$337 with an additional \$90 in labor to replace them. This seems like a lot, but when I replaced the 12 basic high voltage parts (6.8meg 4w, 10K 5w and 10K 15w only) and bought them from Acoustat in 1989, they charged me \$212. The sonic effect of replacing these resistors is impossible to overlook. The transparency of the audio signal is vastly improved, the soundstage is significantly enlarged and the music becomes separated from the panel. It begins to approach live music.

Now available are replacements for critical output coupling capacitors custom made for us by one of the premier audio capacitor manufacturers. These are a major improvement over all of the caps supplied by Acoustat (and there were at least 4 different versions from them before they quit selling them) including the Fdyne polypropylene caps they made available for a short time. These new caps flesh out voices, particularly female voices, take some hardness out of the upper frequencies and result a more “relaxed” and less strained sound. The image is now extended further into the room, moving the listener up from row 8 to row 3. In combination with the high voltage resistor updates, these allow the amplifiers/speakers to play significantly louder before breaking up. We had special leads made up for these that will allow for the bypassing of three additional solder joints and the leads from the pcb to the output socket. These are large (2"x2") and have to be placed in a slightly different location to allow the chassis cage to function as normal. At \$39.50@, for a total of \$158 per pair, we are able to provide these at a price cheaper than Acoustat sold theirs for in 1990. If they are installed along the high voltage resistor upgrade the installation labor is \$35, otherwise the installation labor is \$70.

**NEW** Along with the new output coupling capacitors we can provide the same quality parts to replace the 10uf 450vt caps in the output section of the amplifier. These are of the same as the output coupling capacitors and since two of them are in the signal path, they have a significant impact on the sound of the amps. The first thing noticed is that the sound field is blacker, that is, quieter. Because of the stock location of these capacitors on the board, we build a stand to mount them and move these underneath the board. This takes them away from the heat of the tubes. The capacitors are \$36@, with 6 required per pair of amplifiers. Installation labor is \$75 if done with other modifications, or \$95 if done by themselves.

Over the last few years the audio world has become more and more aware of the value of using good resistors in audio circuits. To that end we install resistors to replace all critical low voltage resistors with Caddock TF020s and MK-132s. We can currently provide these resistors at a very competitive price, approximately \$4 for the TF020'S. The total cost for all 66 of the resistors is \$257. We tried Holco's but they will not stand up to the voltages and do not sound as good. The cost of installation is high as well, but you are talking about taking out and replacing nearly every resistor in the amps. We charge \$110 per amp for the labor, totaling about \$477 for the pair. It is hard to express the difference this change makes but the purity of the signal takes a quantum leap. With the advent of the new Discrete Opamps and transistors this upgrade becomes paramount. The difference in the improvement the TF020s make with the Discrete Opamp and upgraded transistors vs. the stock resistors is astounding. While each of these can be done on their own, it has become apparent that the component changes that represent our “Ultimate Upgrades” are best appreciated when done together.

**NEW** Until recently the high voltage power supply has seemed to be the one area that we could not do much with, but that has now changed. We went back to Audience and asked them to build a part for us that had not been done before, a 1uv 3000vt polypropylene capacitor. The first prototypes took eight weeks to get and were an immediate success. These capacitors impart what I like to refer to as “scare factor”, that is when there is a very dynamic high volume attack required in the music it seems to come out of the black, blindsiding the listener, much like a scary movie. The transient quality of the music, most obvious in the bass but evident throughout the frequency range and is, well, scary. I would never have thought of the transient response of this amplifier and speaker as being slow, but there was obviously room for improvement. Again, blacker background, better articulation, etc, are all evident and it makes sense that this would happen with better capacitors in the area. This also proved to be timely, as we have begun to experience failures in the

stock oil filled capacitors provided with these amplifiers due to age. We have seen two such failures in the last 6 months. When the stock capacitors fail they short out and the amplifier will just blow the 5amp fuse. These new capacitors are very large and best mounted inside the chassis below where the original stock capacitors are located. This allows for the chassis safety cage to remain in place. Additionally because the capacitors have lots of voltage and will be mounted together, we wrap the capacitors with a Teflon tape which has a rated insulation value of 10,000vdc. This protects the capacitors from arcing between each other and the chassis. These capacitors are not cheap at \$45.00@ (well actually they are a fantastic value) and you will need to replace all four in a pair of amps. As a last stand effort (well there really is more to come) to extract the maximum out of the high voltage power supply we also are installing a .01uf 3kv bypass capacitor for each of the 1uf capacitor. The impact of this bypass capacitor is to further expand the soundstage and more clearly delineate the acoustic space for each instrument. The bypass capacitors are \$12@ and four are required per pair of amplifiers. This brings the total for the parts to \$228 and the labor for installation is \$90 per pair (when done with any other upgrade, otherwise the labor is \$112) so the total installed cost for these is \$318, a veritable bargain

In summary (yes this will actually come to an end) we are always working on and developing new revisions for these amplifiers, but will not perform any of them for others until they have stood the test of time in our own environment. As you read this it would appear that some of the same improvements are indicated for each modification and that if all were done at the same time it would unbelievably better. That is correct. We have had the benefit of doing each of these one at a time to our own units and being surprised by the outcome of each, particularly when comparing them to a stock pair as a baseline. It is shocking to hear the difference between a fully modified pair and a stock pair. We have always been of the opinion that a stock pair of Servo's driving Monitor 4's will produce a musical image that is still nearly state of the art, so we feel that a fully modified pair is, well...and we can produce the glowing reviews by customers to prove it.

### **THE CAVEATS**

All of the above parts and labor prices are subject to change without notice. The cost of the updates along with return shipping must be paid in advance of the work being performed. Please see the Servoamp Upgrade Summary for the most current pricing. We are not doing this to get rich, merely to make it worth the significant amount of time it takes to do these modifications and do them correctly. We are not professional technicians and do not perform the work as a sideline just for profit. We want you to love these amplifiers as much as we do. A lot of time has gone into the development of these modifications and we feel justifiably proud of the results. We typically do only one modification at a time and then listen to the results in a complete system using either Monitor 3's, Monitor 4's, converted Model 66's or a pair of custom Double Monitor 4's. This way if a problem arises it is easier to track down the culprit. If it doesn't sound like it should, it doesn't leave. Therefore this is not done in a hurry. Expect a turnaround of from 1 week for a minor modification and four to six weeks plus for complete overhaul. We will not be rushed. All modifications are done on a 100 % money back guarantee basis with the amplifiers being returned to you in their original status, but you would be responsible for all shipping costs. Since we can't afford to restore the amps back to their original state frequently, these upgrades are done with great care.

We are always interested in the reactions to the changes made, even if they are negative and are open to suggestions for other improvements. Our only goal is to build the best sounding ServoAmplifiers we can for ourselves and any others who share our love affair with these amplifiers. In order to continue to develop these modifications, we need to make sure that they are accepted in the field and address any problems that may arise.

If you should decide in the future that you are interested in selling your speakers, let us know and we will help you find a buyer. We like to keep track of these for our own selfish reasons as we now have about 24 amplifiers under our wing locally as well as many others nationally and internationally.

Happy Listening,  
Michael Savuto,  
Analogue Associates, LLC