Restoration Kit Instruction & Hints

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Introduction

Thank you for your purchase of this Audio Restoration Kit. This kit includes a list of parts organized into individual bags according to the board they are intended for.

A few quick notes about parts amid ongoing supply chain challenges: Sourcing can occasionally be difficult. You may sometimes see parts in the kit that don't exactly match the parts sheet included with the kit. For instance, we might send Bourns 200 ohm trimmers when the service manual calls for 100 ohm versions. Rest assured, we will never send parts

that aren't correct and usable without issue—unless, of course, an error occurs during packaging. If you have any questions or concerns in this regard, please don't hesitate to ask.

FILTER CAPS - All supplied filter caps meet or exceed the rated capacitance and voltage. More filtering is generally beneficial, so if the filter caps in your kit have slightly higher specifications than those they are replacing, consider it an upgrade. Modern caps are often smaller than their older counterparts; our instructions include options and hints on how to install these smaller filter caps.

If not already included, Marblehead Audio stocks off-board filter caps for most units. Feel free to contact us if you'd like to inquire about pricing or place an order.

CAPACITORS: Each capacitor is labeled with two values—a rated voltage (V) and microfarad (µF). The capacitance (µF) of the part needs to match the one it is replacing. Before you begin, please read the following to ensure you will complete the job successfully.

Wima and Kemet Film caps (always an upgrade over electrolytics) are included for values of 1µF and below in most kits. While we offer a less expensive standard kit with high-quality electrolytic caps, we highly recommend choosing the upgraded kit with Wima and Kemet film caps for the best performance. If you ordered the standard kit but would like to upgrade, message us, and we will ship the Film Cap Upgrade for free. Film caps are bipolar and do not have a specific lead orientation. Film caps are more expensive, which was especially true when these units were made. While these units are of very high quality, they were still mass-produced with cost considerations in mind. The inclusion of Wima and Kemet film caps in our upgraded kit will undoubtedly make your unit sound better—better than it did before you restored it and better than it did when it

was new!

As mentioned earlier regarding filter caps, modern caps are usually smaller than those they are replacing.

TRANSISTORS: Not all transistors need to be replaced. This kit includes replacement transistors for those that are known to be problematic. Be sure to install the legs of the new transistors correctly. See the end of this document for more information on transistors.

Tools needed:

● Soldering iron

● Desoldering braid or desoldering tool

● Screwdrivers

● Snips (to remove the excess leads on your new capacitors once they are installed)

● Multimeter (for adjustments on new trimpots)

● Allen wrenches, hemostats, and other small tools will also come in handy.

Note: Keep the work surface and your soldering tip clean; it makes more of a difference than most who are new to soldering can appreciate. We recommend applying a little DeoxIT with an old toothbrush prior to desoldering. For more detailed information about tools and their usage, refer to the "Tools" section later in this document.

AN ABSOLUTE MUST!!! We provide service manuals, parts lists, this document, and sometimes additional related information (such as owner's manuals) for your convenience. To access these resources, please visit our website at marbleheadaudio.com/ebay-sales-links/. You'll find all the

necessary materials to help you with your restoration project.

If you encounter any issues with this kit (missing part, incorrect unit, incorrect values, etc.), please contact us. We double-check kits before shipping, but mistakes can still occur. We will send out the correct parts ASAP.

We strongly recommend working on one board at a time, checking your work—especially verifying that electrolytic caps were installed correctly—and testing the unit for proper operation. Most issues with an install result from incorrectly installed parts or poor solder joints. By testing each board as you progress, you'll make troubleshooting much easier. With careful and patient work, the restoration process should be a satisfying experience.

Remember: DO ONE BOARD AT A TIME!

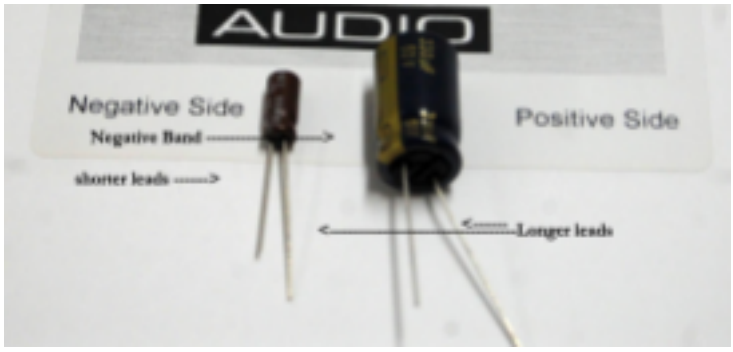
Any included transistors replace those known to be noisy, underpowered, etc. Not all transistors are included, nor should they be, as transistors have a virtually unlimited life when treated kindly. While they aren't overly fragile, avoid overheating them during installation. Ensure the pins are inserted correctly. New transistors often have the same orientation as the old ones, but always check the pinout to be sure.

Trimmers, if included with your kit (the Blue Bourns units), are coded with their resistance values. If you're unsure, just ask or Google the number on the trimmer. You'll need to adjust these with a small screwdriver to the correct settings. Occasionally, a unit may have a different orientation from the originals, but the resistance value is what matters, and a jeweler's screwdriver can adjust even the most awkward placement. The new units

are either single-turn or 25-turn and can be dialed in precisely.

If you lift a tracer during desoldering, you may need to run a thin wire to a connecting connection/component. It happens to the best of us. If you lift more than a couple, your iron or skills might be the issue.

CRITICAL: Most capacitors you will install are polarized electrolytic capacitors. This means they have a specific lead orientation. Please note the old capacitor's installation and ensure you install the new one with the same polarity. They WILL fail (with a boom) if installed backward. The picture below shows TWO ways to determine the polarity on a new capacitor. The gold band on the larger capacitor indicates the negative side—the smaller cap has one too, but it isn't visible from this angle. Film capacitors DO NOT have polarity, so you don't need to worry about lead orientation for them.



While we don't provide instructions on disassembling the unit to access each board, it usually isn't difficult to understand and accomplish. The Service Manual is your friend in this regard. If you still face challenges, a Google search of your unit will likely yield helpful details, including visual guides. Audiokarma forum, advanced AI-based search tools, and other resources such as YouTube can also provide guidance.

Thank you AGAIN for your purchase. If you encounter any issues (occasional packing mistakes can happen), need assistance, or want to purchase kits or other parts in the future, feel free to contact us at

Marbleheadaudio@gmail.com.

We can create kits for MOST vintage audio gear. If you need a kit for a cassette deck, receiver, turntable, or any other device, just ask—many are not yet listed on our website.

Your feedback is greatly appreciated, whether it's on the site of purchase or directly via email, to help us improve these kits moving forward. Once again, thank you for choosing Marblehead Audio!

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IN BRIEF

- Kit includes parts organized into individual bags for each board
- Modern capacitors and transistors may differ in appearance but are suitable replacements
- Wima or Kemet film caps included for an upgraded sound quality
- Desoldering and soldering tools, screwdrivers, snips, and a multimeter are essential tools
- Refer to the Service Manual for guidance; consult Audiokarma, AI-based search tools, and YouTube for additional help
- Contact Marblehead Audio for support, to request kits for other devices, or to provide feedback
- Work on one board at a time, double-check work, and test the unit after each board
- Make sure to install polarized capacitors with the correct orientation

Restoring Your Receiver/Amp/Cassette Deck, etc:

Think of a receiver as four separate sections powered by the same supply: tuner, phono section, preamp, and power amp sections.

1. Tuner:
    - Work on one board at a time and test
    - Avoid replacing transistors in the tuning section, as it may affect tuning alignment
2. Phono Section:
    - Amplifies the signal coming from a phonograph/turntable/record player
    - Also referred to as the EQ amp/board in service manuals
3. Preamp/Tone:
    - Processes signals coming from the tuner, phono section, and line-level inputs (CD players, cassette decks, etc.)
    - Handles volume, balance, and other controls
4. Main Amp:
    - The power section, responsible for the wattage per channel
5. Power Supply:
    - Transforms power from the wall into usable DC voltage for each section
    - Old capacitors may show physical signs of stress

More complex receivers may have separate boards for protection circuitry, Dolby, etc. For simplicity, this guide will not cover those.

Integrated amps, preamps, and standalone power amps will have different combinations of these sections but still require a power supply.

Work on one board/section at a time, preferably in the order listed above, and test after each section. This approach minimizes potential issues and helps in troubleshooting if a problem arises. Use the service manual, schematic, board layout, and parts list as references during the restoration

process.

Why do we care about all this? As stated in the instructions above, and ESPECIALLY if you are inexperienced at electronics work…doing one board/section at a time makes so much sense. And with most units, doing them in the revised order below makes even more sense:

1. Phono section
2. Preamp/tone section
3. Main Amp
4. Power Supply
5. Tuner

Unless the design of your unit makes this difficult or impossible, restore your unit in the order shown above and test after each section. You can't (well, anything is possible, I guess) ruin any other section by working on a phono section. Restore that board, hook up your turntable and test it. If that works, move on to the preamp section…test again, etc.

The fact that all these units are at least stereo is also your friend. Say, you restore the phono section and have no left channel signal from your turntable…you have a working channel to do some comparison to.

Alright, let's go through each section in a general way. You have the service manual which in most cases will include the schematic, board layout, board parts lists, etc.

> A quick note: Some units (generally smaller ones, but not always) combine sections and put them on the same board. However, there is usually still a method to that organization. For example, parts for the

phono section might all be labeled with a 100 level, such as part numbers C101, etc. Preamp parts could be labeled with a 300 level (C301, etc). There is no strict rule for the numbering, but almost all manufacturers follow this pattern. With a few moments of examining the manual and schematic, you can likely figure it out. If it's confusing, don't hesitate to ask me for assistance.

PHONO SECTION: Generally, the phono section is the easiest board to work on (unless it is physically hard to access) with relatively few components. As it amplifies a very small signal, replacing noisy transistors in this section can significantly lower the noise floor. Using Wima film caps here can also greatly enhance performance. Film caps generally sound better, and this improvement is even more noticeable when the signal comes from a phono cartridge.

Assuming your unit is functioning correctly before the restoration, you may instantly notice an improvement in the sound of your vinyl records after restoring this board. Power up the unit, ensure everything looks good, and no "magic smoke" appears. Then, test the restored phono section with a record.

If you don't have a turntable to test the phono section, you can perform a rough test using a line-level input, such as a phone with volume control. To do this, connect the phone to the phono input and play audio at a low volume. Keep in mind that this method will not produce the exact sound quality you would get with a turntable, as the phone's output isn't equalized like a record. However, it should provide output in both channels and give you a general idea of the phono section's functionality. Remember to proceed with caution and always start with the lowest volume setting when testing with this method.

PREAMP SECTION: The preamp section has a relatively low signal level, similar to the phono section. Restoring this section typically involves replacing capacitors and transistors. After completing this section, power up the unit and test it using both a record and a line level source, such as a CD player or a smartphone.

POWER AMP SECTION: Some units, especially larger ones, will have two separate boards for the power amp section, one for each channel. Others may have both channels on a single board. Depending on the type of kit you have, it may include trimmers for DC offset and bias adjustments. It's important to use HFE matched transistors in this section, and the ones provided in your kit are already matched. Be careful not to mix up transistors from different bags.

Replacing capacitors and transistors in the power amp section is similar to the process for the other boards. For trimmers, measure the resistance of the legs on the ones you are removing, and set the resistance of the new trimmers you are installing to the same level. This will give you a baseline that you know works since your unit was functioning before the restoration.

If possible, before starting the work, perform the DC offset and bias adjustments (which can be found in every service manual) on your unit with the old components. Clean the old trimpots with some Deoxit while you're at it, and then adjust the new ones accordingly.

After restoring the power amp section, power up the unit and perform the DC offset and bias adjustments with the volume at zero and no source connected. Leave the unit on for half an hour and adjust the new trimpots again if needed. Finally, connect a source or tune into your favorite FM station to ensure you have music in both channels.

POWER SUPPLY/PROTECTION: You might have already noticed this, but modern capacitors are physically smaller than those from the 70s. If you didn't, you will in this section. There might be a trimmer included with your kit that is used here; if so, set it to the same resistance as the one you are replacing.

Power up – again, with a dim bulb tester if you have one – and readjust the trimmer to service manual specifications. Leave it on for a half hour or so, and adjust again. If a relay is included in your kit, the new one should install exactly as the old one did, OR if not, there will be notes on the parts list we included. If your unit uses a relay that we could no longer source, you may want to clean the contacts of the old one. We won't cover that process here, but it isn't difficult, and information on how to do so is readily available.

Cassette decks, reel decks, EQs, and similar devices all somewhat conform to the above guidelines but are free from the main amp section and the power it requires. As for turntables, there is no signal path in their electronics, and capacitors are replaced for stability and reliability purposes.

Relays

Relays are electrical switches used in various audio equipment, including receivers, amplifiers, and speaker systems. They play a crucial role in controlling the flow of electrical current in these devices, enabling functions like protection circuits, soft start, and speaker switching. In the context of vintage audio gear, relays can wear out over time, leading to potential issues with sound quality or device operation. This section will discuss considerations for replacing or maintaining relays in your equipment, as well as addressing challenges in sourcing the right relay for more obscure units.

If included, if you are having NO problems with your current relay and you

intend on keeping the unit (as opposed to selling it) long term, there is no absolute need to replace it. That is up to you; there is no wrong answer. If you plan on selling it or are prone to audio upgradeitis, you should replace the relay. If you bought a kit without the relay, you can (and should) clean/burnish the contacts on the original. A note: ALWAYS turn down the volume of your unit prior to turning it off - relays fail faster when units are shut off with a signal still running. If this kit includes a relay that is board mounted and has “extra” pins, it is still the correct relay, just snip any pins off the new relay that are superfluous.

If your unit uses a relay for protection, soft start or speakers it is normally included. There are exceptions to that rule. Some relays made years ago are simply unavailable now. In some units, it is simply impossible to ascertain the relay used. The manufacturer's part numbers are of no help here. We do extensive searching to find the correct relay for all kits we sell but (especially if a unit was not popular) occasionally simply can not find the information to include a relay with the kit. If that is the case, refer to the above regarding cleaning the original relay. The price of any given kit reflects the relays included in that kit. If a given relay is not included and you need to replace it, if you contact us with pictures of the relay (top and bottom) we may be able to source it for you and oftentimes will already have it in stock. We will happily sell you the correct relay at our cost plus shipping which will (in most cases) be less than what you could source it for yourself.

No other parts in our kits run into that problem. As customers provide feedback on relays we currently have no information on we WILL include those with appropriate kits.

INSTALLING OFF BOARD FILTER CAPS

Large filter capacitors are crucial components in vintage amplifiers and receivers, responsible for power supply filtering and DC voltage smoothing. Over time, they can degrade, leading to issues like increased noise, reduced power output, and decreased performance. Replacing these capacitors with new, high-quality ones can significantly enhance your vintage audio gear's performance and extend its lifespan.

As noted elsewhere...DISCHARGE LARGE FILTER CAPS!!! There is plenty of juice left in those things! It probably won't kill you but it can SHOCK you or short out something when you disassemble things. Do it every time you power up and down the unit.

OFF BOARD CAPS:
Smaller units, tuners, cassette decks and similar usually have the filter caps on a board. Larger units that have a power amplifier section usually house the Filter (and/or coupling) Capacitors off board. There are options here, depending on your skill level, desire to keep things looking original, etc.

As mentioned in the power supply section, Caps today are smaller than those of old. When replacing filter caps this means we may need to get creative. It depends on the unit, the diameter of the old caps and the price of sourcing caps of that same diameter. We have tried to keep the cost of these kits reasonable and sourcing caps of the same diameter as originals is oftentimes either impossible or pricey so there is a good chance those we supplied are smaller than the originals. There are a few solutions:

1. Unstuff the originals and place the smaller ones inside them. If keeping the exact look of the inside is very important to you, this is the way to do it. You can neatly cut the bottom of the old cap off where it is clamped

in. Doing so will reveal the innards of that cap which you can remove. The smaller new cap can be glued inside, the old cap reattached to itself with electrical tape and remounted. Very clean if done correctly but a far amount of work.

2. Install the new caps underneath: When possible, this is my preferred method. Like unstuffing, from the top the unit looks the same as the old caps aren't removed. The new caps are secured to the chassis (and usually there is a screw nearby to help) via terminal strips or small hose clamps.

The old cap New cap underneath or mount it with this!

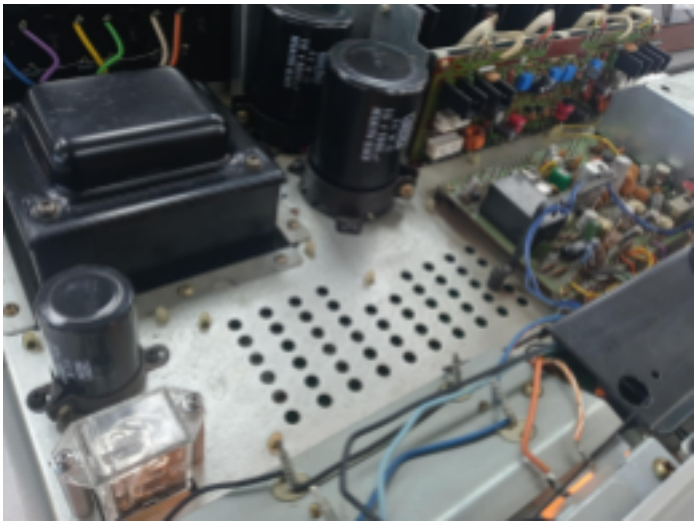
3. Use the existing clamps to install smaller caps. The clamp won't tighten enough to reach the diameter of the smaller cap so something must be used to fill that space. The option many use is to purchase foam that insulates pipe...glue it to the clamp and/or caps and install. It works and is cheap and easy. I prefer to use an electrical pipe spacer/reducer whenever

possible. The right size is generally easily available. I paint it black, maybe have to ever so slightly file down the inside to allow just enough room to slide the new, smaller cap in and tighten the original clamp. Note: the original clamp screw may not be long enough so you may need to procure a longer one. A bit of glue securing the new caps to the reducing washer and the reducing washer to the clamps is recommended. No need to over do it.

The old cap (8000uf 50V) is on the left for reference. The new caps (8200uf 63V) with a reducer installed

Reducers at any hardware store!

With this method, you can also implement the above idea (#1) of cutting off the bottom of the original caps - and gluing the empty shells to the reducing washer. The picture below shows the Same SX-838 after doing just that. I find this less hassle than trying to stuff the old cap. The shell of those old caps is thin and, for metal, easy to cut with a jigsaw, dremel, etc.



UNDERNEATH

If the old caps had screw mounts or were wire wound, attaching the wire to the new caps can be achieved by using uninsulated terminal rings. When soldering, keep your iron on the terminal until the solder flows to the tab or through wire. Shrink wrap isn't necessary but if you have some, use it when installing the terminal on a through hole cap like in the last picture below.


All these parts are available CHEAP at any decent hardware store. The Pioneer SX-838 shown as an example here cost me less than $3 total in parts to secure the three offboard caps.

Desoldering/Soldering Tips

Desoldering old components:

The goal here is to not lift the tracer. Oftentimes (usually) the old part will have the lead bent over and irritatingly hugging the tracer. If not,

desoldering, whether with a suction tool or braid is fairly easy and straightforward. If the lead is bent into the tracer you will want to make sure all the solder hiding underneath it is removed. I have both a suction tool and braid. I use the suction tool to grab most of the solder and when necessary use the braid to clear out the rest. If you only have braid, the same method works. If you only have a suction tool, you can still get the job done but that last bit may be more difficult. Some boards are easier to work than others. If you aren't getting desired results (and especially if early in the process, you are lifting tracers) you may want to invest in desolder braid. If you see yourself restoring more units down the line...just buy some!

Do NOT wiggle the component to free it. You can lightly move it to ensure it's desoldered but if it isn't do not keep trying. Remove the remaining solder and try again. Good lighting or magnification are helpful here. A bit of practice will make this process pretty easy, but if desoldering is new to you...expect a mild learning curve. Once both (or all three if it's a transistor) legs are free..snip off any excess leg and it should slide out smoothly. When snipping those
little pieces off, be sure they are REMOVED. Stray conductive material inside a running amp is a very bad thing. I learned that the hard way early on so you don't have to!

Pay attention to polarity on caps. Don't trust the service manual or board to get that info right. The same goes for the base, emitter and collector position of transistors. Trust a working unit over documentation (including mine) every time!

With desoldering and soldering both, be aware of your iron and nearby wires...the smell of burning shielding is not a big deal but not overly appealing.

Soldering in new components:

I won't go into much detail here. With a clean board, new components and a good iron, I find soldering to be a joy, almost therapeutic. I DO NOT bend the leads much, just enough to keep the component from moving. Apply the iron evenly to the pad and lead. Don't apply the new solder directly to the iron but instead very close to it and once it starts to flow, drag your iron UP the lead…the new solder should fill the pad hole and surround the lead. Take a quick look at the other side to ensure the cap isn't cockeyed and snip the excess. Keep everything CLEAN, it matters more than you might think and ensures a nice shiny, secure joint. If soldering seems to be a problem joint after joint, your iron may not be getting hot enough. Within reason, hotter is generally better.

Lifted Tracers

It happens, especially if you are new to this. If it happens again and again, something is amiss. If it is a random occurrence once or twice in your restoration work…you can simply run a wire from that component to something common to it. Use your multimeter to ensure continuity of the run you just made…Congratulations you now know how to wire point to point like they did in the 50's! See the comments on Blu Tack to make this job SO MUCH easier. Desoldering Old Components:

The goal here is to avoid lifting the tracer. Often, the old part will have the lead bent over and tightly hugging the tracer. Desoldering, whether with a suction tool or braid, is fairly straightforward if the lead isn't bent into the tracer. Make sure to remove all solder hiding underneath the lead. If you see yourself restoring more units in the future, investing in desoldering braid is a good idea.

- Do NOT wiggle the component to free it. Gently move it to ensure it's

desoldered, and if it isn't, remove the remaining solder and try again.
- Good lighting or magnification can be helpful.
- Trust a working unit over documentation (including this guide) for cap polarity and transistor positions.
- Be aware of your iron and nearby wires to avoid burning shielding.

Soldering New Components:

Soldering can be an enjoyable process with a clean board, new components, and a good iron.

- Don't bend the leads too much, just enough to keep the component from moving.
- Apply the iron evenly to the pad and lead, and once the new solder starts flowing, drag your iron UP the lead.
- Keep everything CLEAN for shiny, secure joints.
- If soldering seems problematic, your iron may not be hot enough; hotter is generally better within reason.

Lifted Tracers:

Lifted tracers can happen, especially if you're new to this. If it's a random occurrence, simply run a wire from the component to something common to it, and use your multimeter to ensure continuity. This process is similar to the point-to-point wiring used in the 1950s. Using Blu Tack can make this job much easier.

Disassembly

Some boards are very easy to access, while others might require more effort. Before taking your unit apart, we recommend following these steps:

1. Consult the service manual, which will likely provide an exploded

view. Some manuals might also offer disassembly hints and tricks. Review these resources first.

2. With the top and bottom of your unit removed, locate the boards you will be working on and set a path, as mentioned previously, to work your way up.
3. Take pictures of the top and bottom overall and of each board you can see from both sides.
4. Be aware that most boards will need to be at least partially removed for restoration work. While it is rare that you will have to desolder wires from boards, some disassembly is usually necessary.
5. Use a system (such as small baggies) to label screws and other removed components clearly. Avoid having a mix of different screws lying around when it's time to reassemble.
6. Don't force anything. If something isn't moving, there's likely a reason. More disassembly may be required if things are too tight.
7. Ensure the board is as stable as possible during work, making desoldering and soldering easier. You can use Blu Tack, helping hands, or even tape to hold the board in place.
8. Free connecting wires from plastic holders or thick twist ties to provide more room to work.
9. Take notes: Don't rely solely on your memory. If something comes apart in an unusual way, make a note to facilitate reassembly without unnecessary frustration.
10. Be prepared to solder at awkward angles occasionally.
11. Avoid desoldering anything you don't need to and resist the temptation to remove a board completely unless necessary. Complete removal is rarely needed. However, if you're working on a unit with molex-type connectors that make removal easy, that's a bonus!

Reassembly

1. If you followed the steps above during disassembly, reassembly should be straightforward. Don't force anything—check for wires or other obstructions that might be getting in the way of putting the board back in place.

Other tasks to complete while inside:

1. Clean all switches, pots, controls, etc. See the section on tools and supplies for more information. Related tasks include cleaning and treating fuses and fuse holders, as well as treating inputs and outputs.
2. Replace lamps - This was a must when I started doing this years ago, but often now someone has already done this. Choose between new LED style or original incandescent lamps, depending on your preference.
3. Replace vellum paper in a receiver - If your unit is glowing a slightly green color when it should be blue (such as in a Marantz), the vellum paper needs to be replaced. This is a relatively simple task. If the previous owner smoked, this is highly recommended.
4. Clean the glass.
5. Clean the faceplate - I use Windex, as it will not remove lettering and does an effective job. Use other cleaners at your own risk.
6. Clean the chassis - Be cautious when cleaning, especially around the tuner boards. Avoid spraying cleaning solution over the entire unit; instead, clean in small sections.
7. Refinish a wood cabinet - Keep in mind that it is most likely a veneer, not solid wood. Be gentle when sanding, especially at the edges where it's easy to sand off the veneer. If the finish starts to look like light maple rather than walnut, stop sanding.
8. Apply new thermal compound to output transistors - I strongly recommend doing this since these components can get hot even under ideal conditions when running at close to full volume. Since you have

the unit open, it's a good opportunity to perform this maintenance.

9. Inspect and secure any loose connections or wires - Check for any loose or frayed wires that may need to be reconnected or secured.
10. Check and clean any ventilation or cooling fans - If the unit has fans, ensure they are free of dust and debris to maintain proper cooling and extend the life of the components.
11. Inspect and replace any damaged or worn belts - In units with mechanical components such as tape decks or turntables, check for worn or damaged belts and replace them if necessary.
12. Lubricate mechanical parts - Apply lubricant to any moving parts, such as gears or bearings, to reduce friction and wear.
13. Inspect for signs of corrosion or damage on the circuit boards - Check for any signs of corrosion, damage, or burnt components on the boards, and consider replacing or repairing them if needed.
14. Perform a general visual inspection - Look for any other issues or signs of wear that may not have been immediately apparent. This can help prevent future problems and ensure the unit is in good condition.

Trimpot adjustments

Many, if not most, units will have internal trimpots for adjusting bias, DC offset and rail voltage. If you bought a kit that includes trimmers, that is what they are for. If you bought a kit that does not include those, clean the trimpots with deoxit.

Service manuals will tell you exactly how to make these adjustments. DO THIS!!!!!!!!! Let your unit warm up for about 5 minute then do it after finishing the main board(s) and the power supply board. Do it again after your unit has sat running at idle for a half hour or so. Do it again after about 50 hours of music.

DC Offset: One for each channel. We don’t want ANY DC voltage going

into your speakers. The trimpots allow us to dial it down to virtually nil. While you are always welcome to go about this as the service manual suggests, it can often be accomplished by adjusting the trimpots with your multimeter hooked up to the speaker connections. If you go this route, be sure the speakers are turned on. The volume should be at zero, no source playing. If you can't get this below around 50mV's something may be amiss. With a unit that is operating correctly and the new bourns trimmers you should be able to dial this to 5mV's or less. There is an awesome thread on Audiokarma titled "DC offset and you" if you would like more info or your unit isn't dialing down as well as we'd hope.

Bias adjustments: Again, one for each channel. Set too high, you can really damage things, set too low, your unit won't sound as good. As mentioned earlier, set the new trimpots to the same resistance as the old one's when installing them. Adjust according to the service manual.

Rail voltage: Some units will have a trimpot on the power supply board for adjusting voltage. This is straightforward. Many units do not have this trimpot.

A hint: take a minute to adjust any trimmers above before doing the restoration work. Having done so, you can measure the resistance on the removed trimmer and set the new one up with the same value resistance ensuring that your unit will be very close to spot on prior to dialing it in.

Trimmer codes: On the top of the trimmers, you'll see something like P501 or Y104. If you're not familiar with electronic codes, here's the key to deciphering them:

Ignore the alpha-character (the letter). The numbers that follow indicate the resistance value. The last digit is the multiplier, and the preceding digits are

the base value.

For example, a 501 trimmer code means:

1. Ignore the letter (P).
2. Read the numbers 50(1).
3. The last digit (1) indicates the number of zeros to add, making it a 500 ohm trimmer.

For the Y104 trimmer code:

1. Ignore the letter (Y).
2. Read the numbers 10(4).
3. The last digit (4) indicates the number of zeros to add, making it a 100,000 (100K) ohm trimmer.

Some service manuals and manufacturers use the same coding system for capacitors. For example, a 471 labeled cap would be 470uF (47 followed by one zero).

Just to make it a bit more confusing, occasionally (fairly rare but it happens) the trimmer sent with your kit will be the next size up than the original. Sometimes it's because the original is an oddball value not currently available. Sometimes it's because shared experience shows that the original didn't always hit the range we want after a recap. Whatever the reason, if, for example, the original was 300 Ohm and the new one is 500 ohm, in most cases it is as simple as finding out which leg is ground and and setting the correct value via the other two legs.

Old Glue: Manufacturers sometimes used glue to hold larger capacitors in place. If it appears a cap was leaking, it probably is just glue. With these caps you will need to massage them loose

after desoldering them. Do your best to remove the old glue from the board as it has been known to become slightly conductive over the years.

1. Heat: Carefully use a heat gun or hairdryer to soften the glue, making it easier to remove. Be cautious not to overheat other components, and avoid using too high a temperature.
2. Isopropyl alcohol: Apply isopropyl alcohol (IPA) to the glue using a cotton swab or small brush. The alcohol helps dissolve the glue and makes it easier to scrape off. Let the IPA sit for a few minutes before attempting to remove the glue. Be sure to clean the area afterward with a clean, dry cloth or cotton swab.
3. Freeze spray: Another option is to use a freeze spray, which can make the glue brittle and easier to remove. Apply the spray according to the manufacturer's instructions and then carefully chip away the glue using a small tool.
4. Plastic or nylon tools: To avoid damaging the board and its components, use plastic or nylon tools like spudgers or pry tools to scrape away the glue. These tools are less likely to scratch or damage the surface compared to metal tools.

Always remember to work gently and patiently, as removing the old glue can be a delicate process. It's essential to avoid damaging the board, traces, or other components while removing the glue.

Troubleshooting After Kit Work

This guide assumes your unit was working before the restoration and that you have at least a minimal understanding of electronics operation.

By following the instructions above and working on one board at a time, troubleshooting becomes much easier. Generally, and applicable to all scenarios below, assume the problem is not catastrophic. Start by checking for user error, such as incorrect settings or loose cables. Double-check all connections and settings.

If you're sure your associated gear, cables, and settings are correct, the first step is to narrow down the problem. Working on one board at a time simplifies this process.

Common issue: No sound

PHONO section:

Note: You don't need to hook up a turntable for this step, as it can be a hassle. Instead, use your phone set at very low volume and play a 1 kHz test tone into the PHONO input. Turn the unit's volume to about 1/3rd or less. The level may still be too high and might sound distorted.

If both channels are not producing sound (or any AC output at the speakers if testing with your multimeter) and you've ruled out human error, check if you're getting a signal OUT of the phono board. If not, verify if there's DC voltage IN to that board from the power supply. If both conditions are true, check for correct capacitor polarity and transistor installation. You've likely found the issue, but if not, reflow all the solder joints and check again. If you still aren't getting sound from either channel, something may be wrong with the power supply to that board. Check if the DC voltage readings are as they should be. After all that, if you're still not getting sound from either channel, you might have damaged a resistor, transistor, or (least likely) a capacitor. Look for burnt-looking resistors, bad solder joints, and lifted traces.

If only one channel is not producing sound, the process is similar but easier. A transistor might be installed backward or there may be another simple

issue. Again, the chance of a catastrophic problem is minimal. If you're frustrated, take a break and return to the problem later – you'll likely find the issue.

The likelihood it is anything catastrophic is very small. If frustrated, take a break from it, you'll find it.

Preamp Section:

Similar to the phono section, you can run a signal with the volume set at a third, but this time use a line-level signal instead of a turntable's weak signal. The troubleshooting process is basically the same as described for the phono section. There is only so much that can go wrong at this stage.

Power Amp Section:

Assuming your unit worked before the restoration and you set the new trimmers to the same value as the old ones, the troubleshooting process is much the same as the previous sections. If your unit doesn't have a relay or it does and the relay isn't engaging, you may want to start by checking if the bias voltage is set correctly. If not, dial it in or turn it down to 20% or so less than what the service manual suggests and proceed from there. Check for DC at the outputs (very unlikely) but worth a look. If those check out and the voltages coming from the power supply match those in the service manual, it's most likely a bad solder joint or a component installed backward.

Power Supply:

While larger units can be more complicated and others may incorporate protection circuitry, generally, there isn't much to go wrong in simpler units. Check the voltages as laid out in the service manual, and you can hopefully quickly narrow down the problem. If only the preamp section supply voltage

is amiss, there's no need to troubleshoot everything on the power supply board; it narrows things down quickly.

Filter Caps & Relay:

For filter caps, DO NOT ASSUME which side is negative. If you aren't familiar with electronics and assume negative is ground, it's NOT necessarily true. When installed correctly, there is little to go wrong; suspect a bad solder joint or user error.

With all of the above, consider the possibility that a wire connecting to that board came loose as you jostled things around. Examine those visually and with a continuity check on your multimeter.

If you've completed all the above steps, your unit was working when you started, and yet you still have problems, you may contact me for help. Similarly, the site Audio Karma has knowledgeable and helpful people, BUT if you want help, whether from me or someone there, be specific and somewhat detailed in your questions.

If your unit was NOT working before buying this kit and you hoped the kit would fix it, DO NOT start installing a bunch of parts. This is how a nice vintage receiver becomes a doorstop. Fix the problem first. Maybe the issue is one that these parts will fix, and you've troubleshot enough to assume that; if so, replace ONLY the questionable parts. If that solves the problem, move on to restoring it.

TOOLS And Such:

Bare minimum ESSENTIALS:

1. Solder: 60/40 rosin core .050 or so diameter will get the job done for

this work.

2. Desoldering Braid: My favorite: MG Chemicals Superwick #444
3. Desoldering Suction Tool: Soldapullt brand is the standard - IF YOU HAVE BOTH GREAT, IF you have neither, I suggest buying the braid. I can do most units without needing the braid, a suction tool may or may not be enough.
4. Hemostats: Useful for holding small components, and they also come in handy if you're a doctor or for those counter culture moments now legal in many states.
5. Snips: Standalone, so you can get close to the board. A more versatile snip and strip tool may also come in handy.
6. Old Toothbrush: Don't put it back in the bathroom, trust me on this; the taste is horrid.
7. Deoxit, Faderlube, Pro-Gold: If you have none of the above, at a minimum buy Faderlube. If you already have Deoxit - good enough. EXCEPT on faders/sliders, Faderlube is best for cleaning those. Pro-Gold is used to treat inputs and outputs for a better electrical connection. If you have it, I suggest using it on the fuse holders as well. Sweetwater.com has all at about as good a price as anyone with free shipping.
8. Multimeter: Nothing as fancy as the Fluke shown is needed.
9. Screwdrivers: You'll need these, including a jeweler's screwdriver to adjust trimpots.
10. Small crescent wrench or similar: To remove the faceplate washers, be gentle - do NOT scratch up your faceplate.
11. Needle-nose pliers: Useful for grasping small components or bending leads.
12. Safety glasses: To protect your eyes from any solder splashes or debris while working on the project.
13. Heat shrink tubing or electrical tape: For insulating any exposed

connections or splices.

14. A well-lit and well-ventilated workspace: Good lighting is crucial for precision work, and proper ventilation helps keep solder fumes away.

Also Handy:

- Clip leads: When doing audio adjustments, be rightfully nervous about the leads of your multimeter shorting something with a slip of your hand.
- Magnetic tool: Somehow a dropped screw ALWAYS ends up in the worst spot.
- Dim Bulb Tester (DBT): A useful tool for safely powering up a unit after repair or restoration work. It helps limit the current and protects the unit from potential damage due to short circuits or incorrect wiring. A must-have for anyone working on vintage electronics.

I'll bunch these together because I rarely use any of them due to Blu Tack:

- Magnetic screwdrivers
- Helping hands

- Tape

Instead, consider using **Blu Tack**. Seriously, buy a bit of Blu Tack. It's inexpensive and incredibly useful. It has decreased my frustration while doing this work tenfold, and I probably save close to an hour on most units I restore with it.

First off, Blu Tack sticks to anything, which would be awful, except for the fact it sticks to more Blu Tack more readily than anything else. That means it can do EVERYTHING helping hands can do, but it's like having 15 helping hands if you need them. Need to solder two wires together in mid-air? EASY. Need to hold a board down securely as you desolder/solder? A bit of Blu Tack between it and whatever is close does the job.

I LOVE it for soldering floppy boards, which can be a pain and much more likely to cause a lifted tracer. But if you do lift a tracer, use it to hold that pesky wire precisely in place as you solder it to another component lead.

It also works WAY better than a magnetic screwdriver in holding a screw to your driver at odd angles. I leave a small piece of it on my regular screwdrivers and reinstall screws in hard-to-reach places and wrong angles with ease.

If you happen to heat it up, it may turn into what appears to be a gooey nightmare. But don't worry; let it cool and grab that mess with a bit more of it.

Need a look at the schematic? Blu Tack it to the wall behind your desk. Honestly, I use it all the time in ways I hadn't thought of before the situation called for it.

It also has great sonic characteristics for coupling/isolating things. I initially bought it to couple my DIY wood horns to a separate cabinet holding the 15"

woofers.

Blu Tack is a low-tech solution that works incredibly well for electronics work in general. Installing a belt in a tight spot in a cassette deck? It'll help with that too. Trust me on this; whether you're working on one unit or one hundred, this stuff is a game-changer for this kind of work.

Transistor Replacement in Vintage Audio:

Transistor construction improved over the time frame most of our kits cover (roughly the 1970s). By the late 1970s, most of the problematic transistors were already replaced with transistors that no longer had the issues found in earlier models. In fact, some transistors on our "should replace" list were improved upon and no longer exhibited the problems of those made years earlier.

Considerations:

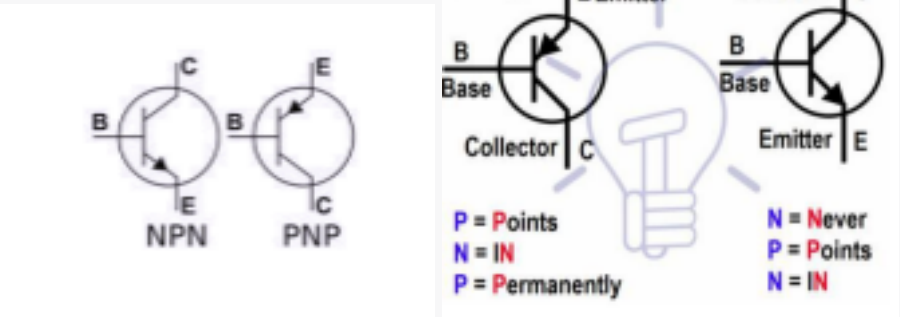
- If your unit was made after 1977, there is a good chance NONE of the transistors truly need to be replaced.
- If your unit was made in the early 1980s or later, it is highly likely NONE of the transistors need to be replaced.
- Some people insist transistors were made better back then and don't need replacement, while others believe they should all be replaced.
- In general, if a transistor is not noisy or otherwise problematic, it doesn't need to be replaced, especially with models made later in the '70s.

Transistor Types:

- Transistors are either NPN or PNP type.
- Understanding the two types and their schematic symbols can be

useful (include the actual images of the schematic symbols and pinouts for the different transistor types).

- NPN can be remembered as "Not Pointing iN" due to the direction of the arrow in the schematic symbol.



Installation Tips:

- Transistors are more susceptible to heat than capacitors, so take care not to overheat them during soldering.
- To be extra cautious, solder one leg, then solder a nearby capacitor, and finally solder another leg, allowing the transistor to cool in the interim.

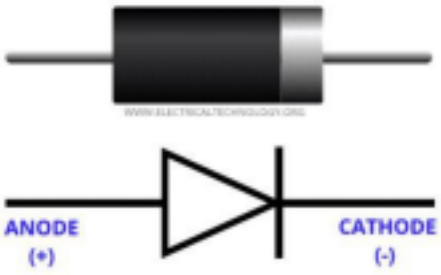
Obsolete Transistors:

- Many units used the now obsolete 2SA798 dual transistor, which can be replaced with a pair of 2SA992s.
- To mount them, first solder the emitter leads together near the body of the transistors and cut off one lead below your solder point. This allows you to insert all 5 pins into the available through holes.
- The combo 992 will have a pinout of B, C, E, C, B.

Below are the most common transistors found in out kits

Diodes:

Kits often include diodes. Like transistors, a few types can replace a variety of older diodes.



Kits often include diodes. Like transistors a few types can replace a number of types originally found in gear.

In general, diodes don't need to be replaced unless they're damaged. "Blob" diodes are an exception (you'll recognize them by their irregular, blob-like appearance, which differs from the standard diode image). If you notice any "blob" diodes in your unit that this kit doesn't include replacements for, please contact us. Like some other parts, these were phased out over time, so it's possible, albeit unlikely, that your unit has some we haven't addressed in this kit.

Additional Resources

1. **Audio Karma (https://www.audiokarma.org/): A popular audio discussion forum with various sections with a strong community of vintage audio enthusiasts.**
2. **Audio Asylum (https://www.audioasylum.com/): A popular audio discussion forum with various sections covering different audio topics, such as vintage audio, amplifiers, and speakers.**
3. **DIY Audio (https://www.diyaudio.com/): An active forum with a focus on DIY audio projects, including restoration and repair of vintage audio equipment.**
4. **The Vintage Knob (http://www.thevintageknob.org/): An online audio museum with a wealth of information about vintage audio equipment, including brand history, product specifications, and user manuals.**
5. **Hi-Fi Engine (https://www.hifiengine.com/): A resource for finding free manuals, schematics, and other documents related to audio equipment, including vintage gear.**
6. **Vinyl Engine (https://www.vinylengine.com/): A resource dedicated to turntables, tonearms, and phono cartridges, with manuals, reviews, and forums.**

Again, Thank you for your purchase. Good luck with the restoration. Your unit will probably sound better from the start but experience suggests that some time on and running (20-50 hours) will have it sounding even better.

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