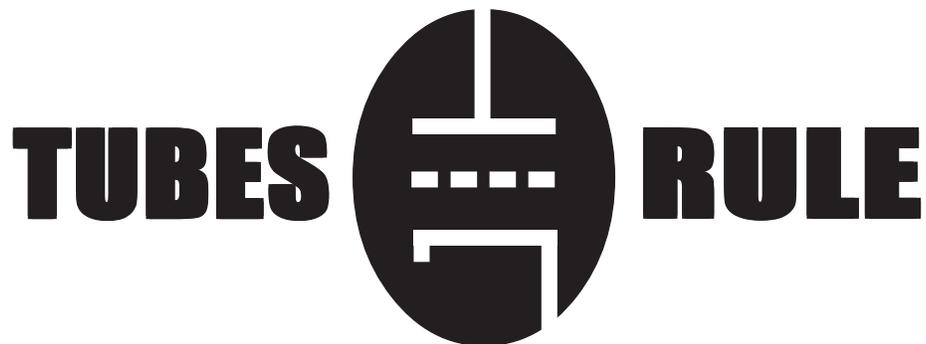




**THE MAHI  
OWNER'S MANUAL**



**brought to you by the clever folks at:**

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**REV 11-1-2005**

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# INTRODUCTION

## THANK YOU!...

for choosing the Manley MAHI monoblock amplifiers for your loudspeaker driving requirements. You have possibly chosen this product because you auditioned it in a store or heard it at a hi-fi show and were impressed with the sound. It may have been the right combination of price, power, features and styling for you. It may have been because you know the Manley Labs reputation for quality, reliability, and integrity. If any or all of these were the reasons, you made a good choice and for that, we thank you.

The MANLEY MAHI is designed to bring unbalanced RCA-type line inputs up to speaker-driving levels in the simplest and most direct way possible. This is accomplished in only three active stages through the judicious use of vacuum tubes, whose purpose-designed applications in audio amplification are pressed to full advantage here.

The MAHI's circuitry contains many subtle and overt refinements that promote uncolored and revealing musical reproduction of the input signal. The MAHI is a follow-on model from our previous "50 watt monoblock" model which was a monoblock version of our famed STINGRAY stereo integrated. The name "50 watt monoblock" and its chassis got somewhat boring and dated after awhile, so new for 2003 we brought this wonderful little champ up-to-date with our current direction in clever styling while retaining the circuitry basically as it was as to not screw with success. But doncha know, we couldn't resist making a few improvements...

The MAHI now features Triode-Ultra Linear mode switching as standard whereas before it was a state secret option on the 50's. Now you can choose whether you'd like to be seduced by a sweet 20 watts of triode operation or whether you prefer the ballsy-er control of 40 some-odd watts of UL. The other switch on the top deck is a Variable Feedback switch allowing the user to choose how much negative feedback is being applied to the amplifier for sonic variation and optimisation of speaker-to-amplifier interface. New for the MAHI we greatly increased the B+ capacity with a hefty bank of 1200uF filter caps. This now provides for nearly 180 Joules of energy storage which audibly equates to tighter and more rock-solid authority in the bass region. The MAHI's output transformer is built right here in our own Manley Magnetics department and is the same one used in the acclaimed Stingray. Low levels of noise, distortion, and negative feedback are partnered with the naturally high dynamic range of tube electronics which makes the MAHI really jump to life.

Please read over this entertaining and enjoyable owner's manual carefully as it contains information essential to the proper operation and maximum enjoyment of this instrument. Many of the remarks contained herein are especially pertinent if the MAHI is to be your first long-term encounter with a vacuum tube power amplifier. Thank you again, and please enjoy your new Mahis! (and the clever Owner's Manual.)

**UNPACKING:** Unpack the amplifiers carefully by removing all the custom foam packing material and make sure that all supplied accessories are present. Carefully examine all items for any possibility of shipping damage. All of the tubes are already installed and should have survived the journey protected by their very own grey foam insert. They should be standing at attention in their sockets, and should show no signs of distress such as chipped glass, loose internal components or obvious breakage. If the amplifier is damaged or fails to operate, notify the shipper or your dealer or us or your local authorities immediately. Or if you suspect The Shipping People threw it off the airplane and onto your front porch whilst flying overhead at 30,000 feet, notify the shipping company without delay and complain to them as we only guarantee this unit to be able to survive a drop of 23,487 feet or less.

Your MAHI's were packed by Manny Q. with extreme love and each box includes the following components and accessories:

- a) 1 each, 6 foot IEC 3-conductor power cable (that you will probably replace with an expensive audiophile cord anyway.)
- b) 1 each, Owner's Manual per pair (that we hope you will keep reading.)

**It is prudent to retain the shipping materials for future use, as they are custom-formed for the amplifier and will greatly minimize the chance of shipping-related damage should you ever need to put your precious MAHI's in the careless hands of The Shipping People again. We have heard that certain rodents might enjoy munching on the packing foam. We are sorry to report that we do not warranty the packing foam against attack by mice, rats, or other hungry critters, hungry children, hungry neighbors, etc. Try glue traps or spring-traps loaded with peanut butter to eliminate these unwelcome freeloaders from your property.**

## MAINS CONNECTIONS

Your MAHI's have been factory set to the correct mains voltage for your country. (Well, that is what we intended to do when we knew where they would be initially shipped.) The mains voltage that we built these MAHI's to operate with is marked on the serial badge, located on the rear of the chassis. Check that this complies with what comes out of your wall.

There is no voltage changeover switch! The power transformer's primaries must be either wired in parallel for 120v operation or in series for 230v or 240v countries so be sure to check the sticker and the serial number voltage indication for proper mains voltage. Failure to properly comply with mains voltage requirements can cause extensive damage to the system, which of course would not be covered by the warranty. If you relocate from, say, a 120v country to a 240v country, you will need us to rewire the MAHI's power transformer for you or get instructions from us to perform this operation if you happen to be as good at soldering as we are, or know someone who is. We are not telling you how to do this in this Owner's Manual because you need to pass a battery of tests for us before we will let you play with soldering inside the amplifiers. Contact [service@manleylabs.com](mailto:service@manleylabs.com) for more details.

The MAINS FUSE may be checked by first disconnecting the IEC mains cord from the power supply's power inlet plug. Then gently push the light grey fuseholder retainer clip located next to the IEC power socket. The fuse and cap should spring outward toward your fingers. The fixed silver springy looking thing is NOT the fuse. Leave that alone. The fuse is a glass or white ceramic thing with silver end-caps. Inspect the mains fuse for the proper rating; change if necessary. Refer to the fuse rating chart in the **specifications** section of this manual. If you do not know what a blown fuse looks like, you may measure for continuity across the fuse ends. If your meter reads "OL" when you measure across the fuse, that means "Open Leads" and that would mean the fuse is blown. A blown fuse usually indicates A Very Bad Thing occurred. If this has happened to you, try to figure out why it may have happened. (Using a Fast Blow fuse when we have specified a SLO-BLO fuse is one reason, output tubes running away into never-never land are another reason.) If you have no idea why a fuse might have just blown on its own, you might want to consult with Manley Labs or your dealer for further advice as Something Very Bad might have occurred, like the power transformer might have decided to retire early.

One way this could happen is by running the wrong mains voltage into the unit. Be sure not to do that.

### **If you live in a strange place...**

Export units for certain markets have a moulded mains plug fitted to comply with local requirements. If your unit does not have a plug fitted the coloured wires should be connected to the appropriate plug terminals in accordance with the following code.

GREEN/YELLOW	EARTH terminal
BLUE	NEUTRAL terminal
BROWN	LIVE terminal

As the colours of the wires in the mains lead may not correspond with the coloured marking identifying the terminals in your plug proceed as follows;

The wire which is coloured GREEN/YELLOW must be connected to the terminal in the plug which is marked by the letter E or by the safety earth symbol or coloured GREEN or GREEN and YELLOW.

The wire which is coloured BLUE must be connected to the terminal in the plug which is marked by the letter N or coloured BLACK.

The wire which is coloured BROWN must be connected to the terminal in the plug which is marked by the letter L or coloured RED.

**DO NOT CONNECT OR SWITCH ON THE MAINS SUPPLY UNTIL ALL OTHER CONNECTIONS HAVE BEEN MADE. (...or else...)**

# GETTING STARTED

## PREPARATION FOR INSTALLATION

Budget a suitable space in which to place the amplifiers and associated interconnect and mains power cables. This space should be free of strong external magnetic and RF fields, and reasonably removed from strong loudspeaker-generated acoustical fields. This space should also be free of excessive heat or dust and large enough to permit easy flow of cool air to the top, bottom and sides of the amps. Do not connect the MAHI's to the AC mains until the other interconnections and items outlined below have been completed.

Keep other associated equipment some distance away from the amplifiers. This will help keep airflow unrestricted, and cut down interference from radiated magnetic hum fields that can emanate from certain power supplies. Notice that the output tube's glass envelopes are capable of reaching high temperatures, depending on operating circumstances. As with other equipment of this sort, it is best to keep the MAHI out of reach of pets or children, or be careful to keep children and pets away from the amplifier when in use.

People sometimes ask us why we don't supply a cage to protect children and pets from the scary exposed tubes. I always answer that I grew up with a tube receiver and survived ok and a cage would look ugly. The only physical harm that came to any of my family growing up from that tube receiver was once The Moving People dropped it on my mother's toe and broke it. (Broke the toe, not the receiver. It worked fine for many years after that. And Mom's toe is fine too.) And so did my little nephew who had one of my amps with scary exposed tubes from the time he was a wee lad. He not only survived and is in college now, but when he was three years old he knew how to fire up the whole hifi even before his mom did. So don't under estimate how smart your kids or pets are unless they are already prone to burning themselves on light bulbs. Or just put these little amps up on a tall shelf out of the way. Actually I'd be more worried about little kids breaking my \$3000 moving coil cartridge needle. Or The Cleaning People...

Before plugging in your interconnects, take a quick visual inspection of the tubes. Sometimes either through shipping or unpacking things get jostled. Make sure all tubes are firmly in their sockets. You might also verify that none have turned white inside. That indicates that air has leaked inside the tube (or the vacuum leaked out!). Though it is rare, a tube is sometimes cracked or broken in shipping. It would need to be replaced before powering up the unit. Give us a holler if this happens to you.

## RCA INPUT

The MAHI has a single-ended input stage and therefore only accepts an unbalanced RCA input. Balanced XLR inputs are not provided as that would necessitate adding more "stuff" such as IC's or transformers to the existing circuitry and for this amplifier, we are going by the "less is more" philosophy. If you only have balanced XLR outputs on your preamplifier, please check with its manufacturer as to how it would prefer to be hooked up into an unbalanced load. Some transistor balancing circuitry wants to see Pin 3 of the XLR lifted while other circuitry, such as transformer-coupled line stages must have their Pin 3 grounded. XLR female to RCA male adaptors are available if you need to make a conversion. The MAHI does not invert polarity.

The MAHI is a sensitive amplifier. (It's soooooo sensitive.) With the Feedback switch set at MIN, less than 175 millivolts RMS into the RCA jack will produce full output power. And there is no mute switch. So make your connections before you power up the MAHI. Otherwise you'll get a big loud noise. That might scare your kids or pets. And keep them away from your scary exposed-tube amplifier. Ah!

## SPEAKER CONNECTIONS

**Never operate the amplifier without a speaker load, or suddenly disconnect the speaker load while the amplifier is producing a signal. This risks punch-through of the enamel insulation covering the transformer's internal magnet wire. Permanent damage to the output transformer may result and for that, you will be made to pay dearly, dear.**

So there you have it. The beautiful WBT binding posts fitted to the MAHI are for hooking up your speakers cables. RED is positive and WHITE is negative. Get these to your speakers by way of nice speaker cabling terminated with bare wire, bananas, or spades. The WBT's feature a nice slipping clutch action which will clamp down on your terminals without spinning them. No need to tighten them like a gorilla or you might break something. Consider yourself well warned.

## MOVING RIGHT ALONG...

**NOW THAT YOU HAVE ALL YOUR CABLES PLUGGED IN**, you may now connect the IEC power cord to the MAHI and to an energized power outlet. (Unless you live in California and are in the middle of a Rolling Greyout<sup>®</sup>™.) Fire up all your *upstream* devices *first*: sources, preamplifier, and such and allow them all to finish their turn-on cycles so your MAHI will not be amplifying any of their waking-up noises. My nephew was able to master that turn-on sequence thing when he was a wee lad of only 3 years old. I swear.

Once your front end components are stabilized, you may now switch ON your MAHI's. The mains power switch is located on the back of the chassis right at the IEC power inlet. You shouldn't need to turn the Mahi around or get yourself behind it. You should be able to "feel" the rocker switch located next to the AC power cord. (We stuck the power switch way back there to keep the noisy mains furthest away from the input circuitry.) Flip the switch away from the power cord to turn on the Mahi or towards the power cord to turn off the unit. The MANLEY MAHI badge will light up. Sometimes you might see a flash out of the little input tube's heater as it turns on. That's normal so don't worry about it. I *told* you, stop worrying about it!

**STOP WORRYING ABOUT EVERYTHING AND JUST GET LISTENING!** Once audio is first heard from the Mahi's, please notice that it takes about 45 minutes of warm-up time for the system to reach thermal equilibrium. During this warm up time, go walk your dog, make dinner, or play some lite pop music. Some Elvis "Blue Hawaii" would be a fun choice. Or even Don Ho. Well, what you listen to is up to you.

**POWER DOWN (What? So soon?)** (No silly, when you're done, unless you just wanna practice!) As a rule, power up your amplifiers last, power down them first so they do not amplify any stray noises which could occur upstream from source components powering up or down. Additionally, it is best to cut power to the Mahi when not in use rather than leaving the power on indefinitely. This will enhance tube and system life. The tubes should last thousands of hours under normal conditions. Especially if you check your BIAS every once in awhile. Keep reading to learn more about tubes and then on page 8 you can learn about biasing your Mahi's.

**TRIODE vs. UL vs. TETRODE:** The MAHI output tubes can be switched to run in TRIODE mode or Ultra-Linear mode. Number one thing though, we really recommend that you TURN OFF the amplifier and count to five BEFORE you throw this switch. Triode is when the screen grids are hooked up to the plates of the EL84's. Triode mode is known to be very sweet and seductive sounding, but alas, it is a more inefficient way to run the output tubes. You only get about half the power in Triode as you would in Tetrode. Ultra-Linear, often called "partial triode," is when the screen grids are hooked up to a special taps on the primaries of the output transformer. These UL taps are located somewhere special between the center tap and the outside anode taps. Tetrode (or Pentode) operation is when the screen grids are hooked up directly to the center tap B+ of the output transformer. We don't give you that choice here but we want to tell you about it to help you understand more about UL. The sound of Tetrode mode is a little rougher and less refined than triode, but way more powerful, and sometimes, you really need more power. What is great about Ultra-Linear is you get the best of both worlds and how much of each world we choose to allow into the final result is dependent on where we choose to put the UL taps when we are designing the output transformer. The closer we choose to put the UL taps to the outside windings, the more triode-like the UL mode will be. The closer we put them to the center tap, the more powerful tetrode-like they will be. For this little amplifier's UL taps, we found a place where we felt the best balance of the two extremes would be so you still get lots more power, and it still is sweet, and it also has that driving and boogie-ing character that makes your toe tap. And again, remember, it is best if you TURN OFF the amplifier, count to five, throw the Triode-UL switch, and then power back on the amplifier if you want to compare between triode and UL modes. Most people find a preference and stick to it. You are free to do as you choose. It's a free country.

**VARIABLE FEEDBACK:** Some global negative feedback is employed in the MAHI. A bit of the output signal is taken off the final speaker outputs and is routed back to the input stage. The entire circuit, including the output transformer and some loudspeaker back-EMF, is thus included in the feedback loop, all 3dB's (MIN), 6dB's (STD), or 10dB's (MAX) of it, which ain't that much actually compared to *some* amplifiers we could mention. You can choose how much negative feedback is applied with the Variable Feedback switch. Negative Feedback alters the slew rate or "speed" of the amplifier. Feel free to experiment with this switch any time, even while playing tunes, even for different music. Use your ears and pick whatever setting you like, whenever you like. Knock yourself out.

**TUBES RULE!** While we could lauch into a whole lecture about the technical advantages of vacuum tubes, such as high headroom, big Joules, graceful overload characteristics and all this stuff, I'd rather get down to what's really important: Music is an emotional thing. There's no "right" or "wrong." Whatever gets your toe tapping is what is "right" for you. We enjoy working with vacuum tubes because we find we can get them to translate this emotional connection from the tunes, through hunks of steel, through the air to your ear where it reaches the enjoyment central station of the brain and then gives you those goosebumps. Try to measure THAT! Nah, don't. What we'd like you to really do is to enjoy years of fabulous music through your Manley MAHI's.

**While we're at it, and since this is a TUBE Amplifier, let's TAWK about TUBES:** As with all tubes, certain parameters degrade with age. This is due to decreasing cathode emission, a natural process found in all tubes. There are just so many electrons on that cathode and one day, they will have all jumped off. An excessive increase in noise level or very unstable output tube bias can indicate the need to replace a tube. The electrolytic capacitors will probably eventually dry out or start leaking and need to be replaced. Maybe in 15 to 20 or 30 years you will need to do this but don't worry about this for now... didn't I tell you to stop worrying?

**But I do worry: How long will these tubes last?** We can't say for sure. Nowadays, as in years past, bad tubes do emerge from the manufacturer's assembly lines. Some tubes die prematurely while others, especially small ones like the 12AX7, AU, AT and so on can last for more than 30 years of continuous use! The chief determinants of tube life expectancy are the stringency of the particular application, and the initial build quality of the tube itself. The average for the tubes in the MAHI should be around 2000+ hours for the output tubes, hey, maybe lots more, depending on usage, more for the input and driver tubes. We've seen 60,000+ hours on a set of tubes, but we're not trying to get your hopes up as it is better for the life on your tubes to exceed what we tell you they will do so you will feel better when they do and be all surprised.

**How can I tell when I need to replace them?** Most problems relating to the output tubes will show up while performing the bias procedure (on the next page). Tubes that cannot be adjusted within the specified range or have a very unstable reading are should be replaced. If the tube's plate (the grey metal rectangular box-like part most visible from the outside) is glowing cherry red or orange, then the tube is severely overheated. Check its bias immediately; if unable to adjust, then turn off the amplifier right away and replace the tube. The input and driver tubes can become noisy (hiss) or the amplifier may exhibit audible distortion; substituting known good tubes is the best way find the bad one. You got 2 channels to play with! They all can't be bad at once.

All tubes are "microphonic" to some extent; that is, they will make ringing noises through the speakers when tapped or vibrated. Here again, substitution will determine which one is overly sensitive to mechanical vibration. Obviously, any tube that is totally dark inside while powered up or is cold to the touch (careful!) is defective, or not making good contact with the heater contacts in the tube socket.

Most tubes have a silvery coating deposited on some area inside the glass bottle. This coating is put there by the "getter", and its job is to soak up or "get" contaminants, such as air molecules left over inside the glass envelope during the tube's manufacture, and help keep the vacuum hard. (Ooooh. You said "hard.") If the getter material has turned white (compare to another tube), then the tube has lost vacuum (or gained air!) and is definitely bad. Replace at once. Don't turn the amp on. Throw the tube out. Or shoot it.

#### **Do I need to replace them all at once?**

No, at least not with these amps, or unless all the tubes have clocked some thousands of hours of use. Some tube amps do require that if one tube has to be replaced that a complete matched set put in. All Manley amps use individual bias trims for each output tube which allows a single tube to be replaced. Absolute best performance is achieved when the tubes are most similar, both in bias requirements and transconductance characteristics. We batch them and label each tube so that in the event of a replacement you can get one from Manley of similar characteristics as the others in your amp. We need that hand written number on the top of the tube (Output tubes only. We know what we need to give ya for input or driver tubes).

#### **Does the "sound" of the amp change as the tube ages?**

Yes, but not too much, and even then, given good tubes, it is fairly strongly related to the amp design. The tubes can be allowed to reach their technical life limit, or they may be replaced more frequently depending on the listener's taste and accompanying equipment. In general, the band edges will suffer first, with very gradual loss of the deepest bass and ultrasonic treble. The MAHI is designed to meet stated power bandwidth specifications at 80% of rated output power at the end of useful tube service life. By way of contrary tube application contrasts, it is not like big guitar amps where tubes are replaced every 6 months for reasons of "tone". The MAHI's tubes are strong, allowing a very long life and less change between old and new tubes. This is where that figure of 2000 hours, or 4 to 5 years of use comes from. You may notice an improvement between tubes this old and new tubes depending on how critical you are. Keep in mind the sound of new tubes changes most in the first weeks of use before they can be considered "broken in". At first they may sound a little "tight" and "direct" (like some people we know).

**Is it difficult to replace a tube?** Yes, but only if you have trouble replacing light bulbs. It is super easy. Turn off the power. Just let the amp cool a few minutes so that you don't burn your pinkies. It helps to wiggle the tube gently rather than pulling it out straight. Use some terry cloth material or an oven mitt if time is pressing.

Even if you don't consider yourself "technical" you probably have more technical ability than your parents and they used to fix the family TV set by taking out the tubes and putting them through the tube tester at the local pharmacy. It is almost as easy to re-insert a tube. Just make sure it is correctly lined up with the socket and you don't bend a pin. Notice that the 9-pin miniature tubes have a gapped set of pins, making a rotational installment error nearly impossible. The larger 8-pin or octal-based tubes have no gap in their pin sets, but instead have a larger keyed center pin formed from the inert plastic plug material. The key makes insertion of the tube into the socket nearly impossible unless the key lines up with the matching hole in the amp's octal socket. Notice that octal tubes which have damaged or missing keyed center pins should NOT be used, since some output tubes internal wiring can cause dramatic equipment failure by short-circuit if incorrectly fitted to the amp's sockets. But you don't have any octal tubes in this amp so don't worry about that.

You can wiggle the tube when reinserting too. If you had a solid state amp (heaven forbid!), transistor replacement would merely be chapter 1 in the saga. You would have to open it up, diagnose the bad transistors and burnt resistors, de-solder 'em, find replacements (good luck on locating those germanium beasts) re-solder 'em, and hold your breath as you turn it on. Best have your Platinum credit card handy for ordering more. Or you could send it back, be without music for a few weeks, pay for service by the hour and be ready to administer nitroglycerine tablets under the tongue when it fries again. (Sarcastic? We're not sarcastic!)

**That's why TUBES RULE:** If you need a tube, or set of tubes, Manley Labs will be happy to sell you matched sets at a good price. And if you prefer to send the unit back for repair or adjustment, our warranty covers most everything except tubes (6 months only please) and abuse (7 months only-- just kidding). Plus we handle ground shipping back to you (unless you live overseas, cuz there's no ground service!) Repairs usually take less than a week. Could we do more? (That's a rhetorical question. It's late. Just keep reading...)

# BIASING YOUR AMPLIFIERS

## **DON'T WORRY! IT IS SUPER-EASY!**

Convenient test points for checking the standing current of each EL84 output tube is available on the top of the chassis, near the output tubes. The test points are connected to each tube's 10-ohm cathode resistor (inside). Everything is clearly labelled on the chassis because we know you guys are prone to throwing away informative Owner's Manuals.

Tube bias is a frequent source of confusion and misinformation, especially as it pertains to output tubes. This is partially due to the practice of using the term 'bias' for many situations throughout the electronics industry in general, along with the nature of the requirements needed to provide a proper electrical environment in which to efficiently operate a given audio output tube. Here, therefore, is a concise (oh really, Mitch?) picture of what is going on in the EL84 output tubes when the "bias" control is adjusted...

When the amplifier power is switched on, several voltages are quickly developed by the amplifier power supply. Around +400 volts DC for the plate, and about -25 volts DC, low current and low power, for the control grids. Six and 12 volts are also applied to the appropriate tube filaments. All of these voltages are referred to the output tube cathode voltage, which is usually within a few volts of circuit ground or chassis potential

The heater (orange glowing filament) of the tube inside the cathode sleeve rises to about 1200 degrees C. This heats the special oxide coated nickel cathode sleeve and, after 10 or 20 seconds, the oxide produces a generous cloud of electrons, which are negatively charged. The electrons are strongly attracted to the large positive plate, which is beckoning them from across the vacuum with an irresistible +400 volt potential. Notice here that, as usual, the differing charges, plus-to-minus, attract, and like charges plus-to-plus or minus-to-minus repel. Without some control, the tube is in danger of running at full cathode current, which due to prodigious input power from the 400V power supply, would lead to red-hot plates and quick tube destruction. Now the control grid is used to throttle back this hazardous situation, by the careful application of a negative voltage to the control grid. This applied negative grid voltage, Mr. Bias, retards the flow of electrons from the cathode to the plate by repelling the cloud of electrons around the cathode with a like charge, minus-to-minus, and confining most (or all) of them to the space between the cathode and control grid. Much like a Venetian window blind is used to control sunlight entering a room.

When you adjust the "bias" control, the control grid is being made slightly less or slightly more negative. How much this electronic venetian blind has been opened or closed may be observed by watching the cathode current with a voltmeter at the tube's test point. The higher the current, the more open the "blind" or valve setting, hence the higher the voltmeter reading. Notice that contaminants in the vacuum and other factors can sometimes conspire to reduce or eliminate the effects of the negative voltage impressed on the control grid, which can lead to runaway over-current conditions and ultimate tube failure.

## **OK, Mitch, that's enough for now. My eyes are glazing over. HOW DO I CHECK THE BIAS?**

Checking the standing current may be performed by connecting a DC millivolt meter between a test point and chassis ground, with the positive red meter lead to the test point, amplifier on, and zero audio signal present. Just leaving your preamplifier turned off is not not a bad idea. Adjust the corresponding bias trim control until a meter reading of 250 millivolts is attained. This corresponds to 25 milliamps of standing current because Ohm's Law tells us that 0.250VDC divided by 10 ohms (the cathode resistor) equals 25mA. Changing the standing current through one output tube may slightly alter the amount of current flowing through the neighboring tubes. Therefore, check the remaining output tubes and readjust as necessary. Turn off the amplifier and replace any tube that cannot be brought to the correct standing current when varying its bias adjustment control. Do not let the standing current exceed 50 milliamps (500 millivolts) except briefly as necessary during the adjustment procedure or you might be in for a surprise. (And we're not going to tell you what that surprise might be or it will spoil it for everybody.)

You should expect extended life from the tubes in your MANLEY MAHI amplifiers if you adhere to the procedures described above, and check your EL84 standing current at least once every 2-3 months. Generally, the longer the tubes operate, the less they should need standing current level inspection. And when that sad day comes, and the tubes have reached their lifetime service limits, be of good cheer, for should you ever need replacements we stock all the tubes used in these amplifiers, pre-screened and tested, and at very reasonable prices too! Oh yes!

# TROUBLESHOOTING

Here are some suggestions to try out in the event you encounter some of the symptoms below. If you encounter some other symptoms, then maybe you have some other problems that we don't know about.

**HUM:** Forgot the words. Try a mains ground adapter if they are legal in your country. They are also called 3 pin to 2 pin adapters or “cheaters” and are available in hardware stores. There should be one ground in your system and only one. If two or more pieces of gear have 3 pin AC mains cables, and they are grounded into the wall, a ground loop can occur which will usually cause hum. Either the preamplifier OR the power amps, when sharing an earth connection, are probably the best ground reference for your system, but not both or all of them.

**HISS:** Stray snakes in the room. Plug a shorted RCA plug into the input. Did the hiss stop? If so, then the source of the hiss is something upstream from the MAHI. If the noise level is the same, then the problem is in the MAHI - probably a noisy 12AT7 or 6414. Try swapping (with the power off please) one tube at a time across to the other channel to see if the hiss moves over there. If it did, then you found the troublemaker and you can contact us and we will report him to the proper authorities and send you a tube. And maybe sell you some spares for next time.

**OUT O' BALANCE:** Mom told you not to put anything smaller than your elbow in your ear. The two speakers sound different. Make sure you have both amplifiers' MODE and FEEDBACK switches set to the same positions. It may be the CD or source and the way it was recorded. First try a different source, or switch the source to the mono mode if possible, and listen for any level shifts. Notice that each MAHI's overall gain is carefully checked at the factory, and should be within 0.25 dB (or better) of each other. Next try swapping the inputs. Power down and swap left and right inputs. If it is the source, then the problem will “follow” the swap. Return them to normal (L=L). Power down again and next try swapping the speaker connections by putting the left speaker wire in the right terminals and right wires into the left terminals. If the problem switched sides then one MAHI is suspect; if the problem stayed on the same side it is probably a damaged or fatigued speaker or some crossover switch that got changed by The Cleaning Lady.

**NO SOUND, NO PILOT LIGHT, TUBES DARK:** Did you pay your Edison bill? Check the MAHI's AC Mains fuse. Check AC power cord. Is the amp plugged into a working electrical outlet? (This has happened to everyone at least once!).

**NO SOUND, PILOT LIGHT ON, TUBES LIT:** Forgot to lower needle onto record. Check speaker connection and input connection (exchange with the other channel). Take a bias measurement. Do all bias test points read zero volts? If so, the B+ fuse is blown. CAREFULLY INSPECT ALL OUTPUT TUBES BEFORE REPLACING THE B+ FUSE because you probably blew one. That B+ FUSE info is on the next page, page 10. (See also “Replacing Tubes” on page 7 if you forgot already what a blown tube might look like).

**ONE OUTPUT TUBE WILL NOT BIAS:** It doesn't want to. Try to will it to comply. If the bias on ONE of the tubes will not adjust at all or reads zero volts, and the tube filament is lit, try replacing replace that particular tube. If the reading still is way off or reads zero, turn the amplifier off. Set your multi-meter to “ohms” (the Omega sign) instead of “DC volts” (NOT the wavy line, that's AC volts!). Now measure the bias test point resistance (that's what Ohms do) between the red test point and the ground test point. It should read approximately 10 ohms. If it reads very high or not at all, then the 10-ohm cathode resistor connected to the tube has become hurt by that tube not being nice to it. One function of this resistor is to act as the final safety valve in case of a shorted (not nice) output tube, preventing damage to the rest of the amplifier should a short occur. Replacing this resistor can be done by anyone with adequate soldering skills. We recommend contacting our service department here at the factory for specific instructions on how to do that because we are only giving you enough information in this owner's manual to *almost* be dangerous.

**MAINS FUSE:** If this has blown, A Very Bad Thing has occurred. See page 3.

**B+ FUSE:** The B+ fuseholder is located on the rear chassis near the speaker binding posts. If all of the sardine NONE of the tubes show any bias reading at all, and the lights are on, and no tunes will play, you might have popped a B+ fuse. This fuse is here to protect the output transformer from a rogue tube or some other strange event. Before replacing it, stop and think a minute if you noticed anything, like a bang or crack noise coming from the speaker. Or maybe you notice one of the tubes looks cracked or sick. Or maybe you smelled something funny? And saw a tube take off and glow bright red or orange? Any of these events could be a tube "running away". If you are aware of what went down and can clearly see the offending tube, then yes, do replace the bad tube and then replace this B+ fuse. Always check the bias on a new tube as the amplifier warms up and watch him closely like a new puppy to make sure he behaves for the next little while. The fuse is a 4/10th Amp, 250v MDA 4/10 SLO-BLO (time delay). The size is 1/4" x 1 1/4". Only use a ceramic fuse here as the glass ones sometimes flame out or crack. Do **not** use a Fast Blow fuse or you will be replacing them on every downbeat. And remember those 400 volts we mentioned? They are living here on this fuse, so you had better **MAKE SURE THE AMPLIFIER IS OFF AND UNPLUGGED AND DISCHARGED** before you play with this!

**SWAPPING TUBES:** Three tube types that are electrically and plug-socket compatible with the 12AT7A dual triode include the 6021, 6679, and the ECC81. There is no exact replacement for the 6414 dual triode, although the 12BH7 or 12AT7 are pin-compatible substitutes, so in a pinch you can jam one of those in to get you by for a few days. The 6414 is really the best choice here, for this circuit, trust us. Actually think long and hard before just trying to score some golden lovely tubes on ebay for \$125 each. Are they really what they claim to be? (Paint can be scraped off or applied at will.) Are they really new? (Hard to tell sometimes.) Are they tested? Were they tested for optimum performance in a Manley MAHI? We didn't think so. By virtue of our experience, testing, and selection we do recommend you obtain replacement tubes from the factory. We will indeed be looking after the best interests of you and your MAHI in our tube selection travails.

**Digging around inside:**

Yes there are user-servicable parts inside! (Contrary to what The Safety Regulatory People tell us to declare on the rear of the chassis, and you have to be a handy kind of user...) But, as with other vacuum tube based products, there is also high voltage present. Therefore caution must be used when covers are removed; otherwise there could be Shock Hazard. Probably not enough to kill you. Only enough to severely annoy you should you inadvertently grab onto the B+ volts. As with all mains-powered gear make sure the mains power is off and mains cord is unplugged if you are planning to get inside and dig around in there. If the amp has been powered up within the last 15 minutes **stop!** and let the large electrolytic capacitors discharge otherwise you could still get a shock even though the unit is unplugged. Really! You will need a #1 Philips screwdriver to remove the bottom cover screws. Use one hand only when reaching into the enclosure or touching any components inside. Keep the other hand away from the amplifier, preferably in your pocket. For real!

**BACKLIT BADGE LAMP REPLACEMENT:** If the tubes are glowing and you have tunes but the MANLEY MAHI badge fails to light up, you may have a burned out badge bulb. This little light bulb looks like a fuse but it is really a light bulb so don't try to put a fuse in there. It is sometimes called a "fuse-lamp" and is 1/4" diameter by 1 1/4" long. It is a 12volt, 0.15 Ampere incandescent lamp. If you need a new one and can't find one readily, you can guess that we probably have plenty in stock and you could order a new one from us. After removing the cover, use a small slot driver to help pry the badge's fuse-lamp straight down out of the clip holder. It is of course located right behind the MANLEY MAHI illuminated badge under the aluminum bracket. Don't crush & break the glass. **NOTE! MAHI's shipped after 5/2003 use LED's to light up the badge, so guess what? You will never have to replace these! Hooray!**

**Please direct any other more involved questions regarding the guts of the MAHI to  
MANLEY LABS Tech Support for further assistance.**

**Taking advantage of the amazing technology of email: [service@manleylabs.com](mailto:service@manleylabs.com)  
is the best way to reach us, because we might be eating lunch or something.**

## TUBE FAQ

**A few general all-too-frequently-asked vacuum tube questions from the manleylabs.com FAQ as found on our website are answered here in case you don't have internet access (which we don't doubt because after all you bought vacuum tube amplifiers, didn't you?):**

(Don't take that comment personally. EveAnna still drives air-cooled Volkswagons... We're not perfect either.)

### **FAQ #16. Do you sell tubes?**

I don't know what you're talking about.

### **FAQ #16a. I need to retube my Manley amplifier. Do you sell tubes?**

Sorry. Just kidding. Yes, of course we do. □ We have about 100,000 tubes in stock of the several major types we use. □

### **FAQ #16b. Why should I buy tubes from you?**

We are only as good as our worst tube. We are very selective about which tubes we use in Manley products and we have several different testing and burn-in jigs to test for certain parameters which will be most important for that tube in a given circuit. We will test and select a tube set for you that will be optimized for your Manley piece of gear and in most cases, your tube set will actually be tested in another one of what you have.

### **FAQ #16c. Are tubes expensive?**

Not especially. Although I might have made a killing in the stock market had I invested the money I instead put into finding and stocking these large quantities of tubes ten years ago when the USA military were dumping their stocks of NOS JAN vacuum tubes. Seriously, there is the stocking cost to consider in the cost we must charge, development charge of the computerized test jigs we built, then more importantly the time it takes one of our guys to run a little tube through its qualification procedures. Remember, a given tube cannot be *improved* during testing. It is the way it is, and one hopes it stays that way. It can only be selected, and in selecting that tube that will work really well for your piece of gear, we probably had to throw away several. In some cases we might have had to go through 30 tubes to find the quietest one, or the one with the lowest microphonics, or the one with the best internal matching, depending on what parameters are important for that circuit. That is all factored into the cost somewhat, but no, overall, we don't charge enough for replacement tubes.

### **FAQ #16d. NOS? JAN? What does *that* mean?**

New Old Stock. Joint Army Navy. Yes our military used to use vacuum tubes. As long as the glass doesn't break, tubes are impervious to a nuclear explosion's electromagnetic pulse unlike little silicon devices whose little junctions would go poof!

### **FAQ #16e. Good to know. How long do tubes last?**

Some of them are dead out of the box. Some tubes don't make it through burn-in and after a few days they just go noisy or quit. Sometimes UPS sabotages our shipments and after all our testing efforts the tube arrives broken at your place. Sometimes a tube decides to end it all early and intentionally misbehaves after a few months. Other tubes are real troopers (like my 98 year old neighbor) and run strong for 30 years. We have documented cases of power tubes in Manley amplifiers going over 60,000 hours non-stop in recording studios 24/7/365 without a re-tube. In one case in particular, the amplifiers were never turned off and had their own dedicated air conditioning for the amplifier rack they lived in. This certainly contributed to their long life.

## More silly vacuum tube questions...

### **FAQ #16f. Should I turn off my gear between uses?**

While power cycling is a factor for ultimate tube life, there also is a fixed number of electrons that can ultimately jump off the cathode. In general we do recommend if you aren't using the gear for more than a few hours you should power it down. Do you leave the lights on in your house when you are away?

### **FAQ #16g. But it sounds different when you first turn it back on. What is the warm-up time for this gear?**

I generally recommend 45 minutes warm-up time for everything to reach operating temperatures and sound like it's supposed to.

### **FAQ #16h. What about break-in time for new gear?**

We burn in the gear for a couple of days before it is shipped out. Folks report that after about a week of break-in that it sounds better. Some of the more fussy people of course report that full break-in takes *much* longer....

### **FAQ #16i. How do I know a tube is broken?**

All the vacuum has leaked out.

### **FAQ #16i.i After the vacuum leaks out, where does it go?□ Is there some way to collect it and put it in another tube, to make it last longer?**

You have to suck really hard.

### **FAQ #16j. No really, how do I know a tube is broken?**

Usually a tube whose glass has been broken or cracked usually will have a white powdery like substance inside it where all that silvery stuff used to be. No, it is not cocaine and we didn't put it there..

### **FAQ #16k. Does the glass explode?**

I haven't seen it happen. Usually the glass will just crack at the base of the tube if it is going to physically break due to a sudden change in temperature and "all the vacuum will leak out".

### **FAQ #16l. Other than outright failure of a tube, how do I know when it is time to re-tube?**

Generally speaking, for the small tubes, if you notice an unacceptable increase in background noise ("hiss") then the tube who is responsible for making the gain in the circuit probably needs to be replaced. The tube(s) making the gain will usually be shorter than the output tube. Common types we use for gain in most of our circuits will be 12AT7, 6201, 12AU7, 5814, 12AX7, 5751, or 6072. The output buffer tube in most of our line-level circuits will be either the 7044, 6414, or 12BH7. These tubes usually don't cause too much trouble and either work or don't work. Turn the lights off and see if you see the little tubes glowing. Look for one that looks like it has cocaine in it.□

For the power tubes in our amplifiers, after a few years if you notice a small revolt going on where several of the output tubes are misbehaving or getting hard to bias, you might consider doing a full re-tube. Keep the old ones that did not join the revolution as emergency spares.

### **FAQ #16m. Can I change a tube myself?**

R.T.F.M.

Do you call in specialists to change your light bulbs for you?

## Optimising Your Sound System

This section is full of Hutch's little hints that may help you get the most out of your stereo - and it may not cost anything or cost very little. Probably, you know most of this, but hopefully some of it may be new or refresh your memory or just be refreshing reading in a manual.

A very important factor is your speakers. Hopefully you have good speakers and they are appropriate for your power amplifier. What is appropriate? Well, with 50 watt of tube power per side and probably a limited budget we would hope for reasonably efficient speakers so that the system will get loud enough for the music you listen to. The "spec" to look for is "sensitivity" or "efficiency". A speaker that is 95 dB efficient will easily get as loud with 50 watts as 85 db speakers with 150 watts. "85" will do if you only listen to folk or chamber music. Usually you pay about the same for high sensitivity speakers but in amplifiers more watts is more \$. By the way, many reviewers confirm that 50 tube watts is similar to 100 solid state watts. If you are buying speakers, it is wisest to carefully listen to them before buying. You will most likely like them longer if they tend to sound natural and real rather than over-emphasized in some area. In other words, think "accurate reproduction" not "numbers" and "hype".

The price of speakers is often directly related to the low frequency response. Great lows generally require deep pockets and plenty of power. Thanks to "home theatre" there are a lot of powered subwoofers available that won't drain your resources. Get one that connects to speaker outputs so that it follows your input selection and volume control. This makes connecting them pretty easy.

There are some very interesting speaker tricks. Most people just place them wherever it is convenient. Spouse approval is a real factor. We suggest that you experiment with speaker placement, then when they sound 100% better you bring in the spouse and demonstrate the difference. They should be able to hear the improvement and may totally agree with your choice. You should aim for equal distances between your listening position to each speaker and from speaker to speaker. The ideal is an "equilateral triangle". Try to get the speakers off the floor, and away from the walls (both side and back). The angle of the tweeter or speaker front panel to your face is also critical and experiment with that too. You should be getting a smooth frequency response so that highs and lows are balanced and mids not too prominent or distant. It should simply sound "natural". When we buy color TVs the first thing most of us relate to is flesh tones because it is something we all relate to and know when they are right. The equivalent thing in audio is vocal tone. We have evolved amazing discrimination for the varieties of human voice and much less for other instruments. Use a few well recorded CDs with vocals and adjust the speakers to get the most natural voices. If you are lucky, you will end up with a system that creates a 3D picture of the music that not only has left/right width but a solid distinct center. It should also make some sounds seem in front of the speakers and some behind. We have heard some systems with our amplifiers even give an illusion of the height of the individual musicians. Most rooms are longer in one dimension. Some systems sound best with the speakers across the short dimension and the listening position part way back but not right at the back wall. Some systems are better across the long dimension. The only way to find out is to try.

If you are getting this amazing imaging and soundstage, you may be interested why you have it if you have a nice vacuum tube amplifier. These are very audible effects that seem to be beyond normal measurement technique or textbook electronic theory. This effect is directly related to the amount of negative feedback used in a design. The less feedback the greater the imaging. In transistor amplifiers it has been common practice to use more than 80 dB of negative feedback. Conventional designs need it because transistors are not particularly linear devices and it forces the circuit to get low distortion figures as well as very high damping factors. Tubes are much more linear and inherently low distortion. Tube amplifier designs use far less negative feedback (less than 20 dB) as a result. We speculate that the negative feedback may have a negative effect on transient accuracy. It is reasonably documented that the feedback does reduce the lower order harmonics in distortion but can raise higher order harmonics that are more audible. Feedback also makes the transition from clean to clipping very abrupt and abundant with high order harmonics. The best audio devices always seem to be simple & aesthetically balanced, with form following function.

## **More Helpful Hints from Hutch...**

You may have bought a great system but there is a good chance that you are only getting a fraction of its potential. Very frequently we have experienced top quality electronics sounding unimpressive simply because acoustics were ignored. Even amongst studio engineers, few can really tell the difference between good speakers in a bad room and bad speakers in a good room - but they all know good speakers in a good room and very likely so do you. Acoustic techniques are better explained in books on recording studio construction. You can buy good ready-made acoustical materials and/or build them yourself for a fraction of the cost. Dollar for dollar, you can expect far greater improvement with acoustic treatment than expensive interconnects.

Most people think acoustics is about sound-proofing but there is a lot of info available for improving the reproduction of music. Sound-proofing is usually expensive. Luckily just improving the acoustics in a room can be pretty painless. You may be able to change or move what is on the floors and walls (without getting expensive or ugly). The improvements may be dramatic.

Number One on the bad list is parallel surfaces. That pretty much includes most rooms. Parallel surfaces can support a very short echo that is known as a standing wave. It boosts some frequencies and cuts others. This effect is often called comb filtering because of the multitude of peaks and dips. One cure is breaking up the big surfaces with a variety of smaller ones. The good news is that book shelves, curtains, wall hangings or macrame, plants, furniture and lamps all help. Not only does this balance live surfaces with dead ones but "checker-boarded" areas also act as a sort of diffuser. You can probably build low cost effective and attractive diffusers or have them made if you want something better (and more efficient). Number Two is very unbalanced room treatment. Both too "live" and too "dead" is generally bad. One might think that wall to wall carpets & curtains is going to be fine but watch out. All that stuff only eats highs and a little mids, but doesn't do anything to the lows. The lows end up very live in contrast to very dead highs. One way to balance this is get some thick absorption into the corners. Thick absorption in the corners is most effective to lows. The idea is to balance high and low absorption. Even normal speech sounds weird in near empty rooms with plain painted gypsum walls and hardwood floors. The simpler the decor the more intense the acoustic problems. The only hints we can offer is that the wall behind the speakers and behind you are often the most important. You can build some simple absorbers. Simply cut two 4'X8' pieces of 2" rigid fiberglass or open cell foam rubber into 16"X8' strips and wrap some white cloth around them. Easy, clean looking and cheap. Experiment, lean them against the wall at various places. Even very experienced acoustic designers experiment, listen then decide rather than attempting to predict every result. A variation is to use "perf-board" as a backing if you intend to stretch the fabric reasonably tight. It may also help with hanging the strips to the walls. Perfboard with a one or two inch space behind it is an alternative front surface to increase diffusion or can do double duty as a simple helmholtz absorber (for the low mids) and can be effective on the ceiling. You can hang a few up there either flush or dropped a few feet if you have the height to absorb lower frequencies. The wall behind the listening position is usually responsible for too much or too little lows compared with the rest of the room. Read up on slat and membrane absorbers for problems there - the panels described above won't help much for that.

Number Three is lack of left/right symmetry. In order to get the left and right similar sounding and getting a rock-solid center you should have identical left and right walls and distances. The ideal is a perfectly symmetrical room but this may not be practical. Again, try to achieve this with positioning. Some of the "test" CDs have a variety of low frequency tones or sweeps. Use them to find rattles and buzzes in the room. Lamps and fixtures, some cabinets and components can do this. A little tape or glue can often fix these types of things. If you are getting serious about this kind of thing you can get a variety of test gear from measurement mics to real time analysers or computer software. These are useful tools but do not depend on the readings unless you are very experienced using them. Best to use your ears and use the test gear to verify what you hear and to document the changes. Remember that test gear neither makes records nor listens to music. Frequency measurement often ignores "time" and exaggerates some factors and glosses over others. Steady tones are virtually useless in real rooms. The more comprehensive tests give complex data that needs to be correctly interpreted to be useful. Use 'em but don't jump to confusions. Always use ears too. Ears are fabulous instruments.

# CREDITS

# MANLEY MAHI

An EveAnna Manley Production

**Featuring concept, layout and industrial design by EveAnna Manley.**

**Starring: Paul Fargo for Input Innovations  
Hutch for Output Outovations**

**Mastered by: Baltazar Hernandez**

In keeping with our new tradition of naming fresh new Manley HIFI products after aquatic creatures, we set out to revisit the 50-ish watt monoblock idea to bring you the MAHI.

From our collective creative brains issued forth all the clever circuitry and schematic design.

Joe Rodriguez heads up the Manley Magnetics department. The special output transformer used first in the Stingray (which is more or less a stereo integrated version of the MAHI circuit) resulted from plenty of studied calculations, laborious winding and lammng, and intensive batteries of tests both on the bench and in our listening environs. All the tunes must pass through this iron beast before reaching the final speaker destination and so it was an important thing to do right. We make this little output transformer sound BIG.

Balta did all the circuit board and metal work drawings and assembled the prototypes.

Humberto, Gamma, Martin, Jose-Luis, and Smokey measured and aligned everything as Quality Control Technicians are prone to do.

You can blame this silly manual on EveAnna and Mitch with some intelligent ramblings contributed by Hutch. There are no pretty pictures in this manual because everything is so clearly labelled on the chassis and that epoxy paint Elias uses on the silk-screen is nearly impossible to get off and so we didn't think you would mind having to just look directly at the amplifiers to understand what we are talking about in these pages.

All the strange and extraneous remarks you have noticed so far in this Owner's Manual have been put here on purpose because we know you will keep reading so you don't miss the next quip. In the rare case that you find a misspelling or an error in grammer in this Owners Manuel, please consider that it was put there for a porpoise as their are allways some people looking for missteaks and they might as well find them hear.

## SPECIFICATIONS

Input Impedance: 110 Kohm

Input Sensitivity:	TRIODE	UL
FB MIN:	175mV	155mV
FB STD:	312mV	340mV
FB MAX:	480mV	566mV

Gain: 29dB

Negative Feedback: MIN= 3dB; STD=6dB; MAX=10dB of global NFB

Max. Output Power defined as power output reaching 1.5% THD @ 1KHz

into 5 ohms:	TRIODE	UL
FB MIN:	18W	20W
FB STD:	27W	42W
FB MAX:	28W	46W

into 8 ohms:	TRIODE	UL
FB MIN:	14W	24W
FB STD:	24W	40W
FB MAX:	25W	41W

Signal to Noise Ratio Ref. 1W: Typically 82 dB A-WGT 20-20K

Noise Floor: Typically 150 $\mu$ V = -74dBu A-WGT  
Typically 650 $\mu$ V = -62dBu unweighted

Dynamic Range: 83dB

THD+noise @ 5W less than 0.15%

Frequency Response at full power UL mode w/MAX NFB: 20 Hz to 20 kHz FLAT

Frequency Response at 5W into 5 ohms: 10 Hz to 30 kHz FLAT, -3.75dB @ 100KHz

Recommended Speaker Load: Optimized for 5 ohms

Actual Output Impedance:	TRIODE	UL
FB MIN:	2.83 ohms	3.57 ohms
FB STD:	1.87 ohms	2.16 ohms
FB MAX:	1.28 ohms	1.36 ohms

Power Consumption (idle): 102 Watts (0.85A @ 120VAC)

Power Consumption (at Rated Full Power): 168 Watts (1.4A @ 120VAC)

Vacuum Tubes: 1 x 12AT7WA Ei, 1 x 6414 JAN NOS, 4 x EL84 Output per monoblock

Output Tube Quiescent Standing Current: 25mA

Set Bias for 250mVDC measured across each 10 ohm cathode resistor

Fuse types for 120VAC operation: MDL or MDA 3 AMP / 250 Volt SLO-BLO

    240VAC operation: MDL or MDA 2 AMP / 250 Volt SLO-BLO

    B+ FUSE: MDA 4/10th AMP, 250 Volt SLO-BLO

Dimensions: 11" deep x 10" wide x 5" tall

Shipping weight each: 18 pounds

Specifications subject to change because they just might.

## WARRANTY

All Manley Laboratories equipment is covered by a limited warranty against defects in materials and workmanship for a period of 90 days from date of purchase to the original purchaser only. A further optional limited 5 year transferrable warranty is available upon proper registration of ownership within 30 days of date of first purchase.

Proper registration is made by filling out and returning to the factory the warranty card attached to this general warranty statement, along with a copy of the original sales receipt as proof of the original date of purchase, or registration can be made online in the Tech Support section of [www.manleylabs.com](http://www.manleylabs.com).

This warranty is provided by the dealer where the unit was purchased, and by Manley Laboratories, Inc. Under the terms of the warranty defective parts will be repaired or replaced without charge, excepting the cost of tubes. Tubes are warranted for six months provided the warranty registration is completed as outlined in paragraph 1.

If a Manley Laboratories product fails to meet the above warranty, then the purchaser's sole remedy shall be to return the product to Manley Laboratories, where the defect will be repaired without charge for parts and labour. The product will then be returned via prepaid, insured freight, method and carrier to be determined solely by Manley Laboratories. All returns to the factory must be in the original packing, (new packing can be supplied if needed), accompanied by a written description of the defect, and must be shipped to Manley Laboratories via insured freight at the customer's own expense. Charges for unauthorized service and transportation costs are not reimbursable under this warranty, and all warranties, express or implied, become null and void where the product has been damaged by misuse, accident, neglect, modification, tampering or unauthorized alteration by anyone other than Manley Laboratories.

The warrantor assumes no liability for property damage or any other incidental or consequential damage whatsoever which may result from failure of this product. Any and all warranties of merchantability and fitness implied by law are limited to the duration of the expressed warranty. All warranties apply only to Manley Laboratories products purchased and used in the USA.

Some states do not allow limitations on how long an implied warranty lasts, so the above limitations may not apply to you. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above exclusion may not apply to you.

This warranty gives you specific legal rights and you may also have other rights which vary from state to state.

**MANLEY LABORATORIES, INC.**

**13880 MAGNOLIA AVE.**

**CHINO, CA. 91710 USA**

**TEL: (909) 627-4256**

**FAX: (909) 628-2482**

**for Tech Support email: [service@manleylabs.com](mailto:service@manleylabs.com)**

**website: [www.manleylabs.com](http://www.manleylabs.com)**

# WARRANTY REGISTRATION

We ask, grovel and beg that you please fill out this registration form and send the bottom half to:

MANLEY LABORATORIES  
REGISTRATION DEPARTMENT  
13880 MAGNOLIA AVE.  
CHINO CA, 91710 USA

**Or** you may FAX this form in to: +1 (909) 628-2482 **or** you may fill in the online warranty registration form found in the Tech Support section of our website [www.manleylabs.com](http://www.manleylabs.com) **or** you can be really diligent and register your warranty three times to see if we get confused!

Registration entitles you to product support, full warranty benefits, and notice of product enhancements and upgrades, even though it doesn't necessarily mean that you will get them (Just kidding!) You **MUST** complete and return the following to validate your warranty and registration. Thank you again for choosing Manley gear and reading all the way through The Owner's Manual. (We really mean that sincerely, the bit about thanking you for choosing our gear. THANK YOU!!!)

MODEL **MAHI** SERIAL #'s \_\_\_\_\_

PURCHASE DATE \_\_\_\_\_ SUPPLIER \_\_\_\_\_

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*PLEASE DETACH THIS PORTION AND SEND IT TO MANLEY LABORATORIES*

MODEL **MAHI** SERIAL #'s \_\_\_\_\_

PURCHASE DATE \_\_\_\_\_ SUPPLIER \_\_\_\_\_

NAME OF OWNER \_\_\_\_\_

ADDRESS \_\_\_\_\_

CITY, STATE, ZIP \_\_\_\_\_

EMAIL: \_\_\_\_\_

TELEPHONE NUMBER \_\_\_\_\_

COMMENTS OR SUGGESTIONS? \_\_\_\_\_

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