



# CAD-808/ *Rocket 88*

## OPERATING MANUAL

**NOTE:** Before installing your new Rocket 88, please read this manual carefully as it will inform you of the Rocket 88 specifications, proper installation procedures and operation procedures. Also included in this manual are guidelines on how to properly service and care for your new Rocket 88.



## ***CAD-808/ROCKET 88 STEREO AMPLIFIER***

Dear Audiophile Friend:

I would like to take this opportunity to personally thank you for purchasing your new Cary Audio Design, Rocket 88, stereo amplifier. I have spent countless hours designing and voicing the Rocket 88. In fact, I have had so much fun during and after the design phase of the 88. There are special product design projects that are stand out. Three come to mind. The CAD-805 mono blocs, the V12 stereo amp and now the CAD-808, or to be better known as the Rocket 88. The new Rocket 88 is a real treat to me personally and I hope for you as well.

The new Rocket 88 is a departure from most home audio amplifiers available on the market today. I have deliberately eliminated a pre-gain stage from the Rocket 88 circuitry. I have discovered over years and years of designing and listening to audio amplifiers, that the more gain and or buffer stages incorporated, the less transparent the amplifier becomes. The basic premise I started with on the Rocket 88 was to develop a true vacuum tube linear amplifier. An amplifier that would mimic the input signals up stream of the source signals. The Rocket 88 was to be a true linear final amplifier. The absolute final stage before the loudspeaker with only a set of output tubes with an on board phase inverter. In simplistic terms, an amplifying device with minimal gain to provide the output power to drive loudspeakers. The Rocket 88 would depend on a high quality, high output, separate preamplifier in the chain. In this case I used the Cary Audio Design, SLP-2002 preamplifier. My source material came from a Cary, CD-306/100 CD

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player. In addition, I used a Rega P9 turntable with a Dynavector XR-1 moving coil cartridge. Each and every time I eliminated a pre-gain stage on the prototype of the Rocket 88 the sound improved vastly. I mean, the difference was not subtle. The amplifier had more control of the loudspeakers and the depth of field went through the back wall. I also noticed a dramatic difference in various recording. Each CD or record had a character of its own. Far more prevalent than in the past with amplifiers incorporating numerous gain and local feedback circuitry. By the time I started zeroing in on the final design, I realized this amplifier would take some explaining. It is that different. Only output tubes and a phase inverter. Oh, the on board EL-84 tubes are used as current sources for the 6922 phase inverters. One for each channel. The EL-84's do not do any of the amplifying but they sure allow the 6922 phase inverters to operate in an equal balanced fashion.

From the first incarnations of this project as a high power, high gain, high feedback amplifier to the final result was intriguing to say the least. In fact the opposite was now providing musical bliss in my listening room. A full circle from a conventional audio amplifier.

I realize you may think I am rambling but I am just so excited about the Rocket 88 amplifier. Imagine listening to a small, compact tube amplifier driving a pair of 15" woofers, B&W 801, Nautilus, loudspeakers to thunderous levels in both the 20 watt class A triode mode and the ultra-linear pentode mode at 40 watts. Full control with complete coverage of frequency extremes. Just can't imagine it any better. Love it!

Please read the complete operating manual before turning on your new Rocket 88 (CAD-808) and get ready for the musical time of your life.

Thank you once again for your interest and support of Cary Audio Design.

Dennis J. Had  
President

2-4-02

# THEORY OF OPERATION

## CAD-808 / ROCKET 88

For the technically minded, a review of the circuit is in order. Your new CAD-808 / Rocket 88 operates in push pull, class A as well as class A/B mode, Ultra-linear. The output stage KT-88 tubes are biased with a negative fixed bias voltage for low distortion and maximum output capabilities. In the triode mode, the Rocket 88 is the most linear and yields the most musically satisfying presentation. The output power is 20 watts of triode power each channel and 40 watts per channel in the ultra-linear, AB mode.

The output transformers on the Rocket 88 are the most important component in the amplifier and have been specifically designed by Cary Audio for use in the Rocket 88. We have taken the approach in the output transformer design not to dissimilar to the single-ended amplifiers we design and produce. The primary and secondary windings on portions of the output transformer are wound in a bi-filer process with the two inductors interleaving sixteen times. The bi-filer wind (two conductors wound at the same time) will yield the closest balance and coupling of any design currently utilized in vacuum tube output transformers. The E/I laminents used are silicone impregnated hipsil steel contributing to the extremely low loss of the Rocket 88 output transformer. The above process is similar to the single-ended air-gap design found on the Cary single-ended output transformers. A balanced drive signal is applied to the control grids of the KT-88 output tubes from the 6922 phase inverter/driver tube. This tube is configured in a dual differential network that operates in the following manner: The first section of the dual triode 6922 tube is direct coupled to the input RCA or XLR jack on the rear apron of the amplifier. The drive signal is amplified through this first section in a class A, grid driven circuit with the output signal inverted 180 out of phase at the anode and then coupled to one half of the push-pull bank of KT-88's. At the same time the second half of the dual triode 6922 is cathode driven in a grounded grid non-inverting class A gain stage coupled to the other half of the push-pull bank of KT-88's. With this network the balance is a perfect plus and minus dual drive signal to drive the final output KT-88's in a balanced push-pull configuration. The 6922 cathodes are direct coupled to the anode (sit on top) of the EL-84 in a infinite current source configuration. The EL-84 stage takes the place of the

conventional dropping resistor network found in conventional gain stages.

The power supply transformer is designed to operate at a 200% continuous commercial service at the full rated 80 watt output level. The high voltage power supply section is a full wave center tap configuration (not some cheap voltage doubler as used in many competitors amps) to a dual PI network with two filter chokes. This high voltage section feeds the final output KT-88 tubes. An additional choke, filter network serves as the power supply for the 6922 phase inverter tubes. Another supply is the negative DC grid bias and current source voltage for the EL-84's.

A great deal of attention during design of your new Rocket 88 was concentrated on the "overload recovery" ability of the amplifier. The ability of an amplifier to instantly recover from clipping is much more important than is commonly believed. In the power war of amplifier manufactures the mentality is focused on high and then even higher power output to solve the clipping problem. When in reality the most critical aspect is how fast of a recovery an amplifier can achieve after overload. With the incredible dynamics range of live and in turn recorded music, even 2,000 watts of power is not enough. Most of the music being listen to in an average home listening room is only requiring about 3 watts of power. It is on the transients of loud low frequency program material that tremendous signal voltages will appear at the input of the amplifier. It is in this situation that the overload recovery ability of an amplifier is of critical concern. The Rocket 88 extols its merits in the ability to handle transients and instantaneously recover from brief or even extended overloads. The Rocket 88 will overload symmetrically at any frequency in the audio bandpass. The Rocket 88 will also yield faithful reproduction of extremely low frequencies at full output levels. Power transformer, power supply regulation and output transformer design and careful shaping of the overall frequency response curve all play a very important part in the ability of the Rocket 88 to recover quickly when over loaded. If one were to monitor the high voltage rail voltage (390 VDC) of the Rocket 88 during soft and also loud music passages it would be found there is no more than a volt or so change from soft to loud passages.

Another technical feature of your new Rocket 88 amplifier is stability. The Rocket 88 maybe operated with no load (without speaker) without damage to the amplifier, output transformer or tubes.

Operating the Rocket 88 stereo amplifier is a simple procedure since each unit is designed for long term stability in virtually any home operating situation. Therefore, if the unit is operated outside the parameters outlined in this owner's manual, damage may result. Please read this manual carefully before putting your new Rocket 88 amplifier in operation.

The following definitions are applicable to this manual. These definitions must be followed explicitly.

**WARNING**  
**HAZARD PRESENTS PERSONAL INJURY OR DEATH**

**Caution**  
EQUIPMENT DAMAGE MAY OCCUR BUT NOT PERSONAL INJURY

**Note**  
Proper performance of the amplifier cannot be ensured if disregarded

## **Specifications**

The following section describes the Rocket 88 basic specs. Specifications are subject to change without notice or obligation.

**DIMENSIONS:** 10" W x 18" D x 6" H

**WEIGHT:** 45 Lbs.

**CIRCUIT TYPE:** Push-Pull Triode Class A, Ultra-linear class/AB

**POWER OUTPUT:** 20 Watts Triode, 40 Watts Ultra-Linear

**INPUT SENSITIVITY:** 3.2 volt for full output

**INPUT IMPEDANCE:** 150,000 ohms

**NOISE AND HUM:** -87dB below rated output

**FREQUENCY RESPONSE:** 10Hz to 82,000Hz + 0 – 3.0dB / 1 watt

**TUBES:** 2-6922 Phase inverter, 2-EL-84 current source, 4-KT-88 output tubes, 2-1629 green eye indicator tubes.

**TRANSFORMERS:** 1-EI laminated core power transformer  
2-Special interleaved output transformer  
3- Filter Chokes  
200% duty cycle on all transformers

**RESISTORS:** 1% metal film

**CAPACITORS:** Polystyrene and polypropylene (oil filled optional)

**POWER SUPPLY CAPACITORS:** 2-560 MFD @ 450VDC  
3-10 MFD Film and foil @ 600  
1-47 MFD @ 450

**AC CORD:** Detachable 3 conductor 14 gauge

**AC POWER REQUIREMENTS:** 117 volts AC 50/60 Hz  
300 watts operate  
240 volts AC 50/60 Hz  
300 watts operate

**WARM-UP TIME:** 3 minutes

**BREAK-IN PERIOD:** 100 hours of music playing time

**FINISH:** Black Epoxy power coat, Aluminum Face Plate

**OPERATING DUTY CYCLE:** 24 Hours a day continuous

### **Front Panel Features**

**AC-ON ROCKER SWITCH:** Turns AC power on in the "on" position.

**GREEN (CAT) EYES:** Indicate audio power output, fully closed eye for maximum power

### **Rear Apron Features**

**INPUT:** Signal input connection via either RCA or XLR shielded interconnect cables. Pin #1 is the shield, #2 positive phase signal on XLR connector.

**INPUT SWITCH:** Push in direction of the type of input to be utilized

**OUTPUT:** The 5-way binding posts provide the output to the speaker system. Red = positive, Black = negative

**AC:** 3 conductor detachable power cord

**AC POWER FUSE:** Use only 3 Amp, 250 V slo/blo

**CAUTION**  
**USE OF ANY OTHER PROTECTION FUSE CAN DAMAGE UNIT**

**CAUTION**  
**NEVER REMOVE/INSERT AC LINE CORD WHEN THE UNIT  
IS ON**

**Please remember the above cautions, thank you!**



## Rocket 88 Top Panel

**BIAS LED:** These indicators will light when there is the proper bias voltage operating for the EL-84 current source tubes along with the proper DC grid bias voltage for the final output tubes. **If these LED's fail to light, discontinue use and place a call to the Cary Audio service advisor.**

**TRIODE/UL SWITCH:** These switches change the operation of the Rocket 88 between triode, class A, to Ultra-Linear, class A/B. These two switches maybe switched during operation. If one channel switch is in the opposite position from the other a channel imbalance will occur. There is more gain in the Ultra-Linear position.

**BIAS:** This screw driver adjustment is used to set the proper DC bias current for the KT-88 output tubes. **REMEMBER, THIS ADJUSTMENT MUST BE ADJUSTED WITH A METER READING DC CURRENT!**

**TUBE FUSE:** This is a fast blow ½ amp fuse to protect the Rocket 88 amplifier should an output tube fail.

### CAUTION

**USE OF ANY OTHER PROTECTION FUSE CAN DAMAGE UNIT**

**200 MA. JACK:** This ¼" two conductor jack is used to plug in the supplied meter cable. This is a shorting jack. In other words, when the plug is removed the circuit is automatically connected. You may plug in the test plug while the unit is playing. You may hear a slight click in the loudspeakers when inserting or removing the plug. This is normal.

**SPEAKER:** These switches change the 4 and 8 ohm output taps from the output transformer to the speaker posts on the rear of the amplifier. They maybe operated with the amplifier in operation.

**EYE TUBE:** There are two of these controls. They set the green eye tube intensity. You may set to any desired level for your listen room. The control does not change any of the sonic characteristics of the amplifier.

## INSTALLATION

This section describes the unpacking and installation procedures for the CAD-808 / Rocket 88 amplifier.

**WARNING**  
**MAKE NO ATTEMPT TO PUT THE CAD-808 AMPLIFIER IN**  
**SERVICE**  
**WITHOUT THE BOTTOM PLATE ATTACHED - CONTACT WITH**  
**VOLTAGE**  
**IN THE CAD-808 / ROCKET 88 CAN BE FATAL!!!**

### Unpacking

All shipping containers have been specifically designed to protect their contents and special care has been taken to prevent damage under normal shipping conditions. Mishandling should be evident upon inspection of the shipping container. If damage is found after visual inspection, take care not to destroy the evidence. If necessary, document the damage with photographs and contact the transport carrier immediately.

Carefully remove your new Rocket 88 amplifier from its packing carton, and examine it closely for signs of shipping damage. It is recommended to save all original packing cartons to protect your amplifier from damage should you wish to store it or ship it for after sales service.

### Warranty Card

Fill out the enclosed warranty registration card and return to Cary Audio Design within 10 days of original purchase. Keep your original sales slip with the packing cartons should you ever need it for reference. **Failure to register warranty will limit the warranty to one year.**

## **Amplifier Placement and Set Up**

In general, the location of your new Rocket 88 amplifier is not critical. The best placement in your system is near the speaker system with short lengths of speaker cables. Certain precautions must be taken to ensure optimum performance. Avoid extremely hot locations such as near radiators or other heating units. Keep the top of the Rocket 88 clear of books, paper or other equipment to protect against overheating.

## **Power Requirements**

The CAD-808 / Rocket 88 is designed to operate from house current mains. The design voltage is 117VAC at 50/60 Hz. (Foreign units 240 VAC at 50/60Hz)

## **Cables**

The speaker cables from the output posts of the Rocket 88 to the speaker system can be any convenient length your set-up requires. Select speaker cables of sufficient size to preserve the outstanding performance capabilities of your Rocket 88. Heavy gauge #16 wire is suitable for distances up to 10 feet; #12 for 25 feet. Our recommendation for best sound is to place the Rocket 88 in between the stereo pair of loudspeakers. Use heavy duty loudspeaker cables with a length to reach from the Rocket 88 to the speakers. Avoid long lengths that have excess slack. If your loudspeaker has the facility for by wiring, then by all means use separate cables or by wire speaker cables. Most audio dealers will have proper speaker cable in stock for this purpose.

Signal input connection is made via the input jacks on the rear of the amplifier located next to the output binding posts. The interconnect cables from the output of the preamplifier can be any convenient length your set-up requires. Through the years we have found that using tube amplifiers like the Rocket 88, it is better to have short loudspeaker cables and long interconnect cables to the preamplifier. The choice of a high quality interconnect cable is important. Once again, your audio dealer will have the proper cables in stock for this purpose.

The tubes used in your new Rocket 88 have gone through a 48 hour burn in process and testing with your individual Rocket 88. They are matched and labeled on the tube boxes. Look at the top panel of the Rocket 88 for the proper placement of the tubes. Be careful to insert the tubes in the proper sockets with the key way in order. At the end of this manual you will also see a block diagram of the tube layout. Your new CAD-808 / Rocket 88 is ready for operation after the speaker, interconnect cables and the vacuum tubes have been installed.

### **AC On Power Switch**

Simply turn the AC power to the ON position (the red bias LED's will light). After 30 to 60 seconds observe that all tubes are lit (filaments) and the green eye tube are illuminated. Should you not observe the above, turn off the amplifier and check the power cord and AC socket.

### **Triode-Ultra/Linear Switch**

On the top of the chassis behind the KT-88 output tubes is located a chrome handle switch. With the handle pushed to the rear of the amplifier the mode of operation is ultra linear. In the forward position the mode will be in triode class A mode. This set of switches maybe switched during listening. A slight click maybe heard in the loudspeakers. This is normal. Usually the triode position will provide plenty of power and is the most preferred position by most audiophiles. (and the designer of the Rocket 88)

### **Bias Setting**

Your new Rocket 88 bias adjustment has been factory set prior to shipping. Please keep in mind that the bias will vary from location to location depending on the AC line voltage. The design of the Rocket 88 is such that you may start listening with the factory set level. **DO NOT TURN THE BIAS SCREW DRIVER SET ADJUSTMENT WITHOUT A DC CURRENT METER!**

The type of meter used must be a DC current meter or a volt ohm meter with a DC ma. current scale. A digital multi-meter is very inexpensive and available at a local Radio Shack or ACE hardware store.

Included with your shipment of the Rocket 88 is a black and orange patch cord with a ¼" male plug and two clips. This is the bias adjustment cable. To check and or set the bias simply place the red clip lead on the positive meter lead. The black clip lead will hook up to the black negative lead of the test meter. The meter must be placed in the DC current mode. If the meter has a selectable scale use the one that measures 0 to 300 ma. DC current. With the Rocket 88 turned on and operating for about ten minutes you will have the resting current level indicated. This measurement should be done without any music playing. A nominal level of 200 ma. Is standard for the Rocket 88. If the level is lower advance the bias adjustment to the clockwise direction. Higher readings, turn the bias control to the left, counter clockwise direction. After you have established a 200 ma. Reading simply pull out the plug from the bias jack. You may hear a slight click in the speaker. This is normal.

Bias levels will change with time of day and power usage in your home. In fact during the summer months with the air conditioner running you may have less AC line voltage available and in turn the bias will be slightly lower. This is not critical. In fact the Rocket 88 is designed to operate in the range of 170 to as high as 270 ma. DC current. The best sound will generally be produced in the 195 to 225 ma. Region. You may wish to experiment if you desire. **NEVER ADJUST BIAS WITH A VOLT METER OR THE METER IN THE VOLTAGE POSITION!**

### **Break In Period**

The tubes, capacitors and output transformers take approximately 100 hours of music playing to fully settle in for peak performance. The Rocket 88 may seem sterile or thin sounding right out of the box. After the first couple of hours you will notice increased depth and tighter bass. This break in period defies all engineering theory, but is true with most audio amplifiers.

## SERVICE AND CARE

**WARNING**  
**MAKE SURE AMPLIFIER IS UNPLUGGED FROM AC MAINS**

### **Rocket 88 Care and Cleaning**

The chassis of the Rocket 88 may be cleaned with a soft rag and Windex (or a similar window cleaner). The frequency of cleaning will be governed by how many hours the Rocket 88 is operated and by operating environmental cleanliness.

### **Tube Replacement**

If it becomes necessary to replace the tubes in the Rocket 88 amplifier, a matched set of tubes of the same brand should be used. A new tube kit is available from your Cary Audio dealer. You should get year's from the output tube with everyday usage and many, many years of use from the 6922's and EL-84 tubes.

### **Factory Service**

Careful consideration has been given to the design of your Rocket 88 amplifier to keep maintenance problems to a minimum. However, it is possible that some problems may arise which cannot be cured by tube substitution. At this point we suggest that you contact our Customer Service Department, phone number 1-919-481-4494, to describe your problem in detail. Do not return the amplifier to the factory without a return authorization number from the Customer Service Department. Cary Audio Design will assume no responsibility if the transportation company refuses to pay a damage claim due to improper packing or lack of insurance should the unit be lost in shipment.

## **WARNINGS**

**MAKE NO ATTEMPT TO PUT THE ROCKET 88 IN SERVICE  
OUTSIDE OF THE  
CABINET. CONTACT WITH HIGH VOLTAGES FOUND IN THE  
UNIT CAN BE FATAL!!!**

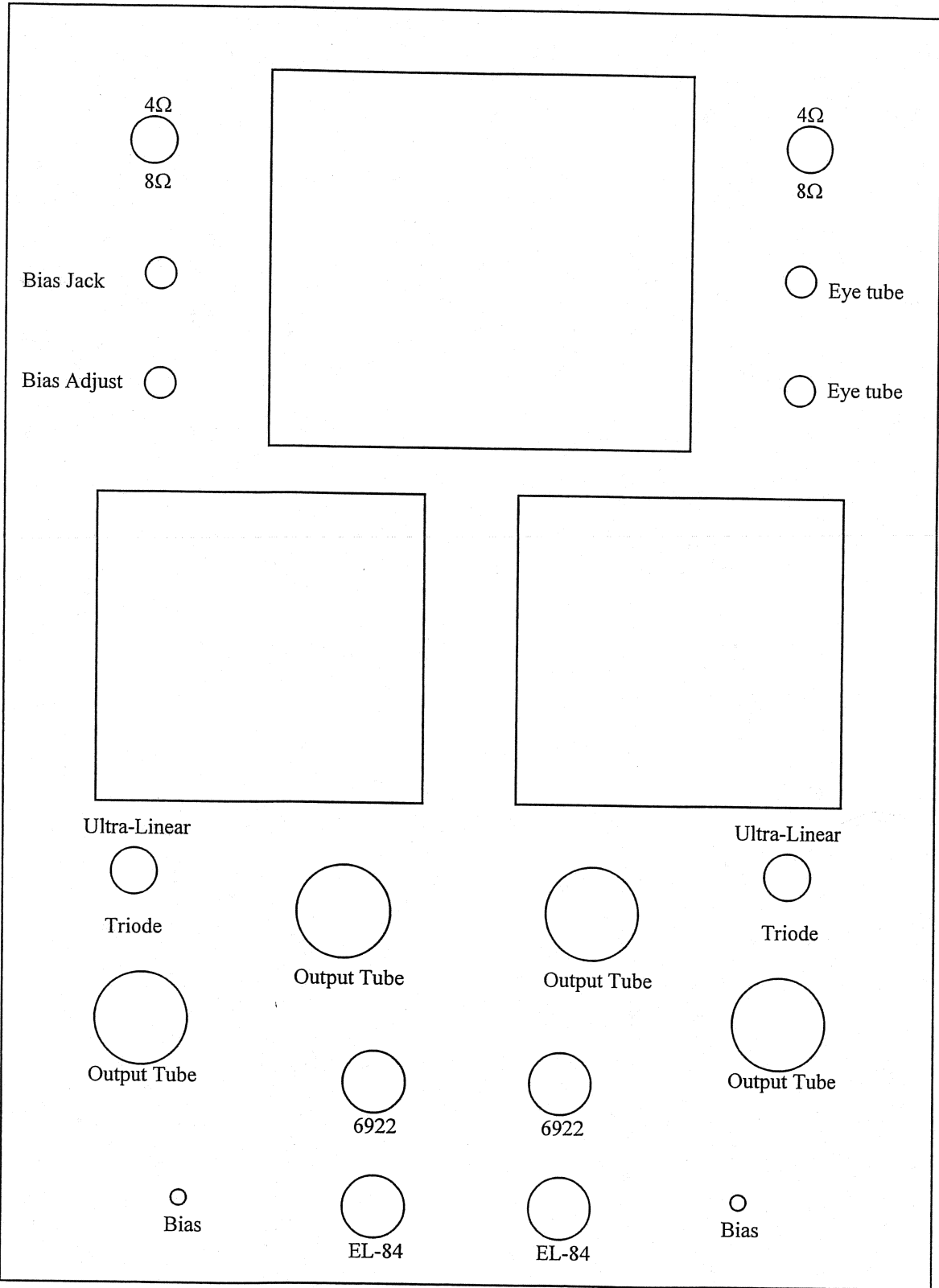
**COMPLETELY REMOVE AC POWER PLUG FROM THE WALL  
AND ALLOW 30 MINUTES FOR THE HIGH VOLTAGE  
CAPACITORS TO DISCHARGE THROUGH BLEEDER  
RESISTORS BEFORE ATTEMPTING TO CHANGE TUBES OR  
CLEAN THE INSIDE OF THE AMPLIFIER.**

## **CAUTIONS**

**NEVER REMOVE/INSERT AC PLUG WHEN THE UNIT IS ON OR  
THE AC POWER SWITCH IS IN THE "ON" POSITION.**

**OBSTRUCTION OF THE TOP PORTION OF THE ROCKET 88  
WILL RESULT IN TUBES OVERHEATING.**

**\*\*\*OBSERVE DIRECTIONS IN THIS MANUAL\*\*\***





**NOTES:**

## UNITED STATES LIMITED WARRANTY

Cary Audio Design, Inc. warrants to the original United States purchaser for use in the United States, that this product shall be free from defects in material (except tubes and AF output transistors) or workmanship for:

Amplifiers and Preamplifiers, Three (3) years from the date of the original purchase.  
Digital Products, One (1) year from the date of original purchase

During the warranty period, Cary Audio Design, Inc. or an authorized Cary Audio Design, Inc. service facility will provide free of charge both parts (except tubes and AF output transistors) and labor necessary to correct defects in material or workmanship.

To obtain such warranty service, the original purchaser must:

- (1) Complete and send in the warranty Registration Card.
- (2) Notify Cary Audio Design, Inc. as soon as possible after the discovery of a possible defect:
  - (a) The model number and serial number;
  - (b) The identity of the seller and the approximate date of purchase;
  - (c) A detailed description of the problem, including details on the electrical connection in the associated equipment and the list of such equipment.
- (3) Deliver the product to Cary Audio Design, Inc. or the nearest authorized service facility, or ship the same in its original container or equivalent, fully insured and the shipping charges prepaid.

Correct maintenance, repair and use are important to obtain optimum performance from this product. Therefore, carefully read the Operating Manual. This warranty does not apply to any defect that Cary Audio Design, Inc. in its sole discretion determines is due to:

- (1) Improper maintenance or repair, including the installation of parts or accessories that do not conform to the quality and the specifications of the original parts.
- (2) Misuse, abuse, neglect or improper installation.
- (3) Accidental or incidental damage.

### WARRANTY DISCLAIMER

Except for the express warranties stated herein, Cary Audio Design, Inc. disclaims all other warranties including, without limitation, all implied warranties of merchantability and fitness for a particular purpose.

### EXCLUSIVE REMEDY

Notwithstanding the foregoing, the purchaser's exclusive remedy for any breach of warranty, express or implied, is limited to the repair or replacement of the defective unit or the refund of the purchase price, at the option of Cary Audio Design, Inc. Under no circumstances is Cary Audio Design, Inc. liable for incidental or consequential damages. Any implied warranties imposed by law terminate one (1) year from the date of purchase.

### FOREIGN PURCHASERS

Cary Audio Design, Inc. warrants its merchandise to purchasers in the United States for use in the United States. It provides no other warranties. If you are a foreign purchaser, consult with your dealer to determine whether your dealer provides any warranty.

The foregoing constitutes Cary Audio Design Inc.'s entire obligation with respect to this product, and the original purchaser and any user or owner shall have no other claim for incidental or consequential damages. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation and exclusion may not apply to you.

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

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