M.A.C.
Magnet And Coil RIAA
Phono Amplifier

BY TUBE TECHNOLOGY

~ USER'S MANUAL ~

TT PART No. McM-02

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Introduction

Thank you for selecting The M.A.C.RIAA Phono Amplifier by Tube Technology.

Please read through this manual so you will know how to operate your M.A.C. properly. After you have finished reading this manual, please put it away in a safe place for future reference.

We have done our utmost in the design and build of the MAC to ensure you a low maintenance, trouble free phono stage that will bring you many years of pleasure as an important part of your hi-fi system.

Please do not forget to complete and return the enclosed registration card.

We wish you many hours of musical enjoyment !

Contents

Conventions

This manual uses the following conventions;

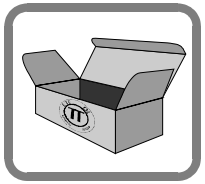
Bold indicates emphasis or a minor heading.

Italic Bold refers to a sub heading of a chapter.

This symbol refers to Notes containing important information set off from the text.

THIS SYMBOL REFERS TO CAUTION MESSAGES AND PROCEDURES WHICH IF NOT OBSERVED CAN LEAD TO DAMAGE OR INJURY

Getting Started



Unpacking

This chapter contains information on;

- ***Unpacking your M.A.C.***

Your phono amplifier is packed in "jiffy-cell" support foam. Grip the M.A.C.and simply lift it out of the box. Remove the the end caps and cellothane bag.

All packing should be retained. Amplifiers returned under guarantee are only accepted in their original packaging.

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1 x M.A.C. Phono Amplifier
1 x Reference Manual & Registration Card
1 x IEC Mains Leads
1 x Allen Key (Lid)

Your preamplifier is supplied with the tubes already in place. Check through the mesh windows on the top lid making sure that the four tubes have not worked free in transit.

Mains Connection

Mains Connection

Earthing Arrangements

This chapter contains information on;

- ***Connecting the M.A.C. to the household mains supply.***
- ***Wiring a mains plug (UK)***
- ***Earthing arrangements***

Your M.A.C. plugs into the mains supply via the IEC socket located on the back panel (see diagram 1). The power supply has been factory set to the correct mains voltage for your country. The voltage setting is marked on the serial badge, located on the rear panel (See diagram 1). Check that this voltage complies with your local supply. The wattage rating is also marked on the serial badge.

When using a pre-power combination it is essential to ensure that no "earth loops" occur, this is when too many earths are connected to the mains earth, resulting in a low frequecy hum through the system. If neccessary you may not need to earth the preamplifier, consult the handbook for your power amplifier or ask your dealer if you are unsure. .

DO NOT CONNECT/SWITCH-ON THE MAINS SUPPLY TO THE AMPLIFIER BEFORE COMPLETING ALL OTHER CONNECTIONS. IF YOU ARE IN ANY DOUBT REGARDING MAINS CONNECTIONS PLEASE DO NOT PROCEED ANY FURTHER WITHOUT CONSULTING YOUR DEALER.

Wiring a Mains Plug

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

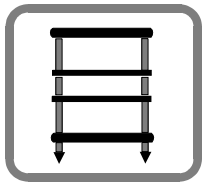
Wire Colour	Label on Plug
GREEN/YELLOW	**E** or EARTH or ⏚
BLUE	**N** or NEUTRAL or BLACK
BROWN	**L** or LIVE or RED

If your mains plug has a fuse, please fit a fuse with **5A** rating.

If your power supply is not set correctly for the local supply or if you intend to move the amplifier to a location where the supply is at a different voltage, it will be necessary to change the voltage switch on the power supply. If this is neccessary please refer to *changing voltage* in the maintenance chapter.

DO NOT SWITCH ON THE AMPLIFIERS BEFORE COMPLETING THE AUDIO CONNECTIONS. IF YOU ARE IN DOUBT REGARDING MAINS CONNECTIONS PLEASE GO NO FURTHER WITHOUT CONSULTING YOUR DEALER.

Installation



Installing & Ventilation

This chapter contains information on;

- ***Installing and Ventilation of your Phono Amplifier***

Ensure that the unit is placed in a stable location that is able to accept the weight of approx. 6 kilograms or 13.2 lbs.

It is not recommended that the phono amplifier is installed in a cupboard or in any enclosed area if there is not sufficient air space and ventilation to keep it cool. A minimum distance of 50mm above the phono amplifier should be allowed as this is where most of the heat is generated. Dedicated racks are available for housing your tube equipment, contact your dealer or Tube Technology for details. Do not locate the phono amplifier close to radiators or any other heat source, this could increase the operating temperature. Do not directly block the ventilation grilles on the top cover of the phono amplifier.

DO NOT SIGHT THE PREAMPLIFIER NEAR WATER OR HEAVY MOISTURE, THE VENTILATION GRILLES ON THE TOP OF THE UNIT ARE AN EASY ACCESS POINT FOR MOISTURE TO ENTER.

Audio Connection

Rear Panel

This chapter contains information on;

- ***Connecting the Inputs & Outputs***

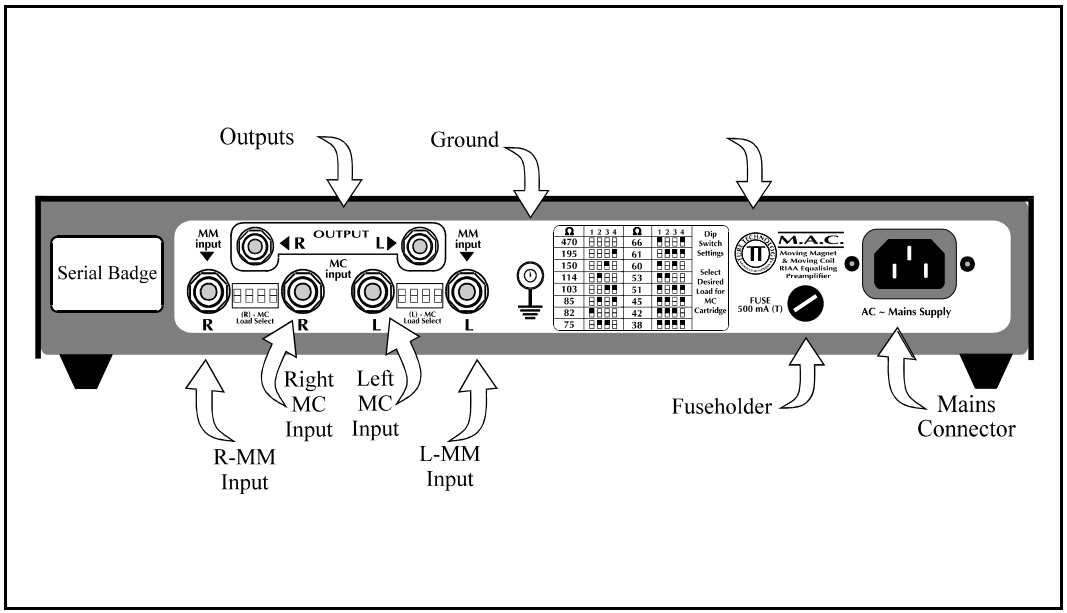


Diagram 1

Connecting the Inputs & Outputs

Your phono amplifier uses high quality connectors to ensure that maximum signal transfer is possible, therefore ensure that all cables used for connection to the phono amplifier are terminated with connectors of similar quality. See Diagram 1 for the Rear Panel layout.

OUTPUT

Connect these outputs to one of the line inputs on your preamplifier, labelled either Phono or Aux 1. If you are using directional cables ensure the arrows point away from the M.A.C. Red denotes the right channel and black the left. The quality of this interconnect is important for sonic clarity, consult your dealer if in doubt.

MM/MC SELECTION

The M.A.C. is shipped from the factory with a default setting for MC. . If you wish to use the MM inputs it will be necessary to remove the lid and select the internal toggle switches to the MM position for each channel. (The label on the carton specifies which input has been selected on leaving the factory either MM or MC)

MM INPUT

The Moving Magnet input is used if the cartridge on your turntable is a moving magnet or high output moving coil type having a typical output voltage of between 1mV - 5 mV. This has a standard 47 Kohm input load impedance. To use this input set the internal toggle switches to both point inward.

MC INPUT

The Moving Coil input is used if the cartridge on your turntable is a moving coil type having a typical output voltage of between 0.05 mV- 1mV. To use this input set the internal toggle switches to both point outward. The load impedance on the mc input has a standard 3 ohm load which can be varied using the dip switch settings - see diagram 1.

GROUND

This terminal is used to ground the turntable earth, usually a separate wire laced with the tonearm lead.

IEC INLET

The IEC connector on the rear of the unit, connects to the mains supply via the mains cable supplied.

FUSE HOLDER

The fuseholder on the rear of the unit protects the unit from serious damage, this fuse is rated at 500 mA Anti-Surge or (T).

DIP SWITCHES

The dip switches are a used to optimise the load impedance of the cartridge. It is recommended that a close value to your cartridge is selected from the 16 options available combined with a listening test until you are satisfied the best load impedance has been chosen. The changes are very subtle as the loading is carried out on the secondary of the step-up transformer, ensuring maximum magnetisation current from your cartridge is used to energise the transformer core.

16 different load settings available

Ω	1 2 3 4	Ω	1 2 3 4	Dip Switch Settings
470	☐☐☐☐	66	■☐☐■	
195	☐☐☐■	61	☐■■■	
150	☐☐■☐	60	■☐■☐	
114	☐■☐☐	53	■■☐☐	Select Desired Load for MC Cartridge
103	☐☐■■	51	■☐■■	
85	☐■☐■	45	■■☐■	
82	■☐☐☐	42	■■■☐	
75	☐■■☐	38	■■■■	

DO NOT SWITCH-ON THE SYSTEM UNTIL YOU HAVE READ CHAPTER 5 **Operating Your System.**

Operating your System

Front Panel

This chapter contains information on;

- ***Switching your phono amplifier ON and OFF.***
- ***Operational Notes***

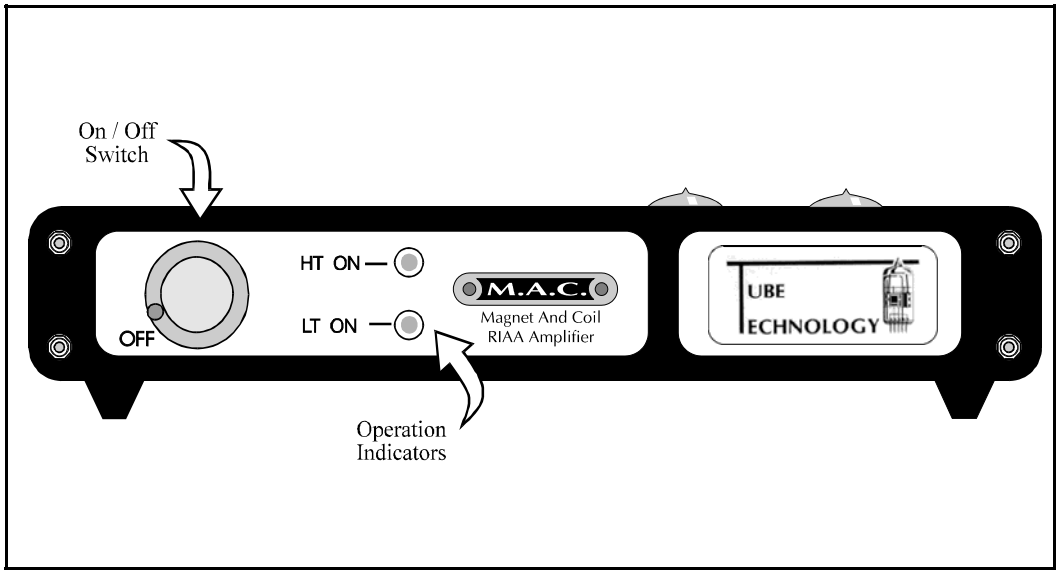


Diagram 2

Switching On & Off

By rotating the knob on the front panel in the clockwise direction the M.A.C. is switched to the On position. By rotating the same knob in the anti-clockwise direction the unit is switched Off. It is always wise to switch on your phono amplifier first and then the pre/power amplifiers after, this always ensures a trouble free warm up. DO NOT SWITCH THE M.A.C. OFF WHEN YOUR COMPLETE SYSTEM IS SWITCHED ON WITH THE VOLUME TURNED UP.

Operational Indicators

These LEDS indicate that the M.A.C. is functional. The HT (High Tension) Indicator is illuminated red and the LT (Low Tension) Indicator is illuminated amber.

Operational Notes

Some users of tube amplifiers believe that because tube amplifiers take some time to warm up that they should be left on all the time. The M.A.C. Phono Amplifier reaches peak performance levels 15-20 minutes after switch on. Unless absolutely necessary it is not recommended that you leave your phono amplifier permanently switched on, this only wastes electricity and tube life, but if necessary the M.A.C. is quite capable of being left switched on for very long periods of time.

DO NOT BE CONCERNED IF THE HT INDICATOR ON THE POWER SUPPLY REMAINS ILLUMINATED AFTER THE UNIT HAS BEEN SWITCHED OFF. THIS IS QUITE NORMAL AND WILL REMAIN ILLUMINATED FOR A FEW SECONDS, WHILE THE RESERVOIR CAPACITORS ARE SLOWLY DIS-CHARGED.

Running-In

This chapter contains information on;

- ***Burning-In your Phono Amplifier***
- ***Tube Information***

Burning-In Amplifiers

"Burning-In" is a generic term given to the basic 'running-in' of the amplifier. You may notice a slight 'electronic-smell' from your phono amplifier during the first few days of operation. This smell is usually caused by various prints and dyes used on the components which takes some time to evaporate This is quite normal and there is no need for concern as your phono amplifier has been extensively soak tested before leaving the factory. This burning-in process continues with your use of the phono amplifier.

This process simply allows for new components like tubes, capacitors and resistors to settle and 'sweeten' enhancing the amplifiers sonic performance. An estimated 40 hours of operation allows your M.A.C. this running-in period.

Tube Information

As with all tubes, their qualities degrade with age due to cathode emission (a natural process common to all tubes) A typical life span of a twin triode signal tube as used in the M.A.C. would be approx. 6000 hours, after which time they should be replaced, thus keeping your phono amplifier at it's maximum sonic performance; Refer to the **Maintenance** chapter.

Maintenance

Care & Cleaning

This chapter contains information on;

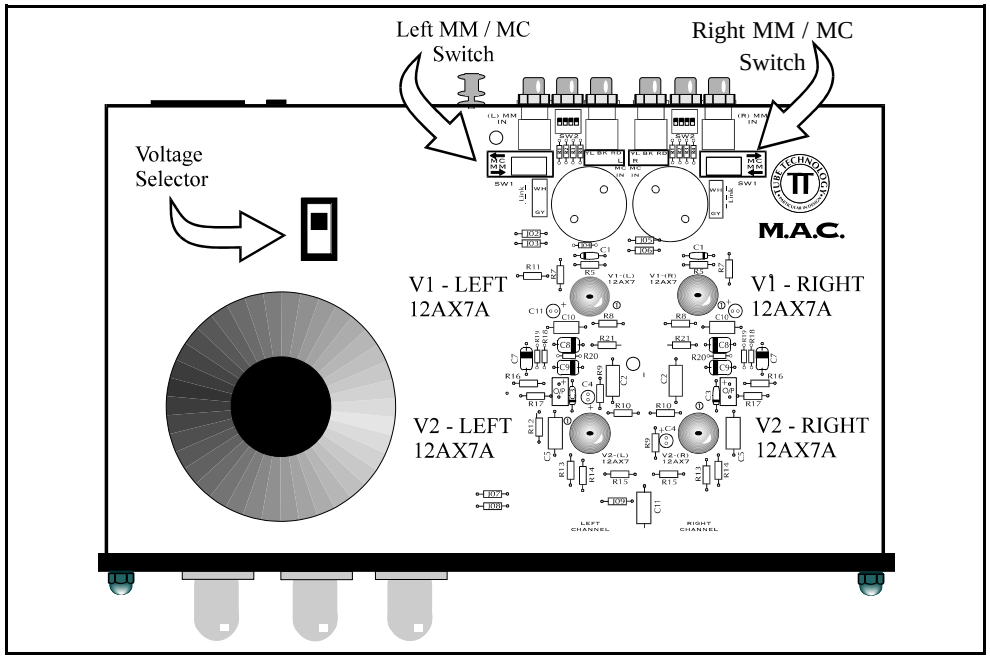
- ***Care and Cleaning of your Phono Amplifier***
- ***Troubleshooting***
- ***Changing Mains Voltage***

All polished metal parts on your amplifier are un-lacquered. These metal parts will in time lack lustre due to oxidisation. They can easily be restored to original condition by using a mild metal polish (such as Duraglit or Brasso) and a soft polishing cloth. Do not clean the polished parts with water as this smears the surface and can leave water marks.

Anodised parts such as the front panel of the M.A.C. & painted parts such as the bottom cover are best cleaned with a damp cloth then buffed with a dry cloth. DO NOT apply any kind of polish. For very stubborn marks a mild solvent such as methylated spirits can be applied.

ENSURE THAT THE UNITS HAVE BEEN DISCONNECTED FROM THE MAINS BEFORE COMMENCING ANY CLEANING OPERATIONS.

Diagram 3



WARNING ELECTRIC SHOCK HAZARD - HIGH VOLTAGES EXIST WITHIN THE EQUIPMENT EVEN AFTER THE UNIT HAS BEEN DISCONNECTED FROM THE MAINS SUPPLY.

Troubleshooting

SYMPTOM	REMEDY
Phono amplifier switches on but there is no sound from the system.	**1.** Look in the top window of the preamp to see if the tubes are glowing. **2**. Ensure you have connected the outputs of the M.A.C. to the inputs of your preamplifier. **3.** Ensure you have the internal MM/MC switch selected to the inputs you are using
Phono amplifier does not switch on	**1**. Ensure IEC plug on the mains lead is a snug fit into the IEC connector on the rear panel. **2.** Check the mains fuse located inside the fuse holder on the rear panel, see diagram 1.
With volume at zero hum is present	**1.** Check that the the earthing arrangements are correct - see chapter **2.** Only one amplifier component should go to the mains earth.
When looking in the top window a tube seems to have gone milky white, it does not light up when the unit is switched on	**1.** The vacuum of this tube has escaped through a small crack in the glass. When inserting tubes into their sockets, place a finger behind the socket ensuring the pcb does not flex and the tube fits into the socket with little stress. Stress at the base of the tube around the pins can cause tiny star fractures in the glass which develop into cracks over time**.**

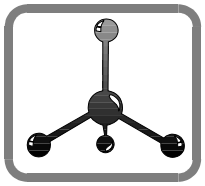
SYMPTOM	REMEDY
After switching on, one of the indicators does not light.	**1.** A fault has occurred with this part of the power supply, check the fuse relating to the indicator. See diagram -3 **2.** Change the fuse and try again, if it fails again refer to a service engineer or Tube Technology.
After replacing a tube, with the volume mid-way, I can hear my hand touching the phono amplifier through the loudspeakers, like an echo.	**1**. The tube you have replaced is ' microphonic '. This is particularly noticeable if the tube has been fitted in the first part of the phono stage - V1. **2.** Change the tube for another.

Changing Mains Voltage

The voltage on the M.A.C. is switchable from 115V to 230V, +/- tolerance of 10%.

The primary of the mains transformer can be changed from 115V to 230V, this is done by removing the top cover of the M.A.C.and selecting the desired voltage using the voltage switch located on the pcb just above the mains transformer. See diagram 3

Specifications



Figures given below are for a typical M.A.C. Phono Amplifier

Vacuum Tubes	ECC83/12AX7A x 4
Output Impedance	127 ohms
Output Voltage (before overload)	6.25 V RMS max @ 5mV in (MM) 6.50 V RMS max @ 1mV in (MC)
Frequency Response	3Hz - 180 KHz @ 1W +/- 0.01dB
Input Sensitivity	MM = 0.8 mV for 1V output (RMS) MC = 0.08 mV for 1V output (RMS)
Input Impedance	MM = 47k 150 pF MC = 3 ohms variable to 470 ohms
Power Consumption	Quiescent = 18 watts
Voltage	110V, 120V, 220V, 230V, 240VAC
Dimensions	350 (W) x 250 (D) x 80 (H) mm
Weight	4.5 Kg

Guarantee

Guarantee

This chapter contains information on;

- ***The Guarantee of your M.A.C. Phono Amplifier***
- ***Tube Guarantee***
- ***Registration***
- ***Claims under this Guarantee***

This equipment has been fully tested and a full record of these tests made before despatch from the factory. Both the workmanship and the performance of this equipment are (*except as set out below) guaranteed against defects for a period of TEN YEARS from the date of purchase, provided that it was originally purchased from an authorised dealer under a consumer sale agreement, at or near the recommended retail price. (The words "consumer sale" shall be construed in accordance with section 15 of the Supply of Goods (Implied Terms) act 1973).

This guarantee covers both labour and parts and is transferable to subsequent purchasers but the liability of the manufacturers is limited to the cost of repair or replacement (at the discretion of the manufacturers) of the defective parts and under no circumstances extends to consequential loss, damage or shipping charges.

* This amplifier only carries a ten year guarantee if used in conjunction with a Tube Technology preamplifier or integrated amplifier otherwise a TWO YEAR guarantee applies. The manufacturers can accept no responsibility for defects arising from accident,

misuse, wear and tear, neglect or through unauthorised adjustments and or repair, neither can they accept responsibility for damage or loss occurring during transit to or from the person claiming under this guarantee.

Tube Guarantee

This equipment has a SIX MONTH guarantee on the tubes allowing for any manufacturing defects to arise. If a tube is found to be defective it should be returned to the dealer or failing this, directly to Tube Technology packed in its original packaging.

Registration

Please complete the registration card and return it to Tube Technology. **Your guarantee is invalid without registration.** To transfer this guarantee to subsequent purchasers, the new owner must notify Tube Technology of their name, address and serial numbers of the equipment.

Claims under this Guarantee

This equipment should be packaged in the original packaging and returned to the dealer from whom it was purchased or, failing this, any other authorised Tube Technology dealer. If it is not possible to return the equipment by hand then it should be sent carriage prepaid by a reputable carrier. Should the original packaging not be available replacement packaging can be purchased from the manufacturers. The equipment should not be sent by post.

DO NOT CONSIGN THE EQUIPMENT TO TUBE TECHNOLOGY UNLESS YOU HAVE FIRST BEEN SPECIFICALLY REQUESTED TO DO SO BY THE MANUFACTURERS TECHNICAL SERVICE DEPARTMENT. DO NOT UNDER ANY CIRCUMSTANCES ATTEMPT TO DISASSEMBLE THE EQUIPMENT BEFORE DESPATCH.

If you have any difficulty complying with these requirements, please contact the manufacturers at the following address:

TUBE TECHNOLOGY
COMPTON HOUSE
DREFACH
CARMARTHENSHIRE
SA14 7BA UK

Tel: +44 (0)1269 844771
Fax: +44 (0)1269 833538

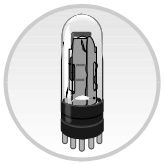
EMail:tubetechnology@lineone.net

In either case you should state clearly your name and address, the date and place of purchase together with a brief description of the fault experienced. In the event of equipment being returned which on test is found to comply with the published specifications the manufacturers reserve the right to charge a reasonable fee for testing the equipment and for return carriage.

The manufacturers are happy to answer any queries you may have regarding the use of this equipment on the condition that this enquiry is by letter. You should state clearly the serial number of the unit, the dealer from whom it was purchased and the date of purchase.

THIS GUARANTEE IN NO WAY VARIES OR REMOVES A PURCHASERS STATUTORY RIGHTS.

Tube Renaissance



Tube Renaissance

A possible expalnation of why tubes may sound better than transistors.

From the late 1960's, tubes were largely, though not entirely, superceded by semiconductors in audio frequency amplifier designs. This was an inevitable consequence of a continuing quest for new techniques. Semiconductors (Transistors and Integrated Circuits) have certain and obvious advantages: their small size, absence of heaters, low voltage operation and consequent opportunity to dispense with output transformers may appear to make tubes obsolete. However, from about 1975 onward, there has been a resurgence of interest in tubes; and it seems worthwhile to consider why.

It is said by 'hi-fi' enthusiasts that tube amplifiers sound better, that their distortion is either lower or less noticable. Carefully conducted listening tests seem to bear this out, although their results are difficult to interpret. If there really are subjective differences to a listener between tubes and semiconductor amplifiers, can they be explained technically?

One thing should be clearly understood: it is possible to design either a tube or a semiconductor amplifier so that over a certain range of output power its distortion will be so small as to be imperceptable to the ear. Therefore, if two similarly rated well-designed high fidelity amplifiers, one using tubes and the other using semiconductors, are compared in the same listening conditions, correctly operated, their performance should be indistinguishable - and subjectively perfect.

Now, on the basis of measured performance, many modern high fidelity semiconductor amplifiers are actually superior to the older tube amplifiers, which were already good enough for their distortion tobe imperceptable; so how can here be subjective differences? It seems that there cannot be any, while the amplifiers are correctly operated: and this may be the key to the mystery, for there are two major problems: one is that it is extremely difficult to avoid occasional over driving of an amplifer, because of the very

large dynamic range of the audio signal; and the other is that the loading is not always resistive. It is under these (usually unintentional) wrong conditions that differences may show up.

Let us consider the over driving first. Owing to continual improvements in recording and playback technique, the possible dynamic range of music signals- from either disc or tape - is greater now than it used to be. As a tentative estimate, it appears that the loadest passage of a modern disc recording maybe 40dB above the average sound level. Now it may be said that amplifiers in a high fidelity system ought theoretically to be able to reproduce the loudest of loud bursts without distortion. However, to allow for 40dB above 50mW - not a very high listening level - a power capability of 500W would be required; and further developments may make the figure even greater. One seems to hear a cry of “where is it all going to end?” Anyway, when setting up an amplifier system one adjusts the gain to give the prefered average sound level. One has no way in advance of knowing in advance whether there is an exceptionally loud passage coming that will over drive the amplifier. Bursts in excess of 30dB above the average are quite rare.

If we accept, then, that occasional over driving is virtually inevitable, how will the amplifier behave? We now come to the first possible reasons why tubes and semiconductors may “sound different”.

Presented with an over large signal, tubes merely clip the peaks, delivering a flat-topped waveform while the over driving is taking place. The limiting may occur at the grid as the circuit resistances are commonly such as to prevent it from being driven more than slightly positive, or it may be the results of coalescence of characteristic curves at lower voltages. The ear is surprisingly tolerant of such clipping when it occurs only on these occasional load bursts.

The semiconductors used in audio amplifiers are virtually always bipolar transistors, either discrete or integrated. They require base

current to be applied in order to make collector current flow. Now transistor amplifiers normally incorporate a large amount of negative feedback, and, when such an amplifier limits, some of its stages are driven very hard, so that extra large base currents are drawn. If any capacitors are affected by such current pulses, the result may well be that a brief over driving is followed by a comparatively long recovery signal, which would be much more noticeable than mere clipping of peaks. Even with dc coupling, there may still be capacitors that can cause such extra signals.

There is a further effect that takes place in the transistor itself, because of the phenomenon of charge storage. A transistor that has been conducting does not switch off immediately when the forward base bias is removed, but continues to take collector current until all the relevant charge carriers that are in transit have been swept out. The effect is most pronounced in a transistor that has been turned on hard: in fact the larger the base current the longer will be the turn-off time. In audio transistors that have been over driven this time may be of the order of hundreds of microseconds, so this effect can also give rise to spurious signals.

When it is realised that even the most critical listener cannot detect peak clipping of occasional short loud bursts by as much as 6dB, we can understand why it is sometimes said that a 50W tube amplifier can sound equal to some 200W transistor amplifiers. A tube amplifier can be quite grossly over driven with little or no subjective effect on sound quality, whereas most transistor amplifiers probably cannot.

The other kind of unintentional wrong operation we have to consider is incorrect oading. The impedance of a loudspeaker system is by no means constant: a so-called 8 ohm system may well present anything from 4 to 16 ohms over the audio frequency range, and be highly reactive at some frequencies. It is under reactive load conditions with large signals that another major difference appears between tubes and transistors. The combina-

tion of simultaneous high voltage drop and high current occurring for brief periods at certain parts of the elliptical load line does not normally affect tubes, may cause a catastrophic second breakdown effect, in which a permanent short circuit develops - not to be confused with ordinary avalanche break down, which is a reversible phenomenon.

The risk of second break down may be avoided by using transistors with sufficiently high ratings to be well clear of the effect, if available; but the alternative commonly employed is to incorporate protective circuitry that cuts the signal whenever the output transistors are subject to a dangerous combination of voltage and current, and this obviously has a very unpleasant effect on the sound. The purpose of these remarks is not to denigrate transistor amplifiers, but to present a case for tubes, and to show that there may be technical reasons for the supposedly subjective effects that have been attributed to transistors. Ways may be found of eliminating or obviating these effects in a transistor amplifier design; but there is a simplicity about tube circuitry which may appeal to many audio engineers, both professional and amateur.

A further point can be made in favour of tubes, concerning cooling. Output transistors have to be conduction cooled, preferably by some method that does not heat up other semiconductors in the circuit. This requires some rather bulky metalwork thermally isolated from the rest of the chassis. Glass envelope tubes, on the other hand, looses most of their heat by a mixture of convection and radiation.

A brief reference may be in order here about what is usually considered to be main disadvantage of a tube amplifier, the output transformer. It is indeed a heavy and costly item, to be set against the relative simplicity of circuit and various other advantages that have here been attributed to the tube equipment. However it can enable the amplifier to work into more than one load impedance, whilst a transformerless

semiconductor amplifier designed to drive an 8 ohm load would usually deliver only half its normal power into a 16 ohms, and might be damaged if operated with 4 ohms. Also, with an output transformer provided that it is correctly loaded, the amplifier input sensitivity without feedback is the same whatever the value of load impedance; and by taking the negative feedback connection from a fixed point on the secondary winding the sensitivity with feedback can be made similarly independent of load impedance: in other words, the number of decibels of feedback and therefore the reduction of distortion, damping factor and so on, are the same whatever the load. So there is something to be said for having an output transformer.

Perhaps enough has been said to suggest at least that the advantages are not entirely on the side of semiconductors, and that points can be made in favour of tubes, concerning both performance and convenience in use. Semiconductors may produce un-welcome effects on over driving, so difficult to avoid in practise; and not only the output stage, but also low level stages are involved in these. Tubes have a distict advantage in operation with reactive loads, and are easier to cool. Even the need for an output transformer is not quite such an unmitigated drawback as it may sometimes seem.

These may be some of the reasons why a substantial part of the audio amplifier market has stayed with tubes during the “transistor era”, and why there has recently been such a remarkable “Tube Renaissance”.