

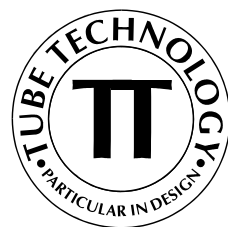
PROPHET

Signature

Preamplifier & Power Supply

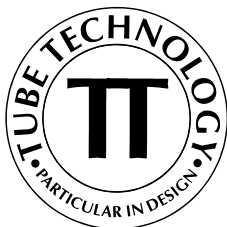
BY TUBE TECHNOLOGY

~ USER'S MANUAL ~



TT PART No. PrM-02

Printed in England
1st Edition - August 1989
2nd Edition - March 1994
3rd Edition - January 1997



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Introduction

Thank you for selecting the Tube Technology Prophet Preamplifier.

Please read through this manual so you will know how to operate your Prophet Preamplifier 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 Prophet to ensure you a low maintenance, trouble free preamplifier 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 !

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Conventions

This manual uses the following conventions;

Bold indicates emphasis or a minor heading.

Bold refers to a sub heading of a chapter.

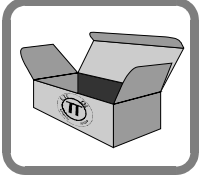


This symbol refers to Notes containing important information set off from the text.



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 Prophet Pre Amplifier & Power Supply***

Your preamplifier is packed in "jiffy-cell" support foam. Each unit has end-caps for left and right hand sides of the unit. Simply remove end-caps and remove each unit from the cellophane bag.

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

The following items are included in the packaging of a Prophet;

- 1 x Prophet Preamplifier
- 1 x Prophet Power Supply
- 1 x XLR Power Supply Connecting Lead
- 1 x Reference Manual & Registration Card
- 1 x IEC Mains Leads

Your pre-amplifier 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 Prophet to the household mains supply.*
- *Wiring a mains plug (UK)*
- *Earthing arrangements*


Your Prophet Power Supply 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 of the power supply. (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 faint low frequency hum through the system. If necessary you may not need to earth the preamplifier to the mains earth, consult the handbook for your power amplifier 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.

<u>Wire Colour</u>	<u>Label on Plug</u>
GREEN/YELLOW	 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.

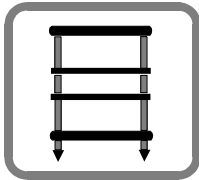


If your power supply is not set correctly for the local supply or if you intend to move the amplifier to a location where the supply is at a different voltage, it will be necessary to change the voltage switch on the power supply. If this is necessary please refer to *changing voltage* in the maintenance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

Ensure that the units are placed in a stable location that is able to accept their weight, both the preamplifier & power supply weigh approx. 11 kilograms or 5 lbs.

It is not recommended that preamplifier 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 four inches above the preamplifier 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. Do not locate the preamplifier 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 preamplifier.

Do not locate the power supply too close to a turntable, as the cartridge could pick up hum from the power transformer. The power supply is exceptionally well screened, and can be sighted directly under the preamp, if you wish to sight it at a distance, longer XLR power supply leads are available directly from Tube Technology.

DO NOT SIGHT THE PREAMPLIFIER OR POWER SUPPLY 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 Prophet's Inputs & Outputs*
- *Connecting the Power Supply.*

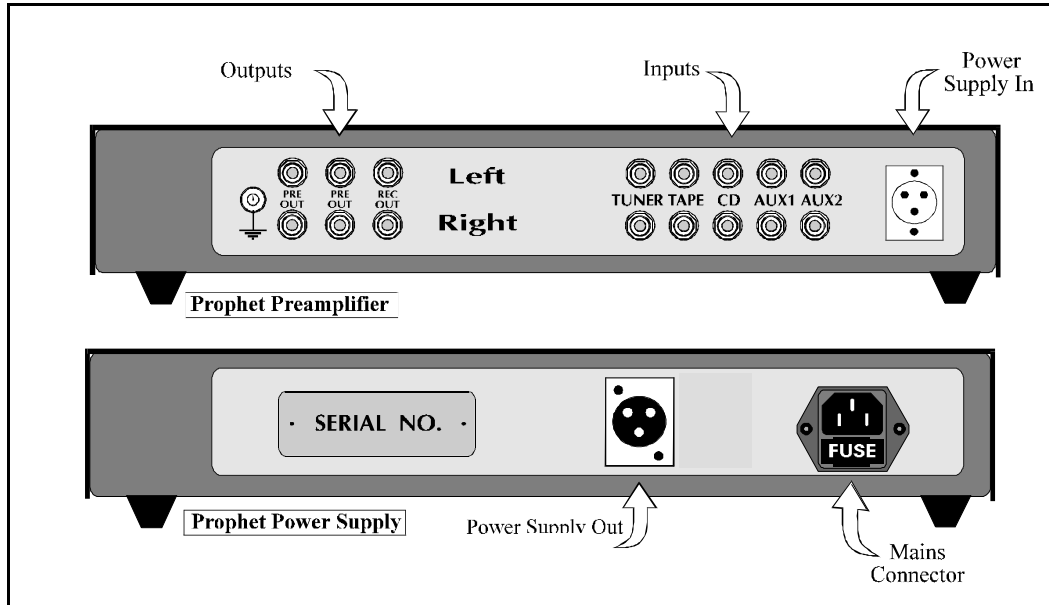


Diagram 1

Connecting the Inputs & Outputs

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

PRE OUT

Connect these outputs to the inputs of your power amplifier. If you are using directional cables ensure the arrows point away from the preamplifier. 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.

REC OUT

These outputs provide an audio output suitable for connection to the RECORD input of a tape deck. The source to be recorded is selected by means of the record selector switch on the left hand side of the front panel.

GROUND

This terminal is used to ground any interconnecting leads which have a separate ground connection.

CD

These inputs are used to connect the audio output of a digital compact disc player or any other audio hi-fi component that produces output voltage within the range 150mV-3 V.

AUX 1 AUX 2 TAPE

These inputs are used to connect the audio output of a tape deck or audio section of a video recorder or any other audio hi-fi component that produces output voltage within the range 150mV - 1V.

TUNER

These inputs are used to connect the audio output of a tuner or any other audio hi-fi component that produces output voltage within the range 150mV-1 V.

Connecting the Power Supply

This output of the power supply utilizes a female 3 pole XLR connector. Plug the Male end of the XLR interconnecting lead supplied into this connector and the other end into the XLR connector on the preamplifier labeled *Power Supply IN* in diagram 1. If you also are using a TT Phono stage, it is possible to power this from the auxiliary output. If you wish to sight the power supply in a different location, specific lengths of this interconnect can be ordered. .



DO NOT USE ANY OTHER CABLE TO CONNECT THE POWER SUPPLY TO THE PREAMPLIFIER AS IT MAY NOT CARRY THE CORRECT VOLTAGE RATING.

The IEC connector on the power supply, connects to the mains supply via the mains cable supplied. It also houses the mains fuse and spare fuse in the drawer at the base of the socket. This fuse is rated at 500mA Anti-Surge or (T).



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

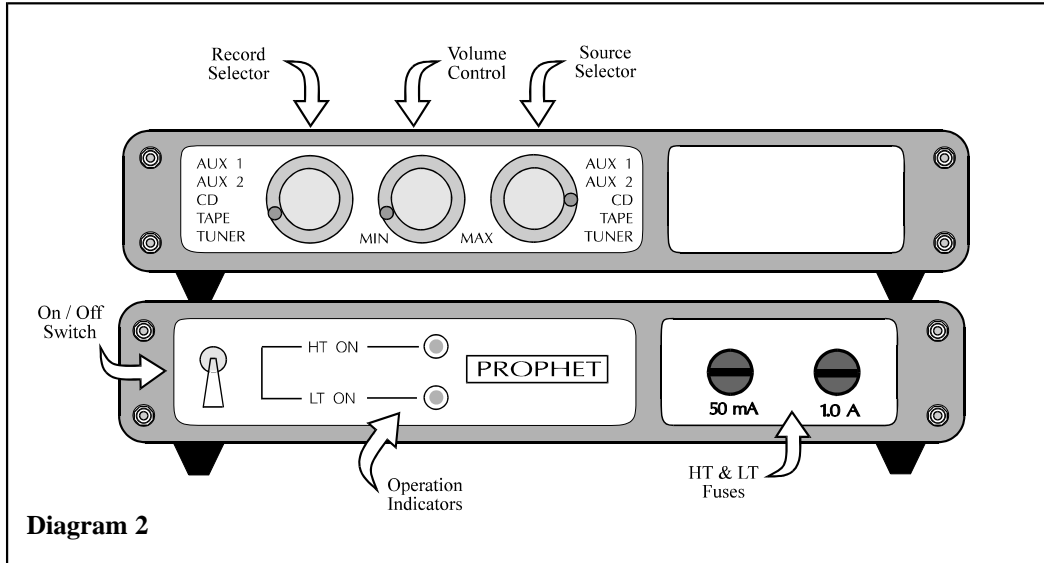
Operating your System



Front Panel

This chapter contains information on;

- *Switching your preamplifier ON and OFF.*
- *Playback & Record Functions*
- *Operational Notes*



Switching On & Off

By switching the toggle switch on the power supply in the down position the unit is switched on, and upwards to switch it off. It is always wise to switch on your preamplifier first and then the power amplifier, this always ensures a trouble free warm up. See Diagram 2.

After switching on the Prophet, there is an electronic delay of 30 seconds, before the unit actually switches on, a small click from inside the unit can be heard when this happens. This delay is a safety feature which ensures a muted warm up of the pre-amp tubes.

Operational Indicators

These LEDS indicate that the power supply is functional. The HT Indicator is illuminated red and the LT Indicator is illuminated amber.

50 mA FuseHolder

This fuseholder houses the protection fuse for the High Tension supply, (B+)

1.0A Fuseholder

This fuseholder houses the protection fuse for the Low Tension Supply, (Heaters)

Source Selector

Selects the source of the input signal.

CD

- Selection for listening to a Compact Disc

AUX 1

- Selection for listening to an Auxiliary Input such as TV or Video

AUX 2

- Selection for listening to an Auxiliary Input such as TV or Video

TAPE

- Selection for listening to a cassette tape

TUNER

- Selection for listening to a radio broadcast

Volume Control

Controls the sound output level for both left and right channels. Counter-clockwise rotation provides minimum output and clockwise rotation provides maximum output. Selects the source of the input signal.

Record Selector

Selects the output for your cassette recorder (can be different to input selector)

- CD - Selection for recording from a Compact Disc
- AUX 1 - Selection for recording from an Auxiliary Input such as TV or Video
- AUX 2 - Selection for recording from an Auxiliary Input such as TV or Video
- TAPE - Selection for recording from a cassette tape (see warning message)
- TUNER - Selection for recording from a radio broadcast



DO NOT SELECT **TAPE** ON THE RECORD SELECTOR AND **TAPE** ON THE SOURCE SELECTOR AT THE SAME TIME WITH YOUR TAPE RECORDER CONNECTED. THIS WILL CAUSE "HOWL- AROUND". WHICH IS A VERY LOUD HIGH PITCH WHISTLING NOISE CAUSED BY CREATING A SIGNAL LOOP WITH YOUR TAPE RECORDER.

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 Prophet preamplifier reaches peak performance levels 15-20 minutes after switch on. Unless absolutely necessary it is not recommended that you leave your preamplifier permanently switched on, this only wastes electricity and tube life, but if necessary the Prophet preamplifier 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



Burning-In Amplifiers

Tube Information

This chapter contains information on;

- *Burning-In your Preamplifier*
- *Tube Information*

"Burning-In" is a generic term given to the basic 'running-in' of the amplifier. You may notice a slight 'electronic-smell' from your preamplifier 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 preamplifier has been extensively soak tested before leaving the factory. This burning-in process continues with your use of the preamplifier.

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 Prophet this running-in period.

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 Prophet would be approx. 6000 hours, after which time they should be replaced, thus keeping your preamplifier at it's maximum sonic performance; Refer to the **Maintenance** chapter.

Maintenance



Care & Cleaning



This chapter contains information on;

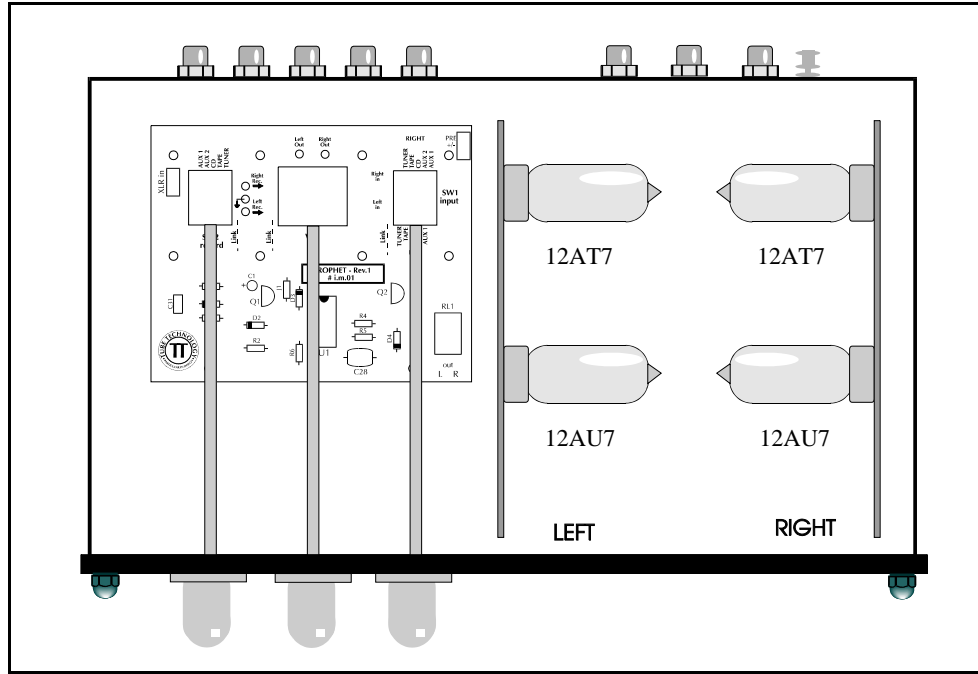
- *Care and Cleaning of your Preamplifier*
- *Troubleshooting*
- *Changing Mains Voltage*

All polished metal parts on your amplifier are unlacquered. 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) 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 and top covers of the Prophet & 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



7 Maintenance



WARNING ELECTRIC SHOCK HAZARD - HIGH VOLTAGES EXIST WITHIN THE EQUIPMENT EVEN AFTER THE UNIT HAS BEEN DISCONNECTED FROM THE MAINS SUPPLY, ENSURE THE POWER SUPPLY IS DISCONNECTED BEFORE REMOVING COVERS OF PREAMPLIFIER.

Troubleshooting

SYMPTOM	REMEDY
Preamplifier switches on but there is no sound from the system.	<ol style="list-style-type: none">1. Check you have connected the power supply to the preamp. Look in the top window of the preamp to see if the tubes are glowing, this is an indicator that the power supply is operating the preamp.2. Ensure you have connected the outputs of the preamp to the inputs of your amplifier.
Preamplifier does not switch on	<ol style="list-style-type: none">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 drawer at the base of the mains inlet, see diagram 1.
With volume at zero hum is present	<ol style="list-style-type: none">1. Check that 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	<ol style="list-style-type: none">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 fractures in the glass which develop in time.

Troubleshooting

SYMPTOM

REMEDY

After switching on the power supply, one of the indicators does not light.

After replacing a tube, with the volume mid-way, I can hear my hand touching the preamplifier through the loudspeakers, like an echo.

After de-selecting an input I can still hear it in the background.

1. A fault has occurred with this part of the power supply, check the fuse relating to the indicator. See Chapter 5 - *Front Panel*.

2. Change the fuse and try again, if it fails again refer to a service engineer or Tube Technology.

1. The tube you have replaced is 'microphonic'. This is particularly noticeable if the tube has been fitted in the phono stage.

2. Change the tube for another.

1. This is caused by breakthrough on the selector switch, it cannot be avoided, unless complicated sound degrading circuitry is employed. The best advice is to switch off the offending signal, this is particularly true for tuners which are often left on.

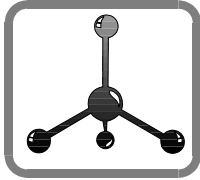
***Changing
Mains Voltage***

The voltage on the Prophet is switchable from 115V to 230V.

The unit operates with a voltage variation of plus or minus 10 per cent.
ie. satisfactory operation from 103.5 to 126.5 VAC or 207 to 253 VAC.

To change the voltage to another setting , this is done by means of an external voltage selector accessible on the underside of the power supply. It can be turned using a coin or large bladed screwdriver.

Specifications

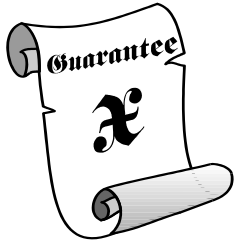


Figures given below are for a typical Prophet Signature Pre

Preamplifier Dimensions	350 x 250 x 75 mm (W,D,H)
Power Supply Dimensions	350 x 250 x 75 mm (W,D,H)
Preamplifier Weight	4 kg
Power Supply Weight	6 kg
No. of Inputs	5 single ended line level inputs per channel
Input Sensitivity	250mV RMS for rated output
Input Impedance	250 kohms
Overload Margin	+14 V RMS
No. of Outputs	2 single ended Preamp outputs per channel 1 single ended Record output per channel
Class of Operation	A
Type of Operation	single ended
Rated Output Voltage	1.0 V RMS (250 mV RMS input)
Gain Ratio	1 : 5 (ie 1.0 V input = 5.0 V output)
Output Impedance (preamplifier)	27 ohms
Output Impedance (record out)	27 ohms
Frequency Response	4Hz - 120kHz @ max output
Total Harmonic Distortion	0.03 % @ rated output
Signal to Noise Ratio	-78dB
Vacuum Tubes	1 x ECC82/12AU7 per channel 1 x ECC81/12AT7 per channel
Power Consumption	35 W @ 240V 50 Hz

∞
Specifications

Guarantee



Guarantee

This chapter contains information on;

- *The Guarantee of your Prophet Preamplifier*
- *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.

* These amplifiers only carry a ten year guarantee if used in conjunction with a Tube Technology power-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
IMAGE HOUSE
326 MOLESEY ROAD
WALTON-ON-THAMES
SURREY KT12 3PD

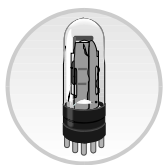
TEL: +44 (0) 1932 242420
FAX: +44 (0) 1932 244455

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 explanation of why tubes may sound better than transistors.

From the late 1960's, tubes were largely, though not entirely, superseded 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 noticeable. 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 imperceptible 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 to be imperceptible; so how can there 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 amplifier, 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 loudest 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 preferred 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 loading. 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 breakdown, 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, loses 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 distinct 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”.