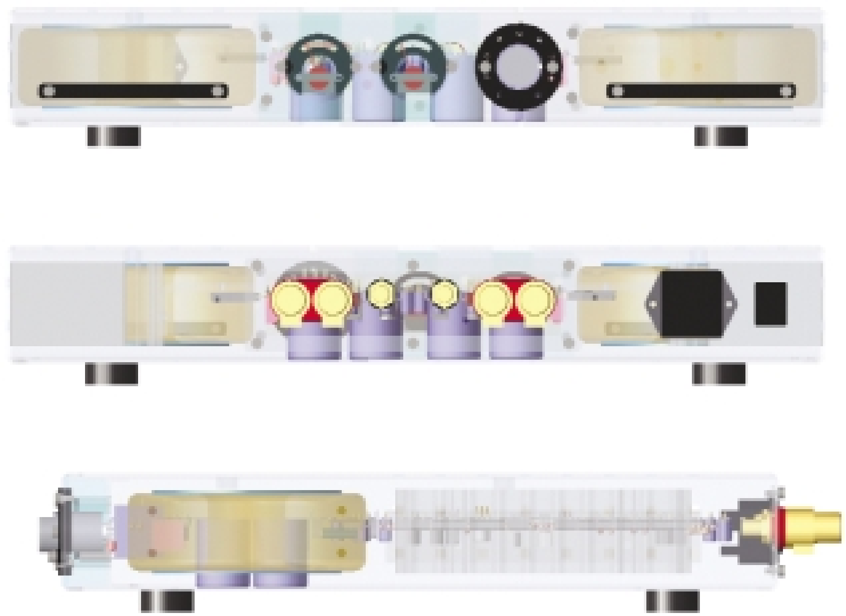
Iraklis



KOSTAS METAXAS DESIGN

Contents

Awards & Innovations

You are about to listen to an amplifier which has evolved from over 20 years of dedicated listening and the application of the state-of-the-art in every process of design and manufacture. I’m sure you’ll enjoy listening to it as much as I do.

-Kostas Metaxas DESIGNER

2 X AUSTRALIAN EXPORT AWARD, BHP STEEL DESIGN AWARD,

runner up in AUSTRALIAN SMALL BUSINESS AWARDS

First - Amplifiers- No wire construction with

shortest possible signal path

First - 'Capacitorless' circuits in Audio design

First power amplifier can put full power into

8 ohm load at 1.0MegaHertz!

(refer to article in USA "AUDIO").

First - High Speed diodes in power supply

First - DAC to use lowest jitter 'APOGEE CLOCK'

First - FULL range and high efficiency electrostatic

First - Audio Manufacturer to use BMW-Porsche CAD-PCB

software design systems

3 Decades of Hi-End : 1980's

Opulence Preamplifier

Assembly

Engraving

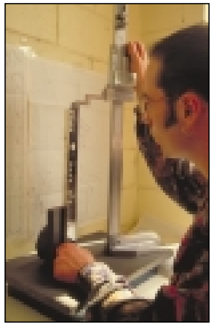
Ecstatic & Revelation Electrostatics

Kostas Metaxas circa 1985

Soliloquy Monoblocks

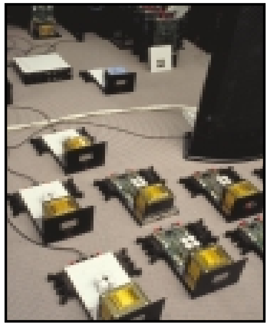
3 Decades of Hi-End : 1990's

Apollo Speaker

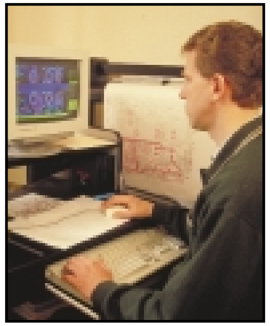


Stainless Steel Turret Punching

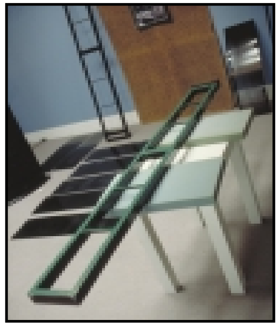
Empress Full-range electrostatics using plastic-composite moulded frame



Iraklis "on-test"



PCB design



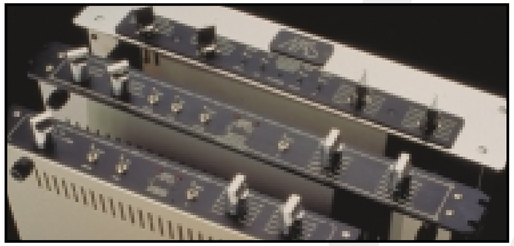
EMPEROR Assembly

Reference System circa 1992

Assembly

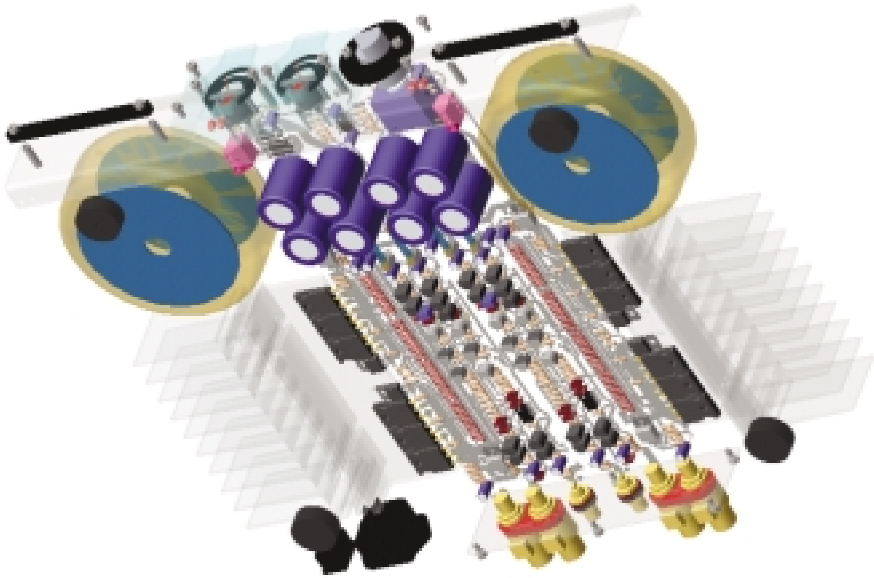
Assembly

Opulence, Marquis & Charisma Preamplifiers



CZAR 2-way full range electrostatic

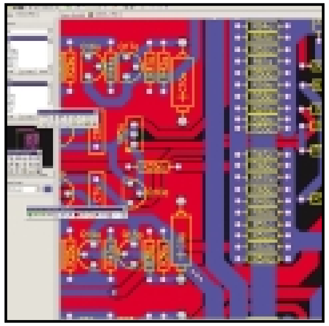
3 Decades of Hi-End : 2000's



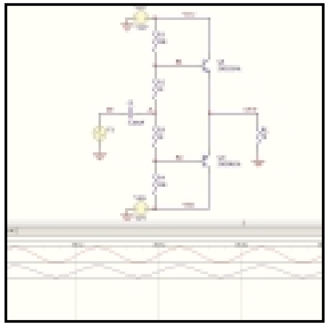
Using technology borrowed from Aerospace and Formula 1, the new Kostas Metaxas *Audio designs reflect the extraordinary advances that have been made recently in modelling and simulation software.*

For the first time, a High End Audio manufacturer offers audiophiles a rare glimpse into the conception, design and execution of a complete product on a component by component basis in 3D.

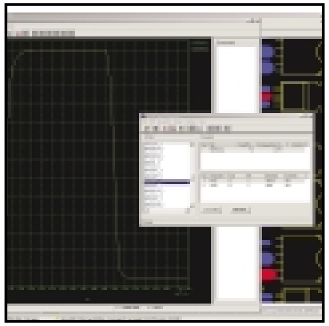
The Protel PCB software [www.protel.com] extends the quite normal listening tests on a component by component level to the PCB level. Schematic Based simulations can test [or verify] the PCB's signal integrity by running the "Signal Integrity Simulator" which displays a Reflection and Crosstalk Analysis. And the 3D visualization allows one to include the PCB as part of the overall wholistic design.



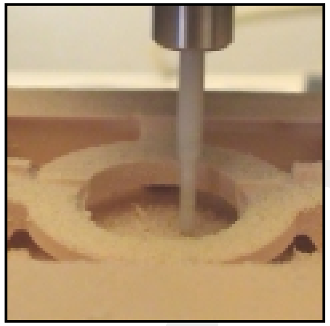
Schematic Capture & PCB design



Schematic "Spice" Circuit Simulation



PCB Track Risetime & Slew rate signal integrity testing.



In-house RAPID PROTOTYPING

Laser Engraving

Listening Philosophy

R E F E R E N C E

The only way to design state-of-the-art audio equipment is to have first-hand experience with the finest available recording equipment AND playback equipment.

This is important for two reasons; it ensures that our designs work and 'mate-well' with other products and that their resolution is not limited by the weakest link in the playback 'chain'.

Kostas Metaxas *products have been conceived using extensive listening tests with a variety of state-of-the-art ancillary equipment for more than 25 years.*

Our amplifiers have been designed using a variety of state-of-the-art phono playback equipment and our ABSOLUTE REFERENCE - a custom-made battery-powered Stellavox SM-8 Tape Recorder using 1/4" tape at 30 ips and a Stellavox TD-9 using 1/2" tape at 30 ips specially calibrated for the Bruel & Kjaer 4003 1/4" omnidirectional electrostatic instrumentation microphones.

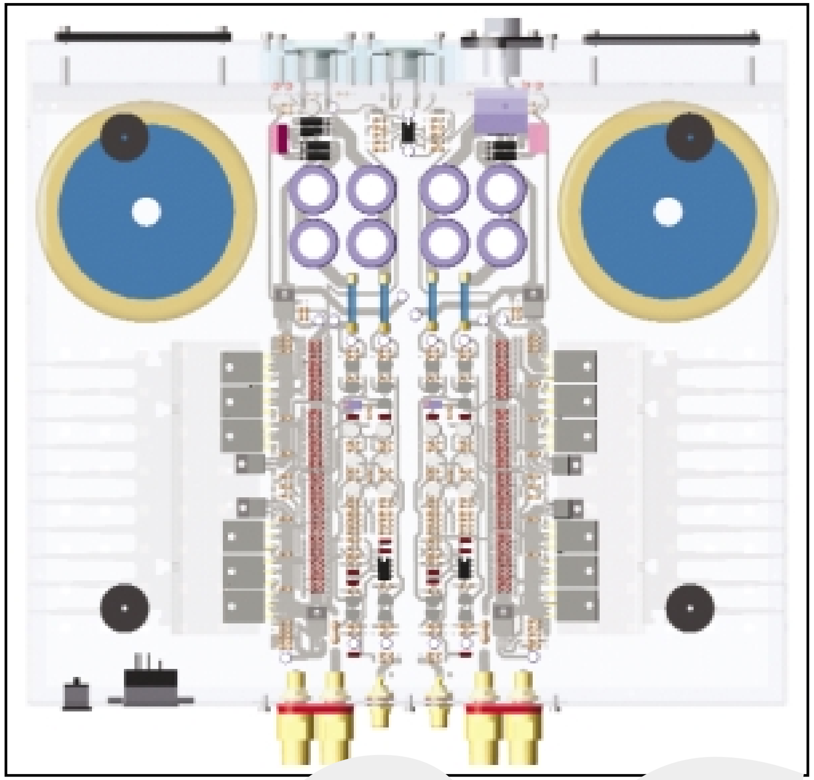
Design Philosophy

ULTRA-SHORT SIGNAL PATH : NO-WIRE DESIGN

A prominent audio designer once described an amplifier as "A straight piece of wire with gain". We take this further by featuring the ***shortest*** *possible signal path in a commercial amplifier. We do not use wire in any of our signal paths and every component is directly soldered to one large printed circuit board.*
From input to output, the signal passes through no more than 150mm of P.C. track. The transformer is connected with only 40mm of wiring to the PC board. This is only possible with our unique construction which features the complete amplifier (including filtering capacitors) is assembled onto one single rectangular Printed Circuit Board where the four sides connect directly to the inputs and outputs, power transistors on their heat sinks and power transformer.
The audio signal passes through ONLY ONE TYPE OF WIRE which is the high speed, wave controlled oxygen free copper of our PC board.

HIGH SPEED POWER SUPPLIES

Every power amplifier uses a large, high-current power transformer which feeds a 'high-current' bridge rectifier to convert the AC from the transformer into DC voltages which are then mains ripple filtered using massive, computer grade capacitors.
The rectifier bridge that is normally used is relatively large, handles high current and low voltage which slow switching speed because of its inherent high internal capacitance.
It has a response time measured in milliseconds which if converted to frequency would mean that it would have a frequency response from DC to around 100Hz .

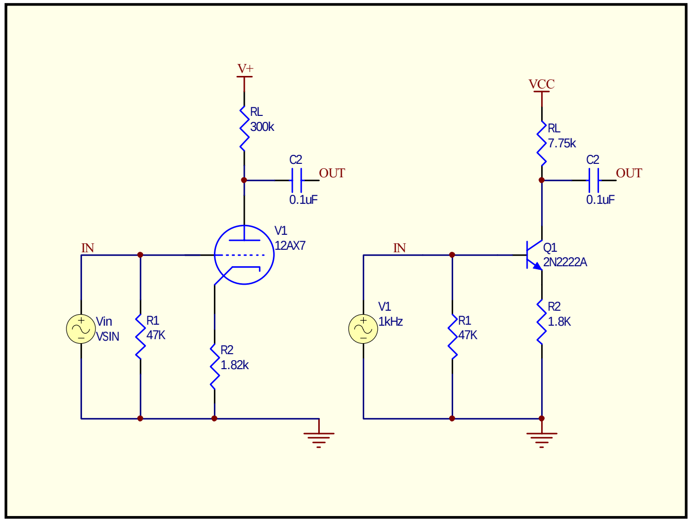


Frequencies above 1 kHz would be unable to draw current instantaneously from the power transformer and would need to rely on the charge stored in the power supply filtering capacitors.
We replace this slow DC rectifier with ultra high speed diodes wired in parallel with switching times in 'nanoseconds' which when converted to audio frequencies have a frequency response from DC-10 MegaHertz.
High and low frequency currents can be drawn from the power supply more effortlessly .

Design Philosophy

LOW NOISE, HIGH SPEED VOLTAGE REGULATOR DESIGN.

The most significant difference between VALVE and TRANSISTOR circuits is the amplifier/power supply interaction.
In VALVE amplifier, the high voltages (from 200-400 Volts DC) result in a 50,000 to 100,000 Ohms value for resistor R. The equivalent transistor amplifier using much lower voltages (from 12-30 Volts) would have a substantially lower value of R between 200 Ohms-100 Ohms. Therefore a normal power supply in a transistor amplifier is more likely to affect the transistor amplifier circuit compared to a Valve amplifier circuit.
If we assume that the regulator impedance at V+ is around 2 Ohms just for the purpose of this illustration, then let us study the amplitude of the 10 VOLT sine wave as it goes through R and returns back to the OUTPUT of the TRANSISTOR circuit and VALVE circuit.
In the VALVE circuit, when 10 VOLTS travels across the 50,000 Ohms R towards the power supply impedance of 2 Ohms , the 10V signal is attenuated 50,000/2 = 25,000 times. Therefore 10V/25,000 = 0.0004 Volts of 1,0kHz sine wave.
On its way back to the OUTPUT of the circuit it is attenuated by the impedance of the amplifier (say 100 Ohms): 0.0004 Volts/50,000/1,000 = 0.000008 Volts. Therefore, 0.000008 VOLTS of out of phase sine wave accompanies the 10 Volts sine wave as out-of-phase distortion in the VALVE CIRCUIT.
In a normal TRANSISTOR circuit, the 10 VOLTS going across the 200 Ohms resistor R would be attenuated only 10/200/2 = 0.1 VOLTS. On the way back to the output, the voltage is attenuated by: 0.1V/200/1000 = 0.05 VOLTS of out-of-phase sine wave added to the 10 VOLT output sine wave.



07

Design Philosophy

In a normal Transistor circuit, the 'phase distortion' is 0.5% as compared to 0.000008% for a normal VALVE circuit .

If we monitor the V+ point of the transistor circuit using an oscilloscope, we would notice this 0.1 Volts, 1.0 kHz signal. If we were to increase the frequency to 10,000 Hz and up to 1.0 MegaHertz the speed of dynamic behaviour of the power supply becomes critical. Using a normal I.C. regulator would result in the signal at V+ actually increasing in amplitude as the frequency increases to that at 1.0 MegaHertz the 1.0 Volt sine wave is now over 1.0 Volt!

To fully understand this interaction between the amplifier an power supply, it is necessary to understand how a voltage regulated power supply works.

A voltage regulated power supply is essentially a D.C. amplifier (not unlike a normal power amplifier) which instead of having an audio signal at the input which is then amplified to become a larger audio signal at the output, has a fixed D.C. voltage reference at the input which is then amplified and becomes a larger DC voltage of at the output. The output impedance of the regulator, not unlike the output impedance (or "Damping Factor') of a power amplifier is less than one ohm at D.C.

If we use a 2.0 Volt zener diode as our fixed DC voltage reference at the input of the D.C. amplifier which has a gain of 10, the resulting output voltage is 20 Volts D.C.

The negative feedback loop of the amplifier which fixes the gain of 10 times the 2.0 Volt zener reference is very important because it maintains the output voltage irrespective; of an increase or decrease in the power supply voltage to the amplifier as long as there is a minimum voltage for the regulator circuit to operate (for a 12 Volt regulator, the minimum voltage is 15 Volts).

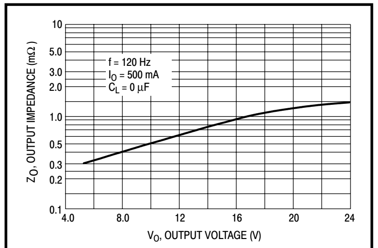


Figure 6. Output Impedance as a Function of Output Voltage (MC78XXC, AC, B)

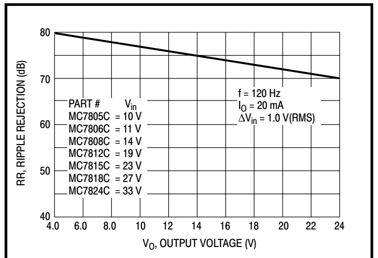
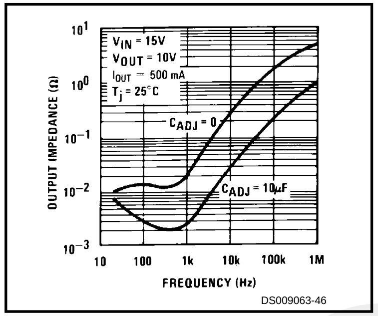


Figure 3. Ripple Rejection as a Function of Output Voltages (MC78XXC, AC, B)



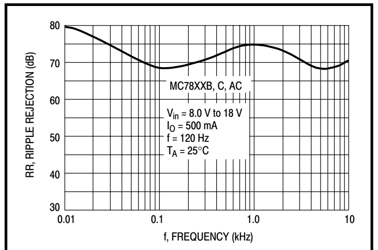
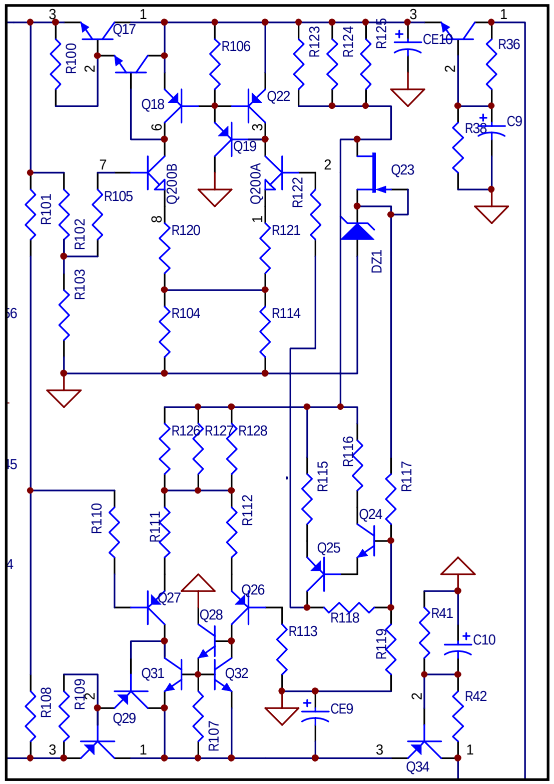


Figure 4. Ripple Rejection as a Function of Frequency (MC78XXC, AC, B)



Marquis Voltage Regulator

This is the STATIC performance of a voltage regulator which although important, does not affect the overall sound of the amplifier as much as the regulator's DYNAMIC performance which is influenced by the speed and 'open loop gain' of the regulator.

To understand why the Dynamic performance of a voltage regulator is so important, we need to go back to our basic amplifier circuit and investigate what happens to the 1.0 Hz, 10 Volt output signal as it goes across resistor R and encounters our voltage regulator.

To ensure an absolutely stable D.C. at V+ the residual of the 10 Volt sine wave at the OUTPUT is fed through the negative feedback loop of the regulator to force the amplifier to correct this error by applying an inverted signal identical to the residual sine wave to totally eliminate the residual sine wave at V+. A high speed regulator would therefore treat a signal 1.0 Mega Hertz in the same manner as a signal at 1.0kHz. The ultimate voltage regulator would effectively have a theoretical output impedance (or 'Damping Factor') at V+ of zero ohms at all frequencies as a result of its wide bandwidth before the addition of negative feedback.

In this way, the attenuation of the 10 Volts across the resistor R residual would be complete, and no attenuated component of the 10 VOLT sine wave could be deflected and return to the OUTPUT of the circuit and cause severe phase anomalies by adding to the new signal p;resent-ed at the output - remember that it would take a few nanoseconds for the signal to go through the resistor and come back.

This extraneous out-of-phase information if allowed to adds to the new OUTPUT signal, would then destroys TIME/PHASE characteristics of the amplifier circuit.

In real world power supply circuits, the impedance of the power supply actually increases with frequency because the open loop gain rolls off at high frequencies .

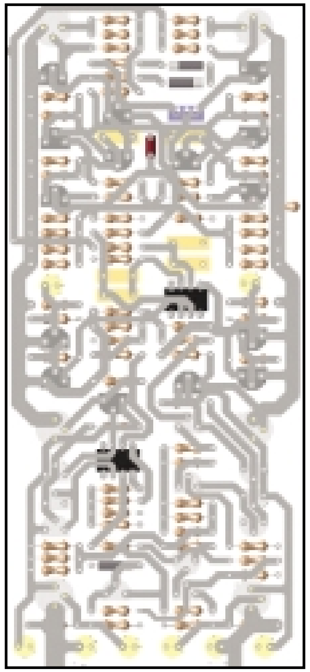
Design Philosophy

If we go back to our basic circuit and analysed the performance of an I.C. positive voltage regulator (say a LM78LXX from NATIONAL SEMICONDUCTORS) it would have an output impedance at the pin of its output lead of around 0.2 Ohms from DC to 10kHz, and then an increase to 0.4 Ohms at 20kHz, then 4.0 Ohms at 1 MEGAHERTZ which clearly illustrates the open loop frequency response has a turnover point around 10 kHz. When you add the normal distance between the regulator output and amplifier circuits which may be as little as 60mm to as much as 200mm in many circuits, the overall impedance in creases 5 to 10 times. Also, to stabilise the operation of this I.C. regulator, it is essential to use an output capacitor for stability.

Clearly, this is not good enough for high performance, high speed transistor circuits. For this reason, we have approached the design of our regulators as PART of our amplifier circuits, rather than make the fastest amplifier circuit and add a slow I.C. voltage regulator with an output capacitor and call it a finished design. Our discrete voltage regulators are designed to have the absolute lowest noise, reject mains ripple, but more importantly to have a speed (1000 V/microsecond) which is a result of their wide bandwidth design (an open loop frequency response greater than 500kHz) and output impedance which is an order of magnitude better than any I.C. The regulator stability is achieved without ANY capacitors by varying the ratio between the local and overall feedback of each device.

We position the regulators within inches of the active circuits (in the case of the OPULENCE, the regulator is 3mm! from the active circuits) and the regulator impedance is flat from DC to beyond 5 MegaHertz at less than 0.05 Ohms.

Beyond this electrical design aspect, we listen to the sound of our regulators whilst developing each amplifier circuit to ensure that every component change or substitution produces an audible improvement from the selection of transistors to best biasing currents , choice of voltage references zeners and degree of local feedback.



Marquis "wholistic" approach to Line Stage/Regulator

Steps for Connection

1. Ensure that the ON/OFF switch on the back panel is in the OFF position before connecting the amplifier into your system.

2. Once connected, ensure that there are no 'short circuits' in the speaker wires, then proceed to switch the unit ON.

Note: For the best results, it is recommended that the unit is powered on for at least 15 minutes before critical listening is attempted.

Protection Circuits

The output stage of the amplifier is fused with +/- 2A fast blow fuses [M205 type] which protects the amplifier in case of operating faults. The low value of fuse inherently protects the following loudspeakers without the need for adding an OUTPUT RELAY.

Mains Fuse

A 2AMP [240VAC- 115VAC fuse is 4A] SLOW BLOW DA205 Type fuse is located on the AC MAINS SOCKET. If this blows, simply replace with the same rating fuse. If the fuse continues to blow, please refer to the Maintenance Section of this manual for further instructions.

Serviceability

The complete active circuitry of the amplifier including primary filtering capacitors are all mounted to the large single ground P.C.B. Easy access to the board is maintained by simply removing the base to gain access to the 'component side' to change a blown fuse.

What the critics say...

" With this amplifier, some instruments which until now were previously hidden by others, appear in all their richness of timbre, with expressivity. The ambience of the concert halls, the reverberation of the cathedral's atmosphere with a sense of air, are one by one reproduced with realism, with a three dimensional effect which transcribes with precision each technique of producing the sound.
The IRAKLIS is an amplifier in the grand class that one must absolutely discover; but beware, once you have experienced it, you won't want to leave it".
Jean Hiraga/Patrick Vercher, LA NOUVELLE REVUE DU SON, France.

" The Metaxas gave an effortless, polished sound for choir recordings and reproduced voices very smoothly without the slightest trace of harshness. One almost felt reminded of an excellent tube amplifier".
M.Kucera, SOUND MAGAZINE, Switzerland.

" The image leaves nothing to be desired, nor does it leave anything up to the imagination. One can clearly hear where the sounds from the various instruments are located. This indicates well maintained focal information and correct placement within the soundstage. Excellent horizontal dimensions, great vertical reach combines with terrific front to back representation. Would we buy this amp? The answer is a resounding YES! We suggest a listen to this amplifier; its entry level high-end without the price tag".
Ernie Fischer THE INNER EAR REPORT, Canada.

" ... after half an hour (the Iraklis), is capable of giving a sonic performance close to excellent, with one or two state of the art touches in terms of imaging and midrange transparency.

What the critics say...

Although quite versatile in terms of functions and real output power (they drive difficult loudspeakers such as the 3 Ohm Thiel with authority), where they really look unbeatable is with small high class speakers, assuming a careful set up; both with the Acoustic Energy AE1 and the ROGERS LS3/5a where they provided a performance of intoxicating vivacity and solidity, with a deep and wide soundstage, especially with vinyl".
Gianfranco Machelli, STEREO, Italy.

" After the initial 'so-so' period while it was settling down it developed that easy confidence which is the signature of a thoroughbred ... This has served to confirm my opinion that although one might describe its appearance as business-like rather than pretty, its sound is fully capable of bringing on the elated feeling that often follows a good live convert performance".
Geoff Horn, GRAMOPHONE, England.

" The first thing I noticed about the amplifier when driven by the NAIM CDS was the outstanding speed and retrieval of detail. While it pulled excellent bass weight and depth from the EPOS ES11's, its transient response and lack of overhang kept the low end commendably tight and articulate. On music where the reverb had been applied with a shovel, and where bass guitar competed with synths and kick drums, the Metaxas combination (Charisma/Iraklis) maintained similar clarity in the lowest register. Further up the scale, especially in its extreme treble, the amp sounded equally precise and taut. This dryness made for detailed appraisal of percussion figures, string harmonics and upper vocal registers. The same effect was noticeable to a lesser extent in the midrange. Notes appeared at the correct pitch and emerged at the right time, so it portrayed music's fundamentals satisfactorily. These amplifiers are clearly high end p;erformers-powerful, revealing and free from serious vices".
Malcolm Steward AUDIOPHILE, England.

"Only the IRAKLIS was able to arrange the musical images even better to the point where you reached the perfect illusion. Rating: Absolute Spitzenclasse Class A."
Johnnes Maier, STEREOPLAY, Germany.

Specifications

All connections are facilitated via customised machined brass, heavily gold plated RCA sockets and high current 5 way binding posts which allow the use of bananas, spades, pins or bare cable.
Internal construction is to a high standard, featuring selectively soldered resin masked 2oz copper printed circuit boards using premium components from European suppliers.
TECHNOLOGY
The internal layout of the IRAKLIS is configured in a dual mono construction with only the case, power cable, ON/OFF switch
1. INPUT STAGE: The input voltage gain stage uses a similar topology to our preamplifier output stages, with extensive use of local feedback and only 10dB of overall negative feedback.
2. OUTPUT STAGE: A two stage 'Darlington' output stage using the fastest output transistors currently available (fT's of 300MHz) with thermal tracking of the biasing current (biased in pure class A operation) eliminates the necessity of including zobel and stability compensation networks which would alter the high frequency phase characteristics of the amplifier.
3. POWER SUPPLY: Our unique concept of paralleling individual high speed diodes (SF-16's) instead of a slow high current rectifier enables faster current delivery response time, especially important to reproduce high frequency transient currents. This rectifier feeds the 20,000uF of primary filtering using low impedance computer-grade capacitors which are located only a scant few inches away from the ultra-high speed output power transistors.
Isolation of the high current output stage from the input voltage gain stage is made via a capacity multiplier filtering system which uses the beta of the transistors to multiply the filtering effect of the capacitor used. The output of the capacity-multiplier is not bypassed with any capacitors, ensuring that the phase response and stability of the gain stage is not altered in and beyond the audible bandwidth of the amplifier.

Specifications

FREQUENCY RESPONSE : DC - 5.0MHz (-3dB)

POWER OUTPUT : 50WRMS per channel into 8 Ohms with no more than 0.05% T.H.D.

DAMPING FACTOR : Greater than 500 wide band

SLEW RATE : Greater than 1000V/us small and large signal

T.H.D. : Less than 0.05% 20Hz-20KHz

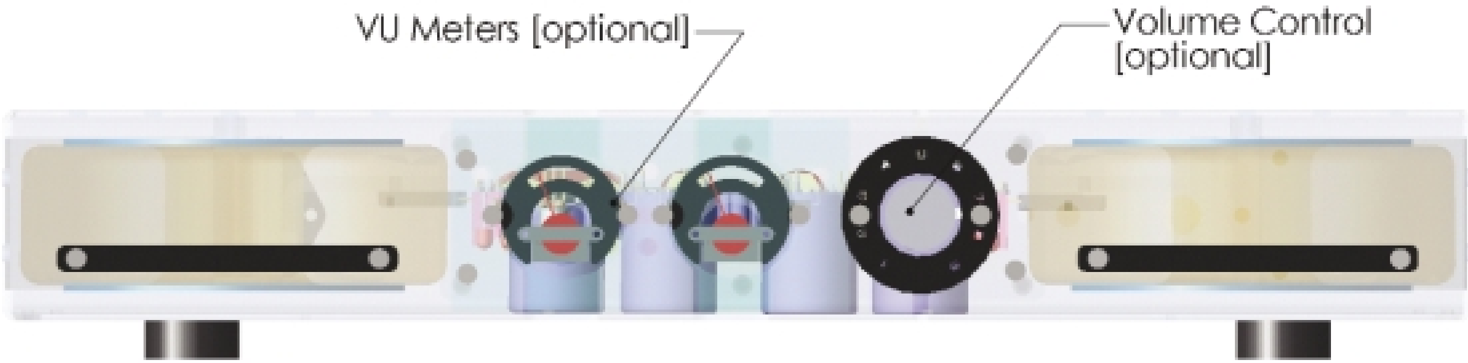
I.M.D.(S.M.P.T.E.) : Less than 0.05%

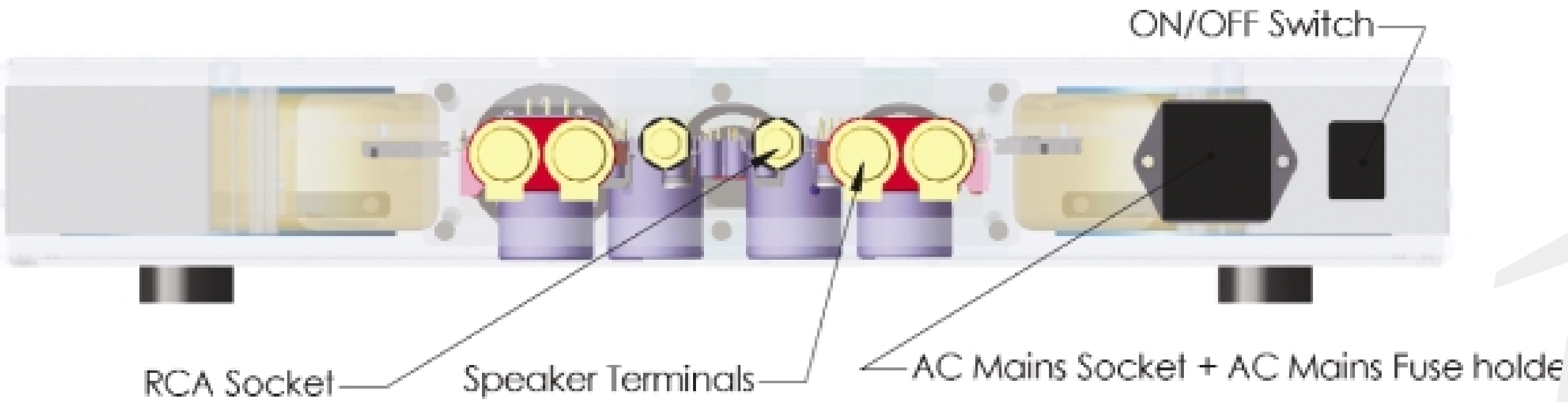
SIGNAL/NOISE : -117DBV unweighed input shorted

SENSITIVITY : 0.5VRMS in for 50WRMS out (35dB)

INPUT IMPEDANCE : 100kOhms in parallel with 11pF

Controls & Features





TESTING

1. Connect the + and - supply lines [at the FUSEHOLDERS or RECTIFIER DIODES] to an external current limiting Power Supply with maximum +/- 30VDC output voltage (or use 2 x 30VDC supplies).

2. Rotate the biasing trimpots VR5 & VR5a fully clockwise.

3. Connect the amplifier to a signal source (Sound Technology 1700B or Oscillator) which generates sine waves at 1.0kHz frequency and monitor the input and output on a dual trace Oscilloscope.

4. Power the module on (ensure that only 1.0 A fuses are installed for extra safety) and check that there is no current limiting. You should be able to monitor the amp on the Oscilloscope. (Connect your
oscillator to any HIGH LEVEL input, and ensure that MUTING switch is in the UP position, and VOLUME control is at position 9).

5. Measure the voltage drop after the "capacity
multipliers" [across the collector & emitter of Q19, 17, 19a 17a for the input stage and Q23,25,23a,25a for the output stage]which should be ~2 volts . If either the positive or negative series-pass transistors drop more than this voltage, check their VBE (voltage between the base and the emitter) and ensure that it is not more than 0.65V. If a greater value is measured, replace the faulty transistor.

6. If voltages are O.K. check the waveform on the oscilloscope, it should show crossover distortion.,

7. Clip a multimeter across any of the [20X] 10 OHMS output stage emitter resistors and turn the trimpot clockwise until you measure approx. 0.02 VDC across this resistor. Maintain for 30 minutes, adjusting the pot as the amp warms up.

IF A FUSE BLOWS

1. Check the 30 OHMS resistors in series with the BASE of the output transistors [R49,39,40,59] to ensure that they have not "open circuited" - i.e. that they are not burnt.

2. Measure the DC resistance between any of the three leads of a power transistors Q14,15,22,24 or driver transistors Q12,13 [the transistors mounted on the heat sink bracket]. If you measure less than 100 Ohms between any two leads, then the device is faulty and must be replaced.

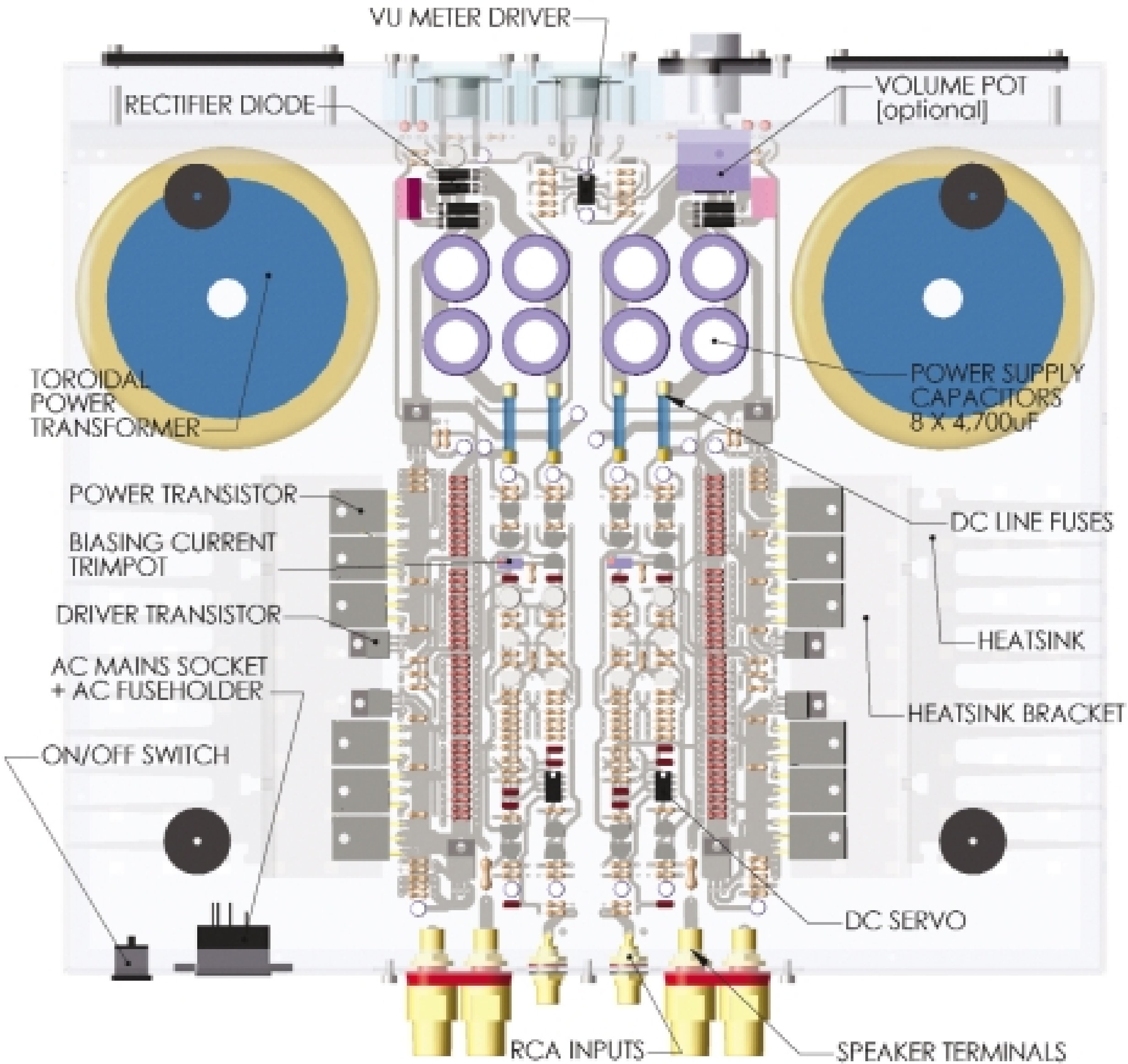
3. Connect the BLACK multi meter lead to earth and check for any short circuits on the positive or
negative voltage rails.

4. If the MAIN FUSE blows then check the SF16
rectifier diodes DE5,6,7,8,9,10,11,12, for a short circuit. if they measure less than 100 Ohms, replace them.

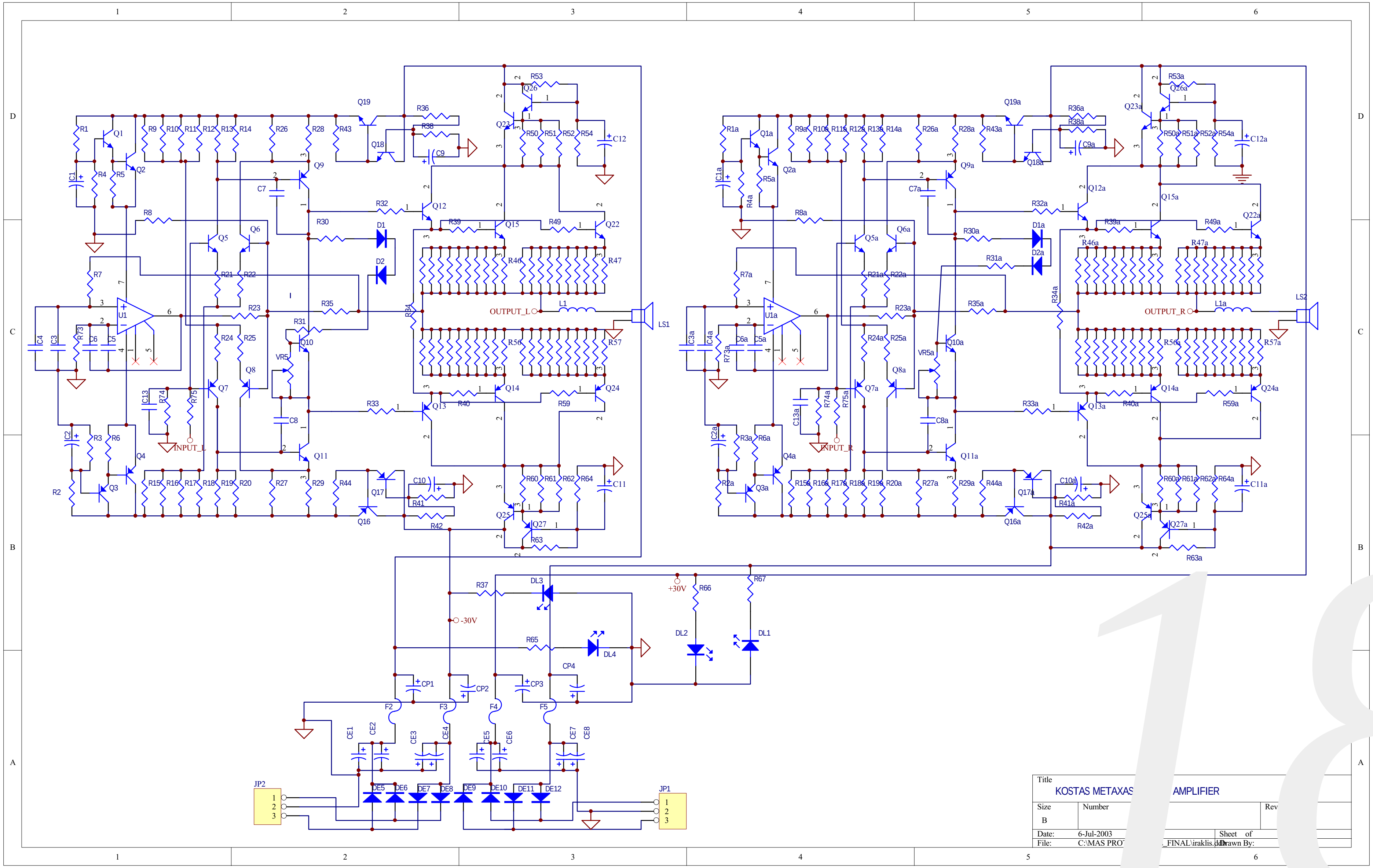
5. DC Offset Voltage at Output. Connect multimeter probes to the BLACK and RED speaker terminals to measure the DC offset. It should be less than 0.05VDC. If it is greater than this please check the LF351 DC SERVO IC[U1]. Check that they are receiving voltage at Pin 4 (-15V) and Pin 7 (+15V) and replace if necessary.

6. Biasing Trimpot has not effect.
Replace the 2N4401 transistor next to the TRIMPOT.

Maintenance



Schematic


Title
KOSTAS METAXAS AMPLIFIER
Size B
Number
Rev
Date: 6-Jul-2003
Sheet of
File: C:\MAS PRO _FINAL\iraklis.ddb
Drawn By:
INPUT_L
INPUT_R

EC Declaration of Conformity to Appropriate Standards

Safety

HD 195-S6

EN 60 065

EMC

Emissions Tested to EN 55013

Sound and television broadcast

receivers and associated equiment

Immunity Tested to EN55020

Electromagnetic immunity of

broadcast receivers and associated equipment

In accordance with

CISPR 16-1

Radio disturbance and immunity measuring apparatus

CISPR 16-2

Methods of measurement of

disturbances and immunity

IEC 801-2)

IEC 801-3 3V/m 20dB

IEC 801-4 1KV (AC lines)

Manufacturer

Metaxas Audio Systems
1460 Woodend Rd
Romsey 3434
Victoria AUSTRALIA
www.metaxas.com
metaxas@netspace.net.au
FAX:+613992 36481

Product

Metaxas Iraklis Amplifier

Full Reviews