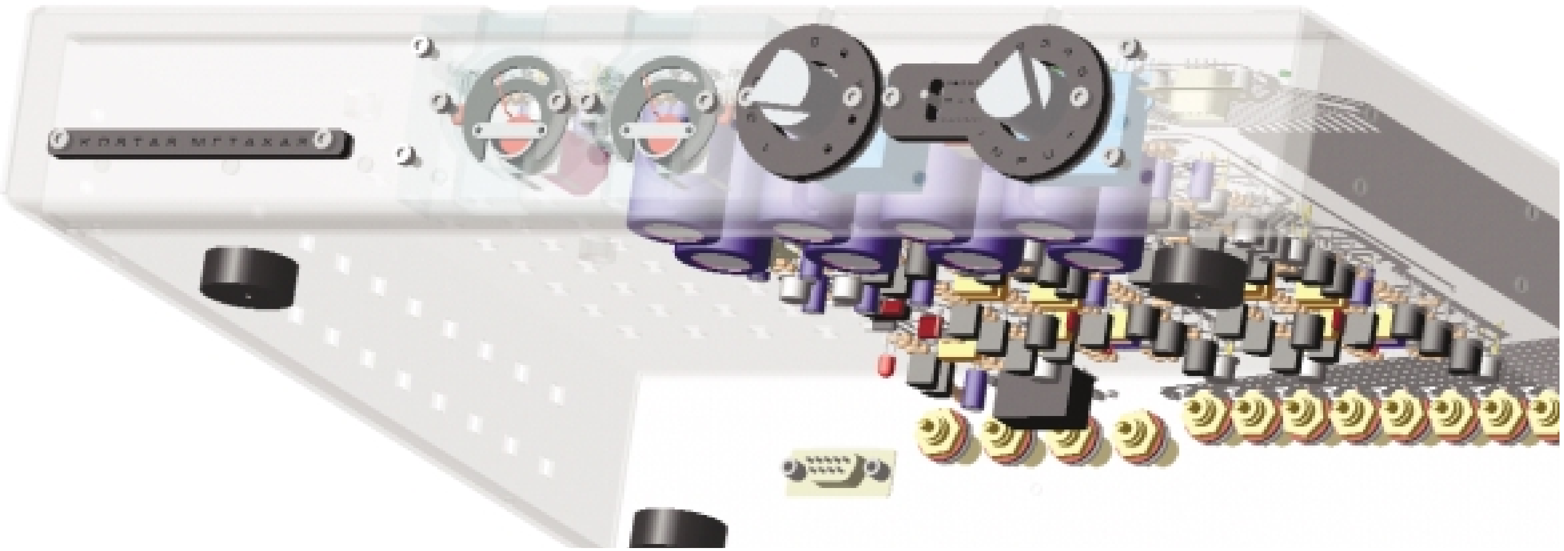
Marquis



KOSTAS METAXAS DESIGN

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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

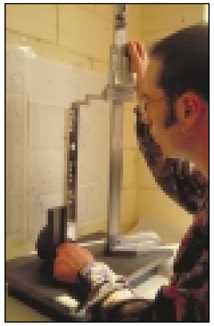
Ecstatic & Revelation Electrostatics

Kostas Metaxas circa 1985

Soliloquy Monoblocks

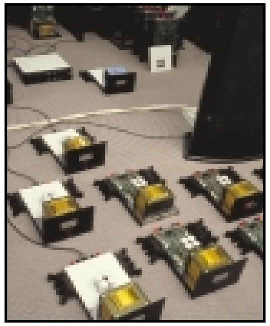
3 Decades of Hi-End : 1990's

Apollo Speaker

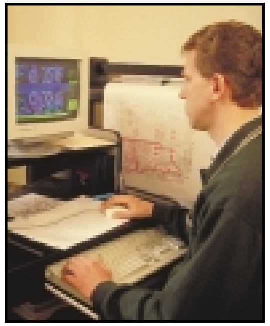


Stainless Steel Turret Punching

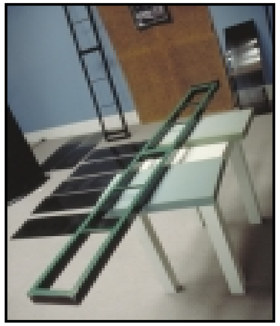
Empress Full-range electrostatics using plastic-composite moulded frame



Iraklis "on-test"



PCB design



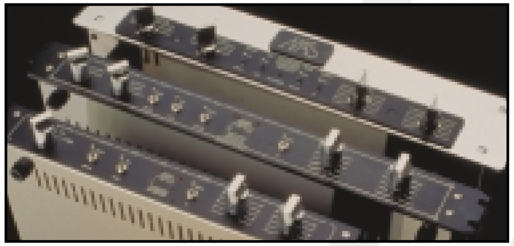
EMPEROR Assembly

Reference System circa 1992

Assembly

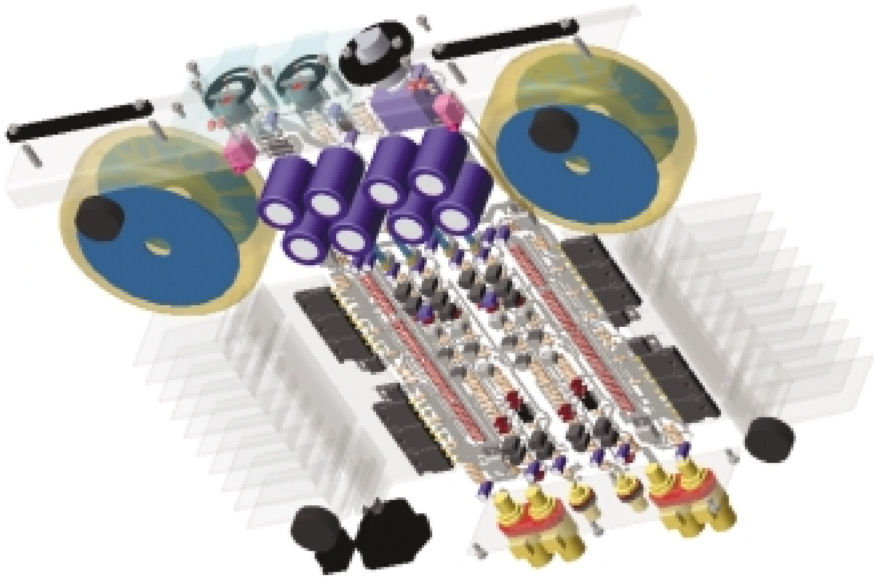
Assembly

Opulence, Marquis & Charisma Preamplifiers



CZAR 2-way full range electrostatic

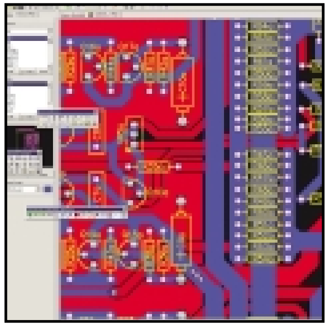
3 Decades of Hi-End : 2000's



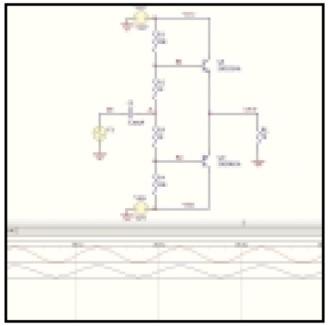
Using technology borrowed from Aerospace and Formula 1, the new Kostas Metaxas *Audio designs reflect the extraordinary advances that have been made recently in modelling and simulation software.*

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.

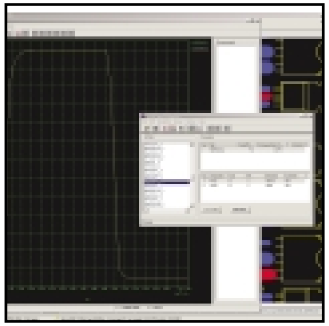
The Protel PCB software [www.protel.com] extends the quite normal listening tests on a component by component level to the PCB level. Schematic Based simulations can test [or verify] the PCB's signal integrity by running the "Signal Integrity Simulator" which displays a Reflection and Crosstalk Analysis.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



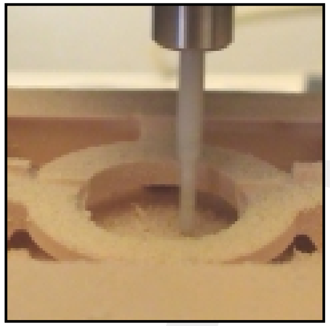
Schematic Capture & PCB design



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.

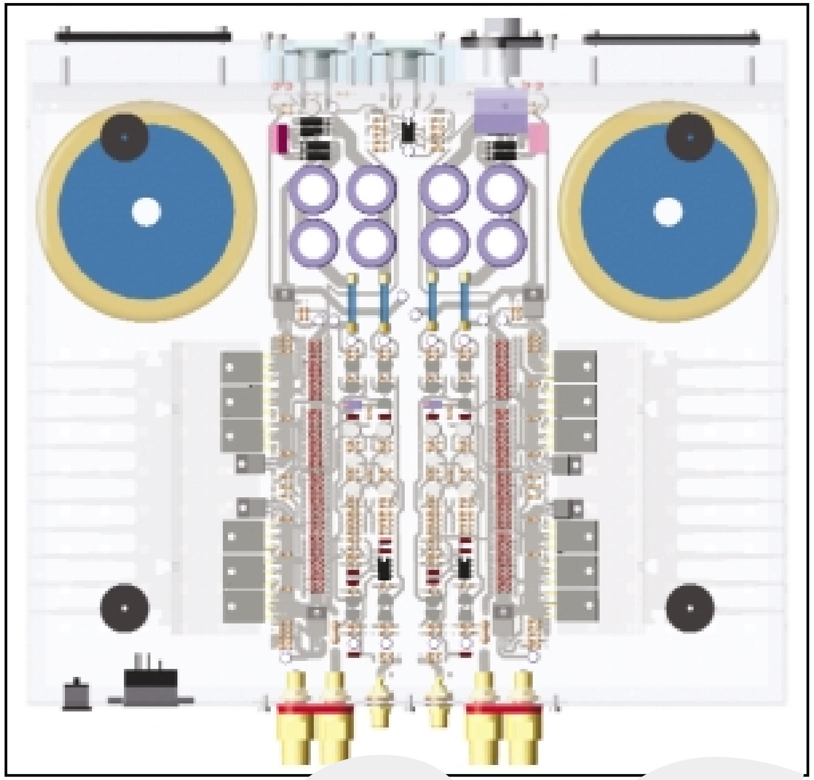
Design Philosophy

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 .

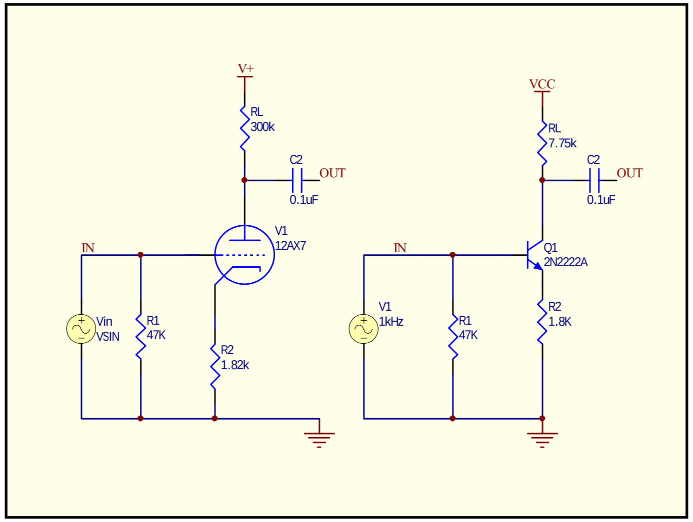


Frequencies above 1 kHz would be unable to draw current instantaneously from the power transformer and would need to rely on the charge stored in the power supply filtering capacitors.
We replace this slow DC rectifier with ultra high speed diodes wired in parallel with switching times in 'nanoseconds' 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).

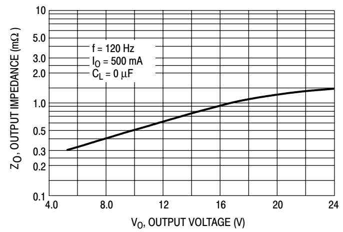


Figure 6. Output Impedance as a Function of Output Voltage (MC78XXC, AC, B)

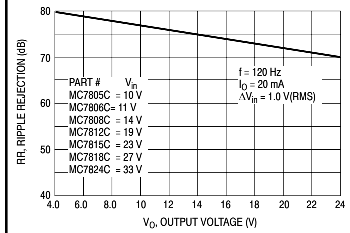
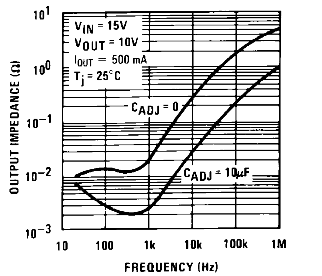


Figure 3. Ripple Rejection as a Function of Output Voltages (MC78XXC, AC, B)



DS009063-46

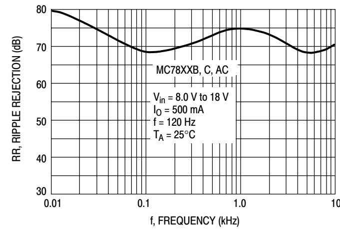
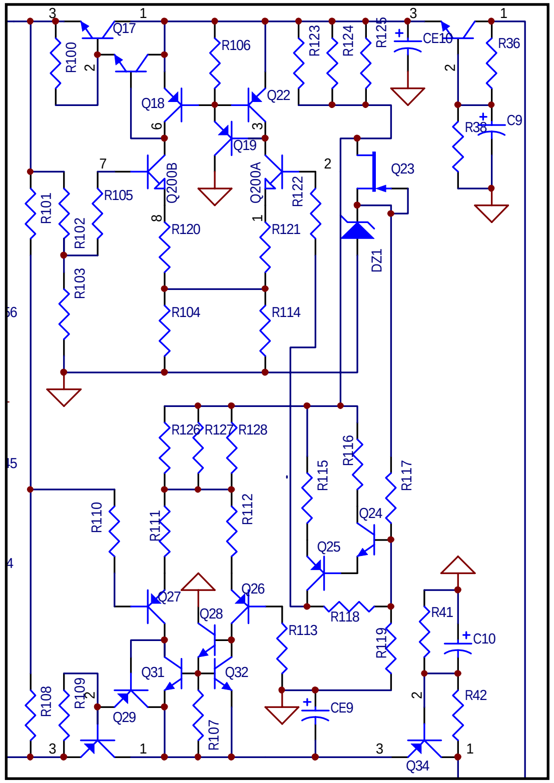


Figure 4. Ripple Rejection as a Function of Frequency (MC78XXC, AC, B)

Design Philosophy

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;resented 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.

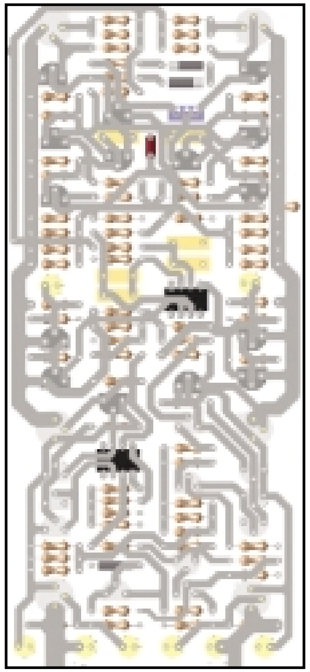
In real world power supply circuits, the impedance of the power supply actually increases with frequency because the open loop gain rolls off at high frequencies .

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.

DC Protection Circuits

The output stage of the preamplifier is connected to a DC protection circuit which activates a relay if it senses any DC before it can cause any damage to your speakers.

Mains Fuse

A 2AMP 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' for servicing.

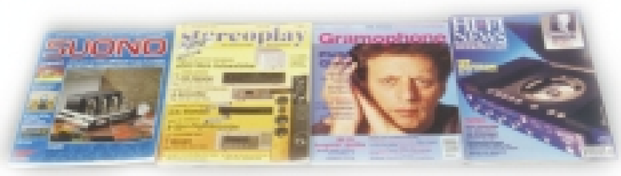
What the critics say...

"The Marquis is as fast as the devil, creates a beautiful aura without any indication of overshoot, has glow and spirit, temperament and cunning. It has fire.
In comparison to the Marquis, most so called super-preamps sound like rubbish, flabby, boring."

Ulrich Michalik, HI FI EXCLUSIV , Germany.

" The Marquis Preamp imposes far less of itself on the signal, handling its chores with near invisibility".
Ken Kessler, HI FI NEWS & RECORD REVIEW, England.

" The Marquis constitutes in our opinion, pure gold and is already the reference point in this price category and will not be superceded in a hurry".
Jean Hiraga/Patrick Vercher LA NOUVELLE REVUE DU SON, France.



" The conclusion: the sensation is perfect. An Amplifier for 9000DM can reach without problems to the position of ABSOLUTE SPITZENCLASSE and is immediately equal to competitors that are three times more expensive".
Alexander Strobel, STEREOPLAY, Germany.

What the critics say...

The performance of various frequencies can, in two words, be described as extremely homogeneous. You will not be able to tell them apart in well recorded material, with able three way transducers. Such a composure exists! The bass is very quick with top grade body and attack, not slowing at all. The mids are very descriptive, with very good detail and purity, soft and extremely sweet. The highs are delicate, with excellent body and special plasticity. The stereo image has excellent dimensions and very good "black" character, and by saying this, I mean the "black" space that separates the instruments and makes them sound as separate entities, with lifelike positioning in space, in well recorded material."

Thanassis Moraitis, SOUND & HI FI ,Athens, Greece

1. LINE STAGE: The MARQUIS Line stage is optimised for operation with any incoming source including the modern Compact Disc playing machines. By virtue of its dual-mono power supply with generous high voltage rails, it is virtually impossible to overload. The preceeding VOLUME potentiometer establishes the input impedance at a steady 10K Ohms.
By virtue of its high current transistor output stage with impedance of 50 Ohms, the MARQUIS is able to develop sufficient current to overcome the increased capacitance of long (greater than 2 metres) interconnection cables.
2. POWER SUPPLY: An external supply houses the completely dual-mono, high current 46,000uF of primary filtering and stacked 100 Watt toroidal transformers. The DC supply is connected via a 5 pin umbilical cord/socket arrangement to the mainframe where the D.C. encounters another 10,000uF of filtering before it reaches the regulation circuits. The regulation circuits of the MARQUIS are generated by a proprietary circuit built around matched and selected transistors. Absolutely no I.C's are used.
The positive Master is composed of a differential sensing circuit which on its positive input is fed by a low noise zener which is amplified by a two-transistor gain stage. The negative input monitors the output voltage to ensure that the DC is stable and that the impedance of the regulator is consistent at eliminating any AC component on the DC line (which is fed back by the amplifier circuits) from effectively DC to at least 5MHz. Both amplifier and regulator are tuned in conjunction with each other to maintain an absolute stability and the highest possible speed of operation (the regulators themselves have a linear frequency response from DC to beyond 5 MegaHertz).
The negative regulator consists of the same differential arrangement (with current mirror) where the positive arm is tied to ground and the negative input is a 'slave' to the positive Master. This ensures that the positive and negative supplies are maintained at a constant voltage within millivolts of each other, and eliminates the possibility of any untoward D.C. surges which could adversely affect the DC servo circuits from maintaining absolute zero level D.C. voltage components at the amplifier outputs.
3. D.C. PROTECTION: In the event of a D.C. voltage being generated on the output of any of the amplifier stages greater than 0.6V, a dual F.E.T. integrated circuit trips the relay in series with the output and short circuits the input of the following amplifier to eliminate the possible damage of the loudspeakers.

Specifications

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

VOLTAGE OUTPUT : 15VRMS per channel into 50 Ohms with no more than 0.05% T.H.D.

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 : 26dB

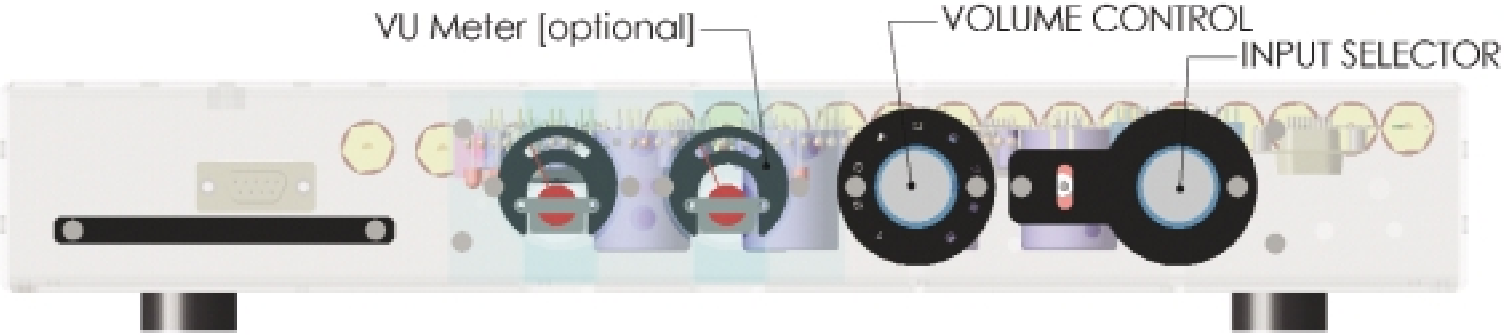
INPUT IMPEDANCE : 100kOhms in parallel with 11pF

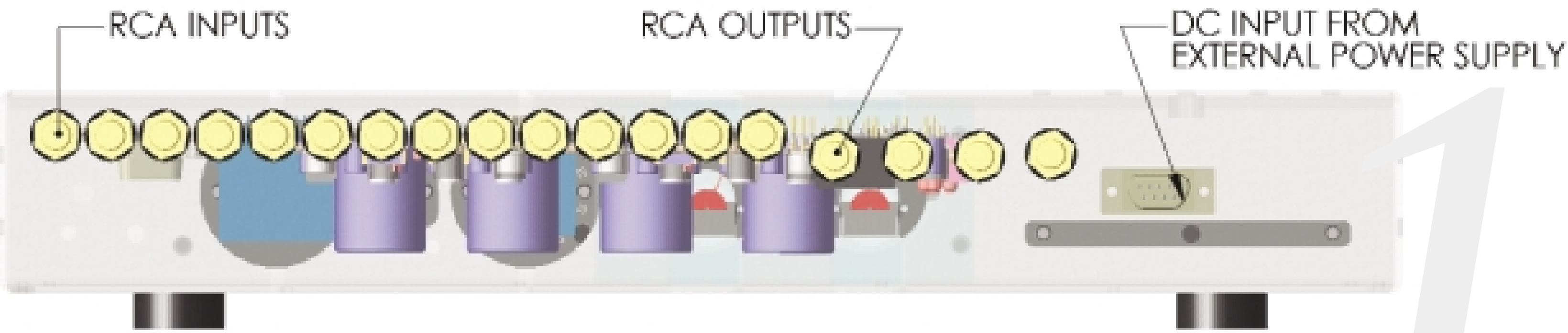
OPTIONAL RIAA PHONO STAGE:

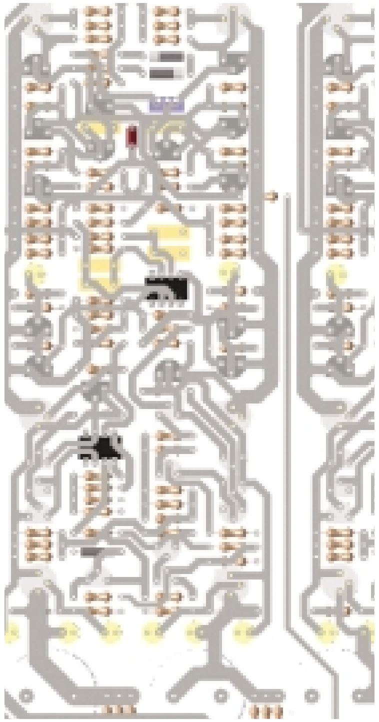
Input micro switches allow over 69 different combinations of input impedance, whilst the phono input stage can be configured for operation with either Moving Magnet or Moving Coil cartridges.The RIAA equalisation is generated via selected polystyrene capacitors and 1% metal film resisters in the inverse feedback loop.

The overall open-loop gain of this stage has been optimised using local feedback in the voltage gain stages to approximate the RIAA time constants before the application of a minimal amount of overall feedback. This allows us to minimise the stability compensation to ensure the high speed (greater than 10MHz) operation of this circuit. The DC operating point is stabilised with the use of a low drift F.E.T. input servo Op Amp which feeds micro-volts to the inverting arm of the differential input to entirely eliminate the need for any input or output capacitors in the signal path.

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 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).

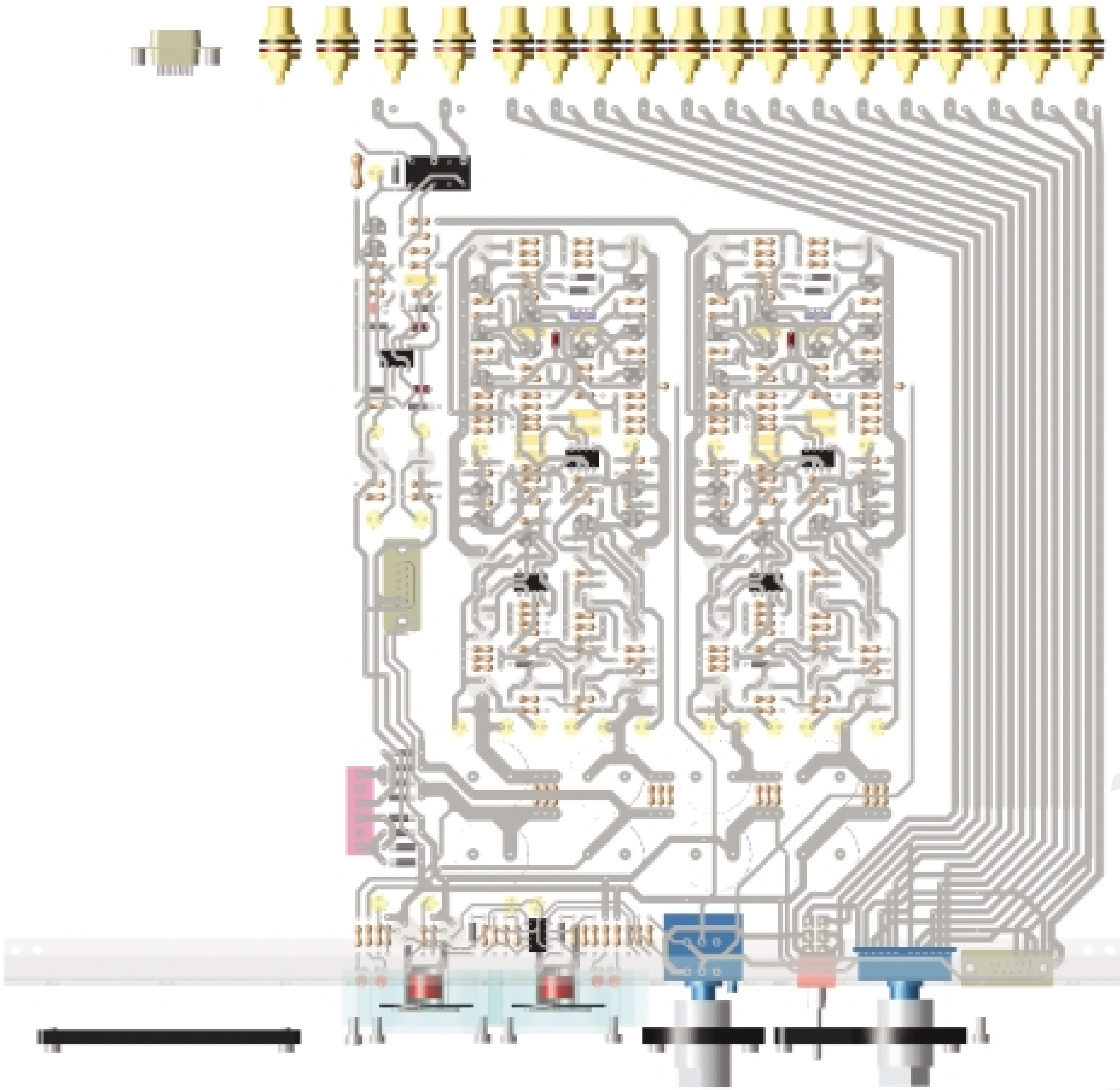
5. Measure the voltage drop after the "regulators" [the emitter of Q16, 30]which should be ~20 volts .

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

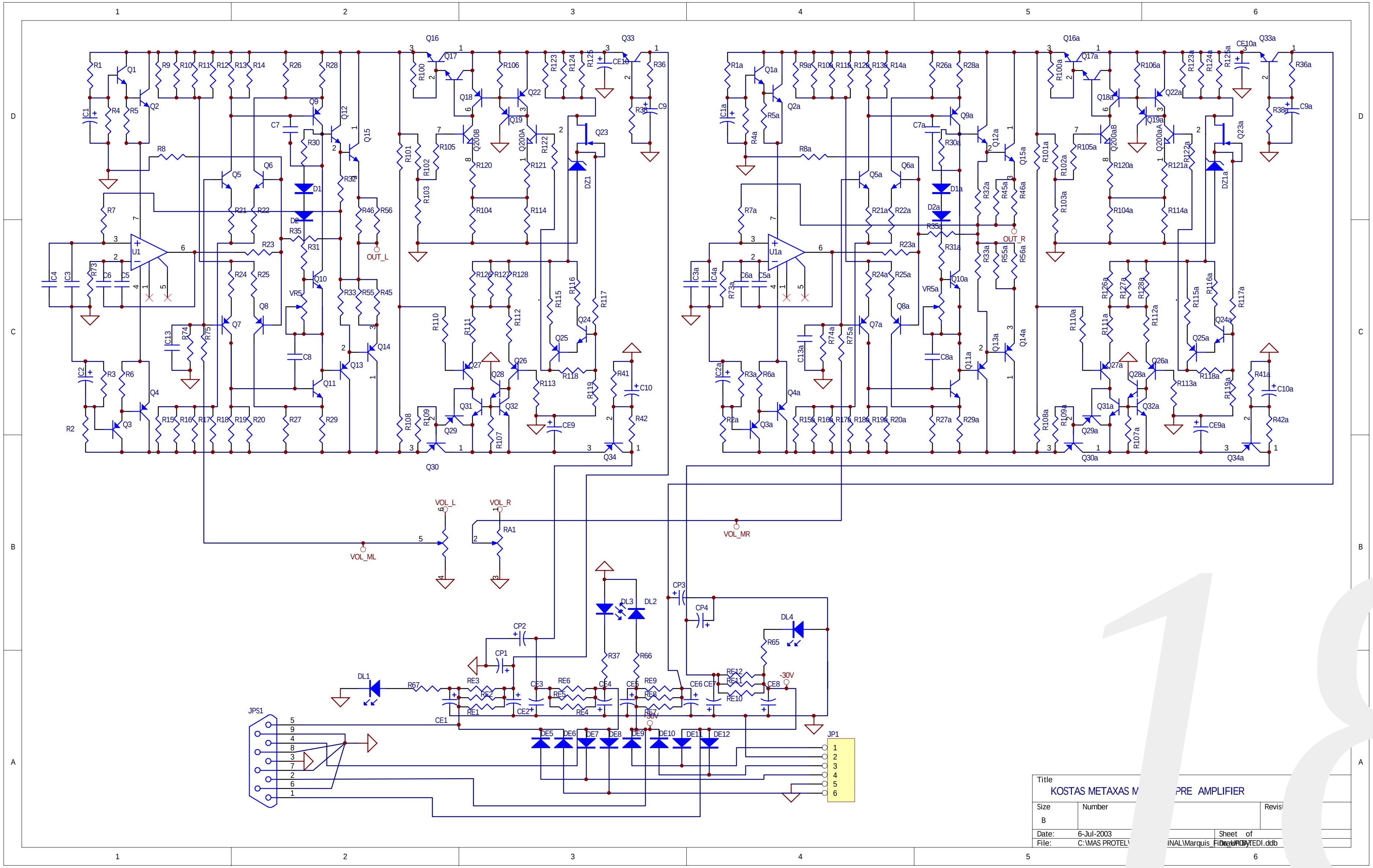
7. Clip a multimeter across any of the 100OHMS output stage emitter resistors [R46,56,55,45] and turn the trimpot anticlockwise until you measure approx. 0.75 VDC across this resistor. Maintain for 30 minutes, adjusting the pot as the amp warms up.

5. DC Offset Voltage at Output. Connect multimeter probes to the intersection of resistors R55 & R56 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.



Schematic



OUT_L
OUT_R
VOL_L
VOL_R
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VOL_MR
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Date:
6-Jul-2003
File:
Sheet of

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

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Product

Metaxas Marquis Preamplifier