

COMMERCIAL MONITOR AMPLIFIER 60 WATT VALVE MONOBLOCK



The CMA-01 60 Watt Professional Valve Monoblock Amplifier is designed specifically for Precision Monitoring in Recording Studios, Audio Production, Mix-Down Control Rooms, Video and Film Sound Post-Production, Mastering Facilities, Critical Audio Quality Evaluation, and of course true enjoyment of High Quality Sound Reproduction.

The CMA-01 is an Ultra Linear class AB Push-Pull Amplifier and occupies 4 RU of 19" Rack Space.

The CMA-01 is designed for a long service life, easy maintenance and no compromises to its audio quality.

Although primarily a professional product the CMA-01 Amplifier is also available to Audiophiles and Hi-Fi Enthusiasts who wish to enjoy the near perfect sound reproduction available only from a very high quality Valve Amplifier. Valve Amplifiers are reputed to sound better than Solid State Amplifiers and have been making a comeback in recent years.

Most High Quality Valve Amplifiers are very expensive, large, heavy, inefficient and power hungry. They generally also have lower measured performance specifications than most high quality Solid State Amplifiers and need regular expert maintenance and valve changes.

Out of curiosity, we designed and built the CMA-01 and found that it actually sounds much better than any Solid State Amplifier we have matched it against so far. It is warmer and friendlier to listen to, it brings out subtleties on recordings we have not heard before, and has a much cleaner mid-range.

Designed and Manufactured in Western Australia by:

Two questions raised are.

- 1: Why does a High Quality Valve Amplifier sound so much better than a Solid State Amp?
- 2: Why did Elan Audio design and market a Valve Amplifier?

We firmly believe that the special qualities of a Valve Power Amplifier are due purely to the Output Stage and nowhere else. Valve Power Amplifiers are more tolerant to load conditions than most Solid State Power Amplifiers and do not suffer from or exhibit any serious Crossover Distortion problems under real Loudspeaker Load conditions.

This tolerance, we believe is caused because the output stage is running fairly heavily into class A and not performing the type and number of Zero Crossover transitions, or switching functions a Solid State Amplifier normally does.

We also believe the fairly modest amount of Negative Feedback applied in the CMA-01 and most other Valve Amplifiers to be beneficial in this regard.

Valve Power Amplifiers also have “Soft or Gentle” overload or clipping and will produce higher sound levels than Solid State Amplifiers of equivalent output powers without sounding objectionable.

Curiosity, an interest in Quality Sound, coupled with a bit of madness made us investigate Valve Amplifier Technology, fall in love with their sound quality and design the CMA-01.

GENERAL DESIGN PHILOSOPHY

We set out with the following criteria for the design:

- 1: Create a Commercial Valve Monitor Amplifier for Professional applications.
- 2: Technical performance and sound quality to be as good or better than any other existing Amplifier.
- 3: Size and weight not particularly critical or important.
- 4: Design to be based on readily available types of valves and other components.
- 5: Able to deliver 60 Watts with potential to go to higher output powers.
- 6: Design for long service life, and easy maintenance.
- 7: Professional neat and attractive Rackmounting configuration.
- 8: Be non-critical of valves used in the driver stages.
- 9: Be able to use KT 88 or 6550 output valves with minimum adjustments required.

Based on the above criteria, we set out to design the CMA-01 which we now believe is the ultimate Professional Valve Monitor Amplifier.

We have always known that the critical circuit sections of a Valve Amplifier are the Output Transformer, the Output Stage Driver, and the Phase Splitter with the remaining circuitry in the main being related to its power supply.

We believe the old principle regarding Valve Amplifiers, first create a very good amplifier, then make it better by applying negative feedback. To do this, we set out to obtain the best possible Output Transformer, regardless of price, and found E.A. Sowter of the UK able and willing to design a Transformer to our specifications.

This transformer turned out to be a true work of art weighing in at 6.5 Kg with the windings broken into 14 sections, 6 Primary and 8 Secondary with all Secondary sections connected in parallel for optimum coupling between all windings in the transformer.

Inherent Frequency Response of the Output Transformer without applying negative feedback is + – 0.5 dB at 10 Hz to 50 KHz, and flat 10 Hz to 100 KHz with 10 dB of negative feedback applied. For best possible performance the output transformer secondary is not tapped for different load impedances as we firmly believe that all the Copper in the secondary winding must be used for best performance.

Instead, the output is optimised for a load impedance of 5 Ohms which we believe is a suitable compromise for driving most modern Loudspeaker Systems generally having an impedance between 4 and 8 Ohms.

Second step was to design a driver stage having inherent low distortion and truly adequate output voltage swing in order to fully and cleanly drive the KT 88 or 6550 output valves. The KT 88 or its alternative, the 6550 exhibit excellent linearity and stability but have only fairly moderate gain and require a very good driver circuit. For this, we designed a circuit employing 3 x 12AU7 or ECC82 valves capable of delivering a clean output swing of about 140 Volts Peak to Peak.

This circuit is suitable for driving parallel Push-Pull KT 88 or 6550 valves to give 120 Watts of audio power in parallel Push-Pull, and 350 Watts when driving five parallel pairs of output valves.

The Phase Splitter stage is another important circuit element. We realised early on in our research that it is not possible to design a Valve based Phase Splitter which is truly balanced at all frequencies. This is due to tolerances between individual valves and Miller Effects. The use of a driver transformer was rejected on the grounds that although it would produce good balance at all frequencies, it would be difficult to apply a useable amount of negative feedback without excessive phase compensation, which would compromise the audio quality, particularly relating to transient response.

Being practical engineers and not Valve Fanatics, we elected instead to use a Solid State Phase Splitter based on Operational Amplifiers giving superior drive balance and performance compared to using valve technology.

The Solid State Phase Splitter also has the added advantage of being able to unbalance the drive conditions slightly by a controlled amount to compensate for minor gain differences in the Output Valves.

The sheer audio quality produced by the CMA-01 Valve Amplifier is in the main caused by its superb Output Transformer, its Driver Stage and its Solid State Phase Splitter, resulting in an amplifier so good it requires no Phase Compensation whatsoever in its Feedback Loop.

GENERAL FEATURES

Apart from the active amplifier and power supply circuitry essential to its operation, the CMA-01 is provided with a number of general and practical features.

1: Forced Air Cooling. The CMA-01 chassis is lightly pressurised by an 80x80 mm 12V DC fan operated by 6V DC to reduce noise. Air escapes through perforations in the chassis around the Output Valves and other locations to keep these and other components cool to extend valve and component life.

2: Turn On Delay. Main DC HT application to the Output Valves is delayed by 60 Seconds after AC Mains is switched on in order to prevent damage to the Output Valves by cathode stripping and to prevent excessive Main HT voltages developing causing unnecessary stress to components.

3: Stand-By Switch. Switches off Main HT. Desirable if the amplifier is to be left idle for a limited time and preferable to switching the amplifier on and off frequently.

4: Mains Voltage Metering. LED meter indicates Mains Voltage.

5: Cathode Current Metering. Will indicate Cathode Current of either Output.

6: Bias Adjustment. Adjust Bias of each valve to match the valves as the Cathode current will drop off as the Output Valves wear out over time.

7: AC Drive Balance Control. Provided to compensate for minor differences in Output Valve Gain. Output Valve gain will differ slightly despite Valve Matching.

8: Feedback On-Off Switch. Intended for test use. Allows operation of the amplifier with 10dB of Negative Feedback and without Negative Feedback.

VALVES

Being a Valve Amplifier periodic Valve changes will be necessary as unlike in Solid State Amplifiers, Valves do wear out, or fail for various internal mechanical reasons such as internal shorts, open circuit filaments, or internal broken spot welds. Some Valves, particularly lowly stressed ones in the driver stages may last almost forever, while some fail in a comparatively short span of time.

Output Valves on the other hand do wear out where a good one can realistically be expected to last about 10000 Hours in service. Elan Audio have so far only used the SOVTEK brand of Output Valves, and to date had no problems, failures or rejects of that particular make.

Various commonly held views on Valve Amplifiers suggest the following:

Some valves of the same type sound better than others, even if they are of the same make.

There is some element of truth in this statement relating to certain valve amplifier designs. However, the valves used in the driver circuit of the CMA-01 are operated under conditions where only moderate gain is required and with DC operating conditions being stabilised by the circuit design.

This places little demand on the accuracy of the characteristics of individual valves used in the CMA-01 Valve Amplifier. We are aware of other existing designs of Valve Amplifiers, where small changes in valve characteristics will make a considerable difference in amplifier performance. The Output Valves used in the CMA-01 are driven by a very generous driver circuit, capable of fully driving KT 88 or 6550 output valves, even ones with abnormally low gain.

Valve amplifiers with less generous or even marginal driver circuitry may be affected by differences between individual valves, particularly valves with low gain. There are also potential stability problems with certain valve amplifiers, particularly amplifiers having a poor quality Output Transformer and using higher gain valves such as EL 34 or EL 84 types where some valves exhibit stability problems while others do not.

This is not a problem with the CMA-01 Valve Amplifier.

Valves need Running In for maybe up to 100 Hours before they sound right.

Again, there may be an element of truth in this, particularly relating to certain designs. We have experienced such problems ourselves, mainly related to stability, with amplifiers having a poor or marginal quality Output Transformer using high gain valves such as EL 34 or EL 84 types. A small amount of wear, such as running these valves for a number of hours usually takes the edge off them and improves the stability. This is certainly not an issue with the CMA-01 Valve Amplifier using a very high quality Output Transformer and relatively low gain valves such as KT 88 and 6550 types.

Valves need Warming Up for several Hours before they sound right.

This may again be an issue in amplifiers of marginal design, or with worn Output Valves. It is not a problem with the CMA-01, which will fully stabilise its operation within the first 10 minutes, provided the Output Valves are not excessively worn.

KT 88's sound better than 6550's. 6550's sound better than KT 88's.

There appears to be some subtle differences in the Sonic performance of these output valves. Although the KT 88 is a Beam Tetrode and the 6550 is a Pentode having nearly identical characteristics and producing practically the same measured performance and output power, there are differences in their overload behaviour.

Critical listening tests at moderate levels reveal no audible differences between the KT 88 and the 6550. On overload however, both on listening tests and visual observations using a Cathode Ray Oscilloscope reveal that the KT-88 does not saturate abruptly, and gives a fairly smooth and gradual overload whereas the 6550 saturates abruptly, and gives a fairly sharp and defined overload, not unlike a Solid State Amplifier.

Our conclusion is that the KT 88 sounds better than the 6550 by being less objectionable when driven into overload conditions.

CMA-01 Amplifier Specifications

General

Type: Commercial Valve Monoblock Monitor Amplifier. Class AB, Push-Pull, Ultra Linear, Fixed Bias.

Input: Cannon XLR Female, Differential Balanced, Bridging 50K, Nominal Level +4 dBu, Suitable for Unbalanced Source, Wired Pin-1 Gnd, Pin-2 Hot, Pin 3-Cold.

Valves: Driver stage, 3 x 12AU7/ ECC82. Output, 2 x KT 88 or 6550.

Configuration: Rack-Mounting 4 RU.

User Adjustments: Gain Control (Alps Conductive Plastic), Output Valve Bias.

Metering: 3 ½ Digit LED Meter, AC Mains Voltage, Cathode Current, Displayed in % of Design Value.

Cooling: Fan 80 x 80 mm 12V DC, Chassis Lightly Pressurised.

Output: Gold Plated Screw Terminals.

Technical Performance

Output Power: 60 Watts into 5 Ohms. Suitable for 4 and 8 Ohm Speakers.

Power Bandwidth: 60 Watts 20 Hz to 10 KHz, 40 Watts 10 Hz to 20 KHz.

Freq Response: + 0 –0.5 dB 10 Hz to 30 KHz,
HF Rolloff by internal passive RC filter, -1 dB 52 KHz, -3 dB 83 KHz.

Signal to Noise: WRT + 4 dBu in, 50 Watts out.

Wideband 87 dB,
20 Hz to 20 KHz 90 dB,
400 Hz to 20 KHz 93 dB.

Distortion: 50 Watts out into 5 Ohms.

100 Hz 0.5%.
1 KHz 0.5%
10 KHz 0.5%

The following figures were achieved under tests, and are not guaranteed.

10 Watts out into 5 Ohms. (With AC Drive Trimmed)

100 Hz 0.06%

1 KHz 0.04%

10 KHz 0.1%

1 Watt out into 5 Ohms. (With AC Drive Trimmed)

100 Hz 0.03%

1 KHz 0.03%

10 KHz 0.03%

Damping Factor: 20

Power Consumption: Stand-By 85 VA

Idling 142VA

50 W Out 220VA

Hard Clipping 275 VA

Weight and Dimensions

Weight: 20 Kg Unpacked.

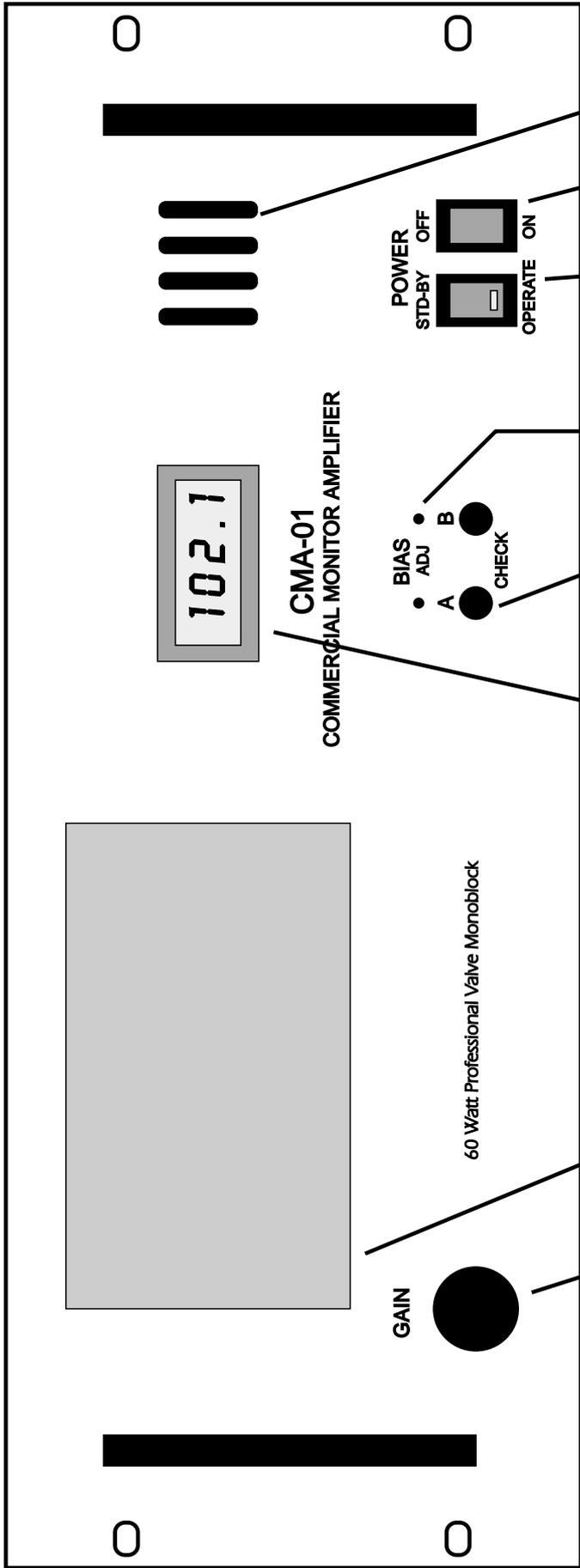
Dimensions: Width 483 mm, 19"

Height 177 mm, 7"

Depth 310 mm

Shipping Crate: 580 mm Wide x 270 mm High x 390 Deep

Shipping Weight: 25 Kg



Cooling Air Intake

AC Mains Power Switch

60 Second HT Turn-On Delay

Standby-Operate Switch

Fast Flash Warming Up
 Slow Flash Stand-By
 Steady Operate

Output Valve Bias Adjustment

A Adjust Left Valve
 B Adjust Right Valve

Output Valve Bias Check

Press A To Check Left Valve
 Press B To Check Right Valve

LED Meter Display

Calibrated In % Of Design Value

No Check Button Pressed
 AC Mains Voltage
 100 Indicates Correct Nominal
 Supply Voltage

Bias Check Button Pressed
 100 Indicates Correct Cathode
 Current

Perspex Window

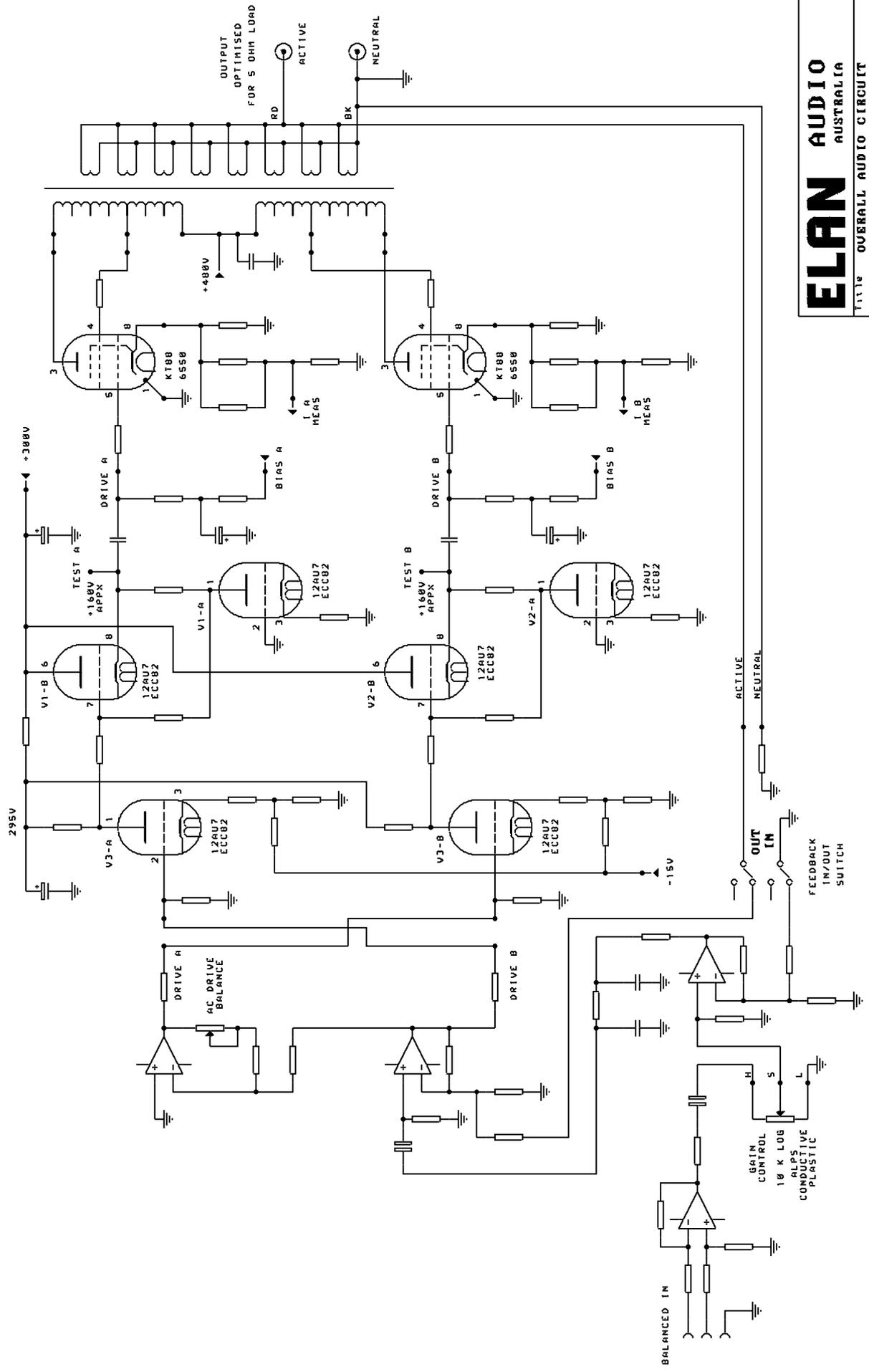
Gain Or Volume Control

ALPS Conductive Plastic
 Audio Potentiometer

CMA-01
 COMMERCIAL MONITOR AMPLIFIER

60 Watt Professional Valve Monoblock

GAIN



ELAN AUDIO AUSTRALIA

Title		OVERALL AUDIO CIRCUIT
Size		COMMERCIAL VALUE MONITOR AMP
Number		CM001 PRO
Revision		
Date:	2-NOV-2008	Sheet 01
File:	CM001PRO.D	Drawn By: