The Citation Sixteen

Professional Stereophonic Power Amplifier

harman/kardon

Owner's Manual

INTRODUCTION

". . . for the sake of music and our demanding love of it."

The name Citation has always meant something special to music lovers. When Citation was first introduced more than a decade ago, it represented a major breakthrough in high fidelity design. "Citation Sound" became the industry's new standard of excellence and captured the imagination of audiophiles throughout the world. Hans Fantel, noted audio authority, stated in a glowing report that "the Citation group bore eloquent witness to the one vital aspect of audio that for so many of us has elevated high fidelity from a casual hobby to a lifelong interest; the earnest attempt to reach an ideal — not for the sake of technical showmanship — but for the sake of music and our demanding love of it."

WARNING: TO PREVENT FIRE OR SHOCK HAZARD, DO NOT EXPOSE THIS APPLIANCE TO RAIN OR MOISTURE.

OUTSTANDING FEATURES OF THE CITATION SIXTEEN

- A completely symmetrical push-pull drive circuit affords output slew rates of 30 V/microsecond with the accompanying minimization of transient intermodulation distortion.
- Foldback current limiting provides total short circuit protection with complete freedom from limiter operation at maximum power into reactive loads.
- Fail-safe operation with all types of loads, including electrostatic speakers. Amplifier can handle power transients, short circuits, or unloaded conditions without damage to the output stages.
- A thermal design that ensures continuous operation under any rated condition without causing the thermal breakers to trip.
- Heavy-duty heat sinks keep amplifier cool even under stress operating conditions.
- Two individual power supplies deliver superb regulation for absolute stability and extended low frequency response. Handling of transients is effortless at any power level. Interaction between channels is eliminated.
- D. C. coupled design provides phenomenal square wave response from 5 Hz to 20 kHz. Phase shift at 5 Hz is less than one degree. Amplifier extends to below one Hz with less than 15 degrees of phase shift. Rise time is three microseconds at 20 kHz.
- A peak indicating light emitting diode display provides instantaneous power monitoring and avoids the ballistic inertia of the conventional VU meter.

UNPACKING

After unpacking the Citation Sixteen, inspect it carefully for signs of transit damage. The amplifier was subjected to numerous quality control tests and inspections prior to packing and should therefore be in perfect operating condition. If damage is visible, notify your dealer at once. If the amplifier was shipped to you, notify the transportation company without delay. HARMAN/KARDON will cooperate with you in such instances, but only YOU can recover from the carrier for damage incurred during shipment.

POWER REQUIREMENTS

Connect the line cord to any outlet furnishing 120 volts, 50-60 Hz A.C. current. The voltage may vary between 110 and 128 volts without damage to the amplifier.

VENTILATION

Although your new Citation Amplifier rarely develops high heat, if you install it in a cabinet, it is recommended that you leave the back of the cabinet open. If this is not possible, provide several large holes or slots as low down and as high up in the cabinet back as possible. As an alternate, holes may be provided in the sides, bottom or top of the cabinet. Remember that really effective ventilation requires provision for cool air to enter at the bottom and hot air to leave at the top. A minimum clearance of two (2) inches should be allowed on each side and in the rear, between the chassis and the cabinet, and six (6) inches is required above it.

Isolate any accessories which might interfere wit. ventilation. For example, do not drape plastic oi rubber covered interconnecting cable over the finned heat dissipating devices on the rear panel.

WIRE DRESSING

Speaker wiring and input cables connected to the rear panel of the Citation Sixteen should be routed to prevent intereference with the cooling fins of the power transistor heat sinks.

CONNECTING THE SPEAKERS FOR STEREO OPERATION

Your two speakers should be identical to obtain optimum results. Experts agree that a perfectly matched system offers the best stereophonic reproduction. The speakers should be placed along the same wall approximately 8 to 10 feet apart depending upon room size and furniture placement. It may be necessary to experiment with speaker placement until best results are obtained.

A relay circuit provides speaker protection against low frequency oscillation and plus or minus DC voltages at the output. One-second delay on turn-on and instant turn-off prevent transients in the speakers.

WARNING: There is no output fuse, however, in the Citation Sixteen that will protect your speakers against current which may damage them. The amplifier can deliver 2.5 amperes to a 16 ohm speaker, 4.5 amperes to an 8 ohm speaker and 8 amperes to a 4 ohm speaker. Therefore, speakers that cannot operate safely with this level of current must be provided with fuses of the proper size. Check with the manufacturer of the speaker to ascertain the proper fuse rating.

Use stranded wire to connect your speakers to the Citation Amplifier. Lamp cord (zip cord) #18 gauge is acceptable, but a heavier gauge is desirable. Do not drive staples or tacks through the center of the wire for this may short out the two sections and will decrease volume or short out the speakers entirely. It is permissible to use approximately 50 feet of speaker connecting wire for each speaker without loss of volume. However, the damping factor is affected, and short leads are desirable.

1. Connect one length of lamp cord to your left speaker system. If the cord has color-coded insulation, connect red to plus (+) and black to minus (—), or ground.
2. Connect the other end of the lamp cord to the LEFT SPEAKER terminals located on the rear panel of the amplifier. The speaker output terminals are of a special industrial grade found in laboratories on professional test equipment. They can accept any type of wire termination such as bare tinned wire, spade lug, banana plug, etc. If the wire is color-coded, connect the red lead to the red terminal (+) and black lead to the black terminal (—), or ground.
3. Now connect another length of lamp cord to your right speaker. Observe polarity, same as step 1.
4. Connect the other end of the lamp cord to the RIGHT SPEAKER terminals. Observe polarity, same as step 2.

Dress the bare wires carefully so they do not touch the chassis or each other to cause a short circuit. Observe the same precaution when connecting the lamp cord to the speaker. If a short circuit does occur, the amplifier will turn itself off automatically, and will continue to cycle until the short is removed.

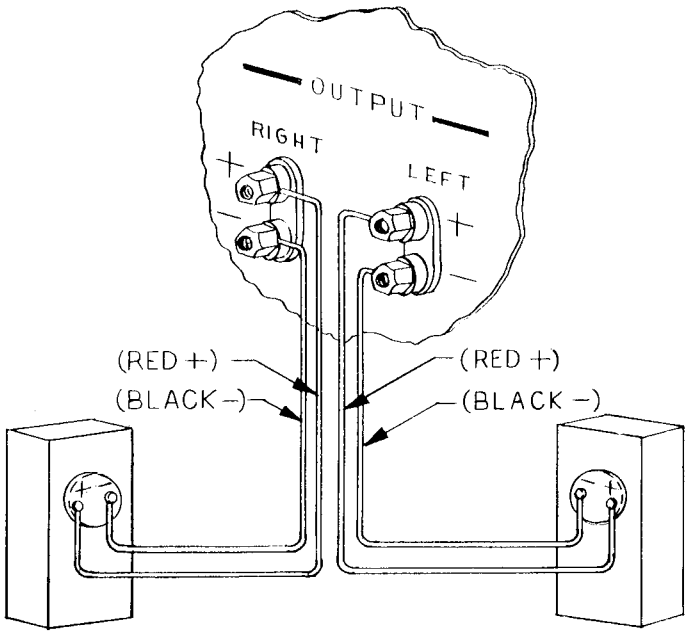
SPEAKER PHASING

When more than one speaker is used in a music reproducing system, the speakers must be connected in a manner which will allow them to work together. Both left and right speakers must operate in perfect unison, moving back and forth together. If the speakers are moving in opposite directions, the result will be diminished bass response and decreased realism of sound. When this occurs, the speakers are said to be out of phase.

Checking for the proper phase and correcting, if required, is quite simple.

1. Place your stereo preamplifier in the A + B or monophonic mode of operation.
2. Play a record, tape, or FM broadcast which has a single speaking or singing voice, or a solo instrument.
3. The voice or instrument should appear to be coming from an area directly between the two speakers. If the speakers are out of phase, the sound will appear to be coming from the two individual speakers.
4. If you determine that the speakers are out of phase, simply disconnect the leads from only one of the speakers and reverse them. The system will then be in phase.

This completes your speaker connections. Since the Citation Sixteen does not contain audio output transformers, it is not necessary to match the impedance of your speakers to the amplifier. The amplifier will perform perfectly with any speaker which has an impedance of 4, 8 or 16 ohms.



BRIDGE MODE OPERATION

The Citation 16 can be run in bridge mode, in which it delivers approximately 500 watts to a single 8 ohm speaker. Details of this mode of operation are included in the technical manual.

FRONT PANEL SWITCHES

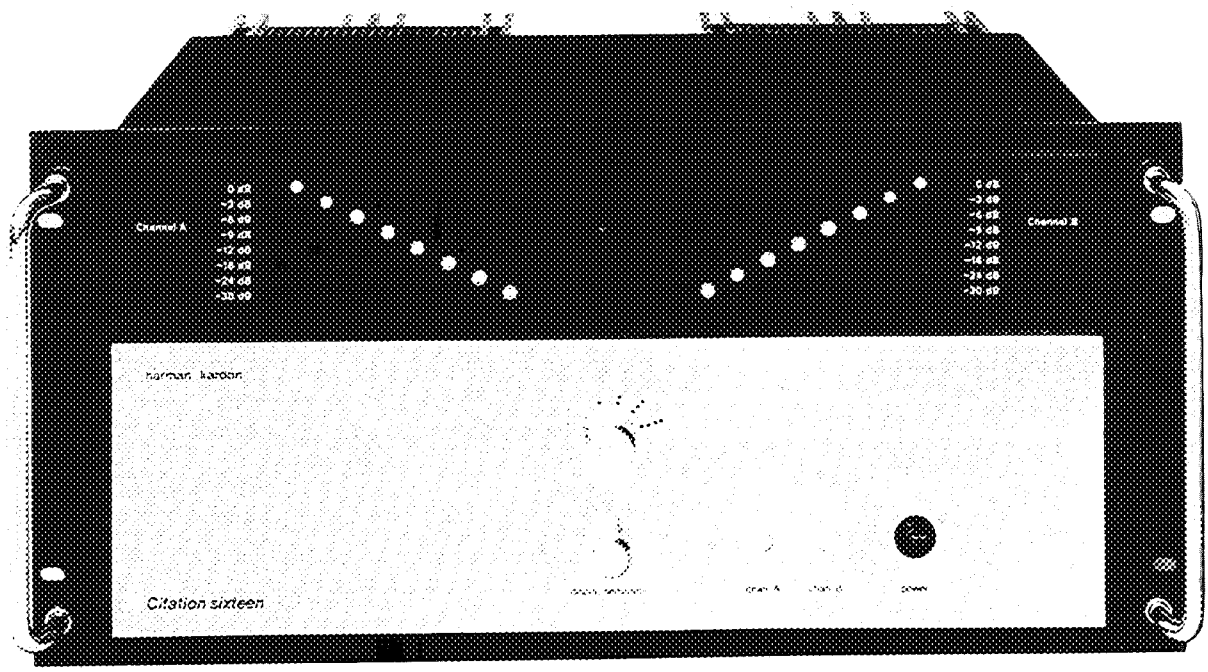
The power switch is on the front panel and switches the amplifier on and off. There are two neon indicator lights, one for channel A and one for channel B. When these lamps glow it indicates that each channel is receiving power from the A.C. line. If a lamp is not lit it indicates that the channel fuse is blown.

There are two rotary switches on the panel and they are used in conjunction with the light emitting diode display.

The 4 ohm/8 ohm switch is to be set in accordance with the nominal speaker impedance. For 4 ohm speakers, set it at 4 ohms; for 8 ohm speakers, set it at 8 ohms. The display is calibrated only for 4 and 8 ohm speakers.

The upper switch provides range control plus an "off" and "test" position. If the display is to be inhibited, set the switch to "off." To test if all the lamps are operative, set the switch to "test" and all the lamps should glow.

The ranges for the display are established by the dots on the panel. One dot represents 4 watts full scale, 2 dots — 16 watts, 3 dots — 64 watts, and 4 dots — 160 watts. Once the range has been established, the dB level of the signal below full scale is indicated by the calibration on the LED dress panel. For instance, if the range switch is at 4 dots, which is 160 watts full scale, the first green lamp will come on at 30dB below 160 watts, the second green lamp at 24dB below 160 watts, etc. The top red lamp will glow at 160 watts output.



TECHNICAL INFORMATION

BIAS AND ZERO ADJUSTMENTS: These adjustments have been made at the factory and it should not be necessary to touch the potentiometers for the life of the amplifier. The only time that readjusting bias will be required is when output transistors are changed. This adjustment should be made only by a competent service technician.

FUSES: There are two fuses protecting the Citation Sixteen. The correct fuse rating for the amplifier should be 4 ampere, slow blow for 100-120V AC applications.

CONNECTING THE PREAMPLIFIER

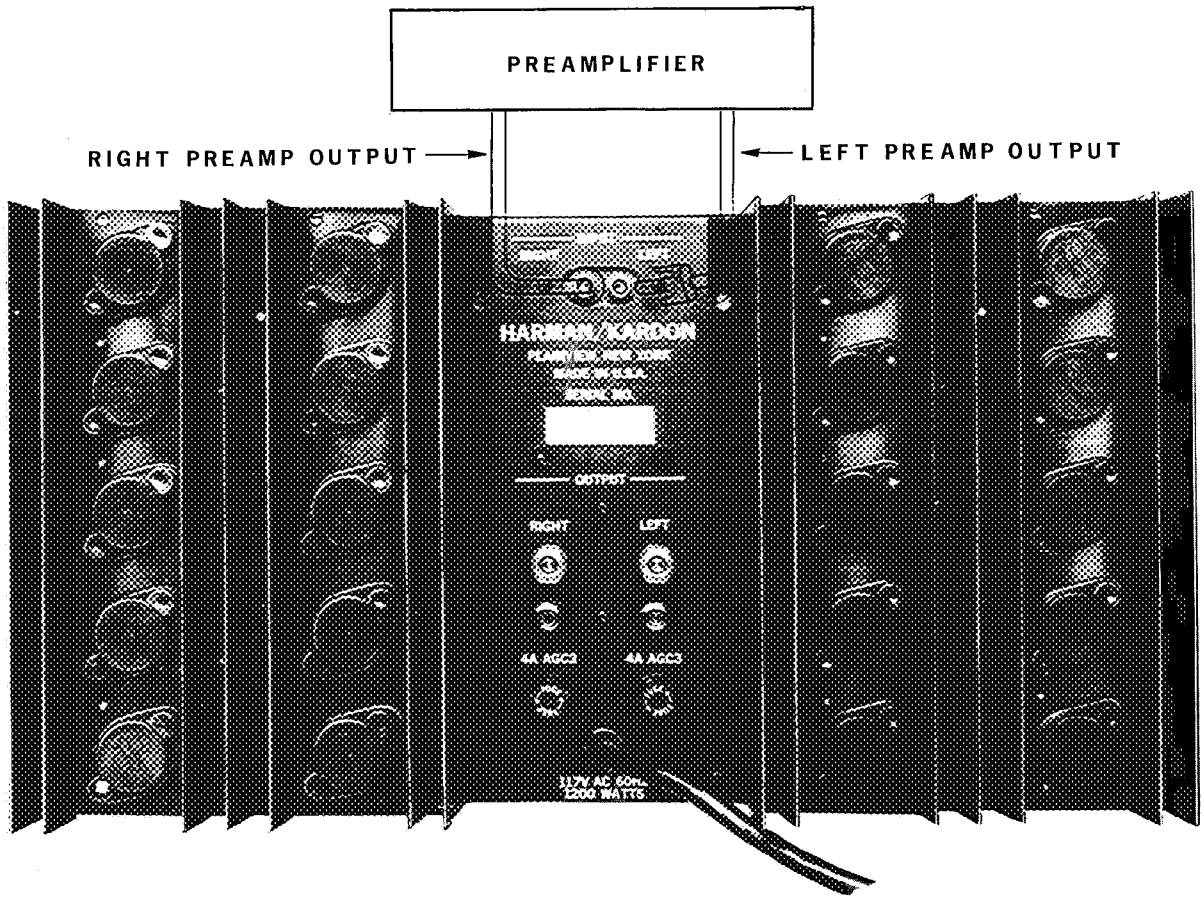
Use standard shielded patch cords with RCA plugs to connect your preamplifier to the Citation Sixteen.

Connect one patch cord from the Left Channel Output of your preamplifier to the Left Channel Input on the rear of the Citation Sixteen and an additional patch cord from the Right Channel Output of your preamplifier to the Right Channel Input of the Citation Sixteen.

Careful attention should be given to the grounding configuration of the components that feed the power amplifier. The Citation Sixteen is provided with a 3-prong power plug and thus the chassis is grounded.

If the preamplifier or the turntable case is also grounded as would be the case if they had 3 wire plugs, a ground loop is set up and this causes an undesirable increase in hum output. For this reason, these components should be provided with isolating plugs that break the third wire. The same problem develops in rack mounted applications if the various chassis are connected to each other via the rack. To keep hum levels in specification, the other chassis should be insulated from the Citation Sixteen chassis.

WARNING: DO NOT REMOVE OR MANIPULATE THE PLUGS OF THESE PATCH CORDS WHILE THE CITATION IS ON. THE TRANSIENT WHICH MAY BE CAUSED BY AN OPEN GROUND OR OPEN SIGNAL LEAD COULD DAMAGE YOUR SPEAKERS. ALWAYS TURN THE SYSTEM OFF BEFORE UNPLUGGING CONNECTIONS.



ENGINEERING DESCRIPTION

The basic design philosophy of the Citation engineering team is to create high fidelity products which contribute no sound of their own and come as close as possible to the design goal of a straight wire with gain.

One of the more important characteristics of a power amplifier with exceptionally high power capabilities is its ability to operate flawlessly at low power levels. It is for this reason that the Citation Sixteen features an integrated circuit differential input amplifier which automatically balances for zero D.C. offset voltage at the speaker terminals. Differential balancing permits the application of negative feedback across the entire frequency spectrum to insure perfectly linear operation for even the most minute signal levels.

Operation in the class AB mode minimizes crossover distortion, which contributes to sharp, raucous sound at low listening levels.

Years ago, when Harman/Kardon engineers first began to design Citation, they recognized that the characteristics of an amplifier in the non-audible range strongly influenced the quality of sound in the audible range. This was proven countless times in carefully controlled laboratory listening tests. Wideband designs exhibited greater spaciousness and clarity than amplifiers whose frequency response was restricted to the narrow range of 20-20,000 Hz. These experimental results confirmed the theoretical requirement of phase linearity and the need for a wide band circuit to provide this linearity.

In the reproduction of music which is comprised of a large number of frequencies, it is essential that the phase relationship of these frequencies be undisturbed as they pass through the amplifier. This is possible only when the phase shift is directly proportional to frequency. Calculations indicate that if linearity is to be maintained, the upper cut off frequency of the amplifier must exceed the upper musical frequency by a factor of 5, and the lower cut off frequency must be one-fifth the lowest musical frequency. Thus, for 20 to 20,000 Hz musical content, the amplifier should have a 4 Hz to 100,000 Hz bandwidth, as a minimum.

Square wave testing instantly exposes any phase nonlinearity in the amplifier. It is for this reason that all Harman/Kardon designs must exhibit perfect square wave response. The Citation Sixteen is a direct coupled amplifier with a 0.1 Hz input R-C network, to block any inadvertent D.C. inputs from causing speaker damage. Thus, it passes a 20 Hz square wave with essentially no tilt and provides an exceptionally dry, tight bass response. The high frequency response of the Citation amplifier extends to 130 kHz and this enables a 3 microsecond rise time in the square wave without evidence of any ringing or instability. Sound quality is totally trans-

parent without harshness or poor instrument differentiation in high overtones.

Since the application of the transistor to the reproduction of sound, discerning listeners have detected a difference between vacuum tube and transistor sound. Initially, this harshness, found in some transistorized amplifiers, was attributed to crossover distortion. More recently, this aberration has been attributed to a phenomenon known as transient intermodulation distortion (TID). This phenomenon is a result of saturation of one of the early gain stages under the stimulus of a large amplitude, high frequency input signal. The actual signal seen by the input of the differential amplifier is the difference between the input signal and a portion of the output signal. If the response time (slew rate) of the amplifier is not instantaneous, the fed back signal does not approach the amplitude of the input signal and the difference signal exceeds the dynamic input range of the stage. The result is a period of saturation, while the input waits for the output to catch up. During this period, the amplifier has lost control and simply follows the charge or discharge path of some internal capacitor. Its output bears no relationship to the input. As in the case of linear phase response, the square wave is also the ideal stimulus for evaluating an amplifier's performance with respect to TID. An impressive 30 volt per microsecond slew rate, wide bandwidth, carefully tailored frequency compensation and feedback ratio combine to make the Citation Sixteen essentially free of TID. It provides tube-like sound while embracing all of the well-known advantages of the transistor over the vacuum tube.

The amplifier is "rock" stable with all types of speakers. To maintain this tight form of stability, especially in an amplifier which carries a low frequency cutoff of 0.1 Hz, the power supply must meet very special requirements in terms of regulation and low source impedance. A dual supply, each with its own power transformer and electrolytics, assures proper operating voltages even under severe stress conditions. The amplifier, therefore, is literally two separate power stages on one chassis. Power measurements can be made with both channels driven simultaneously without deterioration of the power ratings or an increase in distortion.

Short circuit output protection is electronically provided. The circuit is of the fold-back type that insures the passage of full load current when an 8 or 4 ohm load is present, but senses the presence of a short circuit and reduces the current level to a point where transistor thermal dissipation is in the safe area. The temperature of the heat sink is allowed to rise to 90°C under short circuit conditions, at which point a thermal breaker operates and prevents a further increase in temperature.

LIMITED 2 YEAR WARRANTY AND SERVICE POLICY

We warrant this product to be free from defects in material and workmanship under normal use and service, and in accordance with the conditions set forth below. Should a defect occur within the period specified, provided that the unit is returned to either Harman/Kardon Plainview or an authorized Harman/Kardon warranty station, transportation prepaid, and which our examination shall disclose to our satisfaction to be defective, we will, for a period of **two (2) years** from the date of purchase, either repair of replace and install any defective parts of this product free of charge.

This warranty is not applicable to any product which shall have been repaired or altered in any any way so as to, in our judgment, affect its stability or reliability; or to any product that has been subject to neglect, misuse, abuse, or accident; or which has had its serial number altered, effaced or removed. Neither shall this warranty apply to any product which has been connected other than in accordance with instructions furnished by us.

Exceptions:

This warranty does not include any obligation as to the repair or replacement of any wooden enclosure or other similar accessory due to damage incurred after initial delivery, nor to any responsibility for transportation charges incurred in the shipment of the defective product to or from Harman/Kardon Plainview or any of its authorized warranty stations.

The duration of implied warranties is 2 years. Our obligation under any warranty, express or implied, is limited to repair or replacement of any unit found to be defective. Under no circumstances shall we be liable for incidental or consequential damages.

To obtain service under the terms of the warranty policy, it is necessary for you to retain your **ORIGINAL BILL OF SALE.** Any card or other registration device does not constitute proof of purchase nor will it be regarded as such. In the event your equipment requires service during the two-year warranty period, only presentation of your **ORIGINAL BILL OF SALE** to either an authorized warranty station or the factory itself will insure your rights under the warranty policy described above.

We have a Customer Relations Department equipped to handle any questions you may have regarding the installation or operation of your unit. Feel free to correspond with us at any time. We will make every effort to give you prompt and complete advice on any inquiry.

If any problem cannot be resolved through correspondence with the factory, we may wish to refer you to an authorized warranty station in your area if we feel this is best in your situation. Similarly, we may prefer to authorize the return of your unit to the factory in Plainview, New York. Should this possibility arise, a Service Return Authorization form, and packing and shipping instructions will be mailed to you. This material will identify your unit as belonging to you during its processing through our Service Department and allow us to return it to you in the shortest possible time. This authorization form **must accompany** your unit when it is returned to us.

UNDER NO CIRCUMSTANCES SHOULD YOU SHIP A UNIT TO US WITHOUT PRIOR AUTHORIZATION. You risk major delays in the processing of your unit and the possibility of loss of your equipment.

CITATION 16 SPECIFICATIONS

Power Output:	150 WATTS MIN. RMS PER CHANNEL BOTH CHANNELS DRIVEN INTO 8 OHMS FROM 20Hz to 20kHz, WITH LESS THAN .05% THD.
Power Bandwidth:	From 5Hz to 110kHz at less than 0.1% THD into 8 ohms, both channels driven simultaneously at 75 watts per channel.
Frequency Response:	From 0.5Hz to 120kHz at less than 0.2% THD into 8 ohms, both channels driven simultaneously at 1 watt per channel.
Square Wave Rise Time:	Better than 3 microseconds.
Phase Shift:	Less than 0.5 degree at 20Hz; less than 12 degrees at 20kHz.
Slew Rate:	Greater than 30 volts per microsecond.
Total Harmonic Distortion:	Less than .05% from 1 watt to 150 watts RMS, both channels driven simultaneously into 8 ohms from 0.5Hz to 20kHz.
Intermodulation Distortion:	Less than .05% at .015 watts to 150 watts.
Hum and Noise:	Better than 100dB below 150 watts.
Damping Factor:	Greater than 300:1
Input Impedance:	22k ohms.
Input Sensitivity:	1.25 volts for 150 watts.
Dimensions:	9¼″ H x 19″ W x 14″ D (complete with metal cage) (23.5 cm. H x 48.3 cm. W x 35.6 cm. D)
Weight:	55 pounds (24.9 kg.)

This unit is internally bridgeable for monaural operation and provides 320 watts driven into 16 ohms from 20 Hz to 20kHz with less than .05% THD.
Information is available upon request with regard to commercial and sound reinforcement applications.