Scientific Audio Electronics, Inc.

MARK XXII/2200
Stereo Power Amplifier

Owner's Manual

CONGRATULATIONS! Your amplifier is the result of many years of painstaking research and development by SAE. This reliable, ultra-low distortion basic stereophonic audio amplifier has been designed around uncompromised parameters. Because of these efforts, SAE products are known around the world as "state-of-the-art components."

In order to achieve maximum performance from your amplifier, please read this manual thoroughly before connection. If you have any questions concerning operation or maintenance, please contact your Dealer or SAE's Customer Service Department, P.O. Box 60271 Terminal Annex, Los Angeles, California 90060.

UNPACKING— Before leaving the factory, every amplifier is carefully inspected for physical imperfections as a routine part of our systematic quality control to insure a flawless appearance.

After the amplifier has been unpacked, inspect it for physical damage.

Save the shipping carton and all packing materials, as they were carefully designed to reduce to a minimum the possibility of transportation damage.

In the unlikely event that damage has occurred, immediately notify your dealer and request the name of the carrier so that a written claim to cover the damages can be initiated.

THE RIGHT TO ANY CLAIM AGAINST A PUBLIC CARRIER CAN BE FORFEITED IF THE CARRIER IS NOT NOTIFIED PROMPTLY AND IF THE SHIPPING CARTON AND PACKING MATERIALS ARE NOT AVAILABLE FOR INSPECTION BY THE CARRIER. SAVE ALL PACKING MATERIALS UNTIL THE CLAIM HAS BEEN SETTLED.

SERVICE CONTRACT— SAE is proud to offer you an unprecedented free Five-Year Service Contract on your component. In order to receive this valuable protection, the enclosed Service Contract Registration Card must be completed and mailed to SAE within one hundred-twenty (120) days of purchase. If you do not receive your Service Contract Label within thirty (30) days after the Registration Card has been mailed, please contact SAE immediately.

While waiting for the Service Contract Label, your sales receipt will serve as proof of purchase and must be presented to the Service Station in the event servicing is required within one hundred-twenty (120) days of purchase.

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

A FEW WORDS ON CIRCUITRY— We at SAE are very proud of the Mark XXII/2200 and ask that you take a few moments to read this section on circuitry. We feel that a thorough understanding of your amplifier will allow for thorough enjoyment.

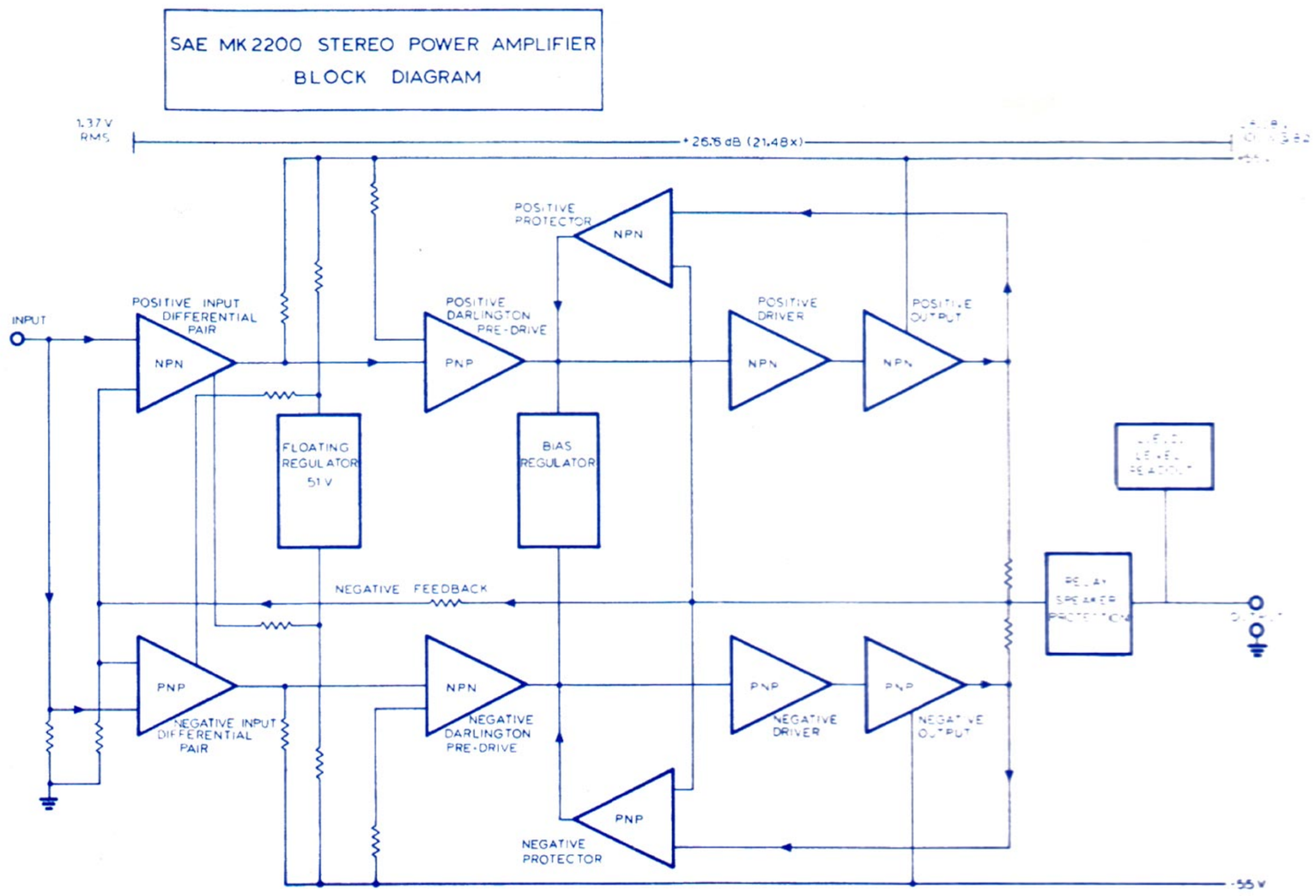
The circuitry in the Mark XXII/2200 is the result of over 9 years of extensive research and manufacturing. This research effort has resulted in an amplifier that is totally complementary from input to output. This is achieved by using dual-complementary differential input stages. These input stages are then followed by full complementary push-pull pre-drivers. These in turn are direct coupled (all stages after A.C. coupled input are D.C. coupled) to two push-pull complementary drivers. All stages up to this point are operated in true Class A. The drivers then drive the full complementary output stage. This output design results in high current capability without loss of wide power bandwidth, high slew rate (40V/usec) and low leakage current.

Previous amplifier designs have used a SINGLE differential input stage followed by a driver stage which then drives a push-pull output stage. The result is low frequency-modulation noise. D.C. coupling at the input does not help or eliminate this condition. Furthermore, D.C. coupling is dangerous to your loudspeakers. All SAE amps are A.C. coupled at the input but the low frequency point is put at .01Hz to effect a D.C. coupled response.

SAE offers a fully complementary output configuration. Four triple-diffused output transistors and four driver transistors are utilized to afford the maximum safe-area capability. In fact the output stage capability is so great that the amplifier will deliver rated power into any load whether resistive or reactive.

Another innovation is the unique controlled biasing system which eliminates any tendencies towards thermal runaway. Unlike other high power amplifiers, the Mark XXII/2200 does not operate with substantial bias current in the output stage but is completely controlled by the compound transistor regulator.

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Many of today's modern loudspeakers are of low efficiency design which means that high power is needed. In order to satisfy the transient nature of this power demand, an extended power bandwidth is necessary. This is where the Mark XXII/2200 excels.

The Mark XXII/2200 is not slew-rate limited in the audio band even into a highly reactive load.

A critical component in the amplifier's overall performance is the power supply which should ideally operate with very low heat generation and high-power regulation. Toward this goal, the Mark XXII/2200 amplifier utilizes a new wide-channel power transformer. This concept in transformer design allows larger square section wire to be used for windings, thus improving the copper-to-iron ratio and power regulation.

The final result is a smaller transformer package with low heat generation and better efficiency (both are end products of lower hysteresis effect). Couple this transformer to two computer-grade capacitors and the result is a power supply which will vary no more than ten (10) percent from no load to full load conditions (other designs vary as much as thirty percent). The Mark XXII/2200 power supply includes an independent floating regulator in each channel for the dual differential input stages. These floating regulators totally eliminate any possible ground loops that can occur in a multiple equipment installation.

CONSTRUCTION— SAE design goals were to "build an amplifier for home audio use with the construction and durability of professional equipment." To meet this goal from a circuit standpoint we utilized a total of 4 driver transistors and 4 output transistors in the Mark XXII/2200. From a mechanical construction standpoint, this was the reason for such items as 1/8" heat-sink material with over 750 square inches of radiating area: a high efficiency power transformer, and 1/8" front mounting panel for strength.

Since the heat-sink is made from a fabrication technique rather than the common extrusion, it has greater surface area per mass. Utilizing this technique, there is no warpage or other mechanical defects which plague extrusion type heat-sinks. This is vital with the flatness of the area directly under the power transistor surface where tolerances are held to better than .001 inches. This is impossible with an extruded heat-sink design. Modular P.C. board construction with minimal wiring assures unit-to-unit repeatability.

With the exception of bias keep there are no adjustments of any kind. Consequently, all units perform alike and will sound alike. Modular construction also improves servicing efficiency. The entire amplifier module can be removed by a qualified technician in less than 60 seconds.

ADEQUATE VENTILATION WILL EXTEND THE TROUBLE FREE LIFE OF YOUR AMPLIFIER.

INSTALLATION—The Mark XXII/2200 should not be completely enclosed with other heat producing components. The amplifier may be mounted either horizontally or vertically. Allow enough space around the opening to clear adjacent panel-mounted components. If your cabinet has doors or a lid, the mounting panel should be a minimum of 2" behind the doors or lid when closed in order to clear the handles. The mounting holes on the bottom of the amplifier accommodate No. 10-32 screws. THE LENGTH OF THE SCREWS MUST NOT PROJECT MORE THAN 1/4" INTO THE AMPLIFIER. If the amplifier is to be mounted in a closed cabinet it is recommended that a vent port be provided to allow air circulation around the amplifier. Do not place the amplifier directly on carpeting or any other material that will restrict air circulation under the unit.

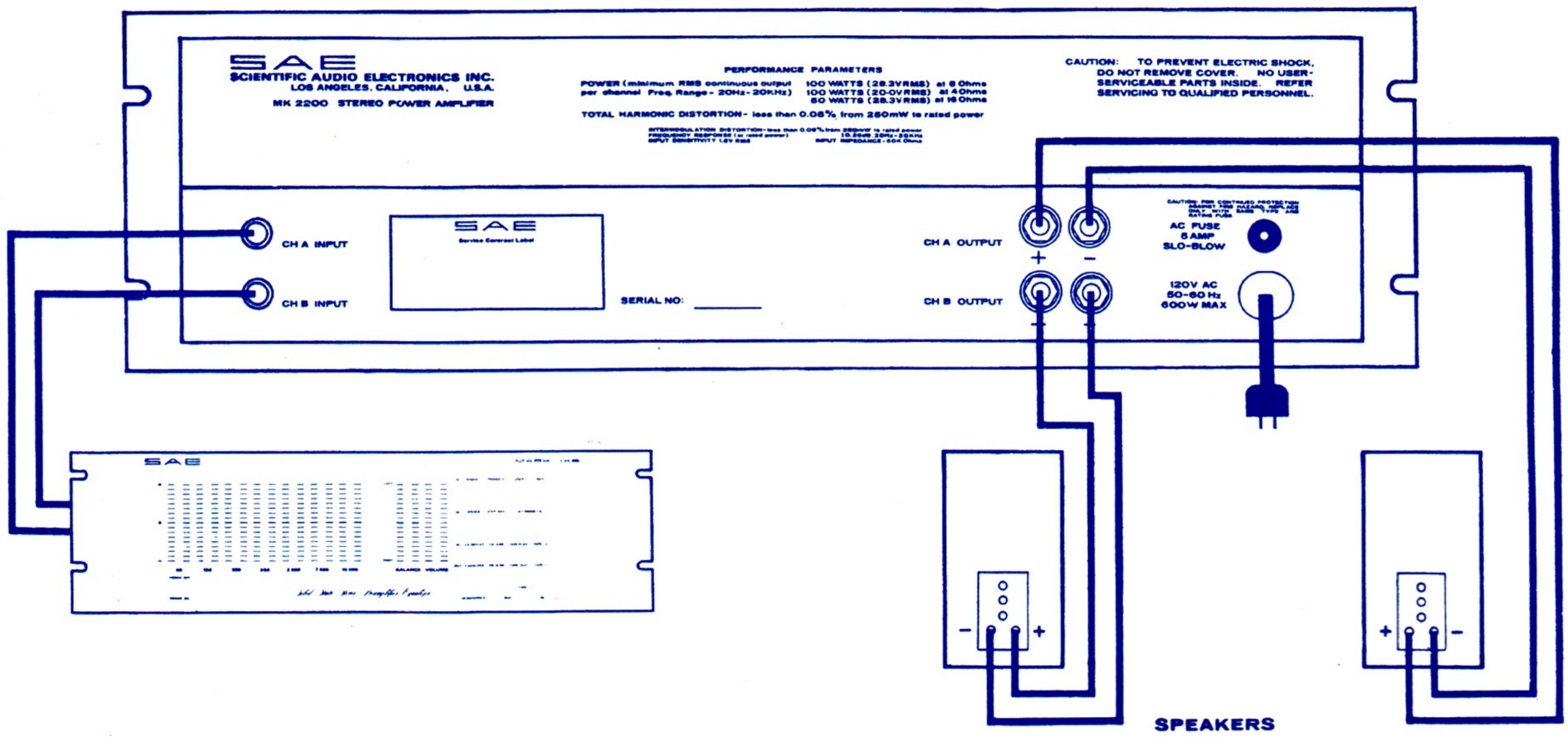
It is not uncommon for the power transformer in high powered amplifiers to generate mechanical humming which is barely audible. To minimize the audibility of this "humming" sound, mount your amplifier on a solid non-resonating surface.

GENERAL CONNECTIONS— All connection facilities are located on the rear panel of the amplifier. Any suitable program source, such as a control preamplifier, tuner, or tape playback preamplifier may be used. ALL CONNECTIONS MUST BE MADE WITH A.C. POWER OFF.

DETAILED CONNECTIONS— All input signal connections are to be made with shielded audio cables such as those provided with the amplifier. The Left Channel input is labeled CHANNEL A. The right Channel input is labeled CHANNEL B. The input jacks accept the standard two-conductor RCA phono plug. The line cord should be plugged into an AC outlet providing 120 Volts AC, 50 to 60 Hertz.

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TYPICAL HOOKUP



The output from the left channel of the program source is connected to the CHANNEL A input on the amplifier. The output from the right channel of the program source is connected to the CHANNEL B input of the amplifier. Proper connection will ensure correct channel correlation. See "Amplifier Protection Circuits," before connection.

AMPLIFIER/LOUDSPEAKER PROTECTION CIRCUITS— Your amplifier is equipped with a fail-safe relay protection circuit which will not only protect your loudspeaker from possible damage but will also protect itself even under the severest load conditions. If under any circumstances any D.C. or subsonic frequencies appear at the amplifier output, the amp will disconnect itself from the load (loudspeaker) and will remain disconnected until the problem has been rectified. The sensitivity and slope of the protection circuit is adjusted so that a "thumping" tuner muting circuit, "flicking" the stylus clear, or dropping the stylus on the record will disconnect the loudspeakers momentarily thus preventing damage! The relay is designed so the amplifier will not shut-off entirely but will allow a very low level signal to be heard. A thermal cutout is also employed to protect the amplifier under high temperature conditions. In addition to the above, the amplifier is also protected by an AC line fuse. Also utilized is a low impedance electronic sensing circuit which limits output current with loads below 2 Ohms without limiting the current with loads of 4 Ohms or higher (or reactive loads such as electrostatic transducers).

You will notice a turn-on delay of 3-5 seconds. This is normal operation to prevent turn-on transients or "thumping".

CAUTION: BURN OUT OF THE OUTPUT STAGE BECAUSE OF FAILURE TO OBSERVE THE FOLLOWING PRECAUTIONS WILL VOID THE WARRANTY.

There is no such thing as absolute reliability or protection **when amplifiers are abused.** While the Mark XXII/2200 amplifiers, as well as all other SAE amplifiers, have been designed to be impervious to most kinds of abuse, there is one condition which must be avoided. This condition is called RF Detection and will almost certainly cause failure of the output devices if initiated. Because all SAE amplifiers have an extremely wide bandwidth, it is almost impossible to protect against burnout if abused. The following acts cause RF Detection and MUST be avoided:

1. Connecting the inputs or outputs while the amplifier is on.
2. Using the "thumb test." It is a dangerous habit to connect cables to the inputs and touch the other end of the cable while the level is up. This may not only cause amplifier failure but may also destroy your loudspeakers due to the high power of the amplifier.

It is wise to follow the procedure of completely hooking-up your system before turning anything on. A few simple precautions will contribute to trouble-free performance.

STEREOPHONIC LOUDSPEAKER CONNECTION— All standard or electrostatic loudspeaker systems (4,8, or 16 Ohms) may be connected to the output binding posts. The black binding posts are connected to the "ground" or negative terminal of the loudspeakers. The red binding posts are connected to the "hot" or positive terminal of the loudspeakers. Connect the left speaker to CHANNEL A and the right speaker to CHANNEL B.

DO NOT USE LOUDSPEAKERS OR COMBINATION OF LOUDSPEAKERS THAT TOTAL LESS THAN 4 OHMS IMPEDANCE.

16 gauge, two-conductor lamp cord (zipcord) should be used for distances up to 25 feet. For distances from 25' to 50' use 14 gauge and for distances of 50' to 250', 12 gauge wire should be used to reduce transmission losses.

STEREOPHONIC LOUDSPEAKER PHASING— Correct phasing is required to obtain maximum bass response and to preserve a unity in sound when solo vocalists perform. The simplest way to effect proper phasing is to closely inspect the wire being used. Some form of coding is always employed, whether a ridge or groove on one edge or one side of the wire may be tinned. Example: If you attach the "rib" side of the wire to the "+" terminal on the amplifier, be sure to attach the "rib" side to the "+" terminal on your loudspeaker. Follow the same procedure with the other loudspeaker.

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PROFESSIONAL USE— The Mark XXII/2200 was designed for sound reinforcement and studio applications, also. Multi-speaker arrays for these applications should be designed to offer a load of 4 Ohms or greater to the amplifier.

The Mark XXII/2200 may be used directly for 25 Volt system and with a matching transformer for 70.7 Volt systems.

Should you encounter a unique condition for the amplifier to operate under and need further technical advice, please contact:

Technical Service Dept.
SAE, Inc.
P.O. Box 60271 Terminal Annex
Los Angeles, California 90060

WHEN MAKING LOUDSPEAKER CONNECTIONS CARE MUST BE TAKEN TO AVOID SHORT-CIRCUITS WHICH WILL CAUSE IMPROPER OPERATION OF THE AMPLIFIER.

WARNING: SAE CANNOT BE RESPONSIBLE FOR DAMAGE RENDERED TO SPEAKERS DUE TO MISUSE OF THE AMPLIFIER'S HIGH POWER.

INVESTIGATE THE SPEAKER MANUFACTURER'S SPECIFICATION FOR POWER-HANDLING CAPABILITY BEFORE ATTEMPTING THEIR USE WITH THE MARK XXII/2200.

LED's—Power Level Display--This unique circuit displays instantly the actual power output of the amplifier. Incorporating 15 LED's per channel, this display constantly monitors the amplifier's output from 20mW to full rated power plus indicating overload.

The far left LED for each channel will illuminate when power is supplied to the amplifier. Should they not illuminate when power is supplied please refer to General Maintenance Section.

The power output indicated on the front panel is for 8 Ohms loads, if your speaker are 4 Ohms the power should be doubled and at 16 Ohms the power indicated should be divided by two.

GENERAL MAINTENANCE— Great care has been taken by the staff of SAE to assure that your amplifier is as flawless in appearance as it is electronically. The panel is finished with a high-grade black anodizing process (MIL Specification 8625-A-Type 2) for durability as well as beauty. If it should become finger-printed, it can best be cleaned by using a soft cloth dampened with a solution of LIQUID detergent and water.

UNDER NO CIRCUMSTANCES SHOULD A LYE SOLUTION OR AN ABRASIVE CLEANER SUCH AS SCOURING POWDER BE USED ON ANY PART OF THE AMPLIFIER.

FUSE—The amplifier is protected by a line fuse on the rear panel. When power is applied to the amplifier and the far left LED for each channel does not illuminate, check the line fuse.

If the fuse is faulty, replace it ONLY with a fuse of equal value.

Replacement with a fuse of a higher current rating will not protect the amplifier and will void the warranty.

If after replacing the fuse, it blows immediately, an electronic component failure might be suspected. No further attempts to replace the fuse should be made.

SERVICE— SAE has a Technical Service Department to answer all questions pertinent to the installation and operation of your unit. Please feel free to write us at any time and we shall endeavor to offer prompt and complete advice.

If your problem cannot be resolved through our combined efforts, we may wish to refer you to a local authorized repair agency or we may prefer to authorize the return of your unit to the factory. To aid in selecting a service station convenient to you, it would be helpful if you would indicate which major city is closest to your home.

Please address inquiry to:

Technical Service Department
SAE, Inc.
P.O. Box 60271 Terminal Annex
Los Angeles, CA 90060

Be sure to include the model and serial number of your unit.

In the event it must be returned, an authorization form and proper packing instructions will be forwarded to you. This authorization form, together with the warranty registration number, MUST BE RETURNED with your unit.

UNDER NO CIRCUMSTANCES SHOULD YOUR UNIT BE SHIPPED TO THE FACTORY WITHOUT PRIOR AUTHORIZATION.

If the original shipping carton has been lost or discarded, or if the carton is not in good condition, a duplicate carton may be obtained from our Service Department for a minimal charge.

Always ship via recognized freight carriers. Suggested carriers will be listed with the Return Authorization. Do not ship via Parcel Post. ALL PARCEL POST SHIPMENTS WILL BE RETURNED.

SPECIFICATIONS

RMS Continuous power output per channel, 20Hz to 20kHz (both channels driven) into 4 or 8 Ohms —100 Watts @ 0.05% Total Harmonic Distortion

Total Harmonic Distortion (THD) from 20Hz to 20kHz, 250mW to rated power into 4 or 8 Ohms —0.05% Max.

Intermodulation Distortion (IM) from 250 mW to rated power at 4 or 8 Ohms with any 2 mixed frequencies between 20Hz and 20kHz at a 4/1 voltage ratio – 0.05% Max.

Frequency Response at rated power
– +0.025dB, 20Hz to 20kHz

Noise – Greater than 100dB below rated power

Transient Response of any Square Wave
– 2.5 microseconds rise and fall time

Slew Rate – 40 Volts/microsecond

Stability – Unconditionally stable with any type of load or no load including full range electrostatic loudspeakers

Damping Factor – 150 Min (100Hz)

Input Sensitivity – 1.5 Volts RMS

Input Impedance – 50kOhms

Overload Protection – 1) Low impedance electronic-sensing circuit limits with output current below 2 Ohms without limiting with 4 Ohms or higher (or reactive loads).
2) Thermal sensing of inadequate ventilation.

Loudspeaker Protection – Relay circuit protects loudspeakers from low frequency oscillations and plus or minus DC output. Five second turn on delay for circuit stability.

Power Requirements – 110-120V, 50/60Hz, 75 Watts @ idling to 500 Watts @ rated power.

Shipping Wieght – 22 pounds(11Kg.)

Dimensions – 19 in. (48.3cm)W x 5.25 in. (13.3cm)H
chassis: 8.0 in (20.3cm)D [excluding handles and connectors]

Cabinet – WC-22 (not included)

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