MC 7200

DIGITAL DYNAMIC STEREO POWER AMPLIFIER

McIntosh®

OWNERS MANUAL

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Your MC 7200 Power Amplifier will give you many years of satisfactory performance. If you have any questions, please contact,

CUSTOMER SERVICE
McIntosh Laboratory Inc.
2 Chambers Street
Binghamton, New York 13903-9990
Phone: 607-723-3512

Take Advantage of 3 Years of Contract Service. . . Fill in the Application NOW.

McINTOSH THREE YEAR SERVICE CONTRACT

An application for A THREE YEAR SERVICE CONTRACT is included with this manual.

The terms of the contract are:

1. If the instrument covered by this contract becomes defective, McIntosh will provide all parts, materials, and labor needed to return the measured performance of the instrument to the original performance limits free of any charge. The service contract does not cover any shipping costs to and from the authorized service agency or the factory.
2. Any McIntosh authorized service agency will repair all McIntosh instruments at normal service rates. To receive the free service under the terms of the service contract, the service contract certificate must accompany the instrument when taken to the service agency.
3. Always have service done by a McIntosh authorized service agency. *If the instrument is modified or damaged as a result of unauthorized repair the service contract will be cancelled.* Damage by improper use or mishandling is not covered by the service contract.
4. The service contract is issued to you as the original purchaser. To protect you from misrepresentation this contract cannot be transferred to a second owner.
5. Units in operation outside the United States and Canada are not covered by the McIntosh Factory Service Contract, irrespective of the place of purchase. Nor are units acquired outside the USA and Canada, the purchasers of which should consult with their dealer to ascertain what, if any, service contract or warranty may be available locally.

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A NEW AMPLIFIER DESIGNED FOR A NEW AGE OF HOME ENTERTAINMENT

The MC 7200 stereo power amplifier is designed for reliability with ruggedness. The mechanical and electrical design is the result of the many years of engineering and manufacturing experience by the designers at McIntosh. This "know how", combined with meticulous attention to design and production details, makes the MC 7200 one of the finest products produced by McIntosh Laboratory.

Some manufacturers of power amplifiers have claimed that their products do not use protection circuits and that such circuits compromise performance. It is indeed possible for such circuits to cause substantial amounts of distortion and undesirable listening effects which is true of almost any protective circuit design. The real genius of good design recognizes these problems and circumvents them while retaining the real merits of the protective circuits. Protection circuits designed to enhance performance are just some of the extra values you receive when you invest in McIntosh equipment. It is precisely for this reason that it takes longer to complete a McIntosh engineering design task. From such engineering dedication comes the McIntosh reputation for highest sound quality with greatest long term reliability.

The MC 7200 incorporates six protection circuits which insure its total reliability; six protection circuits that protect the music and your listening, not interfere with them. These circuits are described in the Technical Description.

Here are some additional benefits of owning the MC 7200:

The output is so distortion-free that it defies measurement, even with the finest distortion analysis instruments. At mid frequencies, 8 ohm load, the distortion meter reads the residual distortion of the oscillator (0.002%) with or without the MC 7200 in the circuit. This means the amplifier distortion is lower than the analyzer is capable of measuring.

Full power output capability is well above and below the frequencies that can be heard by humans.

More than 42 amperes of peak output current is available to drive uneven speaker loads. Poor speaker designs have input impedance curves that dip to 1 or 2 ohms at various frequencies. The MC 7200 has the output current reserve to drive these speakers.

The McIntosh 50 ampere gold plated output terminals will deliver full output power to speaker wires from 18 GA to wire that is nearly 1/4 of an inch in diameter. Wire can be connected directly without special lugs or pins that can cause power loss.

Huge main filter capacitors guarantee the energy storage necessary for the wide dynamic range that digital audio demands and the amplifier's excellent signal to noise ratio.

The MC 7200 has a circuit that delays amplifier operation for about 2 seconds after turn on. This prevents unwanted noises generated in other equipment from causing annoying turn-on thumps or from damaging your speakers.

Modern technology has made it possible to build preamplifiers and amplifiers with the high signal to noise ratio necessary to reproduce the sound quality present on compact discs. Interconnecting cables can pick up electrical interference from other equipment or appliances which can depreciate the excellent dynamics of today's equipment performance. The balanced inputs of the MC 7200 provide a minimum of 40dB more protection against such noise pick-up.

Output power meters calibrated in watts, indicate the output power of each channel. The meters respond to the peak output of each channel. Ordinary meters lack the capability of indicating the short interval information in a sound wave. The mass of the meter movement is too great to respond to the nearly instantaneous changes in music program material. Short interval information can have a duration as short as half a thousandth of a second. Ordinarily, a meter pointer moving over its scale in such a short time could not be seen. McIntosh has developed circuits that drive the meters to respond to the short interval information in a sound wave to an accuracy of 90%. The electrical pulse that drives the meter pointer is time stretched so that the peak position of the pointer can register in the persistence of vision characteristic of the retina of the human eye.

Your investment in the McIntosh MC 7200 has been wisely made. You can depend on it for maximum enjoyment over a long period of trouble-free time.

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LOCATION

The MC 7200 may be installed in a McIntosh cabinet or custom installed in furniture of your choice. Always provide adequate ventilation. The trouble-free life of an electronic instrument is greatly extended by providing sufficient ventilation to prevent the buildup of high internal temperatures that cause deterioration. Allow enough clearance so that cool air can enter at the bottom of the cabinet and be vented from the top. The recommended minimum space for installation is 15-5/8 inches (39.7 cm) deep, 17 inches (43.2 cm) wide, and 8 inches (20.3 cm) high. Never place it above heat generating components.

CUSTOM INSTALLATION

The PANLOC system of installing equipment conveniently and securely, is a product of McIntosh research. The PANLOC buttons on the front panel will lock the unit firmly in place when turned approximately one-quarter turn clockwise. A one-quarter counterclockwise turn of the PANLOC buttons unlocks the chassis from its mounting.

To install the instrument in a McIntosh cabinet, follow the instructions that are enclosed with the cabinet. For any other type of installation follow these instructions:

1. Unpack from Carton

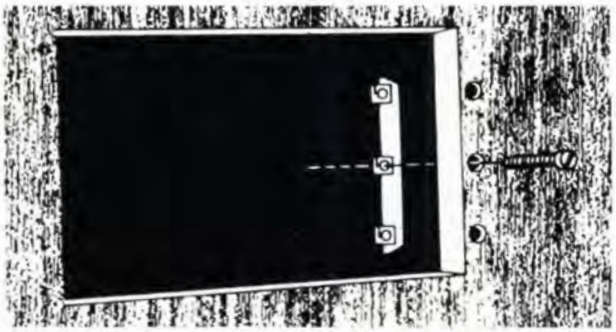
Open the carton and remove the PANLOC brackets, hardware package, and mounting template. Remove the instrument from its plastic bag and place it upside down on the shipping pallet. Unscrew the four plastic feet from the bottom of the chassis.

2. Mark the Cabinet Panel

Tape the mounting template in position on the cabinet panel where the instrument is to be installed. The broken lines that represent the outline of the rectangular cutout also represent the outside dimensions of the chassis. Make sure these lines clear shelves, partitions, or any equipment. With the template in place, first mark the six A and B holes and the four small holes that locate the corners of the cutout. Then, join the four corner markings with pencil lines, using the edge of the template as a straightedge.

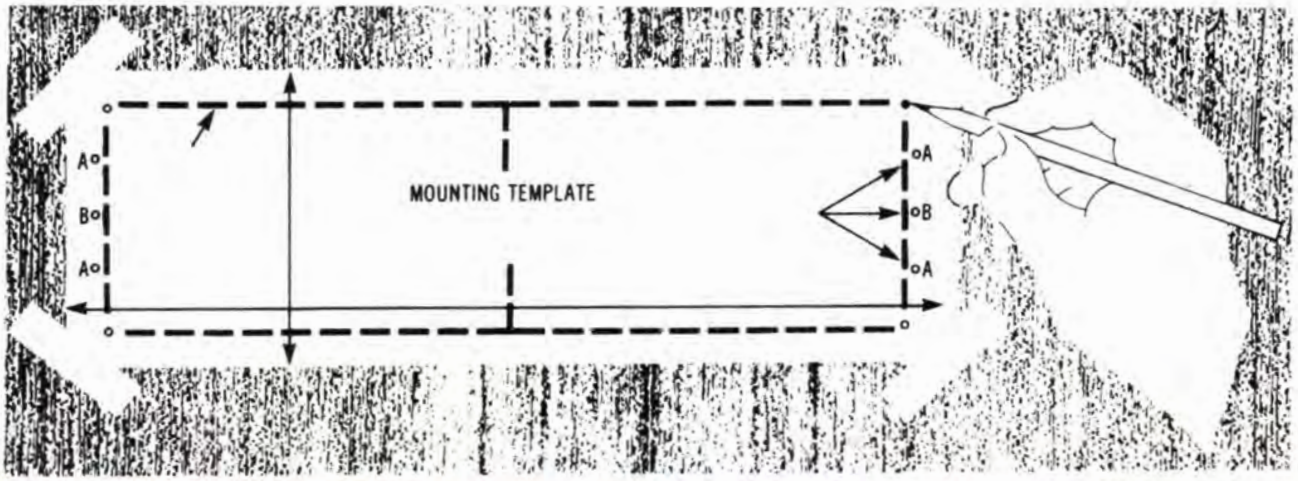
3. Drill Holes

Use a drill with a 3/16 inch (5 mm) bit held perpendicular to the panel and drill the six A and B holes. Then, using a drill bit slightly larger than the tip of your saw blade, drill one hole at each of two diagonally opposite corners. The holes should barely touch the inside edge of the penciled outline. Before taking the next step, make sure that the six A and B holes have been drilled.



4. Saw the Panel Cutout

Saw carefully on the inside of the penciled lines. First make the two long cuts and then the two short cuts. After the rectangular opening has been cut out, use a file to square the corners and smooth any irregularities in the cut edges.



4 INSTALLATION

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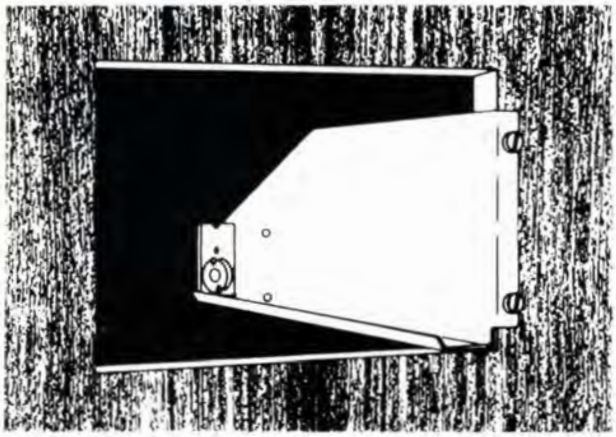
5. Install the Mounting Strips
In the hardware package are two mounting strips, and two 4-40 x 1-1/4″ (31.8mm) black screws that have a flat head. Use these screws, one on each end, to fasten the mounting strips. They are attached through the center hole, marked B on the template. Make sure the screw heads are drawn flush or slightly into the wood before attaching the Panloc brackets.

6. Attach the PANLOC Brackets
Using two 6-32 x 1-1/4″ (31.8mm) screws in the A holes on each side, attach the PANLOC brackets to the cabinet panel; the short flange is mounted against the front (face) of the cabinet panel. The screws pass through the PANLOC bracket flange, the cabinet panel, and then through the mounting strips previously mounted.



7. Install the Instrument
Guide the AC power cord through the panel opening to the back of the cabinet; then, slide the instrument into the opening carefully so that the rails on the bottom of each side of the chassis engage the tracks on the mounting brackets. Continue to slide the instrument into the cabinet until the front panel is flush with the cabinet panel. Turn the PANLOC buttons at the lower left and right corners of the instrument panel clockwise to lock the unit firmly in the cabinet. Turn the PANLOC buttons counterclockwise to unlock the instrument. It can then slide outward to permit the removal of the instrument from the cabinet.

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INPUT

Use shielded cables to connect the signal from the preamplifier or signal source to the power amplifier. To minimize the possibility of hum, the shielded cables should be of parallel construction or loosely twisted together, located away from speaker connecting cables and AC power cords. Be certain to use good quality shielded cables for all interconnections. Your dealer can advise you on the kind and length of cable that will best suit your installation.

FOR STEREO OPERATION (UNBALANCED INPUT)

Using a single conductor shield cable with RCA type plugs, plug the left output of the preamplifier into the UNBALANCED LEFT jack of the power amplifier. Plug the right output of the preamplifier into the UNBALANCED RIGHT/MONO input jack of the power amplifier.

Because the crosstalk between channels is almost non-existent, each channel can be used as a separate amplifier. (Example; use one channel for mono background program in one area and the other channel for paging in a separate area.)

FOR STEREO OPERATION (BALANCED INPUT)

Modern technology has made it possible to build preamplifiers and power amplifiers with the high signal to noise ratio necessary to reproduce the sound quality present on compact discs. Interconnecting cables can pick-up electrical interference from other equipment or appliances. The balanced inputs on the MC 7200 provide a minimum of 40 dB more protection against such noise pick-up. To help prevent this possibility, 2 conductor shielded cables can be used to connect between the preamplifier and the power amplifier balanced connectors.

When using 2 conductor shielded cable with XLR type connectors or shielded phone plugs, connect the left output of the preamplifier into the INPUT BALANCED LEFT XLR connector or phone jack. Connect the right output of the preamplifier into the INPUT BALANCED RIGHT XLR connector or phone jack.

CONNECTING FOR MONOPHONIC BRIDGE OR SINGLE CHANNEL OPERATION

When the MC 7200 is used as a monophonic or single channel power amplifier, the two channels are added in a bridge configuration to produce output up to 600 watts for monophonic operation.

Plug a shielded cable from the signal source or preamplifier into either the BALANCED or the UNBALANCED RIGHT/MONO input connector only. No connection is made to INPUT LEFT connector. Change the MODE switch on the back panel of the amplifier to the MONO position. In the MONO position, the output of the right channel input amplifier is fed to both left and right channel power amplifiers with the phase of the left channel inverted to achieve bridge operation and increased power output.

OUTPUT

The appropriate length and size of loudspeaker cable for your installation will help to preserve the quality of sound for which the loudspeakers have been designed. If under-size wire is used, resistance is added to the amplifier/loudspeaker combination which adversely affects the performance. Added resistance reduces the damping factor, modifies the frequency response and reduces the power output. Your dealer's advice will serve you best for your installation. The cables to and from the speaker should be of parallel construction or be loosely twisted together. The chart shows the recommended minimum wire size for the length of wire between the amplifier and the loudspeakers.

SPEAKER CABLE LENGTHS
AMPLIFIER TO SPEAKER

For 4 Ohm Load		For 8 Ohm Load		Wire
Feet	Meters	Feet	Meters	Gauge
15	4.6	30	9.1	18
25	7.6	50	15.2	16
40	12.2	80	24.4	14
60	18.3	120	36.6	12
100	30.48	200	60.0	10

These speaker cable lengths represent a wire resistance equal to 5% of the speaker impedance.

6 HOW TO CONNECT

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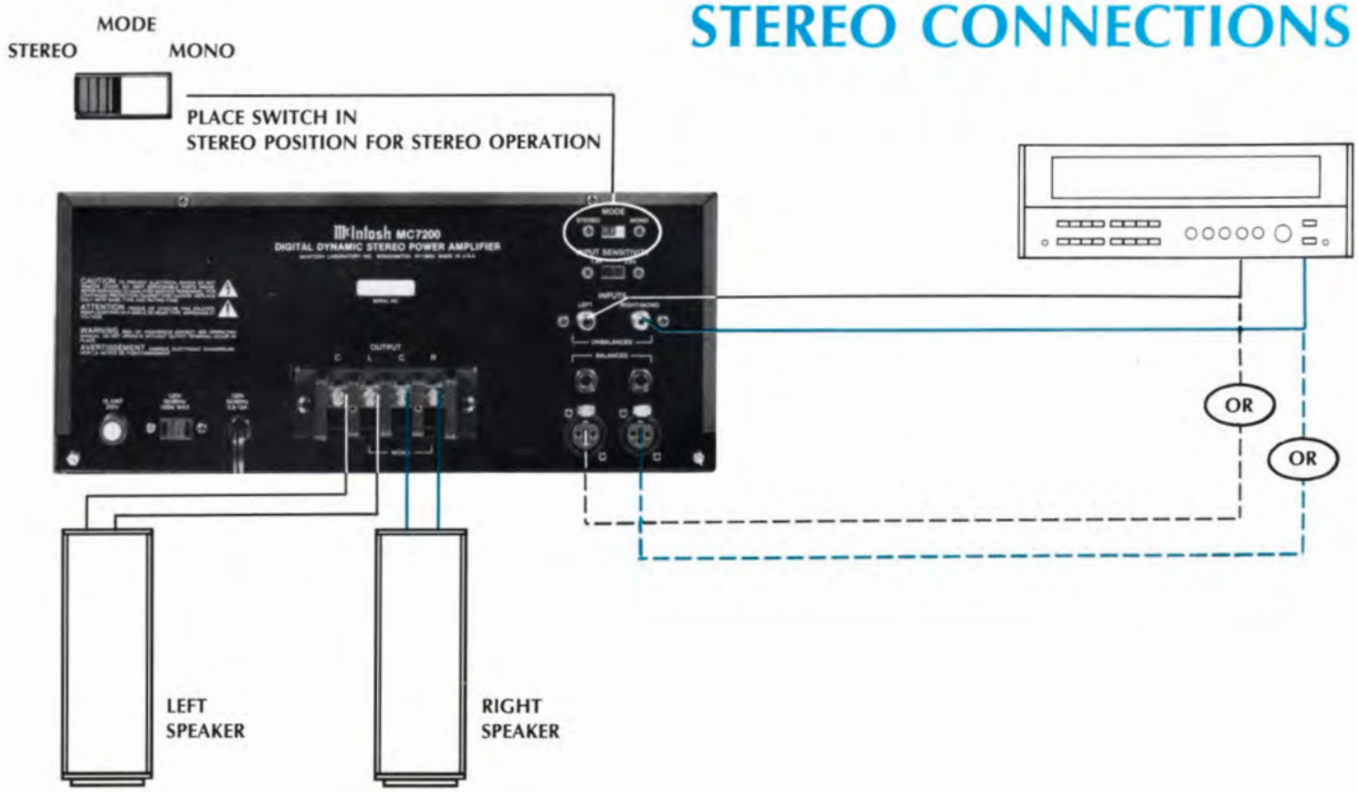
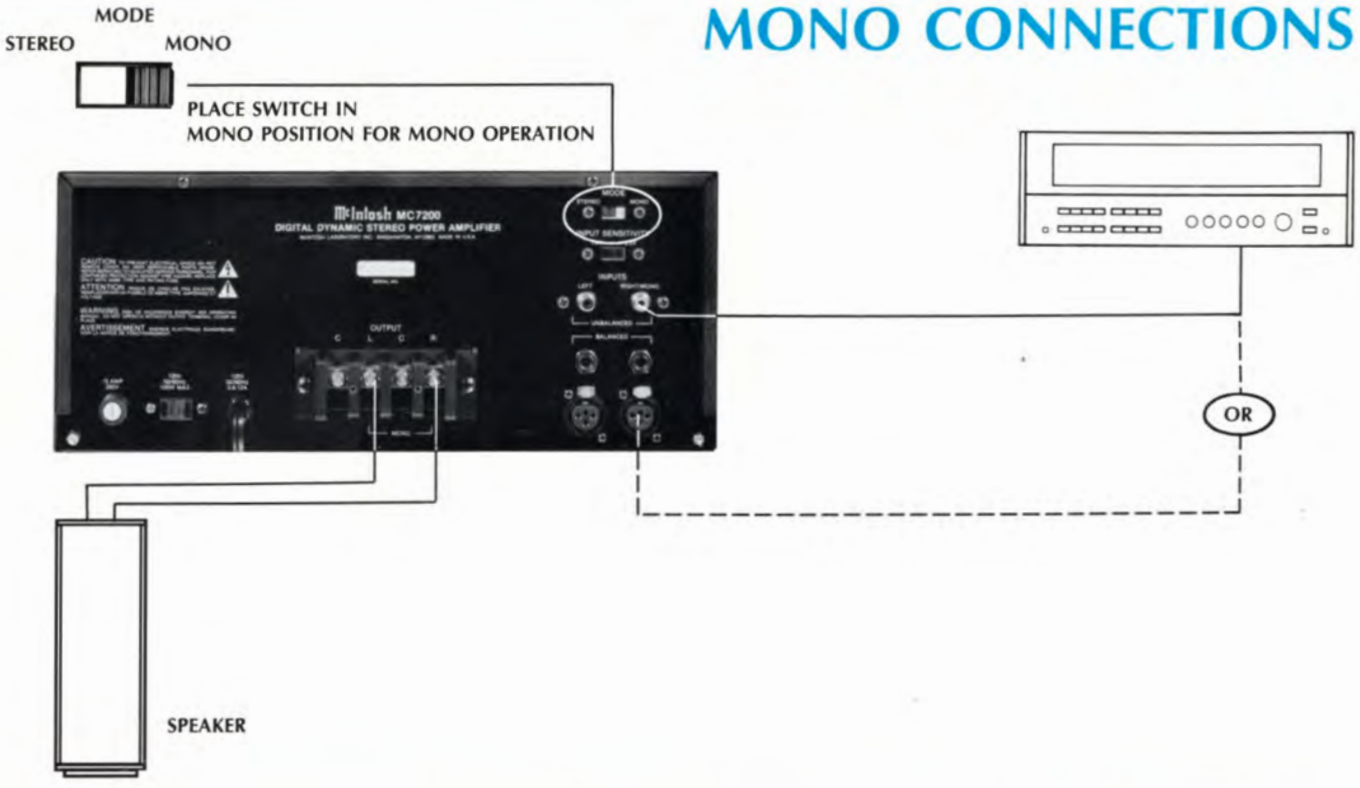
STEREO CONNECTIONS



MONO CONNECTIONS



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CONNECTING LOUDSPEAKERS FOR STEREO

Connect the leads from the left loudspeaker to the OUTPUT Left and Common terminals. Connect the leads from the right main loudspeaker to the OUTPUT Right and Common terminals.

For multiple speaker operation, run separate leads from the amplifier to the speakers.

CONNECTING ONE LOUDSPEAKER FOR MONO

The MONO operation of the amplifier requires the speaker load to be connected between the L and R terminals. The Common terminals are not used.

AC POWER

The MC 7200 is designed to operate on 120 volts 50/60 Hz. Plug the AC power cord directly into a wall outlet. Make certain that the AC power outlet has at least 15 ampere capacity with nothing else connected to the circuit. Do not plug the MC 7200 into an auxilliary AC power outlet on a preamplifier or other source equipment unless it is known there is adequate current capacity. If remote power operation is required, use the accessory McIntosh SCR2 or SCR3 Speaker Control Relays or R612 Power Relay. If an extension cord is used, make certain that it has 15 ampere current capacity.

The MC 7200 draws 15 amperes AC line current when amplifying music or speech at rated output on program peaks. The amplifier uses only 0.6 ampere while idling at no output. The AC auxilliary outlet will provide up to 100 watts and is not fused nor switched.

FUSE

A 15 amp fuse protects the MC 7200 circuits. The fuse does not protect additional equipment connected to the rear panel AC power outlet.

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METERS

Output power monitor meters calibrated in both watts and decibels, indicate the output power of each channel. The upper scale on the meter has been calibrated to show average watts and the lower scale, decibels. Reading from right to left, the marks between the numbers indicating watts are (from the indicated 200 watts): first mark, 80 watts. Second 40 watts, the indicated 20 watts, 8 watts, 4 watts, the indicated 2 watts, 0.8 watts, 0.4 watts, the indicated 0.2 watts, 0.08 watts, 0.04 watts, the indicated 0.02 watts 0.008 watts, 0.004 watts, the indicated 0.002 watts, 0.0004 watts, and 0.0002 watts.

The meters respond to the peak output of each channel. Ordinary meters lack the capability of indicating the short interval information in a sound wave. The mass of the meter movement is too great to respond to the nearly instantaneous changes in music program material. Short interval information can have a duration as short as half a thousandth of a second. Ordinarily, a meter pointer moving over its scale in such a short time could not be seen. McIntosh has developed circuits that drive the meters to respond to the short interval information in a sound wave to an accuracy of 90%. The electrical pulse that drives the meter pointer is time stretched so that the peak position of the pointer can register in the persistence of vision characteristic of the retina of the human eye. The pointer can be locked at the peak indication by switching to the METER HOLD position of the switch. In the usual position of the METER HOLD switch, the meter needle indicates the variations in program loudness.

METER HOLD

In the METER HOLD position, the meter pointer locks to the highest power peak in a sequence of peaks. The meter is driven to maximum power, electronically held there until a higher peak passes through the amplifier, which moves the meter pointer upward to the new indication. If no further peaks are reached, the meter pointer will very slowly return to its rest position (decay rate: 6 dB per minute).

LEFT GAIN

Use the LEFT GAIN control to adjust the output in the left channel to the desired listening level. Turn the control clockwise to increase the output.

For the best signal to noise ratio when using McIntosh source equipment, place the INPUT sensitivity switch in the 2.5V position and the front panel LEFT GAIN and RIGHT/MONO GAIN controls in the fully clockwise position.

RIGHT/MONO GAIN

Use the RIGHT/MONO GAIN control to adjust the output in the right channel to the desired listening level.

Turn the control clockwise to increase the output. For the best signal to noise ratio when using McIntosh source equipment, place the INPUT sensitivity switch in the 2.5V position and the front panel LEFT GAIN and RIGHT/MONO GAIN controls in the fully clockwise position.

When connected for monophonic operation, use only the RIGHT/MONO GAIN control. The rear panel MODE switch must be in the MONO position.

POWER

The AC power switch turns the MC 7200 ON or OFF. The switch does not control the power outlet on the back panel. If you wish to control the AC power from another source, leave the switch in the ON position.

THE McINTOSH (EXCLUSIVE) POWER GUARD DIGITAL DYNAMICS PROTECTION CIRCUIT

Improved recordings and recording techniques have imposed higher power demands on today's amplifiers. Poorly designed amplifiers can present music listeners with a form of harsh unpleasant distortion due to amplifier overload (hard clipping). Clipping, which looks and acts like non musical square waves, is caused when the amplifier is asked to produce more power output with low distortion than it is capable of or designed to deliver. Amplifiers, when driven to clipping, can deliver up to 40% harmonic and intermodulation distortion that decreases the pleasure and enjoyment you get from listening. This form of distortion (clipped signal) also produces extra heat energy which will damage most speakers. McIntosh leadership in engineering has developed the Power Guard circuit which:

(1) dynamically prevents power amplifiers from being overdriven into hard clipping,

(2) assures that the amplifier will produce its maximum output without increased distortion,

(3) protects your speaker from excessive heating. Power Guard is a patented McIntosh design (U.S. patent #4048573).

The MC 7200 has a circuit that compares the wave shape of the output signal to the input signal. If the

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disparity between the two signals, due to overdrive, exceeds an average of 0.3% (equivalent to 0.3% total harmonic distortion) an amber POWER GUARD indicator illuminates. Any further disparity causes the POWER GUARD circuit to operate. It limits the amplifier input dynamically so that the amplifier cannot be overdriven. POWER GUARD only operates when the amplifier is asked to deliver more power than it was designed for. While the power output remains within these limits the POWER GUARD indicator does not illuminate.

10 FRONT PANEL

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MODE SWITCH

The MC 7200 will operate in two modes, Stereo and Mono Bridge.

INPUT LEVEL

The input sensitivity of the MC 7200 is 1.4 volts or 2.5V depending on the position of the INPUT sensitivity switch. For the best signal to noise ratio when using McIntosh source equipment, place the INPUT sensitivity switch in the 2.5V position and the front panel LEFT GAIN and RIGHT/MONO GAIN controls in the fully clockwise position. If more gain is desired, the 1.4V position may be used. All McIntosh preamplifiers have been designed to deliver 2.5 volts output with rated input. For source equipment other than McIntosh, set the switch in the position nearest to the stated output rating of the source equipment.

INPUT

Both LEFT and RIGHT UNBALANCED and BALANCED input connectors function in the stereo mode of operation. In the mono mode of operation only the RIGHT/MONO input in either UNBALANCED or BALANCED accepts signal. In mono, the LEFT channel input connectors are disconnected.

Modern technology has made it possible to build preamps and amplifiers with the high signal to noise ratio necessary to reproduce the sound quality present on compact discs. The interconnecting cables can pick up electrical interference from other equipment or appliances. The balanced inputs on the MC 7200 provide a minimum of 40dB more protection against such noise pick-up.

LEFT AND RIGHT OUTPUT TERMINALS

McIntosh 50 ampere, gold plated output terminals will deliver full output power to speaker wires from 18 GA to wire that is 1/4 of an inch in diameter. The MC 7200 has greater than 42 amperes peak output current to drive speakers whose impedance varies from 8 ohms to 1 ohm over the speaker's frequency range. Wire can be connected directly to the output terminal. Special lugs or pins that can cause power loss are not required.

AC POWER

The input to the MC 7200 is 120 volts 50/60 Hz at up to 15 amps. The primary circuit is protected by a 15 amp fuse. The AC auxilliary outlet is not fused nor switched.

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PERFORMANCE LIMITS

Performance limits are the maximum deviation from perfection permitted for a McIntosh instrument. We promise you that when you purchase a new MC 7200 from a McIntosh franchised dealer, it will be capable of or can be made capable of performance at or exceeding these limits or you can return the unit and get your money back. McIntosh is the only manufacturer that makes this statement.

PERFORMANCE

McIntosh audio power ratings are in accordance with the Federal Trade Commission Regulation of November 4, 1974 concerning power output claims for amplifiers used in home entertainment products.

POWER OUTPUT

200 watts across 8 ohm or 300 watts across 4 ohm loads is the minimum sine wave continuous average power output per channel for 20 Hz to 20,000 Hz with both channels operating.

MONO (Bridged)

600 watts minimum sine wave continuous average power output across an 8 ohm load from 20 Hz to 20,000 Hz.

OUTPUT LOAD IMPEDANCE

STEREO: 4 ohms to 8 ohms.

MONO: 8 ohms obtained by connecting to the output terminals (L and R) of both channels.

RATED POWER BAND

20 Hz to 20,000 Hz

TOTAL HARMONIC DISTORTION

STEREO

0.005% maximum harmonic distortion at any power level from 250 milliwatts to rated power per channel from 20 Hz to 20,000 Hz, both channels operating.

MONO

0.005% maximum harmonic distortion at any power level from 250 milliwatts to rated power from 20 Hz to 20,000 Hz.

INTERMODULATION DISTORTION

STEREO

0.005% maximum if instaneous peak power output does not exceed twice the output rating or less per channel with both channels operating for any combination of frequencies, 20 Hz to 20,000 Hz.

MONO

0.005% maximum if instantaneous peak power output does not exceed twice the output rating or less for any combination of frequencies, 20 Hz to 20,000 Hz.

FREQUENCY RESPONSE (at one watt output)

+0, −0.25dB from 20 Hz to 20,000 Hz
+0, −3.0dB from 10 Hz to 100,000 Hz

HUM AND NOISE

105dB below rated output (A weighted).

RATINGS

DAMPING FACTOR

Greater than 200

INPUT IMPEDANCE

20,000 ohms UNBALANCED
40,000 ohms BALANCED

INPUT SENSITIVITY

Switchable for either 1.4 volt or 2.5 volt

POWER GUARD

Clipping is prevented and THD does not exceed 2% with up to 20 dB overdrive at 1 kHz

GENERAL INFORMATION

POWER REQUIREMENT

120 volts, 50/60 Hz, 0.6 to 15 amperes

SEMICONDUCTOR COMPLEMENT

84 Transistors
63 Diodes
6 IC
2 Triac

MECHANICAL INFORMATION

SIZE

Front panel measures 16 3/16 inches wide (41.1 cm) by 7 1/8 inches high (18.1 cm). Chassis measures 14 3/4 inches wide (37.5 cm) by 5 1/4 inches high (13.3 cm) by 15 5/8 inches deep (39.7 cm), including connectors. Clearance required in front of the mounting panel is 3/4 inches (1.9 cm).

FINISH

Front panel is glass with gold/teal nomenclature illumination and anodized gold and black aluminum. Chassis is black.

MOUNTING

McIntosh developed professional PANLOC.

WEIGHT

53 pounds (24 kg) net,
65 pounds (29.5 kg) in shipping carton.

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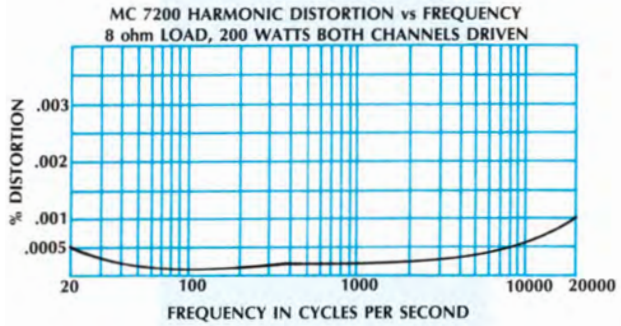

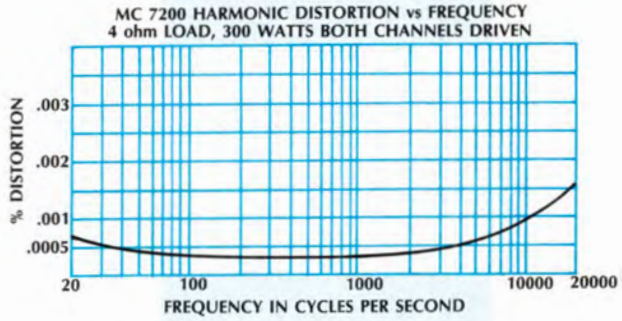

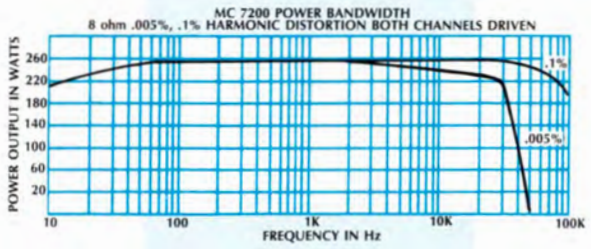

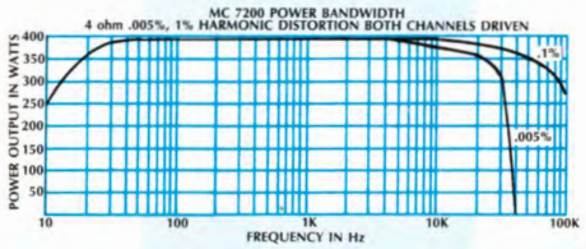

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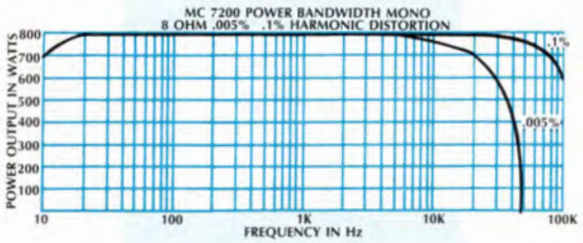
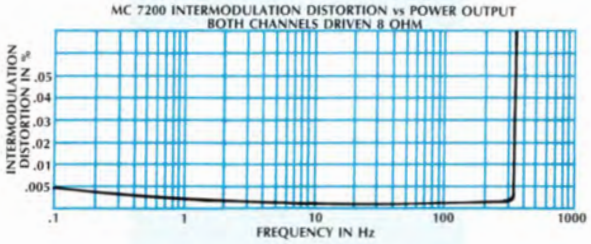
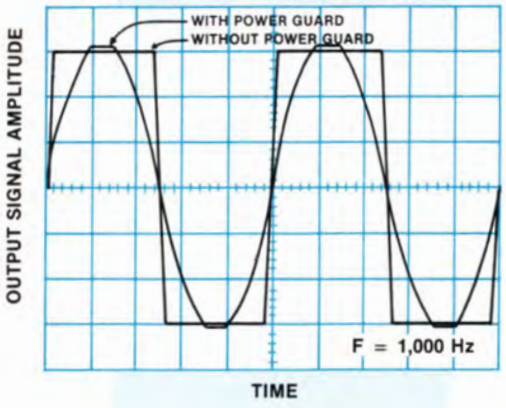
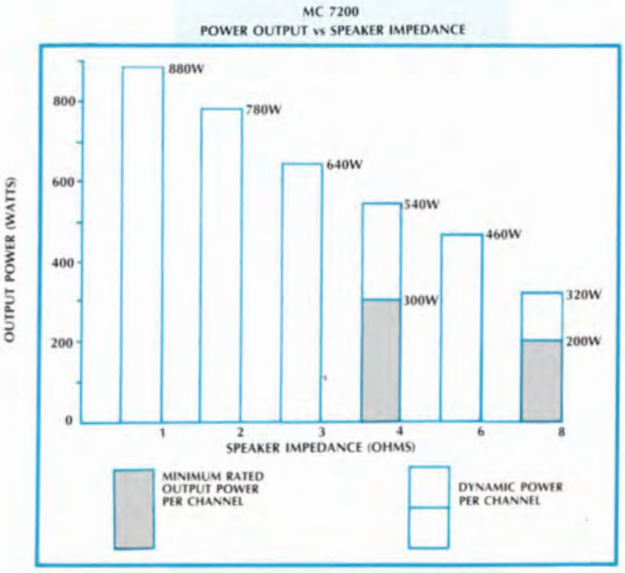




OUTPUT SIGNAL WAVEFORM SHOWING ACTION OF POWER GUARD TO ELIMINATE OUTPUT SIGNAL CLIPPING. AMPLIFIER INPUT IS OVERDRIVEN BY 20 dB FOR BOTH OSCILLOGRAM TRACES.





14 PERFORMANCE CHARTS

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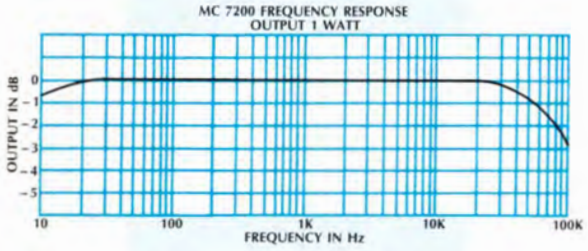
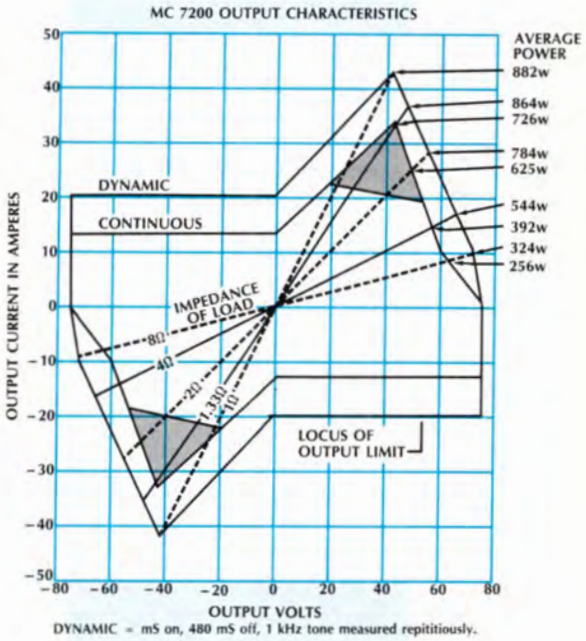
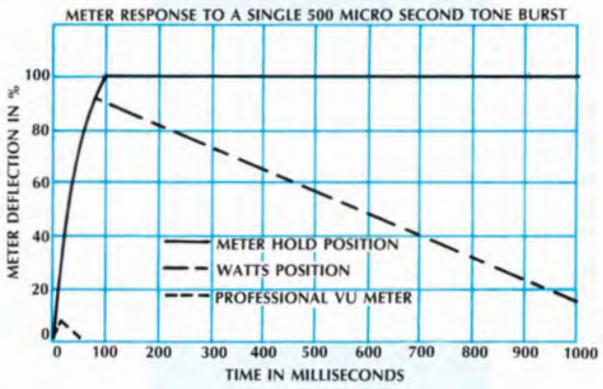
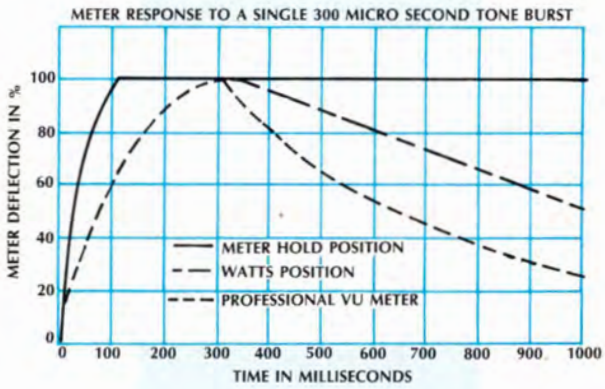




DYNAMIC = mS on, 480 mS off, 1 kHz tone measured repititiously.

(Continuous operation over a long period is not possible in this area because AC input current will exceed 15A rating of the power line.)





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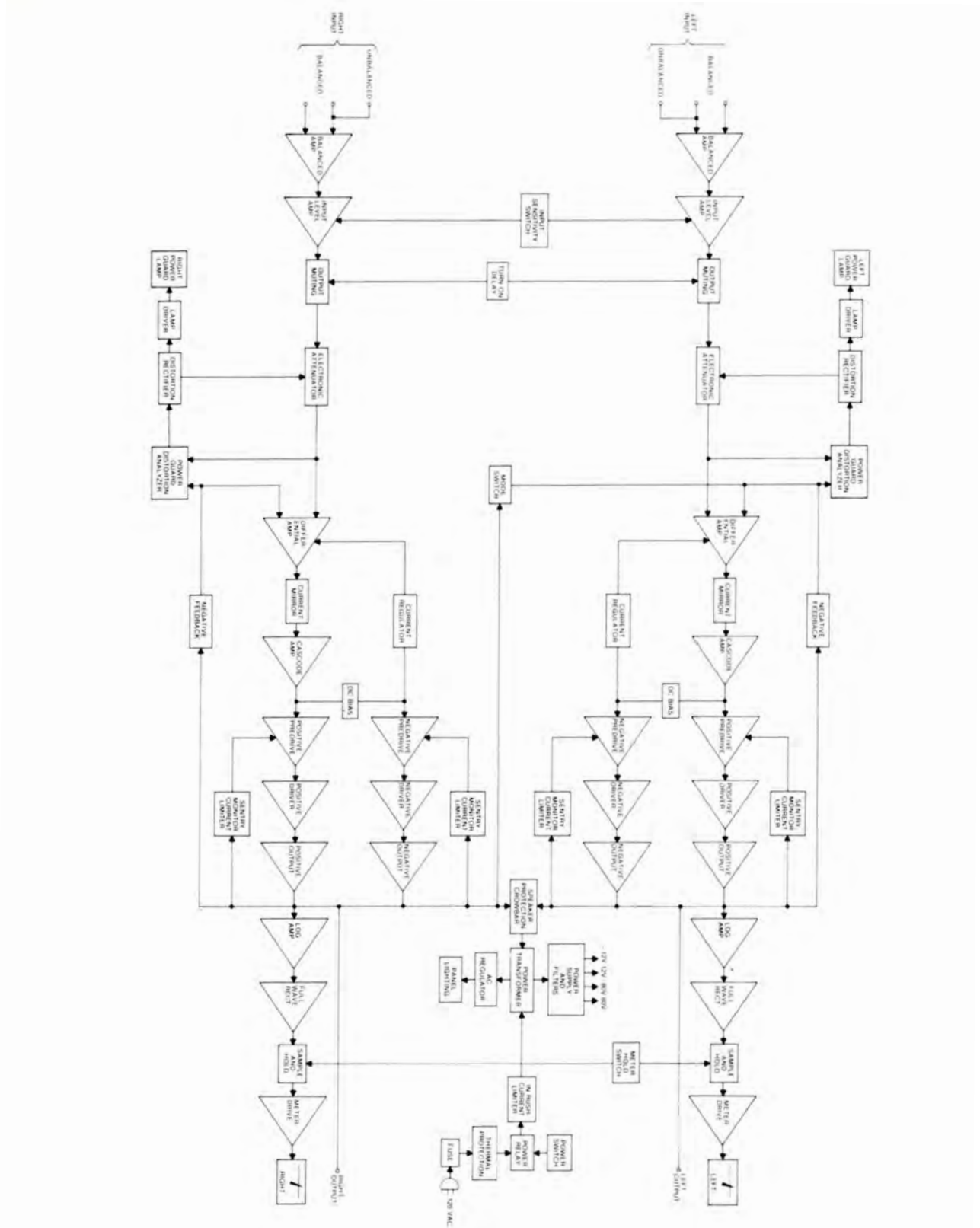

16 BLOCK DIAGRAM

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TECHNICAL FEATURES

The MC 7200 is a stereo power amplifier designed to operate with loudspeakers having a nominal impedance of 4 ohms or 8 ohms. The amplifier is rugged and reliable.

Balanced inputs are provided to make preamplifier connection less critical. Modern technology has made it possible to build preamplifiers and amplifiers with the high dynamic range and signal to noise ratio necessary to reproduce the sound quality present on compact discs. This high signal-to-noise ratio can be lost due to interconnecting cables that pick up electrical interference from other equipment or appliances. The balanced inputs on the MC 7200 cancel this type of noise and provide a minimum of 40dB more protection.

The MC 7200 uses a new circuit design that is so free of harmonic distortion that distortion is far below the amplifier's remarkably low noise floor. Only by using special spectrum analysis measuring techniques is the distortion measurable at all.

The design for this high level of performance is more difficult to carry out than it may seem. The principle used in the design of the MC 7200 provides nearly perfect linear operation without feedback for every stage of voltage or current amplification.

This linear operation is accomplished by using several different techniques:

1. Each transistor is selected to have nearly constant current gain (Beta) over the entire range of currents at which the transistor must operate.
2. The load impedance presented to each amplification stage is constant for all signal levels. This requires loading each stage as lightly as possible by its following stage. Resistive or reactive loading is used to reduce the effects of varying input impedance of the next stage.
3. The input impedance of stages is increased and made linear when possible by using emitter degeneration.
4. Resistors and capacitors in the signal path are carefully selected to have exceedingly low voltage coefficients (low change of resistance or reactance with applied voltage). Precision metal film resistors and low dielectric absorption film capacitors are used in all critical circuit locations.
5. Output transistors have matched uniform current gain, high current gain bandwidth product, low output capacitance, and large active-region safe operating area. These characteristics and the automatic tracking bias system eliminates cross-over distortion, which is associated with other high efficiency amplification designs. The performance graphs show, clearly, that distortion does not increase with power output levels until the amplifier design level is reached.

The mechanical and electrical design of the MC 7200 is the result of the many years of engineering and manufacturing experience held by the staff at McIntosh. This "know-how", the meticulous attention to design and production details, makes the MC 7200 one of the finest products ever produced by McIntosh Laboratory.

PROTECTION CIRCUITS

Some manufacturers of power amplifiers have claimed that their products do not require or use protection circuits and that such circuits compromise performance. McIntosh Laboratory agrees that dilligent measures are required to allow unrestricted performance, but we also insist and can prove that protection circuits are desirable and necessary to prevent amplifier or loudspeaker damage due to abnormal circumstance, and that they actually enhance performance. To enhance its performance, assure its reliability and to protect loudspeakers driven by the MC 7200, it incorporates six protection circuits.

1. POWER GUARD

The patented McIntosh Power Guard* circuit eliminates amplifier clipping due to overdrive. In the Power Guard circuit, the output waveform is compared to the input waveform. As long as there is no disparity between these signals, the circuit has no influence on the performance of the amplifier. Should the amplifier drive try to exceed the amplifier's maximum power capacity, a waveform difference will develop. If the disparity exceeds 0.3% on the average, (equivalent to 0.3% total harmonic distortion), the difference causes the POWER GUARD indicators to light. A further increase in the disparity, controls an electronic attenuator at the amplifier input to reduce the amplifier gain, thus holding the amplifier output to its maximum undistorted value regardless of the degree of overdrive to the amplifier.

The difference signal is fed to a specially compensated operational amplifier integrated circuit, its output is detected by a full wave bridge that

*U.S. Patent #4048573

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feeds signals to the control circuitry for the POWER GUARD indicators and to the electronic attenuator at the amplifier input. The attenuator is a light emitting diode/light dependent resistor network selected specially for its low distortion and time constant characteristcs.

2. SENTRY MONITOR

The patented* McIntosh Sentry Monitoring circuit constantly monitors the output signal and instantly reacts to prevent overload of the output transistors.

All power transistors have limits for the maximum amount of current they can handle. The MC 7200 output transistors and power supply have been designed to allow very high current flow into properly matched load impedances. If, however, a short circuit or very low value of load impedance is applied to the output of the MC 7200, a destructive current level could be reached. The Sentry Monitor Circuit senses the dynamic operating time, temperature, voltage, and current of the amplifier output stage and controls the current flow to non-destructive limits. Sentry Monitor does not limit the power output available from the amplifier.

3. THERMAL SHUT-DOWN

All power transistors have limits for the maximum amount of heat they can tolerate. The MC 7200 uses a highly efficient amplifying circuit which produces relatively little heat for the output power produced. The amplifier has two oversized heat sinks (1100 square inches surface area) to dissipate transistor generated heat. Under normal conditions, the transistors will operate well below their safe temperature limits. If ventilation is restricted by improper mounting, or if amplifier efficiency reduces by operating into a short circuit or a very low load impedance, extra heat will be produced. Thermal sensors within the MC 7200 will interrupt the AC power if temperatures become excessive. This prevents the transistors from producing life reducing heat. When the temperature reduces to a safe value, the amplifier operation will return to normal.

4. TURN-ON DELAY

The MC 7200 has a turn-on circuit that delays amplifier operation for about 2 seconds after power turn on. Any pops or thumps generated will be prevented from causing annoying noises or from damaging your loudspeakers.

5. DIRECT CURRENT FAILURE PROTECTION

All power amplifiers, which do not use output transformers to bypass DC (direct current), can destroy loudspeakers should there be a failure within the amplifier. Safety circuits are necessary to protect loudspeakers. The MC 7200 has a DC detecting circuit connected to the output of each channel. Should there be DC present, the circuit clamps the power supply to zero voltage to prevent damage to loudspeakers. This clamp action will cause the MC 7200 fuse to blow. The circuit returns to normal when the cause for DC is corrected and the fuse is replaced.

6. POWER LINE TRANSIENT SURGE PROTECTION

High voltage surges are sometimes present on 120 volt power lines due to switching of heavy electrical loads. Such surges can destroy critical electronic circuits. The MC 7200 power supply circuit is arranged to control momentary surges to safe levels.

PEAK RESPONDING POWER OUTPUT METERS

The meter circuit has three basic sections: a logarithmic amplifier, a full wave rectifier, and a DC amplifier.

The logarithmic amplifier consists of a high gain operational amplifier with a bipolar connected silicon diode pair as feedback elements. These diodes have a uniform logarithmic characteristic over an 80 dB range. Only 60 dB of this logarithmic range is used.

The full wave rectifier circuit uses an operational amplifier with silicon diode feedback networks. This amplified diode circuit has nearly perfect rectification characteristics. One rectifier detects only positive signals. The other responds only to negative signals and produces a positive output. The outputs of the rectifiers are combined at the operational amplifier output, so the highest signal, either positive or negative, is the one that is indicated by the meters. Gate diodes are used to charge a low leakage capacitor which attains and holds a charge during signal peaks. The operational amplifier provides a large amount of current so the peak holding capacitor can charge suddenly. The charge on the peak holding capacitor is amplified in a two transistor DC amplifier which is used to drive the meter. The output of the amplifier has a DC feedback network connected to the detector to assure excellent overall linearity and frequency response. The current drive to the meters has a peaking capacitor to accelerate the upscale response of the meter needle. The meters also have a parallel

*U.S. Patent #3526846

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shunt resistor to correctly damp their action. In the normal mode the discharge of the peak holding capacitor is controlled by a resistor current source. In METER HOLD, the resistor is disconnected so the peak reading is retained. The rate of decay in METER HOLD is about 6 dB per minute.

While the meters do not actually provide amplifier or loudspeaker protection, they do allow monitoring the power produced by the amplifier. This knowledge can be useful to prevent overdriving loudspeaker systems or to provide a power indication of the actual loudness of program material.

CIRCUIT OPERATION

Each amplifier channel of the MC 7200 uses two stages of voltage amplification followed by three stages of current amplification. The input signal feeds one input of a differential amplifier stage. Negative feedback from the amplifier output is applied to the other input. The differential amplifier outputs connect to current mirrors and feed a positive drive cascode voltage amplifier. Negative drive is provided by an active current source. The cascode voltage amplifier output feeds complementary Darlington driver transistors. These supply the signal to 14 complementary connected output transistors. Ancillary components for Power Guard, Sentry Monitor, Power Output Meters and other protection circuits interconnect with the amplifier circuits. The MC 7200 chassis is arranged for vertical airflow for convection cooling.

POWER SUPPLY

The power supply uses a massive power transformer, full wave bridge rectifiers and large filter capacitors having 100 joules of energy storage. Two large heatsinks provide cooling for the 28 output power transistors.

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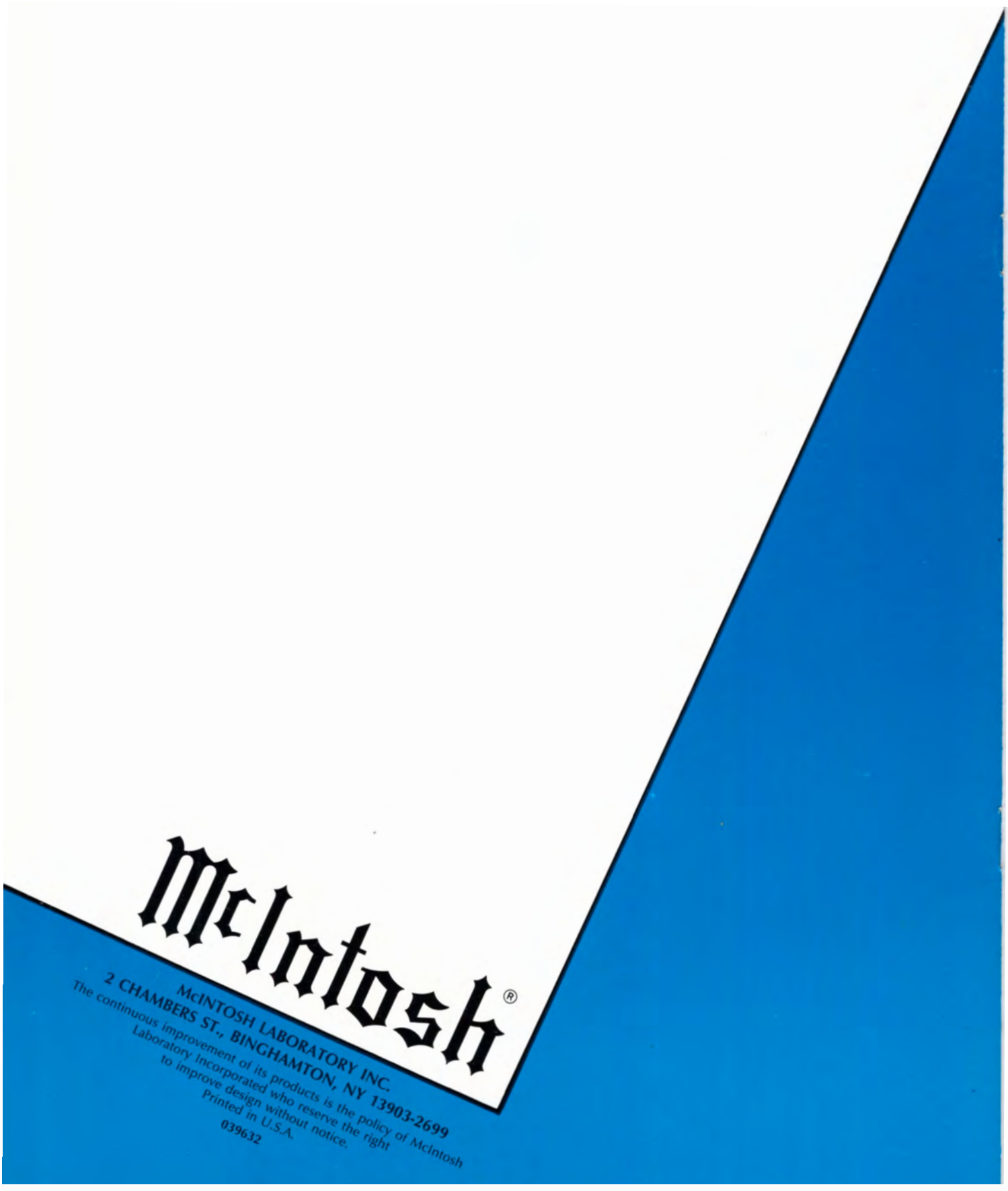

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