Your MCP 1 Head Amplifier is designed to operate to its performance limits for many years. If you have any questions, please contact:

CUSTOMER SERVICE
Mcintosh Laboratory Inc.
2 Chambers Street
Binghamton, New York 13903-2699
Phone: 607-723-3512

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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. Mcintosh will provide all parts, materials and labor needed to return the measured performance of the instrument to the original performance limits. 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 Mcintosh instruments at normal service rates. To receive service under the terms of the SERVICE CONTRACT, the SERVICE CONTRACT CERTIFICATE must be presented when the instrument is 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. To receive the SERVICE CONTRACT, your purchase must be made from a Mcintosh franchised dealer.
6. Your completely filled in application for the SERVICE CONTRACT must be postmarked within 30 days of the date of purchase of the instrument.
7. To receive the SERVICE CONTRACT, all information on the application must be filled in. The SERVICE CONTRACT will be issued when the completely filled in application is received by Mcintosh Laboratory Incorporated in Binghamton. New York.
8. 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 U.S.A. and Canada, the purchasers of which should consult with their dealer to ascertain what, if any, service contract or warranty may be available locally.

Introduction

WHY A HEAD AMP?

It is in the very nature of a moving coil cartridge, the way in which it must be made with the limitations imposed by today's materials, that it requires a head amp. A moving coil cartridge is really an electrical generator. Just like the generators at an electrical generating plant that convert the energy from falling water, the moving coil cartridge must have a source of mechanical energy which it can convert to electrical energy. For the moving coil cartridge the mechanical energy is supplied by the motion of the stylus as it follows the music signal impressed on the record groove walls. The movement of the stylus corresponding to the musical information is very small, being measured in only thousandths of an inch or tens of microns. Such a small mechanical motion converts into a correspondingly small electrical energy. The output of a moving coil cartridge is measured in only millionths of a volt. A typical moving coil cartridge will deliver only two or three hundred millionths of a volt which is equivalent to an energy output of only a billionth of a watt. The head amp must amplify this energy and increase its voltage level to a few thousandths of a volt in order to protect the musical content from loss of information and contamination by interfering electrical fields which surround everything and everyone of us. Such contaminating fields would add noise and hum to the musical signal and decrease its meaning for us.

AN ALTERNATIVE DESIGN

There is another possible means of increasing the voltage level of the head amp and that is by using an input transformer. While the transformer can increase the voltage output of the moving coil cartridge it can not amplify the energy content of the musical signal from the moving coil. Hence as the voltage of the moving coil is increased its corresponding current is decreased. The source impedance, the ratio of the moving coil voltage to its current is increased by the square of the voltage gain. Thus a voltage gain of say one hundred times is accompanied by an impedance increase of ten thousand. The higher the impedance of the output circuit the more susceptible it is to interfering hum and noise fields. The head amp can solve this problem by being designed to have an output impedance of only a few ohms. . .

But there is another problem with transformers operating at extremely low voltage levels. The ease with which the magnetic core concentrates lines of magnetic force varies with voltage level at extremely small levels. This variation adds distortion to the music signal at low frequencies. The MCP 1 head amp solves this problem too. The musical definition of the MCP 1 is far superior to input transformers that are many times the weight and size of the MCP 1.

For the highest quality music recovery from your recordings it is best to locate the head amp close to the base of the turntable arm. The extremely low energy levels developed by moving coil cartridges must be protected from exposure to loss of quality from long cables to the preamplifier. When the low voltage signals of the cartridge are amplified by the head amp, they can then leave for the preamplifier in robust form, able to survive the passage without loss of content and be uncontaminated by added noise or distortion components.

The MCP 1 is powered directly from your 117 volt line. But an ingenious new development from the Mcintosh engineering group completely isolates the MCP 1 from any noise components in the power line.

How To Connect

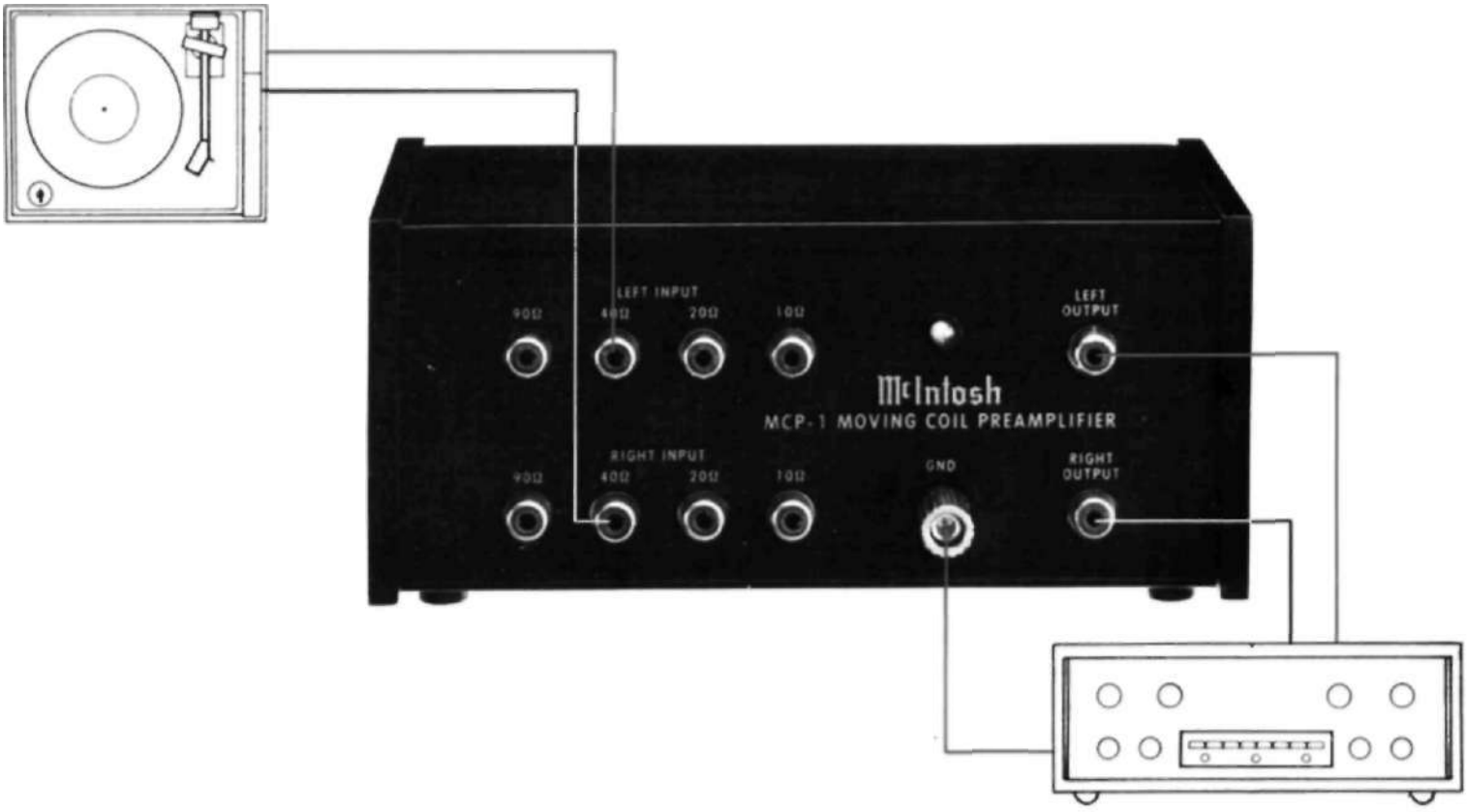
Connect the leads from your turntable to the proper impedance for your cartridge on the MCP 1 input.

Connect the output of the MCP 1 head amplifier to the moving magnet phono input on the preamplifier.

Connect the turntable ground to the MCP 1 ground terminal.

Then, connect a ground wire between the MCP 1 ground terminal and the ground terminal on the preamplifier.

It is imperative that there be no ground loops (multiple grounding paths) on the input and output cables connecting the MCP 1. Each channel of the MCP 1 has independent ground circuits. The input cables from the tonearm must have separate grounds for each channel and these grounds must not connect to the turntable frame ground. The output cables from the MCP 1 should have independent ground paths to the preamplifier. If you would like to, you can test the grounding system using an ohm meter. When testing the MCP 1 without any connections to other equipment, the ohm meter should measure 200 ohms between the left and right channel grounds and 100 ohms from each channel ground to the MCP 1 ground terminal.



Performance Limits And Ratings

Performance Limits

Performance limits are the maximum deviation from perfection permitted for a Mcintosh instrument. We promise you that when you purchase a new MCP 1 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.

INPUT IMPEDANCES—10, 20, 40 and 90 ohms

GAIN —10W - 31 dB, 20W - 26 dB, 400 - 20 dB, 90W - 13 dB

FREQUENCY RESPONSE— + 0, -0.5 dB, 20 Hz to 70 kHz

TOTAL HARMONIC DISTORTION —Less than .01%

SIGNAL TO NOISE RATIO—83 dBA (re: 500μV input at 1 kHz, 10W input, with RIAA equalization) (equivalent to - 149 dBV at input at 1 kHz).

PHASE SHIFT—Non inverting

CHANNEL SEPARATION —More than 90 dB, 20 Hz to 20 kHz

GENERAL INFORMATION

SEMICONDUCTOR COMPLEMENT—

22 Bipolar Transistors
2 Integrated Circuits
11 Diodes

POWER REQUIREMENT—85-135 V, 50/60 Hz, 2 watts

MECHANICAL INFORMATION

Size—7 inches wide (17.8 cm) by $3\frac{3}{16}$ inches high (8.1 cm) by 5 inches deep (12.7 cm)

FINISH—Cabinet is rosewood finish on solid macassar ebony. Front panel is black with gold nomenclature. Chassis is black.

WEIGHT—3 pounds (1.4 kg) net, 5.5 pounds (2.5 kg) in shipping carton

How To Design A Head Amp

The input transistors, input circuit configuration, and the power supply required critical design consideration since noise and hum must be held to an absolute minimum.

Transistor noise is characterized by two noise components; e_n, Equivalent Short-circuit RMS Noise Voltage, and i_n, Equivalent Open-circuit RMS Noise Current. The resistance or impedance of the MC cartridge and resistance in the input circuit of the amplifier also contribute Thermal Noise Voltage, e_r, as a result of random electron movement within these resistances. The combined noise voltage, e_n, appearing at the input of the amplifier can be calculated as:

$$e_N = \sqrt{e_n^2 + e_r^2 + i_n^2 R_{gen}^2}$$

The significance of this equation is that it tells us the noise in a MC preamplifier is largely determined by e_n, transistor noise voltage and not i_n, transistor noise current, since R_{gen} is small. This dictates the transistor design. For a transistor to have low e_n it must have low base diffusion resistance, r_{bb}. This requires that the transistor must have a large base diffusion area with a long case perimeter and use a low resistivity silicon material. Also, surface leakage must be absolutely minimum.

The complementary input stage transistors in the MCP 1 have these characteristics. The equivalent r_{bb} can be lowered further by parallelling a number of transistors. Eight transistors are parallelled in the MCP 1 which gives a reduction of 9 dB in noise level over using just one transistor. This design approaches closely the theoretical optimum. To guarantee performance each input transistor is individually tested for noise voltage and noise current at 100 Hz, 1 kHz, and 10 kHz before it is mounted in the MCP 1. This testing is time consuming but assures noise free operation.

Each channel of amplification in the MCP 1 uses two stages of amplification. The first stage has eight low noise bipolar transistors in a parallel complementary push-pull configuration. This stage amplifies the signal between 2.5 and 20 times (8 to 26 dB) depending on which input impedance is used. The second stage uses a pair of complementary bipolar transistors with a gain of 1.8 times (5 dB). The over all amplifier is described as a noninverting parallel cascaded complementary low noise bipolar transistor amplifier circuit.

The two cascaded stages of amplification in the MCP 1 preserve the phase of the input signal and increase the signal handling ability or dynamic range. The input stage inverts the signal and the second stage restores the phase to zero. The inverting input stage has an important additional noise advantage. If the input is open circuited the noise output reduces instead of increasing as in some other designs.

The power supply circuit required a new approach with very careful design. Many MC amplifiers use batteries to avoid hum and noise problems. These amplifiers, of course, require battery replacement and usually the noise and distortion performance is compromised to allow better battery life. The MCP 1 uses a line voltage power source to eliminate the need to compromise its noise performance. But the usual problem of a power transformer had to be solved first. Power transformers which use 50/60 Hz have external magnetic fields which can modulate the minute signal in the moving coil cartridge, add hum and noise to the cartridge, to the cartridge connecting cable and even to the main preamplifier. The design of the MCP 1 eliminates all of these problems. Knowing that a 50/60 Hz hum field simply could not be tolerated the Mcintosh design group chose a totally new approach. A high frequency, completely shielded, solid state switch mode power supply was used.

The AC power line feeds a reactive voltage divider and a full wave bridge rectifier. The rectifier produces 24 volts DC which is filtered and supplied to a 15 volt series voltage regulator. This regulator has 70 dB ripple rejection and reduces the power line hum to a negligible level. The 15 volts DC powers a stable multivibrator/frequency divider with an output frequency of 200 kHz. The 200 kHz drives a push-pull power switching amplifier followed by a ferrite core toroidal transformer. This transformer has two secondary windings bifilarly wound. Each winding feeds a separate rectifier and filter system. The two outputs are completely independent. One feeds the left amplifier channel and the other feeds the right. Filters and shielding are used to contain the 200 kHz switching within the power supply itself and there is no unwanted interference radiation or conduction.

The MCP 1 has three independent grounding systems to prevent ground loops when connecting input and output cables. The steel metal enclosure connects to a ground post for grounding to the turntable frame and associated amplifying equipment. The left and right channels have separate grounds. There is no hum or noise introduced as a result of the routing of input and output cables.