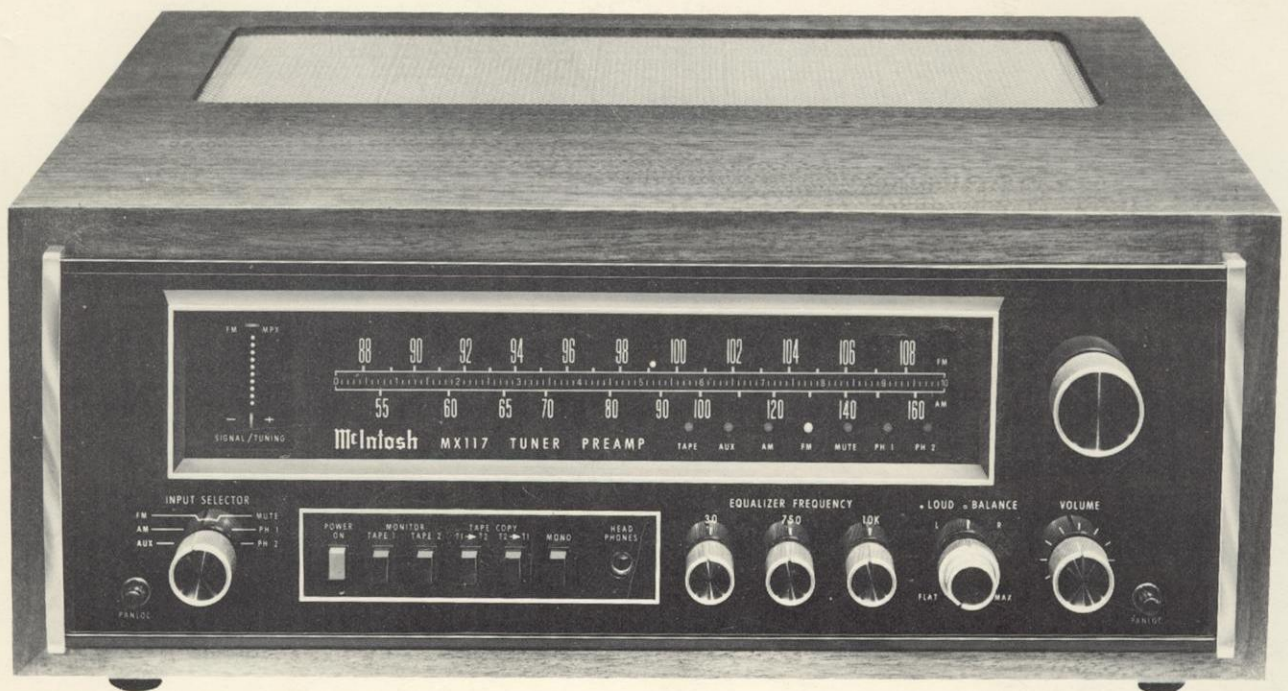


McIntosh
MX 117

OWNER'S MANUAL

THE MX 117 AM/FM TUNER PREAMPLIFIER



Reading Time: 32 Minutes

Price \$2.00

VARIOUS REGULATORY AGENCIES REQUIRE THAT WE BRING THE FOLLOWING INFORMATION TO YOUR ATTENTION. PLEASE READ IT CAREFULLY.

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

The McIntosh you have purchased is a Model MX 117. It has a serial number located on the rear panel of the chassis. Record that serial number here:

Serial Number

The model, serial number and purchase date are important to you for any future service. Record the purchase date here:

Purchase date

Upon application, McIntosh Laboratory provides a Three-Year Service Contract. Your McIntosh authorized Service Agency can expedite repairs when you provide the Service Contract with the instrument for repair. To assist, record your Service Contract number here:

Service Contract Number

Your MX 117 AM/FM Tuner Preamplifier will give you many years of pleasant and satisfactory performance. If you have any questions, please contact:

CUSTOMER SERVICE

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

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

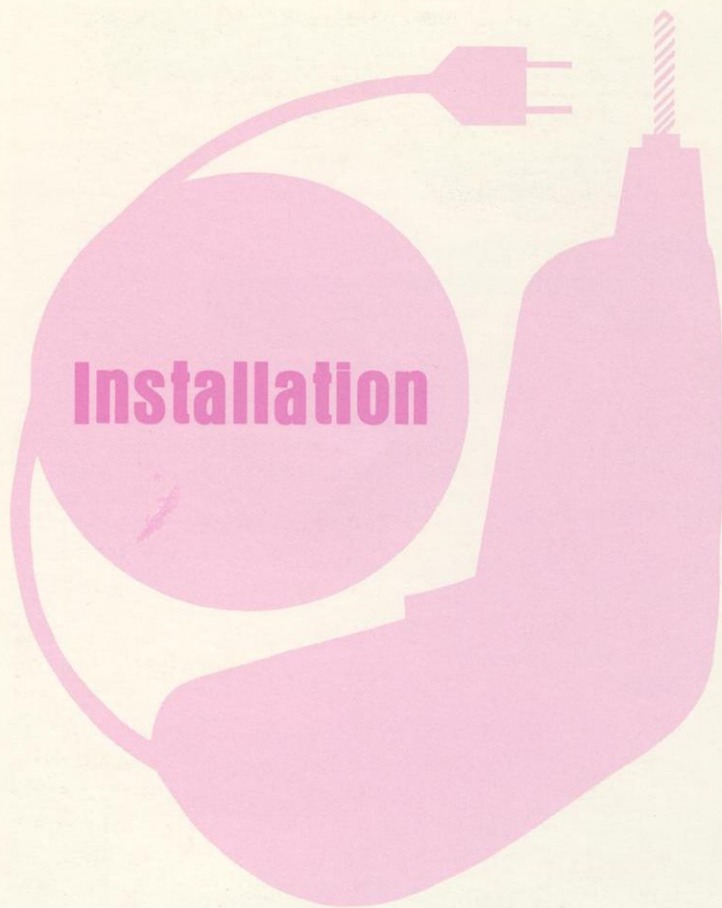
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McINTOSH THREE YEAR SERVICE CONTRACT

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 post-marked 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.



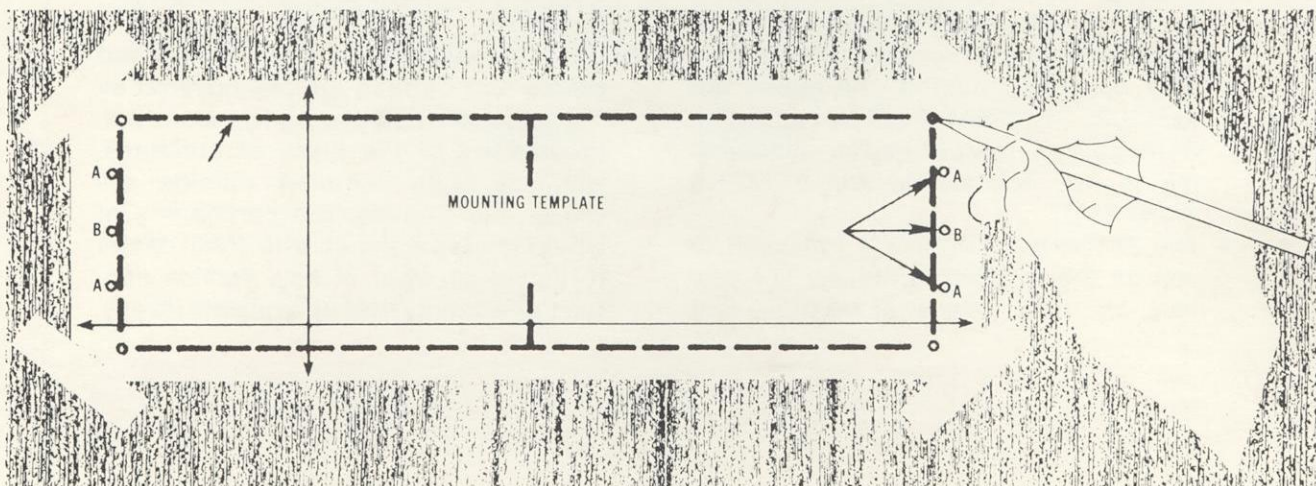
The PANLOC system of installing equipment conveniently and securely is a product of McIntosh research. By depressing the two PANLOC buttons on the front panel, the instrument can be locked firmly in place or it can be unlocked so that the chassis can slide forward, giving you easy access to the top and rear panels.

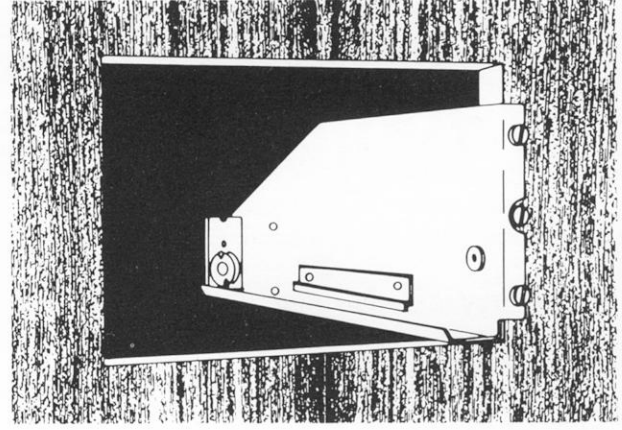
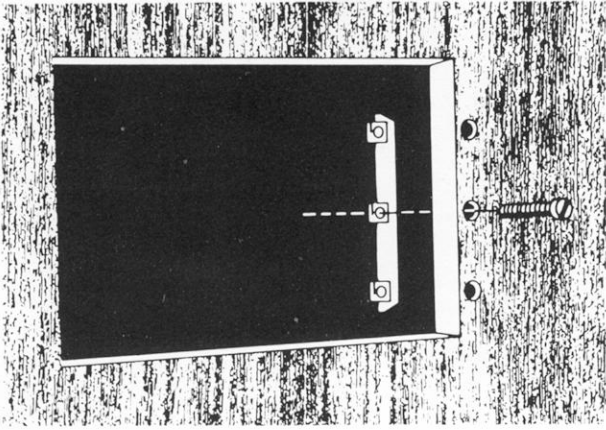
The trouble-free life of an electronic instrument is greatly extended by providing sufficient ventilation to prevent the buildup of high internal temperatures that cause deterioration. Allow enough clearance so that cool air can enter at the bottom of the cabinet and be vented from the top. With adequate ventila-

tion the instrument can be mounted in any position. The recommended minimum space for installation is 15 inches (38.1 cm) deep, 17 inches (43.2 cm) wide, and 6 inches (15.2 cm) high.

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. Open the carton and remove the PANLOC brackets, hardware package, and mounting template from the carton. Remove the MX 117 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. Place the mounting template in the position on the cabinet panel where the instrument is to be installed, and tape it in place. 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 bit held perpendicular to the panel and drill the six A and B holes. Then, using a drill bit slightly wider 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.





5. Install the Mounting Strips.

In the hardware package you will find two mounting strips, four 6-32 x 1-1/4 inch fillister head screws and two 4-40 x 1-1/4 inch flat head screws. These are long enough for any cabinet panel thickness up to one inch.

Starting at the right-hand side of the panel, insert a 4-40 x 1-1/4 inch flat head screw into the center hole in the panel, marked B on the template. On the back of the panel, align a mounting strip with the holes in the panel and tighten the screw until the screwhead is pulled slightly into the wood.

Repeat this procedure to attach the mounting strip to the left side of the panel.

6. Attach the PANLOC Brackets.

Using two of the 6-32 x 1-1/4 inch fillister head 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 it is stopped by the adjust position latches. Press the latches inward, this permits the instrument to slide into the cabinet until its front panel is flush with the cabinet panel. Depress the PANLOC buttons at the lower left and right corners of the instrument panel to lock the unit firmly in the cabinet. Depressing the PANLOC buttons again will unlock the instrument so that it can slide forward to the adjust position; if you press inward on the adjust position latches then you can remove the instrument from the cabinet.

How to Connect and Back Panel Information



Refer to the drawing on page 5.

Rear panel input jacks are provided for a stereo high level source (AUX), 2 stereo turntables (PH 1 and PH 2) and 2 stereo tape recorders (TAPE 1 and TAPE 2).

Rear panel output jacks are provided to feed 2 stereo tape recorders (TAPE 1 and TAPE 2), a stereo 600 ohm unbalanced line (LINE) and 2 stereo 2.5 volt outputs (MAIN).

A Front panel headphone jack is provided which is fed by an amplifier in the MX 117.

CONNECTING TURNTABLES

Connect the cable from the left channel of the turntable into the INPUT PHono 1 Left jack. Connect the cable from the right channel of the turntable into the INPUT PHono 1 Right jack. The MX 117 has shorting plugs in the Phono 2 inputs. To prevent unwanted noise remove the shorting plugs from the input jacks only when they are to be used. For a second turntable, connect PHono 2 in the same way, after removing the shorting plugs.

CONNECTING TAPE RECORDERS

To Record:

Connect a cable from the OUTPUT TAPE 1 Left jack to the left high level input of the tape recorder. Connect a cable from the OUTPUT TAPE 1 Right jack to the right high level input of the tape recorder. Connect a second recorder in the same manner to the OUTPUT TAPE 2 jacks.

To Playback/Monitor:

Connect a cable from the left channel output of a tape recorder to the TAPE INPUT 1 Left jack. Connect a cable from the right channel output of a tape recorder to the TAPE INPUT 1 Right jack. Connect a second recorder in the same manner to the TAPE INPUT 2 jacks.

CONNECTING AUX

Connect the left channel cable from any high level source (tuner, TV set, tape recorder, etc.) to the INPUT AUX left jack. Connect the right channel cable to the INPUT AUX Right jack.

CONNECTING TO POWER AMPLIFIERS

Connect the jacks labeled "OUTPUTS MAIN" to the input of a stereo power amplifier. The Left MAIN

jack is connected to the left amplifier input jack. The Right MAIN jack is connected to the right amplifier input jack. A second pair of MAIN OUTPUT jacks have been supplied to feed a second power amplifier.

The LINE OUTPUT jacks also deliver the same output signals as the MAIN OUTPUT jacks, however, the LINE OUTPUT jacks have 600 ohm source impedance. This output is used to connect to an amplifier having 600 ohms input impedance. When not so used, the LINE OUTPUT can be used as an extra pair of MAIN OUTPUT jacks.

CONNECTING PROGRAM SOURCE GROUNDS

A single GROUND post is provided to which grounds for turntables, record changers, tape decks, etc. are connected. To prevent hum pickup, the left and right program cables and the ground wire from that source should be wound or twisted together. Make sure the ground wire does not make any connection to the shields of the left and right program cables between the source and the input of the MX 117.

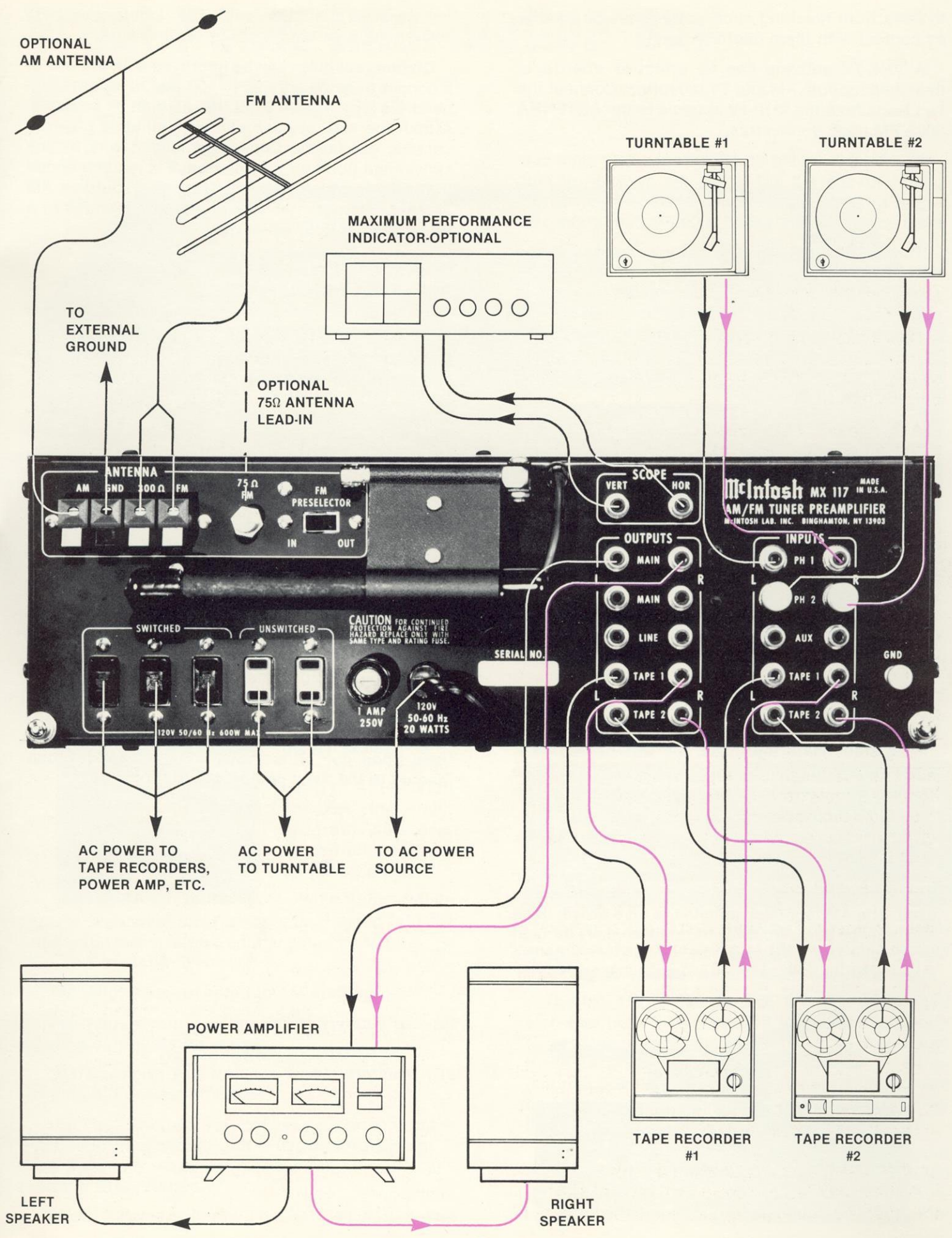
CONNECTING AN FM ANTENNA

One of the three antenna systems can be used: (1) an outdoor FM antenna, or (2) an VHF-TV antenna, or (3) the indoor dipole supplied.

An outdoor antenna is recommended for optimum performance in all areas. In fringe (outlying) areas, best results will be obtained with a highly directional FM antenna used in conjunction with a rotator. If the antenna uses a 300 ohm lead, connect it to the ANTENNA 300Ω FM push connectors.

If the antenna uses a 75 ohm coaxial cable, connect it to the ANTENNA 75Ω FM type F coaxial receptical.

An outside antenna system should not be located in the vicinity of overhead power lines or other electric light or power circuits, or where it can fall into such power lines or circuits. When installing an outside antenna system, extreme care should be taken



to keep from touching such power lines or circuits as contact with them might be fatal.

A VHF-TV antenna can be effective when it is designed for both FM and TV reception. Connect the two leads from the VHF-TV antenna to the ANTENNA 300Ω FM push connectors.

The flexible folded dipole antenna (300 ohm) supplied with the MX 117 is for use in urban or high signal strength areas. Connect the two leads from the dipole to the ANTENNA 300Ω FM push connector.

The flexibility of the twin flat wire assembly permits it to be placed under a rug, tacked behind the stereo or placed in any other convenient location. In some cases, it may be necessary to "position" the antenna for best signal reception. This should be done before it is permanently located.

Avoid locating the antenna next to other wires or metal objects. Any indoor antenna may be ineffective in houses having metal siding or metal foil insulation.

FM PRESELECTOR SWITCH

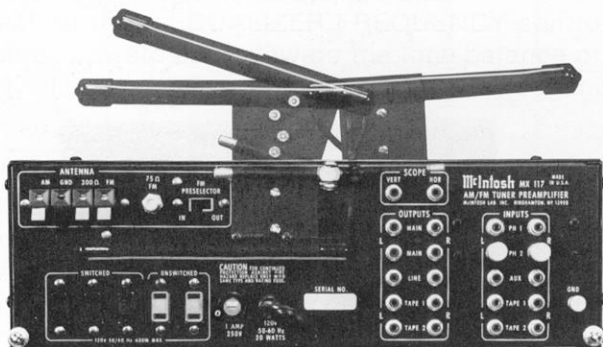
FM receivers can be overloaded by very large antenna input signals when the receiver is located very near to a FM broadcasting station or when a high gain directional antenna is used in a metropolitan area.

The preselector may be switched into or out of the FM RF circuit by a slide switch located on the rear panel.

We recommend the FM PRESELECTOR switch be used in the "out" position for all FM listening conditions except where there is evidence of overload by strong stations. In that case, the "in" position will protect against overload. For most stations there will be no listening difference between the two switch positions.

AM ANTENNA

For local and most moderately distant AM reception the built-in ferrite loopstick antenna may be used. The AM loopstick antenna is on a swivel base and must be adjusted away from the chassis for best reception. The illustration shows examples of the many positions the AM antenna may be placed in.



Try several positions until you locate the best performing location for your listening area.

Distant reception can be improved with the use of a copper antenna wire 50 to 150 feet in length. Suspend the wire in a straight line as high as possible. Attach the wire at each end with suitable glass or ceramic insulators. Connect a lead-in wire at any convenient point on the antenna. It is recommended that a lightning arrester be used with an outdoor AM antenna. The arrester should be well grounded to a ground rod or cold water pipe.

CONNECTING A MAXIMUM PERFORMANCE INDICATOR

The scope vertical and horizontal jacks on the rear panel are used to connect a McIntosh maximum performance indicator or an oscilloscope. Follow directions outlined in the maximum performance indicator owner's manual. The maximum performance indicator gives a display of signal strength versus frequency and allows adjusting a directional antenna for the best multipath free FM reception condition.

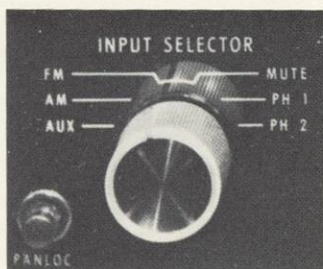
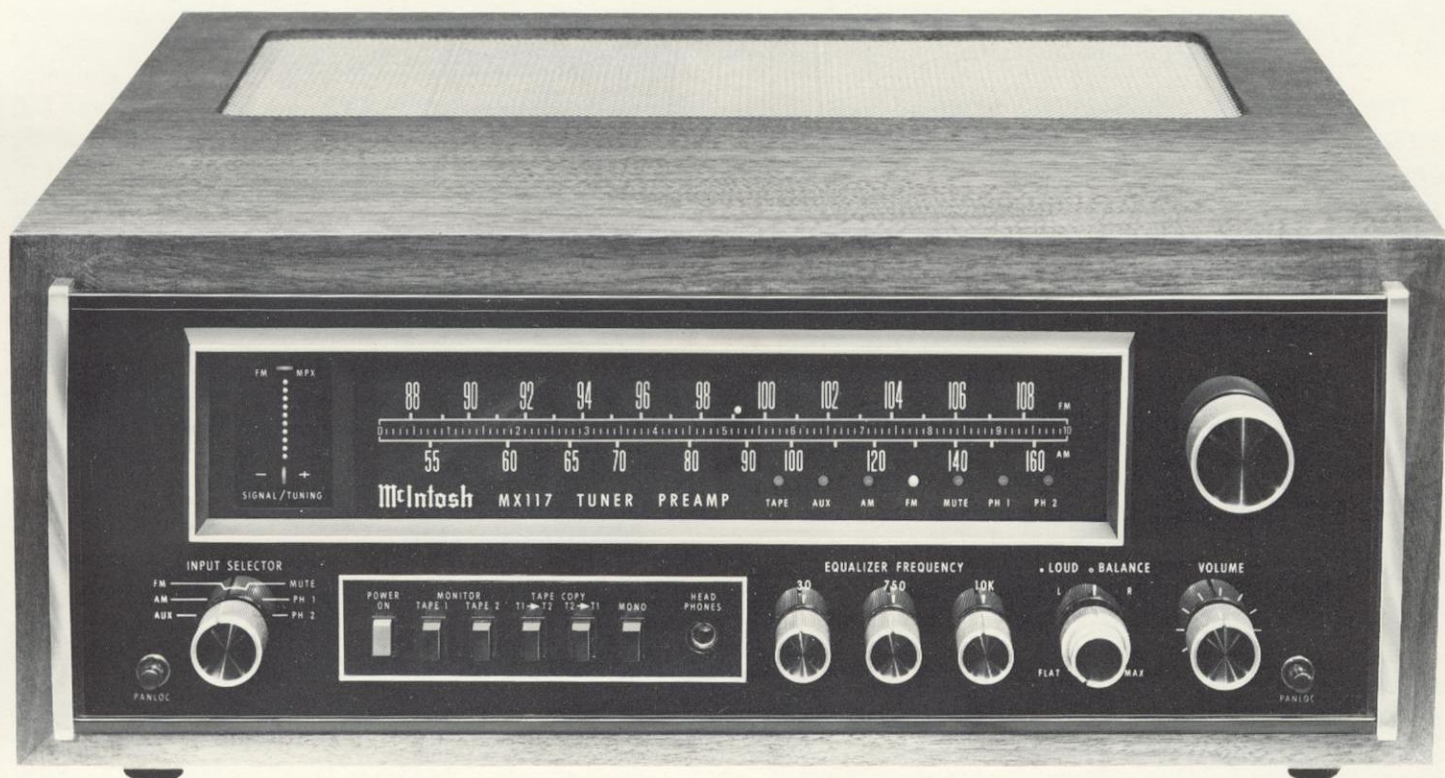
AC POWER OUTLETS

There are 3 black AC power outlets, and 2 red AC power outlets. The AC power to the black outlets is controlled by the front panel switch. Use these outlets for a power amplifier, tuner, or tape recorder, etc. The red receptacles are on at all times. Use the red outlets for turntables or record changers. Turntables are protected by this arrangement since it is necessary to turn off a turntable or record changer with its own AC power switch.

FUSE

A 1.0 AMP fuse protects the MX 117 circuits. The fuse does not protect additional equipment connected to the back panel AC outlets.

Front Panel Information and Use of Controls



INPUT SELECTOR

The six position INPUT SELECTOR chooses the input program selected. The switch positions do the following:

AUX: Allows you to hear a high level program source plugged into the AUX input jacks. Such a source could be a television set, another tape recorder, etc.

AM: Allows you to listen to AM stations.

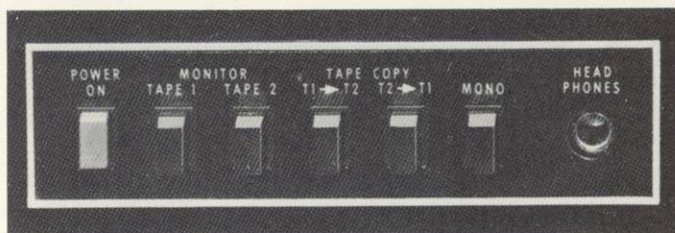
FM: Allows you to listen to FM stations without muting of interstation noise.

MUTE: Allows you to listen to FM stations with muting of interstation noise.

PHono 1: Allows you to hear program from a magnetic phono cartridge plugged into PHono 1. The frequency response is shaped to precisely conform to RIAA standards.

PHono 2: Same as PHono 1 but for a second turntable.

PUSHBUTTONS



POWER ON: The POWER ON pushbutton energizes the MX 117 circuits and connects power to the black AC power outlets on the rear panel.

The MX 117 is designed so that it may be used with two tape recorders. The four center pushbuttons on the front panel control the signal to and from these recorders. They permit playback of either recorder, monitor of either recorder as recordings are being made, or copying of tapes from one recorder to another while listening to a separate program.

MONITOR TAPE 1 pushbutton out: The program source as selected by the INPUT SELECTOR is fed to the power amplifiers and heard through the loudspeakers; pushbutton in: Signal from a tape recorder

plugged into TAPE 1 IN is fed to the power amplifiers and heard through the loudspeakers.

MONITOR TAPE 2 pushbutton: Functions similarly to monitor Tape 1 for a second tape recorder.

IMPORTANT: When the MX 117 is operated with either MONITOR pushbutton at the in position, the program heard will be that from the tape recorders only. Signal from any other source will not be heard. To hear any other source, make sure the MONITOR pushbuttons are OUT.

The MONITOR switches are mechanically interlocked to prevent simultaneous monitoring from two tape recorders. If one button is at the in position, it must be pushed again to release it to the out position before the other button can be pushed.

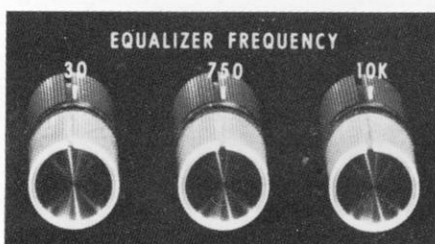
TAPE COPY T1 → T2 pushbutton out: The program source selected by the INPUT SELECTOR is fed to the input of tape recorder 2. Pushbutton in: Connects the output from tape recorder 1 to the input of tape recorder 2 without affecting the program being heard from the speakers. In this position a copy of the program on tape recorder 1 can be made on tape recorder 2. To monitor the original use MONITOR TAPE 1 pushbutton and to monitor the copy use MONITOR TAPE 2 pushbutton.

TAPE COPY T2 → T1 pushbutton out: The program source selected by the INPUT SELECTOR is fed to the input of tape recorder 1. Pushbutton in: Connects the output from tape recorder 2 to the input of tape recorder 1 without affecting the program being heard from the speakers. In this position a copy of the program on recorder 2 can be made on recorder 1. To monitor the original use MONITOR TAPE 2 pushbutton and to monitor the copy use MONITOR TAPE 1 pushbutton.

MONO: The MONO pushbutton switches the audio sections of the MX 117 from stereo mode to MONO so that the program heard will be MONO. When the INPUT SELECTOR is in the FM position the FM MPX (multiplex) light will remain on when tuned to a FM stereo station regardless of the position of the MONO pushbutton. The program heard will be mono. The TAPE OUT jacks are not affected by the MONO pushbutton.

EQUALIZER FREQUENCY CONTROLS

Each of three EQUALIZER FREQUENCY controls modifies upward or downward the tone balance of a band of frequencies centered on the frequency



marked above the control. The flat position of the control has a detent for easy reference. Each control provides 12 dB boost or cut at the specified center frequency.

Use the EQUALIZER FREQUENCY controls to modify the sound and tone balance of program material. Here are some suggestions from which to start:

Problem	Equalizer Correction
Bass too weak	Raise 30
Male vocalist needs reinforcing	Raise 30
Female vocalist reinforcing	Raise 750
Hum on program	Reduce 30
Violins, trumpets dull	Raise 750
Drum "brushes" not audible	Raise 10 K
Noise and hiss	Reduce 10 K



BALANCE and LOUDNESS

The BALANCE and LOUDNESS controls are concentric. The BALANCE control (large outer knob) adjusts for equal volume of either the left or right channels. The volume of the channels can be varied relative to each

other without affecting their combined volume.

left...turning the control to the left accents the left channel by reducing the right channel output.

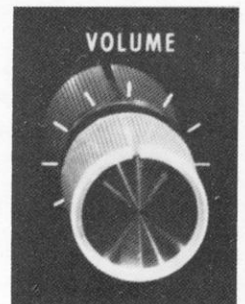
right...turning the control to the right accents the right channel by reducing the left channel output.

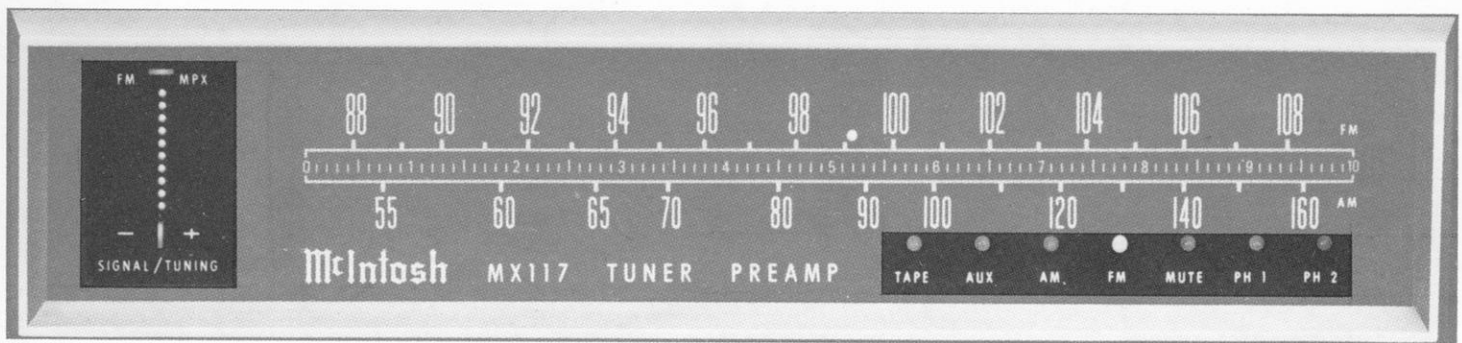
The LOUDNESS control (small center knob) increases both bass and treble frequencies of both channels as it is turned clockwise. Adjustment of the LOUDNESS control allows life-like frequency balance when playing music softly. Its contour is the same, regardless of the position of the volume control. This contour is accurately modeled after the family of "Equal Loudness" curves identified by Fletcher and Munson.

The loudness circuitry is completely independent of the volume control. Therefore, any desired amount of compensation can be introduced regardless of volume control position.

VOLUME CONTROL

The VOLUME control is a precision step control manufactured for McIntosh Laboratory. It has 32 steps with a 70 dB range, plus volume off. Left and right channel tracking are within 1 dB. This extreme accuracy is obtained through special electronically controlled resistance element trimming. Tracking accuracy is permanently maintained and operation is noise free.





TUNING KNOB

The Tuning Knob selects AM or FM stations. An AM station is tuned in correctly when the vertical column signal strength indicator shows a maximum. An FM station is correctly tuned when the center bar indicator at the bottom of the signal strength column illuminates and the signal strength display is at a maximum. There are indicators marked + and - on each side of the FM center bar. These light as you approach FM stations and indicate if you are above (+) or below (-) the station. When the center tuning bar lights, the FM AFL (automatic frequency lock) circuit is active and the tuner is locked to the FM station. This locked condition will give the best FM reception with lowest background noise, lowest distortion and best stereo separation.

Because of the locking action of the AFL circuit, the Tuning Knob can be tuned mechanically slightly away from the frequency of the FM station without detuning the MX 117. This makes tuning the MX 117 very easy but can cause the MX 117 to not return to the FM station when power is turned off and on again. This condition can be avoided if, when tuning in a station, you stop turning the Tuning Knob as soon as the center bar indicator lights. Then the MX 117 will return to the same station when power is turned on again.

INPUT INDICATORS

At the bottom right of the tuning dial area are seven LED (light emitting diode) lamps; six of them indicate the status of the INPUT SELECTOR switch. The illuminated LED indicates the program source selected.

The remaining LED marked TAPE indicates when either of the TAPE MONITOR pushbuttons is in the MONITOR position. When the light is on only the tape can be heard. To listen to any other program source the light must be off.

SOLID STATE TUNING INDICATOR

The MX 117 utilizes an all solid state tuning indicator. Fourteen LEDs make up the display, which consists of four bars and 10 small dots.

The bar at the top indicates reception of a FM stereo multiplex (MPX) station. The 10 little dots arranged in a vertical column indicate relative station signal strength for AM or FM. The three bars at the bottom of the display indicate if you are tuned above (+), below (-), or right on station when receiving FM.

HEADPHONE JACK

A HEADPHONE jack is provided to drive low impedance dynamic headphones from an internal power amplifier.

Performance Limits

Performance limits are the maximum deviation from perfection permitted for a McIntosh instrument. We promise you that when you purchase a new MX 117 from a McIntosh Franchised dealer it will be 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.

PREAMP SECTION

FREQUENCY RESPONSE

+0 -0.5 db from 20 Hz to 20 kHz

RATED OUTPUT LEVELS

Main Out	2.5V
Line Out	1.25V
Headphone	750mV
Tape Out	250mV

DISTORTION

0.02% maximum at 2.5V output from 20 Hz to 20 kHz

INPUT SENSITIVITY AND GAIN

Input to Main Out

Phono 1 and 2	2.2mV in for 2.5V out (61.1 dB gain at 1 kHz)
Aux, Tape 1 and 2	250mV in for 2.5V out (20 dB gain at 1 kHz)

Input to Line Out

Phono 1 and 2	2.2mV in for 1.25V out (55 dB gain at 1 kHz)
Aux, Tape 1 and 2	250mV in for 1.25V out (14 dB gain at 1 kHz)

Input to Headphone Out

Phono 1 and 2	2.2mV in for 750mV out (50.7 dB gain at 1 kHz)
Aux, Tape 1 and 2	250mV in for 750mV out (9.5 dB gain at 1 kHz)

Input to Tape Out

Phono 1 and 2	2.2mV in for 250mV out (41.1 dB gain at 1 kHz)
Aux, Tape 1 and 2	250mV in for 250mV out (0 dB gain at 1 kHz)

SIGNAL TO NOISE

Phono 1 and 2	- 90 dB IHF A-weighted, below 10mV input - 80 dB unweighted, below 10mV input
Aux, Tape 1 and 2	- 100 dB IHF A-weighted, below 250mV input - 90 dB unweighted, below 250mV input

INPUT IMPEDANCE

Phono 1 and 2	47k Ω and 50pF
Aux, Tape 1 and 2	47k Ω

OUTPUT IMPEDANCE

Main Out	less than 100 Ω (to operate into 5k Ω or greater)
Line Out	600 Ω (to operate into a 600 Ω line)
Headphone	8 Ω
Tape Out	less than 200 Ω (to operate into 5k Ω or greater)

EQUALIZER CONTROL RESPONSE

Center Frequencies	30, 750, and 10 kHz
Boost and Cut	\pm 12 dB

AM SECTION

SENSITIVITY

75 μ V IHF with external antenna

SIGNAL TO NOISE RATIO

45 dB minimum IHF or 55 dB at 100% modulation

FREQUENCY RESPONSE

+0 -6 dB from 20 Hz to 3500 Hz

HARMONIC DISTORTION

0.8% maximum at 30% modulation

ADJACENT CHANNEL SENSITIVITY

30 dB minimum IHF

IMAGE REJECTION

65 dB minimum from 540 kHz to 1600 kHz

FM SECTION

USABLE SENSITIVITY

2 μ V (11.2dBf) IHF

QUIETING SENSITIVITY

5 μ V (19.1dBf) IHF - 50 dB (Mono)
50 μ V (39.5dBf) IHF - 50 dB (Stereo)

SIGNAL TO NOISE RATIO

70 dB IHF minimum both Mono and Stereo

HARMONIC DISTORTION

0.18% (Mono) IHF maximum
0.38% (Stereo) IHF maximum

ALTERNATE CHANNEL SELECTIVITY

75 dB IHF minimum

IMAGE REJECTION

100 dB IHF minimum

STEREO SEPARATION

45 dB minimum at 1 kHz

GENERAL INFORMATION

POWER REQUIREMENT

120 Volts 50/60 Hz, 45 Watts

SEMI CONDUCTOR COMPLEMENT

24 Bipolar Transistors
18 Field Effect Transistors
62 Diodes
24 Integrated Circuits

MECHANICAL INFORMATION

SIZE

Front panel measures 16 inches wide (40.6 cm) by 5 7/16 inches high (13.8 cm). Chassis measures 14 3/4 inches wide (37.5 cm) by 4 13/16 inches high (12.2 cm) by 13 inches deep (33 cm), including connectors. Knob clearance required is 1 1/4 inches (3.2 cm) in front of mounting panel.

FINISH:

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

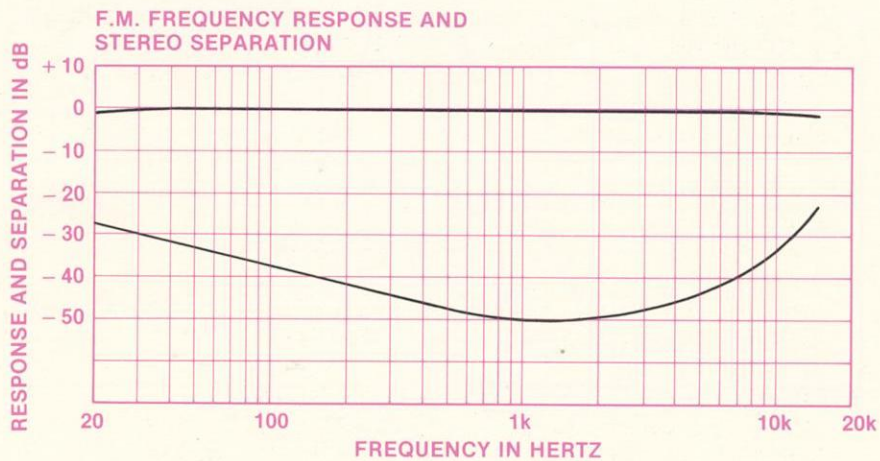
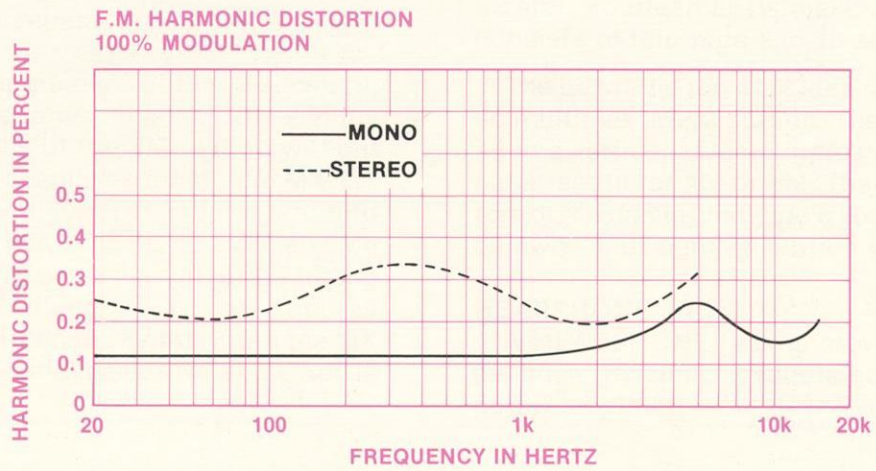
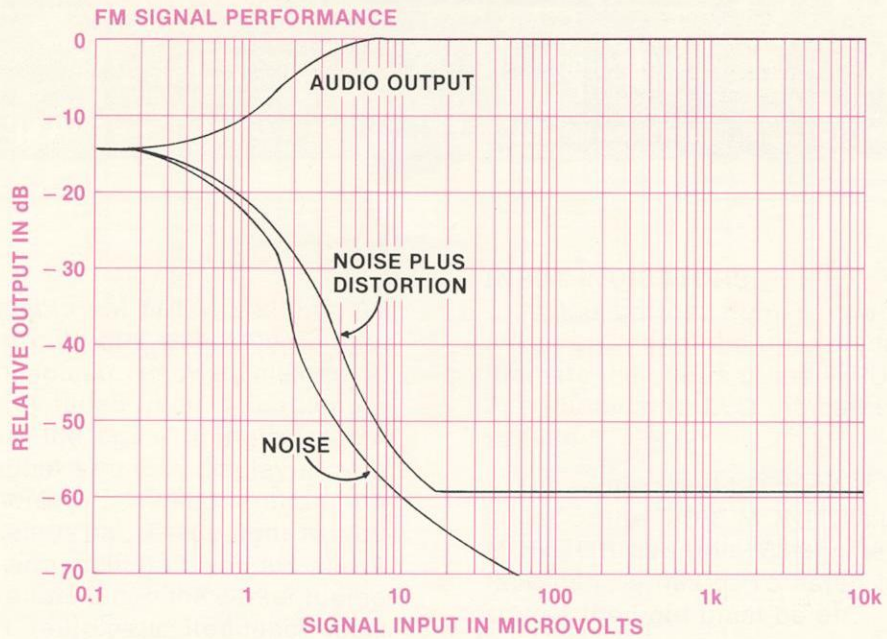
MOUNTING:

Exclusive McIntosh developed professional PANLOC.

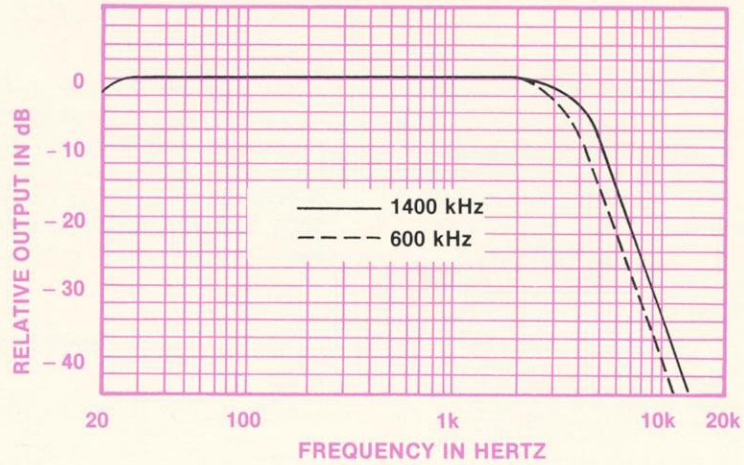
WEIGHT:

24 pounds (10.9 kg) net, 36 pounds (16.3 kg) in shipping carton.

Performance Charts

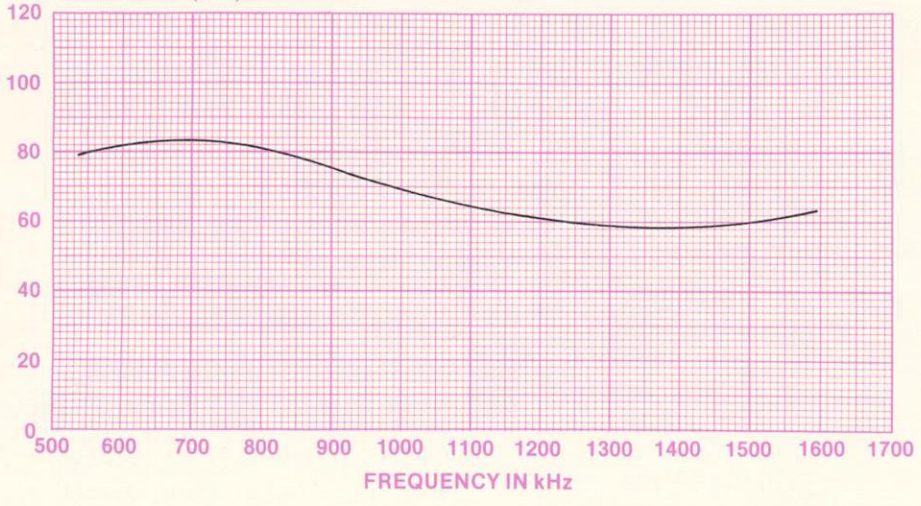


A.M. FREQUENCY RESPONSE
80% Modulation

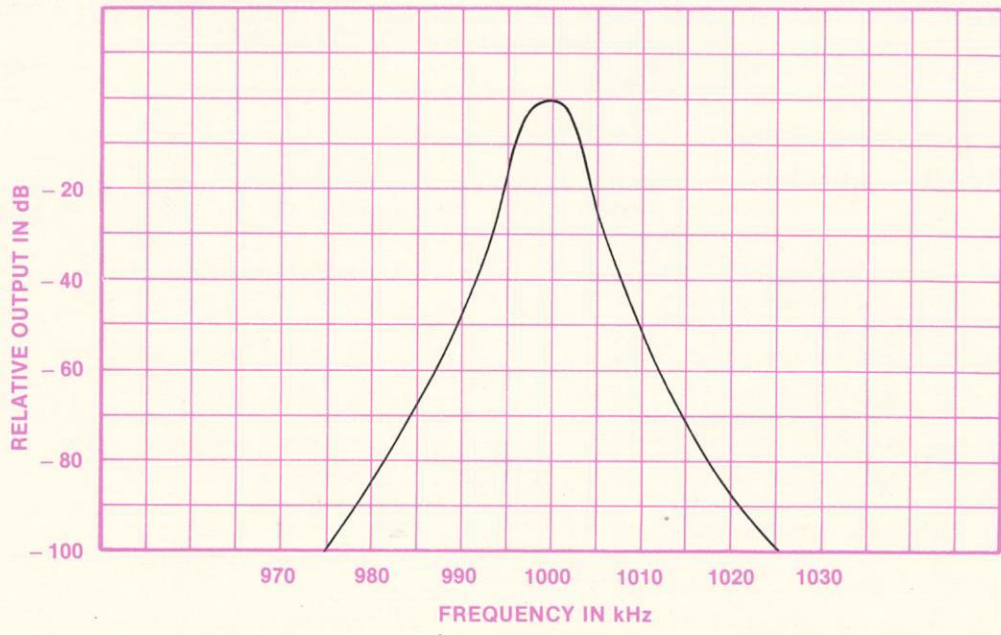


RF INPUT USING DUMMY ANTENNA IN MICROVOLTS

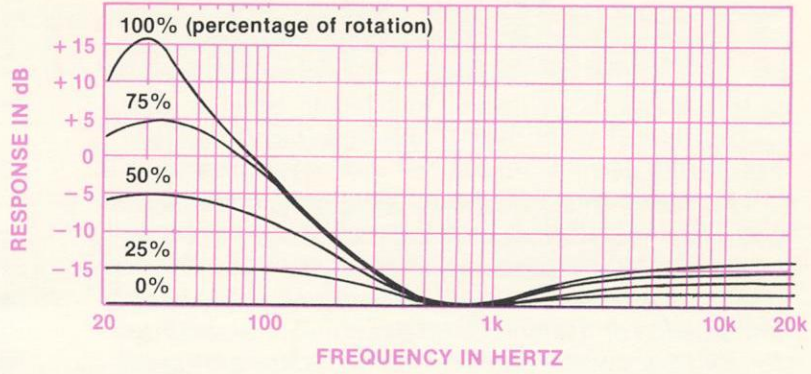
AM MINIMUM USABLE SENSITIVITY (IHF)



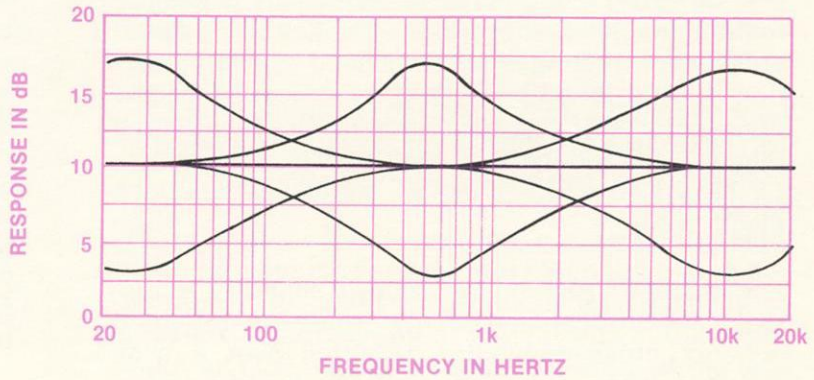
AM SELECTIVITY AT 1000 kHz



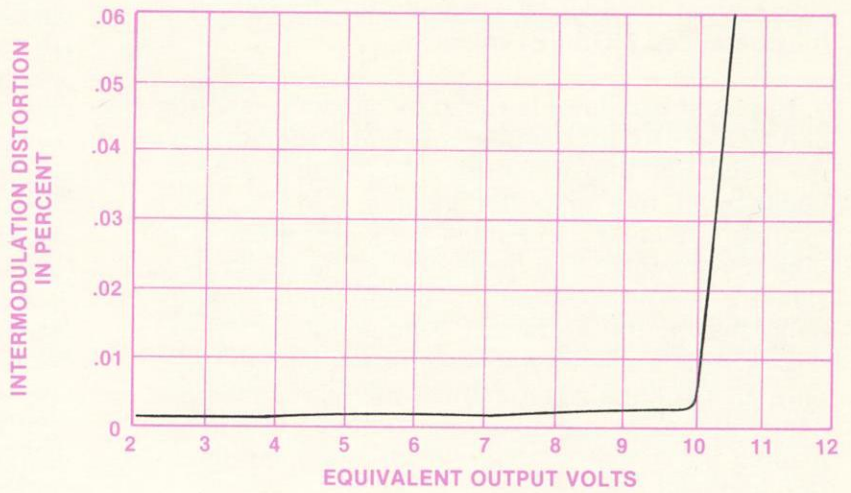
LOUDNESS CONTROL RESPONSE:
FOR VARIOUS CONTROL
POSITIONS



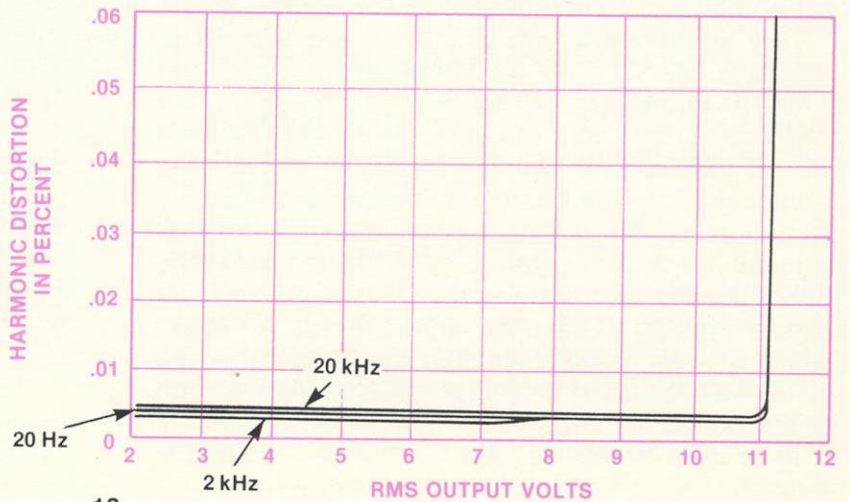
EQUALIZER FREQUENCY RESPONSE:
CONTROLS SET AT MAXIMUM
AND MINIMUM



INTERMODULATION DISTORTION:
IN: AUX; OUT: MAIN
INPUT FREQUENCY: 60 Hz & 7 kHz:
RATIO: 4:1



HARMONIC DISTORTION:
IN: AUX; OUT: MAIN



Technical Description

FM SECTION

The radio frequency (RF) assembly houses the complete FM-RF front end and part of the AM-RF circuitry. An eight section variable capacitor is the heart of the RF assembly. Five sections, 1, 2, 4, 6 and 8 are used for FM and three sections, 3, 5 and 7 are for AM. Sections 1 and 2 of the capacitor are for the FM antenna RF input circuits. Section 2 is always in use, however, if additional RF selectivity is desired to protect against strong signal overload, additional preselector filtering is accomplished by adding section 1. This is accomplished by operation of the preselector switch on the rear panel. This switch directs a DC voltage that controls PIN semiconductor diodes to perform the RF switching functions electronically.

A MOS-FET RF amplifier follows section 2 to provide exceptional sensitivity while maintaining superior cross-modulation rejection over a wide dynamic range. Capacitor sections 4 and 6 follow the RF amplifier to increase selectivity and to provide correct impedance matching for the following fully balanced MOS-FET mixer.

The local oscillator is tuned by capacitor section 8. A MOS-FET buffer amplifier is employed between the oscillator and the mixer. The high input impedance of this amplifier insures that oscillator loading is minimal, therefore, oscillator stability is greatly enhanced. The oscillator is fine tuned by a varactor diode operated by a correction voltage generated by the Automatic Frequency Lock (AFL) circuit. AFL is a McIntosh patented circuit that turns on a lock voltage when manual tuning reaches the center of the FM station carrier. This AFL tuning aid insures the tuning is accurate for minimum distortion and best performance.

The FM-IF system that follows the mixer consists of five integrated circuit amplifiers and four piezoelectric filters. They combine to give a total amplification of 140 dB. The IF response characteristic is very selective, being 170 kHz wide at -3 dB and only 500 kHz wide at -50 dB. The response is symmetrical about the center frequency of 10.7 MHz. The IF filters are permanently sealed and cannot drift nor vibrate out of adjustment. The exceptionally high gain of the IF system assures proper limiting at all input signal levels. A Foster-Seely discriminator completes the IF system. The detected output of this discriminator has a high signal to noise ratio and extremely low distortion. This output feeds to the FM stereo multiplex section.

FM STEREO MULTIPLEX

The heart of the multiplex section is a new third generation phase locked loop (PLL) stereo decoder integrated circuit (IC). This PLL IC incorporates two special systems, an automatic variable separation control circuit to reduce background noise when receiving weak stereo stations, and tri-level digital waveform generation which eliminates interference from SCA signals and from the sidebands of adjacent channel FM signals.

The variable separation control is operated from the IF amplifier's signal strength detector. A smooth transition is provided from mono to stereo or from stereo to mono at weak signal levels to provide the optimum signal to noise ratio and best stereo separation for the prevailing signal conditions. The circuit operates only during stereo reception. It switches automatically to monophonic if the 19 kHz pilot tone is absent.

In the PLL the internal oscillator operates at 228 kHz, locked onto the 19 kHz pilot tone. The 228 kHz feeds a 3 stage Johnson counter via a binary divider to generate a series of square waves. Suitably connected NAND gates and exclusive OR gates produce the tri-level drive waveform for the various demodulators in the circuit. The usual square waveforms have been replaced in the PLL and decoder sections by tri-level waveforms. These tri-level forms contain no harmonics which are multiples of 2 or 3. This eliminates frequency translation and detection of interference from the side-bands of adjacent stations since the third harmonic of the sub-carrier (114 kHz) is excluded. It also eliminates interference from SCA broadcasts since the third harmonic of the pilot tone (57 kHz) is excluded. Unwanted spurious audible components and phase jitter in the PLL are inherently eliminated by this technique.

Additional advantages of the phase locked loop stereo demodulation are the elimination of inductors to minimize drift, integral lamp driving capability to indicate the presence of the 19 kHz pilot carrier, excellent channel separation over the entire audio frequency range, extremely low distortion, low output impedance, and transient-free mono/stereo switching.

After multiplex detection, 19 kHz pilot and 38 kHz carrier suppression circuits are used to prevent tape recorder interference.

The FM muting circuit is unusual. It operates both by detecting ultrasonic noise and by sensing correct tuning of the detector circuit. To 'un-mute' it is necessary for the signal to have an adequate signal-

to-noise ratio and to be tuned to the center of the FM carrier. The MUTING circuit can be activated or defeated by the front panel muting switch. The muting of the audio signal is done with FET analog switches.

AM SECTION

The AM-RF amplifier circuit includes a three section variable tuning capacitor in a metal enclosure. This three section variable capacitor is used for greater spurious rejection. The McIntosh AM-RF amplifier circuit is unique. It has constant sensitivity, constant selectivity and high image rejection across the complete AM band. Ordinary AM-RF circuits cannot do all of this simultaneously. This design achieves equal sensitivity even down to the low end of the band. Spurious, image and intermediate frequency rejection are all superior. The same circuit delivers equal selectivity across the entire band. The McIntosh circuit is unique in a superheterodyne AM receiver. In addition, there is no loss of audio frequency response at the low end of the band. Another advantage of the McIntosh circuit is freedom from cross modulation and overloading by strong local stations.

A loopstick antenna is provided which can be rotated for maximum sensitivity over 180 degrees. Each MX 117 loopstick is individually tuned. This custom matching of the loopstick to the AM-RF front end maximizes the performance of the antenna. A rear panel antenna connector is provided for connecting an external antenna if desired.

To maintain the excellent image rejection and spurious cross modulation rejection of the AM-RF amplifier, an autodyne circuit is used for the AM mixer. The AM-IF uses two double tuned IF transformers designed to obtain a high degree of selectivity yet allowing good audio fidelity. A 10 kHz active filter eliminates the whistle and irritating "monkey chatter" caused by an adjacent station. The automatic volume control system was designed to prevent bursting or thumps when the AM is tuned through a strong signal. Distortion at low audio frequencies is minimized by using a two-section AVC filter instead of the conventional single section.

INPUT SELECTOR SWITCHING

Low level, noise critical input selector switching is done electronically using field effect transistor analog switches. The front panel selector simply switches small amounts of DC which turn the FET analog switches off or on. This design eliminates degradation of frequency response and noise pickup from long signal paths necessary with conventional switching.

PHONO AMPLIFIER

The phono amplifier uses a high technology integrated circuit operational amplifier. Its differential

input stage has been optimized for low noise and low distortion performance. Open loop gain of this integrated circuit is 100,000. With high open loop gain a large amount of negative feedback can be used around the phono amplifier to further reduce noise and distortion. The feedback network also provides precision RIAA frequency compensation. The network uses 1% metal film resistors and 5% poly film capacitors. To achieve low noise performance it is essential that the feedback network have very low impedance. As a consequence, the preamplifier must be capable of operating as a power amplifier to drive this impedance. The actual power output capability of this preamplifier stage is more than 100 milliwatts, a great margin beyond that which is required.

Input sensitivity of the phono amplifier is 2.2 millivolts. The gain of the amplifier is 41.1 dB at 1000 Hz. The phono amplifier has a very wide dynamic range. At 1000 Hz the phono input circuit will accept 100 millivolts without overload, a voltage far greater than the output of any current magnetic phono cartridge. Phono input overload therefore is virtually impossible. A signal level of 10 millivolts at the phono input at 1000 Hz will produce 1.25 volts at the tape output. The tape output has a source impedance of 200 ohms and is designed to operate into a load impedance of 5,000 ohms or greater.

HIGH LEVEL AMPLIFIER

At the input to the high level or loudness amplifier the signal passes through the MONO/stereo switch, then through the volume control, and into the amplifier. In the past, loudness controls have typically used simple passive circuits connected to a tap on the volume control. As a consequence, compensation accuracy was dependent on many variables such as volume control position and differences in the input level. The MX 117 uses active circuitry. The same type of integrated circuit operational amplifier that is used in the phono amplifier is used here. It has two feedback loops. One feedback loop is flat. The other feedback loop conforms to the Fletcher-Munson equal loudness compensation. A potentiometer is placed between these two feedback loops making it possible to select any combination of the two from a flat response to full loudness compensation. The overall gain of the stage is 20 dB at mid-frequencies and is not affected by the position of the loudness control.

EQUALIZER AMPLIFIER

The equalizer amplifier is constructed with another of the same type low noise operational amplifier as used in the phono amplifier. Three other operational amplifiers are arranged in circuit configurations that are the equivalent of three series tuned circuits. One is resonant at each of the three equalizer center frequencies. These series tuned cir-

circuits are inserted via the control potentiometers in either the input circuit or feedback circuit of the equalizer amplifier thereby providing a boost and cut capability of 12 dB for each band of frequencies. The equalizer amplifier has a flat response gain of 0 dB.

OUTPUT/HEADPHONE AMPLIFIER

The output amplifier is a push-pull complementary class AB amplifier using a signal inverting differential stage at its input. This amplifier drives the main outputs, the line output, and the headphone jack. More than 10 volts RMS output can be produced with typically no more than 0.003% harmonic distortion.

A turn-on delay circuit is located ahead of the output amplifier. This circuit uses a light emitting diode/light dependent resistor network that func-

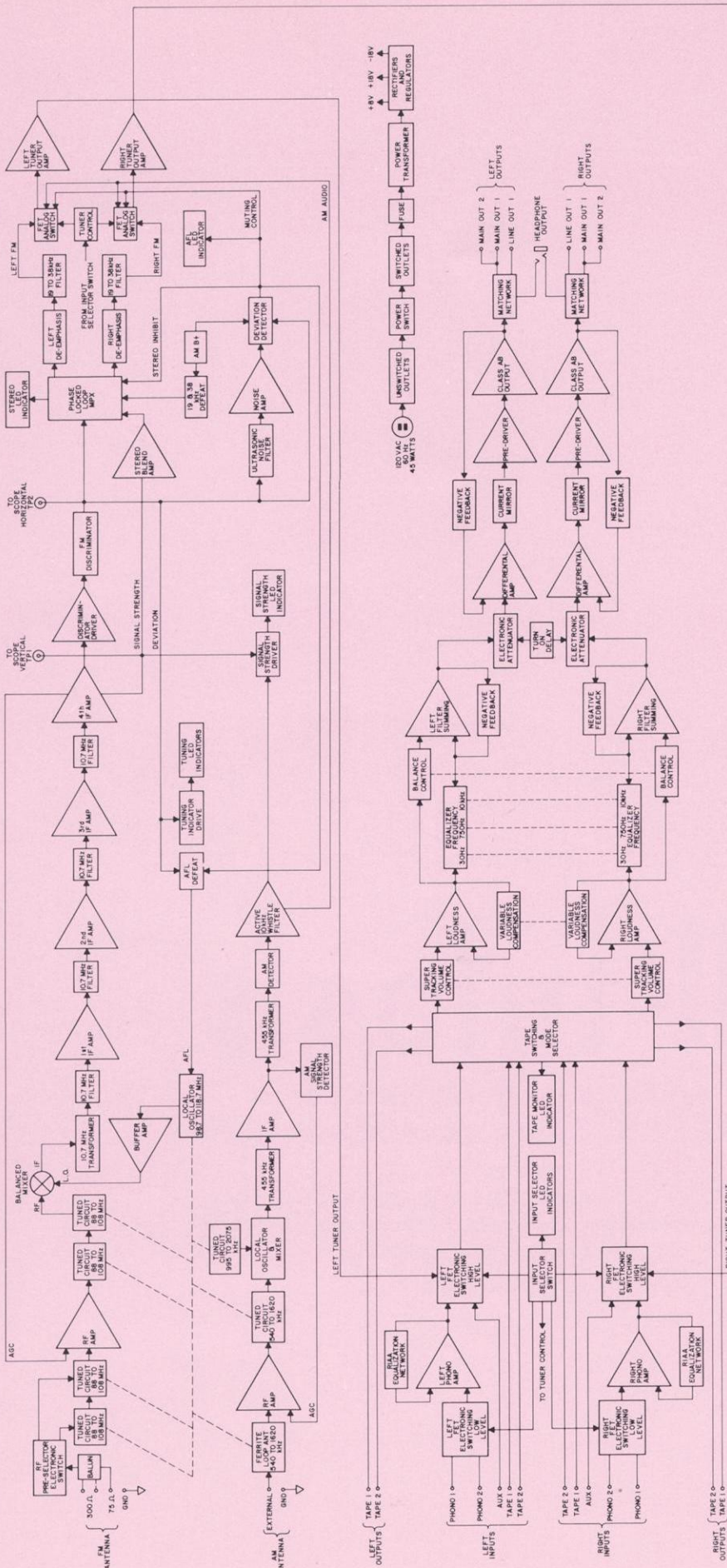
tions to transmit no signal until two seconds after the power switch is turned on and to remove the output signal almost instantly upon power turn-off. Thus the turn-on and turn-off is transient and noise free.

POWER SUPPLY

To minimize magnetic hum, radiation and thus improve signal to noise ratio the MX 117 power transformer is triple shielded. Shielding includes a copper strap, a silicon steel strap, and finally a steel outer shell. The transformer output voltage is fed to a full wave bridge rectifier and 3,300 microfarad filter capacitors to provide the +24 volts for powering the plus regulator and -24 volts for the minus regulator. Integrated circuit voltage regulators supply the ± 18 volts needed for low level amplifier stages.



Block Diagram



McINTOSH MX 117 AM/FM TUNER PREAMPLIFIER

McIntosh

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Printed in U.S.A.

039242