

# OWNER'S MANUAL

THE McINTOSH MR 77 SOLID STATE FM/FM STEREO TUNER





Your MR 77 FM/FM Stereo Tuner 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

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

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

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## **THREE YEAR SERVICE CONTRACT**

An application for a FREE 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 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. For your protection McIntosh selects only dealers who have technical competence to guide purchasers fairly, and provide service when necessary. To receive the SERVICE CONTRACT your purchase must be made from a McIntosh franchised dealer.
6. Your completely filled in application for a 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 at McIntosh Laboratory Incorporated in Binghamton, New York.

# Installation



Adequate ventilation extends the trouble-free life of electronic instruments. It is generally found that each 10° centigrade (18° F) rise in temperature reduces the life of electrical insulation by one half. Adequate ventilation is an inexpensive and effective means of preventing insulation breakdown that results from unnecessarily high operating temperatures. The direct benefit of adequate ventilation is longer, trouble-free life.

Allow at least 15 inches deep x 17½ inches wide x 6 inches high for mounting the MR 77. Always allow for air flow by either ventilation holes or space next to the bottom of the tuner and a means for warm air to escape at the top.

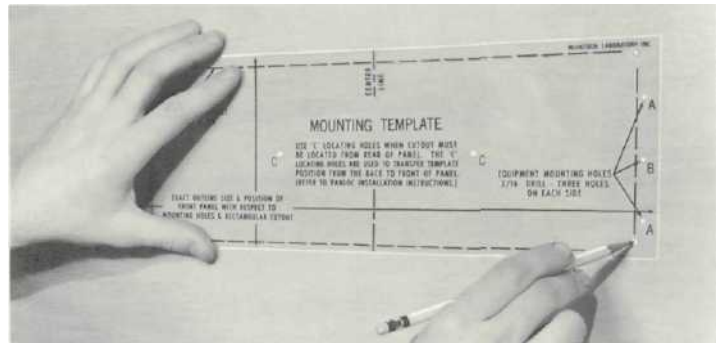
It is recommended that the MR 77 be mounted in a normal or horizontal position. However, with adequate ventilation the tuner can be mounted in any position.

To prepare the MR 77 for installation remove the plastic protective covering. Turn the MR 77 upside down so that it rests on its top on the shipping pallet. Remove the four plastic feet fastened to the bottom of the chassis.

Next, place the mounting brackets, the parts bag and the mounting template at hand.

The PANLOC professional mounting design eliminates the need for any shelf or bracket to support the MR 77. It is completely supported by its own mounting brackets.

The design of the mounting template allows you to position or locate the cutout from the front or rear of the panel to which the instrument is to be mounted. Position the plastic mounting template over the area of the panel to be cut out for installation.



If the cutout is to be located from the front of the panel, begin at step 2. If the cutout is to be located from the rear of the panel, begin here.

1. On the back of the cabinet panel, scribe a vertical centerline through the exact center of the area in which the cutout is to be made.

Place the template against the back of the panel and match the template centerline with the centerline on the cabinet panel.

Make sure that there is at least ¼ inch clearance between the bottom of the dashed line of the cutout area on the template and any shelf or brace below the proposed cutout.

Mark the two locating holes ("C" holes on the mounting template).

Drill the two locating holes. Be certain the drill is perpendicular to the panel.

Now position the template on the front of the panel by aligning the "C" locating holes on the template with the drill holes.

2. If the cutout is to be located from the front of the panel:

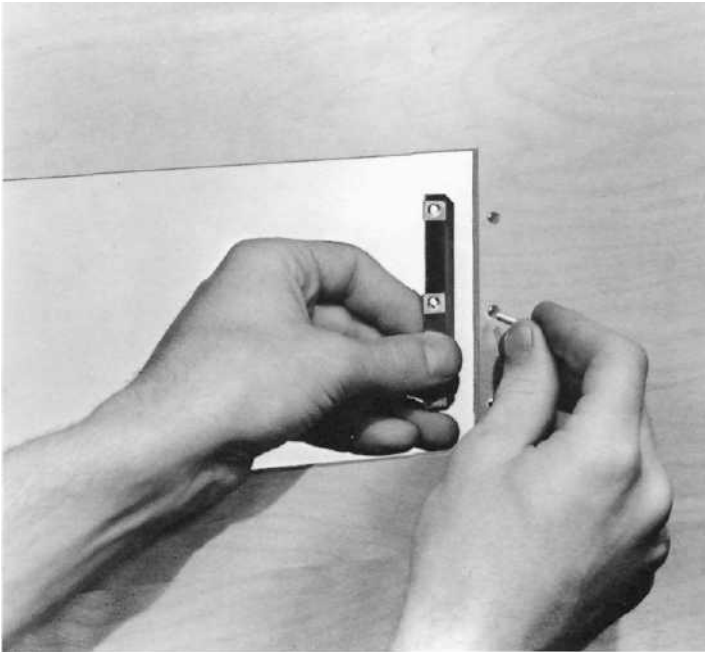
With the template in place against the cabinet, mark the "A" and "B" drill holes and the four small holes that identify the corners of the cutout. Join the corner marks with a pencil. The edge of the template can be used as a straight edge.

**IMPORTANT: DRILL THE 6 HOLES BEFORE MAKING THE CUTOUT.**

Accurately drill the three holes on each side of the cutout area with a  $\frac{3}{16}$  inch drill.

With the saw on the **INSIDE OF THE PENCIL LINES** carefully cut out the rectangular opening.

Secure the mounting strips to the rear of the cabinet panel using two screws from the hardware package.

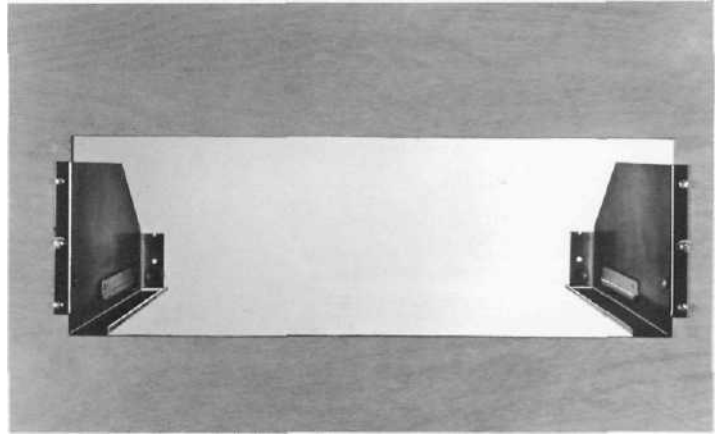


Insert the screws in the center holes of the cabinet panel ("B" holes on the template) and tighten. The screw head should pull into the wood slightly. (Use two  $\frac{3}{4}$  inch long screws for panels under  $\frac{1}{2}$  inch, or two  $1\frac{1}{4}$  inch long screws for panels  $\frac{1}{2}$  inch thick and larger.)

Attach the mounting brackets to the cabinet panel using four screws.

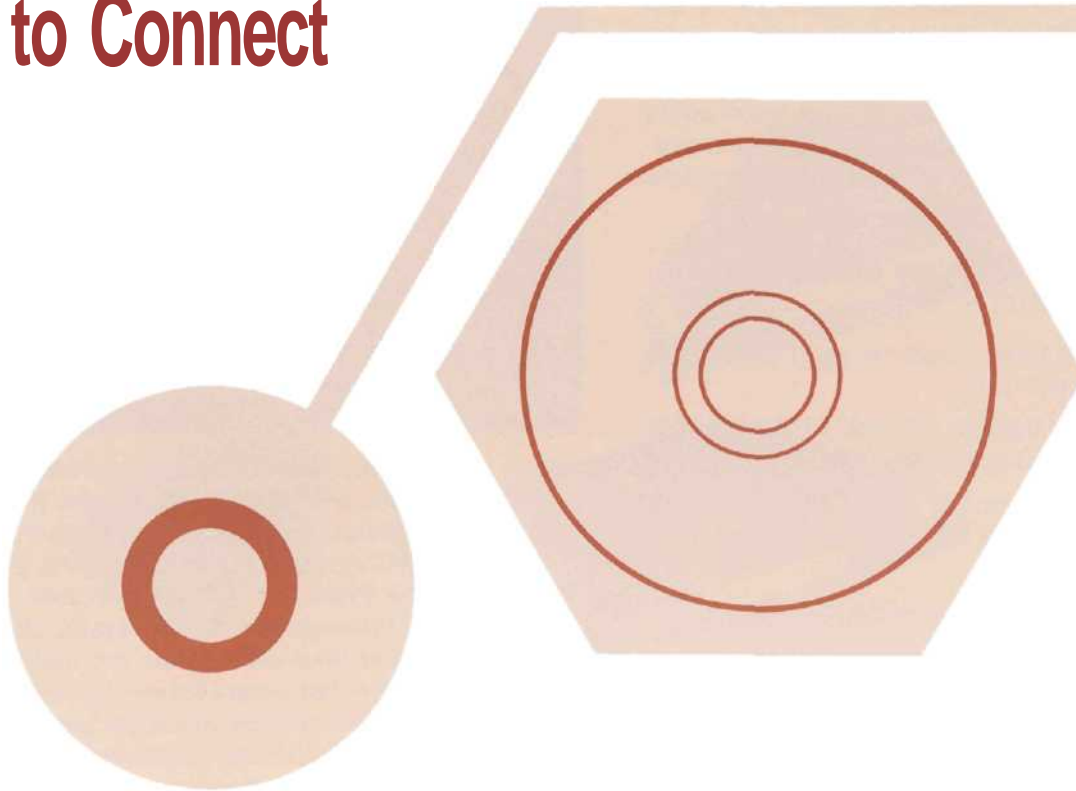
Place the template over the mounting screws. The mounting screws should be centered in the "A" and "B" holes on the template. The sides of the mounting brackets should match the vertical dash lines on the template. If necessary, loosen the screws and push the brackets into alignment and retighten.

Insert the power cord through the opening. Carefully slide the MR 77 into the opening so the rails on the bottom of the equipment slide in the track of the mounting brackets. Slide the instrument in until it stops at the



adjust position latches. Press the latches in and continue to slide the instrument in until the front panel is against the cabinet panel. At the bottom front corners of the PANLOC instruments are the PANLOC buttons. Depressing the PANLOC buttons will lock the instrument firmly in the installation. Depressing the PANLOC buttons a second time will release the instrument. You can then slide the instrument forward to the inspection-adjustment position latches will allow the instrument to be slid completely out of the installation.

# How to Connect



## AUDIO OUTPUTS

Use the FIXED OUTPUT jacks to connect to a conventional control preamplifier which has its own volume control. The VOLUME CONTROL does not affect the output of the tuner at the FIXED OUTPUT jacks.

The output impedance at the FIXED OUTPUTS is 600 ohms. Longer cables than are normally supplied can be used to interconnect the MR 77 with other equipment. The length of the cable is limited by the capacity of the cable. The total capacity must not exceed 1600 pF. For instance: cables with a capacity of 32 pF per foot may be 50 feet long; 16 pF per foot cable may be 100 feet long.

Use the FRONT PANEL CONTROLLED jacks to connect to a conventional control preamplifier when use of the tuner volume control is desired. These jacks may be used to connect to external equipment such as power amplifiers or tape recorders where control of volume at the tuner is necessary. The load impedance connected to the front panel controlled packs should not be less than 47,000 ohms. There is no difference in the signal quality or maximum output levels available at each pair of output jacks.

## CONNECTING AN FM ANTENNA

One of three antenna systems can be used: (1) an outdoor FM antenna, (2) a VHF-TV antenna, or (3) the indoor dipole supplied with the MR 77.

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. Rotate the antenna until the best reception is obtained. Connect the 300 ohm antenna to the 300W ANT (red) terminals.

## CONNECTING A 75 OHM ANTENNA

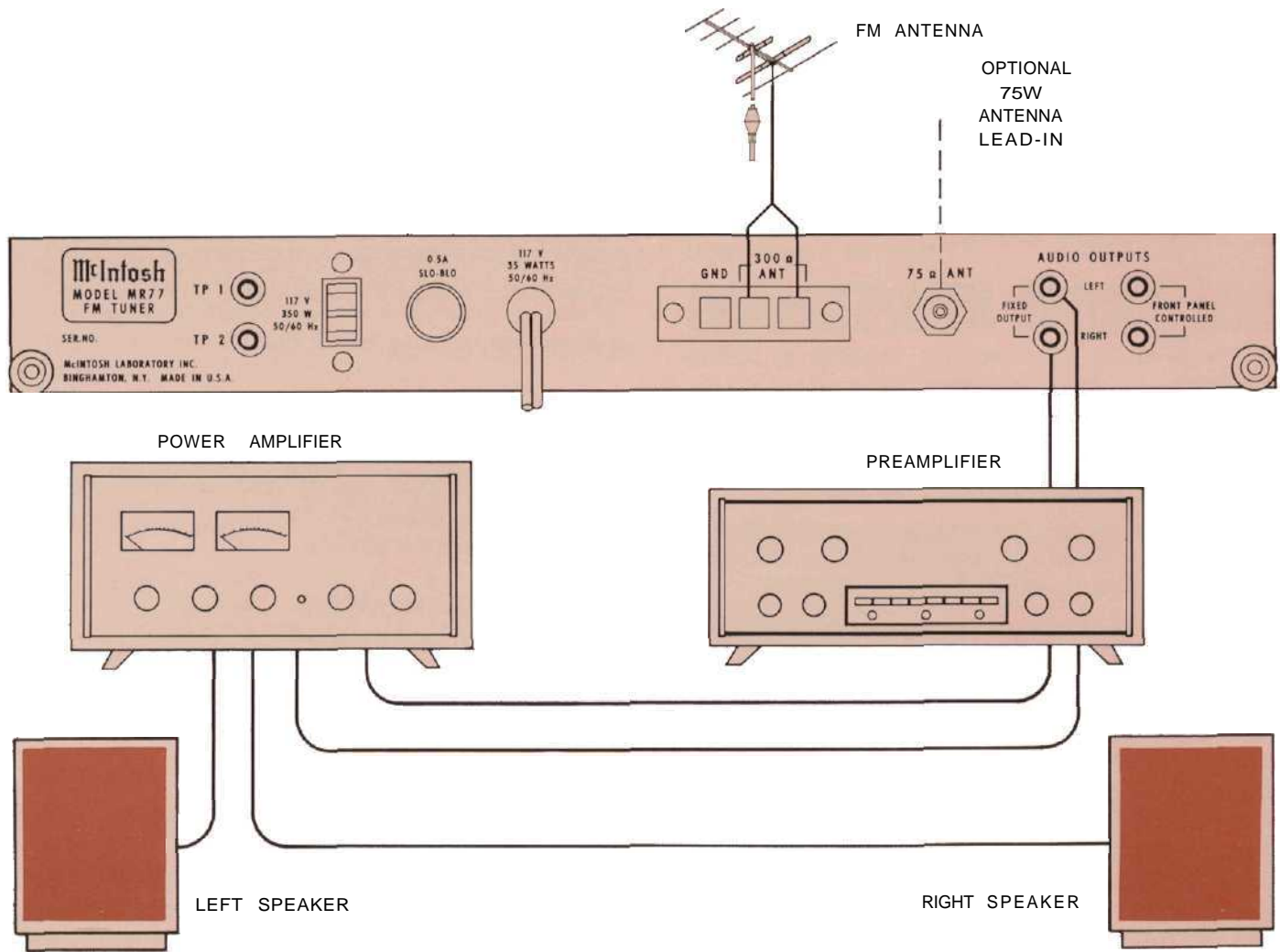
An unbalanced 75 ohm antenna can be connected to the MR 77. A "type F" connector is used to connect the 75 ohm coaxial cable to the back panel 75W ANT input.

A VHF-TV antenna is often effective but the antenna must be designed for both FM and TV reception. Connect the leads from the VHF-TV antenna to the 300 ohm ANT (red) terminals.

## CONNECTING AN INDOOR DIPOLE ANTENNA

The flexible folded dipole antenna (300 ohm) is for use in urban or high strength signal areas.

Connect the two leads from the dipole to the 300W ANT (red) terminals. The flexibility of the thin 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 this antenna next to other wires or metal objects. This antenna may not prove effective in houses having metal siding or metal-clad insulation.



## Back Panel Information

### TP1 and TP2

Test point TP1 and TP2 is used with the McIntosh Maximum Performance Indicator.

### 117 V. AC OUTLET

Provides 117 volt AC power up to 350 watts for additional equipment such as amplifiers, etc. This outlet is not fused. It turns on and off with the front panel AC power switch on the VOLUME control.

### AC POWER CORD

Connect the AC power cord to a 117 volt, 50 to 60 Hz power line receptacle. The power used by the MR 77 is 35 watts.

### FUSE

A 0.5 AMP fuse protects the tuner circuits. This fuse

does not protect additional equipment connected to the back panel AC outlet.

### ANTENNA CONNECTION STRIP

Provides easy push type connectors for 300 ohm FM antenna and a ground connection.

### FM ANTENNA—75 OHM

Provides a "type F" connector for a 75 ohm unbalanced FM antenna.

### AUDIO OUTPUTS

The left-hand pair of AUDIO OUTPUT jacks provides FIXED OUTPUT audio signals. The program at these jacks is unaffected by the MR 77 front panel VOLUME control. Use these output jacks to connect the tuner

to a stereo control preamplifier which has its own master volume control.

The right hand pair of AUDIO OUTPUT jacks, provides FRONT PANEL CONTROLLED audio signal. The program at these jacks is controlled by the MR 77 front panel VOLUME control. Use these output jacks to connect to external power amplifier, tape recorders, or any equipment which requires continuous front panel control of tuner output volume.

# Front Panel Information

## TUNING DIAL

The MR 77 has two dial scales:

1. FM —Marked 88 to 108 MHz
2. Logging scale—Marked 0 to 100

The logging scale can be used to accurately retune any station. You may find it easier to keep a record of your favorite stations by use of the logging scale.

A small portion of dial pointer has been illuminated to increase the ease of tuning.

## INDICATORS

There are four indicators on the MR 77 dial panel. They are: STEREO indicator, MULTIPATH indicator, SIGNAL STRENGTH meter, and the TUNING meter.

## MULTIPATH INDICATOR

The MULTIPATH indicator is an exclusive McIntosh development.

The proper use of the MULTIPATH indicator makes it possible to improve FM reception with precise FM antenna positioning.

An electron ray indicator is used to show multipath reception. It operates by movement of electron beams inside a vacuum tube. When rotating the antenna, ob-

servation of the multipath indicator will show best orientation for the FM station being received. Multipath distortion causes the two beams on the indicator to fluctuate rapidly. When the antenna is rotated to the best position, the indicator beams tend to remain steady. The directional antenna is then picking up only the desired signal and rejecting the reflected multipath signals. In some locations it is possible for the best reception to occur when picking up a strong reflected signal rather than the direct signal. Multipath distortion is practically independent of signal strength.

## STEREO INDICATOR

The STEREO indicator lights red when the dial pointer is tuned to or crosses a station broadcasting the 19 kHz carrier for stereo. The special circuit used will light only when the 19 kHz multiplex carrier is present in the signal. The indicator will not light on noise pulses or interference.

## SIGNAL STRENGTH METER

The SIGNAL STRENGTH meter indicates the strength of the signal as received from the antenna. The higher the indication, the stronger is the signal.

## FM TUNING METER

An FM station is correctly tuned when the meter needle is in the black area of the FM TUNING meter. The action of the TUNING indicator is independent of station signal strength.

## MODE SELECTOR

Selects one of three operating conditions:

**FM-MONO** — In this position all broadcasts will be heard monophonically. This position bypasses the automatic stereo switching. The stereo indicator will still light when a station is transmitting stereo,





but the program heard from the loudspeakers will be mono.

**AUTO** — The FM position provides monophonic FM or FM stereo at the left and right channel audio output jacks automatically. With the **MODE SELECTOR** in the FM position a station broadcasting a monophonic program will be heard in mono. When the station switches to stereo broadcast, or the tuner is changed to a stereo station, the stereo indicator will light and the MR 77 will automatically switch to stereo operation. If mono broadcasting is resumed the MR 77 will automatically switch to mono.

**STEREO** — Only stations broadcasting stereo can be heard in this position. All monophonic stations and background noises are suppressed. The **TUNING** meter and **SIGNAL STRENGTH** meter function normally.

### STEREO FILTER

The **STEREO FILTER** reduces noise on weak stereo stations.

Position 1 reduces noise by approximately 10 dB.

Position 2 reduces noise by approximately 20 dB.

### FM MUTING

Muting suppresses the background noise and hiss normally heard between stations. Turn the control to either **LOCAL** or **DISTANT** position for muting. Weak stations that may not override noise and interference are also suppressed by the muting. In the **AC OUT** position, the muting is turned off. This allows conventional FM tuning with the noise and interference present.

### VOLUME

The **VOLUME** control has been precision tracked throughout the listening range (0 to —65 dB) for accurate stereo balance.

It adjusts the output level of the tuner **FRONT PANEL CONTROLLED AUDIO OUTPUT** jacks. The **FIXED OUTPUT** jacks are not affected by the volume control.

### AC POWER ON/OFF

The AC power switch is part of the **VOLUME** control. Turning the volume control totally counterclockwise turns the AC power to the MR 77 off.

### PANLOC BUTTONS

At the bottom of the front panel corners are the **PANLOC** buttons. After a tuner is installed on the **PANLOC** shelf, depressing the **PANLOC** buttons will lock the tuner firmly in position. Depressing the **PANLOC** buttons a second time will release the tuner. The tuner can then be slid forward to the inspection

and adjustment position. The **PANLOC** system gives you absolute ease of installation, operation and maintenance.

### SECONDARY CONTROLS

On the top of the chassis behind the front panel is the **DIAL SCALE INTENSITY** switch.

### DIAL SCALE INTENSITY

Adjust the brightness of the dial panel lights by means of this switch on the tuner top panel. Set the switch to **BRIGHT** for maximum panel light. Set the switch to **DIM** for lower dial light.

## Listening to the MR 77

### LISTENING TO MONOPHONIC FM

Turn the **MODE SELECTOR** to **FM MONO** to listen only to monophonic FM.

Turn the **STEREO-FILTER** to **OUT**.

Turn the **MUTING** control to **DISTANT**.

Turn the tuning knob to the desired station. The station is properly tuned when the **FM TUNING** meter pointer comes to rest anywhere in the black area of the meter scale. While tuning across the dial you may notice movement of the tuning meter, without hearing a station. This is caused by a station so weak or distant that it does not over-ride the background noise. Extremely weak stations can be heard by turning the **MUTING** switch to **OUT**.

Rotate the directional antenna for best reception as shown by the **SIGNAL STRENGTH** and **MULTIPATH** indicators.

Adjust the **VOLUME** control to desired listening level.

### LISTENING TO STEREO FM

If you wish to have the MR 77 automatically switch to a stereo broadcast, set the **MODE SELECTOR** to **FM AUTO**.

When the **STEREO** indicator is lighted, the station is broadcasting a 19 kHz carrier for stereo and the MR 77 will automatically switch to stereo. If a station is broadcasting monophonic FM program, and is not transmitting the 19 kHz carrier for stereo, the **STEREO** indicator will remain off and the tuner will automatically switch to mono.

Repeat the same procedure as for Monophonic FM but set the **MODE SELECTOR** to **FM AUTO**.

When MR 77 **MODE** selector is set to **STEREO** only stereo stations will be received. Mono stations and background noise between station will be muted.

The stereo filter switch reduces noise on weak stations in position 1 and 2.

# Technical Description

The MR 77 FM tuner is the end result of over nine years of intensive research.

Twenty years ago McIntosh developed the first low distortion power amplifier. Now, the world's first low distortion FM tuner — The MR 77 — has arrived. Just as old concepts were abandoned in order to achieve the improvement in amplifier performance, so have old ideas been forgotten in creating the MR 77.

Here is a description of these monumental changes that have produced such a superior product.

## FRONT END

FM signals enter the tuner through the antenna terminals. A coaxial cable is used to conduct the signal to the front end. In the front end the stations are separated, amplified, and converted to a common 10.7 MHz IF frequency. Instead of using a conventional easily overloaded small transistor or FET as a straight RF amplifier, the MR 77 takes a different approach. A rugged Junction Field Effect Transistor is used as an impedance converter to drive a real 5-watt power transistor. This hefty combination (called a cascode circuit) makes the RF amplifier virtually impossible to overload or cross modulate. As an example, if you are tuned to a 3-micro-volt signal at 96.3 MHz, the MR 77 will reject signals elsewhere on the dial which are at least 4,000,000 times stronger. For example, a 12-volt signal received at 104.3 MHz would not bother the signal at 96.3 MHz at all. And, when tuned to 104.3 MHz, your tuner will not overload. All MR 77 tuners must pass the 12-volt overload test.

A six-gang tuning capacitor is used with this powerful RF amplifier. This permits over 100 dB rejection of spurious signals (IHF).

Another design first in the MR 77 front end is the integrated circuit balanced mixer. This mixer is immune to overload, oscillator pulling, cross modulation, and other types of distortion so common in ordinary transistor or FET mixers. A balanced bifilar transformer couples the 10.7 MHz mixer output to the IF amplifier.

Completing the MR 77 front end is the oscillator. It uses a balanced tank circuit. The oscillator is free from spurious radiations, and operates at high efficiency. AFC is not required.

## IF AMPLIFIER

The MR 77 uses the first linear phase IF filters. The filter, designed from a FORTRAN computer program, is for minimum-phase and constant delay. The mathematical complexity of the filter design procedure is

almost beyond belief. Using numerical integration in the S-Plane, an "IBM" 1130 high speed computer spent eighteen minutes on the mathematics for the design of the MR 77 IF filter. It would have taken a human engineer, working twenty-four hours a day, seven days a week, and working error-free three-hundred years to perform the same mathematical calculations!

Ordinary "wide-band" IF filter concepts no longer apply with the advent of this new filter. The MR 77 has the narrowest IF bandwidth ever used in a stereo tuner - only 150 kHz wide at the 6 dB points. This is enough width to let just one FM station squeeze through.

With tremendous selectivity of the MR 77 (480 kHz wide at 60 dB down) you will hear stations loud and clear that are absolutely inaudible on the other tuners!

The IF filter has flat time delay in its pass band region. Any error in time delay causes FM distortion. All other IF filters have delay distortion, some as much as 100%. The MR 77 filter has less than 1.0% delay distortion from antenna input to discriminator output!

## LINEAR PHASE BRIDGE DISCRIMINATOR

The advantages of the IF filter would be lost if it had to work into an ordinary FM detector. Thus, a new detector had to be developed. It is the linear phase bridge discriminator. The linear phase bridge discriminator uses a balanced transmission line bridge in conjunction with a differential voltage-doubling rectifier to achieve nearly distortionless demodulation of FM signals. A U.S. Patent is pending on this new FM detector.

## STEREO DECODER

An integrated circuit audio amplifier with over 120 dB of negative feedback in two loops is used to drive the stereo demodulator. This new circuit keeps the distortion low in the stereo mode of operation. Highly stable pilot recovery circuits are used to minimize 19 kHz intermodulation beats. You will hear crystal-clear stereo on the MR 77.

Muting, stereo only, and automatic stereo/mono switching are functions also performed within the stereo decoder.

## AUDIO PREAMPLIFIER SECTION

The audio amplifier increases the level of the program adequate to drive a preamplifier or other accessory equipment. It consists of two, three transistor amplifiers, one for each channel. The design uses considerable negative feedback to help achieve low distortion, wide frequency response, and excellent stability. Each audio

amplifier delivers 2.5 volts to the FIXED OUTPUT jacks. A second pair of outputs are available where level can be varied by the VOLUME control.

The STEREO FILTER is connected in the audio amplifier to reduce noise when listening to weak stereo stations. Careful design permits an ideal compromise between channel separation and noise rejection when using the STEREO FILTER.

## POWERSUPPLY

Special design attention has been given to the power supply section. Three separate power circuits are used.

The first is a 24 volt regulated supply. This 24 volt regulator is very elaborate in design, using a specially selected transistor and associated circuit. The regulator uses electronic filtering to insure the lowest possible background hum level, maximum stability and extremely good regulation. All signal stages are powered from this regulator.

The second circuit is a half wave rectifier and filter for the DC high voltage needed for the anode of the multipath indicator. The third power circuit is a half wave rectifier with electronic filter which supplies DC to the multiplex decoder.

# Performance Limits

**PERFORMANCE GUARANTEE**—Performance limits are the maximum deviation from perfection permitted for a McIntosh instrument. We promise you that the MR 77 you buy must be capable of performance at or exceeding these limits or you get your money back. McIntosh is the only manufacturer that makes this guarantee.

**SENSITIVITY:** 2 $\mu$ V for 35 dB of quieting; 2.5 $\mu$ A at 100% modulation ( $\pm$ 75 kHz deviation) for 3% total noise and harmonic distortion

**SIGNAL TO NOISE RATIO:** 75 dB below 100% modulation

**HARMONIC DISTORTION:** 0.2% mono or stereo at 100% modulation, 20 Hz to 15,000 Hz. Typically, 0.05% at 1,000 Hz

**DRIFT:** 25,000 Hz in first two minutes; thereafter 5,000 Hz at 25°C in 24 hours

**FREQUENCY RESPONSE:**  $\pm$ 1 dB 20 Hz to 15,000 Hz with standard de-emphasis, (75 $\mu$ S) and 19,000 Hz pilot filter

**CAPTURE RATIO:** 0.25 dB detector only; 2.5 dB complete tuner

**SELECTIVITY:** Adjacent channel 6 dB IHF, carrier 47 dB down; Alternate channel 50 dB IHF, carrier 90 dB down

**SPURIOUS REJECTION:** 100 dB IHF

**IMAGE REJECTION:** 100 dB; 88 to 108 MHz (IHF)

**MAXIMUM SIGNAL INPUT:** 12 volts across 300 ohms antenna terminals will not increase harmonic or intermodulation distortion

**INTERMODULATION DISTORTION:** 0.2% mono or stereo for any combination of frequencies from 20 Hz to 15,000 Hz with peak modulation equal to 100% or less. Typically 0.1%

**AUDIO HUM:** 75 dB down from 100% modulation

**MUTING:** 70 dB noise reduction between stations

**MUTING THRESHOLD:** Position 1; 5 $\mu$ V; Position 2, 20 $\mu$ V

**SCA FILTER:** 50 dB down from 67 kHz to 74 kHz; 275 dB per octave slope

**STEREO SEPARATION:** 40 dB at 1,000 Hz

**STEREO FILTER:** 10 dB noise reduction in position 1; 20 dB noise reduction in position 2

**ANTENNA INPUTS:** 300 ohms balanced; 75 ohms unbalanced

**AUDIO OUTPUT:** 2.5 volts into 47,000 ohms; 1 volt into 600 ohms from fixed output

**POWER REQUIREMENT:** 120 volts, 50/60 Hz. 35 watts

**IF SYSTEM:** 8-Pole Rimo Filter, 2 IC's, 1 J-Fet, and push-pull overlay power transistor stage driving a linear phase bridge discriminator

**STEREO INDICATOR:** Front panel stereo light activated by 19,000 Hz only

**AUTOMATIC MONO-STEREO SWITCH:** McIntosh developed; all electronic automatic mono-stereo switching circuit

**SEMICONDUCTOR COMPLEMENT:** 21 Transistors, 24 Diodes, 4 Integrated Circuits, 1 Indicator Tube

## MECHANICAL INFORMATION

**SIZE:** Front panel measures 16 inches wide (40.64 cm) by 5-7/16 inches high (13.81 cm). Chassis measures 15 inches wide (38.1 cm) by 13 inches deep (33.02 cm), including PANLOC shelf and back panel connectors. Knob clearance required is 1½ inches (3.81 cm) in front of mounting panel

**FINISH:** Front panel is anodized gold and black with special McIntosh gold/teal panel nomenclature illumination. Chassis is chrome and black

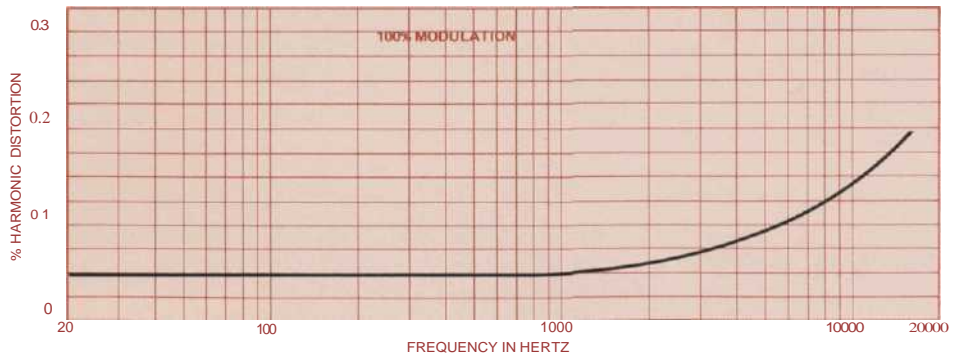
**MOUNTING:** Exclusive McIntosh developed professional PANLOC

**WEIGHT:** 27 pounds (12.25 kg) net, 39 pounds (17.69 kg) in shipping carton

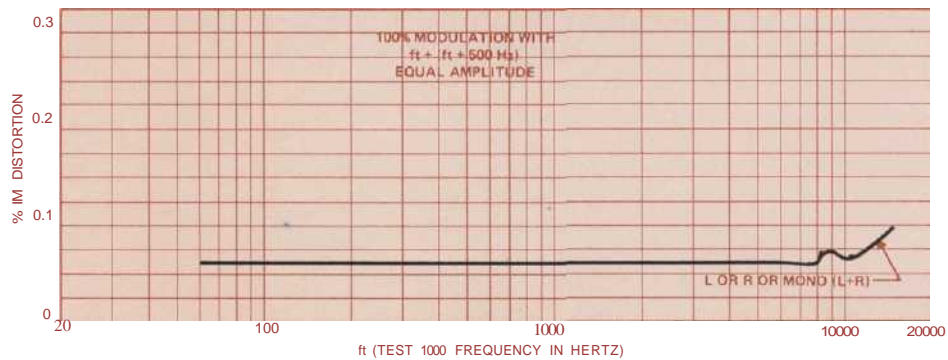
# Performance Charts



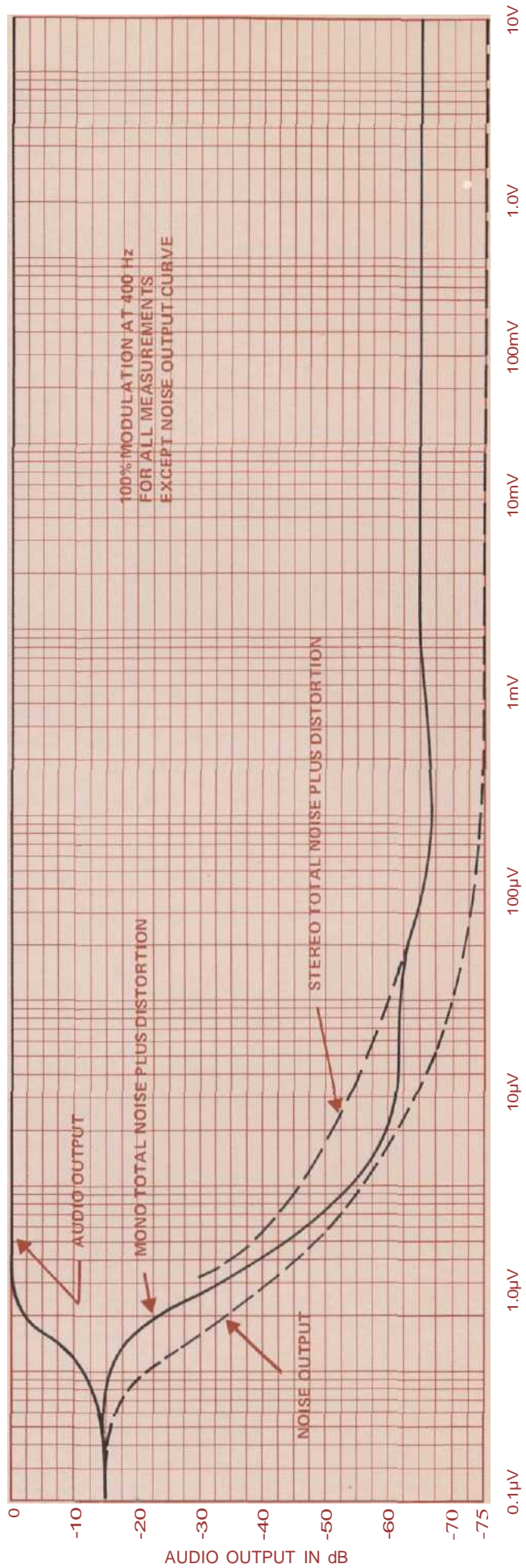
## HARMONIC DISTORTION (STEREO AND MONO)



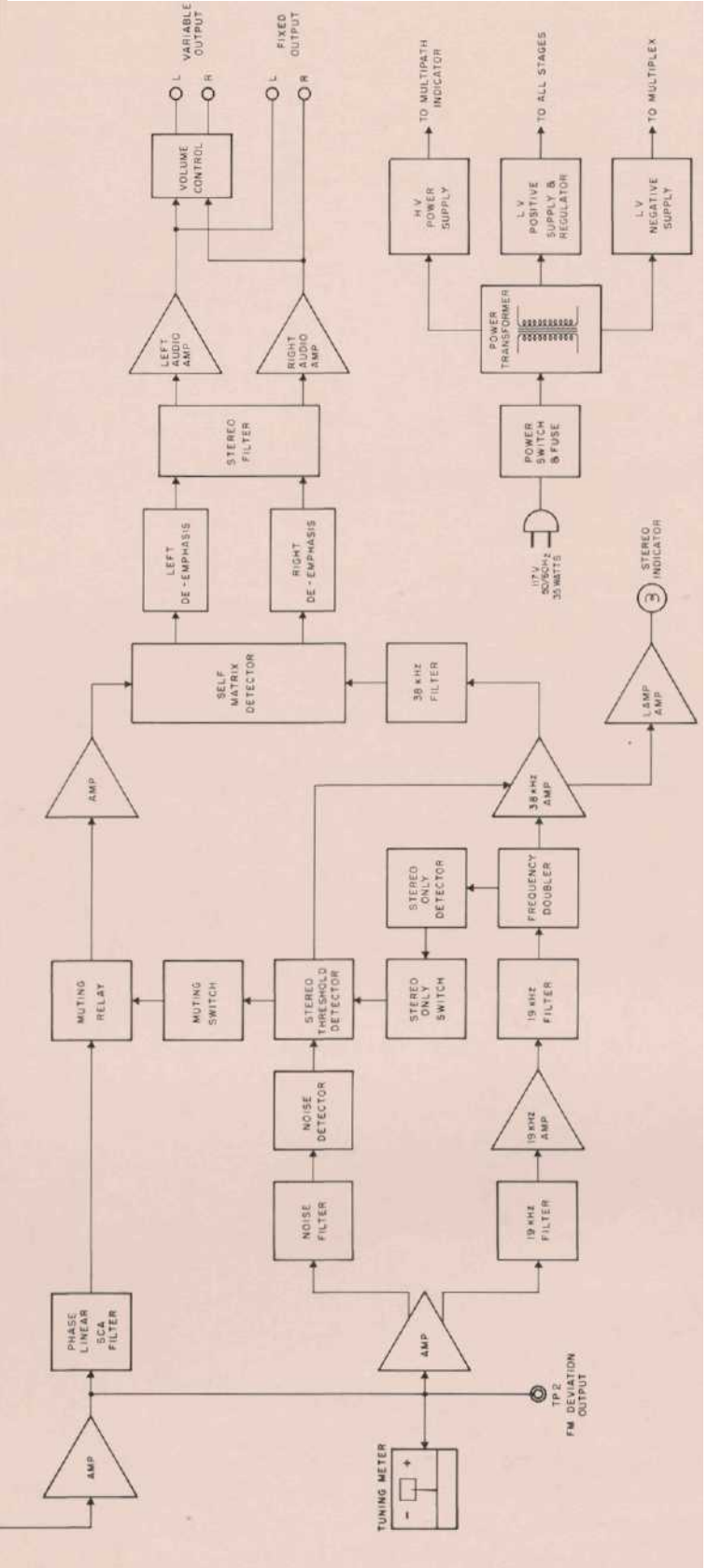
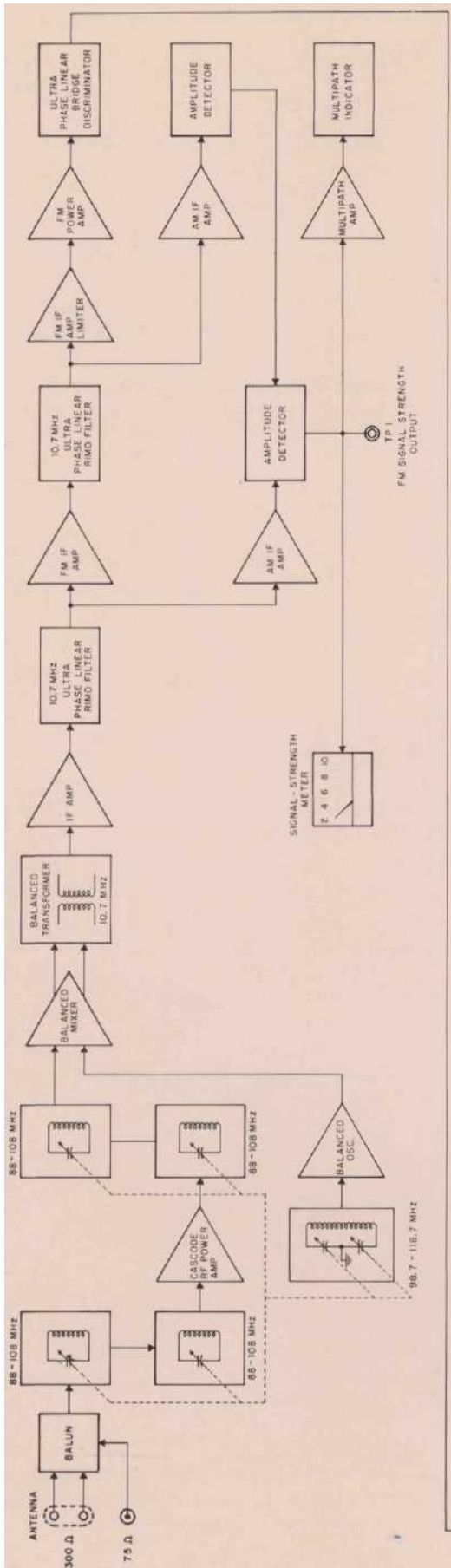
## INTERMODULATION DISTORTION (STEREO AND MONO)



# SIGNAL PERFORMANCE



# Block Diagram





# McIntosh

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