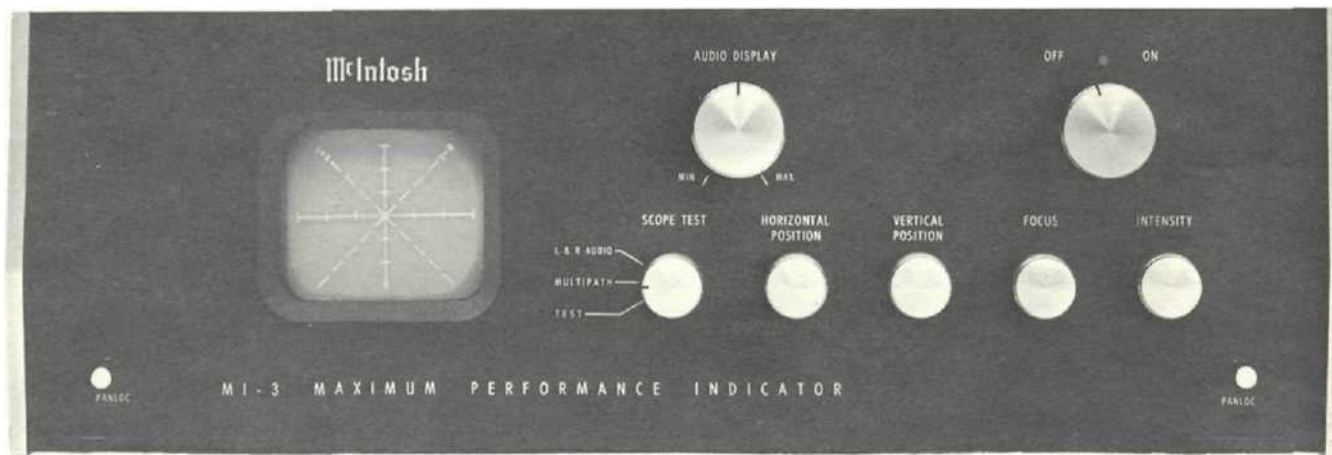


# McIntosh

## *Owner's Manual*



MAXIMUM  
PERFORMANCE  
INDICATOR

**MI3**



## GENERAL DESCRIPTION

THANK YOU for purchasing this MI 3. To insure your enjoyment please read this manual carefully and follow instructions.

## CONTENTS

GENERAL DESCRIPTION.....	1
TECHNICAL DESCRIPTION.....	2
SPECIFICATIONS.....	3
FRONT PANEL INFORMATION.....	4
BACK PANEL INFORMATION.....	5
CABINET INSTALLATIONS.....	6
CONNECTIONS.....	7, 8
SET UP PROCEDURES.....	9
SYSTEM HOOK UP.....	10
TYPICAL PATTERNS.....	11
GUARANTEE.....	12

The McIntosh MI 3 is five laboratory instruments combined into one compact instrument. It is a professional oscilloscope, relative signal strength indicator, calibrated FM deviation meter, calibrated balance meter, and phase indicator. These instruments are used by FM stations to determine the best possible performance for your listening enjoyment.

The McIntosh MI 3 Maximum Performance Indicator makes it easy for you to attain professional broadcasting quality FM listening.

The McIntosh MI 3 shows you what you need to do to improve your system's overall performance. It is designed to be used with an FM tuner and stereo preamplifier.

When the MI 3 is used with an FM tuner it will detect and display multipath reception. Multipath reception is the result of a reflected signal arriving at the tuner antenna slightly later than the direct signal. By rotating or repositioning your FM antenna it is possible to reduce the multipath reception. The MI 3 Maximum Performance Indicator makes it easy to know when the FM antenna is oriented for the best reception of any station.

To show multipath reception the MI 3 displays instantaneous signal strength versus frequency deviation. Signal strength is shown as vertical deflection of the indicator display beam. Frequency deviation is shown as horizontal deflection. Multipath reception appears as a peak or valley in the MI 3 picture tube display.

Multipath reception degrades FM tuner performance in several ways:

1. Usually there is an increase in background noise level.
2. Distortion is often heard in the program signal.
3. Stereo separation may be reduced.
4. The stereo effect may be completely lost.
5. Stereo indicators may fail to function, or function erratically.

To overcome multipath reception it is usually necessary to turn the antenna to receive the FM signal by one predominant path. Rotating a directional antenna is effective at correcting multipath reception. In a metropolitan area where a simple antenna such as a dipole is used repositioning the antenna will achieve the same result.

The MI 3 is a very effective tuning indicator:

1. Signal strength is shown by the vertical position of the display trace. The higher the position of the trace the greater the signal strength.

MAXIMUM  
PERFORMANCE  
INDICATOR

MI3

2. Correct tuning occurs when the display trace is centered horizontally on the screen. Since the display trace effectively follows the tuner I.F. response curve, centering the trace tunes the detector to the center of the I.F. curve.

The MI 3 Maximum Performance Indicator is a versatile instrument. When used with either a stereo preamplifier, or power amplifier the MI 3 when switched to the L+R AUDIO position will show you the character of the audio signals present. The MI 3 will:

1. Display a trace along the L+R line when a monaural program is playing.
2. Will display along the L—R line when a monaural program source has one channel out of phase.
3. Display a vertical trace if only the left channel is being delivered.
4. Display a horizontal trace when only the right channel is being delivered.
5. Helps you set the precise balance of your system. With the balance control you can change the angle of the L+R or L—R display.
6. A stereo program will be a complex and varying circular or elliptical display of irregular outline that depends on channel separation or on the phase amplitude relation of the left and right channel.

## TECHNICAL DESCRIPTION

The MI 3 Maximum Performance Indicator is essentially an oscilloscope using a three inch cathode-ray tube. Adequate brightness is assured with a 1350 volt accelerating voltage. A sharper well defined trace is provided by using separate focus and astigmatism controls.

Two identical direct coupled push-pull amplifiers are used in the horizontal and vertical deflection circuits. Phase shift in each amplifier is held to within a few degrees from D.C. throughout the operating frequency range. Phase differences between vertical and horizontal amplifiers are held to within a few degrees.

The high voltage power supply uses a selenium rectifier. The low voltage supplies use selenium rectifiers, two gas filled rectangular tubes and an electronic voltage regulator. The operating voltages from these supplies are carefully regulated over a wide range of power line variations. This design feature assures a steady indicator trace despite changing line voltage.

For multipath display the horizontal deflection voltage is obtained from the tuner discriminator output ahead of the de-emphasis network. This voltage is proportional to the frequency deviation of the FM transmission. The maximum width of the indicator screen is designed to correspond to approximately plus and minus 75 kilocycle deviation of the FM transmitter.

The horizontal multipath input is connected through the deviation input jack and the deviation (horizontal) calibration control.

For multipath display the vertical deflection voltage is obtained from the tuner Automatic Gain Control circuit at the input to the first limiter. This voltage is proportional to the FM stations instantaneous signal strength. However, the average proportionally is exponential. Because of the exponential characteristic, a weak station will produce adequate vertical deflection. A powerful local station should position the center of the indicator trace about half to three quarters of an inch below the top of the vertical scale. The vertical Multipath Input is connected through the Signal Strength Input and the Signal Strength (vertical) Calibration Input Control.

For L+R audio display the horizontal deflection voltage is obtained from the right channel output of a tuner, a preamplifier or even a power amplifier. The deflection voltage is connected through the Right Audio Input and the Right Gain Control. For L+R audio display the vertical deflection voltage is obtained from the left channel output of a tuner, a preamplifier, or a power amplifier. The deflection voltage is connected through the Left Audio Input and the Left Gain Control.

With a normal loudness monaural signal both audio input controls are adjusted for equal deflection of the display trace. (At this point the trace will be on the L+R line if the two signals are in phase or the L - R line if they are 180° out of phase.)



## MI3 SPECIFICATIONS

### SENSITIVITY

Signal Strength (vertical) Input	— 700 MV
Left Audio (vertical) Input	20 MV
Deviation (horizontal) Input	±350 MV
Right Audio (horizontal) Input	20 MV

### DIMENSIONS

Front panel: 16 inches wide by 5-7/16 inches high; chassis (including PANLOC shelf) 15 inches wide by 5 inches high by 13 inches deep, including connectors; clearance in front of mounting panel including knobs, 1 ½ inches.

### TUBE AND SEMICONDUCTOR COMPLEMENT

- 1—3RP1, 3 inch cathode ray tube.
- 4—6EA8, horizontal and vertical deflection amplifiers.
- 1—6EA8, electronic voltage regulator.
- 2—OB2, voltage regulators.
- 1—Selenium rectifier, high voltage rectifier.
- 6—Selenium rectifiers, low-voltage supply.
- 4—silicon planar transistors.

### WEIGHT

Chassis only, 23 pounds.  
In shipping carton, 30 pounds.

### FINISH

Anodized gold and black glass front panel

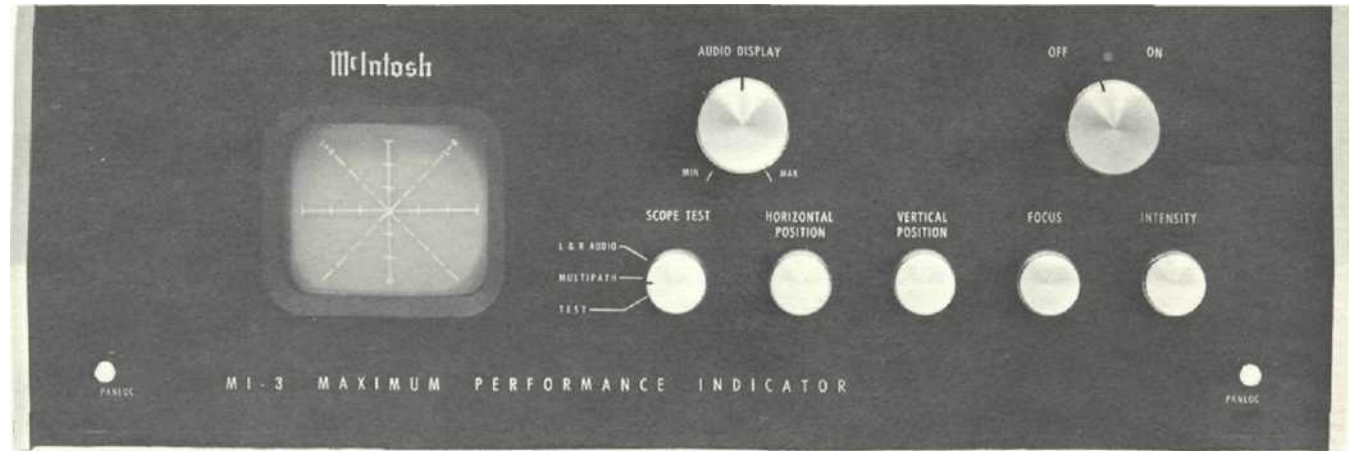
### POWER CONSUMPTION

50 watts, 105 to 125 volts.  
50 to 60 cycles.

### FUSE

1 Ampere Slo-Blo

## FRONT PANEL INFORMATION



**INDICATOR SCREEN**—The screen is the face of a cathode ray tube. Calibration marks are provided to allow correct positioning of the indicator trace.

A correctly tuned station free of multipath distortion appears as a smooth curve centered on the indicator screen vertical scale. The vertical line is marked to show the relative strength of the FM signal. A strong local signal should position the display about  $\frac{1}{2}$  to  $\frac{3}{4}$  inch from the top of the vertical scale. The horizontal line is marked to show deviation.

The two 45° sloped lines show L+R and L—R audio information.

**SCOPE TEST**—This control switches the indicator circuits to show multipath, Left and Right audio signals or TEST. The TEST position switches the indicator trace to a single dot for adjustment of trace position, focus and intensity. Different trace reference positions are necessary for multipath and L+R Audio.

**HORIZONTAL POSITION**—This control moves the indicator trace to the left or right. With the Scope Test switch in TEST position, the trace dot can easily be centered on the indicator screen.

**VERTICAL POSITION**—This control moves the indicator trace up or down. With the Scope Test switch in TEST posi-

tion the indicator trace can be easily moved to the correct vertical position. For multipath display the trace is positioned at the bottom reference point.

For audio indications the trace is positioned at the center reference point. This shift in position occurs automatically as the Scope Test control is turned. An internal adjustment labeled L+R position is factory preset but can be readjusted if needed.

**INTENSITY**—This control adjusts the brightness of the indicator trace. After the Intensity control has been tuned, the Focus control may have to be adjusted for the best possible indicator trace.

**FOCUS**—This control adjusts the sharpness and clarity of the indicator trace. Focus is easiest with the Scope Test switch in the TEST position.

**AUDIO DISPLAY**—This control will increase the display area on the face of the cathode ray tube. At low volumes you will find the display would be small. To see all the information present turn the AUDIO DISPLAY toward max. This will increase the size of the display. At high volumes you may want to turn down the AUDIO DISPLAY to reduce the size of the display.



### SIGNAL STRENGTH (VERTICAL) MULTIPATH CONTROL

This control adjusts the position of the Multipath trace display along the vertical scale of the indicator screen.

### DEVIATION (HORIZONTAL) MULTIPATH CONTROL

This control adjusts the maximum width of the multipath trace display along the horizontal scale of the indicator screen.

### LEFT GAIN (VERTICAL) AUDIO CONTROL

This control adjusts the maximum vertical indicator trace deflection for a left channel audio signal.

### RIGHT GAIN (HORIZONTAL) AUDIO CONTROL

This control adjusts the maximum horizontal indicator trace deflection from a right channel audio signal.

### SIGNAL STRENGTH INPUT (TP1)

This input connects to a McIntosh tuner Test Point No. 1, which supplies a voltage proportional to Signal Strength for vertical deflection of the indicator trace.

### DEVIATION INPUT (TP2)

This input connects to a McIntosh tuner Test Point No. 2, which supplies a voltage proportional to deviation of the FM transmission for horizontal deflection of the indicator trace.

### LEFT AUDIO INPUT

This input connects to the left output of a tuner, preamplifier, or power amplifier. The left channel audio signal voltage causes vertical deflection of the indicator trace. This input jack is in parallel with the left audio output jack.

### LEFT AUDIO OUTPUT

This output jack is in parallel with the left audio input jack. This parallel connection makes it convenient for connecting a pre-amplifier or tuner output to both the MI 3 and the power amplifier.

### RIGHT AUDIO INPUT

This input connects to the right output of a tuner, preamplifier, or power amplifier.

The right channel audio signal voltage causes a horizontal deflection of the indicator trace. This input jack is in parallel with the right audio output jacks.

### RIGHT AUDIO OUTPUT

This output jack is in parallel with the right audio input jack. This parallel connection makes it convenient for connecting a pre-amplifier or tuner output to both the MI 3 and the power amplifier.

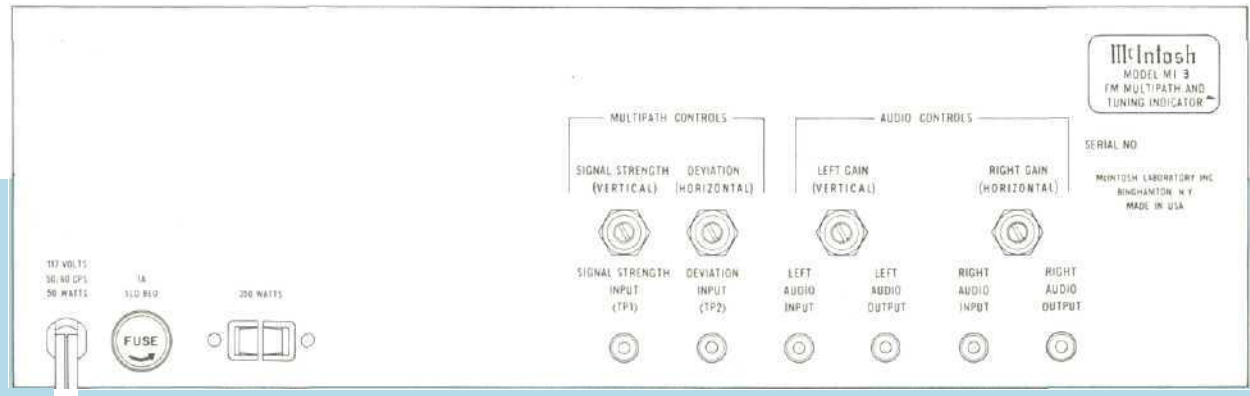
### 1A SLO BLO

A 1 ampere SLO-BLO fuse protects the MI 3 indicator circuits. This fuse does not protect additional equipment connected to the back panel AC outlets.

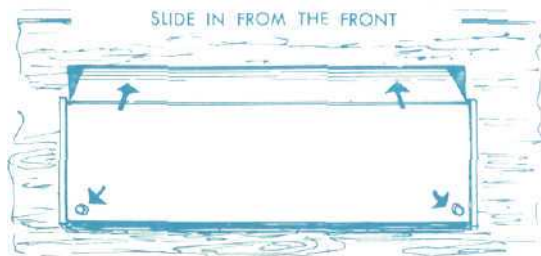
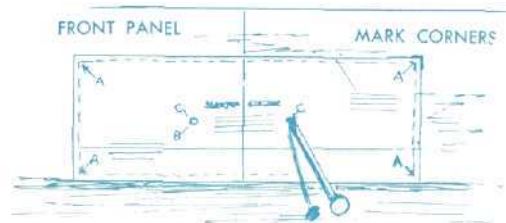
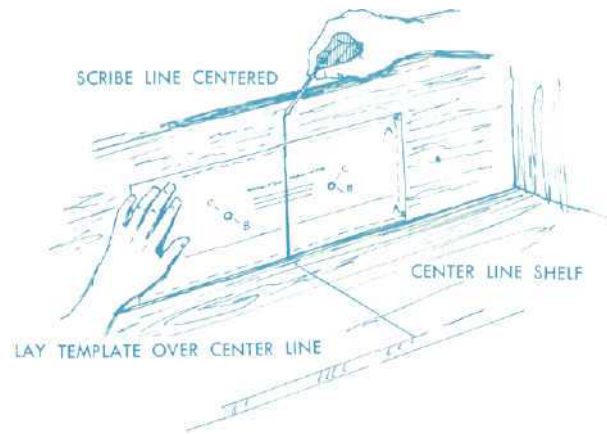
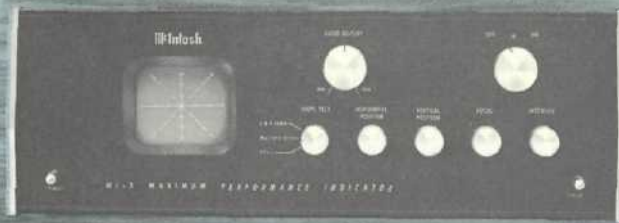
### 350 WATTS AC OUTLET

A 117 volt AC outlet is provided for extra equipment drawing as much as 350 watts power. The outlet is not fused and is on whenever the MI 3 power cord is connected to an AC outlet.

## BACK PANEL INFORMATION



# HOW TO INSTALL YOUR MI 3 IN A CABINET



1 Use the mounting template to position where you will mount the instrument.

NOTE: The template lets you position the cutout from the front of the panel.

2 Mark the "A" and "B" drill holes.

3 Mark the four corners. Join the four corners to make a rectangle. Use the edge of the template as a straight edge.

4 Drill the mounting holes and cut out the rectangular hole.

5 Fasten the two mounting strips to the panel. Use two of the fillister-head screws provided. There are 12 fillister-head screws in the package. Six are  $\frac{9}{16}$  inches long and six are  $1\frac{1}{8}$  inches long. For panels under  $\frac{1}{2}$  inch thick use the  $\frac{3}{4}$  inch screws. For panels over  $\frac{1}{2}$  inch thick use the  $1\frac{1}{4}$  inch screws. Insert a screw in the center hole. ("B" hole on the template.) Tighten the screws so the heads are pulled half of their thickness into the wood.

6 Fasten the shelves to the mounting brackets. Use two fillister-head screws in the "A" holes for each shelf.

7 Place the template over the mounting screws. The screws should be centered in the "A" and "B" holes on the template. The PAN-LOC shelves should match the vertical dash lines on the template.

8 Remove the plastic protective covering from the instrument. Turn the instrument over. To prevent damage rest the instrument on the shipping pallet.

9 Remove the four (4) plastic feet.

10 Now the instrument is ready for installation.

11 Put the power cord through the opening. Slide the unit into the brackets. Carefully slide the MI 3 into the opening so the plastic rails on the bottom of the chassis engage the grooves in the metal mounting brackets. Slide the MI 3 in until its front panel is against the cabinet mounting panel.

12 Secure the instrument to the mounting bracket by pushing "in" the Panloc Buttons.



# Connections

**TWO PAIRS OF 3 FOOT LONG LOW LOSS SHIELDED CABLES ARE SUPPLIED WITH THE MI 3. USE THESE CABLES TO CONNECT THE MI 3 TO A TUNER FOR MULTIPATH RECEPTION. A PAIR OF 6 FOOT LONG SHIELDED CABLES ARE SUPPLIED FOR CONNECTING THE MI 3 IN AUDIO CIRCUITS.**

## **CONNECTING TO McINTOSH MR 71 OR MR 67 TUNER.**

Connect a 3 foot low loss shielded cable from the TP No. 1 (Test Point No. 1 jack on top of the tuner chassis) to the Signal Strength (vertical) Input on the MI 3.

Connect a second 3 foot low loss shielded cable from the TP No. 2 (Test Point No. 2 jack on rear of the tuner chassis) to the deviation (horizontal) Input on the MI 3.

## **CONNECTING TO McINTOSH MX 110 TUNER-PREAMPLIFIER WITH Z OR X SERIAL NUMBERS**

Connect a 3 foot low loss shielded cable from the MX 110 TP No. 1 (Test Point No. 1 jack on top of the tuner chassis) to the Signal Strength (vertical) Input on the MI 3.

Connect a second 3 foot low-loss shielded cable from the MX 110 TP No. 2 (Test Point No. 2 jack on top of the tuner chassis) to the Deviation (horizontal) Input on the MI 3.

## **CONNECTING TO McINTOSH MX 110 TUNER-PREAMPLIFIER WITH M SERIAL NUMBERS**

Remove capacitor C 130 (.005 MF) connected between the test point and ground.

Solder the center lead of a 1 foot low-loss shielded cable to the junction point of R 139 (10K) and C 125 (.1 MFD). Solder the outer shield of the

cable to the tuner chassis ground. Use one of the 1 foot long low-loss shielded cables, stripped and tinned on one end (female jacks on the other end) supplied with the MI 3.

Use a connector with male plugs to connect the soldered-in cable from the tuner to the Deviation (horizontal) Input on the MI 3. Connect a 3 foot low-loss shielded cable from the test point (on top of tuner chassis) to the Signal Strength (vertical) Input on the MI 3.

## **CONNECTING TO McINTOSH MR 65B TUNER.**

Remove capacitor C 27 (.005 MFD) connected between TP No. 1 and chassis ground. MR 65B tuners, serial numbers 300UO and above, do not have this capacitor.

Connect a 3 foot low-loss shielded cable from the MR 65B TP No. 1 (Test Point No. 1 on tuner back panel) to the Signal Strength (vertical) Input on the MI 3.

Connect a 3 foot long low-loss shielded cable from the MR65B TP No. 2 (Test Point No. 2 on rear of tuner chassis) to the Deviation (horizontal) Input on the MI 3.

## **CONNECTING TO McINTOSH MR 65 AND 65A**

Remove capacitor C 31 (.005 MFD) connected between the test point and ground.

Connect a 3 foot low-loss shielded cable from the MR 65A Test Point (jack on top of tuner chassis) to the Signal Strength (vertical) Input on the MI 3.

Connect a 3 foot low-loss shielded cable from the MR 65A MPX out jack on the tuner back panel to the Deviation (horizontal) Input on the MI 3.

If an external multiplex adapter is being used with the MR 65 a "Y" connector will be needed in the MPX output jack. This allows both the MPX adapter and the lead to the MI 3 to be connected.

## **CONNECTING TO McINTOSH MR 66 TUNER**

Remove capacitor C 125 (.005 MFD) connected between the test point and ground.

Connect a 3 foot low-loss shielded cable from the TEST POINT (on top of tuner chassis) to the Signal Strength (vertical) Input on the MI 3.

Connect a 3 foot low-loss shielded cable from the FM multiplex output jack on the tuner back panel to the Deviation (horizontal) Input on the MI 3.

#### CONNECTING TO McINTOSH MR 55A TUNER

Remove the feed-through capacitor L 43 (1000 MMF) connected to TP No. 1. This capacitor can best be removed by unsoldering. Solder the center lead of a 1 foot low-loss shielded cable to the Test Point end of R 27 (100K resistor). Solder the outer shield of the cable to the chassis where the feed through capacitor was soldered. The cable can feed through the hole in the chassis where the capacitor was soldered. Use one of the 1 foot long low-loss shielded cables, stripped and tinned on one end (female jacks on the other end) supplied with the MI 3.

Use a connector with male plugs to connect the soldered-in cable to the signal strength (vertical) Input on the MI 3. Connect a 3 foot low-loss shielded cable from the multi-out (multiplex output) jack on the tuner to the Deviation (horizontal) Input.

If a multiplex adapter is being used with the MR 55A, a "Y" connector will be needed in the MULTI-OUT jack. This allows both the multiplex adapter and the lead to the MI 3 to be connected.

#### CONNECTING TO McINTOSH MR 55 TUNER

Solder a wire across resistor R 62 (meg) connected to the test point on the tuner chassis.

Connect a 3 foot low-loss shielded cable from the test point on top of the tuner chassis to the Signal Strength (vertical) Input on the MI 3.

Connect a 3 foot low-loss shielded cable from the MULTIPLEX OUTPUT jack on the tuner to the Deviation (horizontal) Input on the MI 3.

#### CONNECTING TO ALL OTHER TUNERS

Connect a low-loss shielded cable from the input to the first FM limiter through a 100K resistor, to the Signal Strength (vertical) Input on the MI 3.

Connect a low-loss shielded cable from the discriminator output (ahead of the de-emphasis network) to the Deviation (horizontal) Input on the MI 3.

Adjust the SIGNAL STRENGTH (vertical) Multipath control on the back panel until the pattern on the indicator screen is about  $\frac{3}{4}$  inch from the top of the vertical scale.

#### DEVIATION MULTIPATH CONTROL

Tune in a relatively strong local signal with the antenna positioned for maximum multipath.

Adjust the DEVIATION (horizontal) Multipath control until the horizontal pattern (loudest signal from the station) does not extend over the ends of the horizontal scale of the indicator screen.

#### L+R AUDIO INDICATIONS

Turn the MI 3 Power switch to ON.

Turn the SCOPE TEST switch to TEST.

Adjust the HORIZONTAL POSITION front panel control until the trace is centered horizontally on the Indicator screen. Calibration lines are provided on the Indicator face for centering purposes.

Adjust the vertical position control until the trace dot is positioned at the bottom of the center vertical scale.

Adjust the INTENSITY AND FOCUS controls for a sharp and clear trace dot.

Turn the SCOPE TEST switch to L+R Audio.

Set the preamplifier or power amplifier to MONO.

Adjust the LEFT GAIN and RIGHT GAIN controls on the MI 3 until the incoming program causes the Indicator trace to align directly over the line.

**NOW YOUR MI 3 IS READY TO HELP YOU ACHIEVE MAXIMUM PERFORMANCE FROM YOUR SYSTEM**

# SET UP PROCEDURES

## MULTIPATH AND TUNING INDICATION

the MI 3 powerswitch to the ON position.  
Turn the SCOPE TEST switch to TEST.

Adjust the HORIZONTAL POSITION front panel control until the trace dot is centered horizontally on the indicator screen. Calibration lines are provided on the indicator face for centering purposes.

Adjust the VERTICAL POSITION front panel control until the trace dot is positioned at the bottom center of the vertical scale.

Adjust the INTENSITY and FOCUS controls for a sharp and clear trace dot.

Turn the SCOPE TEST switch to MULTIPATH position.

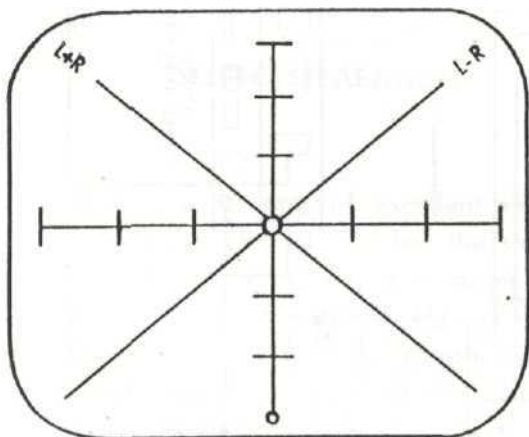
Turn the tuner tuning dial to the desired FM station, either stereo or monophonic.

Observe the trace pattern on the MI 3 indicator screen. If the pattern is uniform and relatively smooth, little or no multipath is present. If the pattern is irregular with vertical traces, multipath is present.

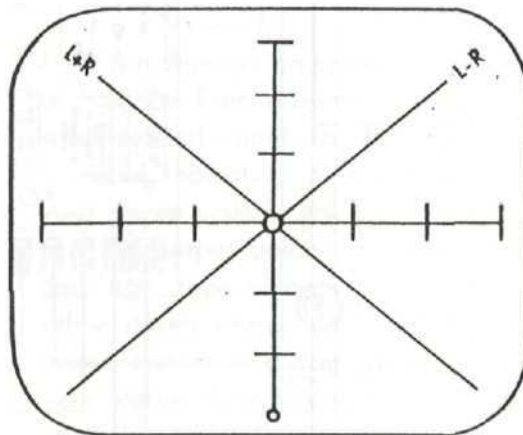
The height of the trace above the base line indicates the relative signal strength of the station being received.

Rotate the tuner antenna, while watching the MI 3 Indicator screen.

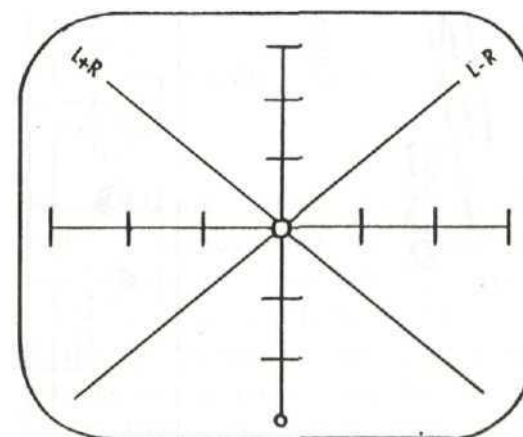
Stop the antenna in the position where the trace is the smoothest curve. In this position there is the least multipath.



1. Trace Dot Positioned at Bottom Center of Vertical Scale.

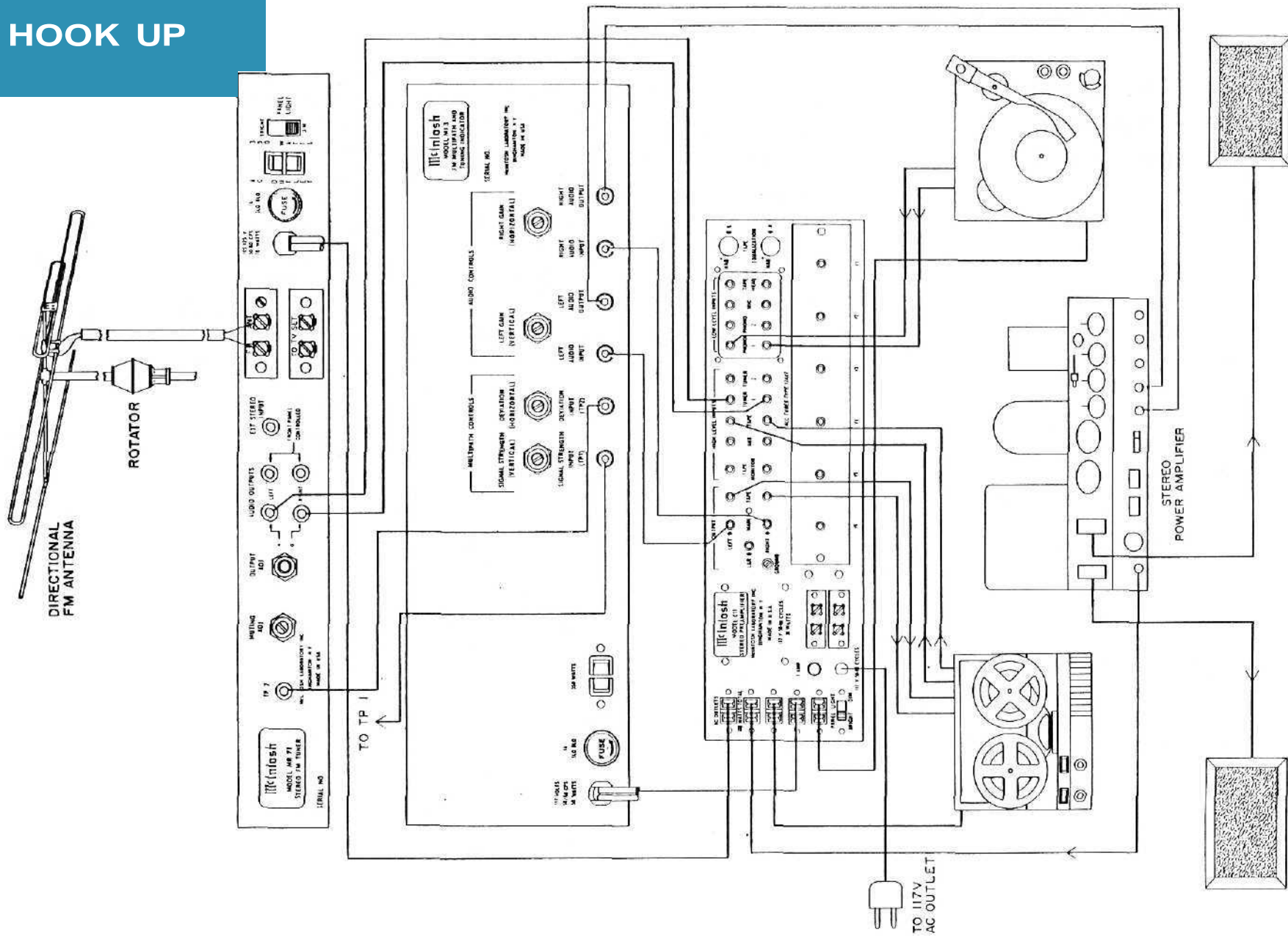


2. Uniform and Relatively Smooth Trace with Little or No Multipath Present (80% Modulation).



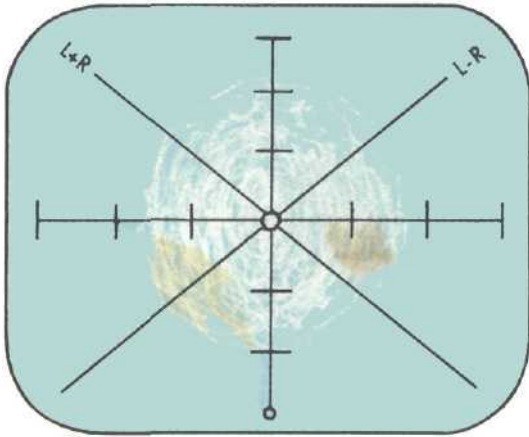
3. Trace Showing Multipath.

# TYPICAL HOOK UP



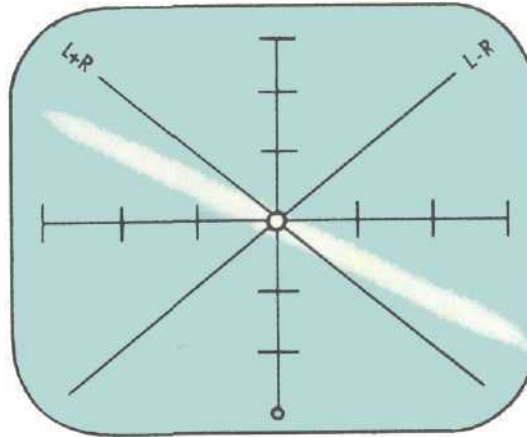
## TYPICAL PATTERNS

The oscilloscope display shows you:



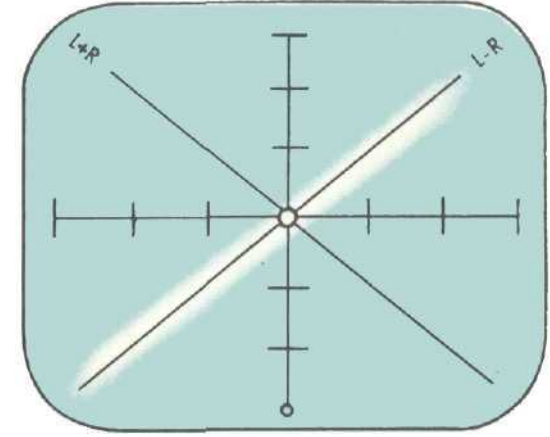
**STEREO SEPARATION**

Here is a display of excellent stereo separation. The MI 3 shows the stereo separation from all stereo program material. You see the display change position and shape with the program material. You interpret what the display means to your listening enjoyment. You see what makes a good stereo record sound good. With practice you know why your records sound the way they do.



**LEFT TO RIGHT BALANCE**

Here is a display of a system that is out of balance. Precise balance assures you a full wall of sound. The MI 3 gives you a visual indication of the balance of your stereo system. You check and correct the output balance of your stereo cartridge, tape recorder, tuner, or any other stereo source connected to your stereo system. It is easy to know when your stereo system is in balance when you use an MI 3.



**SYSTEM PHASE**

Here is a stereo system that is out of phase. A stereo system out of phase sounds un-natural and thin. A stereo system in phase sounds alive and rich. Occasionally a stereo record or tape is recorded out of phase. With the MI 3 you are immediately aware of this and can correct the condition.



Your MI 3 will give you many years of pleasant and satisfactory performance. If you have any questions concerning the operation or maintenance of this indicator please contact:

Customer Service  
McIntosh Laboratory Inc.  
2 Chambers Street  
Binghamton, New York 13903

Our telephone number is 723-5491.  
The direct dial area code is 607.

## **GUARANTEE**

McIntosh Laboratory Incorporated guarantees this equipment to perform as advertised. We also guarantee the mechanical and electrical workmanship and components of this equipment to be free of

defects for a period of 90 days from date of purchase. This guarantee does not extend to components damaged by improper use nor does it extend to transportation to and from the factory.

## **3-YEAR FACTORY SERVICE CONTRACT**

An application for a FREE 3-YEAR FACTORY SERVICE CONTRACT is included in the pocket in the back cover of this manual. The FREE 3-YEAR FACTORY SERVICE CONTRACT will be issued by McIntosh Laboratory upon receipt of the completely filled out application form. If the application is not mailed to

McIntosh Laboratory, only the services offered under the standard 90-day guarantee will apply on this equipment. TAKE ADVANTAGE OF 3 YEARS OF FREE FACTORY SERVICE BY FILLING IN THE APPLICATION NOW.



# McIntosh

**McINTOSH LABORATORY INC.**

**2 CHAMBERS ST., BINGHAMTON, N. Y. 13903**

**607-723-3512**

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