

McIntosh[®]

MR 510 DIGITAL FM TUNER

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Your MR 510 Digital FM Tuner will give you many years of satisfactory performance. If you have any questions, please contact:

CUSTOMER SERVICE

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

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

McINTOSH THREE YEAR SERVICE CONTRACT

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

The terms of the contract are:

1. Your completely filled in application for the SERVICE CONTRACT must be postmarked within 30 days of the date of purchase of the instrument.
2. 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.
3. To receive the SERVICE CONTRACT, your purchase must be made from a McIntosh franchised dealer.
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. 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.
6. 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.
7. 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.
8. Units in operation outside the United States and Canada are not covered by the McIntosh 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.

FRONT PANEL CONTROLS

On the front panel of the MR 510 there are: volume control with tuner on/off AC power switch, 6 momentary feather-touch pushbuttons for selecting preset stations, a jack for headphone listening, 1 on/off pushbutton for between station noise muting, 4 momentary tuning assistance feather-touch pushbuttons, a digital frequency display, 6 preset station indicators, an all solid state tuning indicator and the manual tuning knob and indicator.

VOLUME CONTROL WITH AC POWER SWITCH

The VOLUME control has been precision tracked throughout the listening range (0 to -65 dB) for accurate stereo balance. The AC power switch is part of the VOLUME control. The output level of the VARIABLE OUTPUT jacks and the front panel HEADPHONE jack is controlled by the VOLUME control. The FIXED OUTPUT jacks are not affected by the position of the VOLUME control except when the VOLUME control is turned fully counterclockwise the AC power is turned off.

PRESET STATION SELECTING 'FEATHER-TOUCH' PUSHBUTTONS

A momentary press on one of the pushbuttons marked 1 thru 6 will recall from the electronic memory the pre-set station assigned to that pushbutton, the corresponding indicator under the digital frequency display will light and the station will be tuned to the exact center of the channel. AFL is then applied and precise tuning is maintained.

HEADPHONE JACK

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

ENTER

The ENTER pushbutton and one of the six momentary feather-touch pushbuttons are used to insert into the electronic memory the desired tuned station. Stations can be selected for insertion in the electronic memory by use of either the manual tuning knob or SCAN tuning. To enter a station in the memory, tune to the desired station with the manual tuning knob, or the SCAN tuning. Then, while pressing the ENTER pushbutton press one of the upper row, numbered pushbuttons. Release both pushbuttons and the station tuning is recorded in the electronic memory for instantaneous recall. Because the memory is retained when the MR 510 is turned off, upon turn on it will operate in the same mode of operation and station tuning as when turned off.

THE ELECTRONIC MEMORY CHARGING BATTERY POWER SUPPLY

A very long life, rechargeable battery power supply provides the energy for the electronic memory when the tuner is turned off. When the tuner is first con-

nected it is wise to assume that the batteries have not been charged. The charge rate is dictated by the 'on' time of the tuner. To bring the batteries to full charge, operate the tuner for twenty-four hours. When fully charged, the tuner will retain the programmed instructions for six months with the tuner turned off.

MANUAL

A momentary press of the MANUAL feather-touch pushbutton will activate the tuning knob as indicated by the lighted arrow above the knob. Rotate the tuning knob until the frequency of the desired station shows on the digital frequency display.

A station is correctly tuned when the center arrow indicator at the bottom of the tuning indicator illuminates. On each side of the center arrow are arrows marked + and -, one of which will light as a station is approached to indicate tuning above (+) or below (-) the center of the station. When the center arrow lights, the station is center channel tuned, the FM AFL (automatic frequency lock) circuit is activated and the tuner is locked to the FM station. McIntosh AFL 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 turned, mechanically, slightly away from the frequency of the station without detuning. This makes tuning very easy but can cause the tuner to lose the station when power is turned off and on again. To prevent this, stop rotation of the tuning knob as soon as the center arrow is lighted.

A momentary press on either the SCAN or preset station pushbuttons deactivates the manual tuning knob and activates the tuning method selected.

SCAN

The tuner will automatically precisely tune the next station up or down the spectrum depending which SCAN pushbutton is pressed. The arrow above the pushbutton indicates the direction of the scan. When the remote scan cable is inserted in the rear panel receptacle, a momentary press of the pushbutton on the end of the remote scan cable will activate the tuner scan-up circuits.

TUNING INDICATOR

Accuracy of tuning and signal strength is indicated by the 9 LED tuning indicator. At the top is a bar which, when illuminated, indicates that the tuned station is transmitting in stereo (MPX). The vertical column of 5 bars shows the relative signal strength for the received station. The greater the number of illuminated bars the greater the station's signal strength.

The three arrows at the bottom of the indicator shows above (+), below (-) or exact center channel tuning. A correctly tuned FM station will have only the center vertical pointing arrow lighted.

BACK PANEL CONTROLS

Use of the back panel connections and controls will be described from right to left when looking at the back panel.

MANUAL AFL

Automatic Frequency Lock (AFL) is a McIntosh design which assures that the station remains ideally tuned regardless of any influences that might cause the station to drift. Because the AFL circuit does not affect the high quality performance of the MR 510, the switch should be used in the NORMAL position. There may be occasions when it would be desirable to deactivate the AFL circuit for manual tuning. With the MANUAL AFL switch in the OUT position, and when using the tuning knob, the AFL circuit is disabled. The AFL circuit is always active when the SCAN tuning and the feather touch preset station selection push buttons are used.

AUDIO OUTPUTS

Use the FIXED OUTPUT jacks on the rear panel to connect the MR 510 to a stereo control preamplifier or other equipment which has its own volume control. The position of the VOLUME control does not affect the loudness of the tuner at the FIXED OUTPUT jacks. The output level is 1 volt for 100% FM modulation.

Use the VARIABLE OUTPUT jacks to connect to equipment such as a power amplifier or a tape recorder where control of the volume is to be at the tuner. With the VOLUME control turned completely clockwise, the output at the VARIABLE OUTPUT jacks is 2.5 volts for 100% FM modulation. There is no difference in the signal quality at either of the pairs of output jacks; and, both pairs may be used simultaneously. The output impedance is very low so that long audio cables can be used without a loss of high frequencies due to cable capacity.

SCOPE

The vertical and horizontal SCOPE jacks are provided to connect to a maximum performance indicator or an oscilloscope which can then indicate FM multipath and signal strength. Connect the vertical jack to the vertical input of the indicator and the horizontal jack to the horizontal input.

REMOTE CONNECTOR

This connector interfaces with remote control systems for remote tuning.

CONNECTING AN FM ANTENNA

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

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

A VHF-TV antenna designed for both FM and TV reception can be effective. Connect the down lead from the VHF-TV antenna to the ANTENNA 300Ω FM push connectors.

The coaxial cable of an unbalanced 75 ohm antenna connects to the rear panel ANTENNA 75Ω FM type F coaxial connector.

Supplied with the tuner is a flexible folded dipole antenna for use in urban or high strength signal areas. Connect it 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. Do this 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.

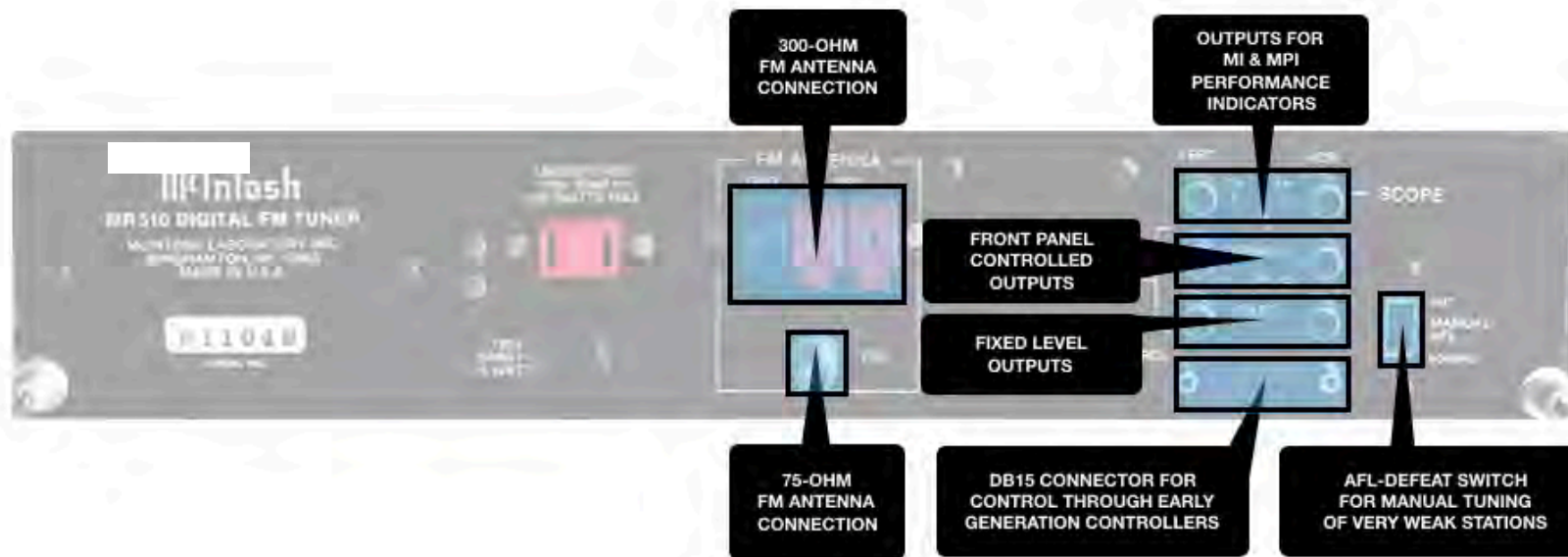
120V AC OUTLET

Provides a 120 volt AC power outlet with up to 300 watts available for additional equipment that has its own AC power switch. The outlet is not fused.

AC POWER CORD

Connect the AC power cord to a 120 volt, 50 to 60 Hz power line receptacle. The power used by the MR 500 is 15 watts.

BACK PANEL



HOW THE CIRCUITS WORK

FM TUNER

Antenna connections for 300 ohm twin lead and 75 ohm coaxial cable are provided on the rear panel. The normal input impedance of the FM-RF section is 75 ohms. An internal balun matching transformer provides a perfect match for a 300 ohm antenna. Connections for the twin lead are made with push type terminals and a type F connector is provided for the coaxial connection.

Following the antenna matching circuit is a RF tuner of exceptional performance. It uses a DMOS-FET RF amplifier, a double balanced mixer, and circuits that are tuned by a series parallel connection of four matched varactor diodes, all of which produce high spurious rejection and great sensitivity. This circuitry and the high tuning voltage (5-25V) eliminates RF intermodulation distortion caused by diode non-linearities.

The FM IF section uses 3 transistors, 3 linear phase piezoelectric filters, and one integrated circuit. They combine to provide over 120 dB of gain and a selectivity greater than 65 dB. Limiting, muting, signal strength drive, and FM detection are all functions of the integrated circuit.

FM STEREO MULTIPLEX

The heart of the multiplex section is a new third generation phase lock 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 a 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 system. A smooth transition is provided from mono to stereo or visa versa 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 monaural if the 19 kHz pilot tone is absent.

In the PLL the internal oscillator operates at 228 kHz locked to 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 and 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 with consequent inter-modulation distortion 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 multiples detection, 19 kHz pilot and 38 kHz carrier suppression circuits are used to prevent tape recorder interference.

The MR 510 has transient free turn on/off characteristics. A light dependent resistor, whose light source is time controlled, connects the tuner outputs approximately two seconds after the power is turned on to allow all circuits to stabilize before sound can be heard.

A low power amplifier with less than .01% harmonic distortion drives headphones output and the variable output jacks.

FREQUENCY COUNTER

The frequency counter consists of two IC's. One is an Emitter Coupled Logic (ECL) buffer circuit and divide by 100 prescaler. The other is a C-MOS LSI IC that contains the reference oscillator, various dividers, latches, and LED segment drivers for the display. The LED display does not generate RF interference because it is static, not multiplexed. An adjustable IF offset is provided so that the display reads the tuned frequency accurately for the full span of IF filter tolerances.

POWER SUPPLY

The +15, -15, and +5 volt supplies use IC three terminal regulators, while the +33 volt supply uses a zener diode regulator. This insures proper operation of the tuner even during periods of low AC line voltages.

HOW THE CIRCUITS WORK

TUNING SYSTEM

Today's FM electronic tuning systems can generally be classified as either a Phase Locked Loop (PLL) Synthesizer System or Voltage Synthesizer, Signal Locked Loop System.

McIntosh has selected the Voltage Synthesizer, a Signal Locked Loop (SLL) System which locks the MR 510 tuning to the incoming signal of the FM station. With the tuner tuned to the station frequency a correction voltage is generated by the detector "zero" crossing and all parts of the tuner, mixer, local osc., IF, etc. are inside the tuning loop. Accurate tuning is assured. As long as the station transmits within the tuning range of the MR 510, regardless of frequency, the SLL system will lock on to the station and remain center channel tuned.

In contrast, in the PLL system, the local oscillator frequency is compared to a reference within the tuner, usually a crystal controlled oscillator. A comparison circuit generates a correction voltage to hold the local oscillator to an exact multiple of the reference oscillator. The frequency of the reference oscillator must be equal to the station channel spacing (200 kHz in the United States) in order to cover all the FM channels. Tuning is accomplished in discrete steps which makes it impossible to tune to frequencies between channels. In areas where FM programs are distributed by cable or non-standard frequencies, and in other parts of the world where stations may be assigned to frequencies other than those standard in the United States, proper reception is not possible. Another limit of the PLL system is that the system can generate harmonics and spurious signals in the divider chain and frequency/phase comparator. These unwanted signals will add noise interference to the received station.

The superiority of the Signal Locked Loop System made it the obvious choice for the demanding performance required of the MR 510.

On the MR 510, three modes of tuning are provided: MANUAL, SCAN and PRESET.

In the MANUAL mode a regulated temperature compensated reference voltage is fed to the tuning potentiometer. A portion of this voltage as selected by the position of the potentiometer is fed to the controller integrated circuit (IC). It is then amplified, filtered and applied to the tuning varactors. Proper tuning is always guaranteed since the output of the FM detector at zero

crossing is referenced to 4.75 volts and is fed to the S curve input of the controller through a DC amplifier. If a deviation from the 4.75 volts is caused by a shift in tuning or station drift, the controller generates a correction voltage and combines it with the voltage being fed to the tuning varactors to maintain proper tuning.

When a SCAN feather-touch pushbutton is pressed a DC ramp tuning voltage is generated, rising in voltage for SCAN up, decaying for SCAN down. The ramp continues until the zero crossing of the detector S curve caused by the presence of a station is sensed at the input of the controller. The tuning voltage ramp, then stops and is maintained with any necessary correction voltage added.

The tuning voltage present at the output of the controller may be put into any of the six memory pushbutton locations at any time. Pressing the ENTER button causes an Analog to Digital conversion of the tuning voltage to take place. Then, while still holding the ENTER button, pressing one of the six numbered buttons stores the tuning information, in digital form, within the control IC memory.

A momentary press of a preset station pushbutton will instantaneously recall the station from the digital memory. The tuning voltage retained in the electronic memory is delivered to the output of the controller. To insure proper tuning a search and fetch operation takes place. The tuning voltage is moved plus and minus its nominal value in increasing steps until the correct station zero crossing signal is received from the detector. The station frequency is captured and once again the tuning voltage is maintained with any necessary correction added. Each time a preset pushbutton is pressed, a mute pulse suppresses any noise that may occur during the tuning process.

During the SCAN mode, an output from the controller is used to lower the tuner sensitivity to prevent weak noisy stations from being heard.

An automatically recharged long life nickel cadmium battery provides the necessary voltage to the memory to retain its instructions when AC power to the tuner is turned off. The last mode of operation used before turn off and the station frequency are retained in the memory. When the power is turned on the tuner will automatically return to the mode of operation and frequency last used.

PERFORMANCE LIMITS

Performance limits are the maximum deviation from perfection permitted for a McIntosh instrument. We promise you that when you purchase a new MR 510 from a McIntosh franchised dealer, it will be capable of or can be made capable of performance at or exceeding these limits or you can return the unit and get your money back. McIntosh is the only manufacturer that makes this statement.

USABLE SENSITIVITY

13 dB_F, which is 2.5 μ V across 300 Ω or 1.25 μ V across 75 Ω

50 dB QUIETING SENSITIVITY

Mono - 16.8 dB_F, which is 3.8 μ V across 300 Ω or 1.9 μ V across 75 Ω

Stereo - 37.3 dB_F, which is 40 μ V across 300 Ω or 20 μ V across 75 Ω

FREQUENCY RESPONSE

Mono ± 1 dB, 20 Hz to 15 kHz.

Stereo ± 1 dB, 20 Hz to 15 kHz.

HARMONIC DISTORTION

Mono 0.08% at 100 Hz

0.08% at 1 kHz

0.1% at 10 kHz

Stereo 0.18% at 100 Hz

0.18% at 1 kHz

0.25% at 10 kHz

SPURIOUS RESPONSE

100 dB

IMAGE RESPONSE

100 dB

AM SUPPRESSION

60 dB

STEREO SEPARATION

40 dB at 100 Hz

50 dB at 1 kHz

35 dB at 10 kHz

SIGNAL TO NOISE RATIO

Mono 80 dB

Stereo 75 dB

INTERMODULATION DISTORTION

Mono 0.08%

Stereo 0.18%

ALTERNATE CHANNEL SELECTIVITY

70 dB

SCA REJECTION

60 dB

GENERAL INFORMATION

ANTENNA INPUTS

300 Ω balanced and 75 Ω unbalanced

TUNING RANGE

88 MHz to 108 MHz

TUNING METHODS

Manual tuning.

Push buttons to select any one of six stations stored in the electronic memory.

Scan tuning up or down; scan-up can be controlled remotely.

AUDIO OUTPUT LEVELS

1V at fixed output

0 to 5.0V at variable output and headphones.

POWER REQUIREMENTS

120V, 50/60 Hz, 15W

SEMICONDUCTOR COMPLEMENT

33 Transistors

18 Integrated Circuits

8 Varactors

16 Light Emitting Diodes (LED's)

40 Diodes

MECHANICAL INFORMATION

SIZE:

Front panel is 16 inches wide (40.6 cm) by 3 5/8 inches high (9.2 cm) by 2 3/8 inches high (6.0 cm). The chassis is 14 1/2 inches deep (36.8 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:

18 pounds (8.2 kg) net, 30 pounds (13.6 kg) in shipping carton.

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