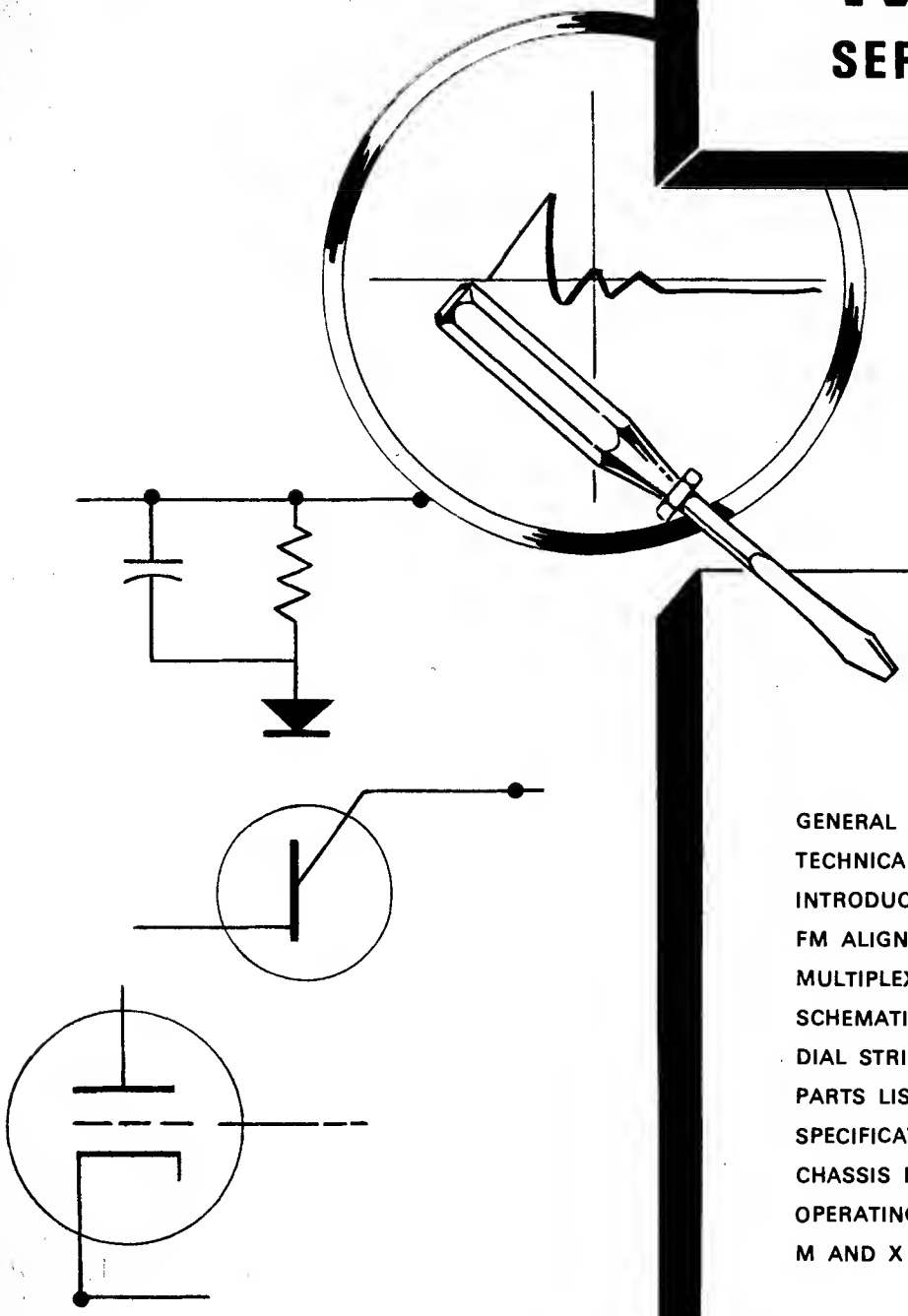
STEREO TUNER PREAMPLIFIER

WARRANTY STATION
MX 110
SERVICE MANUAL



CONTENTS

McIntosh

2 CHAMBERS ST.
BINGHAMTON, N.Y.

McIntosh MX 110

MX 110 TUNER PREAMPLIFIER

GENERAL DESCRIPTION

The MX 110 combines in one unit an extremely low-distortion preamplifier with a highly sensitive FM multiplex stereo tuner. Every desirable feature of a tuner and a preamplifier is included in this design. Interstation noise suppression, tuning indicator, FM multiplex indicator, individual channel bass controls, individual channel treble controls, electronic phase switch have all been engineered into the MX 110. The INPUT SELECTOR gives you a choice of six different program sources. The MODE SELECTOR is a newly developed control which makes it very easy to balance a stereo system. It is designed to add left to right for monophonic operation, to control the left to right stereo perspective or to compare the left and right channels of a stereo program. The loudness of the phono channels and the auxiliary channel may be balanced to the tuner loudness. These adjusting controls are located on the top of the MX 110 behind the front panel. By releasing the PANLOC buttons on the front panel, you can slide the MX 110 out of its mounting until the second latch engages. The top mounted LEVEL set controls are now available.

The McIntosh designed PANLOC system is the first professional installation technique to be used on stereo instruments. The PANLOC system gives you absolute ease of installation, operation, and maintenance.

The McIntosh MX 110 is a beautifully engineered control center for the finest stereo sound systems. The extreme care in manufacturing, in layout design and in thermal engineering promises the usual McIntosh extra values of reliability, performance, and long life.

TECHNICAL DESCRIPTION

The radio-frequency amplifier of the MX 110 is a "cascode" type circuit. The circuit is specially designed to amplify weak signals with less noise and distortion. By carefully tuning this RF amplifier during manufacturing and controlling other circuit constants, spurious response rejection is improved. The high-frequency oscillator mechanical layout is engineered for minimum response to temperature variations. In fact the combination of mechanical and electronic design is so unusually good in this circuit that automatic frequency control is not needed in the MX 110. The mixer output is amplified by four intermediate frequency amplifiers. The transformers used in the I.F. amplifiers are designed for maximum adjacent channel rejection, for electrical stability, and for electrical and mechanical resistance to shock and vibration.

The R.F. and I.F. circuits of the MX 110 are completely shielded and exceed the FCC requirements for suppression of oscillator radiation. Either a 300 ohm or 75 ohm antenna may be used with the MX 110. A VHF television antenna which is suitable for FM reception can be connected to the MX 110.

In the MX 110, a new type of mechanical tuning assembly gives smooth flywheel tuning. By controlling the relations between mass and mechanical resistance, and dividing work loads in the dial drive system, it becomes nearly impossible to detect any backlash. Yet the entire dial drive is a model of mechanical stability. For smooth, quiet action and extended life with virtually no wear, a teflon lined dial pointer carriage and nylon pulleys are used in the dial cord assembly.

MULTIPLEX DECODER

The multiplex decoder uses a special McIntosh developed detecting circuit. One of the advantages of this circuit is the elimination of the critical adjustments necessary with commonly used matrixing methods. This circuit detects the L+R sidebands and automatically matrixes the recovered information with the L+R main carrier signal. This circuit then yields the left and the right program with maximum separation.

A temperature stabilized 19KC amplifier locks-in a highly stable push-pull synchronous oscillator. Apart from other advantages, this method provides greatest noise immunity. Balanced detectors cancel the 38KC component in the output and insure low distortion.

A three-section sharp cut off filter rejects SCA interference and reduces susceptibility to spurious signals.

The MX 110 has an MPX stereo indicator that lights when the dial pointer crosses a station broadcasting MPX stereo. A unique circuit using a transistor operates the MPX stereo indicator. The transistor is controlled by a differential detecting circuit that amplifies the 19KC pilot signal. This circuit automatically discriminates between the 19KC signal and noise.

AUDIO

The MX 110 audio amplifier consists of three negative-feedback amplifying sections in duplicate for the left and right stereo channels and a separate L+R monophonic amplifier. The first section in each channel is a feedback preamplifier used to amplify and compensate for the input signals coming from phonograph pickups or tape heads. Level set controls are connected into the output circuit of this preamplifier section when the INPUT SELECTOR is switched to PHONO 1 or PHONO 2. These controls may be used to maintain uniform loudness between phono and tuner inputs. Skillful layout, grounding, and shielding for low-hum pickup, metal film resistors, low-noise tubes and extreme care in manufacturing combine to reduce noise and hum in t input amplifiers.

The third amplifier section is a two stage negative feedback amplifier. The variable bass and treble controls are included in the feedback loop to maintain the lowest possible distortion. For example a wave meter analysis of the three amplifier sections of the MX 110 shows less than 1/10 of 1% distortion at 3 volts output. The MODE SELECTOR, balance controls and left and right outputs are associated with the third amplifier section.

The L+R monophonic amplifying section is a feedback summing amplifier. It supplies monophonic output as well as L+R output.

The second amplifier section in each channel is a cathode follower. The sharp cut-off (18db per octave) rumble and high-frequency filters are associated with this section.

POWER SUPPLY

The power supply of the MX 110 has received very special design attention. Two separate rectifier circuits are used.

A full-wave rectifier supplies D.C. to the heaters of all audio stages.

A bridge rectifier supplies D.C. to the anodes of the audio stages.

A half-voltage tap on the bridge rectifier supplies D.C. to the tuner stages.

This elaborate power supply design insures the lowest possible background hum level and also the maximum stability. In addition to this careful work the power transformer uses special magnetic shielding to minimize possible hum pickup in the MX 110 as well as in any other equipment used with it.

INTRODUCTION

All McIntosh tuners are carefully aligned and tested at the factory using the finest available test equipment. All McIntosh tuners will meet their published specifications when shipped from the factory.

After extensive operation, especially when tubes have been replaced, it may be desirable to realign the tuner circuits for best performance. This manual gives complete information on the circuit realignment procedure for the MX 110 tuner-preamplifier.

The test equipment listed below (or its equivalent) is necessary to properly align an MX 110. The accuracy of the alignment will be directly related to the accuracy and calibration of the test equipment used.

FM Signal Generator (Measurements 210A or equivalent)

VTVM

Multiplex Generator (RCA WR-51A or equivalent)

10.7 MC Generator (Preferably crystal controlled)

Oscilloscope (Hewlett-Packard 120B or equivalent)

Harmonic Distortion Analyzer, desirable but not essential—(Hewlett-Packard 330B or equivalent)

If the necessary test equipment is not available, alignment should not be attempted. You may contact the McIntosh Customer Service Department for additional information.

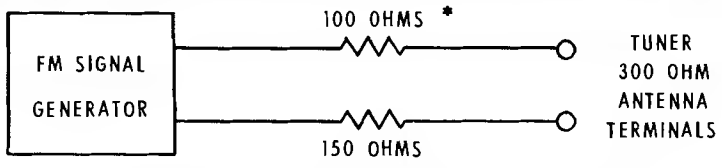
Customer Service
McIntosh Laboratory, Inc.
2 Chambers Street
Binghamton, New York

Our telephone number is 723-5491

The direct dial area code is 607

STEPS	TUNER DIAL SETTING	SIGNAL GENERATOR			INDICATOR	
		FREQ.	COUPLING	MODULATION	TYPE	CONNECTED TO
1	Point of no interference or signal	10.7MC	Through external .01MF cap to pin 7 of 12AT7 mixer	CW	VTVM	TP #1
2	SAME	SAME	SAME	SAME	MX 110 tuning eye	
3	SAME	SAME	SAME	SAME	VTVM	TP #2 or (discriminator output on "M" series)
4	SAME	SAME	SAME	SAME	SAME	Pin 6 of discriminator transformer
5	105MC	105MC	300 ohm antenna terminals with * matching network	400 cycles 75KC deviation (100% modulation)	VTVM connected to TP1 and scope connected to L or R audio output	
6	90MC	90MC	SAME	SAME		SAME
7	105MC	105MC	SAME	SAME		SAME
8	90MC	90MC	SAME	SAME		SAME
9	Point of no interference				Scope	L or R output
10	105MC	105MC	SAME	400 cycles 75KC deviation (100% modulation) attenuated to 2.5 microvolts output	VTVM connected to TP #1 and Scope connected to L or R audio output	

ANTENNA MATCHING NETWORK



* IF SIGNAL GENERATOR HAS OTHER THAN 50 OHM INTERNAL IMPEDANCE, USE A RESISTOR OF 150 OHMS, LESS INTERNAL GENERATOR IMPEDANCE.

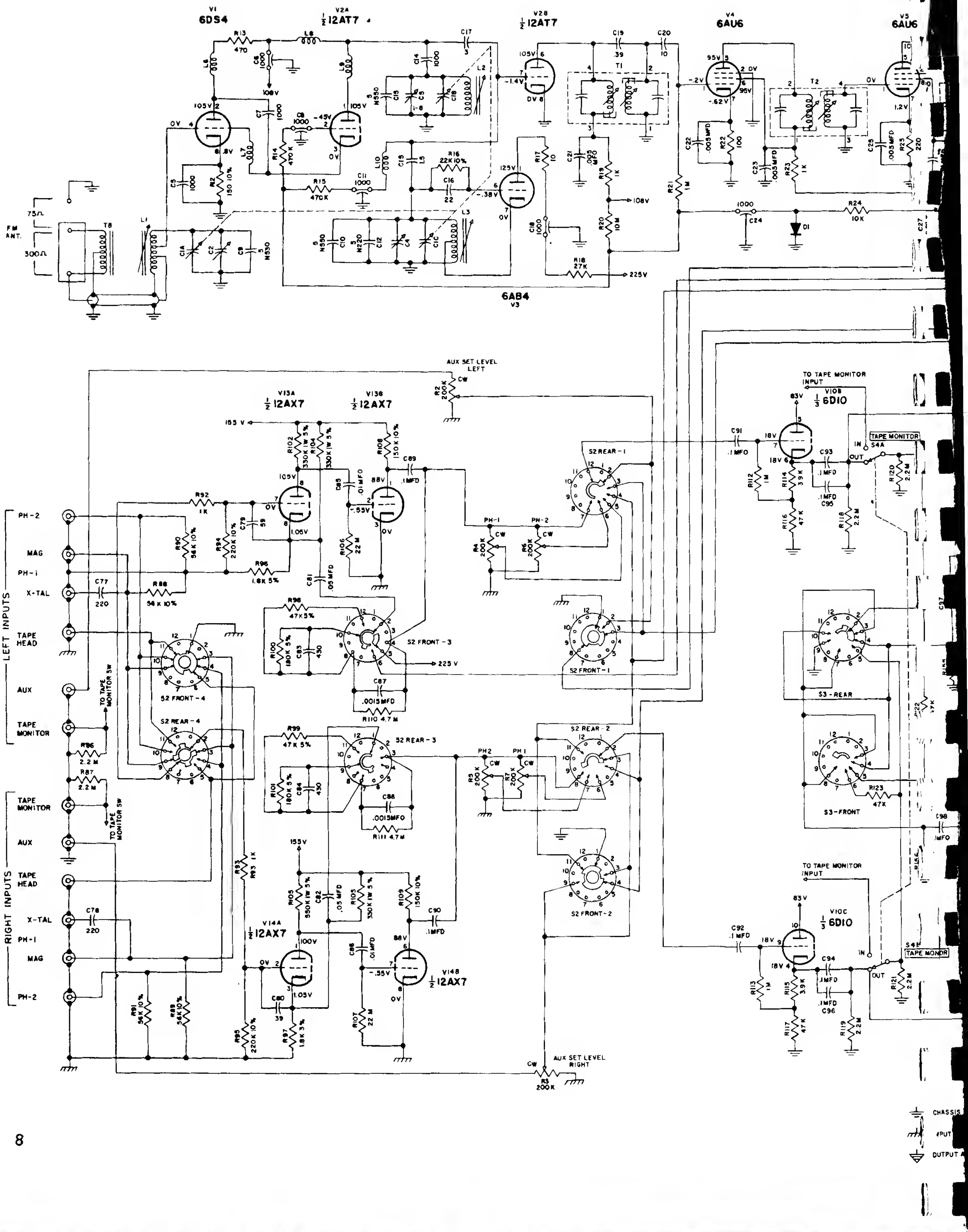
ALIGNMENT

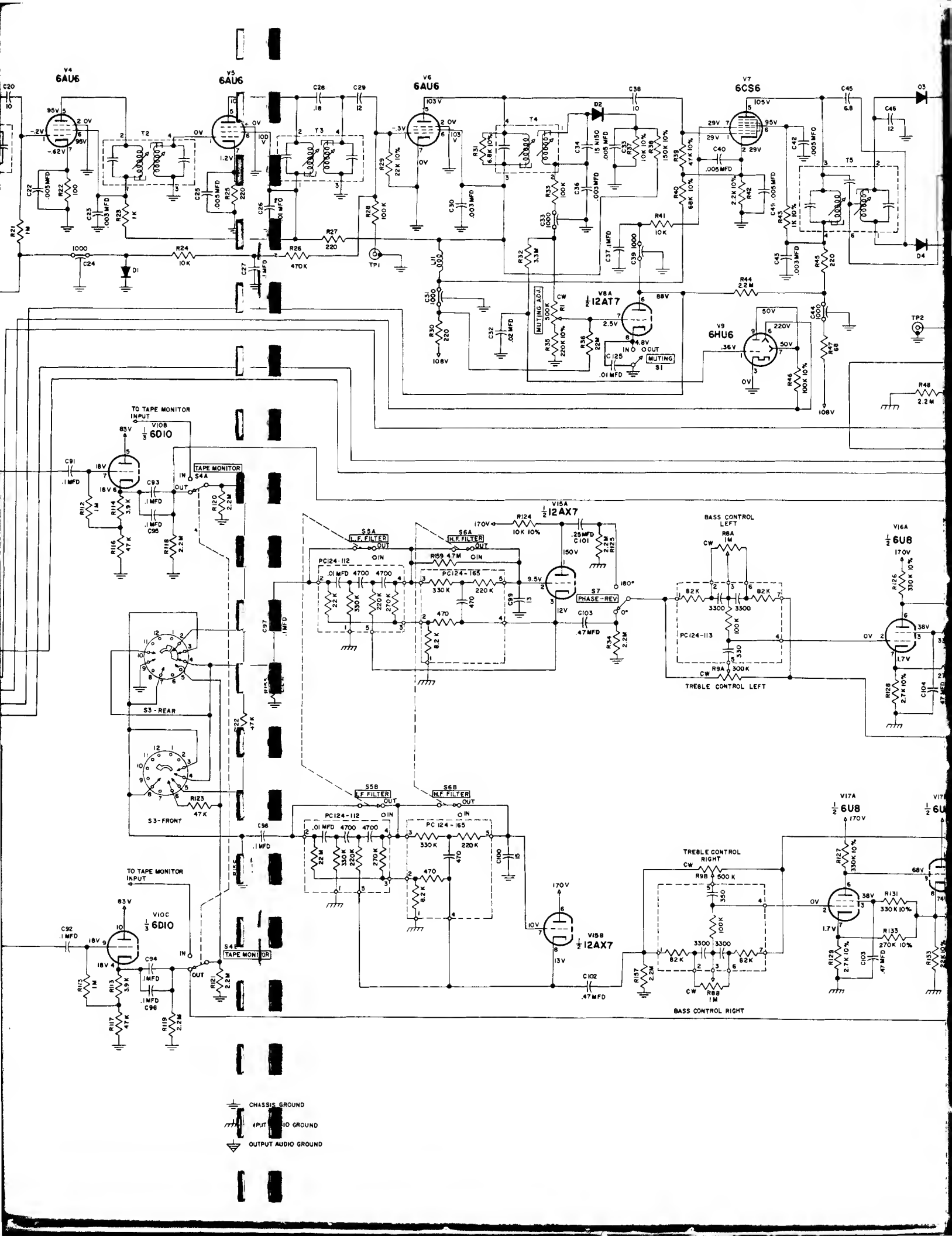
ADJUST	TEST LIMITS	REMARKS
Top (secondary) and bottom, (primary) of 1st, 2nd and 3rd IF transformers	Maximum possible negative voltage	Shunt to ground the winding not being adjusted with a .01MF capacitor in series with a 1K resistor. Attenuate signal generator until output voltage at TP #1 is less than 1.5 volts with one IF transformer winding shunted. IF transformers have terminal #1 marked with a green dot and are numbered clockwise.
4th IF transformer, top and bottom.	Eye should close to approx. $^1/_{16}$" with strong signal. Make additional adjustments of eye closure by varying the length of parallel conductors connected to pins 1 and 4 of the 4th IF transformer. (This changes the capacitive coupling between pins 1 and 4.)	
Discriminator transformer upper core (secondary)	Adjust for 0 volts	
Discriminator transformer lower core (primary)	Maximum negative voltage	Repeat step 3 if a large change is made in the setting of the lower core.
Oscillator trimmer cap.	Maximum negative voltage	As output increases, attenuate signal generator to keep maximum output at TP #1 to less than 2 volts.
Oscillator coil tuning slug	SAME	Repeat steps 5 and 6 until dial calibration is accurate.
Mixer trimmer and RF trimmer	SAME	
Mixer coil tuning slug and RF coil tuning slug	SAME	Repeat steps 7 and 8 until output is as high as possible.
Muting adj. control		Turn muting switch to "in" position. Adjust muting control until background noise just disappears.
	IHFM sensitivity 2.5 microvolt for 3% total noise and distortion	Step 10 is an overall sensitivity check, and requires a distortion analyzer and FM signal generator with attenuator. With 2.5 microvolts input at the 300 ohm antenna terminals, TP #1 voltage should be .6 volts or more.

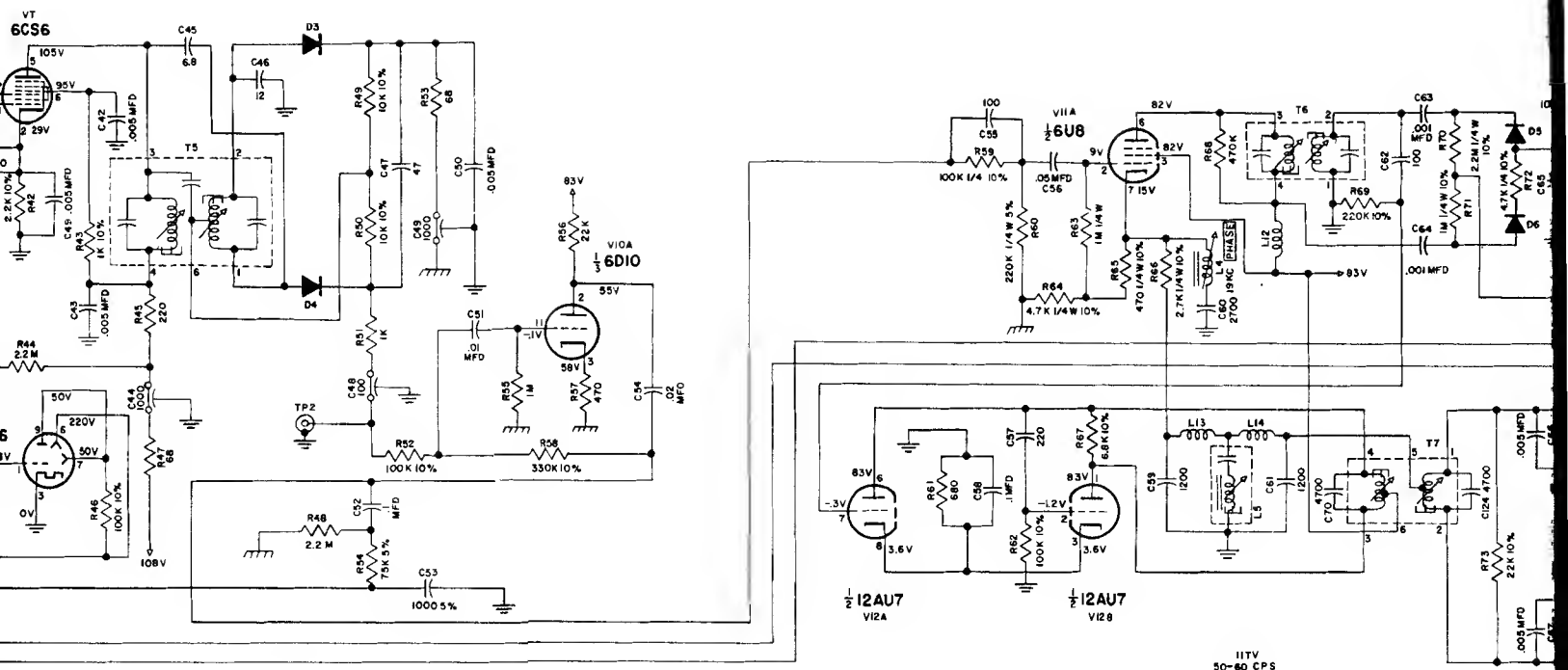
STEPS	TUNER DIAL SETTING	SIGNAL GENERATOR			INDICATOR	
		FREQ.	COUPLING	MODULATION	TYPE	CONNECTED TO
1	Point of no interference or signal	Audio generator set to 67KC, 0.5 volts output or less	TP #2 (MPX input on "M" series)		Audio VTVM	Pin 6 of 38KC transformer (yellow wire connected at this pin)
2	SAME	MPX generator with 19KC pilot attenuated to approx. 5% level (5% level is ½ of normal 10% level) 19KC pilot *must* be attenuated for correct alignment	SAME		SAME	Pin 3 or 8 of 12AU7 MPX oscillator
3	100MC	100MC modulated by MPX generator, 19KC pilot at normal output	300 ohm antenna terminals with approx. 1000 microvolt signal	1KC 100% modulation (34KC deviation) modulating left or right only	SAME	Pin 1 or 2 of 38KC transformer
4	SAME	SAME	SAME	SAME	Audio VTVM and scope	L or R output jack
5	SAME	SAME	SAME	SAME	SAME	SAME
6	SAME	SAME	SAME	SAME	SAME	SAME
7	SAME	SAME	SAME	Turn off 1KC audio modulation	SAME	SAME
8	SAME	SAME	SAME	Same as step 3	SAME	SAME

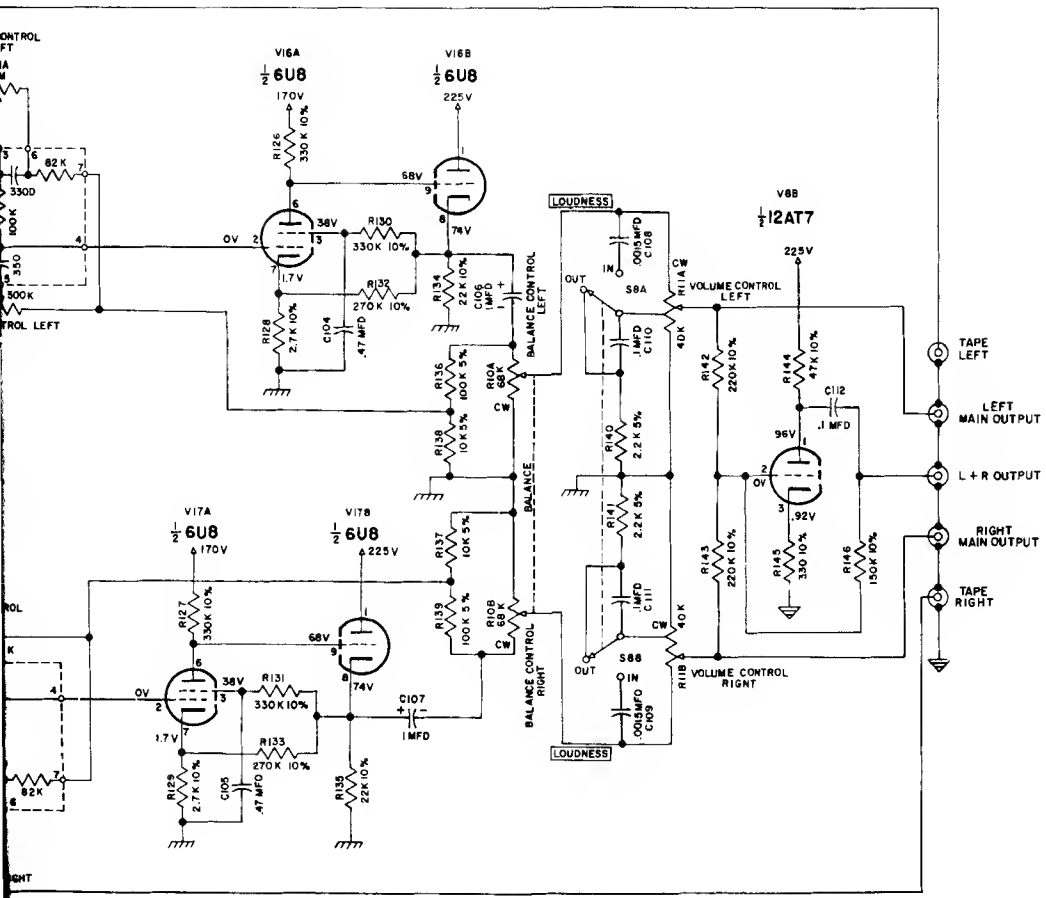
DECODER ALIGNMENT

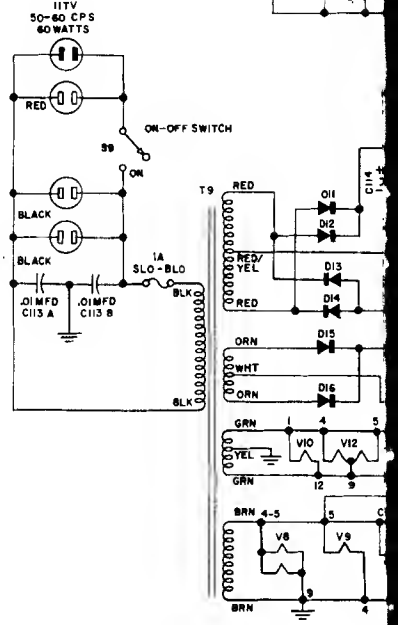
ADJUST	TEST LIMITS	REMARKS
67KC trap	Adjust for minimum voltage	
19KC phase coil and 19KC transformer	1. Disable local 38KC oscillator by placing a jumper wire across 6.8K resistor connected to pins 1 and 6 of 12AU7 MPX oscillator. 2. Shunt pin 2 of 19KC transformer to ground with .01 capacitor in series with 1K resistor. 3. Adjust 19KC phase coil for maximum output. Proper adjustment places core approx. ¼" from bottom of coil form. 4. Adjust lower core of 19KC transformer for maximum output. 5. Shunt pin 3 of 19KC transformer to ground with .01 capacitor in series with 1K resistor. 6. Adjust upper core of 19KC transformer for maximum output. 7. Remove jumper used in step 1 above.	
38KC transformer bottom core	Adjust for maximum voltage	
38KC transformer upper core	Adjust for stable scope display	1. Turn off 19KC pilot on MPX generator. 2. Adjust upper core of 38KC transformer to obtain a stable and uniform 1 KC signal scope display. This adjustment may be critical, so turn core very slowly. 3. Turn 19KC pilot back on.
19KC phase coil	30db separation or more	Modulate left channel and measure right channel output. Adjust 19KC phase coil for minimum right channel output (maximum separation). Remove all test leads from TP #2 for separation checks.
	SAME	Modulate right channel and measure left channel output. Separation in steps 5 and 6 should be at least 30db
	This step checks the rejection of 19KC and 38KC frequencies. Residual output should be at least 40db below modulated output.	
		Check for MPX indicator light 1. MPX light should turn on with MPX signal 2. Tuning slowly across dial, MPX light should turn on only with MPX signal.


V1
6DS4
V2A
½ 12AT7
V2B
½ 12AT7
V4
6AU6
V5
6AU6
6AB4
V3
FM ANT.
75Ω
300Ω
T8
L1
T1
T2
D1
225V
108V
AUX SET LEVEL LEFT
AUX SET LEVEL RIGHT
V13A
½ 12AX7
V13B
½ 12AX7
V14A
½ 12AX7
V14B
½ 12AX7
155 V
TO TAPE MONITOR INPUT
V10B
⅓ 6D10
V10C
⅓ 6D10
TAPE MONITOR
S4A
S4B
IN
OUT
S2 REAR - 1
S2 FRONT - 1
S2 REAR - 2
S2 FRONT - 2
S2 FRONT - 3
S2 REAR - 3
S2 FRONT - 4
S2 REAR - 4
S3 - REAR
S3 - FRONT
PH-1
PH-2
LEFT INPUTS
PH-2
MAG
PH-1
X-TAL
TAPE HEAD
AUX
TAPE MONITOR
RIGHT INPUTS
TAPE MONITOR
AUX
TAPE HEAD
X-TAL
PH-1
MAG
PH-2
TO TAPE MONITOR SW
CHASSIS
INPUT
OUTPUT

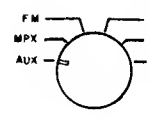

V4 6AU6
V5 6AU6
V6 6AU6
V7 6CS6
V8A 12AT7
V9 6HU6
V10B 1/3 6D10
V10C 1/3 6D10
V15A 1/2 12AX7
V15B 1/2 12AX7
V16A 1/2 6U8
V17A 1/2 6U8
TO TAPE MONITOR INPUT
TAPE MONITOR
S4A
S4B
S5A L.F. FILTER
S5B L.F. FILTER
S6A H.F. FILTER
S6B H.F. FILTER
S7 PHASE-REV
S8 MUTING
S3-REAR
S3-FRONT
PC124-112
PC124-165
PC124-113
BASS CONTROL LEFT
TREBLE CONTROL LEFT
TREBLE CONTROL RIGHT
BASS CONTROL RIGHT
CHASSIS GROUND
INPUT AUDIO GROUND
OUTPUT AUDIO GROUND



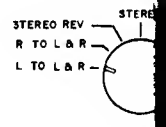




ALL SWITCHES SHOWN IN CCW POSITION



INPUT SELECTOR SWITCH, S2

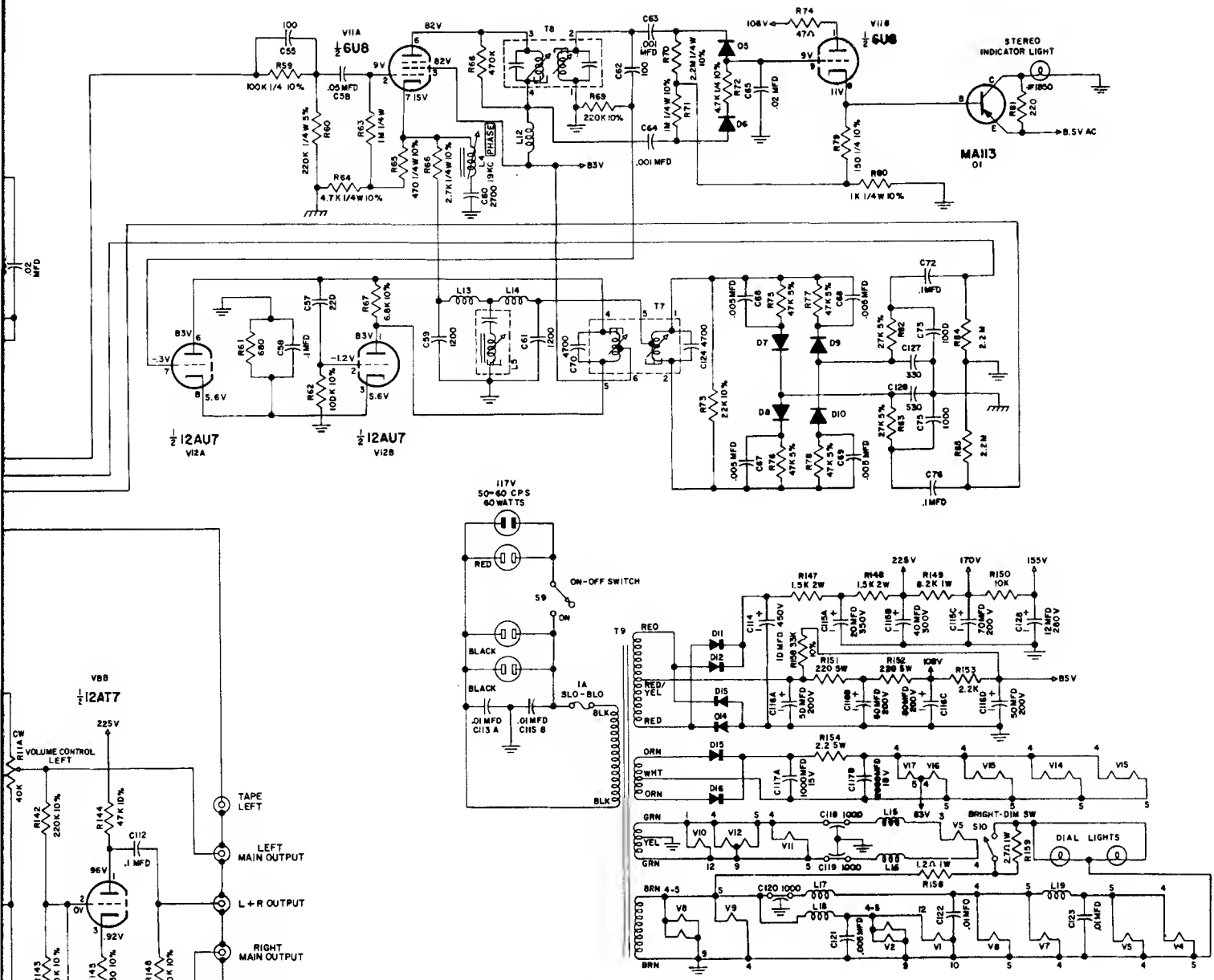


MODE SELECTOR

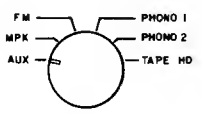
ALL VOLTAGES MEASURED UNDER FOLLOWING CONDITIONS:

1 – USE OF 11 MEGOHMS INPUT IMPEDANCE VTVM VOLTMETER.
2 – ALL VOLTAGES ±10%, WITH RESPECT TO GROUND.
3 – A.C. INPUT AT 117 V 50–60 CPS.
4 – NO SIGNAL AT ANTENNA AND OTHER INPUT TERMINALS.
5 – FRONT PANEL CONTROLS AT

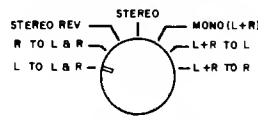
MODE SELECTOR	– STEREO	MUTING	– OUT
INPUT SELECTOR	– MPX	LF/HF FILTERS	– OUT
VOLUME CONTROL	– MAX	LOUD	– OUT
BALANCE CONTROL	– ZERO	TAPE MONITOR	– OUT
TONE CONTROLS	– FLAT	PHASE	– 0°



ALL SWITCHES SHOWN IN CCW POSITION



INPUT SELECTOR SWITCH, S2



MODE SELECTOR SWITCH, S5

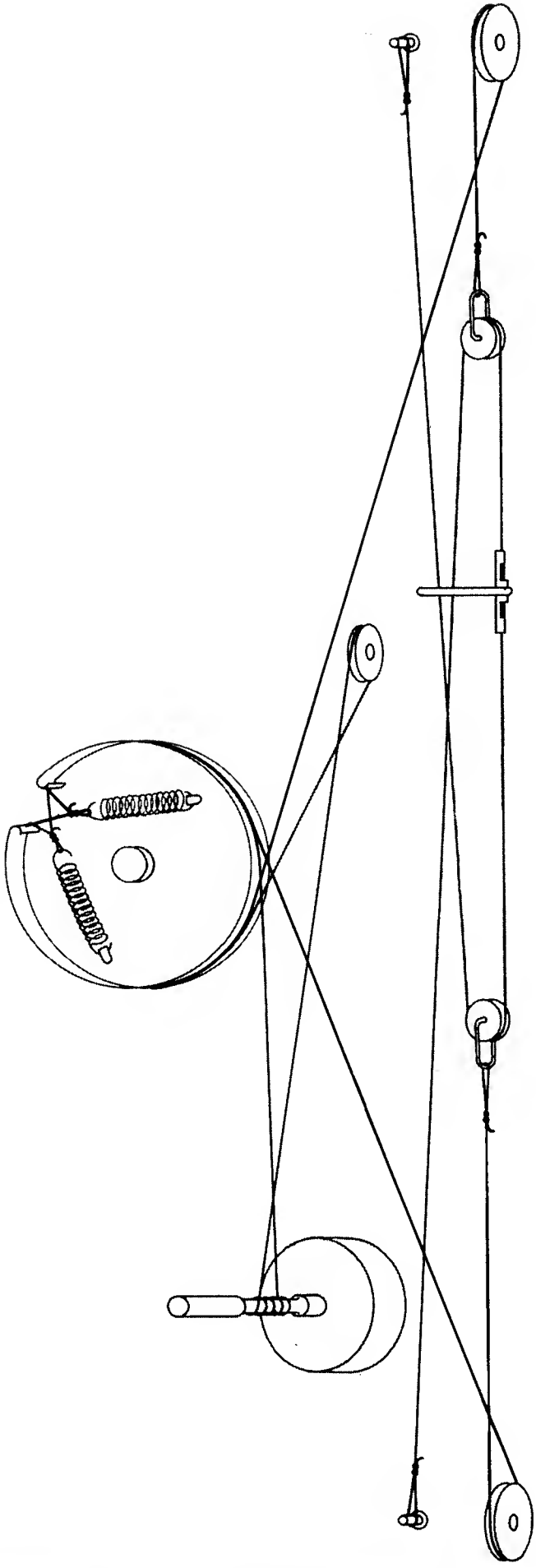
ALL VOLTAGES MEASURED UNDER FOLLOWING CONDITIONS:

1 – USE OF 11 MEGOHMS INPUT IMPEDANCE VTVM VOLTMETER.
2 – ALL VOLTAGES ±10%, WITH RESPECT TO GROUND.
3 – A.C. INPUT AT 117 V 50–60 CPS.
4 – NO SIGNAL AT ANTENNA AND OTHER INPUT TERMINALS.
5 – FRONT PANEL CONTROLS AT

MODE SELECTOR	– STEREO	MUTING	– OUT
INPUT SELECTOR	– MPX	LF/HF FILTERS	– OUT
VOLUME CONTROL	– MAX	LOUD	– OUT
BALANCE CONTROL	– ZERO	TAPE MONITOR	– OUT
TONE CONTROLS	– FLAT	PHASE	– 0°

UNLESS OTHERWISE SPECIFIED
ALL RESISTORS 1/2 W 20%
ALL CAPACITORS IN PF
ALL INDUCTORS IN MICRON

FM, IF: 10.7 MC



MX 110 PARTS LIST

TUBES

ITEM NO.	USE	IDENTIFICATION NUMBER
V1	RF Amplifier 1	6DS4
V2	RF Amplifier 2; Mixer	12AT7
V3	Oscillator	6AB4
V4	IF Amplifier 1	6AU6
V5	IF Amplifier 2	6AU6
V6	IF Amplifier 3; Limiter 1	6AU6
V7	Limiter 2	6CS6
V8	Muting; L+R Amplifier	12AT7
V9	Tuning Indicator	6HU6/EM87 (X, Z series) 6FG6 (EM84A) M series
V10	FM Audio (Left and Right); 1st Audio Amplifier	6D10
V11	MPX. Amplifier and 19KC Separator/Indicator control	6U8
V12	MPX. 38KC Oscillator	12AU7
V13	Phono Preamplifier Left	12AX7
V14	Phono Preamplifier Right	12AX7
V15	Left and Right 2nd Audio Amplifier	12AX7
V16	Left 3rd Audio Amplifier	6U8
V17	Right 3rd Audio Amplifier	6U8

TRANSISTOR

Q1	Transistor (Switching)	Motorola #MA-113

DIODES

D1	AGC Clamp	Type 1N542 Germanium Diode
D2	Muting and Tuning Eye Detector	Type 1N542 Germanium Diode
D3, D4	Discriminator (Matched Pair)	Type 1N542 Germanium Diode
D5, D6	Balanced Detector (Matched Pair) for Indicator	Type 1N542 Germanium Diode
D7, D8	Balanced MPX. (Matched Pair) Detectors (Left Channel)	Type 1N542 Germanium Diode
D9, D10	Balanced MPX. (Matched Pair) Detectors (Right Channel)	Type 1N542 Germanium Diode
D11, D12, D13, D14	High and Low Voltage Supply	G.E. #6RS20PH6RGD1
D15, D16	DC Filament Supply	#1N1217

MX 110 PARTS LIST (Cont.)

CONTROLS

ITEM NO.	FUNCTION	RESISTANCE	IDENTIFICATION NUMBER
R1	Muting Adj. Pot.	500K	R142-217
R2	Aux. Set Level (Left)	200K	R142-144
R3	Aux. Set Level (Right)	200K	R142-144
R4	Phono 1 Set Level (Left)	200K	R142-144
R5	Phono 2 Set Level (Right)	200K	R142-144
R6	Phono 2 Set Level (Left)	200K	R142-144
R7	Phono 1 Set Level (Right)	200K	R142-144
R8	Bass Control	1M (dual)	R142-142
R9	Treble Control	500K (dual)	R142-141
R10	Balance Control	68K (dual) with switch	R142-109
R11	Volume Control	40K (dual)	R142-110B

SWITCHES

ITEM NO.	FUNCTION	DESCRIPTION	IDENTIFICATION NUMBER
S1	Muting	SPST	Stackpole #SS-26
S2	Input Selector	6 position rotary	S142-108A
S3	Mode Selector	7 position rotary	S142-147A
S4	Tape Monitor	DPDT	Stackpole #SS-50
S5	LF Filter	DPDT	Stackpole #SS-50
S6	HF Filter	DPDT	Stackpole #SS-50
S7	Phase Reverse	SPDT	Stackpole #SS-26-1
S8	Loudness	DPDT	Stackpole #SS-50
S9	On-Off (Part of R10)		
S10	Panel Light Dim—Bright	SPST	Stackpole #SS-26

TRANSFORMERS

ITEM NO.	FUNCTION	IDENTIFICATION NUMBER
T1	FM first IF	T107-134A
T2	FM second IF	T107-133A
T3	FM third IF	T107-133A
T4	FM fourth IF	T124-136A
T5	FM discriminator	T107-135B
T6	19KC amplifier	T129-101
T7	38KC oscillator	T129-102A
T8	Balun	
T9	Power	T124-127B

MX 110 PARTS LIST (Cont.)

CAPACITORS

ITEM NO.	DESCRIPTION	CAPACITANCE	VOLTAGE	TOLERANCE	IDENTIFICATION NUMBER
C1	Variable FM				C142-130A
C2	Antenna Trimmer				Part of C-1
C3	Mixer Trimmer	1-8pf			
C4	Oscillator Trimmer	1-8pf			
C6	ceramic feed thru	.001			
C8	ceramic feed thru	.001			
C9	ceramic tubular	5pf		±.25pfN330	
C10	ceramic tubular	5pf		±.25pfN330	
C11	ceramic feed thru	.001			
C12	ceramic tubular	5pf		±.25pfN220	
C13	ceramic tubular	5pf		±.25pfN330	
C15	ceramic tubular	1.5pf		±.25pfNPO	
C16	ceramic disc	22pf		20% N470	
C17	ceramic tubular	3pf		±.25NPO	
C18	ceramic feed thru	.001mf			
C19	phenolic	.39pf		10%	
C24	ceramic feed thru	.001			
C28	phenolic	.18pf		10%	
C31	ceramic feed thru	.001			
C33	ceramic feed thru	.001			
C34	ceramic tubular	15pf		±.75pfN150	
C38	ceramic tubular	10pf		NPO	
C39	ceramic feed thru	.001			
C44	ceramic feed thru	.001			
C47	ceramic disc	47pf		20% N470	
C48	ceramic feed thru	100pf			
C49	ceramic feed thru	.001			
C53	silver mica	1000pf	100v	5%	
C55	ceramic disc	100pf		10%N1500	
C59	silver mica	1200pf	100v	5%	
C60	silver mica	2700pf	100v	5%	
C61	silver mica	1200pf	100v	5%	
C70	silver mica	4700pf	100v	5%	
C73	silver mica	1000pf	100v	5%	
C75	silver mica	1000pf	100v	5%	
C79	ceramic disc	39pf		20%N1500	
C80	ceramic disc	39pf		20%N1500	
C83	ceramic tubular	430pf		±5%	
C84	ceramic tubular	430pf		±5%	
C113	ceramic disc	2x .01mf	1400v		
C114	electrolytic	10mf	450v		
C115	electrolytic	40, 40, 20, 30	300, 200, 350, 200		
C126	electrolytic	12mf	250v		
C117	electrolytic	1000, 2000	15v		
C118	ceramic feed thru	.001			
C119	ceramic feed thru	.001			
C120	ceramic feed thru	.001			
C116	electrolytic	50, 50, 50, 50	200v		
C124	silver mica	4700	100v	5%	

MX 110 PARTS LIST (Cont.)

COILS

ITEM NO.	DESCRIPTION	VALUE	IDENTIFICATION NUMBER
L1	Antenna Coil		L124-227
L2	Mixer Coil		L124-247
L3	Oscillator Coil		L107-206A
L4	Peaking coil: 19KC trap		L129-103
L5	Filter coil: 67KC trap		L129-110
L6	RF choke	.47 micro H.	
L7	RF choke	2.2 micro H.	
L8	RF choke	1.2 micro H.	
L9	RF choke		SP10, 004
L10	RF choke	1.2 micro H.	
L11	RF choke	75 micro H.	
L12	RF choke	38 micro H.	L129-123
L13	Filter coil		L129-109
L14	Filter coil		L129-109
L15	RF choke	2.2 micro H.	
L16	RF choke	2.2 micro H.	
L17	RF choke	1.2 micro H.	
L18	RF choke	1.2 micro H.	
L19	RF choke	1.2 micro H.	

SPECIAL RESISTORS

ITEM NO.	DESCRIPTION VALUE	TOLERANCE	WATTAGE
R102	metallic film 330K	5%	1
R103	metallic film 330K	5%	1
R104	metallic film 330K	5%	1
R105	metallic film 330K	5%	1
R96	metallic film 1.8K	5%	½
R97	metallic film 1.8K	5%	½

MISCELLANEOUS

Lamp, festoon: 7 volts, 2 watts, 6 x 43mm

Lamp, Incandescent: No. 1850 (for MPX. indicator light)

Plate, printed circuit for tone control: No. PC 124-113

Plate, printed circuit for LF Filter: No. PC 124-112

Plate, printed circuit for HF Filter: No. PC 124-165

Cable, coaxial: 50 ohms, Amphenol No. 21-598

MECHANICAL SPECIFICATIONS

DIMENSIONS

Chassis: 16 inches wide; $5^{7}/_{16}$ inches high; 13 inches deep including connectors.
Front Panel: 16 inches wide; $5^{7}/_{16}$ inches high.
Knob Clearance: 1 ½ inches.

WEIGHT

Chassis: 27 ½ pounds.
Shipping Weight: 36 pounds.

FINISH

Anodized gold and black (front panel).

INSTALLATION

Convenient, professional PANLOC.

TUNER SPECIFICATIONS

SENSITIVITY

Better than 2.5 microvolts at 100% modulation.

R.F. AMPLIFIER

Cascode.

I.F. AMPLIFIERS

Four.

LIMITERS

Two.

I.F. BANDWIDTH

200KC flat top.

I.F. TRANSFORMERS

Mechanically captive.

MUTING

I.F. injected.

TUNING INDICATOR

Tuning is indicated by an electron ray tube.

FREQUENCY RESPONSE

Within ±1db 20 to 20,000 cycles. (Including 75 microseconds deemphasis.)

HUM

Greater than 70db or more below 100% mod. (Audio tubes have D.C. on the filaments.)

DRIFT

Less than 25KC.

ANT. INPUT IMPEDANCE

300 balanced, 75 ohms unbalanced.

RADIATION

Substantially below F.C.C. requirements.

DISTORTION

Less than 0.6% distortion at 100% modulation, ±75KC deviation above 2.5 microvolts at antenna.

MULTIPLEX DECODER SPECIFICATIONS

MPX DECODER

Hum Level: Better than 60db below 100% stereo modulation.

Distortion: Less than 0.3% (Multiplex Decoder only).

Channel Separation: Better than 30db at 1000 cps.

Suppression of Pilot (19KC), and Carrier (38KC): Greater than 40db below 100% modulation.

Front Panel Stereo Indicator Light: Activated by 19KC pilot carrier only.

AUDIO SPECIFICATIONS

INPUTS

Total 5 each channel:
AUX.;
PHONO 1 MAG. or XTAL;
PHONO 2 MAG.;
TAPE HEAD;
TAPE MONITOR.

OUTPUTS

Main Stereo Outputs; 1 Tape Stereo Output; 1 L+R Output.

AC AUX OUTLETS

1 unswitched, 2 switched.

CONTROLS

Input Selector: Total 6 positions: AUX, MPX, FM, PHONO 1, PHONO 2, TAPE HEADS.

Mode Selector: Total 7 positions: L TO L&R, R TO L&R, STEREO REV., STEREO, MONO, L+R TO L, L+R TO R.

Tone: Dual treble and bass negative-feedback controls with slip clutch for independent adjustment of each channel. Bass Boost: 15db at 50 cycles. Bass Cut: 18db at 50 cycles. Treble Boost: 15db at 10,000 cycles. Treble Cut: 15db at 10,000 cycles.

Balance: Turn to right to emphasize the right channel. Turn to the left to emphasize the left channel.

Phase: 2 positions: NORMAL or REVERSED: Changing phase does not increase distortion. H.F. Cutoff Filter: 2 positions: Flat, or 5KC cutoff. (20db per octave.) L.F. Cutoff Filter: 2 positions: Flat, or 50 cycles cutoff. (20db per octave.)

Loudness: Fletcher Munson compensation.

Tape Monitor: 2 positions: IN and OUT. For comparison of recorded tape with program source after recording.

Tuning: Flywheel tuning—no backlash.

Muting: 2 positions: IN or OUT for interstation noise suppression.

Level Set: Three left and three right controls. 2 for AUX, 2 for PHONO 1, and 2 for PHONO 2. These controls are located back of the front panel on the top of the MX 110.

AC Power—Concentric with BALANCE control: ON-OFF.

AUDIO ELECTRICAL SPECIFICATIONS

FREQUENCY RESPONSE

± ½db 20 to 20,000 cycles.

DISTORTION

Less than 0.2 % at rated output.

HUM AND NOISE

High-level inputs: 80dg below rated output. Low-level inputs: less than 3 microvolts at input terminals.

INPUT SENSITIVITY

AUX: 0.3 volt at 200K.
PHONO 1: 3 millivolts at 47K.
PHONO 2: 3 millivolts at 47K.
TAPE HEAD: 3 millivolts at 220K.
TAPE MONITOR: 0.3 volt at 100K.

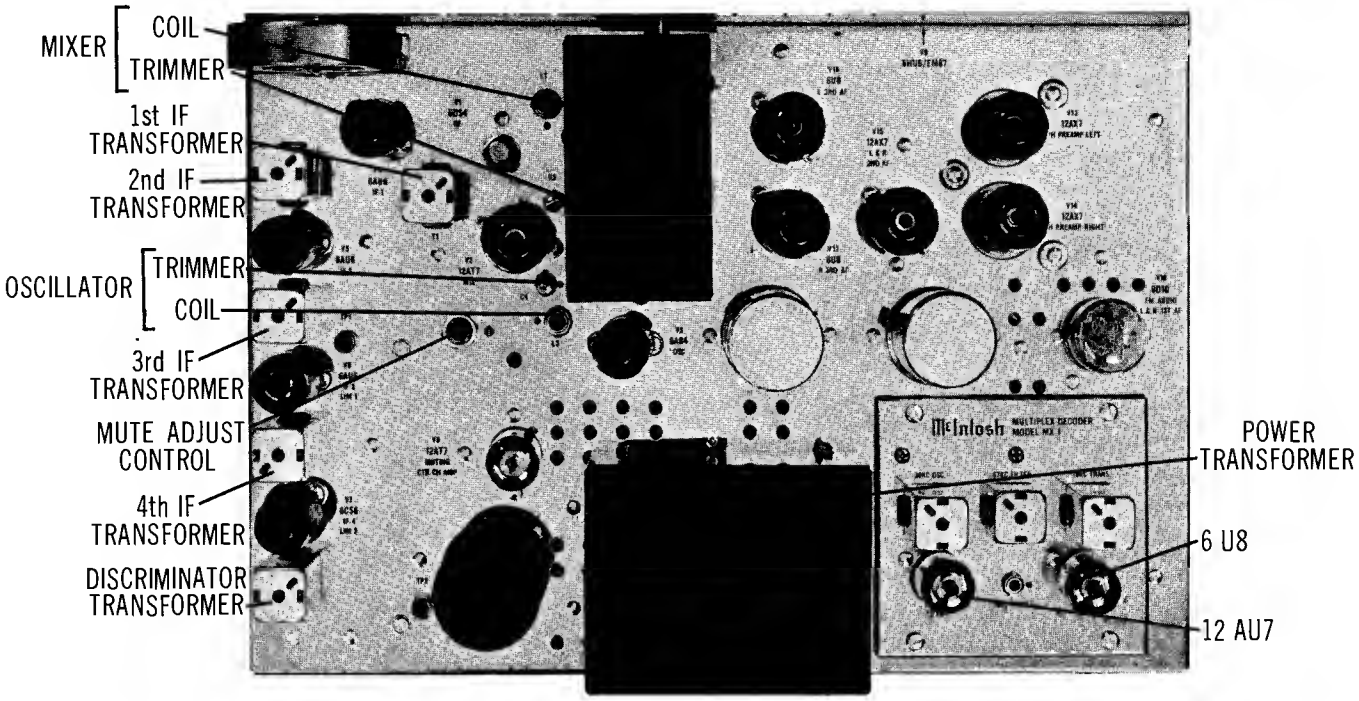
OUTPUTS

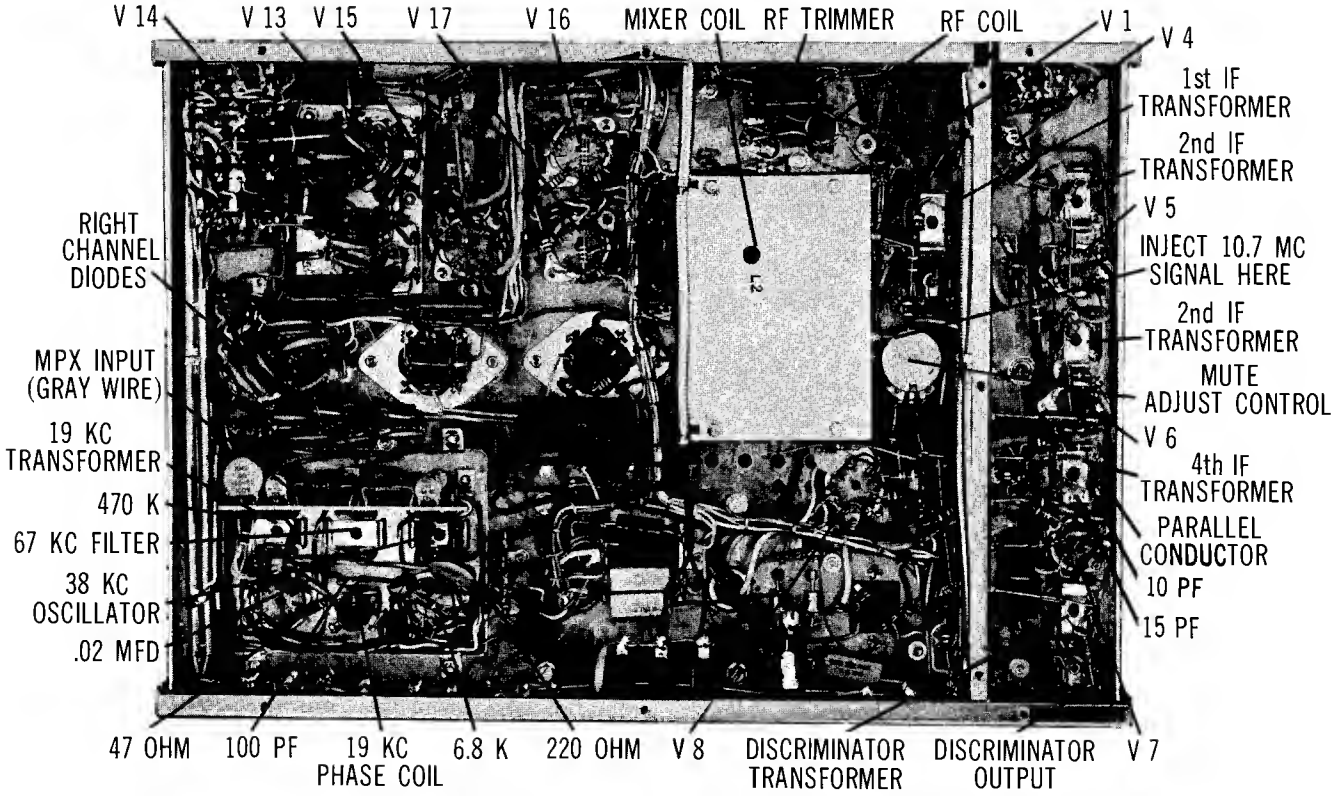
MAIN: 3 volts each channel.
L+R: 3 volts.
TAPE: From FM 0.9 volt.
PHONO is 0.9 volt for 9 millivolts cartridge.

POWER REQUIREMENTS: 105-125 volts AC 50/60 cycles; 75 watts.
FUSE: 1 amp. Slo-Blo.

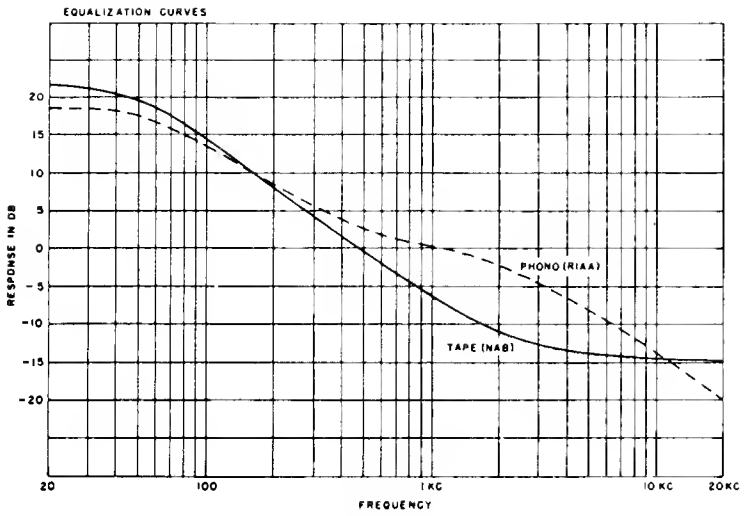
TUBE COMPLEMENT

1	6DS4	R.F.-1 amplifier (nuvistor)
1	12AT7	R.F.-2 Mixer
1	6AB4	Oscillator
1	6AU6	IF-1
1	6AU6	IF-2
1	6AU6	IF-3/Limiter 1
1	6CS6	IF-4/Limiter 2
1	12AT7	Muting/L+R Amplifier
1	6HU6/EM87	Tuning Indicator
1	6D10	FM AUDIO/Left and Right 1st Audio Amplifier
1	6U8	MPX Amplifier and 19KC Separator/Indicator control
1	12AU7	MPX 38KC Oscillator
1	12AX7	Phono Preamplifier Left
1	12AX7	Phono Preamplifier Right
1	12AX7	Left and Right 2nd Audio Amplifier
1	6U8	Left 3rd Audio Amplifier
1	6U8	Right 3rd Audio Amplifier
2	Diodes	Discriminator
1	Diode	Muting and Tuning Eye Detectors
1	Diode	AGC Clamp
4	Diodes	Balanced MPX Detectors
2	Diodes	Balanced Det. for Indicator Light

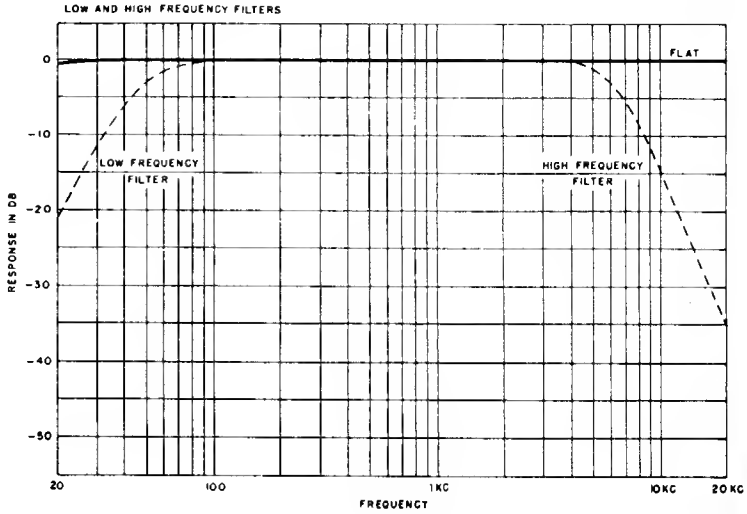

MIXER
COIL
TRIMMER
1st IF TRANSFORMER
2nd IF TRANSFORMER
OSCILLATOR
TRIMMER
COIL
3rd IF TRANSFORMER
MUTE ADJUST CONTROL
4th IF TRANSFORMER
DISCRIMINATOR TRANSFORMER
POWER TRANSFORMER
6 U8
12 AU7


V 14
V 13
V 15
V 17
V 16
MIXER COIL
RF TRIMMER
RF COIL
V 1
V 4
1st IF TRANSFORMER
2nd IF TRANSFORMER
V 5
INJECT 10.7 MC SIGNAL HERE
2nd IF TRANSFORMER
MUTE ADJUST CONTROL
V 6
4th IF TRANSFORMER
PARALLEL CONDUCTOR
10 PF
15 PF
RIGHT CHANNEL DIODES
MPX INPUT (GRAY WIRE)
19 KC TRANSFORMER
470 K
67 KC FILTER
38 KC OSCILLATOR
.02 MFD
47 OHM
100 PF
19 KC PHASE COIL
6.8 K
220 OHM
V 8
DISCRIMINATOR TRANSFORMER
DISCRIMINATOR OUTPUT
V 7

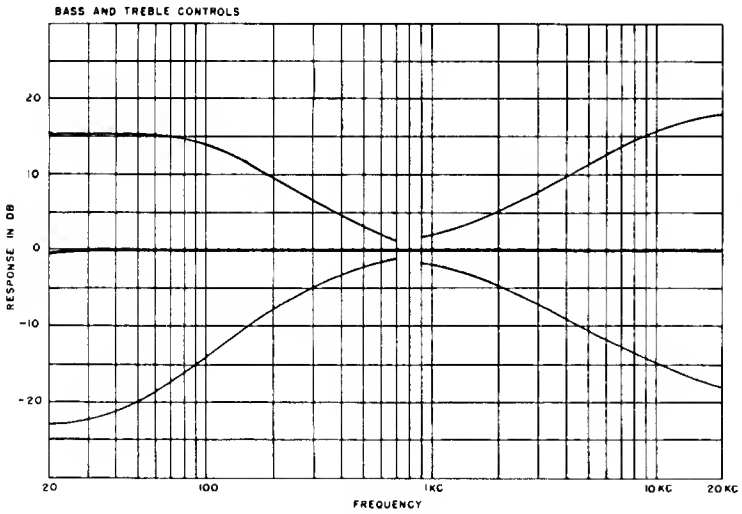
OPERATING CURVES
(MX 110)



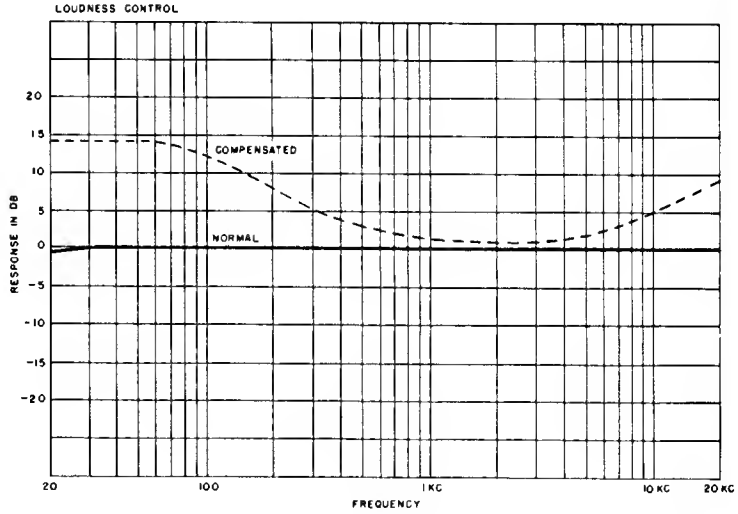
Equalization Curves.



L.F. Filter and H.F. Filter.



Bass and Treble Controls.



Loudness Control.

McIntosh
LABORATORY INC.
2 Chambers St., Binghamton, N.Y.

Made in U.S.A.

Phone—Area Code 607-723-5491

Design subject to change without notice.

Printed in U.S.A.

864500TC

McIntosh

DATE: NOVEMBER, 1965

MODEL NUMBER: MX110

MODIFICATION: Popping noise from the speakers when the switch controls on the MX110 are operated can be caused by "leaky" .1 MFD disc ceramic coupling capacitors.
Changing these capacitors to high insulation resistance mylar units will eliminate the problem. MX110 equipment built since April 1965 have this change.

PROCEDURE: Replacement of capacitors.

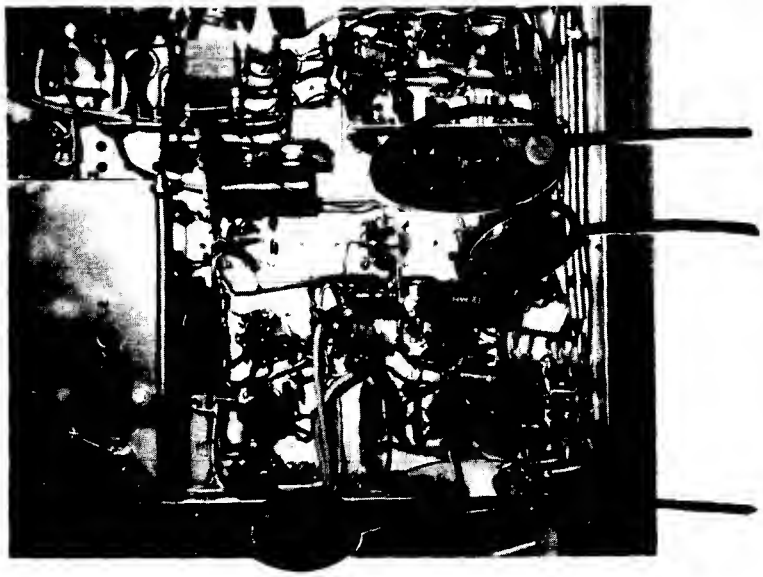
A. If a popping is heard when depressing the LF filter replace C 97 or C 98. They are located on the LF filter switch. The replacement part number is 064-027. (.1 mfd 40 v).

B. If a popping is heard when rotating the mode selector switch replace C 93 and C 95, or C 94 and C 96. The components are to be replaced with one 064-024. (.22mfd 40v). C 97 and C 98 may also cause popping.

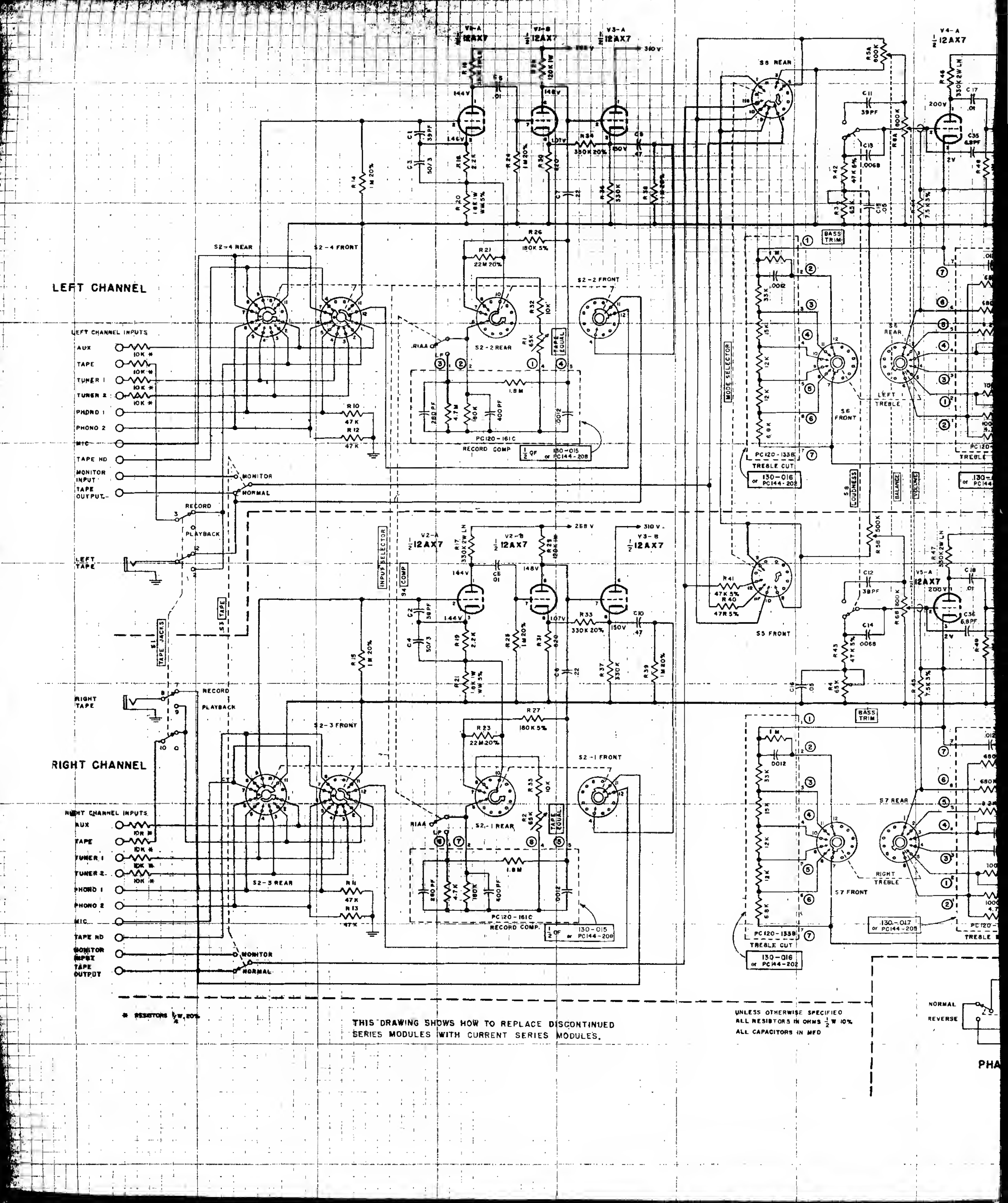
C. If a popping is heard when rotating the input selector switch between MPX and AUX or FM MONO, replace C 72, C 76, or C 52. Use 061-0455. (.02 mfd)

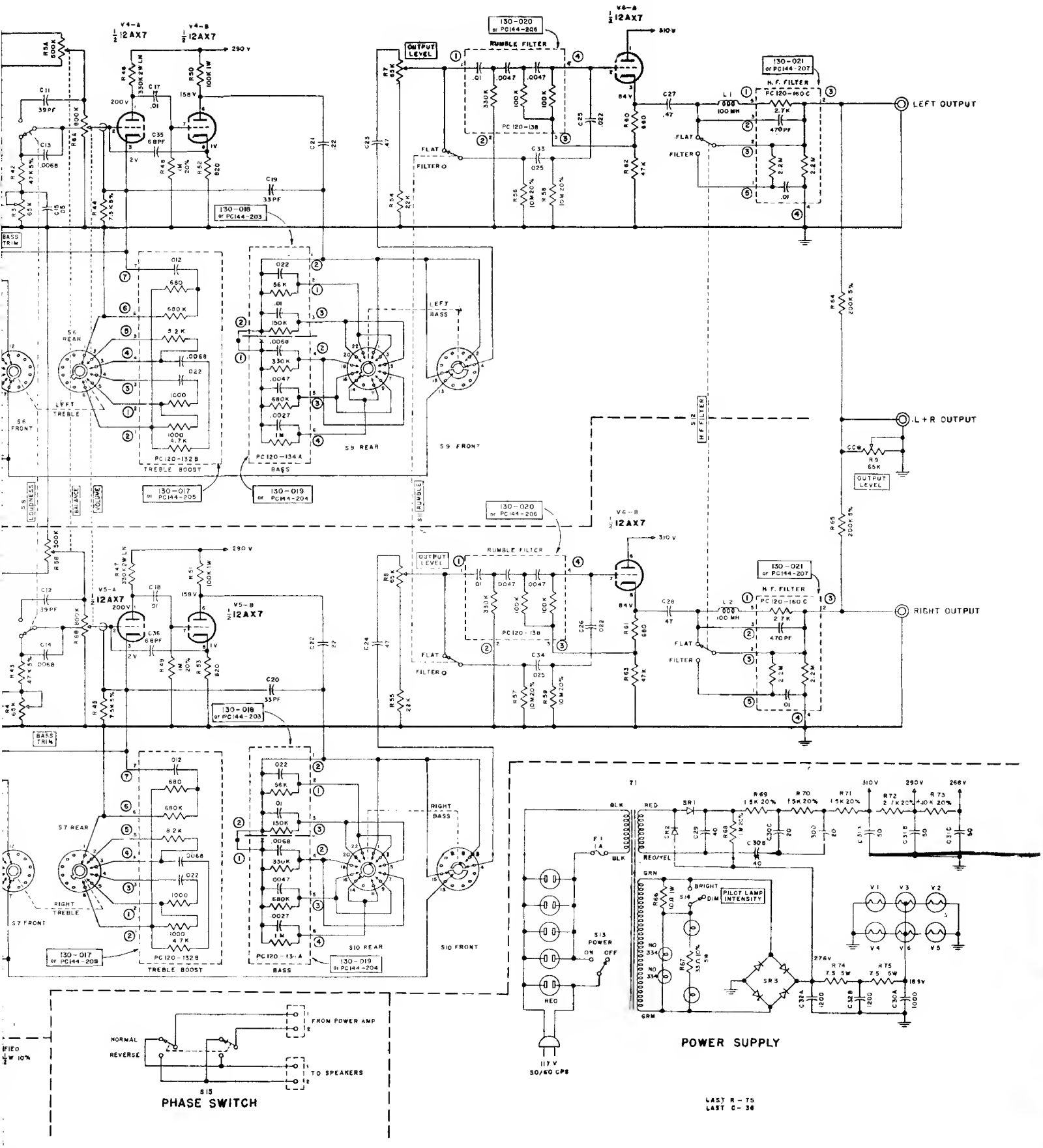
D. If a popping is heard when rotating the input selector switch to various positions, replace C 91 or C 92. Use 061-045. (.02 mfd).

E. If a high level of distortion is present on FM mono, replace C 54. Use 064-028. (.1 mfd 200 v).



NOTE: All of the above replacement parts should be acquired from McIntosh Lab.


LEFT CHANNEL
LEFT CHANNEL INPUTS
AUX
TAPE
TUNER 1
TUNER 2
PHONO 1
PHONO 2
MIC
TAPE HD
MONITOR INPUT
TAPE OUTPUT
RECORD
PLAYBACK
LEFT TAPE
RIGHT TAPE
RIGHT CHANNEL
RIGHT CHANNEL INPUTS
MONITOR
NORMAL
INPUT SELECTOR
MODE SELECTOR
TAPE EQUAL
RECORD COMP
PC120-161C
130-015 or PC144-208
PC120-133B
TREBLE CUT
130-016 or PC144-202
130-017 or PC144-205
BASS TRIM
LOUDNESS
BALANCE
VOLUME
LEFT TREBLE
RIGHT TREBLE
12AX7
310 V
268 V
NORMAL
REVERSE
* RESISTORS 1/4 W, 20%
THIS DRAWING SHOWS HOW TO REPLACE DISCONTINUED SERIES MODULES WITH CURRENT SERIES MODULES.
UNLESS OTHERWISE SPECIFIED ALL RESISTORS IN OHMS 1/2 W 10% ALL CAPACITORS IN MFD


LEFT OUTPUT
L+R OUTPUT
RIGHT OUTPUT
RUMBLE FILTER
H.F. FILTER
OUTPUT LEVEL
LEFT BASS
RIGHT BASS
LEFT TREBLE
RIGHT TREBLE
TREBLE BOOST
BASS
FLAT
FILTER
BASS TRIM
LOUDNESS
BALANCE
VOLUME
PILOT LAMP INTENSITY
BRIGHT
DIM
POWER SUPPLY
117 V 50/60 CPS
PHASE SWITCH
NORMAL
REVERSE
FROM POWER AMP
TO SPEAKERS
LAST R-75
LAST C-38

McIntosh

MODEL NUMBER: MX110 Z and X series. **DATE: JUNE 1966**

MODIFICATION: This modificotion eliminates both the "opening" of the tuning eye after warm up, ond the muting threshold change with tuner warm up.

The drift problem is corrected by replacing the IF transformer T 4. T 4 is replaced by o transformer of improved design. There ore several circuit modificotions thot must also be made.

Port of the chonge includes adding o potentiometer. This potentiometer ollows adjustment of the amount of tuning eye closure.

After the modification has been made it is necessary to align the IF tronsformer T 4, the tuning indicotor adjustment, and the muting odjustment control.

PROCEDURE:

1. Remove IF tronsformer T 4. Reploce this tronsformer with McIntosh port #162-029. Remove and do not connect bock into the circuit capacitor C 24 ond the small porollel leod capacitor that was between pins 1 and 4 on the transformer.
2. Reploce diode D2 with o new diode, McIntosh part #070-022.
3. Change R 33 from 100K to 47K 10% 1/2W. This is McIntosh part #136-180.
4. Remove the present muting control. Discard it. Instoll o duol control. (#134-168). The top of the duol control is re-wired os the previous muting control. The bottom of the control is the new control.
5. Connect the end contoct of the tuning indicator odjust control to the end contoct of R1.
6. Remove resistor R 35. Replace it with o short section of wire. Solder the wire to ground.
7. Disconnect the end of R 32 which connects to feed through copocitor C33. Connect this end of R 32 to the orm contact on the tuning indicotor odjust control. To moke this connection extend the leod on R 32. Use o short section of wire and spoghetti tubing.
8. Align ond odjust the MX 110 os follows: If proper olignment equipment is ot hond use procedure A. If limited test equipment is ovoiloble use procedure B.

   A) Switch the MX 110 muting control to the "out" position. Connect o 10.7MC signol to the grid of the first IF omplifier. Feed in enough signal to develop ot leost 10 volts ot test point 1 (TP-1). Turn the "tuning indicator adjust" control to mid position. Adjust T-4 top and bottom cores for moximum tuning indicotor closure. Then odjust the "tuning indicator adjust" control for 1/16" opening of the tuning eye.

   With the 10.7MC signal connected to the MX 110 check the odjustment of IF tronsformer T 5. Measure the DC voltage present ot test point 2 (TP-2). If this voltage measures more than $\pm$0.2 volts, adjust the top core on T 5 so the voltoge at TP-2 is zero. DO NOT ADJUST THE BOTTOM CORE OF T 5.

Next feed a 6 microvolt FM signal into the antenna terminals of the MX 110. Tune the MX 110 to the FM signal generator. Modulate the FM signal generator with a 400 cps or 1000 cps audio signal. Switch the muting switch to the "in" position. Adjust muting control R1 so the MX 110 output just starts to mute.

THIS COMPLETES THE ADJUSTMENT PROCEDURE.

IF YOU DO NOT HAVE TEST EQUIPMENT USE THE FOLLOWING ADJUSTMENT PROCEDURE.

B) Switch the muting switch to the "out" position. Connect a FM antenna to the MX 110. Tune in a strong local station. Connect a DC voltmeter to test point 2 (TP-2). Carefully tune the MX 110 tuning knob for zero volts at TP-2. Adjust the "tuning indicator adjust" control to mid position. Adjust T4 top and bottom cores for maximum tuning indicator closure. Then adjust the "tuning indicator adjust" control for 1/16" opening of the tuning indicator.

Next tune in a weak station. The station should have background noise but still be listenable. Switch the muting switch to the "in" position. Adjust the "muting adjust" control R1 so the MX 110 output just starts to mute.

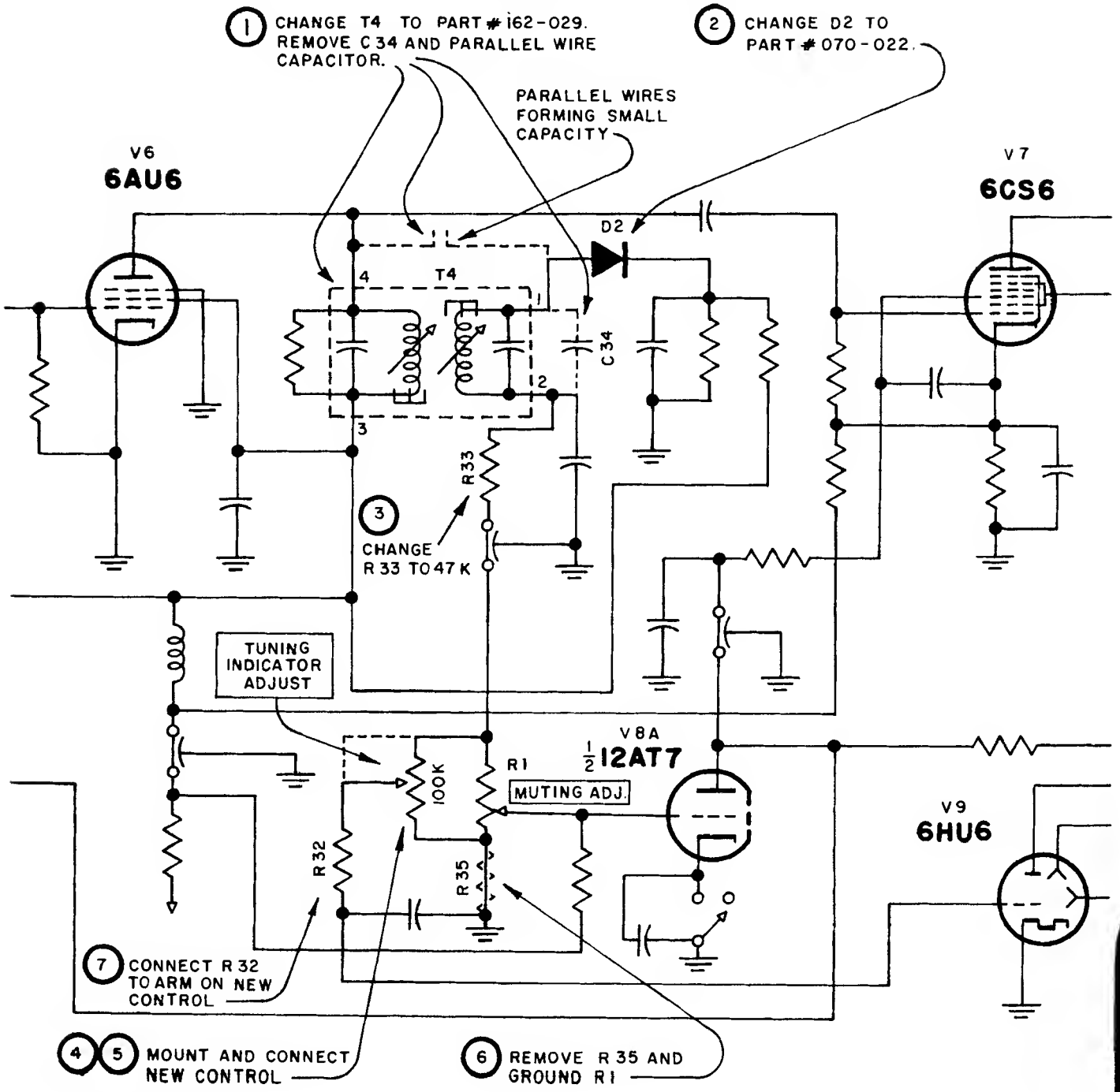
THIS COMPLETES THE ADJUSTMENT PROCEDURE.

PARTS NEEDED:

1 162-029 IF Transformer
1 070-022 Diode
1 136-180 47K Resistor
1 134-168 Control

McIntosh

PROCEDURE FOR MOUNTING "TUNING INDICATOR ADJUST" CONTROL



McIntosh

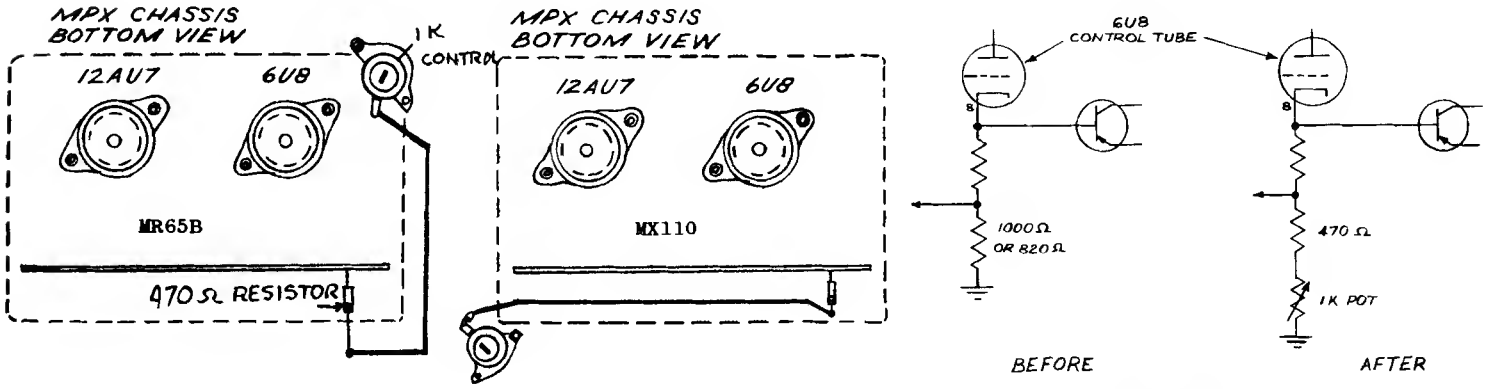
MODEL NUMBER: MR 65B, MX 110, MR 67 **DATE:** MARCH 1965

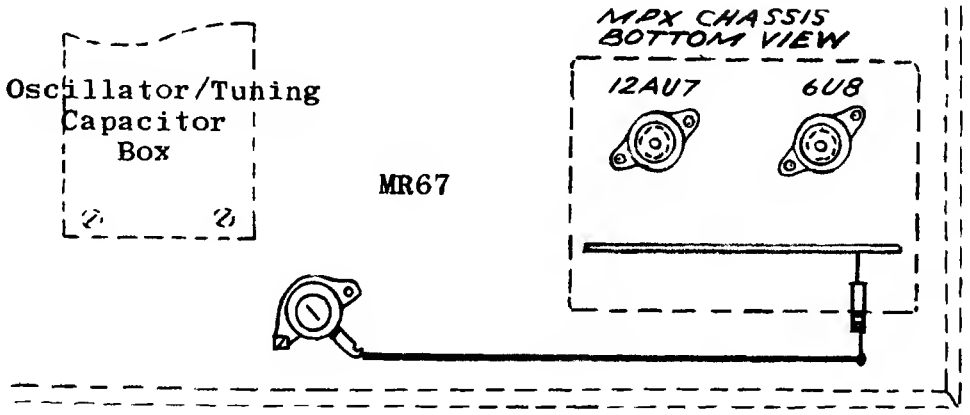
MODIFICATION: To allow adjust control for instant correction of tube and circuit variations. This will insure proper MPX indicator light operation.

PROCEDURE: This modification will allow you to adjust the MPX light on all tuners with ease. The reason for this modification is to allow simple field adjustment of varying tube and circuit characteristic.

MR 65B
and
MX 110 tuner/preamp.

1. Install 1K control (WC 807) to MPX chassis. Use the existing MPX chassis mounting screw.
2. Remove the 820 ohm or 1K ohm resistor. (cathode circuit of 6U8)
3. Solder one end of 470 ohm resistor to bottom hole nearest the chassis.
4. Connect a lead from other end of the resistor to the terminal lug on a 1K control.





1. Install 1K control to the tuner chassis under the existing screw as shown in the diagram.
2. Follow steps 2, 3, 4, as above.

TO ADJUST THE CONTROL: Tune to point of no station. Place mute to "IN" position. Turn control from full clockwise position to a point where the light just goes out.