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GENERAL INFORMATION M 350 STEREO FM RECEIVER

POWER REQUIREMENTS: 120VAC 60HZ
POWER CONSUMPTION: 30 Watts quiescent, 400 Watts maximum
DIMENSIONS: 17" (435mm) WIDE, 3.75" (95mm) HIGH,
13.5" (345mm) DEEP (including controls and connectors)
WEIGHT: 20 LBS. (9kg)

POWER AMPLIFIER SECTION M 350

FTC POWER OUTPUT: 50 Watts/channel (THD 0.4% or less), 20HZ to 20KHZ
into 8 OHM load
70 Watts/channel (THD 0.6% or less), 20HZ to 20KHZ
into 4 OHM load
DYNAMIC HEADROOM: 8 OHM load: 1.85dB
4 OHM load: 2.00dB
INPUT SENSITIVITY: 1.5V RMS for 50 Watts into 8 OHM load
SIGNAL TO NOISE: 120dB (1HF 'A' weighted)
INPUT IMPEDANCE: 10kOHM in parallel with 390pF
DAMPING FACTOR: Greater than 40
MODE: Non-inverting

PREAMP SECTION M 350

INPUT IMPEDANCE: Phono: 47kOHM in parallel with 100pF
Auxiliary: 40kOHM in parallel with 50pF
Tape: 40kOHM in parallel with 100pF
INPUT SENSITIVITY: FOR 1 WATT OUTPUT:
Phono: 2.5mV Auxiliary: 25mV Tape: 24mV
FOR 50 WATT OUTPUT:
Phono: 18mV Auxiliary: 180mV Tape: 180mV
SIG.+NOISE TO NOISE: Phono: -73dB Auxiliary: -95dB Tape: -95dB
('A' weighted measurements)
R.I.A.A. EQUALIZATION: Accurate to ± 0.35 dB from 20HZ to 20kHZ
INFRASONIC FILTER: 50HZ: 0dB 20HZ: -0.25dB 4HZ: -37.5dB
MAXIMUM INPUT SIGNAL: Phono: 70mV @1kHz Auxiliary: 5V RMS Tape: 5V RMS
PHASE MODE: Control amp: inverting Phono preamp: non-inverting

TUNER SECTION M 350

THRESHOLD, 50dB QUIETING: 40 μ V (37.3dBf) or less on stereo broadcast.
ULTIMATE SIG.+ NOISE TO NOISE AT 65dBf: Greater than 70dB on mono broadcast
Greater than 67dB on stereo broadcast
STEREO THRESHOLD: Less than 2.3 μ V
CAPTURE RATIO: Less than 2dB

ALTERNATE CHANNEL SELECTIVITY: Greater than 60dB

STEREO SEPARATION: Greater than 35dB @ 100HZ
 Greater than 45dB @ 1kHz
 Greater than 40dB @ 10kHz

AM REJECTION: Greater than 58dB

IMAGE REJECTION: Greater than 60dB

FREQUENCY RESPONSE: 20HZ - 10kHz 0.25dB 10kHz - 15kHz +0.5 to -1dB

SUPPRESSION OF 19kHz: Greater than 70dB

TOTAL HARMONIC DISTORTION: Less than 0.15% with stereo signal 100% modulated by
 1kHz signal

TEST EQUIPMENT REQUIRED TO PROPERLY SERVICE THE M 350 STEREO RECEIVER

1. FM GENERATOR: Sound Technology Model 1000A with Model 100 matching transformer
 (50 OHM to 300 OHM)
2. DISTORTION ANALYZER: Sound Technology Model 1700B or equivalent
3. DUAL TRACE OSCILLOSCOPE: Phillips Model 3226 or equivalent
4. RF VOLTMETER: Boonton Model 92B or equivalent
5. RMS VOLTMETER: Hewlett-Packard model HP400GL or equivalent
6. DIGITAL VOLTMETER: Data Precision Model 245 or equivalent
7. SIGNAL GENERATOR 10.7 MHZ WITH 400HZ, 100% FM MODULATION CAPABILITY, 50 OHM OUTPUT
8. FREQUENCY COUNTER: Monsanto Model 115A or Equivalent
9. AUDIO OSCILLATOR: KRONE-HITE Model 4100 or equivalent

ALIGNMENT PROCEDURE, AMPLIFIER SECTION, M350

- PREPARATION:
- 1) Remove top and bottom covers of the receiver (14 screws)
 - 2) Connect the "A" speaker outputs (left and right channels) across 8 Ohms 100 Watt non-inductive load resistors.
 - 3) Connect RMS Voltmeter, Distortion Analyzer and Dual Trace Oscilloscope across the loadresistors.
 - 4) Preset front panel controls as follows:

VOLUME: minimum	COPY 1/2: out
MODE SELECT: aux	LOUDNESS: out
BALANCE: midrange	TONE OUT: in
BASS: midrange	MUTING: out
TREBLE: midrange	SPKR A: in
MONITOR 1: out	SPKR B: in
MONITOR 2: out	MONO: out

- POWER SUPPLY CHECK: Turn power on and wait for protection relay to engage, which is a rudimentary confirmation of proper operation of the power supply and the power amplifier section.
- 1a) If "Power On" LED doesn't light up, troubleshoot main power supply.
 - 1b) If circuit breaker trips, remove power amplifier board (3 screws), and troubleshoot main power supply - rectefier - regulator ckt.
 - 2) Confirm presence of +40VDC, -40VDC unregulated supplies, -20VDC unregulated supply and +12VDC / -12VDC regulated supplies.

- OUTPUT BIAS:
- 1) Output bias adjustment is CRITICAL and should always be performed before unit is released to the consumer, and it is MANDATORY to perform if any transistors have been replaced on the power amplifier assembly
 - 2) Preset bias pots fully CCW, connect DC VOM across R632, R636, R732 and R736 resistors (0.33 Ohm emitter resistors), 200mV scale.
 - 3) Turn power on and confirm bias readings to be under 10mVDC. In case of excessive bias, troubleshoot the amplifier board with the output transistors disconnected.
 - 4) If bias is under 10mVDC with bias pots fully CCW, slowly advance bias pots to a reading of 20mVDC. The reading of all four emitter resistors must be within 3mVDC from each other.

- AMPLIFIER TEST:
- 1) Connect the output of the Audio Oscillator to the Auxiliary input of the amplifier, adjust generator for a 250mV 1kHz signal.
 - 2) Confirm clean waveform on both load resistors, with volume control of M 350 at $\frac{1}{4}$ of its range
 - 3) Advance M 350 volume control until top and bottom of signal starts clipping evenly on top and bottom. At this point the RMS VOM should be reading no less than 20.0VRMS with an 8 OHM load, or 23.6VRMS with a 4 OHM load.
 - 4) Decrease the input signal level about 10% so that signal clipping is eliminated. Observe reading of the Distortion Analyzer.
 - 5) Increase the Audio Oscillator frequency to 20kHz, adjust input signal level if necessary for an RMS VOM reading identical as noted in step 4. Observe reading of the Distortion Analyzer.
 - 6) Distortion Analyzer readings in steps 4 and 5 must not exceed 0.4% with an 8 OHM load or 0.6% with a 4 OHM load for each channel.

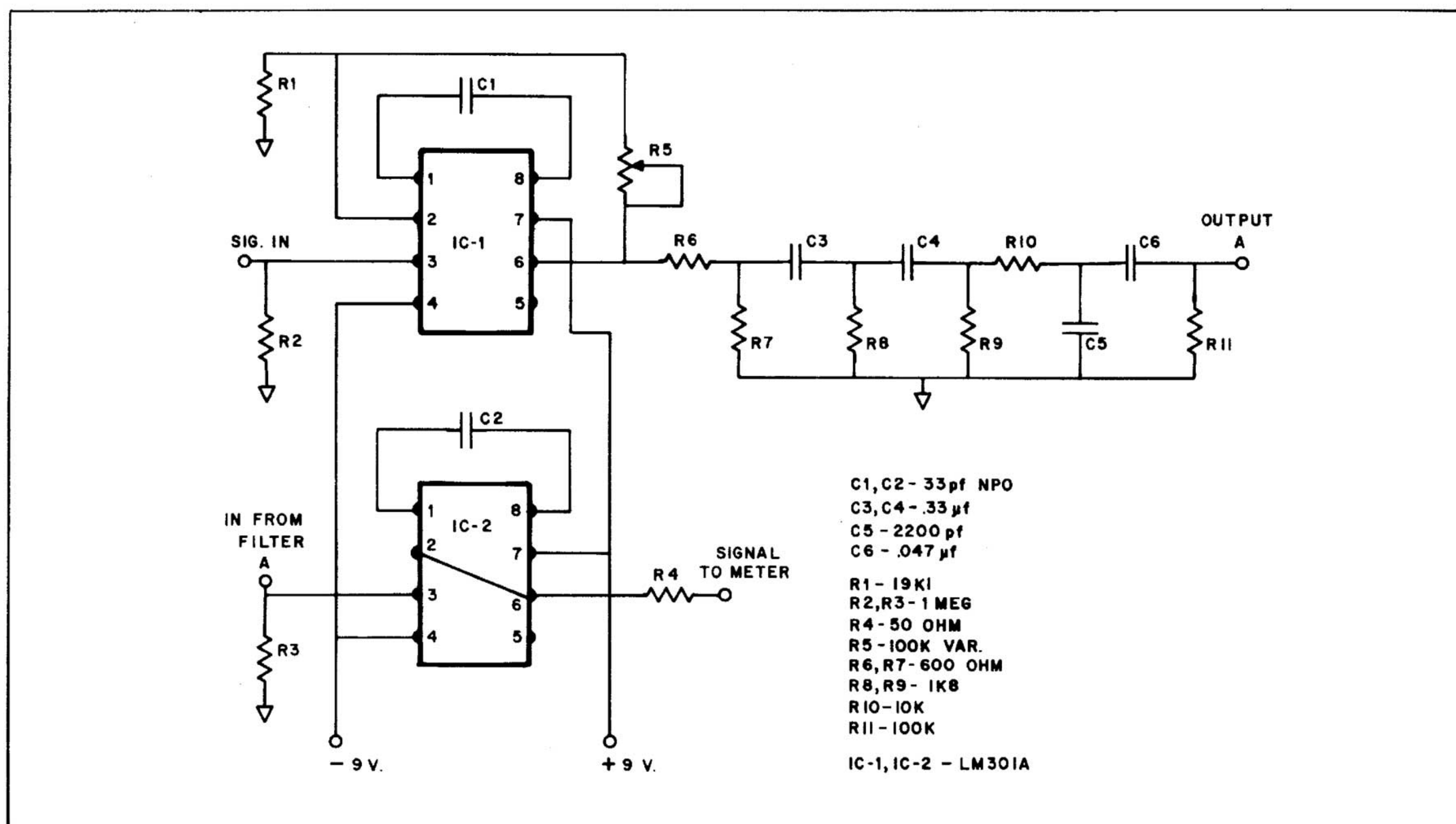
TESTING PROCEDURE, PHONO PREAMP SECTION, M 350

- PREPARATION:
- 1) MODE SELECT switch to "PHONO"
 - 2) Connect the output of the Audio Signal Generator to the phono inputs of the M 350. Adjust generator for 10mV 1kHz signal.
 - 3) Connect the Distortion Analyzer to the TAPE 1 OUT terminals of the M 350.

DISTORTION CHECK: Turn set on and observe a measurement of less than 0.02% THD.

- INPUT CAPABILITY:
- Connect scope to TAPE 1 OUT terminals and increase Audio Signal Generator output level to cause signal clipping.
- 2) The level of signal capable of causing clipping of signal must exceed 75mV at the input of the phono preamp.

- HUM AND NOISE:
- 1) Install shorting plugs into the phono inputs of the M 350.
 - 2) In order to get noise readings that are corresponding to actual noise levels perceived by the human ear, build the following "A" weighting network.



- 3) Connect the input of the weighting network to the TAPE 1 OUT terminal of the M 350, and connect the RMS VOM to the output of the weighting network.
- 4) Turn set on and measure hum and noise from each channel. Readings must not exceed 0.1mV, "A" weighted.

- PREPARATION:
- 1) MODE SELECT switch to "TUNER"
 - 2) Audio monitoring to be done at the TAPE 1 OUT jacks.
 - 3) Tests are performed at 100% modulation, except where otherwise noted.
 - 4) During testing and alignment, keep gate of Q16 FET grounded to defeat the FM MUTE circuit, except where otherwise noted (such as when depressing of MUTE switch is called for).
 - 5) Stereo and tuning indicator LED's (D8, D10, D12) must be in circuit during testing and alignment.

AUDIO FREQUENCY RESPONSE (DE-EMPHASIS TEST):

- 1) Inject an 80mV 400 HZ audio signal at the junction of L34 and R70. Left channel output level should be 1.0 VRMS \pm 100mV.
- 2) Maintaining the 80mV input level change the audio frequency to 10kHz. Confirm a 13.5 dB drop in the audio output level.
- 3) Repeat the steps described in 1 and 2 for the right channel, by injecting the signal at the junction of L38 and R74 and monitoring the right TAPE 1 OUT terminal.

MPX DECODER TEST AND ALIGNMENT:

- 1) With no signal applied to the receiver, connect the Frequency Counter to pin 10 of IC4 (19kHz test point) and turn power on. Adjust R62 to a reading of 19kHz \pm 20Hz. Remove counter.
- 2) Apply an 800mVpp composite stereo audio signal from the Stereo Generator to the junction of R50 and C68 (input of stereo de-modulator IC). Be sure to maintain the proper stereo pilot level (9% of total modulation). At this point the stereo indicator LED should be lit.
- 3) With the generator in the stereo LEFT ONLY mode with a 1kHz modulation, null the 19kHz component in the Right audio output by adjusting L38. Also confirm Right audio output to be a minimum of 30dB below the level of the Left audio output.
- 4) Repeat the procedure in step #3 with the generator in the RIGHT ONLY mode, and nulling the left channel 19kHz component by adjusting L34. Also confirm the Left audio output to be a minimum of 30 dB below the level of the Right audio output.

IF SENSITIVITY TEST AND INITIAL DETECTOR ALIGNMENT:

- 1) Connect a 10 μ V, 10.7MHz signal with 400 HZ modulation \pm 75kHz deviation, via a 0.01 μ F capacitor to the base of the 1st IF amplifier Q8.
- 2) Adjust L26 for maximum audio output (approximately 1.2VRMS) at the TAPE 1 OUT jack. Recovered signal must be noise-free (indicating full limiting).

LOCAL OSCILLATOR TEST AND CALIBRATION:

- 1) Preset core of oscillator coil L8 to midrange.
- 2) With no signal input, turn set on and measure the RF signal at the source of Q4 (MIXER FET). It should be between 250mV and 400mV.
- 3) Remove RF VOM and connect Frequency counter to the source of Q4. Adjust tuner dial of M 350 receiver to 92MHz. Adjust oscillator coil L8 until Frequency Counter reads 102.7 MHz. Remove counter.
- 4) With the receiver dial still at 92MHz, apply a 92MHz 1000 μ V 400 HZ mono test signal to the antenna input. Touch up L8 as necessary to tune in the 92MHz test signal at the proper point on the receiver dial.

- 5) Adjust the signal generator to 104MHZ and set the M 350 receiver dial to read 104 MHZ. Touch up oscillator tuning capacitor C25 as necessary to tune in the 104MHZ test signal at the proper point on the receiver dial.
- 6) Due to interaction between L8 and C24, repeat steps 4 and 5 until no further improvement is noted in accuracy of tuning.

RF ALIGNMENT:

- 1) Preset cores of L6 and L7 to midrange.
- 2) Tune receiver and signal generator to 92.0MHZ with 400HZ modulation. Reduce signal level until audio output becomes noisy.
- 3) Adjust L6 and L7 for maximum sensitivity.
- 4) Tune receiver and signal generator to 104.0MHZ with 400HZ modulation. Adjust signal level to receive noisy output signal. At this time adjust trimmer capacitors associated with L6 and L7 that are part of the ganged tuning capacitor assembly, for best sensitivity.
- 5) Due to interaction between the adjustments, repeat steps 2 through 4 until no further improvement is noted in the sensitivity of the receiver.

MIXER OUTPUT TRANSFORMER AND FINAL DETECTOR ALIGNMENT:

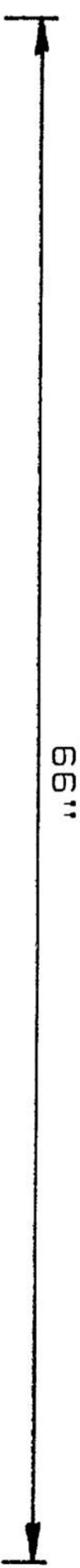
- 1) With the FM Generator in the dual sweep mode (600 kHz sweep), feed a 10uV 98 MHz signal to the receiver. Adjust the receiver tuning until the recovered audio signal displays equal periods of noise between the sweep lines, indicating perfect center-tune in the IF bandpass.
- 2) Without changing the tuning of the generator or the receiver, set the generator to MONO mode with 400HZ modulation. Reduce output of signal generator until noise appear in the recovered signal. At this time adjust T4 (Mixer Output Transformer) for best sensitivity.
- 3) Without changing tuning, increase generator output level to 1000uV. At this time touch up L26 for maximum recovered audio, and adjust L28 for minimum reading on the distortion analyzer.
- 4) Repeat touch up of L26 and L28 for maximum recovered audio and minimum distortion.
- 5) Measure the voltage difference between the collectors of Q26 and Q28. Adjust R82 for a reading of 0.0VDC. Confirm that both LED's are lit equally bright. Disconnect DVM.

STEREO SEPARATION ADJUSTMENT:

- 1) With the FM Generator in the Stereo LEFT ONLY mode modulated by a 1kHz signal, apply a 1000uV 98 MHz signal to the antenna terminal of the receiver, and tune in the test signal.
- 2) While monitoring the right output, adjust R46 for best separation. Note the amplitude of the right channel signal.
- 3) With the FM Generator in the Stereo RIGHT ONLY mode modulated by a 1kHz signal, note amplitude of the left channel signal.
- 4) If necessary, touch up R46 to to balance out the differences noted in steps 2 and 3 (left and right separation).

MUTE ADJUSTMENT AND TEST:

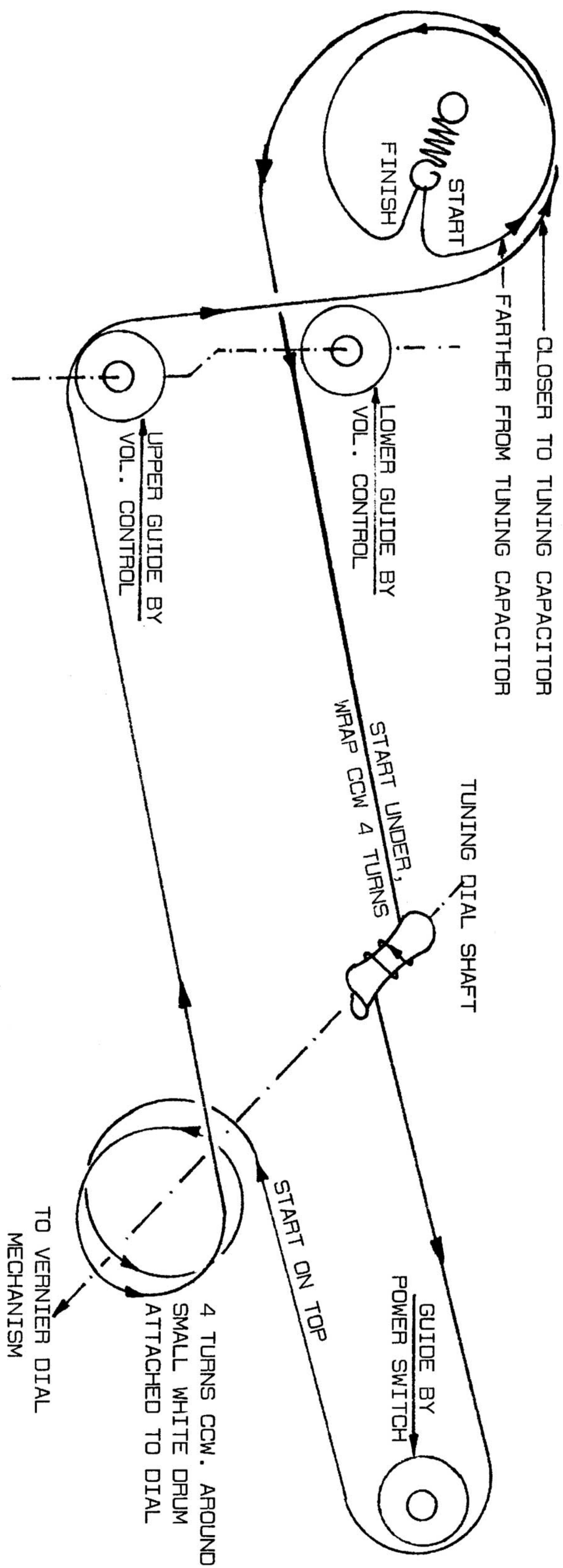
- 1) Switch FM Signal Generator to MONO mode and reduce signal level to get about 50dB signal to noise ratio (about 3uV).
- 2) Remove ground from gate of Q16 (FM MUTE FET).
- 3) Adjust R104 (Mute Threshold) to where the audio just mutes.
- 4) Increase and decrease the signal level repeatedly to confirm mute action at a signal to noise ratio around 50 dB. Touch up R104 as necessary.



1) PREPARE REPLACEMENT DIAL CORD: 

2) PRESET TUNING CAPACITOR 50% OPEN, PRESET TUNING DIAL TO 100 MHZ.

3) INSTALL DIAL CORD ACCORDING TO DIAGRAM BELOW:



- 4) TURN DIAL TO 106 MHZ. SLIP END TURN OF DIAL CORD INTO LOCKING SLOT ON SMALL WHITE DRUM.
- 5) ROTATE DIAL BACK AND FORTH FROM END TO END AND ADJUST DIAL CORD IN LOCKING SLOT TO SYNCHRONIZE ENDS OF DIAL WITH ENDS OF TUNING CAPACITOR RANGE.

DIAL CORD STRINGING, ADVENT M 350

PARTS LIST, POWER SUPPLY CIRCUIT, M 350

<u>SYMBOL</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
D 912, D 914, D 926	60 - 663 - 010	Rectefier -20V source
D 910	60 - 663 - 042	Bridge rectefier
IC 902	60 - 663 - 051	IC +12V regulator 0.5A
IC 904	60 - 663 - 052	IC -12V regulator 0.5A
D 902, D 904,	60 - 666 - 010	Power rectefier 6A/200V
D 906, D 908	60 - 666 - 010	Power rectefier 6A/200V
T 902	80 - 000 - 142	Main power transformer
S 902	50 - 263 - 070	Main power switch
CB 902		Circuit breaker 3.9A Hold/ 6.0A Trip

PARTS LIST, SPEAKER PROTECTION CIRCUIT, M 350

<u>SYMBOL</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
D 916, D 918, D 920	60 - 663 - 003	Diode, protection bias
D 922, D 924	60 - 663 - 003	Diode, protection bias
Q 902	60 - 674 - 038	Transistor, NPN, excessive drive detector
Q 904	60 - 674 - 003	Transistor, PNP, protection switch
Q 906	60 - 674 - 035	Transistor, PNP, turn-on delay timer
Q 908	60 - 674 - 040	Transistor, NPN, protection relay driver

PARTS LIST, PREAMP SECTION, M 350

<u>SYMBOL</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
Q 202, Q 204	60 - 674 - 009	Transistor, FET, phono preamp
Q 206, Q 208	60 - 674 - 009	Transistor, FET, phono preamp
IC 202, IC 302	60 - 677 - 111	IC, dual op-amp, phono equalizer
IC 402, IC 404	60 - 677 - 111	IC, dual op-amp, volume & tone buffer

PARTS LIST, POWER AMPLIFIER BOARD, M 350

<u>SYMBOL</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
D 608, D 708, D 610,	60 - 663 - 003	Diode, current source & protection bias
D 602, D 604, D 710,	60 - 663 - 003	Diode, current source & protection bias
D 702, D 704,	60 - 663 - 003	Diode, current source bias
D 606, D 706	60 - 663 - 003	Diode, current source bias
Q 602, Q 604, Q 606	60 - 674 - 039	Transistor, PNP, diff. input & curr. source
Q 702, Q 704, Q 706	60 - 674 - 039	Transistor, PNP, diff. input & curr. source
Q 610, Q 612	60 - 674 - 113	Transistor, NPN, predriver
Q 710, Q 712	60 - 674 - 113	Transistor, NPN, predriver
Q 614, Q 714	60 - 673 - 034	Transistor, NPN, bias regulator
Q 608, Q 708	60 - 674 - 037	Transistor, PNP, current source
Q 616, Q 716	60 - 674 - 113	Transistor, NPN, output driver
Q 618, Q 718	60 - 674 - 037	Transistor, PNP, output driver
Q 620, Q 720	60 - 674 - 028	Transistor, NPN, power output
Q 622, Q 722	60 - 674 - 029	Transistor, PNP, power output
Q 627, Q 724	60 - 674 - 038	Transistor, NPN, overcurrent detector

PARTS LIST, TUNER SECTION, M 350

<u>SYMBOL</u>	<u>PART NUMBER</u>	<u>DESCRIPTION</u>
T 2	60 - 623 - 137	Input matching transformer
Q 2	60 - 674 - 027	Transistor, FET, RF amplifier
Q 4	60 - 674 - 113	Transistor, FET, Mixer
Q 6	60 - 674 - 023	Transistor, NPN, Local Oscillator
T 4	80 - 000 - 132	Transformer, mixer output
Q 8, Q 10	60 - 673 - 079	Transistor, 1st & 2nd IF amplifier
CF 2, CF 4, CF 6	60 - 623 - 093	Ceramic filter, 10.7 MHz IF
IC 2	60 - 677 - 109	IC, FM demodulator
L 26, L 28	60 - 623 - 128	Coil, FM demodulator, tank & quadrature
Q 15	60 - 674 - 034	Transistor, FM Multiplex driver, NPN
Q 16	60 - 674 - 005	Transistor, FET, FM Mute switch
IC 4	60 - 677 - 112	IC, Stereo MPX decoder
IC 6	60 - 677 - 111	IC, dual op-amp, stereo demod. buffer
IC 8	60 - 677 - 113	IC, dual op-amp, tuning LED control
Q 18, Q 20, Q 22	60 - 674 - 034	Transistor, NPN, FM Mute detector
Q 24, Q 26, Q 28	60 - 674 - 034	Transistor, NPN, Tuning LED bias
D 2, D 3	60 - 663 - 088	Diode, Tuning LED window
C 10	60 - 629 - 010	Tuning capacitor, 3 section