

**SERVICE MANUAL**

# The Fisher®

# 234

## 4/2-Channel Stereo Receiver



WORLD LEADER IN HIGH QUALITY STEREO

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## REQUIRED TEST EQUIPMENT

The following test equipment is required to completely test and align the 234 Receiver.

- Line Voltage Autotransformer or Voltage Regulator
- AC DC Multimeter
- Accurately Calibrated AC Voltmeter
- Oscilloscope (Flat to 100 kHz Minimum)
- Low-Distortion Audio Oscillator
- Harmonic Distortion Analyzer
- CD-4 Generator (Fisher 3109 or equivalent)
- Frequency Indicator or Frequency Counter
- Four (4) Load Resistors, 8-ohms, 50 Watts (Minimum Rating)
- Low-Distortion AM-FM Signal Generator
- 10.7 MHz Sweep Generator, Fisher Model 3024 or equivalent
- 455 KHz Sweep Generator, Fisher Model 3025 or equivalent
- Multiplex Generator, Fisher Model 1536 or equivalent
- Two (2) RCA Shorting Plugs

**CAUTION:** This precision high-fidelity instrument should be serviced only by qualified personnel, trained in the repair of transistorized equipment and printed circuitry.

## CHASSIS PARTS LIST

Ref. Des.	Description	Part Number	Ref. Des.	Description	Part Number
	FRONT PANEL			Receptacle, AC	JK25009
R148A, B, C, D	Control, MASTER BALANCE	RP50160-312		Terminal strip, antenna	ET51459
	Dial Pointer, tuning	AP20508-1		Terminal strip, SPEAKERS	ET5130-2
	Dial glass	AS4119-111		Terminal strip, 15 RCA jacks	JK25007
	Dial cord pulley, metal (main)	AM51468		Voltage selector (export)	EA51449
	Hub for above (both items required)	AM51469		PRINTED CIRCUIT BOARDS	
	Dial cord pulley, plastic, smallest	E50549-2		Tuner, FM/AM/IF	PB2395-3
	Dial cord pulley, plastic, larger	E50540-3		Control Amp	PB2398-3
	Dress Panel	AA4119-111		Preamp/SQ	PB2381-2
	Jack (PHONES, RCDR OUT)	JK20627-5		Power Amp	PB2379-1
	Knob (TUNING)	EK20060-2		Power Supply	PB2380-2
	Knob (SELECTOR, VOLUME, TREBLE, BASS SPEAKERS)	EK20058-2		Dial lamp	PB2390-3
I901-908	Lamp, dial	LM21421-6		Decoder lamp	PB2395
				P.S. Rectifier	PB2401-1
I910	Lamp, pointer	LM21442-1		MISCELLANEOUS	
I101-104	Lamp, SQ, 4-C, 2-CH, MONO	LM21421-7		Cabinet	KK4130-215
CR508	L.E.D., STEREOBEACON	TR19001		Bottom cover for above	AA4130-116
M1	Meter, signal strength	MC21627-1		Foot for above	EM51492
	Clip for above	AB4130-123	C913, 914	Capacitor, electrolytic, 4700 UF, 35V	CE2237-2
	Tuning shaft assembly	AS20734		Cutout, thermal, 85°	SM51455
				Grille, plastic, ventilating	EA51406
	REAR PANEL		R143	Resistor, 270, 5%, 2W	RW200W271J
	AM ferrite loopstick antenna	LA51417-2	R807, 808	Resistor, 2.2, 5%, 15W, wire wound	RP15WA27
	Bracket for above	EA51464	R891-894	Resistor, 220, 5%, 2W, wire wound	RW200W221J
F801-804	Fuse (SPKR) 1A, 250 V, Slow Blow	FL51313-3	R895-898	Resistor, 100, 5%, 5W	RF500101J
F901	Fuse (POWER) 1½ A, 125 V, Slow Blow	FL51313-20	T1	Transformer, power, 120V	TD4130-115
F901	Fuse (POWER -- Export) ¾ A, 120 V, Slow Blow	FL51313-7	T1	Transformer, power (export) 240V	TD4120-215
	Fuseholder	EA51408			

Note: Chassis mounted components may also be listed on the parts list of the circuit with which they function electrically.

All resistors are deposited film 5%, ¼W unless otherwise noted.

## HARMONIC DISTORTION TEST

**CAUTION:** Limit the following tests to no more than ten minutes each. Use 8-ohm resistors with a minimum power rating of 50 watts when connecting a load across the speaker terminals. Connect a jumper wire across each of the speaker fuses while performing this test.

Control Settings: Unplug the AC power cord and set the front panel controls as follows:

BASS, TREBLE, and MASTER BALANCE controls to center positions.

SPEAKERS/POWER switch to AC OFF.

SELECTOR switch to AUX/CD-4

MODE SELECTOR "AUX/CD-4" pushbutton depressed.

LOUDNESS pushbutton out (not depressed).

VOLUME control to MIN.

## HARMONIC DISTORTION TEST

(CONTINUED)

### ONE CHANNEL DRIVEN:

- 1) Connect a low distortion Audio Oscillator to AUX IN FRONT LEFT jack. Set generator frequency to 1 kHz and output to minimum.
- 2) Connect an 8-ohm load resistor between FRONT SPEAKERS LEFT and COM terminals. Connect a Harmonic Distortion Analyzer and an AC VTVM in parallel across the 8-ohm load.
- 3) Connect the AC power cord and set the SPEAKERS/POWER switch to 4. Increase VOLUME control to MAX.
- 4) Increase Audio Oscillator output to 10 watts RMS (8.8 volts RMS across the 8-ohm load). The meter on the Harmonic Distortion Analyzer should read less than 1.0%.

- 5) Repeat steps 1 through 4 for FRONT SPEAKERS RIGHT, REAR SPEAKERS LEFT, and REAR SPEAKERS RIGHT channels.

### ALL CHANNELS DRIVEN:

- 1) Connect an 8-ohm load resistor across each of the SPEAKER output terminals.
- 2) Depress the MODE SELECTOR "MONO" pushbutton.
- 3) Check for distortion of 1.0% or less at 10 watts RMS (8.8 volts RMS) on each channel with all channels driven simultaneously.
- 4) Disconnect all test equipment. Remove the jumper wires installed at the beginning of the test.

## TUNER ALIGNMENT

FM ALIGNMENT – BASS, TREBLE, and MASTER BALANCE controls to center positions, SPEAKERS/POWER switch to PHONES position, MODE SELECTOR "2 CH" pushbutton depressed, SELECTOR switch to FM position, and VOLUME control to MIN position.

Maintain generator output as low as possible for suitable indication.

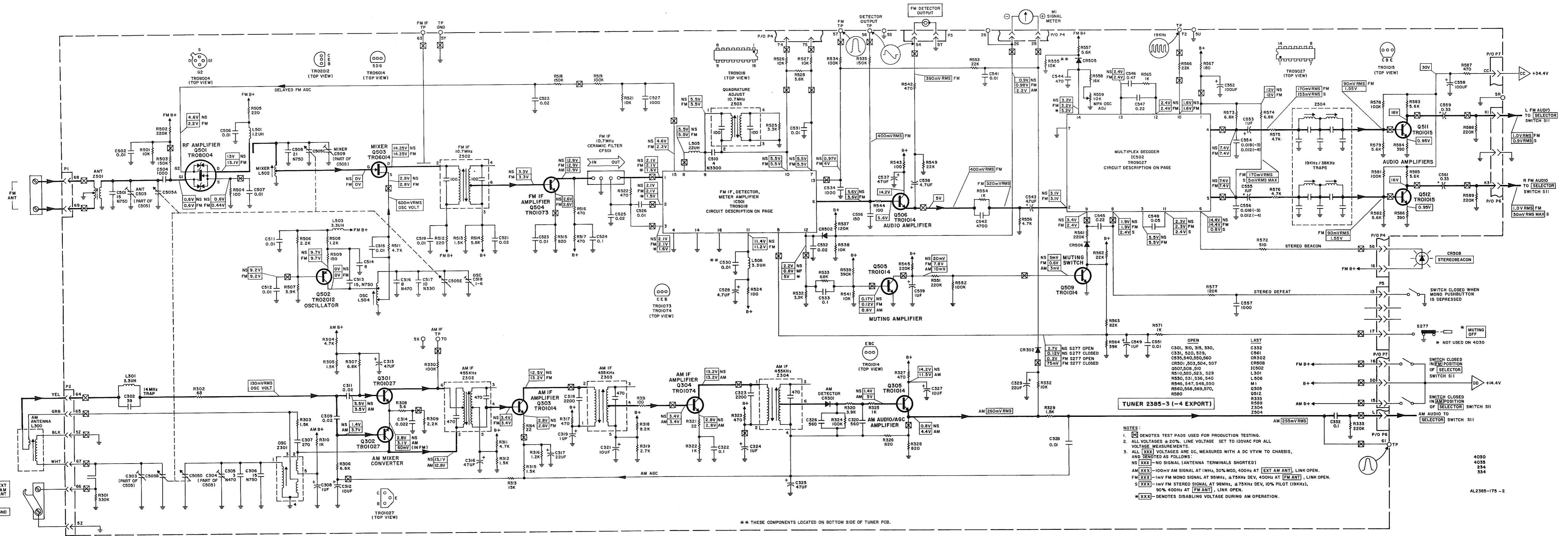
ITEM	GENERATOR	DIAL SETTING	INDICATOR	PROCEDURE
<b>Note:</b> The FM IF circuit utilizes a non-tunable ceramic filter which establishes the IF bandpass. To ensure symmetrical tuning and selectivity, the IF must be aligned precisely to the center of the filter bandpass, rather than to 10.7 MHz as in conventional LC circuits.				
1. FM IF ALIGNMENT	Connect 10.7 MHz Sweep Generator to pin 63, ground to pin 5Y. Markers are not required. Set generator output to -10 dB (300 mV).	Position of non-interference. Connect jumper from pin 26 to pin 5R on Tuner board.	Scope vertical input to pin 57, ground to pin 5U. Set vertical sensitivity to 0.5 V/cm.	Adjust Z502 top and bottom slugs for maximum gain and best symmetry. See figure for FM IF ALIGNMENT.
2. PRELIMINARY FM DETECTOR ALIGNMENT	Same as above. Adjust for S-curve display. Generator output to -20 dB.	Position of non-interference.	Scope vertical input to pin 58, ground to pin 5K.	Adjust Z503 top slug for maximum gain and best linearity. Adjust Z503 bottom slug for minimum gain and best linearity. See figure for FM DETECTOR ALIGNMENT. Remove jumper from between pins 26 and 5R on Tuner board.
<b>Note:</b> Connect 120-ohm composition resistors in series with each lead from the FM generator to match the 50-ohm output to the 300-ohm receiver input impedance. Generator output voltage is reduced to one-half at antenna terminals. Signal voltages specified in this table are generator output levels, not antenna voltages.				
3. FRONT END FM ALIGNMENT		Tuning knob fully counterclockwise.		Center dial pointer on "0" and cement.
4.	Connect FM generator to FM ANT terminals through 120-ohm resistors. Set to 90 MHz. Adjust output for approximately 2 on signal strength meter.	Center of 90 MHz calibration mark on dial.	Front panel signal strength meter.	Adjust L504, L502, and Z501 for maximum deflection on signal strength meter. Reduce generator output to keep meter indication at approximately 2.
5.	Set to 106 MHz.	Center of 106 MHz calibration mark on dial.	Front panel signal strength meter.	Adjust C503, C509, and C518 for maximum deflection on signal strength meter. Reduce generator output to keep meter indication at approximately 2. Repeat steps 4 and 5 for optimum alignment.

## TUNER ALIGNMENT

(CONTINUED)

ITEM	GENERATOR	DIAL SETTING	INDICATOR	PROCEDURE
6. FINAL FM DETECTOR ALIGNMENT (MINIMUM THD)	Set generator to receiver frequency. Modulate with 400 Hz ± 75 kHz deviation. Connect generator to FM ANT. terminals.	Tune receiver to position of non-interference.	Scope vertical input to OUT TO RECORDER-FRONT LEFT jack on rear panel.	Reduce generator output for noise to be visible on sine wave. Readjust generator frequency to center noise on positive and negative half cycles. See figure for SYMMETRICAL TUNING response. <b>Note:</b> Do not change generator or receiver tuning. Proceed with step 7.
7.	Same as above. Increase generator output to 2 mV.	Same as step 6.	AC VTVM and Harmonic Distortion analyzer to OUT TO RECORDER-FRONT LEFT jack on rear panel.	Adjust Z503 top slug for maximum audio output. Adjust bottom slug for minimum THD. (Typically 0.2%.)
8A. MPX OSC ADJUSTMENT	Same as step 7.	Tune receiver to FM signal generator frequency.	Connect frequency counter to pin 72.	Adjust R559 for indication of 19 kHz (±100 Hz).
8B. ALTERNATE MPX OSC ADJUSTMENT	Same as step 7.	Same as step 8A.	Scope vertical input to pin 72. Scope horizontal input to MPX generator 19 kHz pilot output.	Adjust R559 for a stable Lissajou display as shown in the figure for MPX OSCILLATOR ALIGNMENT.
<b>AM ALIGNMENT – BASS, TREBLE, and MASTER BALANCE controls to center positions, SPEAKERS/POWER switch to PHONES position, MODE SELECTOR "2-CH" pushbutton depressed, SELECTOR switch to AM position, and VOLUME control to MIN position.</b>				
Maintain generator output as low as possible for suitable indication.				
ITEM	GENERATOR	DIAL SETTING	INDICATOR	PROCEDURE
1. AM IF ALIGNMENT	455 kHz sweep generator to pin 70, ground to pin 5X.	Position of non-interference near 1400 kHz.	Scope vertical input to pin 61 ground to pin 5X. Set vertical sensitivity to 0.2 V/cm.	Connect a jumper between pin 67 and pin 5Z. Adjust Z302, Z303, and Z304 top and bottom slugs for maximum gain and best symmetry. Keep signal low enough for noise to appear on response as shown in the figure for AM IF ALIGNMENT. Disconnect jumper.
2. FRONT END AM ALIGNMENT	AM generator to EXT AM ANT. and GND terminals. Open GND link. Set to 600 kHz. Modulate with 400 Hz, 30% modulation.	Center of 600 kHz calibration mark on dial.	Front panel signal strength meter.	Adjust Z301 and L300 (antenna) for maximum signal meter indication. Reduce generator output to keep meter reading below 3.
3.	Set to 1400 kHz.	Center of 1400 kHz calibration mark on dial.	Front panel signal strength meter	Adjust C303 and C304 for maximum deflection. Keep meter reading below 3. Repeat steps 2 and 3 until optimum alignment is reached.

# TUNER SCHEMATIC





## TUNER PARTS LIST

Ref. Des.	Description	Part Number	Ref. Des.	Description	Part Number
C302	Ceramic, 39 pF, N330, 50V	CK22344-22	L504	Coil, FM OSCILLATOR	LC21833-1
C303, 304	P/O C505	-	L505	Choke, RF, 22 uH	L50848-18
C305	Ceramic, 3 pF, ±0.25 pF, N470	CK22346-4	M1	Meter, Signal Strength	MC21627-1
C306, 501, 513	Ceramic, 15 pF, 5%, 50V, N750	CK22344-2	Q301, 302	Transistor, NPN (A494/BF194)	TR01027
C307	Ceramic, 270 pF, 10%, 50V	CK22350-5	Q303, 305, 505, 506, 509	Transistor, NPN (BC239C)	TR01014
C308, 319, 324, 539, 549, 553, 555	Electrolytic, 1 uF, 50V	CE22342-2	Q304	Transistor, NPN (BF199)	TR01074
C309, 311, 521, 522, 525, 532	Ceramic, 0.02 uF, +80 -20%, 50V	CK22354-2	Q501	Transistor, Dual-Gate MOSFET	TR08004
C312, 321, 327	Electrolytic, 10 uF, 50V	CE22342-4	Q502	Transistor, PNP (SP871)	TR02012
C313, 316, 325, 537	Electrolytic, 47 uF, 16V	CE22342-8	Q503	Transistor, FET	TR06014
C314	Mylar, 2200 pF, 10%, 50V	CY22356-9	Q504	Transistor, NPN (BF198)	TR01073
C317, 329	Electrolytic, 22 uF, 35V	CE22342-6	Q511, 512	Transistor, NPN	TR01015
C318, 323	Polystyrene, 2200 pF, 5%, 33V	C51256-30	R301	330K	RF25DC334J
C320, 326	Ceramic, 560 pF, 10%, 50V	CK22350-9	R302	68	RF25DC680J
C322, 524, 533	Ceramic, 0.1 uF, +80 -20%, 50V	CK22354-3	R303, 305, 312, 315, 329, 513	1.5K	RF25DC152J
C328, 502, 506, 507, 511, 512, 515, 519, 523, 526, 528, 531, 541, 551	Ceramic, 0.01 uF, +80 -20%, 50V	CK22354-1	R304, 311, 511, 556, 575, 576	4.7K	RF25DC472J
C332	Mylar, 0.1 uF, 10%, 50V	CY22356-11	R306, 307, 573, 574	6.8K	RF25DC682J
C503	P/O C505	-	R308	5.6	RF25DC5R6J
C504, 527, 534, 557	Ceramic, 1000 pF, 10%, 50V	CK22350-12	R309, 506	2.2K	RF25DC222J
C505	Tuning Gang Assembly (A,B,C,D)	CV21015	R310, 322, 325, 554, 565, 571	1K	RF25DC102J
C508	Ceramic, 21 pF, 10%, 50V, N750	CK22345-15	R313	15K	RF25DC153J
C509	P/O C505	-	R314, 321	22	RF25DC220J
C510	Tubular, 4 pF, ±0.25 pF, N3300	CT22336-11	R316, 508	1.2K	RF25DC122J
C514	Ceramic, 8 pF, 5%, 50V, NPO	CK22344-5	R317, 323, 327, 516, 517, 522, 542, 587	470	RF25DC470J
C516	Tubular, 8 pF, 5%, N220	CT22336-13	R318	8.2K	RF25DC822J
C517	Tubular, 10 pF, 5%, N330	CT22336-14	R319	2.7K	RF25DC272J
C518	Trimmer, 1-6 pF	C50B938-5	R320, 507	3.9K	RF25DC392J
C528, 538, 543	Electrolytic, 4.7 uF, 50V	CE22342-3	R324, 330, 519, 534, 552, 578, 581	100K	RF25DC104J
C536	Ceramic, 150 pF, 10%, 50V	CK22350-2	R326, 328, 515	820	RF25DC821J
C542	Ceramic, 4700 pF, 10%, 50V	CK22347-22	R331, 504, 524, 543, 544	100	RF25DC101J
C544	Silvered Mica, 470 pF, 5%, 50V	CA22313-1	R332, 501, 521, 526, 527, 538, 541, 555	10K	RF25DC103J
C545, 547	Mylar, 0.22 uF, 10%, 50V	CY22356-12	R333, 502, 545, 551, 561, 588, 589	220K	RF25DC224J
C546	Sintered Aluminum, 0.47 uF, 20%	CS22340-4	R503, 518, 535	150K	RF25DC154J
C548	Polyester, 0.05 uF, 10%, 100V	CY22335-5	R505, 512	220	RF25DC221J
C552	Electrolytic, 100 uF, 16V	CE22342-12	R509	150	RF25DC151J
C554, 556	Polyester, 0.018 uF, 10%, 100V	CY22335-10	R514, 529, 557, 579, 582, 583, 585	5.6K	RF25DC562J
C558	Electrolytic, 100 uF, 35V	CE22342-10	R525, 532	3.3K	RF25DC332J
C559, 561	Tantalum, 0.33 uF, 35V	CL22305-9	R533	68K	RF25DC683J
CF501	Filter, Ceramic, 10.7 MHz	ZK22110	R537, 577	120K	RF25DC124K
CR301, 502	Diode, Germanium (AA119)	TR12001-4	R539	390K	RF25DC394J
CR302, 505, 506	Diode, Silicon	TR13006-2	R549, 553, 562, 566	22K	RF25DC223J
CR508	Light Emitting Diode (LED) - STEREOBEACON	TR19001	R558	16K	RF25DC163J
IC501	Integrated Circuit - FM IF	TR09018	R559	Variable, 10K, 20%	RV50150-23-V
IC502	Integrated Circuit - MPX DECODER	TR09027	R563	82K	RF25DC823J
L300	Antenna, AM Ferrite	LA51417-2	R564	39K	RF25DC393J
L301, 503, 506	Choke, RF, 303 uH	LC21814-2			
L501	Choke, RF, 1.2 uH	LC21822-2			
L502	Coil, FM MIXER	LC21833-2			

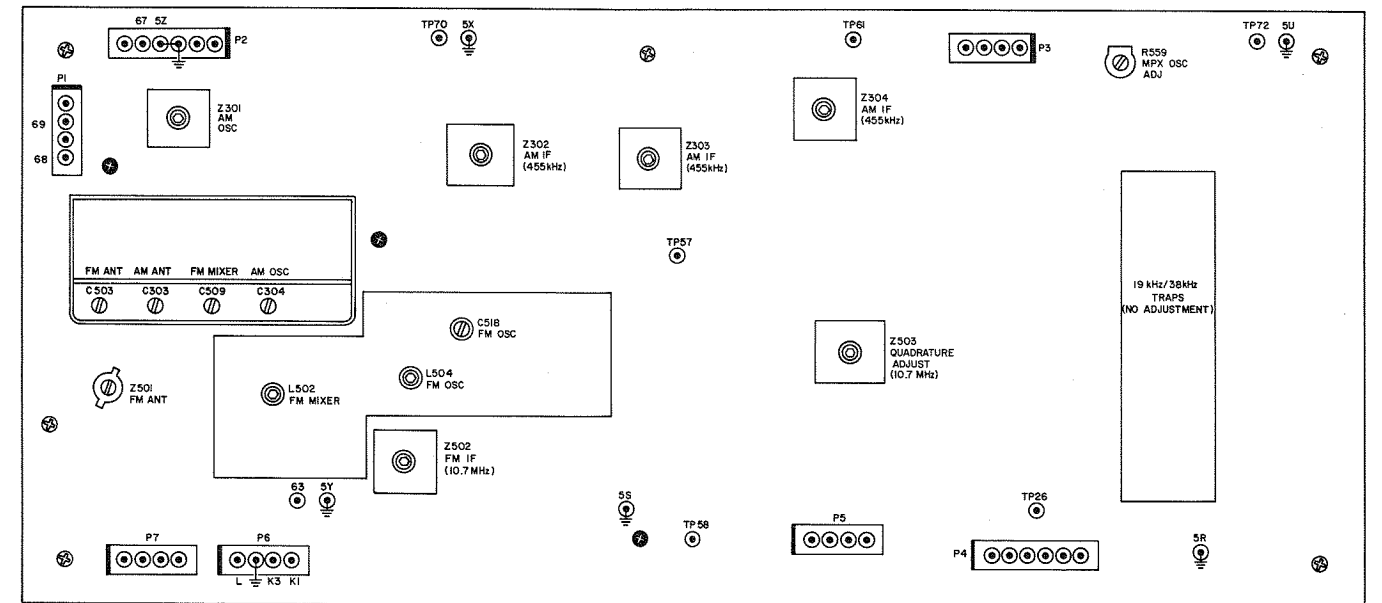
## TUNER PARTS LIST

(CONTINUED)

Ref. Des.	Description	Part Number	Ref. Des.	Description	Part Number
R567	180	RF25DC181J	Z304	Transformer, IF Output	ZZ50210-159
R572	Composition, 510, 5%, 1/2W	RC20BF511J	Z501	Coil, FM Antenna	LC21832
R584, 586	390	RF25DC391J	Z502	Transformer, FM IF	ZZ50210-146
S11	Switch, SELECTOR	SR4130-151	Z503	Transformer, FM IF	ZZ50210-180
Z301	Coil, AM Oscillator	ZZ50210-181	Z504	Filter, Dual Multiplex (FM ANT, EXT AM ANT)	ZZ50210-190
Z302	Transformer, AM IF Input	ZZ50210-161	-	Terminal Board, Antenna	ET51459
Z303	Transformer, AM IF Interstage	ZZ50210-156			

All resistors are deposited film, 5%, 1/4W unless otherwise noted.  
K = Kilohm

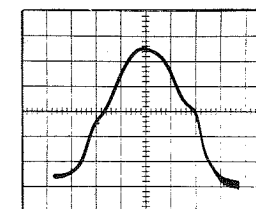
## TUNER BOARD LAYOUT



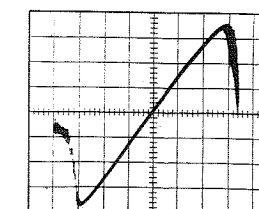
NOTE: CHASSIS GROUNDS ARE COMPLETED THROUGH MOUNTING SCREWS (⊙). TIGHTEN BEFORE ATTEMPTING ALIGNMENT.

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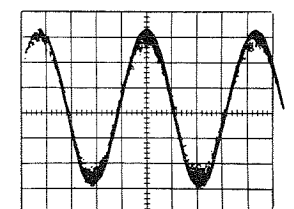
## TUNER ALIGNMENT WAVEFORMS



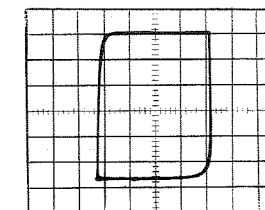
FM IF ALIGNMENT



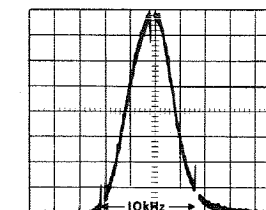
FM DETECTOR ALIGNMENT



SYMMETRICAL TUNING

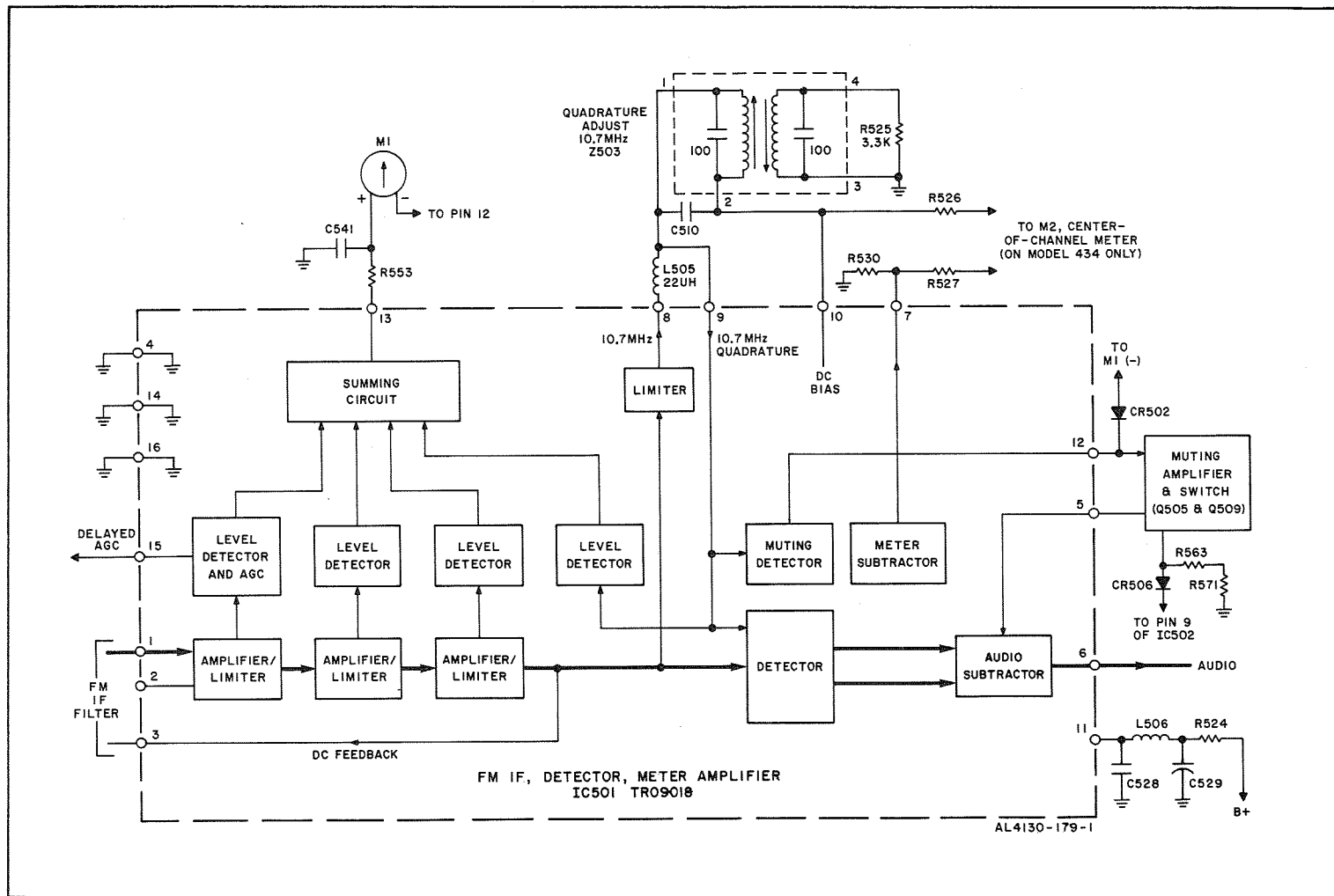


MPX OSC ADJUSTMENT



AM IF ALIGNMENT

## TUNER IC SIGNAL FLOW



## TUNER IC DESCRIPTION

### IF DETECTOR IC

The input from the IF filter is processed through three stages of amplification and limiting. The output of the third limiter is applied to a fourth limiter, and a balanced detector. The push-pull output from the detector is combined differentially in the subtractor stage to produce an audio output at pin 6.

The output from the fourth limiter is applied through L505 to tuned circuit Z503. At the exact center of the IF passband (nominally 10.7 MHz), Z503 is preset to provide a 10.7 MHz quadrature (90 degrees out-of-phase) signal to the detector. The phase of the signal from the tuned circuit changes proportionally with changes in the frequency of the IF signal. With no audio modulation, the inputs of the detector are in quadrature and the outputs of the detector are balanced. No differential signals appear at the outputs of the subtractor stages. When the frequency on the IF signal deviates from 10.7 MHz (as a result of audio modulation or station detuning), the de-

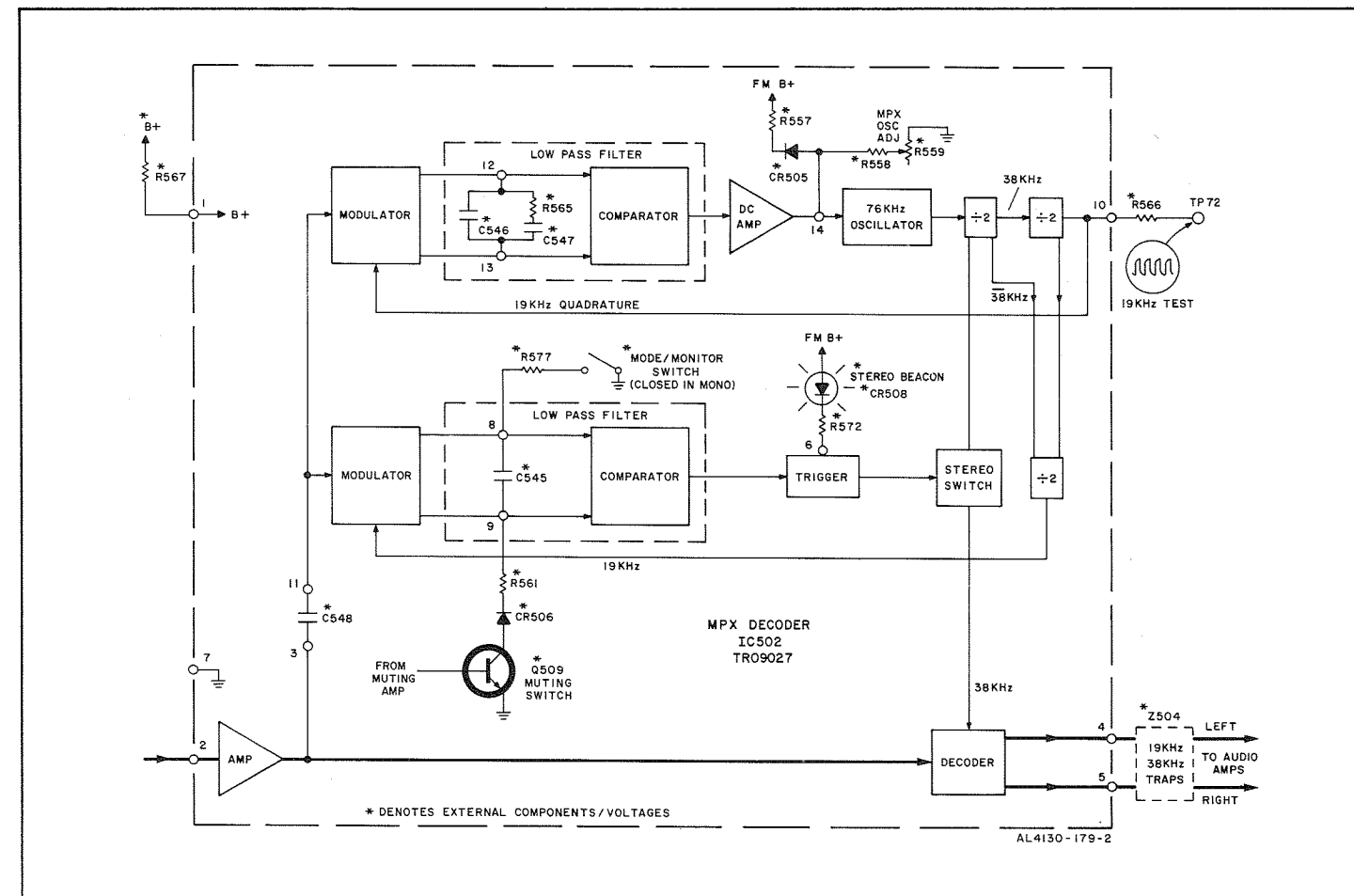
tector outputs are unbalanced and a differential DC signal appears at pin 6.

The muting detector (pin 12) monitors the envelope signal-to-noise ratio across the tuned circuit and feeds the detected noise to the muting amplifier and switch. Excessive noise in the signal generates a control voltage which is amplified and applied to pin 9 of IC502 to force the receiver into monophonic operation.

Level detectors monitor the IF signal levels at the three amplifier/limiter stages and at the tuned circuit. Each limiter, beginning with the last, saturates progressively as the input level increases. Rectified signals from the level detectors are summed and applied (pin 13) as a linear-log voltage to the signal strength meter.

An AGC voltage (pin 15) for the RF amplifier is obtained from the first level detector. This AGC voltage is delayed until the IF signal in the first amplifier approaches limiting.

## TUNER IC SIGNAL FLOW



## TUNER IC DESCRIPTION

### MPX DECODER IC

When the receiver is tuned to a stereo broadcast the composite audio fed to pin 2 consists of sum-and-difference signal information (L+R and L-R), and a 19 kHz pilot tone. The L+R information is in the form of normal audio. The L-R information is Amplitude Modulated on a suppressed 38 kHz subcarrier. (At the transmitter, the subcarrier is derived from the pilot tone through a frequency-doubler.) In order to extract the L-R information, it is necessary to regenerate the 38 kHz subcarrier and apply it, together with the composite signal, to the decoder. Left and Right channel information is then decoded by addition and subtraction of the L+R and L-R information. The top line of the block diagram shows the 38 kHz subcarrier regeneration loop. The 76 kHz oscillator output is processed through two frequency divider stages to furnish 38 kHz and 19 kHz outputs. The 19 kHz output is a quadrature (90° out-of-phase) signal which is applied to the modulator. When the composite input signal contains a 19 kHz pilot tone (stereo broadcast) the 19 kHz quadrature signal is phase-compared to the pilot signal and the resulting DC voltage fed through the DC amplifier to the oscillator, where it corrects the frequency. As a

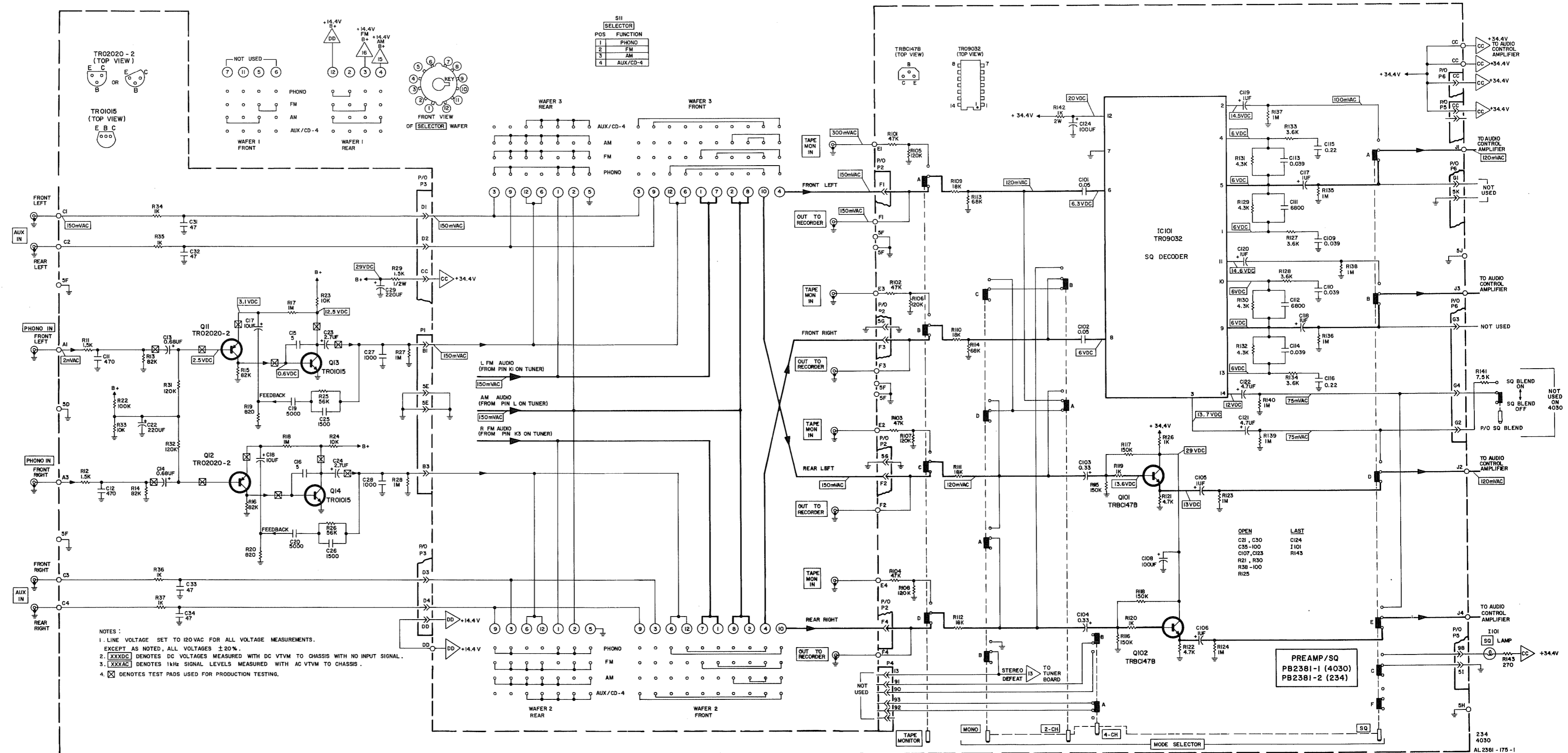
result, the oscillator is continuously phase-locked to the pilot signal. The setting of R559 determines the frequency of the free-running oscillator. With the oscillator phase-locked to the pilot, the 38 kHz output from the first divider is in the correct phase for decoding a stereo signal. The regenerated 38 kHz signal is fed to the decoder via a stereo switch. The stereo switch closes when a sufficiently large 19 kHz pilot tone is detected in the second modulator-comparator circuit. A third frequency divider stage, which processes signals derived from the first two dividers, returns a 19 kHz in-phase signal to the second modulator-comparator for pilot detection. The DC voltage derived from the second modulator-comparator circuit is applied to the trigger which activates the STEREO-BEACON indicator and the stereo switch.

The circuit is forced into the monophonic mode by grounding pin 8, or by applying a positive DC voltage to pin 9. With very low-level, noisy FM signals, a positive voltage from pin 12 of IC501 is amplified without change of polarity and applied to pin 9 of IC502 forcing the circuit into mono operation. During AM operation pin 14 is effectively grounded thus disabling the 76 kHz oscillator and eliminating interference.

PREAMPLIFIER/SQ PARTS LIST

Ref. Des.	Description	Part Number
C11, 12	Ceramic, 470pF, 10%, 50V	CK22350-8
C13, 14	Tantalum, 0.68uF, 35V	CL22305-2
C15, 16	Ceramic, 5pF, 5%, 50V	CK22344-1
C17, 18	Tantalum, 10uF, 10V	CL22305-12
C19, 20	Ceramic, 0.005uF, 20%, 50V	CK22349-2
C22	Electrolytic, 220uF, 35V	CE22343-29
C23, 24	Tantalum, 2.7uF, 35V	CL22305-4
C25, 26	Ceramic, 1500pF, 10%, 50V	CK22351-8
C27, 28	Ceramic, 1000pF, 10%, 50V	CK22358-12
C29	Electrolytic, 220uF, 16V	CE22342-15
C31, 32, 33, 34	Ceramic, 47pF, 10%, 50V	CK22345-9
C101, 102	Ceramic, 0.05uF, +80-20%, 100V	CK22362-4
C103, 104	Sintered Aluminum, 0.33uF, 25V	CS22340-3
C105, 106	Tantalum, 1.0uF, 35V	CL22305-3
C108, 124	Electrolytic, 100uF, 35V	CE22342-10
C109, 110, 113, 114	Mylar, 0.039uF, 5%, 50V	CY22356-16
C111, 112	Mylar, 0.0068uF, 5%, 50V	CY22356-2
C115, 116	Mylar, 0.22uF, 5%, 50V	CY22356-17
C117, 118, 119, 120	Sintered Aluminum, 1.0uF, 25V	CS22340-5
C121, 122	Sintered Aluminum, 4.7uF, 25V	CS22340-6
I101	Lamp (2187D), SQ	LM21421-7
IC101	IC, Four-Channel SQ Decoder	TR09032
Q11, 12	Transistor, 2N4250	TR02020-2
Q13, 14	Transistor, BC414C	TR01015
Q101, 102	Transistor, BC147B	TRBC147B
R11, 12	1.5K	RF25DC152J
R13, 14, 15, 16	82K	RF25DC823J
R17, 18, 27, 28, 123, 124, 135, 136, 137, 138, 139, 140	1M	RF25DC105J
R19, 20	820	RF25DC821J
R22	100K	RF25DC104J
R23, 24, 33	10K	RF25DC103J
R25, 26	56K	RF25DC563J
R29	1.5K, 1/2W, 5%	RF50DC152J
R31, 32, 105, 106, 107, 108	120K	RF25DC124J
R34, 35, 36, 37, 119, 120, 126	1K	RF25DC102J
R101, 102, 103, 104	47K	RF25DC473J
R109, 110, 111, 112	18K	RF25DC183J
R113, 114	68K	RF25DC683J
R115, 116, 117, 118	150K	RF25DC154J
R121, 122	4.7K	RF25DC472J
R127, 128, 133, 134	3.6K	RF25DC362J
R129, 130, 131, 132	4.3K	RF25DC432J
R141	7.5K	RF25BF752J
R142	Wirewound, 1K, 2W, 5%	RW200W102J
R143	Wirewound, 270, 2W, 5%	RW200W271J
S1	Switch, SELECTOR	SR4130-151
S101	Switch, MODE SELECTOR	SP50200-72-1
	Connector, 15 Jack (TAPE MON IN, OUT TO RECORDER, AUX IN, and PHONO IN)	JK25007

PREAMPLIFIER/SQ SCHEMATIC



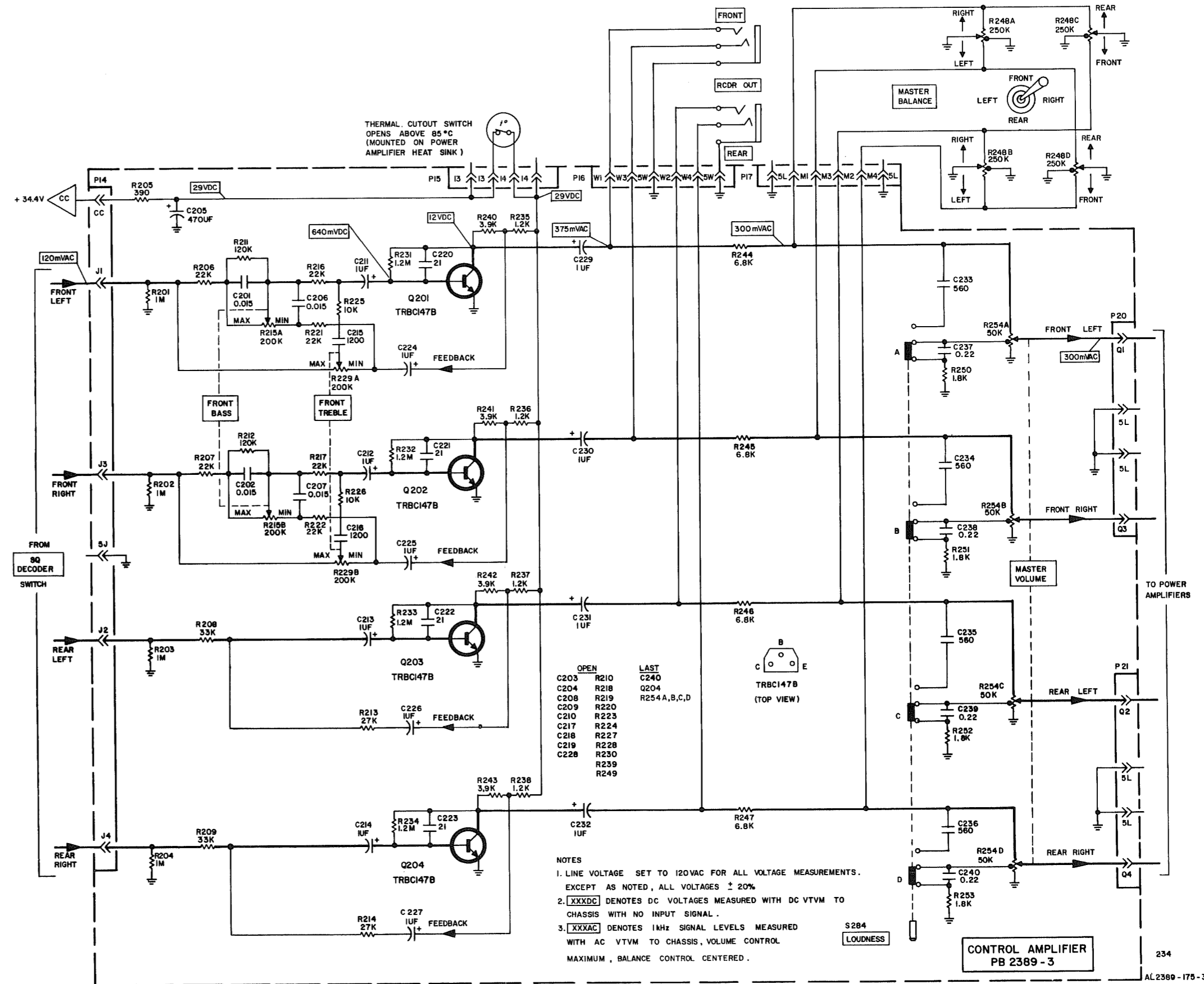
All resistors are Deposited Film, 5%, 1/4W unless otherwise noted.  
K = Kilohm, M = Megohm.

# AUDIO CONTROL AMPLIFIER SCHEMATIC

## AUDIO CONTROL AMPLIFIER PARTS LIST

Ref. Des.	Description	Part Number
C201, 202, 206, 207	Mylar, 0.015 UF, 10% 50V	CY22356-5
C205	Electrolytic, 470 UF, 35V	CE22343-34
C211, 212, 226, 227	Sintered Aluminum, 1 UF, 25V	C522340-5
C213, 214, 224, 225, 229 thru 232	Tantalum, 1 UF, 35V	CL22305-3
C215, 216	Ceramic, 1200 pF, 10%, 50V	CK22350-1
C220 thru 223	Ceramic, 21 pF, 5%, 50V, N470	CK22344-16
C233 thru 236	Ceramic, 560 pF, 10%, 50V	CK22350-9
C237 thru 240	Mylar, 0.22 UF, 10%, 50V	CY22356-17
Q201 thru 204	Transistor, BC147B	TRBC147B
R201 thru 204	1M	RF25DC105J
R205	390	RF50DC391J
R206, 207, 216, 217, 221, 222	22K	RF25DC222
R208, 209	33K	RF25DC333J
R211, 212	120K	RF25DC124J
R213, 214	27K	RF25DC273J
R215A & B, 229 A & B	Potentiometer, 200K (BASS, TREBLE)	RP50160-320
R225, 226	10K	RF25DC103J
R231 thru 234	1.2M	RF25DC105J
R235 thru 238	1.2K	RFDC122J
R240 thru 243	3.9K	RF25DC392J
R244 thru 247	6.8K	RF25DC682J
R248A, B, C, D	Potentiometer, 250K, MASTER BALANCE	RP50160-315
R250 thru 253	1.8K	RF25DC182J
R254A, B, C, D	Potentiometer, 50K, MASTER VOLUME	RP50160-311
S284	Switch, pushbutton, LOUDNESS	SP50200-77

All resistors are deposited Film 5%, 1/4W unless otherwise noted.  
K = Kilohm, M = Megohm.



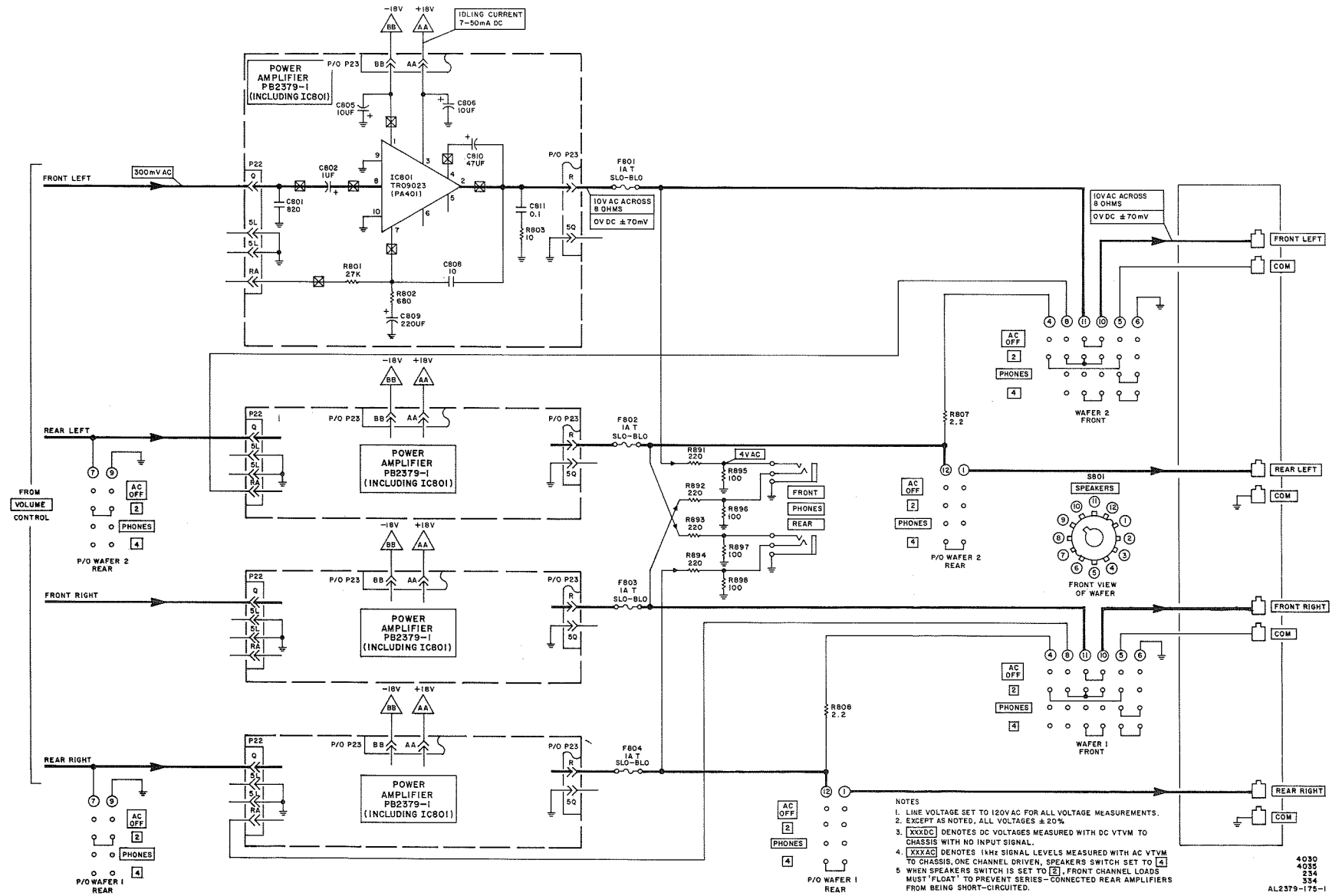


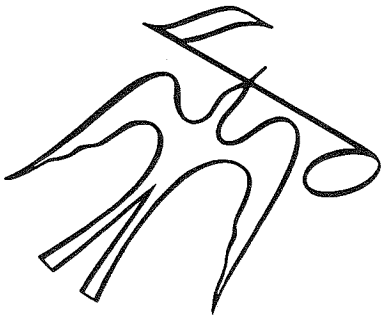
# POWER AMPLIFIER SCHEMATIC

## POWER AMPLIFIER PARTS LIST

Ref. Des.	Description	Part Number
C801	Ceramic, 820 pF, 10%, 50V	CK22358-11
C802	Sintered Aluminum, 1 uF, 25V	CS22340-5
C805, 806	Electrolytic, 10 uF, 50V	CE22342-4
C808	Ceramic, 10 pF, 50V	CK22360-3
C809	Electrolytic, 220 uF, 25V	CE22342-14
C810	Electrolytic, 47 uF, 35V	CE22342-7
C811	Ceramic, 0.1 uF, ±35%, 100V	C51163
IC801	IC, Power Amplifier (18W/8 )	TR09023
R801	27K	RF25DC273J
R802	680	RF25DC681J
R803	10, 1/2W	RF50DC100J
CHASSIS MOUNTED COMPONENTS		
F801, 802	Fuse, 1A, 250V, Slo-Blo	FL51313-3
803, 804	Wirewound, 2.2, 15W	RP15W2R2J
R807, 808	Wirewound, 220, 2W	RW200W221J
R891, 892, 893, 894	100, 1/2W	RF50DC101J
R895, 896, 897, 898		
S801	Switch, SPEAKERS/POWER	P/O SR4130-155
-	Jack, PHONES - FRONT, REAR	JK20627-5
-	Terminal Board, Speakers	ET51340-2
-	Washer, Insulator (IC801)	HW51419

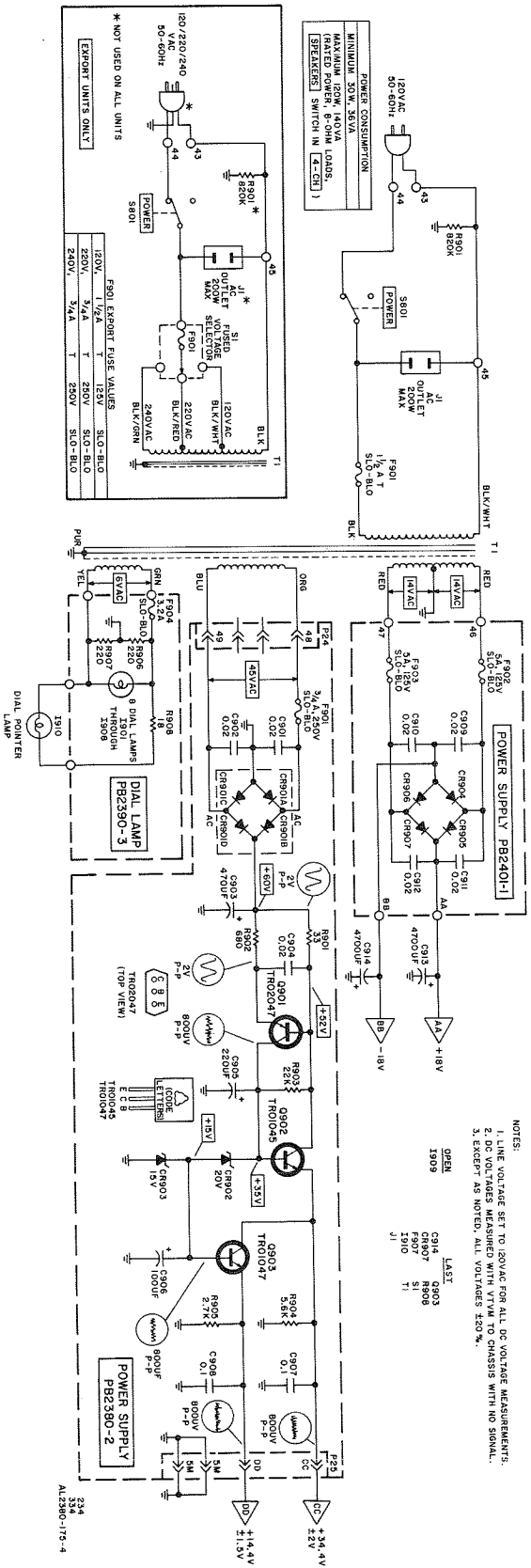
All resistors are deposited film, 5%, 1/4W unless otherwise noted.  
K = Kilohm





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### POWER SUPPLY/DIAL LAMP SCHEMATIC



NOTES:  
 1. LINE VOLTAGE SET TO 120VAC FOR ALL DC VOLTAGE MEASUREMENTS.  
 2. DC VOLTAGES MEASURED WITH V1VM TO CHASSIS WITH NO SIGNAL.  
 3. EXCEPT AS NOTED, ALL VOLTAGES ±20%.

### POWER SUPPLY/DIAL LAMP PARTS LIST

Ref. Des.	Description	Part Number	Ref. Des.	Description	Part Number
C901, 902, 904	Ceramic, 0.02 uF, ±20%, 500V	CK22359-3	F902, 903	Fuses (2), 5A, 125V, SiO-Bio	FL51313-10
C903	Electrolytic, 470 uF, 100V	CE22343-44	F904	Fuse, 3.2A, 125V, SiO-Bio	FL51313-14
C905	Electrolytic, 220 uF, 50V	CE22343-28	F901 thru	Lamp (2112D)	LM21421-6
C906	Electrolytic, 100 uF, 25V	CE22343-26	1908	Lamp, Pointer	LM21442-1
C907, 908	Mylar, 0.1 uF, 10%, 100V	CY22373-1	1909	Composition, 220, 10%, 1/2W	RC20BF221K
CR901	Bridge Rectifier, 1.5A, 200V	BR51400-1	R908	Composition, 18, 10%, 1/2W	RC20BF180K
(A,B,C,D)					
CR902	Zener, 20V, 5%, 1W	TR14002-4	CHASSIS MOUNTED COMPONENTS		
CR903	Zener, 15V, 5%, 1W	TR14002-2	C913, 914	Electrolytic, 4700 uF, 35V	CE22372-2
F901	Fuse, 3/4A, 250V, SiO-Bio	FL51313-7	F901	Fuse, 1-1/2A, 125V, SiO-Bio	FL51313-20
O901	Transistor, PNP	TR02047	F901	Fuse, 3/4A, 250V, SiO-Bio	FL51313-7
O902	Transistor, NPN	TR01045	J1	AC Outlet	JK25009
O903	Transistor, NPN	TR01047	R901	Composition, 820K, 10%, 1/2W	RC20BF824K
R901	Wirewound, 33, 5%, 5W	RMSW5330J	S1	Switch, SPEAKERS/POWER	P/O SR4130-155
R902	680	RF50DC681J	S1	Switch, Fused Voltage Selector	EA51449
R903	22K	RF50DC223J	T1	Transformer, Power	TD4130-115
R904	5.6K	RF50DC562J	TT1	Transformer, Power	TE4130-215
R905	2.7K	RF50DC272J			
C909, 910, 911, 912	Ceramic, 0.02 uF, ±20%, 500V	CK22359-3			
CR904, 905, 906, 907	Diode, Silicon, 5A, 200V	SID51169-2			

All resistors are deposited film, 5%, 1/4W unless otherwise noted.  
 K = Kiloohm  
 \*Used in Export Units