

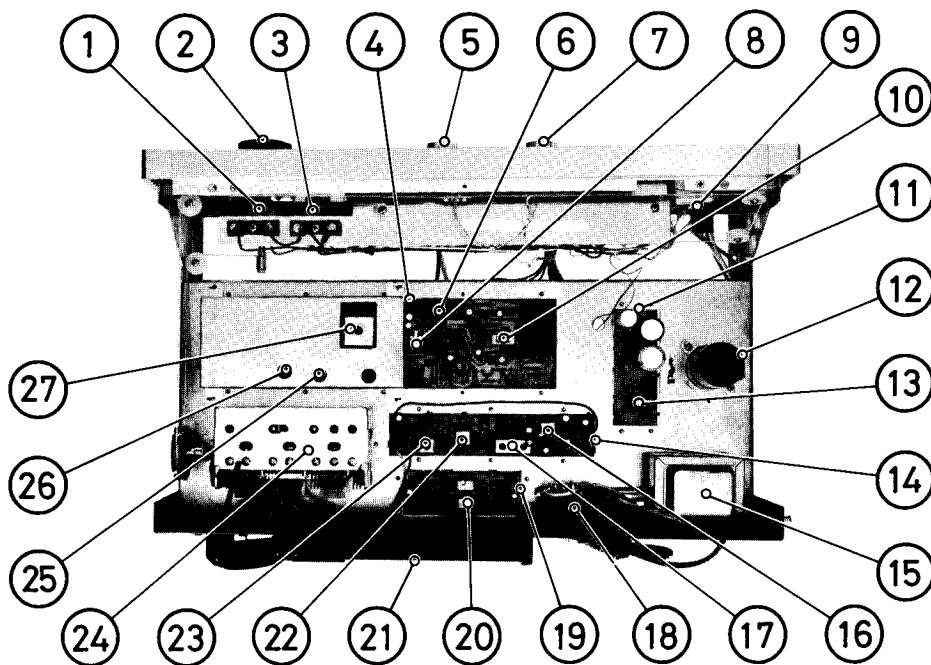
technical manual

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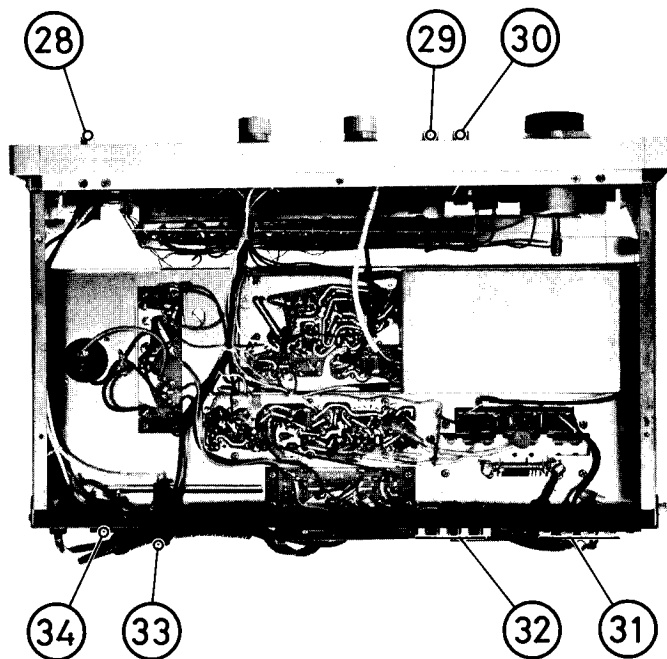
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CHASSIS LAYOUT

1. M001, FM Tuning Meter
2. Tuning Knob
3. M002, Signal Meter
4. FM IF & MPX Circuit Board
5. VR001, Muting Level Control
6. L301, MPX Coil, 19KHz & 38KHz Tune
7. S2, Selector Switch
8. VR301, FM-Stereo Separation Adj.
9. PL10, FM Stereo Indicator Lamp
10. S5, De-emphasis Switch
11. Rectifier Circuit Board
12. C002, Ripple Filter Capacitor
13. D902, Rectifier
14. AM Conv. & IF Amp. Circuit Board
15. T001, Power Transformer
16. T202, AM IFT (Det.)
17. T201, AM IFT (Bandpass Filter)
18. Voltage Selector
19. Audio Amp. Circuit Board
20. VR501, Output Level Control
21. L003, AM Antenna Coil
22. L202, AM OSC Coil
23. L201, AM RF Coil
24. AM/FM Front end
25. VR401, FM Signal Meter Level Adj.
26. VR101, Mono-Stereo Auto-Switch Level Adj.
27. T101, FM IFT (Ratio Det.)



28. S1, Power Switch
29. S3, Muting Switch
30. S4, MPX Fil. Switch
31. Antenna Terminal Strip
32. Output Jacks
33. F001, AC Fuse
34. AC Outlet



PRECAUTIONS

1. Always disconnect the chassis from power line when soldering. Turning the power switch OFF is not enough. Power line leakage passing through the heating element may destroy the transistors and IC.
2. Never attempt to do any work on the transistor amplifiers without first disconnecting the AC line cord and waiting until the power supply filter capacitors have discharged.

AM ALIGNMENT PROCEDURE

Instruments: AM Signal Generator and AC VTVM.

NOTES: Set Selector switch to AM position.

Input signal must be kept as low as possible to avoid AVC action.

Step	Generator		Tuning Dial Setting	Output Indicator Connected to	Adjust	Adjust for
	Coupling	Frequency				
1	Pin 5 (on AM IF board) through a 0.01 mfd capacitor.	455 KHz (400 Hz 30% Mod.)	Non interfering at low end of scale.	AC VTVM to Output jack.	T201 and 202 (on AM IF board)	Maximum reading on VTVM.
2	Connect to short loop of wire. Radiate signal into ferrite loop-stick antenna.	600 KHz (400 Hz 30% Mod.)	600 KHz		L202 (OSC) L201 (RF) (on AM IF board) and L003 (ANT)	
3		1400 KHz (400 Hz 30% Mod.)	1400 KHz		CT3 (OSC), CT2(RF) and CT1 (ANT) (on Front end)	
4	Repeat steps 2 and 3 until no further improvement is noticed.					

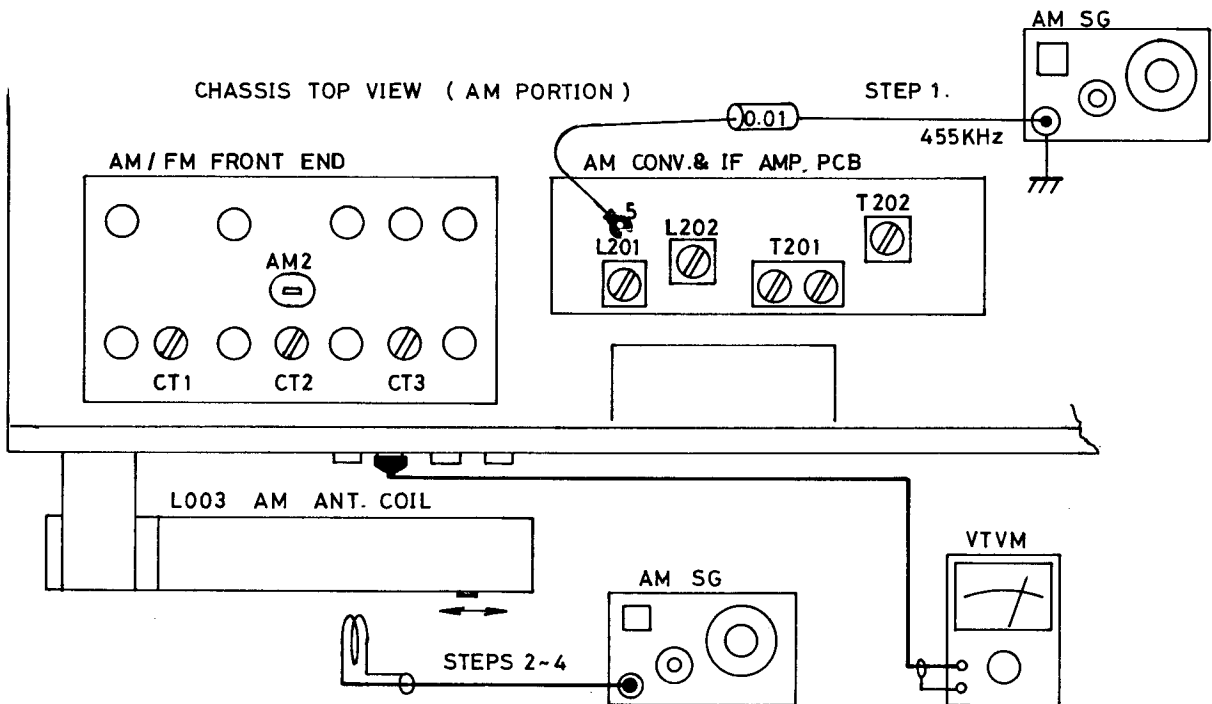


Figure 1. AM Alignment Hook-up

FM ALIGNMENT PROCEDURE

Instruments: FM Signal Generator, Oscilloscope and Distortion Analyzer.

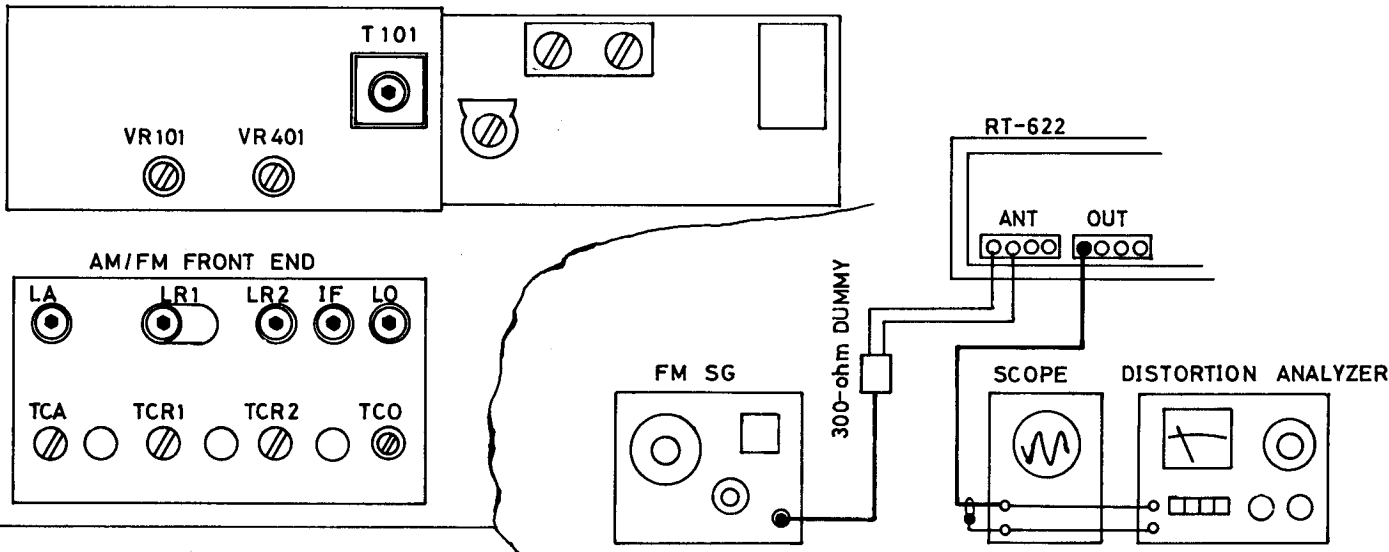
Set Selector switch to FM MONO, Muting switch to OFF and MPX Filter switch to OFF position.

Connect FM Signal Generator to FM antenna terminals.

Connect Oscilloscope and Distortion Analyzer to Output jack.

Step	Generator		Tuning Dial Setting	Adjust	Adjust for
	Sig. Strength	Frequency			
1	No signal input.		Quiet point on band.	T101 (on FM IF board) Top	Center of Tuning Meter (zero reading on Tuning Meter)
2	1 mV	98 MHz (400 Hz 100% Mod.)	Tune for Center of Tuning Meter	T101 Bottom	Minimum reading on Distortion Analyzer (minimum distortion).
3	1 mV → 0			T1 (on Front end) Top and Bottom.	
4	Repeat steps 2 and 3 until no further improvement is noticed.				
5	3μV	90 MHz (400 Hz 100% Mod.)	90 MHz	LO (FM OSC), LR2, LR1 (FM RF) and LA (FM ANT) coil (on Front end)	Maximum output and maximum I.H.F. sensitivity.
6		106 MHz (400 Hz 100% Mod.)	106 MHz	TC0 (FM OSC), TCR1, TCR2, (FM RF) and TCA (FM ANT) trimmer (on Front end)	
7	Repeat steps 5 and 6 until no further improvement is noticed.				

FM IF AMP & MPX DECODER PCB



CHASSIS TOP VIEW (FM PORTION)

NOTE Set the antenna input level (terminal voltage) to 1-mV by controlling the Signal Generator and adjust the potentiometer VR401 so that the Signal Meter indicates toward "8" on the scale.

Figure 2. FM Alignment Hook-up

FM-STEREO (MPX) ALIGNMENT PROCEDURE

NOTE: The FM IF Alignment must be completed before attempting this FM MPX Alignment.

Poor IF alignment will result in poor FM MPX Adjustment.

Set Selector switch to FM STEREO, MPX Filter switch and Muting switch to OFF position.

Connect FM Stereo Generator to FM antenna terminals.

Set Separation Adj. VR301 (on FM IF board) to mid-poistion before starting this procedure.

Step	Stereo Generator		Output Indicator Connected to	Adjust	Adjust for
	Modulation	RF Deviation			
1	19 KHz Pilot only	1 – 2%	VTVM & Oscilloscope to Test Point (Pin No. 18)	L301	Maximum reading on VTVM.
2	Composite 1 KHz signal to Left chan- nel only.	Pilot 10% Signal 70%	VTVM & Oscilloscope to Left channel Output jack.	L301 (Back core)	Maximum and un- distorted sine wave on scope.
3	Composite 1 KHz sig- nal to Right channel only				
4	Same as in Step 2		VTVM & Oscilloscope to Right channel Output jack.		
5	Repeat steps 3 and 4 until no further improvement is noticed.				

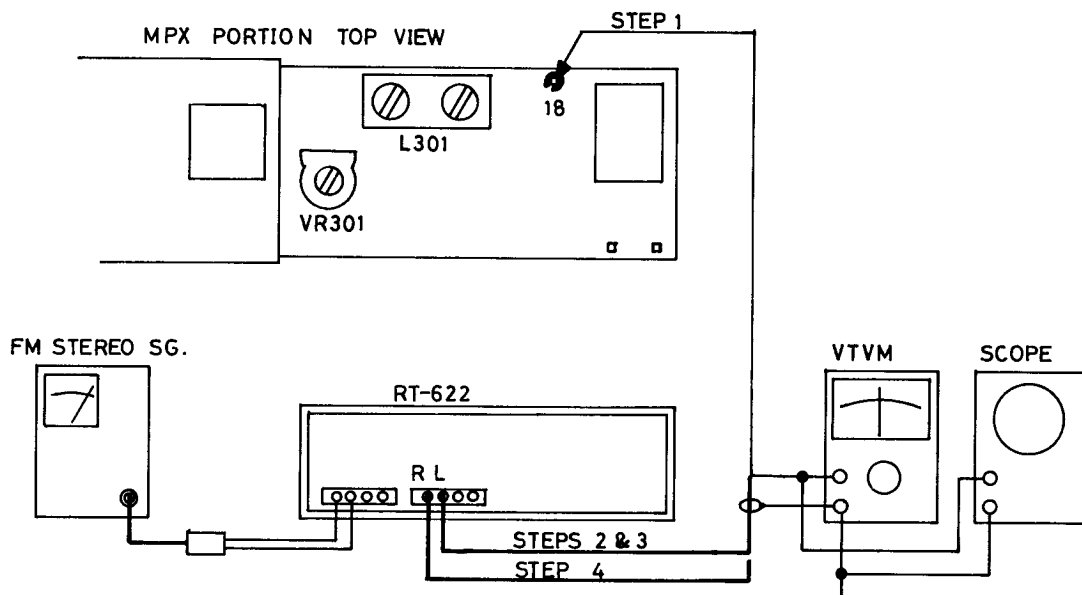


Figure 3. MPX Alignment Hook-up

FM MONO-STEREO AUTOMATIC SWITCHING LEVEL ADJUSTMENT PROCEDURE

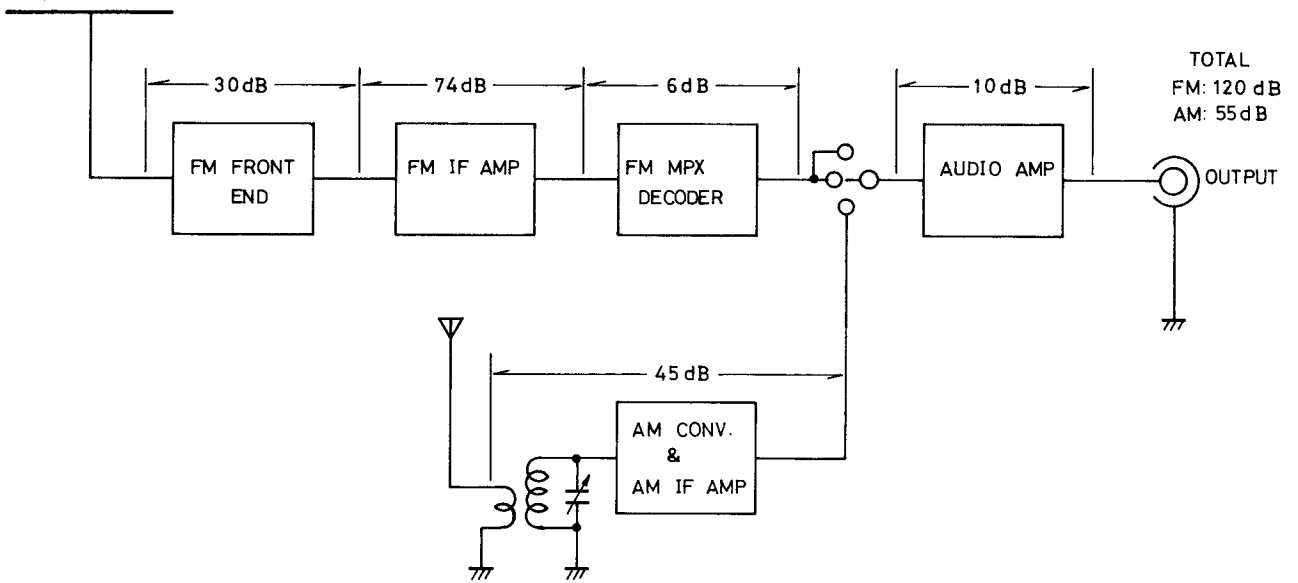
1. Connect a VTVM and Oscilloscope to the Output jack (Left or Right).
2. Feed the FM signal whose MPX has been varied into the FM ANT terminals.
MPX VARIATION:

Pilot	10%
Modulation Frequency	1kHz Left or Right
RF Deviation	±45k Hz
3. Set the frequency at 98 MHz (when there is disrupting signal, choose another setting).
4. Set the FUNCTION switch to FM STEREO.
5. Turn CCW the MONO-STEREO Auto-switching Level Adj. VR101 (on FM IF board): this is a condition in which Auto-switching does not function.
6. Adjust the FM MPX so that the distortion and separation will be best.
7. Adjust the VR101 so that when the antenna input level is 30 μ V or more, Stereo will switch in and when the input is below the 30 μ V level, Mono will switch in.
8. After adjustment, check to make sure that, indeed, when the antenna input level exceeds 30 μ V, Stereo will switch in.

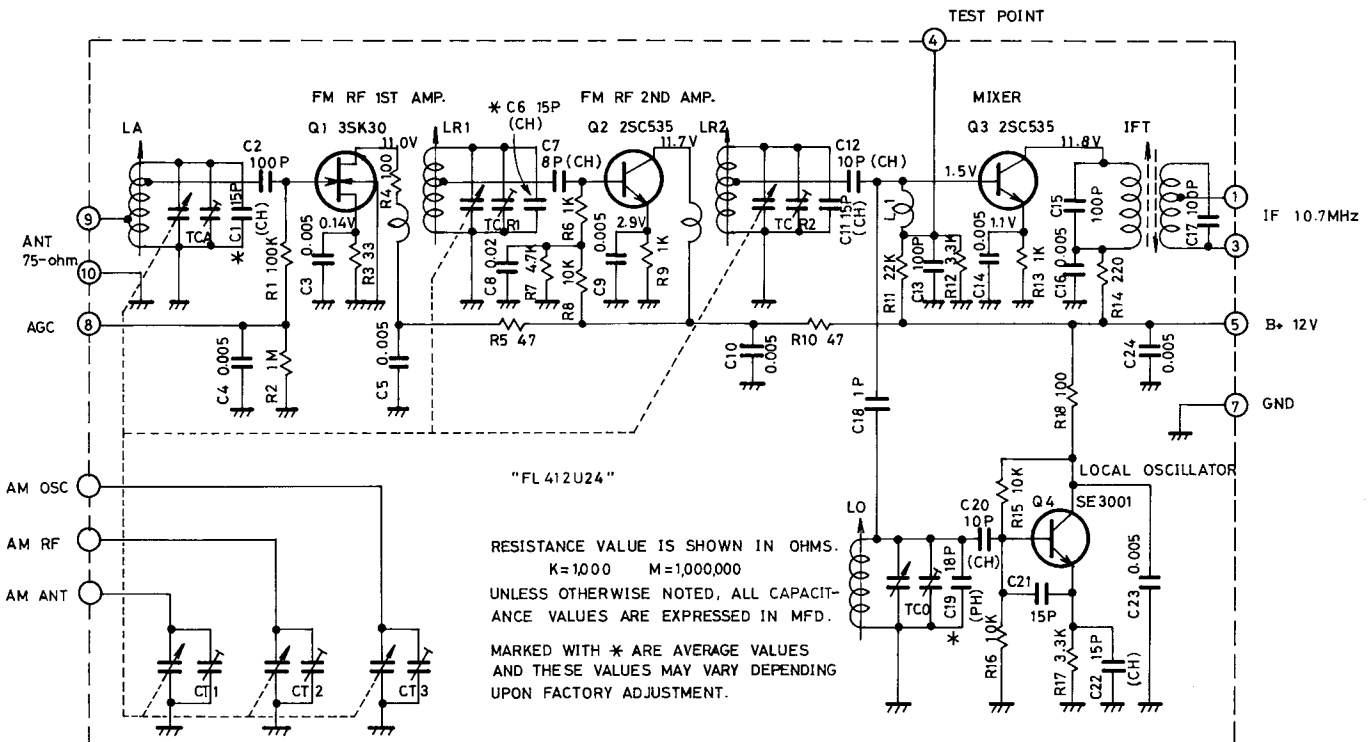
TROUBLE SHOOTING

- I. If both AM and FM is inoperative,
Check to see if the fuse is not blown.
 1. If the fuse is OK,
 - a. Power switch may be faulty, or
 - b. Power Transformer (Pri. winding) may be faulty, or
 - c. Fuse connection may be faulty.
 2. If the fuse is blown,
 - a. Power Transformer (Pri. or Sec. winding) may be shorted, or
 - b. Capacitor C002 or 904 may be shorted, or
 - c. Rectifier D902 may be shorted.
- II. If only AM is inoperative,
Measure voltage at Pin No. 2 (on AM IF pcb).
 1. And if there is no voltage,
 - a. Capacitor C210 may be faulty, or
 - b. Selector switch (+B circuit) connection may be faulty,
or
 2. And if there is proper voltage,
 - a. Transistor Q201, 202, 203 or 204 may be faulty, or
 - b. Coil L003, 201 or 202 may be faulty, or
 - c. Transformer T201 or 202 may be faulty.
- III. If only FM is inoperative,
Measure voltage at Pin No. 13 (on FM IF pcb).
 1. And if there is no voltage,
 - a. Capacitor C125 or 126 may be faulty, or
 - b. Selector switch (+B circuit) connection may be faulty.
 2. And if there is proper voltage,
 - a. Transistor Q101 or 105 may be faulty, or
 - b. IC101, 102 or 301 may be faulty, or
 - c. Capacitor C301 may be faulty, or
 - d. Transformer T101 may be faulty, or
 - e. Front end may be faulty.

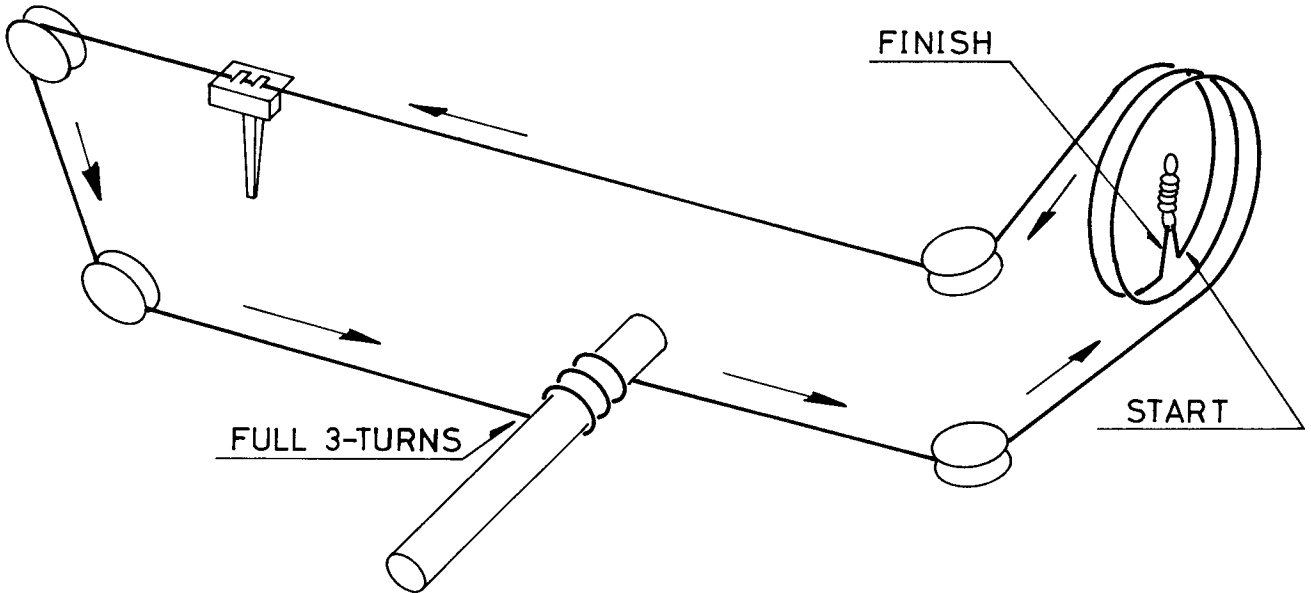
GAIN DIAGRAM



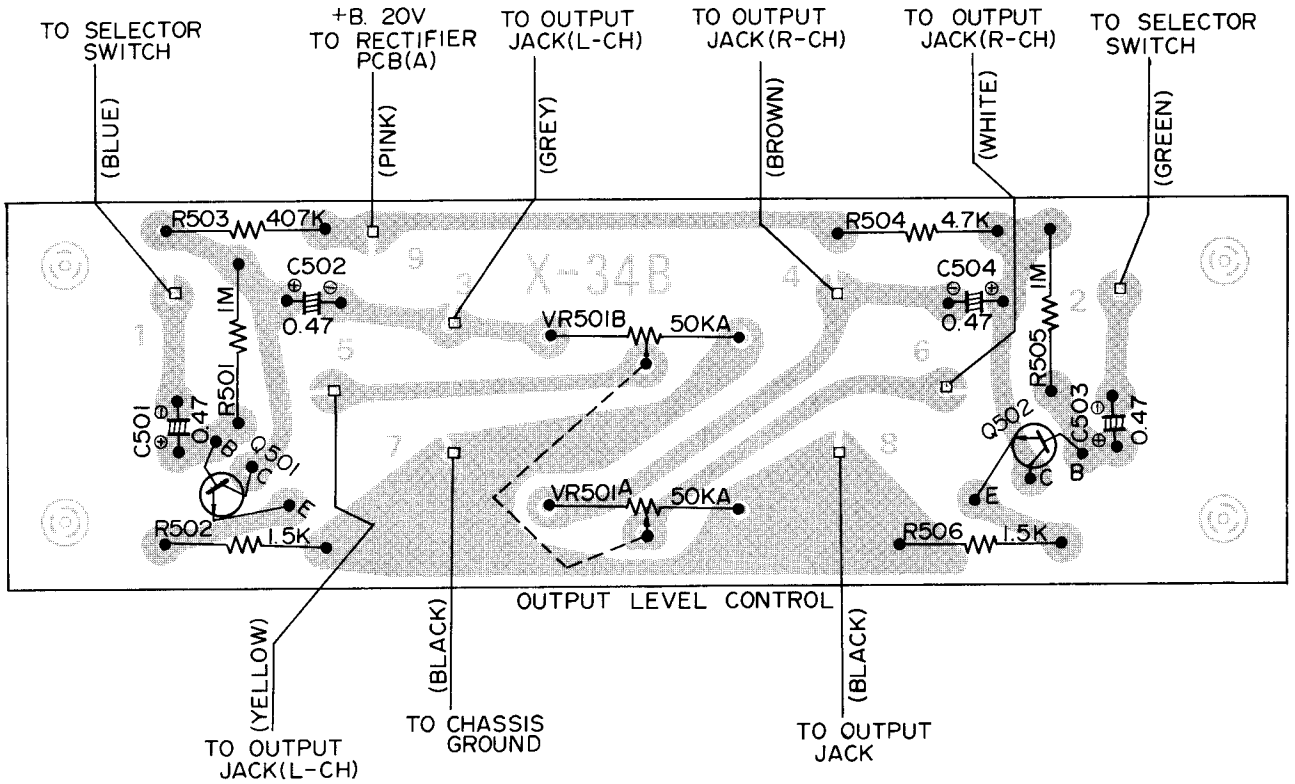
FRONT END SCHEMATIC DIAGRAM



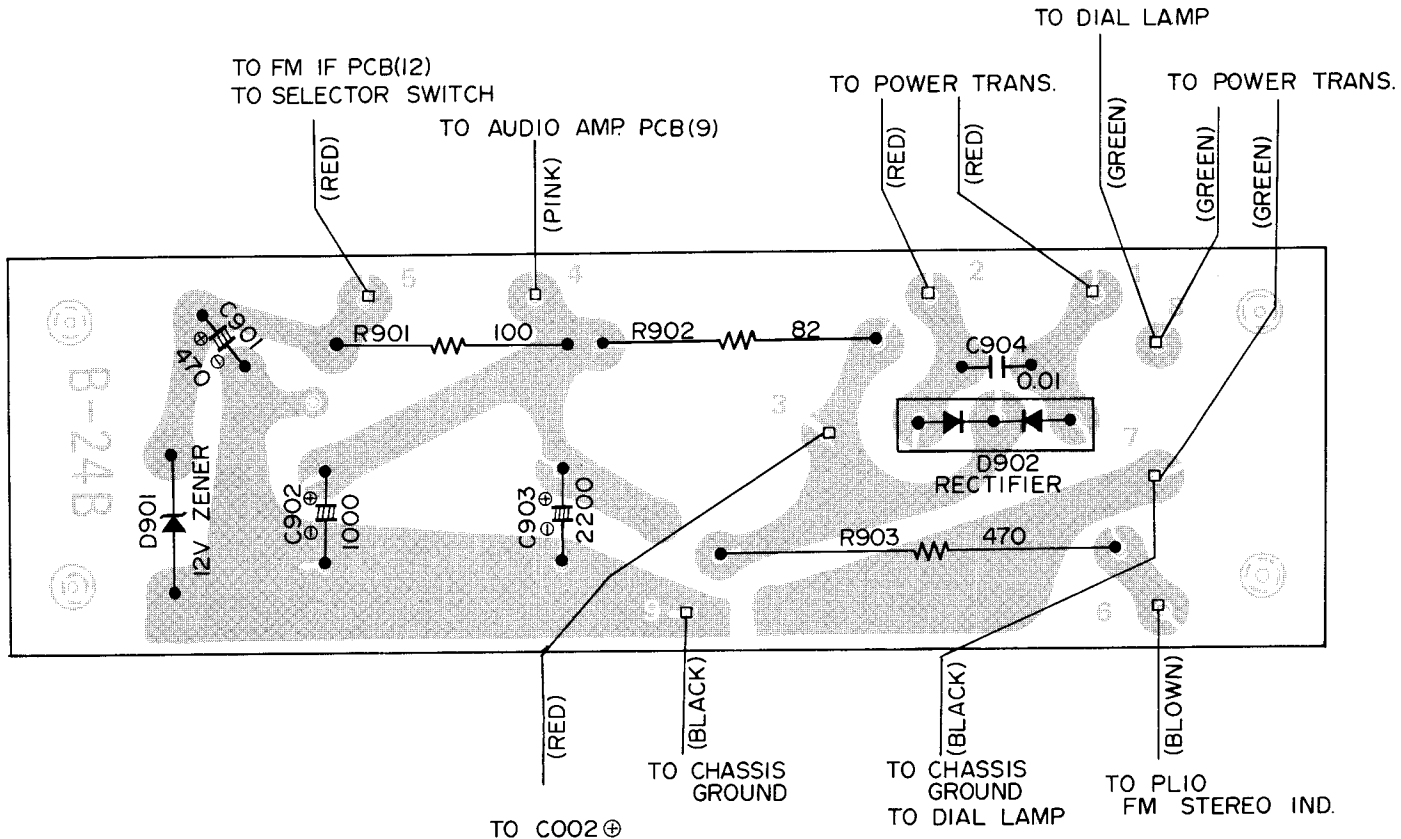
DIAL STRINGING DIAGRAM



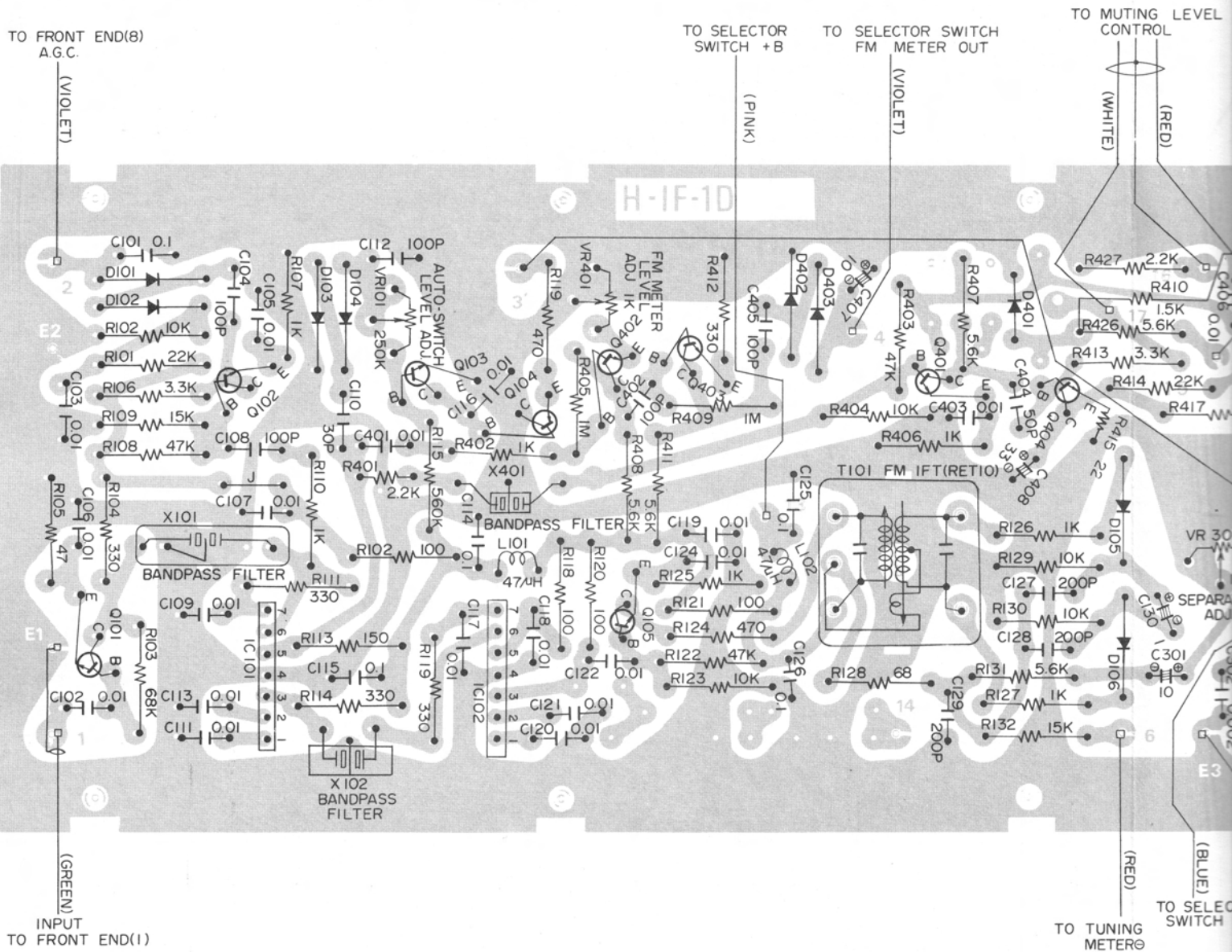
AUDIO AMPLIFIER CIRCUIT BOARD DIAGRAM

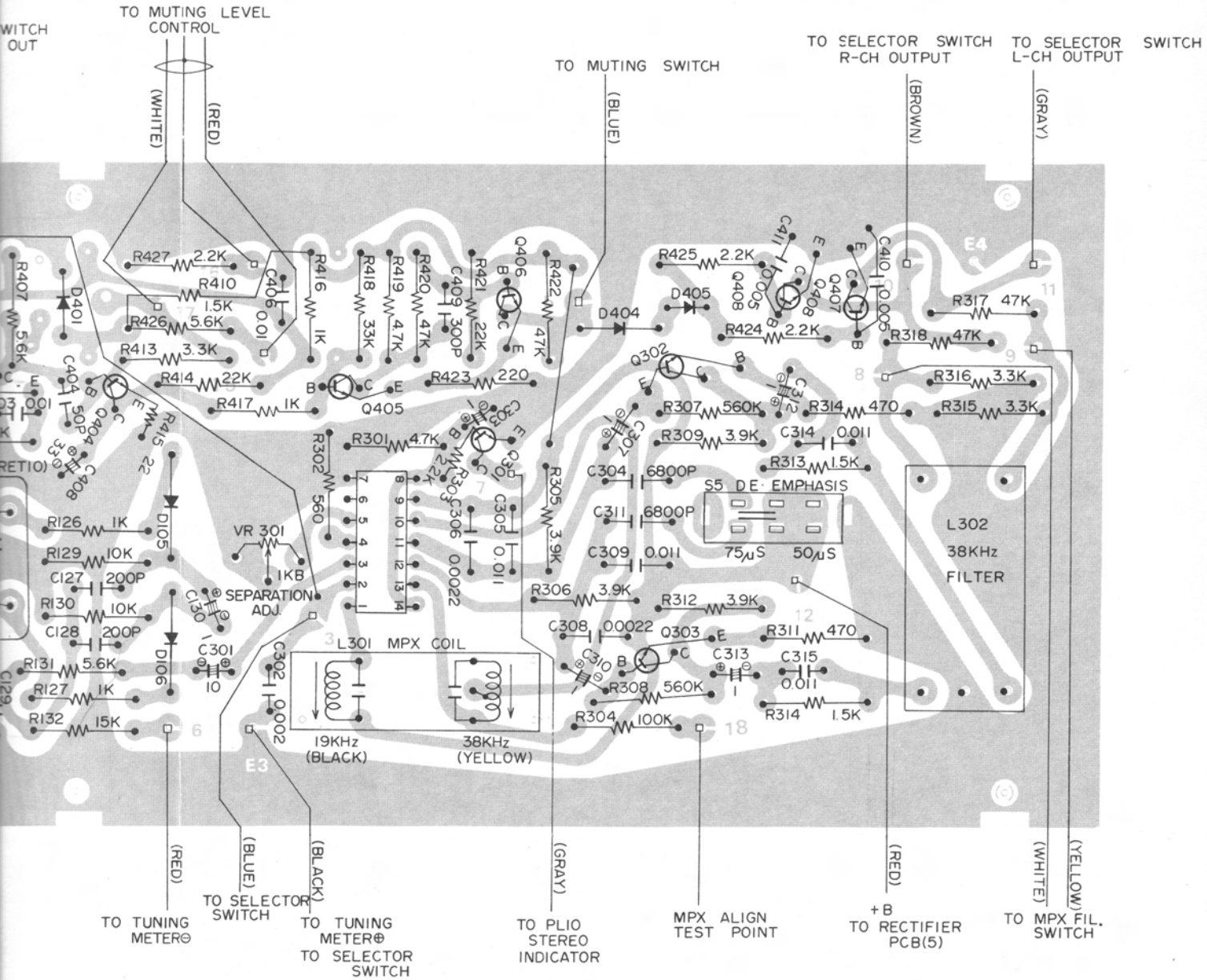


RECTIFIER CIRCUIT BOARD DIAGRAM

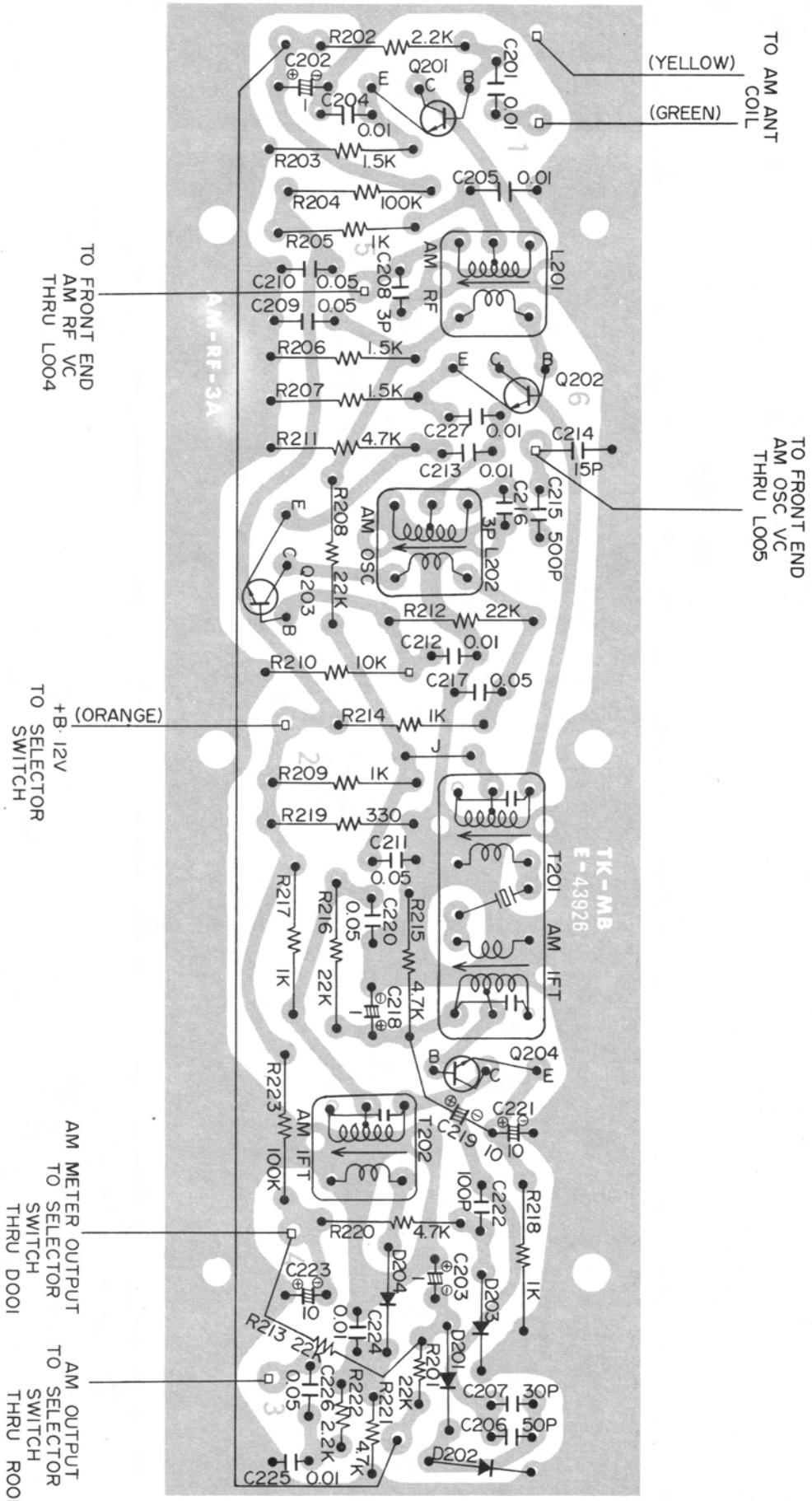


FM IF & FM MPX CIRCUIT BOARD DIAGRAM

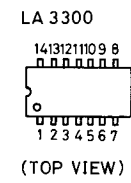
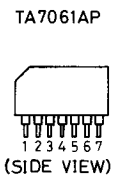
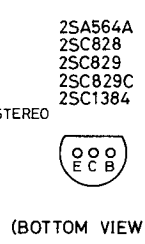
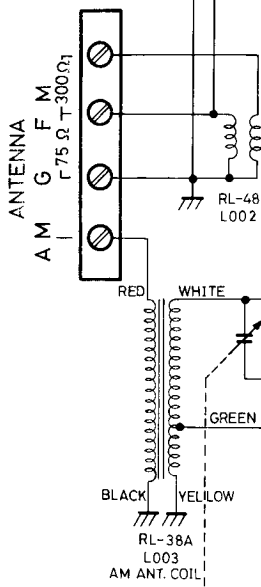
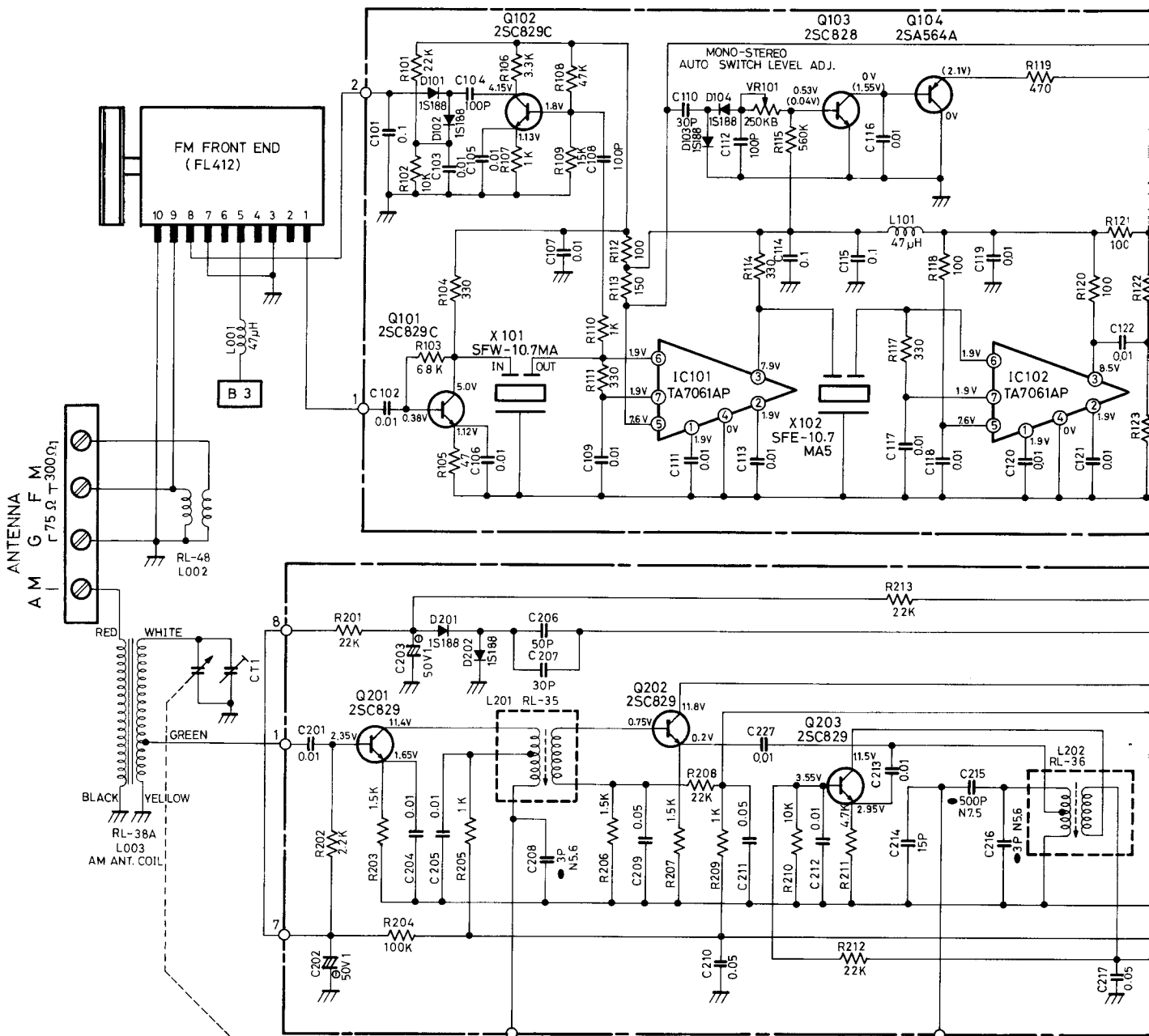




AM CONVERTOR AND IF AMPLIFIER CIRCUIT BOARD DIAGRAM



SCHEMATIC DIAGRAM

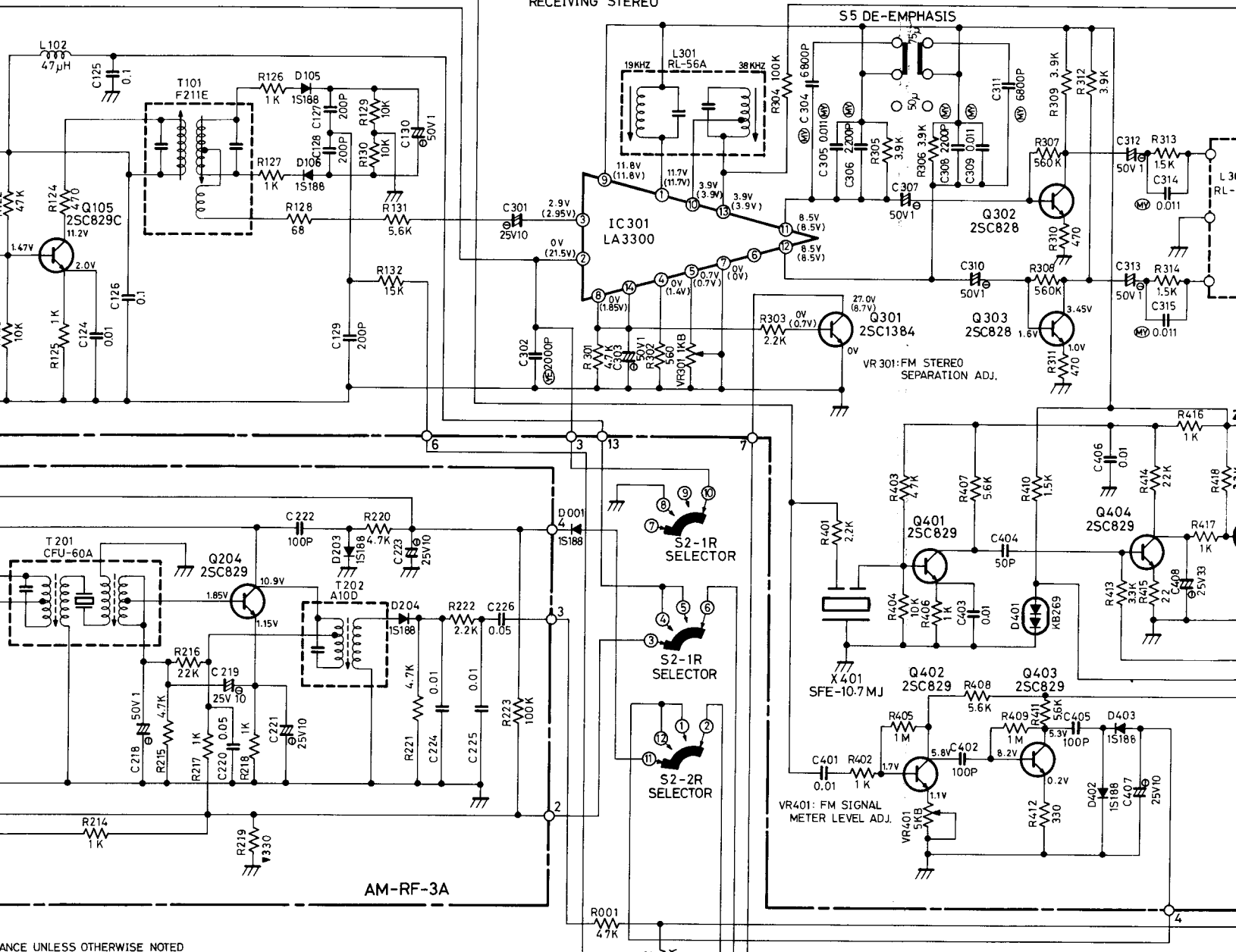


ITEM	SCHEMATIC LOCATION (LAST)
FM IF AMP	R 132
AM IF AMP	C 130
FM MPX AMP	C 227
FM MUTING	R 318
AF AMP	C 427
POWER SUPPLY	R 903
	C 904
CHASSIS	R 003
	C 002

(RESISTORS)
5% TOLERANCE
K---KILO OHM
M---MEGA OHM
V---COMPOSITE
NON MARK---

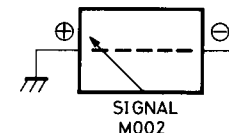
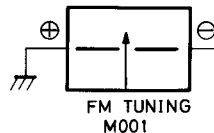
(CAPACITORS)
M---MYLAR
C---CERAMIC
S---POLY S
T---TEMPERATURE
ELECTROLYTIC
NON MARK---
UNLESS OTHERWISE SPECIFIED
VALUES ARE IN VOLTS RELATIVE TO THE CHASSIS
VOLTAGE RELATIVE TO THE CHASSIS

() VOLTAGES INDICATED WHEN RECEIVING STEREO



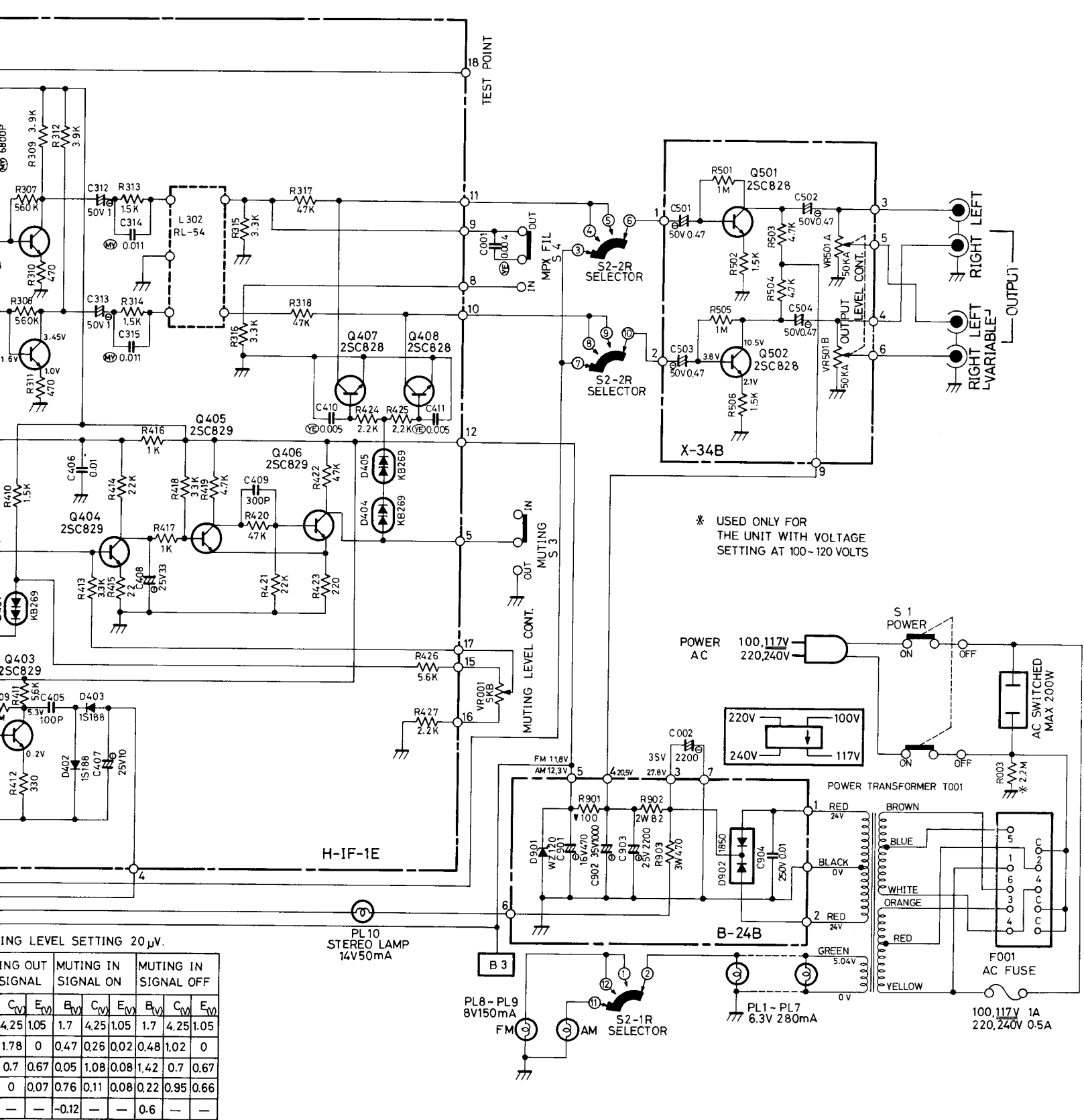
ANCE UNLESS OTHERWISE NOTED
OHM
OHM
POSITION RESISTORS 1/2 WATT
--LOW NOISE TYPE CARBON RESISTORS 1/4 WATT

R FILM CAPACITORS
MIC CAPACITORS YE TYPE
STYROL CAPACITORS
TEMPERATURE COEFFICIENT CAPACITORS
POLYESTER CAPACITORS
-- CERAMIC CAPACITORS
UNLESS OTHERWISE NOTED IN SCHEMATIC ALL CAPACITOR
VALUES ARE EXPRESSED IN MFD
READING WITH VTVM FROM THE POINT SHOWN
IN SCHEMATIC (LINE VOLTAGE 120 VOLT)
READING MAY VARY $\pm 20\%$



MUTING LEVEL SETTING 20 μ V.

	MUTING OUT NO SIGNAL		MUTING IN SIGNAL ON		MUTING IN SIGNAL ON	
	B _v	C _v	E _v	B _v	C _v	E _v
Q 401	1.7	4.25	1.05	1.7	4.25	1.05
Q 404	1.49	1.78	0	0.47	0.26	0.02
Q 405	1.42	0.7	0.67	0.05	1.08	0.08
Q 406	0.22	0	0.07	0.76	0.11	0.08
Q 407	0	—	—	-0.12	—	0.6



MUTING LEVEL SETTING 20 μV.

MUTING OUT SIGNAL		MUTING IN SIGNAL ON			MUTING IN SIGNAL OFF		
C _V	E _V	B _V	C _V	E _V	B _V	C _V	E _V
4.25	1.05	1.7	4.25	1.05	1.7	4.25	1.05
1.78	0	0.47	0.26	0.02	0.48	1.02	0
0.7	0.67	0.05	1.08	0.08	1.42	0.7	0.67
0	0.07	0.76	0.11	0.08	0.22	0.95	0.66
-	-	-0.12	-	-	0.6	-	-

PARTS LIST

CHASSIS PARTS

Schematic		
Location	Part No.	Description
RESISTORS		
R001, 002	552047322	Carbon Film, 47K \pm 5%, 1/4W
R003*	551022533	Composition, 2.2M \pm 10%, 1/2W
VR001	515321114	Variable, 5KB, Muting Level Control
		*Used only for the unit with line voltage setting at 100V or 120V
CAPACITORS		
C001	442401033	Ceramic, 0.004mfd \pm 10%, 50V
C002	400220439	Electrolytic, 2200mfd, 35V
COILS AND TRANSFORMERS		
L001	220001121	RF Choke, 47 Micro-Henry
L002	226501111	FM ANT, Matching Trans.
L003	222391119	Antenna Assembly
T001	205001344	Power Transformer, Multi-voltage type
MISCELLANEOUS		
S1	614010107	Switch, Power Supply
S2	601011249	Switch, Selector

Schematic		
Location	Part No.	Description
S3, 4 (1 set)	614020402	Switch, Push 2-keys, Muting and MPX Fil.
M001	231310006	Meter, FM Tuning
M002	231310007	Meter, Signal Strength
	321304371	Front end, AM/FM
PL1, 2, 3,	352063028	Lamp, 6.3V, 0.28A, Dial Illumination
PL4, 5, 6,		
PL7		
PL8, 9	351080015	Lamp, 8V, 0.15A, Function Indicator
PL10	351140005	Lamp, 14V, 50mA, FM Stereo Indicator
F001	341220010	Fuse, 1A-3AG, (line voltage 100V or 120V)
	341220005	Fuse, 0.5A-3AG, (line voltage 220V or 240V)
	641200104	Antenna Terminal Strip, 4P
	624100104	Output Jack, 4P
	648211127	Bracket, Fuse
	648211115	Bracket, Dial Lamp
	648211121	Voltage Selector
	648211126	AC Outlet
	151691120	Dial Pointer w/Lamp
	654911288	Tuning Shaft w/Flywheel

FM IF AMP. & MPX DECODER CIRCUIT BOARD

Schematic		
Location	Part No.	Description
RESISTORS		
R101	552022322	Carbon Film, 22K \pm 5%, 1/4W
R102, 123,	552010322	Carbon Film, 10K \pm 5%, 1/4W
R129, 130		
R103	552068322	Carbon Film, 68K \pm 5%, 1/4W
R104, 111,	552033122	Carbon Film, 330 \pm 5%, 1/4W
R124, 117		
R105	552047022	Carbon Film, 47 \pm 5%, 1/4W
R106	552033222	Carbon Film, 3.3K \pm 5%, 1/4W
R107, 110,	552010222	Carbon Film, 1K \pm 5%, 1/4W
R125, 126,		
R127		
R108, 122	552047322	Carbon Film, 47K \pm 5%, 1/4W
R109, 132	552015322	Carbon Film, 15K \pm 5%, 1/4W
R112, 118,	552010122	Carbon Film, 100 \pm 5%, 1/4W
R120, 121		
R113	552015122	Carbon Film, 150 \pm 5%, 1/4W
R115	552056422	Carbon Film, 560K \pm 5%, 1/4W
R119, 124	552047122	Carbon Film, 470 \pm 5%, 1/4W
R128	552068022	Carbon Film, 68 \pm 5%, 1/4W
R131	552056222	Carbon Film, 5.6K \pm 5%, 1/4W
VR101	510502127	Potentiometer, 250KB, Stereo switch level Adj.

Schematic		
Location	Part No.	Description
R301	552047222	Carbon Film, 4.7K \pm 5%, 1/4W
R302	552056122	Carbon Film, 560 \pm 5%, 1/4W
R303	552022222	Carbon Film, 2.2K \pm 5%, 1/4W
R304	552010422	Carbon Film, 100K \pm 5%, 1/4W
R305, 306,	552039222	Carbon Film, 3.9K \pm 5%, 1/4W
R309, 312		
R307, 308	552056422	Carbon Film, 560K \pm 5%, 1/4W
R310, 311	552047122	Carbon Film, 470 \pm 5%, 1/4W
R313, 314	552015222	Carbon Film, 1.5K \pm 5%, 1/4W
R315, 316	552033222	Carbon Film, 3.3K \pm 5%, 1/4W
R317, 318	552047322	Carbon Film, 47K \pm 5%, 1/4W
VR301	510502131	Potentiometer, 1KB, Stereo Separation Adj.
R401, 424,	552022222	Carbon Film, 2.2K \pm 5%, 1/4W
R425, 427		
R402, 406,	552010222	Carbon Film, 1K \pm 5%, 1/4W
R416, 417		
R403, 420,	552047322	Carbon Film, 47K \pm 5%, 1/4W
R422		
R404	552010322	Carbon Film, 10K \pm 5%, 1/4W
R405, 409	552010522	Carbon Film, 1M \pm 5%, 1/4W
R407, 408,	552056222	Carbon Film, 5.6K \pm 5%, 1/4W
R411, 426		

Schematic				
Location	Part No.	Description		
R410	552015222	Carbon Film, 1.5K \pm 5%, 1/4W		
R412	552033122	Carbon Film, 330 \pm 5%, 1/4W		
R413	552033222	Carbon Film, 3.3K \pm 5%, 1/4W		
R414, 421	552022322	Carbon Film, 22K \pm 5%, 1/4W		
R415	552022022	Carbon Film, 22 \pm 5%, 1/4W		
R418	552033322	Carbon Film, 33K \pm 5%, 1/4W		
R419	552047222	Carbon Film, 47K \pm 5%, 1/4W		
R423	552022122	Carbon Film, 220 \pm 5%, 1/4W		
VR401	510502128	Potentiometer, 5KB, FM Signal Meter Adj.		
CAPACITORS				
C101, 114, } C115, 125, } C126 }	440100835	Ceramic, 0.1mfd, 50V		
C102, 103, } C105, 106, } C107, 109, } C111, 113, } C116, 117, } C118, 119, } C120, 121, } C122, 124 }				
C104, 108, } C112 }			440101183	Ceramic, 100pF \pm 10%, 250V
C110	440301283	Ceramic, 30pF \pm 10%, 250V		
C127, 128, } C129 }	440201183	Ceramic, 200pF \pm 10%, 250V		
C130			402100749	Electrolytic, 1mfd, 50V
C301	402100629	Electrolytic, 10mfd, 25V		
C302	442201033	Ceramic, 0.002mfd \pm 10%, 50V		
C303, 307, } C310, 312, } C313 }	402100749	Electrolytic, 1mfd, 50V		
C304, 311			451681032	Mylar Film, 0.0068mfd \pm 5%, 50V
C305, 309, } C314, 315 }			451110932	Mylar Film, 0.011mfd \pm 5%, 50V
C306, 308	451221032	Mylar Film, 0.0022mfd \pm 5%, 50V		
C401, 403, } C406 }	440100935	Ceramic, 0.01mfd, 50V		
C402, 405			440101183	Ceramic, 100pF \pm 10%, 250V
C404	440501283	Ceramic, 50pF \pm 10%, 250V		

Schematic				
Location	Part No.	Description		
C407	402100629	Electrolytic, 10mfd, 25V		
C408	402330629	Electrolytic, 33mfd, 25V		
C409	440301183	Ceramic, 300pF \pm 10%, 250V		
C410, 411	442501033	Ceramic, 0.005mfd \pm 10%, 50V		
TRANSISTORS AND DIODES				
Q101, 102, } Q105 }	301201117	2SC829C, FM IF Amp., FM AGC Amp., etc.		
Q103			301201115	2SC828, Stereo Auto-switching Amp.
Q104	301001117	2SA564A, Stereo Auto-switching Threshold		
IC101, 102	303452146	TA7061AP, FM IF 2nd and 3rd Amp.		
D101, 102, } D103, 104, } D105, 106 }	300111008	1S188, FM AGC Rect. and FM Det.		
Q301			301201132	2SC1384, FM Stereo Indicator Driver
Q302, 303			301201115	2SC828, FM Audio Amp.
IC301	303452145	LA3300, FM MPX Decoder		
Q401, 402, } Q403, 404, } Q405, 406 }	301201117	2SC829C, Muting Amp. and FM Meter Amp.		
Q407, 408			301201115	2SC828, Absorber
D401, 404, } D405 }			300212004	KB-269,
D402, 403	300111008	2S188, FM Meter Rect.		
COILS AND TRANSFORMER				
L101, 102	220001121	RF Choke, 47 Micro-Henry		
T101	225501113	FM IFT, Ratio Det.		
L301	225601129	FM MPX 19KHz/38KHz Tune		
L302	228641113	FM MPX 38KHz Filter		
BANDPASS FILTERS				
X101	229101144	FM IF 10.7MHz Tune (Red)		
X102	229101134	FM IF 10.7MHz Tune (Red)		
X401	229101139	FM Muting 10.7MHz Tune (Red)		
S5	613000024	Switch, FM De-emphasis, 6P		
	770101225	Pin, Terminal		
	140300347	Printed Circuit Board "H-IF-1"		
	141311352	FM IF Amp. & MPX Circuit Assembly		

AM CONVERTER AND AM IF AMP. CIRCUIT BOARD

Schematic		
Location	Part No.	Description
RESISTORS		
R201, 208, } R212, 213, } R216 }	552022322	Carbon Film, 22K \pm 5%, 1/4W

Schematic		
Location	Part No.	Description
R202, 222	552022222	Carbon Film, 2.2K \pm 5%, 1/4W
R203, 206, } R207 }	552015222	Carbon Film, 1.5K \pm 5%, 1/4W
R204, 223		

Schematic				
Location	Part No.	Description		
R205, 209, } R214, 217, } R218 }	552010222	Carbon Film, 1K \pm 5%, 1/4W		
R210			552010322	Carbon Film, 10K \pm 5%, 1/4W
R211, 215, } R220, 221 }			552047222	Carbon Film, 4.7K \pm 5%, 1/4W
R219	551033133	Composition, 330 \pm 5%, 1/2W		
CAPACITORS				
C201, 204, } C205, 212, } C213, 224, } C225, 227 }	440100935	Ceramic, 0.01mfd, 50V		
C202, 203, } C218 }			402100749	Electrolytic, 1mfd, 50V
C206				
C207			440301283	Ceramic, 30pF \pm 10%, 250V
C208, 216	441301336	Ceramic, 3pF, N5.6, 50V		
C209, 210, } C211, 217, } C220, 226 }	440500935	Ceramic, 0.05mfd, 50V		

Schematic		
Location	Part No.	Description
C214	440151283	Ceramic, 15pF \pm 10%, 250V
C215	441501136	Ceramic, 500pF, N7.5, 50V
C219, 221, } C223 }	402100629	Electrolytic, 10mfd, 25V
C222		
TRANSISTORS AND DIODES		
Q201, 202, } Q203, 204 }	301201117	2SC829C, AM RF, OSC and IF Amp.
D201, 202, } D203, 204 }		
COILS AND TRANSFORMERS		
L201	226501112	AM RF Coil (green)
L202	223301123	AM OSC Coil (red)
T201	229101129	AM IFT, 1st,
T202	225301124	AM IFT, Det,
	770101224	Pin, Terminal
	140100123	Printed Circuit Board "AM-RF-3"
	141110137	AM Conv. and IF Amp. Circuit Assembly

AUDIO AMPLIFIER CIRCUIT BOARD

Schematic		
Location	Part No.	Description
RESISTORS		
R501, 505	552010522	Carbon Film, 1M \pm 5%, 1/4W
R502, 506	552015222	Carbon Film, 1.5K \pm 5%, 1/4W
R503, 504	552047222	Carbon Film, 4.7K \pm 5%, 1/4W
VR501	525101111	Variable, 50Kx2, Output Level Control
CAPACITORS		
C501, 502, } C503, 504 }	402470849	Electrolytic, 0.47mfd, 50V

Schematic		
Location	Part No.	Description
TRANSISTORS		
Q501, 502	301201115	2SC828, Audio Amp.
	770101225	Pin, Terminal
	140800163	Printed Circuit Board "X-34"
	141810582	Audio Amplifier Circuit Assembly

RECTIFIER CIRCUIT BOARD

Schematic		
Location	Part No.	Description
RESISTORS		
R901	551010133	Composition, 100 \pm 10%, 1/2W
R902	553182053	Metal Oxide, 82 \pm 10%, 2W
R903	553147163	Metal Oxide, 470 \pm 10%, 3W
CAPACITORS		
C901	402470519	Electrolytic, 470mfd, 16V
C902	402100439	Electrolytic, 1000mfd, 35V

Schematic		
Location	Part No.	Description
C903	402220429	Electrolytic, 2200mfd, 25V
C904	440100985	Ceramic, 0.01mfd, 250V
DIODES		
D901	300313013	WZ-120, Zener Regulator
D902	300919005	1S1850, Rectifier
	770101225	Pin, Terminal
	140800162	Printed Circuit Board "B-24"
	141810581	Rectifier Circuit Assembly