

# The Harman Kardon Model TU915

Manual No.77A

## DIGITAL SYNTHESIZED QUARTZ-LOCKED TUNER

# Technical Manual



## SPECIFICATIONS

## ● FM SECTION

	Nominal	Limit
Tuning Range	87.5 ~ 108.0MHz	
50dB Quieting Sensitivity		
Mono	15.2dBf	≤ 18dBf
Stereo	36.2dBf	≤ 40dBf
Usable Sensitivity	10.6dBf (IHF)	≤ 15dBf
Image Ratio	98dB	≥ 80dB
IF Rejection	105dB	≥ 85dB
Spurious Response Rejection	120dB	≥ 95dB
Capture Ratio	1.0dB	≤ 2.0dB
Alternate Channel Selectivity	70dB	≥ 50dB
AM Rejection	64dB	≥ 45dB
Signal to Noise Ratio		
for U.S.A. & Canada models		
Mono	83dB	≥ 78dB
Stereo	75dB	≥ 70dB
for General model		
Mono	77dB	≥ 72dB
Stereo	69dB	≥ 64dB
Total Harmonic Distortion		
Mono	0.05%	≤ 0.15%
Stereo	0.06%	≤ 0.3%
Stereo Separation at 1kHz		
for U.S.A. & Canada models	65dB	≥ 45dB
for General model	55dB	≥ 40dB
Output Level/Impedance (Stereo)		
for U.S.A. & Canada models	780mV/2.2kΩ	
for General model	420mV/2.2kΩ	

## ● AM SECTION

	Nominal	Limit
Tuning Range	520 ~ 1,710kHz	
Usable Sensitivity		
External Antenna	10μV	≤ 20μV
Loop Antenna	220μV/m	
Selectivity	54dB	≥ 35dB
Signal to Noise Ratio	54dB	≥ 50dB
Image Rejection	48dB	≥ 38dB
IF Rejection	69dB	≥ 50dB
● DIMENSIONS(WxHxD)	17-1/2"x2-11/16"x14-11/16" (443 x 68 x 372 mm)	
● WEIGHT	8 lbs. 6 oz. (3.8 kg)	
● POWER SUPPLIES		
for U.S.A. & Canada models	AC120V, 60Hz	
for General model	AC100/120/220/240V, 50/60Hz	
● POWER CONSUMPTION	16W	

This specification is the target of servicing. But, there is a case that the specification is not applicable to the measurement condition and instrument.

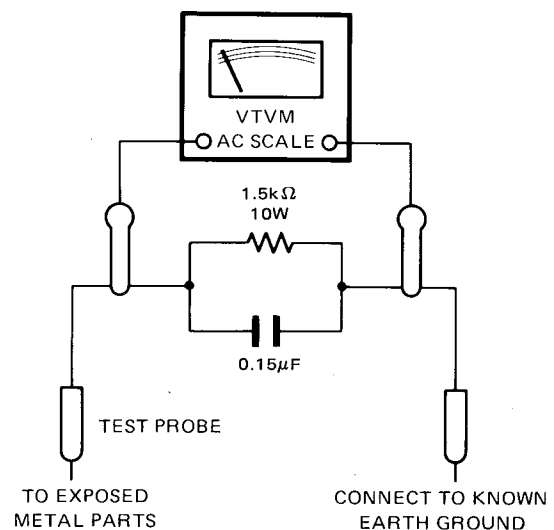
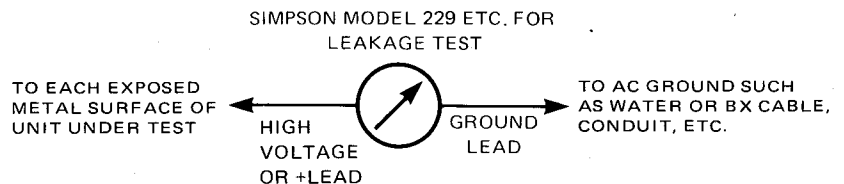
Specifications and components subject to change without notice. Overall performance will be maintained or improved.

## LEAKAGE TEST (FOR SERVICE ENGINEERS IN THE U.S.A.)

Before returning the unit to the user, perform the following safety checks:

1. Inspect all lead dress to make certain that leads are not pinched or that hardware is not lodged between the chassis and other metal parts in the unit.
2. Be sure that any protective devices such as nonmetallic control knobs, insulating fishpapers, cabinet backs, adjustment and compartment covers or shields, isolation resistor-capacity networks, mechanical insulators, etc. which were removed for servicing are properly reinstalled.
3. Be sure that no shock hazard exists; check for leakage current using Simpson Model 229 Leakage Tester, standard equipment item No. 21641, RCA Model WT540A or use alternate method as follows:  
Plug the power cord directly into a 120-volt AC receptacle (do not use an Isolation Transformer for this test). Using two clip leads, connect a 1500 Ohm, 10-watt resistor paralleled by a 0.15μF capacitor, in series with all exposed metal cabinet parts and a known earth ground, such as a water pipe or conduit. Use a VTVM or VOM with 1000 Ohms per volt, or higher, sensitivity to measure the AC voltage drop across the resistor. (See Diagram.) Move the resistor connection to each exposed metal part having a return path to the chassis (antenna, metal, cabinet, screw heads, knobs and control shafts, escutcheon, etc.) and measure the AC voltage drop across the resistor. (This test should be performed with the power switch in both the On and Off positions.)

A reading of 0.35 volt RMS or more is excessive and indicates a potential shock hazard which must be corrected before returning the unit to the owner.



## DISASSEMBLY PROCEDURES (REFER TO PAGES 8 AND 16)

### 1 CABINET TOP (131) REMOVAL

Remove 6 screws (A) and remove the Cabinet Top (131).

### 2 CABINET BOTTOM ASSEMBLY (102) REMOVAL

Remove 4 screws (B) and remove the Cabinet Bottom Assembly (102).

### 3 FRONT PANEL ASSEMBLY (101) REMOVAL

1. Remove the Cabinet Top (131). (Refer to step 1.)
2. Remove 7 screws (C) and remove the Front Panel Assembly (101).

### 4 MAIN P.C. BOARD (PCB-1) REMOVAL

1. Remove the Cabinet Top (131). (Refer to step 1.)
2. Loosen 2 screws (D) and pull out the Shaft (198) with the Knob Assembly (103).
3. Open the lid of connectors (J10, J11, J151, J351, J701, J801) on the Main P.C. Board (PCB-1) and then disconnect the lead wires.
4. Disconnect the connector (J12) from the connector (P12) on the Main P.C. Board (PCB-1).
5. Open the lid of connector (J1) on the Power Switch P.C. Board (PCB-4) and then disconnect the lead wires.

6. Unsolder the Holding Brackets (175) from shield case of FM front end on the Main P.C. Board (PCB-1).

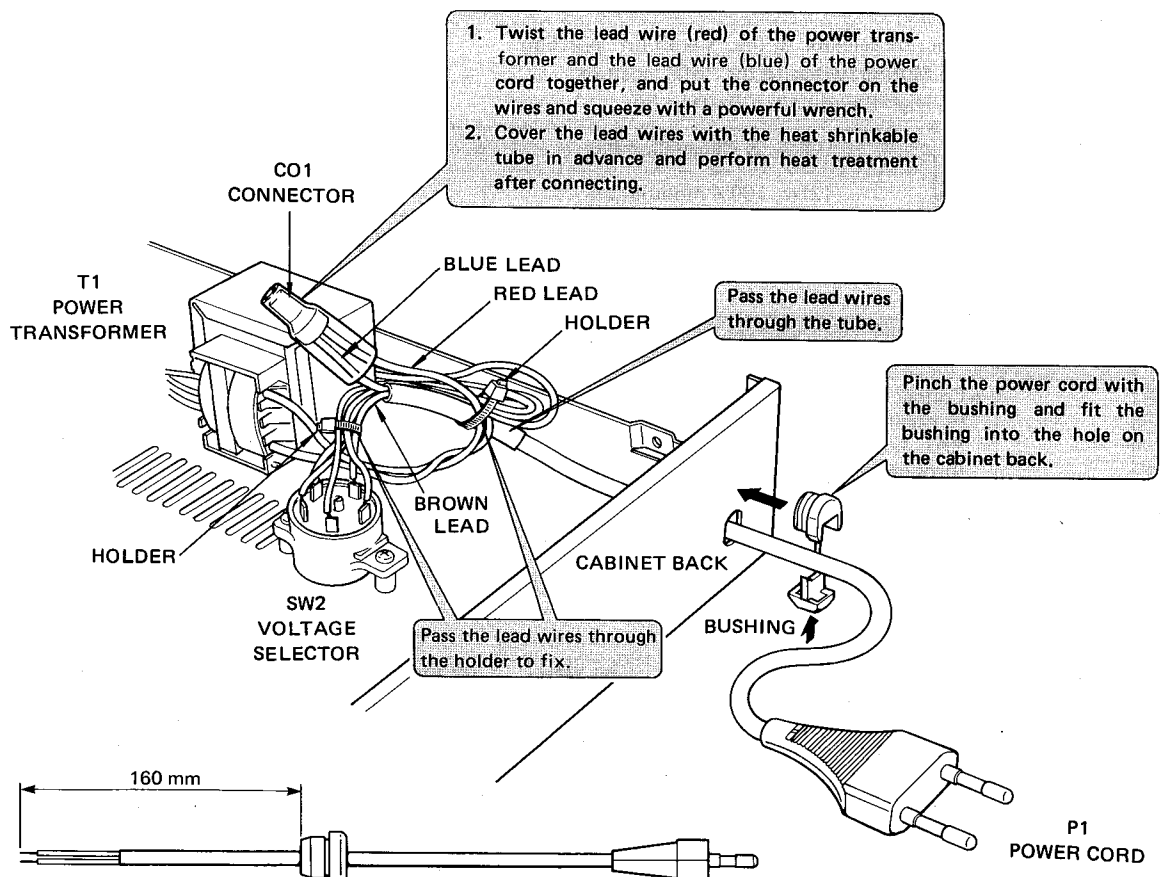
7. Remove 10 screws (E) and hexagon nut (F) and remove the Main P.C. Board (PCB-1).

### 5 STATION DISPLAY P.C. BOARD (PCB-2) REMOVAL

1. Remove the Front Panel Assembly (101). (Refer to step 3.)
2. Remove 4 screws (G) and remove the Station Display P.C. Board (PCB-2) with the Tuning & High Blend Switches P.C. Board (PCB-7), LED Display Assembly (D901), Window (142) and Bracket (180).
3. Remove 2 screws (H) and remove the Bracket (180) with the LED Display Assembly (D901) and Window (142) from the Station Display P.C. Board (PCB-2).
4. Remove the solder of the connector (J355) between Tuning & High Blend Switches P.C. Board (PCB-7) and Station Display P.C. Board (PCB-2) and break the connection.

## POWER CORD REPLACEMENT (FOR SERVICE ENGINEERS OTHER THAN NORTH AMERICA)

In order to prevent fire or shock hazard when replacing the power cord, follow the procedure below to replace the parts with the standard supply parts.



**ALIGNMENT PROCEDURES (REFER TO PAGES 15 AND 16)**

**STANDARD FREQUENCY CHECK**

Condition: ●Set the Function selector to the "fm" position.

Step	Connection Equipments	Measurement Frequency	Station display	Adjustment	For
1	●Connect the Frequency counter to TP2 (+) and TP5 (-).		98.3MHz		109MHz ± 2kHz

**AM ALIGNMENT**

Conditions: ●Set the Function selector to the "am" position.

- Depress the Muting switch to the "off" position.
- Standard modulation of the AM Signal Generator is 400Hz at 30%.

Step	Alignment	Connection Equipments	Measurement Frequency	Station display	Adjustment	For
1	Tuning Voltage	●Connect the DC Volt Meter to TP1 (+) and TP5 (-).		1710kHz	TC252	23V ± 0.5V
2	IF	●Connect the AM Test Loop Antenna cable into the output jack of AM Signal Generator. Place AM Test Loop Antenna close enough to couple signal into the AM Loop Antenna (L1). Make the signal as weak as possible. ●Connect the VTVM and Oscilloscope to the Fixed Output jacks.	1400kHz	1400kHz	T251 T252	Maximum output level and symmetrical curve on scope.
3	Tracking		1400kHz	1400kHz	TC251	Maximum output
4			600kHz	600kHz	L251	
5			Repeat steps 3 and 4 for optimum sensitivity.			
6	Tuned Indicator		1000kHz	1000kHz		Confirm the Tuned indicator lights at 60dB input.

**FM ALIGNMENT**

Conditions: ●After the Power switch is pushed on, wait for 5 minutes before adjusting so that the most stable operation is obtained.

- Set the Function selector to the "stereo fm" position.
- Depress the Muting switch to the "off" position.
- Depress the High Blend switch (button in).

	U.S.A. & Canada models	General model
FM Signal Generator	1kHz, 100% modulation	1kHz, 53% modulation
Stereo Modulator	L+R=45.5%, L-R=45.5%, 19kHz=9%	L+R=22.5%, L-R=22.5%, 19kHz=8%

Step	Alignment	Connection Equipments	Measurement Frequency	Station display	Adjustment	For
1	Discriminator	●Connect the FM Signal Generator to FM 300Ω BAL Antenna terminals through the 300Ω balanced dummy. ●Connect the Oscilloscope and Distortion meter to the Fixed Output jacks.	98.1MHz	98.1MHz	T201 (A)	Adjust so that the Tuned indicator lights when the output frequency of the FM Signal Generator is shifted to Low Frequency side and High Frequency side by the same but limited amount both from 98.1MHz (1mV).
2			98.1MHz	98.1MHz	T201 (B)	Minimum distortion
3			Repeat steps 1 and 2 for optimum sensitivity.			
4	Tuned Indicator	●Connect the DC Volt Meter to TP3 (+) and TP5 (-).			VR202	Tuned indicator lights at 7μV input.
5	Signal Indicator		98.1MHz	98.1MHz	VR201	Adjust so that the DC voltage becomes 9V at 1mV input. At this time, Confirm the five signal indicator lights.



Step	Alignment	Connection Equipments	Measurement Frequency	Station display	Adjustment	For
6	MPX Free Run	<ul style="list-style-type: none"> <li>Connect the Stereo Modulator to FM Signal Generator. Connect FM Signal Generator to FM 300Ω BAL Antenna terminals through the 300Ω balanced dummy.</li> </ul>	98.1MHz (unmodulation)	98.1MHz	VR151	19.00kHz ± 0.02 kHz
7	Stereo Threshold	<ul style="list-style-type: none"> <li>Connect the Frequency Counter to TP4 (+) and TP5 (-).</li> <li>Connect the VTVM and Oscilloscope to the Fixed Output jacks.</li> </ul>	98.1MHz	98.1MHz	VR351	Stereo FM indicator lights at 30μV ± 2dB input.
8	SCA Rejection	<ul style="list-style-type: none"> <li>Connect the Stereo Modulator to FM Signal Generator. Connect FM Signal Generator to FM 300Ω BAL Antenna terminals through the 300Ω balanced dummy. Apply 67kHz, 10% FM modulation SCA signal to the SCA input jack of Stereo Modulator.</li> <li>Connect the VTVM and Oscilloscope to the Fixed Output jacks through 19kHz Low Pass Filter.</li> </ul>	98.1MHz	98.1MHz	VR191	Minimum output
9	Sub-carrier Rejection		98.1MHz	98.1MHz	VR152 LPF151	Minimum output at 19kHz pilot signal only by Stereo Modulator.
10	Separation	<ul style="list-style-type: none"> <li>Connect the Stereo Modulator to FM Signal Generator. Connect FM Signal Generator to FM 300Ω BAL Antenna terminals through the 300Ω balanced dummy.</li> <li>Connect the VTVM and Oscilloscope to the Fixed Output jacks.</li> </ul>	98.1MHz	98.1MHz	VR301	Adjust so that the right channel output becomes minimum when only the left channel of the Stereo Modulator is modulated.
					VR301	Adjust so that the left channel output becomes minimum when only the right channel of the Stereo Modulator is modulated.
11	Separation Balance		98.1MHz	98.1MHz	VR192	With the VR192, correct unbalance between minimum outputs the right and left channels.
12			Repeat steps 10 and 11 for optimum sensitivity.			

## CIRCUIT DESCRIPTION

### (1) SIGNAL PATH

The FM signal is amplified in the RF amplifier 3SK74 (3SK85, 3SK101) at the front end, then mixed with the output of the local oscillator 2SC461 (2SC930, 2SC2834) and converted into a signal of the 10.7MHz intermidlate frequency. This 10.7MHz signal is amplified in the IF amplifier consisting of the ceramic filters CF201 ~ CF203 and Q201 ~ Q204 and fed to ① pin of IC201. In IC201, the signal is amplified in the triple IF amplifiers, and after being detected in the quadrature, it is put out from ⑥ pin as an audio signal, which is then sampled and holded by means of the 38kHz signal produced in IC151 and fed to the audio amplifier.

### (2) MUTING OPERATION WHILE TUNING

When not of tune or the signal is too weak, the muting control voltage is taken out from ⑫ pin of IC201 and is fed to the base of Q205, whose collector then becomes low level. The muting signal is sent to the muting control circuit. As Q357 becomes high level, the signal is fed to NAND IC351. The ③ pin of IC351 and Q7 become low level and high level respectively and muting gates Q317 (Lch) and Q318 (Rch) become low level, thus muting operation is completed.

### (3) SIGNAL INDICATOR CIRCUIT

#### 1) FM tuner section

The signal indicator drive signal taken out from ⑬ pin of IC201 passes through VR201, amplified in Q351 ~ Q353 amplifiers and fed to D901.

#### 2) AM tuner section

The signal indicator drive signal taken out from ⑯ pin of IC251 is fed to the base of Q351, amplified in Q351 ~ Q353 amplifiers and fed to D901.

### (4) SYNTHESIZER SECTION

#### 1) FM

The output of local oscillator in the front-end is fed to ⑤ pin of the pre-scaler IC701, then divided by 30 or 32 and fed to ⑳ pin of the PLL synthesizer IC702. The standard quartz oscillator output (7.2MHz) is divided by 288 in IC702 and 25kHz standard signal is obtained. The divided local oscillator output is compared with the 25kHz standard signal in the phase comparator.

When the divided local oscillator frequency is higher than standard frequency, ㉓ pin of IC702 becomes high level but when it is lower, ㉓ pin of IC702 becomes low level. When the both frequencies are equal, ㉓ pin becomes floating.

㉓ pin output of IC702 is fed to the vari-cap diode of the front-end through L.P.F. (Q701, Q702, Q703) and controls the frequency of VCO (local oscillator frequency.)

#### 2) AM

(When SW712 frequency step control switch is set to 10 kHz position.)

The local oscillator output of AM IC251 is fed to ㉑ pin of the PLL synthesizer IC702 and divided. The standard quartz oscillator output (7.2MHz) is divided by 720 in IC702 and 10kHz standard signal is obtained. The divided local oscillator output is compared with the 10kHz standard signal in the phase comparator.

### (5) PRESET MEMORY

#### 1) Memory

While the memory button is pressed ON (the memory indicator is lit), pressing one of the preset keys of M1 ~ M8 (SW701 ~ SW708) causes the pin corresponding to the pressed key among ㉒ ~ ㉕ pins of IC702 becomes high level. The frequency displayed then is memorized.

#### 2) Call

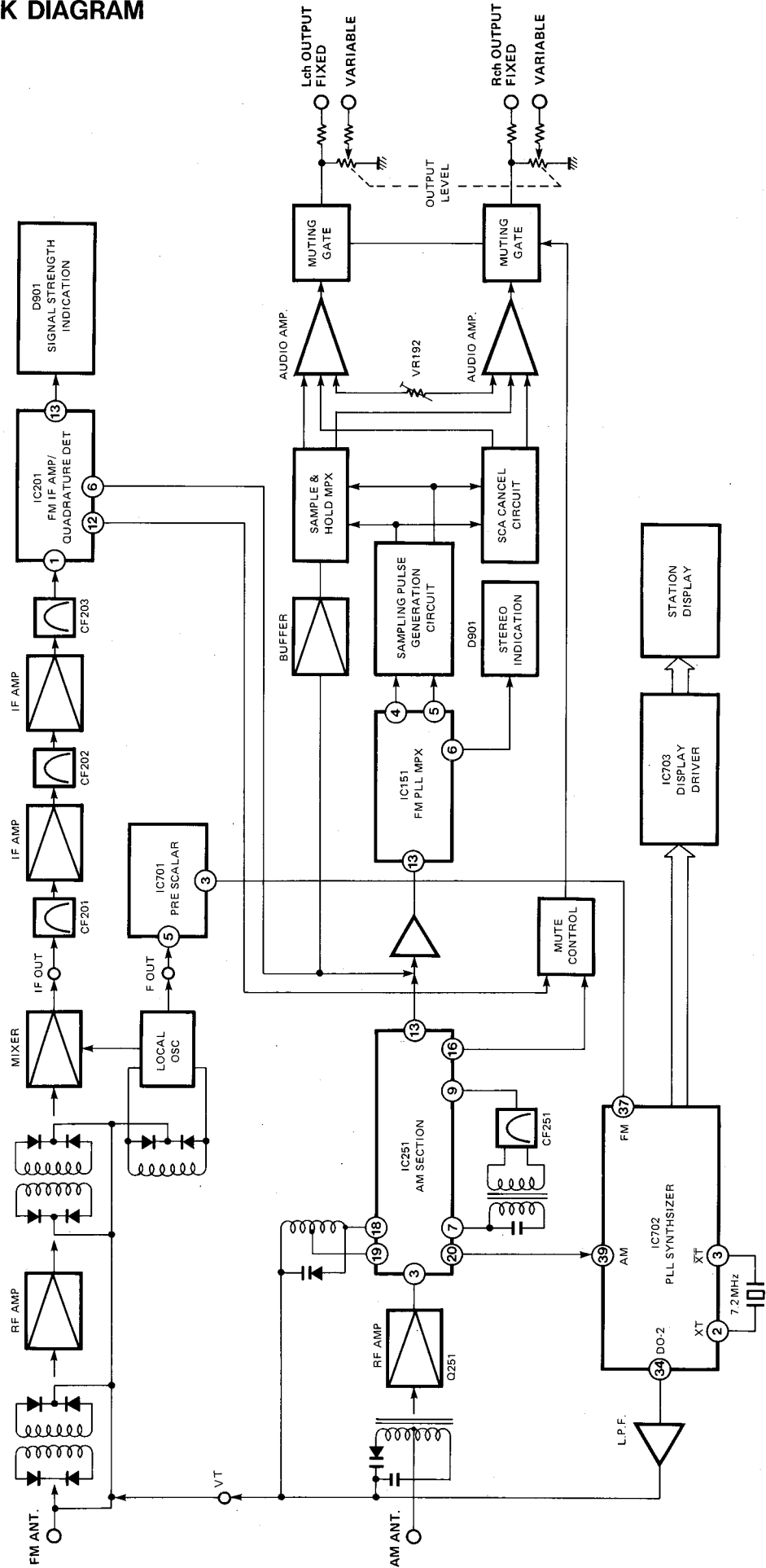
The memory content (frequency) is called out by pressing one of the preset keys of M1 ~ M8 (SW701 ~ SW708).

### (6) FM/AM SCANNING

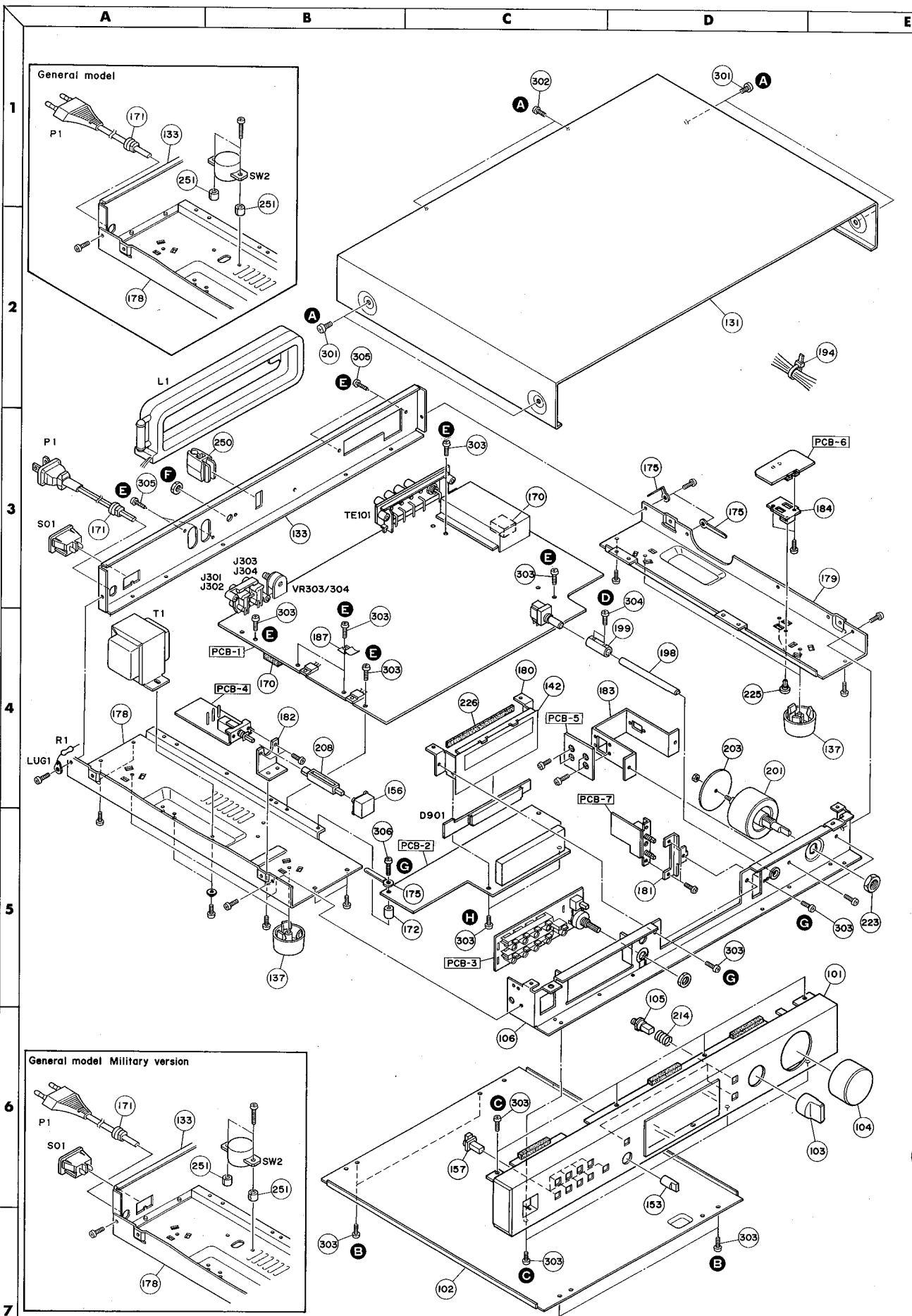
1) With the tuning mode switch (SW201) set to AUTO, tuning the tuning control clockwise causes the photo switch Q801 or Q802 to turn OFF and the frequency increases, while turning the tuning control counterclockwise causes the photo switch Q801 or Q802 to turn OFF and the frequency decreases. Scanning stops when ㉖ pin (stop terminal) of IC702 becomes high level.

2) With the tuning mode switch (SW201) set to MANUAL, turning the tuning control clockwise or counterclockwise causes the frequency to increase or decrease by one step (channel space).

# BLOCK DIAGRAM



GENERAL UNIT EXPLODED VIEW



## GENERAL UNIT PARTS LIST

Ref. No.	Part No.	Description
101	A443-TU915A	Front Panel Assembly
102	A424-TU915A	Cabinet Bottom Assembly
103	A630-TU915A	Knob Assembly, Function
104	A630-TU915B	Knob Assembly, Tuning
105	A662-TU915A	Push Button Assembly, Muting, Tuning, High Blend
106	B211-TU915A	Chassis Assembly
131	1414-02201	Cabinet Top
133	1424-12702	Cabinet Back (for U.S.A. & Canada models)
"	1424-13002	Cabinet Back (for General model)
"	1424-12703	Cabinet Back (for General model Military version)
137	1319-0139	Foot
142	1531-07101	Window
153	1634-04901	Knob, Muting Level
156	1660-00401	Push Button, Power
157	1662-16501	Push Button, Preset, Memory
170	2112-11773	Sponge
171	2114-415027	Bushing
172	2132-01401	Spacer
175	2218-7001	Holding Bracket
178	2219-7981	Bracket (for U.S.A. & Canada models)
"	2219-8000	Bracket (for General model)
179	2219-7999	Bracket
180	2219-8001	Bracket
181	2219-8021	Bracket
182	2219-7984	Bracket
183	2219-8002	Bracket
184	2219-7964	Bracket
187	2222-7169	Heat Sink
194	2240-7120	Holder
198	2601-7130	Shaft
199	2601-7069	Shaft
201	2602-007120	Tuning Shaft
203	2133-7026	Protector
208	2672-7018	Lever
214	2651-210189	Spring
223	2447-10227	Hexagon Nut
225	2459-3003511	Rivet
226	2111-11160	Felt
250	2240-7218	Holder, Antenna
251	2132-7116	Spacer (General model only)
301	2347-400647	Self-Tapping Screw (+) (4 x 6 mm)
302	2347-300647	Self-Tapping Screw (+) (3 x 6 mm)
303	2347-300627	Self-Tapping Screw (+) (3 x 6 mm)
304	2322-300629	Screw (+) (3 x 6 mm)
305	2347-301041	Self-Tapping Screw (+) (3 x 10 mm)
306	2347-301427	Self-Tapping Screw (+) (3 x 14 mm)
	1111-J30169	Owner Guide (for U.S.A. model & General model Military version)
	1111-J30170	Owner Guide (for Canada & General models)
	1222-7224	Packing Cushion
	1221-787147	Packing Box
	4474-29	AC Adaptor (for General model Military version)

△

## ELECTRICAL PARTS LIST

Ref. No.	Part No.	Description
<b>CHASSIS MISCELLANEOUS</b>		
△ P1	4161-71147	Power Cord (for U.S.A. & Canada models)
△ "	4161-7256	Power Cord (for General model)
△ T1	5584-701477	Power Transformer (for U.S.A. & Canada models)
△ "	5584-701478	Power Transformer (for General model)
△ SW2	4411-104736	Rotary Switch, Voltage Selector (General model only)
△ SO1	4474-164	AC Socket, Unswitched (U.S.A. & Canada models & General model Military version only)
△ CO1	4443-712	Connector, Power Cord (General model only)
△ R1	5135-335J50P	Resistor, 3.3M $\Omega$ , 1/2W, Carbon (U.S.A. & Canada models only)
D901	5623-LT1137	LED Display Assembly
L1	5911-244	AM Loop Antenna
LUG1	4211-5005	Lug Terminal (U.S.A. & Canada models only)
	1397-6	Dipole Antenna (Accessory)
	4161-71184	Connection Wire (Accessory)
<b>PCB-1 MAIN P.C. BOARD</b>		
<b>RESISTORS</b>		
△ R2, 3	5102-2R2579	2.2 $\Omega$ , $\pm$ 5%, 1/4W, Fuse
△ R10, 13, 17, 151, 220	5102-2204715	22 $\Omega$ , $\pm$ 2%, 1/4W, Fuse
△ R171, 172, 301, 302	5102-1004715	10 $\Omega$ , $\pm$ 2%, 1/4W, Fuse
R158	5174-163381	16k $\Omega$ , $\pm$ 1%, 1/4W, Metal
△ R703	5102-1014715	100 $\Omega$ , $\pm$ 2%, 1/4W, Fuse
R787, 788	5171-121581	120 $\Omega$ , $\pm$ 5%, 1W, Metal
<b>CONTROLS</b>		
VR151	5101-4727173	4.7k $\Omega$ B
VR152	5101-10371920	10k $\Omega$ B
VR191, 301	5101-50271920	5k $\Omega$ B
VR192	5101-50171920	500 $\Omega$ B
VR201, 351	5101-50371920	50k $\Omega$ B
VR202	5101-20371920	20k $\Omega$ B
VR303/304	5113-50271151	5k $\Omega$ B, Output Level
<b>CAPACITORS</b>		
C5, 6	5345-228D0962	2200 $\mu$ F, $\pm$ 20%, 25V, Electrolytic
C7, 8, 15, 171, 172, 206, 301, 302	5345-477C041	470 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C9, 10	5345-108C041	1000 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C11	5345-476F041	47 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C12	5345-107F041	100 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C13, 709	5345-107E041	100 $\mu$ F, $\pm$ 20%, 35V, Electrolytic
C14, 17	5345-476D041	47 $\mu$ F, $\pm$ 20%, 25V, Electrolytic
C16, 18, 352	5345-226C041	22 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C19, 20, 152, 155, 257	5345-106C041	10 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C101, 151, 262	5345-227C041	220 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C102, 158, 718, 719, 806, 807	5345-225F0952	2.2 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C153	5359-4725851	4700pF, $\pm$ 5%, 100V, Polypropylene
C154	5359-6815851	680pF, $\pm$ 5%, 100V, Polypropylene
C156	5345-105F0952	1 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C157	5345-475D0952	4.7 $\mu$ F, $\pm$ 20%, 25V, Electrolytic
C160, 161, 187, 209	5359-1015851	100pF, $\pm$ 5%, 100V, Polypropylene
C162, 175, 176	5359-4715851	470pF, $\pm$ 5%, 100V, Polypropylene
C163	5359-1225851	1200pF, $\pm$ 5%, 100V, Polypropylene
C173, 179	5359-2215851	220pF, $\pm$ 5%, 100V, Polypropylene
C174	5359-1515851	150pF, $\pm$ 5%, 100V, Polypropylene
C177	5359-8215851	820pF, $\pm$ 5%, 100V, Polypropylene
C178	5359-1215851	120pF, $\pm$ 5%, 100V, Polypropylene
C180, 181, 185	5345-226C0951	22 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C182, 183, 184, 186, 311, 312	5359-1025851	1000pF, $\pm$ 5%, 100V, Polypropylene

Ref. No.	Part No.	Description
C210, 356	5345-105F041	1 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C211	5345-107C0952	100 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C216	5345-104F0952	0.1 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C265	5345-225F041	2.2 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C267, 268	5345-475D041	4.7 $\mu$ F, $\pm$ 20%, 25V, Electrolytic
C270	5359-3915851	390pF, $\pm$ 5%, 100V, Polypropylene
C272, 351, 353	5345-474F041	0.47 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C305, 306, 307, 308	5359-1525851	1500pF, $\pm$ 5%, 100V, Polypropylene
C309, 310	5359-3025851	3000pF, $\pm$ 5%, 100V, Polypropylene
C313, 314	5359-5125851	5100pF, $\pm$ 5%, 100V, Polypropylene
C315, 316	5359-2425851	2400pF, $\pm$ 5%, 100V, Polypropylene
C317, 318	5345-336C0951	33 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C319, 320	5345-106C0951	10 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C321, 322	5359-1535851	0.015 $\mu$ F, $\pm$ 5%, 100V, Polypropylene (for U.S.A. & Canada models)
"	5359-1035851	0.01 $\mu$ F, $\pm$ 5%, 100V, Polypropylene (for General model)
C704	5345-476B041	47 $\mu$ F, $\pm$ 20%, 10V, Electrolytic
C710	5345-106E041	10 $\mu$ F, $\pm$ 20%, 35V, Electrolytic
C711	5345-334F0951	0.33 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
C713	5345-227B041	220 $\mu$ F, $\pm$ 20%, 10V, Electrolytic
C714	5343-2260653	22 $\mu$ F, $\pm$ 20%, 6.3V, Tantalum
C715	5350-4730H651	47000 $\mu$ F, +80%–20%, 5V, Special
C801	5345-107C041	100 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
TC251, 252	5371-93	Trimmer Capacitor
<b>INTEGRATED CIRCUITS</b>		
IC151	5652-BA1330	BA1330
IC152, 803	5654-TC4011BP	TC4011BP
IC153, 802, 804	5654-TC4001BP	TC4001BP
IC154	5654-TC4066BP	TC4066BP
IC155	5652-M5219P	M5219P
IC201	5652-HA11225	HA11225
IC251	5652-LA1245	LA1245
IC701	5654-TD6104P	TD6104P
IC702	5654-TC9147BP	TC9147BP
IC801	5654-TC4069BP	TC4069BP
<b>TRANSISTORS</b>		
Q1	5611-1305(Y)	2SA1305(Y)
Q2	5613-3297(Y)	2SC3297(Y)
Q3, 10, 11, 205, 252, 151, 152, 153, 154, 157, 159, 305, 306, 307, 308, 309, 310, 352, 355, 704, 705, 803, 804	5613-2603(F)	2SC2603(F) or 2SC2603(E)
Q4, 5, 6, 7, 8, 9, 155, 156, 158, 303, 304, 311, 312, 313, 314, 351, 353, 354, 703	5611-1115(F)	2SA1115(F) or 2SA1115(E)
Q201, 202, 203, 204	5613-2058(N)	2SC2058(N) or 2SC2058(P)
Q251	5616-2SK241(Y)	F.E.T., 2SK241(Y) or 2SK241(GR1)
Q301, 302, 319	5616-2SK381(D)	F.E.T., 2SK381(D)
Q315, 316	5615-2SJ103(G)	F.E.T., 2SJ103(GR)
Q317, 318	5613-2878(B)	2SC2878(B)
Q701	5616-2SK117(Y)	F.E.T., 2SK117(Y)
Q702	5613-2240(GR)	2SC2240(GR) or 2SC2240(BL)
<b>DIODES</b>		
$\Delta$ D1	5685-1F	Bridge Silicon, SIRBA10
D2, 3	5635-HZ15-1L	Zener, HZ15-1L
D4, 5, 7, 10, 11	5636-1S2471	1S2471
D6	5635-HZ27-3L	Zener, HZ27-3L
D8	5635-HZ12B2L	Zener, HZ12B2L
D9, 705	5635-HZ6B1L	Zener, HZ6B1L

Ref. No.	Part No.	Description
D12, 151, 152, 153, 154, 201, 301, 351, 701, 702, 703, 704, 803, 804, 805, 806, 807, 808, 809, 810	5631-1S2473	1S2473
D251, 252	5633-1SV102	1SV102
<b>COILS</b>		
L101	5995-703027	
L102, 151, 201, 701	5995-2R2074	2.2 $\mu$ H
L251	5933-70228	
L252	5922-00212	
<b>TRANSFORMERS</b>		
T201	5574-7024	
T251	5552-70113	
T252	5932-70123	
<b>MISCELLANEOUS</b>		
LPF151	6114-7130	FM Tuner Assembly
CF201, 202, 203	5214-64	LC Component
CF201	5671-7119A	Ceramic Filter (for U.S.A. & Canada models)
CF202, 203	5671-7141A	Ceramic Filter (for General model)
CF251	5671-7142A	Ceramic Filter (for General model)
CF252	5671-7139G	Ceramic Filter
X701	5671-7137C	Ceramic Filter
SW301	5691-00720022	Crystal OSC.
SW710	4421-022110	Slide Switch, De-Emphasis (General model only)
J301/302/303/304	4411-203732	Rotary Slide Switch, Function
TE101	4484-31	4-Pin Jack, Output
"	4214-154	External Antenna Terminals (for U.S.A. & Canada models & General model Military version)
J10	4215-58	External Antenna Terminals (for General model)
J11	4443-030185	Connector, 3-Pos.
J151, 351	4443-080185	Connector, 8-Pos.
J701, 801	4443-070185	Connector, 7-Pos.
P12	4443-050185	Connector, 5-Pos.
	4443-117114	Connector, 11-Pos.

### PCB-2 STATION DISPLAY P.C. BOARD

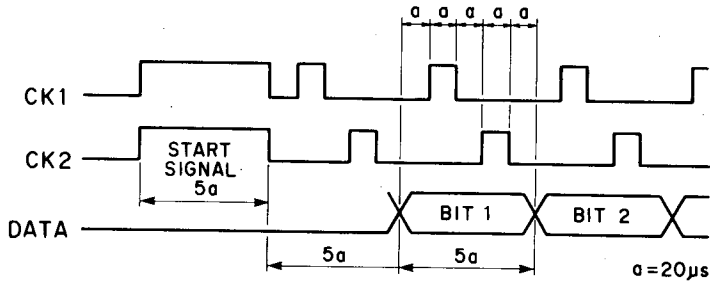
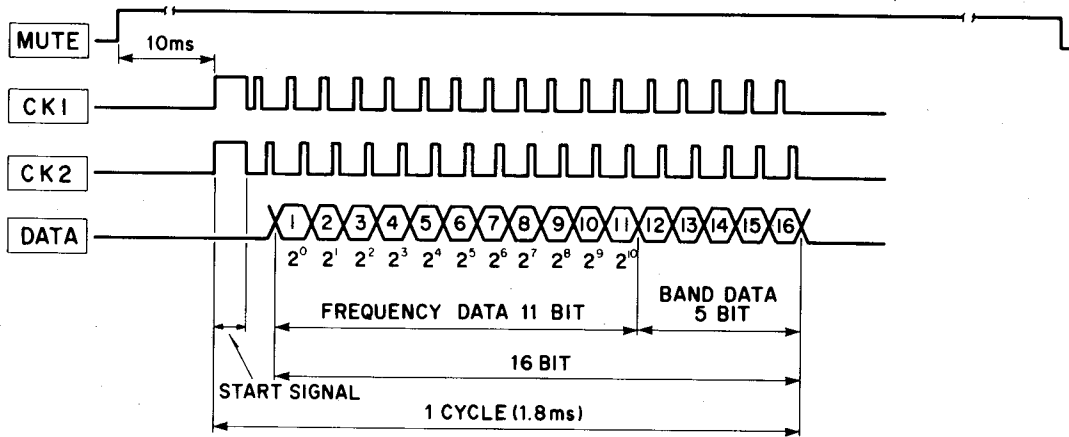
<b>RESISTORS</b>		
$\Delta$ R391	5102-2204715	22 $\Omega$ , $\pm$ 2%, 1/4W, Fuse
R731 ~ 737, 738 ~ 744, 745 ~ 751	5212-3	47k $\Omega$ , R Components
<b>CAPACITORS</b>		
C354, 721	5345-106C041	10 $\mu$ F, $\pm$ 20%, 16V, Electrolytic
C355	5345-105F041	1 $\mu$ F, $\pm$ 20%, 50V, Electrolytic
<b>INTEGRATED CIRCUITS</b>		
IC351	5654-TC4011BP	TC4011BP
IC703	5654-TD6301AP	TD6301AP
<b>TRANSISTORS</b>		
Q356, 358, 360, 707	5611-1115(F)	2SA1115(F) or 2SA1115(E)
Q357, 361, 708, 709	5613-2603(F)	2SC2603(F) or 2SC2603(E)
<b>DIODES</b>		
D352, 353, 354, 356	5631-1S2473	1S2473
D355, 357	5635-HZ9B2L	Zener, HZ9B2L
D708	5635-HZ11A2L	Zener, HZ11A2L (for U.S.A. & Canada models only)
<b>MISCELLANEOUS</b>		
J352	5722-14	Station Display, FIP7F8S
J353, 354	4443-050185	Connector, 5-Pos.
	4443-040185	Connector, 4-Pos.



Ref. No.	Part No.	Description
<b>PCB-3 PRESET MEMORY SWITCHES P.C. BOARD</b>		
	<b>CONTROL</b>	
VR353	5113-50371153	50k $\Omega$ B, Muting Level
	<b>DIODES</b>	
D711, 712, 713, 714, 715, 716, 717, 718, 719	5637-GL5NG6	L.E.D., GL5NG6, Green, Preset, Memory
	<b>MISCELLANEOUS</b>	
SW351	4431-A027117	Push Switch, Muting
SW701, 702, 703, 704, 705, 706, 707, 708	4431-04047165	Push Switch, Preset
SW709	4431-A010132	Push Switch, Memory
J12	4163-71096	Connector with Lead Wire, 11-Pos.
<b>PCB-4 POWER SWITCH P.C. BOARD</b>		
SW1	4431-A027153	Push Switch, Power
J1	4443-050185	Connector, 5-Pos.
<b>PCB-5 TUNING SENSOR P.C. BOARD</b>		
Q801, 802	5624-GP411	Photo-Interrupter, GP411
<b>PCB-6 FREQUENCY STEP CONTROL SWITCHES P.C. BOARD</b>		
SW711, 712	4421-012413	Slide Switch, FM 50kHz/100kHz, AM 9kHz/10kHz
<b>PCB-7 TUNING &amp; HIGH BLEND SWITCHES P.C. BOARD</b>		
SW201, 202	4431-02047170	Push Switch, Tuning, High Blend
J355	4443-05418	Connector, 5-Pos.

# TIMING CHART

Frequency display timing chart of IC702 (TC9147BP)



SCHEMATIC DIAGRAM

FM FRONT END

PRE SCALER

L.P.F.

STATION DISPLAY

FM IF AMP. QUADRATURE DET

PLL SYNTHESIZER

FM IF AMP.

AM SECTION

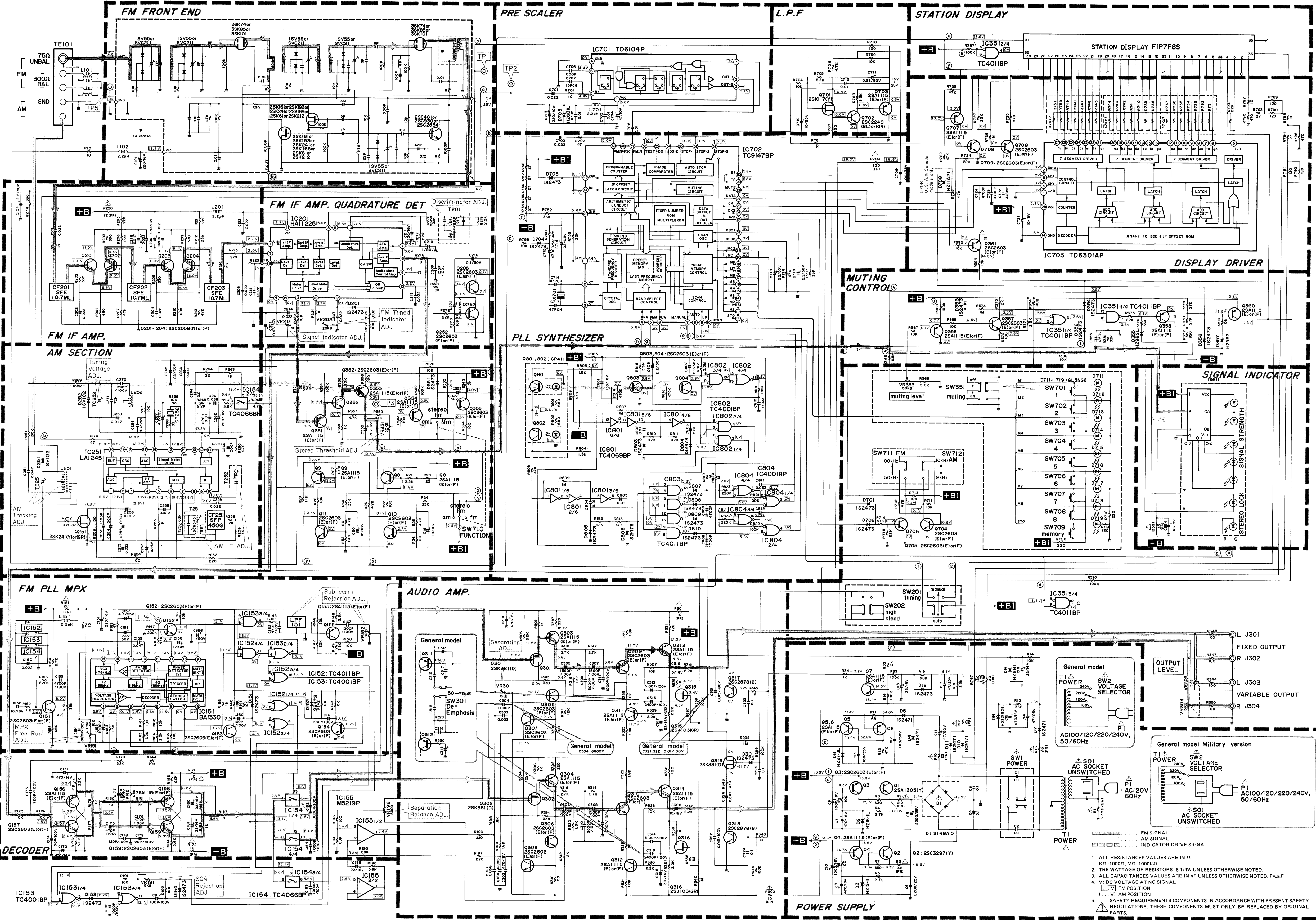
MUTING CONTROL

SIGNAL INDICATOR

FM PLL MPX

AUDIO AMP.

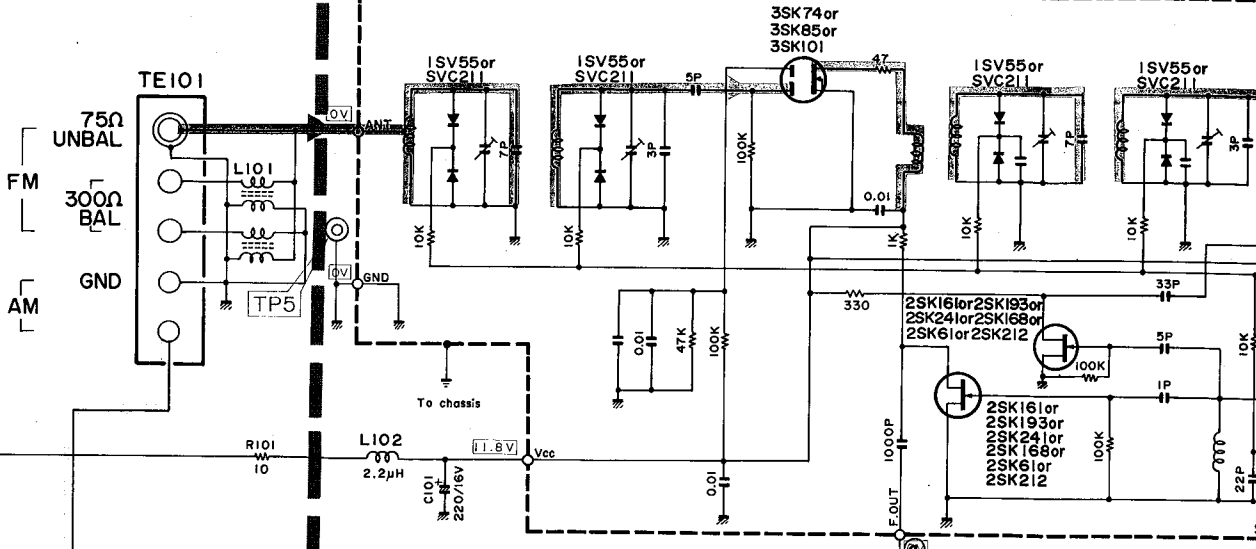
POWER SUPPLY



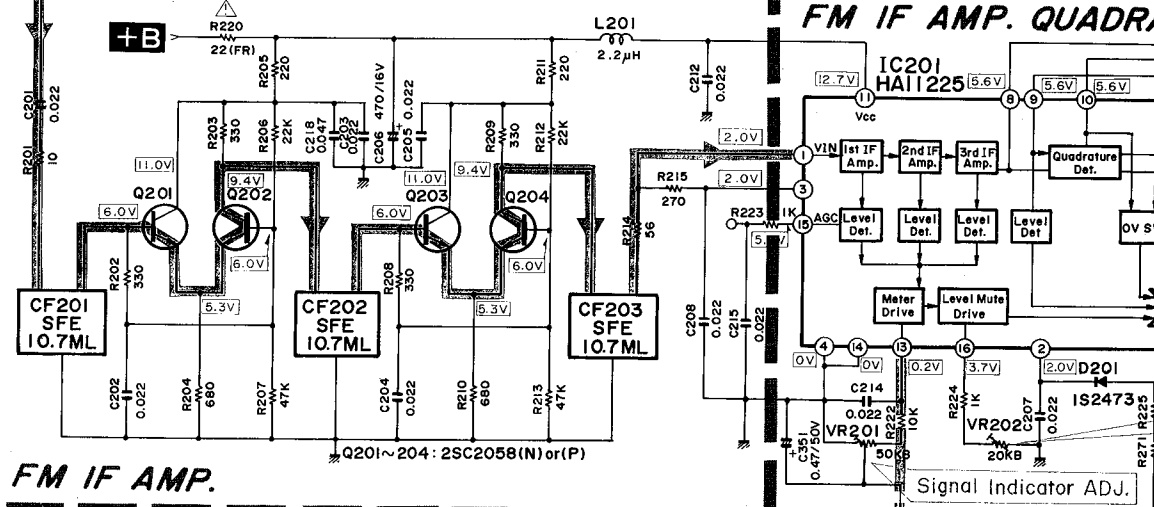
1. ALL RESISTANCE VALUES ARE IN  $\Omega$ . K $\Omega$ =1000 $\Omega$ , M $\Omega$ =1000K $\Omega$ .
2. THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
3. ALL CAPACITANCE VALUES ARE IN  $\mu$ F UNLESS OTHERWISE NOTED. P=POLARIZED.
4. V=DC VOLTAGE AT NO SIGNAL.
5. (FM) AM POSITION.
6. SAFETY REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS, THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.

**SCHEMATIC DIAGRAM**

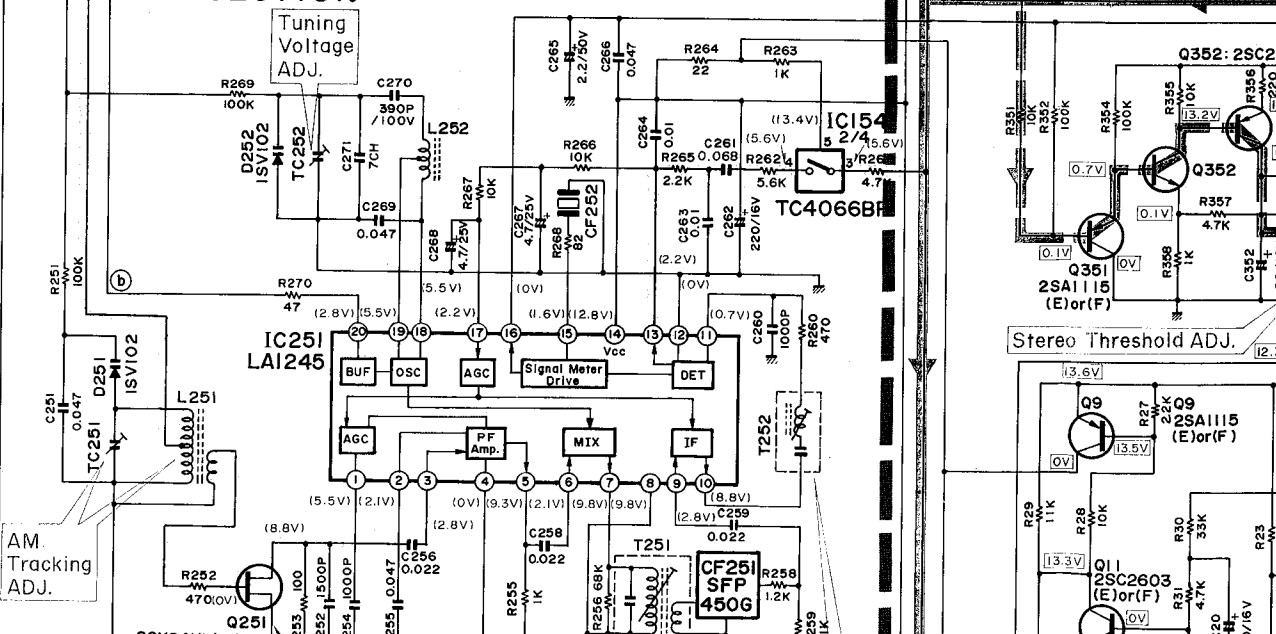
**FM FRONT END**



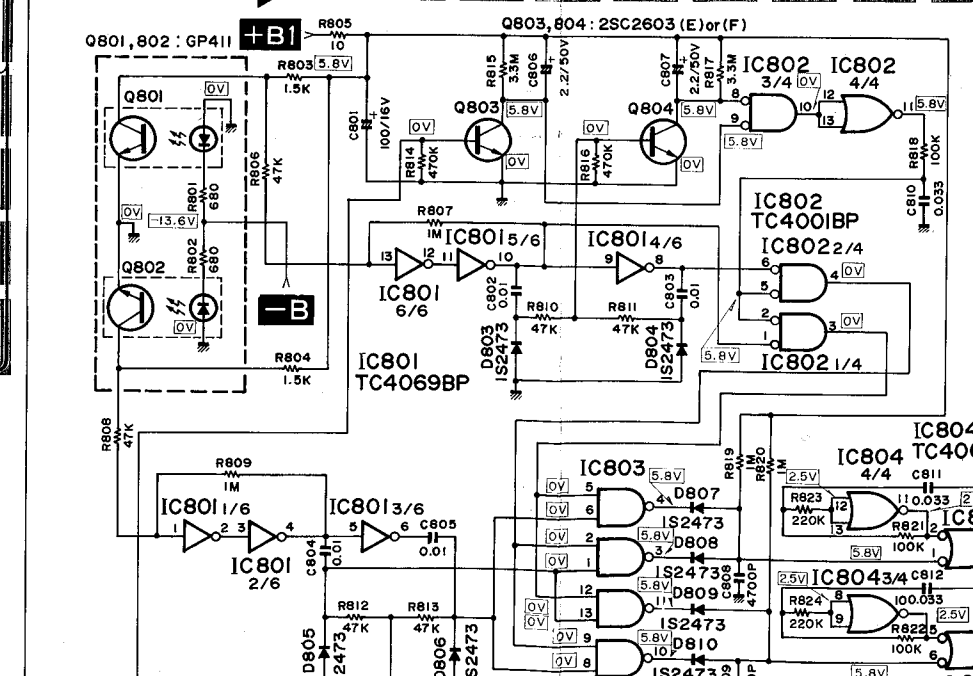
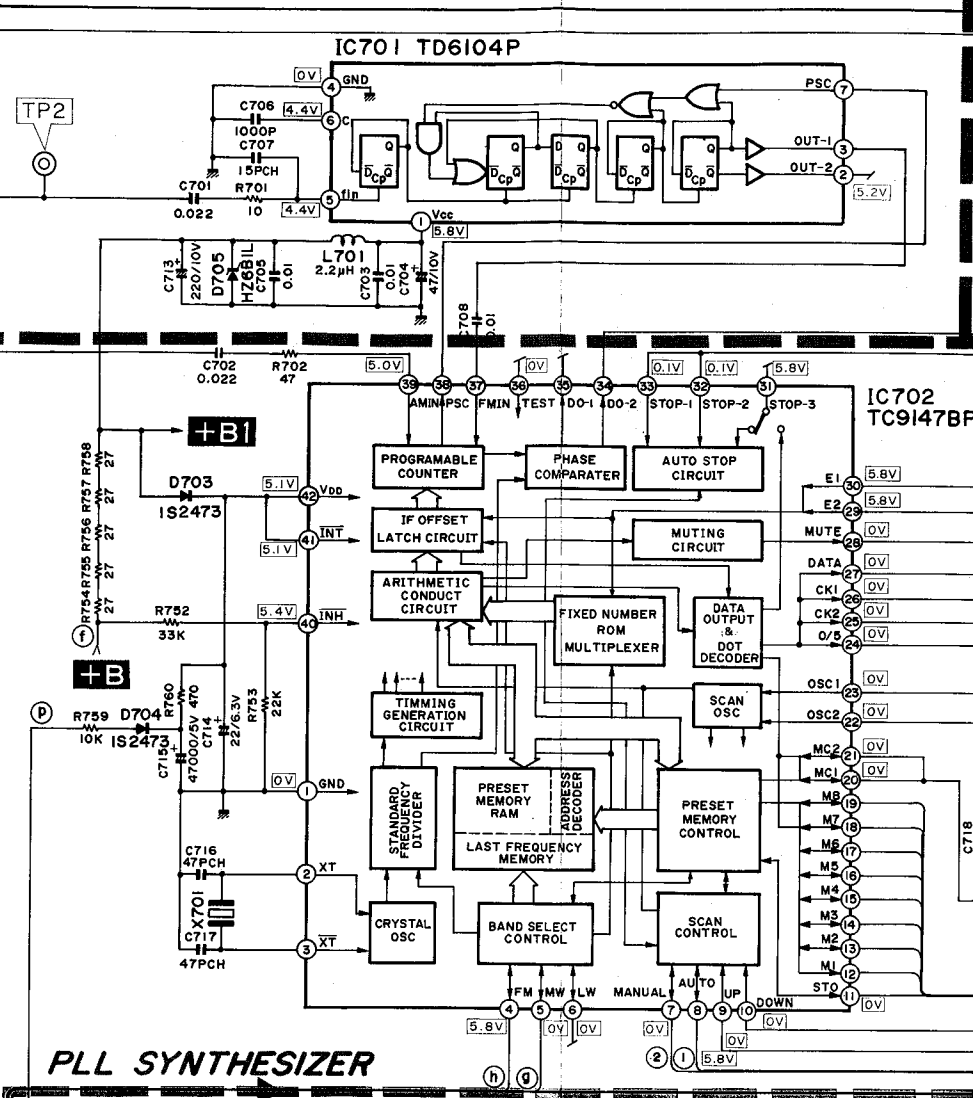
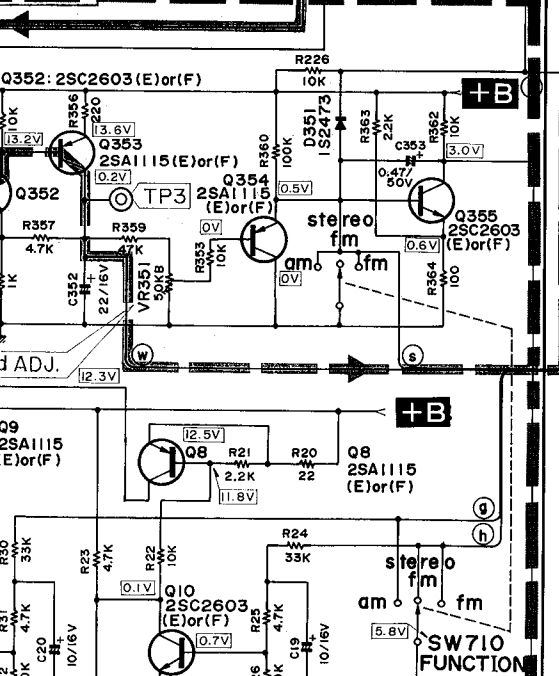
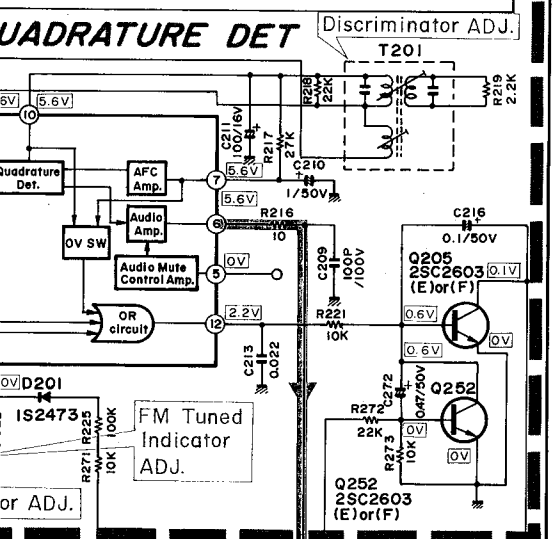
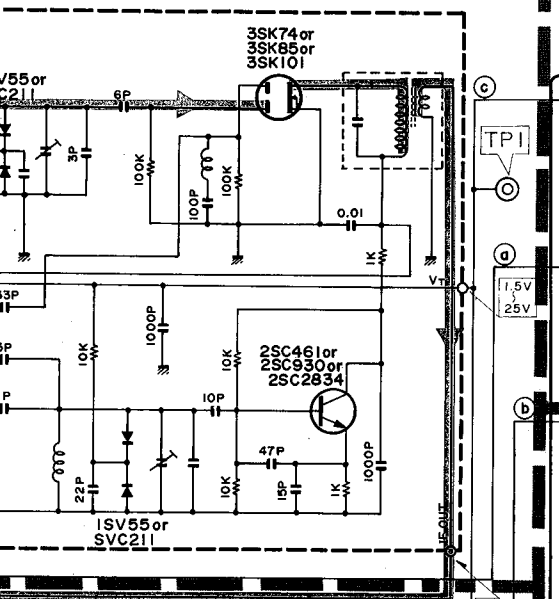
**FM IF AMP. QUADRA**



**FM IF AMP.  
AM SECTION**



# PRE SCALER

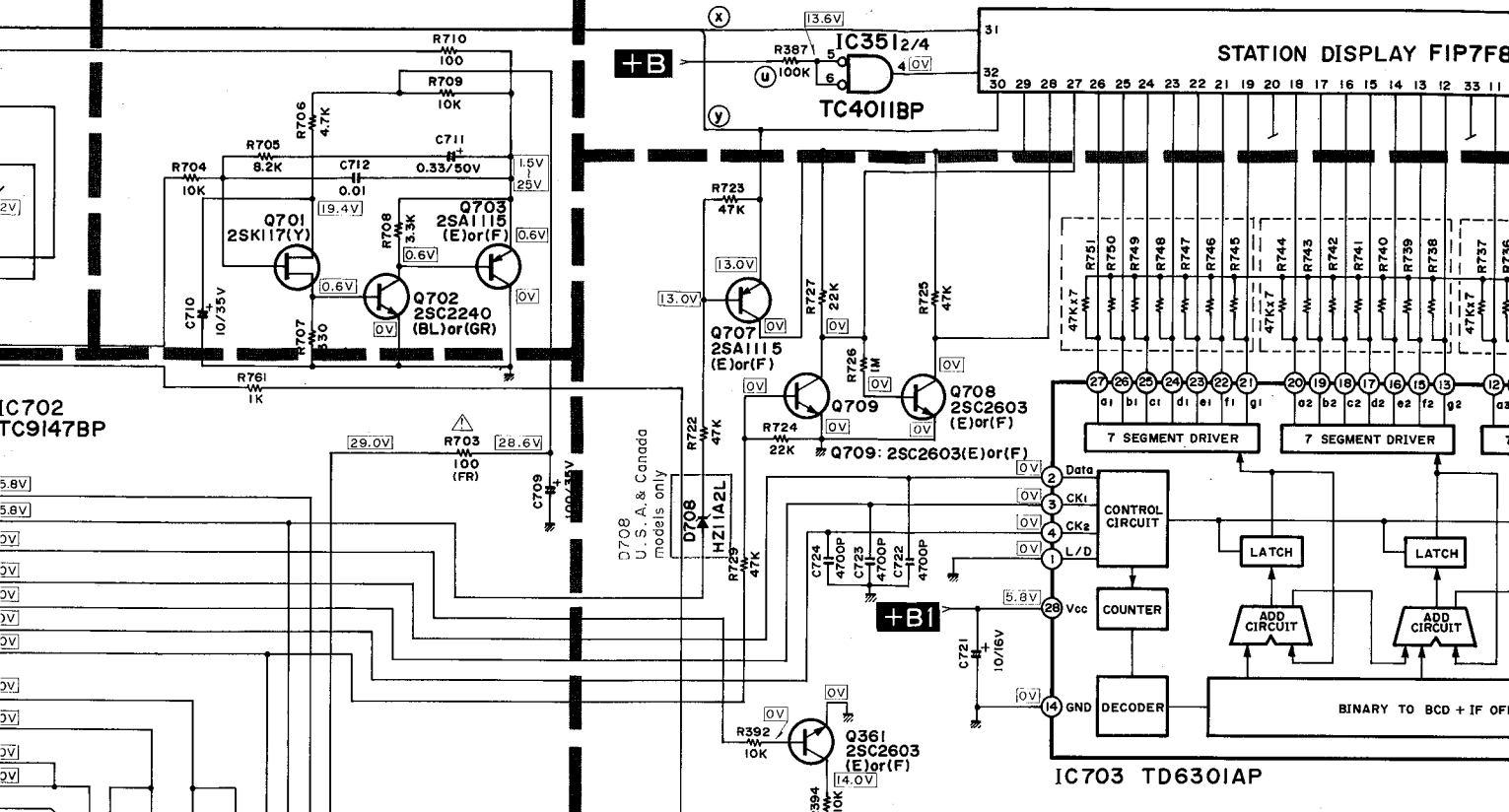




L.P.F

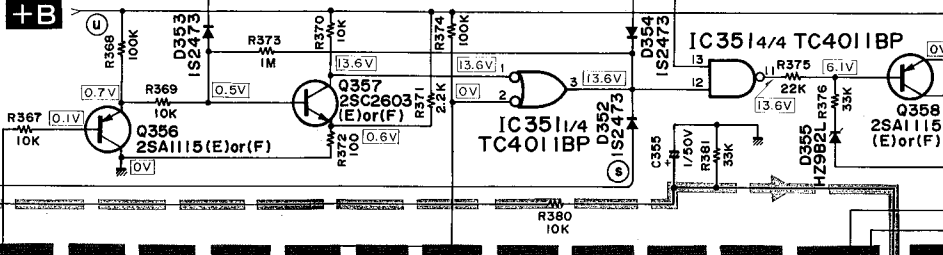
STATION DISPLAY

STATION DISPLAY FIP7F8



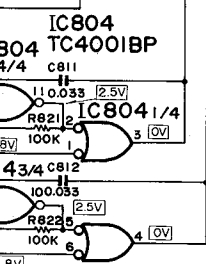
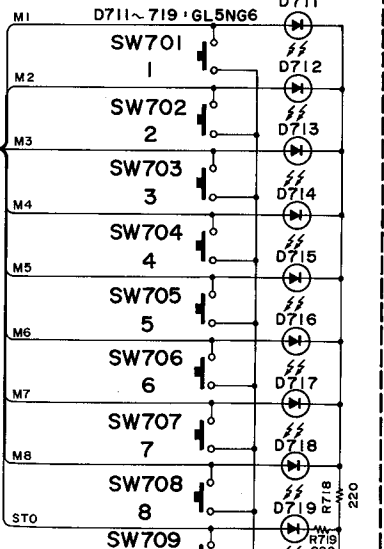
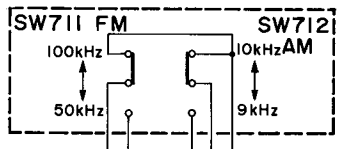
MUTING CONTROL

U.S. & Canada models only

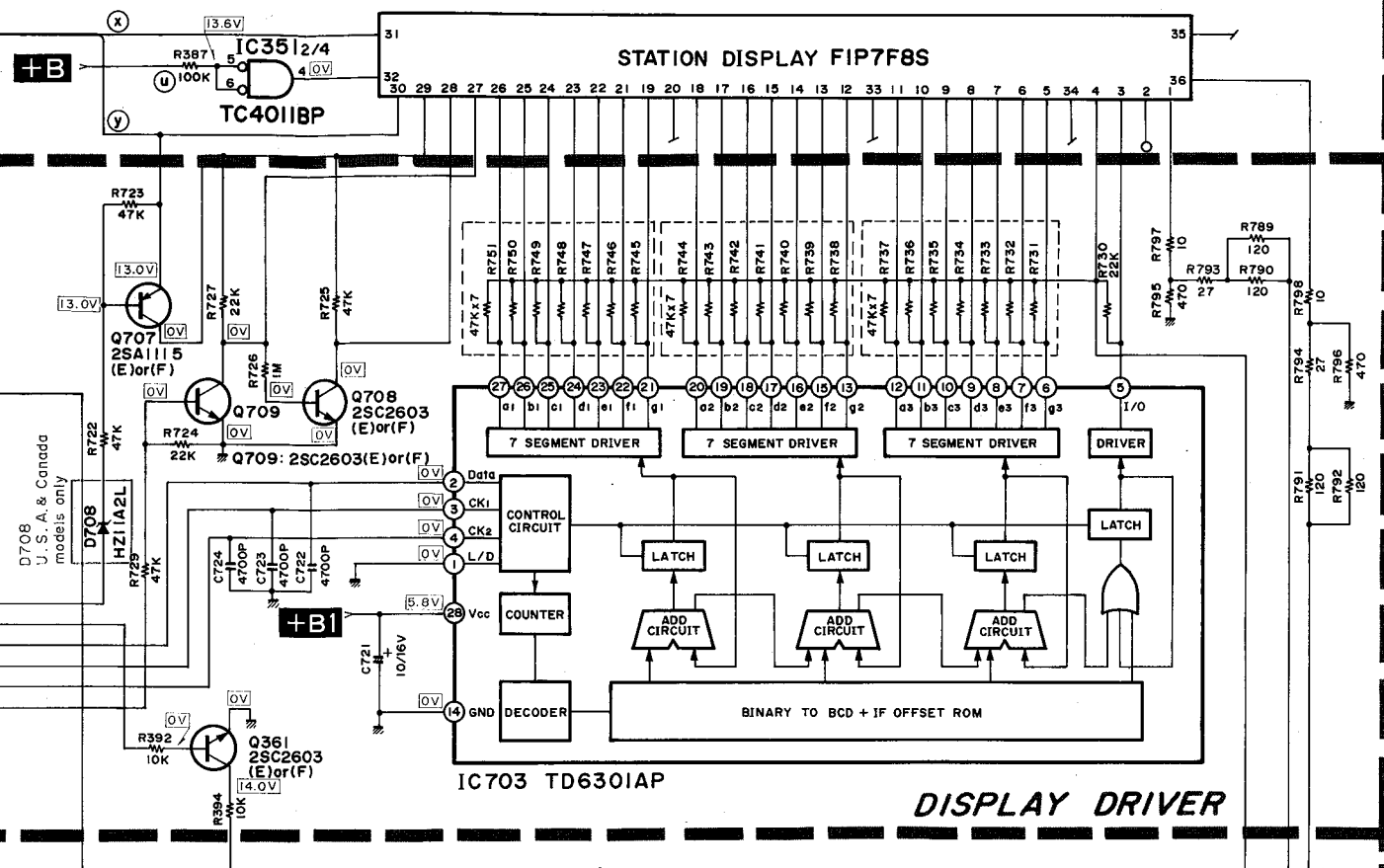


muting level

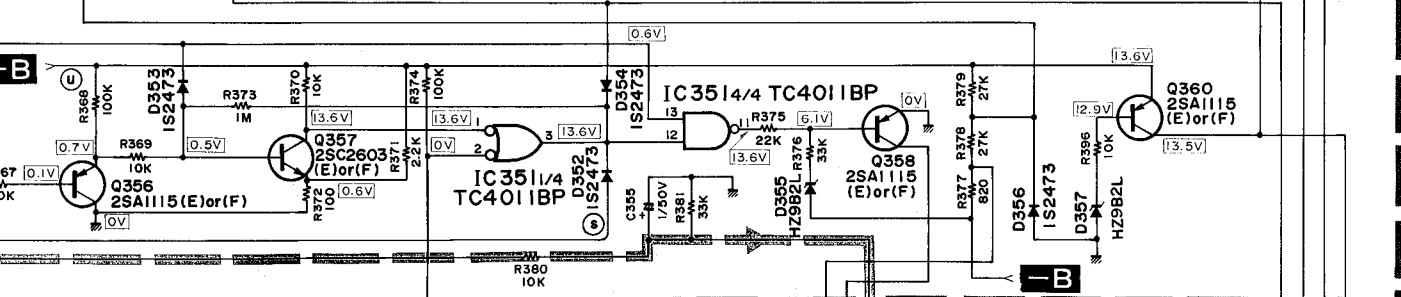
muting



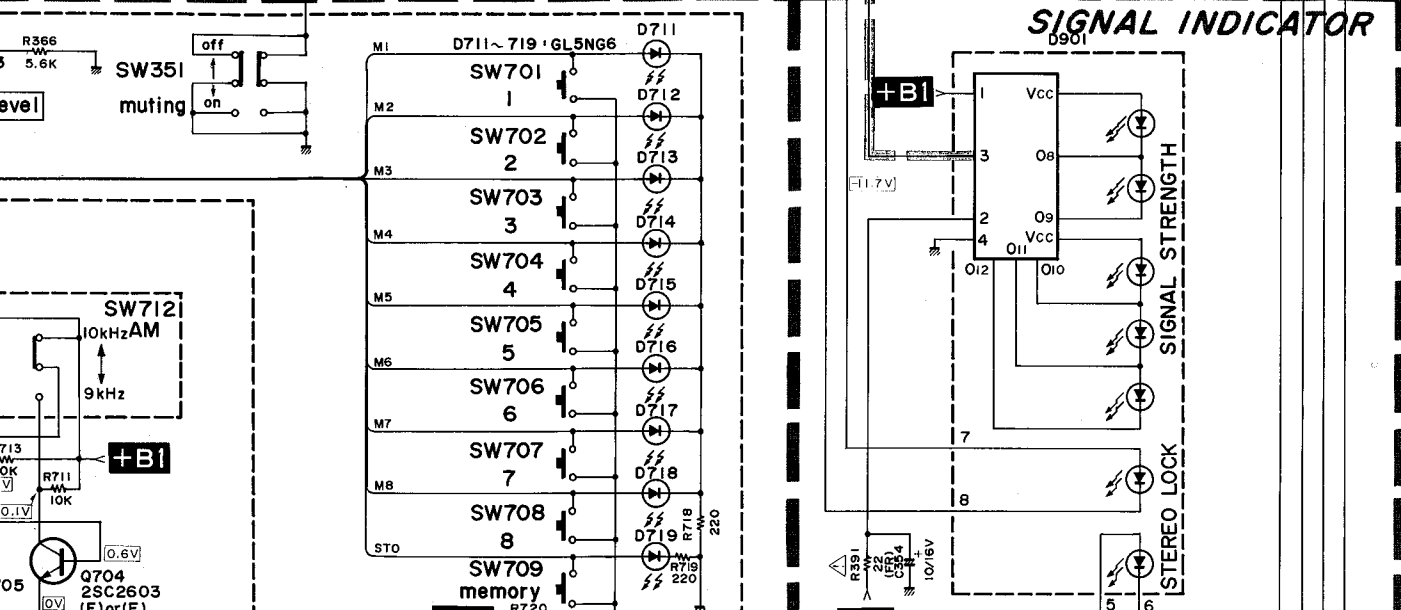
# STATION DISPLAY



# DISPLAY DRIVER



# SIGNAL INDICATOR



5

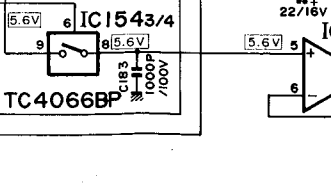
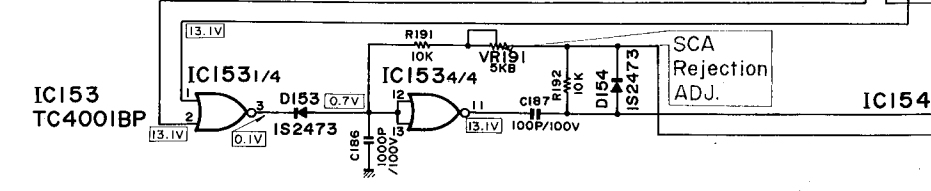
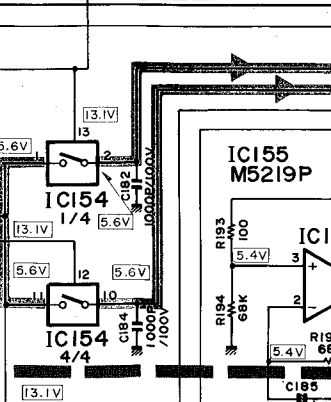
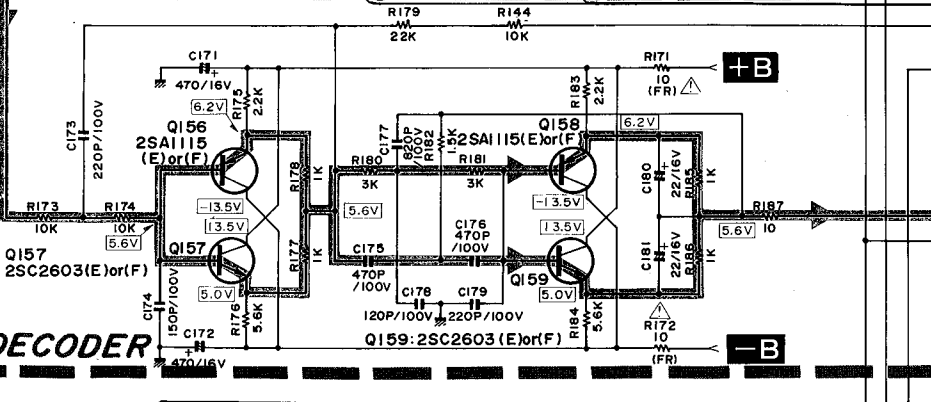
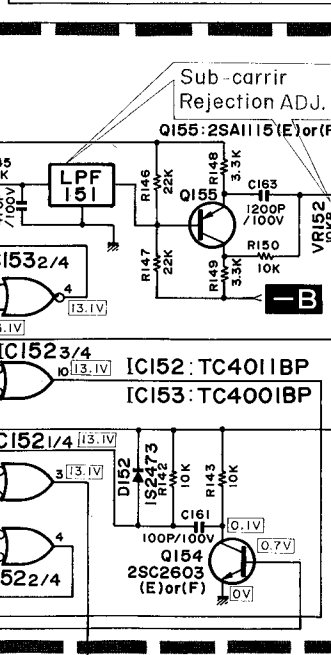
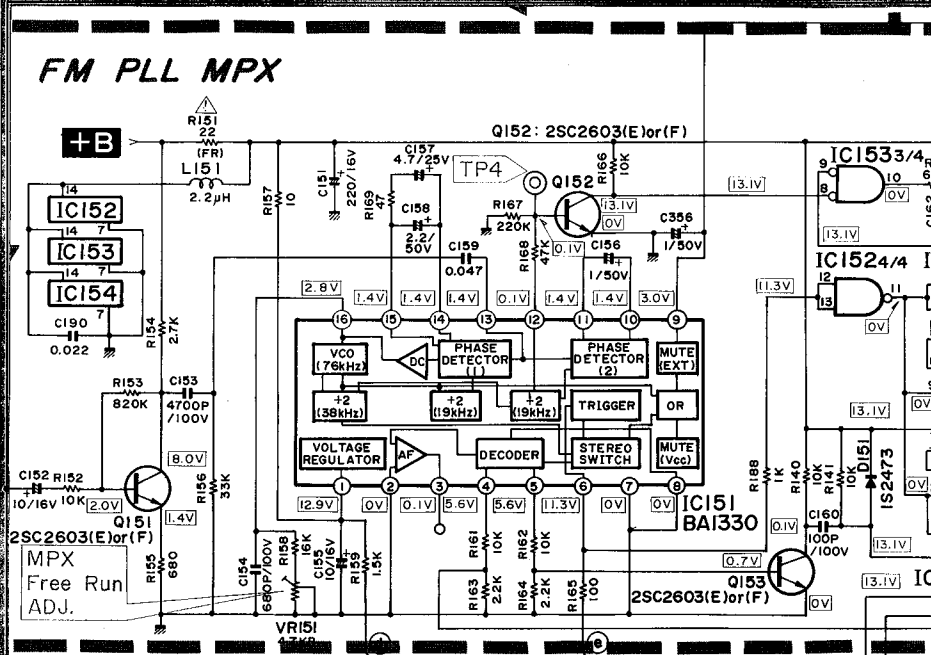
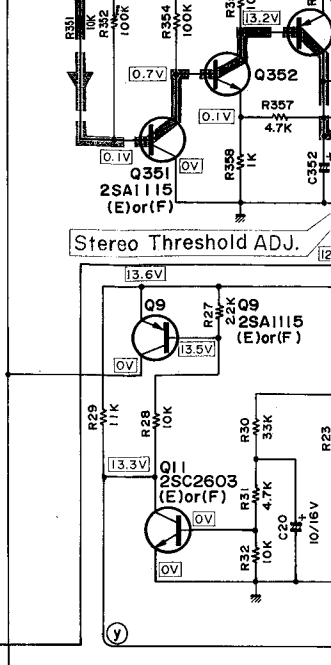
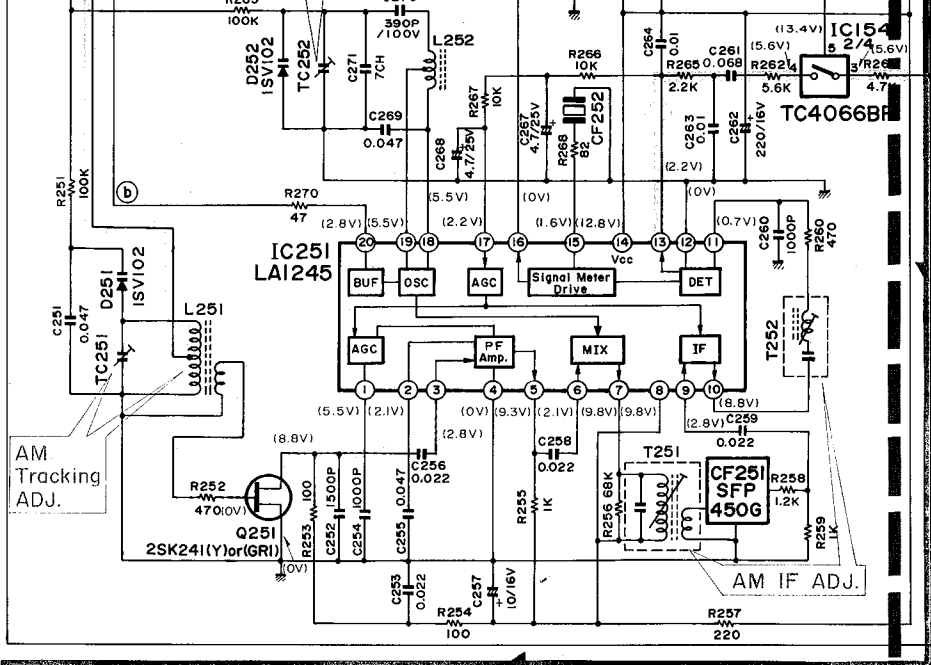
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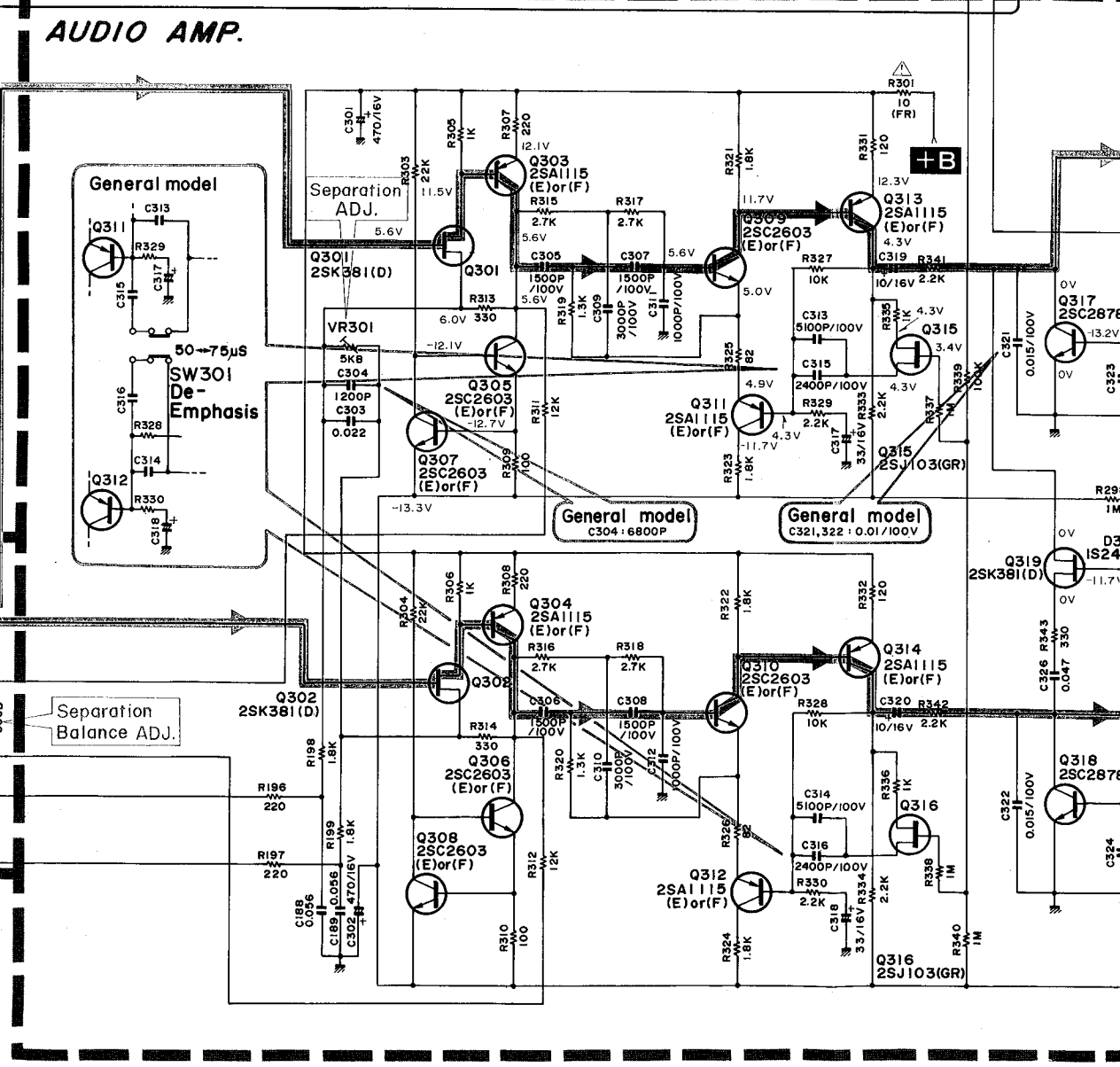
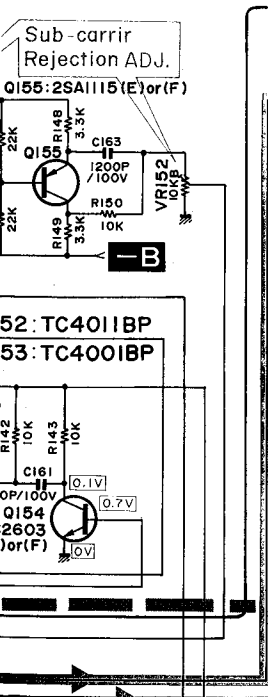
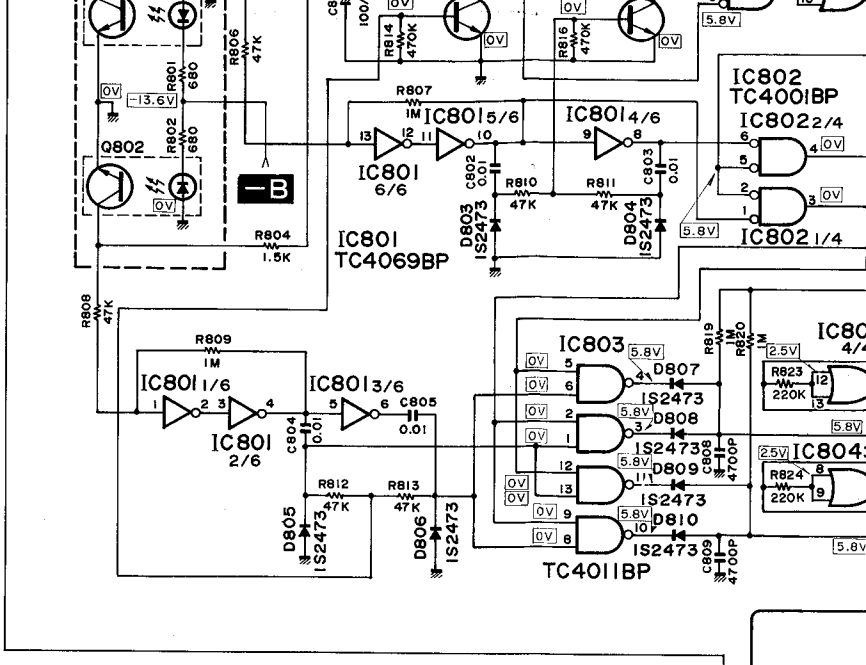
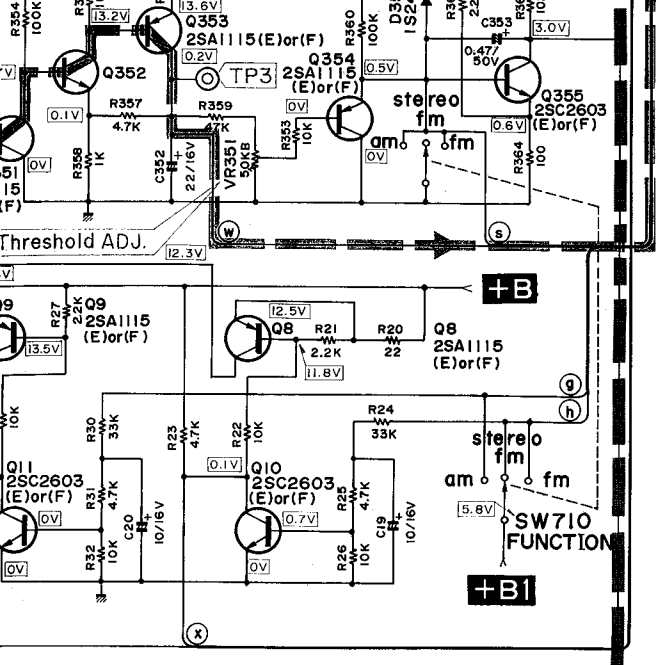
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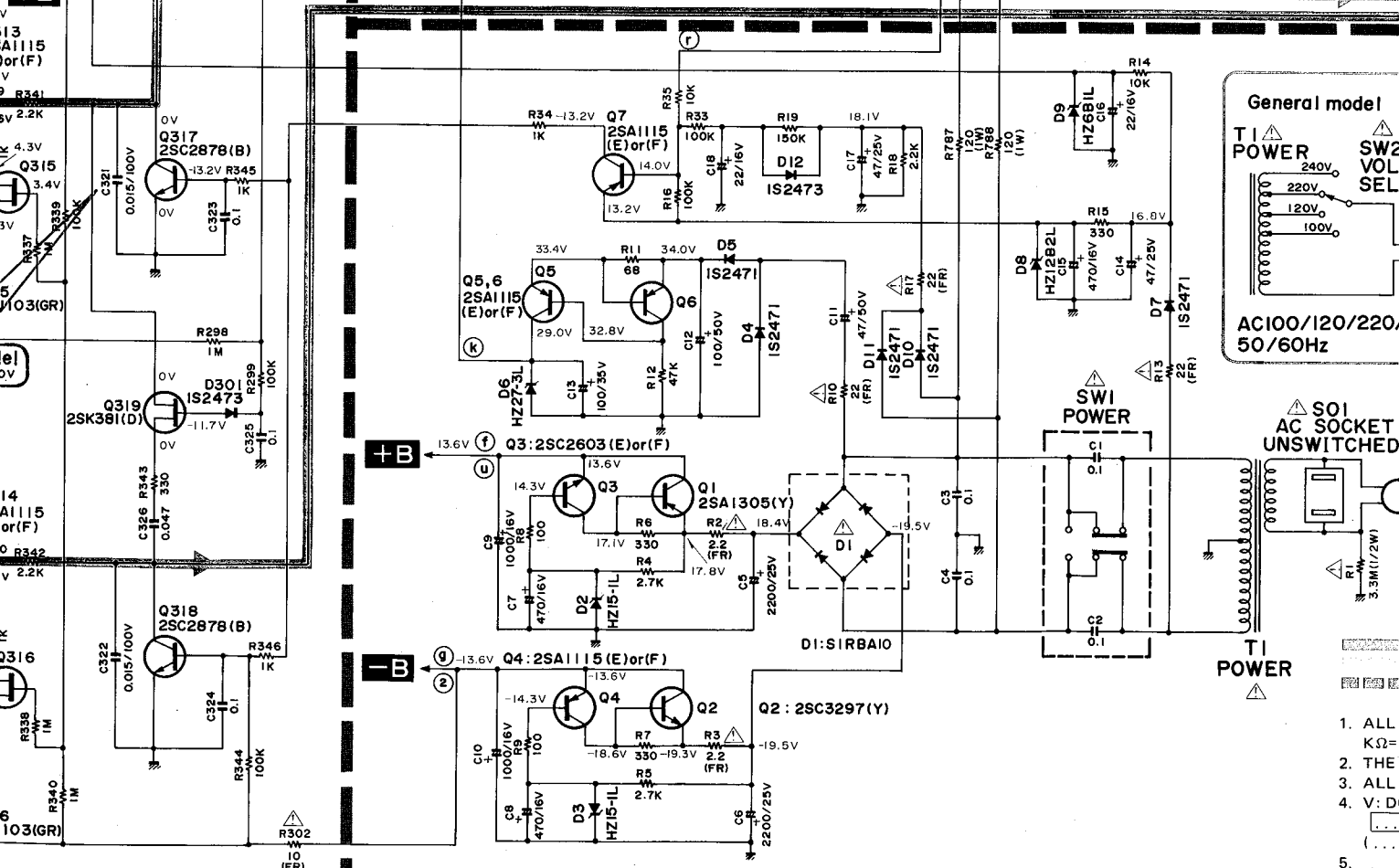
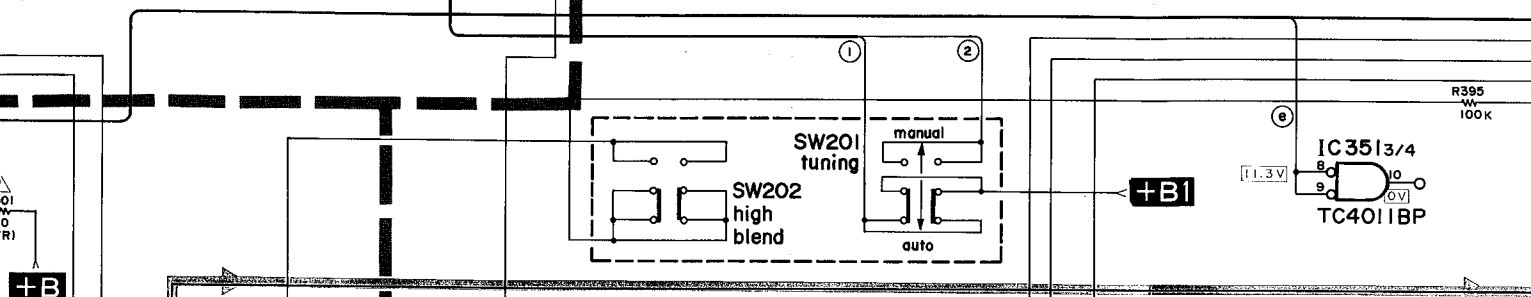
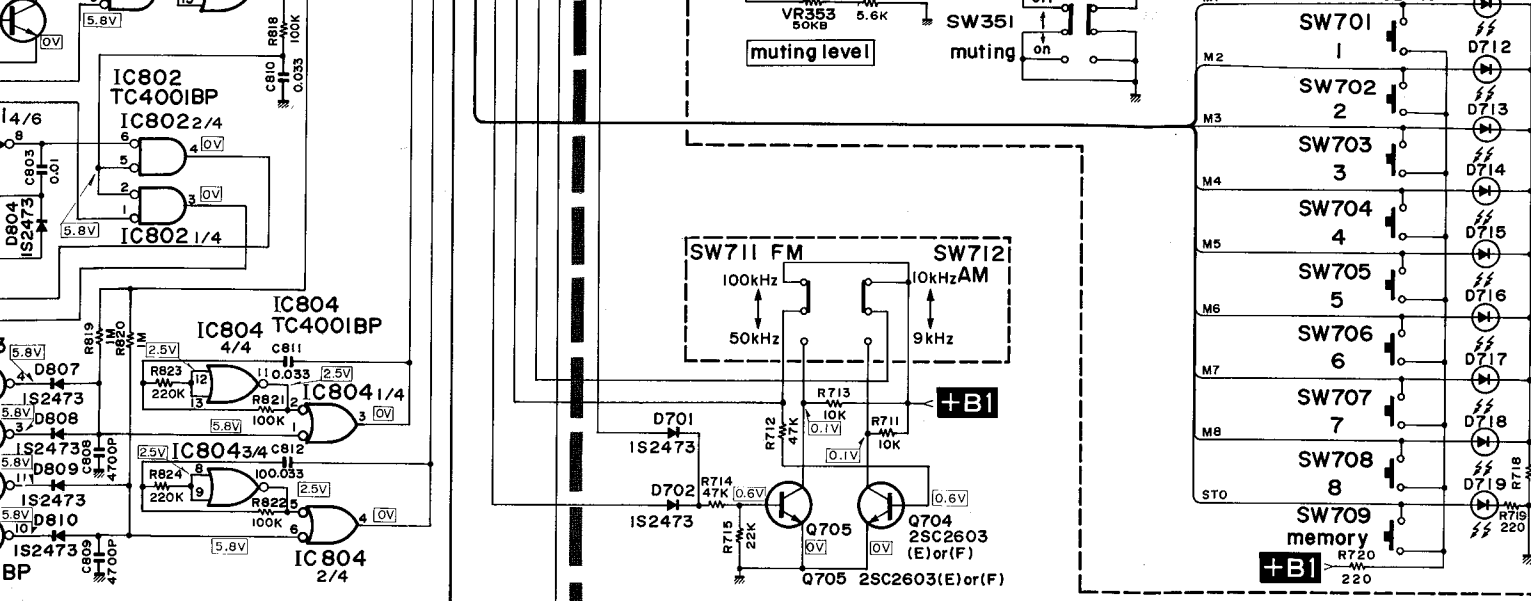
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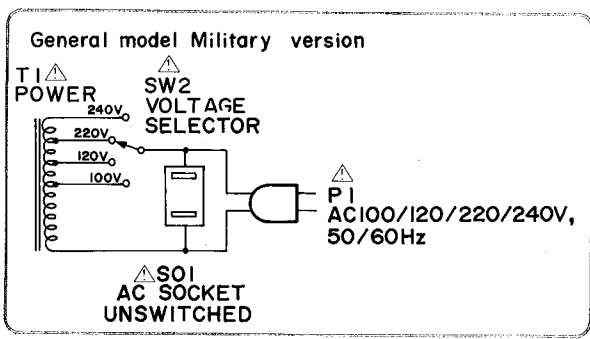
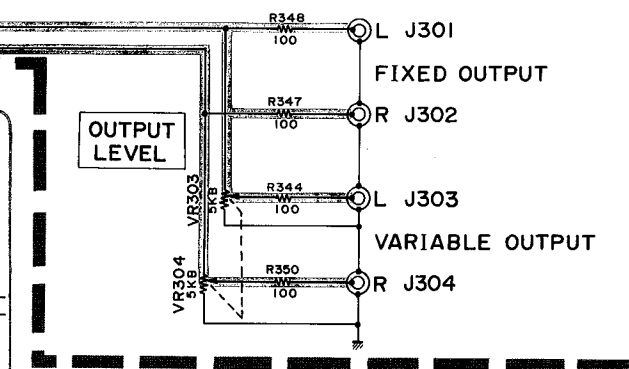
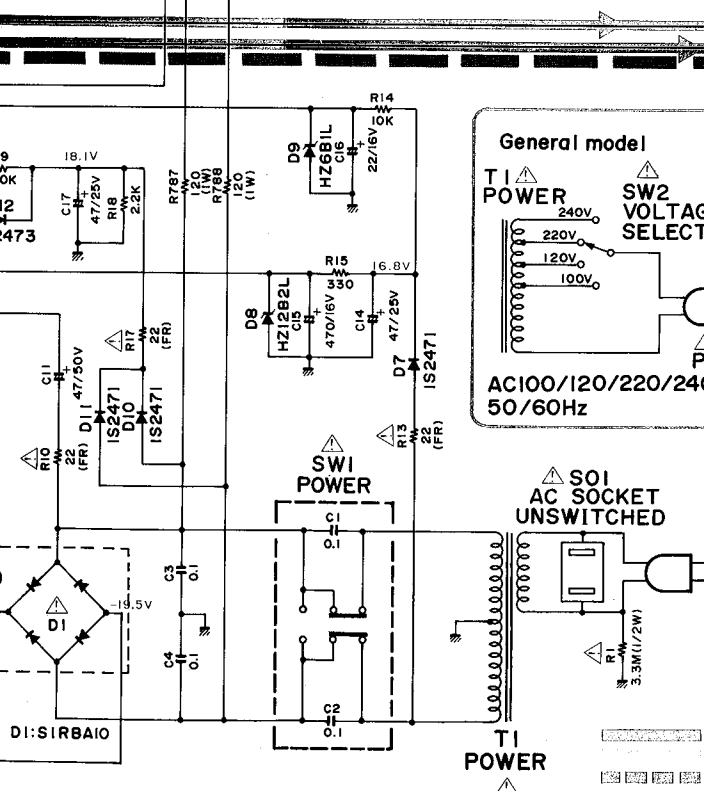
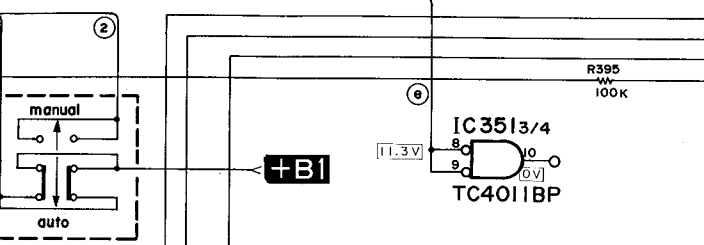
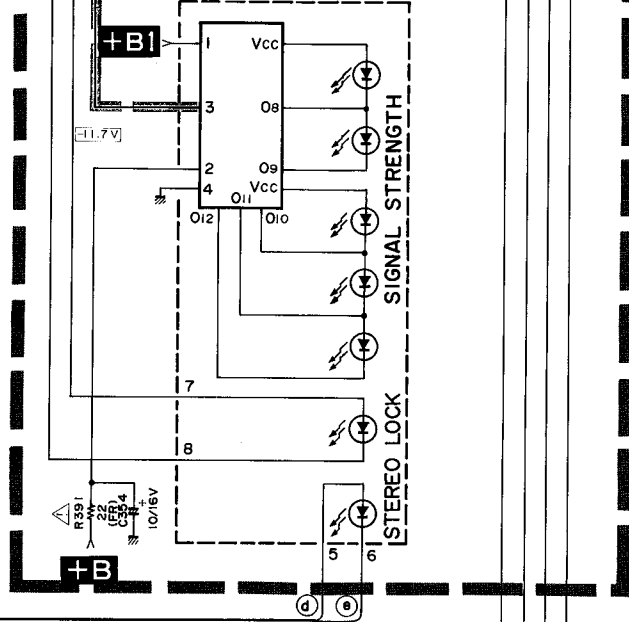
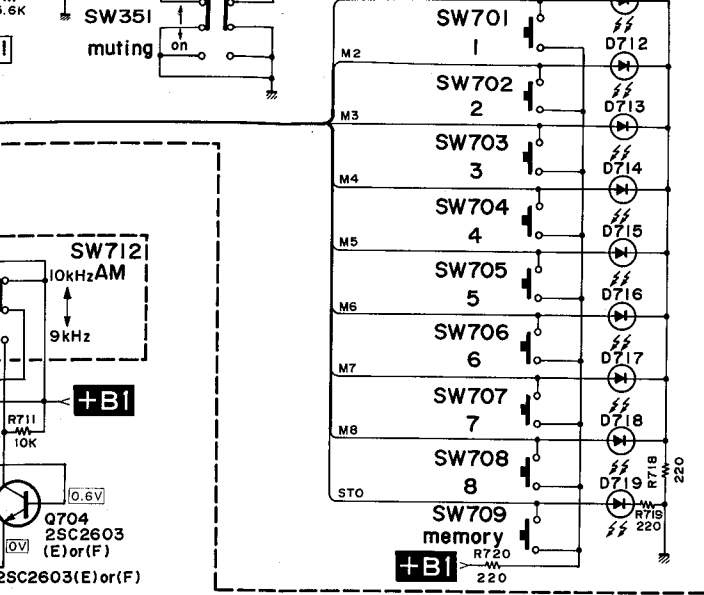






**POWER SUPPLY**

1. ALL
2. THE
3. ALL
4. V: D
5. ...

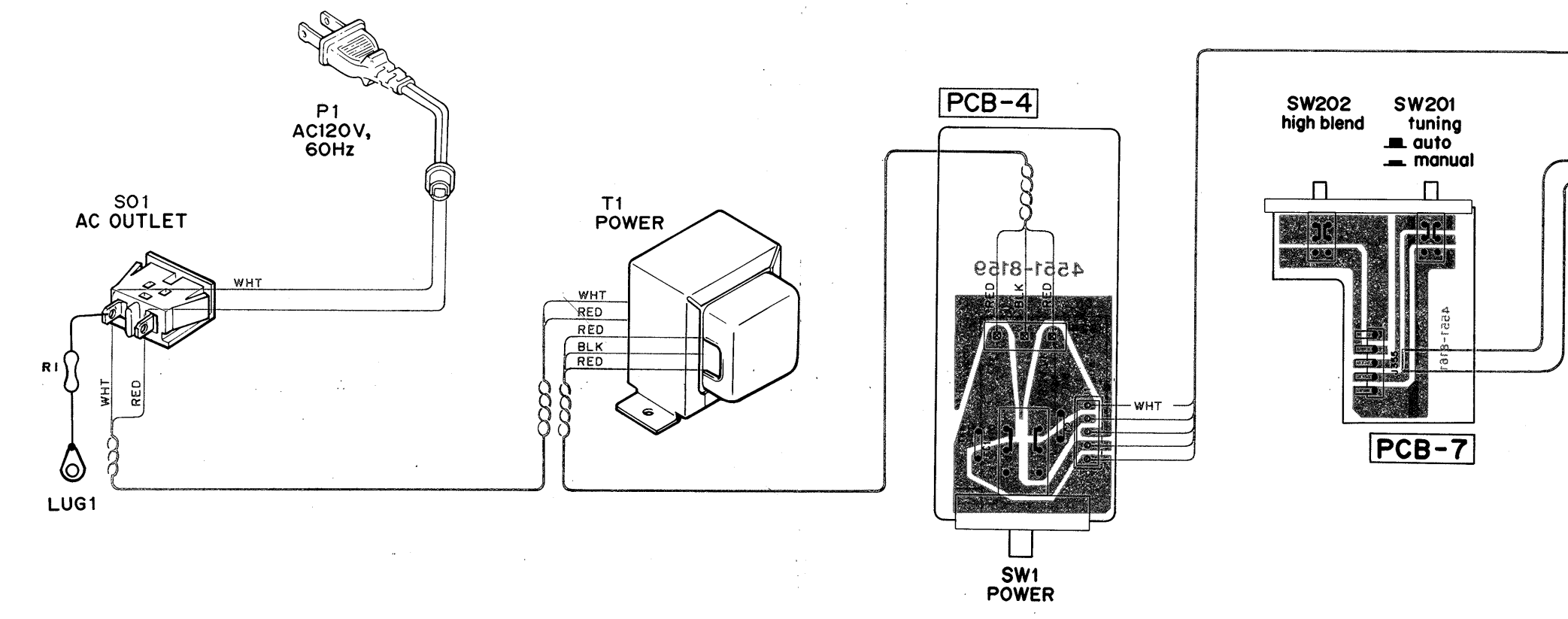
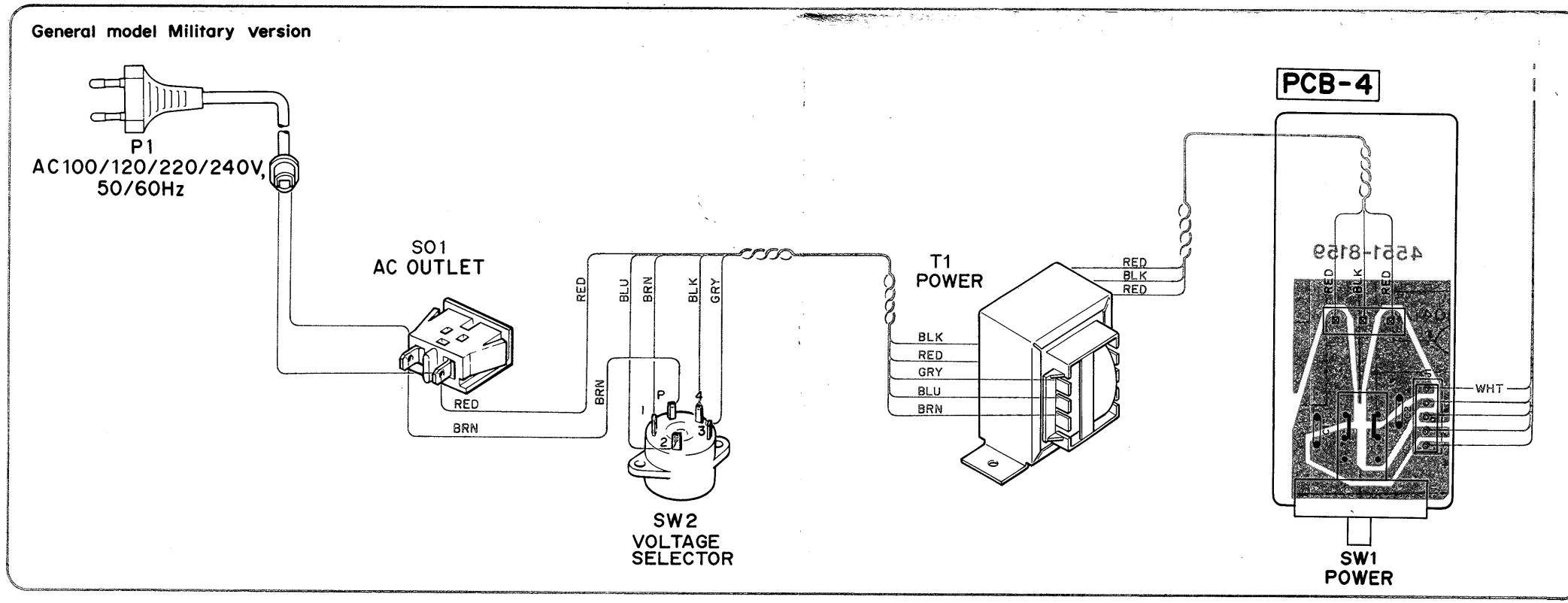
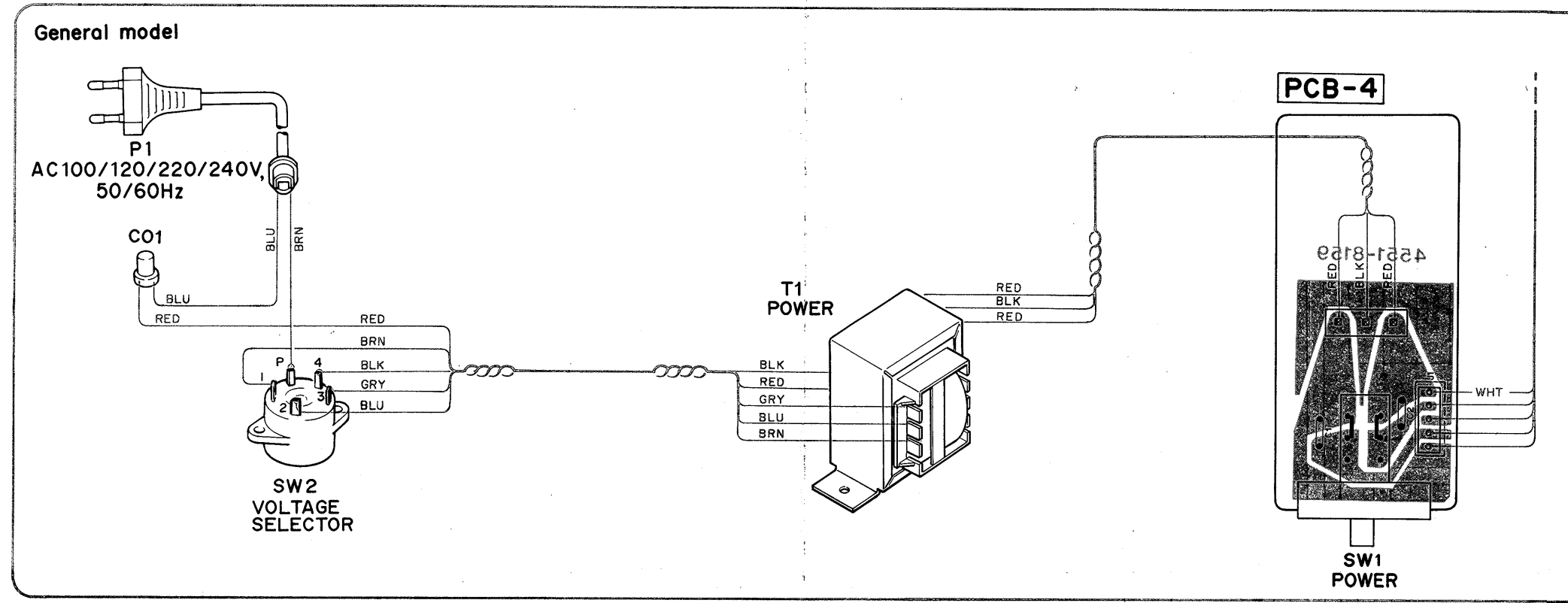
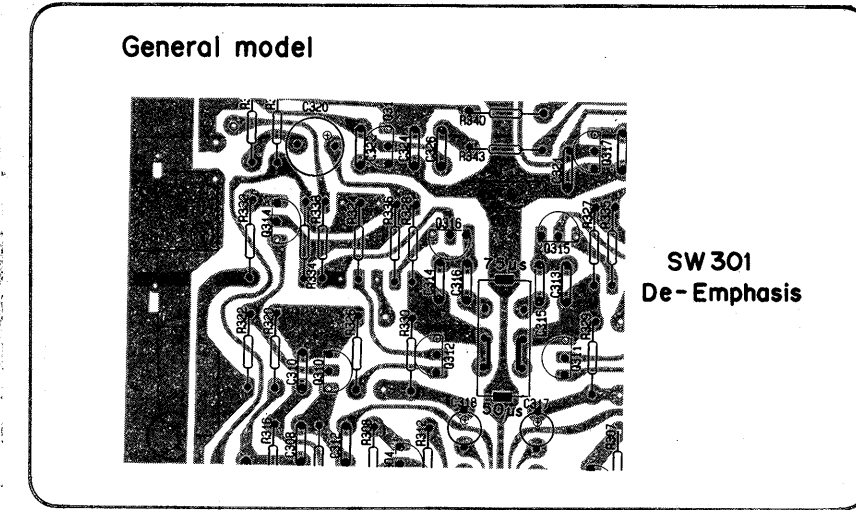
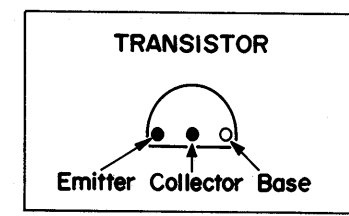


FM SIGNAL  
 AM SIGNAL  
 INDICATOR DRIVE SIGNAL

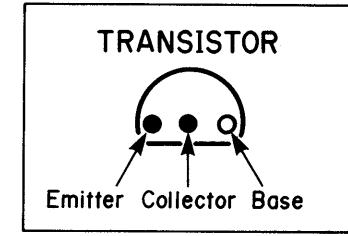
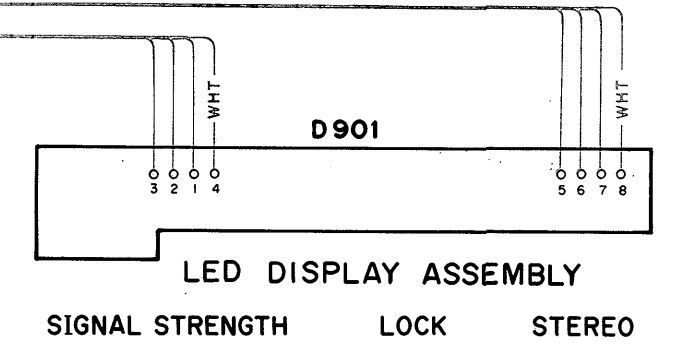
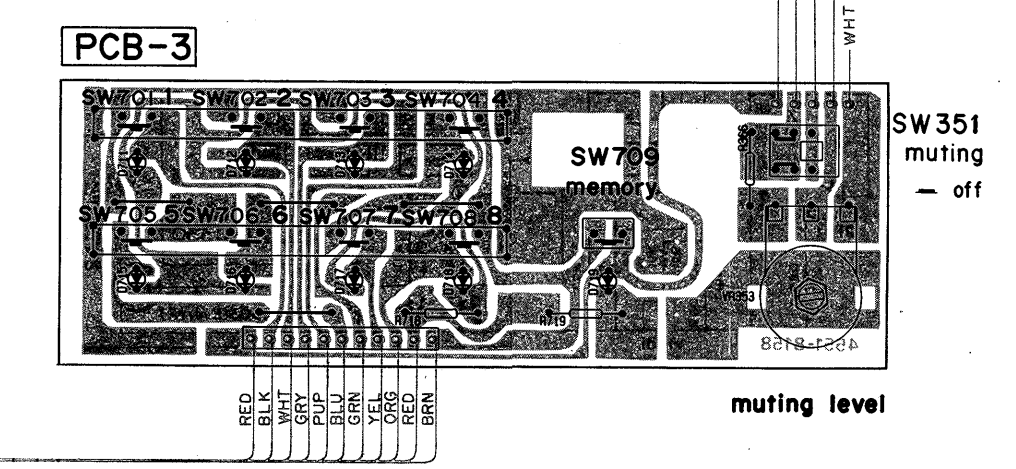
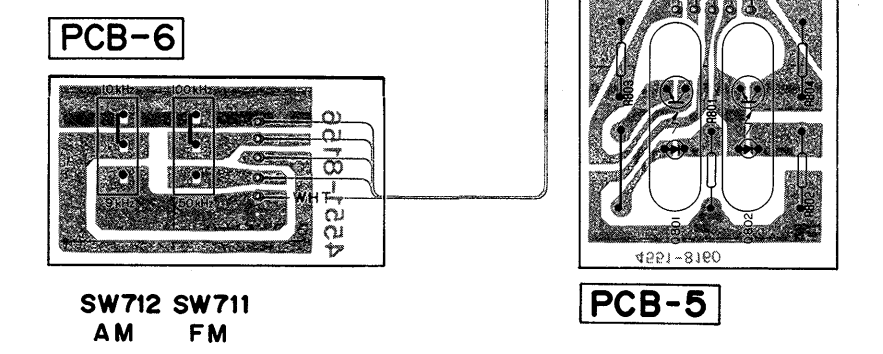
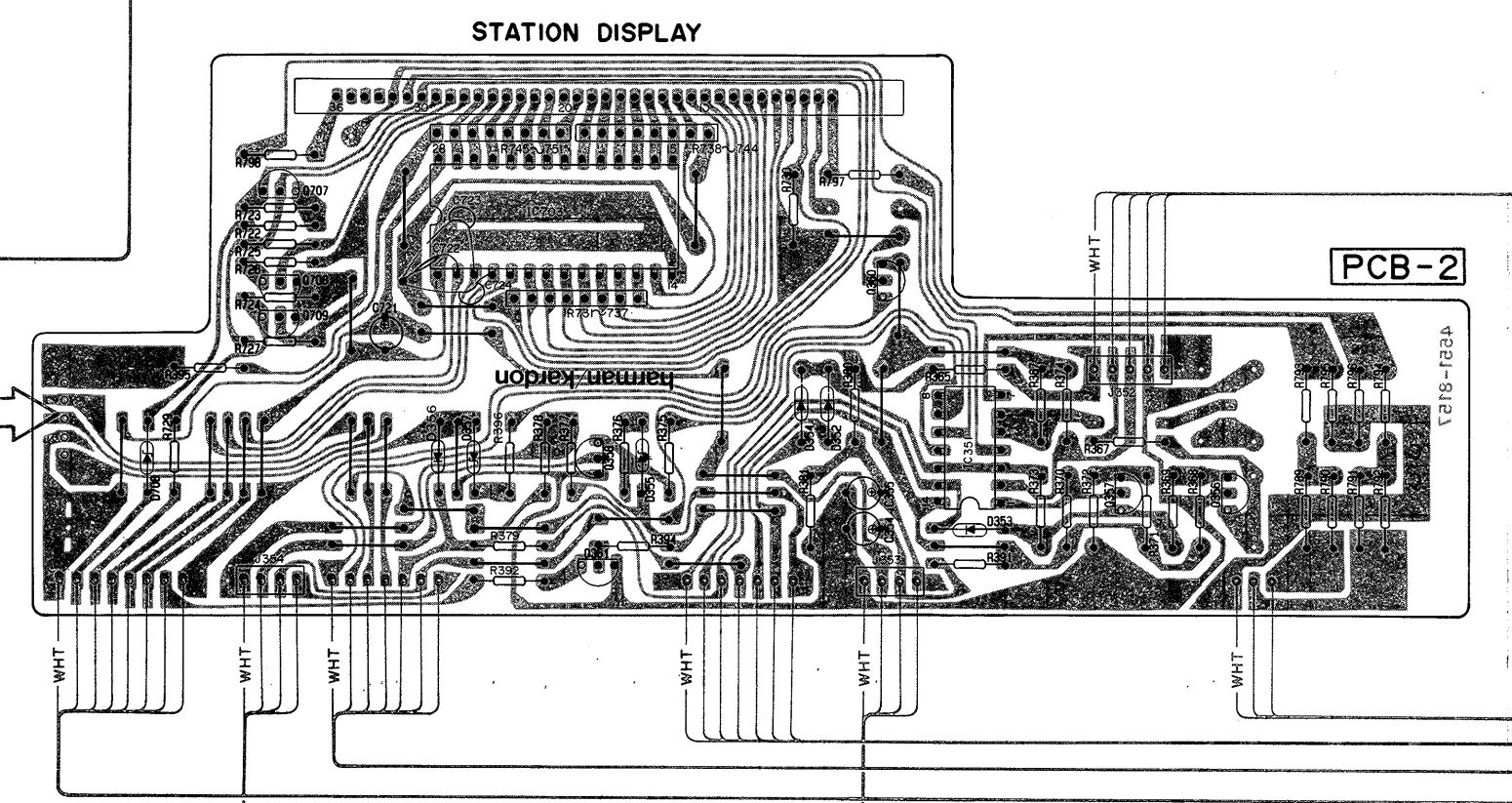
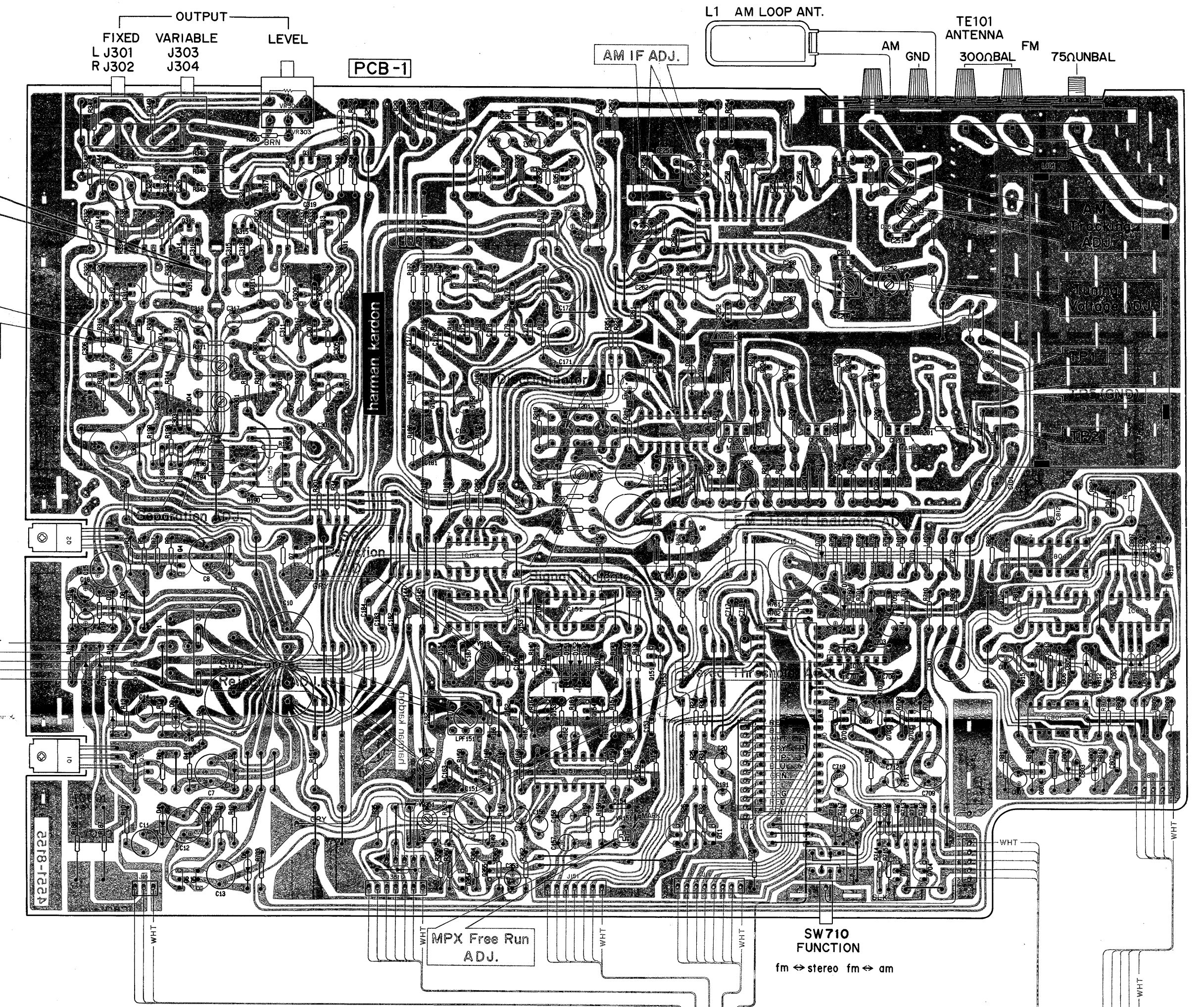
- ALL RESISTANCES VALUES ARE IN  $\Omega$ .  
K $\Omega$ =1000 $\Omega$ , M $\Omega$ =1000K $\Omega$ .
- THE WATTAGE OF RESISTORS IS 1/4W UNLESS OTHERWISE NOTED.
- ALL CAPACITANCES VALUES ARE IN  $\mu$ F UNLESS OTHERWISE NOTED. P= $\mu$ F
- V: DC VOLTAGE AT NO SIGNAL  
 ( . . . V ) FM POSITION  
 ( . . . V ) AM POSITION
- SAFETY-REQUIREMENTS COMPONENTS IN ACCORDANCE WITH PRESENT SAFETY REGULATIONS, THESE COMPONENTS MUST ONLY BE REPLACED BY ORIGINAL PARTS.



WIRING DIAGRAM



Separation Balance ADJ.



PIN CONNECTION DIAGRAM OF TRANSISTORS, DIODES AND ICs.

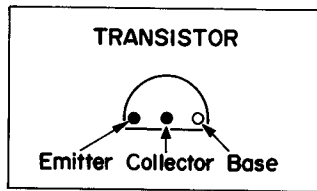
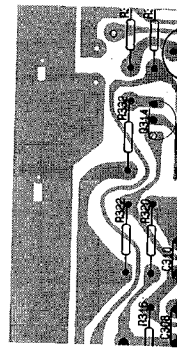
2SA1305 2SC297	2SC2603 2SA1115	2SC2878 2SC2058 2SC2240	2SK241 2SK381	2SJ103 2SK117	SIRBA10	1S2471 1S2473 HZ15-1L HZ12B2L HZ27-3L	HZ681L HZ982L HZ11A2L Anode Cathode	1S102	GL5NG6 Cathode Anode	BA1330	TC4066BP TC4069BP TC4011BP TC4001BP	M5219P	HA11225	LA1245	TD6104P	TC9147BP	TD6301AP
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- WIRE COLOR ABBREVIATIONS
- RED : Red
  - ORG : Orange
  - BLU : Blue
  - WHT : White
  - GRN : Green
  - BLK : Black
  - YEL : Yellow
  - PUR : Purple
  - PIK : Pink

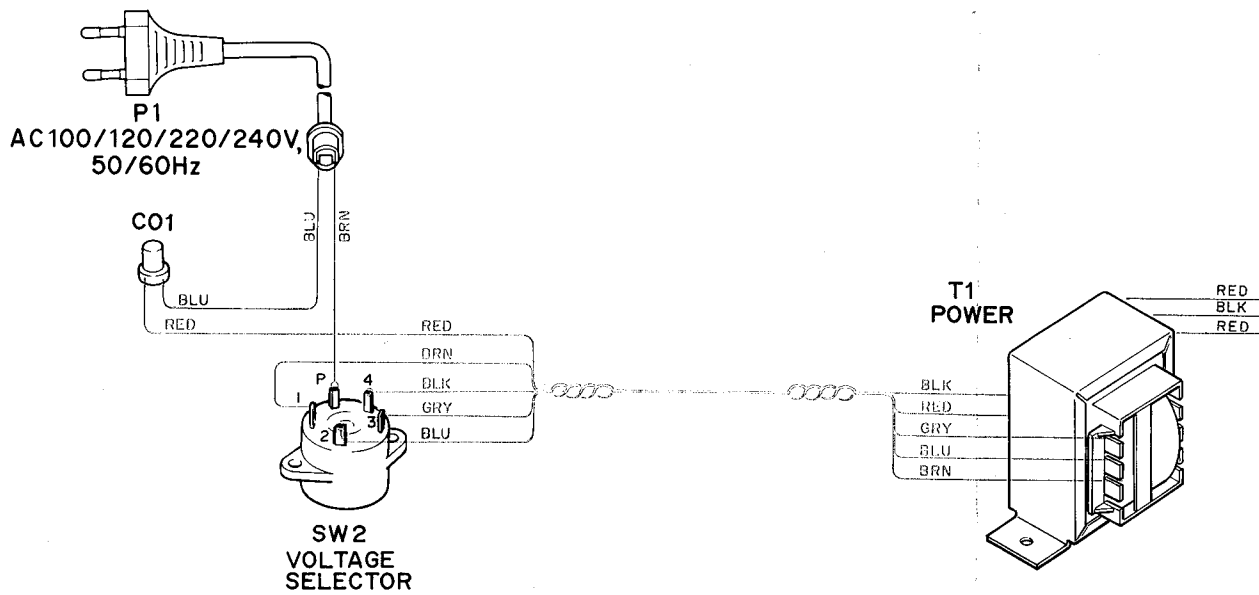


WIRING DIAGRAM

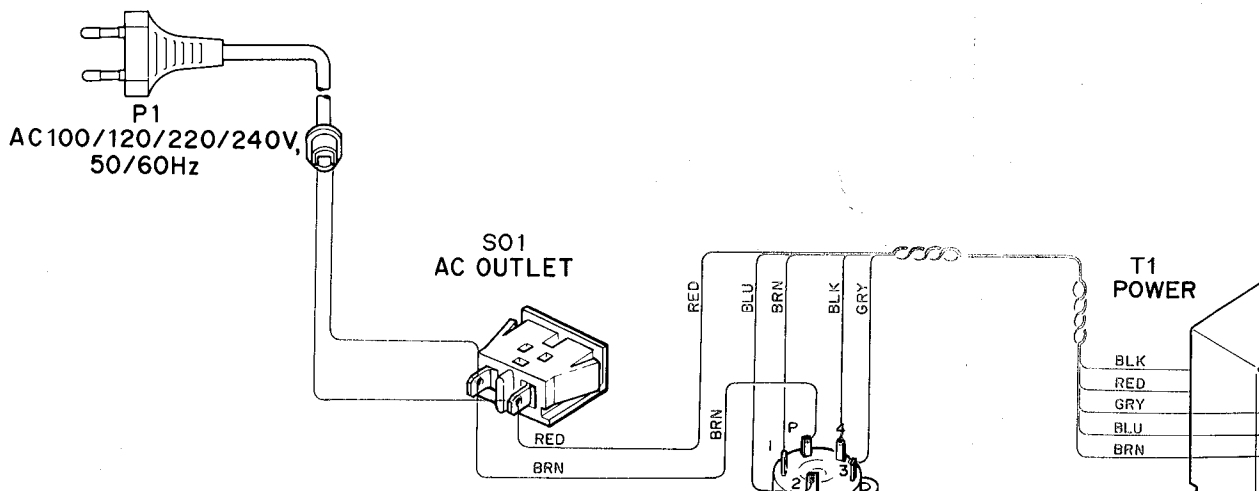
General mode



General model



General model Military version



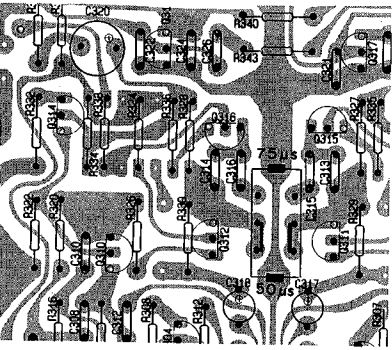
E

F

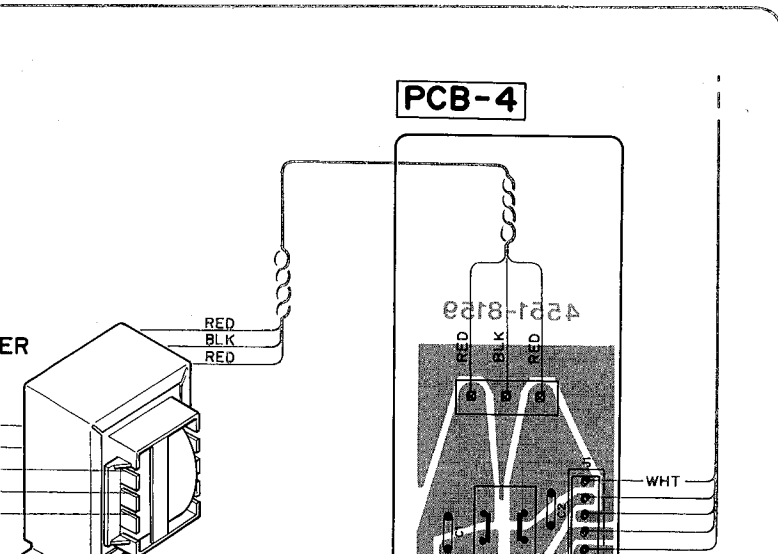
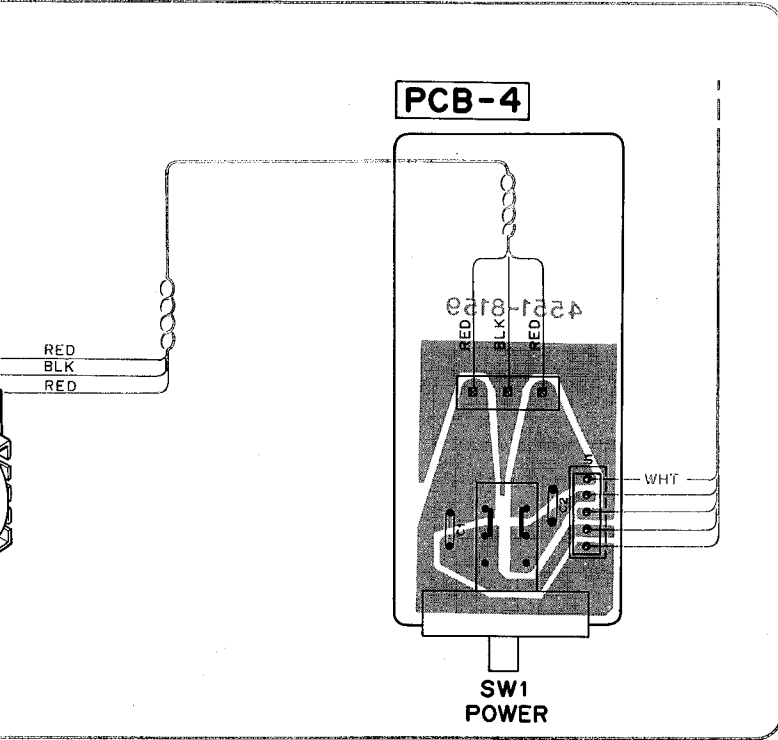
G

H

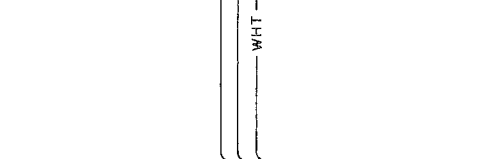
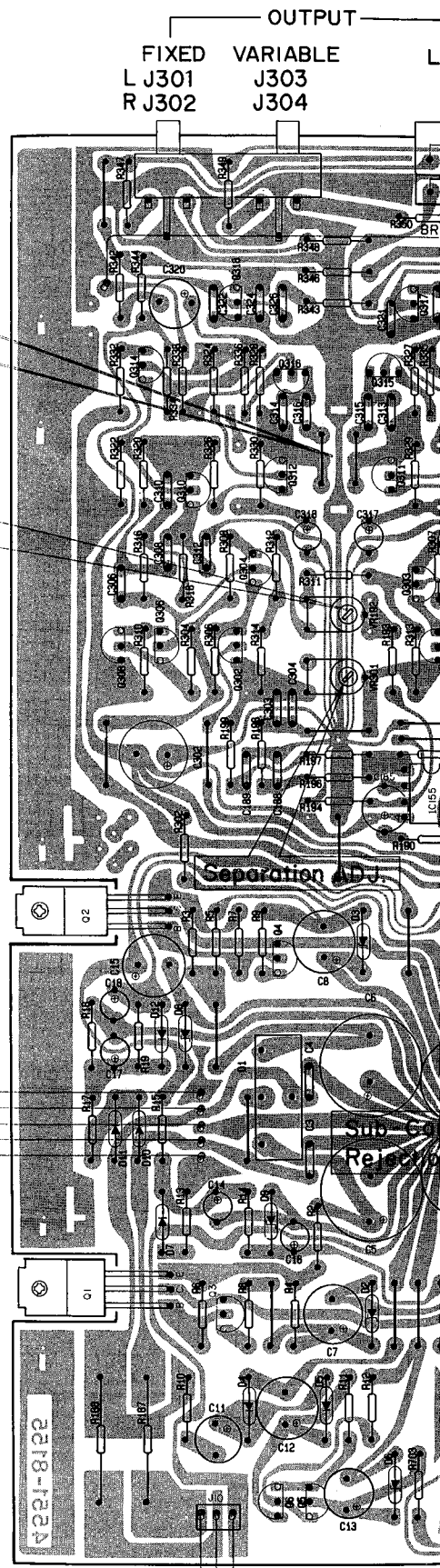
I model



SW 301  
De-Emphasis



Separation  
Balance  
ADJ.



PCB-1

AM IF ADJ.

L1 AM LOOP ANT.

TE101 ANTENNA  
300Ω BAL

LEVEL

harman kardon

Discriminator

FM Tuning Indicator ADJ.

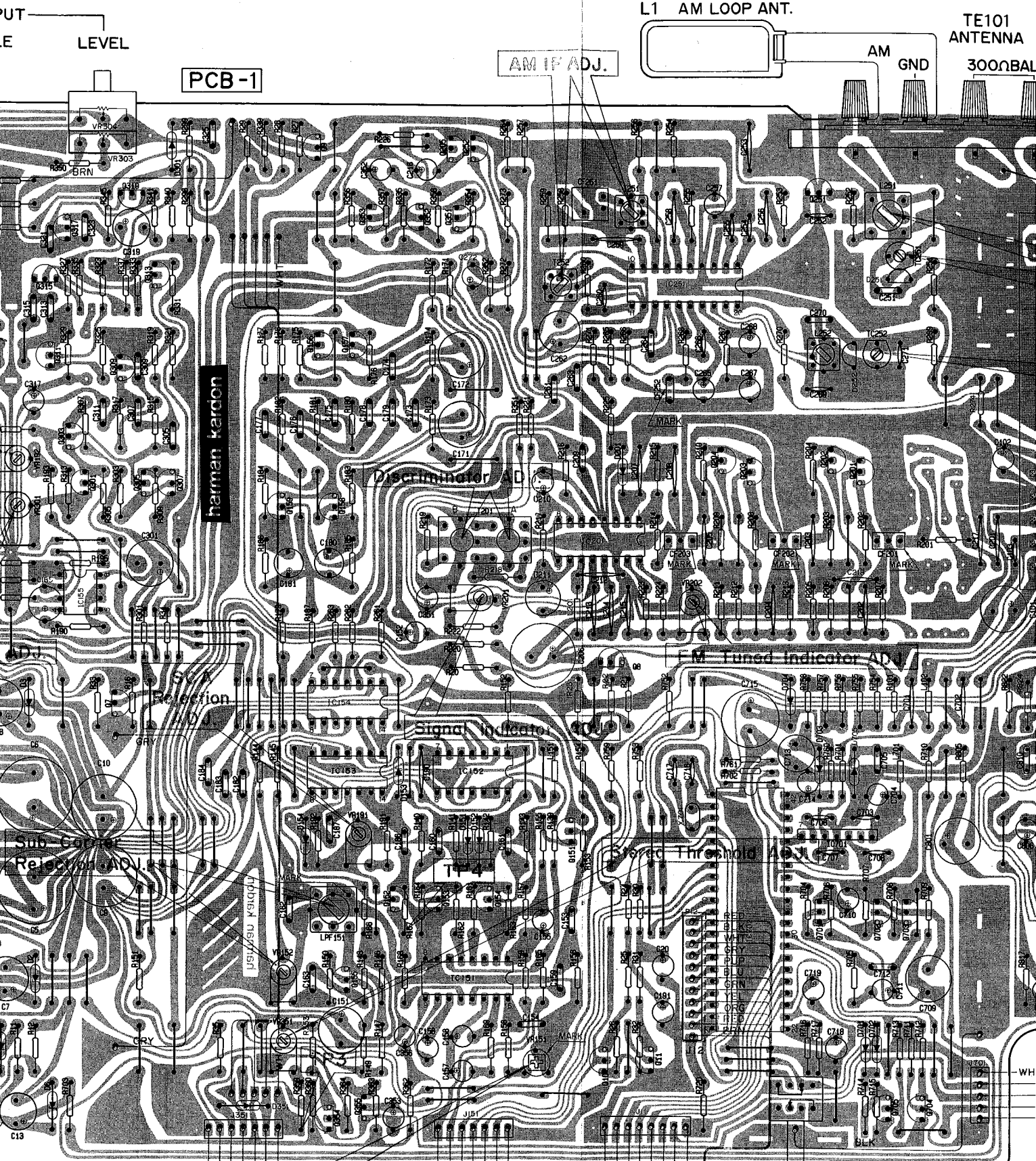
Signal Indicator

Threshold

MPX Free Run ADJ.

SW 710 FUNCTION

fm ↔ stereo fm ↔ am



L1 AM LOOP ANT.

TE101 ANTENNA

FM

300ΩBAL 75ΩUNBAL

AM IF ADJ.

AM GND

AM Tracking ADJ.

Tuning Voltage ADJ.

TP1

TP5 (GND)

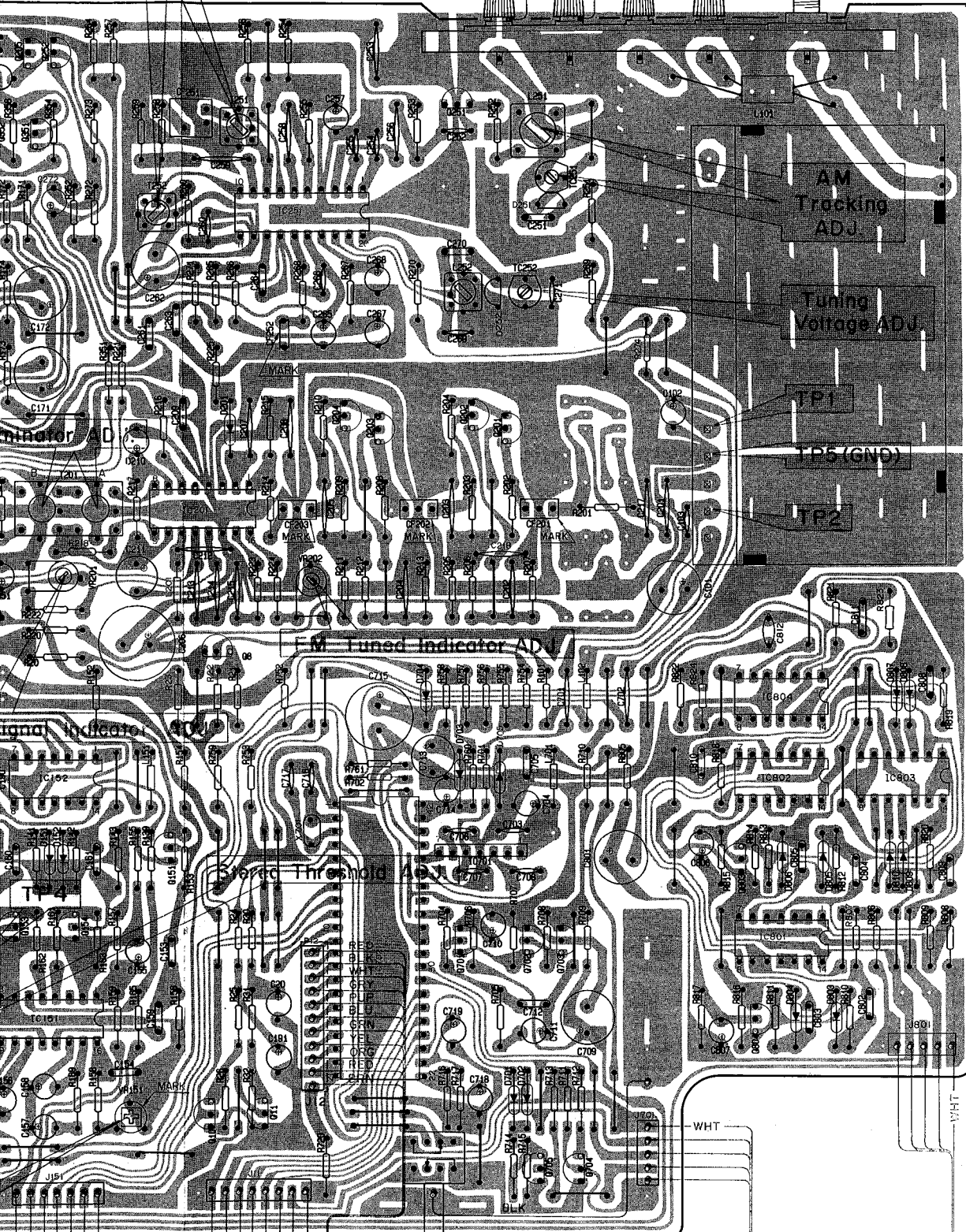
TP2

FM Tuned Indicator ADJ.

Overload Threshold ADJ.

SW 710 FUNCTION

fm ↔ stereo fm ↔ am



WHT

WHT

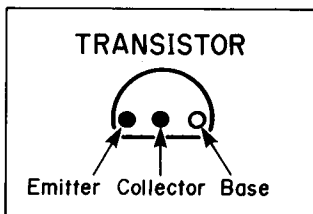
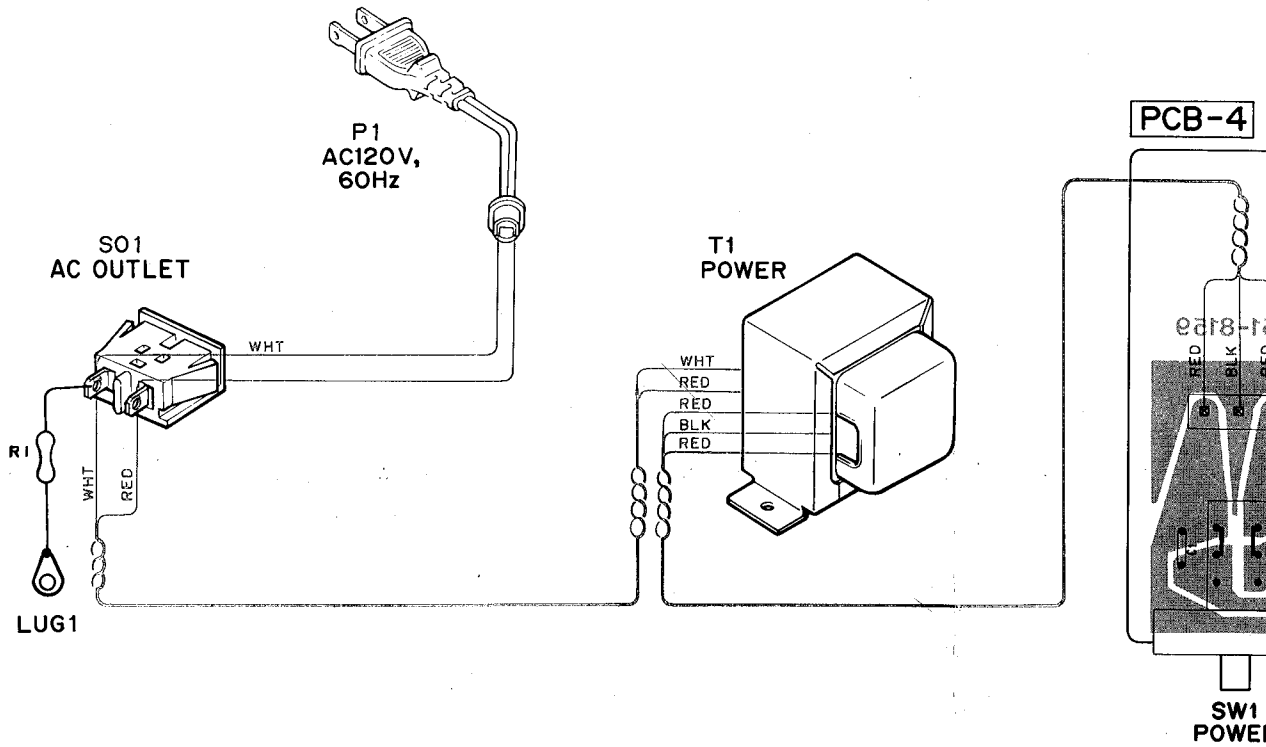
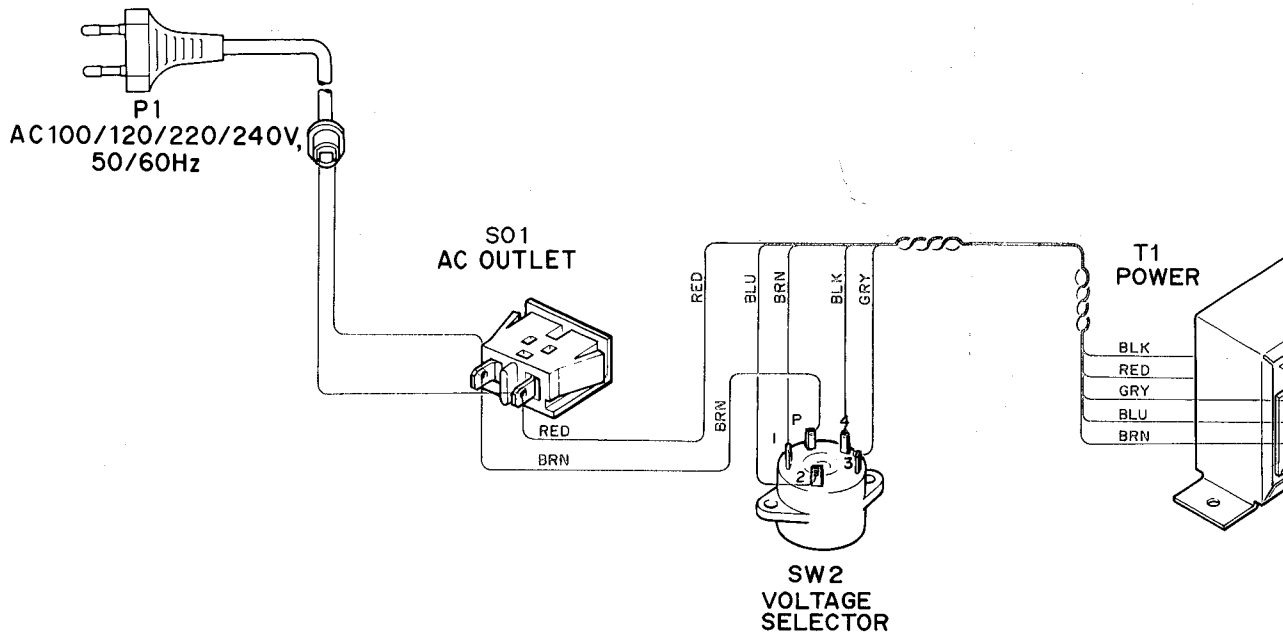
WHT

WHT

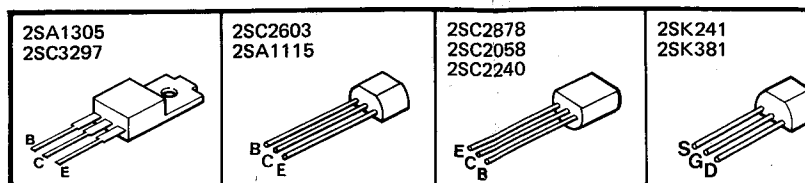
WHT

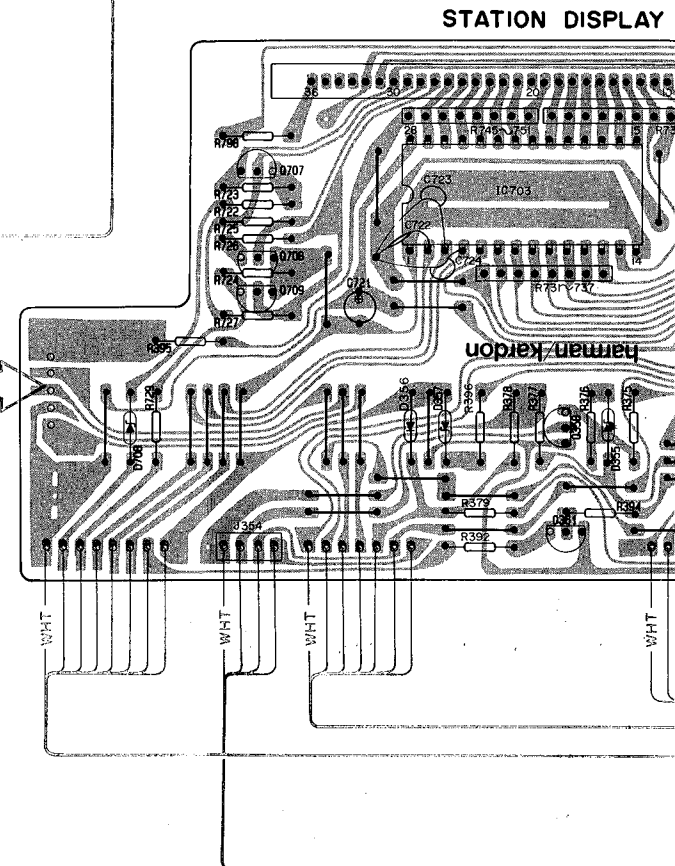
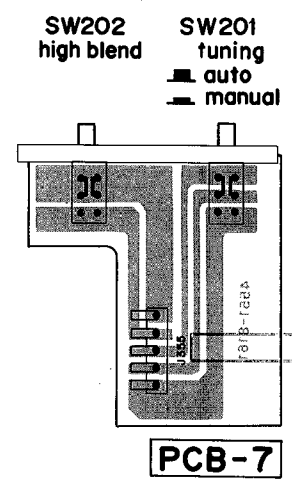
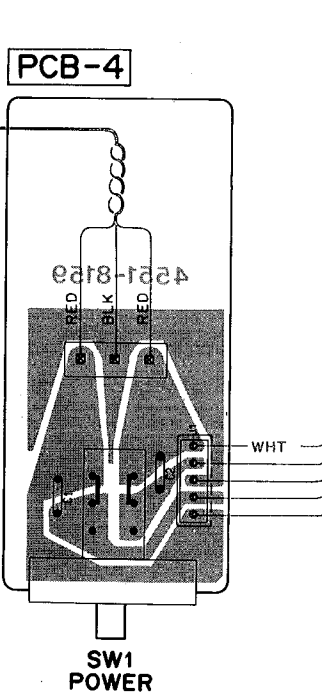
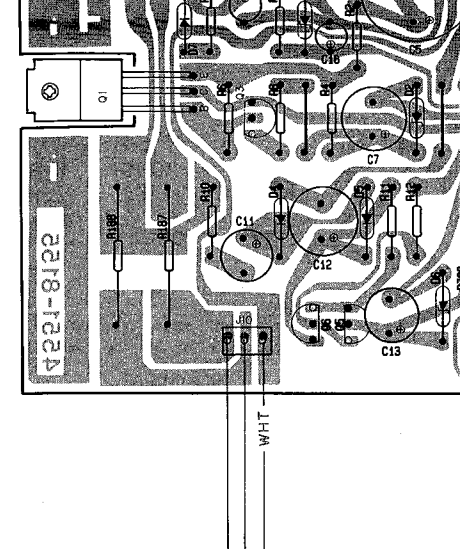
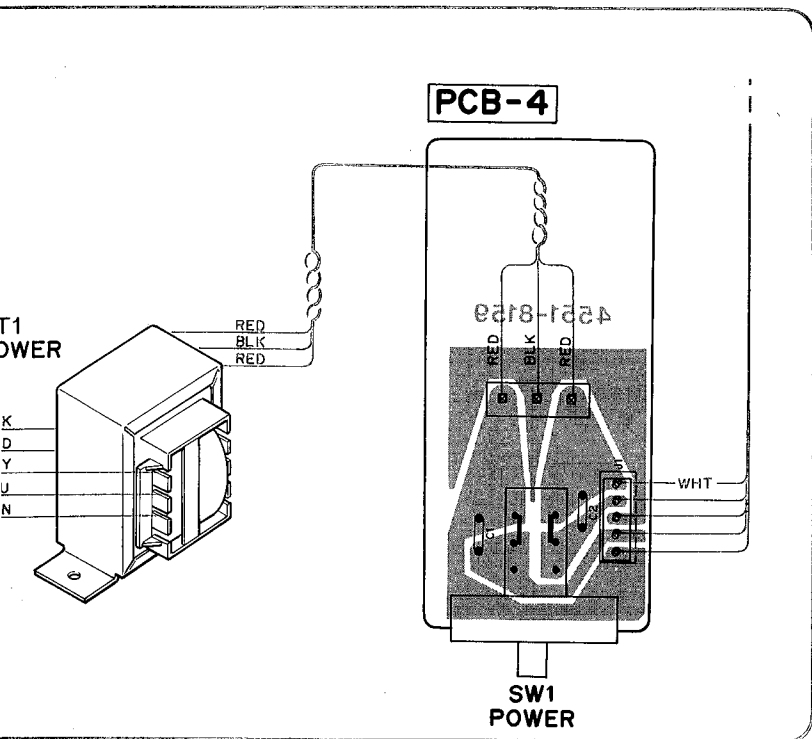


General model Military version



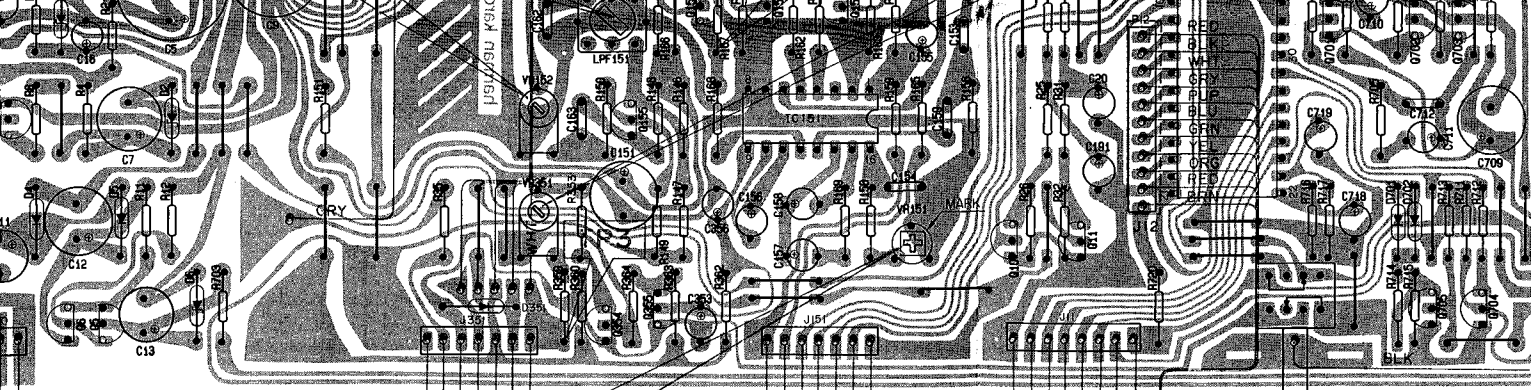
PIN CONNECTION DIAGRAM OF TRANSISTORS, DIODES AND ICs.





AND ICs.

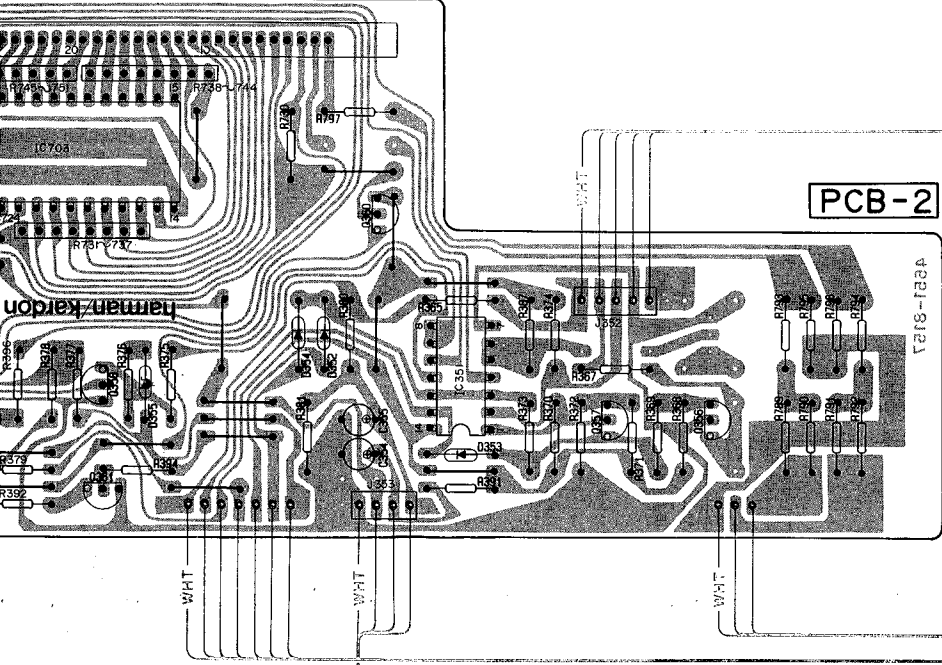
2SK241 2SK381 	2SJ103 2SK117 	SIRBA10 	1S2471 HZ6B1L 1S2473 HZ9B2L HZ15-1L HZ11A2L HZ12B2L Anode HZ27-3L Cathode 	1SV102 	GL5NG6 Cathode Anode 	BA1330 	TC40 TC40 TC40 
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MPX Free Run  
ADJ.

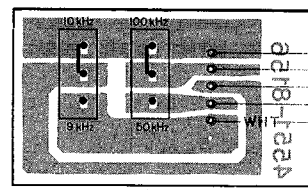
SW710  
FUNCTION  
fm ↔ stereo fm ↔ am

ATION DISPLAY



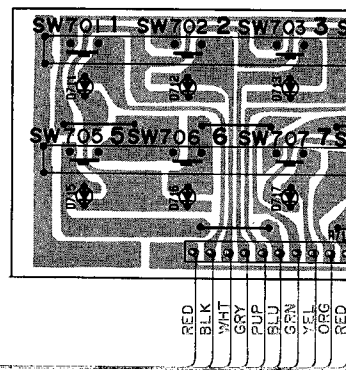
PCB-2

PCB-6

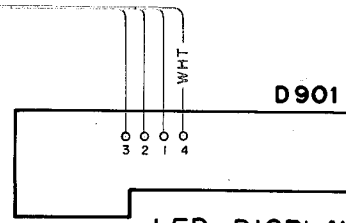


SW712 SW711  
AM FM

PCB-3

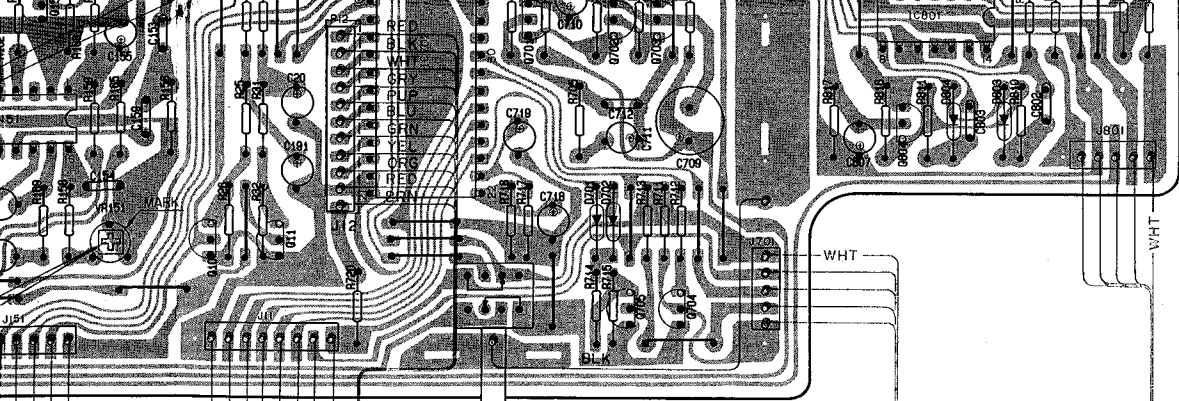


D901

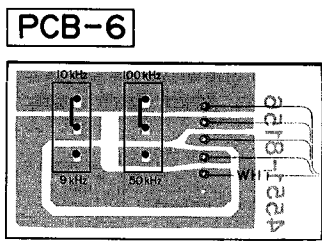


LED DISPLAY  
SIGNAL STRENGTH

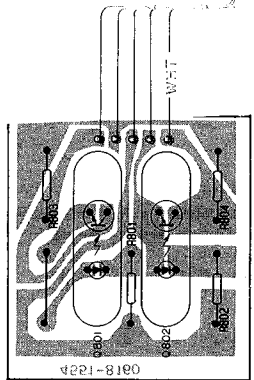
<p>30</p>	<p>TC4066BP TC4069BP TC4011BP TC4001BP</p>	<p>M5219P</p>	<p>HA11225</p>	<p>LA1245</p>	<p>TD6104P</p>	<p>TC9147BP</p>	<p>TD6301A</p>
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**SW710**  
**FUNCTION**  
 fm ↔ stereo fm ↔ am

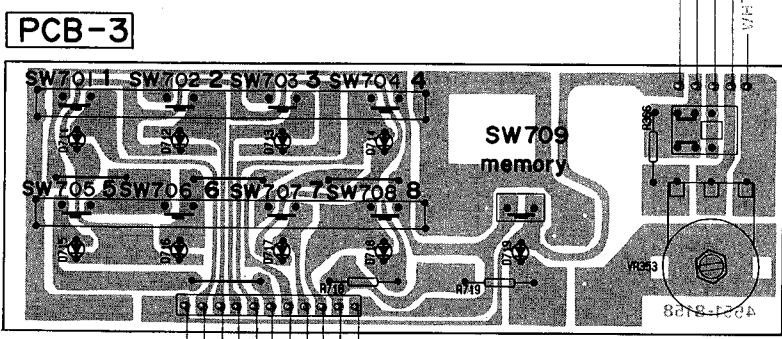
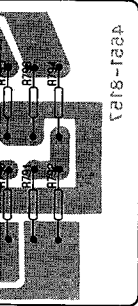


**SW712 SW711**  
**AM FM**



**PCB-5**

**PCB-2**

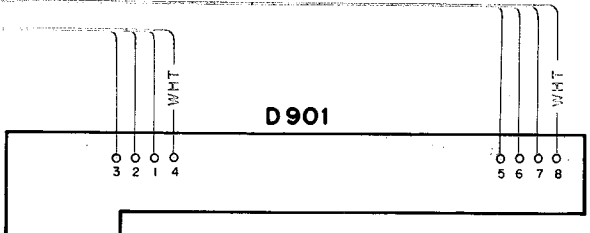


**PCB-3**

**SW351**  
 muting  
 — off

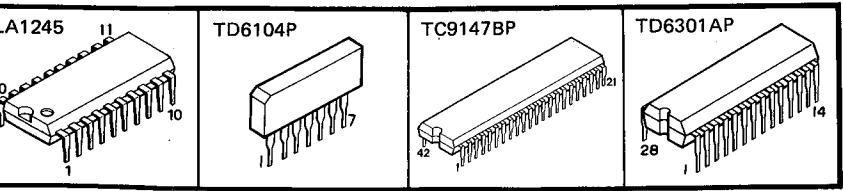
- RED
- BLK
- WHT
- GRY
- PUP
- BLU
- GRN
- YEL
- ORG
- RED
- BRN

**muting level**



**LED DISPLAY ASSEMBLY**

**SIGNAL STRENGTH      LOCK      STEREO**



- **WIRE COLOR ABBREVIATIONS**
- RED : Red
  - ORG : Orange
  - BLU : Blue
  - WHT : White
  - GRN : Green
  - BLK : Black
  - YEL : Yellow
  - PUP : Purple
  - PIK : Pink