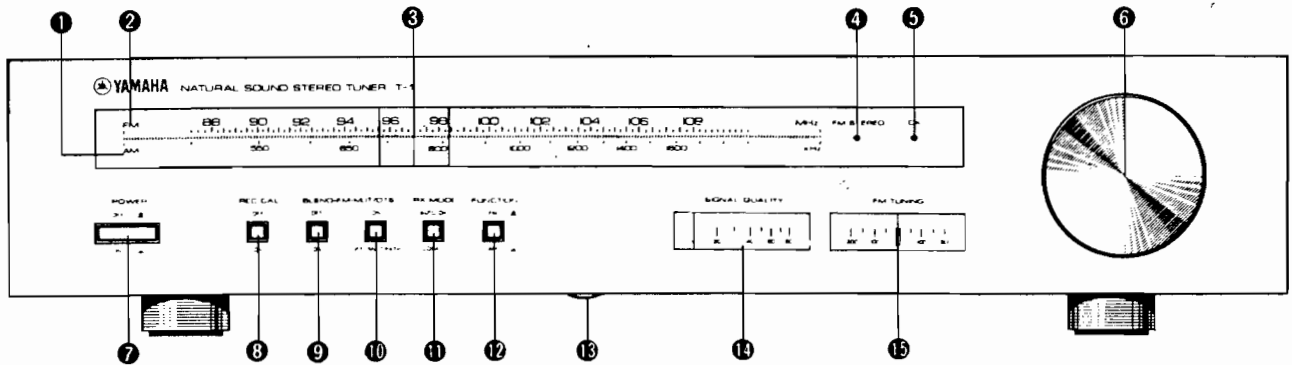


T-1

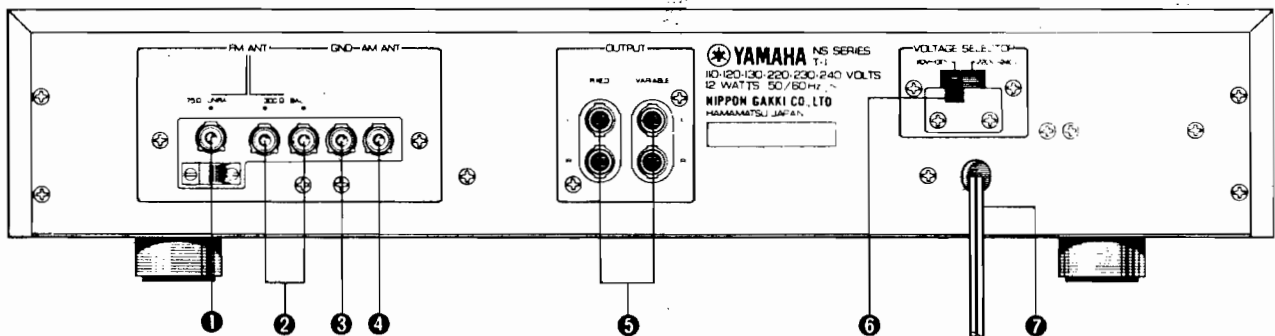
SERVICE MANUAL

FRONT PANEL



- 1 AM DIAL SCALE
- 2 FM DIAL SCALE
- 3 DIAL POINTER
- 4 FM STEREO INDICATOR
- 5 DX INDICATOR
- 6 TUNING KNOB
- 7 POWER SWITCH
- 8 REC CAL SWITCH
- 9 FM BLEND SWITCH
- 10 FM MUT /OTS SWITCH
- 11 RX MODE SWITCH
- 12 FUNCTION SWITCH
- 13 OUT PUT LEVEL CONTROL
- 14 SIGNAL QUALITY METER
- 15 FM TUNING METER

REAR PANEL (GENERAL MODELS)



- 1 FM ANTENNA TERMINAL (75Ω UNBAL)
- 2 FM ANTENNA TERMINAL (300Ω BAL)
- 3 GROUND TERMINAL
- 4 AM ANTENNA TERMINAL
- 5 OUT PUT JACKS
- 6 VOLTAGE SELECTOR
- 7 AC CORD

004357

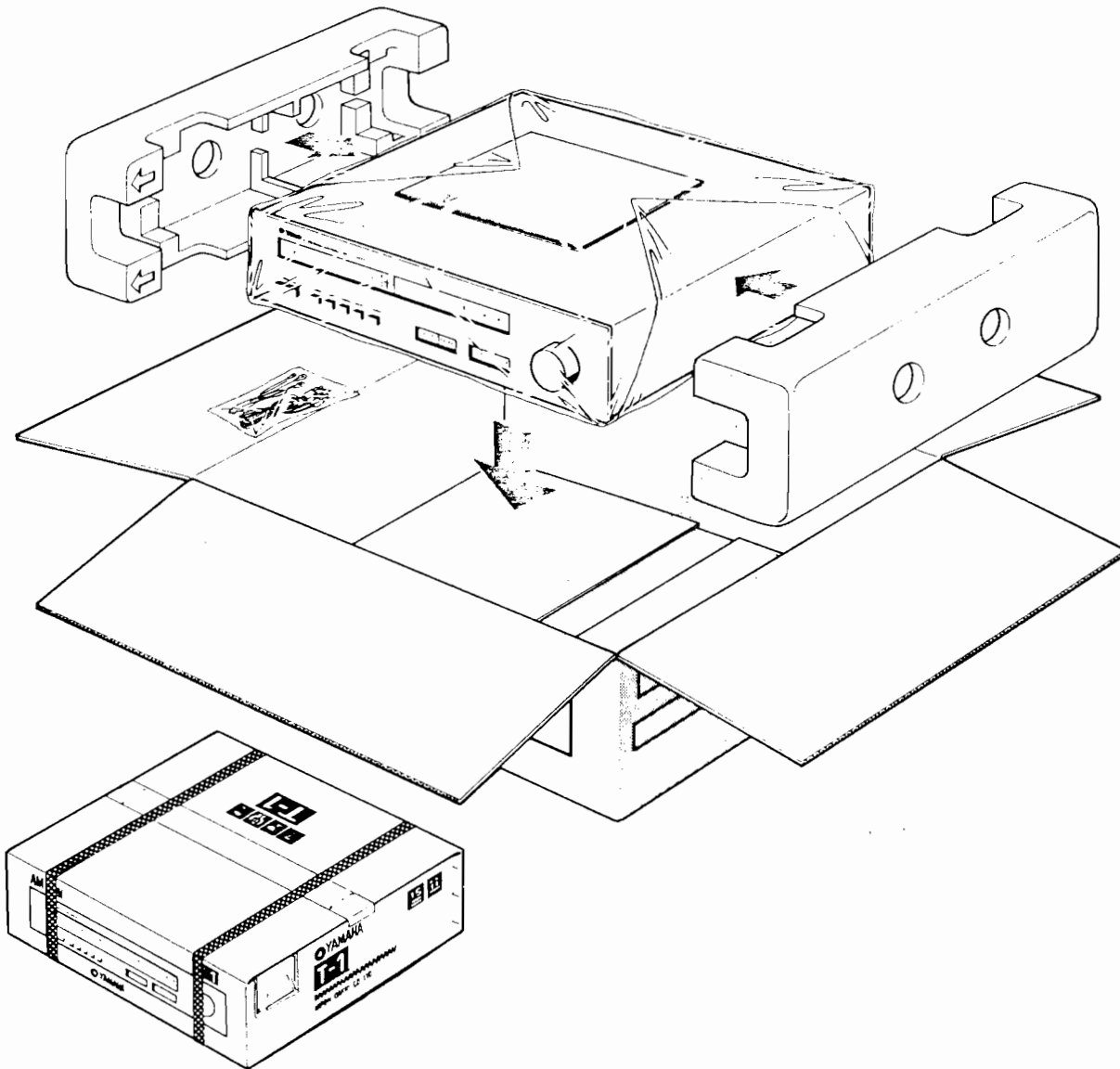


Printed in Japan 5.78. T.T 2K

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PACKAGE

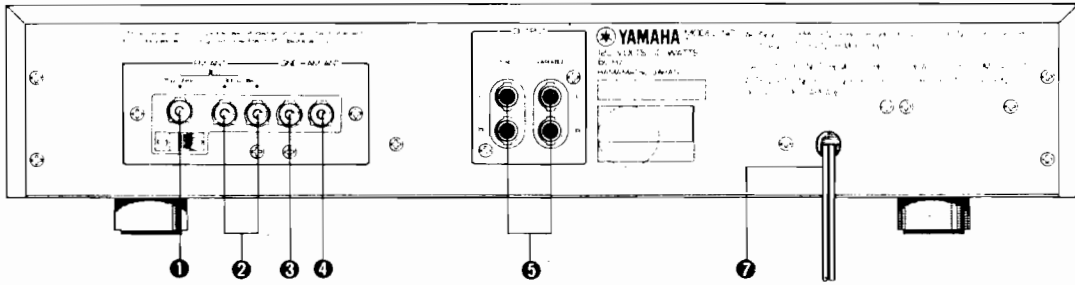


SPECIFICATIONS (SPECIFICATIONS SUBJECT CHANGE WITHOUT NOTICE.)

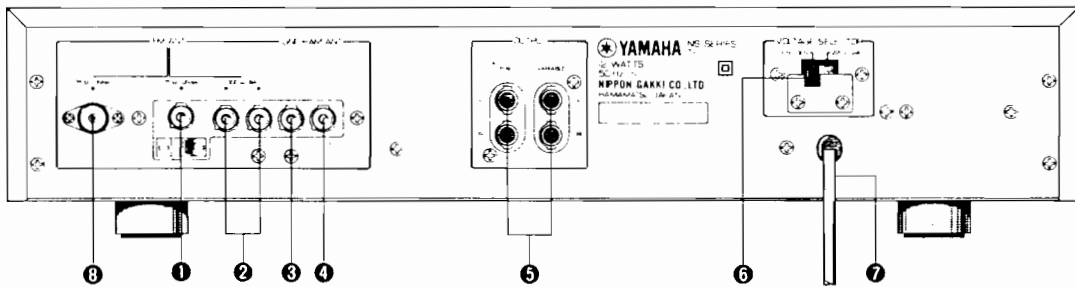
■ FM SECTION						
Tuning Rang	87.5 ~ 108 MHz					
Usable Sensitivity	IHF MONO	1.7 μ V (300 Ω) 9.8dBf				
	STEREO	0.85 μ V (75 Ω) 9.8dBf				
	DIN MONO (40KHZ. Dev. : S/N 26dB)	1.1 μ V				
	STEREO (40KHZ. Dev. : S/N 46dB)	35 μ V				
50dB S/N Sensitivity	MONO	3 μ V (14.8dBf)				
	STEREO	35 μ V (36dBf)				
Signal to Noise Ratio	MONO (IHF)	86dB (DIN 40KHZ Der)				80dB
	STEREO (IHF)	84dB (DIN 40KHZ Der)				78dB
Image Frequency Rejection	(98MHZ)	90dB				
IF Rejection	(98MHZ)	100dB				
Spurious Response Rejection	(98MHZ)	100dB				
AM Rejection	(IHF)	65dB				
Capture Ratio	(IHF)	1.0dB				
Effective Selectivity	DX MODE (IHF)	92dB				
	LOCAL MODE (IHF)	55dB				
	DIN (\pm 300KHZ, 40KHZ Dev)	65dB				
Total Harmonic Distortion	MONO	100HZ	LOCAL MODE :	0.05%	DX MODE :	0.1%
		1KHZ		0.05%		0.1%
		6KHZ		0.08%		0.3%
		10KHZ		0.05%		0.1%
	STEREO	100HZ		0.05%		0.5%
		1KHZ		0.05%		0.5%
		6KHZ		0.08%		0.8%
		10KHZ		0.13%		1.5%
Inter modulation Distortion	MONO		LOCAL MODE :	0.05%	DX MODE :	0.5%
	STEREO			0.08%		1.0%
Stereo Separation	1KHZ		LOCAL MODE :	55dB	DX MODE :	30dB
	50 ~ 10KHZ			46dB		25dB
Frequency Response	50 ~ 10KHZ	\pm 0.3dB				
	30 ~ 15KHZ	\pm 0.5dB				
	10 ~ 18KHZ	\pm 0.5dB				
Sub Carrier Suppression	70dB					
Muting Level	AUTO DX MODE : 5 μ V (19.2 dBf)					
AUTO DX MODE	50 μ V (39.2dBf) at Stereo -50dB					
■ AM SECTION						
Tuning Range	525 ~ 1605KHZ					
Usable Sensitivity	(IHF)	15 μ V				
Selectivity	+30dB (1000KHZ \pm 10KHZ)					
Signal to Noise Ratio	50dB (80dBm)					
Image Frequency Rejection	(1000KHZ)	70dB				
IF Rejection	(1000KHZ)	70dB				
Spurious Response Rejection	(1000KHZ)	70dB				
Total Harmonic Distortion	0.4%					
■ AUDIO SECTION						
Out put Level / Impedance	FM (100% MOD)	VR min ~ max	0.1 ~ 1V / 220 Ω	VR center	0.5V / 2.5K Ω	
	AM (30% MOD)	VR min ~ max	25 ~ 250mV / 220 Ω	VR center	125mV / 2.5K Ω	
	REC CAL (333HZ)	VR min ~ max	50 ~ 500mV / 220 Ω	VR center	250mV / 2.5K Ω	
■ GENERAL						
REC CAL SW, FM BLEND SW, FM MUTING & OPTIMUM TUNING SYSTEM, AUTO DX/NORMAL SW, FUNCTION SW, SIGNAL STRENGTH/QUALITY METER, FM TUNING METER, FM STEREO/AM FM DX IND, FM TUNING IND (Full - - Half Bright)						
Semiconductors	IC	5				
	Transistors	60				
	FET	1				
	Diodes	17				
	Zener Diodes	2				
	LEDs	2				
	Ceramic filters	3				
Power Consumption	General model	AC110 ~ 130V, 220 ~ 240V, 50 60HZ, 12W				
	US & Canadian models	AC120.60HZ, 12W				
	European models	AC110 ~ 130V, 220 ~ 240V, 50HZ, 12W				
	Australian & British models	AC240V, 50HZ, 13W				
Dimensions (W x H x D) mm	435 x 97 x 376					
Weight	5.7Kg (12 lb 9 oz)					

REAR PANEL

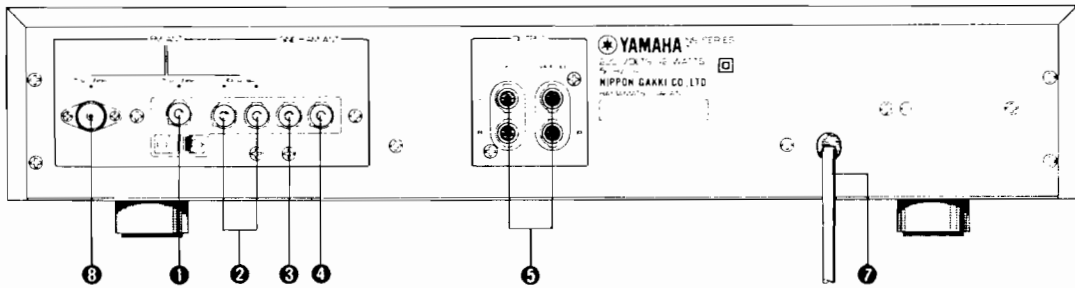
▼ US & CANADIAN MODELS



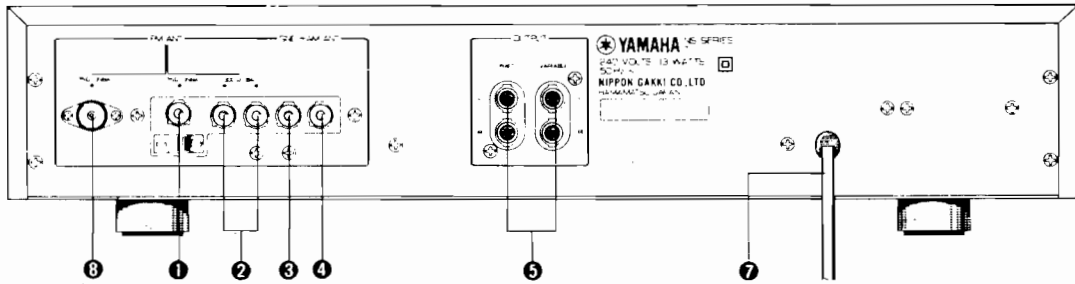
▼ EUROPEAN MODEL



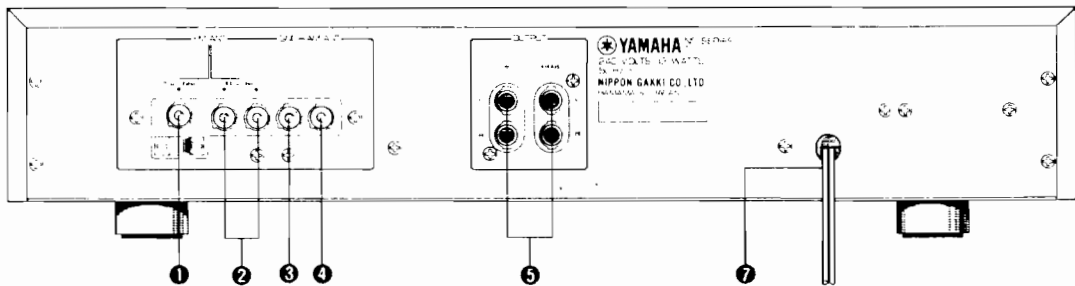
▼ NORTH EUROPEAN MODEL



▼ BRITISH MODEL



▼ AUSTRARIAN MODEL



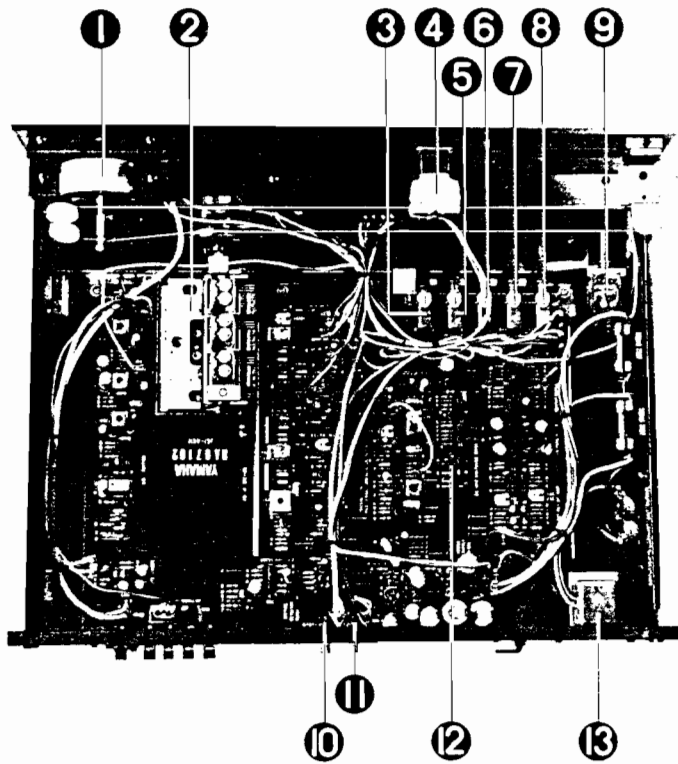
- ① FM ANTENNA (75Ω UNBAL)
- ② FM ANTENNA (300Ω BAL)
- ③ GROUND TERMINAL

- ④ AM ANTENNA TERMINAL
- ⑤ OUTPUT JACKS

- ⑥ VOLTAGE SELECTOR
- ⑦ AC CORD
- ⑧ FM ANTENNA (75Ω UNBAL)

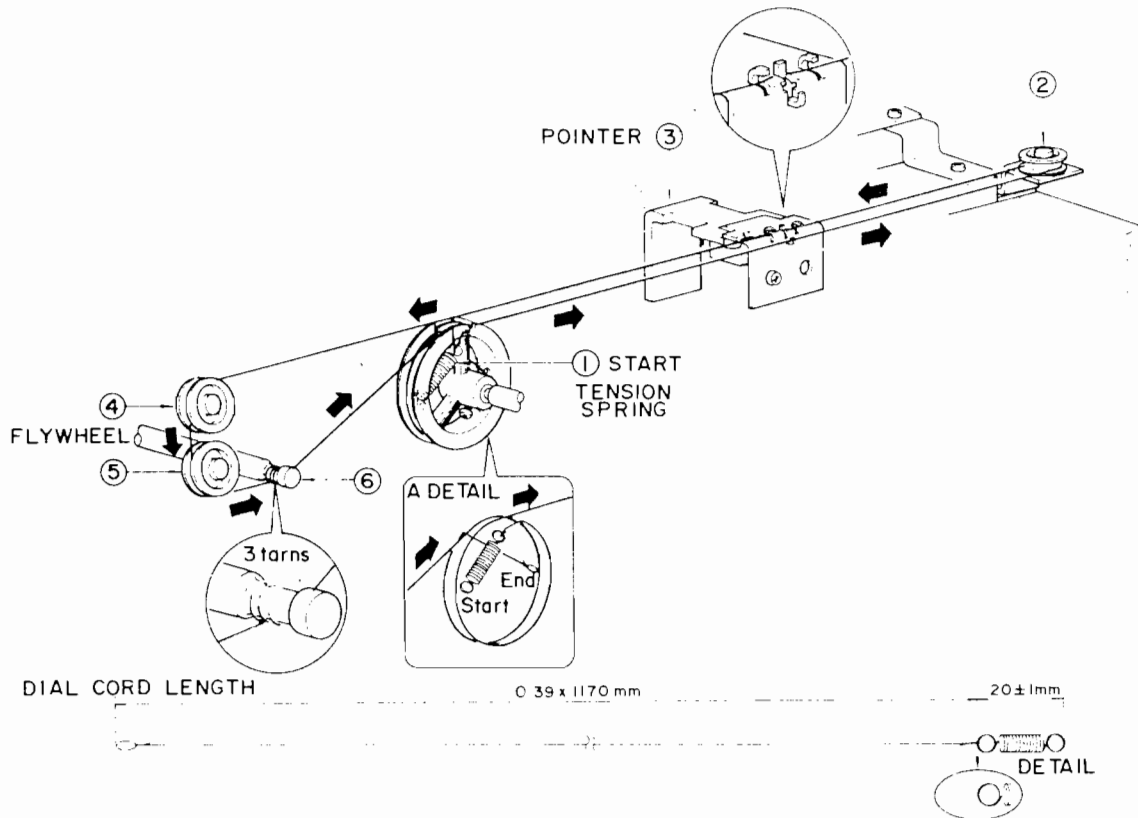
INTERNAL VIEW

▼ TOP VIEW



- ① FLY WHEEL
- ② FRONT END
- ③ FUNCTION SWITCH
- ④ DIAL POINTER
- ⑤ RX MODE SWITCH
- ⑥ MUT /OTS SWITCH
- ⑦ BLEND SWITCH
- ⑧ REC CAL SWITCH
- ⑨ POWER SWITCH
- ⑩ OUTPUT JACKS (FIXED)
- ⑪ OUTPUT JACKS (VARIABLE)
- ⑫ TUNER CIRCUIT BOARD
- ⑬ POWER TRANSFORMER

DIAL MECHANISM



DISASSEMBLY PROCEDURES

1. Top cover removal

Turn the model over so that the bottom cover is facing up, remove screws (1) to (4) in Photo 1, slide the top cover to the rear panel side and remove.

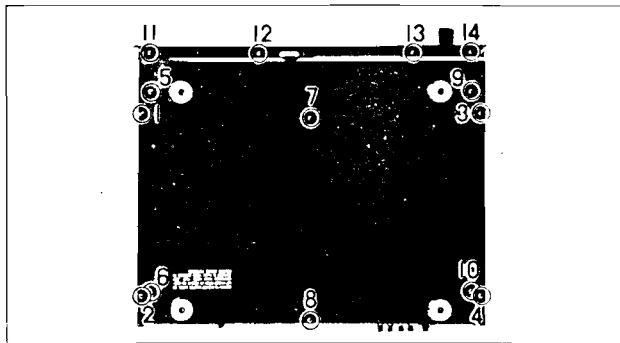


Photo 1

2. Bottom cover removal

Remove screws (5) to (10) in Photo 1 and then detach the bottom cover.

3. Front panel removal

- Remove the top and bottom covers first. (Proceed according to steps 1 and 2.)
- As in Fig. 1, use a 2mm diameter hexagonal wrench to loosen the screws (1) and (2) of the tuning knob from between the front panel and the sub-chassis. Then draw the knob out and remove.
- Remove screws (11) to (14) in Photo 1 and also screws (1) to (3) in Photo 2, and then draw the front panel out toward you gently.

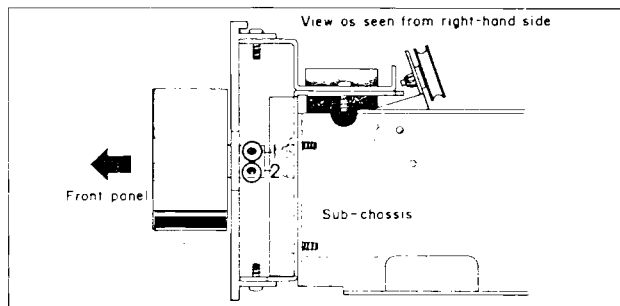


Fig. 1

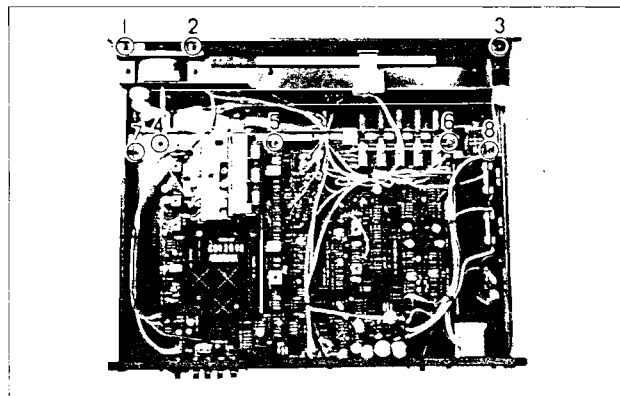


Photo 2

4. Tuner printed circuit board removal

- Remove the front panel. (Proceed according to step 3.)
- Remove screws (1) to (5) in Photo 3 and also plastic rivet (6).
- Detach the lead wires which are connected to the tuner printed circuit board.
- Loosen the two screws which serve to hold the variable capacitor pulley in position, and take out the pulley from the variable capacitor shaft. If the pulley and dial thread are connected together by solder, the thread will not get tangled up and it will be easier to mount.

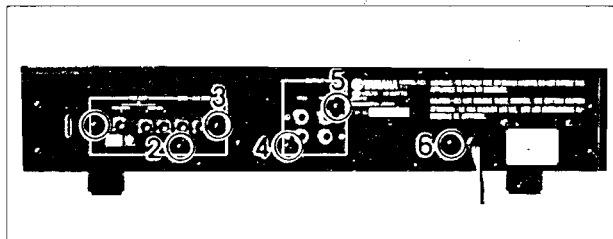


Photo 3

- Remove plastic rivets (4) to (6) in Photo 2, and remove the tuner printed circuit board.
 - * If the screws (7) and (8) in Photo 2 are removed, the center frame and the power switch can be removed at the same time as the tuner printed circuit board.

5. Meter removal

- Remove the front panel. (Proceed according to step 3.)
- Remove the lead wires which are attached to the meters, and the meters can be removed when the rear section of the meters is pushed toward the front panel.

6. Dial illumination lamp removal

- Remove the front panel. (Proceed according to step 3.)
- Remove screws (1) and (2) in Photo 4, and then remove the dial illumination lamp.

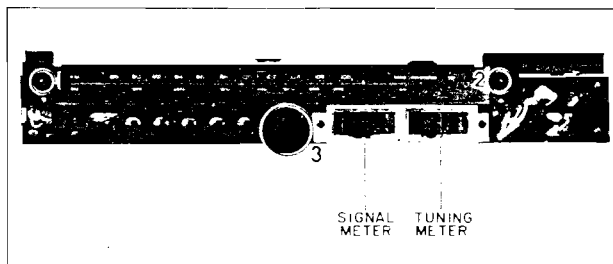


Photo 4

7. Output level adjustment volume control (VR207, 10KB x 2) removal

- Remove the front panel. (Proceed according to step 3.)
- Draw knob (3) in Photo 4 out, remove the VR207 nuts and then remove the volume controls.

CIRCUIT DESCRIPTIONS

▼ Muting circuit

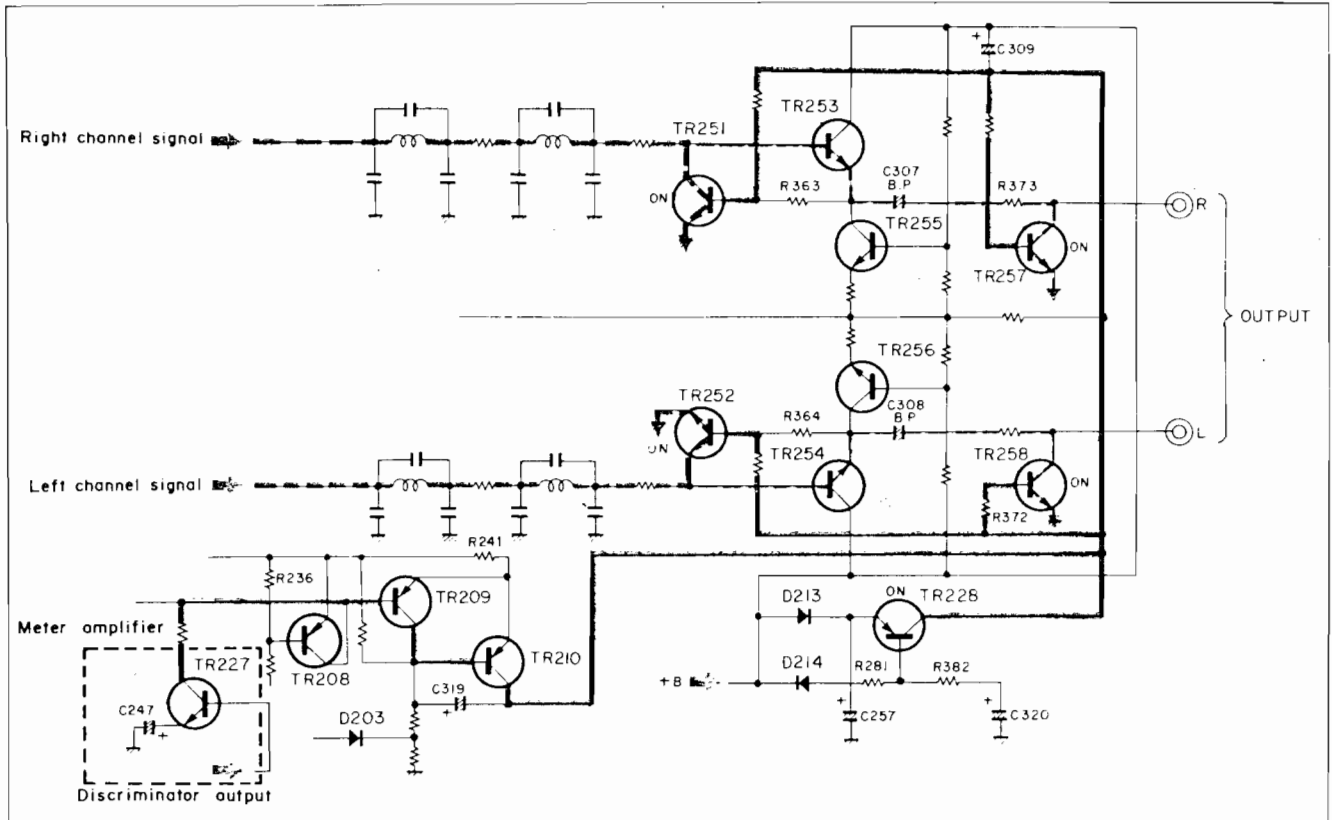


Fig. 1

1. When the POWER switch is set to ON

The +B voltage enters from D213 to the emitter of TR228 and its base, it passes through R382 (22k) and charges C320 (10uF/16V) (about 3 seconds). TR228 is actuated, and TR251 and TR257 (right channel) as well as TR252 and TR258 (left channel) of the muting circuit connected to the collector side are also actuated, and undesirable noise produced when the power is switched on is cut out.

2. When the POWER switch is set to OFF

C257 (220uF/16V) discharges the charge accumulated when the POWER switch is set to ON, TR228 is actuated and the muting circuit is made to function. (Fig. 1)

3. Muting operation with detuning

During detuning the noise components from the discriminator are applied to the base of TR227 and so TR227 is almost cut off by the actuation of the AGC, and the collector side of TR227 virtually maintains the power line voltage. This means that the voltage at the base side of TR209 increases, TR209 goes off, TR210 goes on, the +B voltage appears at the collector side of TR210, TR251 and 257 (right channel) as well TR252 and 258 (left channel), becomes on, and the signals are cut off. (Fig. 1)

4. When tuning in perfectly from an approximate accurate tuning point

When the tuning knob is rotated for tuning, the signal meter pointer starts to deflect in accordance with the DC output from the discriminator, and the TR227 collector's potential decreases.

The base potential of TR209 starts to decrease but a positive (+) and negative (-) voltage is applied to the differential amplifier composed of TR206 and TR207, the current increases, and TR208 goes on. This means that the base voltage of TR209 does not drop and so the muting circuit continues to function. Next, when the station has been tuned in accurately, the total current of the differential amplifier decreases without being applied to the TR206 base, and the TR208 base voltage increases. This sets TR208 off and the TR209 base voltage drops, setting TR209 on. This action sets TR210 off, all the muting circuit's transistors go off and the reception signals are allowed to pass through. (Fig. 2)

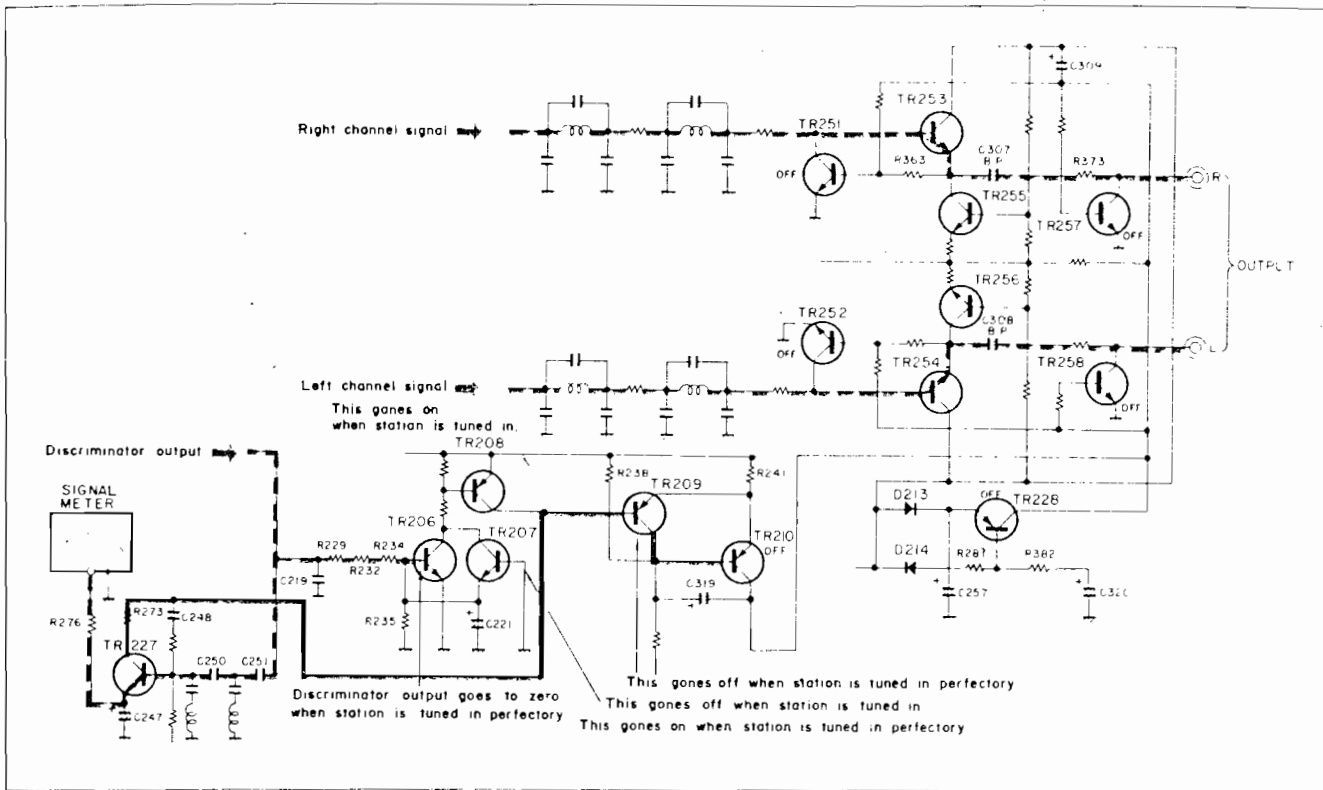


Fig. 2

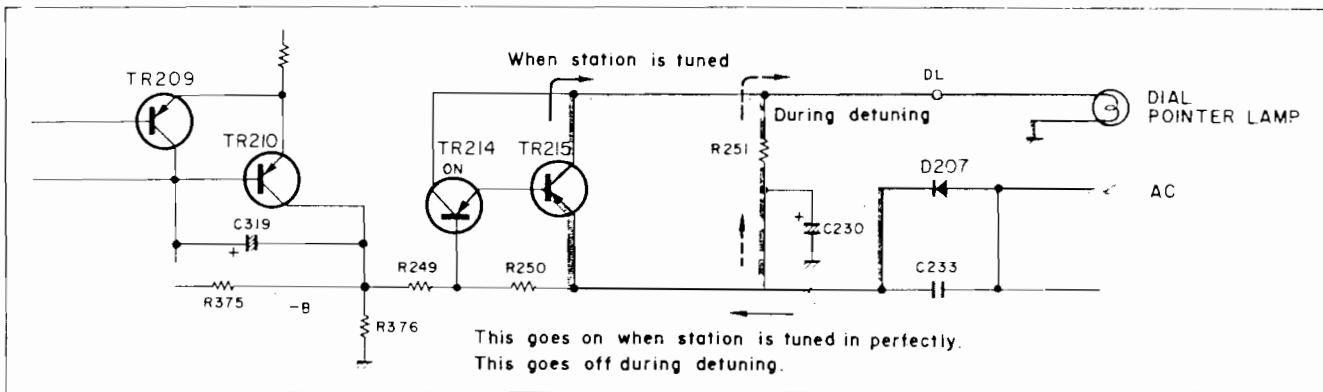


Fig. 3

5. Dial pointer lamp drive

When TR215 goes off (detuning), the pointer lamp lights up with the bypass resistance of R251. When a station is tuned in, TR210 goes off, the base voltage of TR214 drops according to the negative (-) voltage which is supplied from R375 at the collector side (left side of R249) of TR201, TR214 goes on, TR215 goes on as well, and the pointer lamp becomes even brighter. (Fig. 3)

6. Auto DX circuit

The basic principle of operation for this circuit is virtually the same as that of CT-G1.

7. Tracking pilot signal pure canceling circuit

The 19kHz pilot signal is required to produce the

38kHz subcarrier. However, it is undesirable as an audio signal. The T-1 tuner is equipped with a tracking type pilot signal pure canceling circuit which is designed to cancel out the pilot signal with the input of the switching circuit using sine waves with the same amplitude but opposite phase. This circuit makes use of the 19kHz square waves generated by the PLL circuit, a 19kHz signal with a phase and level which track the input pilot signal is generated, and the signals which have been converted into sine waves by the waveform converter circuit are canceled out before the switching circuit (these signals have the same level as the pilot signal but the opposite phase). Fig. 4 shows a block diagram of this circuit as well as the waveforms produced at each of the sections.

This tracking type pilot signal pure canceling circuit is designed to track the level automatically in accordance with the variations in the level, even if the level of the pilot signals from the broadcasting stations fluctuate, and also to cancel the pilot signal out. This means that there is hardly any pilot signal leakage.

Fig. 5 gives the pilot signal leakage in the T-1's tracking type pilot signal pure canceling circuit as well as that in a circuit where the level is not tracked, as seen through a spectrum analyzer. 'a' shows no pilot signal cancellation at all, 'b' shows the T-1 with a 9% pilot, 'c' shows the T-1 with a 10% pilot, and 'd' shows the waveform with the 10% pilot signal of a circuit which does not track the level.

With the T-1, the pilot signal leakage is less than -70dB even if the level of the pilot signal fluctuates. Furthermore, the pilot signal is canceled out with the input of the switching circuit. This means that no undesirable 19kHz pilot signals are contained in the switching circuits handling multiple signals and that only pure composite signals are demodulated. As a result, the MPX circuit features an exceedingly low level of intermodulation distortion. In addition, no 19kHz signals are contained in the output from the MPX circuit and so an almost flat frequency response is obtained up to the 18kHz cut-off frequency of the following low-pass filter.

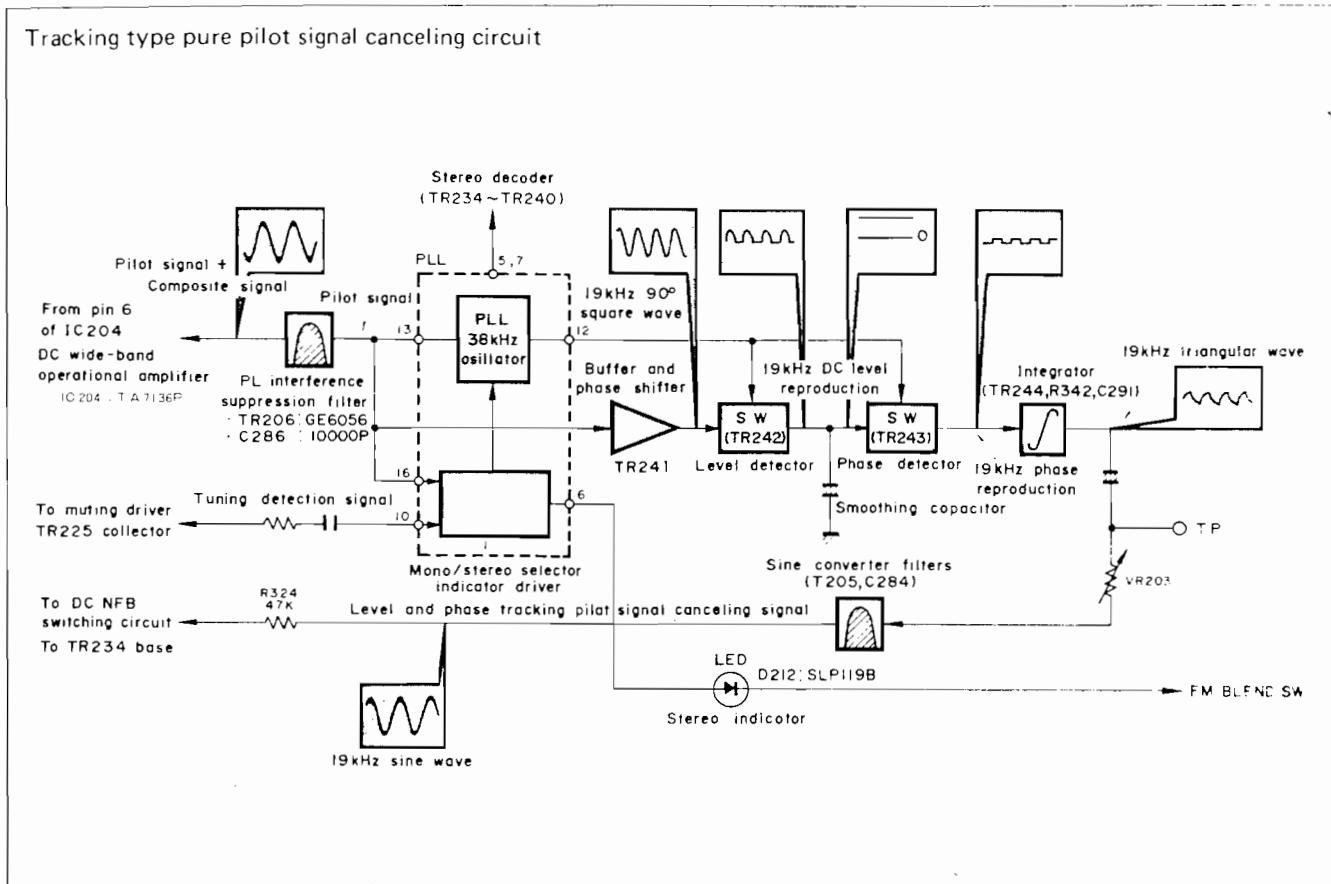


Fig. 4

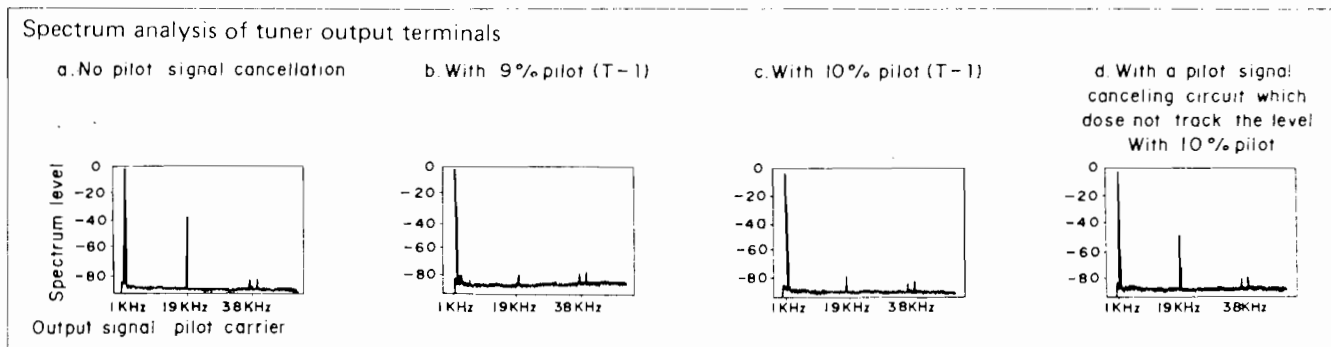
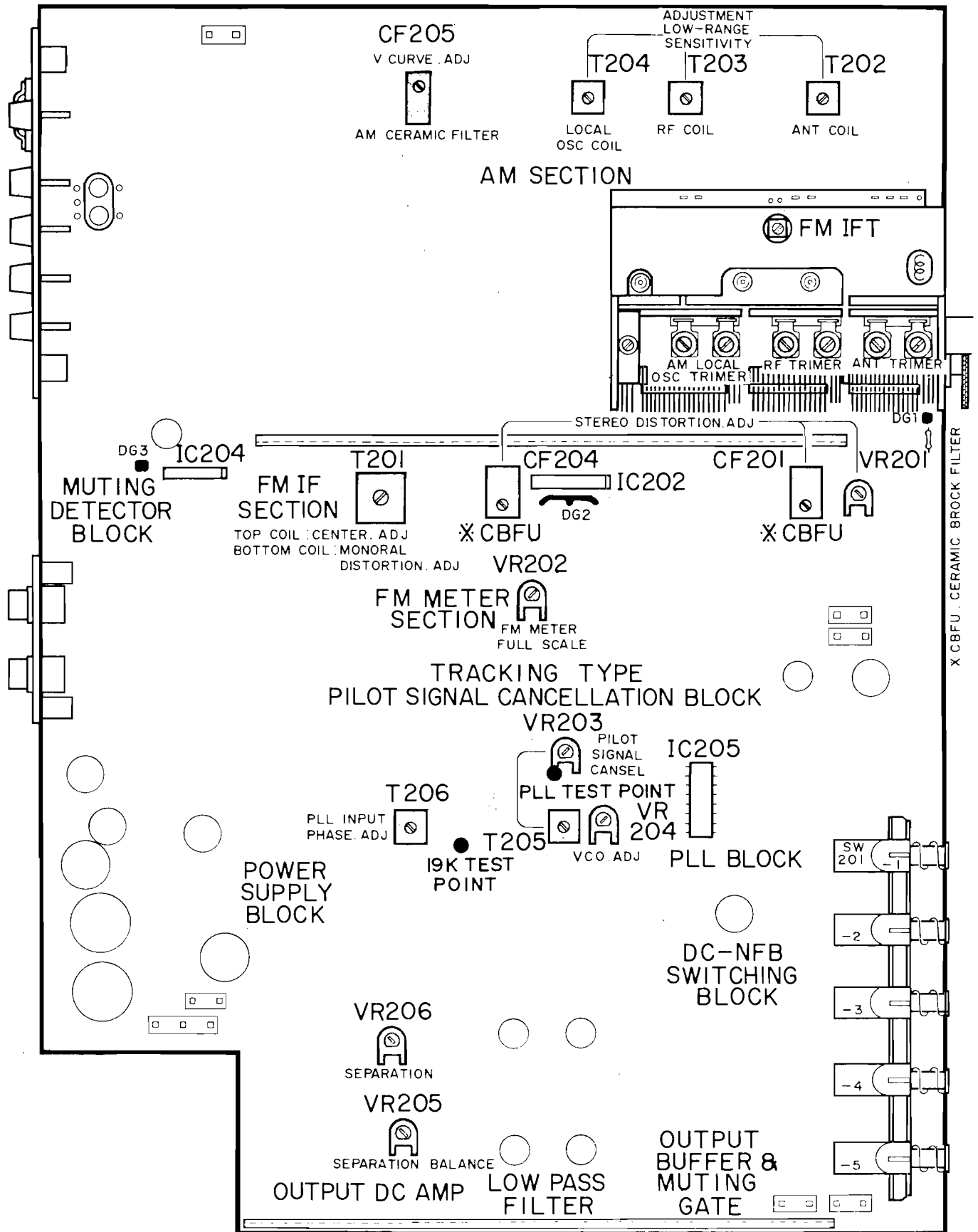
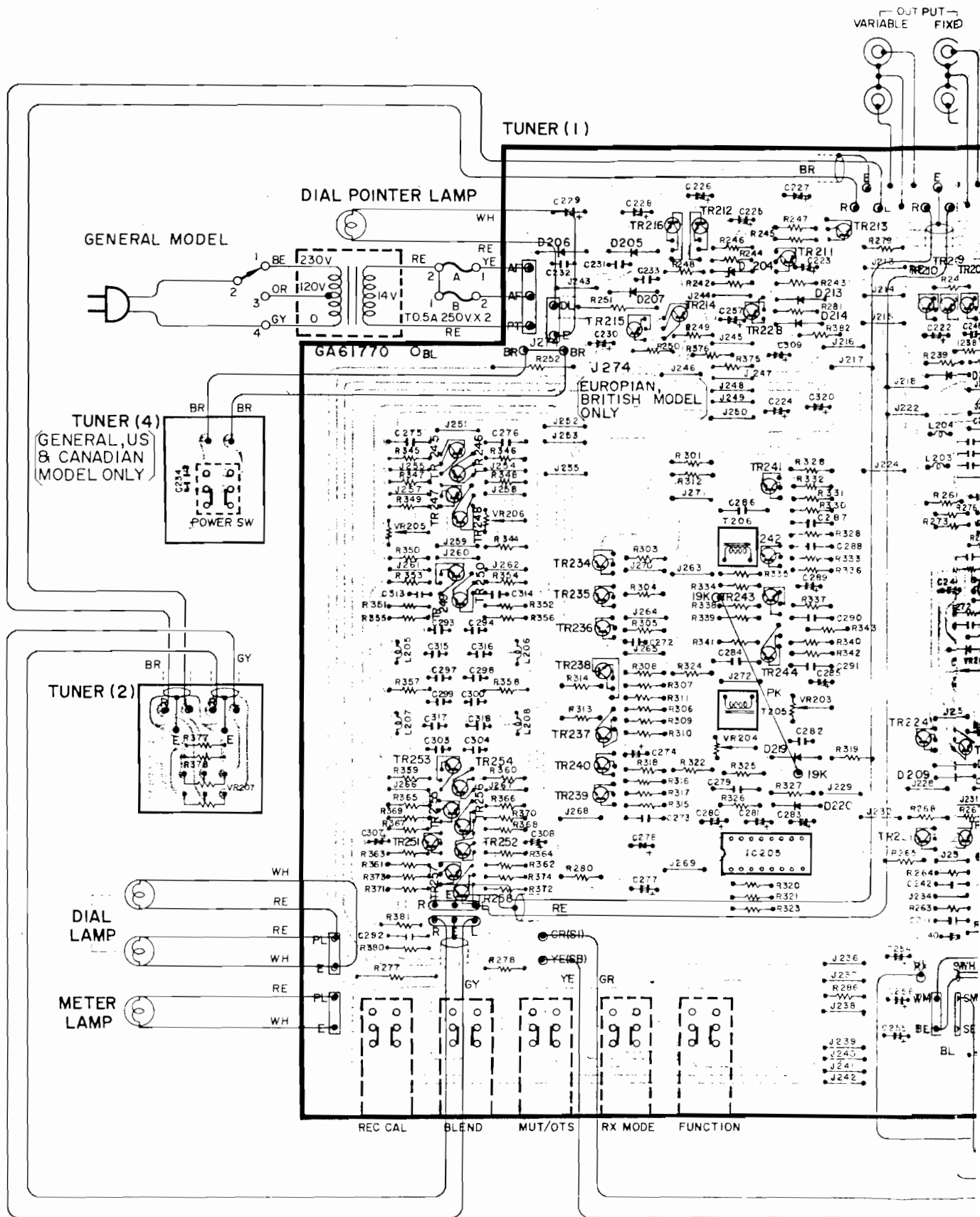


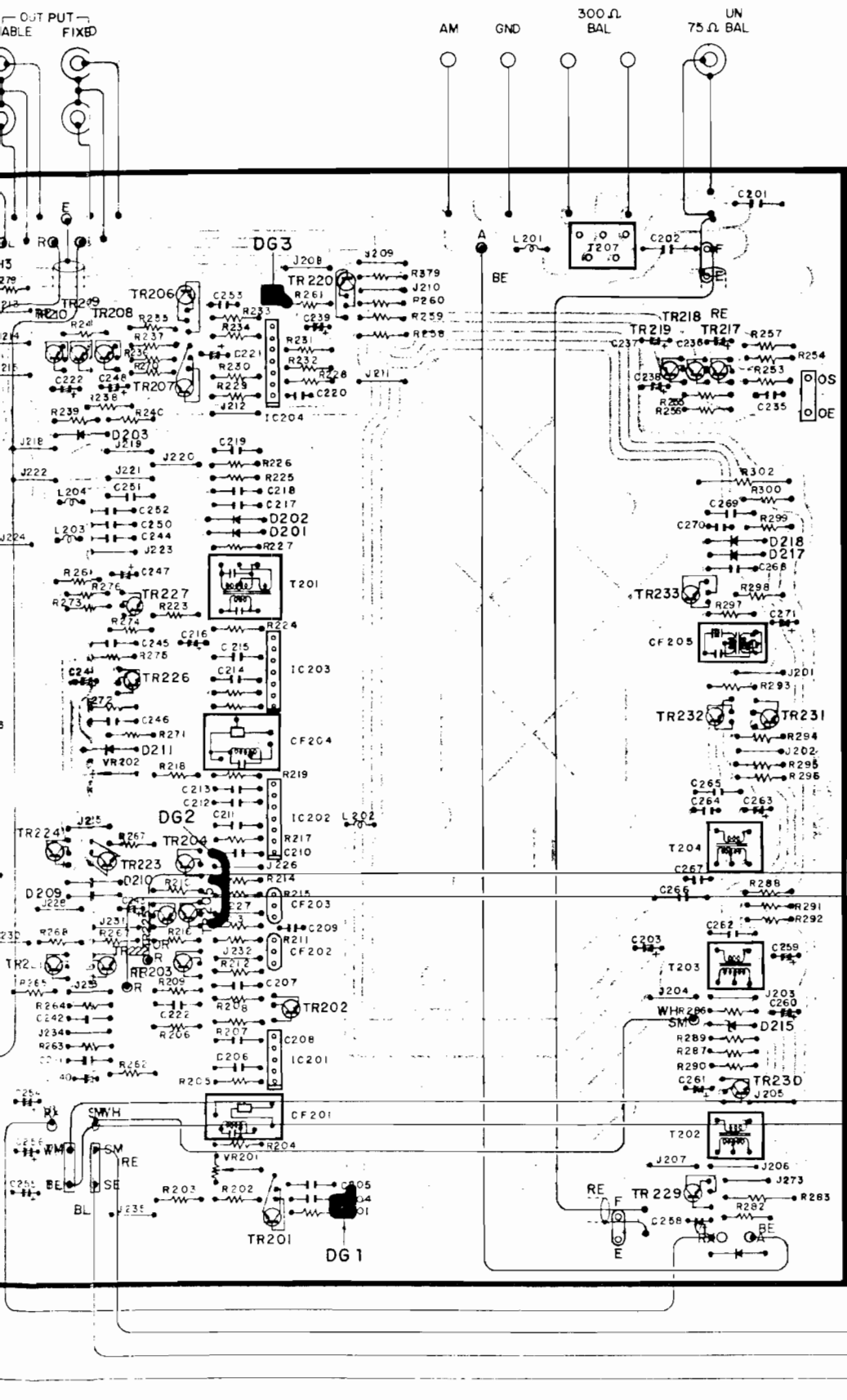
Fig. 5

TEST POINTS

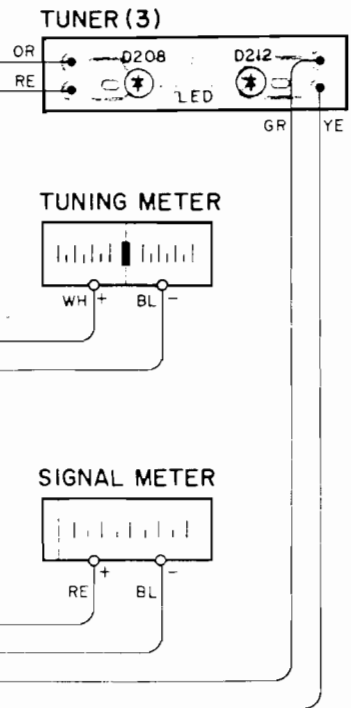


PRINTED CIRCUIT BOARD/WIRING



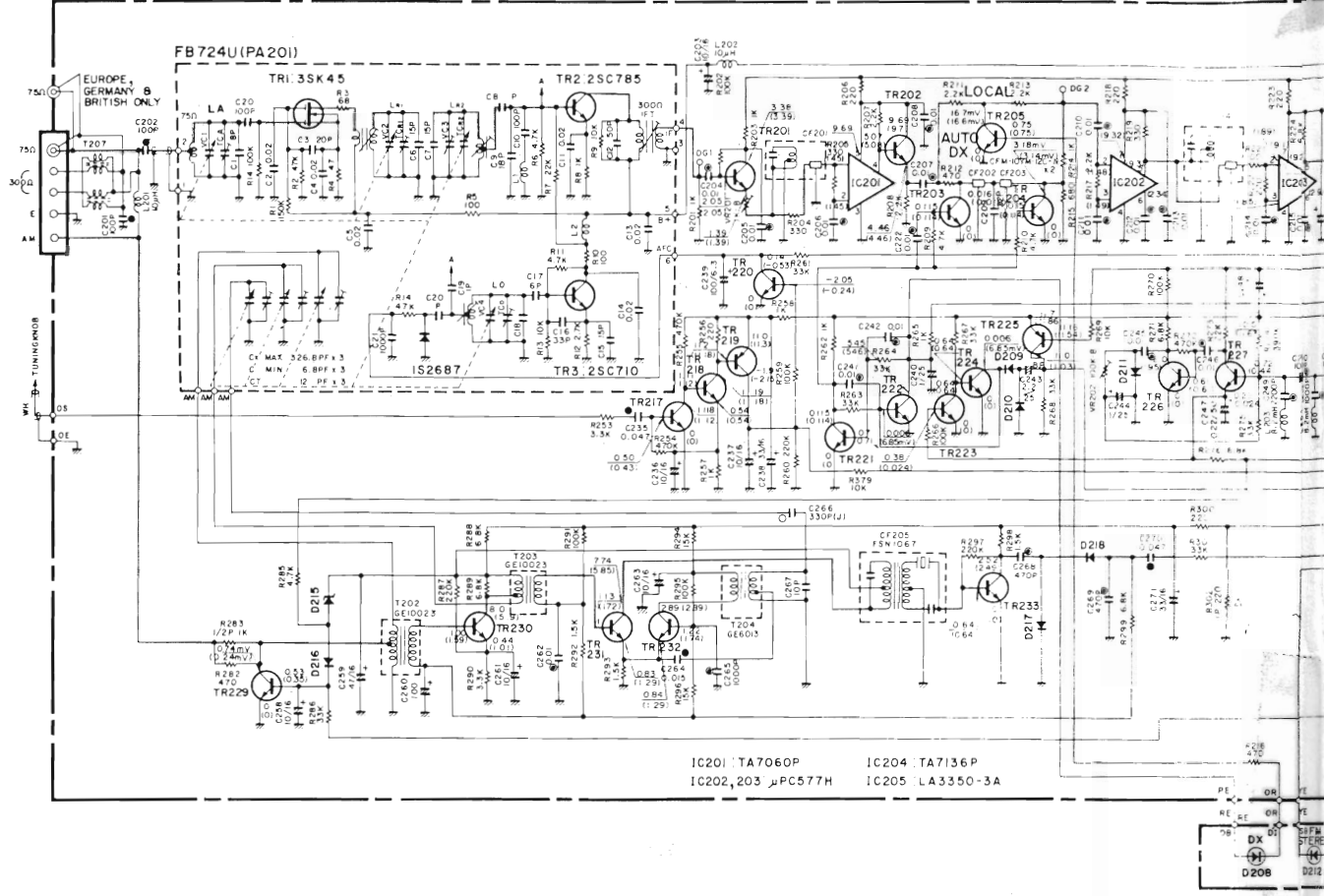


PARTS	BRITISH AUSTRALIAN EUROPEAN	GENERAL US & CANADIAN
C293 C294	0.0011	0.0016
C297 C298	0.0051	0.0068
C299 C300	0.0013	0.0018
C303 C304	0.0022	0.0027
R252	1/2 P 10	



SCHEMATIC DIAGRAM

EUROPEAN & BRITISH MODELS : NA07104
 AUSTRALIAN MODEL : NA07103
 TUNER GENERAL, US & CANADIAN MODELS : NA07102



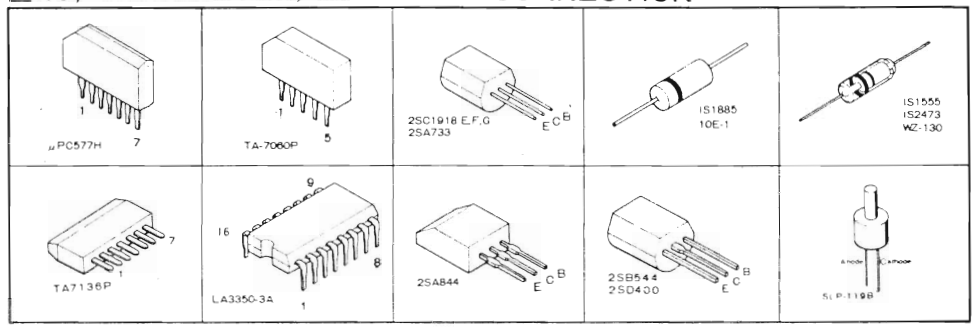
WIRE COLOR ABBREVIATIONS

- BL ▶ Black
- BR ▶ Brown
- RE ▶ Red
- OR ▶ Orange
- VI ▶ Violet
- GY ▶ Gray
- WH ▶ White
- GG ▶ Light Green
- YE ▶ Yellow
- GR ▶ Green
- BE ▶ Blue
- SB ▶ Light Blue
- PK ▶ Pink

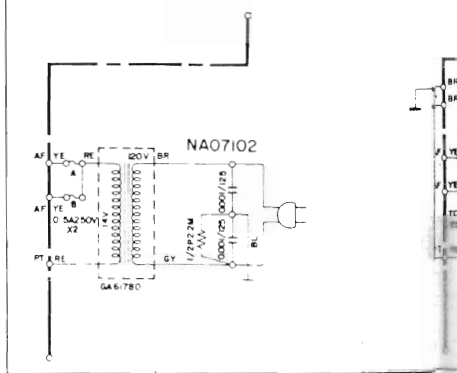
RESISTOR		CAPACITOR	
	Metalized Film Resistor		Ceramic Film Capacitor (Cylinder type)
	Metalized Oxidation Resistor		SBL Film Capacitor
	Fire Proof Resistor		Mylar Film Capacitor
	Metal Film Resistor		Polyester Film Capacitor
	Cement Molded Resistor	ND MARK	Ceramic Capacitor
ND MARK	Carbon Film Resistor		Tantalum Electrolytic Capacitor
		ND MARK	Aluminum Electrolytic Capacitor

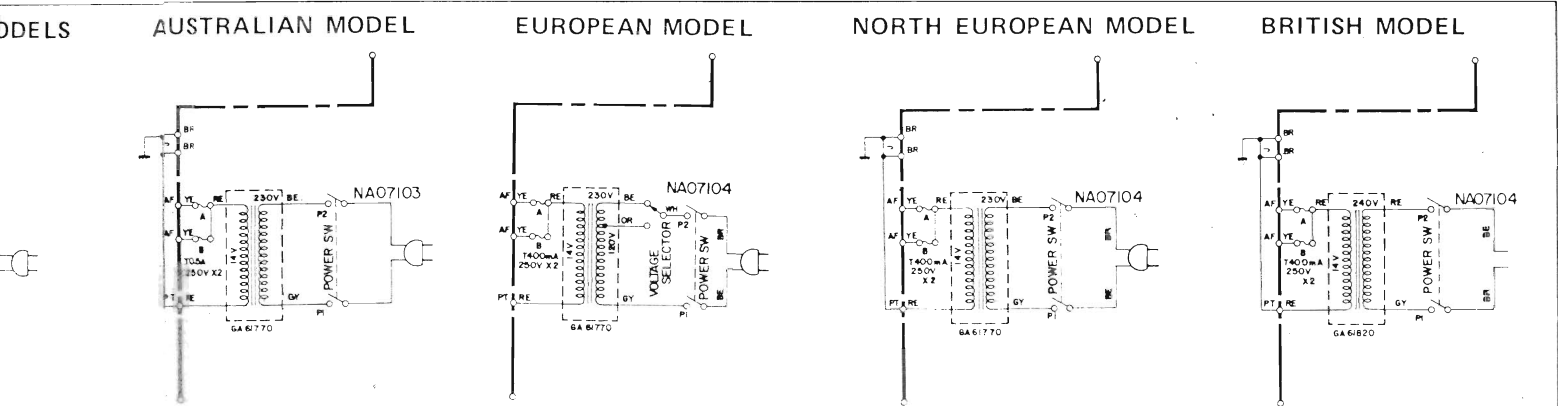
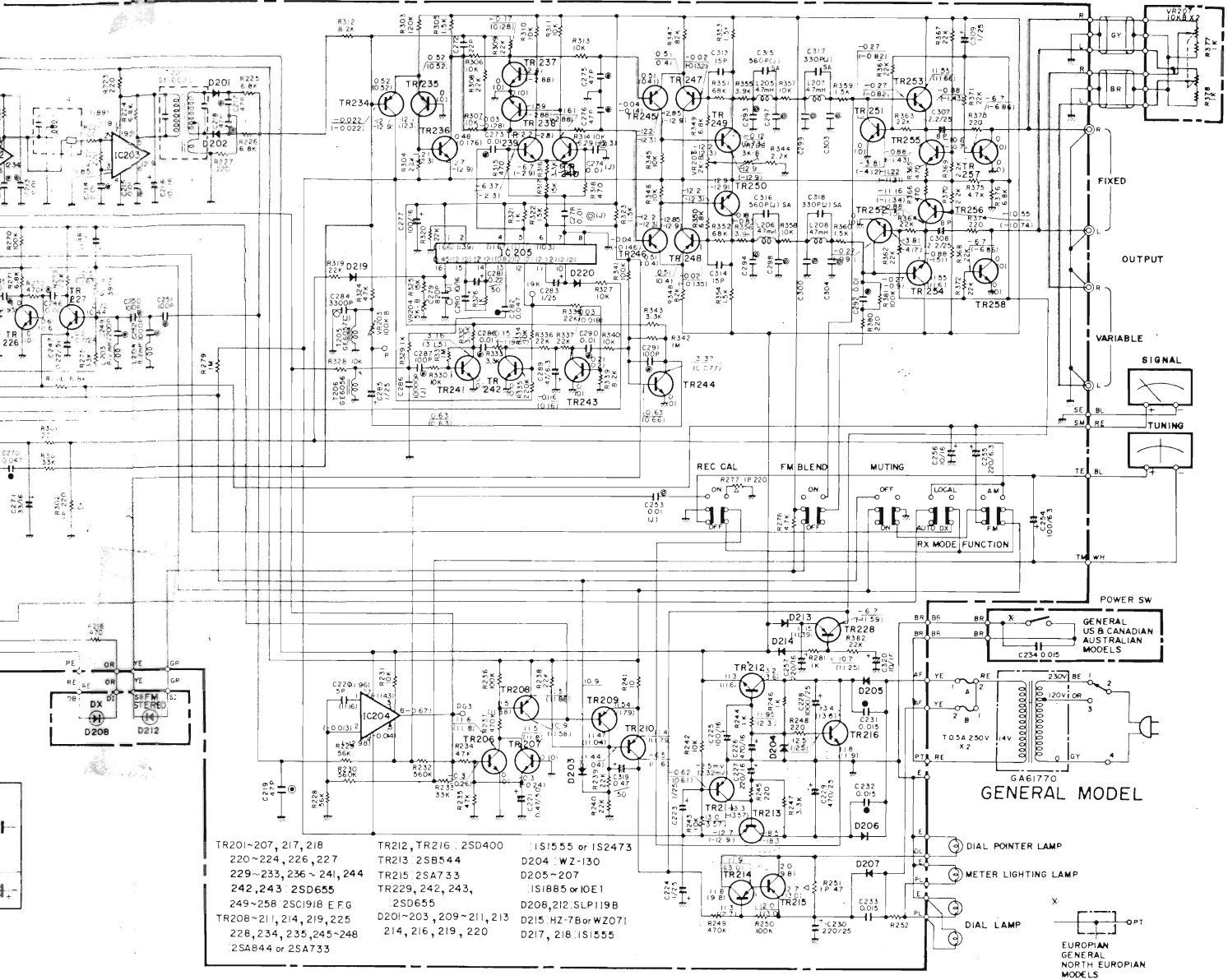
* All Voltages measured with a 1 kΩ DC electron volt meter.

I.C., TRANSISTOR, DIODE PIN CONNECTION



US & CANADIAN MODELS

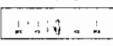
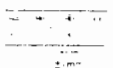


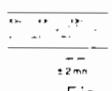


ADJUSTMENT

1. FM tuner section

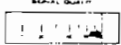
- Set the switches to the following positions: FUNCTION → FM, REC CAL → OFF, RECMODE → LOCAL, FM MUTING/OTS → ON
- Use a low-pass filter for the steps following 6.
FM BLEND → OFF

Step	Adjustment item	Terminal to be connected	Instrument required	Adjustment location	Adjustment method	Rating or standard	Remarks
1.	Discriminator balance	Connect 300Ω balanced antenna to FM antenna terminals.		T201 (GE-10020): Secondary (top) core of discriminator coil	Move core until tuning meter pointer deflects to 0 with noise at detuned point near 98MHz		Check that meter pointer mechanically points to 0 when power switch is set OFF. (See Fig. 1)
2.	Tuning point setting	FM antenna terminals	Antenna input: 60dBμ, 98MHz	Tuning knob	Adjust knob until tuning meter pointer points to center		Fig. 1 
3.	Monaural distortion adjustment	FM antenna terminals, L OUTPUT terminal only	Same as Step 2. Monaural 1kHz, 100% modulation, oscilloscope, valve voltmeter, distortion meter	T201 (GE-10020) primary (bottom) core	Reduce distortion to minimum.	Less than -60dB (-66dB)	
4.	VCO adjustment	FM antenna terminals, 19kHz TP terminal	Same as Step 2 Unmodulated frequency counter	VCO ADJ VR204 (3kΩ)	Set to 19kHz.	19kHz ±20Hz (±5Hz)	
5.	PLL input phase adjustment	FM antenna terminals, P terminal (PLL T.P)	Same as Step 4 Pilot 9%, MOD, Oscilloscope	T206	Observe waveforms on oscilloscope and set so that 19 kHz triangular waveforms are brought to their maximum.		
6.	Stereo distortion adjustment	FM antenna terminals, L OUTPUT terminal only	Same as Step 2. Stereo L, 1kHz 100% modulation, dual-trace oscilloscope, dual-channel valve voltmeter, distortion meter	VR201, CF-201, CR204 Front end IF core	Reduce distortion to minimum	Less than -60dB (-66dB)	
7.	Pilot canceling adjustment Carrier leakage adjustment	FM antenna terminals, L, R OUTPUT	Same as step 5. Pilot 9%, MOD, oscilloscope, valve voltmeter	PCL VR203 (100kΩ), T205, T206	Observe waveforms on oscilloscope and adjust so that level is reduced to minimum.	Carrier leakage for both channels: less than 60dB	
8.	Separation adjustment	Same as step 6	Stereo L, R 1kHz, 100% modulation	SEP VR206 (3kΩ), SEP, BAL VR205 (2kΩ)	Attain balance between left and right channels with VR205, and then bring to maximum with VR206.	Less than 50dB (55dB)	
9.	Signal meter full scale adjustment	Same as step 5.	Non-modulated 60dBμ	FM METER ADJ VR202 (100kΩ)	Adjust so that pointer is within rated range	70-80 (75)	
10.	Pointer alignment	FM antenna terminals	98MHz, antenna input 60dBμ	Tuning knob pointer	Rotate the knob, and tune in station so that tuning meter pointer is at center. Now align pointer with 98 on dial scale.	Within ± 1mm	Within ± 1mm  Fig. 2

Step	Adjustment item	Terminal to be connected	Instrument required	Adjustment location	Adjustment method	Rating or standard	Remarks
11.	High-range tracking check	FM antenna terminals	108MHz	Tuning knob	Rotate the knob, and set to center of tuning meter. Read out deviation between pointer and scale.	Within ± 2 mm from center of numerals	Within ± 2 mm  Fig. 3
12.	Tracking adjustment I	FM antenna terminals	FM signal generator	Pointer	Re-set pointer so that it comes within specifications on right across whole frequency range.	± 2 mm less than	Adjust only when pointer deviates with Step 10 setting.
13.	Tracking adjustment II	FM antenna terminals	FM signal generator	Pointer PACK	Adjust deviation mainly with pack for low frequency range and with pointer for high frequency range.	Same as step 10	Adjust only when pointer deviates with Step 11 adjustment.
14.	Muting operation check	FM antenna terminals	Oscilloscope, valve voltmeter, antenna input: 60dB μ , 84MHz	FM MUT/OTS switch tuning knob	Check that detuning point noise is canceled when FM MUT/OTS switch is set to ON, and that normal waveforms are obtained.		
15.	Stereo reception check, PLL input phase adjustment	FM antenna terminals, P (T.P terminal)	Stereo L, R 1kHz, 100% modulation oscilloscope, valve voltmeter	T206, LEVEL VR (keep at MAX)	Observe waveforms on oscilloscope and adjust T206 so that 19kHz triangular waves at terminal P are brought to their maximum.		Check that stereo indicator comes on.
16.	Blend operation check	FM antenna terminals	Stereo L, R 1kHz, 100% modulation 60 dB μ oscilloscope, valve voltmeter	FM BLEND switch	Check that separation drops when FM BLEND switch is set to ON.		
17.	OTS operation check	FM antenna terminals	Stereo L, R 1kHz, 100% modulation 60dB μ , oscilloscope, valve voltmeter	Tuning knob	Let go of tuning knob when detuning at + and - sides and when waveforms have disappeared, and check that tuning meter pointer returns to center, and that waveforms reappear.		
18.	Pointer lamp tuning indication check	FM antenna terminals	Stereo L, R 1kHz, 100% modulation 60dB μ	Tuning knob	Check that pointer lamp comes on when 60dB μ signal is received and that it goes off during detuning.		
19.	AUTO DX operation check	FM antenna terminals	Stereo L, R 1kHz, 100% modulation 60dB μ	RX MODE switch tuning knob	1) When RX MODE switch is set to AUTO DX: Check that DX indicator comes on during detuning and that it goes off when 60dB μ signal is received 2) When RX MODE switch is set to LOCAL: Check that DX indicator goes off during signal reception and detuning.		

2. AM tuner section

1. Set the FUNCTION switch to AM.
2. Proceed with the AM section adjustments after having finished the FM section adjustments.

Step	Adjustment item	Terminal to be connected	Instrument required	Adjustment location	Adjustment method	Rating or standard	Remarks
1.	Local oscillator coil adjustment	OUTPUT Lor R	AM signal generator 600kHz, 60dB μ	Tuning knob T204 (GE-6013)	Align pointer with 600kHz using tuning knob, rotate coil core and adjust for a maximum signal quality meter deflection.		
2.	Low-frequency range sensitivity adjustment	Same as step 1.	Same as step 1.	T202 (GE-10023) T203 (GE-10023)	Adjust for a maximum signal meter pointer deflection at same tuning point as under step 1.		 Fig. 4
3.	Local oscillator trimmer adjustment	Same as step 1	AM signal generator 1350kHz, 60dB μ	Tuning knob front end local oscillator trimmer	Align pointer with 1350kHz using tuning knob, rotate trimmer and set for a maximum signal meter pointer deflection.		
4.	High-frequency range sensitivity adjustment	Same as step 1	Same as step 3	Front end AM ANT trimmer, inter-AM stage trimmer	Adjust for a maximum signal quality meter pointer deflection at step 3 tuning point		
5.	Sensitivity difference adjustment	Same as step 1	AM signal generator 600kHz, 1350kHz	Repeat steps 1 to 4.		Scale deviation: less than ± 1.5 mm for 600kHz, 1350kHz	
6.	Medium frequency range check	Same as step 1	AM signal generator 950kHz	Tuning knob	Set for maximum signal quality meter pointer deflection	Scale deviation: less than ± 2 mm	

3. REC CAL output voltage check

Step	Adjustment item	Terminal to be connected	Instrument required	Adjustment location	Adjustment method	Rating or standard	Remarks
1.	REC CAL output check	OUTPUT L or R	Frequency counter Valve voltmeter Oscilloscope		Check that output is within specified range with 333 ± 6 Hz oscillation frequency.	-4 ± 2.5 dBm with volume control at maximum	

4. Variable output check

1. Set the switches to the following positions
FUNCTION — FM, RX MODE — LOCAL, REC CAL — OFF, FM MUT/OTS — OFF

Step	Adjustment	Terminal to be connected	Instrument required	Adjustment location	Rating or standard
1.	Variable output check	FM antenna terminals	Antenna input 60dB μ	OUTPUT LEVEL VR (VR207)	Rotate VR 2-7 counterclockwise and check that output drops -6 dB at center and -20 dB when set to lowest position.