



AT-2250



AM-2250

**AKAI STEREO TUNER
AND
AKAI STEREO INTEGRATED AMPLIFIER**

MODEL AT-2250 AM-2250

I. TECHNICAL DATA

1. MODEL AT-2250

FM TUNER SECTION

FREQUENCY RANGE	87.5 MHz to 108 MHz
SENSITIVITY (IHF)	1.9 μ V
CAPTURE RATIO	1.3 dB
SELECTIVITY (IHF)	More than 65 dB
IMAGE REJECTION	More than 60 dB (98 MHz)
IF REJECTION	More than 85 dB (98 MHz)
SPURIOUS REJECTION	More than 85 dB (98 MHz)
AM SUPPRESSION	60 dB
SIGNAL TO NOISE RATIO	70 dB
HARMONIC DISTORTION	MONO STEREO
	Less than 0.1% (100% modulation) Less than 0.2% (100% modulation)
STEREO SEPARATION	More than 42 dB (1 kHz)
SUB CARRIER SUPPRESSION	More than 40 dB
OUTPUT VOLTAGE	500 mV (100% modulation)
ANTENNA INPUT IMPEDANCE	300 ohms balanced / 75 ohms unbalanced

AM TUNER SECTION

FREQUENCY RANGE	520 kHz to 1,605 kHz
SENSITIVITY (IHF)	100 μ V/m (Bar Antenna), 17 μ V (External Antenna)
SELECTIVITY (IHF)	More than 30 dB
IMAGE REJECTION	More than 50 dB (1 MHz)
IF REJECTION	More than 40 dB
SIGNAL TO NOISE RATIO	More than 55 dB
OUTPUT VOLTAGE	500 mV (30% modulation)
ANTENNA	Built-in Ferrite Bar Antenna

MISCELLANEOUS

SEMICONDUCTORS	Transistors: 6, Diodes: 7, FET: 1, ICs: 3
POWER REQUIREMENT	120V, 60 Hz for U.S.A. and Canada 220V, 50 Hz for Europe except U K. 240V, 50 Hz for U K. 110/220/240V, 50/60 Hz switchable for other countries
DIMENSIONS	380 (W) x 130 (H) x 220 (D) mm (15 x 5.1 x 8.7) inches
WEIGHT	4.7 kg (10.3 lbs)

* For improvement purposes, specifications and design are subject to change without notice.

2. MODEL AM-2250

POWER AMPLIFIER SECTION

RATED OUTPUT POWER 2-CHANNELS DRIVEN	25 watts per channel, minimum RMS at 8 ohms from 20 to 20,000 Hz with no more than 0.2% total harmonic distortion.
POWER BANDWIDTH (IHF)	10 Hz to 40 kHz/8 ohms (Total Harmonic Distortion: 0.2%)
SIGNAL TO NOISE RATIO (IHF) PHONO AUX	Better than 75 dB Better than 95 dB
RESIDUAL NOISE	Less than 0.7 mV at 8 ohms
CHANNEL SEPARATION (IHF) PHONO	Better than 45 dB at 1,000 Hz
DAMPING FACTOR	More than 50 (1 kHz, 8 ohms)
OUTPUT SPEAKERS HEADPHONE	A, B (4 to 16 ohms)/A+B (8 to 16 ohms) 4 to 16 ohms

PREAMPLIFIER SECTION

INPUT SENSITIVITY/IMPEDANCE PHONO AUX TUNER TAPE MONITOR	3 mV/47 kohms 150 mV/100 kohms 150 mV/100 kohms PIN: 150 mV/100 kohms DIN: 30 mV/80 kohms
OUTPUT LEVEL/IMPEDANCE TAPE REC	PIN: 150 mV/100 kohms DIN: 30 mV/80 kohms
FREQUENCY RESPONSE PHONO (RIAA EQUALIZATION) TUNER, AUX, TAPE MONITOR	30 Hz to 15 kHz +1 dB, -1 dB 10 Hz to 40 kHz +0 dB, -1 dB
TONE CONTROL BASS TREBLE LOUDNESS CONTROL	±8 dB at 100 Hz ±6 dB at 10 kHz +9 dB at 100 Hz, +4 dB at 10 kHz (Volume control set at -30 dB position)

MISCELLANEOUS

SEMICONDUCTORS	Transistors: 3, Diodes: 4, ICs: 2
POWER REQUIREMENTS	120V, 60 Hz for U.S.A. and Canada 220V, 50 Hz for Europe except U K. 240V, 50 Hz for U K. 110/220/240V, 50/60 Hz Switchable for other countries
DIMENSIONS	380 (W) x 130 (H) x 220 (D) mm (15 x 5.1 x 8.7) inches
WEIGHT	6.2 kg (13.6 lbs)

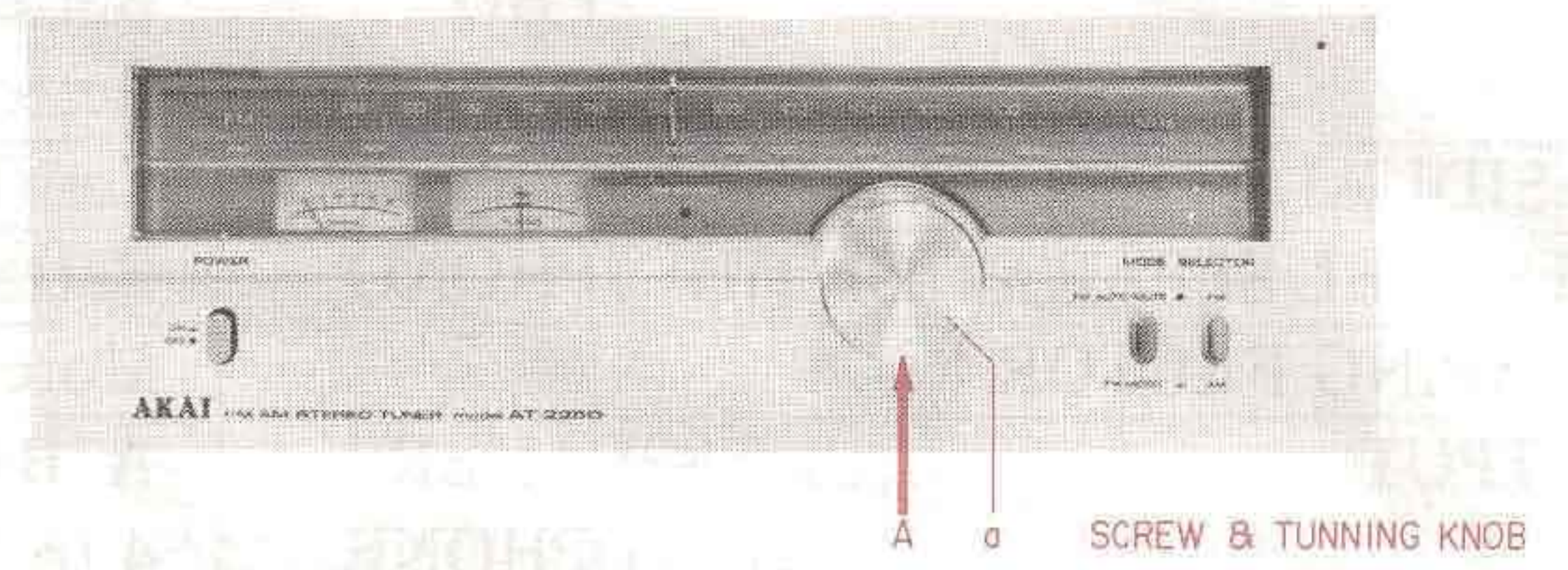
* For improvement purposes, specifications and design are subject to change without notice.

1. MODEL AT-2250

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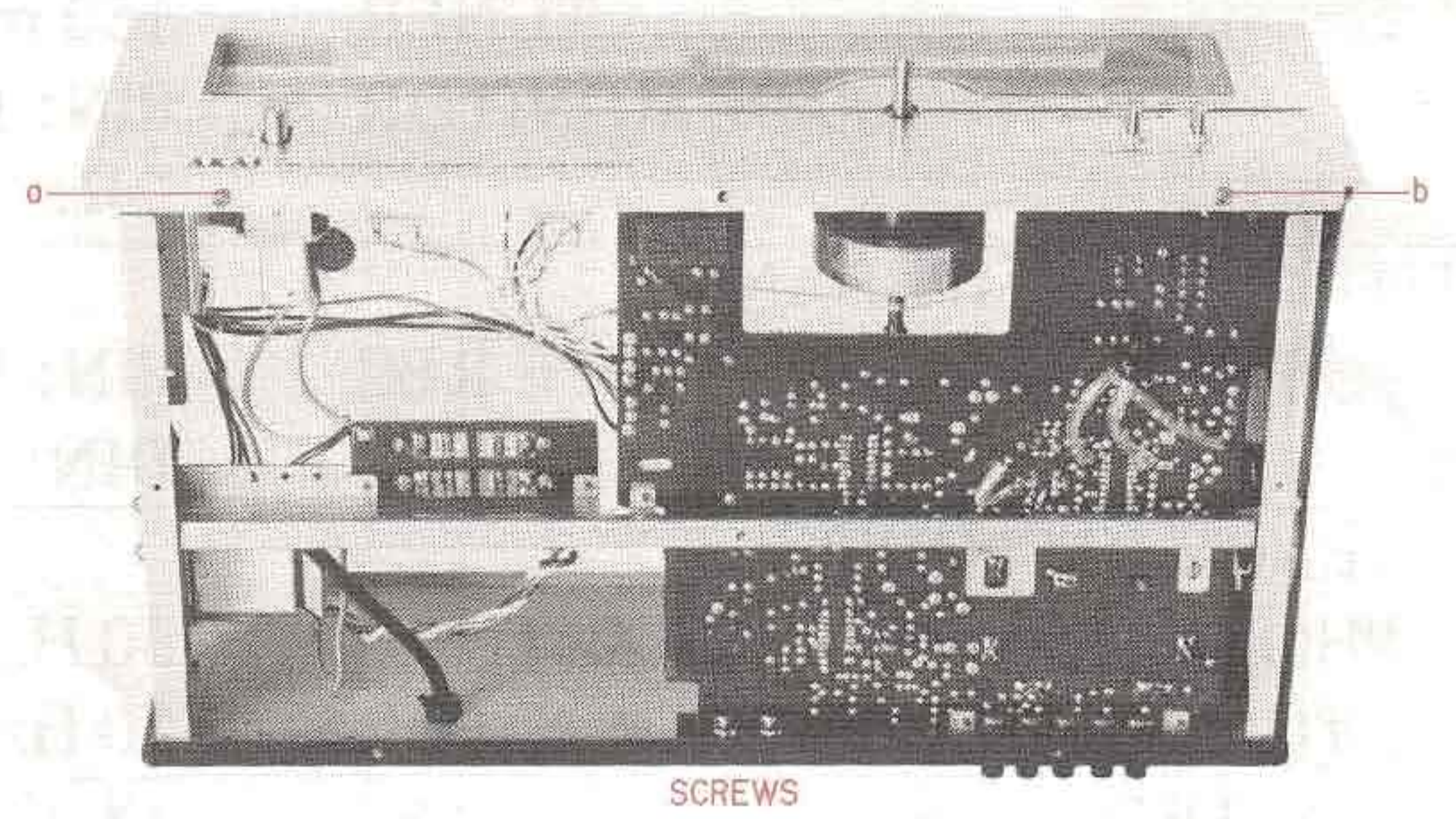
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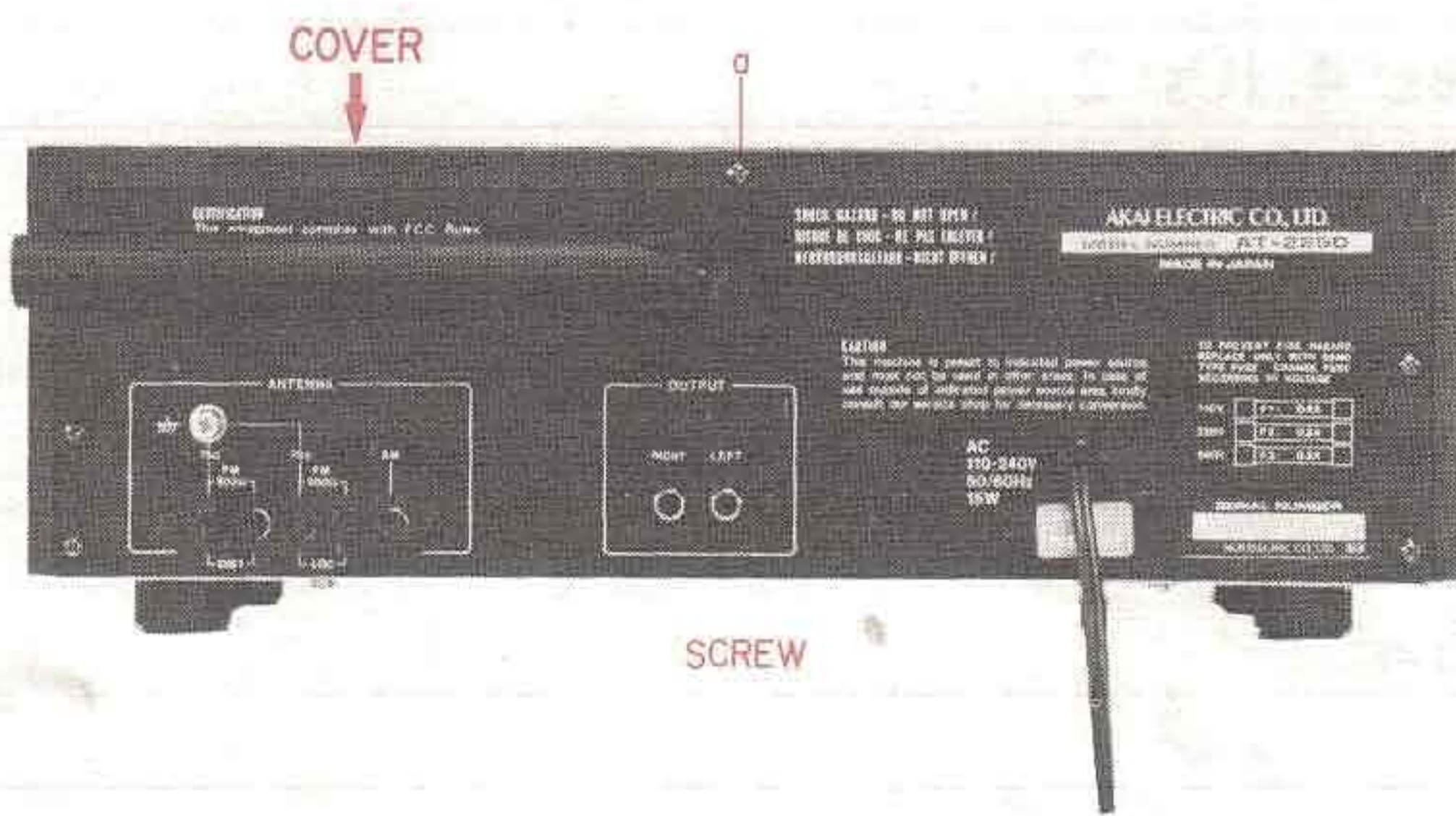
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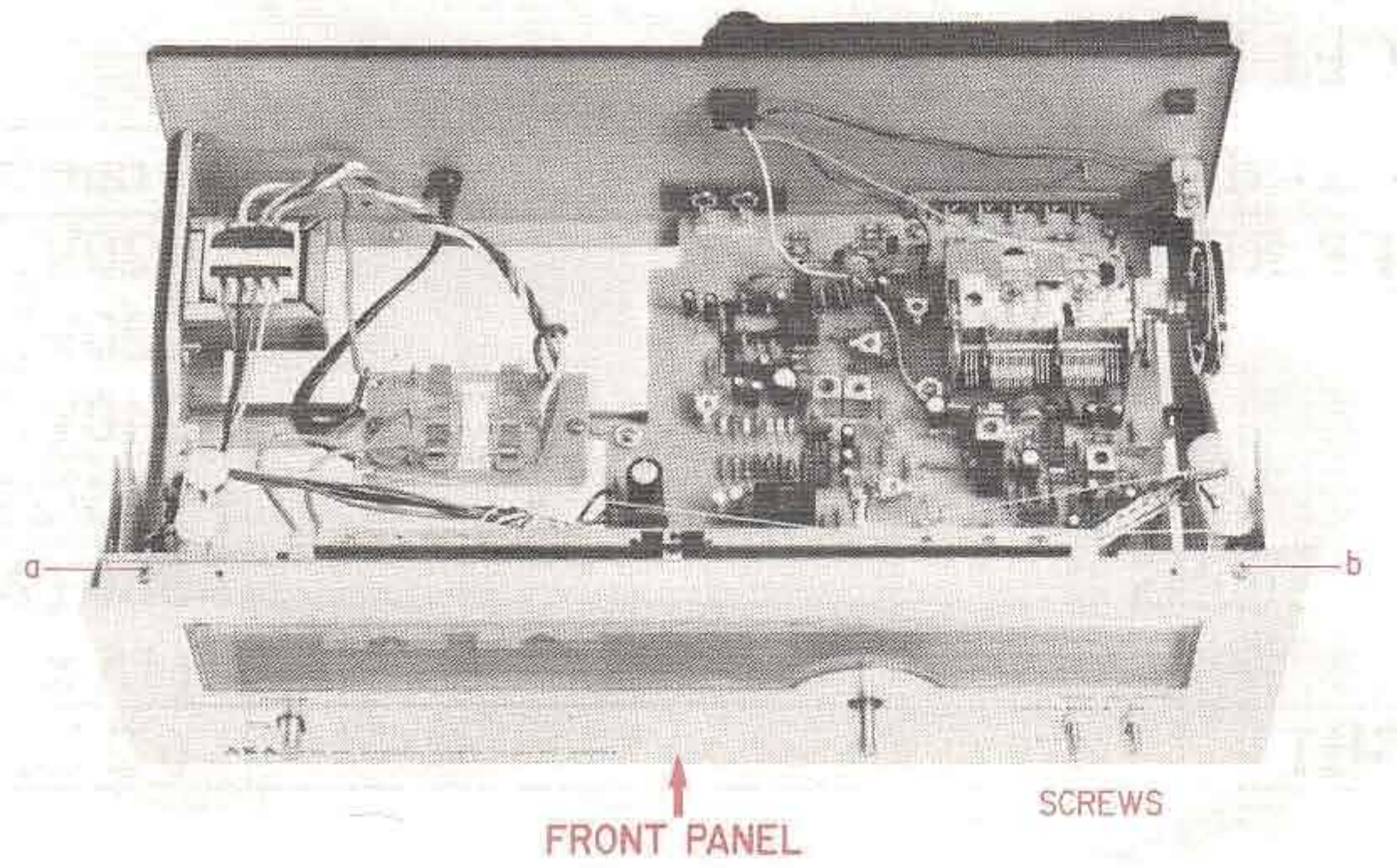
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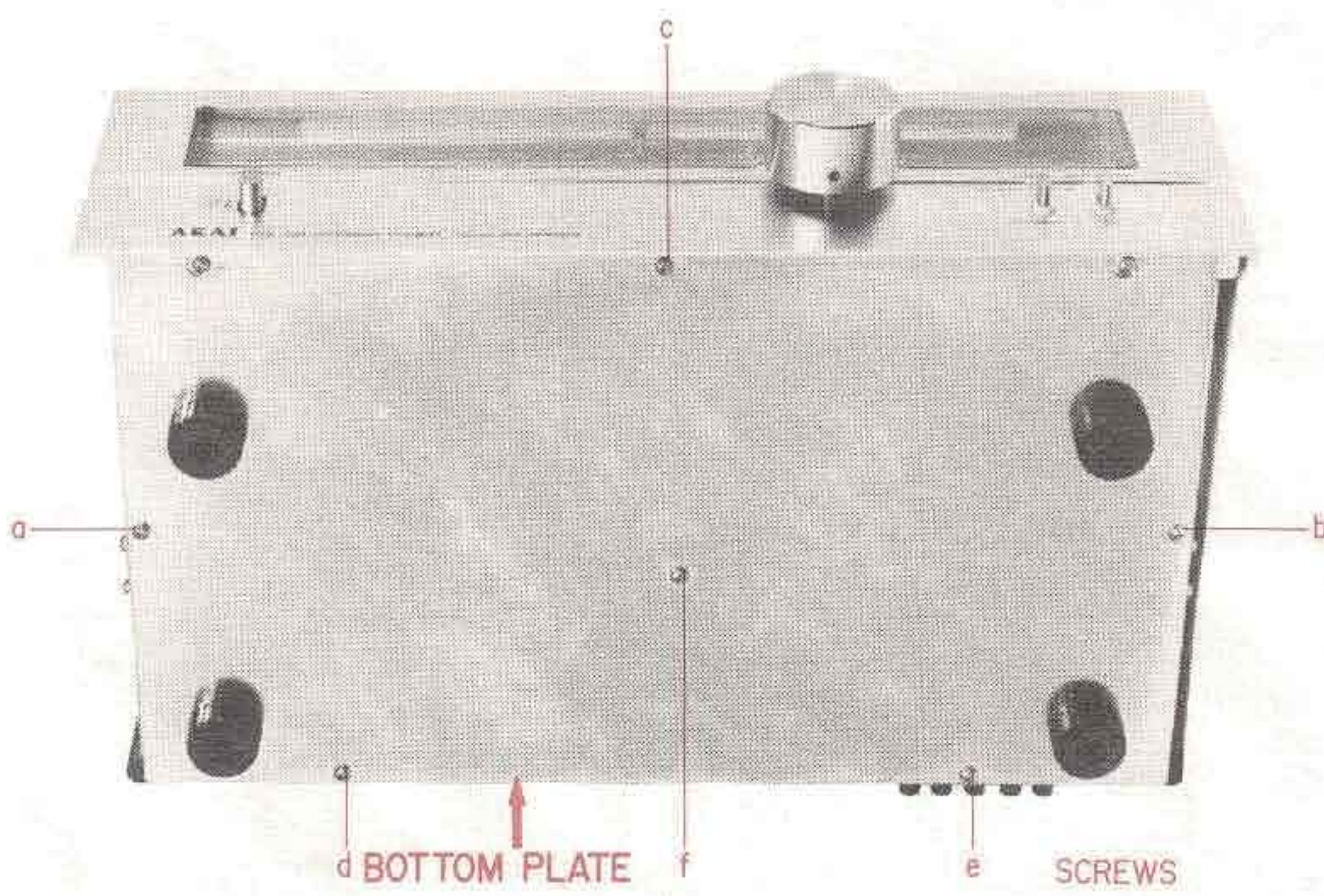
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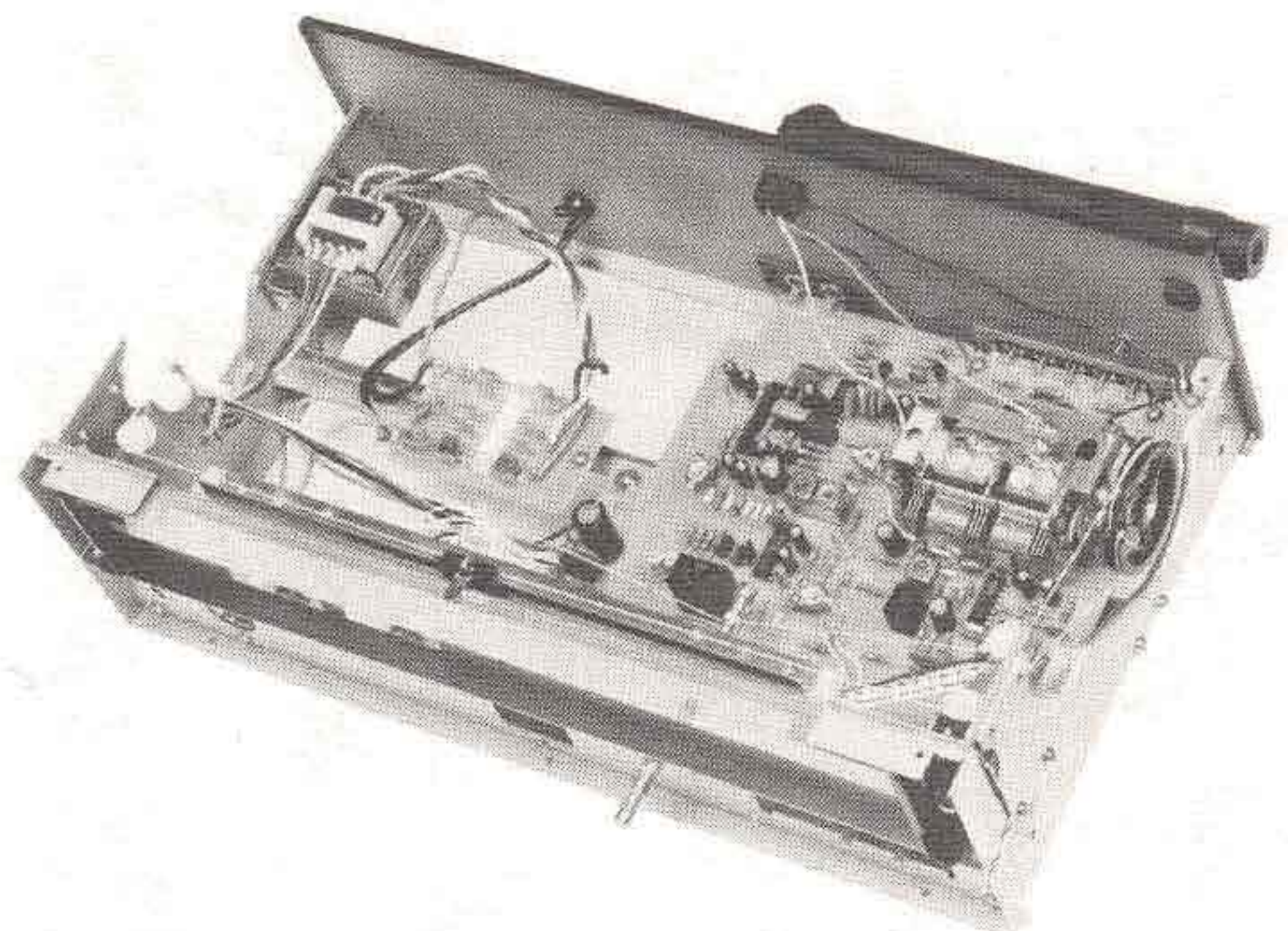
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4



8



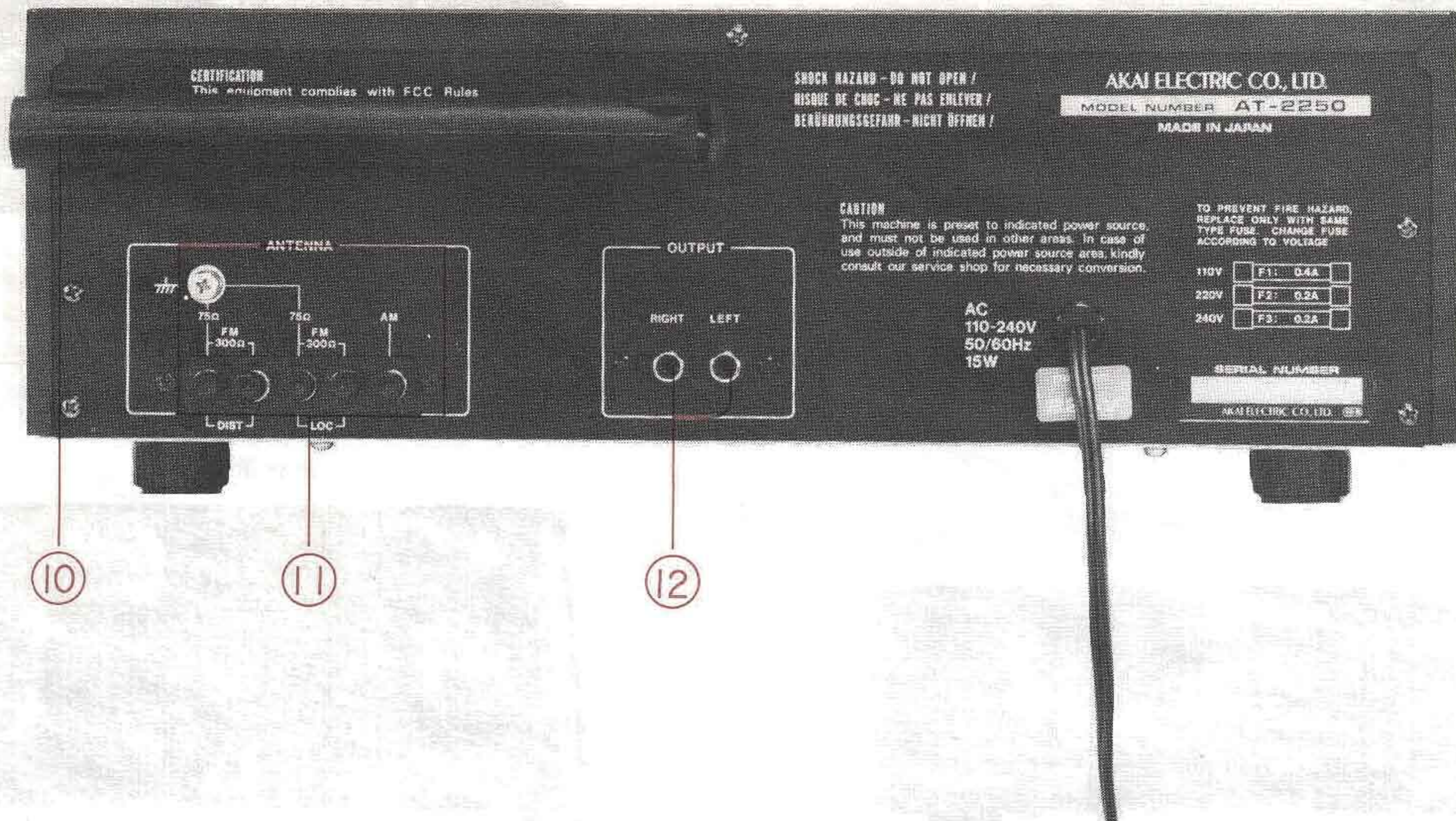
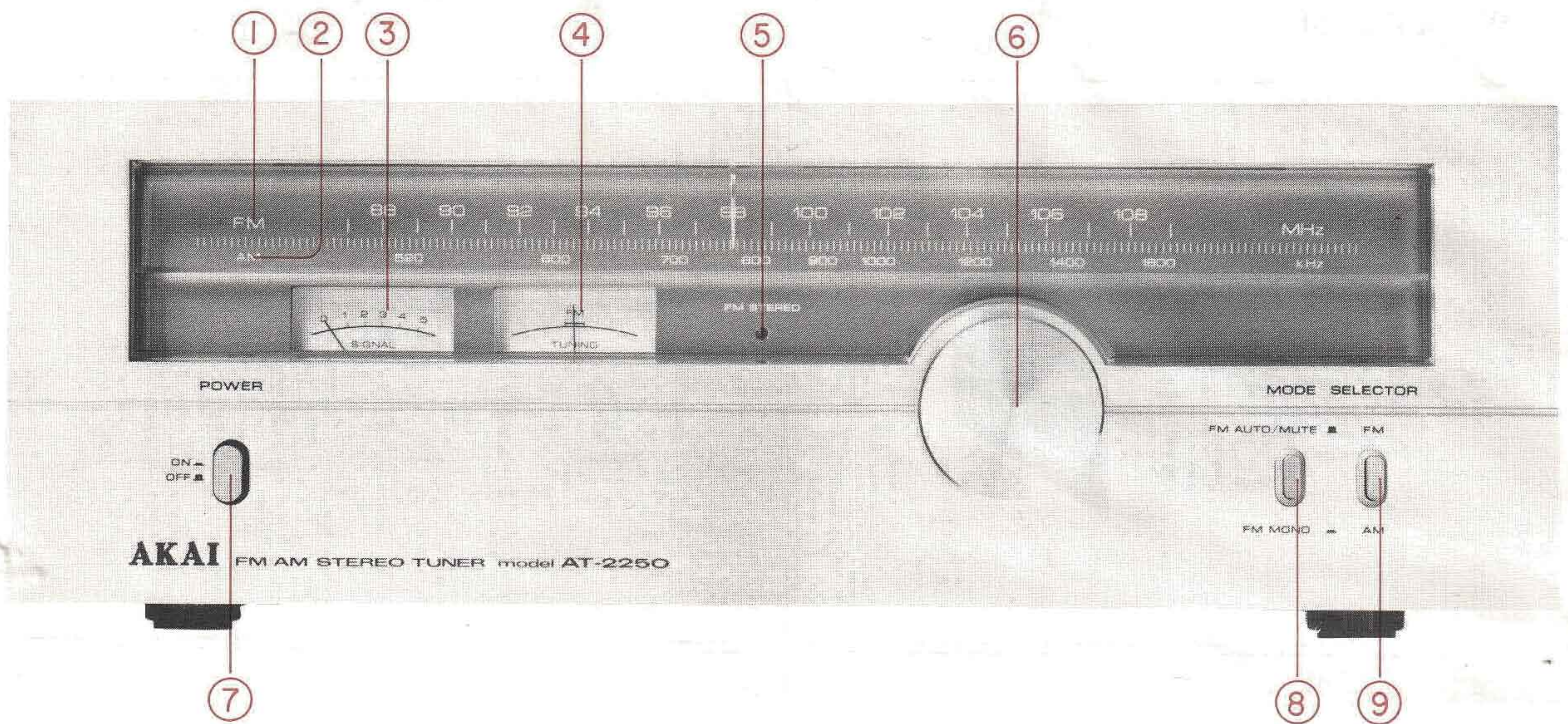


Fig. 1 Controls AT-2250

1. FM DIAL SCALE
2. AM DIAL SCALE
3. SIGNAL STRENGTH METER
4. FM CENTER TUNING METER
5. FM STEREO LAMP
6. TUNING KNOB
7. POWER SWITCH
8. FM MODE SWITCH
9. FM/AM SELECTOR SWITCH
10. AM FERRITE BAR ANTENNA
11. FM AND AM ANTENNA TERMINALS
12. OUTPUT JACKS

2. MODEL AM-2250

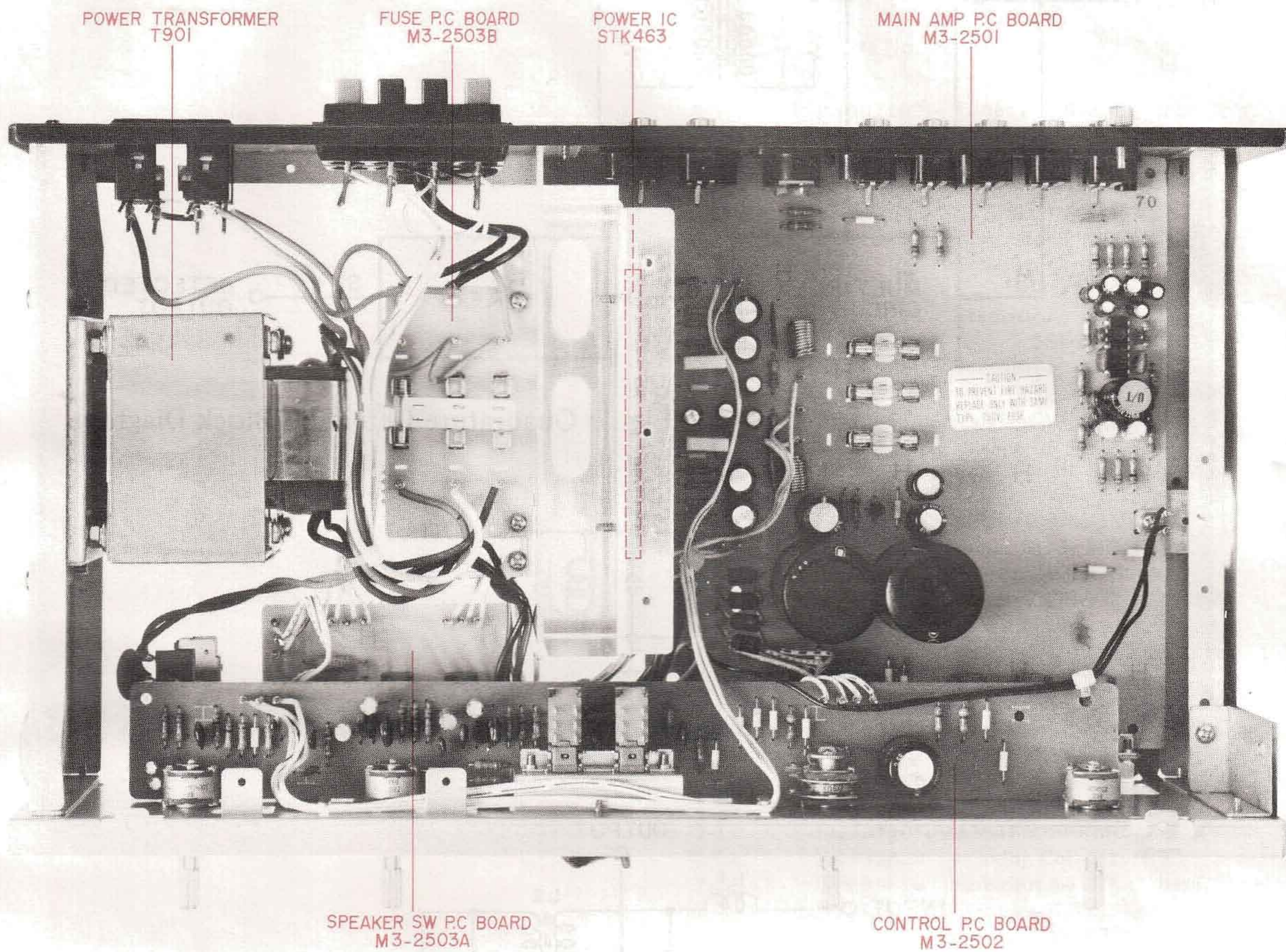
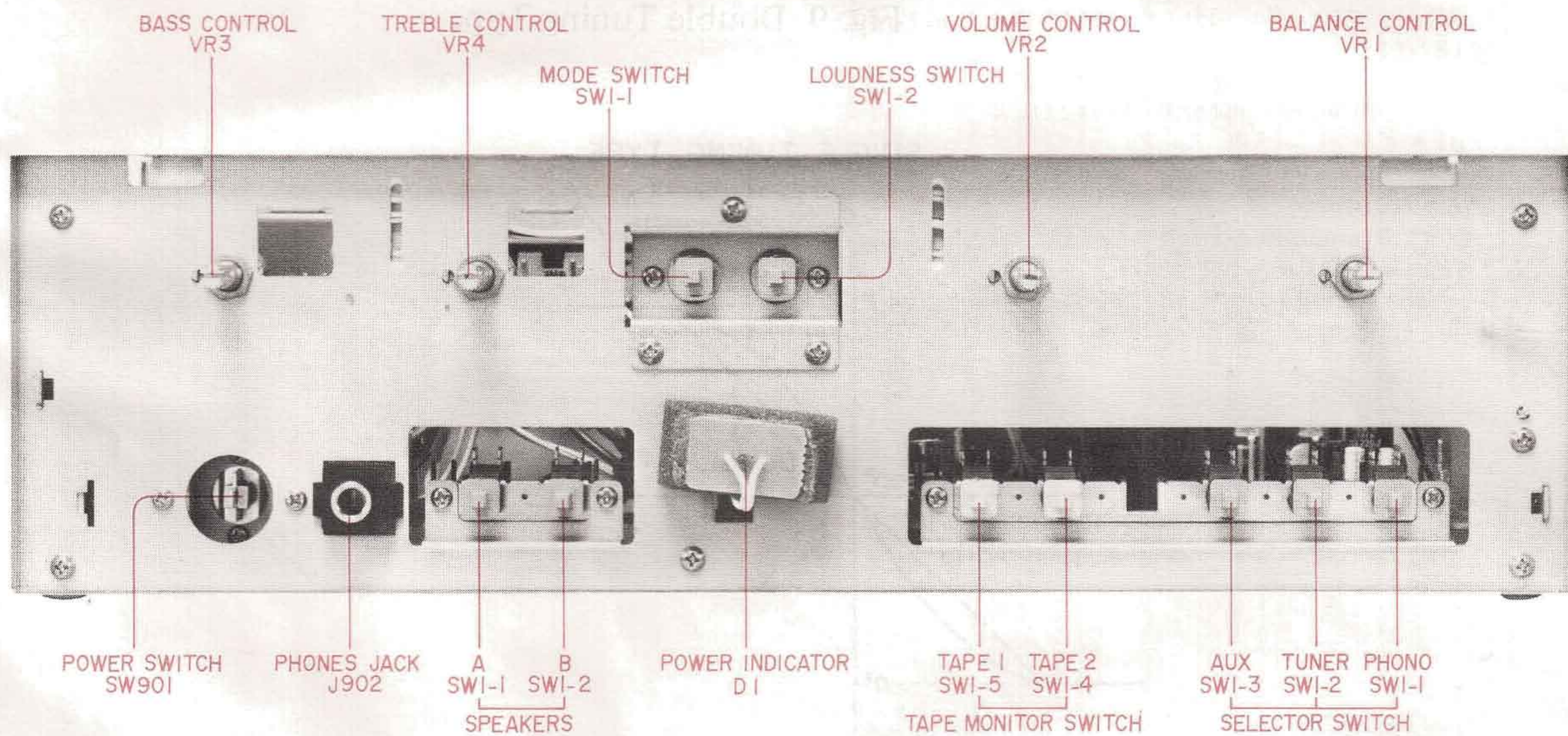


Fig. 5 Top View



V. OPERATING PRINCIPLES OF QUADRATURE DETECTION SYSTEM

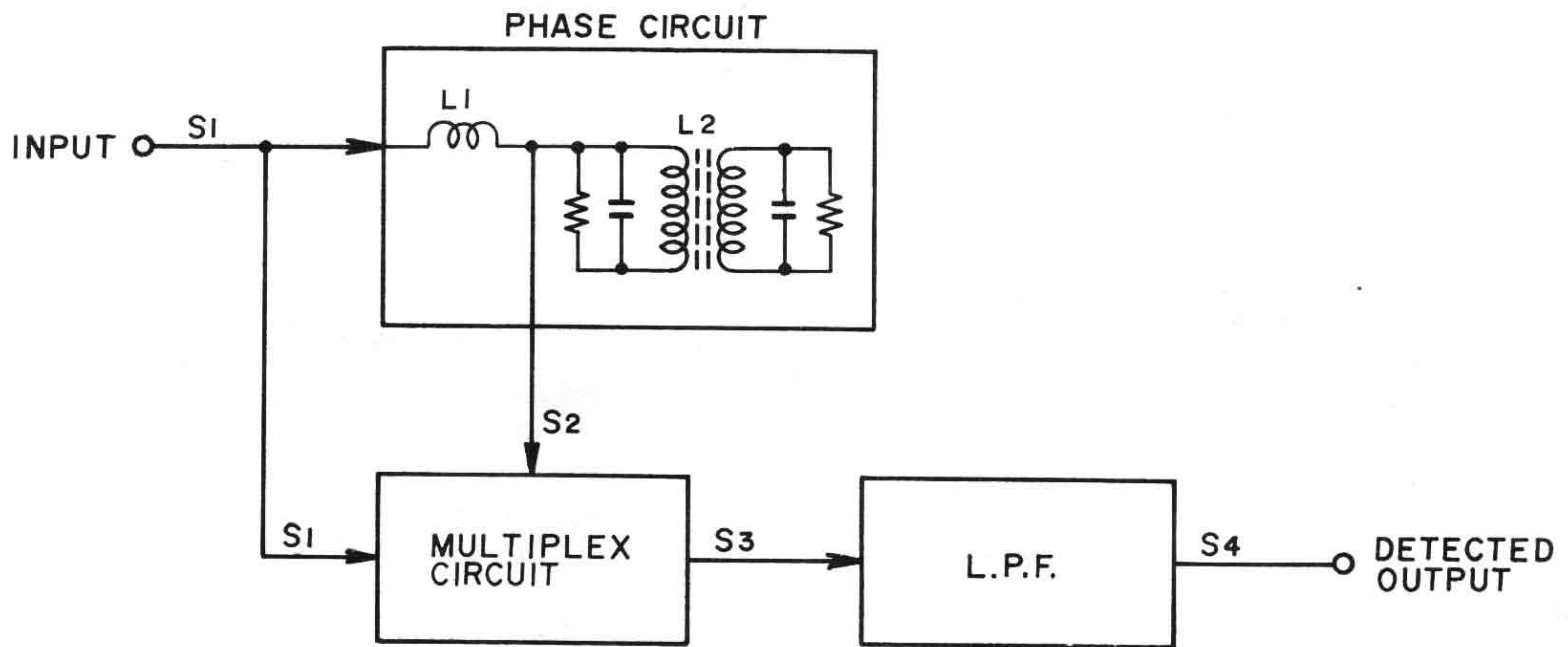


Fig. 7 Quadrature Detection Block Diagram

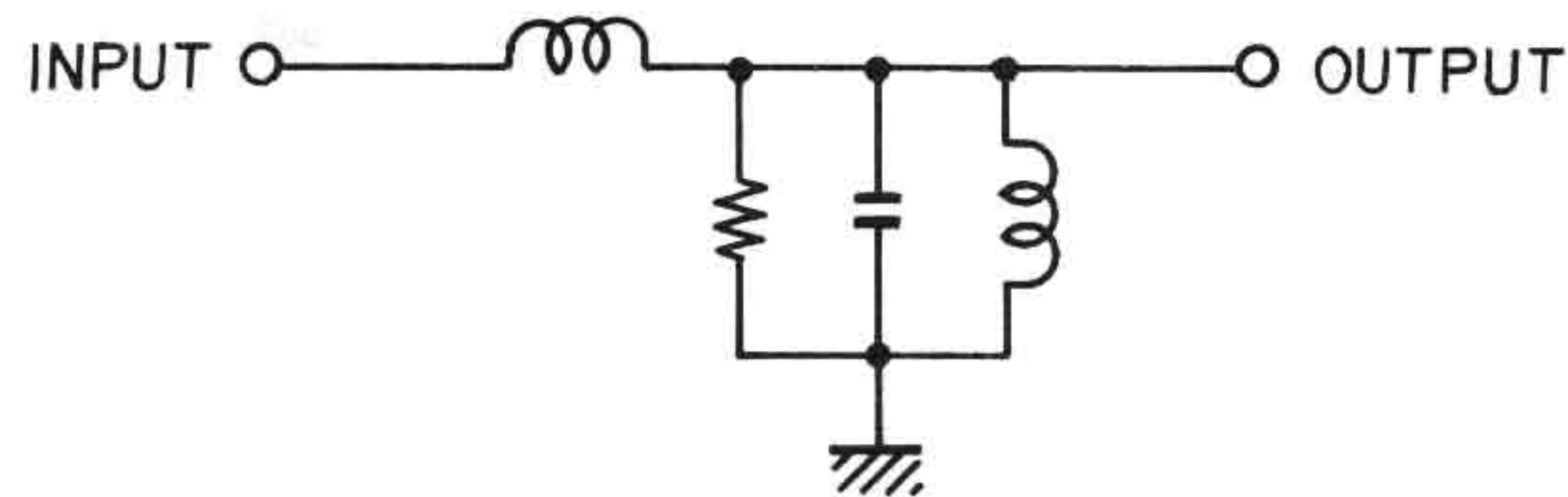


Fig. 8 Single Tuning Type

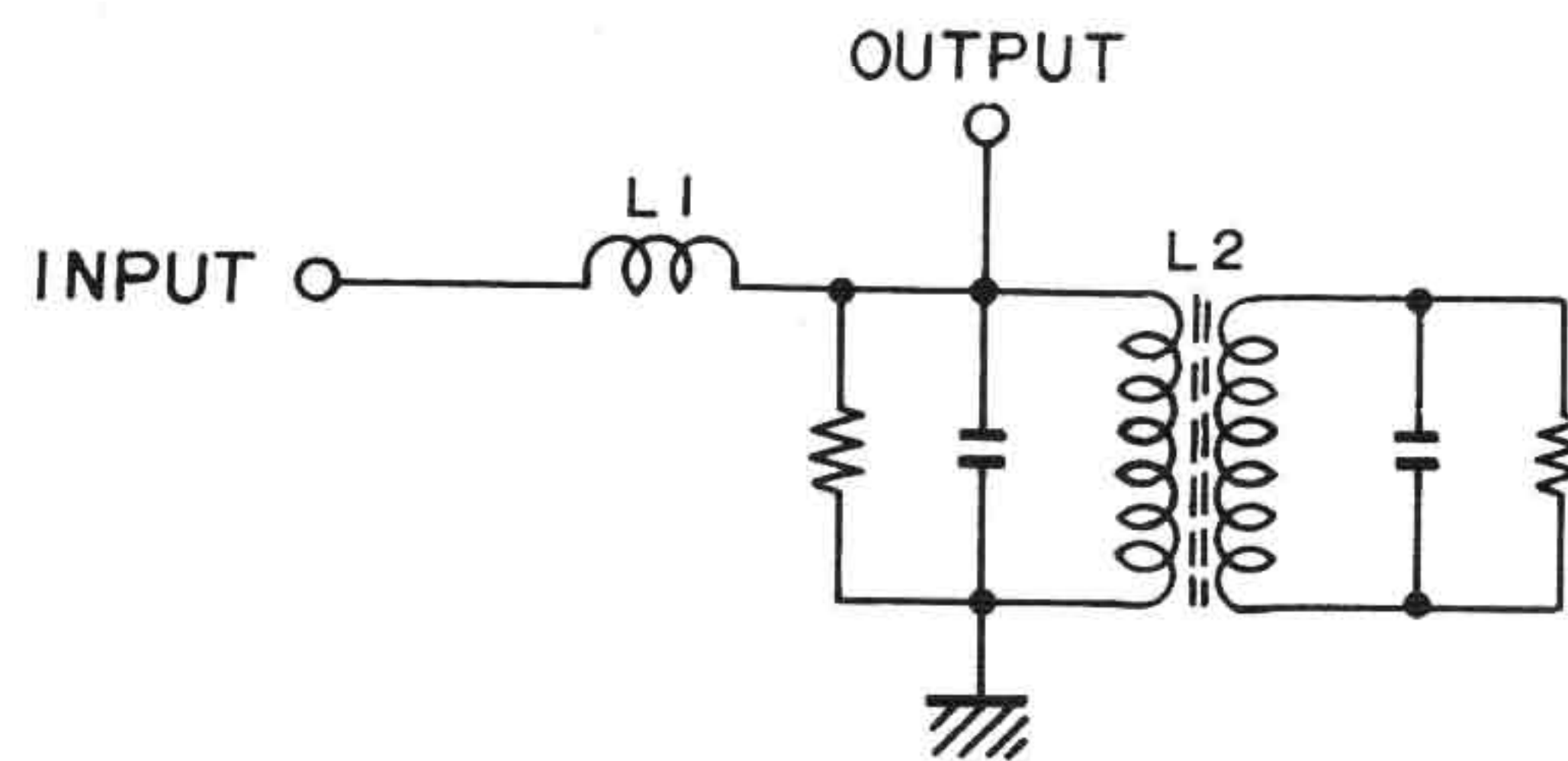


Fig. 9 Double Tuning Type

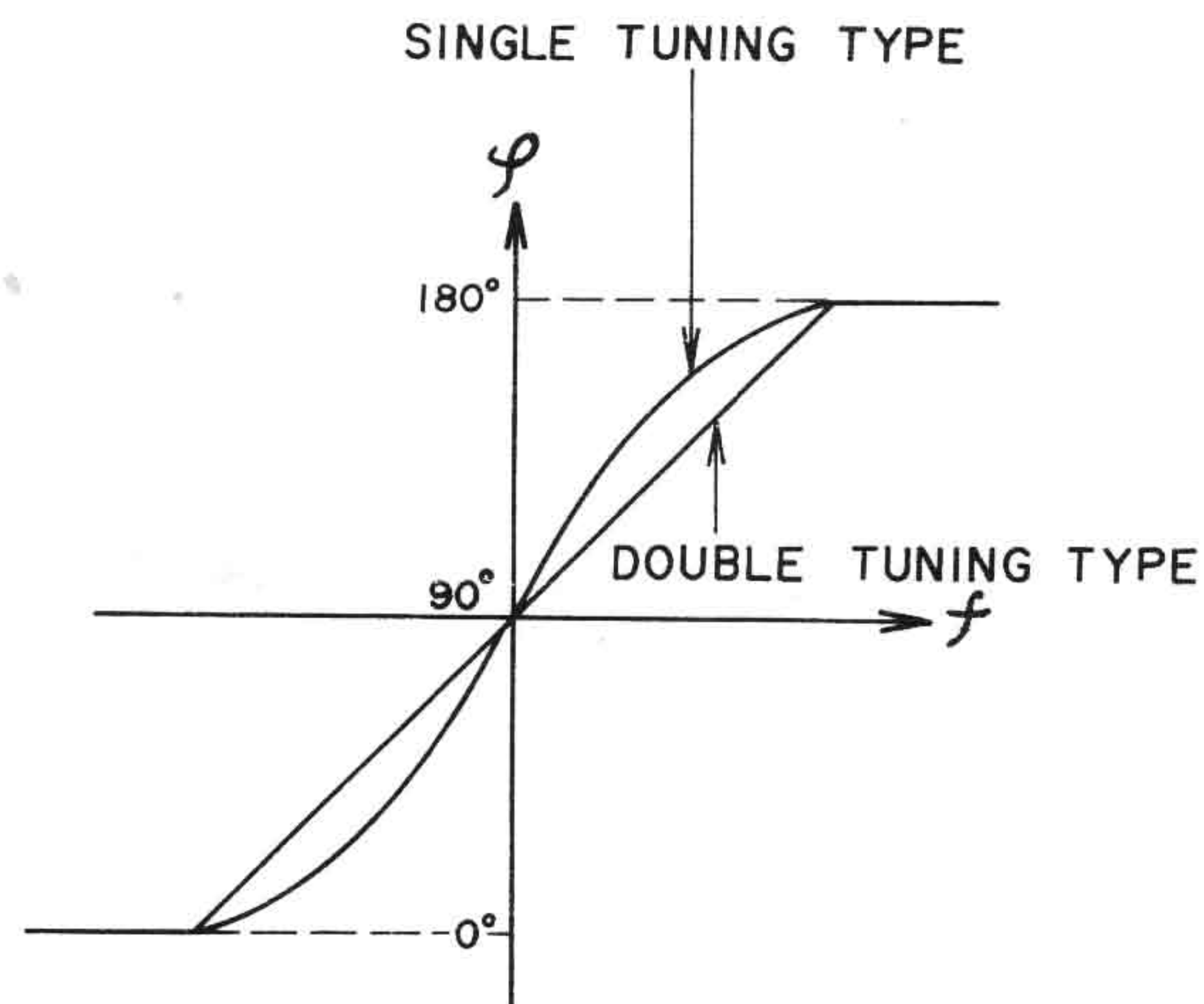


Fig. 10 Tuning Curve

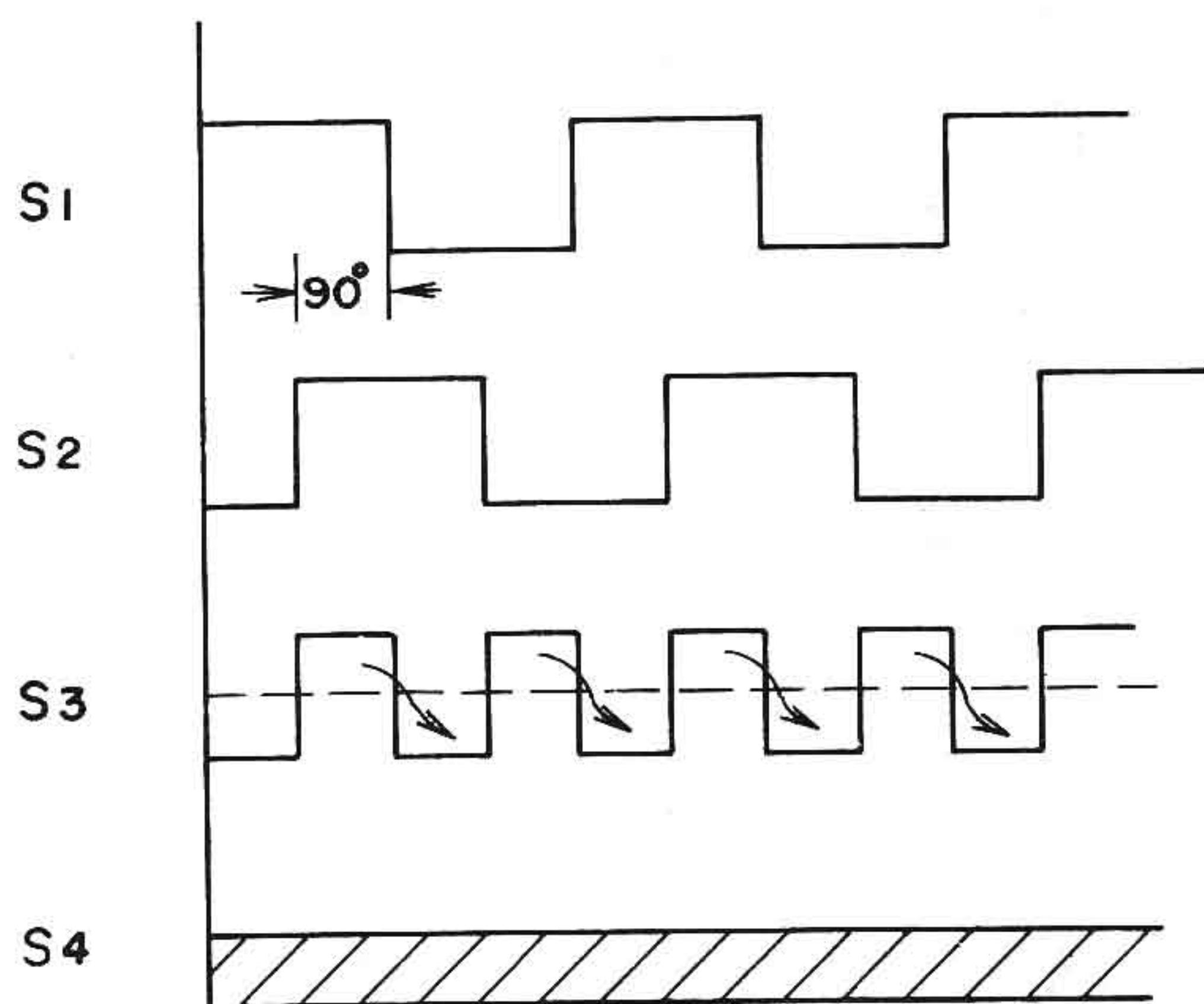


Fig. 11 Output at Non-modulation

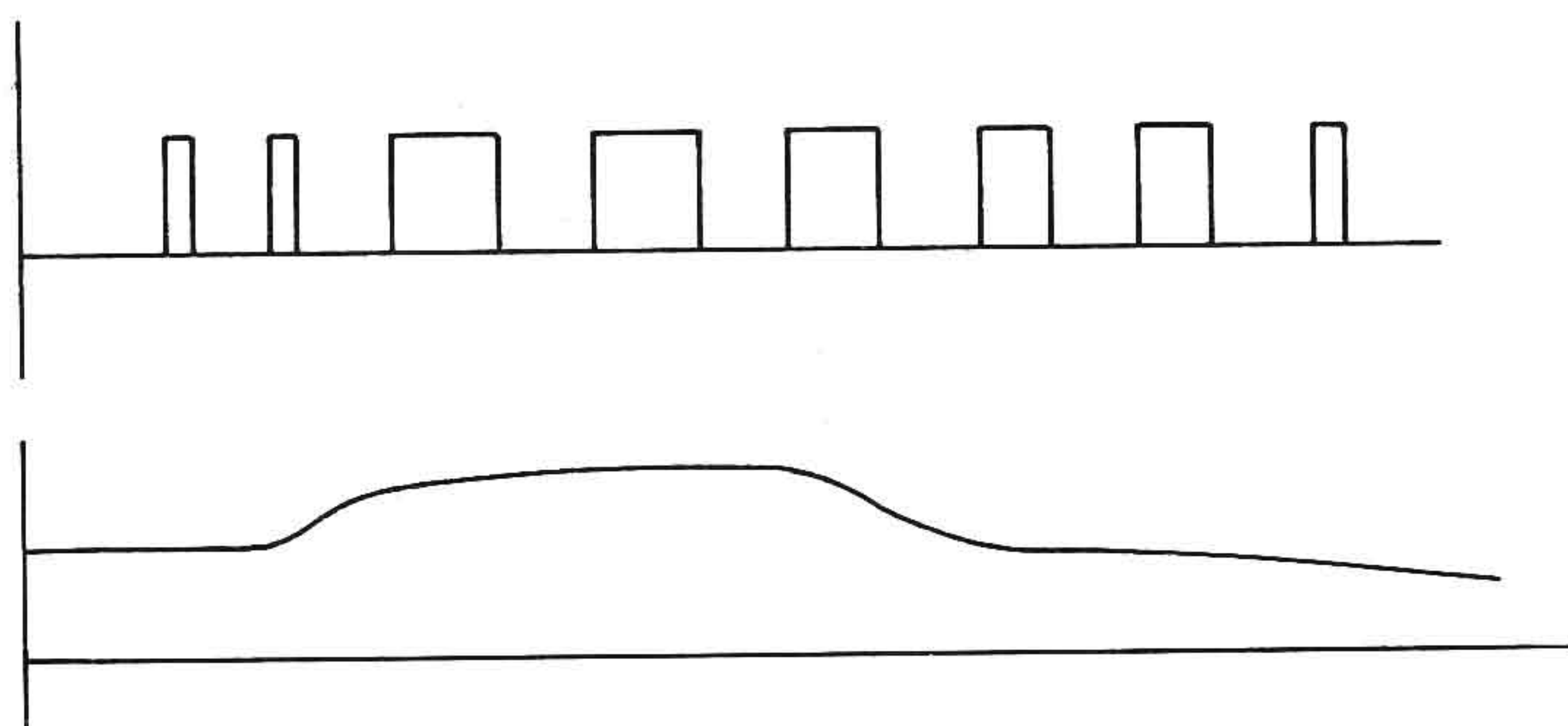


Fig. 12 Output at Modulation Time

The Quadrature Detection Circuit is comprised of a Phase Circuit, a Multiplier Circuit and a Low Pass Filter (L.P.F.) as shown in Fig. 7.

There are two types of Phase Circuits, the Single tuning type shown in Fig. 8 and the Double tuning type shown in Fig. 9. However, because with the double tuning type there is less frequency deviation in relation to carrier frequency, linearity is improved as shown in Fig. 10 and phase distortion is reduced, this type phase circuit is employed in the AT-2250.

Input signal S1 is divided into the part which enters the direct multiplier circuit and the part which passes the phase circuit and enters the multiplier circuit. The signal supplied to the phase circuit is always 90° phase delayed at L1. Also because at Non-modulation time, L2 is tuned to 10.7 MHz, if modulation is applied and S1 is changed from 10.7 MHz, phase deviation at L2 will take place proportionately in relation to this changed part and this becomes S2 signal which is delayed in relation to S1.

At Non-modulation, because as shown in Fig. 11, input signal S1 and 90° phase delayed (by means of L1) signal S2 are switched by means of the multiplier circuit, the output signal becomes S3.

Because this S3 passes the low pass filter and becomes S4 fixed direct current, the detector output is zero.

Then, when modulation is applied, because the switched output is varied according to the degree of modulation, and the output which passed the low pass filter becomes the pulsating current part as shown in Fig. 12 detector output is obtained.

VI. OPERATING PRINCIPLES OF PLL CIRCUIT EMPLOYED IN STEREO DEMODULATION CIRCUIT

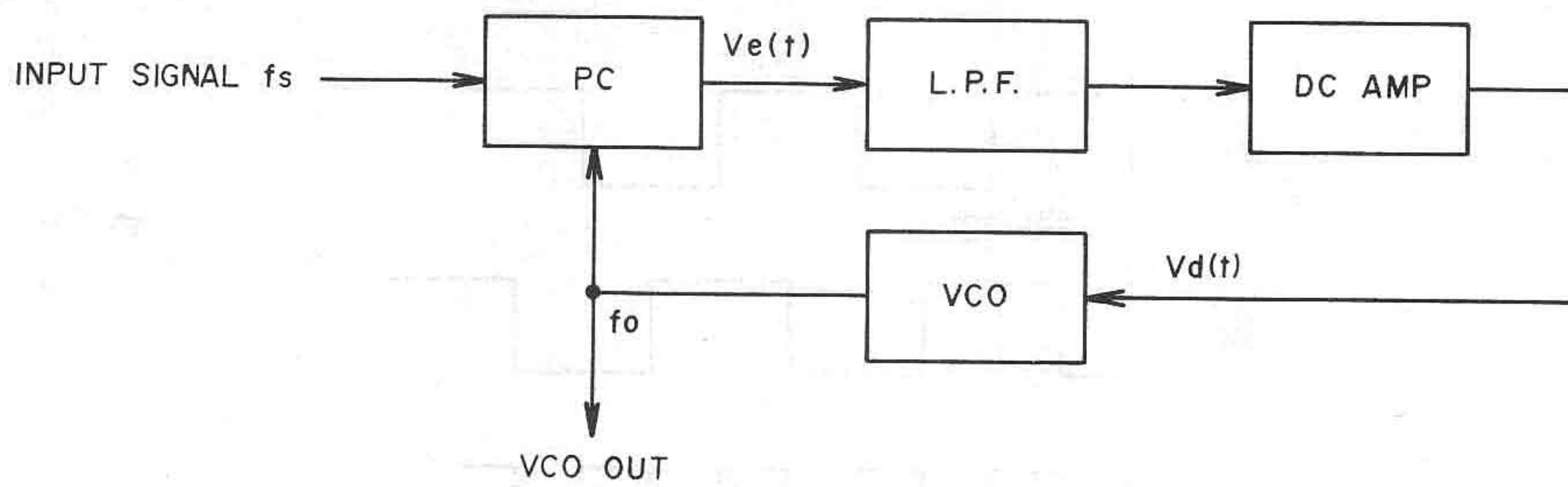


Fig. 13 PLL Circuit

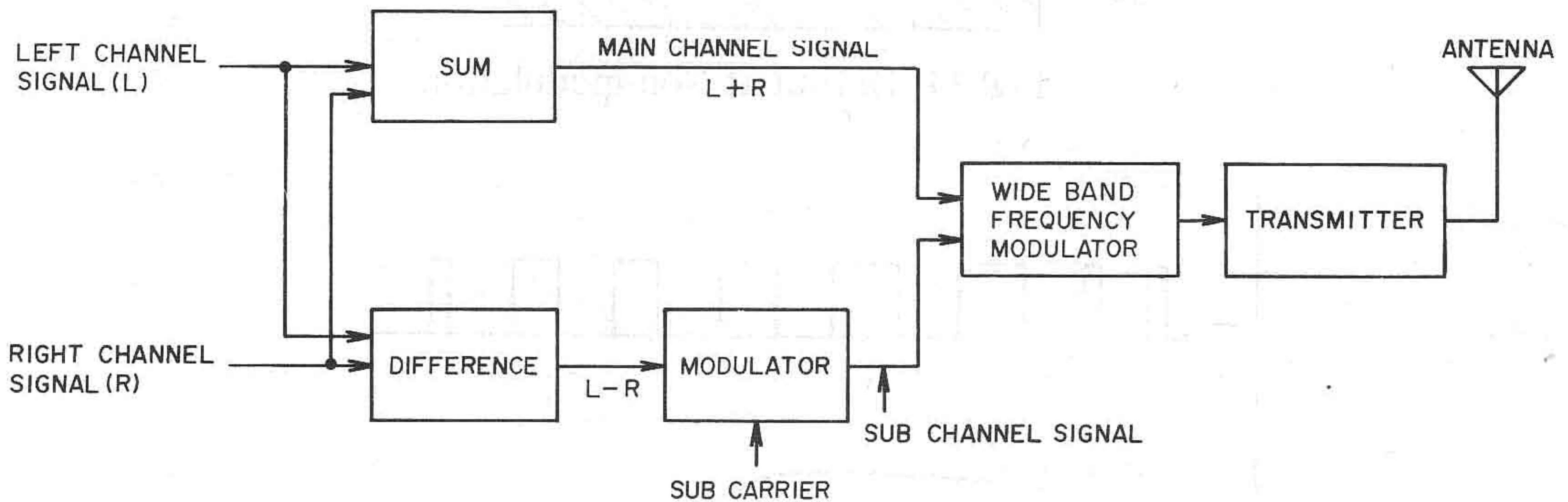


Fig. 14 FM Broadcasting System Diagram

To separate FM stereo broadcast signal received to date into left and right signals, a 19 kHz pilot signal was successively multiplier to form a 38 kHz signal and stereo separation was effected from this. However, with this multiplier system, change in coils due to wear occurred and adjustment points were numerous, etc. Therefore, this model employs a newly developed PLL circuit which produces an exceedingly accurate 38 kHz switching signal.

1. PLL CIRCUIT OPERATION

PLL circuit is a kind of feedback circuit and is comprised of a Phase Comparator (PC), a Low Pass Filter (LPF), a Direct Current Amplifier (DC Amp.), and a Voltage Control Oscillator (VCO) as shown in Fig. 13. The PC compares input signal F_s and VCO oscillator output and generates the difference in signal voltage $V_e(t)$ proportionately to this phase deviation. This $V_e(t)$ passes LPF and the DC Amp. and becomes control voltage. This control voltage supplied to VCO and VCO oscillation frequency is DC controlled. When there is no input signal F_s , because there is also no $V_e(t)$, control voltage $V_d(t)$ becomes zero, and VCO maintains a *Free-running oscillation frequency. When a signal enters, VCO oscillation frequency F_o is controlled to narrow the difference between F_s by means of feedback as described above, and the PLL circuit assumes a synchronous condition. This is referred to as input signal lock. (In case the difference between F_o and F_s is too large, the differential signal frequency becomes high and is reduced at the LPF. However, because the VCO control voltage does not change, PLL will not stay within the *lock range).

Because of the ability of the signal interference removing LPF to accumulate the previous voltage in case the PLL deviates from within the lock range due to certain interference, the original condition is quickly reinstated.

*Free running frequency: Oscillating frequency when there is no input signal.

*Lock range: At the condition in which the VCO oscillation frequency is locked to the input signal, the lock range is the oscillating frequency in which when the input signal changes, the PLL maintains it's input signal lock condition.

Accordingly, in case F_s is changed inside the PLL lock range, VCO oscillation frequency always follows this, and a no frequency deviation and no phase difference signal is obtained. In other words, VCO oscillation frequency can be locked to F_s .

2. STEREO DEMODULATION CIRCUIT

As shown in Fig. 14 for FM broadcasts, the sum signal (L+R) consists of left signal (L) and right signal (R) and the audio frequency band of this signal in its original form is frequency modulated.

On the other hand, the difference signal of both (L-R) is changed to high frequency through the use of the sub carrier, and is referred to as the sub channel signal. The carrier is further frequency modulated and sent to the FM stereo transmitter. Accordingly, for composite stereo signal demodulation, the sub carrier used for demodulation at the transmitter must be the same uniform 38 kHz signal as the frequency and phase. If the 38 kHz waveform is asymmetrical, channel separation will become poor.

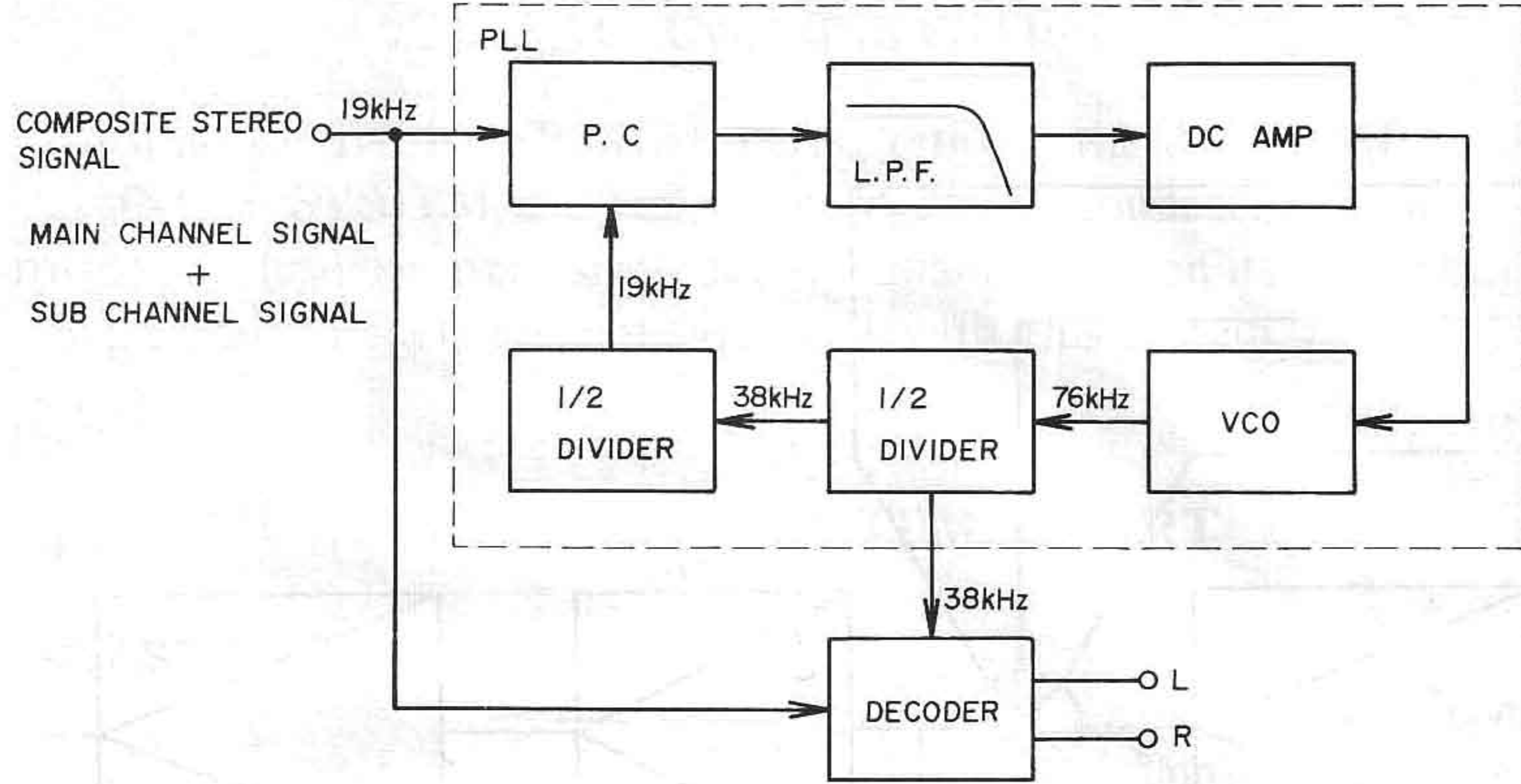


Fig. 15 MPX IC Function

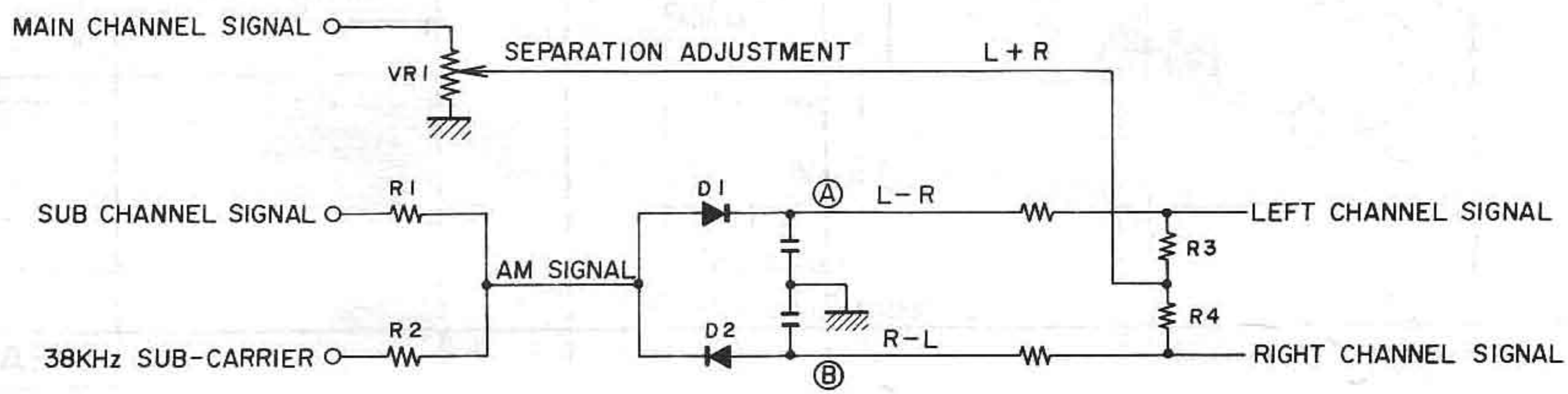


Fig. 16 Multiplex Decoder

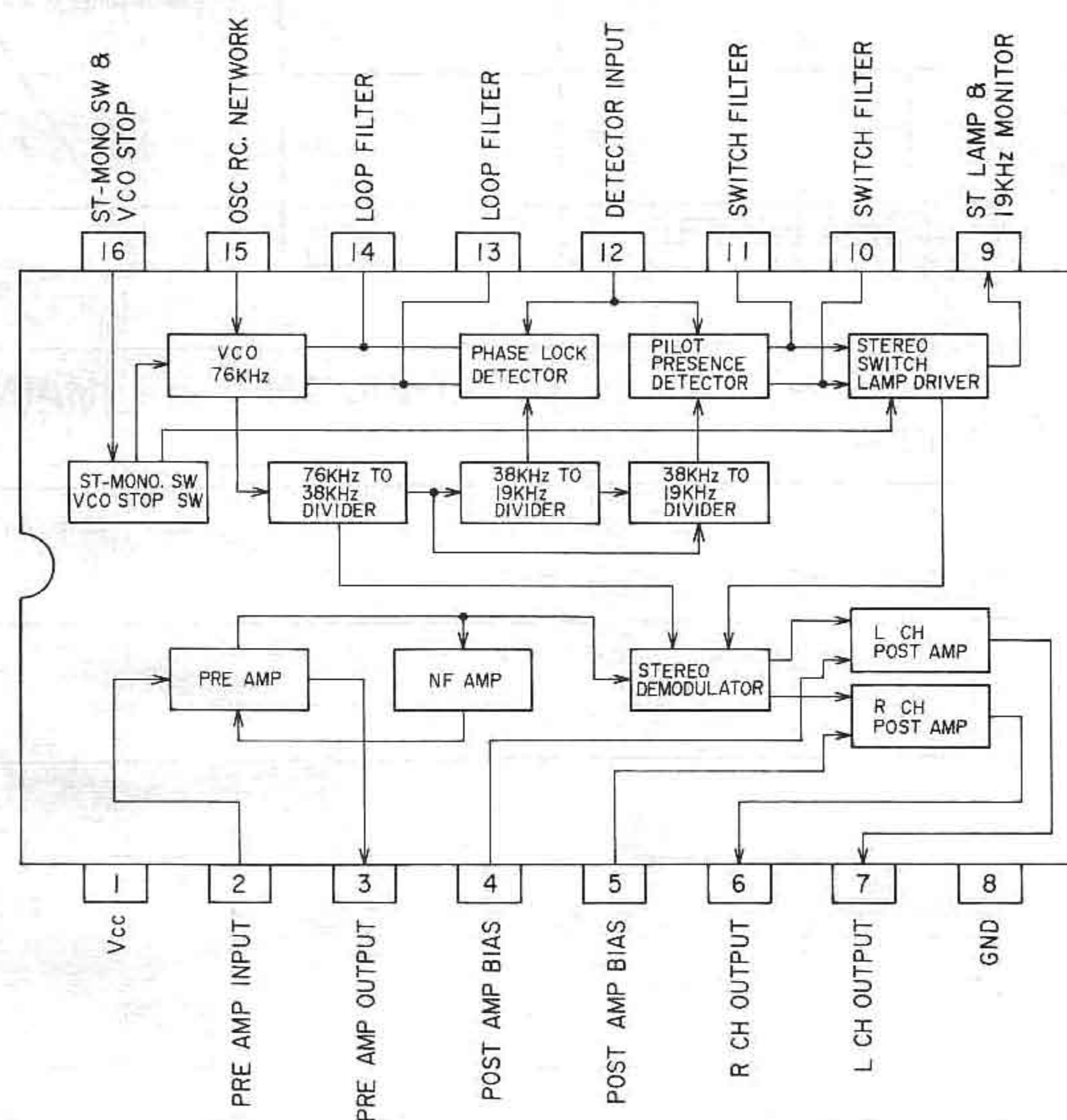


Fig. 17 μ PC1161C Block Diagram

At the PLL employed MPX stereo demodulator circuit, as shown in Fig. 15 first a 76 kHz signal is oscillated and when this passes the divider, a symmetrical 38 kHz signal is obtained.

This 38 kHz sub carrier is supplied to the multiplex decoder together with the sub channel of the composite stereo signal. At the multiplex decoder, left and right channel audio signals are separated in order as shown in Fig. 16.

The 38 kHz sub carrier composited with the sub channel signal of which the carrier part was removed when sub channel signal and sub carrier passed R1 R2 produces the regular AM wave. Then, because this envelop is

detected by mutually reverse polarity connected diodes D1 and D2, L-R signal is emitted at point A and R-L signal at point B.

Also, because main channel signal (L+R) is supplied to R3, R4 center point, A B point voltage is added and subtracted and becomes

$$(L+R) + (L-R) = 2L \text{ (left channel)}$$

$$(L+R) + (R-L) = 2R \text{ (right channel)}$$

The level of the main channel signal (L+R) can be adjusted by means of variable resistor VR (VR1) for optimum separation.

However, please refer to Fig. 17 for the Block Diagram of PLL IC μ PC1161C used in the model AT-2250.

VII. LEVEL DIAGRAM

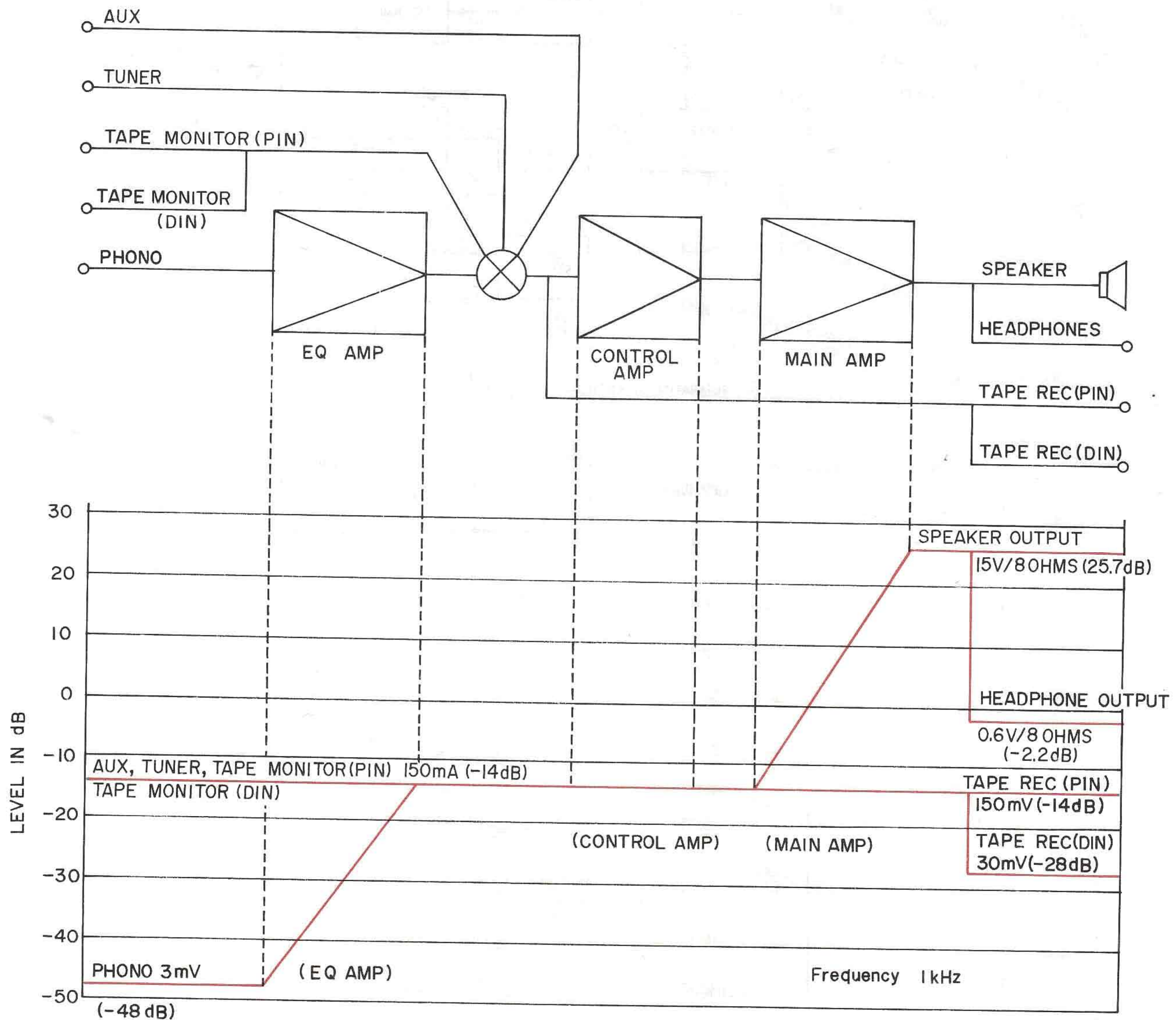


Fig. 18 Level Diagram AM-2250

VIII. TUNER ADJUSTMENT

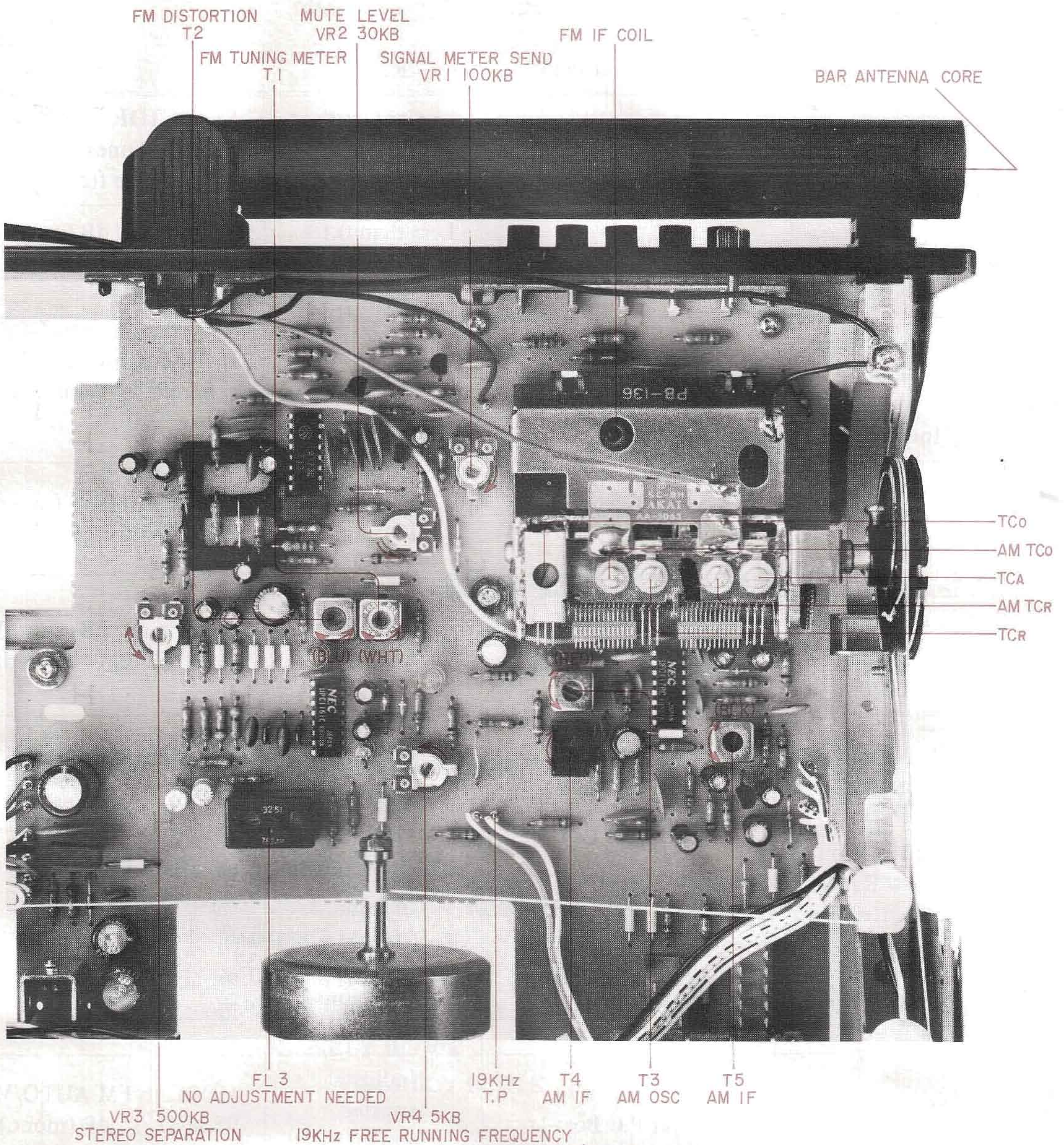


Fig. 19 Tuner P.C Board T3-2501A

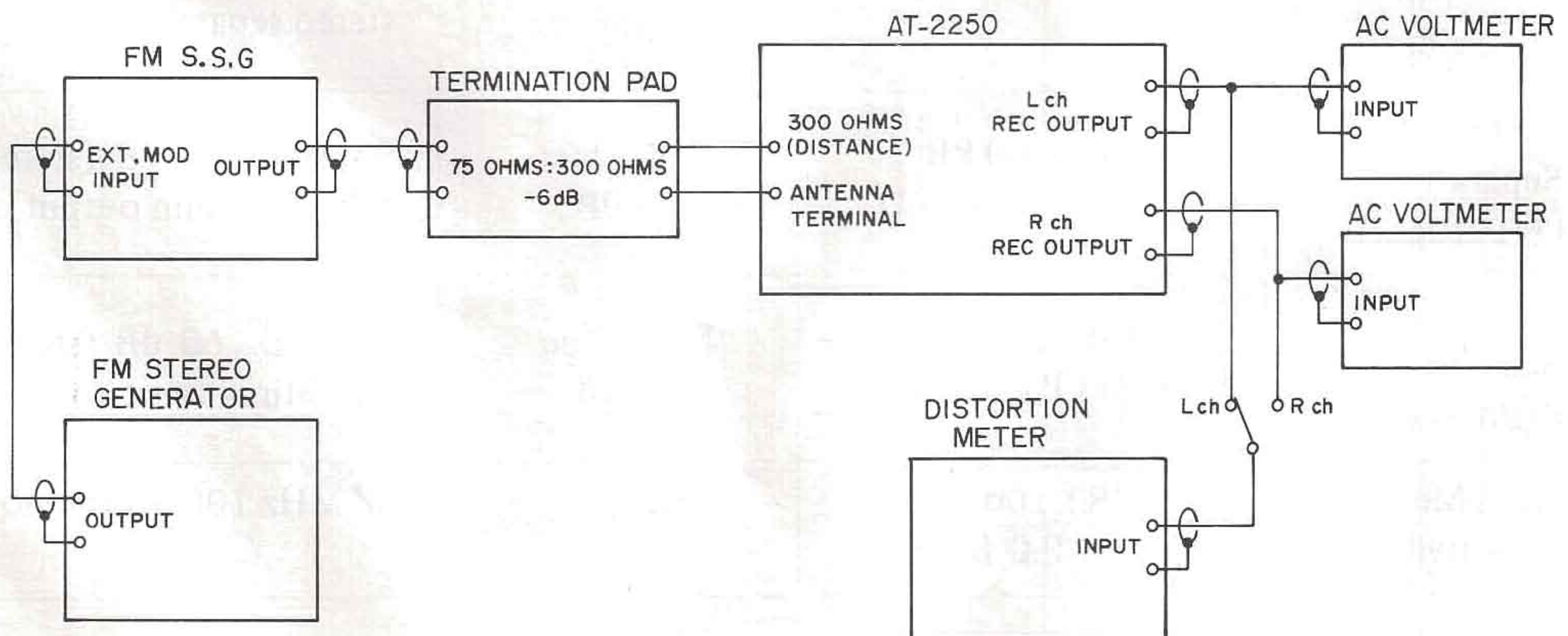
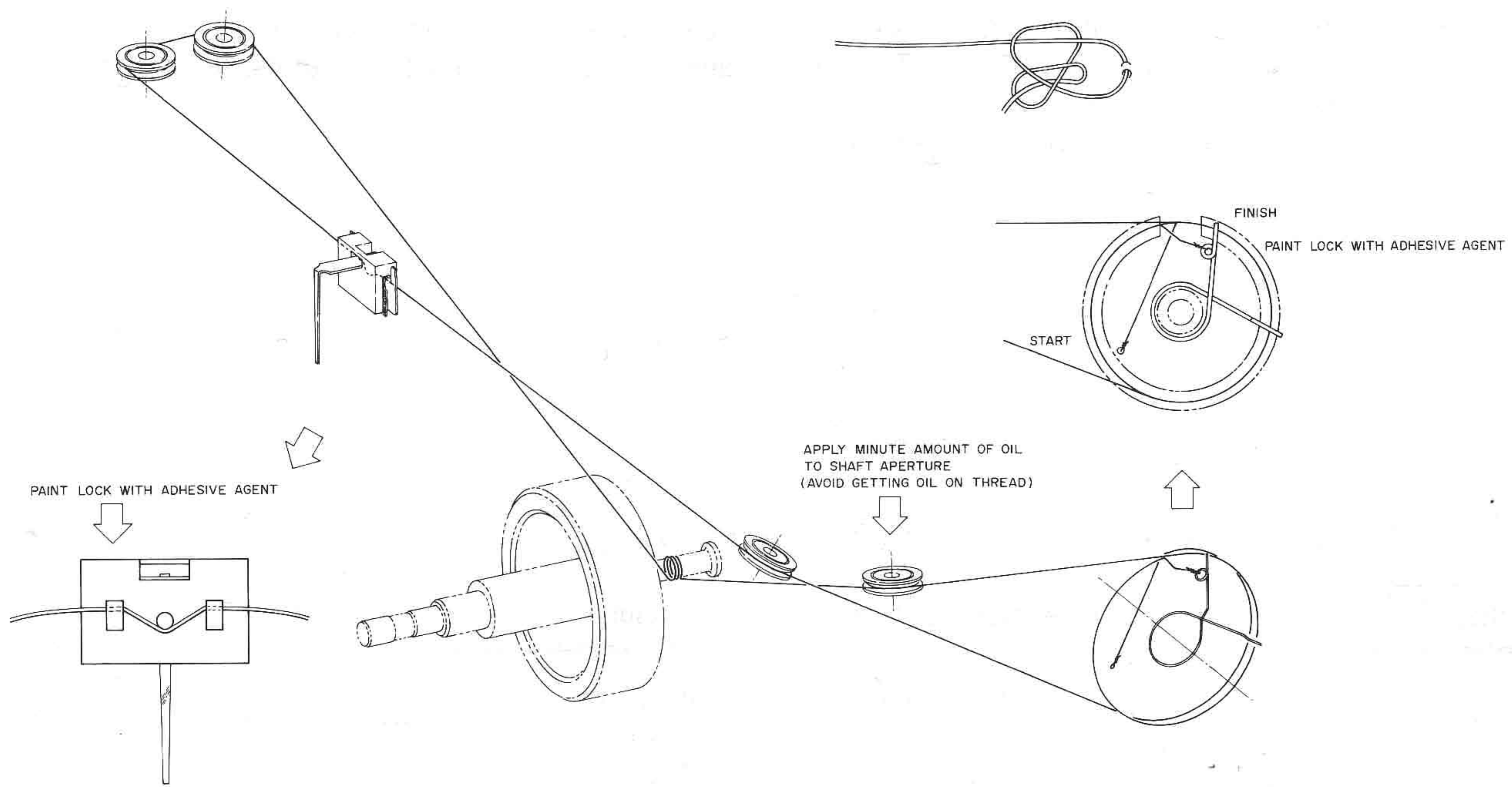


Fig. 20 Instrument Connections

IX. TUNING CORD THREADING



X. CLASSIFICATION OF VARIOUS P.C BOARDS

1. P.C BOARD TITLE AND IDENTIFICATION NUMBER

1) Model AT-2250

P.C Board	Number of P.C Board
Tuner P.C Board	T3-2501A
LED P.C Board	T3-2501B
Lamp P.C Board	T3-2501C
Fuse P.C Board	T3-2501D
Antenna P.C Board	AA-5063

Chart-3

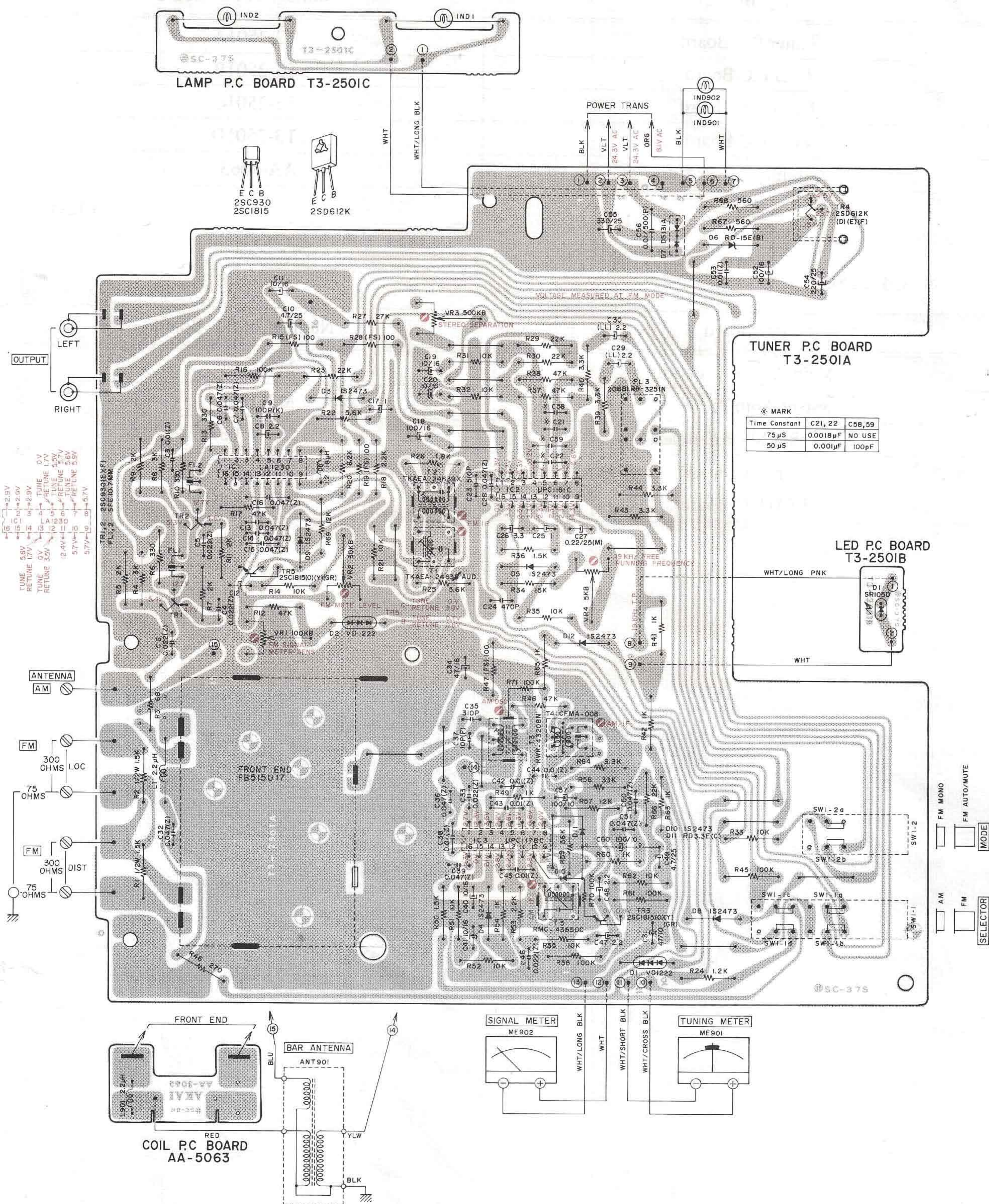
2) Model AM-2250

P.C Board	Number of P.C Board
Main Amp P.C Board	M3-2501
Control Amp P.C Board	M3-2502
Speaker SW P.C Board	M3-2503A
Fuse P.C Board	M3-2503B
LED P.C Board	M3-2503C

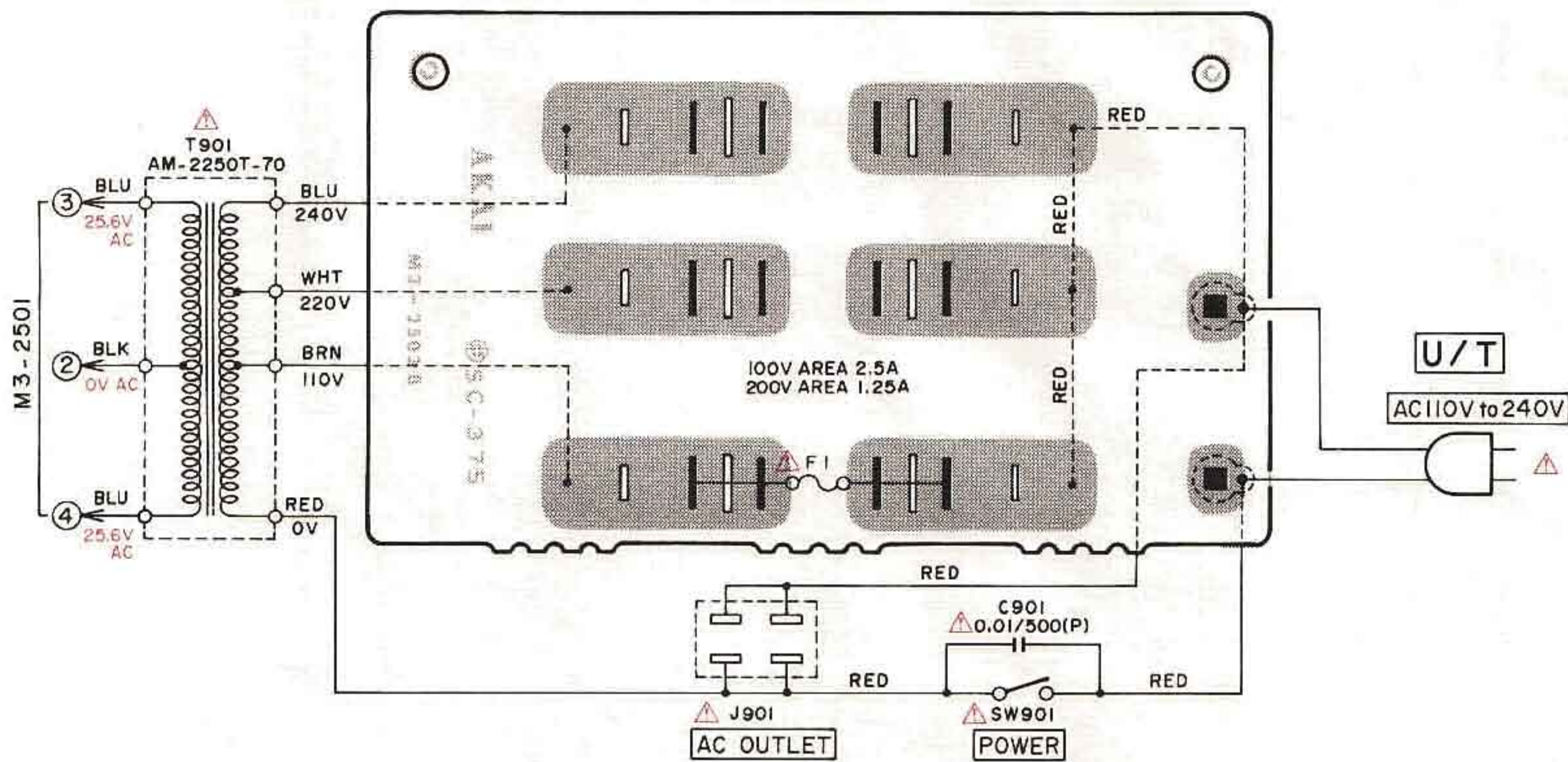
Chart-4

2. MODEL AT-2250 COMPOSITION OF VARIOUS P.C BOARDS

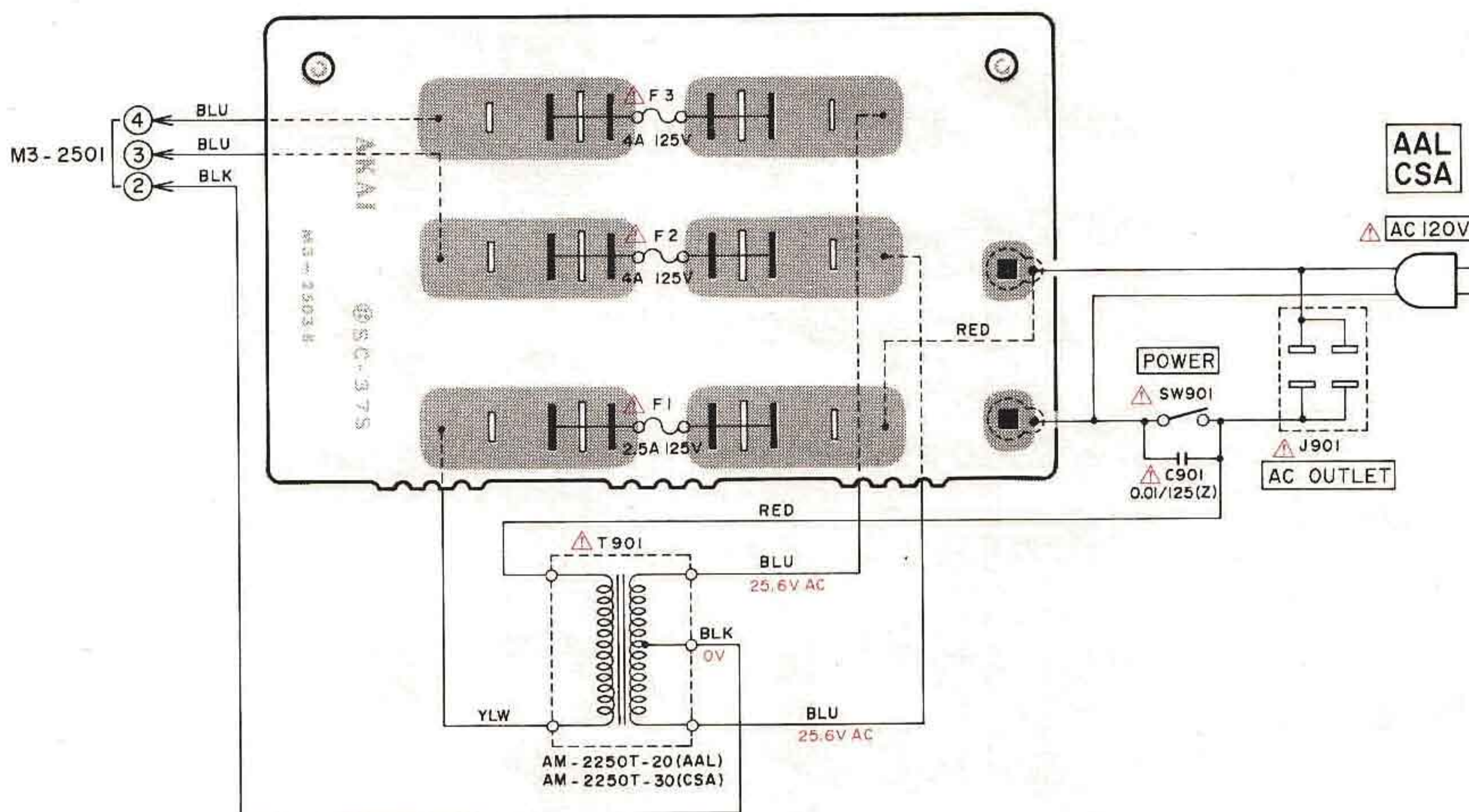
1) TUNER P.C BOARD T3-2501A, LED P.C BOARD T3-2501B, LAMP P.C BOARD T3-2501C and ANTENNA P.C BOARD AA-5063



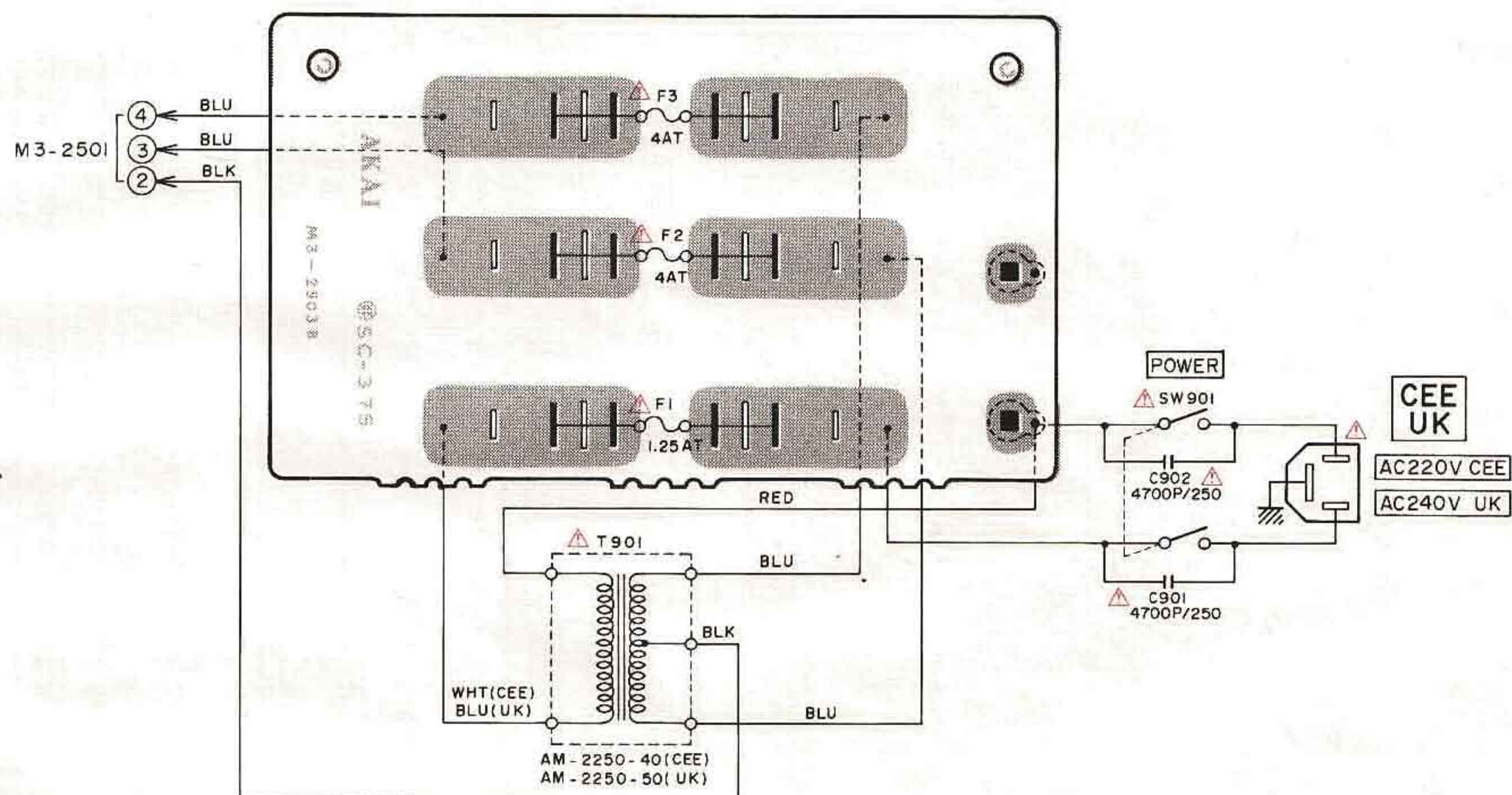
4) FUSE P.C BOARD M3-2503B (U/T)



5) FUSE P.C BOARD M3-2503B (AAL, CSA)



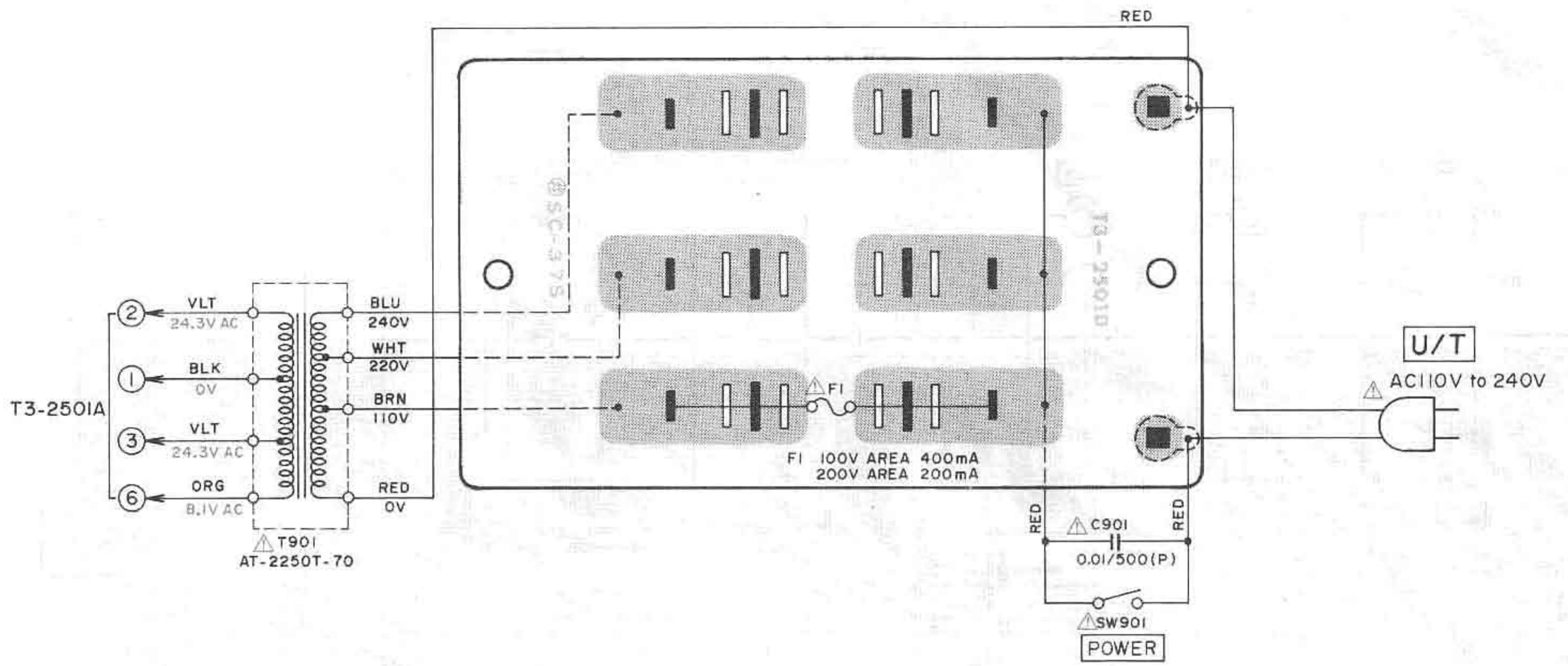
6) FUSE P.C BOARD M3-2503B (CEE, U K.)



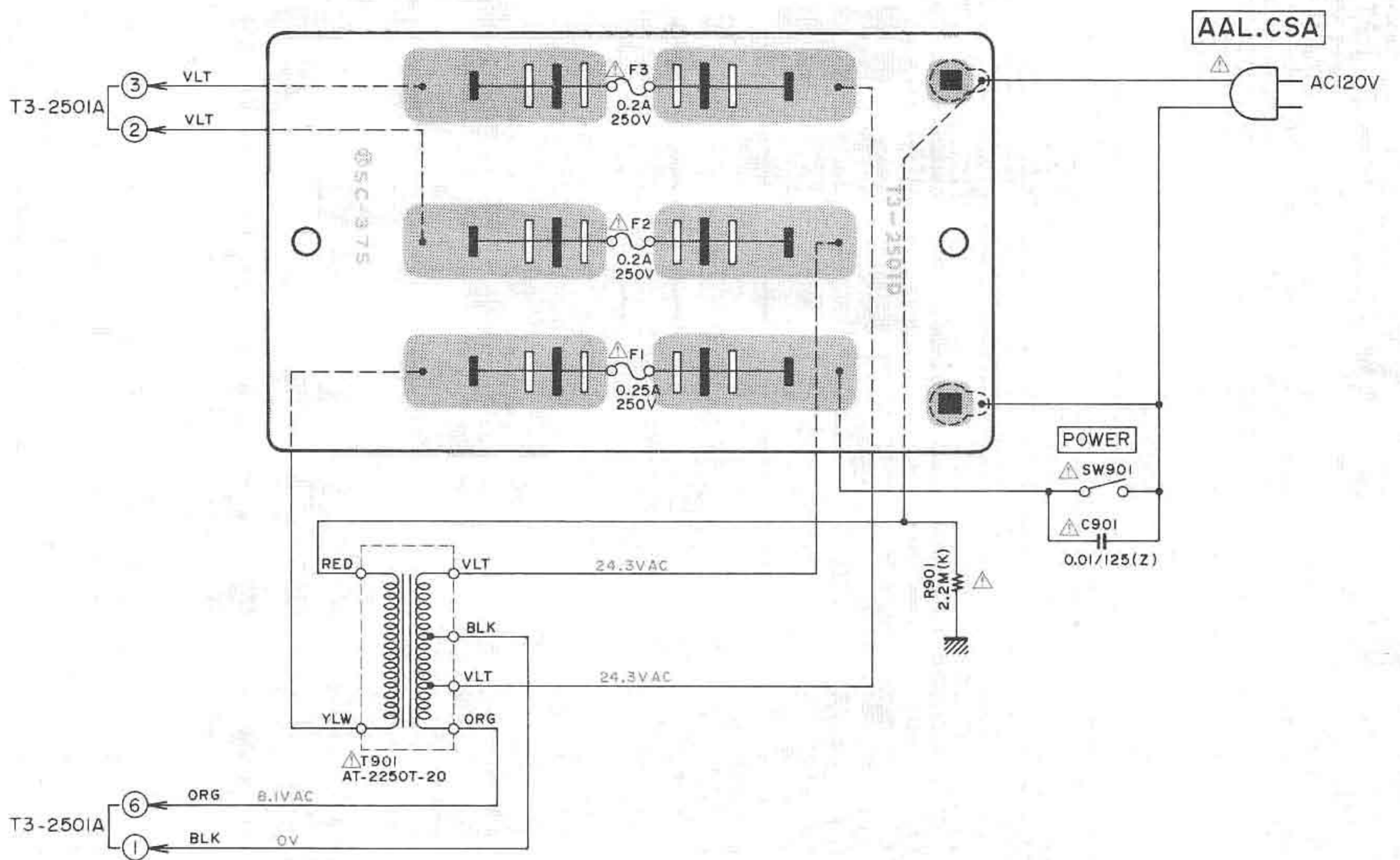
WARNING: Δ INDICATES SAFETY CRITICAL COMPONENTS. FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS

AVERTISSEMENT: Δ IL INDIQUE LES COMPOSANTS CRITIQUES DE SÛRETÉ. POUR MAINTENIR LE DEGRÉ DE SÛRETÉ DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SÛRETÉ QUE PAR DES PIÈCES RECOMMANDÉES PAR LE FABRICANT

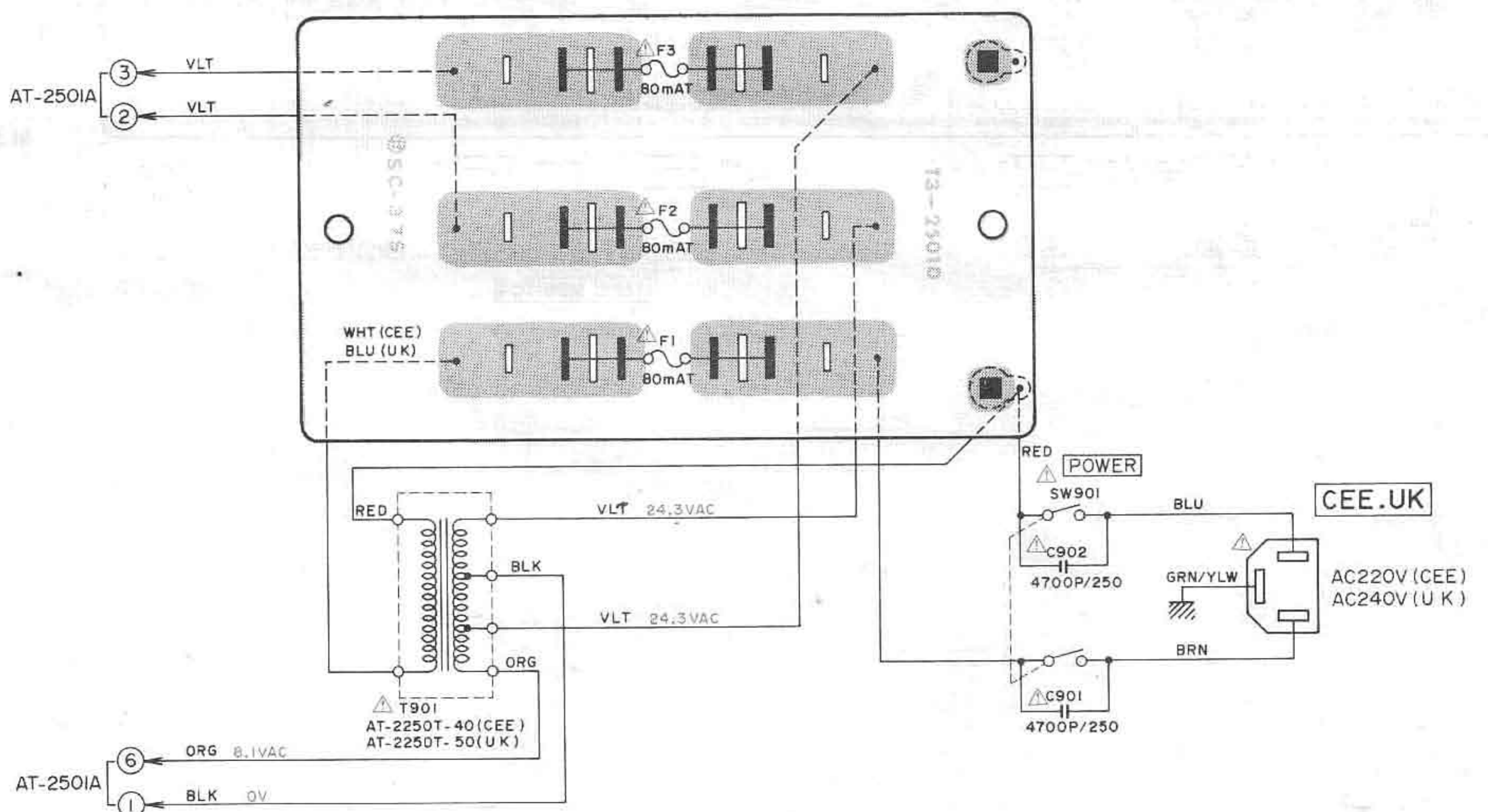
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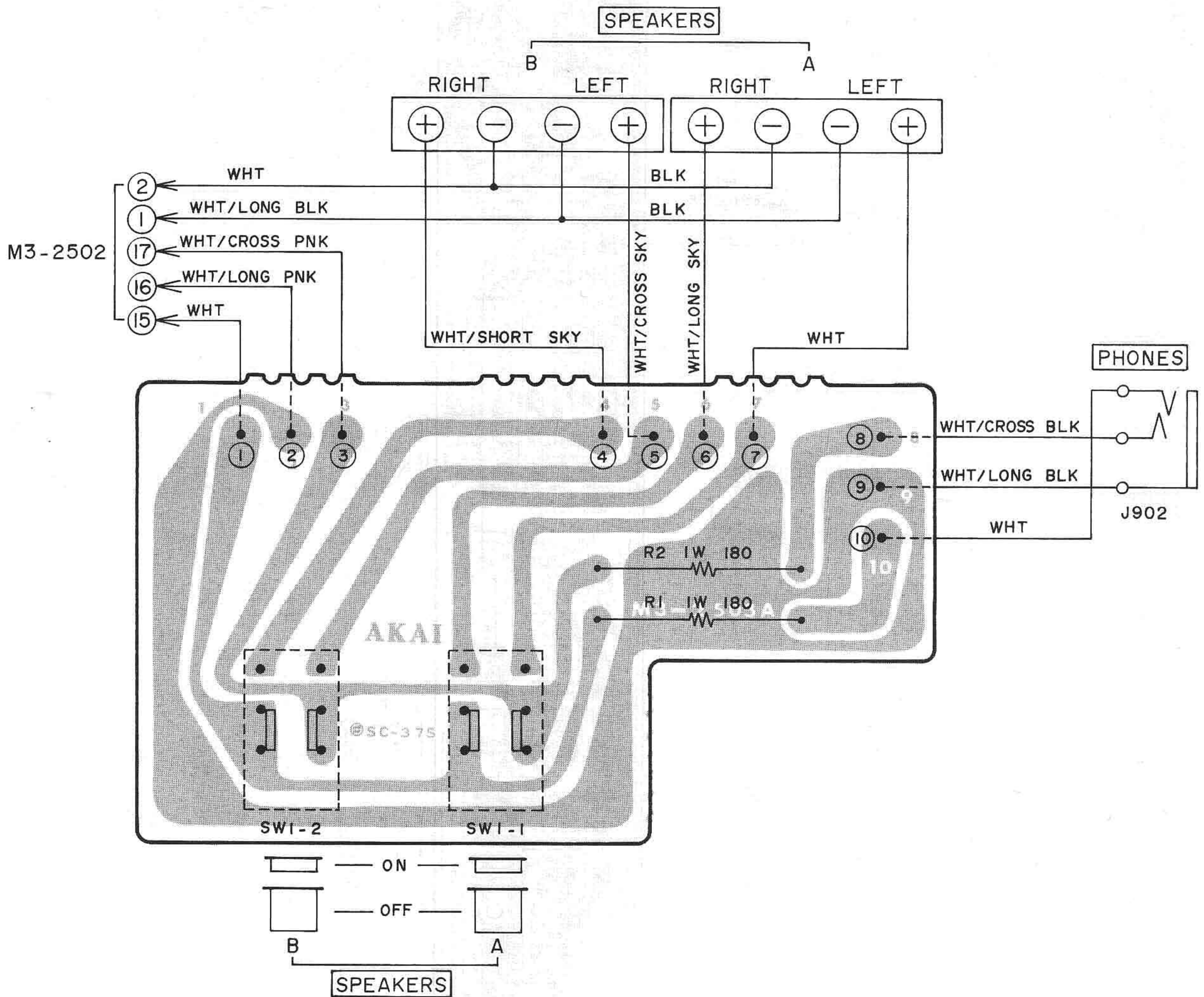
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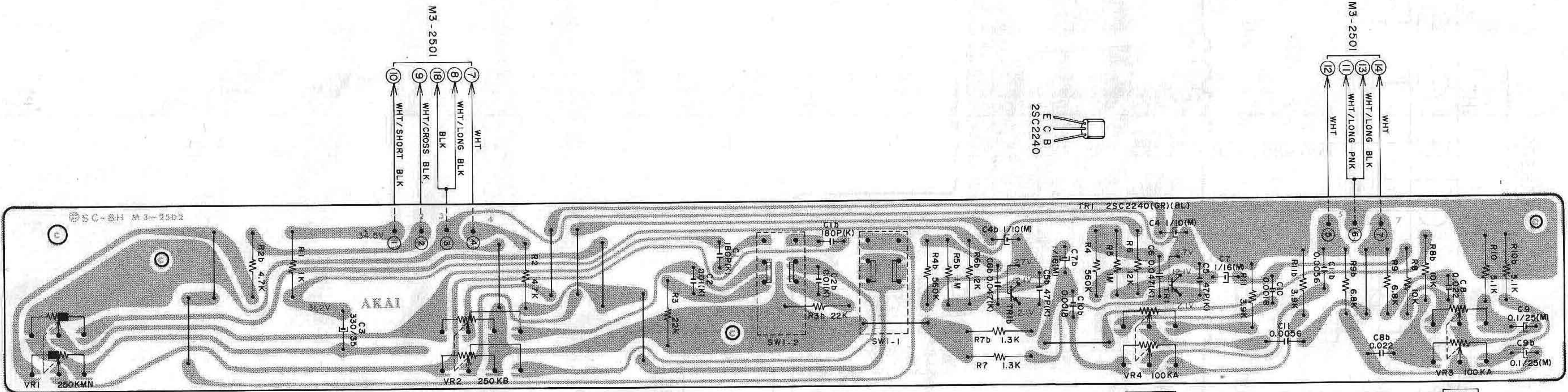


4) FUSE P.C BOARD T3-2501D (CEE, U K.)



3) SPEAKER SW P.C BOARD M3-2503A

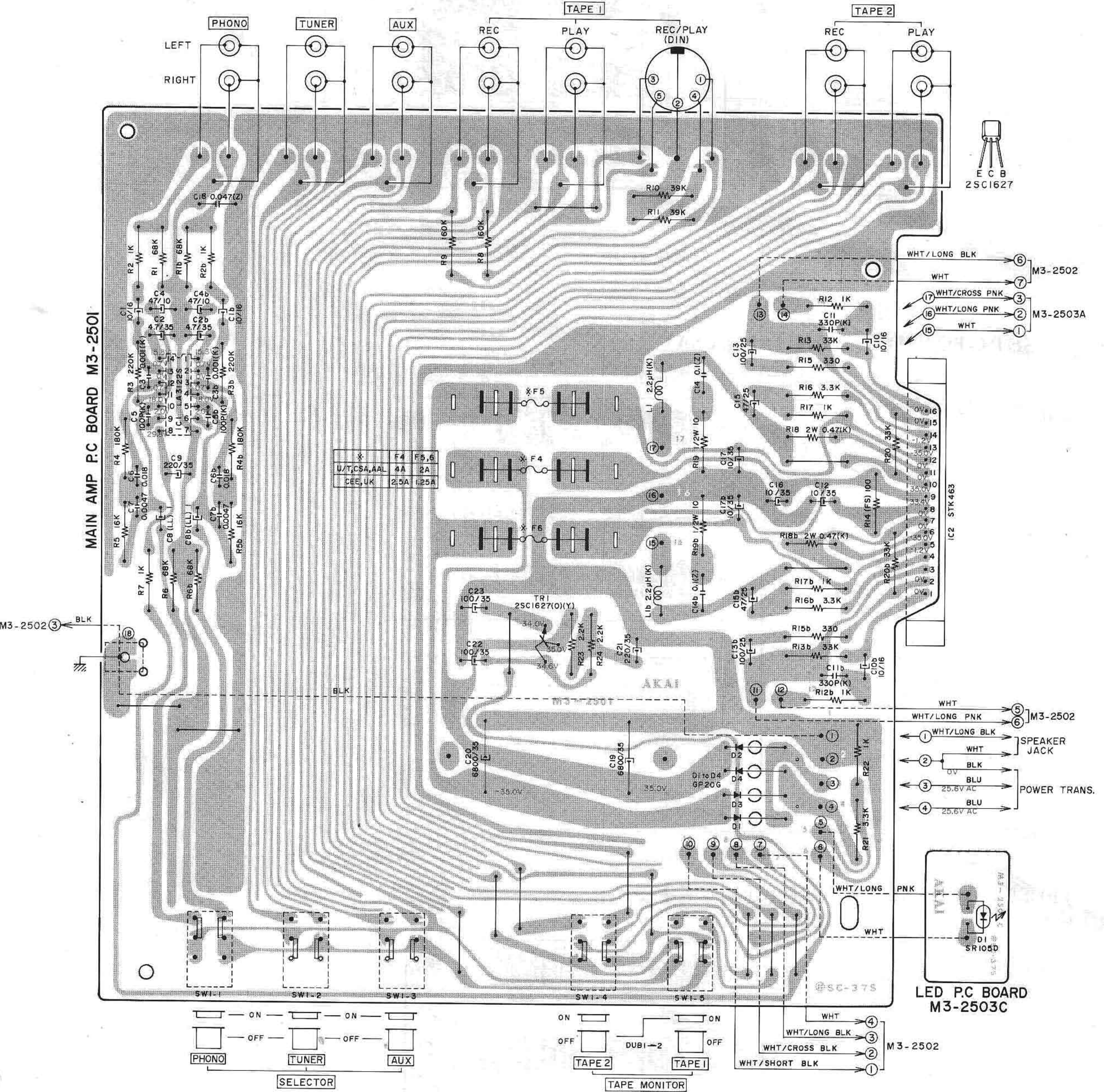




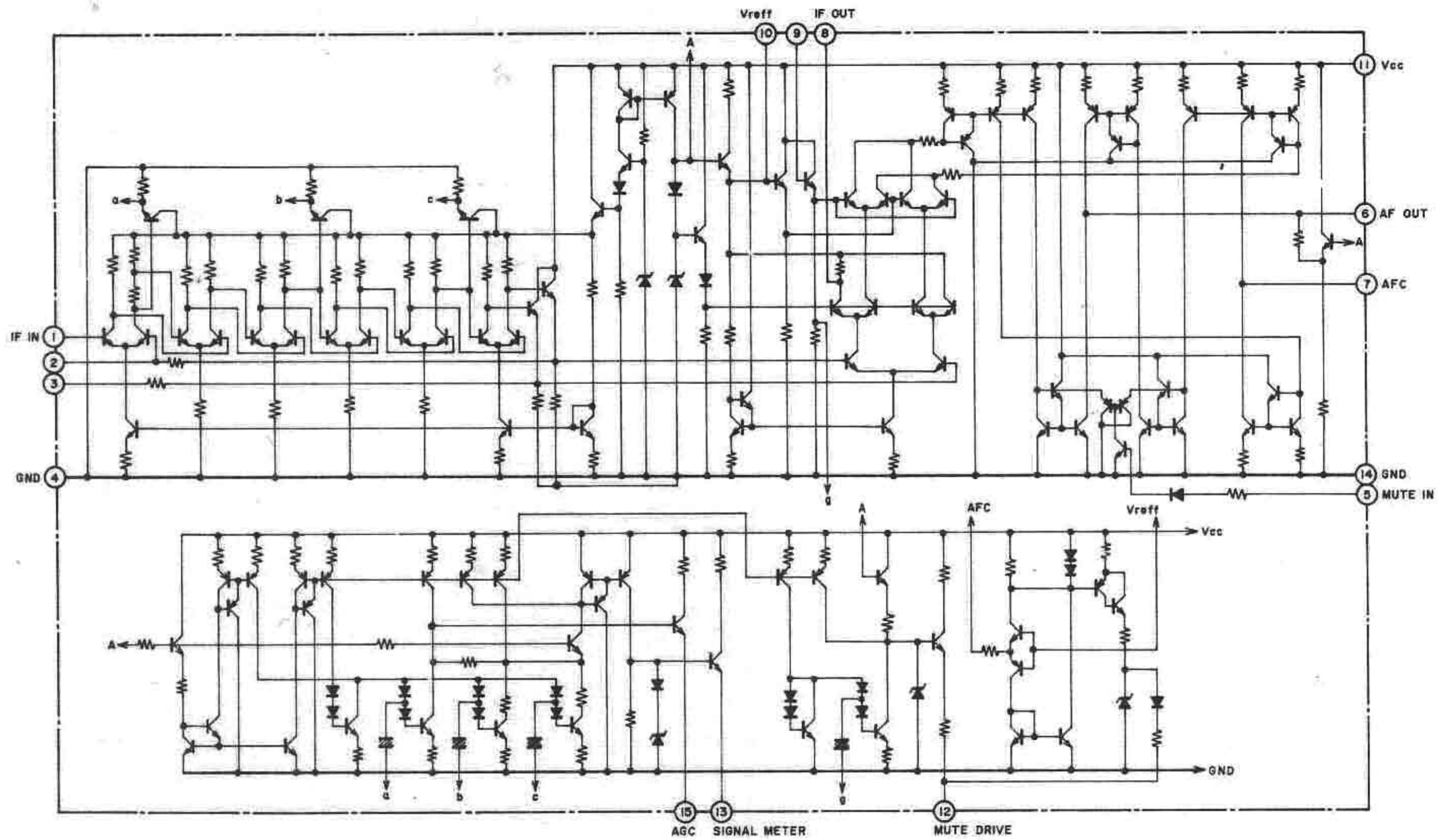
- BALANCE
- VOLUME
- TREBLE
- BASS
- ON
- MONO
- OFF
- STEREO
- LOUDNESS
- MODE

3. MODEL AM-2250 COMPOSITION OF VARIOUS P.C BOARDS

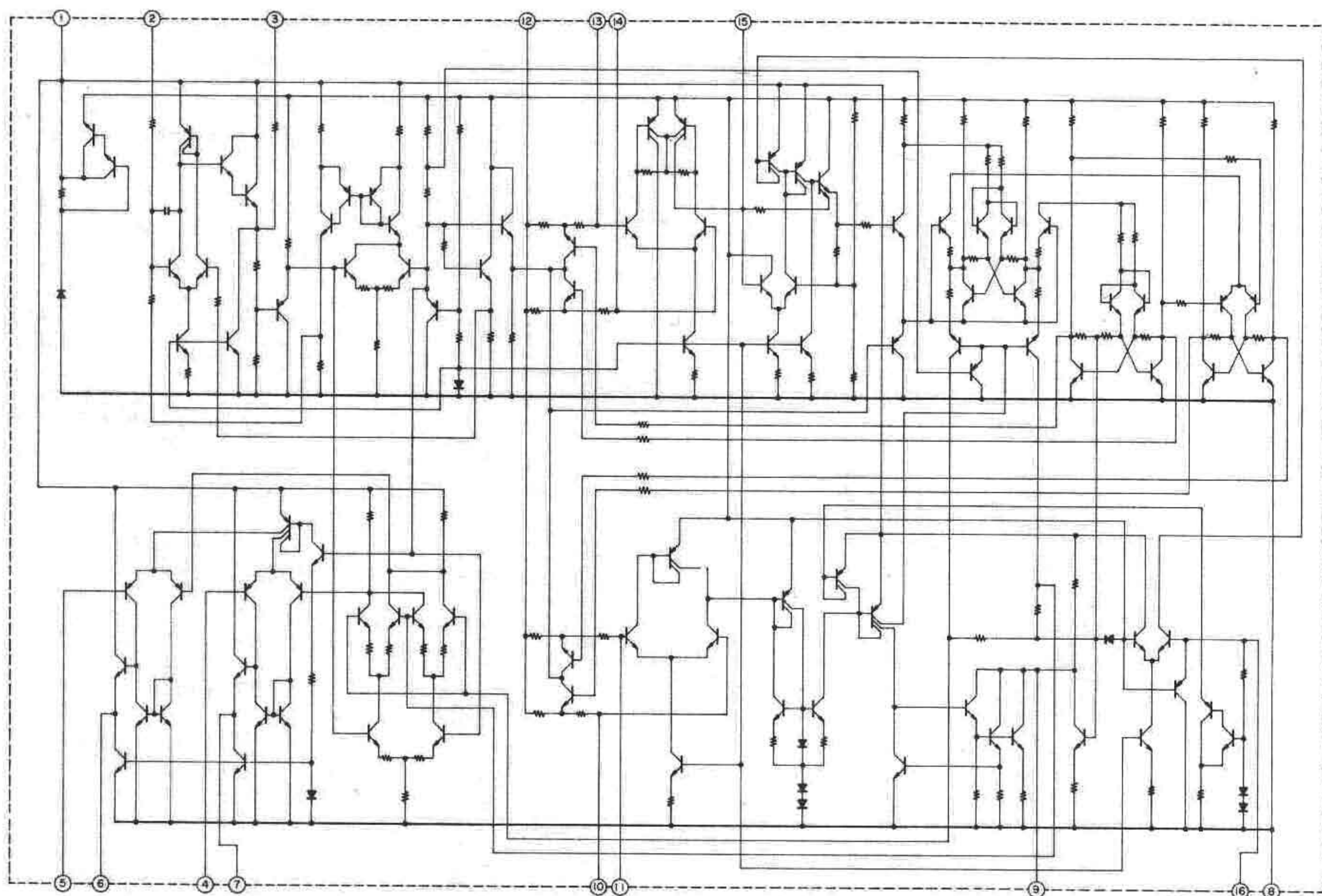
1) MAIN AMP P.C BOARD M3-2501 and LED P.C BOARD M3-2503C



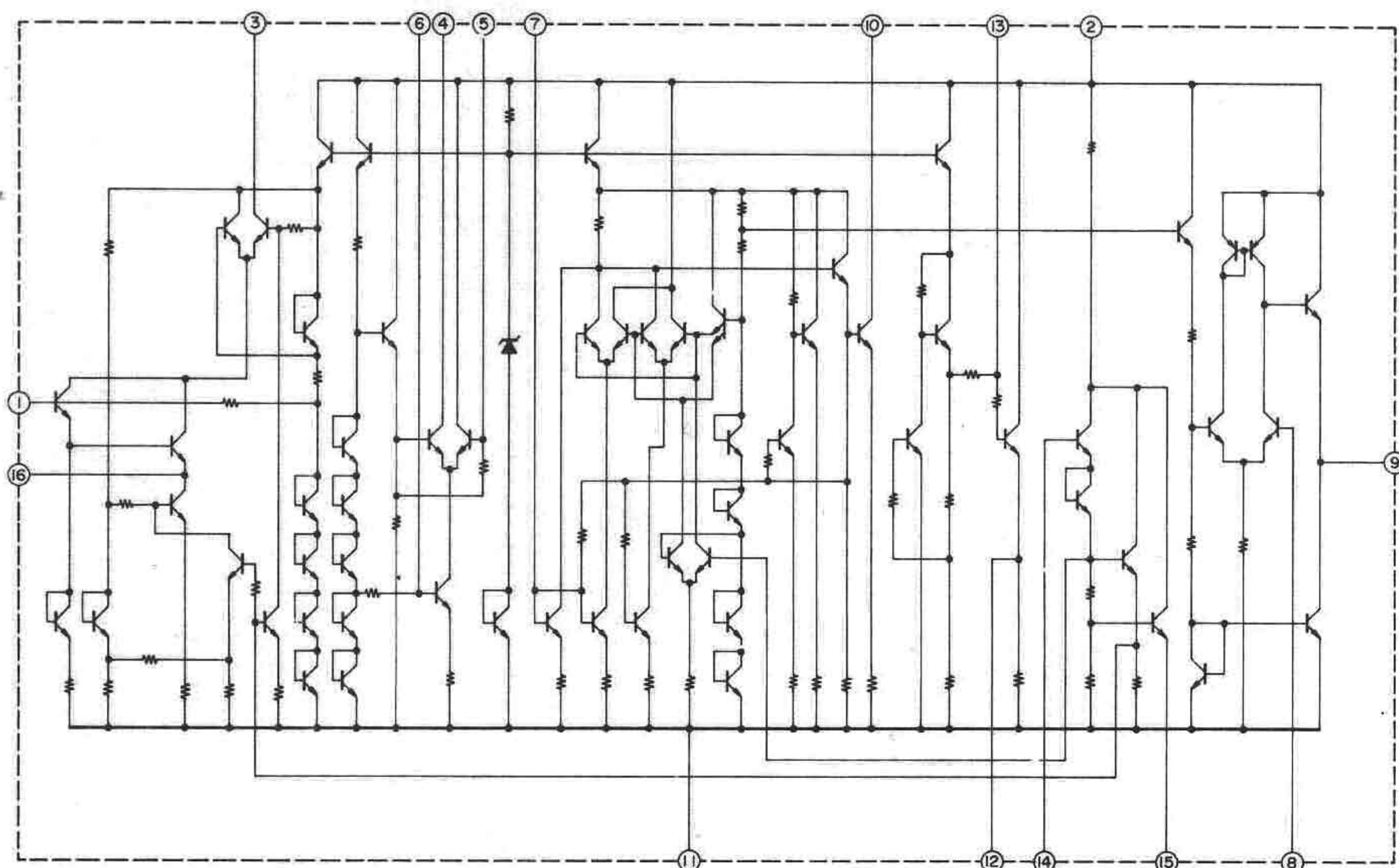
LA1230

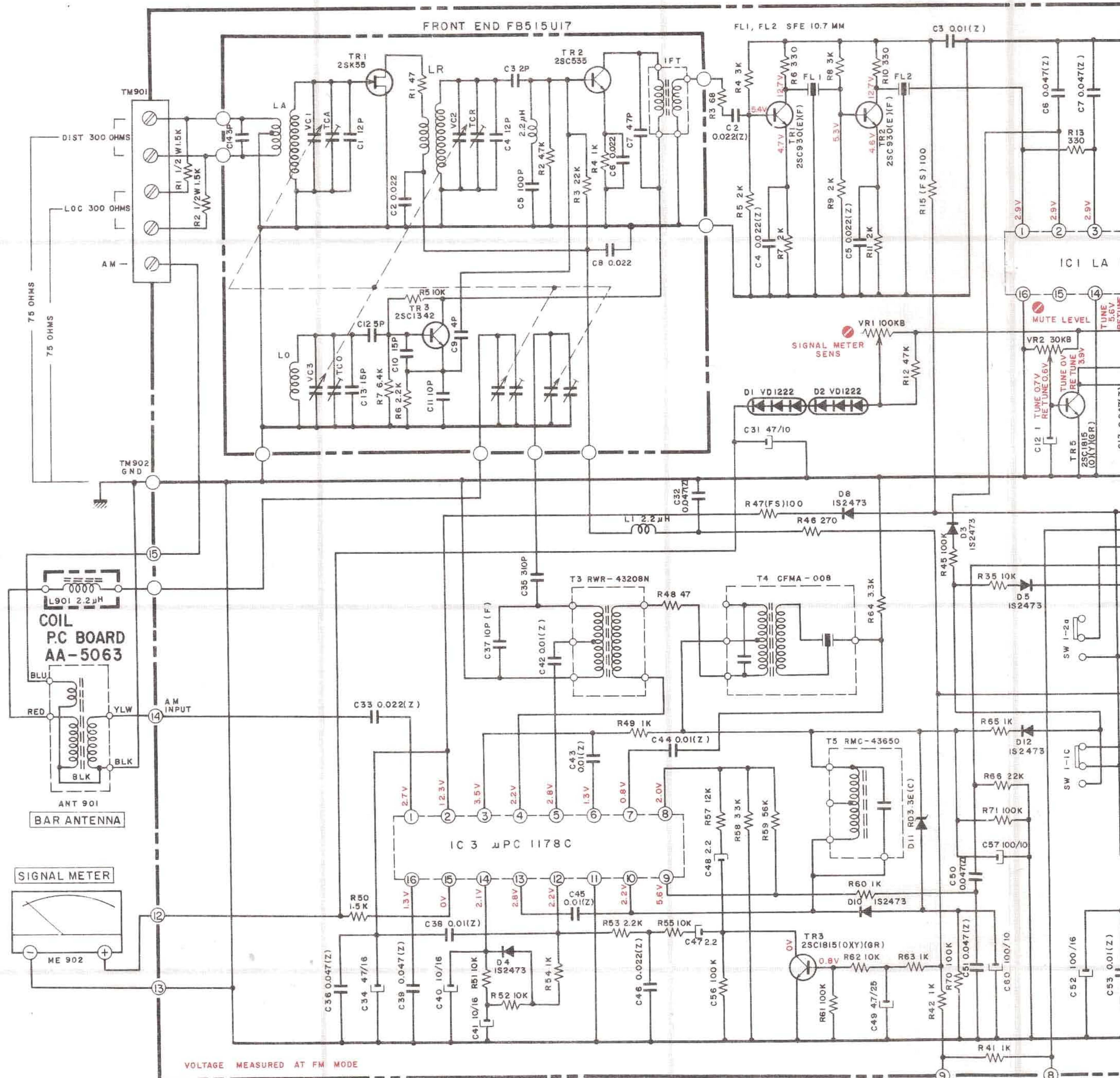


μPC1161C

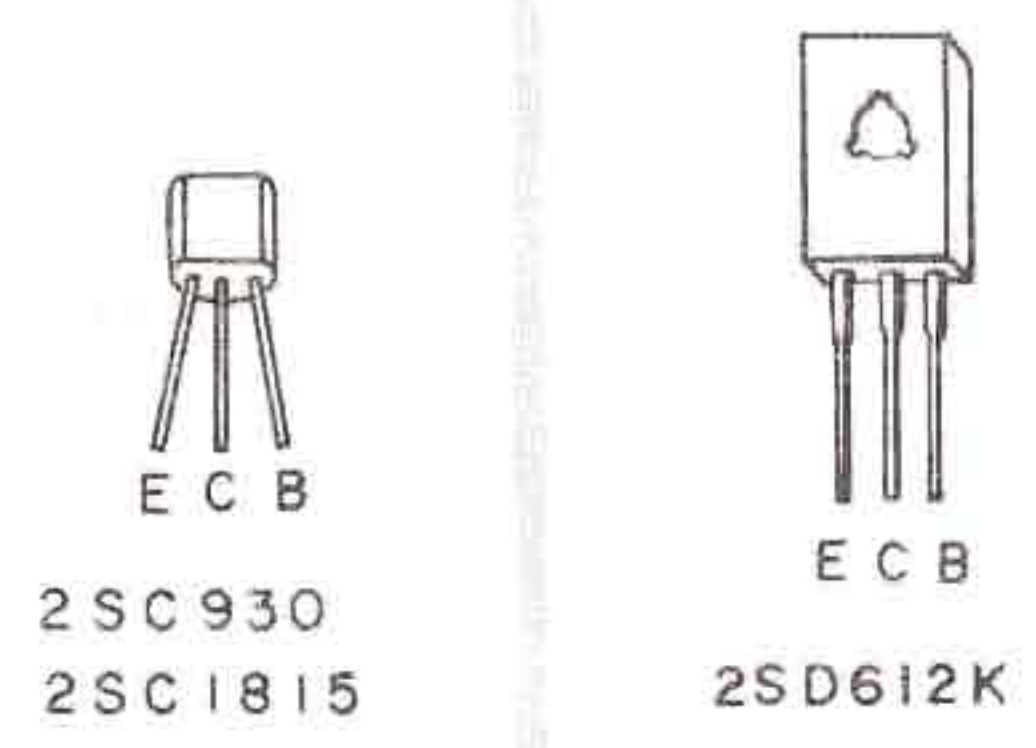


μPC1178



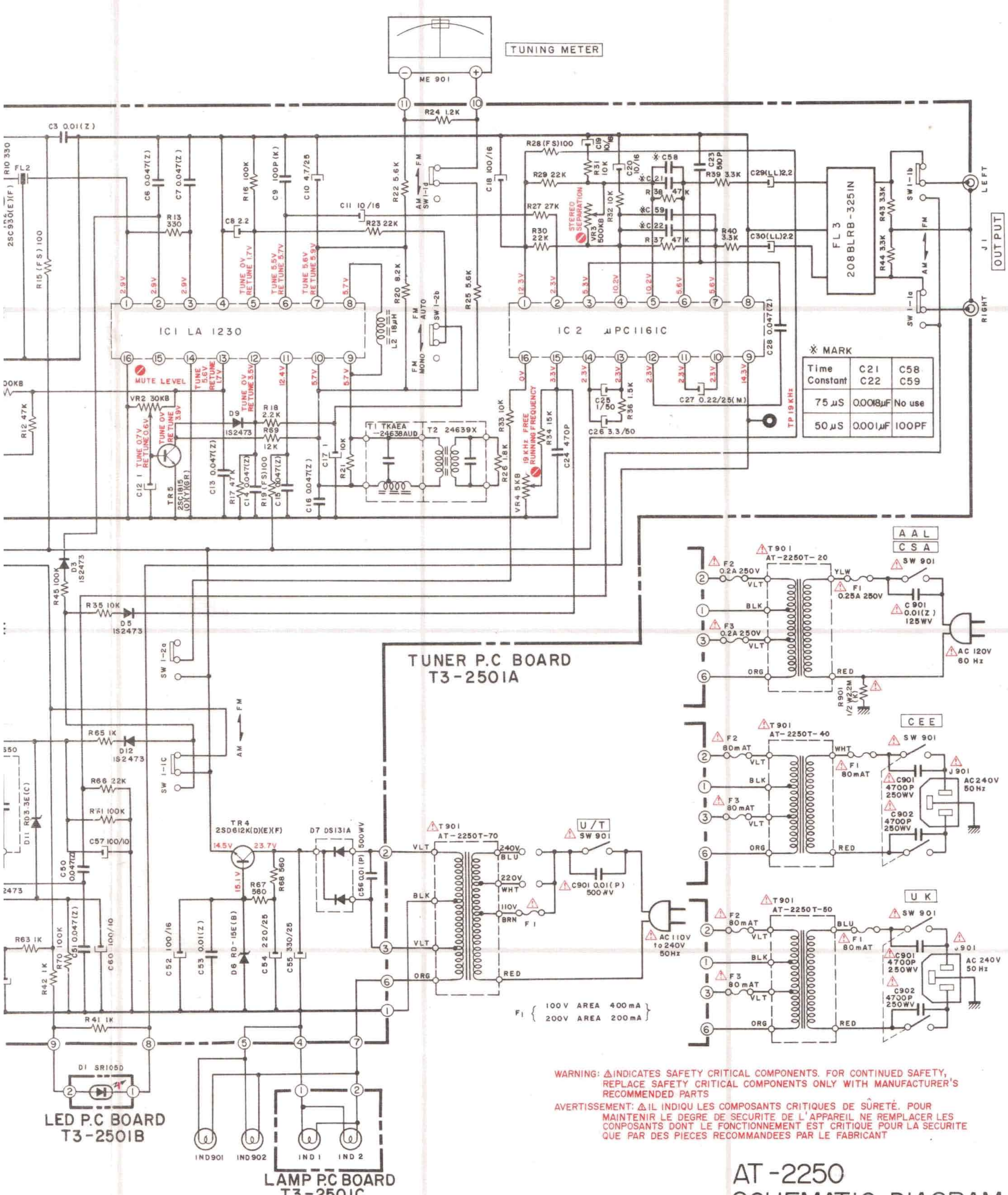


VOLTAGE MEASURED AT FM MODE



NOTE
UNLESS OTHERWISE SPECIFIED;
ALL RESISTORS IN OHMS 1/4W (J)
ALL CAPACITORS IN μF 50WV (J)
POWER TRANSFORMER IS DIFFERENT
ACCORDING TO AREA
(FS) = FAIL SAFE RESISTOR
(LL) = LOW LEAKAGE CAPACITOR





TUNING METER

IC1 LA 1230

IC2 μPC1161C

TUNER P.C BOARD
T3-2501A

LED P.C BOARD
T3-2501B

LAMP P.C BOARD
T3-2501C

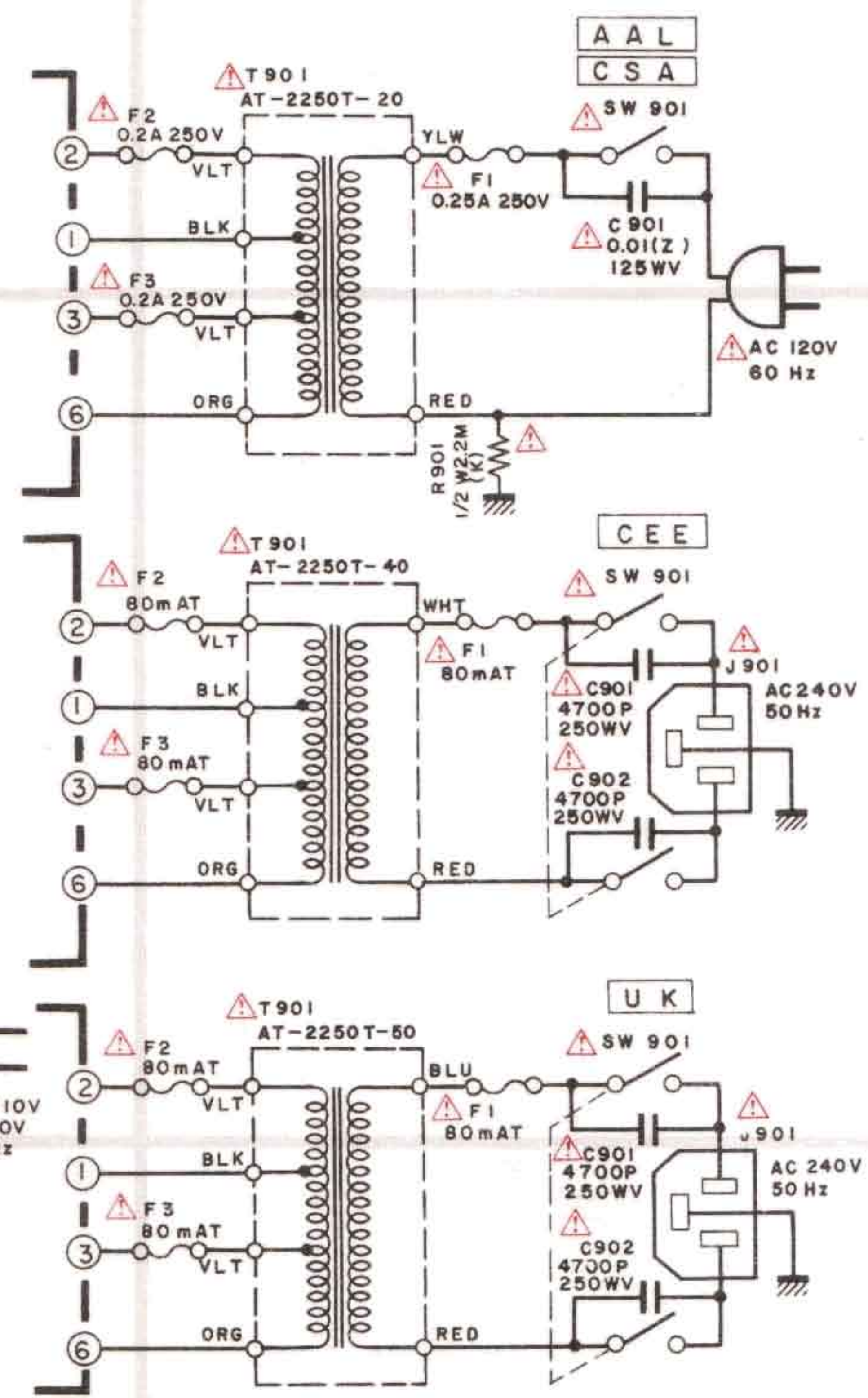
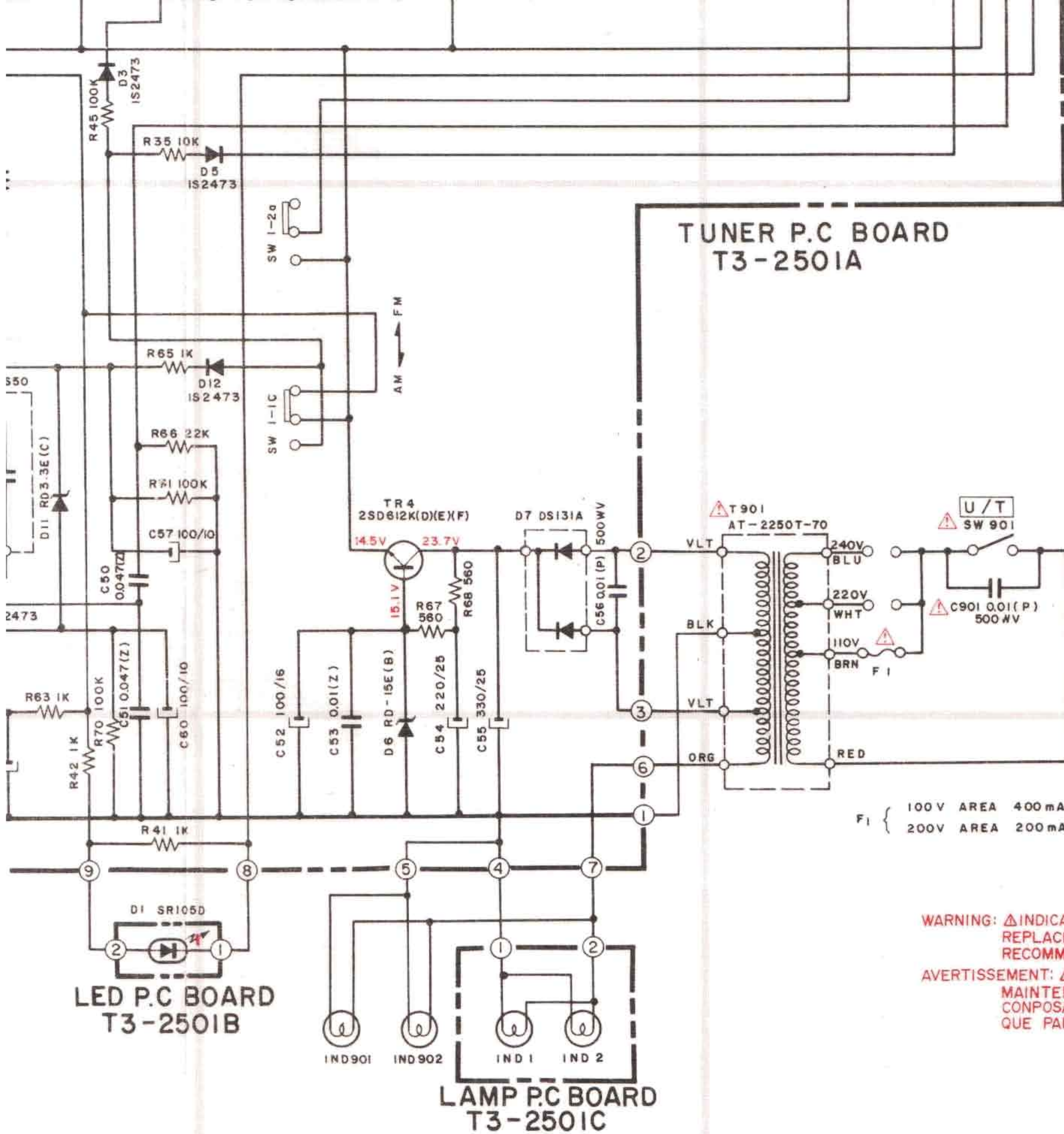
* MARK

Time Constant	C21 C22	C58 C59
75 μS	0.008μF	No use
50 μS	0.001μF	100PF

WARNING: Δ INDICATES SAFETY CRITICAL COMPONENTS. FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS

AVERTISSEMENT: Δ IL INDIQUE LES COMPOSANTS CRITIQUES DE SÛRETÉ. POUR MAINTENIR LE DEGRÉ DE SÛRETÉ DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SÛRETÉ QUE PAR DES PIÈCES RECOMMANDÉES PAR LE FABRICANT

AT-2250
SCHEMATIC DIAGRAM
NO.2-1 1561836A

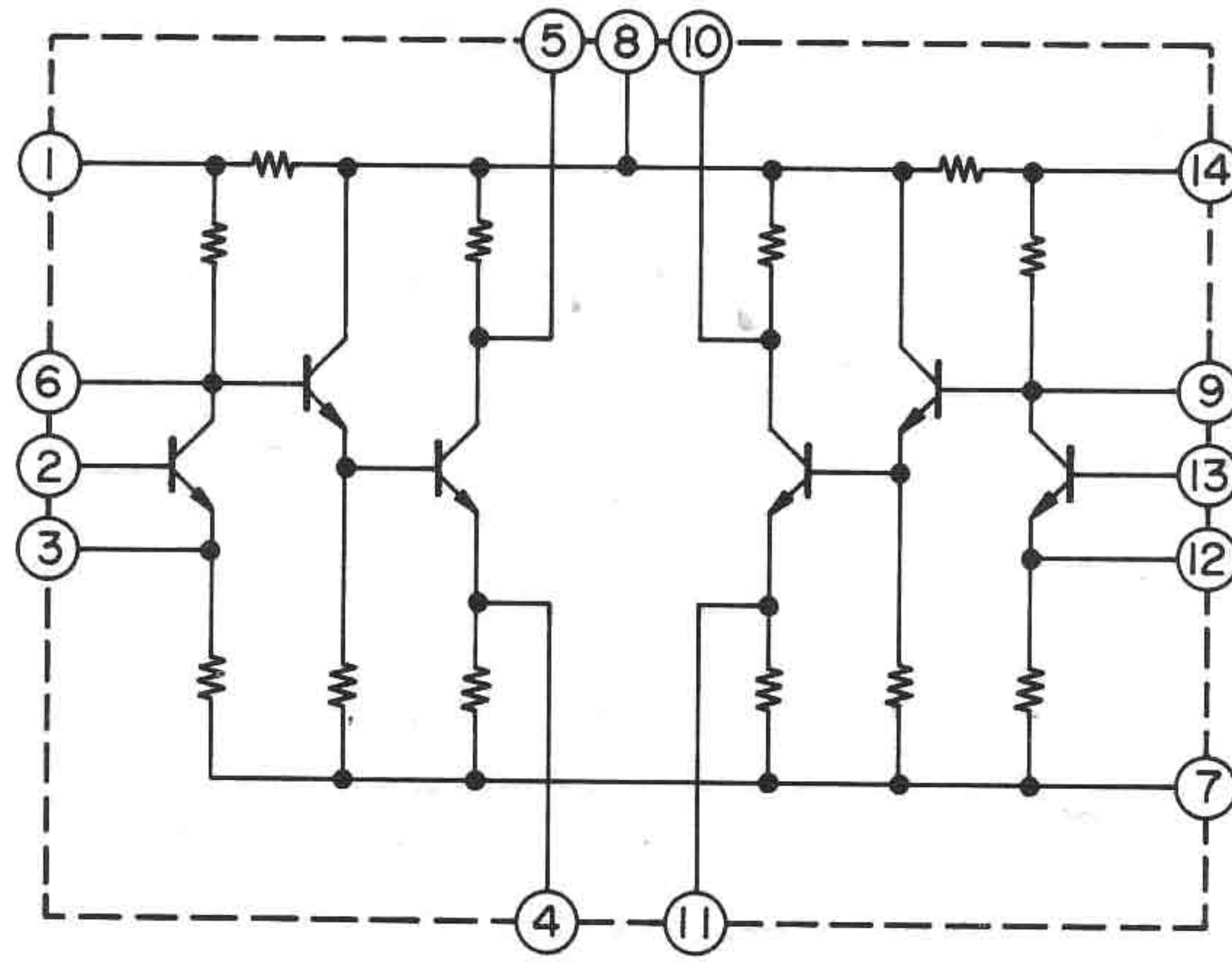


WARNING: ⚠ INDICATES SAFETY CRITICAL COMPONENTS. FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS

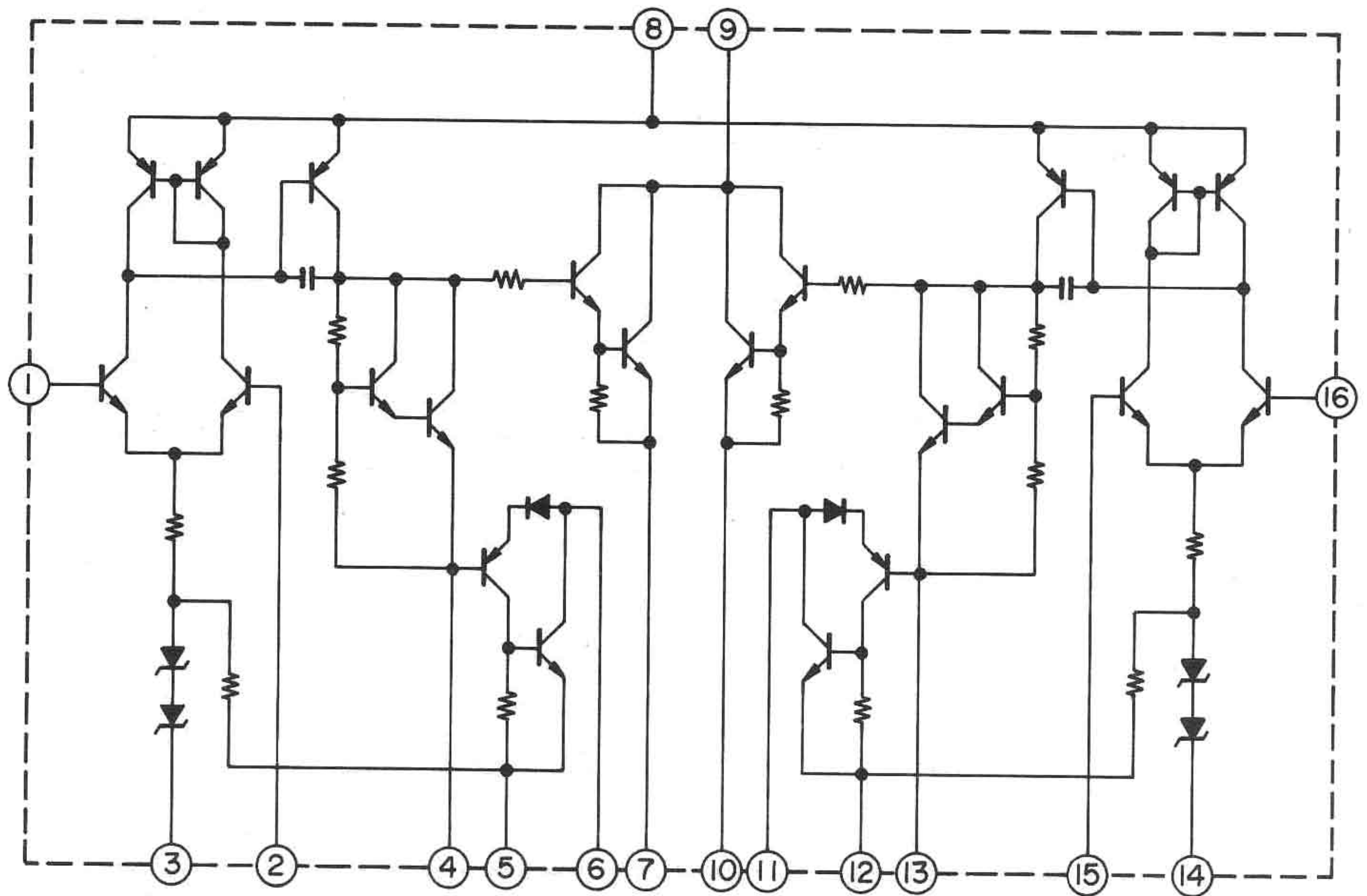
AVERTISSEMENT: ⚠ IL INDIQUE LES COMPOSANTS CRITIQUES DE SÛRETÉ. POUR MAINTENIR LE DEGRÉ DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIÉCES RECOMMANDÉES PAR LE FABRICANT

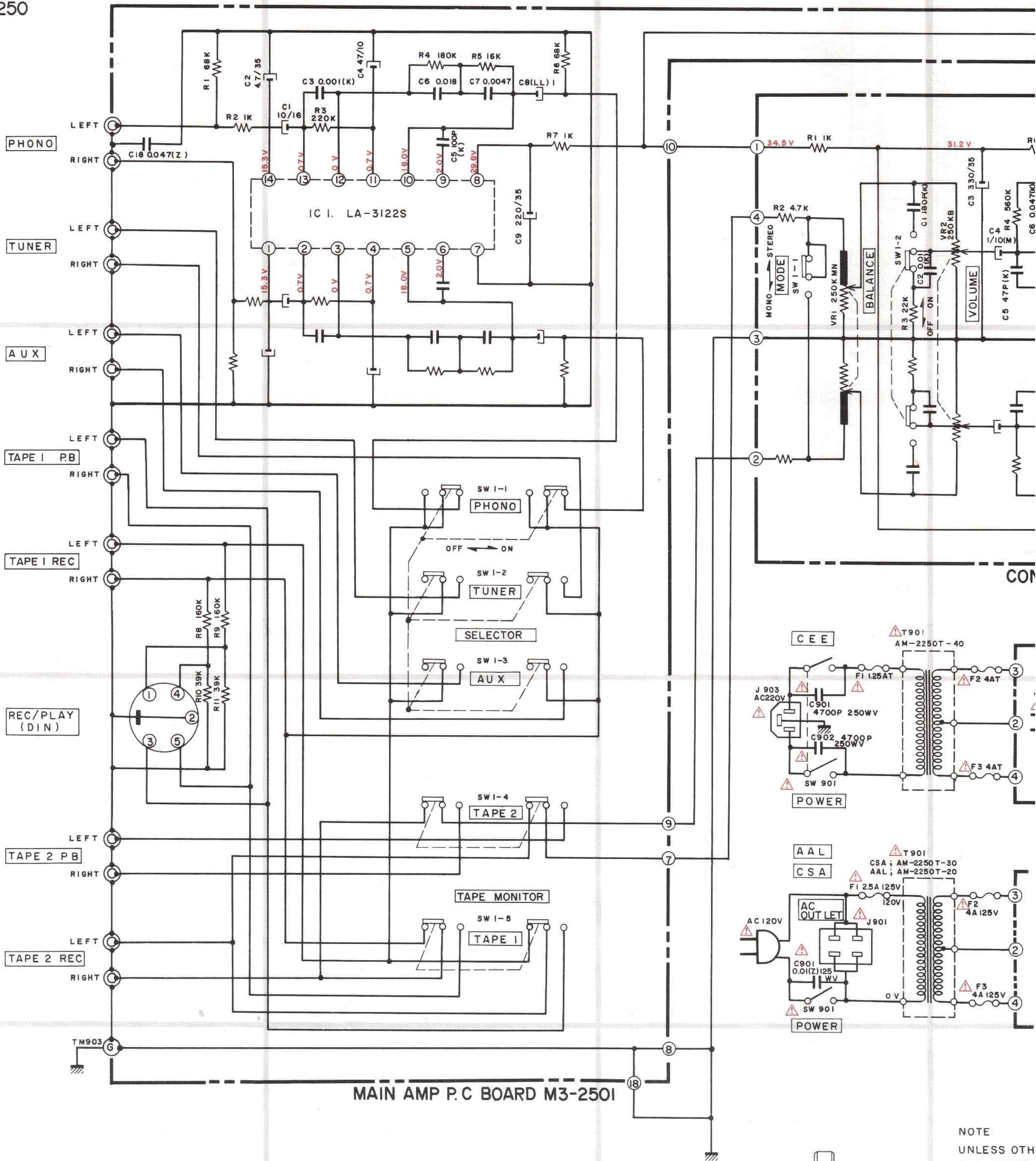
**AT-2250
SCHEMATIC DIAGRAM
NO. 2-1 1561836A**

LA3122S



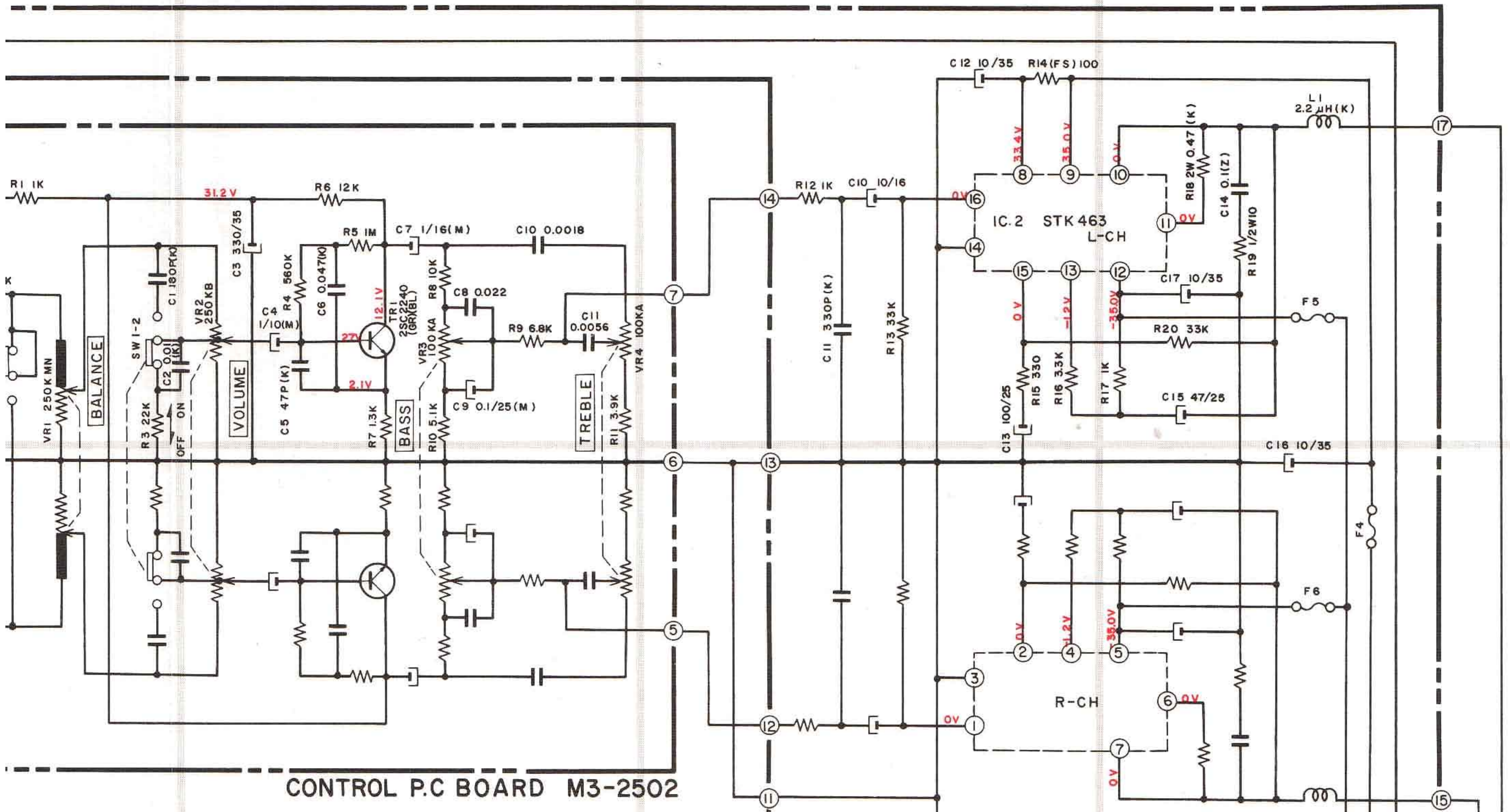
STK463



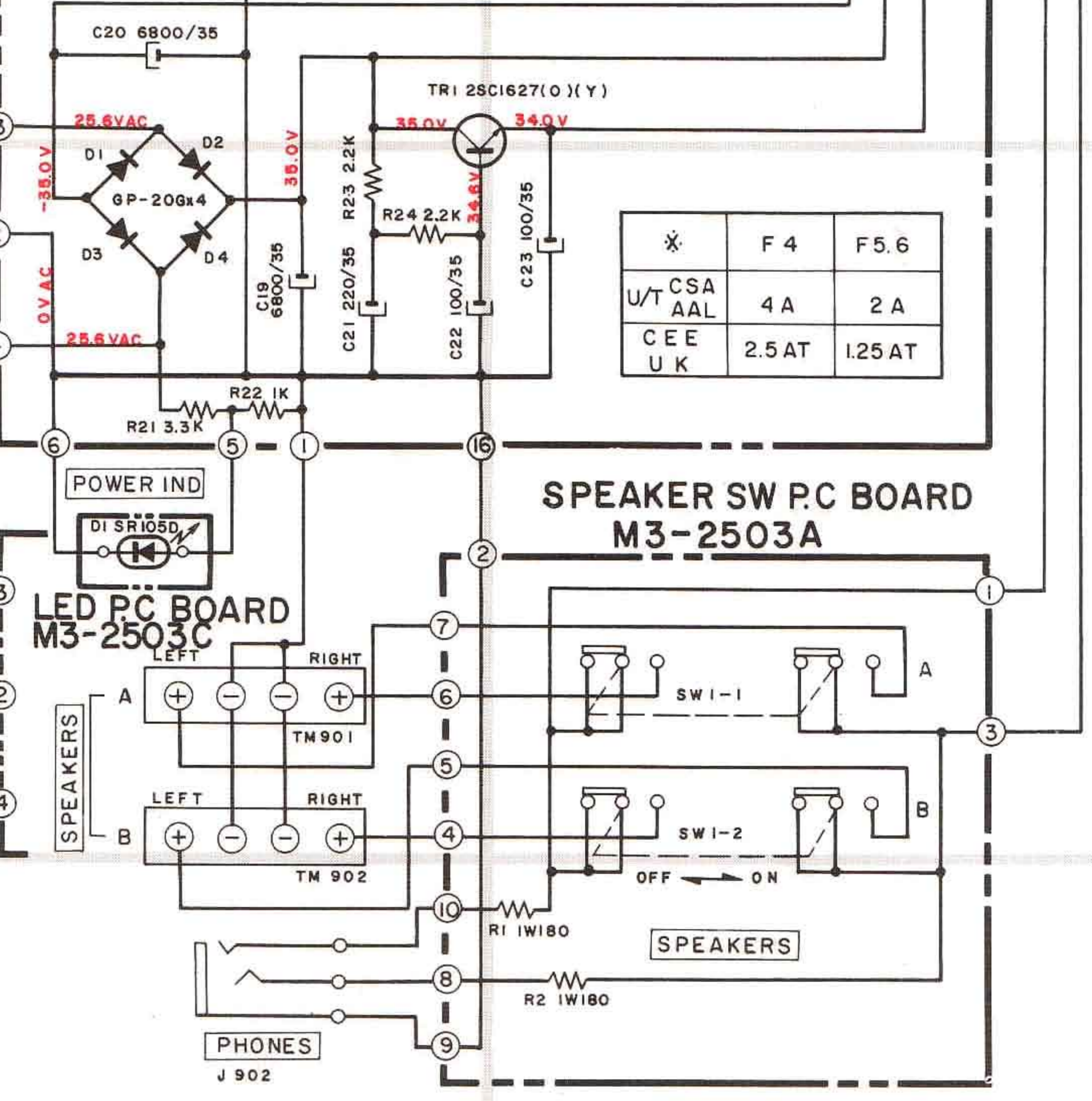
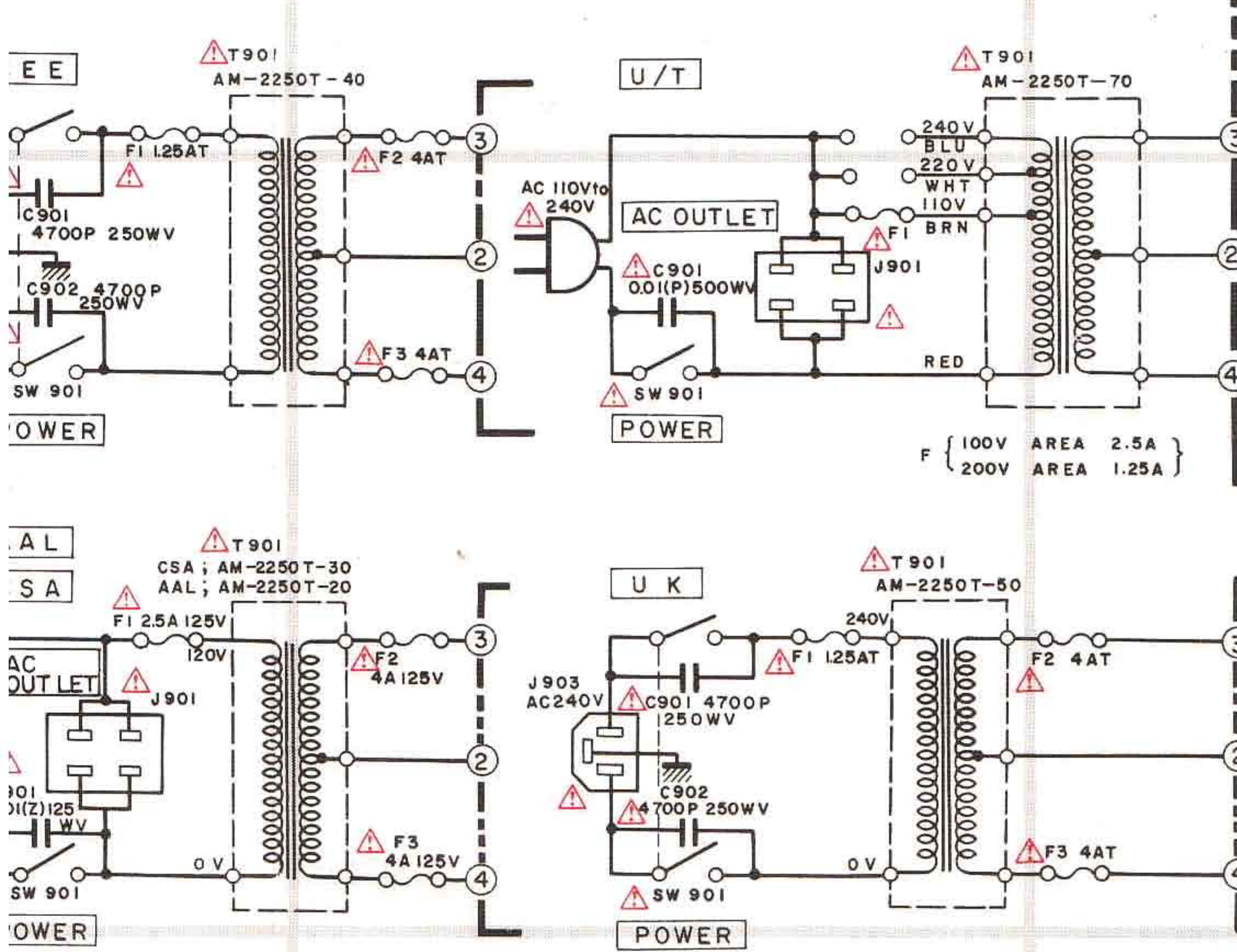


ECB
2SC1627
2SC2240

NOTE
UNLESS OTH
ALL RESIST
ALL CAPACI
POWER TRAN
ACCORDING
(FS) = FAIL
(LL) = LOW I



CONTROL P.C BOARD M3-2502



SPEAKER SW P.C BOARD M3-2503A

LED P.C BOARD M3-2503C

NOTE
 UNLESS OTHERWISE SPECIFIED
 ALL RESISTORS IN OHMS 1/4W(J)
 ALL CAPACITORS IN μ F 50WV(J)
 POWER TRANSFORMER IS DIFFERENT
 ACCORDING TO AREA
 (FS) = FAIL SAFE RESISTOR
 (LL) = LOW LEAKAGE CAPACITOR

WARNING: Δ INDICATES SAFETY CRITICAL COMPONENTS. FOR CONTINUED SAFETY, REPLACE SAFETY CRITICAL COMPONENTS ONLY WITH MANUFACTURER'S RECOMMENDED PARTS
 AVERTISSEMENT: Δ IL INDIQU LES COMPOSANTS CRITIQUES DE SÛRETÉ. POUR MAINTENIR LE DEGRE DE SECURITE DE L'APPAREIL NE REMPLACER LES COMPOSANTS DONT LE FONCTIONNEMENT EST CRITIQUE POUR LA SECURITE QUE PAR DES PIECES RECOMMANDEES PAR LE FABRICANT

2SC1627
 2SC2240