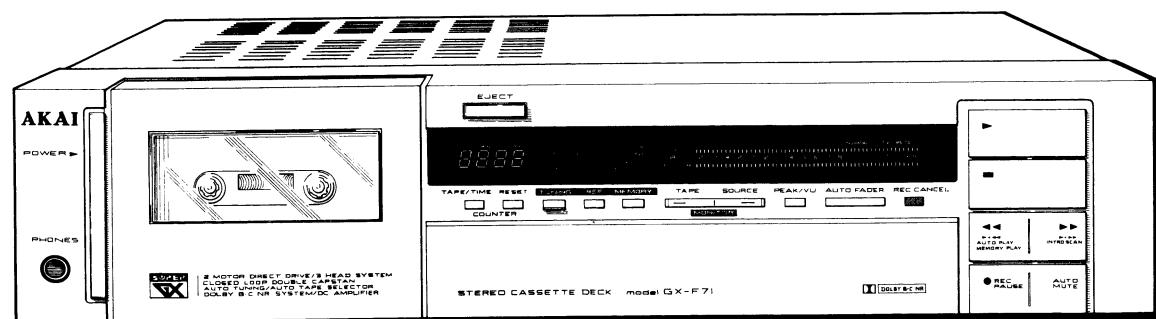
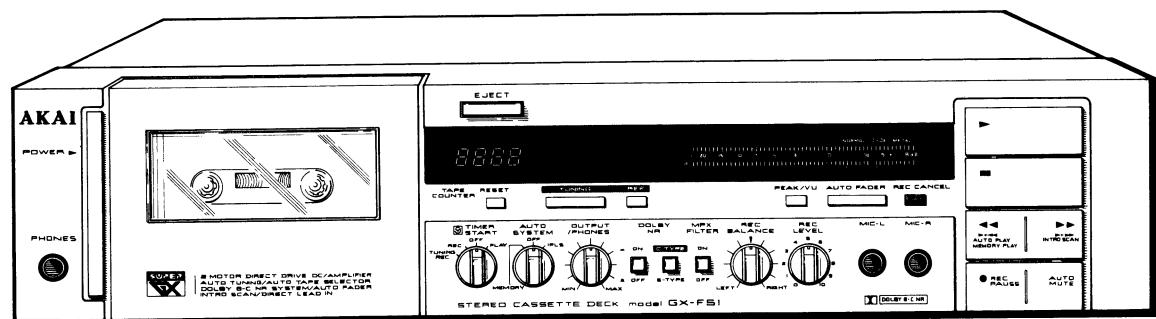
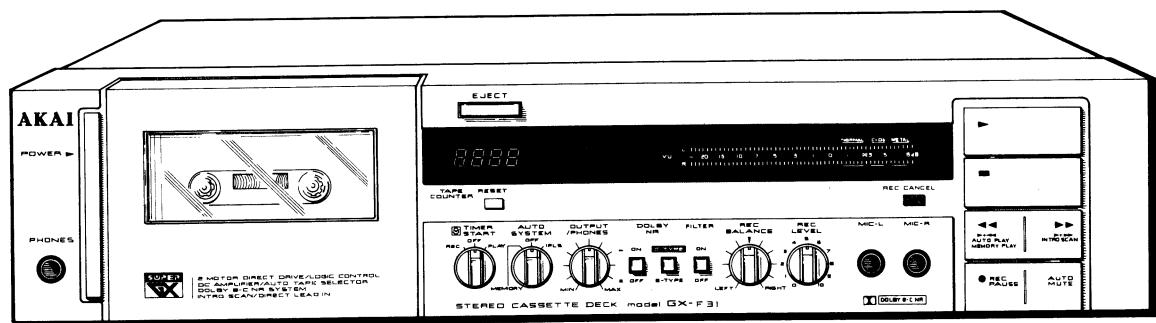


# AKAI SERVICE MANUAL



**STEREO CASSETTE DECK**

**MODEL GX-F31**

**MODEL GX-F51**

**MODEL GX-F71**



GX-F31



GX-F51



GX-F71

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## **STEREO CASSETTE DECK**

# **GX-F31**

# **GX-F51**

# **MODEL GX-F71**

**THIS MANUAL IS APPLICABLE TO BOTH SILVER  
AND PEARL SHADOW PANEL MODELS**

- SECTION 1 CIRCUIT OPERATION DESCRIPTION**
  - SECTION 2 MODEL GX-F31 SERVICE MANUAL**
  - SECTION 3 MODEL GX-F51 SERVICE MANUAL**
  - SECTION 4 MODEL GX-F71 SERVICE MANUAL**
  - SECTION 5 PARTS LIST**
  - SECTION 6 SCHEMATIC DIAGRAM**
-

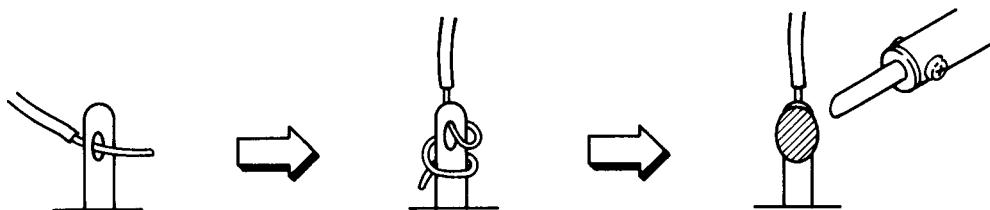
# SAFETY INSTRUCTIONS

## SAFETY CHECK AFTER SERVICING

Confirm the specified insulation resistance between power cord plug prongs and externally exposed parts of the set is greater than 10 Mohms, but for equipment with external antenna terminals (tuner, receiver, etc.) and is intended for **C** or **A**, specified insulation resistance should be more than 2.2 Mohms (ground terminals, microphone jacks, headphone jacks, line-in-out jacks etc.)

## PRECAUTIONS DURING SERVICING

1. Parts identified by the  $\Delta$  symbol parts are critical for safety.  
Replace only with parts number specified.
2. In addition to safety, other parts and assemblies are specified for conformance with such regulations as those applying to spurious radiation. These must also be replaced only with specified replacements.  
Examples: RF converters, tuner units, antenna selector switches, RF cables, noise blocking capacitors, noise blocking filters, etc.
3. Use specified internal wiring. Note especially:
  - 1) Wires covered with PVC tubing
  - 2) Double insulated wires
  - 3) High voltage leads
4. Use specified insulating materials for hazardous live parts. Note especially:
  - 1) Insulation Tape
  - 2) PVC tubing
  - 3) Spacers (Insulating Barriers)
  - 4) Insulation sheets for transistors
5. When replacing AC primary side components (transformers, power cords, noise blocking capacitors, etc.), wrap ends of wires securely about the terminals before soldering.



6. Observe that wires do not contact heat producing parts (heatsinks, oxide metal film resistors, fusible resistors, etc.).
7. Check that replaced wires do not contact sharp edged or pointed parts.
8. Also check areas surrounding repaired locations.
9. Use care that foreign objects (screws, solder droplets, etc.) do not remain inside the set.

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## SECTION 1

# CIRCUIT OPERATION DESCRIPTION

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# I. DESCRIPTION OF GX-F71 AUTO TUNING FUNCTION

## 1. GX-F71 AUTO TUNING BLOCK DIAGRAM

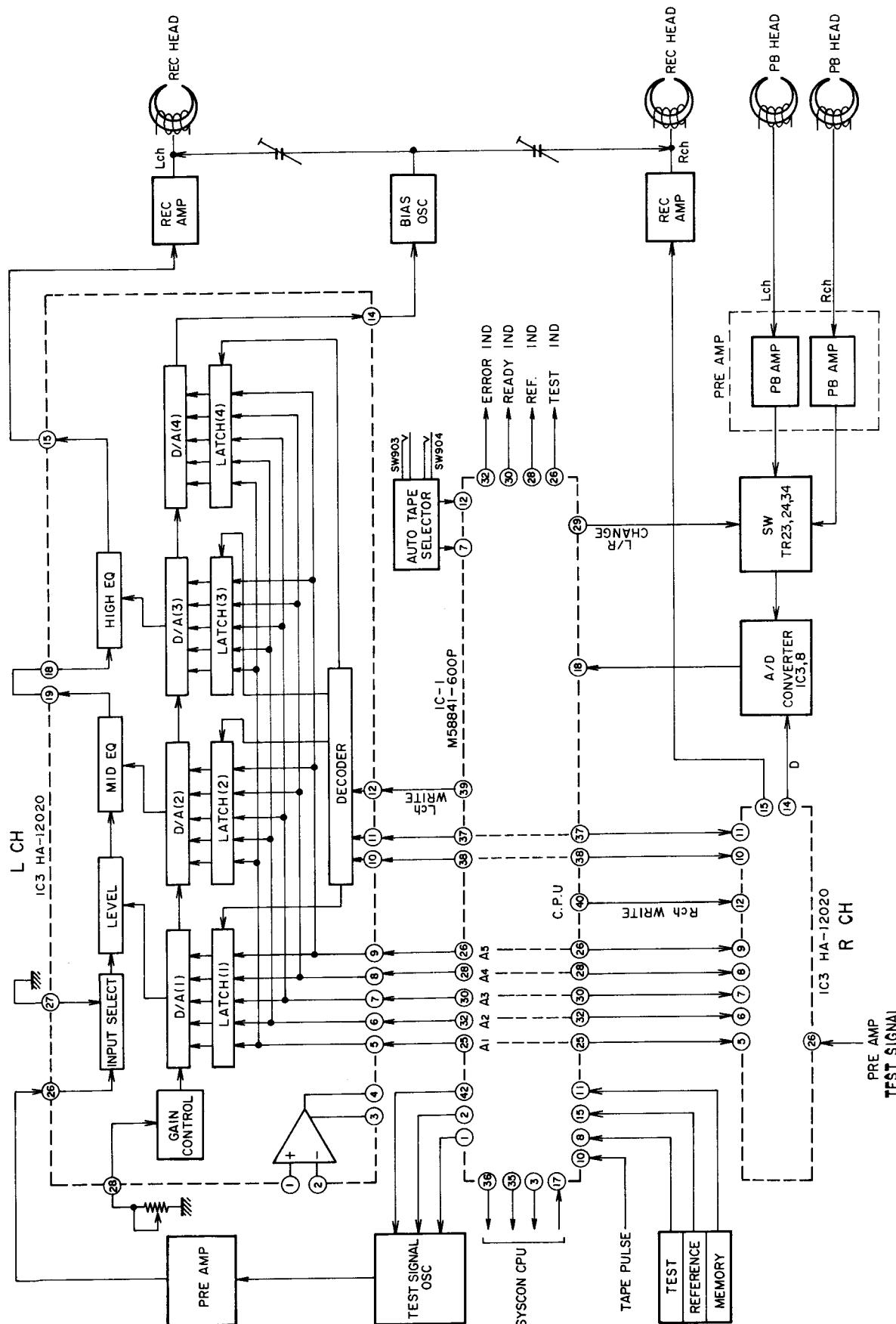


Fig. 1 Auto Tuning Block Diagram

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## 2. DESCRIPTION OF GX-F71 AUTO TUNING FUNCTION

1) When, after the power is "on", the cassette-pack is set and the test key is set to "on" position, terminals, ③, ⑯ and ⑰, of tuning CPU (IC1) becomes "L", "L" and "H", respectively, system control (IC8) is set to FF mode and the counter quickly winds 64 counts. Then, ③, ⑯ and ⑰ becomes "H", "L" and "L", respectively, the syscon CPU is set to Rec/Play mode and the bias circuit oscillates.

### 2 Coarse adjustment of level

Terminals ①, ② and ④ of tuning CPU (IC1) becomes "L", "L", and "L" respectively when CPU is set to Rec/Play mode and the test signal OSC oscillates 1 kHz. This output passes through the PRE-Amp circuit, enters terminal ⑯ of IC3 as the test signal and is output from ⑮. Then, the signal passes through Rec Amp, mixed with the bias and is applied to the REC head.

The 1 kHz signal recorded on the tape passes through the PB Head and PB Amp, Lch and Rch signals are selected by the switch circuit of TR23, 24 and 34 (Tuning P.C Board), A/D converted at IC8 and IC3 (Part) and, then, input into IC1 ⑯ as a PB signal level detection signal.

Under this condition, the signal level of 1 kHz is positively half-wave rectified by IC8 and charged to C35 ( $10\mu/16V$ ) and applied to IC3 ②, but 5 bits (32 steps) of stair step waveform signal is applied to the terminal, IC3 ①, and when the level of IC3 ① becomes equal to that of terminal ②, the output is changed from "L" to "H" while the collector of TR49 is trailed from "H" to "L". PB signal level is detected by this trailing. At this time, the data outputs at terminals ⑯, ⑰, ⑳, ㉑ and ㉒ of IC1 are written as level data in latch (1) of IC3. This operation is performed once for Lch and Rch, respectively.

### 3) Bias adjustment

When the coarse level adjustment is completed, a step form wave (up direction) is output from IC3 (Lch) ⑯ terminal and controls IC7 ⑥ → IC7 ④ → TR19, thus changing the amount of bias.

As the bias is changed, the signal of 1 kHz from the test signal circuit is recorded on the tape as

a signal of changed level and accordingly the PB level is changed. Since these changes are in proportion to the bias change, the PB level is detected.

The bias is adjusted twice; in up direction and down direction, therefore, the mean value added +4 step is written as bias data into the latch of IC3 (Lch) as the most suitable bias amount. Only Rch is subjected to bias adjustment.

### 4) 1 kHz level adjustment

When the bias adjustment is completed, the 1 kHz level adjustment is made in the same manner as the coarse level adjustment.

### 5) 7 kHz EQ adjustment

When the 1 kHz level adjustment is completed, terminals ①, ② and ④ of IC1 become "L", "H" and "L", respectively and the test signal OSC circuit oscillates 7 kHz. The inner D/A (2) and latch (2) of IC3 are controlled by the 5 bit signal from CPU (IC1) so that the 7 kHz PB level is adjusted to the same level as the 1 kHz reference. When the 7 kHz level is adjusted to the same level of 1 kHz reference, the data are written into latch (2).

The 7 kHz EQ adjustment is made once in Lch and Rch, respectively.

### 6) 13 kHz EQ adjustment

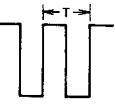
After 7 kHz EQ is adjusted, terminals ①, ② and ④ of IC1 become "H", "H" and "L", respectively and the test signal OSC circuit oscillates 13 kHz and when the PB signal level of 13 kHz is adjusted to the same level as the 1 kHz reference level, the data of 13 kHz EQ are written into latch (3) of IC3.

The adjustments from 4) to 6) are repeated three times.

### 7) When the above tuning is completed, terminals ③, ⑯ and ⑰ of IC1 become "L", "H" and "H", respectively and the syscon CPU is set to RWD mode.

In case of TUNING REC, the tape counter is rewound to "0" and in case where Rec/Play and Timer Start SW are off, REW is changed to REC/PAUSE at "23" on the counter.

### 3. INPUT OUTPUT MODES OF EACH TERMINAL OF AUTO TUNING CPU (M58841-600P)

PIN NO.	NAME	FUNCTION								
1 2	FRQ I FRQ II	TEST SIGNAL OSC FREQUENCY CONTROL	(1) (2) OSC	L L 1 kHz	L H 7 kHz 13 kHz					
42	OSC START	L: OSC ON      H: OSC OFF								
35 36 3	MECHA CON I MECHA CON II MECHA CON III	(35) (36) (3) NON OPERATION	L L L STOP	H L L FF	L L H REW					
12 7	TAPE POSITION I TAPE POSITION II	<table border="1"> <tr> <td>(12) (7) POSITION</td><td>H H NORMAL</td><td>H L CrO<sub>2</sub></td><td>L L METAL</td></tr> </table>				(12) (7) POSITION	H H NORMAL	H L CrO <sub>2</sub>	L L METAL	
(12) (7) POSITION	H H NORMAL	H L CrO <sub>2</sub>	L L METAL							
8	TEST START KEY	Started by "L" input								
11	MEMORY KEY	Memory output by "L" input								
15	REFERENCE KEY	Reference output by "L" input								
10	COUNTER PULSE	 <p>"T" means one full counts</p>								
16	TIMER	With "L" input, Tuning REC is feasible but with "H", it is not feasible.								
17	TUNING SAFE	With "H" input, tuning is feasible, but with "L" input, tuning is not feasible. If the "H" input enters during tuning, the tuning stops.								
18	PB DETECT	Judged by the trailing edge								
25 32 30 28 26	DATA I (A <sub>1</sub> ) DATA II (A <sub>2</sub> ) DATA III (A <sub>3</sub> ) DATA IV (A <sub>4</sub> ) DATA V (A <sub>5</sub> )	<p>"H" output is used as data output</p>								
27	IND OUT	The "H" synchronized with one of Data II - V is output to light the tuning indicator.								
29	Lch/Rch CHANGE	"H" output → Lch. "L" output → Rch.								
41	TUNING TEST	While testing → "H" output. While test is off → "L".								
37 38	LATCH SELECT I LATCH SELECT II	<p>Latch of HA12020 is selected</p> <table border="1"> <tr> <td>(37) (38) DATA</td><td>L L 1 kHz Data</td><td>H L 7 kHz Data</td><td>L H 13 kHz Data</td><td>H H Bias, A/D Data</td></tr> </table>				(37) (38) DATA	L L 1 kHz Data	H L 7 kHz Data	L H 13 kHz Data	H H Bias, A/D Data
(37) (38) DATA	L L 1 kHz Data	H L 7 kHz Data	L H 13 kHz Data	H H Bias, A/D Data						
39 40	Lch WRITE Rch WRITE	 <p>Output pulse. Latch data at the edge of rise.</p>								
31	HOLD RESET	When "H" output is being made, reset is OK. It is "H" while test is off.								

## II. GX-F71 SYSCON CIRCUIT FUNCTIONS

### 1. GX-F71 SYSCON BLOCK DIAGRAM

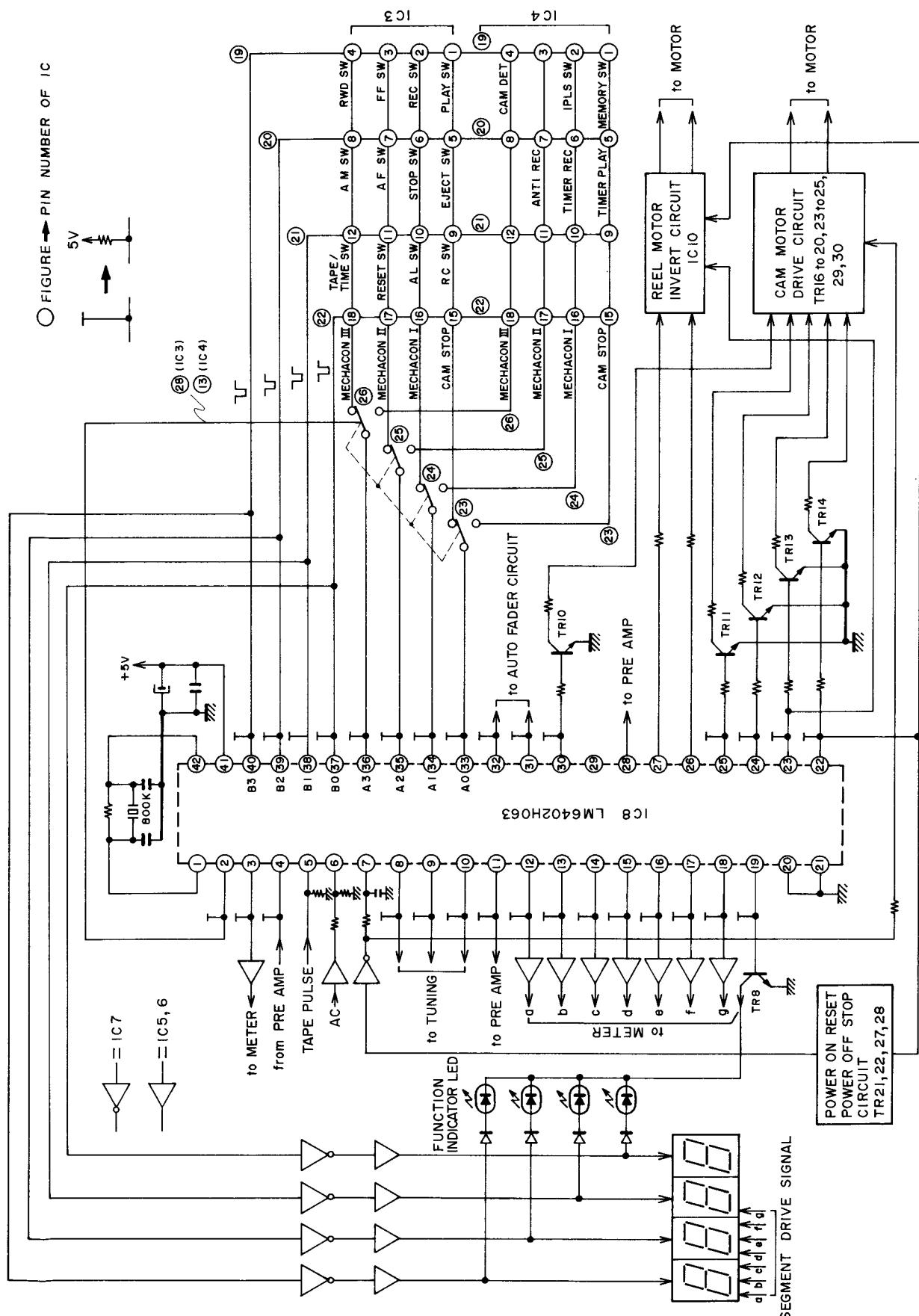
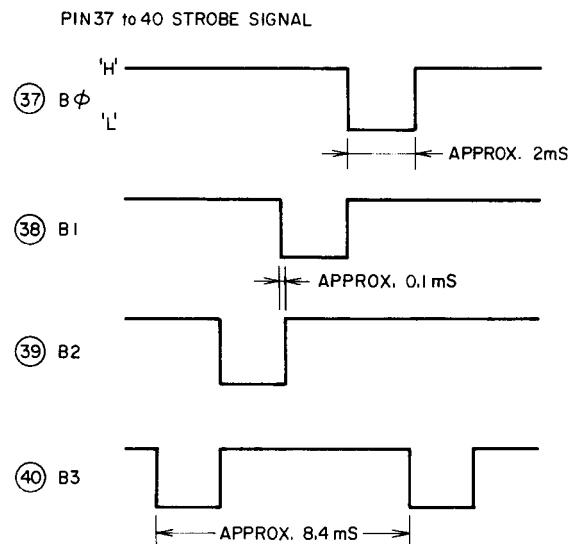
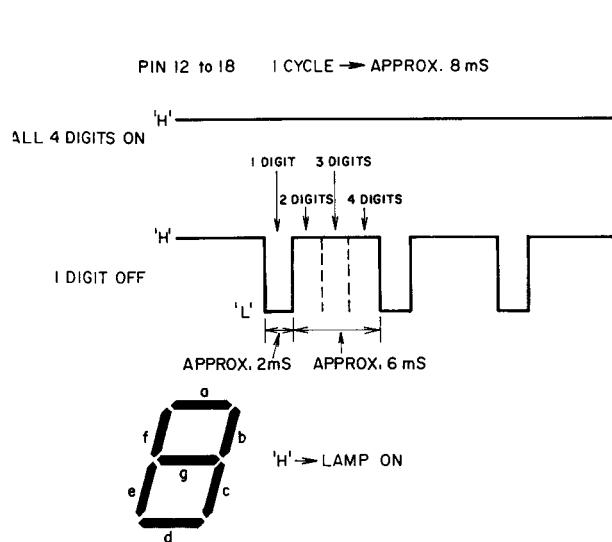
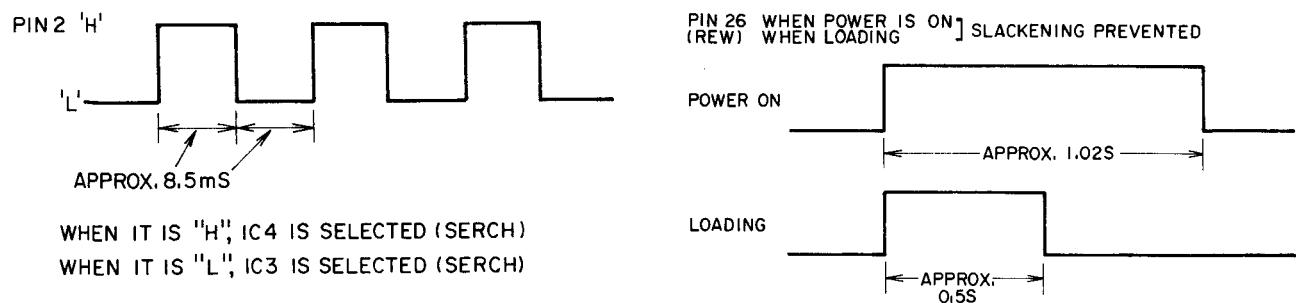


Fig. 2 Syscon Block Diagram

## 2. MEANING EACH TERMINAL OF CPU (LM6402 H063)

PIN NO.	SYMBOL	MEANING
1	XTAL	Input of crystal oscillator
2*	C0	Input port selection strobe
3	C1	Colon, MIN/SEC is lit, turned on when level is "H".
4	C2	Between musics signal input. "H" while between musics.
5	C3	Tape pulse input
6	INT	Terminal for interruption. Power supply frequency input.
7	RES	Reset terminal. When power is on, reset when it is "L".
8	D0	Mecha stop terminal. Stops when it is "L".
9	D1	BIAS OSC control terminal. Stop when it is "H".
10	D2	REC MUTE terminal. MUTE when it is "H".
11	D3	PB MUTE terminal. MUTE when it is "H".
12*	E0	Segment LED Drive a
13*	E1	Segment LED Drive b
14*	E2	Segment LED Drive c
15*	E3	Segment LED Drive d
16*	F0	Segment LED Drive e
17*	F1	Segment LED Drive f
18*	F2	Segment LED Drive g
19	F3	Strobe signal for driving function indication LED. Synchronized LED is lit. Refer to B0 ~ B3.
20	GND	Connect to ground
21	GND	Connect to ground
22	G0	Cam motor drive terminal. When played → "H"
23	G1	Cam motor drive terminal. When stopped → "H"
24	G2	Cam motor drive terminal. When searching → "H" (when CUE)
25	G3	Cam motor drive terminal. When FAST → "H" (when FF, REW)
26*	H0	REEL M. reverse turn terminal. When REW → "H". Prevents tape slackening.
27	H1	REEL M. normal turn terminal. When FF, PLAY → "H".
28	H2	When PLAY → "H". When REC → "L".
29	H3	No connection
30	I0	Cam motor drive terminal. When EJECT → "H".
31	I1	AUTO FADE IN. → "L" active
32	I2	AUTO FADE OUT. → "L" active
33*	A0	Data input
34*	A1	
35*	A2	
36*	A3	
37*	B0	REC LED Drive
38*	B1	PLAY LED Drive
39*	B2	REW LED Drive
40*	B3	FF LED Drive
41	VCC	+5V
42	EXTAL	Input of crystal oscillator

\* Please refer to Fig. of this terminals.



Syscon IC8 Pin ⑬ ~ ⑯ data input waveform

IC 3 ⑬ IC 8 ⑯ OTHERS → +5V

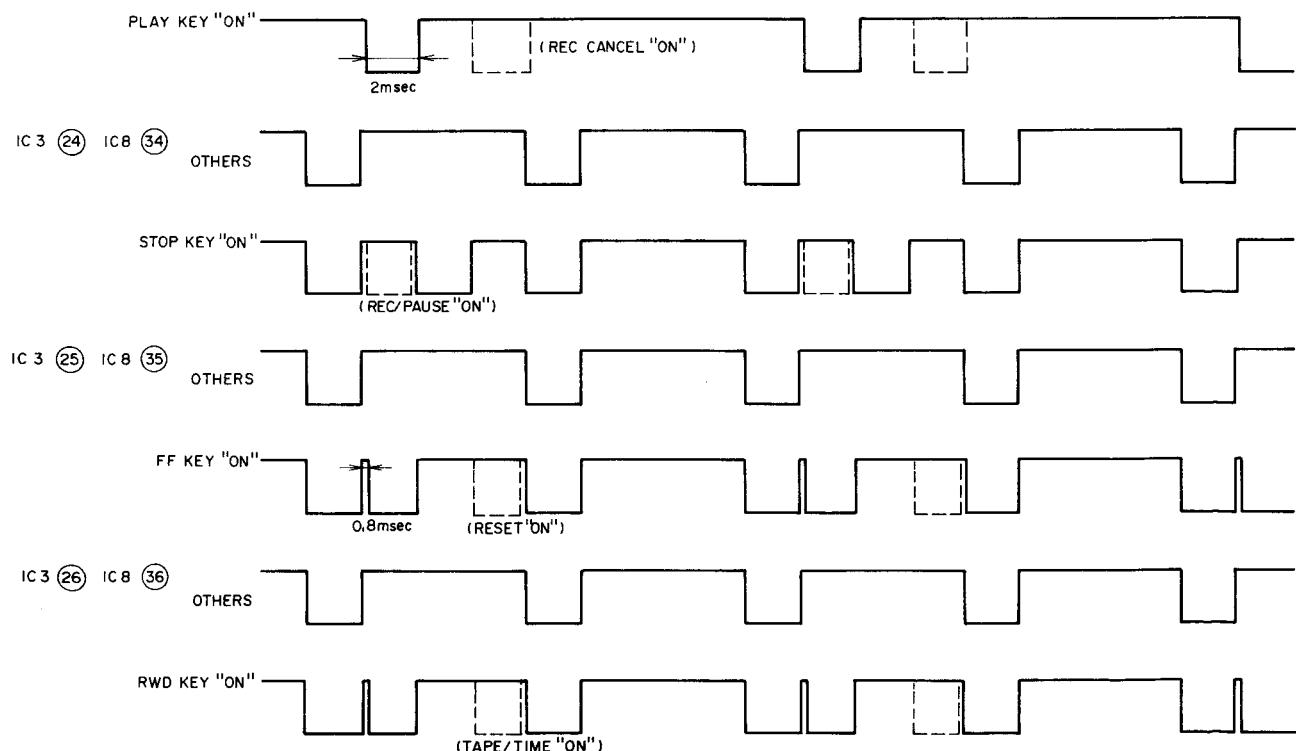


Fig. 3

**3. CONNECTION OF EACH TERMINAL OF IC (LC 7800)  
FOR EXPANDING GX-F71 INPUT PORT**

PIN	Items connected to IC3	Items connected to IC4						
1	PLAY SW	MEMORY SW						
2	REC SW	IPLS SW						
3	FF SW	OPEN ("H") (No connection)						
4	REW SW	R104 of cam motor drive circuit						
5	EJECT SW	TIMER PLAY SW						
6	STOP SW	TIMER REC SW						
7	AUTO FADER SW	ANTIREC SW						
8	AUTO MUTE SW	+5V (No connection)						
9	REC CANCEL SW	+5V (No connection)						
10	AUTO LOADING SW	+5V (No connection)						
11	RESET SW	+5V (No connection)						
12	TAPE/TIME SW	+5V (No connection)						
13	GND	MICON PIN2						
14	GND	GND						
15		C-stop signal of cam motor drive circuit						
16		TUNING MICON PIN 35 (For Mechacontrol)						
17		TUNING MICON PIN 36 (Signal)						
18		TUNING MICON PIN 3 (When TUNING)						
Mechacontrol signal from TUNING MICON								
TUNING MICON PIN	SYS CON MICON PIN	NON OPER- ATION	STOP	FF	REW	REC/ PLAY	REC/ PAUSE	TEST OFF
35 ( $O_0$ ) MECHA CON I	34 (A1)	L	H	L	H	L	H	L
36 ( $O_1$ ) MECHA CON II	35 (A2)	L	L	H	H	L	L	L
3 ( $O_2$ ) MECHA CON III	36 (A3)	L	L	L	L	H	H	L
19								
20								
21								
22								
23								
24								
25								
26								
27	+5V					+5V		
28	MICON PIN 2					+5V		

### III. DESCRIPTION OF GX-F51 CIRCUIT

#### 1. OUTLINE OF GX-F51

##### AUTO TUNING SYSTEM

When the test switch is set to STOP position, the microprocessor sets the mode to FF for 64 counts, the leader tape is avoided and REC mode is set.

While changing the bias by variation of 3 bits 8 steps, the standard input of 1 kHz/10 kHz is recorded in one step. When 8 steps are completed, the tape is rewound and the point where the level of 1 kHz is equal to that of 10 kHz is picked up as a bias setting point. If there is no equal point, the same process is repeated and a point with minimum difference between 1 kHz and 10 kHz is picked up as the setting point. The variable range is  $\pm 20\%$ .

Next 1 kHz signal is record at 8 different levels

(8 steps). Then the tape is played back and the recording sensitivity level is set at the level equal to the reference input level (-20VU). If there is no level equal to the reference input level, recording & playback will be carried out again and the recording sensitivity level will be set at the level closest to the reference input level. The variable range is -3 dB to +4 dB. By changing the bias, frequency characteristics 1 kHz/10 kHz can be adjusted and by setting REC/PB levels, the fluctuation of frequency characteristics can be absorbed when, for instance, using Dolby-C type, etc. The contents of tuning is not changed unless REF is depressed or the tuning is repeated again.

GX-F51 should set nearest to REF without indication of errors.

#### 2. GX-F51 AUTO TUNING BLOCK DIAGRAM

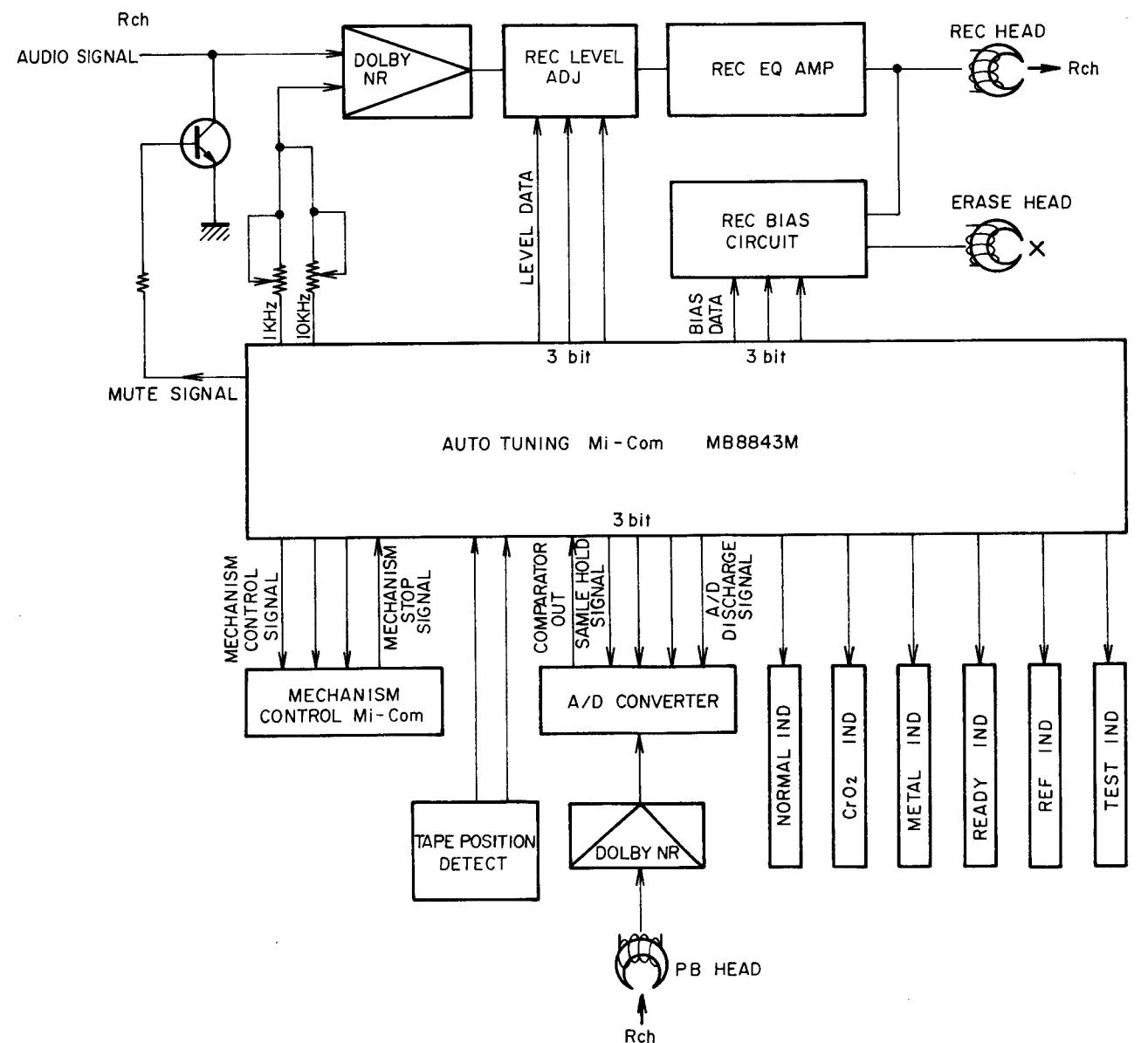


Fig. 4

### 3. GX-F51 AUTO TUNING FUNCTION DIAGRAM

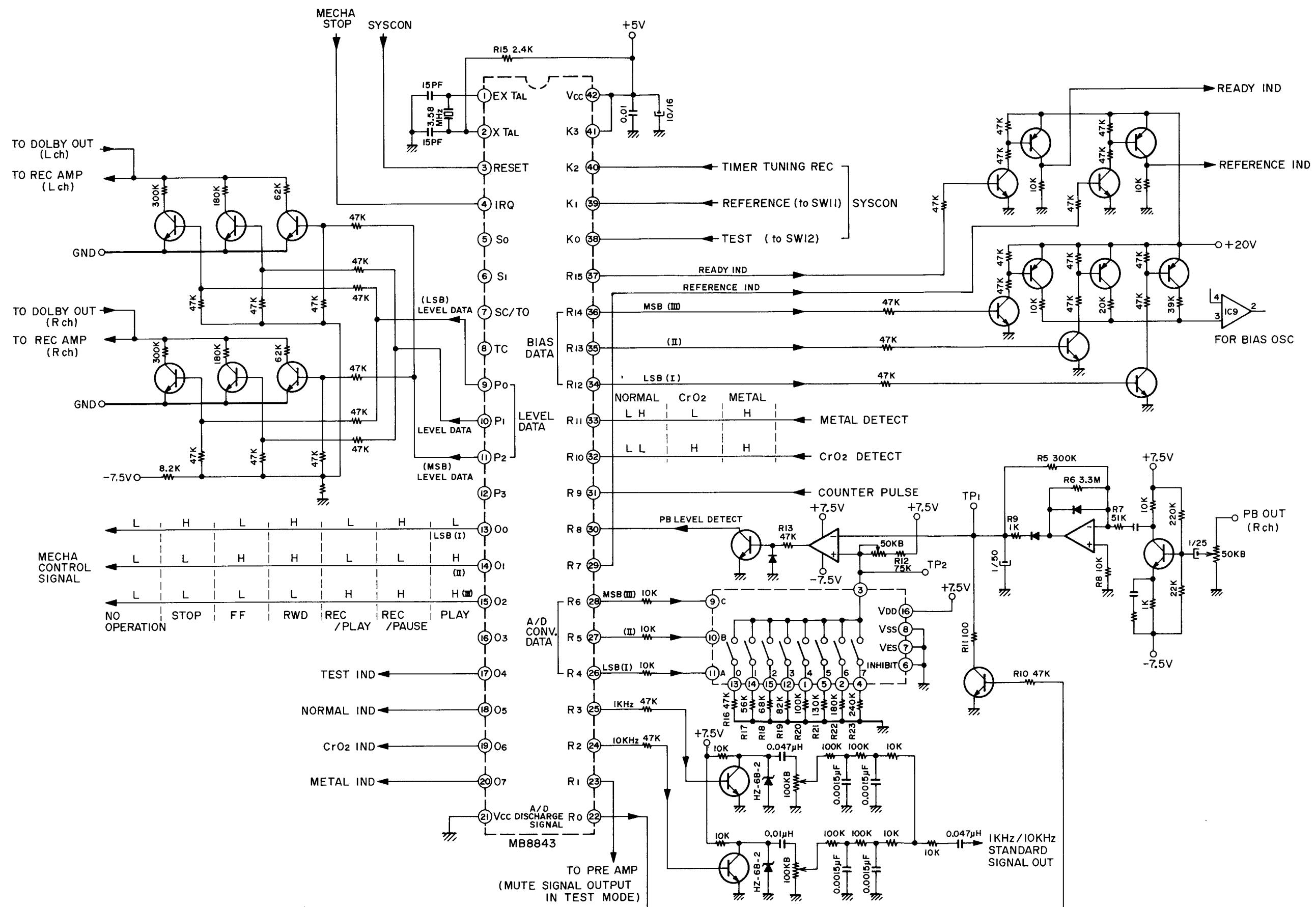
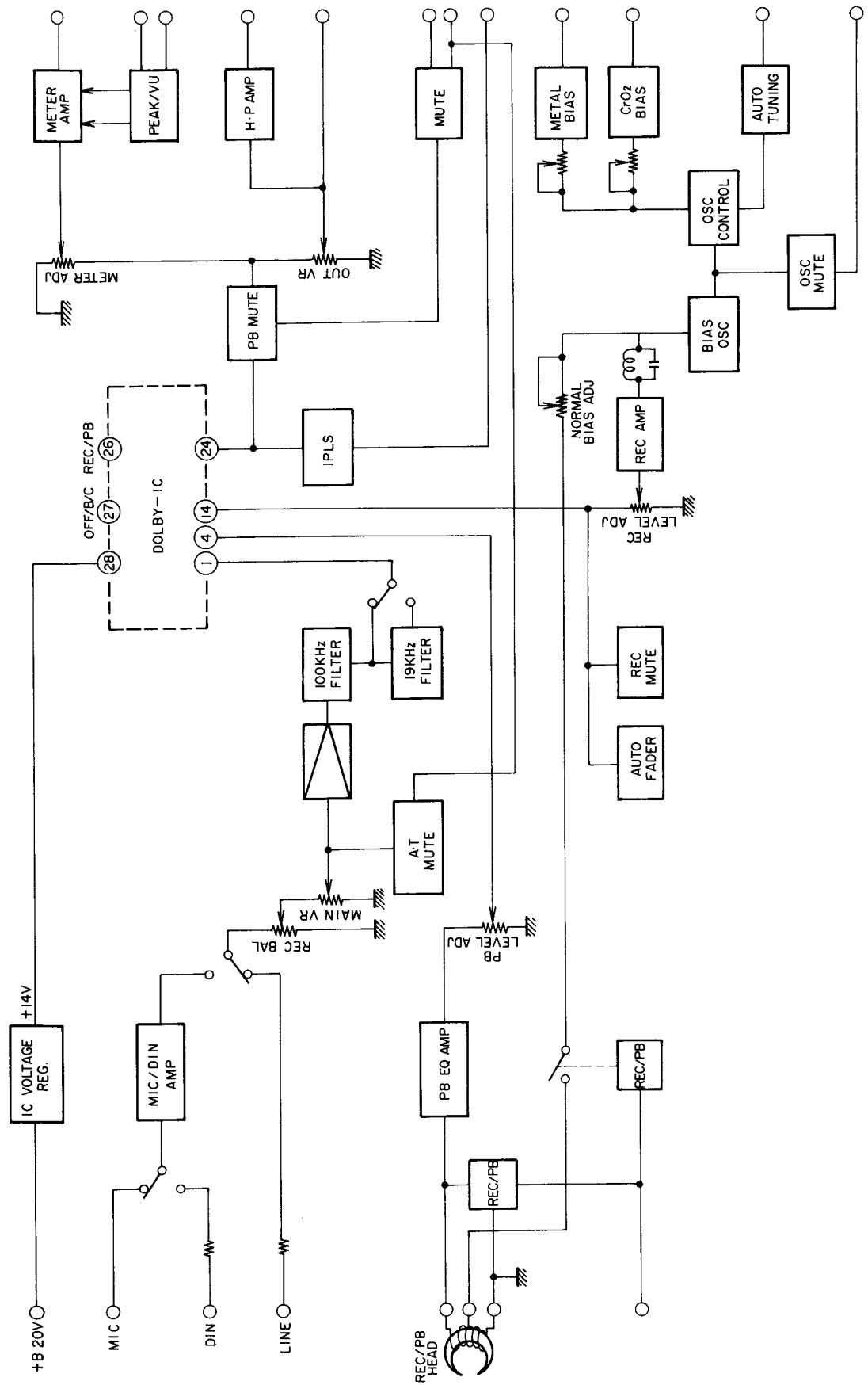


Fig. 5

#### 4. GX-F51 PRE AMP BLOCK DIAGRAM



Features; Circuit of REC-PB is switched in DOLBY IC.  
Switching of DOLBY-OFF, DOLBY-B, DOLBY-C are made in DOLBY IC.

Fig. 6

## IV. AUTO FADER CIRCUIT

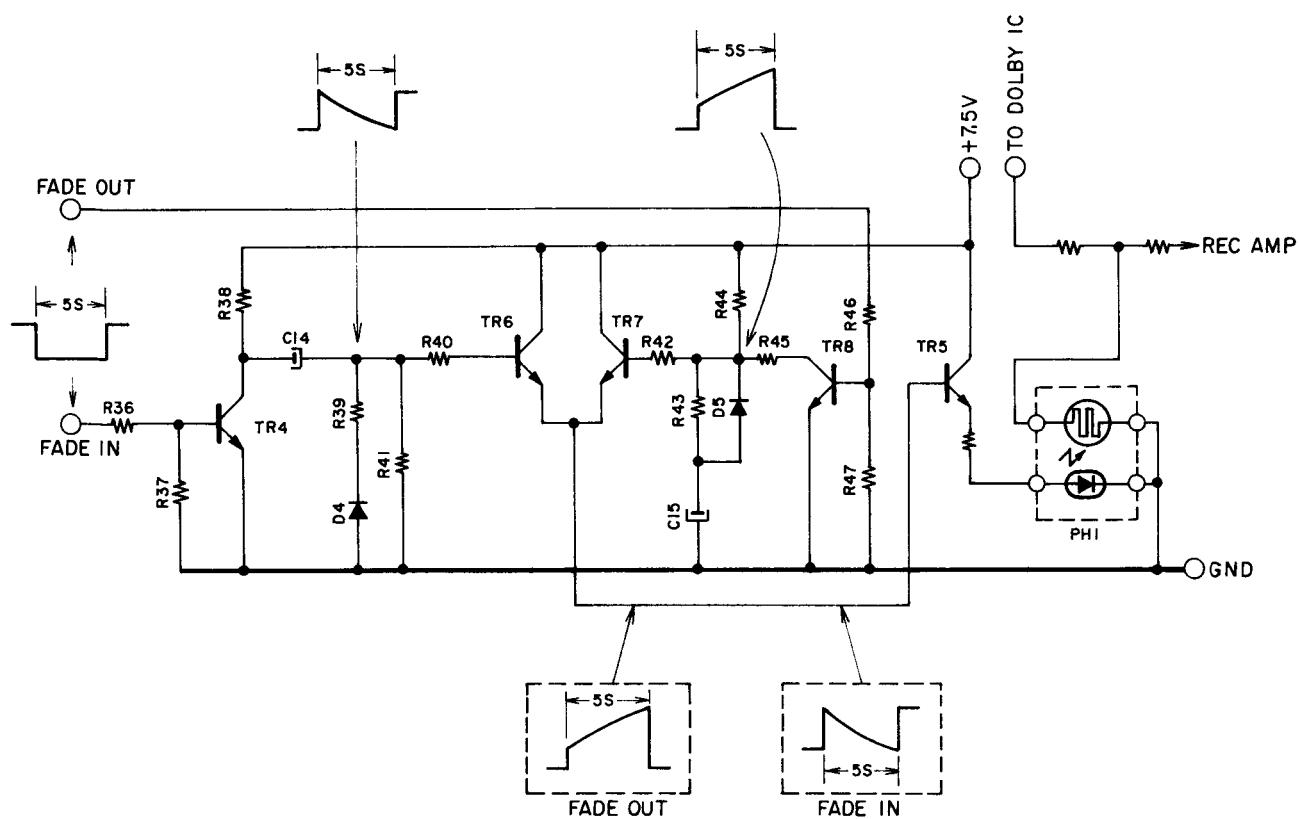


Fig. 7

Functions (Symbol numbers of GX-F71 are used to explain, but the function of GX-F51 is same as the function of GX-F71).

1. FADE IN; When AUTO FADER is depressed in REC PAUSE mode, the FADE IN terminal becomes "L" level for about 5 seconds. Then, TR4 is turned off and TR4's collector becomes "H" level and, therefore, an excessive current flows through C14. This excessive current is discharged at R41, 68K. By using this discharge curve, the current flowing through photo sensor (MCD7213P) is reduced gradually.

- Photo sensor; The internal resistance is changed by the current which flows through the diode in the sensor. The more current flows, the less resistance becomes and the less current flows, the more resistance becomes.

2. FADE OUT; When AUTO FADER is depressed in REC mode, the FADE OUT terminal becomes "L" level for about 5 sec. Then, since TR8 is turned off, C15 is electrically charged through R44 and R43. By using the charging curve, the current flowing through the photo sensor is increased gradually.

## V. CAM MOTOR DRIVE CIRCUIT

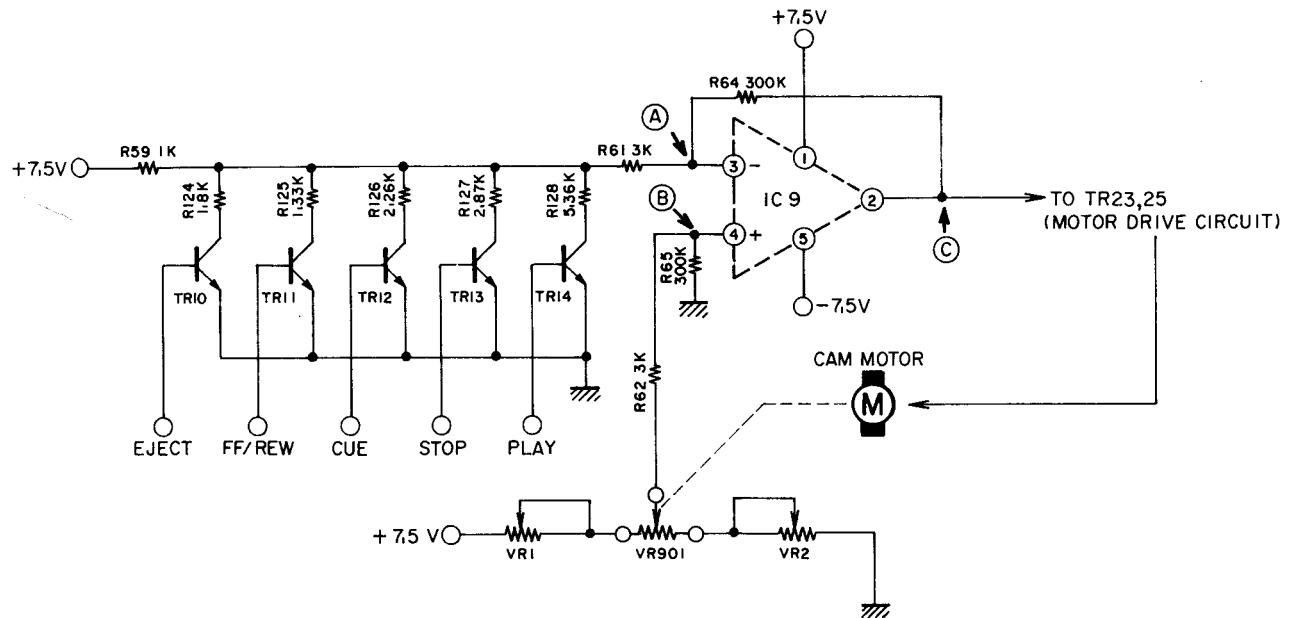


Fig. 8 Motor Revolution Indication Circuit

The cam motor is used for the operation of mechanism. It determines the position of the head base in each mode; power eject mode and auto loading mode. (Plunger used to be employed for this operation.) Circuit functions (Symbol numbers of GX-F71 are used for the explanation, but the functions are same as those of GX-F31/F51).

TR10~TR14 are turned on by the signal from IC8 (MICOM) in each mode.

By the difference in the value of resistances of R124 ~ R128, the voltage at point A is determined in each mode and this voltage is used as the standard voltage of OP Amp (IC9).

At IC9, the voltage at point A is compared with that at point B and when A > B, point C becomes "L" (-7V) and when A < B, point C becomes "H" (+7V) and when A = B, point C becomes "0" (Approx. -3V ~ +3V).

Supposing that point C is "H" (+7V).

TR23 "ON" → TR24 "OFF" → TR30 "OFF" → TR19 "OFF" and the collector of TR19 becomes "H"

while at the same time, TR25 "ON" → TR29 "OFF" → TR20 "ON" and the collector of TR20 becomes "L". Therefore, the motor turns.

Since the cam motor and VR901 are interlock each other, the voltage at point B is changed as the motor turns. The motor stops when the voltage at point A becomes equal to the voltage at point B, that is, when the voltage at point C becomes "0".

While point C is "L" (-7V), the on/off of TR is reverse direction.

TR31 and 32 are provided for shorting both ends of motor and applying brakes when the voltage at point C is "0".

When point C is "H" or "L", "H" is applied to IC7 ⑨ and IC7 ⑩ becomes "L" and then TR33 "OFF" → TR31 and 32 "OFF" and, therefore, both ends of motor are not shorted. When point C is "0", IC7 ⑨ is "L" and IC7 ⑩ "H" → TR33 "ON" → TR31 and 32 "ON" and, consequently, both ends of motor are shorted and brake is applied.

## VI. REEL MOTOR DRIVE CIRCUIT

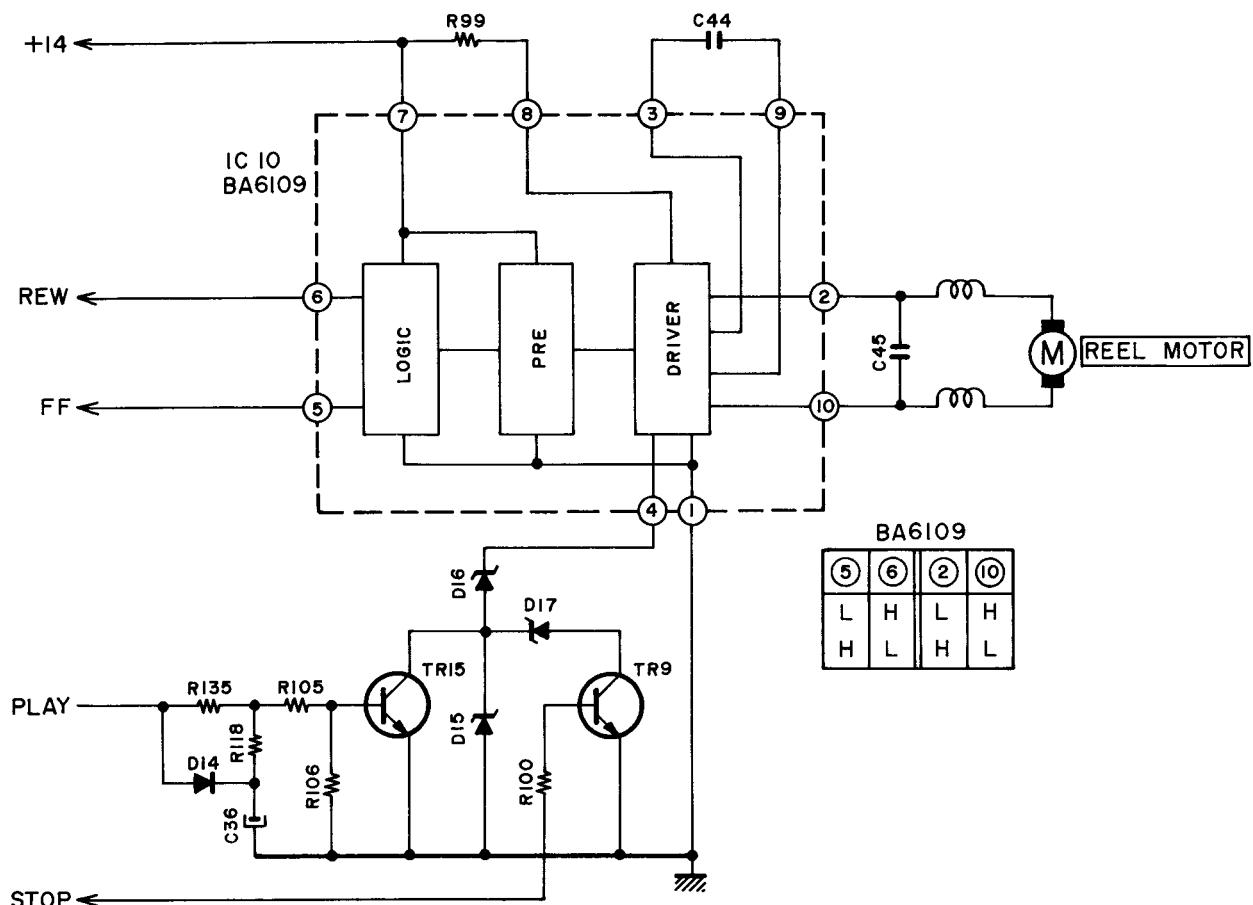


Fig. 9 GX-F71 Reel Motor Drive Circuit

### Functions

IC10 ⑥ is "H" in REW mode and then ⑩ : H and ② : L and the motor turns in the reverse direction.

IC10 ⑤ is "H" in FF mode and the ② : "H" and ⑩ : "L" and the motor turns in the normal direction.

In the PLAY mode, IC10 ⑤ becomes "H" and the motor turns, but voltage ④ changes to voltage (5V) D16 as TR15 is turned on and voltage ② is reduced to 5V, thus determining the take up tension.

With GX-F51, F31, FF input is ⑥ and REW input is ⑤.

Only the outputs of ② and ⑩ are reversed and the function remains unchanged.



## SECTION 2

# SERVICE MANUAL

**MODEL GX-F31**

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For basic adjustments, measuring methods, and operating principles, refer to GENERAL TECHNICAL MANUAL.

# I. SPECIFICATIONS

TRACK SYSTEM	4 Track 2 Channel Stereo System
TAPE	Philips Type Cassette
TAPE SPEED	4.76 cm/s ± 1.0% (1-7/8 ips. ± 1.0%)
HEADS	Twin Field Super GX head for recording/playback × 1 Erase head × 1
MOTORS	FG servo D.C. motor for direct capstan drive × 1 D.C. motor for reel drive × 1
WOW & FLUTTER	0.10% WTD (DIN) 0.035% WRMS
TAPE WINDING TIME	90 sec. using a C-60 cassette tape
FREQUENCY RESPONSE	Normal: 20 to 17,000 Hz ±3 dB CrO <sub>2</sub> : 20 to 18,000 Hz ±3 dB Metal: 20 to 19,000 Hz ±3 dB
FREQUENCY RANGE	Normal: 15 to 18,000 Hz CoO <sub>2</sub> : 15 to 20,000 Hz Metal: 15 to 21,000 Hz
SIGNAL TO NOISE RATIO	Metal: 60 dB (measured via tape with peak recording level) Dolby B-type NR switch ON: Improves up to 5 dB at 1 kHz, 10 dB above 5 kHz Dolby C-type NR switch ON: Improves up to 15 dB at 500 Hz, 20 dB at 1 kHz to 10 kHz
HARMONIC DISTORTION	1 kHz, 3rd harmonic distortion Metal: 0.8%
INPUT	MIC: 0.25 mV (600 ohms) Line: 70 mV (47 kohms)
OUTPUT	Line: 410 mV (less than 2 kohms) Phone: 1.3 mW (8 ohms)
DIN	Input: 2.0 mV (10 kohms) Output: 410 mV
POWER REQUIREMENTS	100V, 50/60 Hz for Japan 120V, 60 Hz for USA and Canada 220V, 50 Hz for Europe except UK 240V, 50 Hz for UK and Australia 110V/120V/220V/240V, 50/60 Hz switchable for other countries.
POWER CONSUMPTION	U, C, A Models 22W J Model 20W
DIMENSIONS	440(W) × 100(H) × 345(D) mm (17.3 × 3.9 × 13.6")
WEIGHT	5.8 kg (12.8 lbs)

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

\* "Dolby" and the Double D symbol are trademarks of Dolby Laboratories.

(Manufactured under license from Dolby Laboratories).

## II. CONTROLS

GX-F31

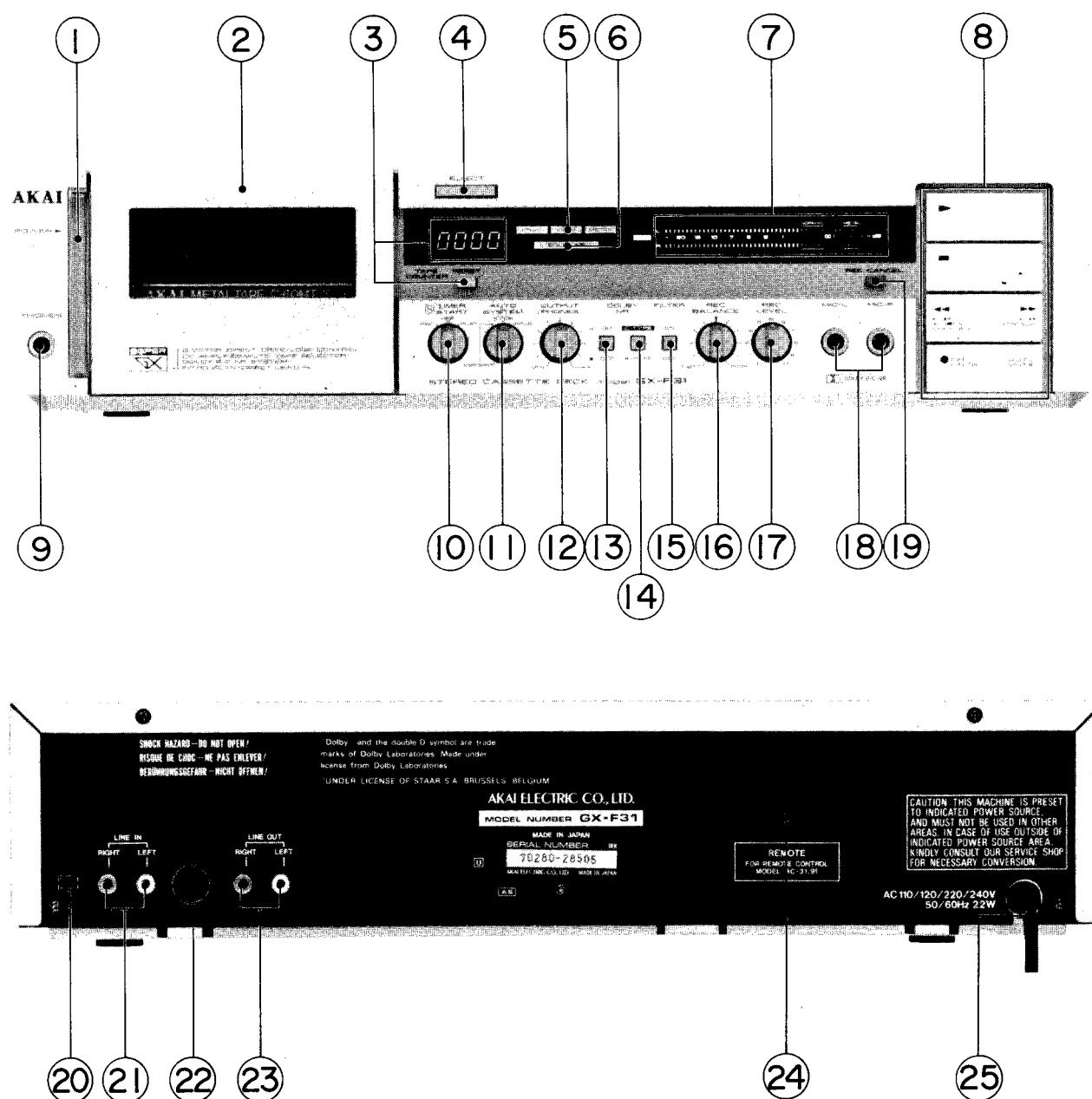


Fig. 1 Controls

1. POWER SWITCH
2. CASSETTE RECEPTACLE
3. FLD TAPE COUNTER and RESET BUTTON
4. EJECT BUTTON
5. TAPE POSITION INDICATOR
6. DOLBY NR INDICATOR
7. FLD BAR METER with MAXIMUM INPUT LEVEL INDICATORS
8. OPERATING BUTTONS  
PLAY (▶) BUTTON with INDICATOR  
STOP (■) BUTTON  
REWIND (◀) BUTTON  
FAST FORWARD (▶▶) BUTTON  
RECORDING (REC)/PAUSE BUTTON with INDICATOR  
AUTO MUTE BUTTON
9. HEADPHONE (PHONES) JACK
10. TIMER START SELECTOR
11. AUTO SYSTEM SELECTOR
12. OUTPUT/HEADPHONE (PHONES) CONTROL
13. DOLBY NR SWITCH
14. DOLBY NR SELECTOR
15. MPX FILTER SWITCH
16. RECORDING (REC) BALANCE CONTROL (LEFT and RIGHT)
17. RECORDING (REC) LEVEL CONTROL
18. MICROPHONE JACKS (MIC-L: left, MIC-R: right)
19. RECORDING (REC) CANCEL BUTTON
20. LINE/DIN SELECTOR  
(Some models do not have this facility.)
21. LINE IN JACKS
22. DIN JACK  
(Some models are not equipped with this facility.)
23. LINE OUT JACKS
24. REMOTE JACK
25. POWER CORD

### III. PRINCIPAL PARTS LOCATION

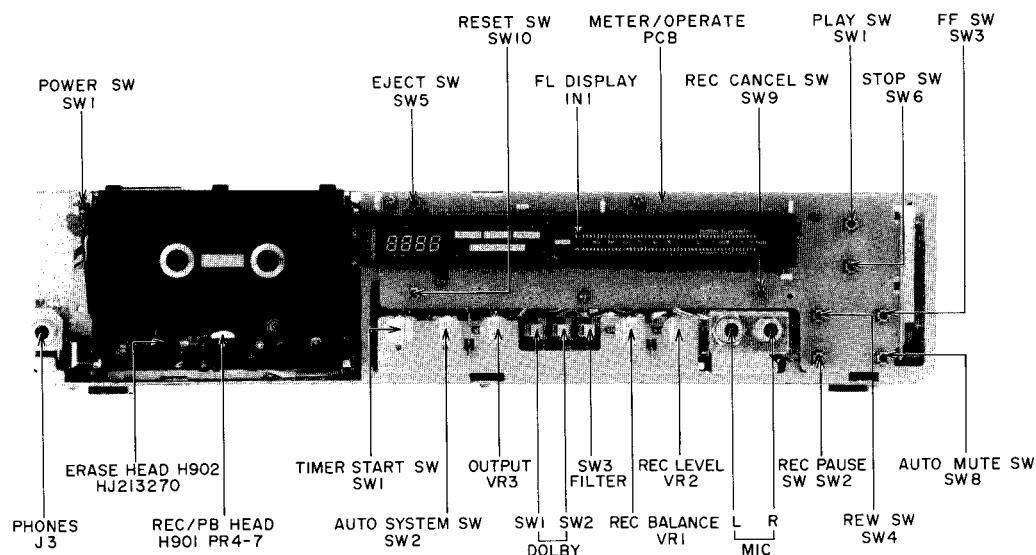


Fig. 2 Front View

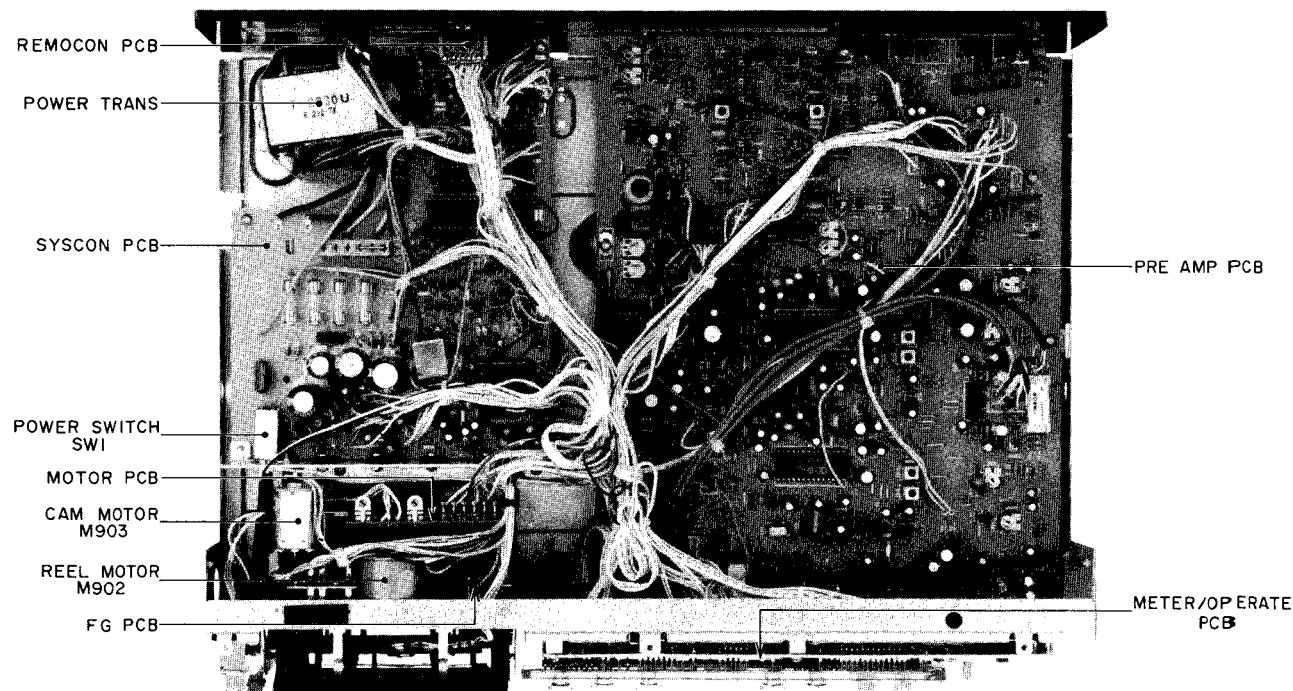


Fig. 3 Top View

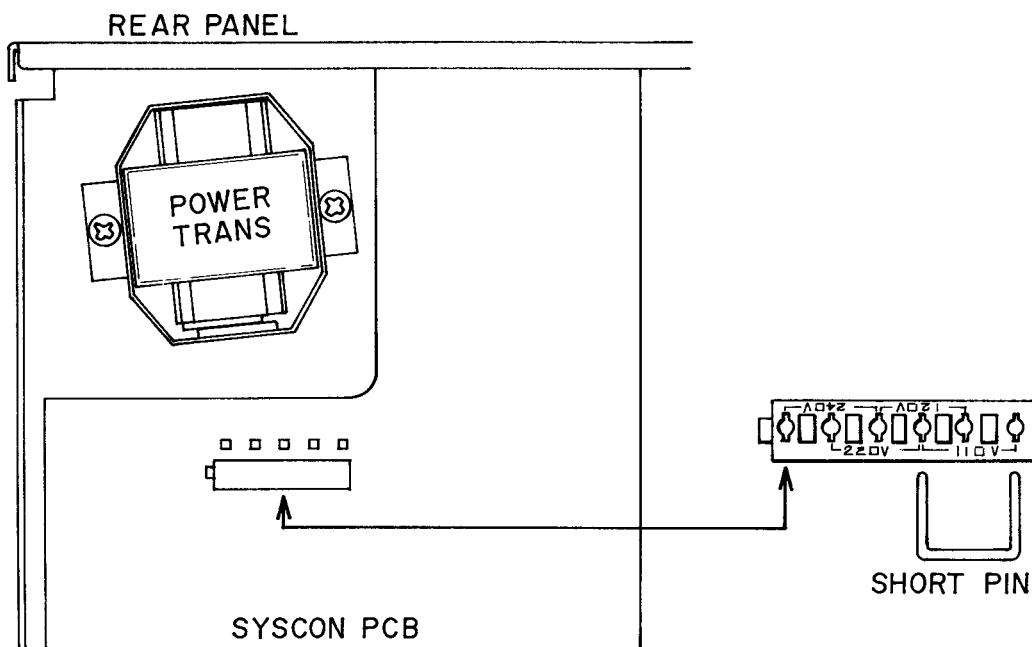


Fig. 4 Voltage Conversion (U Model only)

### 1. VOLTAGE CONVERSION

Models for Canada, Europe, USA, UK and Australia are not equipped with this facility.

Each machine is preset at the factory according to destination, but some machines can be set to 110V, 120V, 220V or 240V as required.

If voltage change is necessary, this can be accomplished as follows:

- 1) Disconnect power cord.
- 2) Loosen holding screws and remove upper cover.
- 3) Remove short pin plug from present holes and replace in correct holes. Follow the markings explicitly.

### 2. CYCLE CONVERSION

With DC motor, cycle conversion is not necessary.

## V. MECHANICAL ADJUSTMENT

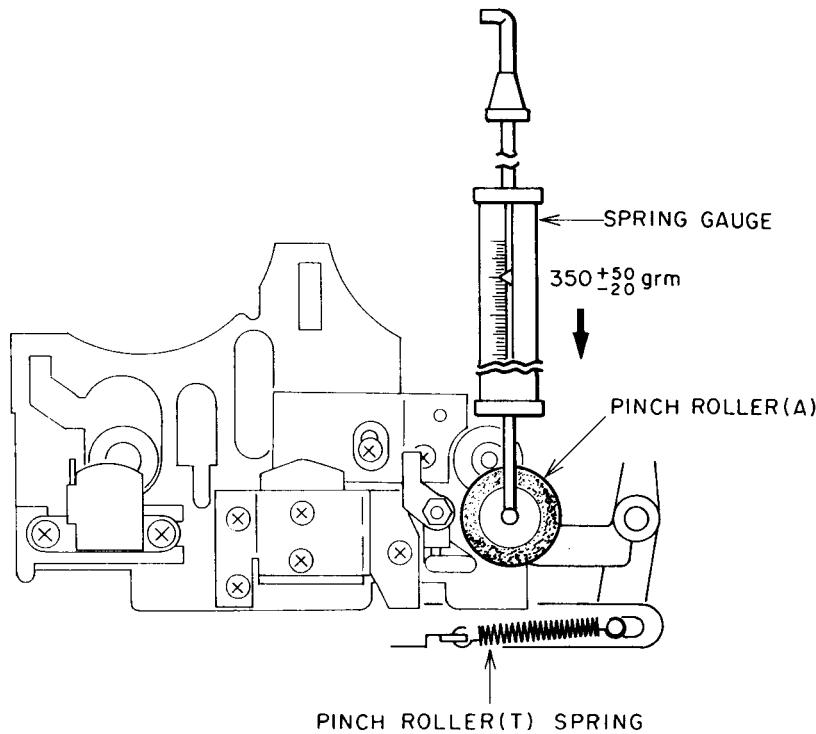


Fig. 5

### 1. PINCH ROLLER PRESSURE MEASUREMENT (Refer to Fig. 5)

Put in PLAY mode. Push pinch roller arm down with the spring gauge push the pinch roller 1 ~ 2 mm from the capstan and release slowly. Read the spring gauge at the moment the pinch roller touches the capstan and begins to rotate.

Specified pressure:  $350 \pm 20$  grm. If there is no measurement obtained, replace the pinch roller spring.

### 2. TAPE SPEED ADJUSTMENT

Play Back a 1,000 Hz (TF-102CS) Pre-Recorded test tape, and Adjust tape Speed Adjustment Volume (VR1 50K) to obtain a tape speed of 1,000 Hz  $\pm 1.0\%$ .

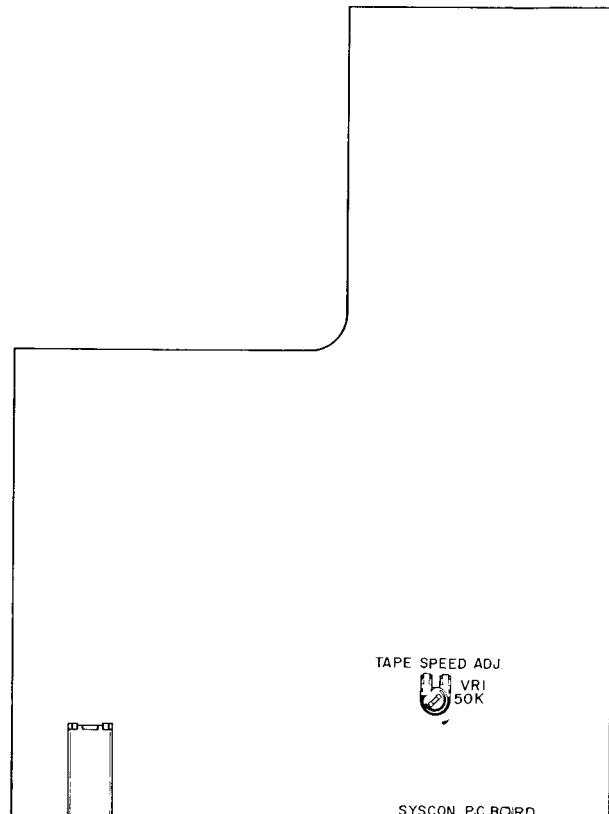


Fig. 6 Syscon P.C Board Adjustment Point

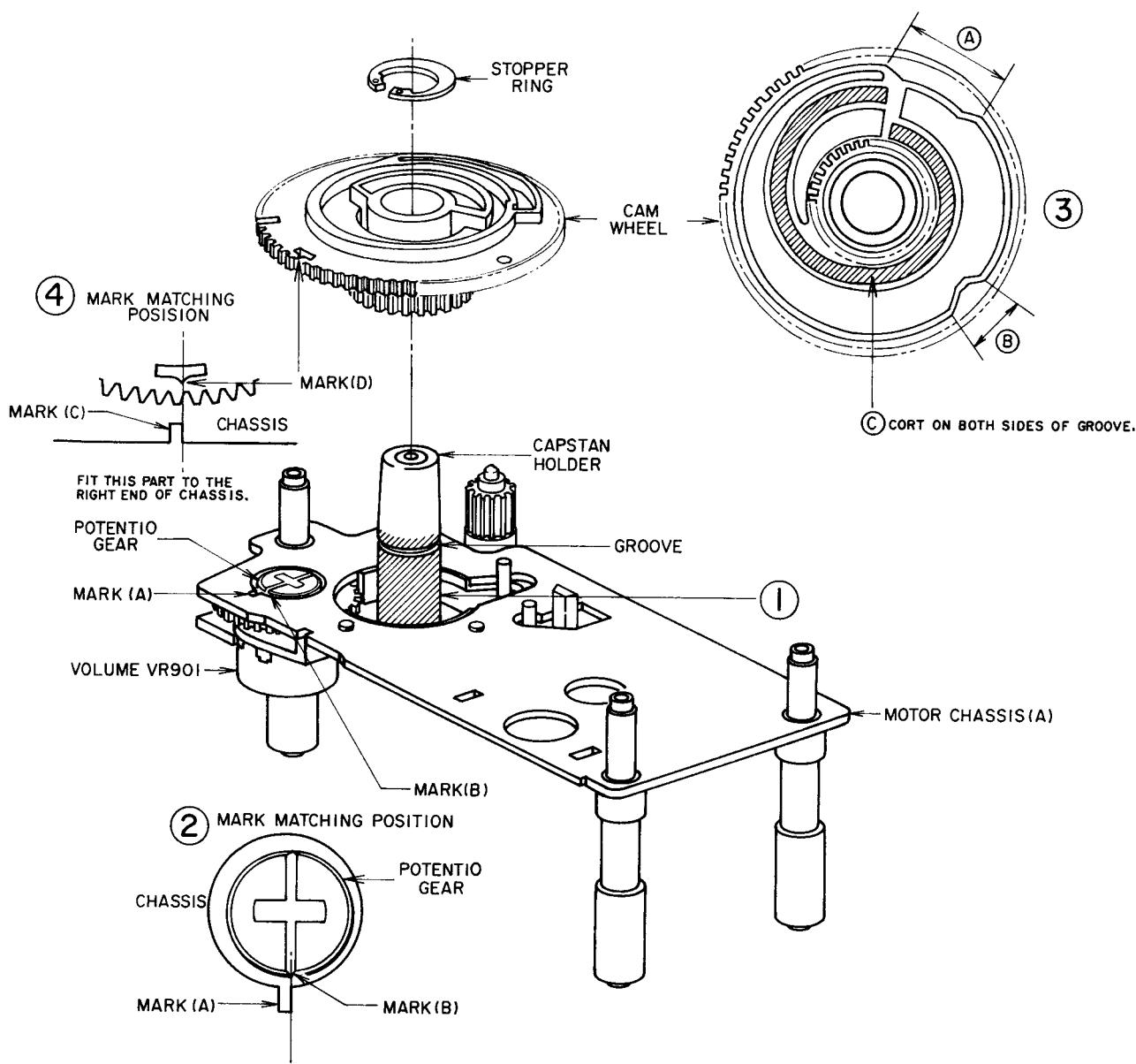


Fig. 7

### 3. HOW TO INSTALL VOLUME (VR901) AND CAM WHEEL

- 1) Apply Molybdenum coat on the capstan holder  
Apply Molybdenum coat on the area of  $360^\circ$  from the bottom to the upside 2 mm of groove as shown in the figure. (Fig. 7-①)
- 2) Fitting position volume (potentio gear)  
Fit the right end of Mark (A) to the center of Mark (B) as shown in the figure. (Fig. 7-②)
- 3) Apply Molybdenum coat on ④, ⑤ and ⑥ shown in Fig. 7-③.
- 4) Set the cam wheel on the capstan wheel  
(Ensure that the cam wheel and potentio gear are

meshed properly). When the cam wheel is set properly, fit the center of Mark (D) to the right end of Mark (C). (Fig. 7-④)

- 5) Fit the stopper ring in the groove of the capstan holder.

#### CAUTIONS:

1. Make sure that the teeth on the periphery of cam wheel and the cam are absolutely free from any scratch, flaw, cut, etc.
2. Make sure that Molybdenum coat is applied on the specified area only.

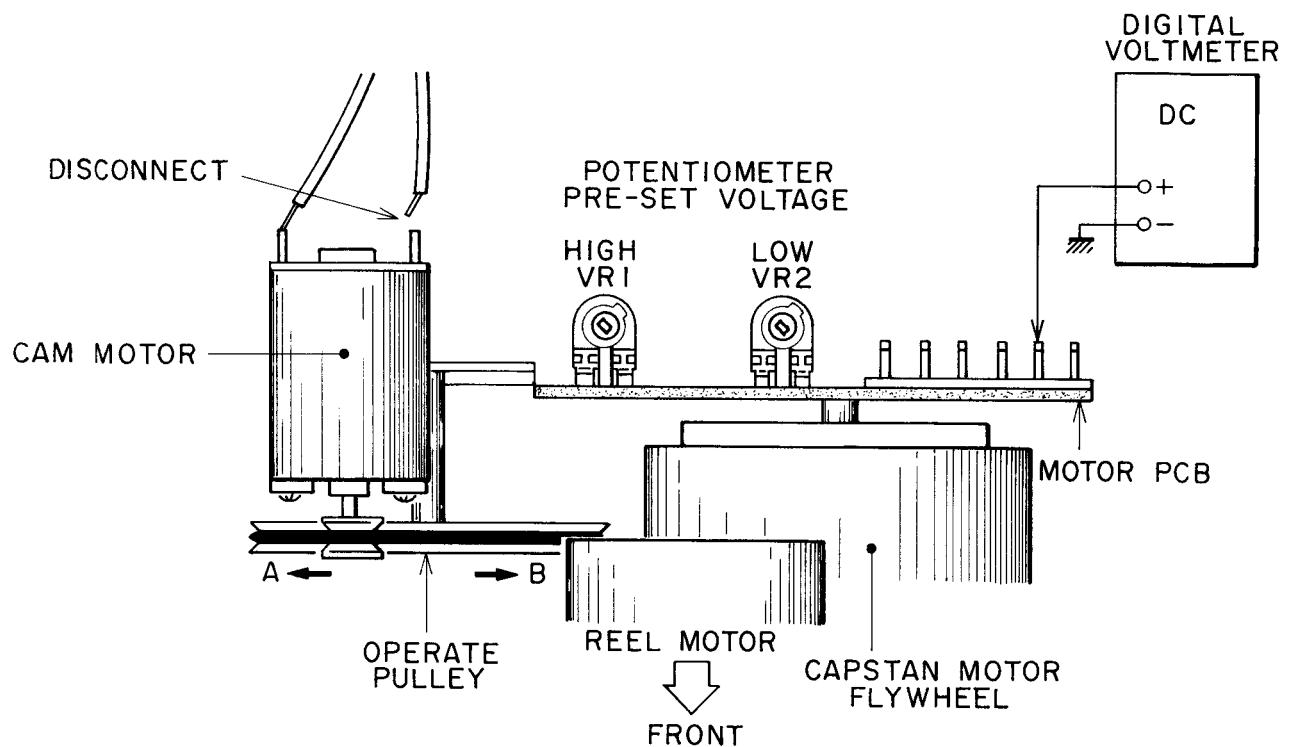


Fig. 8-1

#### 4. POTENTIOMETER PRESET VOLTAGE ADJUSTMENT

##### 1) LOW VOLTAGE ADJUSTMENT

- With power OFF, remove the connecting cord of the cam motor and turn the operate pulley fully with your fingers in A direction.
- Connect the digital voltmeter as shown in Fig. 8-1.
- With power ON, adjust VR2 so that the voltage reading will be 0.78V (DC).

##### 2) HIGH VOLTAGE ADJUSTMENT

- With power OFF, turn the operate pulley fully with your fingers in B direction.
- With power ON, adjust VR1 so that the voltage reading will be 6.73V (DC).

##### 3) Repeat Items 1) and 2).

- With Power OFF, connect the connecting cord of the motor.
- Remove the digital voltmeter.

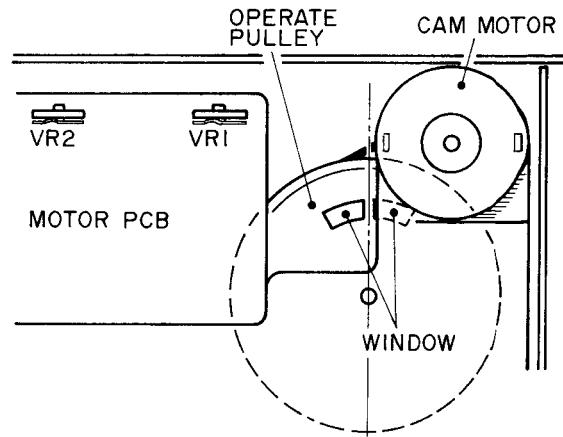


Fig. 8-2 Position of Operate Pulley in STOP Mode

- Set power to ON.

- Adjust VR1 slightly so that a center line between windows of the operate pulley will face directly above during STOP Mode. (Fig. 8-2)
- Remove the cassette lid and set the AUTO SYSTEM switch to IPLS Mode.
- Confirm that the head and pinch roller do not move up and down when the FF and REW switches are alternately depressed.
- Turn the reel with fingers in STOP Mode to check that the brake works sufficiently. When the brake acts normally, the take-up reel does not turn clockwise while the supply reel does not rotate counterclockwise.

## VI. HEAD ADJUSTMENT

GX-F31

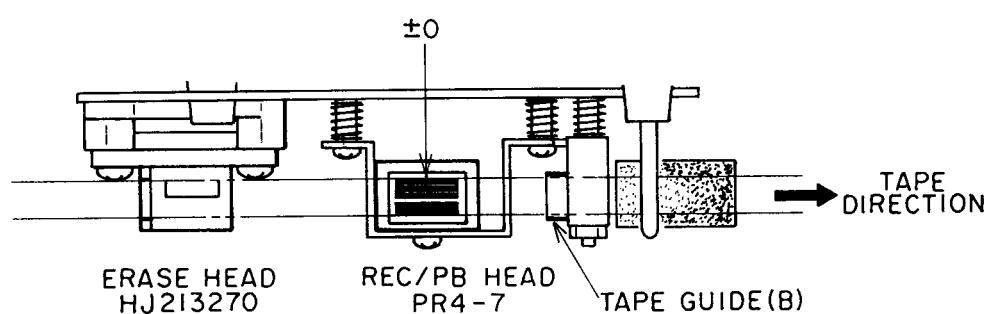
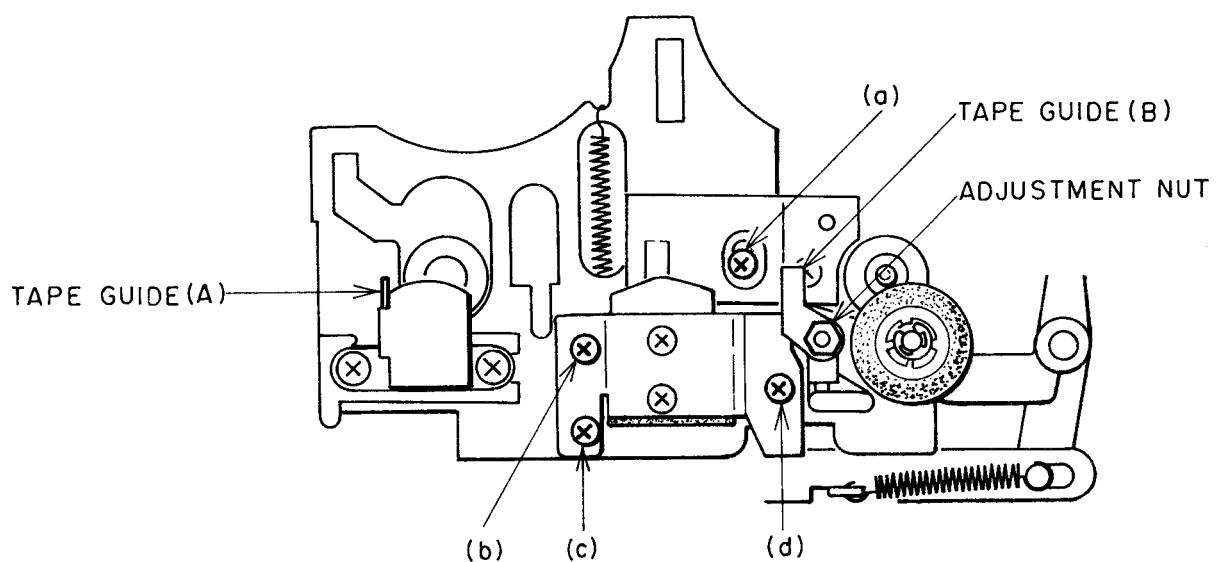


Fig. 9

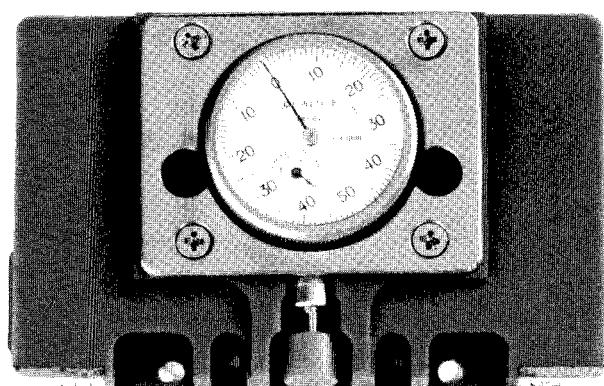


Fig. 10 Cassette Head Projection Gauge (TF-111CJ)



Fig. 11 Mirror Cassette Tape (TF-109CM)

---

## **1. REC/PB HEAD PROJECTION**

### **ADJUSTMENT**

Set the cassette head projection gauge (TF-111CJ) and set to PLAY mode. Loosen the screw (a) and adjust so that the gauge indication at that time will be  $3.2 \pm 0.05$  mm. After adjustment, apply paintlock on the screw (a).

## **2. TAPE GUIDE HEIGHT ADJUSTMENT**

- 1) Set the mirror cassette tape (TF-109CM) and set to PLAY mode.
- 2) Using the tape guide (A) as reference height, adjust the tape guide (B) so that the tape runs smoothly and is not hitched by the tape guide. For the adjustment, use the adjustment nut. After adjustment, apply paintlock on the adjustment nut.

## **3. REC/PB HEAD HEIGHT ADJUSTMENT**

- 1) Set the mirror cassette tape and set to PLAY mode.
- 2) Adjust screws (b), (c) and (d) so that the upper edge of the REC/PB head L-ch core is in alignment with the upper side of the tape.
- 3) Playback the head height adjustment tape (4Tr 1,000 Hz) (TF-103CF) and fine-adjust the screws (b), (c) and (d) so that the largest output is obtained for both channels.

## **4. REC/PB HEAD AZIMUTH**

### **ALIGNMENT ADJUSTMENT**

- 1) Playback a 10 kHz head azimuth alignment tape (TF-106CH) and adjust the screw (d) until the output level of both channels is maximum.
- 2) After adjustment, better to check again head height and azimuth alignment.
- 3) After adjustment, paintlock the screws (b), (c) and (d).

#### **NOTES:**

1. Be sure to clean the heads prior to head adjustment.
2. Be careful not to use a magnetized driver or other magnetized tools in the vicinity of the heads.
3. Be sure to demagnetize the heads with a Head Demagnetizer before and after head adjustment.

## VII. AMPLIFIER ADJUSTMENT

GX-F31

\* direction increases the level (bias will be shallower)

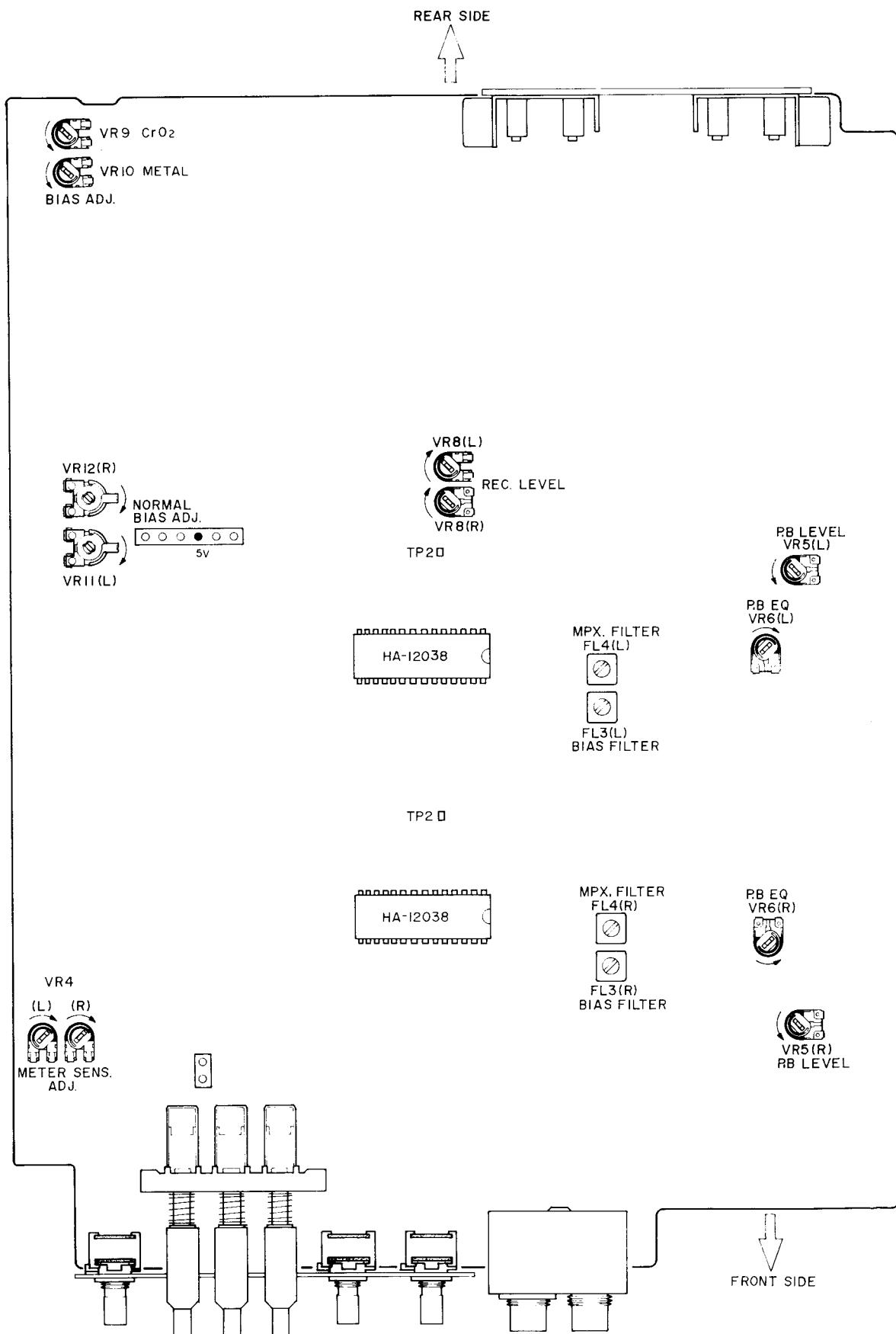


Fig. 12 Pre-Amp P.C Board Adjustment Point

Step	Adjustment Item	Test Tape Supply Signal	Mode	Adjustment Parts	Result	Remarks
1	PB Level	333 Hz (TF-101CL)	PB	VR5	$-5.5 \pm 0.2$ dBm (410 mV)	
2	PB EQ	10 kHz (TF-106CH)	PB	VR6	$-22.5 \pm 1.5$ dBm	
3	Normal Position Frequency Response	Normal Blank Tape 1 kHz, 10 kHz $-22.5$ dBm	REC/PB	VR11	1 kHz to 10 kHz flat response	
4	CrO <sub>2</sub> Position Frequency Response	CrO <sub>2</sub> Blank Tape 1 kHz, 10 kHz $-25.5$ dBm	REC/PB	VR9	1 kHz to 10 kHz flat response	
5	Metal Position Frequency Response	Metal Blank Tape 1 kHz, 10 kHz $-25.5$ dBm	REC/PB	VR10	1 kHz to 10 kHz flat response	
6	REC Level	Normal Blank Tape 1 kHz, $-5.5$ dBm	REC/PB	VR8	$-5.5 \pm 0.3$ dBm (410 mV)	
7	MPX Filter	19 kHz from oscillator	REC	FL4	Minimum Output	MPX Filter ON
8	Bias Filter	No Signal Input	REC	FL3	Minimum Output	Set REC Volume to maximum
9	Meter Sensitivity	1 kHz, $-5.5$ dBm from oscillator	REC	VR4	0 dB Indication	+1VU puts out the light in Line out $-5.2$ dBm

**NOTES:** 1. Except for Step 7 set MPX Filter Switch to OFF Position.

2. Use the following cassette measuring tapes:

Normal Tape : Maxell UD C-60

CrO<sub>2</sub> Tape : TDK SA C-60

Metal Tape : TDK MA-C C-60

#### For your reference:

Confirmation of Dolby level

1) Set to REC/PAUSE.

2) Input a signal of 400 Hz and adjust the input level so that the level of pin ②4 of Dolby I.C (HA-12038) will be 580 mV when Dolby NR is OFF.

3) Check that the level of TP-2 is 580 mV.

## VIII. DC RESISTANCE OF HEADS

GX-F31

Description	Name	DC Resistance
REC/PB Head	PR4-7	650 ohms ± 10%
Erase Head	HJ213270	3.5 ohms

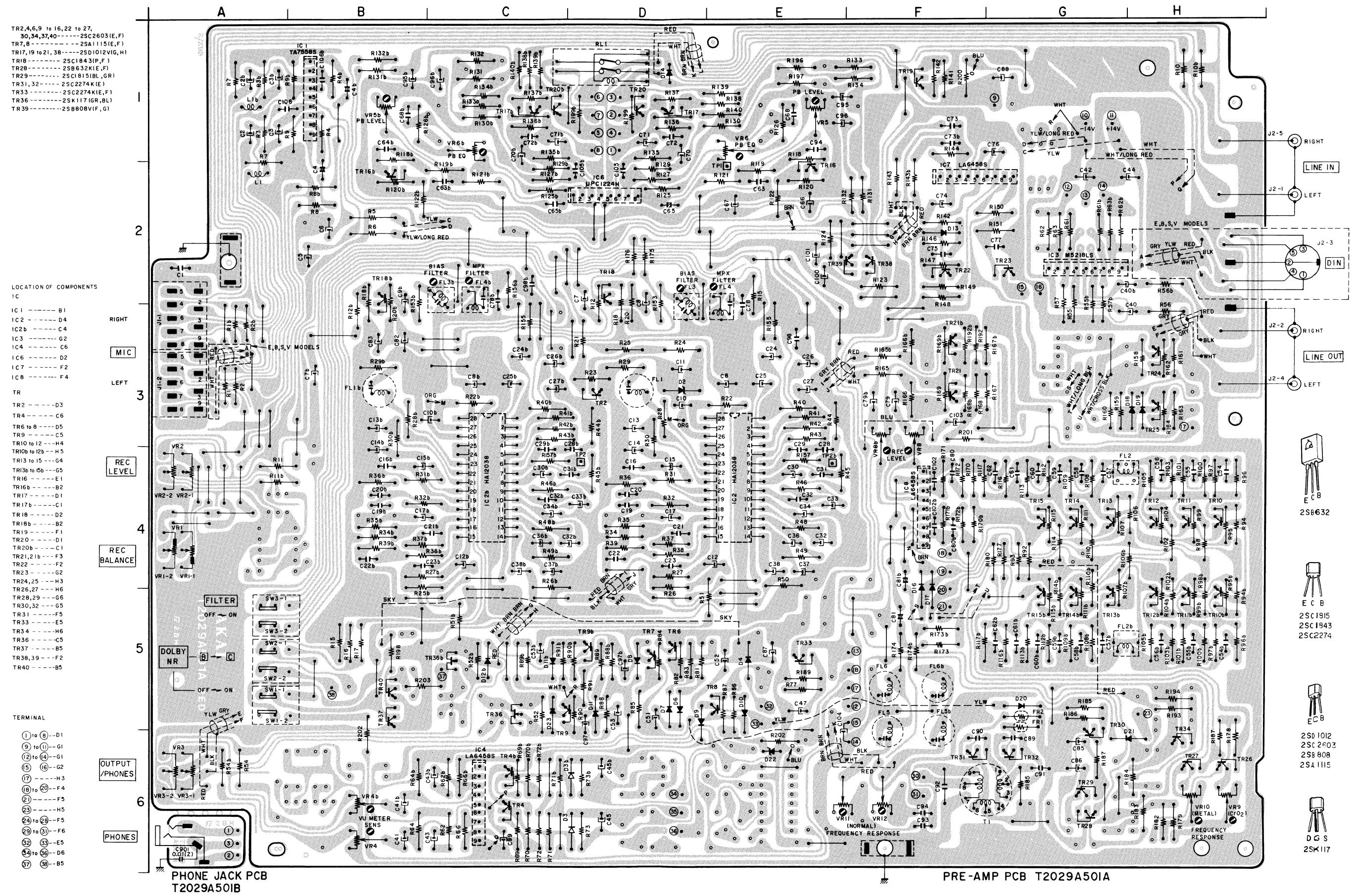
## IX. CLASSIFICATION OF VARIOUS P.C BOARDS

### 1. P.C BOARD TITLES AND IDENTIFICATION NUMBERS

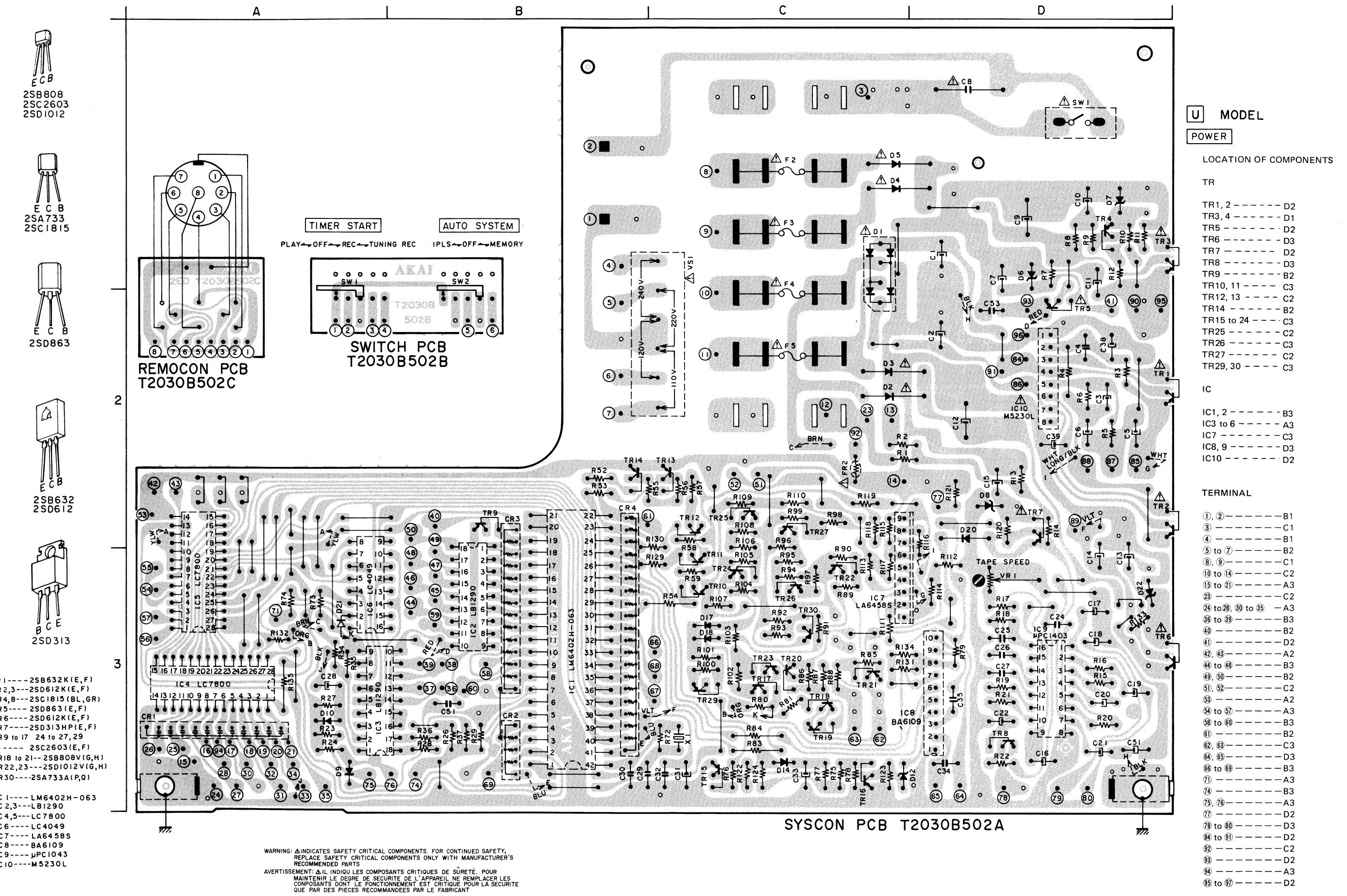
P.C Board Title	P.C Board Number
Pre Amp P.C Board	T2029A501A
Phone Jack P.C Board	T2029A501B
Syscon P.C Board	T2030B 502A
Switch P.C Board	T2030B502B
Remocon P.C Board	T2030B502C
Meter/Operate P.C Board	T2030B5030
Motor P.C Board	M3103C726A
Potention P.C Board	M3103C726B
FG P.C Board	M3103C7130
Filter P.C Board	T2029D5040
Detector P.C Board	T2029D5030
Micro SW P.C Board	T2029D5020

## 2. COMPOSITION OF VARIOUS P.C BOARDS

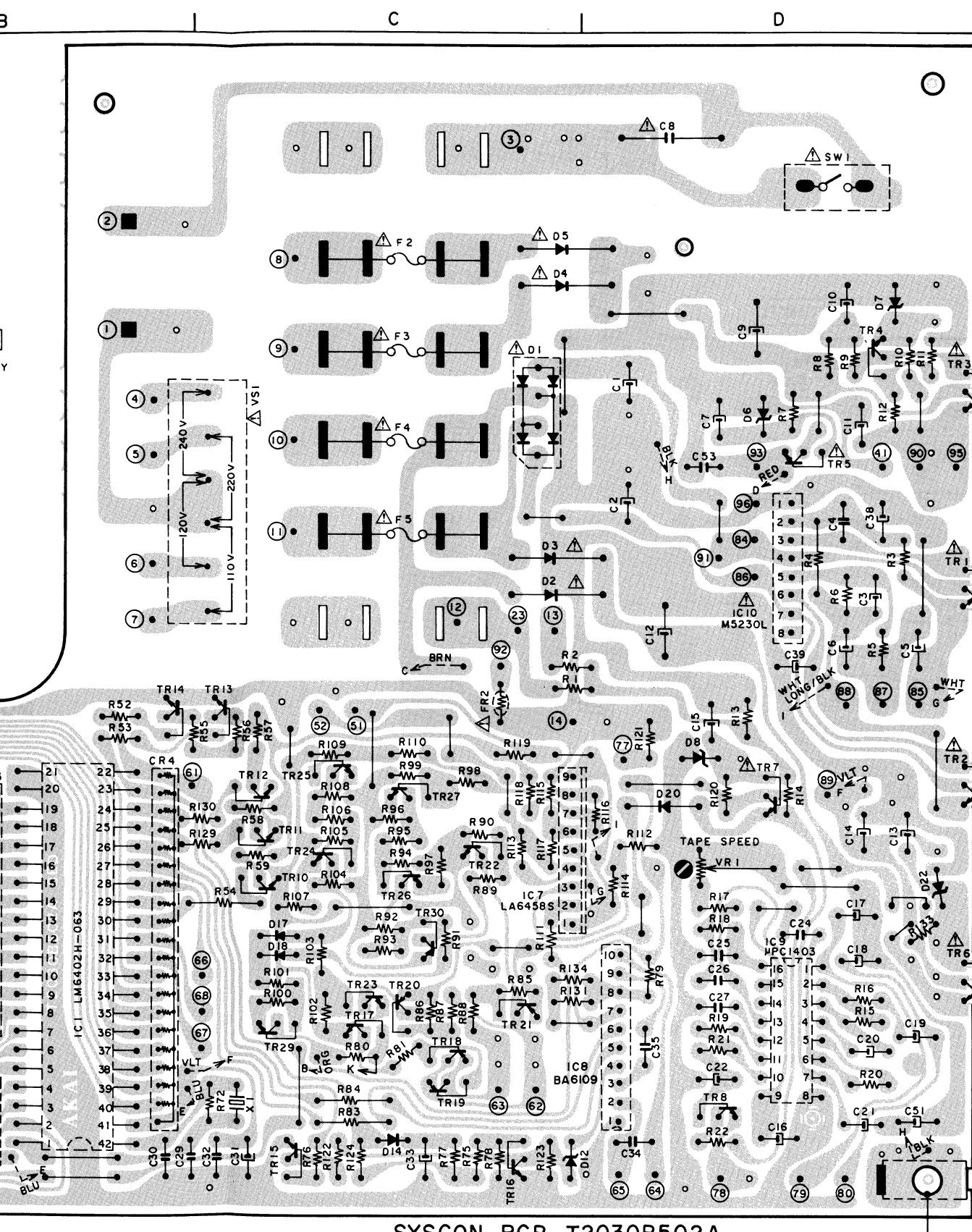
### 1) PRE AMP P.C BOARD T2029A501A (2ED) and PHONE JACK P.C BOARD T2029A501B



2) SYSCON P C BOARD T2030B502A (3ED), SWITCH P.C BOARD T2030B502B and REMOCON P.C BOARD T2030B502C (2ED)



## CON P.C BOARD T2030B502C (2ED)



**U MODEL**  
**POWER**

## LOCATION OF COMPONENTS

## TR

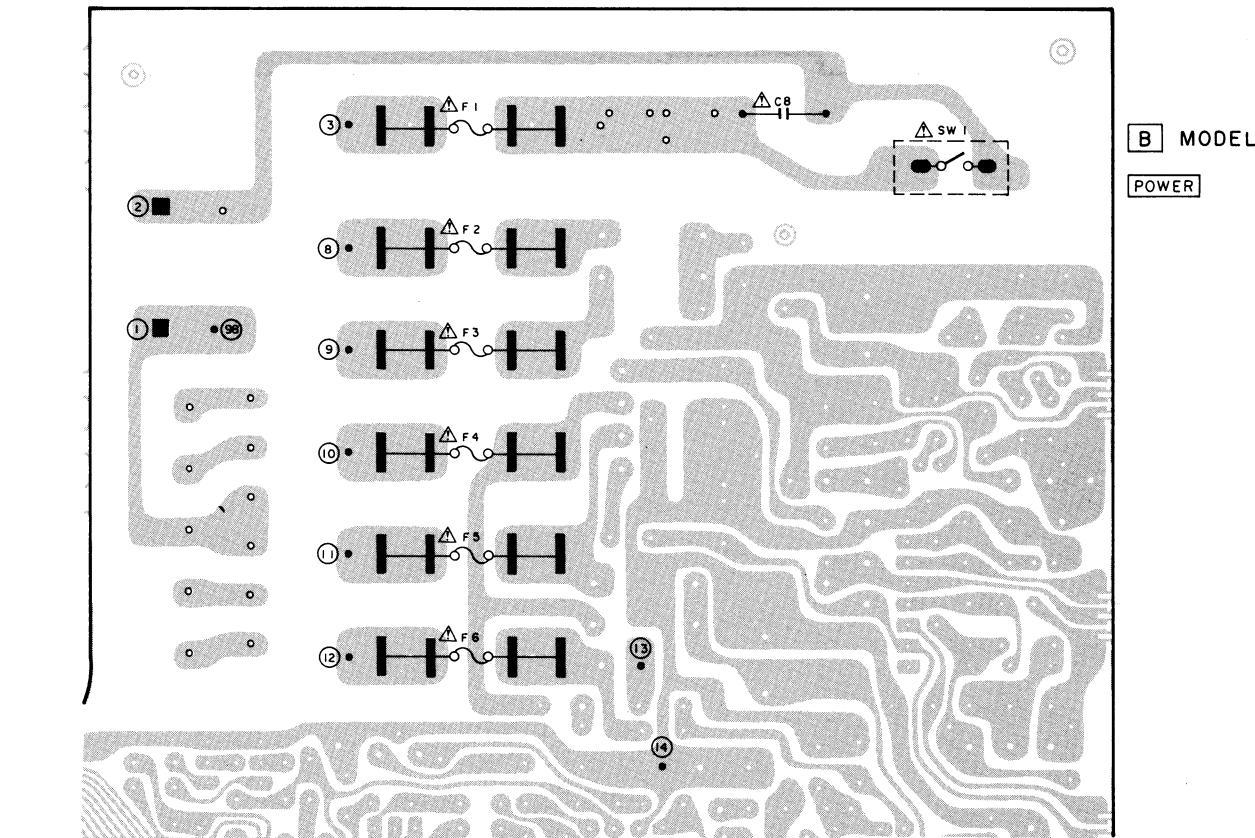
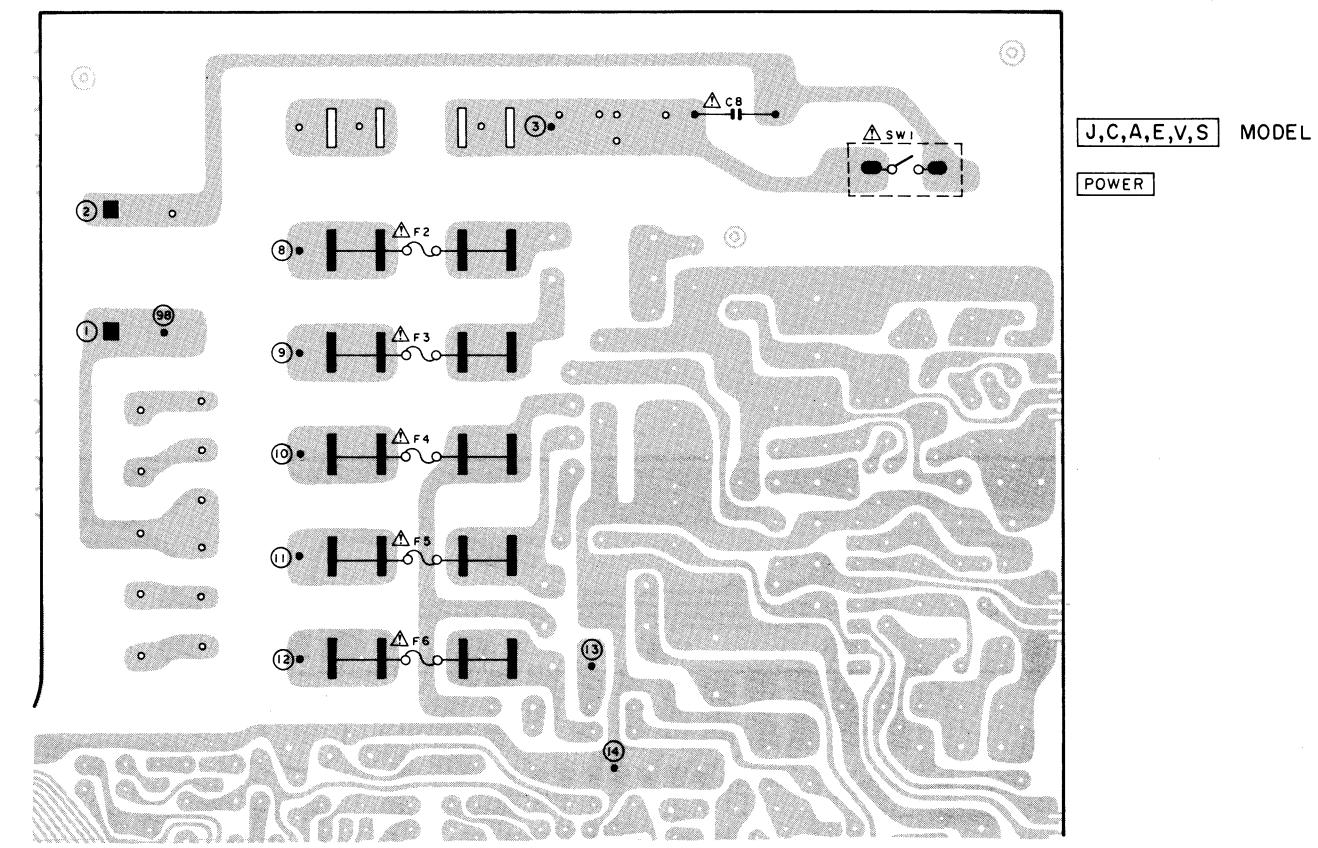
- TR1, 2 ----- D2
- TR3, 4 ----- D1
- TR5 ----- D2
- TR6 ----- D3
- TR7 ----- D2
- TR8 ----- D3
- TR9 ----- B2
- TR10, 11 ----- C3
- TR12, 13 ----- C2
- TR14 ----- B2
- TR15 to 24 ----- C3
- TR25 ----- C2
- TR26 ----- C3
- TR27 ----- C2
- TR29, 30 ----- C3

## IC

- IC1, 2 ----- B3
- IC3 to 6 ----- A3
- IC7 ----- C3
- IC8, 9 ----- D3
- IC10 ----- D2

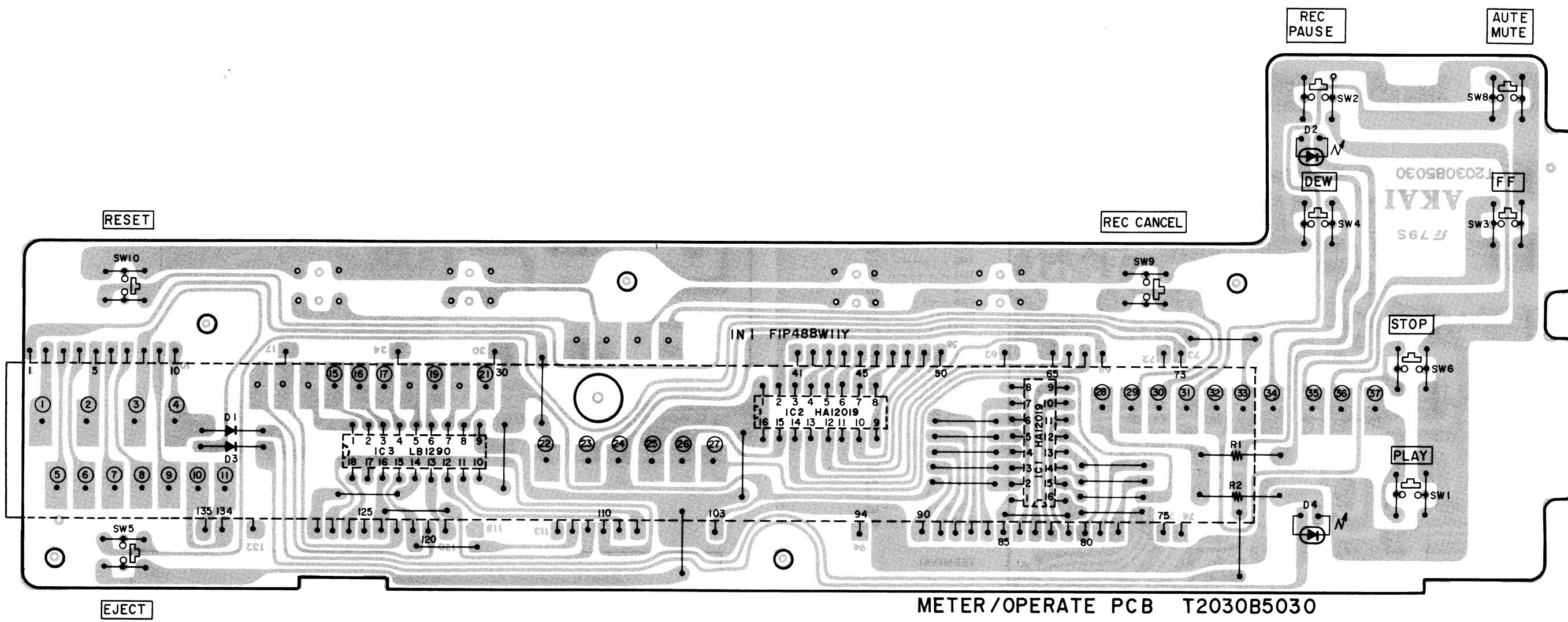
## TERMINAL

- ①, ② ----- B1
- ③ ----- C1
- ④ ----- B1
- ⑤ to ⑦ ----- B2
- ⑧, ⑨ ----- C1
- ⑩ to ⑯ ----- C2
- ⑯ to ⑳ ----- A3
- ㉑ ----- C2
- ㉔ to ㉖, ㉙ to ㉜ ----- A3
- ㉖ to ㉙ ----- B3
- ㉚ ----- B2
- ㉛ ----- D2
- ㉕, ㉖ ----- A2
- ㉗ to ㉘ ----- B3
- ㉙, ㉚ ----- B2
- ㉛, ㉜ ----- C2
- ㉝ to ㉞ ----- A2
- ㉞ to ㉟ ----- A3
- ㉟ to ㉟ ----- B3
- ㉟ ----- B2
- ㉟, ㉟ ----- C3
- ㉟, ㉟ ----- D3
- ㉟ to ㉟ ----- B3
- ㉟ ----- A3
- ㉟ ----- B3
- ㉟, ㉟ ----- A3
- ㉟ ----- D2
- ㉟ to ㉟ ----- D3
- ㉟ to ㉟ ----- D2
- ㉟ ----- C2
- ㉟ ----- D2
- ㉟ ----- A3
- ㉟ to ㉟ ----- D2



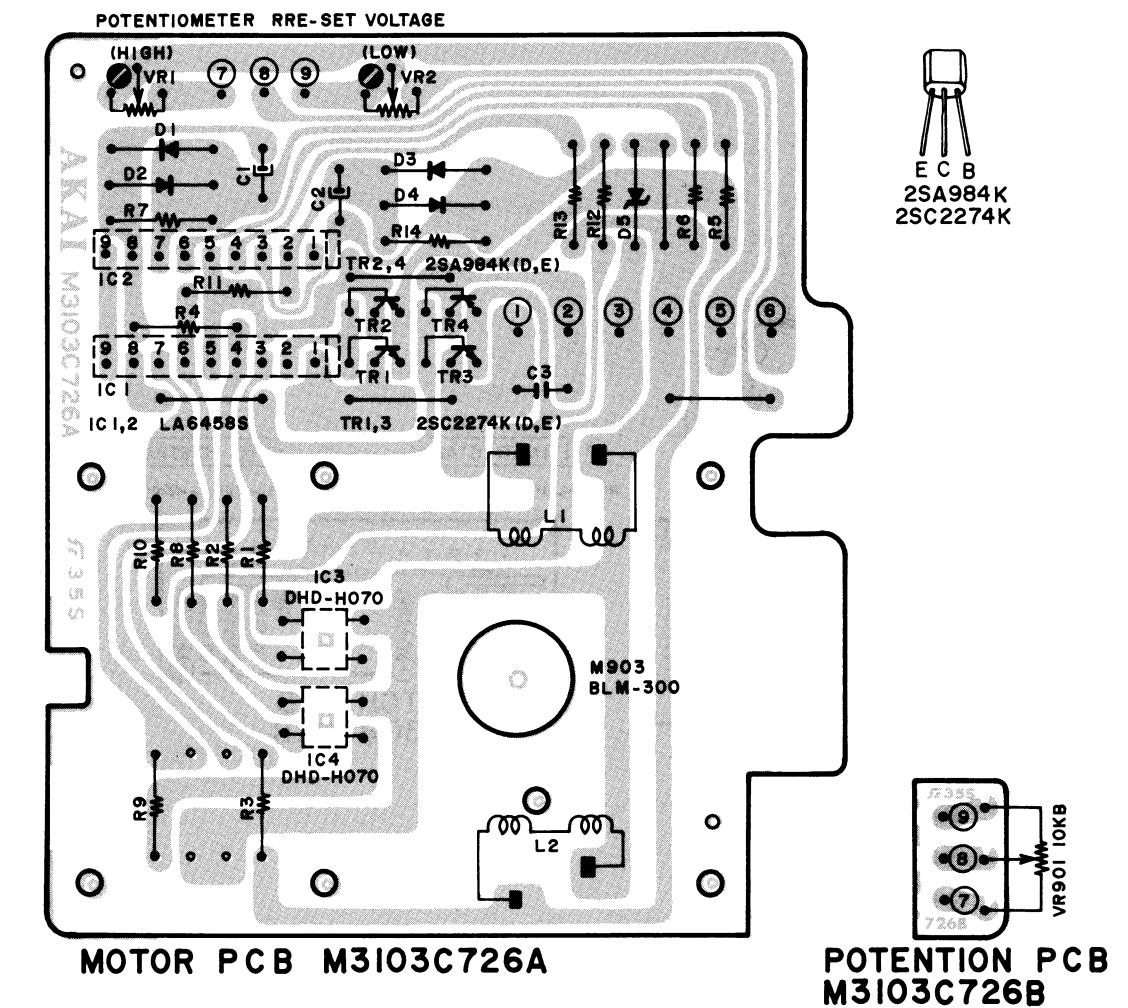
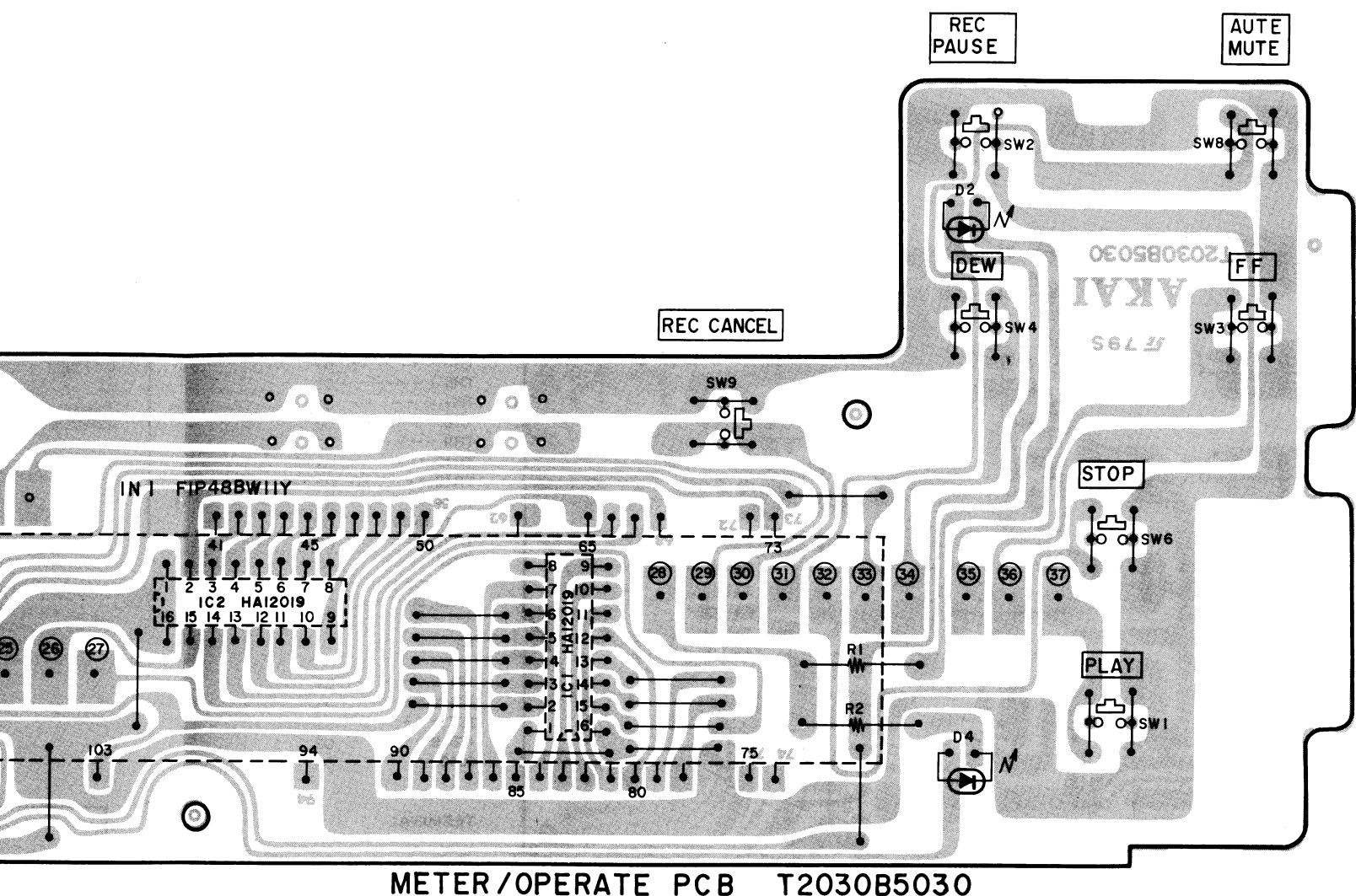
### **3) METER/OPERATE P.C BOARD T2030B5030**

#### **4) MOTOR P.C**

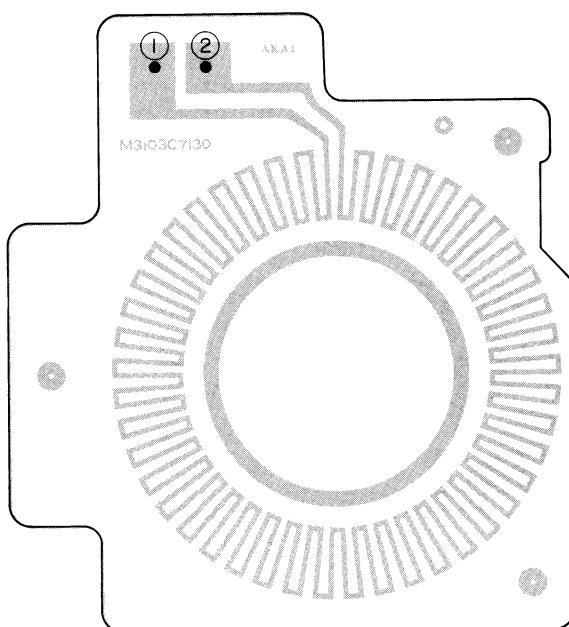


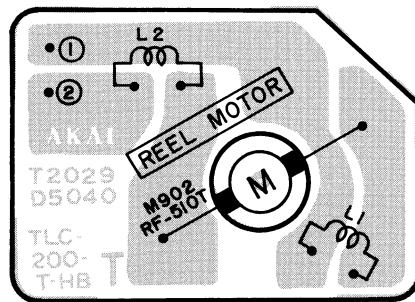
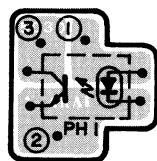
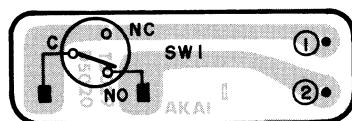
## **5) FG P.C BOAR**

4) MOTOR P.C BOARD M3103C726A and POTENTION P.C BOARD M3103C726B



5) FG P.C BOARD M3103C7130



**6) FILTER P.C BOARD T2029D5040****7) DETECTOR P.C BOARD T2029D5030****8) MICRO SW P.C BOARD T2029D5020**



## SECTION 3

# **SERVICE MANUAL**

## **MODEL GX-F51**

### **TABLE OF CONTENTS**

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X.	CLASSIFICATION OF VARIOUS P.C BOARDS .....	3- 9
	1. P.C BOARD TITLES AND IDENTIFICATION NUMBERS .....	3- 9
	2. COMPOSITION OF VARIOUS P.C BOARDS .....	3-10

For basic adjustments, measuring methods, and operating principles, refer to GENERAL TECHNICAL MANUAL.

# I. SPECIFICATIONS

TRACK SYSTEM	4 Track 2 Channel Stereo System
TAPE	Philips Type Cassette
TAPE SPEED	4.76 cm/s ± 1.0% (1-7/8 ips. ±1.0%)
HEADS	Twin Field Super GX head for recording/playback × 1 Erase head × 1
MOTORS	FG servo D.C. motor for direct capstan drive × 1 D.C. motor for reel drive × 1
WOW & FLUTTER	0.10% WTD (DIN) 0.035% WRMS
TAPE WINDING TIME	90 sec. using a C-60 cassette tape
FREQUENCY RESPONSE	Normal: 20 to 17,000 Hz ± 3 dB (-20 VU) CrO <sub>2</sub> : 20 to 18,000 Hz ± 3 dB (-20 VU) Metal: 20 to 19,000 Hz ± 3 dB (-20 VU)
FREQUENCY RANGE	Normal: 15 to 18,000 Hz CrO <sub>2</sub> : 15 to 20,000 Hz Metal: 15 to 21,000 Hz
SIGNAL TO NOISE RATIO	Metal: Better than 60 dB (measured via tape with peak recording level) Dolby B-type NR switch ON: Improves up to 5 dB at 1 kHz, 10 dB above 5 kHz Dolby C-type NR switch ON: Improves up to 15 dB at 500 Hz, 20 dB at 1 kHz to 10 kHz
HARMONIC DISTORTION	1 kHz, 3rd harmonic distortion Metal: Less than 0.8%
INPUT	MIC: 0.25 mV (input impedance 5.0 kohms) Required microphone impedance: 600 ohms Line: 70 mV (input impedance: 47 kohms)
OUTPUT	Line: 410 mV at 0 VU Required load impedance: 2.0 kohms Phone: 1.3 mW/8 ohms at 0 VU
DIN	Input: 2.0 mV Output: 410 mV Required impedance: more than 20 kohms
POWER REQUIREMENTS	100V, 50/60 Hz for Japan 120V, 60 Hz for USA and Canada 220V, 50 Hz for Europe except UK 240V, 50 Hz for UK and Australia 110V/120V/220V/240V, 50/60 Hz switchable for other countries.
POWER CONSUMPTION	U, C, A Model: 24W J Model: 22W
DIMENSIONS	440(W) x 100(H) x 345(D) mm (17.3 x 3.9 x 13.6")
WEIGHT	6.1 kg (13.4 lbs)

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

\* "Dolby" and the Double D symbol are trademarks of Dolby Laboratories.  
(Manufactured under license from Dolby Laboratories).

## II. CONTROLS

GX-F51

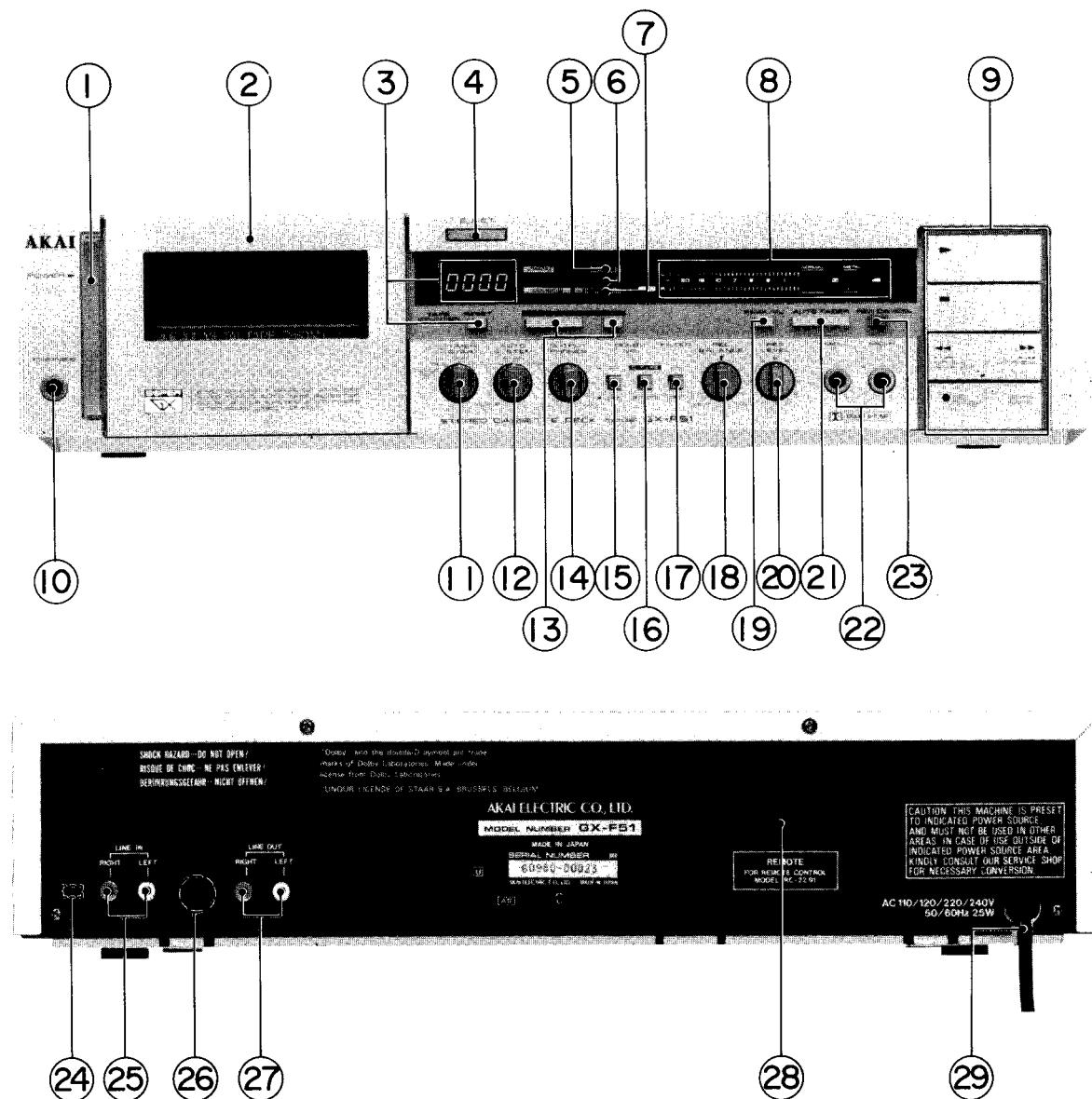


Fig. 1 Controls

1. POWER SWITCH
2. CASSETTE RECEPTACLE
3. FLD TAPE COUNTER and RESET BUTTON
4. EJECT BUTTON
5. TAPE POSITION INDICATORS
6. AUTO TAPE TUNING INDICATORS
7. DOLBY B and DOLBY C INDICATORS
8. FLD BAR METER with MAXIMUM INPUT LEVEL INDICATORS
9. OPERATING BUTTONS  
PLAY (►) BUTTON with INDICATOR  
STOP (■) BUTTON  
REWIND (◀) BUTTON  
FAST FORWARD (►►) BUTTON  
RECORDING (REC)/PAUSE BUTTON with INDICATOR  
AUTO MUTE BUTTON
10. HEADPHONE (PHONES) JACK
11. TIMER START SELECTOR
12. AUTO SYSTEM SELECTOR
13. TUNING and REFERENCE (REF) BUTTONS
14. OUTPUT/HEADPHONE (PHONES) CONTROL
15. DOLBY NR SWITCH
16. DOLBY NR SELECTOR
17. MPX FILTER SWITCH
18. RECORDING (REC) BALANCE CONTROL (LEFT and RIGHT)
19. PEAK/VU SELECTOR
20. RECORDING (REC) LEVEL CONTROL
21. AUTO FADER BUTTON
22. MICROPHONE JACKS (MIC-L: left, MIC-R: right)
23. RECORDING (REC) CANCEL BUTTON
24. LINE/DIN SELECTOR  
(Some models do not have this facility.)
25. LINE IN JACKS
26. DIN JACK  
(Some models are not equipped with this facility.)
27. LINE OUT JACKS
28. REMOTE JACK
29. POWER CORD

### III. PRINCIPAL PARTS LOCATION

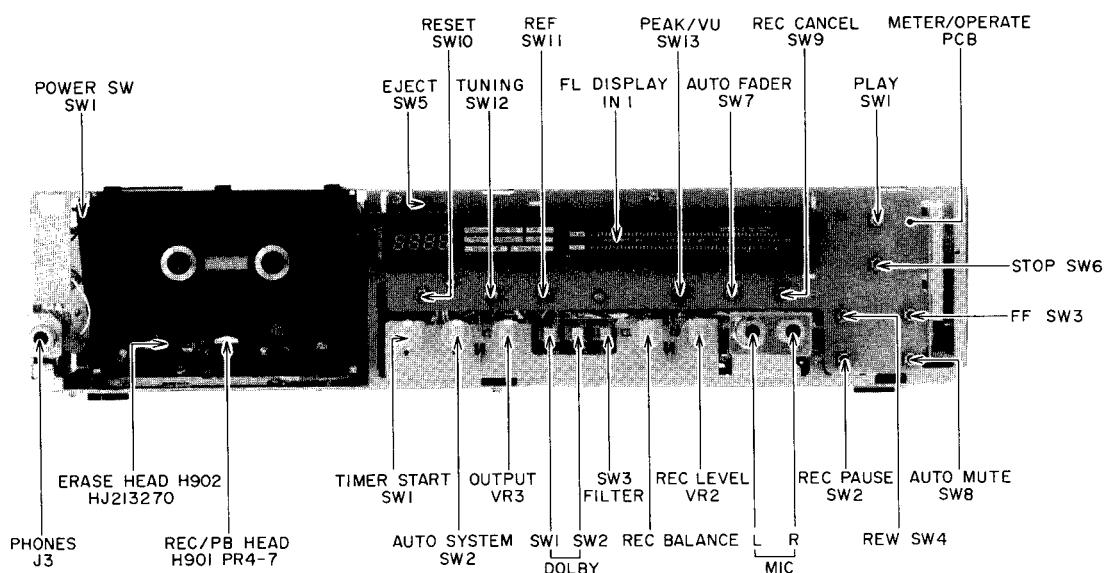


Fig. 2 Front View

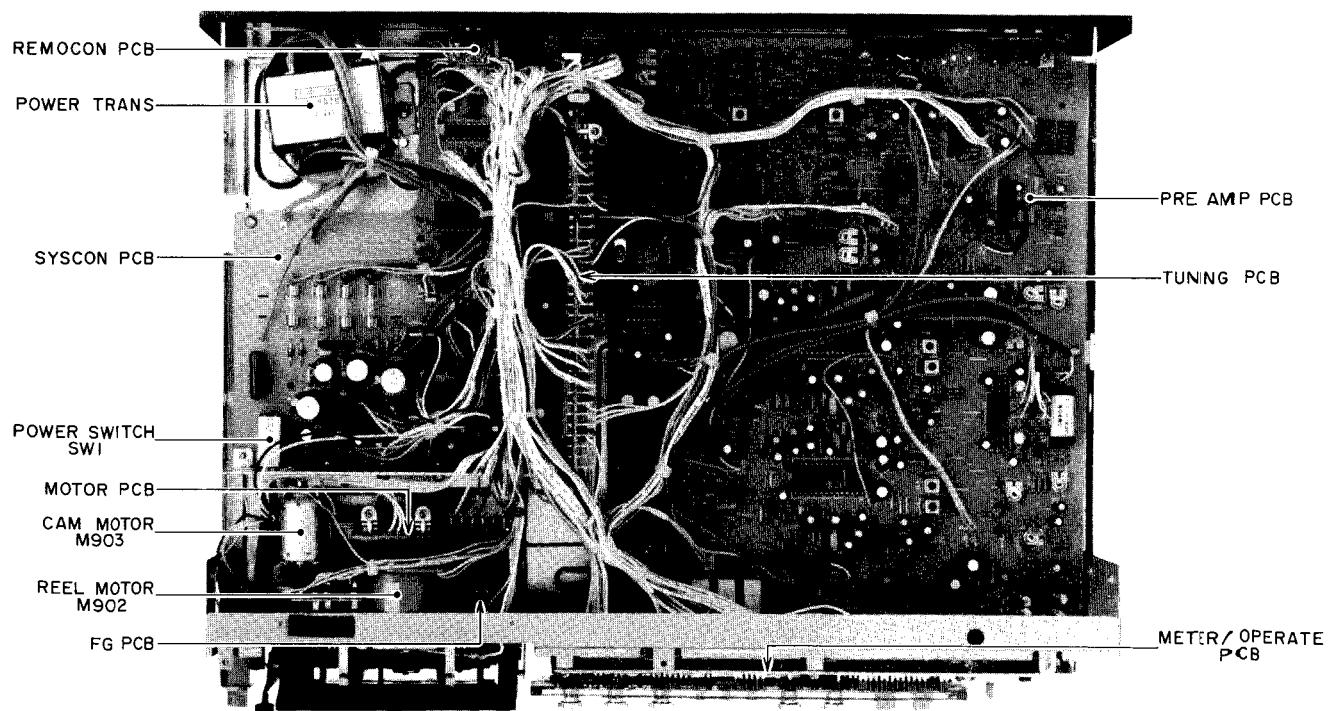


Fig. 3 Top View

## **IV. VOLTAGE CONVERSION**

Refer to Section 2-IV (GX-F31)

## **V. MECHANICAL ADJUSTMENT**

Refer to Section 2-V (GX-F31)

## **VI. HEAD ADJUSTMENT**

Refer to Section 2-VI (GX-F31)

## VII. AMPLIFIER ADJUSTMENT

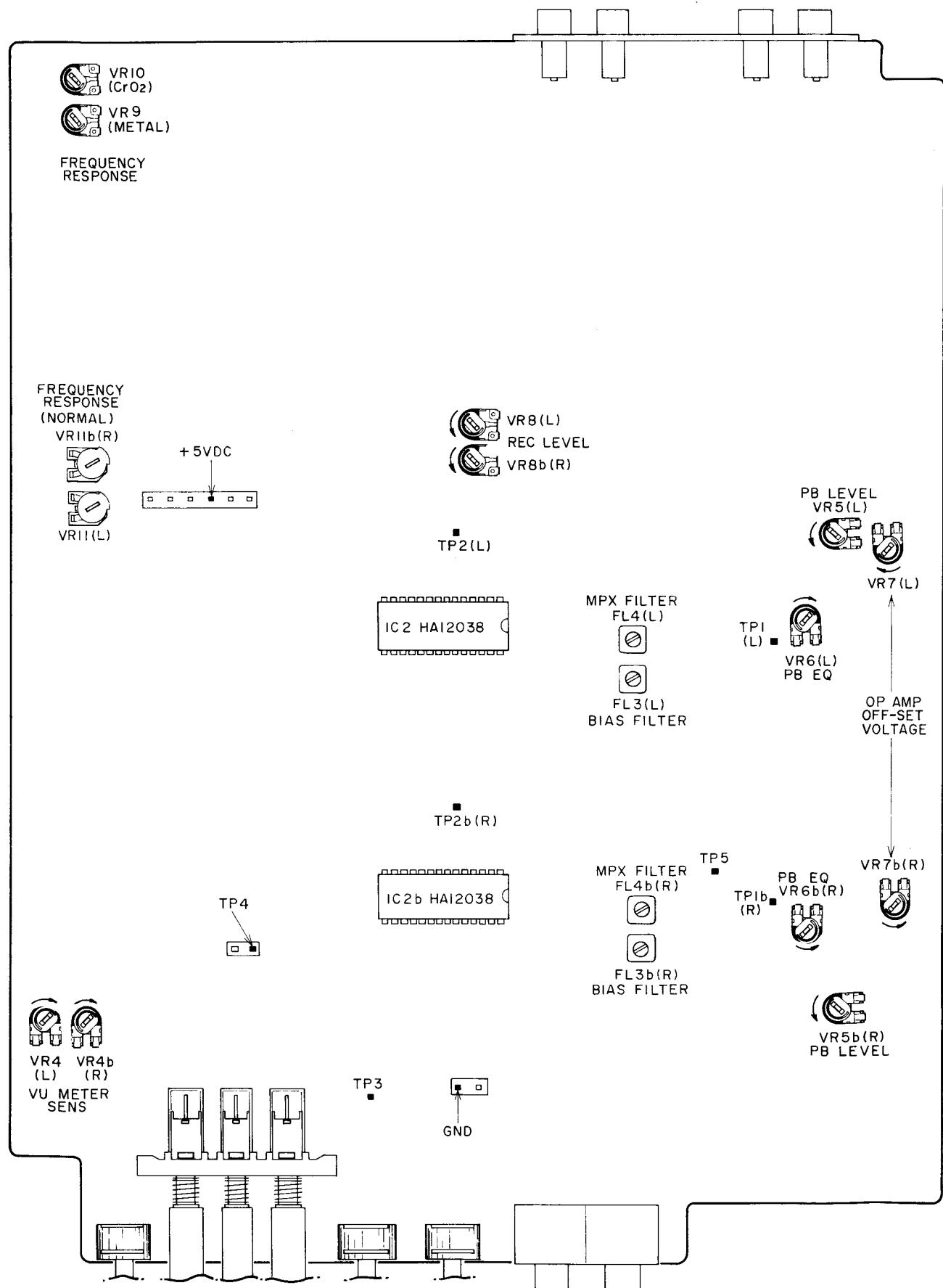


Fig. 4 Pre Amp P.C Board

Step	Adjustment Item	Test Tape Supply Signal	Mode	Adjustment Parts	Result	Remarks
1	OP Amp Off-Set Voltage		STOP	VR7 Pre Amp PCB	TP1 $0 \pm 0.1$ VDC	
2	PB Level	333 Hz Test Tape (TF-101CL)	PB	VR5 Pre Amp PCB	$-5.5 \pm 0.5$ dBm (410 mV)	
3	PB EQ	10 kHz Test Tape (TF-106CH)	PB	VR6 Pre Amp PCB	$-22.5 \pm 1.5$ dBm	
4	Normal Position Frequency Response	Normal Blank Tape 1 kHz, 10 kHz $-25.5$ dBm	REC/PB	VR11 Pre Amp PCB	1 kHz to 10 kHz flat response	
5	CrO <sub>2</sub> Position Frequency Response	CrO <sub>2</sub> Blank Tape 1 kHz, 10 kHz $-25.5$ dBm	REC/PB	VR10 Pre Amp PCB	1 kHz to 10 kHz flat response	
6	Metal Position Frequency Response	Metal Blank Tape 1 kHz, 10 kHz $-25.5$ dBm	REC/PB	VR9 Pre Amp PCB	1 kHz to 10 kHz flat response	
7	REC Level	Normal Blank Tape 1 kHz, $-5.5$ dBm	REC/PB	VR8 Pre Amp PCB	$-5.5 \pm 0.3$ dBm (410 mV)	
8	MPX Filter	19 kHz from oscillator	REC	FL4 Pre Amp PCB	Minimum Output	MPX Filter ON
9	Bias Filter	No Signal Input	REC	FL3 Pre Amp PCB	Minimum Output	Set REC Volume to maximum
10	VU Meter Sensitivity	1 kHz, $-5.5$ dBm from oscillator	REC	VR4 Pre Amp PCB	0 dB (VU) indication	

- NOTES:**
1. Output volume should be at maximum.
  2. Dolby NR Switch to OFF Position.
  3. Except for Step 8 set Dolby Filter Switch to OFF Position.
  4. Use the following cassette measuring tapes:

Normal Tape : Maxell UD C-60  
 CrO<sub>2</sub> Tape : TDK SA C-60  
 Metal Tape : TDK MA-C C-60

#### For your reference:

Confirmation of Dolby level

- 1) Set to REC/PAUSE.
- 2) Input a signal of 400 Hz and adjust the input level so that the level of pin ②4 of Dolby I.C (HA-12038) will be 580 mV when Dolby NR is OFF.
- 3) Check that the level of TP-2 is 580 mV.

## VIII. TUNING CIRCUIT ADJUSTMENT

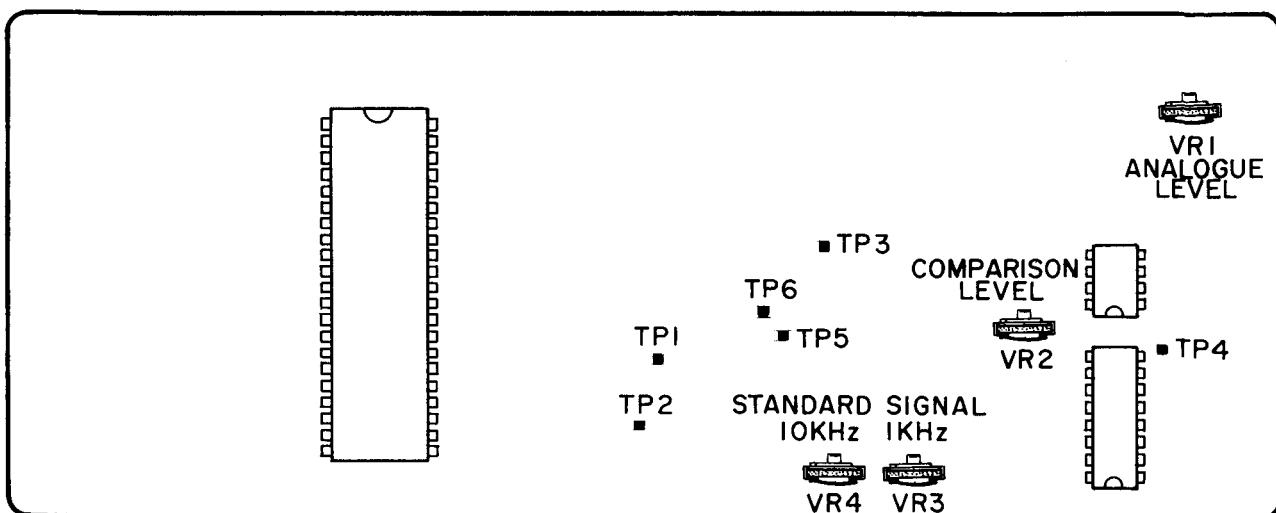


Fig. 5 Tuning P.C Board

- 1) Standard Signal (1 kHz) output Adjustment
  - a. Set to REC/PAUSE.
  - b. Apply +5V DC to TP3 of the Pre Amp PCB.
  - c. Input square wave of 3Vp-p or more,  $1057 \pm 10$  Hz, into TP1 of the tuning PCB.
  - d. Adjust VR3 of the tuning PCB so that the level of TP4 of Pre Amp PCB will be  $-25.5 \pm 0.1$  dBm.
- 2) Standard Signal (10 kHz) Output Adjustment
  - a. Set to REC/PAUSE.
  - b. Apply +5V DC to TP3 of Pre Amp PCB.
  - c. Input square wave of 3Vp-p or more,  $9941 \pm 100$  Hz, into TP2 of the tuning PCB.
  - d. Adjust VR4 of the tuning PCB so that the level of TP4 of Pre Amp PCB will be  $-24.0 \pm 0.1$  dBm.
- 3) A/D Converter Analogue Level Adjustment
  - a. Set to PLAY mode without inserting a tape.
  - b. Input a signal of 1 kHz into TP5 of Pre Amp PCB and adjust the input level so that TP4 of Pre Amp PCB will be  $-25.5$  dBm.
  - c. Adjust VR1 of the tuning PCB so that the level of TP3 of the tuning PCB will be  $3.49 \pm 0.05$  V DC.
- 4) A/D Converter Comparison Level Adjustment
  - a. Connect TP5 and TP6 of the tuning PCB to GND.
  - b. Adjust VR2 of the tuning PCB so that the level of TP4 of the tuning PCB will be  $3.70 \pm 0.05$  V DC.

**NOTE:** A digital voltmeter should be used for the measurement of DC voltage and an AC voltmeter (mV meter) for the measurement of AC voltage, and the input impedance should be 10M ohm or more.

## **IX. DC RESISTANCE OF HEADS**

**GX-F51**

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Description	Name	DC Resistance
REC/PB Head	PR4-7	650 ohms ± 10%
Erase Head	HJ213270	3.5 ohms

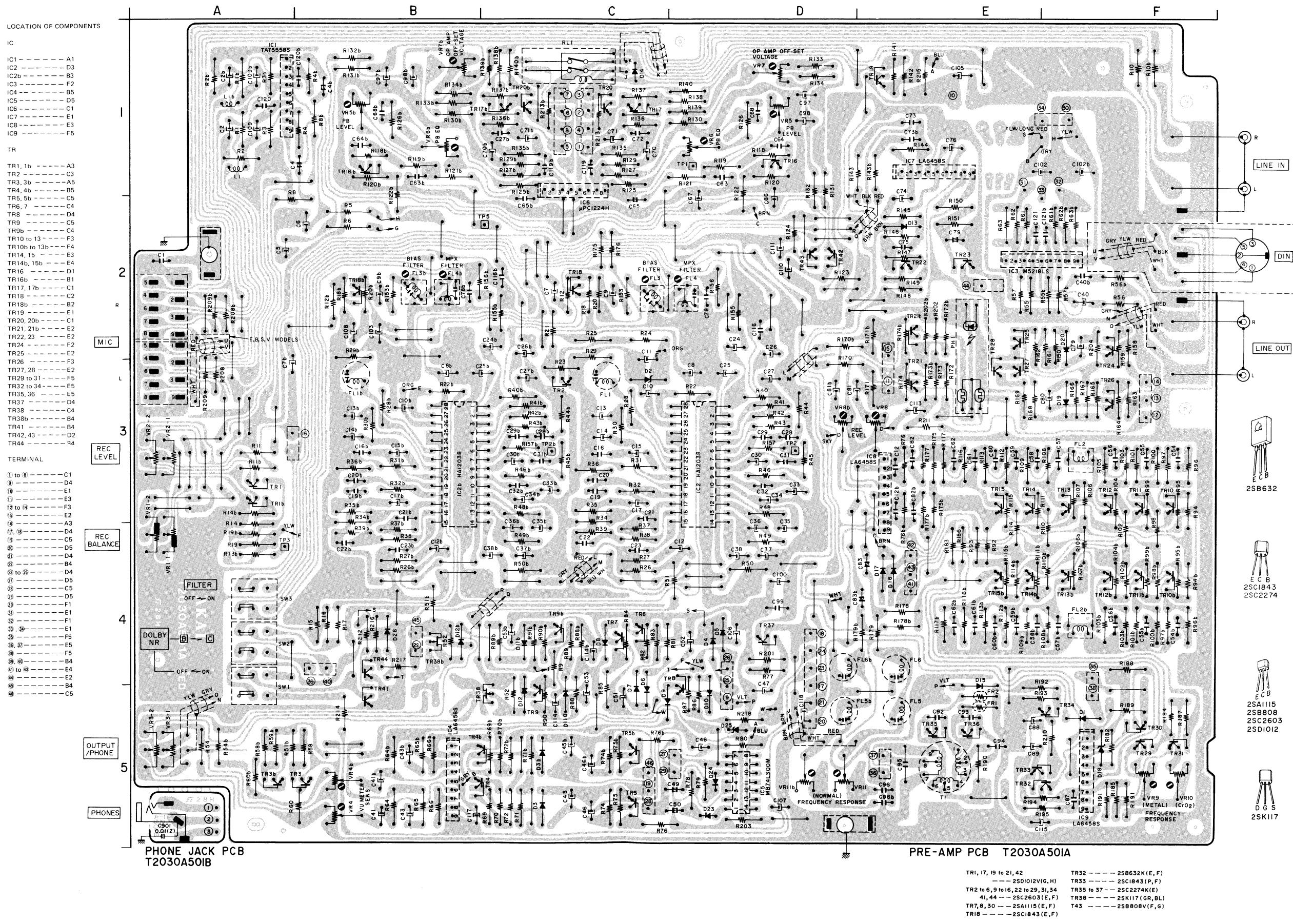
## **X. CLASSIFICATION OF VARIOUS P.C BOARDS**

### **1. P.C BOARD TITLES AND IDENTIFICATION NUMBERS**

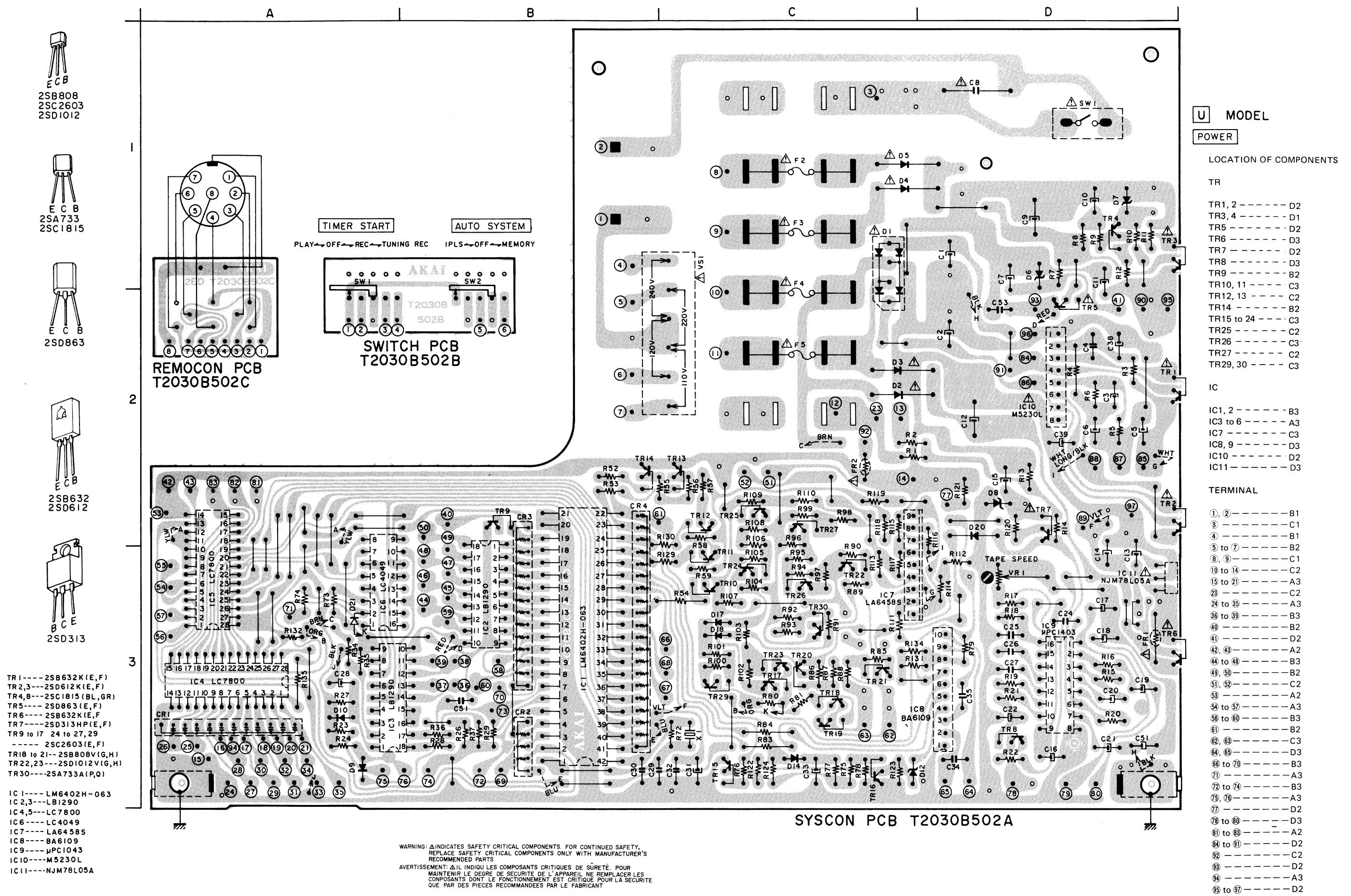
P.C Board Title	P.C Board Number
Pre Amp P.C Board	T2030A501A
Phone Jack P.C Board	T2030A501B
Tuning P.C Board	T2030C5040
Syscon P.C Board	T2030B502A
Switch P.C Board	T2030B502B
Remocon P.C Board	T2030B502C
Meter/Operate P.C Board	T2030B5030
Motor P.C Board	T3103C726A
Potention P.C Board	M3103C726B
FG P.C Board	M3103C7130
Filter P.C Board	T2029D5040
Detector P.C Board	T2029D5030
Micro SW P.C Board	T2029D5020

## **2. COMPOSITION OF VARIOUS P.C BOARDS**

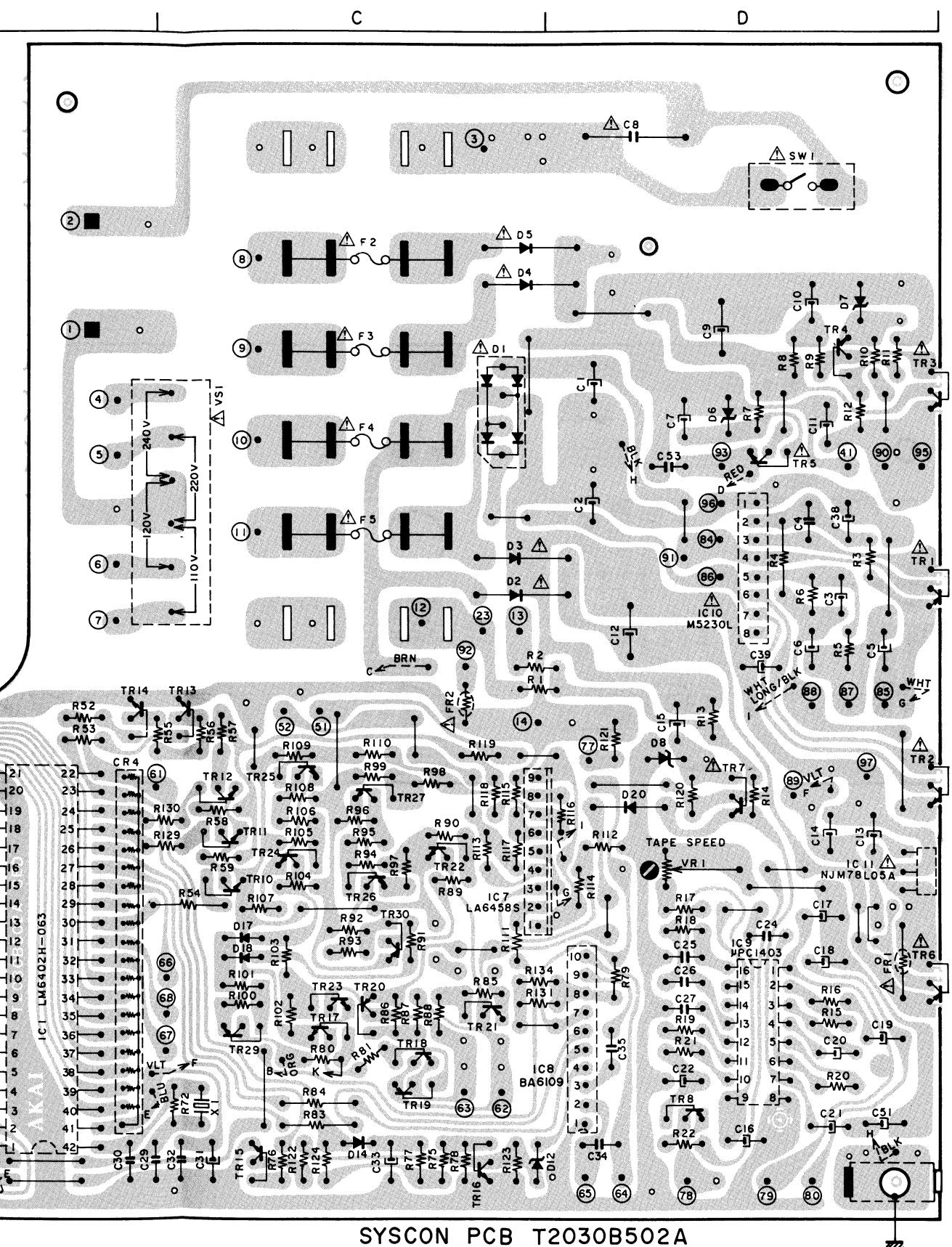
1) PRE AMP P.C BOARD T2030A501A (2ED) and PHONE JACK P.C BOARD T2030A501B



2) SYSCON P.C BOARD T2030B502A (3ED), SWITCH P.C BOARD T2030B502B and REMOCON P.C BOARD T2030B502C (2ED)



## ON P.C BOARD T2030B502C (2ED)



## U MODEL

## POWER

## LOCATION OF COMPONENTS

## TR

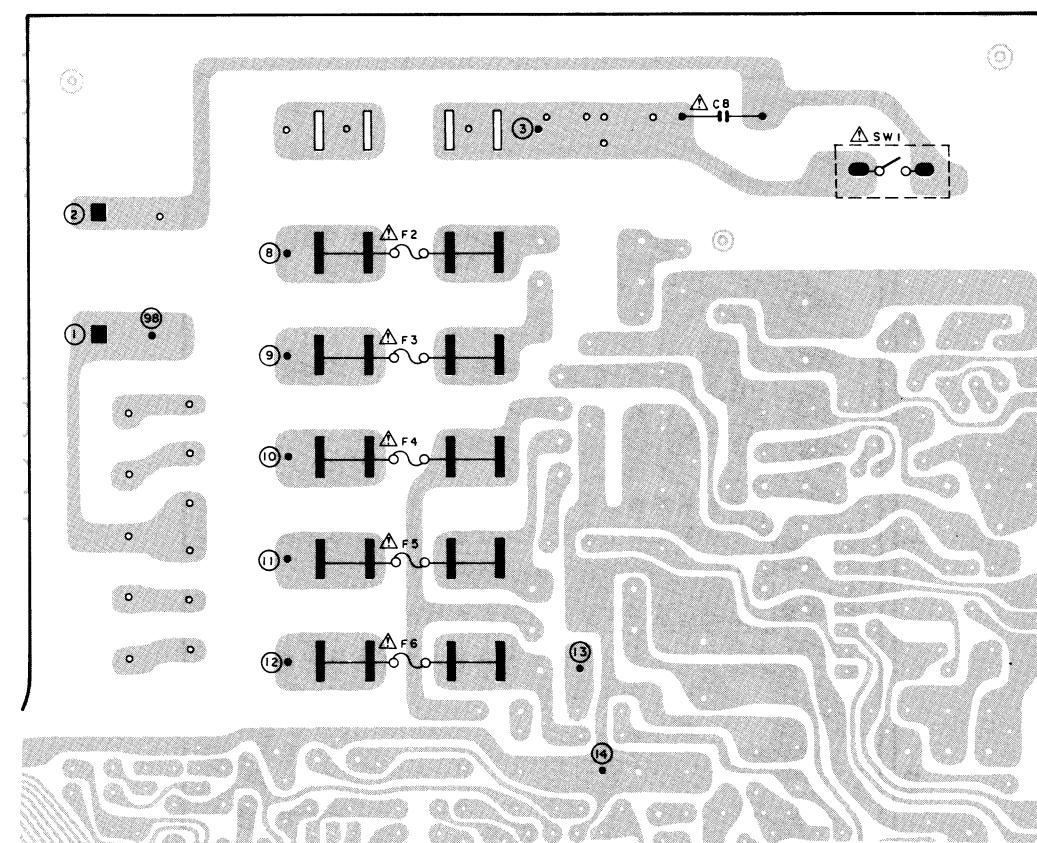
- TR1, 2 ----- D2
- TR3, 4 ----- D1
- TR5 ----- D2
- TR6 ----- D3
- TR7 ----- D2
- TR8 ----- D3
- TR9 ----- D2
- TR10, 11 ----- C3
- TR12, 13 ----- C2
- TR14 ----- B2
- TR15 to 24 ----- C3
- TR25 ----- C2
- TR26 ----- C3
- TR27 ----- C2
- TR29, 30 ----- C3

## IC

- IC1, 2 ----- B3
- IC3 to 6 ----- A3
- IC7 ----- C3
- IC8, 9 ----- D3
- IC10 ----- D2
- IC11 ----- D3

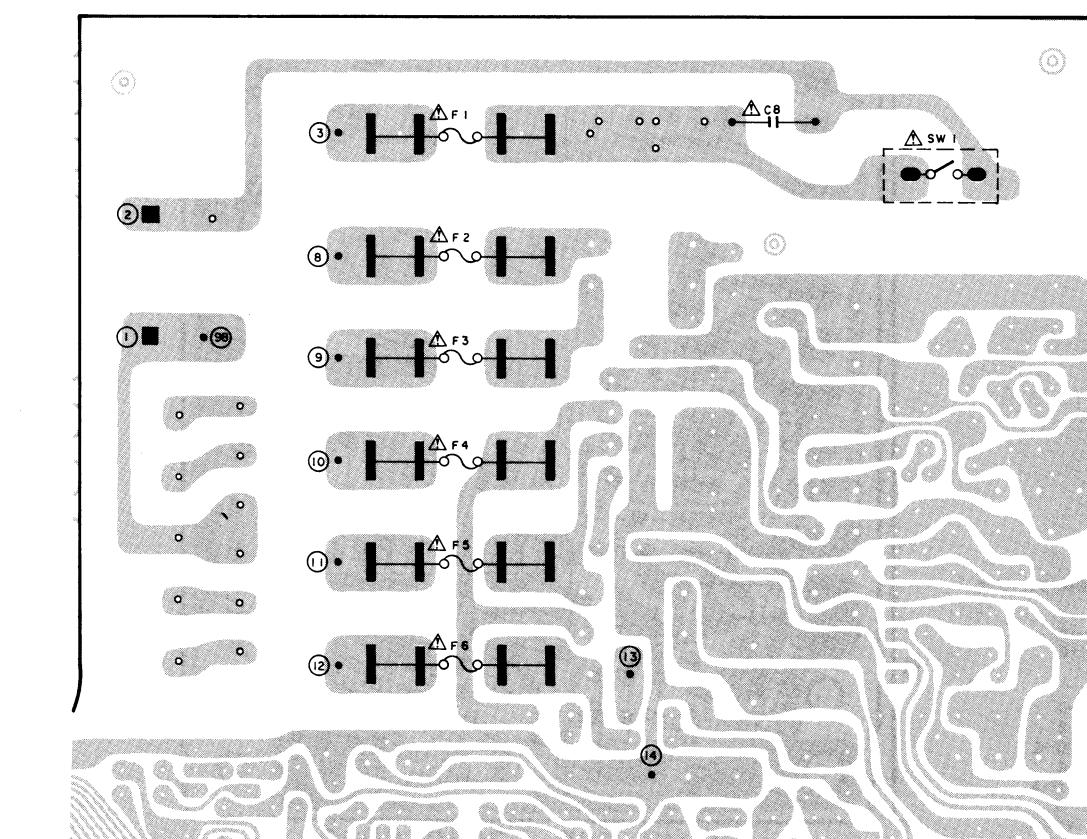
## TERMINAL

- ①, ② ----- B1
- ③ ----- C1
- ④ ----- B1
- ⑤ to ⑦ ----- B2
- ⑧, ⑨ ----- C1
- ⑩ to ⑯ ----- C2
- ⑯ to ⑳ ----- A3
- ㉑ ----- C2
- ㉒ to ㉓ ----- A3
- ㉔ to ㉕ ----- B3
- ㉖ to ㉗ ----- B2
- ㉘ ----- D2
- ㉙, ㉚ ----- A2
- ㉛ to ㉜ ----- B3
- ㉝, ㉞ ----- B2
- ㉟ to ㉟ ----- A3
- ㉟ to ㉟ ----- B3
- ㉟ to ㉟ ----- B3
- ㉟ to ㉟ ----- B2
- ㉟ to ㉟ ----- C3
- ㉟ to ㉟ ----- D3
- ㉟ to ㉟ ----- A3
- ㉟ to ㉟ ----- D3
- ㉟ to ㉟ ----- A2
- ㉟ to ㉟ ----- D2
- ㉟ to ㉟ ----- C2
- ㉟ to ㉟ ----- D2
- ㉟ to ㉟ ----- A3
- ㉟ to ㉟ ----- D2



J, C, A, E, V, S MODEL

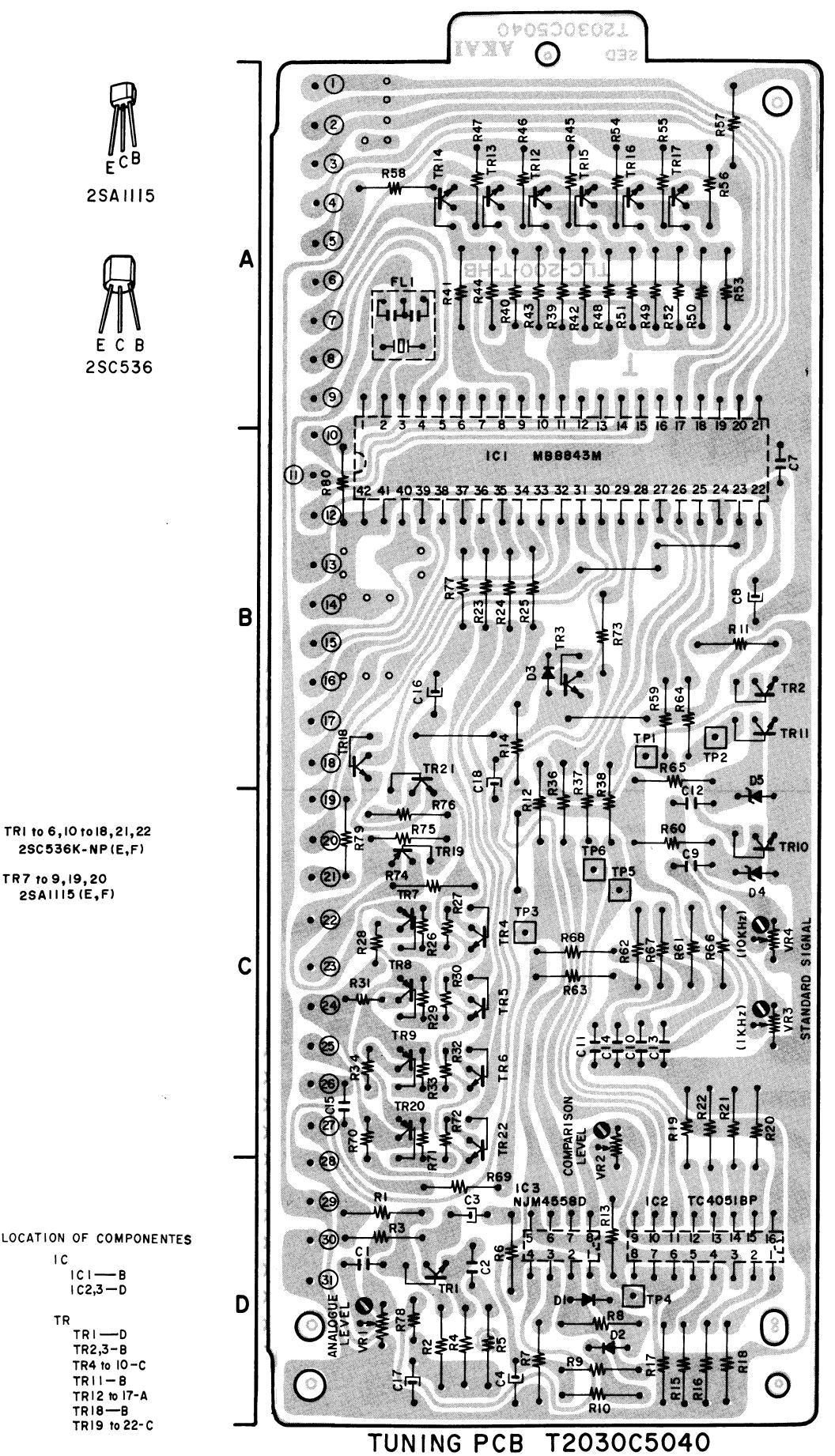
POWER



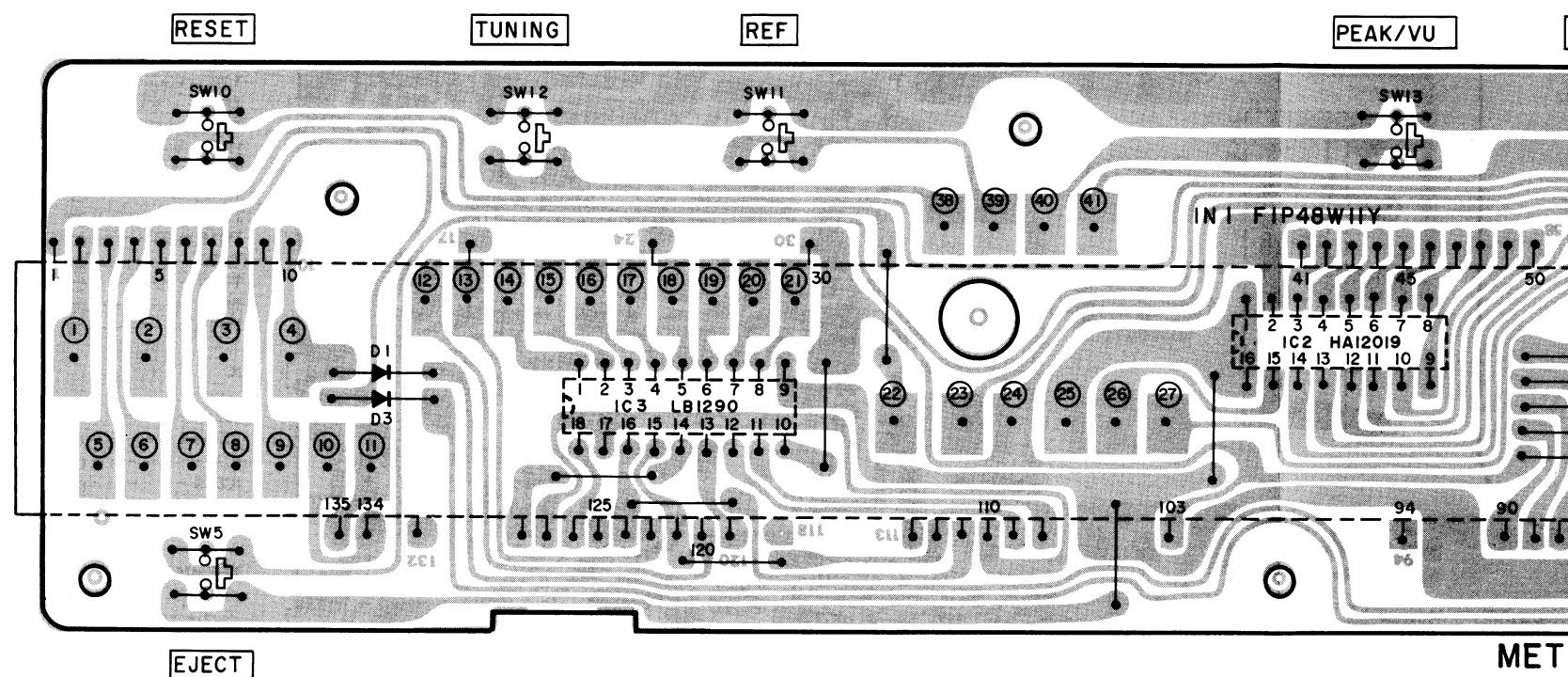
B MODEL

POWER

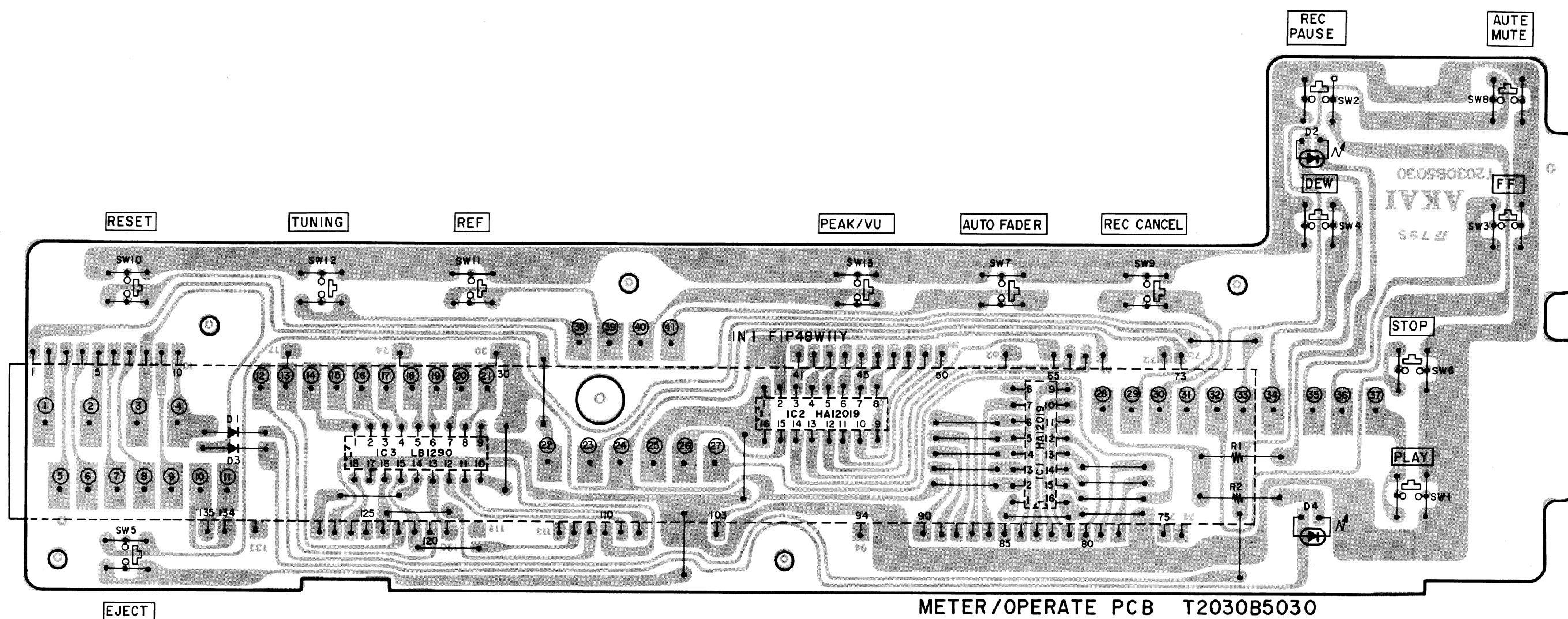
3) TUNING P.C BOARD T2030C5040 (2ED)



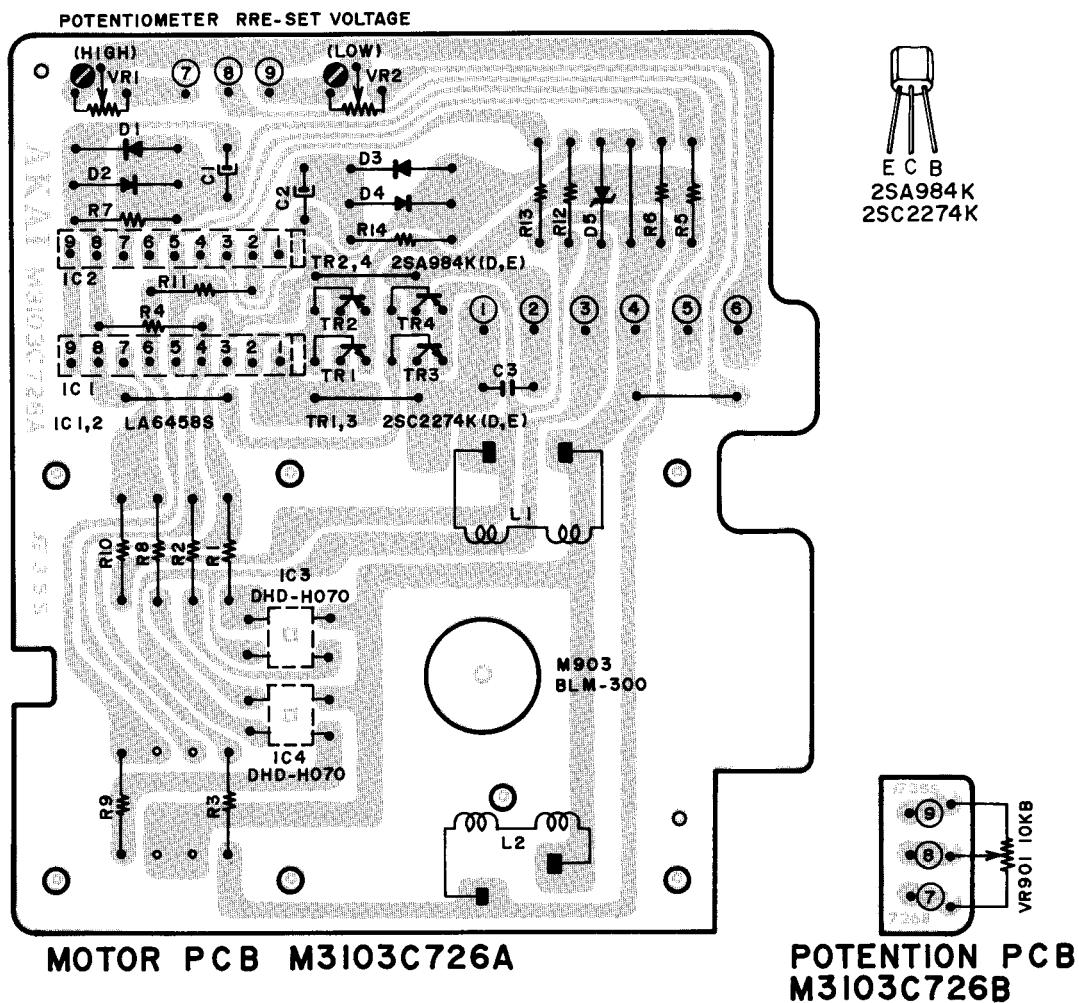
4) METER/OPERATE P.C BOARD T2030B5030



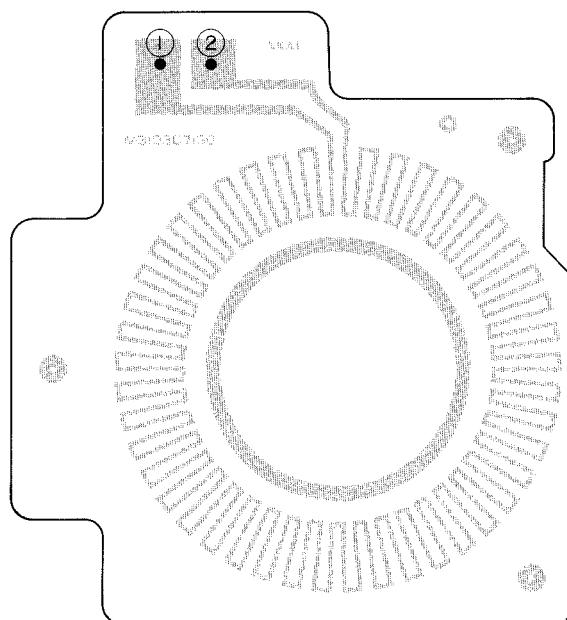
4) METER/OPERATE P.C BOARD T2030B5030



## 5) MOTOR P.C BOARD M3103C726A and POTENTION P.C BOARD M3103C726B

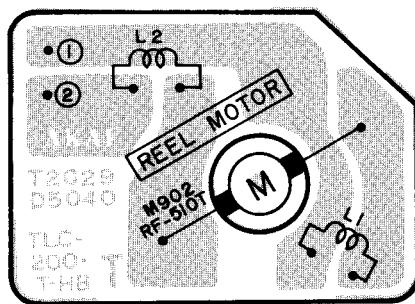


## 6) FG P.C BOARD M3103C7130

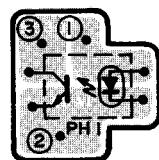


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**7) FILTER P.C BOARD T2029D5040**



**8) DETECTOR P.C BOARD T2029D5030**



**9) MICRO SW P.C BOARD T2029D5020**

