PIONEER

Service Manual

CIRCUIT & MECHANISM DESCRIPTIONS
REPAIR & ADJUSTMENTS

The photo shows the black version of PL-970.

ORDER NO.
ARP 1115-0

STEREO TURNTABLE

PL-970(BK)
PL-970

MODEL PL-970(BK) COMES IN TWO VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Applicable model		Power Requirement	Destination
	PL-970 (BK)	PL-970		
WEM	○	○	AC 220V – 240V	European continent
WB	○	○	AC 220V – 240V	United Kingdom

- **This service manual is applicable to the PL-970 (BK)/WEM, WB and PL-970/WEM,WB types.**
- **As to the WB type, please refer to pages 33.**
- **Ce manuel d'instruction se refère au mode de réglage en français.**
- **Este manual de servicio trata del método ajuste escrito en español.**
- **PL-970 (BK) is Black versions of PL-970.**

CONTENTS

PIONEER ELECTRONIC CORPORATION 4-1, Meguro 1-Chome, Meguro-ku, Tokyo 153, Japan
PIONEER ELECTRONICS SERVICE AND ENGINEERING, INC. P.O. Box 1760, Long Beach, California 90801 U.S.A.
TEL: (213) 420-5700
PIONEER ELECTRONIC (EUROPE) N.V. Keetberglaan 1, 2740 Beveren, Belgium TEL: 03/775·28·08
PIONEER ELECTRONICS AUSTRALIA PTY. LTD. 178-184 Boundary Road, Braeside, Victoria 3195, Australia
TEL: (03) 580-9911

1. SPECIFICATIONS

PHONOGRAPH MOTOR AND PLATTER

Motor type.....Quartz PLL Hall motor
Drive system.....Direct drive system
Speed of rotation.....2 speeds: 33-1/3, 45 rpm
Wow and Flutter.....Less then *0.012% (WRMS)
0.025% (WRMS)
±0.035% WTD Peak (DIN)
Values marked with an "*" designate the wow and flutter for the motor, and do not include the cartridge or tonearm load.
Motor characteristics
Start up.....Less then 1/3 revolution
Speed variation.....Less then 0.002%
Drift.....Time: 0.0003%/h
Temp: 0.003%/°C
S/N ratio.....78 dB (DIN-B)
Platter.....Diameter 304 mm, aluminium die cast

TONE ARM

Type.....Integrated straight tone arm
Effective arm length.....221 mm

SUPPLIED CARTRIDGE (PC-305T)

Type.....MM type
Replacement stylus.....PN-305T
Stylus.....0.6 mil diamond
Output voltage.....2.5 mV (1 kHz, 5 cm/s LAT Peak)
Suitable stylus pressure.....1 - 1.5 g
(optimum value 1.25 g)
Frequency response.....10 Hz - 33,000 Hz
Load resistance.....50 kΩ
Weight.....6 g

FUNCTIONS PROVIDED

Auto lead-in, auto return, auto cut, arm elevation, manual play, quick play, free stop hinges.

POWER SUPPLY, OTHER

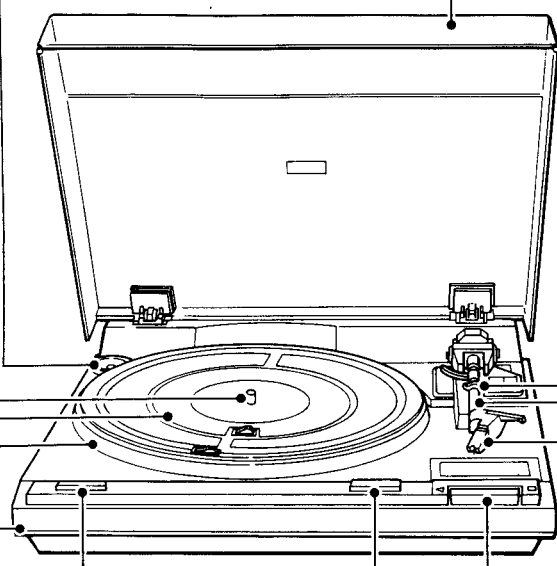
Power requirements
European, U.K., Australian models.....AC 220 V — 240 V ~, 50/60 Hz
U.S., Canadian models.....AC 120 V, 60 Hz
Other destination models.....AC 110 V — 120 V/220 V — 240 V ~ (switchable), 50/60 Hz
Power consumption
European, U.K., Australian models.....9 W
U.S., Canadian models.....9 W
Other destination models.....5 W
External dimensions....420(W) x 118(H) x 365(D) mm
16 - 1/2(W) x 4-5/8(H) x 14-3/8(D) in
Net weight.....4.7 kg (10 lb 6 oz)

SUPPLIED ACCESSORIES

EP adaptor.....1
Operating instructions.....1

NOTE:
Specifications and design subject to possible modification without notice, due to improvements.

2. PANEL FACILITIES



EP Adaptor
When playing a record with a doughnut hole, place this over the platter spindle.

Dust Cover

Platter Spindle

Platter Mat

Platter

Cabinet

Arm rest

Tone Arm

Cartridge (PC-305T)

SPEED Selector Switch
Set this switch to the rotation speed of the record which you intend to play.
On [45] — For 45 rpm records
On [33] — For 33-1/3 rpm records

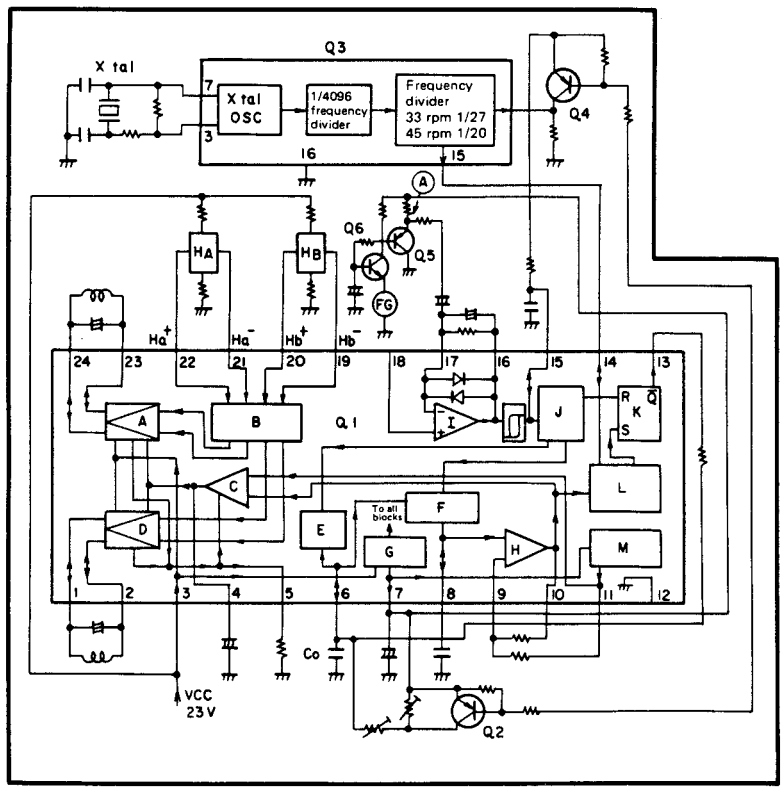
START/STOP switch
Press to start auto play mode, and to stop play.

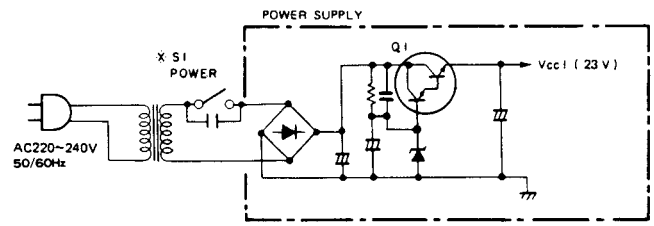
ARM ELEVATION Switch
- Use to perform manual play.
- Use to temporarily stop playing.
- Use to change tracks in the middle of play.
  When changed, the tone arm moves up or down.
  On [UP] position — To elevate the tone arm. (The stylus is lifted off the record.)
  On [DOWN] position — To lower the tone arm. (The stylus is lowered onto the record.)

3. BLOCK DIAGRAM

A : Drive amplifier
B : Hall amplifier + position signal composite circuit
C : V-I conversion
D : Drive amplifier
E : Reset circuit
F : Sample and hold circuit
G : Voltage regulator circuit
H : Buffer amplifier
I : FG amplifier
J : Timing circuit
K : Phase comparison
L : Lock indicator circuit
M : 1/2 VCC circuit

Phono motor





*S1 (microswitch) is at the mechanism section.

4. CIRCUIT DESCRIPTIONS

4.1 Phono Motor Circuit

The phono motor of this player uses magnetism along the outside edge of the drive magnet to determine its rpm value. (Formerly, a separate magnet was needed in addition to the drive magnet.)

This motor uses a PA2017 as its control drive IC and a crystal oscillator circuit in the oscillator circuit unit. Also, since this motor is brushless and coreless, the position of the rotor magnet is detected by two Hall elements HA and HB, which make the motor turn by switching the current to the drive coil electronically. When voltage is applied to the hall elements HA and HB, a voltage differential is created in the output interval by the magnetic field of the approaching rotor. The Hall elements HA and HB are also attached 90° electrically out of phase so their output signals have a 90° phase difference. (See Fig. 4-1)

After the output voltage from the Hall elements have been amplified by the PA2017 Hall amplifier, it enters a position signal composite circuit (See Fig. 4-3). The output from the position signal composite circuit is then input into the respective drive amplifiers. The coil current at this time is as shown is figure 4-1 coils A and B. This current produces a magnetic field in the drive coil, and the polarity of the coil and the polarity of the rotor attract and repel each other causing the motor to start turning.

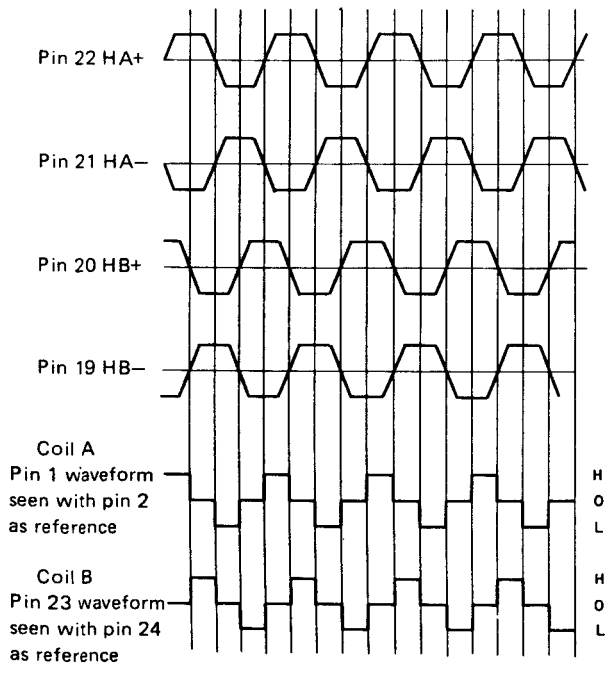


Fig. 4-1 Hall Elements and Coil Terminal Waveforms

When the motor starts turning, the signal (approximately 0.5mV p-p) produced by a frequency generator (FG) in the motor rotation unit, is amplified to about 0.3V p-p by an FG amplifier (Q5, Q6) and is input into the FG amplifier (input pin 17) inside PA2017. Possible frequencies at this point are 55.55 Hz for 33 rpm and 75 Hz for 45 rpm.

The signal then undergoes waveform shaping in the Schmitt transistor, and is then input into the reset circuit, the sample and hold circuit and finally the timing circuit for a timing pulse for the phase comparison circuit. In the PD0008, the crystal generated 6.144MHz frequency is divided into 1.5kHz (a division of 1/4096) by the frequency divider circuit. This signal is further divided by a dividing ratio selection circuit to 55.55 Hz for 33 rpm (a division of 1/27) and to 75 Hz for 45 rpm (a division of 1/20). These pulses are output to PD0008 pin 15. This reference pulse from PD0008 and the signal from the timing circuit of PA2017 undergo phase comparison in the phase comparison circuit. Output pulses can then be made in reference to the phase difference. Because these pulses speed up the charging time constants of their output sections, P — V conversion takes place. Also, F — V conversion takes place in those sections of the sample and hold circuit and the reset circuit when there is no output pulse from the phase comparison circuit. As a result, voltage which has undergone P — V and F — V conversion is output to pin 8. This output is then amplified by the buffer amplifier and input into the V — I conversion circuit. The V — I conversion circuit controls the current that flows into the drive circuit based on the difference between the output of the buffer amplifier and the reference voltage (1/2VCC2).

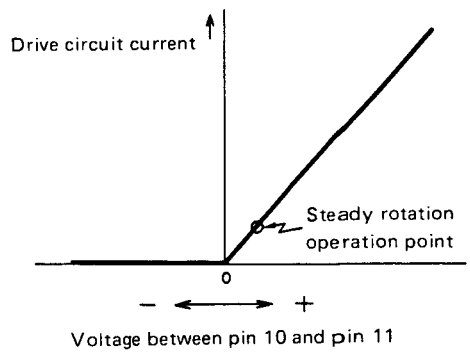


Fig. 4-2 V – I Conversion + Drive Circuit I/O Characteristics

When the motor has just begun turning, the F — V conversion voltage will be higher than the reference voltage, so current will flow into the drive coil, and the motor will speed up. Gradually, the motor will return to a constant rotation speed.

When the motor spins faster than regulation speed, both the P — V and F — V conversion voltage become lower than the reference voltage. This causes the current to stop flowing in the drive circuit and the rpms decrease because of a loss of torque.

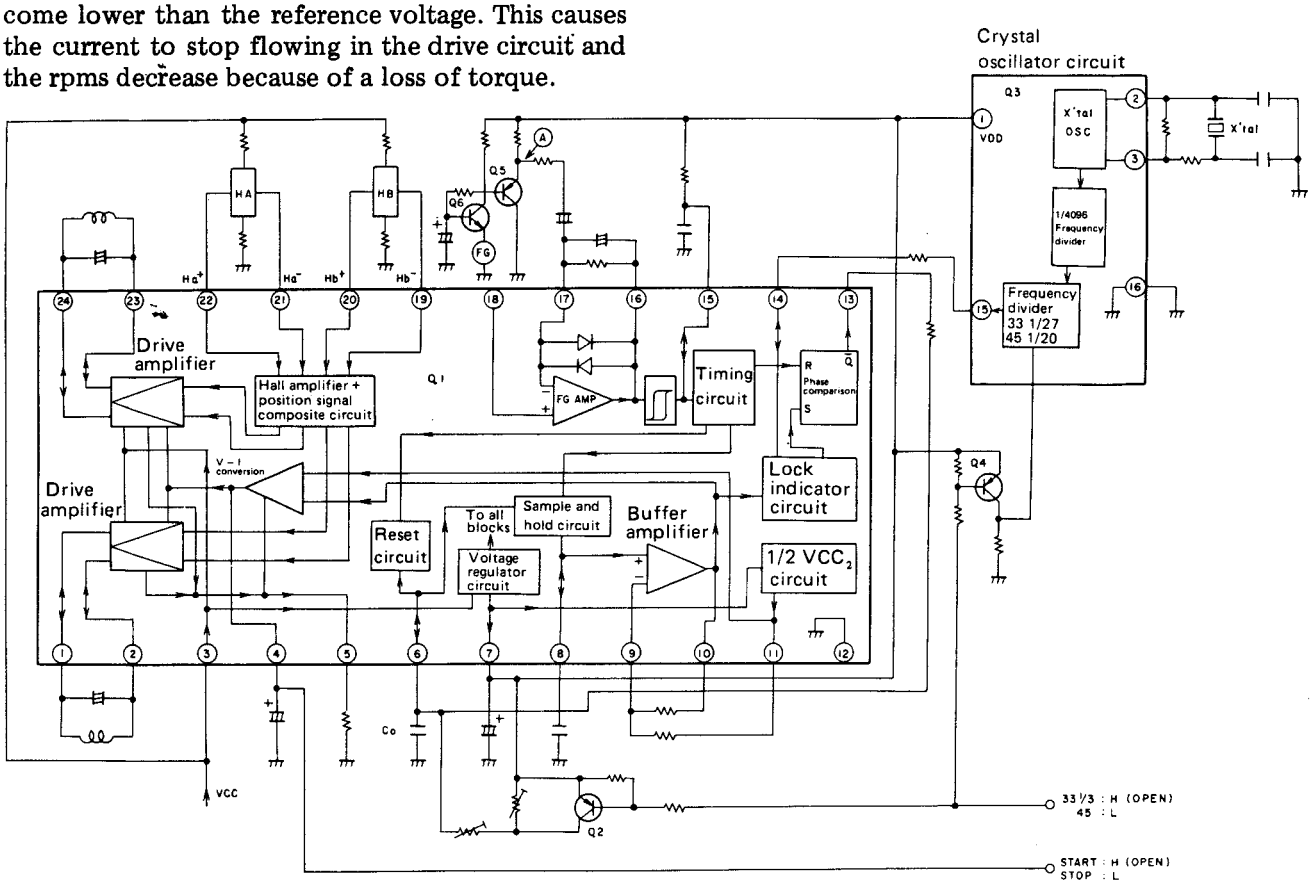


Fig. 4-3 Phono motor circuit

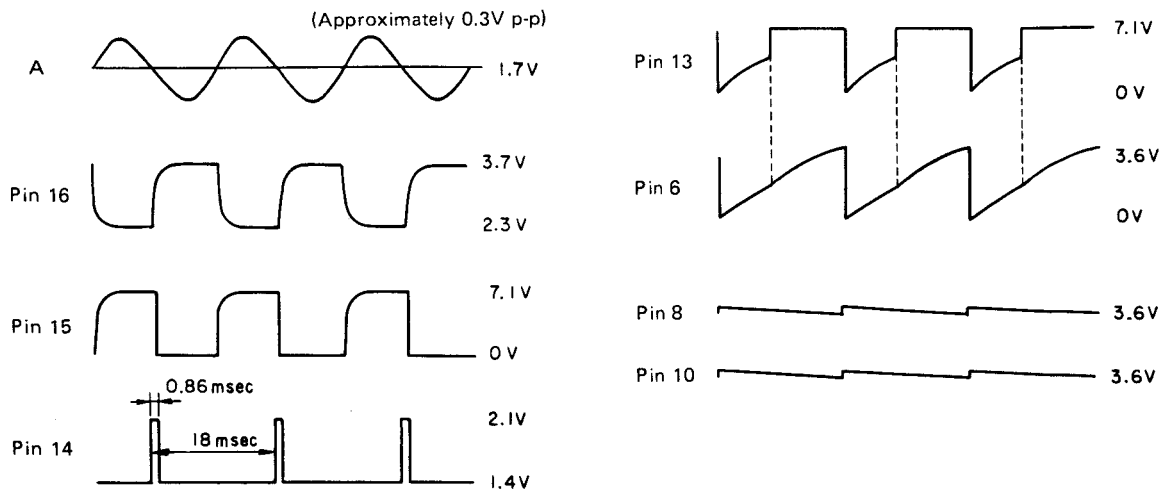


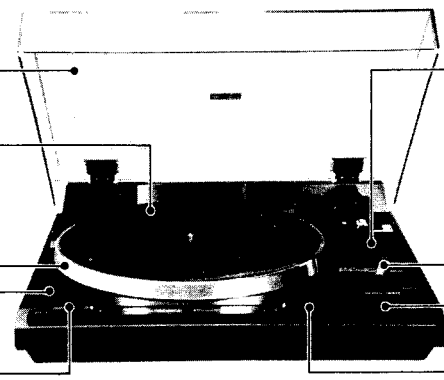
Fig. 4-4 Phono Motor Circuit Waveforms

5. PARTS LOCATION

NOTES:

- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

Front View



★★ Dust cover PNV-061

Rubber sheet assembly PEA-066

Turntable platter PNR-219

Panel
PNY-339 (BLACK)
PNY-371 (SILVER)

SP button PAC-231

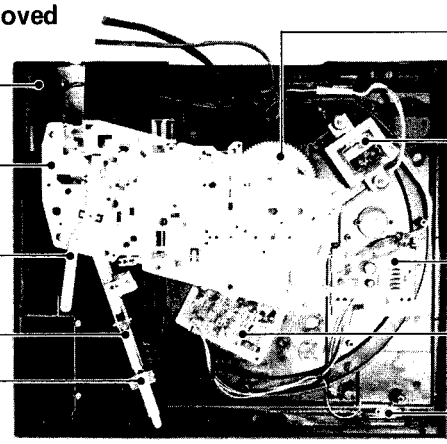
★ Tonearm assembly PPD-681

Cartridge assembly

S/S button PAC-230

EV button PAC-232

Bottom View with Under base Removed



Shield plate PNM-024

⚠ Sub-panel assembly

★★ Start lever unit PXV-036

EV lever (A) PNC-311

★★ Push switch PSG-048

Cam assembly PYY-164

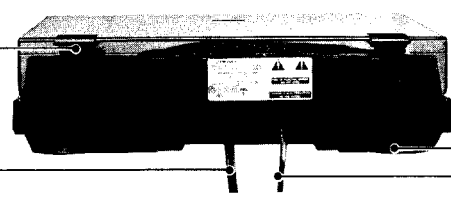
⚠ ★ Power transformer assembly PTX-070

⚠ Power supply assembly PWR-084

Motor P.C. board PWM-197

SP button PAC-231

Rear View



★ Hinge assembly PXB-321

PU cord assembly PXB-333

Insulator PEB-251

⚠ Power cord assembly PDF-224

6. DISASSEMBLY

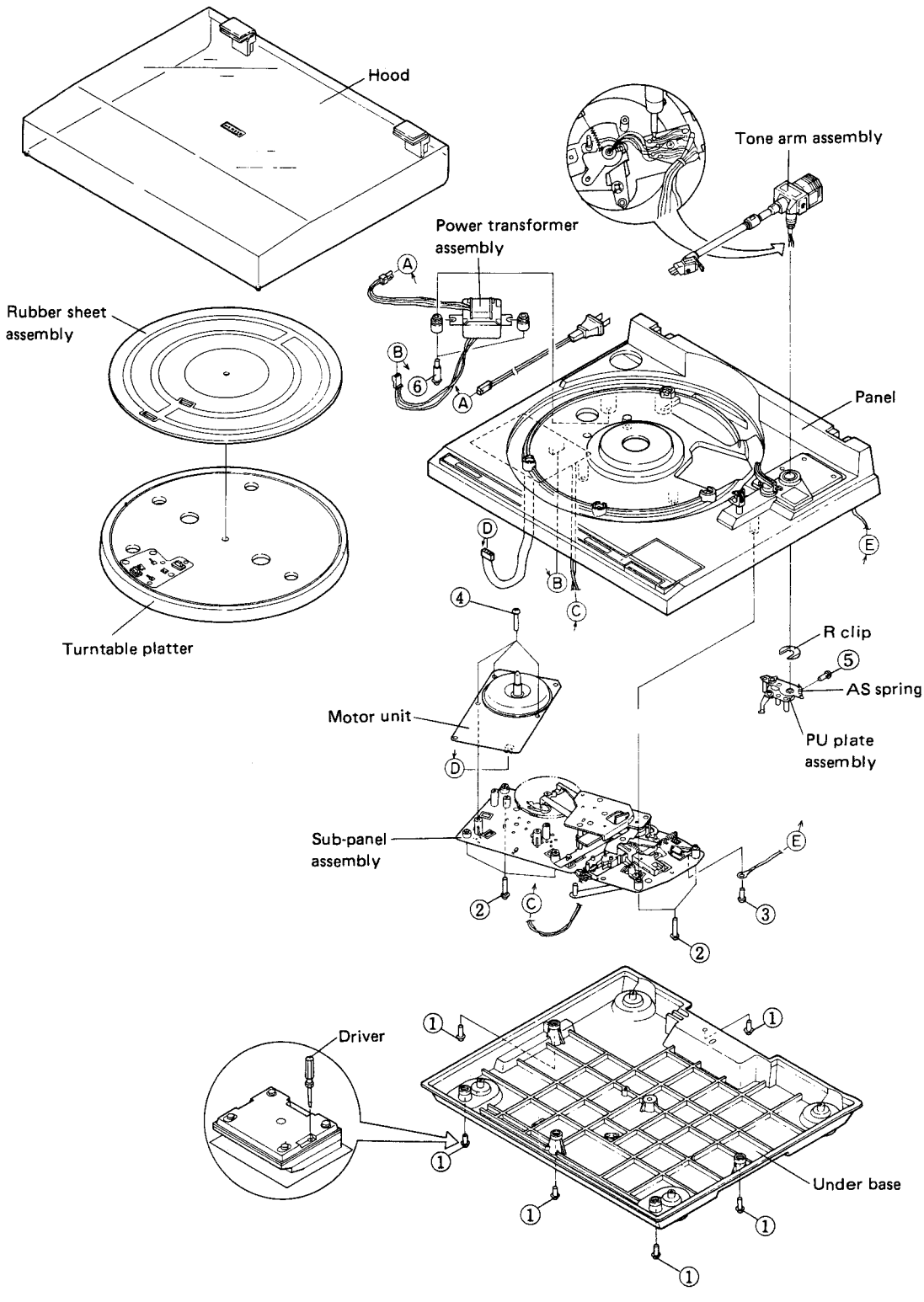


Fig. 6-1 Disassembly

- **Mechanism Assembly and Motor**

1. Turn on the turntable and free the mechanism.
2. Fasten the tone arm to the arm rest.
3. Remove the rubber sheet and turntable.
4. Close the player hood and turn the player upside down and place it on a soft cloth so that the player hood is not damaged.
5. Remove the six screws ① , and remove the under base.
6. Remove five screws ② and one screw ③
7. Disconnect connectors Ⓐ and Ⓑ
   The mechanism assembly can be removed from the panel.
8. Remove the three screws ④ , and remove the motor.

See pages 29 to 32 for the parts installation and assembly precautions.

- **Tone Arm**

1. Remove the mechanism assembly from the panel.
2. Using a soldering iron, disconnect the PU lead wires (arm lead wires) from the PU P.C. board.
3. Remove the PU plate assembly AS spring.
4. Remove the one screw ⑤ , and remove the PU plate assembly from the tone arm.
5. Remove the R clip.
6. Turn the player onto its side, remove the arm rest clamp, and remove the tone arm from the panel.

- **Power Transformer Assembly**

Remove the two screws ⑥ .

7. EXPLODED VIEW AND PARTS LIST

7.1 EXTERIOR

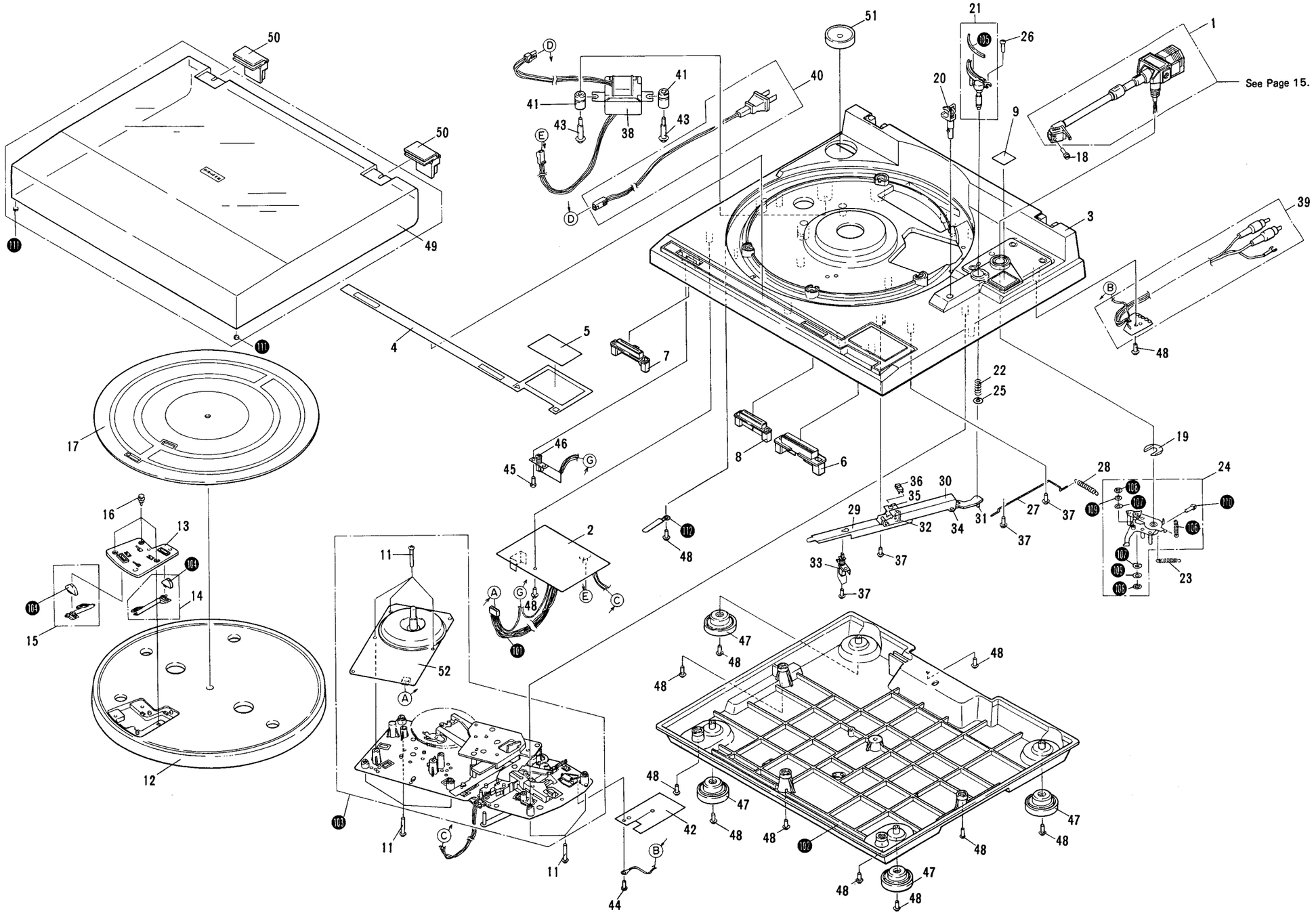
NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

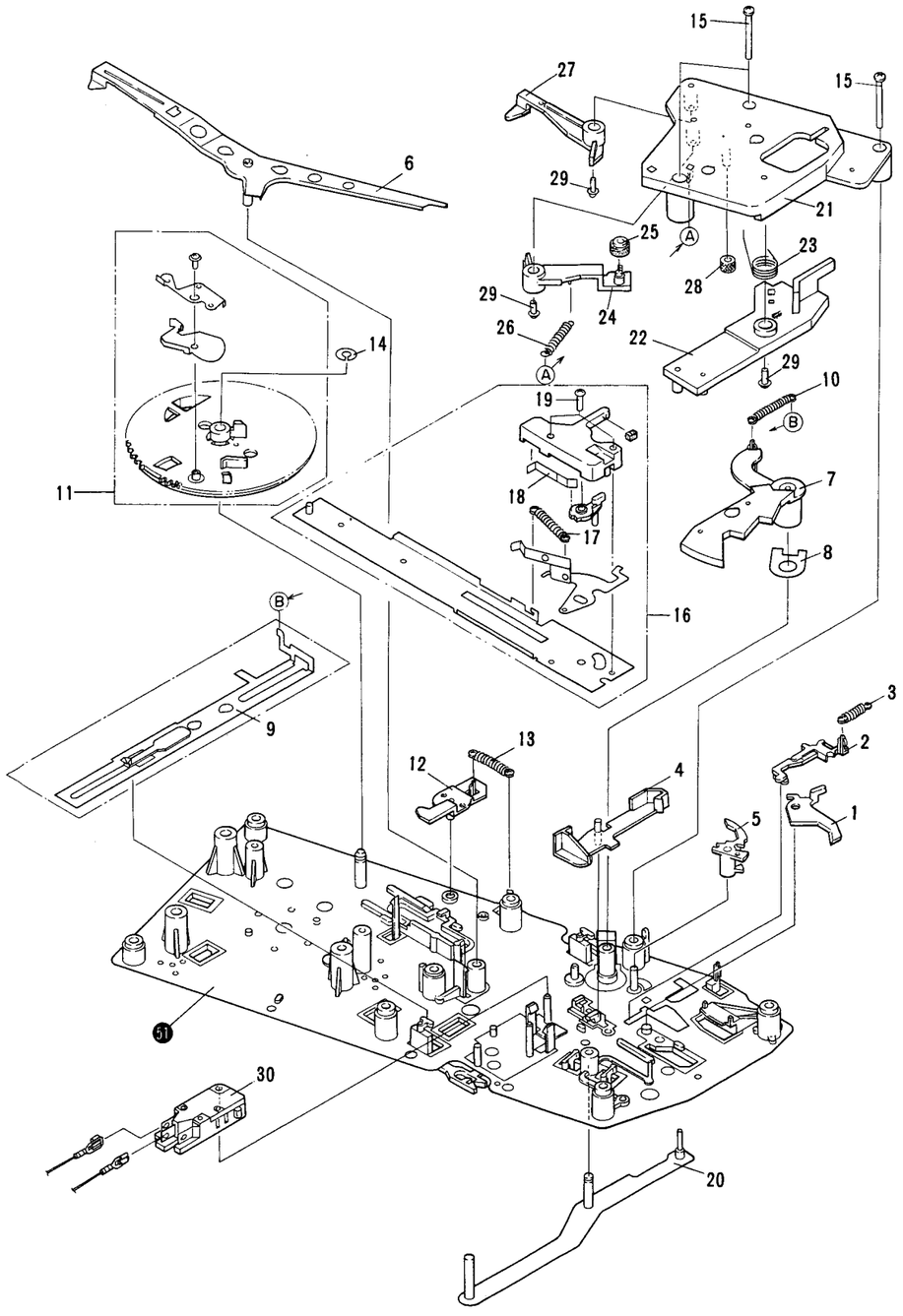
Parts List of Exterior

Mark	No.	Part No.	Description
★	1.	PPD-681	Tonearm assembly
⚠	2.	PWR-084	Power supply assembly
	3.	PNY-339	Panel (BLACK)
		PNY-371	Panel (SILVER)
	4.	PAM-218	Screen
	5.	PAN-142	Panel board (BLACK)
		PAN-165	Panel board (SILVER)
	6.	PAC-230	S/S button
	7.	PAC-231	SP button
	8.	PAC-232	EV button
	9.	PAN-066	AS board
	10.		
	11.	IPC30P290FMC	Screw
	12.	PNR-219	Turntable platter
	13.	PNY-059	Hook holder
★★	14.	PXV-037	Record detector unit
★★	15.	PXV-038	Size detector unit
	16.	PBM-011	Plastic rivet
	17.	PEA-066	Rubber sheet assembly
	18.	PBA-170	Cartridge mounting screw
	19.	PBK-059	R clip
★	20.	PXB-332	Arm rest assembly
★★	21.	PXV-068	EV sheet unit
	22.	PBH-355	EV spring
	23.	PBH-425	AS spring
	24.	PXB-323	PU plate assembly
	25.	PBF-020	Washer
	26.	BPZ26P120FZK	Screw
	27.	PBH-421	S/S rod
	28.	PBH-356	Select lever spring
	29.	PNC-311	EV lever (A)
	30.	PNC-312	EV lever (B)
	31.	PNY-130	EV lever (C)
	32.	PBH-375	EV lever spring
★★	33.	PSG-048	Push switch
	34.	PLB-210	EV lever shaft
	35.	TMZ30P120FMC	Screw
	36.	YU30FUC	Nut
	37.	IPC30P100FMC	Screw
⚠ ★	38.	PTX-070	Power transformer assembly
	39.	PXB-333	PU cord assembly
⚠	40.	PDF-224	Power cord assembly
	41.	PEB-250	Damper rubber
	42.	PNM-024	Shield plate
	43.	PBA-144	Clamp screw
	44.	PSZ30P060FMC	Screw
	45.	PPZ30P080FMC	Screw
★★	46.	PSG-050	Push switch
	47.	PEB-251	Insulator
	48.	IPC30P100FMC	Screw
★★	49.	PNV-061	Dust cover
★	50.	PXB-321	Hinge assembly
	51.	N93-603	45 adaptor
★★	52.	PXM-141	Motor assembly
	53.	PDE-307	Connector assembly
	101.		Lead wire assembly
	102.		Under base
⚠	103.		Sub-panel assembly
	104.		Rubber guard
	105.		Rubber sheet
	106.		PU plate spring
	107.		PU spring washer
	108.		Washer
	109.		Washer
	110.		Screw
	111.		Rubber foot
	112.		Cord stopper

Exterior



7.2 MECHANISM SECTION (SUB-PANEL ASSEMBLY)



NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

Parts List of Mechanism Section (Sub-Panel Assembly)

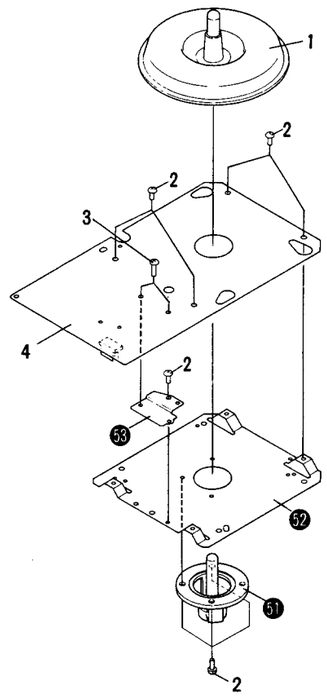
Mark	No.	Part No.	Description
	1.	PNY-028	Reset plate
	2.	PNY-140	Selector
	3.	PBH-394	Reset plate spring
★★	4.	PNX-030	Switch lever
★★	5.	PNY-141	Switch locker
	6.	PXT-446	Detector lever unit
	7.	PNY-138	Index cam
	8.	PBK-039	Spring washer
★★	9.	PXV-060	Select lever unit
	10.	PBH-393	Select lever spring
	11.	PYY-164	Cam assembly
	12.	PNY-139	Lock plate
	13.	PBH-392	Lock plate spring
	14.	PBH-018	Polyslider washer
	15.	PBA-172	Screw (2.6 x 10)
	16.	PXB-376	Drive board assembly
	17.	PBH-224	Start board spring
	18.	PBK-038	Click spring
	19.	PMZ26P100FMC	Screw
★★	20.	PXV-036	Start lever unit
	21.	PNY-054	Stay
	22.	PNY-055	Hook guide
	23.	PBH-357	Hook guide spring
	24.	PNY-056	Click lever
★★	25.	PXV-044	Roller unit
	26.	PBH-358	Click lever spring
	27.	PNY-058	Timing lever
	28.	PED-027	Cushion
	29.	IPZ30P100FMC	Screw (3 x 10)
⚠ ★★	30.	PSF-023	Microswitch (POWER)
	51.		Sub-panel unit

7.3 MOTOR ASSEMBLY (PXM-141)

Parts List of Motor Assembly

Mark	No.	Part No.	Description
	1.	PXV-107	Rotor unit
	2.	PSZ30P050FMC	Screw (3 x 5)
	3.	PBZ30P100FMC	Screw
	4.	PWM-197	Motor P.C. board assembly
	51.		Spindle base unit
	52.		Base
	53.		Heat sink

Motor Assembly

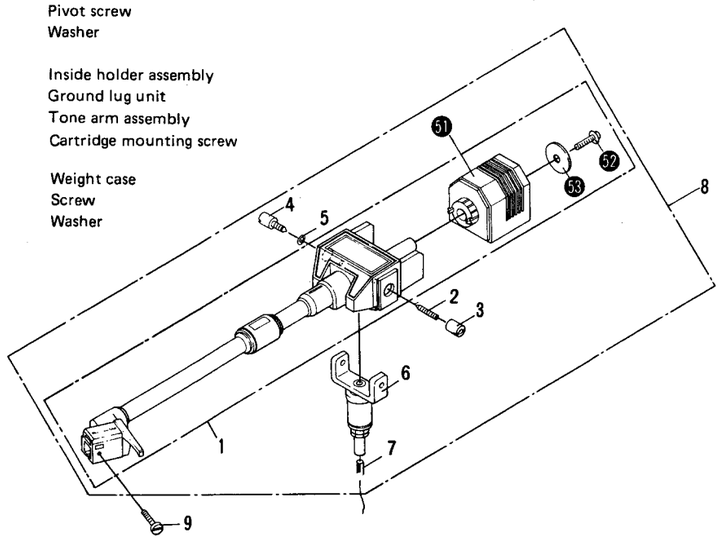


7.4 TONE ARM ASSEMBLY (PPD-681)

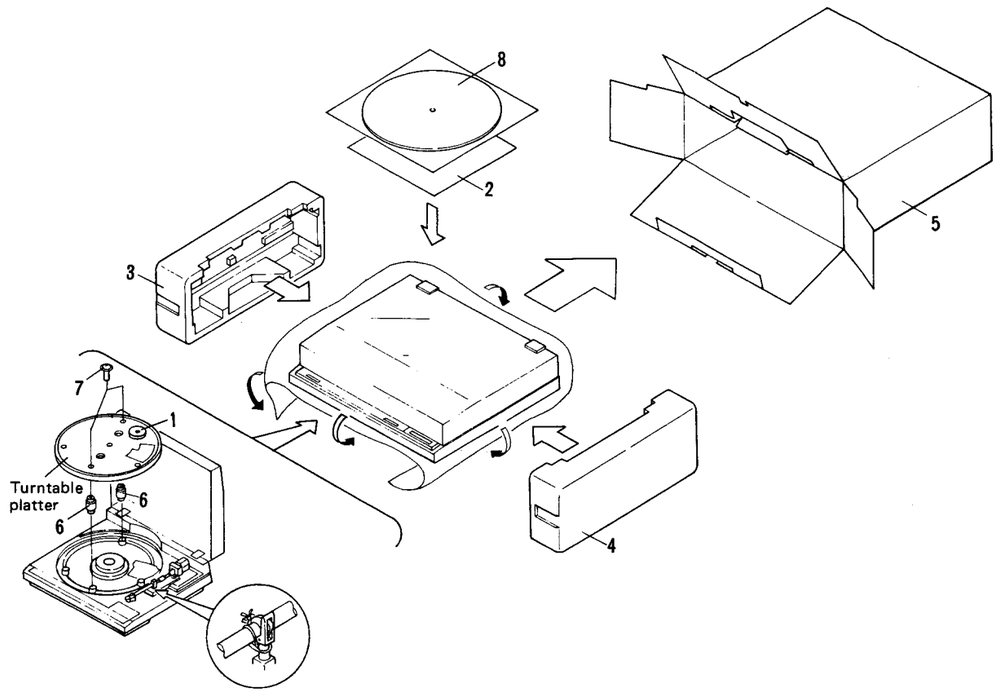
Parts List of Tonearm Section

Mark	No.	Part No.	Description
	1.	PXB-621	Pipe holder assembly
	2.	PLB-654	Pivot
	3.	PLB-655	Pivot lock nut
	4.	PLB-653	Pivot screw
	5.	WS30FMC	Washer
	6.	PXB-622	Inside holder assembly
★★	7.	PDF-514	Ground lug unit
★	8.	PPD-681	Tone arm assembly
	9.	PBA-170	Cartridge mounting screw
	51.		Weight case
	52.		Screw
	53.		Washer

Tone Arm Assembly



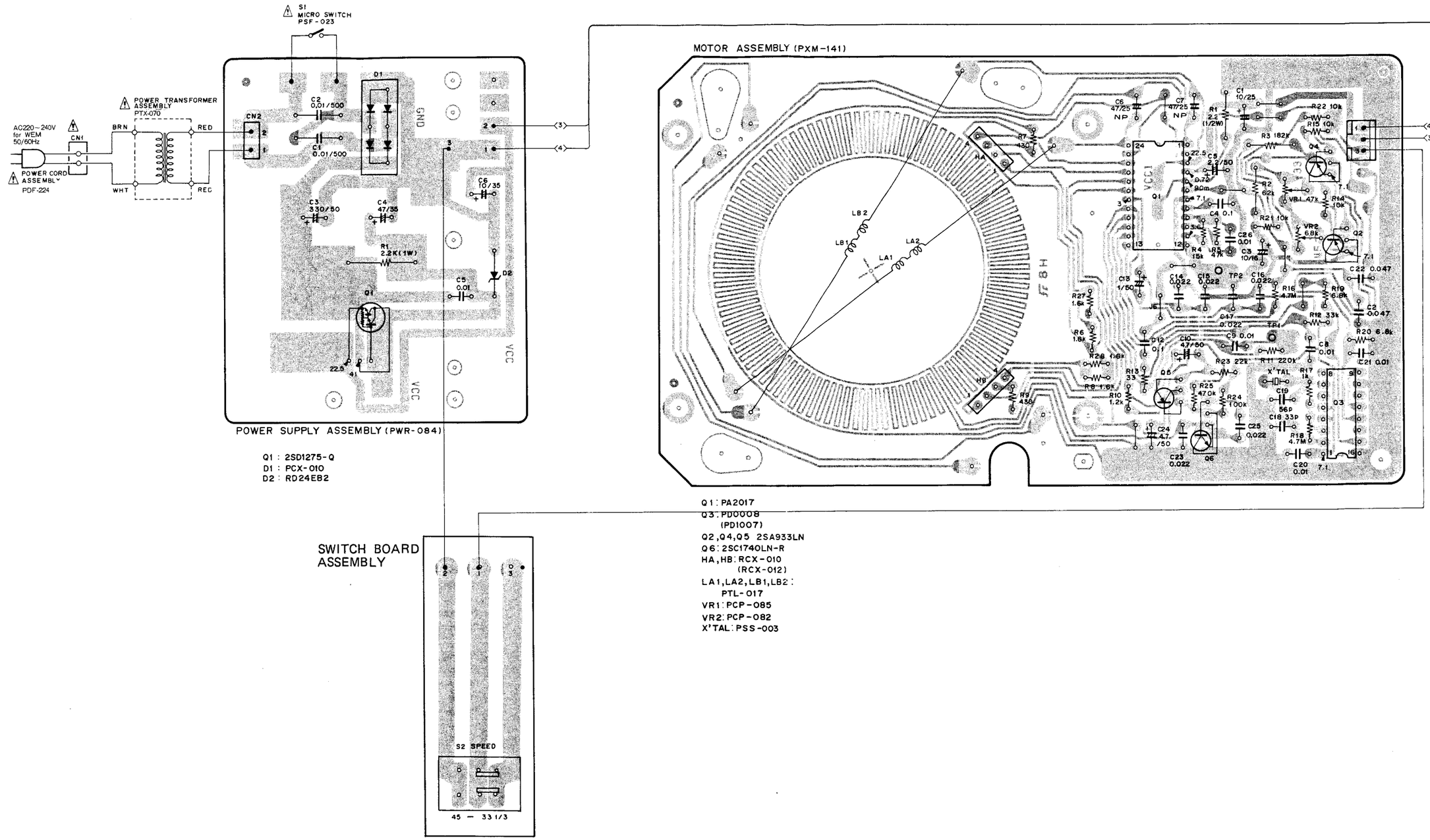
8. PACKING



Parts List of Packing

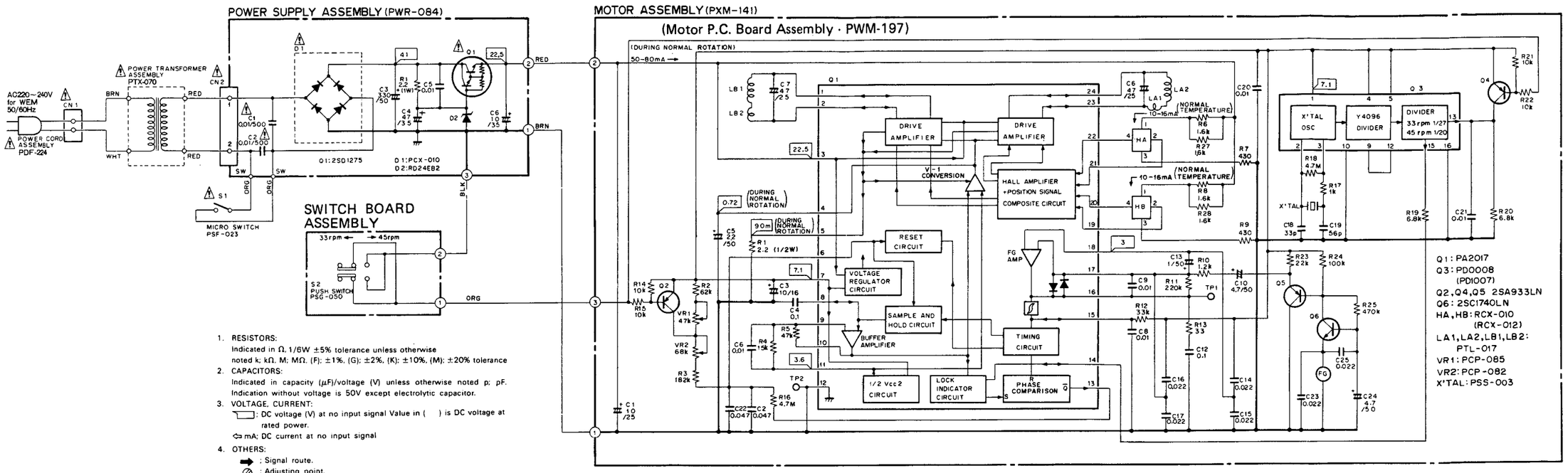
Mark	No.	Part No.	Description
	1.	N93-603	45 adaptor
	2.	PRE-064	Operating instructions (English/German/French/Italian)
	3.	PHA-173	Protector (L)
	4.	PHA-174	Protector (R)
	5.	PHH-378	Packing case (BLACK)
		PHH-380	Packing case (SILVER)
	6.	PNY-198	Packing
	7.	PBA-178	Screw
	8.	PEA-066	Rubber sheet assembly

9. P.C. BOARDS CONNECTION DIAGRAM



10. SCHEMATIC DIAGRAM

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.



1. RESISTORS:
   Indicated in Ω, 1/6W ±5% tolerance unless otherwise noted k; kΩ. M; MΩ. (F); ±1%, (G); ±2%, (K); ±10%, (M); ±20% tolerance
2. CAPACITORS:
   Indicated in capacity (μF)/voltage (V) unless otherwise noted p; pF. Indication without voltage is 50V except electrolytic capacitor.
3. VOLTAGE, CURRENT:
   ▭: DC voltage (V) at no input signal Value in ( ) is DC voltage at rated power.
   ⇦ mA; DC current at no input signal
4. OTHERS:
   ➡ : Signal route.
   ⊘ : Adjusting point.

The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.
※ marked capacitors and resistors have parts unmbers.
The underlined indicates the switch position.

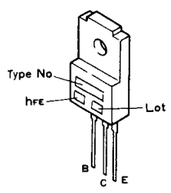
This is the basic schematic diagram, but the actual circuit may vary due to improvements in design.

5. SWITCHES:
   S1 : POWER ON – OFF
   S2 : SPEED 33 1/3rpm – 45rpm

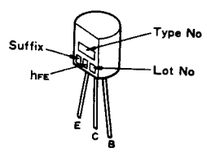
THE UNDERLINED INDICATES THE SWITCH POSITION

External Appearance of Transistor and ICs

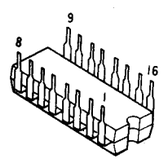
2SD1275



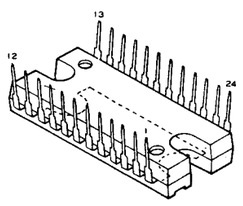
2SA933LN
2SC1740LN
2SA933S



PD0008
PD1007



PA2017



11. ELECTRICAL PARTS LIST

NOTES:

- *When ordering resistors, first convert resistance values into code form as shown in the following examples.*
  Ex. 1 When there are 2 effective digits (any digit apart from 0), such as 560 ohm and 47k ohm (tolerance is shown by J = 5%, and K = 10%).

560Ω	*56 × 10¹*	*561*	*RD1/4PS 5 6 1 J*
47kΩ	*47 × 10³*	*473*	*RD1/4PS 4 7 3 J*
0.5Ω	*0R5*		*RN2H 0 R 5 K*
1Ω	*010*		*RS1P 0 1 0 K*

  Ex. 2 When there are 3 effective digits (such as in high precision metal film resistors).

5.62kΩ	*562 × 10¹*	*5621*	*RN1/4SR 5 6 2 1 F*

- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

Miscellaneout parts

P.C. BOARD ASSEMBLIES

Mark	Symbol & Description	Part No.
	Power supply assembly	PWR-084
	Switch board assembly	No supply
	Motor P.C. board assembly	PWM-197

OTHERS

Mark	Symbol & Description	Part No.
★★	Motor assembly	PXM-141
★★ S1	Microswitch (POWER)	PSF-023
⚠ ★	Power transformer assembly	PTX-070
⚠	Power cord assembly	PDF-224
	PU cord assembly	PXB-333

Power Supply Assembly (PWR-084)

SEMICONDUCTORS

Mark	Symbol & Description	Part No.
⚠ ★★	Q1	2SD1275
⚠ ★	D1	PCX-010
★	D2	RD24EB2 (RD24EB1)

CAPACITORS

Mark	Symbol & Description		Part No.
	C3		CEA331M50L
	C4		CEA470M35
	C6		CEA100M35
⚠	C1	(0.01/500V)	CKDYE103P500
⚠	C2	(0.01/500V)	CKDYE103P500
	C5		CKDYF103Z50

RESISTOR

Mark	Symbol & Description	Part No.
	R1	RS1PMF222J

OTHERS

Mark	Symbol & Description	Part No.
	Screw (3 x 6)	PZZ30P060FMC

Motor P.C. Board assembly (PWM-197)

SEMICONDUCTORS

Mark	Symbol & Description	Part No.
★★	Q1	PA2017
★★	Q3	PD0008 (PD1007)
★★	Q6	2SC1740LN
★★	Q2, Q4, Q5	2SA933LN (2SA933S)

CAPACITORS

Mark	Symbol & Description	Part No.
	C2	CQPA473J50
	C8, C9	CQMA103K50
	C4, C12	CKDYX104M25 (PCL-046)
	C22	PCL-052
	C18	CCDCH330J50
	C19	CCDCH560J50
	C20, C21, C26	CKDYF103Z50
	C14, C15, C16, C17, C23, C25	CKDYF223Z50
	C1	CEA100M25
	C6, C7	CEANP470M25
	C3	CEA100M16
	C13	CEA010M50
	C5	CEA2R2M50
	C10, C24	CEA4R7M50

RESISTORS

NOTE: When ordering resistors, convert the resistance value into code form, and then rewrite the part no. as before.

Mark	Symbol & Description		Part No.
★	VR1	Semi-fixed 47k(B) (33rpm)	PCP-085
★	VR2	Semi-fixed 68k(B) (45rpm)	PCP-082
	R1		RD1/2PM2R2J
	R2, R3		RN1/4PQ□□□□F
		Other resisters	RD1/6PM□□□J

OTHERS

Mark	Symbol & Description		Part No.
★		X'tal	PSS-003
	HA, HB	Hall element	PCX-010 (RCX-012)
		Screw (3 x 5)	PSZ30P050FMC
		Screw (3 x 10)	PBZ30P100FMC
	LA1, LA2, LB1, LB2	Coil	PTL-017

Switch Board Assembly

SWITCH

Mark	Symbol & Description	Part No.
★★	Switch (SPEED)	PSG-050

12. ADJUSTMENT

12.1 MOTOR OPERATION ADJUSTMENT

1. Remove the underbase.
2. Connect the Ach of a dual trace oscilloscope to the circuit board unit, Q3 (PD0008) pin 15, and GND. Adjust the time axis so that 1 period of the output waveform is equal to 8 divisions in the 33 rpm mode. Fig. 12-2 (a).
3. Connect the Bch of a dual trace oscilloscope to Q1 (PA2017) pin 15, and GND. Adjust VR2 (45 rpm) so that the relation between the Ach and Bch waveforms in the 45 rpm mode is as shown in Fig. 12-2 (b).
4. Set the turntable to 33 rpm and adjust VR1 (33 rpm) until the relation between the Ach and Bch waveforms are as shown in Fig. 12-2 (c).
5. Always make motor operation adjustments starting with 45 rpm and ending with 33 rpm.

12.2 MECHANISM ADJUSTMENT

- **Stylus Landing Position Adjustment**

When the tone arm doesn't land in the correct position during automatic playback, adjust according to the following procedure.

1. Place a 30 cm record on the platter.
2. Press the START/STOP switch and start automatic playback. Note the direction and amount if the landing point is off. (How many mm to the inside or outside from the record grooves.)
3. Depress the START/STOP switch to return the tone arm to its rest.
4. Press the arm elevation switch to raise the stylus.
5. Move the tone arm to the outside edge of the record by hand.
6. Turn the adjustment screw with a small screwdriver according to the direction and amount checked at item 2 as follows:
   - When the stylus lands at the outside of the record, turn the adjustment screw in the ↷ direction.
   - When the stylus lands at the inside of the record, turn the adjustment screw in the ↶ direction.

   One half turn of the adjustment screws moves the tone arm about 12 mm.
7. After adjustment, press the START/STOP switch and check if the stylus landing point was correctly adjusted.
   If adjustment is incorrect, repeat items 3 to 6.

Be careful not to damage the record and stylus when making this adjustment.

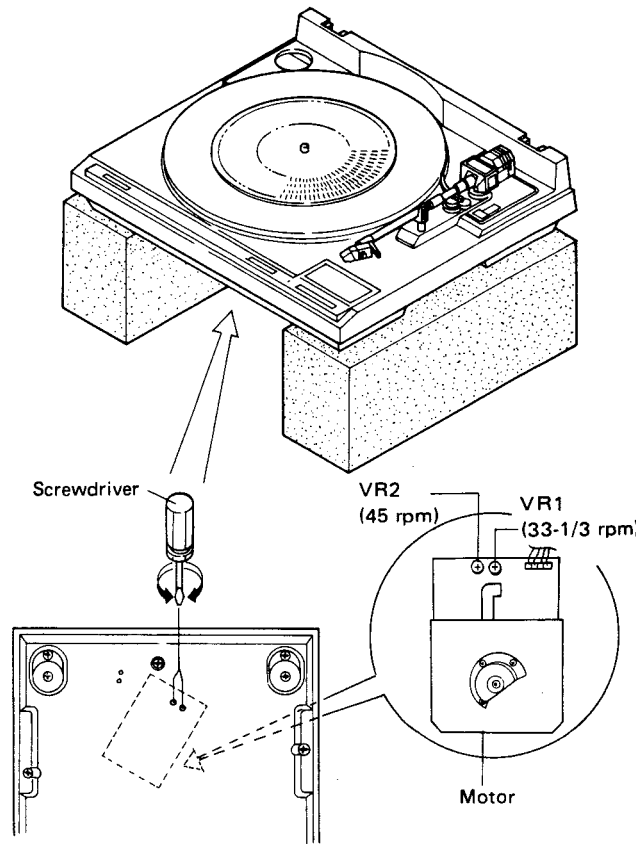


Fig. 12-1 Motor adjustment

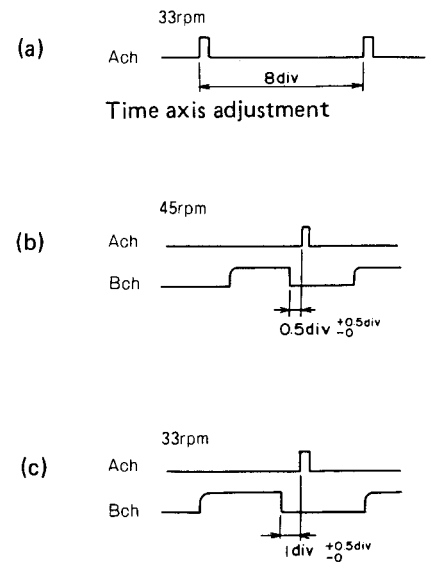


Fig. 12-2 Motor Operation Adjustment Waveforms

Adjustment using a test record

(Lowering position adjustment is made with the tone arm on the outside edge of the record.)

30 cm landing point . . . Lands between count 306 and 313.

17 cm landing point . . . Lands between count 175 and 183.

• Auto-Return Position Adjustment

When auto-return occurs too early or too late, make the following adjustments.

1. Check the stylus landing position. If the stylus does not land at the correct position, adjust the landing position.
2. Set the arm elevation switch to UP and turn the auto-return adjustment screw fully counter-clockwise.
3. Move the tone arm as far as it will go toward the inside.
4. When the auto-return adjustment screws is turned slowly clockwise, the tone arm will begin to move toward the inside.
5. Stop turning the adjustment screw at the point at which there is a space of 32 mm between the cartridge stylus and the center shaft. (Fig. 12-3)
6. After adjustment, check is auto-return is performed correctly and that the stylus landing position is correct.

• Arm Elevation Height Adjustment

1. Depress the arm elevation switch to lower the arm.
2. Adjust the screw under the turntable so the stylus is 11 mm above the panel. When the adjustment screw is turned counterclockwise, the stylus rises. (Fig. 12-3)
3. Depress the arm elevation switch to raise the tone arm.
4. Adjust the screws next to the arm elevation switch so the stylus is 25.5 mm above the panel.

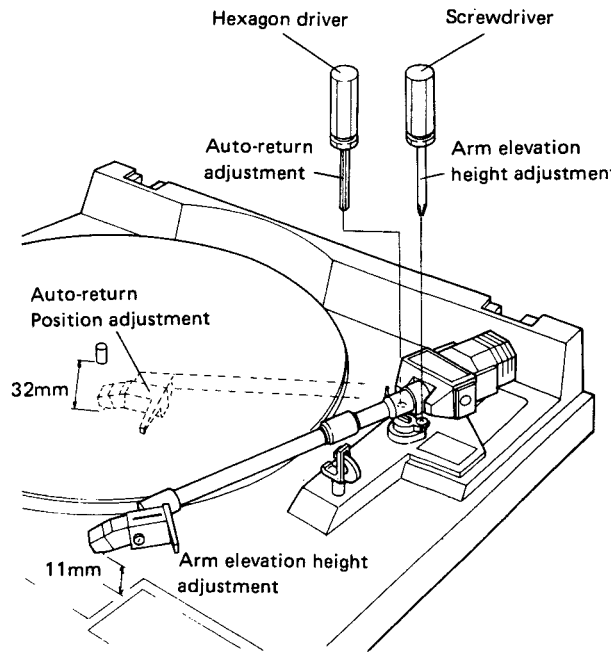


Fig. 12-3 Arm elevation height adjustment and auto-return adjustment

13. PRECAUTIONS FOR REASSEMBLY

If new parts have been used, follow these directions and precautions when reassembling a unit after completing repairs. Be sure to lubricate as required, make no mistakes when attaching parts, and avoid all other careless mistakes that may be the cause of trouble later on.

13.1 AREAS THAT REQUIRE LUBRICATION

NOTE:
Types of lubricants and areas where they are used are listed in table 1.

Table 1

Type of Oil	Areas used
Silicon Oil #50000	raising shaft
GYA-008	all other areas

Lubrication points are specified for oils other than GYA-008. Never use a different type of oil.

- **Cam Section**

Apply grease to the heart-shaped grooved section (rear side of the cam) and lock plate sliding section in order to minimize wear on the sliding section and the burden on the mechanism.

- **Driving Plate Assembly**

Decrease the burden on the mechanism and the wear on the sliding section.

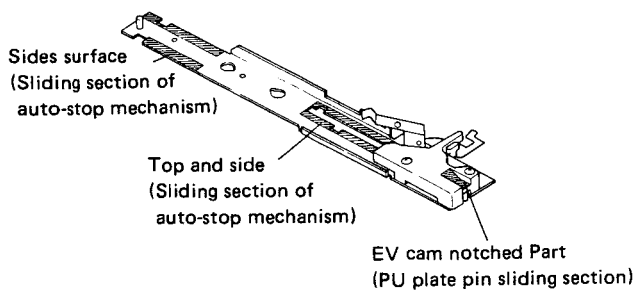


Fig. 13-1 Driving panel assembly section Switch Locker Section

- **Switch Locker Section**

Apply grease to the switch locker (opening) and sub-panel base sliding section to decrease the burden on the mechanism.

When applying grease to the opening (shaft hole), do not apply any grease 2 ~ 3mm from the bottom surface. If grease is applied 2~3mm within the bottom surface, it may come out the bottom and go between the switch lever and sub-panel base causing the switch lever to operate ineffectively.

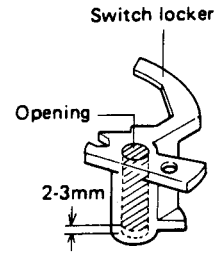


Fig. 13-2 Switch locker section

- **Selector Section**

Apply grease to the surface of the sub-panel base of the selector sliding section to decrease the burden on the mechanism and wear on the sliding section.

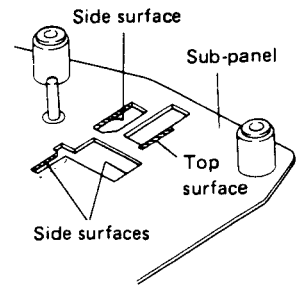


Fig. 13-3 Selector section

- **Reset Plate Section**

Apply grease to the sub-panel base (shaft) and sliding section of the reset plate to decrease the burden on the mechanism.

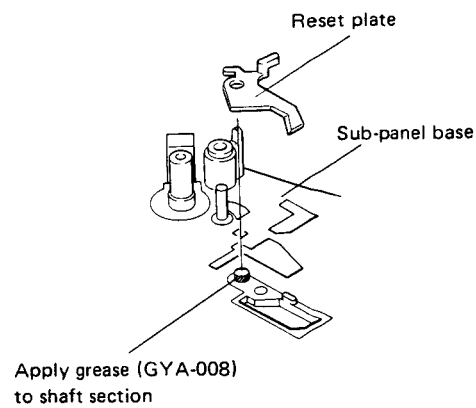


Fig. 13-4 Reset plate section

- **Index Cam Section**

Apply grease to the index cam and lower surface of the hooked section to decrease the burden on the mechanism.

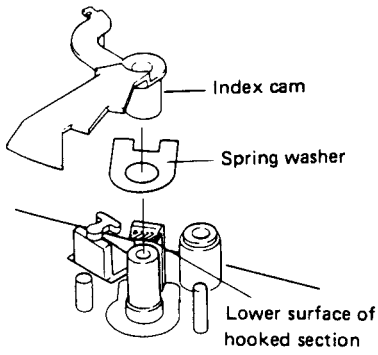


Fig. 13-5 Index cam section

- **EV Sheet Section**

Apply oil to the raising shaft and sliding section of the bearing to assure stability in the elevation lowering speed.

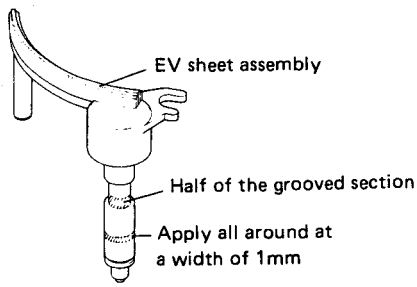


Fig. 13-6 EV sheet section

- **Cam section**

Coat the convex side of the cam with grease to prevent cam and timing lever contact section wear.

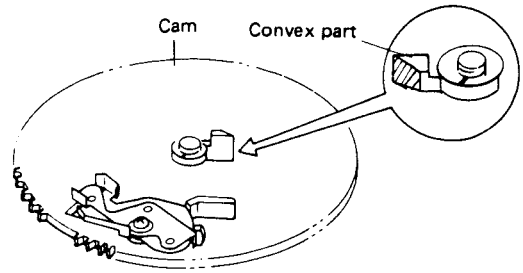


Fig. 13-7 Cam section

13.2 PRECAUTIONS FOR ATTACHMENT OF PARTS AND REASSEMBLY

- **Reset Plate SP Attachment**

As shown in Fig. 13-8, the reset plate SP hook is attached by putting the open section on the sub-panel base side.

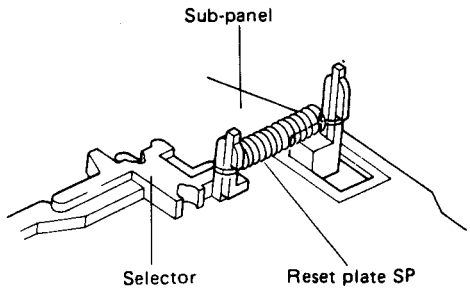


Fig. 13-8 Reset plate SP attachment

- **Cam Assembly Attachment**

The cam assembly is attached by letting the lock plate go in the direction Ⓐ as shown in Fig. 13-9.

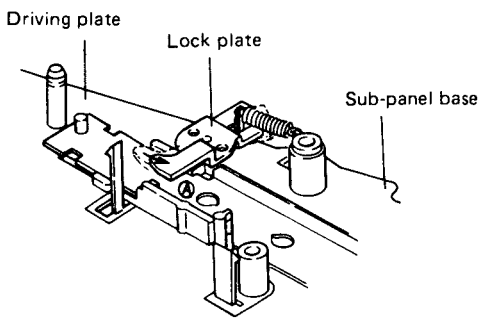


Fig. 13-9 Cam assembly attachment

- **Motor Attachment**

When installing the motor, set the cam in the mechanism stop location and verify that the starting plate section Ⓑ does not protrude beyond surface Ⓐ of the cam. If the motor is attached with the starting plate section Ⓑ protruding, the starting plate may be deformed, the motor pinion gear may be scratched, and the return function may be damaged.

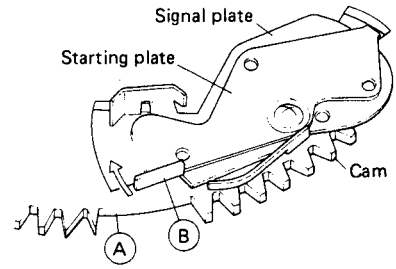


Fig. 13-10 Motor attachment

- **Start Lever Unit Attachment**

Attach the shaft section of the start lever unit as shown in Fig. 13-11 so that it comes between the reset plate and start plate.

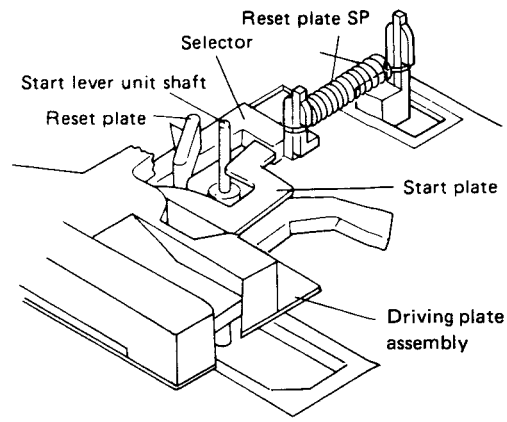


Fig. 13-11 Start lever unit attachment

- **Mechanism assembly Attachment**

1. PU plate shaft position confirmation

When attaching the arm base section to the mechanism section, put the mechanism section switch locker and switch lever in the locked position and verify that the tone arm is in the arm rest location. Also check that the PU plate shaft is in the position shown in Fig. 13-12.

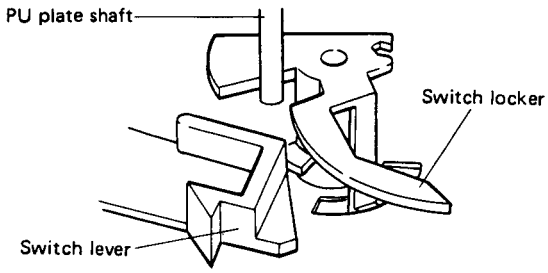


Fig. 13-12 Arm base attachment

2. PU lead wire position confirmation

When attaching the mechanism assembly to the panel, be careful that the PU lead wire is not pinched at the panel boss as shown in Fig. 13-13.

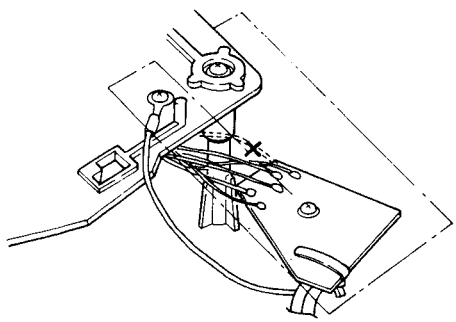


Fig. 13-13 PU lead wire attachment

- **PU Plate Attachment**

Push the PU plate into place so that the PU plate bearing section touches the revolution shaft attachment nut. Installation direction is as shown in Fig. 13-14.

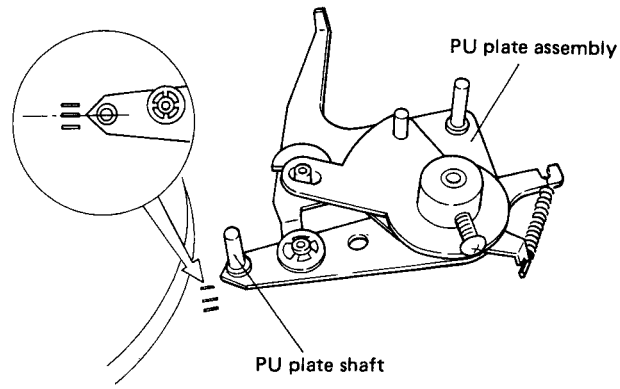


Fig. 13-14 PU plate attachment

14. FOR WB TYPE

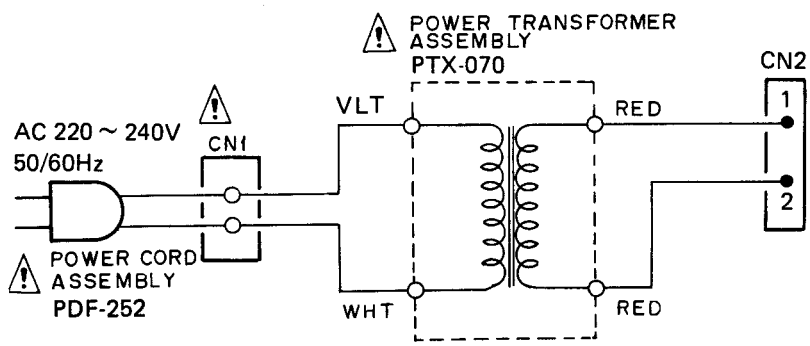
NOTES:

- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your parts Stock Control, the fast moving items are indicated with the marks ★★ and ★.*
  ★★ GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model number, temperature, humidity, etc.
- *Parts marked by "◉" are not always kept in stock. Their delivery time may be longer than usual or they may be unavailable.*

PL-970 (BK)/WB and PL-970/WB types are the same as the PL-970 (BK)/WEM type except for following sections.

Mark	Symbol & Description	Part No.				Remarks
		PL-970(BK)/WEM	PL-970/WEM	PL-970(BK)/WB	PL-970/WB	
	Panel (BLACK)	PNY-339	. . .	PNY-339	. . .	
	Panel (SILVER)	. . .	PNY-371	. . .	PNY-371	
	Panel board (BLACK)	PAN-142	. . .	PAN-142	. . .	
	Panel board (SILVER)	. . .	PAN-165	. . .	PAN-165	
⚠	Power cord assembly	PDF-224	PDF-224	PDF-252	PDF-252	
	Operating instructions (English)	. . .	. . .	PRB-318	PRB-318	
	Operating instructions (English/German/French/Italian)	PRE-064	PRE-064	. . .	. . .	
	Packing case	PHH-378	PHH-380	PHH-378	PHH-380	

Power Supply Circuit for WB Type



12. RÉGLAGE

12.1 RÉGLAGE DU FONCTIONNEMENT DU MOTEUR

1. Déposer la base inférieure.
2. Connecter le Ach de lóscilloscope à deux traces, au bloc de la plaquette de circuit, à la broche No. 15 de Q3 (PD0008), et GND. Régler l´axe de temps de telle maniére quúne période de la forme d´onde de sortie soit égale à 8 divisions en mode de 33 tours/minute. Fig. 12-2 (a).
3. Connecter le Bch de l´oscilloscope à deux traces à la broche No. 15 de Q1 (PA2017), et GND. Régler VR2 (45 tours/minute) de telle manière que le rapport entre les formes d´onde Ach et Bch en mode de 45 tours/minute soit celui indiqué par la Fig. 12-2 (b).
4. Régler le plateau sur 33 tours/minute et régler VR1 (33 tours/minute) jusqu'à ce que le rapport entre les formes d´onde de Ach et Bch soit celui indiqué par la Fig. 12-2 (c).
5. Toujours effectuer les réglages de fonctionnement du moteur en commençant avec le mode de 45 tours/minute et en terminant avec celui 33 tours/minute.

12.2 RÉGLAGE DE LA POSITION DE DESCENTE DE LA POINTE DE LECTURE

Lorsque le bras de lecture ne descend pas sur la position correcte lors de la lecture automatique, réaliser le réglage en suivant la procédure suivante.

1. Placer un disque de 30cm sur le plateau.
2. Appuyer sur la touche de marche/arrêt (START/STOP) et faire débuter la lecture automatique. Noter la direction et la grandeur de l'écart du point de descente. (Nombre de mm vers l'intérieur ou vers l'extérieur du sillon.)
3. Appuyer sur la touche START/STOP pour faire retourner le bras de lecture sur son support.
4. Appuyer sur la touche de relevage du bras pour soulever la pointe de lecture.
5. Déplacer à la main le bras de lecture vers la périphérie du disque.
6. Tourner la vis de réglage à l'aide d'un petit tournevis, en fonction de la direction et de la quantité mesurées lors du point 2, comme suit:

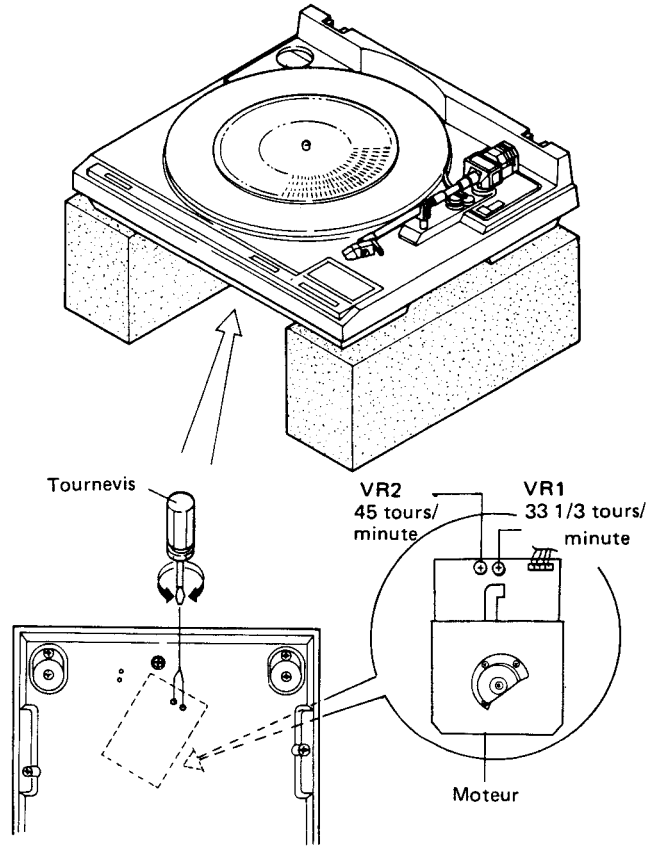


Fig. 12-1 Réglage du moteur

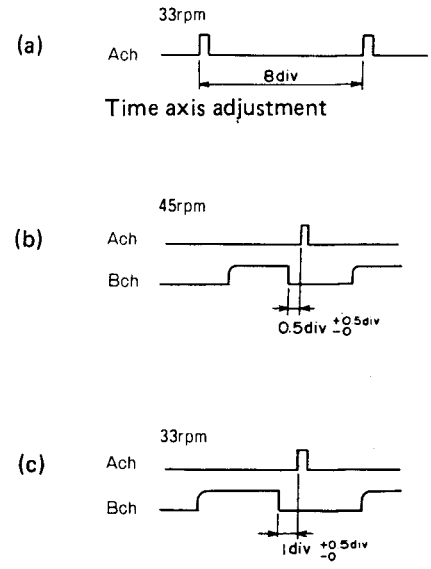


Fig. 12-2 Formes d´onde de réglage du fonctionnement du moteur

- Lorsque la pointe de lecture descend vers l'extérieur du disque, tourner la vis de réglage dans le sens
- Lorsque la pointe de lecture descend vers l'intérieur du disque, tourner la vis de réglage dans le sens
  Un demi-tour de la vis de réglage correspond à un déplacement d'environ 12mm du bras de lecture.

7. Après le réglage, appuyer sur la touche START/STOP et vérifier si le réglage de la position de descente a été correctement effectué.
   Si le réglage n'est pas correct, répéter les étapes 3 à 6.

Prendre soin de ne pas endommager le disque ni la pointe de lecture en réalisant ce réglage.

Réglage au moyen d'un disque d'essai

(Le réglage de la position d'abaissement est réalisé avec le bras de lecture placé sur la périphérie du disque.

Point de descente
pour 30cm ..... Descente entre les valeurs 306 et 313.

Point de descente
pour 17cm ..... Descente entre les valeurs 175 et 183.

- **Réglage de la position de retour automatique**

Réaliser les réglages suivants lorsque le retour automatique se produit tôt ou trop tard.

1. **Contrôler la position de descente de la pointe de lecture. Si la pointe de lecture ne descend pas sur la position correcte, ajuster la position de descente.**
2. **Régler la touche de relevage du bras sur la position "UP" et tourner la vis de réglage du retour automatique à fond dans le sens contraire des aiguilles d'une montre.**
3. **Déplacer le bras de lecture le plus possible vers l'intérieur.**
4. **Lorsque la vis de réglage du retour automatique est tournée lentement dans le sens des aiguilles d'une montre, le bras de lecture commence à se déplacer vers l'intérieur.**
5. **Arrêter de tourner la vis de réglage sur le point pour lequel il y a un écart de 32mm entre la pointe de lecture et l'axe central. (Fig. 12-3)**
6. **Après le réglage, vérifier que le retour automatique se réalise correctement et que la position de descente de la pointe est correcte.**

- **Réglage de la Hauteur D'élévation du Bras Acoustique**

1. Presser l'interrupteur d'élévation du bras acoustique pour abaisser le bras acoustique.
2. Régler la vis en dessous de la platine de lecture de telle manière que la hauteur de la pointe de lecture soit de 11 mm au-dessus du panneau. La pointe de lecture se lève lorsque l'on tourne la vis de réglage dans le sens contraire des aiguilles d'une montre.
3. Presser l'interrupteur d'élévation du bras acoustique pour soulever le bras acoustique.
4. Régler les vis du côté de l'interrupteur d'élévation du bras acoustique de telle manière que la hauteur de la pointe de lecture soit de 25,5 mm au-dessus du panneau.

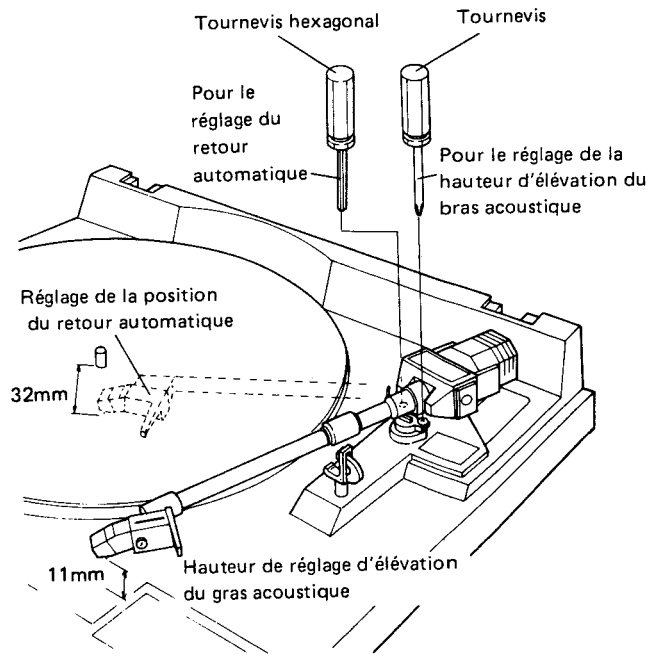


Fig. 12-3 Réglages de la hauteur d'élévation du bras acoustique et du retour automatique

12. AJUSTE

12.1 AJUSTE DE LA OPERACIÓN DEL MOTOR

1. Sacar la sub-base.
2. Conectar el Ach del osciloscopio de trazas dobles a la unidad de tablero de circuito, al pasador No. 15 de Q3 (PD0008) y GND. Ajustar el eje de tiempo, de manera que la forma de onda de salida sea igual a 8 divisiones en el modo de 33 rpm. Figura 12-2 (a).
3. Conectar el Bch del osciloscopio de trazas dobles a Q1 (PA2017) pasador No. 15, y GND. Ajustar el VR2 (45 rpm) de manera que la relación entre las formas de onda de Ach y Bch en el modo de 45 rpm sea como se muestra en la Fig. 12-2 (b).
4. Fijar el disco giratorio a 33 rpm y ajustar el VR1 (33 rpm) hasta que la relación entre las formas de onda Ach y Bch sea como se muestra en la Fig. 12-2 (c).
5. Siempre efectúe los ajustes de la operación del motor comenzando por 45 rpm y terminando con 33 rpm.

12.2 AJUSTE DE LA POSICIÓN DE DESCENSO DE LA AGUJA

Cuando el brazo fonocaptor no desciende en la posición correcta durante la reproducción automática, ajustar de acuerdo con el procedimiento siguiente.

1. Poner un disco de 30cm sobre el plato.
2. Presionar el interruptor de inicio/parada (START/STOP) e iniciar la reproducción automática. Notar la dirección y cantidad si el punto de descenso es incorrecto. (Cuántos mm hacia el interior o exterior de los surcos del disco.)
3. Presionar el interruptor de inicio/parada (START/STOP) para hacer volver el brazo fonocaptor a su posición de apoyo.
4. Presionar el interruptor de elecación del brazo para hacer ascender la aguja.
5. Desplazar el brazo fonocaptor hacia el borde exterior del disco con la mano.
6. Girar el tornillo de ajuste con un destornillador pequeño de acuerdo con la dirección y cantidad comprobadas en el item 2 del modo siguiente:
   - Cuando la aguja desciende fuera del disco, girar el tornillo de ajuste en la dirección
   - Cuando la aguja desciende en el interior del disco, girar el tornillo de ajuste en la dirección

   Media vuelta de los tornillos de ajuste desplaza el brazo fonocaptor unos 10mm.

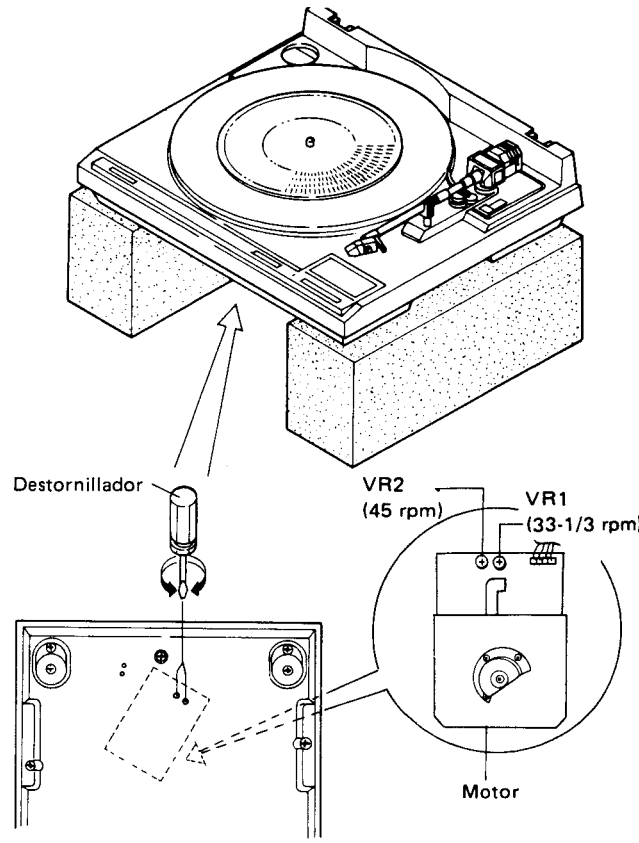


Fig. 12-1 Ajuste del motor.

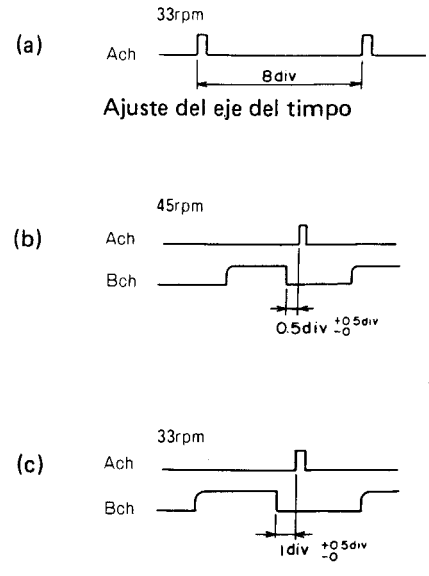


Fig. 12-2 Formas de onda de ajuste de la operación del motor

7. Después del ajuste, presionar el interruptor de reproducción/parada (START/STOP) y comprobar si el punto de descenso de la aguja se ha ajustado correctamente.
   Si el ajuste es incorrecto, repetir los items 3 al 6.

Tener cuidado de no dañar el disco ni la aguja al efectuar este ajuste.

Ajuste empleando un disco de prueba

(El ajuste de la posición de descenso se efectúa con el brazo fonocaptor sobre su borde exterior del disco.)

Punto de descenso
para 30cm ..... Desciende entre el cómputo 306 y 313.

Punto de descenso
para 17cm ..... Desciende entre el cómputo 175 y 183.

- **Ajuste de la posición de retorno automático**

  Cuando el retorno automático se produce demasiado rápido o demasiado tarde, efectuar los ajustes siguientes.

1. Comprobar la posición de descenso de la aguja. Si la aguja no desciende en la posición correcta, ajustar la posición de descenso.
2. Ajustar el interruptor de elevación del brazo en la posición UP y girar el tornillo de ajuste de retorno automático completamente hacia la izquierda.
3. Desplazar el brazo fonocaptor hacia el interior al máximo.
4. Cuando se giran lentamente los tornillos de ajuste de retorno automático hacia la derecha, el brazo fonocaptor emplezará a moverse hacia el interior.
5. Dejar de girar el tornillo de ajuste en el punto en el que haya un espacio de 32mm entre la aguja de la cápsula y el eje central. (Fig. 12-3)
6. Después del ajuste, compronar que la operación de retorno automático se efectúe correctamente y que la posición de descenso de la aguja sea la correcta.

- **Ajuste de la Altura de Elevación del Brazo Sonoro**

1. Presionar el interruptor de elevación del brazo sonoro para bajar el brazo.
2. Ajustar el tornillo bajo el tocadiscos de modo que la altura de la aguja sea de 11 mm sobre el panel. La aguja se levanta cuando se gira el tornillo de ajuste en el sentido contrario al de las agujas del reloj.
3. Presionar el interruptor de elevación del brazo sonoro para levantar el brazo.
4. Ajustar los tornillos al lado del interruptor de elevación del brazo sonoro de modo que la altura de la aguja sea de 25.5 mm sobre el panel.

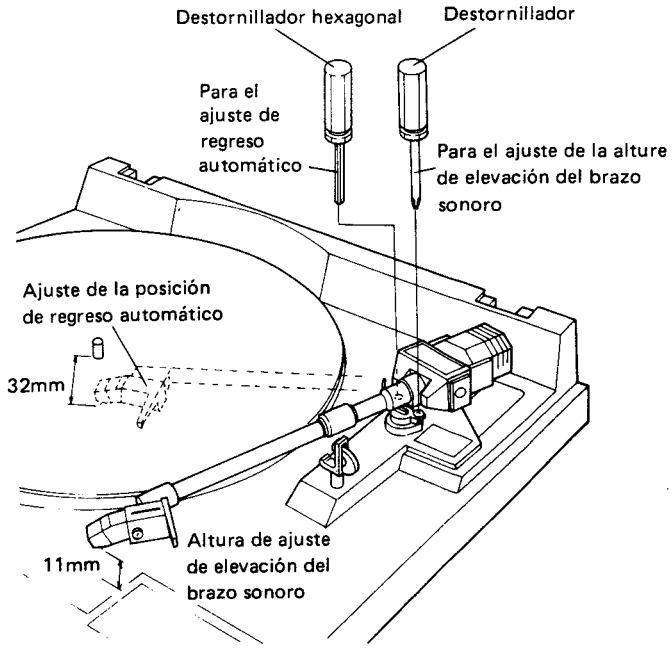


Fig. 12-3 Ajustes de la altura de elevación del brazo sonoro y de regreso automático;