Quality. Uncompromised.

ROTEL®

Technical Manual

STEREO AUTOMATIC DIRECT DRIVE TURNTABLE

RP-9400

TABLE OF CONTENTS

Serial No. Beginning Z905001

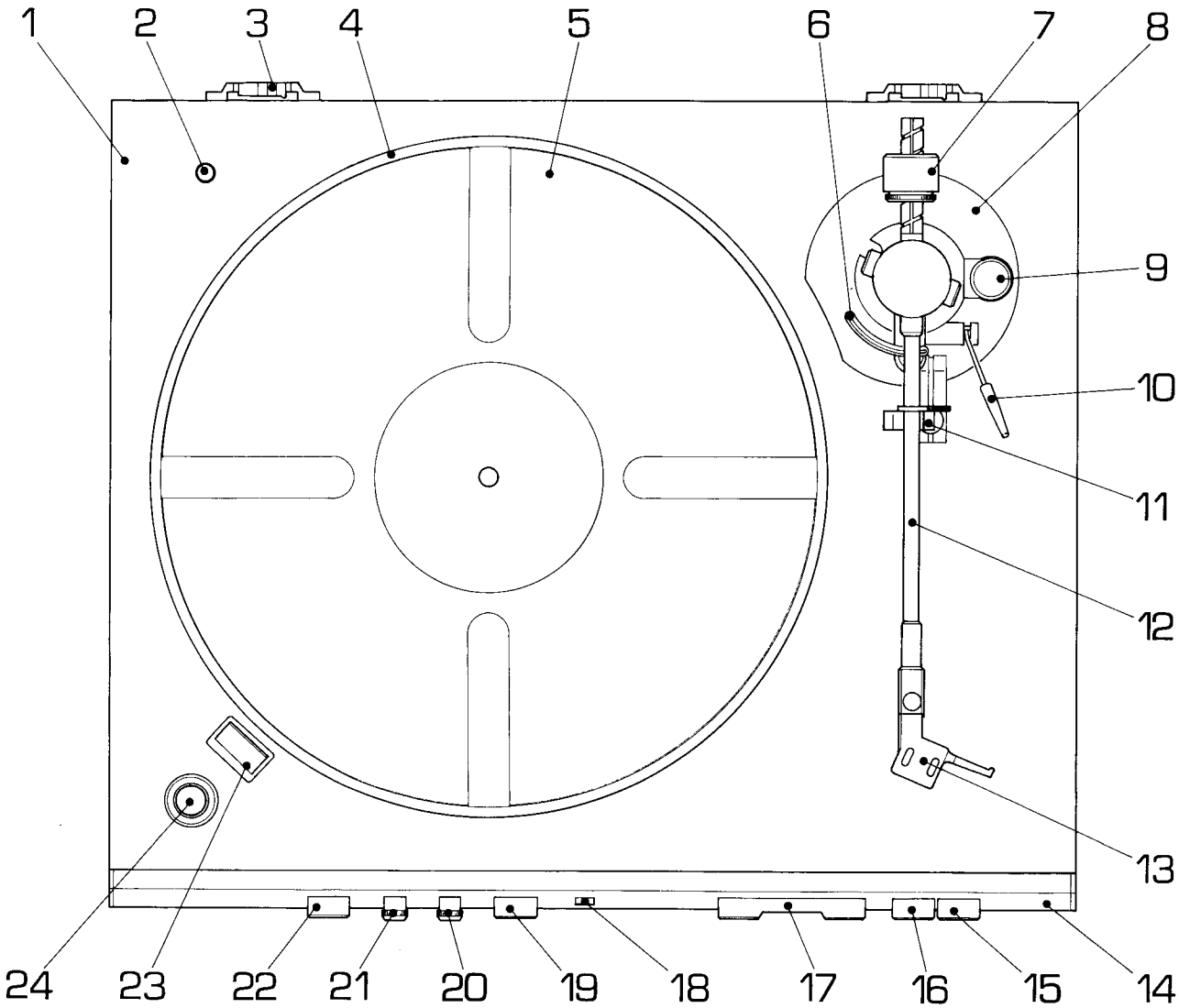
THE ROTEL CO., LTD.
1-36-8 OHOKAYAMA, MEGURO-KU, TOKYO 152, JAPAN

ROTEL ELECTRONICS CO., LTD.
2ND FLOOR, EVERGLORY BLDG., NO. 305, SECTION 3, NANKING E. ROAD, TAIPEI, TAIWAN, REPUBLIC OF CHINA

ROTEL OF AMERICA, INC.
1055 SAW MILL RIVER ROAD, ARDSLEY, N.Y. 10502, U.S.A.

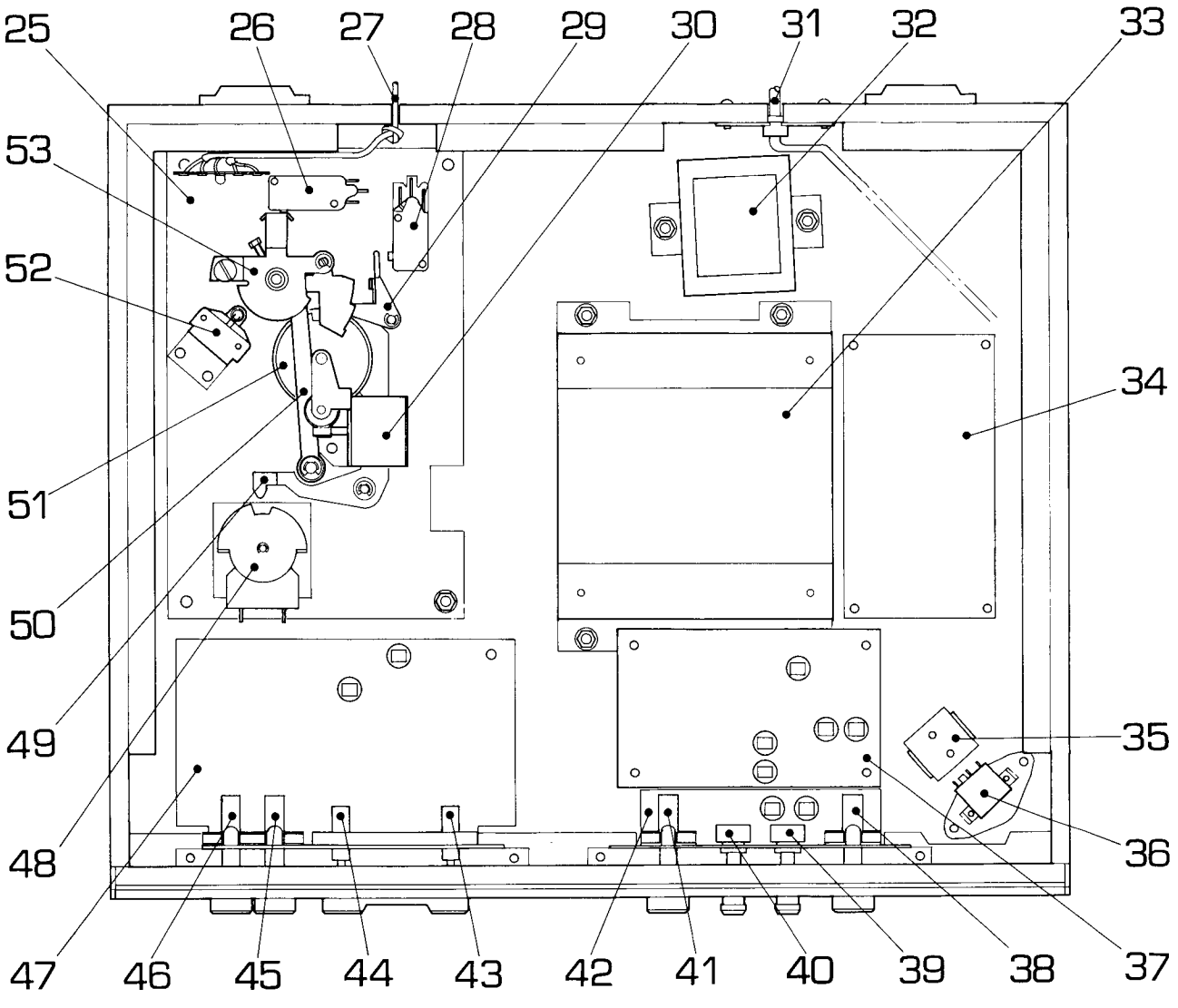
ROTEL HI FI LIMITED.
2-4 ERICA ROAD, STACEY BUSHES, MILTON KEYNES, BUCKINGHAMSHIRE, ENGLAND

Chassis Layout (Top View)



1. CABINET
2. SUPPORTER, EP ADAPTER
3. LOCK PLATE
4. TURNTABLE
5. RUBBER SHEET
6. ELEVATION ARM
7. MAIN WEIGHT
8. TONE ARM BASE
9. KNOB, IFC
10. KNOB, LIFTER LEVER
11. ARM REST
12. TONE ARM
13. HEAD SHELL
14. FRONT PANEL
15. BUTTON, SIZE SELECTOR
16. BUTTON, REPEAT
17. BUTTON, START/STOP
18. LED, QUARTZ INDICATOR
19. BUTTON, QUARTZ
20. KNOB, PITCH CONTROL, 45 rpm
21. KNOB, PITCH CONTROL, 33 1/3 rpm
22. KNOB, SPEED SELECTOR
23. PRISM
24. BUTTON, POWER

Chassis Layout (Bottom View)



25. MECH CHASSIS
26. REST SWITCH
27. SIGNAL CORD
28. GEAR SWITCH
29. SWITCH ARM
30. SUB-MOTOR
31. POWER SUPPLY CORD
32. POWER TRANSFORMER
33. MAIN MOTOR
34. POWER SUPPLY PCB
35. LAMP PCB
36. POWER SWITCH
37. MOTOR CONTROL PCB
38. SPEED SELECTOR
39. PITCH CONTROL, 33 1/3 rpm
40. PITCH CONTROL, 45 rpm
41. QUARTZ SWITCH
42. SWITCH PCB
43. START SWITCH
44. STOP SWITCH
45. REPEAT SWITCH
46. SIZE SELECTOR
47. FUNCTION CONTROL PCB
48. SIZE INDEX COIL
49. SIZE SENSING LEVER
50. FRICTION CLUTCH LEVER
51. MAIN GEAR
52. RETURN SENSOR
53. RESTORE LEVER

Adjustment

Instruments: Wow/Flutter Meter, Milliheltz Counter, DC Millivoltmeter, Test Record "LF-1003 (Toshiba)," "RG-667 (JVC)."

A. Wow and Flutter Adjustment

Set the speed selector to "33 1/3." Connect Wow/Flutter meter to output signal cord. Play the test record and adjust potentiometers VR1, VR2 and VR3 (on the motor control PC board) to obtain minimum meter reading. (Fig. 1)

B. Oscillation Frequency Adjustment

1. Connect the Milliheltz Counter to the motor control PC board (plus lead to pin 24 and minus lead to pin 1). (Fig. 2)
2. Adjust trimmer capacitor VC 1 on the motor control PC board so that the counter reads as follows.
   LP (33 1/3 rpm): 22500±2μs (44.44Hz)
   EP (45 rpm): 16666±2μs (60Hz)

C. Phase Adjustment

1. Connect the Dual-trace Oscilloscope to the motor control PC board (plus lead of channel 1 to pin 24, plus lead of channel 2 to pin T.P. and both minus leads to pin 1).
2. Adjust potentiometers VR4 and VR5 so that the phase of waveform at channel 2 is as shown below, in reference to the waveform of channel 1. (Fig. 3)
   "33 1/3" (LP): t = 14±0.4ms. . . . . adjust VR4
   "45" (EP): t = 11±0.4ms . . . . . adjust VR5

D. Return Point Adjustment

1. Loosen the set-screw of the restore lever to adjust the distance between the restore lever and photo coupler.
   a. Turn the restore lever clockwise (as you see the bottom of the unit), and the return point will be delayed, or
   b. Turn the lever counterclockwise, and the return point will be earlier.
   ★ When fixing the lever, check the distance between the restore lever and the friction rubber. The distance should be 2mm. (Fig. 4)
2. Adjust the voltages of the sensor as follows:
   Place the tone arm on the arm rest. Set the speed selector to "33 1/3." Connect the DC millivolt meter to the function control PC board (plus lead to pin 10 and minus lead to pin 9). Adjust potentiometer VR1 on the function control PC board to obtain 0.2V reading on the voltmeter.
   Next, connect the plus lead to pin 11 and adjust potentiometer VR2 so that the voltmeter reads 0.7V. (Fig. 5).
3. After completing adjustment in steps 1 and 2 above, adjust the eccentric pin on the restore lever so that the return point is within a range designated on the test record RG-667 (JVC) or equivalent.
   Fig. 6 shows the reference position of the eccentric pin.
   a. Rotate the eccentric pin clockwise to obtain earlier retun point.
   b. Rotate the pin counterclockwise to obtain delayed return point.

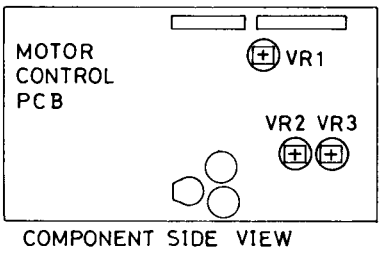


Fig. 1 Wow and Flutter Adjustment

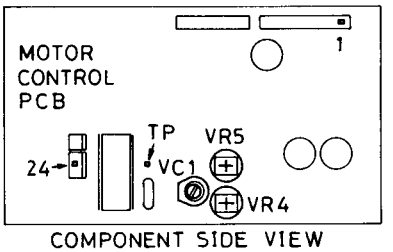


Fig. 2 Oscillation Frequency Adjustment

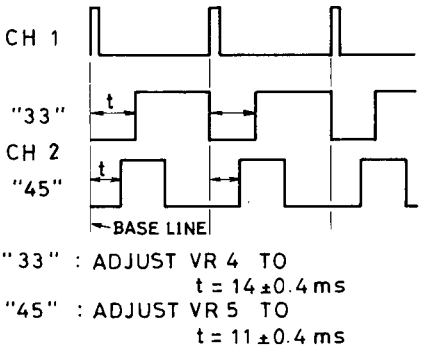


Fig. 3 Phase Adjustment

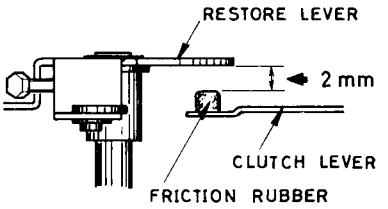


Fig. 4 Return Point Adjustment

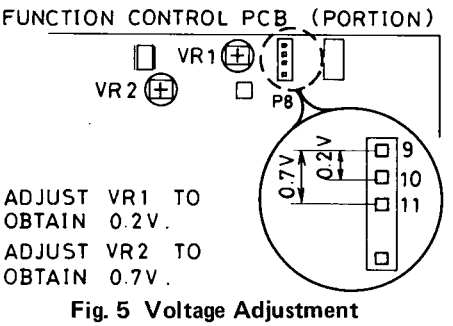


Fig. 5 Voltage Adjustment

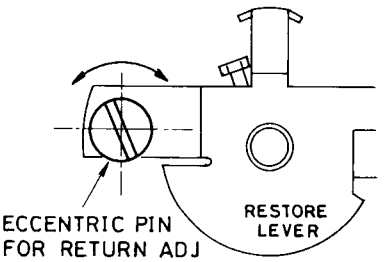


Fig. 6 Return Point Adjustment

E. Lead-in Point Adjustment

Lead-in point depends on the position of the eccentric pin on the restore lever.

Rotate the eccentric pin (Fig. 7) counterclockwise (as you see the bottom of the unit) and lead-in point will shift outward.

Rotate the pin clockwise and lead-in point will shift inward.

F. Adjustment of Height of Elevation Arm

Normally, when the tone arm is lifted up, its headshell end should be slightly higher than the other end.

a. Rotate the adjusting nut clockwise to reduce the height of stylus tip. (Fig. 8)

b. Rotate the nut counterclockwise to increase the height.

Note: The height of the stylus tip over the surface of the disk should be within 5 to 10mm. If the height is inadequate, it may scratch the disk and if too high, it may not come in contact with the disk.

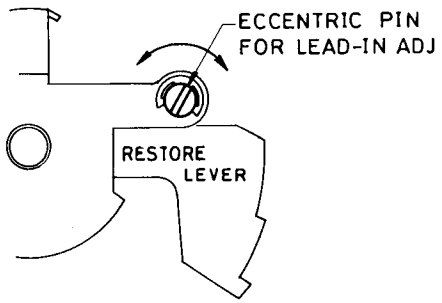


Fig. 7 Lead-in Point Adjustment

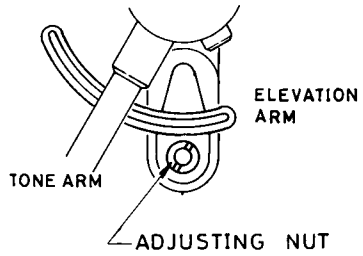


Fig. 8 Elevation Height Adjustment

PRINCIPLE OF OPERATION

A. Start

1. Upon pressing the START button, the turntable driving motor (main motor) and the tone arm motor (sub-motor) will start. At the same time, the cam of the indexing coil ass'y rotates until it stops at the designated position.
2. The sub-motor drives the main gear to raise the tone arm and lead it into the disk. The lead-in position is controlled by the indexing cam. When the main gear is turning, the gear switch is in the "on" state, so the sub-motor and the indexing cam continue to operate.
3. When the main gear performs a full turn so as to return itself to the initial position, the gear switch turns off. The flip-flop circuit, which activates the tone arm, will be reversed so that the sub motor stops and the indexing cam returns to the initial position. The main motor will continue to rotate without being affected by this process.

B. Reject

1. When the REJECT button is pressed during play, the sub-motor starts and the main gear rotates so as to return the tone arm to its rest.

   During this, the gear switch is in the "on" state to keep the sub motor running.
2. When the tone arm reaches its rest, the rest switch turns off, shutting off the entire unit.

C. Return

When the voltage at the terminal 3 exceeds the reference voltage at the terminal 2 of IC5 on the function control PC board, terminal 6 will climb to "HIGH" level. The voltage level at terminal 3 depends on the shifting speed of the restore lever to come inside the photo-coupler (consisting of LED and the photo transistor). Motion of the restore lever is governed by the tone arm.

2. The output at terminal 6 will be differentiated so as to activate only the flip-flop circuit which controls the sub-motor. The sub-motor will drive the main gear to return the tone arm to its rest.

D. Repeat

When, at the end of the play, the stylus tip is led to the 3mm-pitch groove on the disk and the tone arm returns as described in section C, the AND circuit allows the indexing cam to act if the REPEAT button is in the depressed position. Even after the tone arm returns to its rest and the main motor stops, the sub motor remains running and during a single rotation of the main gear the sensing lever determines the lead-in position. The tone arm will move to that position, so that the unit reenters the play mode, starting the main motor.

E. Lead-in Point Indexing Mechanism

The lead-in point is determined in the following manner:

Set the disk size selector switch to either "30" or "17." Press the START button, and the indexing cam will rotate in the designated direction. At the same time, the main gear will give a single turn by means of the sub motor so as to activate the sensing lever and the restore lever. The sensing lever stops when its one end is pressed to the indexing cam that prevents further rotation. On the other hand the restore lever rotates until one of its projections is caught by the other end of the sensing lever. In this position, lead-in of the tone arm takes place: when the main gear rotates one turn and stops, the tone arm indexes to the lead groove of the disk of the selected size. Fig. A illustrates the lead-in mechanism and operation for 30cm disk. The dotted line shows the initial position of each part. For 17cm disk, the indexing cam will turn in the direction reverse to that illustrated in the figure. The sensing lever moves less in distance than in the case of 30cm disk, so the restore lever rotates further until its outer projection is caught by the sensing lever.

If, for any reason, the disk size indexing coil assembly has to be removed or replaced, be sure to provide 0.5 to 1mm clearance between the sensing lever and the restore lever in installation, by adjusting their fitting positions, following the steps below for both "30cm" and "17cm." (Fig. B)

1) Turn on the power, and press START button. After the main gear has turned slightly more than one-half a full rotation, turn off the power so as to stop the gear.
2) Turn the cam lightly with the fingers until it stops. In this state, move the tone arm with the sensing lever pushed against the indexing cam. Stop the tone arm when the projection of the restore lever engages with the sensing lever.
3) Loosen the mounting screws for the indexing coil assembly. With the sensing lever pressed against the indexing cam, adjust the clearance between the restore lever and the sensing lever by shifting the coil assembly forward or backward. After completing the adjustment, secure the coil assembly.
4) Turn on the power to return the main gear to the initial position.

F. Manual Operation

When the tone arm is lifted from its rest, the rest switch turns on to activate the main motor. When it returns to the rest, the rest switch turns off to stop the main motor.

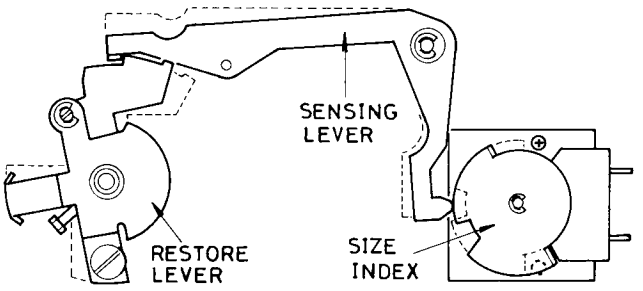


Fig. A

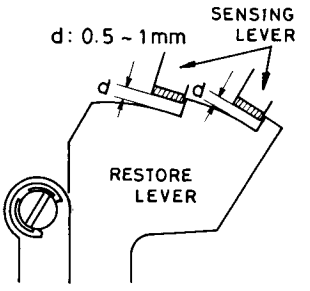


Fig. B

Note: The sensing lever is actually one. Fig. B shows its positions for respective sizes.

Specifications

MOTORS AND TURNTABLE

Main Motor (for turntable)	Quartz-lock servo-motor
Sub-Motor (for automatic function)	DC motor
Drive	Direct drive
Speeds	33 1/3 rpm, 45 rpm
Speed Control Ragne	±3% (individual control for 33 1/3 and 45 rpm)
Wow and Flutter	0.025% (JIS WRMS) (Quartz-lock on)
Signal-to-Noise Ratio	Better than 63dB (IEC-B) Better than 73dB (DIN-B)
Platter	Aluminum diecast (310 mm diameter with strobe rim)

TONE ARM

Type	Static-balanced straight pipe arm with plug-in headshell, oil-damped cueing device, direct-readout stylus gauge counter weight, anti-skating device.
Overhang	16mm
Tracking Error	+2.2° to −1.0°
Suitable Cartridge Weight	4g to 12g
Suitable Stylus Pressure	0.75g to 3g

MISCELLANEOUS

Power Requirement	120V, 220V, 240V 50 or 60Hz
Power Consupmtion	12 watts max.

Specifications subject to change for improvement without prior notice.

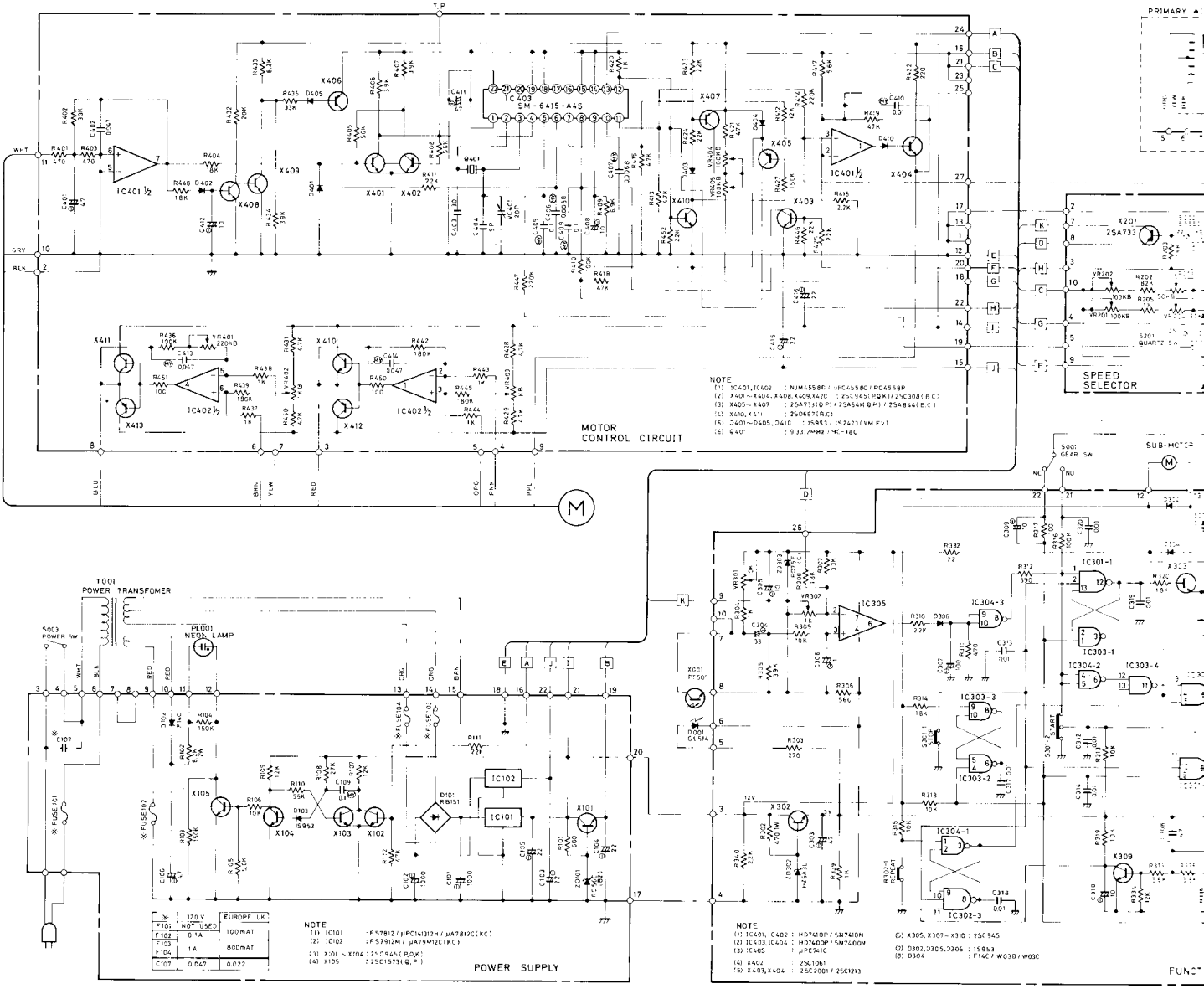
Repair Parts List

Schematic Location	Description	Part No.
	TRANSISTORS, DIODES AND IC'S	
X101 to 104, 305, 307, 308, 309, 310, 401, 402, 403, 404, 408, 409, 420	2SC945 (Q, P or K)	301201215
X105	2SC1573 (Q or P)	301201219
X201, 405, 406, 407	2SA733 (Q or P)	301001172
X302	2SC1061 (B, C or D)	301201127
X303, 304	2SC2001 (L or K)	301201220
X410, 411	2SD667 (B or C)	301301143
X412, 413	2SB647 (B or C)	301101130
X001	PT-501, Photo Tr	301410001
D101	RB151, Rectifier	300919045
D102, 304	F14C, Rectifier	300919046
D103, 302, 305, 306, 401, 402, 403, 404, 405, 410	1S953	300111011
D001	GL514, LED, Sensor	300414041
D002	GL-9PR2, LED, Quartz Ind	300414035
ZD101	RD5.6EB2, Zener Regulator	300313057
ZD302	HZ6A3L, Zener Regulator	300313058
ZD303	RD7.5E (c), Zener Regulator	300313059
IC101	FS7812, Regulator, 12V, 1A	303452242
IC102	FS7912M, Regulator, −12V, 500mA	303452243
IC301, 302	HD7410P	303452244
IC303, 304	HD7400P	303452245
IC401, 402	NJM4558D	303452215
IC403	SM-6415-A4S	303452246
	VARIABLE RESISTOR	
VR201, 202, 404, 405	100KB, Potentiometer, Speed Adj	510502180
VR203, 204	50KB, Pitch Control	515101206
VR301	10KB, Potentiometer	510502138
VR302, 402, 403	1KB, Potentiometer	510502170
VR401	220KB, Potentiometer	510502135
	OTHERS	
VC401	Capacitor, Trimmer, 20pF max	092044301
Q401	Crystal Resonator, 9.33120MHz, HC18C	224110005
F101*	Fuse, 100mAT, Midget (for Europe)	345952010
F102	Fuse, 0.1A-3AG	341222010
	Fuse, 100mAT, Midget (for Europe)	345952010
F103, 104	Fuse, 1A-3AG	341222100
	Fuse, 800mAT, Midget (for Europe)	345952080
T001	Power Transformer, 120V Type	201001495
	" 220/240V Type	206001495
S201, 202	Switch, Push 1-key, Speed, Quartz	092046540
S301	Switch, Push 2-key, Start/Stop	092046533
S302	Switch, Push 2-key, Repeat, Size	092046534

*F101 is not used for 120V areas.

Schematic Location	Description	Part No.
S001	Micro-switch, Gear	615212280
S002	Micro-switch, Rest	615212281
S003	Switch, Push 1-key, Power, 120V Type	614010147
	220V/240V Type	614010148
PL001	Lamp, Neon (DC)	092043113
	Main Motor Ass'y w/Control Circuit	260101129
	Sub Motor	260101128
	Power Supply PCB Ass'y (for 120V)	092041096
	(for 220V/240V)	092041141
	Switch PCB Ass'y	092041140
	Function Control PCB Ass'y	092041126
	Sensor Ass'y, Return	092041131
	Coil Ass'y, Size Index	240111246
	Front Panel Ass'y	092041123
	Mech Chassis Ass'y (2)	092041124
	Restore Lever Ass'y (2)	092041116
	Tone Arm Ass'y	902111126
	Prism Ass'y	092041130
	Tone Arm Base Ass'y	092041115
	Dust Cover	092041029
	EP Adapter	648211249
	Signal Cord	791001143
	Cabinet	092041095
	Bottom Cover	092041118
	Foot	673402024
	Knob, Pitch Control	092041113
	Button, Speed, Repeat, etc.	092041111
	Button, Start/Stop	092041112
	Knob, Power Switch	092041099
	Rubber Sheet	672301115
Screw, M2.6 x 4mm, Sub-motor Mtg, etc.		703202604
Screw, 3 x 6mm, B-tight, Gear Bracket Mtg		092047024
Screw, 3 x 8mm, Tapping-I		092047018
Screw, 3 x 6mm, Tapping-II, Index Coil Ass'y Mtg		723203006
Screw, M3 x 6mm, Sensor Bracket Mtg, etc.		703203006
Screw, 3 x 16mm, Tapping-I, Power Supply PCB Mtg		092047027
Screw, 2.6 x 6mm, Tapping-II, Lamp PCB Mtg		723202606
Screw, 3 x 10mm, w/Flange, Tapping-I, Front Panel Mtg, etc.		092047028
Screw, 3 x 8mm, Tapping-I		092047018
Screw, 3 x 8mm, B-tight, Bottom Cover Mtg, etc.		092047017
Screw, M4 x 8mm, w/SPW, Main Motor Mtg		713204008
Screw, 3 x 6mm, Tapping-I, Lug Mtg		092047020
Screw, M3 x 14mm, w/Flange		709203014
Wood Screw, 3.1 x 13mm, Bottom Cover Mtg		730203113
Wood Screw, 3.1 x 16mm, Lock Plate Mtg		730203116
Screw, M2.6 x 14mm, Micro-switch Mtg		703202614
Screw, M4 x 12mm, Foot Mtg		703204012
Screw, 3 x 25mm, Tapping-I, Motor Control PCB Mtg		092047030
Screw, 3 x 12mm, w/Flange, Tapping-I, Function Control PCB Mtg		092047031
Screw, M3 x 14mm, Hex Head, Restore Lever Mtg		092047029
Screw, M4 x 8mm (BLZ), Hinge Mtg		707224008
Nut, M4, w/Flange, Motor Bracket Mtg, etc.		770402218
Washer, Fiber, ø5 x ø10 x t1, Clutch Lever Mtg		770500063
Washer, Fiber, ø3.2 x ø10 x t0.8, Motor Control PCB Mtg		770500077
E-ring, ø3.2, Size Sensing Lever Mtg		770500045
E-ring, ø4, Clutch Lever Mtg		770500040

Schematic Diagram



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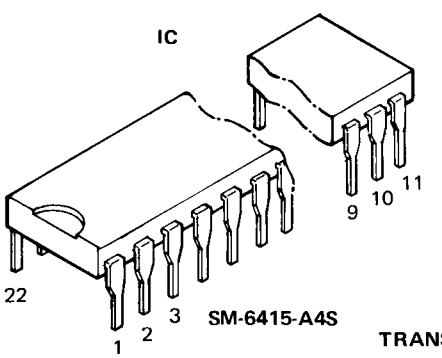

SM-6415-A4S

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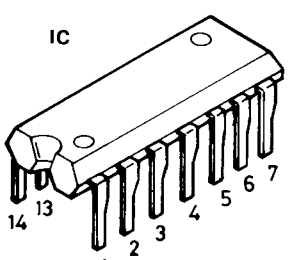
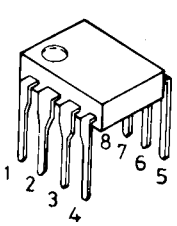


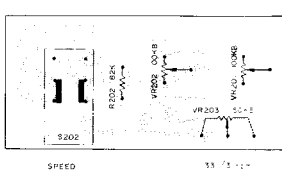
HD7400P/SN7400N
HD74100P/SW7410N

IC

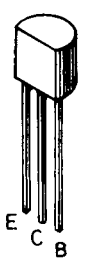


μPC741C
NJM4558D/
μPC4558C

SWITCH CIRCUIT

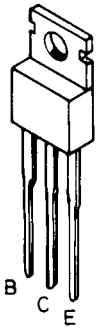


TRANSISTOR



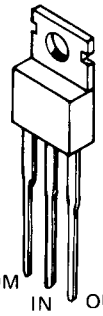
2SA733/2SA641
2SB647 2SD667
2SC2001/2SC1213
2SC1573

TRANSISTOR



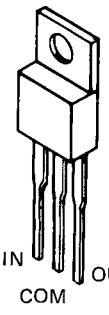
2SC1061

IC REGULATOR



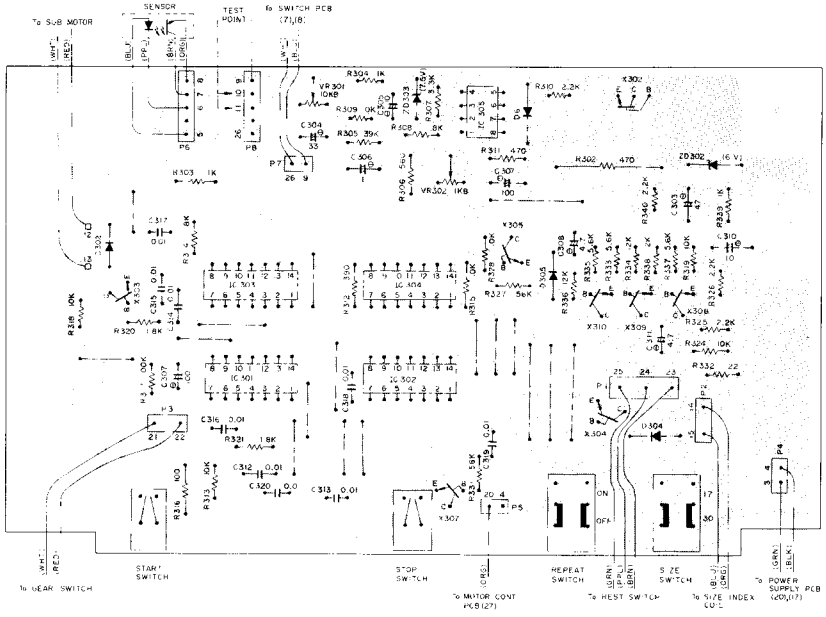
8 FS7912M

IC REGULATOR

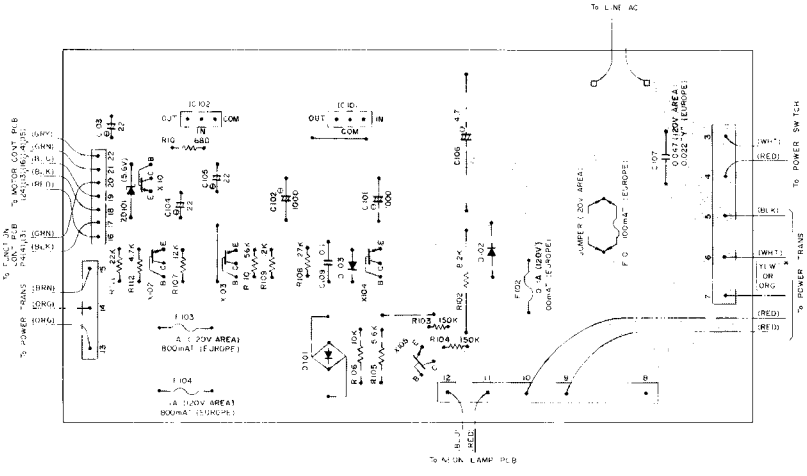


μPC14312/FS7812

FUNCTION CONTROL CIRCUIT

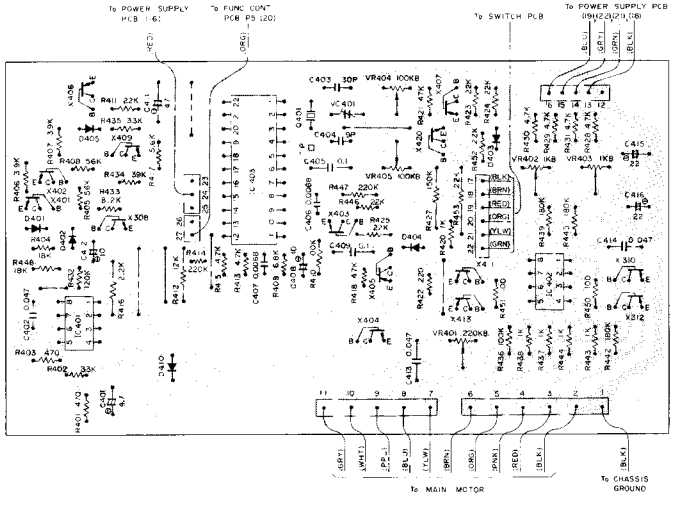


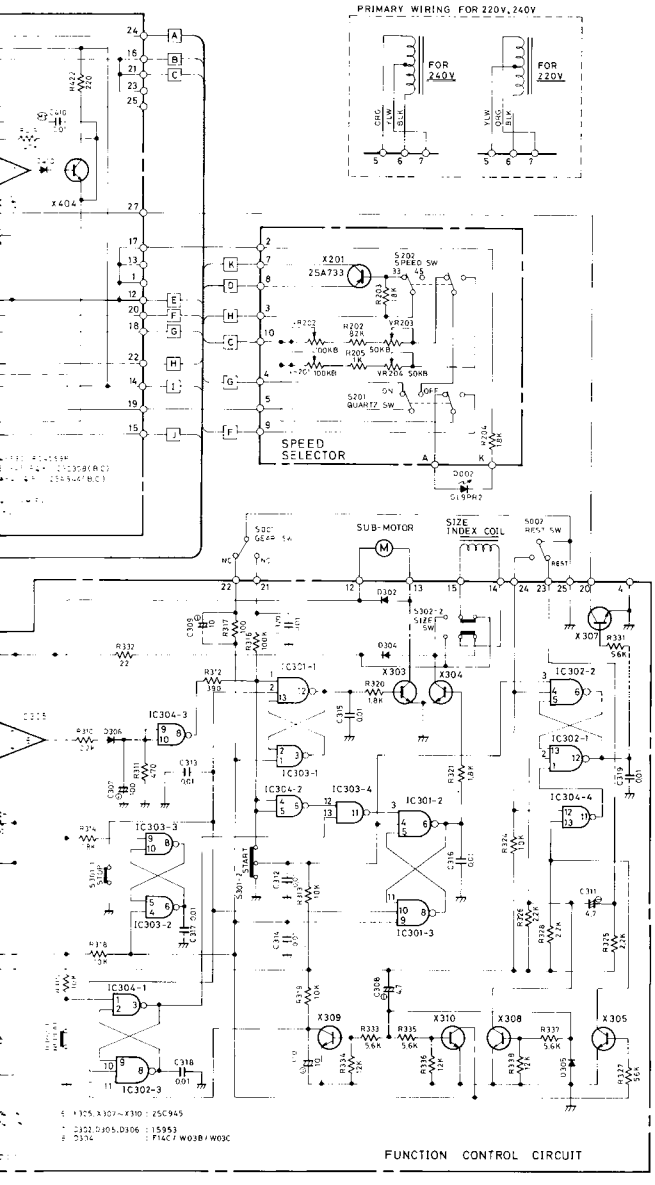
POWER SUPPLY CIRCUIT



*At 220V: Pin 6. . . . . YLW Pin 7. . . . .ORG
At 240V: Pin 6. . . . . ORG Pin 7. . . . .YLW

MOTOR CONTROL CIRCUIT





SWITCH CIRCUIT