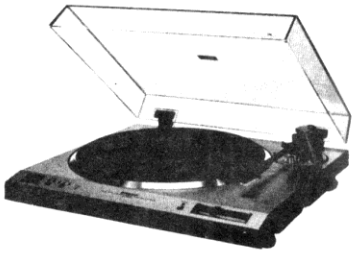
Service Manual

PIONEER



ORDER NO.
ART-607-0

STEREO TURNTABLE

PL-9

MODEL PL-9 COMES IN TWO VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
S	110V, 120V, 220V and 240V (Switchable)	General export model (With cartridge)
S/G	110V, 120V, 220V and 240V (Switchable)	U.S. Military model (With cartridge)

- **Ce manuel d'instruction se refère au mode de réglage, en français.**
- **Este manual de servicio trata del método de ajuste escrito en español.**

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1. SPECIFICATIONS

Motor and Turntable

Drive System . . . . . Direct-drive
Motor . . . . . Quartz PLL Hall motor
Turntable Platter . . . 330mm diam. aluminum alloy die-cast
Speeds . . . . . 33-1/3 and 45rpm
Wow and Flutter . . . . . Less than *0.012% (WRMS)
0.023% (WRMS)
0.035% (DIN)
Values marked with an " * " designate the wow and flutter for motor, and do not include the cartridge or tonearm load.
Signal-to-Noise Ratio . . . . . More than 78dB (DIN-B)
(with Pioneer cartridge model PC-3MC)

Rotational Characteristics

Build-up Time . . . . . Within 90° rotation at 33-1/3 rpm
Speed Deviation . . . . . Less than 0.002%
Speed Drift . . . . . Less than 0.00008%/h at 33-1/3rpm
Less than 0.00003%/degree temp. change at 33-1/3rpm

Tonearm

Type . . . . . Static-balance type, straight pipe arm
Effective Arm Length 235mm
Overhang 15mm
Usable Cartridge Weight . . . . . 3g (min.) to 8g (max.)

Subfunctions

Auto lead-in
Auto-return
Auto cut
Auto repeat (Special DC motor)
Quick play
Quick stop
Anti-skating force control
Stylus tracking force direct-readout counterweight
Cueing device (Special DC motor)
Free stop hinges
Arm height adjusting device

PC-3MC Specifications

Type . . . . . Moving coil type
Stylus . . . . . 0.5 mil diamond (PN-3MC)
Output Voltage 2.5mV
(1kHz, 50mm/s Peak velocity, LAT)
Tracking Force . . . . . 1.7g to 2.3g (proper 2g)
Frequency Response . . . . . 10 to 32,000Hz
Recommended Load 50kΩ
Weight 3.1g

Miscellaneous

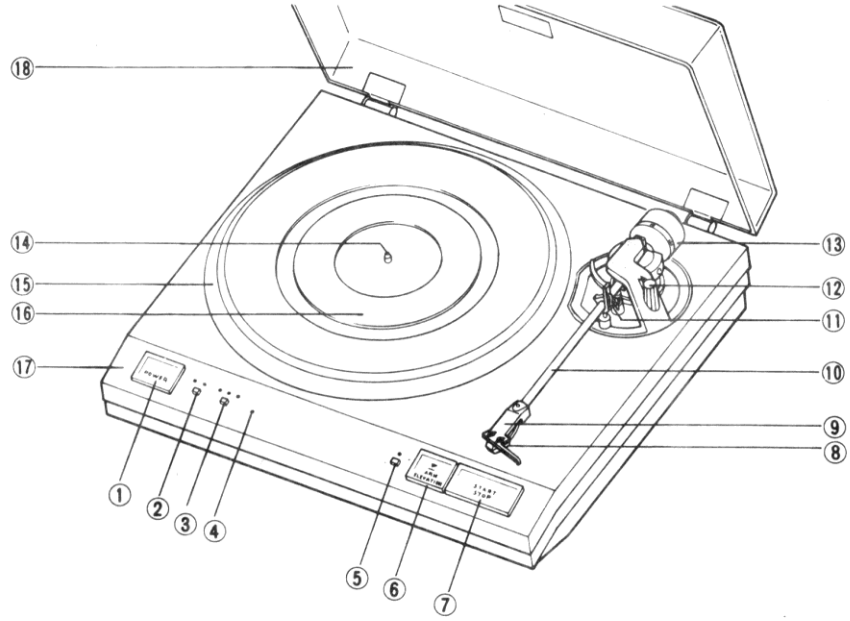
Power Requirements AC110/120/
220/240V~(switchable) 50, 60Hz
Power Consumption 9W
Dimensions . . . . . 420(W) x 114(H) x 394(D)mm
16-9/16(W) x 4-1/2(H) x 15-1/2(D) in.
Weight 8.5kg/18lb 12oz

Accessories

EP Adapter 1
Operating instructions 1

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

2. FRONT PANEL FACILITIES



① POWER SWITCH (POWER)

Press this switch to turn power ON and OFF. When power is turned ON, the power lamp is illuminated; turning power OFF extinguishes the lamp.

② SPEED SWITCH (SPEED)

This switch is used to select turntable speed. The "33" lamp is illuminated for 33-1/3 rpm records, and the "45" lamp is illuminated for 45 rpm records.

③ RECORD SIZE SELECTOR SWITCH (SIZE)

Depress this switch to select the proper record size for the record you are playing. Repeat until the lamp indicating the correct size is illuminated. When the POWER switch is turned ON, the unit will automatically be set to 12" 30.

12" 30 Lamp . . 30 cm LP record 10" 25 Lamp . . 25 cm record
7" 17 Lamp . . . 17 cm EP record

④ QUARTZ LOCK INDICATOR (QUARTZ LOCK)

This lamp illuminates indicating accurate speed at 33-1/3 or 45 rpm.

⑤ REPEAT PLAYBACK SWITCH (REPEAT)

Depressing this switch will cause the turntable to play the present record repeatedly.

⑥ ARM ELEVATION SWITCH (ARM-ELEVATION)

This feature is used for starting manual playback, or for temporarily stopping playback in the middle of the record.

Lamp illuminated ▼(UP) . . . . . Tonearm rises.
Lamp extinguished (DOWN) . . . . Tonearm lowers.

⑦ PLAYBACK START/STOP SWITCH (START/STOP)

This switch is depressed to start automatic playback or to stop playback in the middle of a record.

⑧ CARTRIDGE (PC-3MC)

⑨ HEADSHELL

⑩ TONEARM

⑪ ARM REST/CLAMP

Serves to support the tonearm and lock it in place. Always unlock the clamp prior to moving tonearm.

⑫ ANTI-SKATING ADJUSTMENT KNOB (ANTI-SKATE)

Turn this knob to adjust anit-skating force.

⑬ STYLUS TRACKING FORCE ADJUSTMENT WEIGHT

Rotate this weight to adjust vertical tracking force.

⑭ CENTER SHAFT

⑮ PLATTER

⑯ RUBBER PLATTER MAT

⑰ CABINET

⑱ DUST COVER

3. DISASSEMBLY

3.1 PANEL ASSEMBLY AND TONEARM BASE

1. Remove screws ❶ and ❷ and lift off the top cover.
2. Remove connectors ❸, ❹, and ❺.
3. Loosen screws ❻ and remove the headshell assembly.
4. Loosen screws ❼ and remove the holder.
5. Remove the tonearm balance weight, then loosen screw ❽ and remove the weight spindle.
6. Remove the cord stopper ❾, and disconnect the PU cord.
7. Remove screws ❿ thru ⓭, then lift the tonearm up in the direction of the arrow.
   Taking care not to strike the tonearm, remove the underbase section.
8. Remove screw ⓮ and take off the ground lead unit. Remove screws ⓯ and ⓰ and take off the tonearm base.

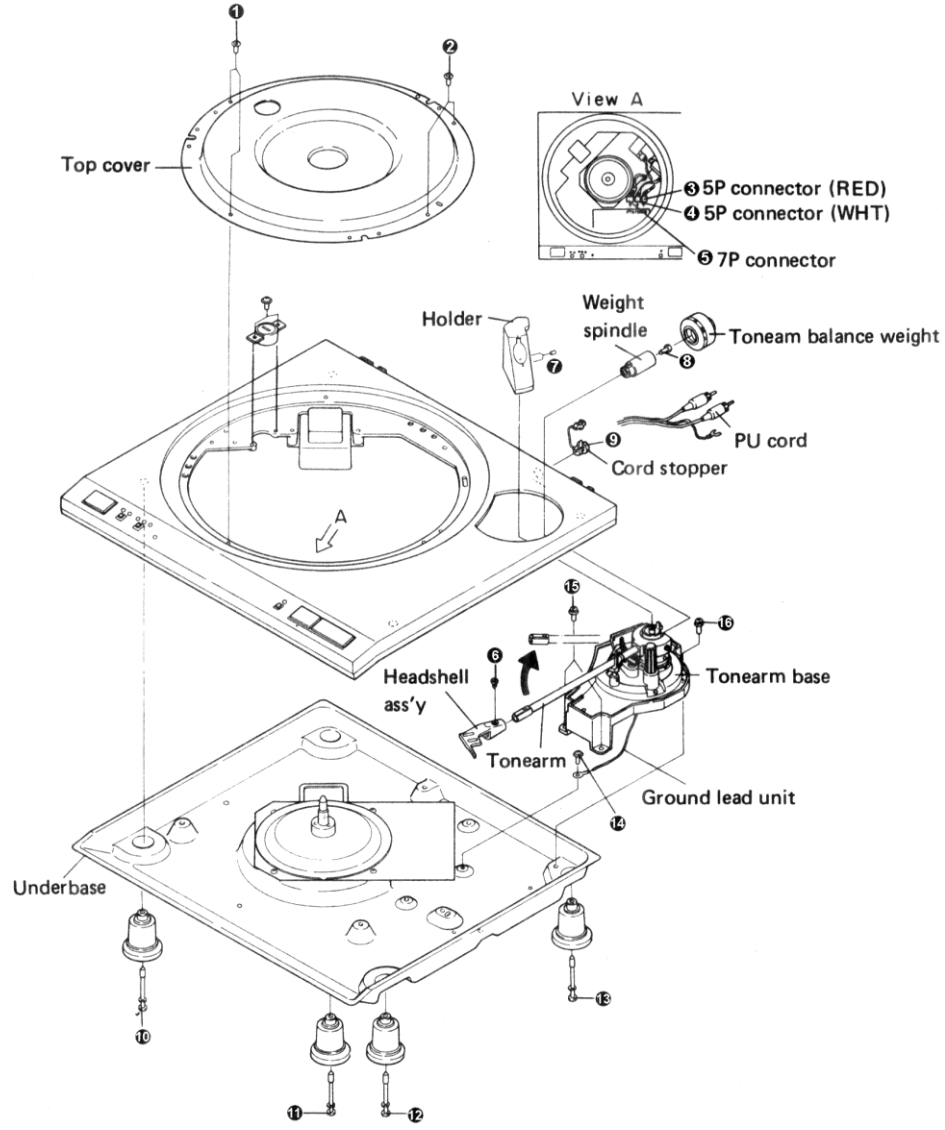


Fig. 3-1 Disassembly 1

3.2 TONEARM SECTION

1. Remove screws ❶ and take off the holder. This allows the AS unit to be disassembled.
2. Unsolder the tonearm lead wires. Then remove screws ❷ to remove the sensor assembly.
3. Remove screws ❸ to free the driver (F) assembly mechanism.
4. Remove screw ❹ to take off the PU plate.

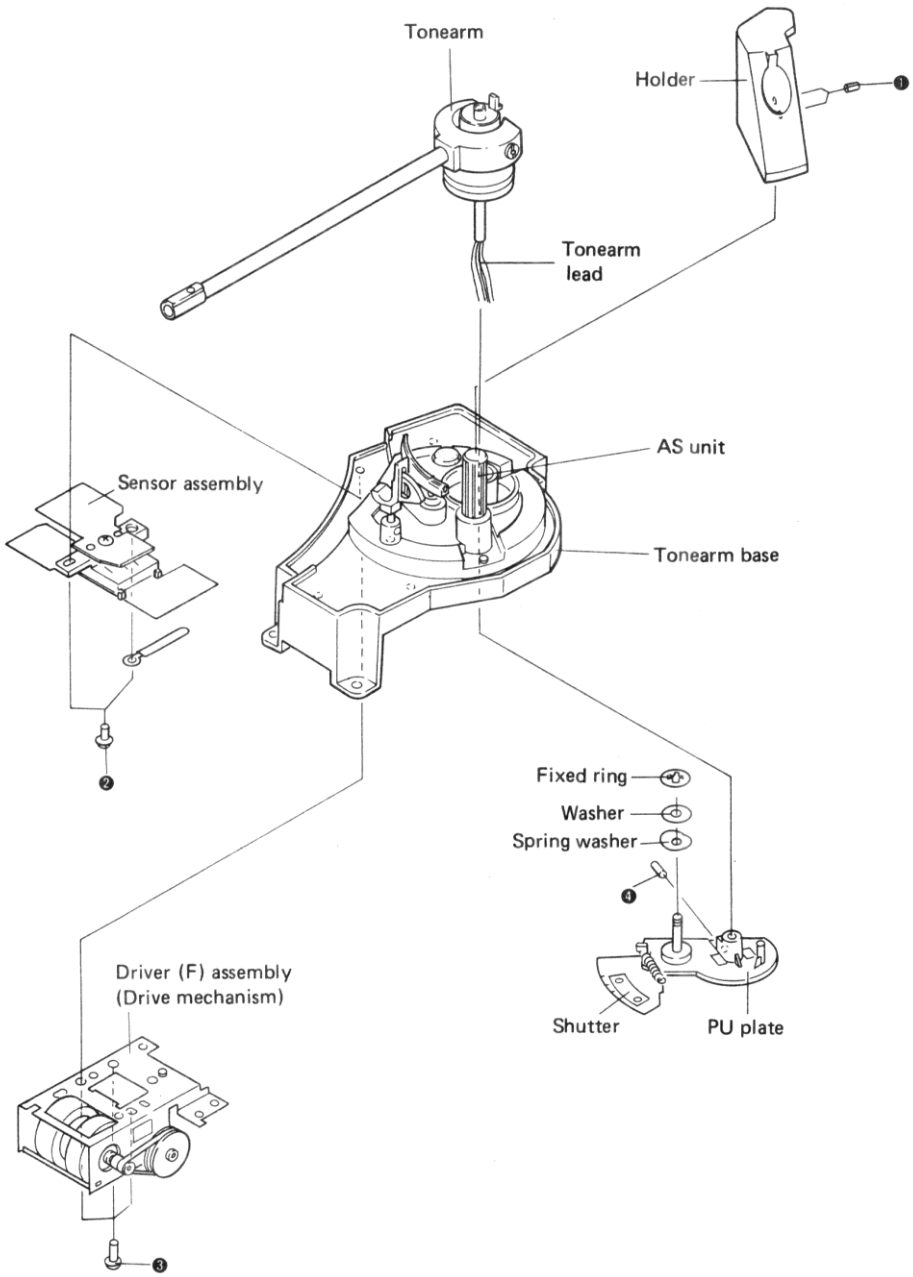


Fig. 3-2 Disassembly 2

3.3 PU PLATE AND SHUTTER ATTACHMENT

1. Assemble the shutter to the PU plate lining up the edges of the two parts.
2. Fit the shutter/PU plate assembly to the arm base, lining the A section of the shutter with the triangle mark on the arm base and secure the assembly.

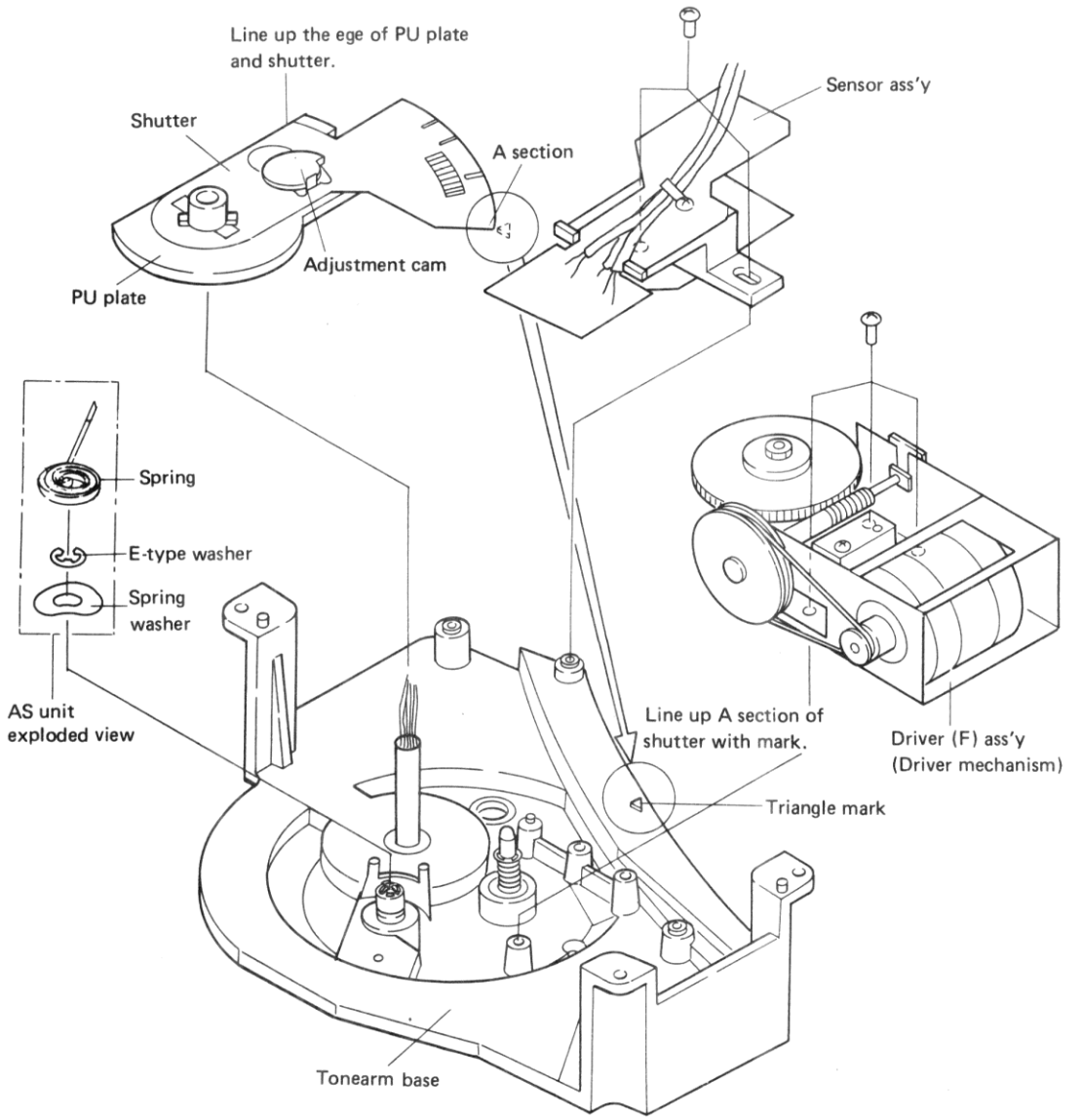


Fig. 3-3 PU plate and shutter attachment

4. MECHANISM DESCRIPTION

To facilitate understanding the operation of the PL-9, the total unit may be broken down into blocks consisting of the tonearm drive mechanism, the sensing mechanism serving to sense lead in and lead out positions of the tonearm, the control section consisting of the full-auto control IC PD6003, and the motor section functioning to drive the turntable platter. ↗

↙ The operational and functional relationship between each block is quite complex, so in order to understand total system operation, it is first necessary to thoroughly understand the operation and function of each block, then carefully study their interrelationships.

This manual covers the subject in that order. First, the operation and function of each block will be described, then a timing chart is presented to clarify block relationships.

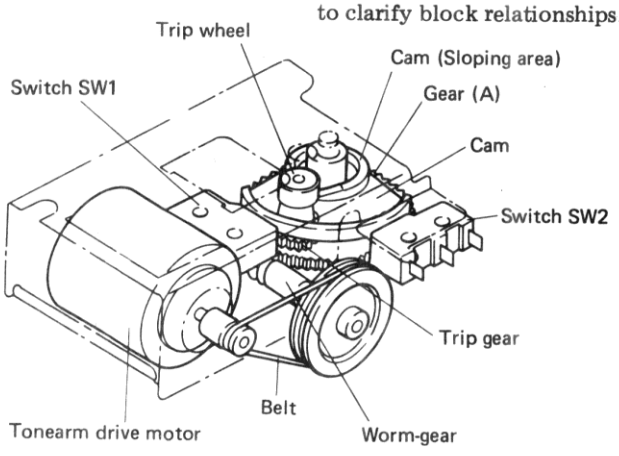


Fig. 4-1 Tonearm drive mechanism

4.1 TONEARM DRIVE MECHANISM

1. The tonearm drive mechanism consists of the tonearm drive motor, worm-gear, gear (A), gear (B), trip gear, trip wheel, cam, switch SW1, and switch SW2. (Fig. 4-1)
2. The gear cluster is shown in Fig. 4-2. When the cam is held immoveable and gear (A) is rotated in a counterclockwise direction, a small amount of friction is felt, but gear (B) and trip gear also rotate. Note that rotation of the trip gear also rotates the trip wheel. (Fig. 4-3) Also note that when the cam is free to rotate, friction will cause it to rotate in the same direction as gear (A) and (B).
3. Refer to Fig. 4-4. The elevation shaft contacts the sloping area located around the center shaft of the cam. Also note the position of the cam at this time. This is the position the mechanism will be in prior to starting up the unit. The tonearm will be on the arm rest, and arm-elevation will be in the DOWN position.

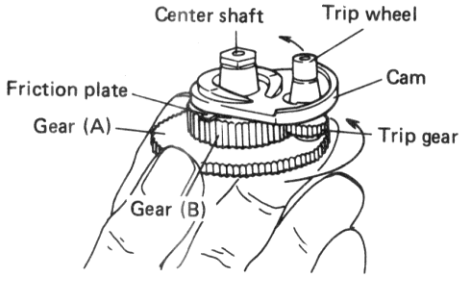


Fig. 4-2 Gear cluster

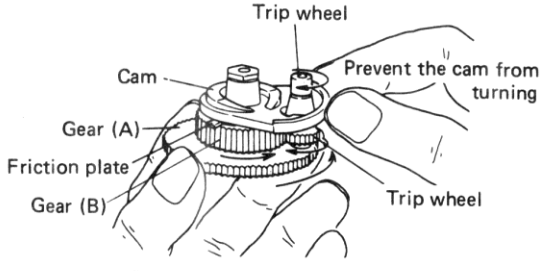


Fig. 4-3 Gear cluster operation

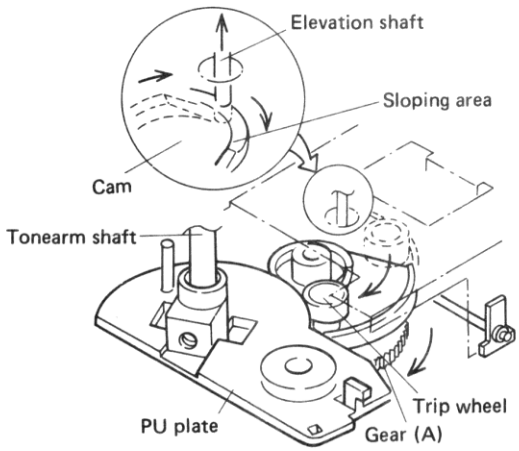


Fig. 4-4 Lead in operation

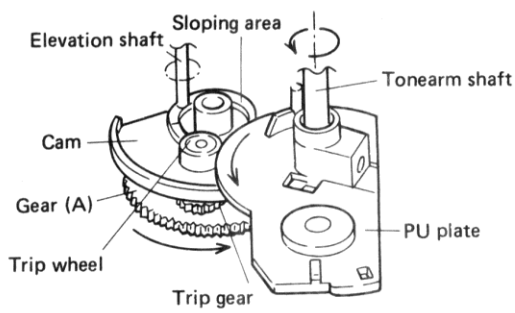


Fig. 4-5 Return operation

4. Turn the worm gear by hand imitating what would occur if the START/STOP button were depressed causing the motor to rotate the gear. Worm gear rotation causes gear (A) to rotate, and the gears shown in Fig. 4-2 and 4-3 of item 2 above all turn in a clockwise direction.
5. The elevation shaft raises as the gear/cam assembly rotates, and this in turn causes the tonearm to raise. The two switches, SW2 and SW1 are also turned OFF.
6. As the assembly rotates further, the trip wheel and PU plate attached to the tonearm shaft come into contact, creating the same condition as occurred in item 2 where the cam was held in an immoveable position. Continued rotation of the trip wheel causes the PU plate attached to the tonearm shaft to turn.
7. Rotation of the PU plate moves the tonearm to the point specified by the sensing and control mechanisms (covered in the following paragraphs). When the tonearm reaches that specified point, the motor reverses itself, and the cam switches SW1 and SW2 ON in sequence. Arm-elevation goes to the DOWN position and playback starts.
8. In practice, each of the above operational steps are controlled either directly or indirectly from the control section or by the forward or reverse rotation of the motor. The control section picks up its operational cues by detecting the ON or OFF status of switch SW1 and SW2, and these switches are controlled by the movement of the mechanism positioning the cam.

4.2 SENSING MECHANISM

As shown in Fig. 4-6, the shutter fixed to the tonearm is positioned to travel in the space between the phototransistors and LEDs mounted on

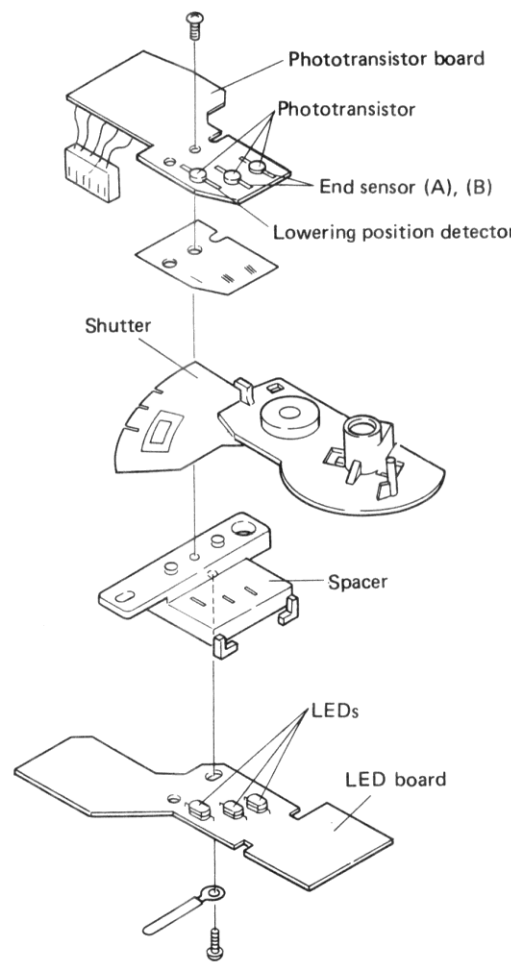


Fig. 4-6 Sensing mechanism

their respective boards. The shutter has three 0.7mm slits cut out of its outer circumference at the position the outer edge of a 30cm, 25cm, or 17cm record disc would be located. The slit, or opening located inside of those three slits is the end sensor slit (Fig. 4-7).

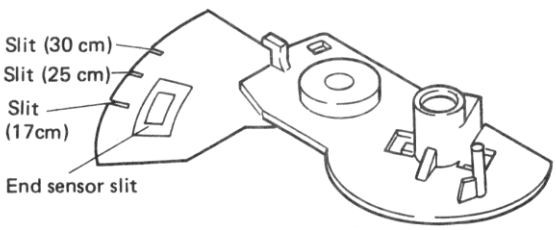


Fig 4-7 Shutter

■ Lowering Position Detector

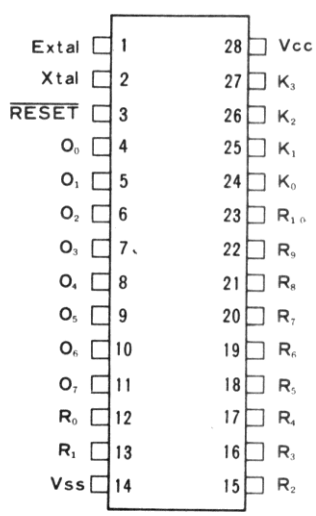
1. This unit is mechanically designed to allow the shutter to pass between two boards mounting the sensing elements or photocoupler. The photocoupler consists of an LED and phototransistor.
2. The shutter moves with the tonearm, and a signal is transmitted to the control section by the light emitted from the LED (normally interrupted by the opaque portion of the shutter) being passed through the 30cm, 25cm, or 17cm slit and triggering the phototransistor ON.

■ End Sensor

1. As the tonearm travels toward the inside of the record disc and reaches the end sensor zone (end sensor slit), the light transmitted by the LED is passed through the end sensor slit and turns the phototransistor ON, then OFF. This causes the pulse signal transmitted by end sensor A and B to go 90° out of phase.
2. The pulse frequency is compared with the rotational speed (movement) of the tonearm, and then sent to the control section as the record disc lead-out groove sensor signal.

■ Arm Rest Position Sensor

1. When the three sensors consisting of the lowering position sensor and end sensor (A) and (B) are all simultaneously picking up transmitted light, control determines that the tonearm is at the arm rest position.
2. This status is used to control starting and stopping of the turntable motor during manual operations, or, in the auto-return mode, simply perceives that the tonearm has returned to the arm rest.



IC PD6003 pins

Pin	Function	Timing	Pin	Function	Timing
O_0	Repeat display output		R_5	CW rotation output	
O_1	EV-UP display output		R_6	SW1 input	—
O_2	START-STOP display output		R_7	SW2 input	—
O_3	Speed selector output	H:33 L:45	R_8		
O_4	Turntable motor stop output	H:STOP L:START	R_9		
O_5	30cm display output		R_{10}	Size selector switch input	
O_6	25cm display output				
O_7	17cm display output		K_0	End sensor B input	—
			K_1	End sensor A input	—
R_0	Repeat switch input		K_2	Lowering position sensor input	
R_1	EV switch input		K_3		
R_2	START-STOP switch input				
R_3	Speed selector switch input				
R_4	CCW rotation output				

PD6003 Pin Function Table

Fig. 4-8 PD6003

4.3 CONTROL SECTION

The functions of the full-auto control IC PD6003 are described in this section. The table shown in Fig. 4-8 lists the function performed by each pin of PD6003. Please refer to this table as the detailed explanation progresses.

1. When the tonearm is at the arm rest position, pressing the START/STOP button causes the turntable motor to start rotating and illuminates the LED built into the START/STOP button and the EV UP display LED. At the same time the tonearm drive motor moves the tonearm toward the lead in groove of the record.
2. The tonearm drive motor continues rotating until it reaches the point where the signal from the lowering position sensor is picked up. When that point is reached, the drive motor is reversed, lowering the tonearm.
3. End sensor A and B is used to detect the end of playback, but if the START/STOP button is depressed during playback, the tonearm drive motor starts rotating in the return direction and tonearm return operation is started. When the tonearm reaches the point directly above the arm rest, the tonearm drive motor starts rotating in the reverse direction and lowers the tonearm on the arm rest.
4. If the operation in the above step is carried out with the repeat switch ON, the tonearm again will return to the lead in groove. If the repeat switch is OFF, the turntable motor will stop at this point.

4.4 ACTUAL OPERATION (PLAYBACK OF A 33 rpm, 17cm RECORD DISC)

- **Automatic Lead in**

1. Depress the button and turn the power switch ON. This will illuminate LED D5 and D6 of the power display. Set the speed for the record to be played (33 rpm). When the 33 rpm button is depressed, an instruction signal from the motor assembly will illuminate the 33 rpm display LED, D8. Next, set the proper size for the record to be played (17cm in this case). When the size selector switch is depressed twice, the 11 pin of PD6003 will go to a low level, and the 17cm display LED, D10 will be illuminated.
2. With the turntable thus set up, depressing the START/STOP button causes the 15 pin of PD6003 to go to a low level. Also, the potential across the base of transistor Q4 (connected to pin 6) drops, turning the transistor ON, illuminating the START/STOP display LEDs, D15 and D16. At the same time, pin 17 goes to a low level and pin 18 goes high starting rotation of the tonearm drive motor in the mechanism section.
3. The worm gear is coupled to the rotating motor by belt, and the worm gear turns gear (A) (and cam) in a clockwise direction. The tonearm is lifted by the arm-elevation mechanism, and switch SW2 and SW1 go OFF.
4. Gear (A) (and the cam) continue rotating until finally, the cam makes contact with the PU plate fixed to the tonearm shaft. When the cam contacts the PU plate, it stops rotating. However, the trip wheel continues rotation along with gear (B).

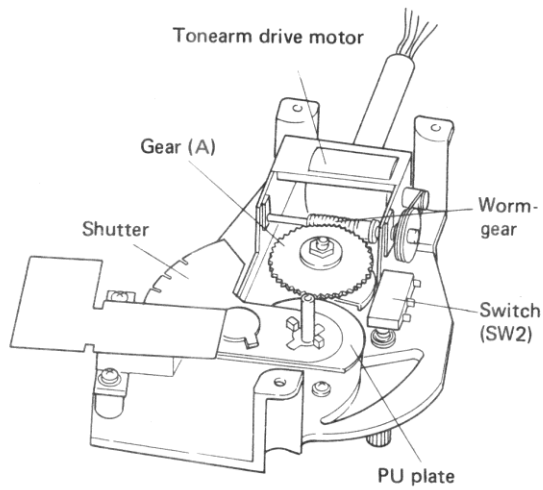


Fig. 4-9 Mechanism section

5. The trip wheel is making contact with the arm rotation stopper, and the rotating trip wheel causes the PU plate to turn. The turning PU plate moves the tonearm toward the center of the platter.
6. As the tonearm moves, so does the shutter attached to the tonearm shaft. The tonearm (and shutter) goes past the 30cm and 25cm lowering position until it reaches the 17cm record disc lead-in groove where the third pulse signal from the lowering position sensor (light from LED passes through the slit in the shutter fixed to tonearm shaft turning phototransistor ON) causes the 26 pin of PD6003 to go to a low level. (Pulse signals are also produced at 30cm and 25cm positions.)

7. This causes the PD6003 17 pin to go low, and the 18 pin to go to a high level, and after the tonearm drive motor stops, it commences reverse rotation. As it rotates, the arm-elevation shaft riding on the sloping area of the cam moves down off the slope and playback starts.
8. When the tonearm drive motor rotating in reverse (switch SW1 ON) turns switch SW2 ON, the PD6003 6 pin goes to a high level, extinguishing the START/STOP display LEDs, D15 and D16.
   The turntable will not go into the auto-stop until the START/STOP display LEDs are extinguished even though the START/STOP button is depressed. Also, when both the tonearm dirve motor and switch SW2 are ON, PD6003 17 and 18 pin both go high, stopping the drive motor.
9. If the tonearm does not move off the arm rest within 8 seconds after the START/STOP button is depressed (tonearm clamped in arm rest), the START/STOP display indicator starts flashing. If this status (flashing) continues for another 11 seconds, the start instruction is cancelled and the tonearm lowers in the arm rest.
10. The elevation display LED, D14 illuminates when the START/STOP button is depressed, and when the tonearm moves to the record disc and lowers down, D14 is extinguished. PD6003 senses the first pulse as the 30cm position, the second as the 25cm, and the third as the 17cm record size position. When it determines that the tonearm has reached the proper lowering position, pin 5 goes to a high level, extinguishing the display.

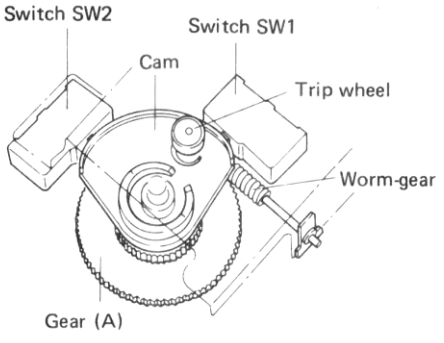


Fig. 4-10 Switch SW1, 2 position

■ **Arm-elevation UP and DOWN**

1. When the arm-elevation switch is depressed during record playback, arm-elevation goes UP and playback is temporarily stopped.
2. When the arm-elevation switch is depressed, the 13 pin of PD6003 goes to a low level. Pin 5 also goes low, turning transistor Q3 ON and illuminating the elevation display LED, D14.
3. At the same time, pin 17 goes to a low level and pin 18 goes high starting tonearm drive motor rotation. This causes the cam to turn, and the elevation shaft to ride up on the sloping section of the cam. This action causes the arm-elevation to go to the UP position, stopping record playback.
4. The tonearm drive motor continues to move the cam until the position is reached where SW1 is turned OFF (tonearm still in UP position).
5. To restart playback, the arm-elevation switch is depressed again. This causes the 13 pin of PD6003 to go to a low level. The 5 pin goes high turning transistor Q3 OFF, extinguishing the elevation display LED, D14.
6. At the same time, pin 17 goes high and pin 18 goes low causing the tonearm drive motor to rotate in an opposite direction of that in the UP position. As the cam turns, the elevation shaft drops down off the slope, lowering the tonearm and starting playback again.
7. The tonearm drive motor continues to move the cam until the position is reached where SW2 is turned ON (tonearm still in DOWN position).

For manual playback operation, depress the arm-elevation switch to raise the tonearm up off the arm rest (UP), then move it to the desired point over the record by hand. Depressing the arm-elevation switch again will then lower (DOWN) the tonearm onto the record. Operationally, this follows the sequence listed in items 2 through 7 above.

Also during manual play, when the tonearm is manually moved toward the center of the record (off the arm rest), the platter commences rotation. When the tonearm is moved off the arm rest, PD6003 26 pin (signal pin from lowering position sensor) goes to a high level, and the 8 pin goes to a low level starting the motor.

■ **Auto-return**

1. When record playback is over, the tonearm stylus goes from the band of audio grooves into the lead out groove, and the pulse width of the signal output from end sensor A and B become more narrow. This informs PD6003 that record playback has ended.

> The phase of the pulse from end sensor A and B is set so that B leads A by 90°, however this phase offset is not used for detection of the end of playback, but to prevent any unintentional operations from sources such as record disc eccentricity.

2. When playback completion is detected, PD6003 pin 17 goes to a high level and pin 18 goes low starting the tonearm drive motor rotating. As rotation moves the cam, the slope causes the arm-elevation to go UP, raising the tonearm.
3. As the cam continues rotating, it strikes the PU plate. This stops cam movement, but the trip wheel continues rotating and turns the PU plate. This results in the tonearm being returned to a position above the arm rest.
4. At this position, light strikes the lowering position detector and end sensor A and B (all three at once), and pin 24, 25, and 26 of PD6003 go to a low level.
5. One to two seconds later, PD6003 pin 17 goes low and pin 18 goes high, and after the tonearm drive motor stops, it reverses rotation and sends the arm-elevation back down the cam slope. This lowers the tonearm on the arm rest ending playback.
6. At the same time, the cam turns switch SW1 ON (switch SW2 is already ON). When both switches come ON, both pin 17 and 18 (PD6003) go to a high level, stopping the tonearm drive motor. Also, when the tonearm reaches the arm rest position, pin 8 goes high, lowering the tonearm and causing pin 5 to go high. This causes the platter to stop rotating and extinguishes the elevation display LED, D14.

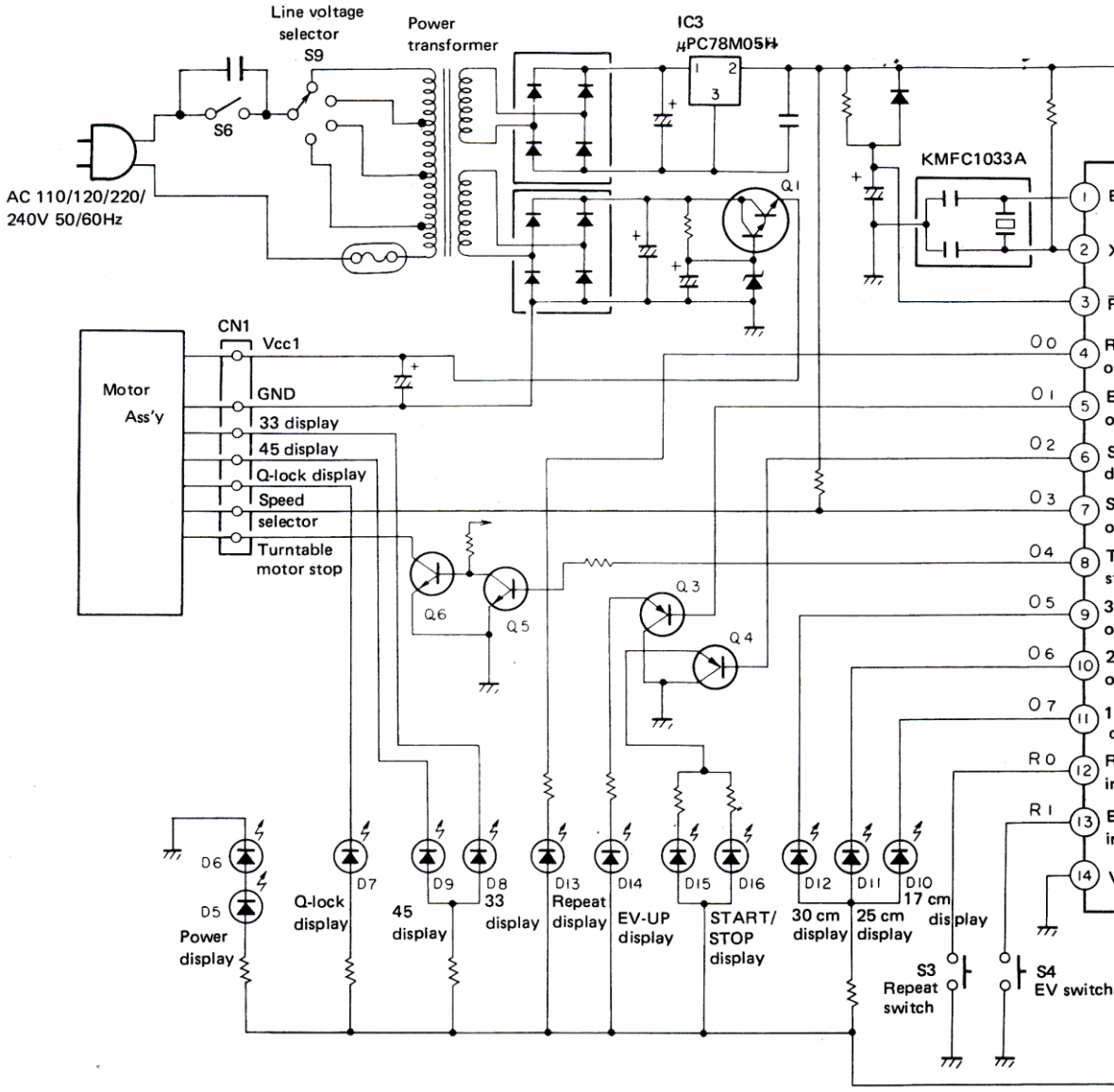
■ **Auto-stop**

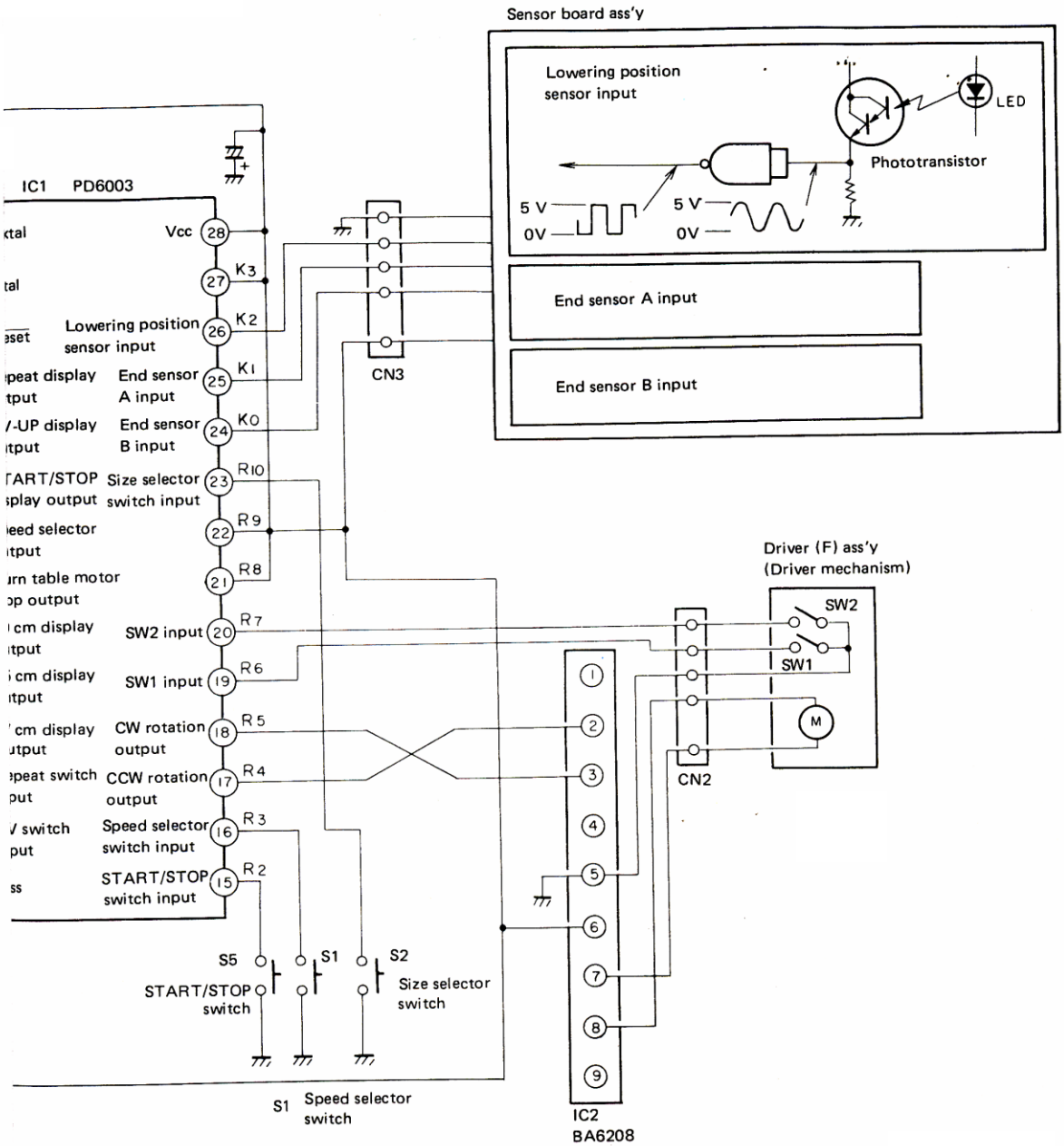
1. When it is desired to stop record playback in the middle of the record, depress the START/STOP button. As the START/STOP button is depressed, PD6003 pin 15 goes to a low level. Pin 17 goes high and pin 18 goes low, starting rotation of the tonearm drive motor. Rotation causes the arm-elevation to ride up on the slope of the turning cam raising the tonearm.
2. Also, the base potential of transistor Q4 (connected to pin 6) drops, turning it ON, thereby illuminating the START/STOP display LEDs, D15 and D16. From here the operation is the same as that for auto-return (above), items 3 through 6.
3. The START/STOP display LEDs, D15 and D16 are extinguished by the tonearm drive motor reversing rotation and turning switch SW1 ON and sending PD6003 pin 6 to a high level.

■ **Auto-repeat**

1. To repeat playback of the same record, depress the repeat button. This causes PD6003 pin 12 to go to a low level. At the same time, pin 4 also goes low, illuminating the repeat display LED, D13.
2. When the repeat button has been depressed, after autoreturn operations have returned and lowered the tonearm on the arm rest, the unit again goes into autolead in operations and continues playback. (The platter motor continues to rotate.)

■ BLOCK DIAGRAM

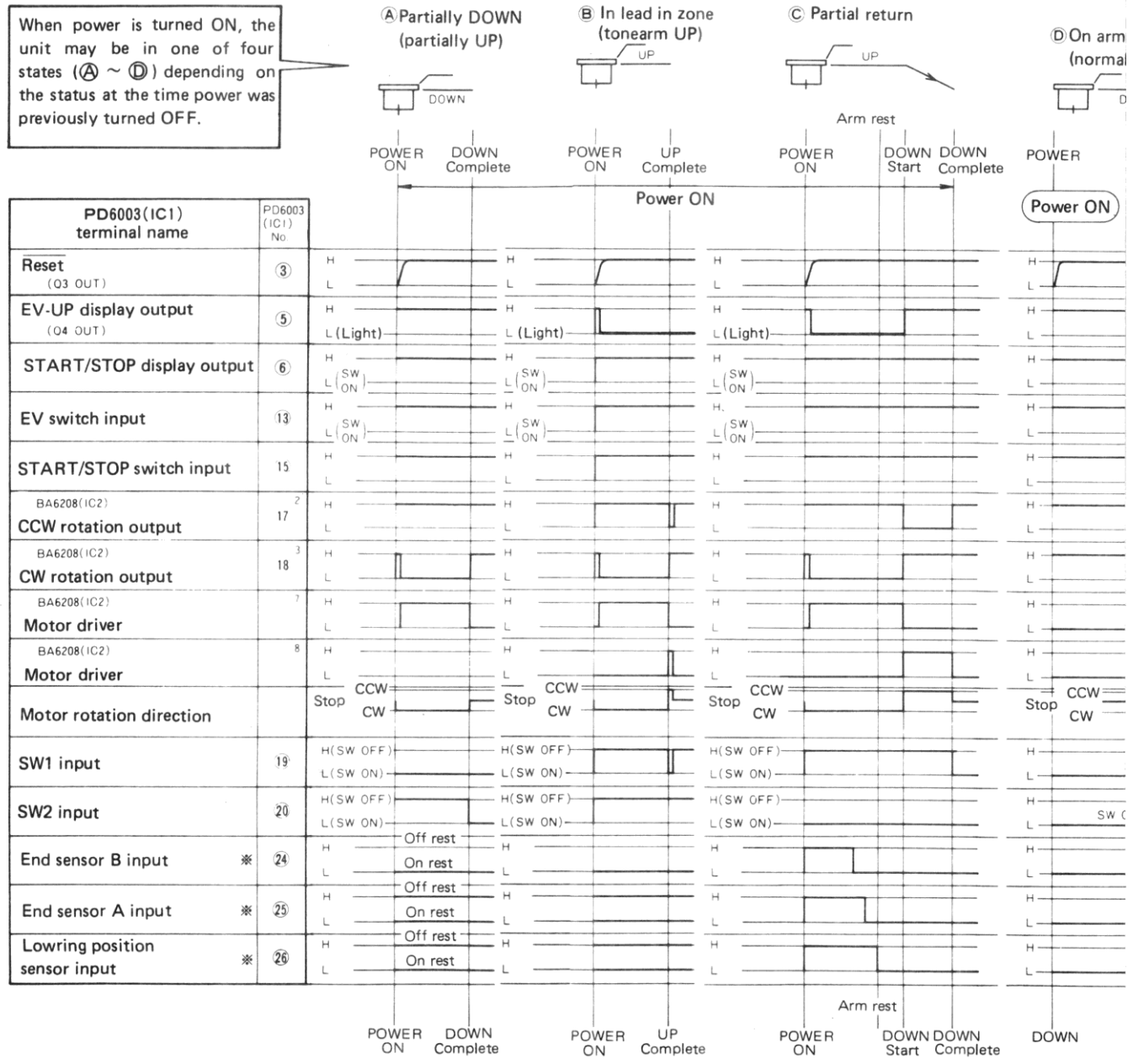


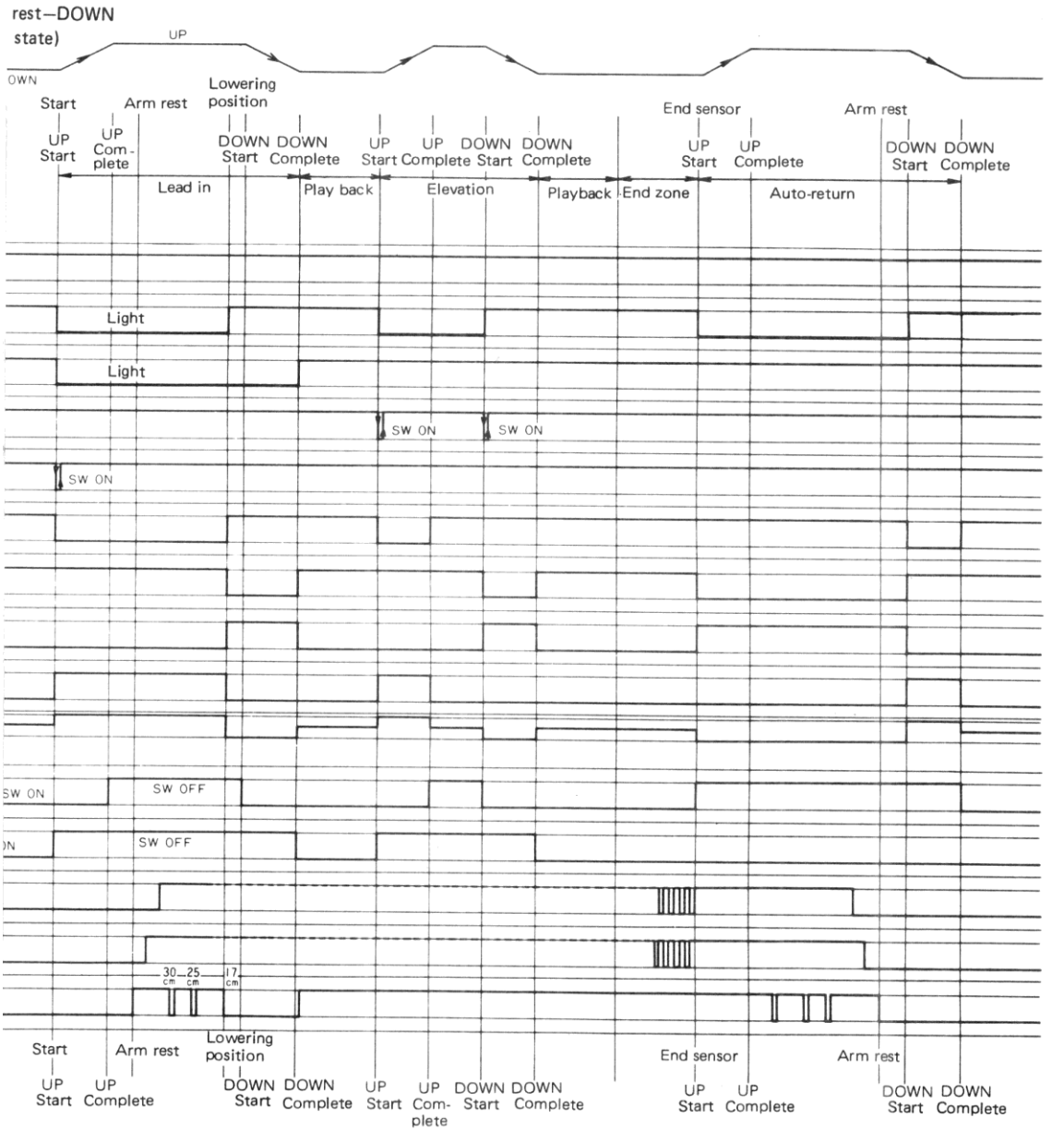


■ TIMING CHART 1

Operational sequence for a single cycle between power ON and automatic stop (full-automatic operation, 17cm record disc).

When power is turned ON, the unit may be in one of four states (Ⓐ ~ Ⓓ) depending on the status at the time power was previously turned OFF.



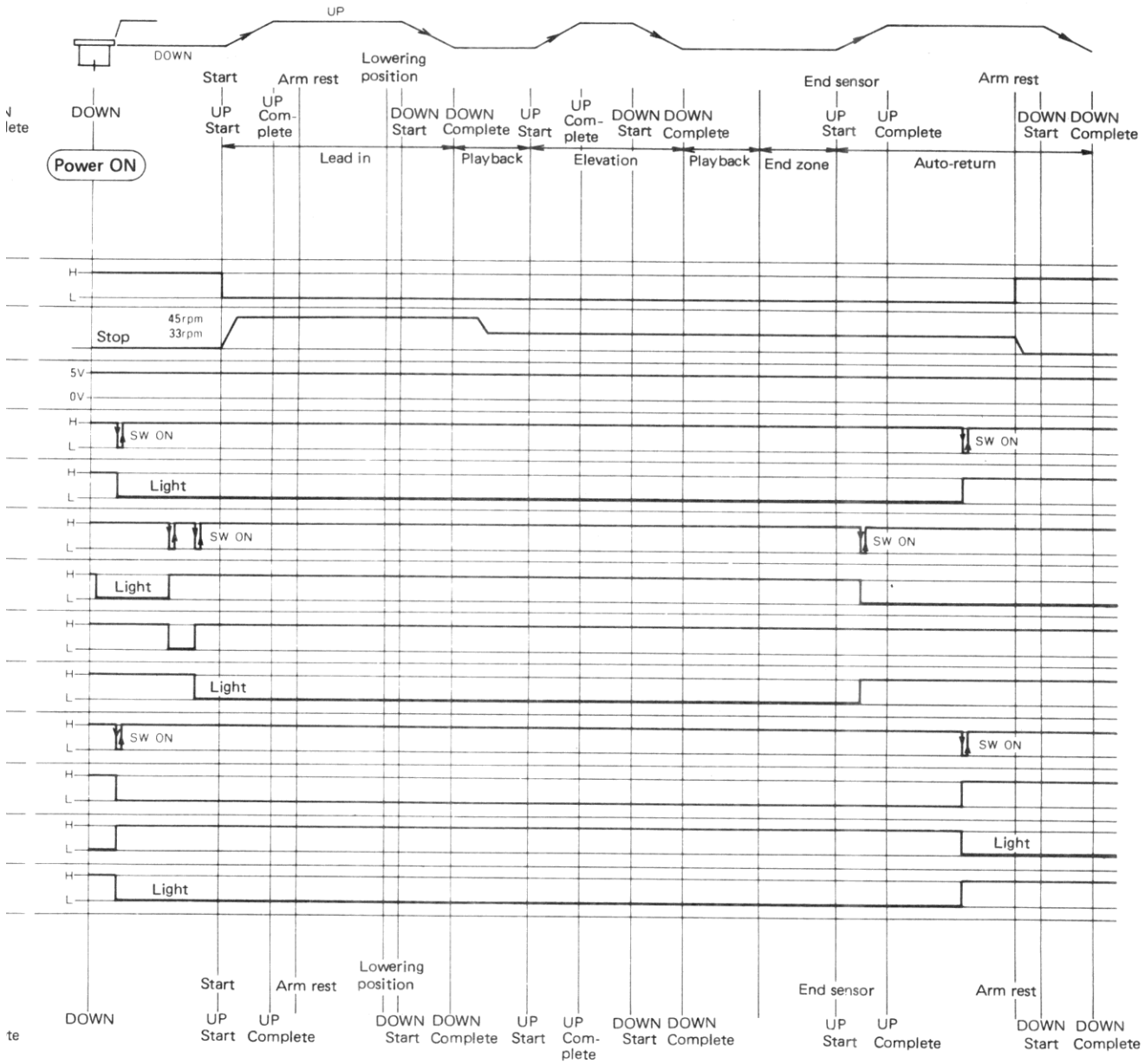


■ TIMING CHART 2

Operational sequence for a single cycle between power ON and automatic stop (full-automatic operation, 17cm record disc).

When power is turned ON, the unit may be in one of four states (Ⓐ ~ Ⓓ) depending on the status at the time power was previously turned OFF.

Ⓓ On arm rest DOWN
(normal state)



■ TIMING CHART 3

Operational sequence for a single cycle between power ON and automatic stop (full-automatic operation, 17cm record disc).

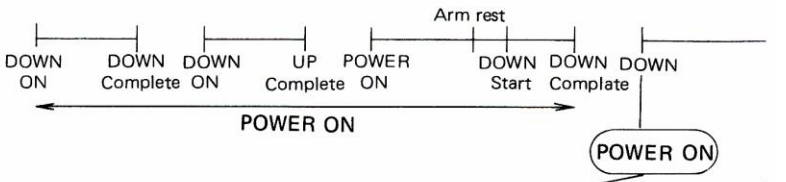
When power is turned ON, the unit may be in one of four states (Ⓐ ~ Ⓓ) depending on the status at the time power was previously turned OFF.

Ⓐ Partially DOWN (partially UP)

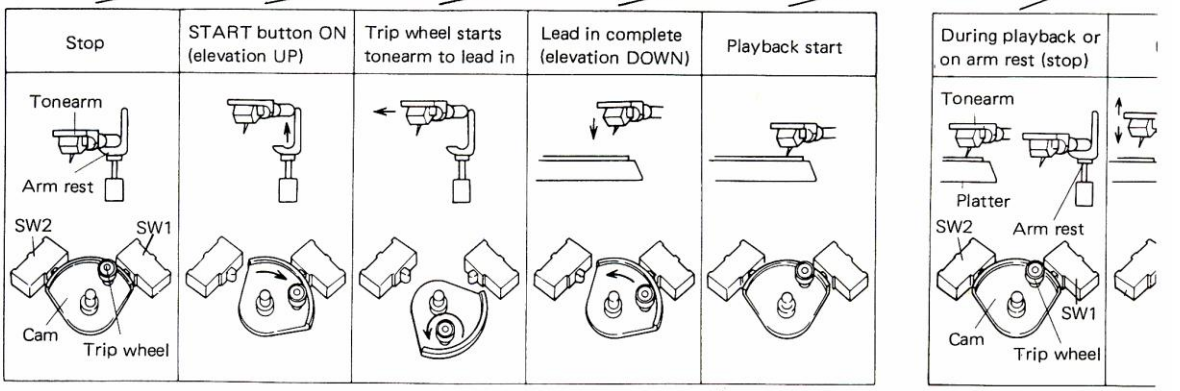
Ⓑ In lead in zone

Ⓒ Partial return (tonearm UP)

Ⓓ On arm re (normal st



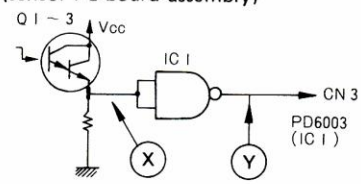
Actual mechanism operation



Auto-lead in

Arr

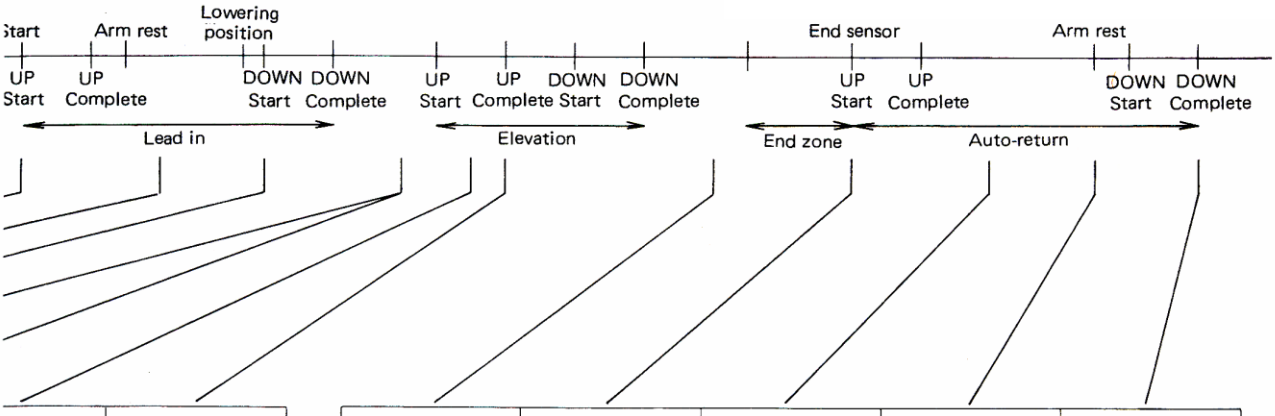
End B, end A, and lowering position sensor input (sensor PC board assembly)

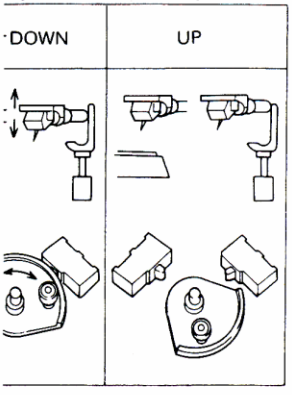


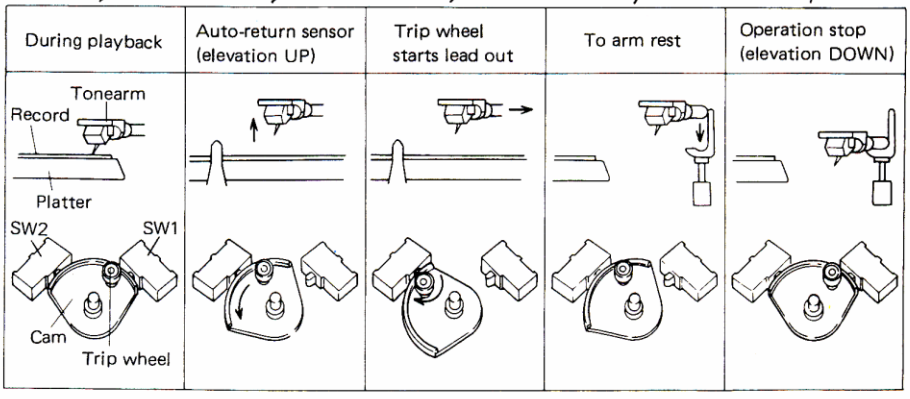
	End B sensor Q3	End A sensor Q2	Lowering position sensor Q1	
IC1 Input pins	12, 13	8, 9	1, 2	(X) wave-form 5V 0V
IC1 Output pins	11	10	3	(Y) wave-form 5V 0V

※ Input waveform for sensors shown in timing chart 1

-DOWN
)





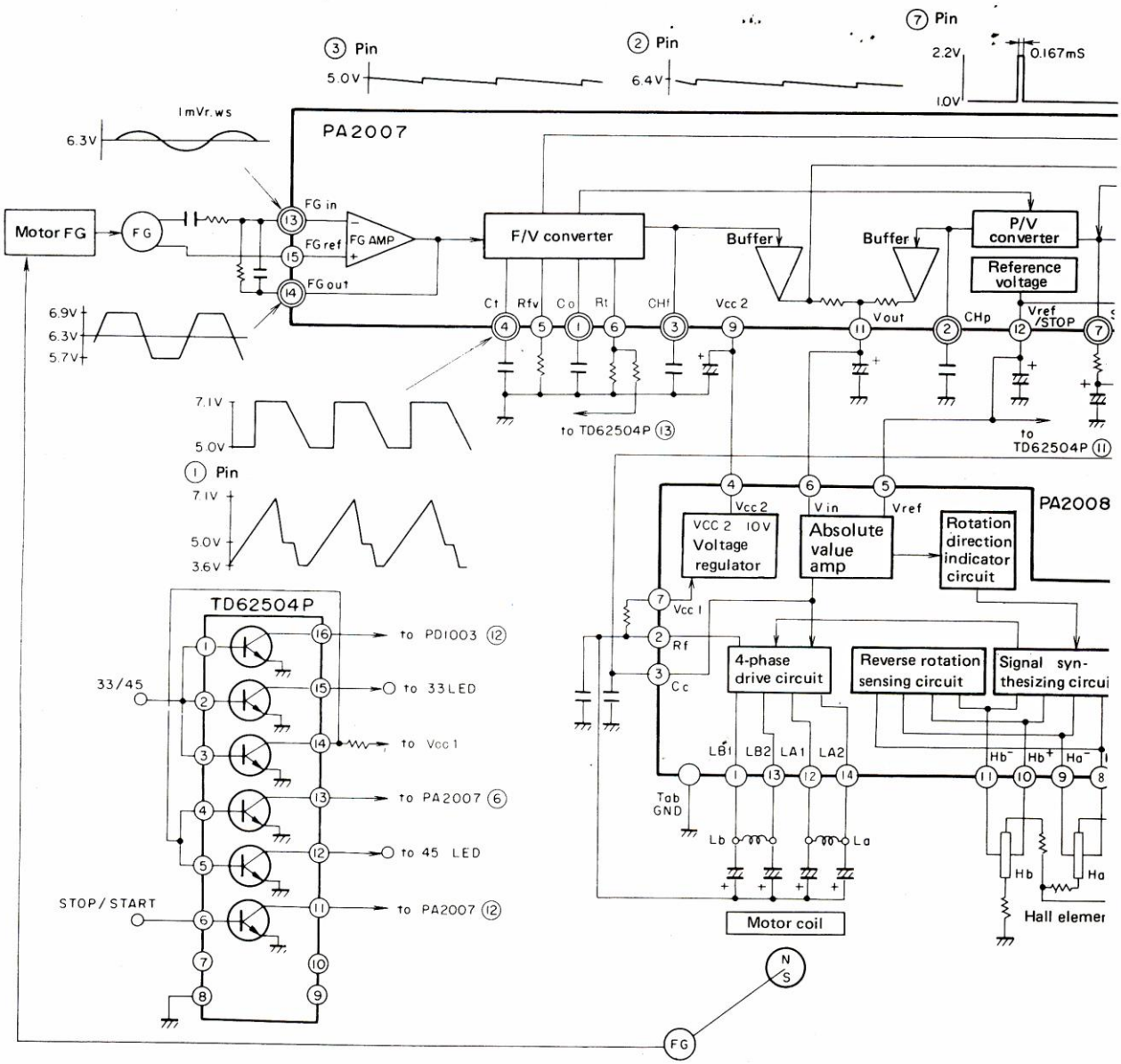


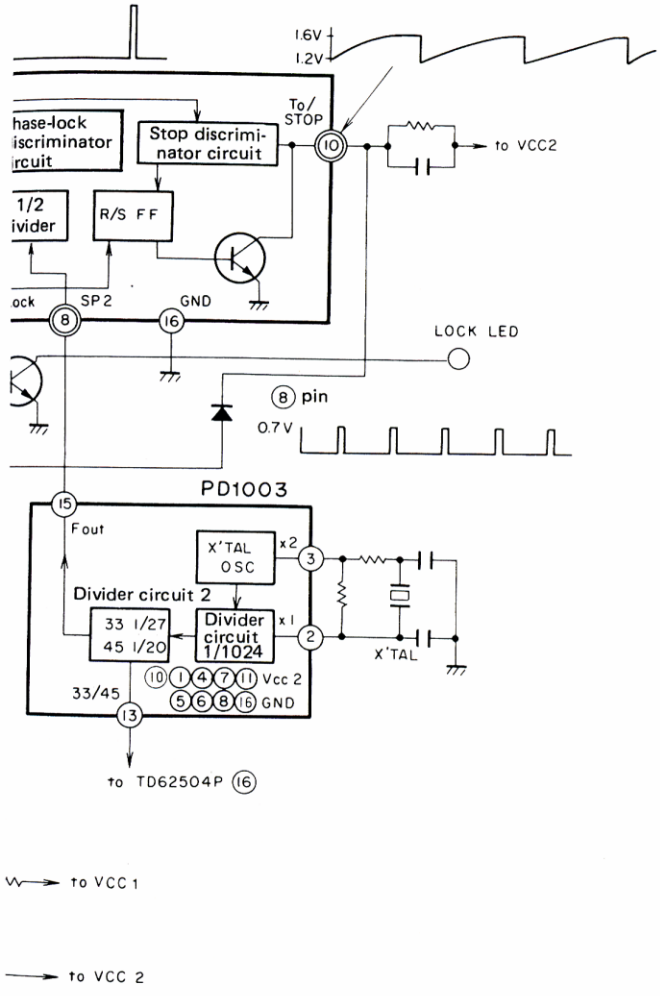
levation

Auto-return

5. CIRCUIT DESCRIPTIONS

■ BLOCK DIAGRAM





The newly developed quartz PLL Hall element motor used in the PL-9 features a number of basic improvements over motors traditionally employed as turntable drive motors.

5.1 BASIC DIFFERENCES

1. PA2005: 6-phase drive circuit; three Hall elements.
   PA2008: 4-phase drive circuit; two Hall elements.
2. PA2004: 2-frequency F/V converter circuit.
   PA2007: Single-frequency F/V converter circuit (loop gain increase)
3. The stop circuit previously fabricated in PA2005 is now included in PA2007. Another new function is the lock indicator illumination circuit built into PA2007. Also, the pins of the control IC PA2007 are provided with multi-function capability for increased control versatility.

5.2 SIMPLE SIGNAL PATH

The PL-9 motor drive circuit consists of the control IC PA2007, reference phase generator IC PD1003, motor drive IC PA2008, and IC TD62504P functioning to produce the various operational switch signals.

The signal picked up from the speed sensor section is amplified by the FG amp, then converted to the speed sensor signal voltage (DC) by the F/V converter.

Reference phase voltage is obtained by extracting the reference phase from PD1003 pin 15, passing it through the 1/2 divider, then sending it through the P/V converter to be used as reference phase voltage (DC).

The speed sensor signal voltage and reference phase voltage are each passed through a buffer amp and resistance and combined (compared). The resulting voltage is taken from the IC PA2008 pin 6 and input into the absolute value amp, and is used to control the 4-phase drive circuit motor rotation voltage, maintaining the motor at a fixed speed.

5.3 SPEED SENSOR SECTION

1. The speed sensor board consists of a single printed circuit.
2. Above this, rotates a rotor with 400 magnetized poles on its lower face. Output varies in accordance with the rotational speed of the rotor.
3. The output (frequency) from the speed sensor board is 111Hz for 33 1/3 rpm and 150Hz for 45 rpm.
4. The output signal is sent to PA2007 as a balanced input.

5.4 FG AMP

In order to square the waveform of the signal obtained from the speed sensor section (output: 0.5 — 2.0 mV rms) prior to inputting it into the F/V converter, it is amplified 69dB across a band width of 20 to 160Hz.

5.5 F/V CONVERTER

1. Since the rotational speed is detected at a fixed frequency, the frequency must be converted to a voltage (DC). This function is performed by the F/V converter.
2. Previously (in PA2004) this was done by a 2-frequency F/V converter, however, increasing control gain of PA2007 allows a signal-frequency F/V to be used.
3. F/V converter gain does not change even with rpm changes.
4. Switching reference frequency is shown in Fig. 5-1.
   When the switch is OFF, speed is set to 33 1/3 rpm, and when the switch is ON, the variable resistor used by 33 1/3 rpm is connected parallel to the 45 rpm variable resistor. The resulting total impedance establishes rotational speed. Thus, each time 33 1/3 rpm is adjusted, 45 rpm must also be adjusted. This arrangement prevents any rotational instability that might result from both switches being temporarily OFF when speed changes are made by switching from 33 1/3 — 45 rpm.
5. Co, Ct, Rt, and Rfv are each connected to ground, but the grounding point is very close to that of PA2007. Also, Rt is a 0.01 μF ceramic capacitor for noise and oscillation removal, and it is grounded in close proximity to PA2007 too.

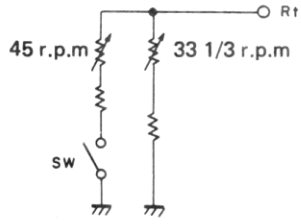


Fig. 5-1 Switching reference frequency

5.6 REFERENCE PHASE GENERATOR IC PD1003

1. When power is turned ON, the X'tal oscillator block generates a 6.144 MHz signal by using the externally connected crystal oscillator.
2. This is reduced to 6kHz by divider circuit 1 (1/1024), then this divided signal is input to divider circuit 2.
3. The 6kHz signal input to divider circuit 2 is further divided 1/27 for 33 1/3 rpm operation, and 1/20 for 45 rpm, then transmitted from pin 15 to PA2007 pin 8.
   33 1/3 rpm: 222.2Hz
   45 rpm: 300Hz

5.7 1/2 DIVIDER AND P/V CONVERTER

The signal received at the 8 pin (item above) is further divided by 1/2 by the 1/2 divider, then input to the P/V converter. The P/V converter serves to convert the reference phase taken from the 1/2 divider to DC voltage.

The reference phase converted into DC voltage is combined (by the buffer amp and resistor) with the DC voltage from the F/V converter (and used for rotation speed) and transmitted from pin 11 as a motor rotation speed control signal to IC PA2008 pin 6, then finally to the absolute value amp (Fig. 5-2).

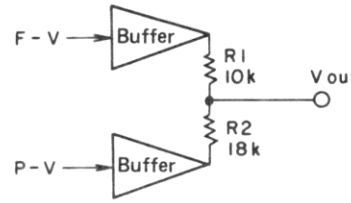


Fig. 5-2 (F—V) + (P—V) circuit

5.8 PHASE-LOCK DISCRIMINATOR CIRCUIT

When phase control is in effect, the output characteristics of the F/V converter appear as in Fig. 5-3. The portion that shows no change in speed when load torque is varied up and down can be considered as the phase-locked area, and the portion where large rotational speed changes occur (as in Fig. 5-4) is outside the phase-locked area. Thus, F/V converter output can be input into an absolute value comparator having an upper and lower threshold. A theoretical diagram of such a circuit is shown in Fig. 5-5.

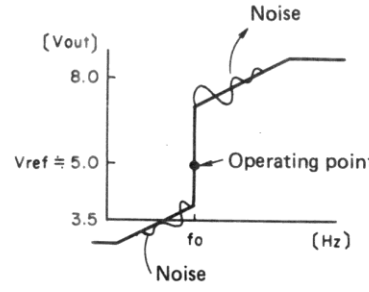


Fig. 5-3 Input/output characteristics

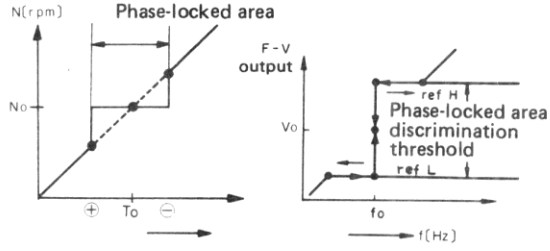


Fig. 5-4 F/V converter output

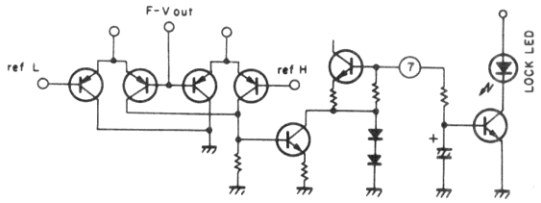


Fig. 5-5 Phase-locked discrimination theoretical circuit

5.9 STOP DISCRIMINATOR CIRCUIT

1. Depressing the START/STOP button of the PL-9 transmits a stop signal generating a reverse torque and applying a brake to the motor. Motor rotation stops almost immediately.
2. The stop discriminator circuit functions to detect low or high rotation speed through the charge/discharge status of capacitors and resistors connected to IC PA2007 pin 10 (To/STOP), and when rotation drops below a certain speed, motor torque is dropped to zero. A theoretical circuit diagram is shown in Fig. 5-6.
3. After that, the platter turns a small amount due to inertia, then stops.

5.10 ABSOLUTE VALUE AMP AND ROTATION DIRECTION INDICATOR CIRCUIT

1. The signal at the 6 pin (control input) is compared with the signal at the 5 pin (reference voltage) and the difference in voltage is used to generate current in the motor winding. The input/output characteristics are shown in Fig. 5-7.
2. The control input is higher than the reference voltage (Vref 5V) when the rotation of the platter is higher than specified speed. When this occurs, the absolute value amp sends an indication (instruction) to the rotation direction indicator circuit to generate reverse torque in order to drop the speed of the motor.
3. The control input is lower than the reference voltage (Vref 5V) when the rotation of the platter is lower than specified speed. When this occurs, the absolute value amp sends an indication (instruction) to the rotation direction indicator circuit to generate forward torque in order to increase the speed of the motor.

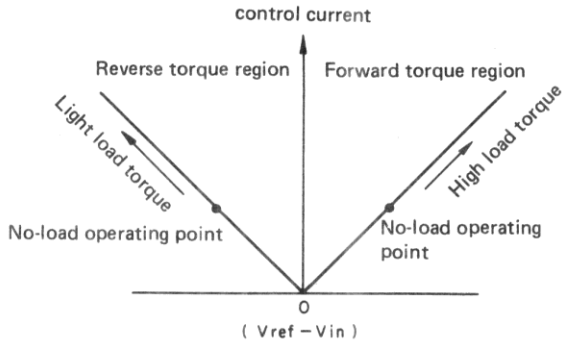


Fig. 5-7 Input/output characteristics

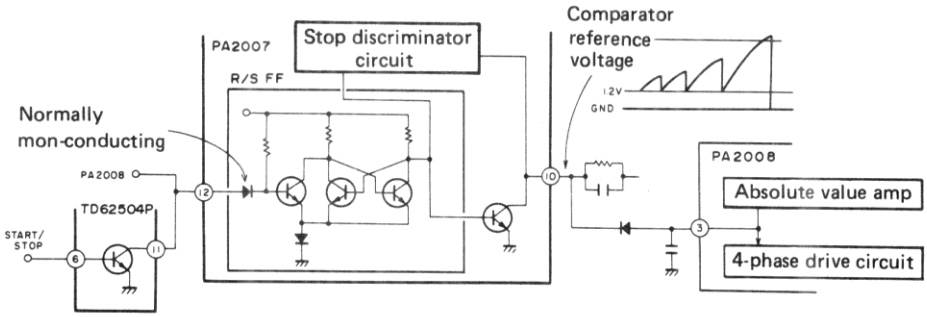


Fig. 5-6 Stop discriminator theoretical circuit

5.11 DRIVE CIRCUIT

1. The HA and HB Hall elements (6 magnetized pole pieces fixed to the circumference of the motor) are attached electrically 90° out of phase with each other. These elements are used to sense the rotational position of the motor.
2. The position sensing signal produced by the Hall elements are each output to the block diagram position signal synthesizing circuit, and their waveforms are shaped as shown in Fig. 5-8.
3. The staircase waves are each input into the block diagram 4-phase drive circuit, and as shown in Fig. 5-8, LA and LB alternate back and forth in a 90° duty cycle (voltage) to turn the motor.
4. LA and LB amplitude is in proportion to the output of the absolute value amp.

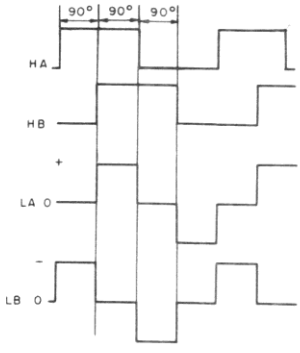


Fig. 5-8 Drive circuit waveforms

5.12 REVERSE ROTATION SENSING CIRCUIT

1. The motor used in the PL-9 is the dual-direction drive circuit type, and if manually forced in the reverse direction, it will continue to apply a forward torque in an attempt to restore forward rotation as long as it does not exceed specified rotation speed.
2. However, when reverse rotation exceeds 45 or 33 1/3 rpm, the rotation direction indicator circuit detects this as an overrun in the forward direction and applies reverse torque in an attempt to bring it to specified rotation speed.
3. Reverse torque applied to the platter already rotating in reverse will further increase the speed and the turntable will run out of control.
4. The reverse rotation guard circuit prevents the platter from running out of control.
5. The equivalent circuit of the reverse rotation sensing circuit consists of a D type flip-flop (D input output at Q by CK triggering).

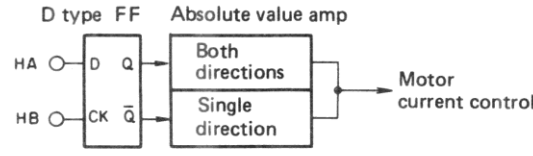


Fig. 5-9 Reverse rotation sensor equivalent circuit

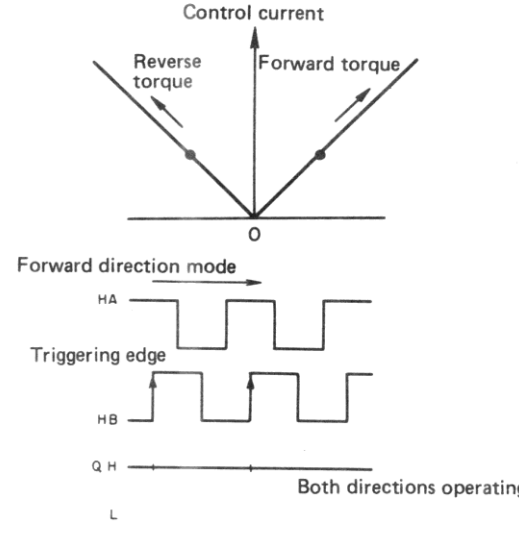


Fig. 5-10 Forward direction mode

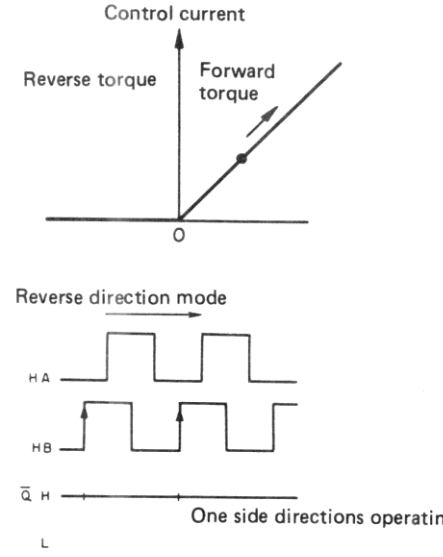
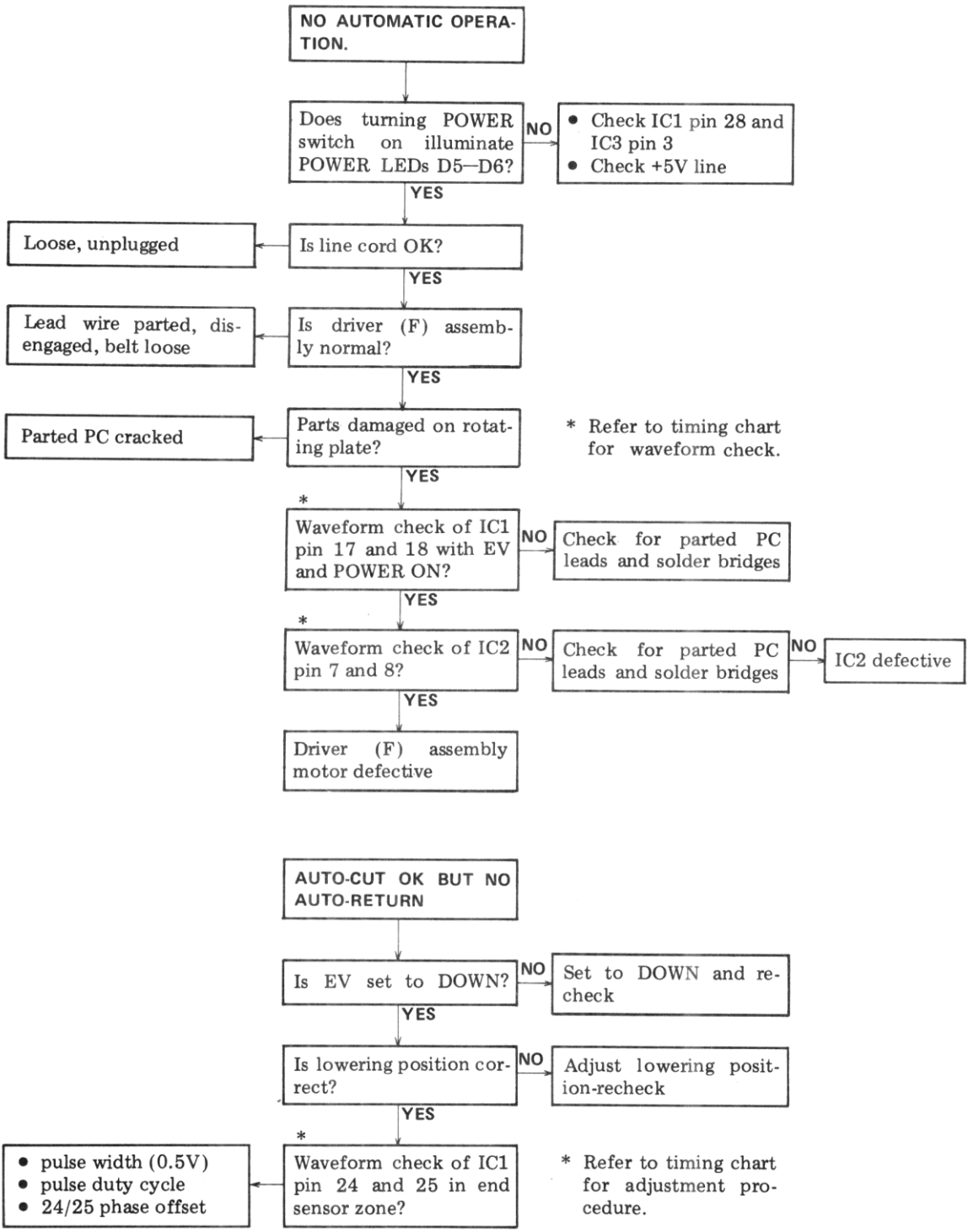
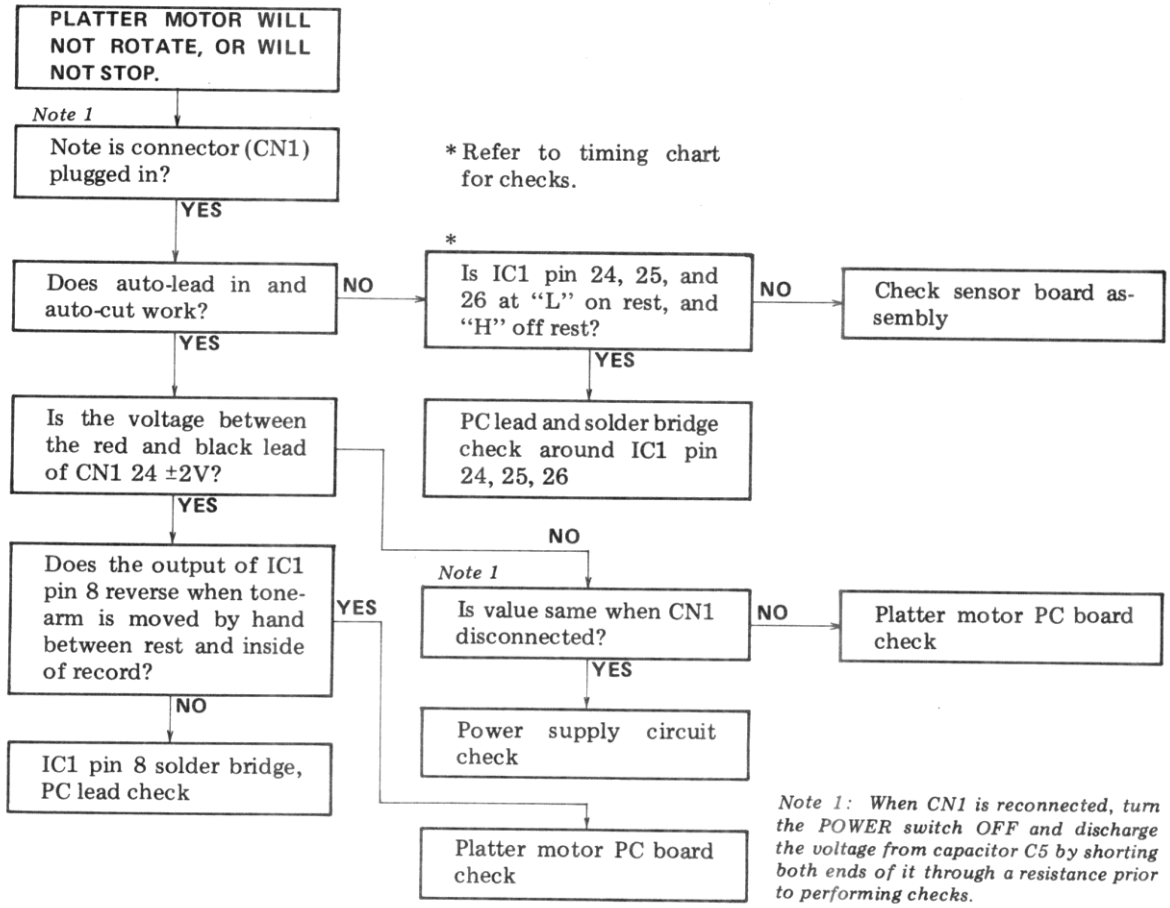


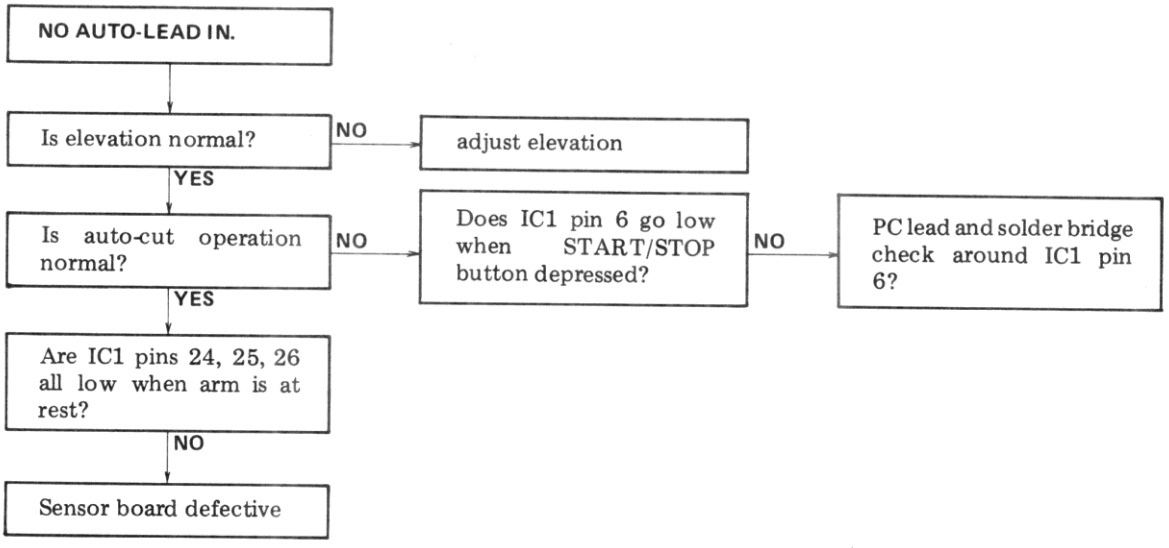
Fig. 5-11 Reverse direction mode

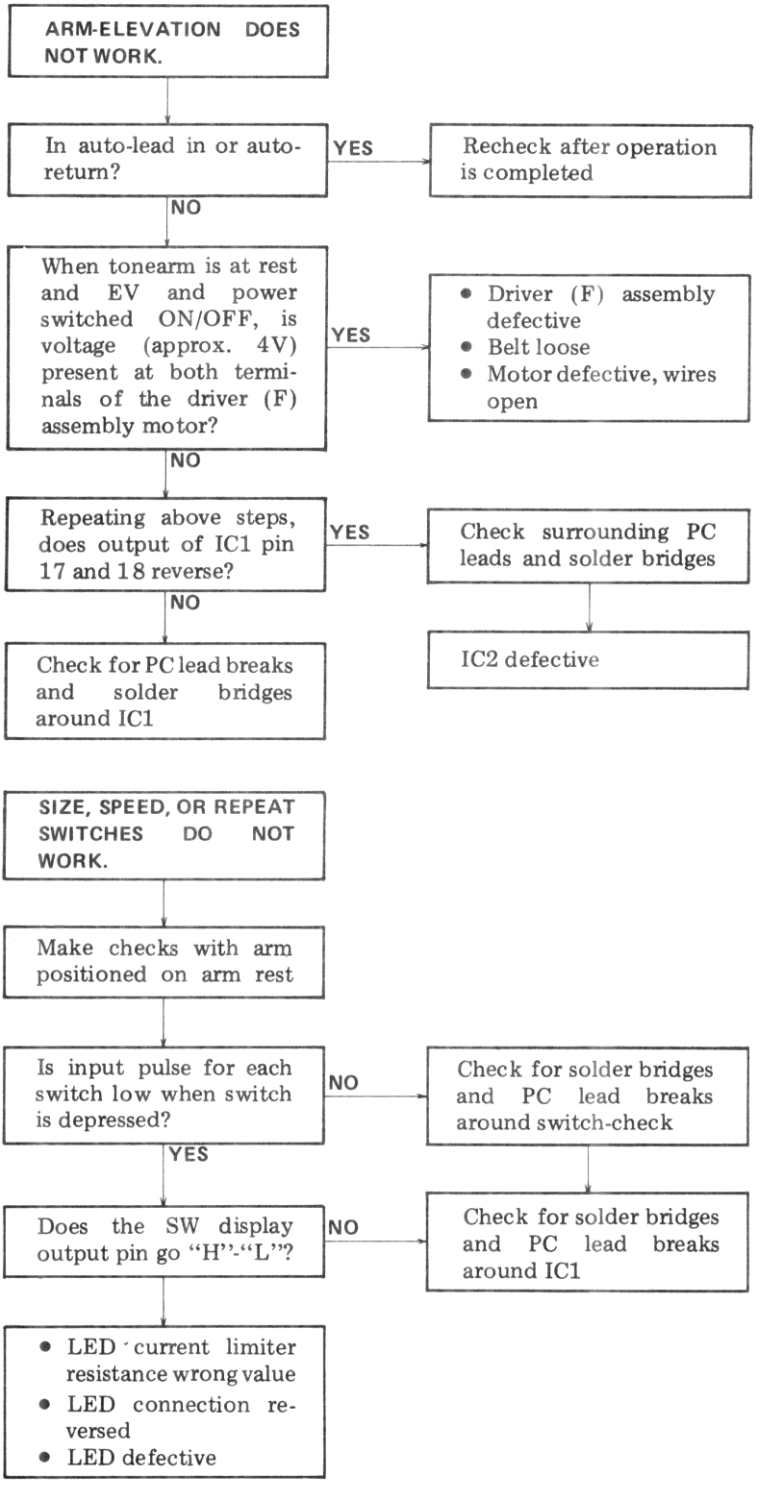
6. TROUBLE SHOOTING



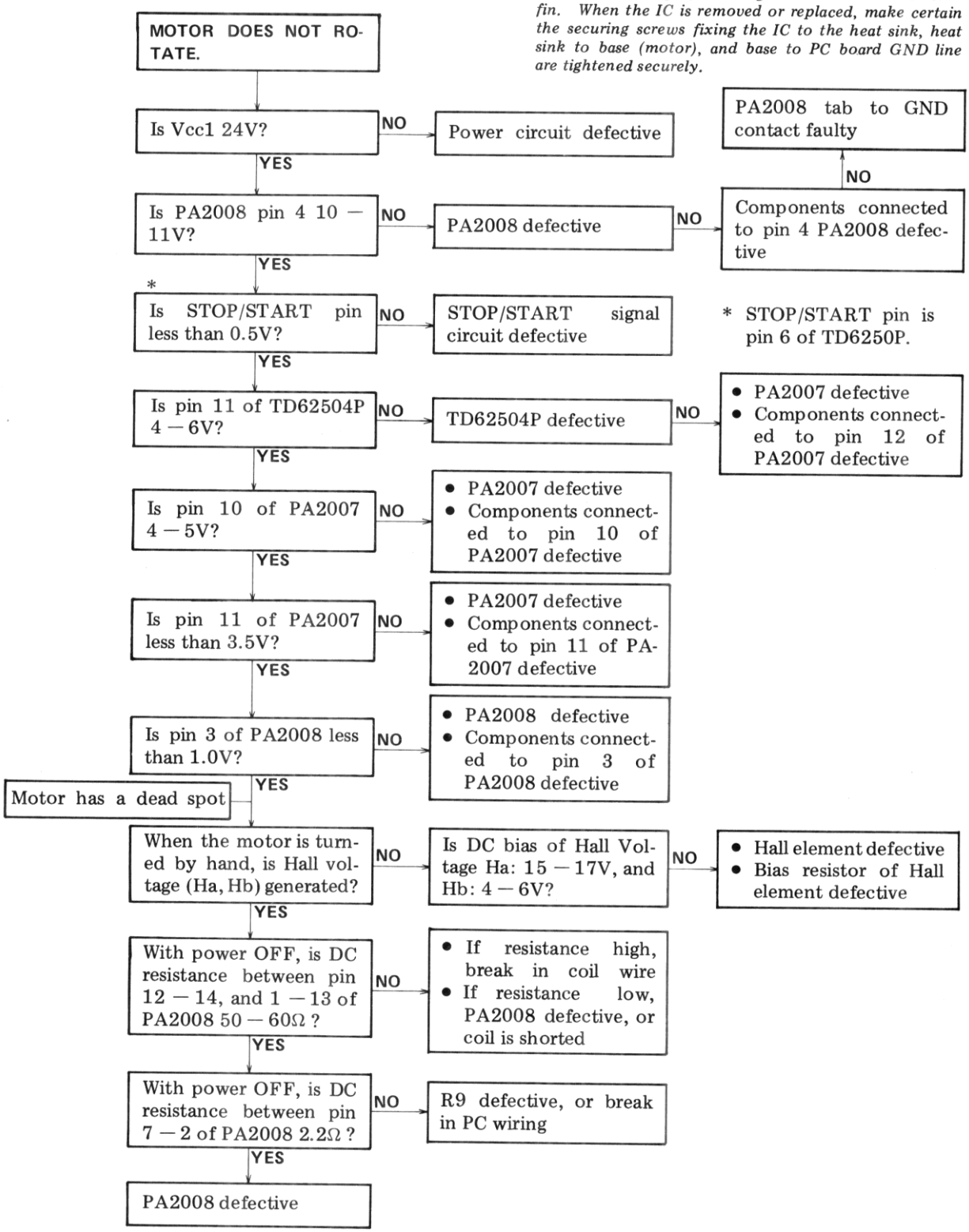


Note 1: When CN1 is reconnected, turn the POWER switch OFF and discharge the voltage from capacitor C5 by shorting both ends of it through a resistance prior to performing checks.

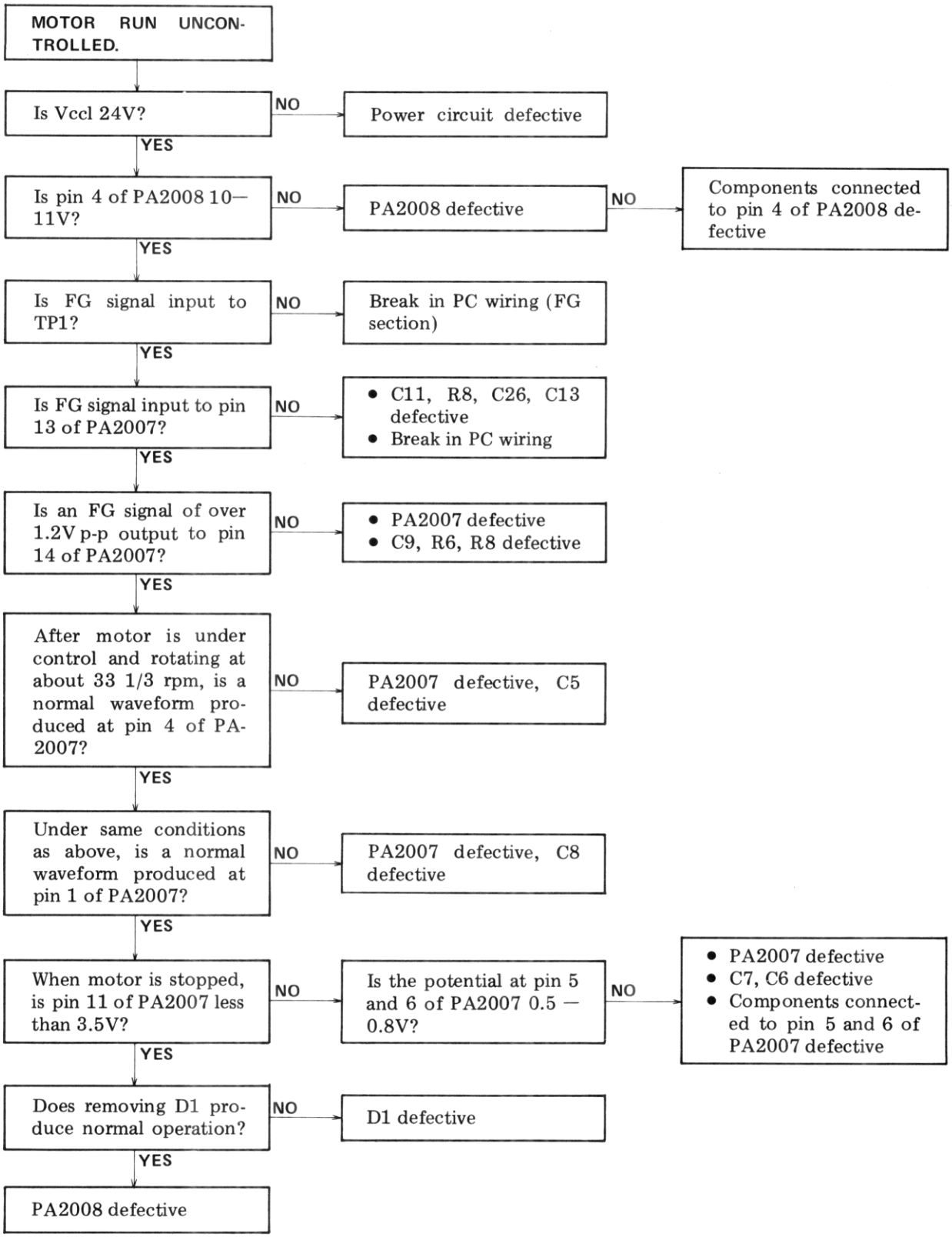


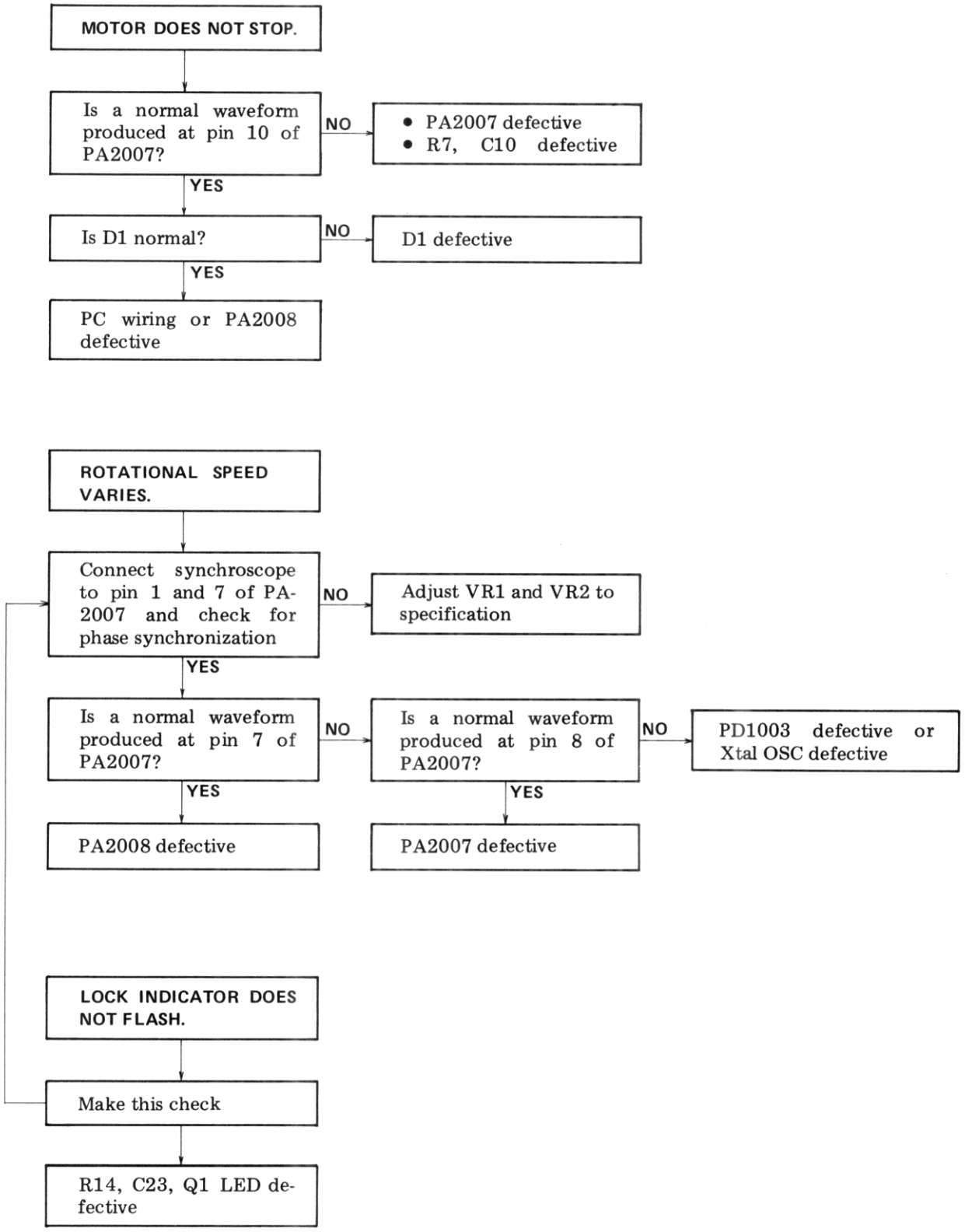


** IC PA2008 used in the motor circuit does not use a dedicated GND pin, but is grounded to the heat sink fin. When the IC is removed or replaced, make certain the securing screws fixing the IC to the heat sink, heat sink to base (motor), and base to PC board GND line are tightened securely.*



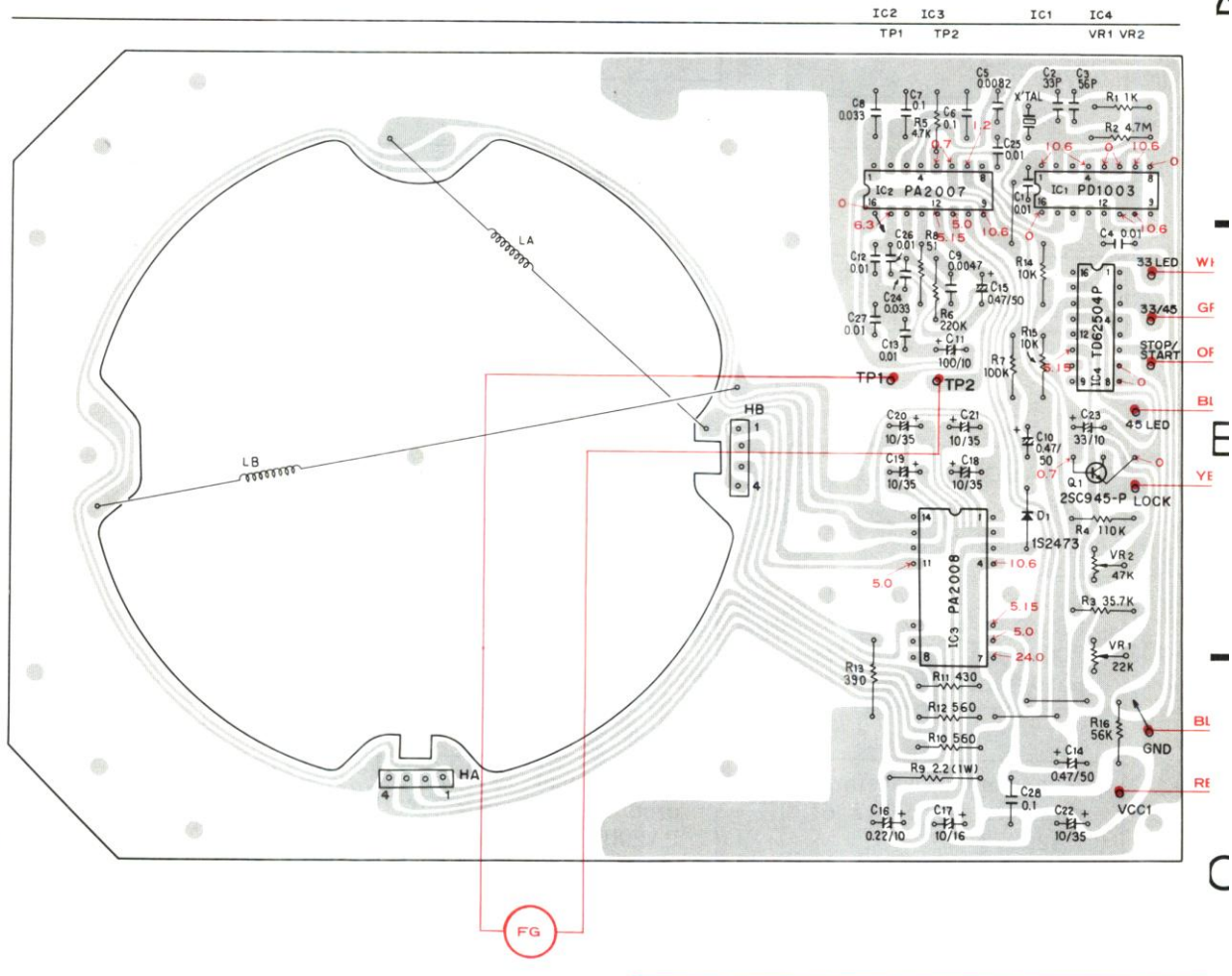
* STOP/START pin is pin 6 of TD6250P.



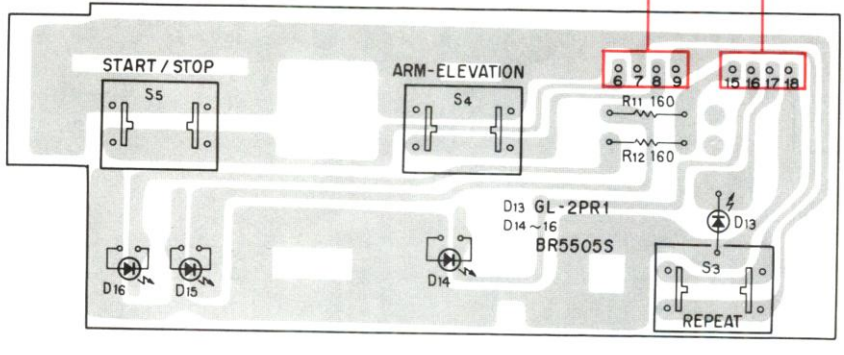


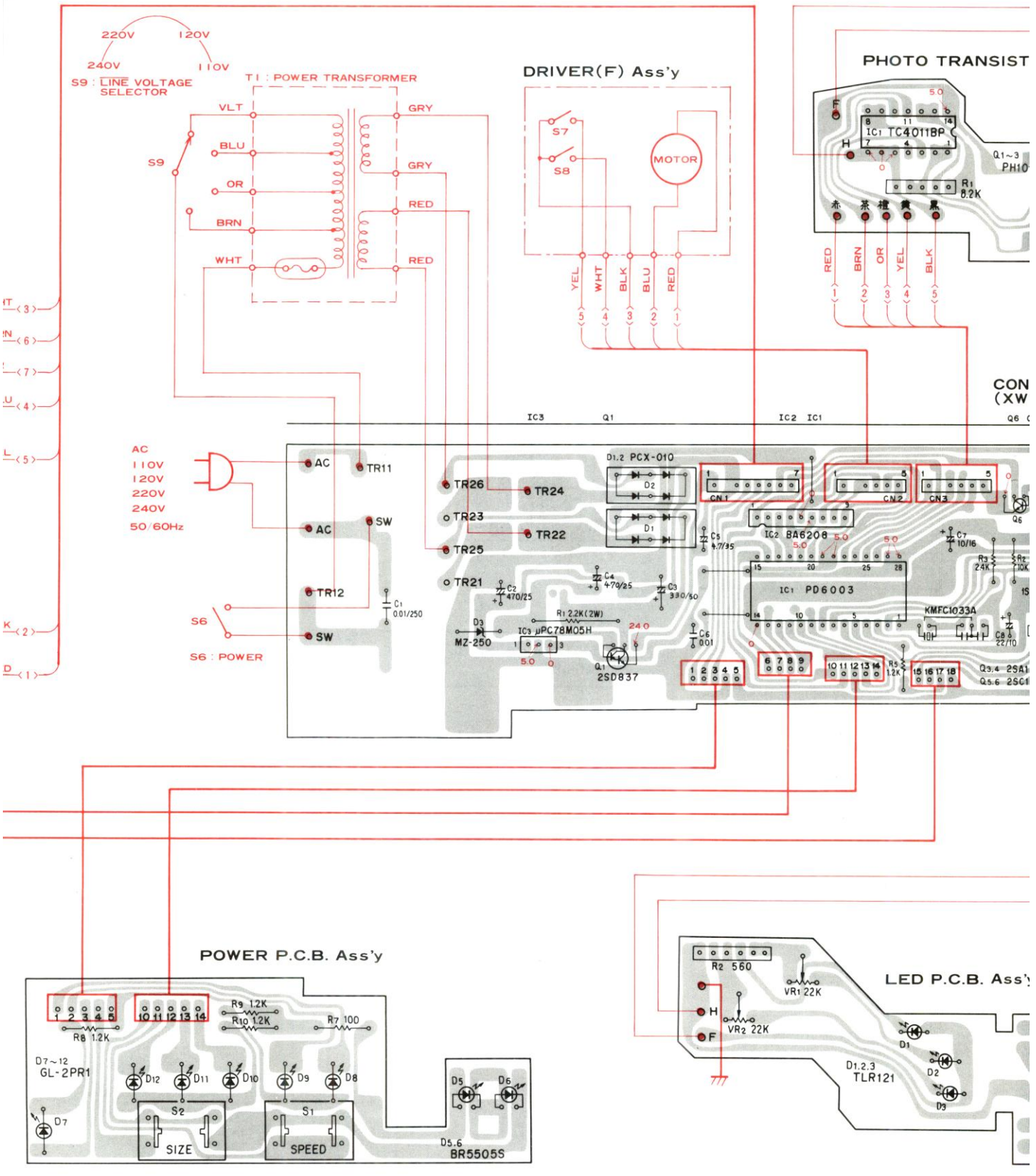
7. P.C.BOARDS CONNECTION DIAGRAM

MOTOR Ass'y (PXM-084)

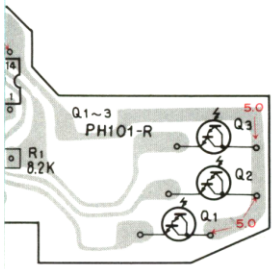


START P.C.B. Ass'y

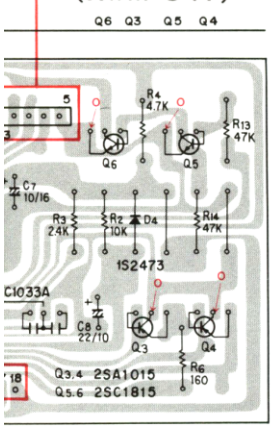




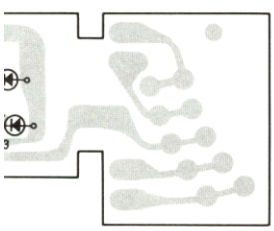
TRANSISTOR Ass'y



CONTROL Ass'y
(XWM-047)

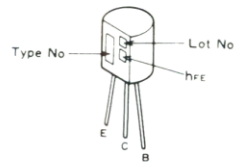


C.B. Ass'y

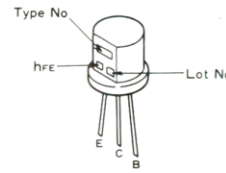


External Appearance of Transistors and ICs

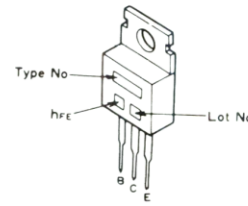
2SA733
2SA1015
2SC945
2SC1815



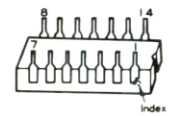
2SC372



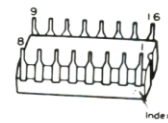
2SD837



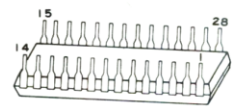
TC4011BP



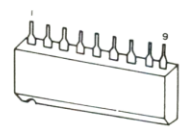
PA2007
PD1003
TD62504P



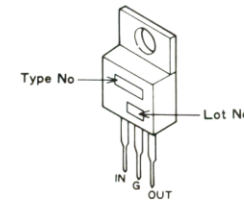
PD6003



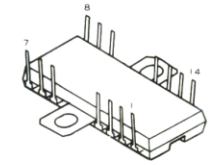
BA6208



μPC78M05H



PA2008



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8. SCHEMATIC DIAGRAM

1. RESISTORS:
Indicated in Ω, ¼W, ±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
: DC voltage (V) at no input signal

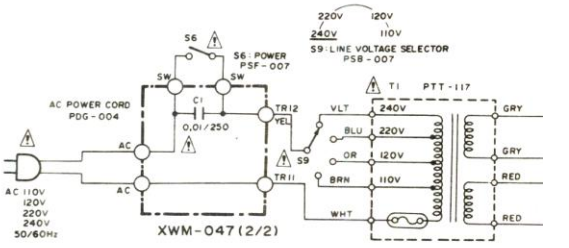
4. OTHERS:
⊘ : Adjusting point.
The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.

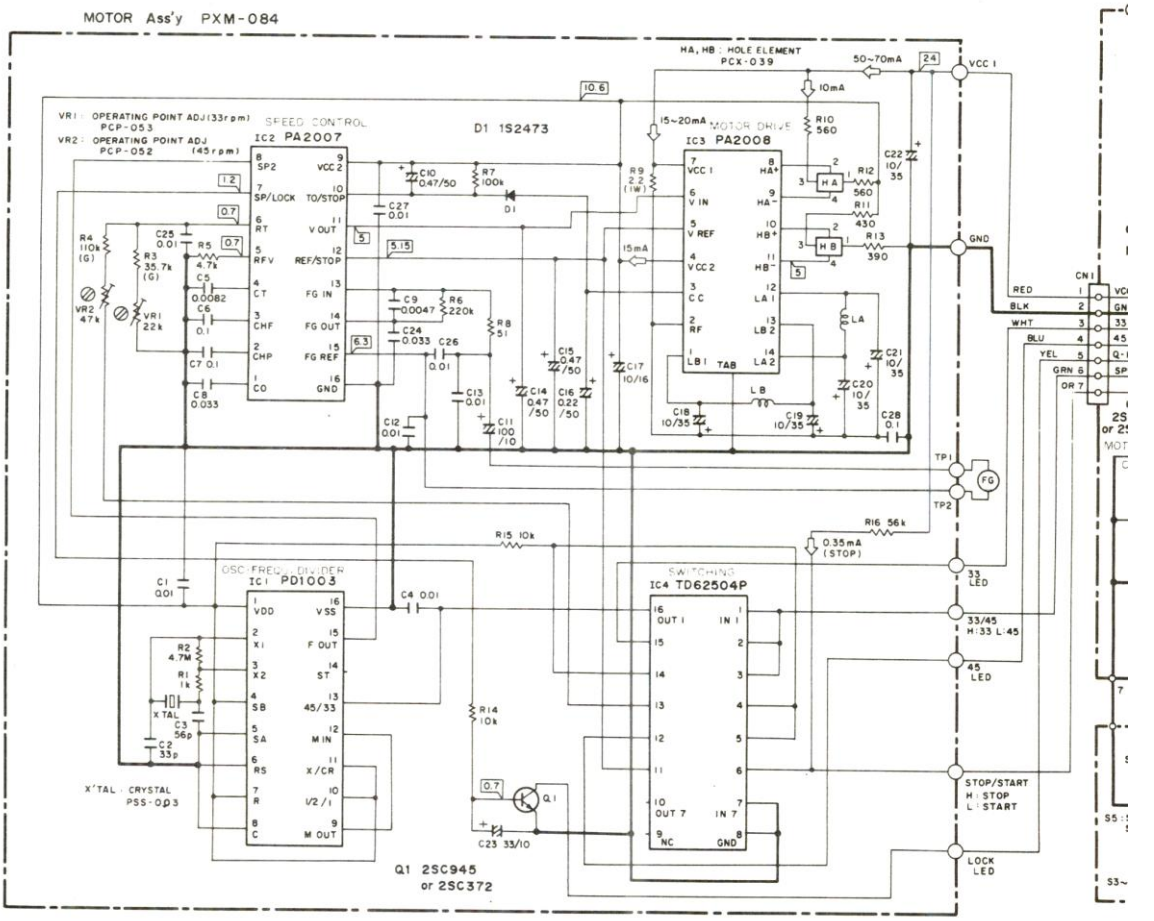
This is the basic schematic diagram, but the actual circuit may vary due to improvements in design.

SWITCHES :

S1	:	SPEED	33⅓ rpm — 45 rpm
S2	:	SIZE	30cm — 25cm — 17cm
S3	:	REPEAT	ON — OFF
S4	:	ARM — ELEVATION	UP — DOWN
S5	:	START / STOP	ON — OFF
S6	:	POWER	ON — OFF
S7	:	MICRO	ON — OFF
S8	:	MICRO	ON — OFF
S9	:	LINE VOLTAGE SELECTOR	110V — 120V — 220V — 240V

The underlined indicates the switch position.





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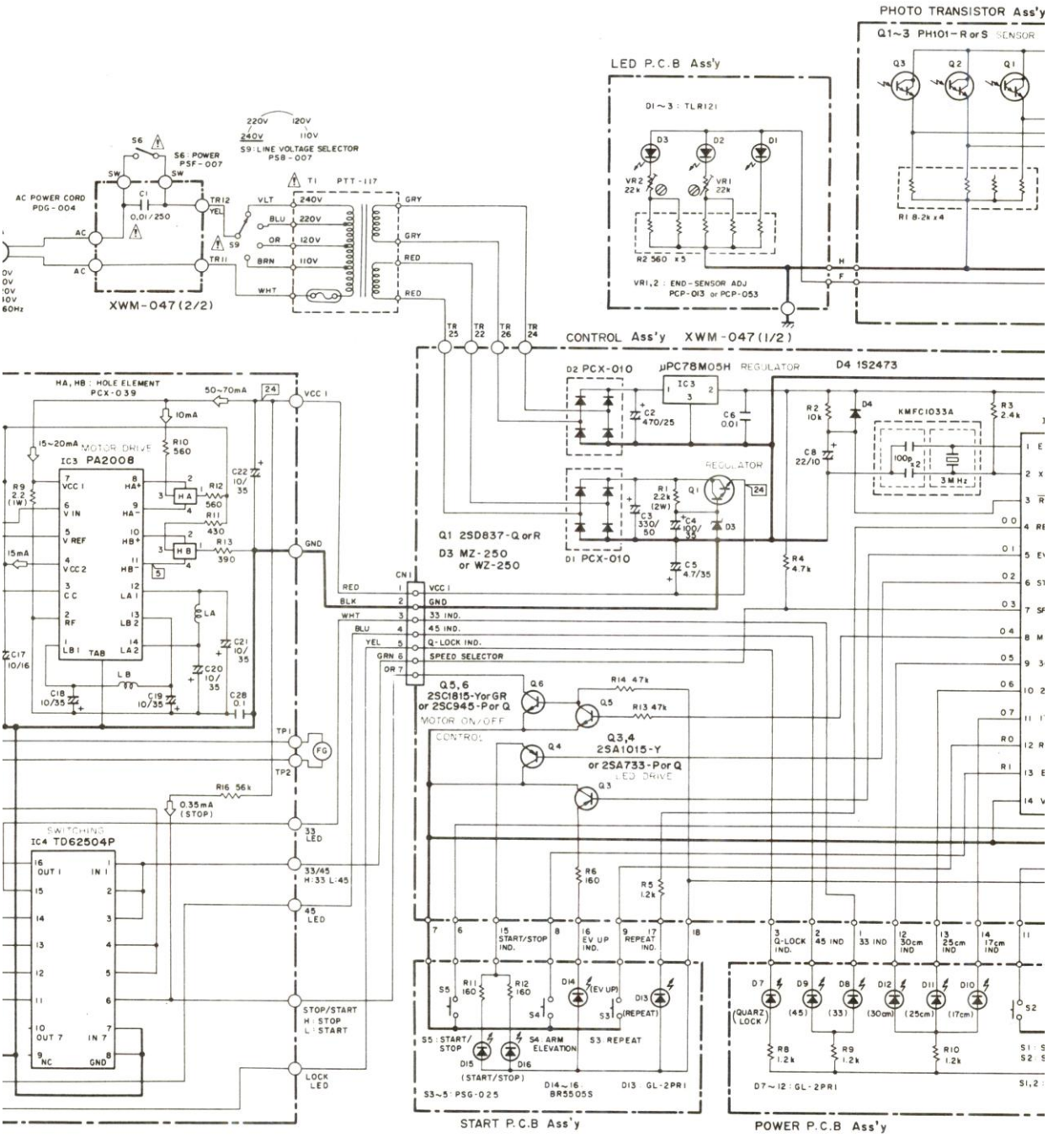
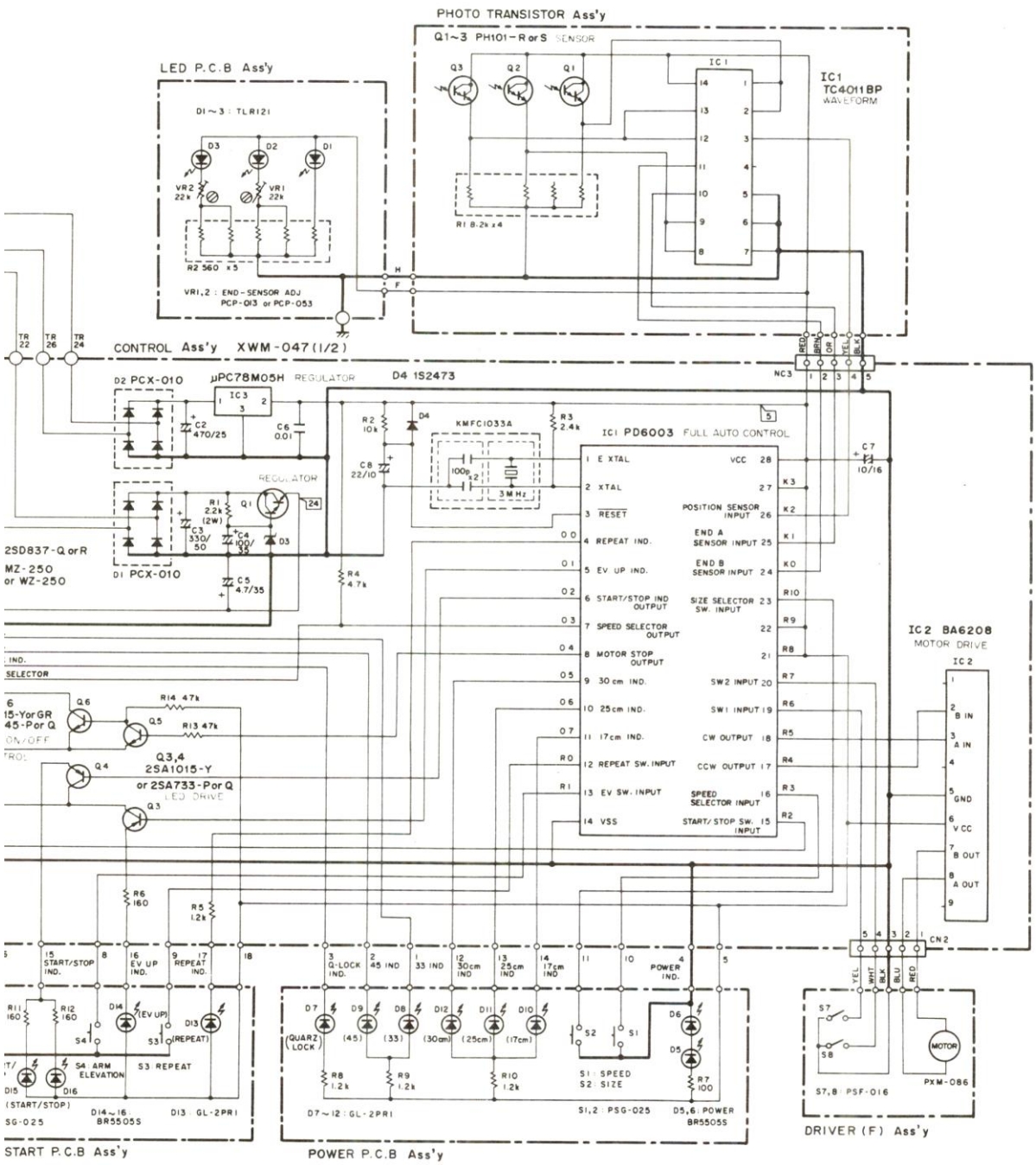


NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.



9. 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 ..... RD¼PS* 5 6 1	*J*
57kΩ	*47 × 10³*	*473 ..... RD¼PS* 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 .... RN¼SR* 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 symbols ★★ and ★ .***

  ★★ : GENERALLY MOVES FASTER THAN ★

  This classification shall be adjusted by each distributor because it depends on model No., temperature, humidity, etc.

CONTROL ASSEMBLY (XWM-047)

CAPACITORS

Mark	Part No.	Symbol & Description
	PCL-040 (PCL-032)	C1
	CEA 471M 50L	C2
	CEA 471M 25L	C3
	CEA 101M 35L	C4
	CEA 100P 16	C7
	CEA 220P 10	C8
	CKDYF 103Z 50	C5,C6

RESISTORS

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

Mark	Part No.	Symbol & Description
	RS1PF222J	R1
	RD¼PM□□□J	R2 –R6,R13,R14

SEMICONDUCTORS

Mark	Part No.	Symbol & Description
★★	PD6003	IC1
★★	BA6208	IC2
★★	μPC78M05H	IC3
★★	2SD837	Q1
★★	2SC1815 (2SC945)	Q5,Q6
★★	2SA1015 (2SA733)	Q3,Q4
★★	KMFC1033A	SL2
★	PCX-010	D1,D2
★	MZ-250 (WZ-250)	D3
★	1S2473	D4

SENSING ASSEMBLY

Mark	Part No.	Symbol & Description
	PDE-089	Connector assembly

SENSING BOARD ASSEMBLY

Mark	Part No.	Symbol & Description
	PNC-183	Plate

PHOTO BOARD ASSEMBLY

SEMICONDUCTORS AND RESISTOR

Mark	Part No.	Symbol & Description
★★	TC4011BP	IC1
★★	PH101-R	Q1-Q3
	RGSD4X822J	R1

LED BOARD ASSEMBLY

SEMICONDUCTORS AND RESISTORS

Mark	Part No.	Symbol & Description
★	TLR121	D1–D3
★	PCP-013	VR1,VR2 Semi-fixed
	RGSD5X561J	R2

START BOARD ASSEMBLY

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

Mark	Part No.	Symbol & Description
★★	PSG-025	S3-S5
★	BR5505S	D14-D16
	RD¼PM□□□J	R11,R12
	PNX-194	LED holder

POWER BOARD ASSEMBLY

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

Mark	Part No.	Symbol & Description
★★	PSG-025	S1,S2
★	BR5505S	D5,D6
	RD¼PM□□□J	R7-R10
	PNX-194	LED holder

MOTOR ASSEMBLY (PXM-084)

CAPACITORS

Mark	Part No.	Symbol & Description
	CKDYF 103Z 50	C1,C4,C12,C13,C25–C27
	CQMA 822K 50	C5
	CAMA 333K 50	C8,C24
	CQMA 104K 50	C6,C7
	CCDCH 330J 50	C2
	CCDCH 560J 50	C3
	CKDYF 472Z 50	C9
	CKDYF 104Z 50	C28
	CEA R47P 50	C10,C14,C15
	CEA 100P 16	C17
	CEA 100P 35	C18-C22
	CEA 330P 10	C23
	CEA 101P 10	C11
	CSYA R22M 10	C16

RESISTORS

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

Mark	Part No.	Symbol & Description
	RN1PF2R2J	R9
	RN¼PR□□□□G	R3,R4
	RD¼PM□□□J	R1,R2,R5–R8,R10–R16
★	PCP-053	VR1 Semi-fixed 22k (B)
★	PCP-052	VR2 Semi-fixed 47k (B)

SEMICONDUCTORS

Mark	Part No.	Symbol & Description
★★	2SC945 (2SC372)	Q1
★★	PA2007	IC2
★★	PA2008	IC3
★★	PD1003	IC1
★★	TD62504P	IC4
★	1S2473	D1

OTHERS

Mark	Part No.	Symbol & Description
★	PSS-003	Crystal
★	PCX-039	Hole element
	PDE-085	Connector assembly
	PCZ30P050FMC	Screw

10. EXPLODED VIEWS

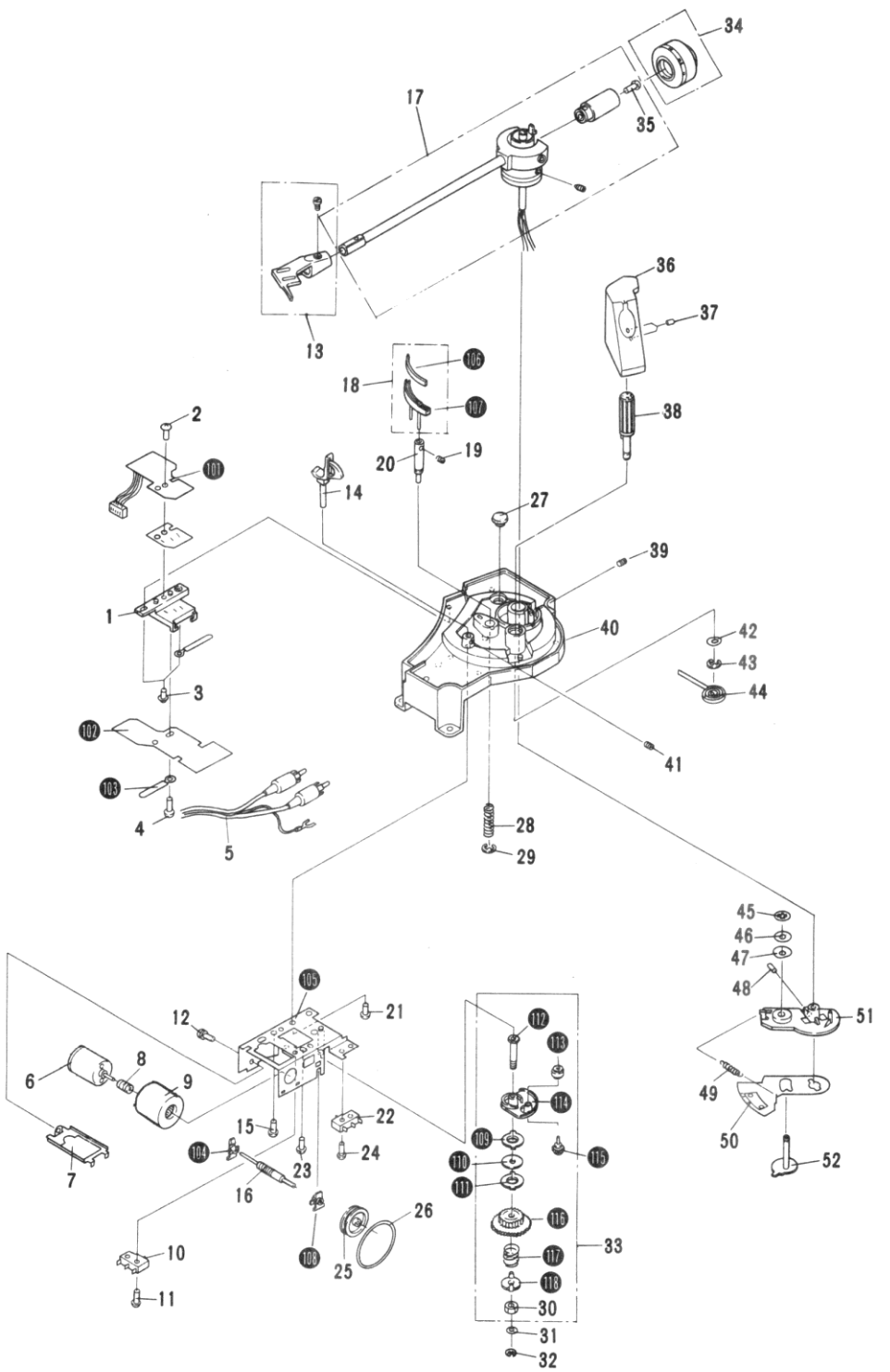
10.1 TONEARM

NOTES:

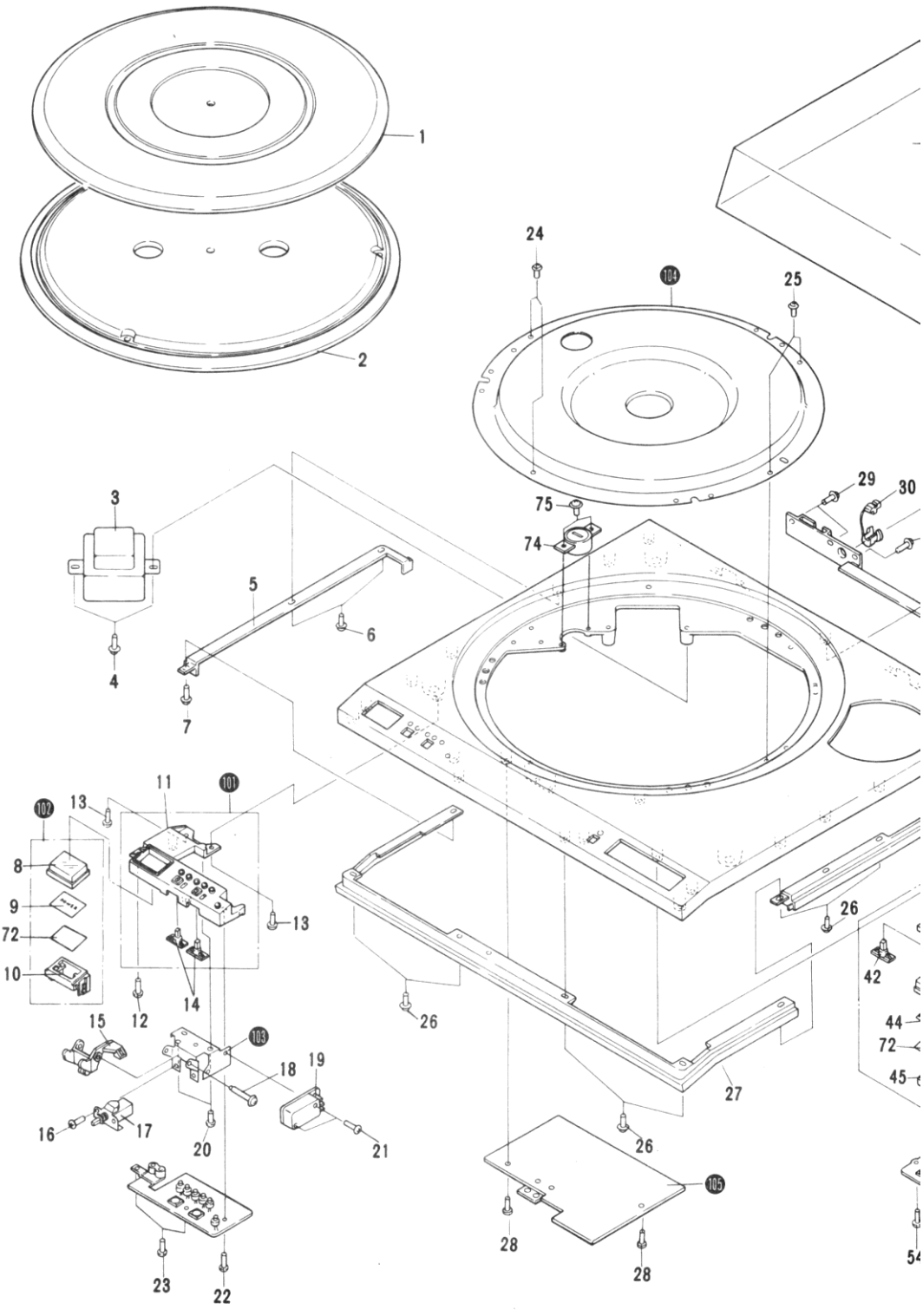
- *Parts without part number cannot be supplied.*
- *The ⚠ mark found on some component parts indicates the importance of the safety factor of the part. Therefore, when replacing, be sure to use parts of identical designation.*
- *For your Parts Stock Control, the fast moving items are indicated with the symbols ★★ and ★ .*
  ★★ : GENERALLY MOVES FASTER THAN ★
  This classification shall be adjusted by each distributor because it depends on model No., temperature, humidity, etc.

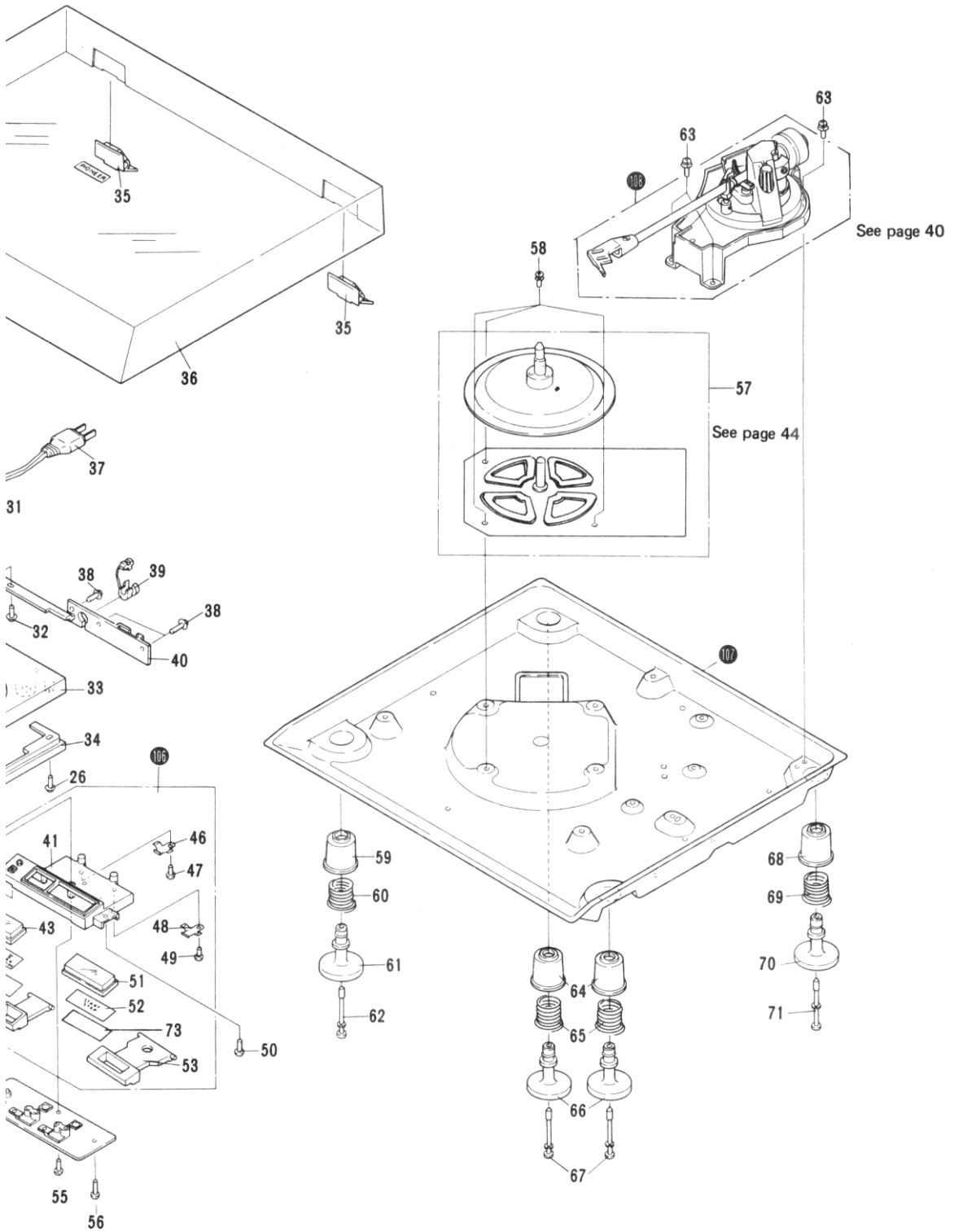
Parts List

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1.	PNX-189	Spacer		41.	ZMK30M030FNI	Screw
	2.	PPZ30P080FMC	Screw		42.	PBE-012	Spring washer
	3.	PPZ30P080FMC	Screw		43.	YE50S	Washer
	4.	PPZ30P080FMC	Screw		44.	PBH-268	Spring
	5.	PDE-044	Output cord		45.	YS40S	Washer
★★	6.	PXM-086	Motor		46.	WC40FMC	Washer
	7.	PNC-044	Frame		47.	PBE-019	Spring washer
★★	8.	PLM-001	Motor pulley		48.	ZMD40H060FZK	Screw
	9.	PEB-180	Tube		49.	PBH-224	Spring
★★	10.	PSF-016	Microswitch		50.	PXT-430	Shutter unit
	11.	PMA20P100FMC	Screw		51.	PNX-212	PU plate
	12.	PMA26P050FMC	Screw		52.	PNW-592	Cam
	13.	PXA-867	Headshell assembly				
★	14.	PXB-198	Arm reset assembly				
	15.	PPZ30P080FMC	Screw				
	16.	PNW-485	Worm unit		101.		P.C. board
★	17.	PPD-611	Tonearm assembly		102.		P.C. board
	18.	PXB-210	EV sheet assembly		103.		Cord clamper
	19.	ZMK26M020FNI	Screw		104.		Collar
	20.	PLB-084	EV shaft		105.		Chassis unit (F)
	21.	PPZ30P080FMC	Screw		106.		EV sheet
★★	22.	PSF-016	Microswitch		107.		EV sheet unit
	23.	PPZ30P080FMC	Screw		108.		Collar
	24.	PMA20P100FMC	Screw		109.		Washer (A)
★★	25.	PNW-393	Pulley		110.		Washer
★★	26.	PEB-097	Belt		111.		Washer (B)
	27.	PEB-100	Rubber bush		112.		Screw
	28.	PBH-166	Spring		113.		Cam unit
	29.	YE50S	E-type washer		114.		Cam
	30.	NB50FMC	Nut		115.		Gear unit
	31.	WA31D054D050	Washer		116.		Gear (F)
	32.	YE25S	E-type washer		117.		Spring
	33.	PYY-077	Gear (F) assembly		118.		Guide
★	34.	PXA-869	Weight assembly				
	35.	PMZ40P250FMC	Screw				
	36.	PNX-177	Holder				
	37.	ZMD30H030FZK	Screw				
	38.	PAD-073	AS knob unit				
	39.	ZMD40H060FZK	Screw				
	40.	PNX-213	Tonearm base				



10.2 EXTERIOR

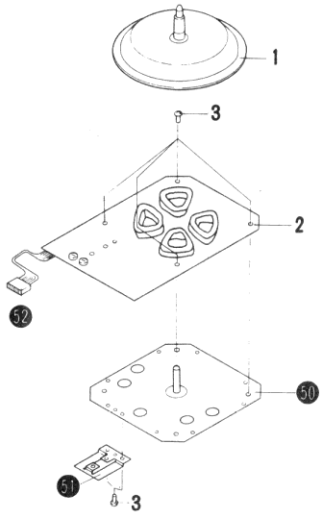




Parts List

Mark	No.	Part No.	Description
	1.	PEA-048	Rubber mat assembly
	2.	PNR-143	Turntable platter
⚠ ★	3.	PTT-117	Power transformer
	4.	PMB40P080FMC	Screw
	5.	PNX-175	Frame (C)
	6.	PAZ30P100FMC	Screw
	7.	PAZ30P100FMC	Screw
	8.	PAC-065	Cap (B)
	9.	PAG-005	Plate (C)
	10.	PNX-188	Switch holder
	11.	PNX-187	Power case
	12.	PAZ30P080FMC	Screw
	13.	PAZ30P080FMC	Screw
	14.	PAD-074	Push button unit
	15.	PNX-182	Switch lever
	16.	IDZ30P060FMC	Screw
★★	17.	PSG-017	Push switch
	18.	PBA-117	Screw
⚠ ★★	19.	PSF-007	Microswitch
	20.	PPZ30P080FMC	Screw
	21.	PMA30P150FMC	Screw
	22.	PAZ30P100FMC	Screw
	23.	PPZ30P080FMC	Screw
	24.	IAZ30P060FZK	Screw
	25.	IAZ30P060FZK	Screw
	26.	PAZ30P100FMC	Screw
	27.	PNX-174	Frame (A)
	28.	PAZ30P080FMC	Screw
	29.	IAZ30P080FZK	Screw
	30.	PEC-058	Strain relief
	31.	IAZ30P080FZK	Screw
	32.	PAZ30P100FMC	Screw
	33.	PNR-149	Panel
	34.	PNX-176	Frame (D)
★	35.	PXB-201	Hinge assembly
★★	36.	PNV-037	Dust cover
⚠	37.	PDG-004	AC power cord
	38.	IAZ30P080FZK	Screw
	39.	PEC-056	Strain relief
	40.	PNX-173	Frame (B)
	41.	PNX-184	Start case
	42.	PAD-074	Push button unit
	43.	PAC-065	Cap (B)
	44.	PAG-004	Plate (B)
	45.	PNX-186	EV lever
	46.	PBK-047	Spring
	47.	PPZ30P080FMC	Screw
	48.	PBK-047	Spring
	49.	PPZ30P080FMC	Screw
	50.	PAZ30P080FMC	Screw
	51.	PAC-064	Cap (A)
	52.	PAG-003	Plate (A)
	53.	PNX-185	Start lever
	54.	PAZ30P100FMC	Screw
	55.	IAZ30P160FMC	Screw
	56.	PPZ30P080FMC	Screw
★★	57.	PXM-084	Motor assembly
	58.	PMA40P060FMC	Screw
	59.	PEB-179	Damper rubber
	60.	PBH-270	Spring
	61.	PNX-190	Foot holder
	62.	PBA-116	Screw
	63.	PMB30P080FMC	Screw
	64.	PEB-179	Damper rubber
	65.	PBH-270	Spring
	66.	PNX-190	Foot holder
	67.	PBA-116	Screw
	68.	PEB-179	Damper rubber
	69.	PBH-270	Spring
	70.	PNX-190	Foot holder
	71.	PBA-116	Screw
	72.	PAG-008	Sheet (A)
	73.	PAG-007	Sheet (B)
⚠ ★★	74.	PSB-007	Line voltage selector
	75.	IAZ30P080FMC	Screw
	101.		Power case assembly
	102.		Power button unit
	103.		Switch base
	104.		Cover
	105.		P.C. board assembly
	106.		Start case assembly
	107.		Under base
	108.		Tone arm assembly

10.3 MOTOR ASSEMBLY

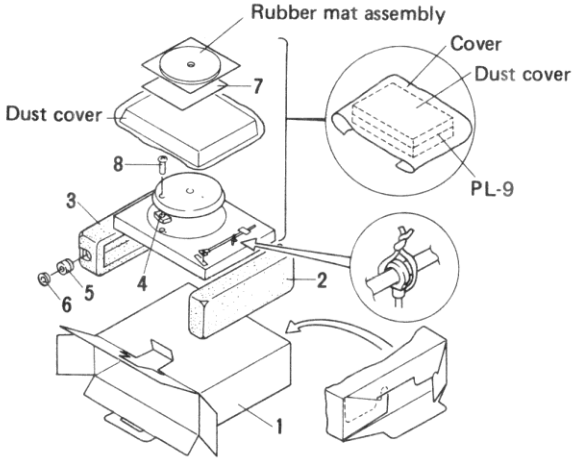


Parts List

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1.	PXT-426	Rotor unit		50.		Base unit
	2.	PWM-048	Circuit board				
	3.	PCZ30P050FMC	Screw		51.		Heat sink
					52.		Connector assembly

11. PACKING

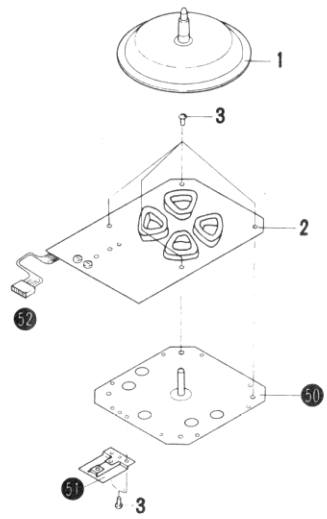
11.1 S MODEL



Parts List

Mark	No.	Part No.	Description
	1.	PHG-432	Packing case
	2.	PHA-123	Protector (L)
	3.	PHA-124	Protector (R)
	4.	PNX-064	Turntable protector
	5.	PXA-869	Weight assembly
	6.	N93-603	45 adaptor
	7.	PRB-185	Operating instructions
	8.	PBA-079	Screw

10.3 MOTOR ASSEMBLY

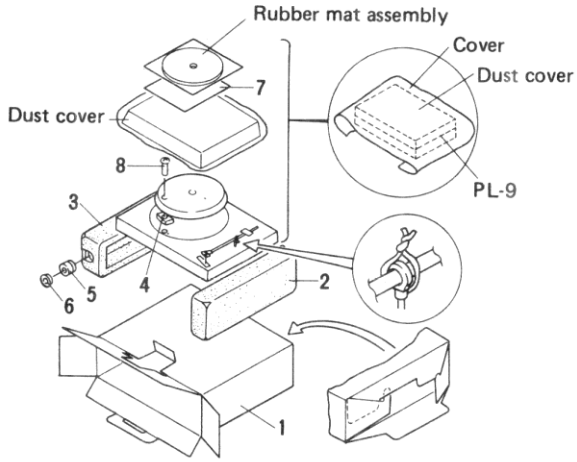


Parts List

Mark	No.	Part No.	Description	Mark	No.	Part No.	Description
	1.	PXT-426	Rotor unit		50.		Base unit
	2.	PWM-048	Circuit board				
	3.	PCZ30P050FMC	Screw		51.		Heat sink
					52.		Connector assembly

11. PACKING

11.1 S MODEL



Parts List

Mark	No.	Part No.	Description
	1.	PHG-432	Packing case
	2.	PHA-123	Protector (L)
	3.	PHA-124	Protector (R)
	4.	PNX-064	Turntable protector
	5.	PXA-869	Weight assembly
	6.	N93-603	45 adaptor
	7.	PRB-185	Operating instructions
	8.	PBA-079	Screw

12. ADJUSTMENTS

12.1 STYLUS LOWERING POSITION

1. Remove the rubber plug (Fig. 12-1).
2. If the tonearm lowers too far to the outside of the record, turn the adjusting screw clockwise.
3. If the tonearm lowers too far to the inside of the record, turn the adjusting screw counter-clockwise.

Specifications for test record use.

30cm lowering position. . . adjust to lower between count 305 and 316.

17cm lowering position. . . adjust to lower between count 174 and 185.

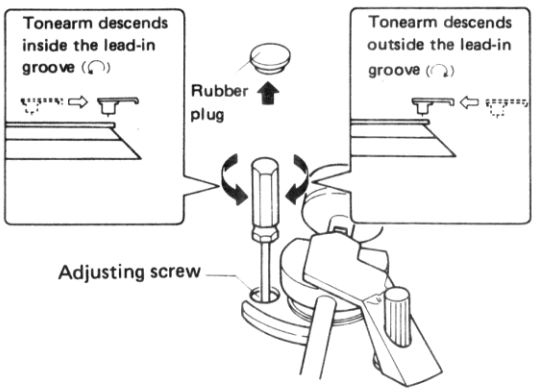


Fig. 12-1 Stylus lowering position

12.2 END SENSOR SENSITIVITY ADJUSTMENT

1. Remove the platter and top cover unit.
2. Make certain the shutter will pass between the sensor board assembly positioned slightly above center (Fig. 12-2).

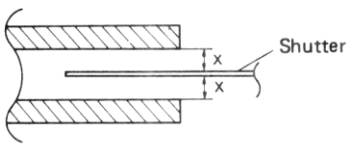
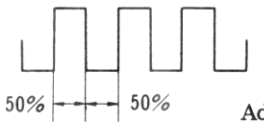


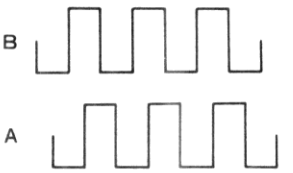
Fig. 12-2 Shutter position

3. Connect an oscilloscope to PD6003 pin 25 (end sensor A) (CN3 3 pin), and PD6003 pin 24 (end sensor B) (CN3 2 pin).
4. Turn the power ON and set the arm-elevation to UP.
   Position the tonearm over the lead out groove zone of the record as if playback were in progress.
5. While making certain outside light is not directly striking the sensor section, adjust VR1 and VR2 so that the output waveform (pulse) for sensors A and B are both at approximately 50% duty cycle (Fig. 12-3, 12-4).



Adjust pulse width of end sensor A and B to 50% duty cycle.

Fig. 12-3 Output waveform 1



The phase of end sensor B leads end sensor A 90°.

Fig. 12-4 Output waveform 2

6. Next, move the tonearm toward the inside of the record at about the speed the tonearm would normally trace the lead out groove.
7. Make certain the phase of end sensor B is 90° advanced over end sensor A (Fig. 12-5).

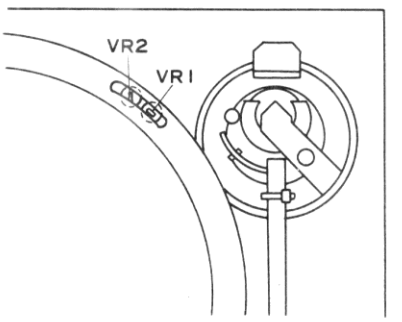


Fig. 12-5 VR1, VR2 position

12.3 MOTOR OPERATING POINT ADJUSTMENT

1. Set the speed to 33 1/3 rpm and depress the START/STOP button to put the unit into the operational mode.
2. Connect a buffer amp to pin 1 of IC PA2007, and connect the output to a oscilloscope (Fig. 12-6).
3. When a waveform like that shown in Fig. 12-7 is obtained, vary oscilloscope gain until a sawtooth wave with 5 div peak-to-peak is obtained. Then, referring to Fig. 12-7, adjust VR1 until a to b equals 3 to 2. (Make sure noise does not affect adjustment.)
4. When the 33 1/3 rpm adjustment is completed, adjust VR2 using the same procedure (item 2 and 3 above) for 45 rpm. Always adjust 33 1/3 first, and always adjust 33 1/3 if 45 rpm is to be adjusted even though it might be accurate.
5. Connect pin 7 of PA2007 to a oscilloscope and make certain the frequency for 33 1/3 rpm is 111.11Hz, and that for 45 rpm is 150Hz.

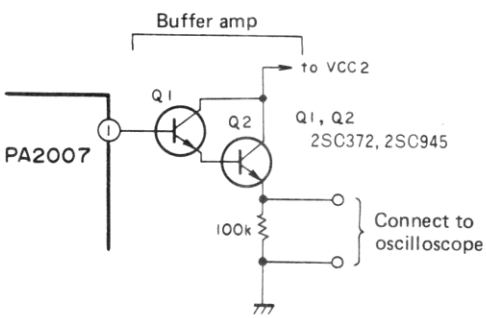


Fig. 12-6 Connect buffer amp

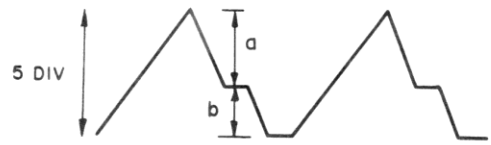


Fig. 12-7 Waveform

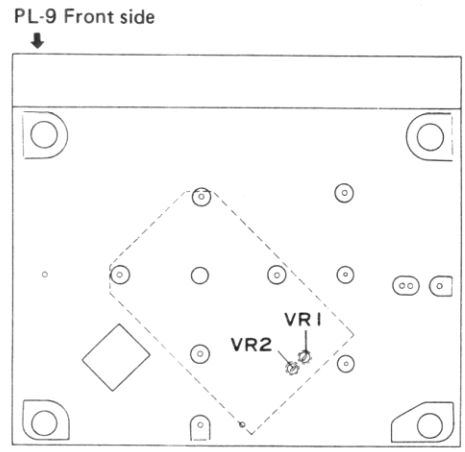


Fig. 12-8 VR1, VR2 position