.INEAR TRACE PROGRAMMABLE PLAY / QUARTZ LOCK DIRECT DRIVE TURNTABLE SYSTEM

MODEL No. LP-3000 H,E,K,G,U

AIWA®

(SERVICE MANUAL)

Cord No.: 14-300-000-51

DATE OF ISSUE 5/1979

SPECIFICATIONS

Type:	Linear trace programmable direct drive quartz lock turntable
Semiconductors:	31 IC (1LSI), 65 transistors, 71 diodes, 25 LED's, 5 numerical
Power source:	H, E, K, G model AC 120V/220V/240V Switchable 50/60 Hz U model AC 120V, 60Hz
Power consumption:	20W
Dimensions:	480(W) x 150(H) x 439(D) mm [18-7/8"(W) x 5-7/8"(H) x 17-1/4"(D) inches]
Weight:	15.2 kg [33.5 lbs]

<Platter section>

Drive system:	Direct drive
Drive motor:	Pulse synthesizer Quartz PLL servo DD motor
Control system:	Quartz PLL servo
Start-up torque:	More than 750 g·cm (More than 7.35 N·m)
Speeds:	33-1/3, 45 rpm
Fine speed adjustment:	Quartz pitch control (digital display), adjustable in 0.1% steps up to ±6%
Braking mechanism:	All-electronic brake
Platter:	Zinc diecast, 310 mm (12-1/4") diameter, 3.2 kg (7 lbs) weight
Moment of inertia:	500 kg·cm² (indlucing rubber mat)
Wow and flutter:	Less than 0.025% (WRMS) Less than 0.038% (DIN)
Signal to Noise ratio:	More than 73 dB (DIN B) More than 60 dB (IEC B)

<Tonearm section>

Type:	Linear tracking static balanced tonearm
Effective length:	182 mm
Rotating shaft sensitivity:	30 mg initial dynamic horizontal, vertical sensitivity
Applicable tracking force:	0 to 3g (direct readout of tracking force)
Suitable cartrige weight:	4 to 15 g (with accessory headshell, sub weight) 18 to 29 g (with other headshell, sub weight) 13 to 24 g (with other headshell, no sub weight) *Spacers weight about 1.5 g per 1 mm thickness
Headshell weight:	16.5 g, aluminum diecast
Output cords:	Low-capacitance, gold-palted cords (1.5 m) with pin plugs

<Cartridge section>

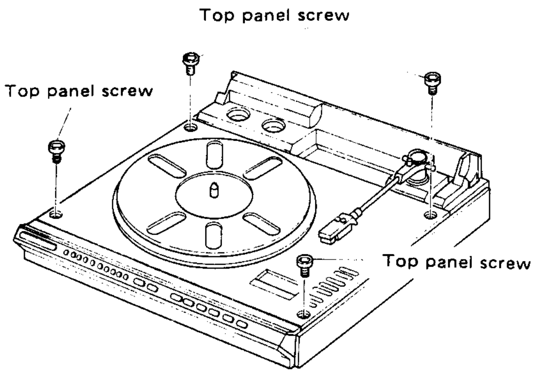
Type:	Moving magnet (MM)
Frequency response:	20 to 20,000 Hz
Output voltage:	3.3 mV
Channel separation:	More than 20 dB (at 1kHz)
Static compliance:	30×10^{-6} cm/dyne
Vertical tracking angle:	20°
Tracking force:	$1 {}^{+0.5}_{-0.25}$ g
Stylus tip:	0.2 mil x 0.7 mil elliptical diamond
Load impedance:	47 kΩ

- The specifications and external appearance of this set are subject to change without prior notice.

DISASSEMBLY INSTRUCTIONS

1. To Remove Top Panel

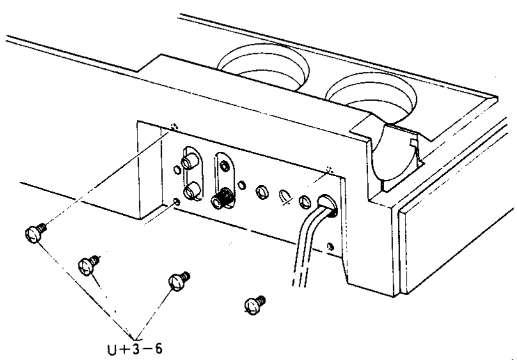
1) Remvoe 4 screws. (Refer to Fig. 1)



<Fig. 1>

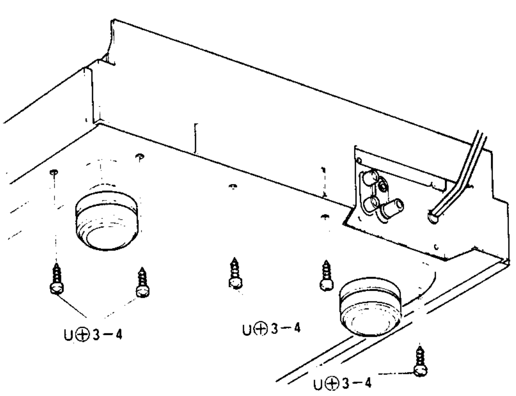
2. To Remove Rear Panel

1) Remove 4 screws. (Refer to Fig. 2)



<Fig. 2>

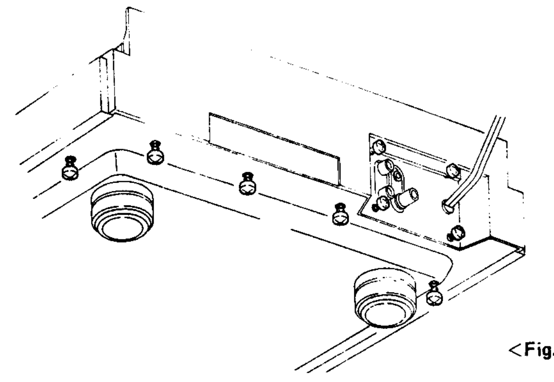
2) Remove 5 screws. (Refer to Fig. 3)



<Fig. 3>

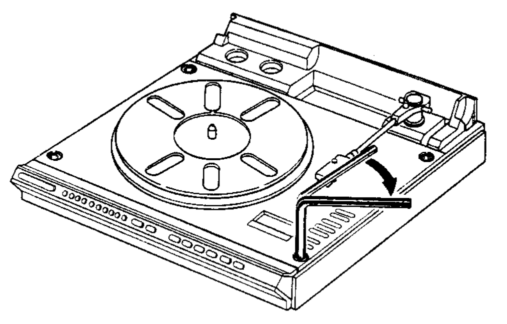
- **Mounting the Rear Panel**

1) Anchor the rear panel and jack panel assembly loosely. (Refer to Fig. 4)



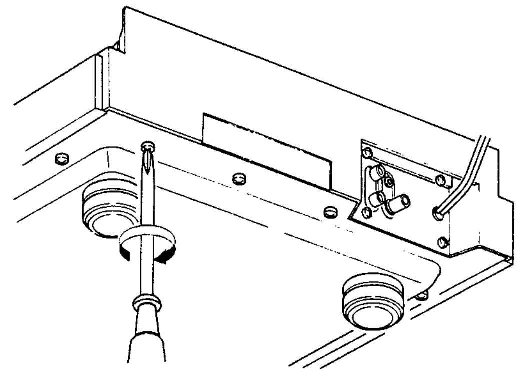
<Fig. 4>

2) Tighten the top panel mounting screws. (Refer to Fig. 5)



<Fig. 5>

3) Tighten the rear panel and jack panel mounting screws. (Refer to Fig. 6)



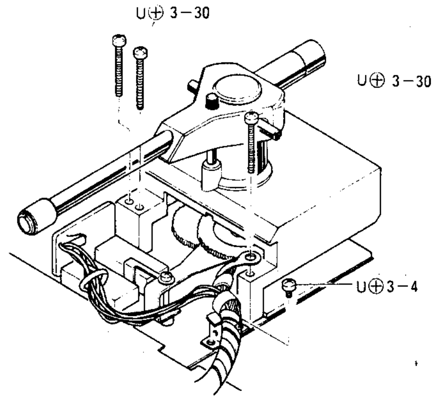
<Fig. 6>

Note: When mounting and removing the rear panel, take care not to bring the rear panel into contact with the angle sensor section.
If this section is touched, it will be thrown out of alignment and this will require a re-adjustment of the angle sensor.

REPLACING THE PARTS AND ADJUSTMENTS

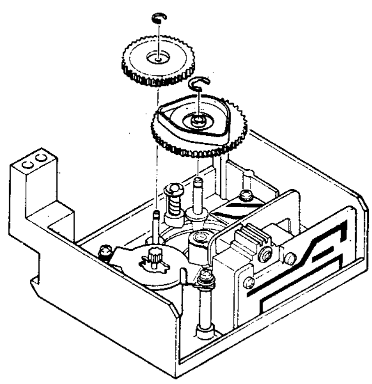
1. Replacing the tonearm

1) Remove 4 screws. (Refer to Fig. 7)



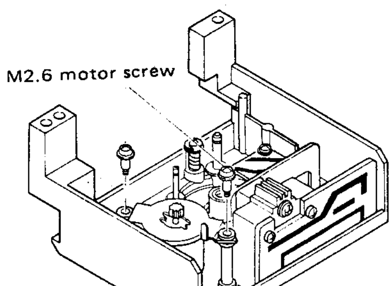
<Fig. 7>

2) Remove 2 E rings and then 2 gears. (Refer to Fig. 8)



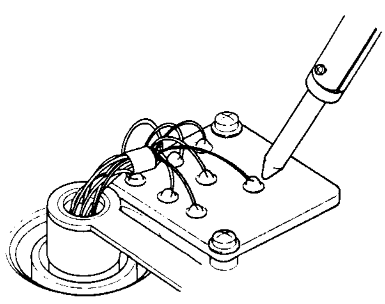
<Fig. 8>

3) Remove 2 motor (UP) screws. (Refer to Fig. 9)



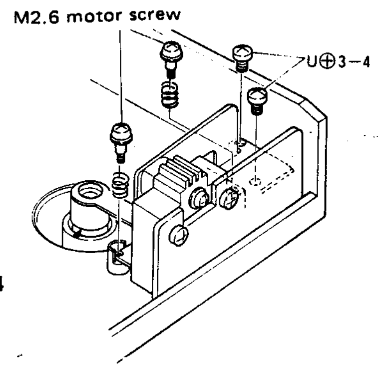
<Fig. 9>

4) Disconnect the arm leads on the relay circuit board with a soldering iron. (Refer to Fig. 10)



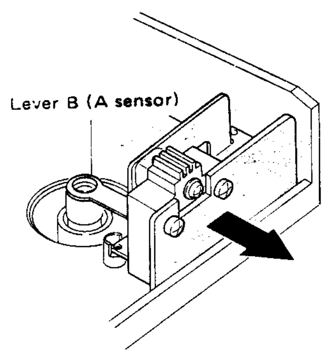
<Fig. 10>

5) Remove 4 angle sensor section screws. (Refer to Fig. 11)



<Fig. 11>

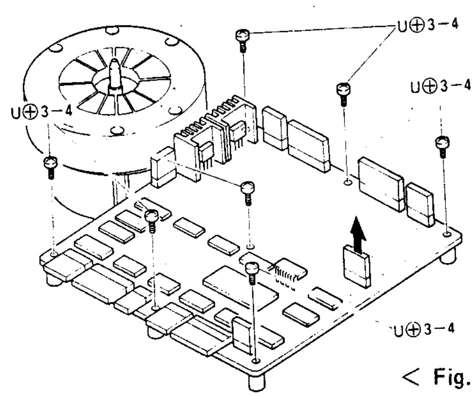
Note: Since lever B (sensor A) may be bent when the angle sensor is removed, remove this section by pulling it out toward the rear. (Refer to Fig. 12)



<Fig. 12>

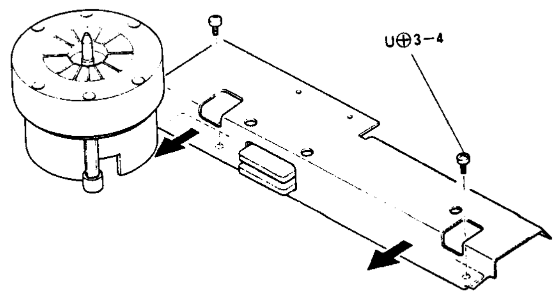
2. Replacing the mask sensor

1) Remove 7 screws and connector of the L1. (Refer to Fig. 13).



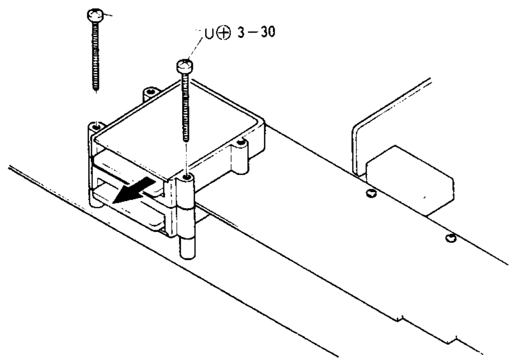
< Fig. 13 >

2) Remove 2 screws of the cable guide. (Refer to Fig. 14).



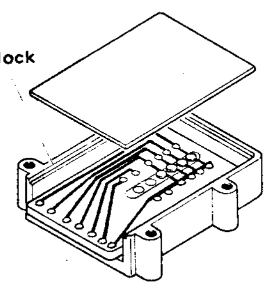
< Fig. 14 >

3) Remove 2 screws and then the mask sensor. Take special care not to bend the mask plate. (Refer to Fig. 15)



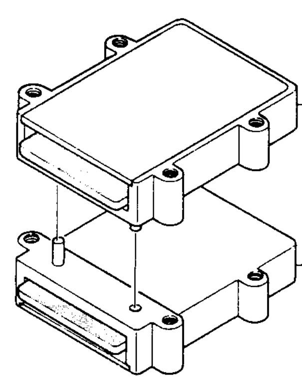
<Fig. 15>

4) Remove the cover of the mask sensor.
(The cover is bonded into position and so care is required in its removal.) (Refer to Fig. 16)



<Fig. 16>

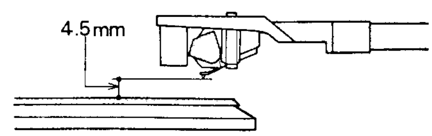
Note: When re-mounting the mask sensor, check first that the LED is on the bottom, and the photo-transistor is on the top. (Refer to Fig. 17)



<Fig. 17>

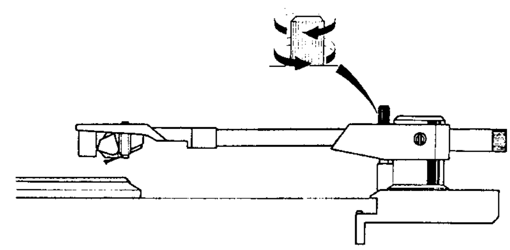
3. Adjusting the height position of the stylus tip

Check that the stylus tip is 4.5mm above the rubber mat when the tonearm is set to the DOWN position. (Refer to Fig. 18)



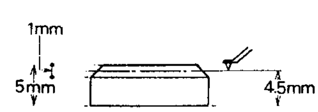
<Fig. 18>

1) Adjust the stylus tip height if it is incorrect.
(1) Set the POWER switch to ON and depress the PLAY button.
(2) When the tonearm has swung across to the proper position, set the POWER switch to OFF. Adjust the stylus knob to bring the stylus tip height to the prescribed 4.5mm.
(Refer to Fig. 19)



<Fig. 19>

Note: To check the height, use the accessory EP adapter as illustrated in the figure.
The height can easily be measured. (Refer to Fig. 20)



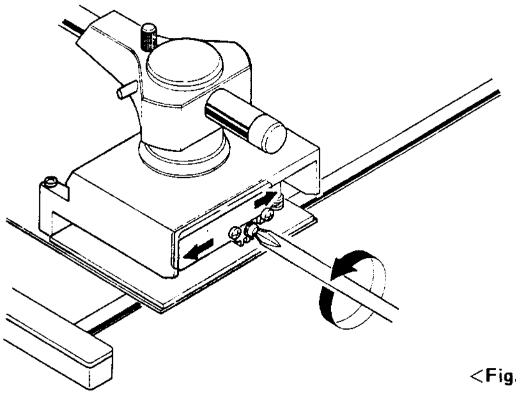
<Fig. 20>

4. Adjusting the angle sensor

If the angle sensor is not working properly, it means that it has been disengaged from the sensor section and so adjust as follows.

1) **Adjustment (1)**

(1) Set the tonearm to the UP position, loosen the screw and move the circuit board laterally (Refer to Fig. 21)

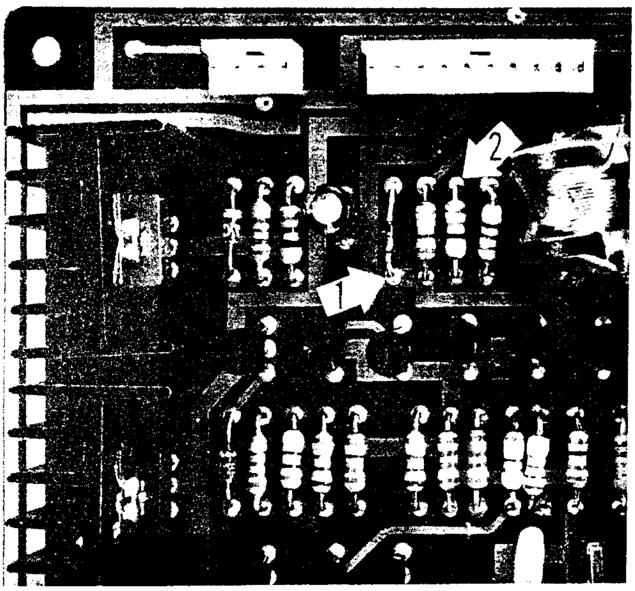


<Fig. 21>

(2) If the prescribed voltage (0.6 ~ 0.7V) is not obtained at the test points (1) and (2) indicated by the arrows, slide the angle sensor again laterally and adjust so that this voltage is obtained. (Refer to Fig. 24)

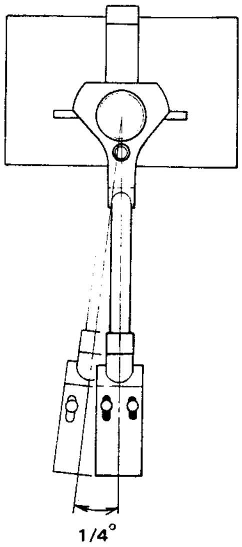
2) **Adjustment (2)**

(1) Remove the platter.
(2) Set the program switches to OFF.
(3) Depress the 30 cm size selector button.
(4) Depress the play button.
(5) Check that the tonearm is in the DOWN position.
(6) Check that the test points yield the same voltage (0.6 ~ 0.7V) as that measured under adjustment (1) ~ (2). (Refer to Fig. 22)



<Fig. 22>

(7) Check that the LM (linear motor) moves slightly when the tip of the tonearm is pushed to the right with a touch of your finger (about 1/4°).
If the LM does not rotate, it means that the voltage (0.6 ~ 0.7V) at the test points between (1) and (2) is not acceptable and so adjust as follows. (Refer to Figs. 22, 23)



<Fig. 23>

① When the motor does not rotate
Shift the angle sensor, make the voltage higher than the prescribed voltage (0.6 ~ 0.7V) and repeat adjustments (1) through (7).

② When the motor rotates too quickly
Slide the angle sensor, make the voltage lower than the prescribed voltage (0.6 ~ 0.7V) and repeat adjustments (1) through (7).

(8) Re-tighten the angle sensor section screw, taking care that the sensor A section does not shift.

- All adjustments above and beyond those outlined above require special tools and equipment. Do not, therefore, adjust indiscriminately.

MOUNTING THE LP3000X CARTRIDGE

The LP3000X is subject to optional cartridge specifications. Mount it at the right height in order to make it work properly and if any of the malfunctions described below result, remedy the trouble by referring to the chart.

1. Improper stylus height and spacer adjustment.

- Fast skipping and stopping in mid-track when set to the UP mode.
  - → Stylus is not high enough. → Rotate stylus height adjust knob and set to prescribed height (4.5 mm). (Refer to Fig. 24)
  - ↓ Interval between headshell and cartridge stylus is less than rating (19 mm, 21 mm). (Refer to Fig. 25) → Adjust to prescribed height by combining spacers A, B and C.

- Fast skipping in UP mode but stylus does not stop between tracks or first one or two tracks are skipped before stopping.
  - → Stylus is too high. → Rotate stylus height adjust knob and set to prescribed height (4.5 mm). (Refer to Fig. 24)
  - ↓ Interval between headshell and cartridge stylus is more than rating (19 mm, 21 mm). (Refer to Fig. 25) → Adjust to prescribed height by combining spacers A, B and C.

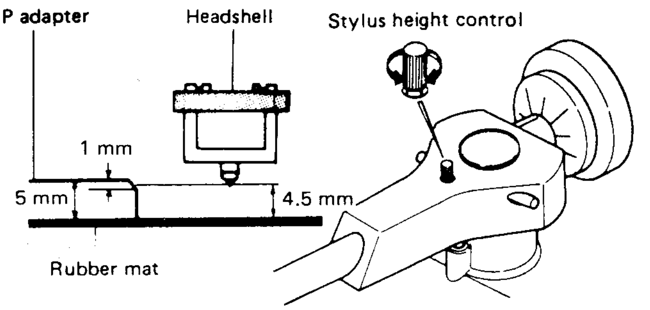
- Even when programmed, set to DOWN mode and when play is completed, cartridge is set to UP but does not move to next track.
  - ↓ While programmed and set to DOWN mode, cartridge moves UP during play and then moves to next track. (During play does not mean the fade-out sound grooves at the end of the track.)
  - Both → Interval between headshell and cartridge stylus is more than rating (19 mm, 21 mm). → Adjust to prescribed height by combining spacers A, B and C.

2. Improper stylus positioning

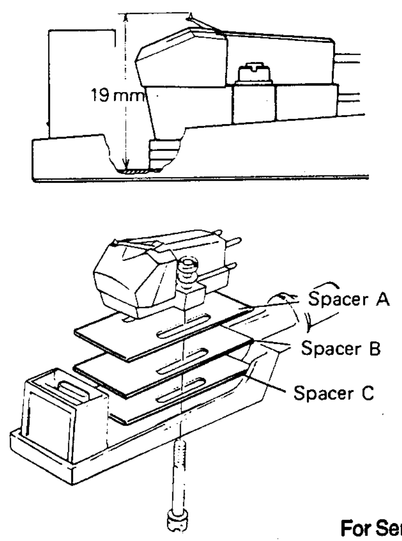
- Stylus enters at track beginning with programmed play. → Check stylus position. → If the stylus position is not correct, re-adjust. If the stylus position is correct, tilt the stylus in direction A and then secure. (Refer to Fig. 26) → Try programming record play and check.

- End of track is skipped during programmed play and cartridge moves on to the next track. → Check stylus height. → If the stylus position is correct, re-adjust. If the stylus position is correct, tilt the stylus in direction B and secure. (Refer to Fig. 26) → Try programming record play and check.

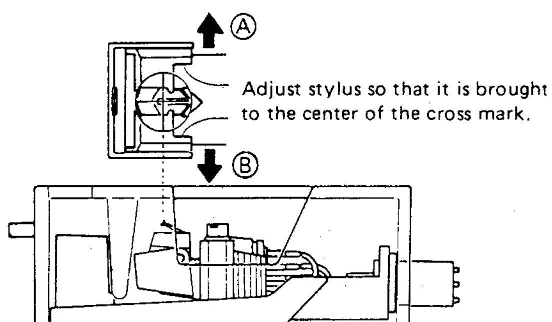
- Stylus moves into DOWN mode before previous track is finished with program play. → Check stylus position. → If the stylus position is correct, tilt the stylus in direction B and secure. (Refer to Fig. 26) → Try programming record play and check.



<Fig. 24>



<Fig. 25>



<Fig. 26>

DESCRIPTION OF CIRCUITRY

1. Tonearm UP/DOWN electric governor circuit

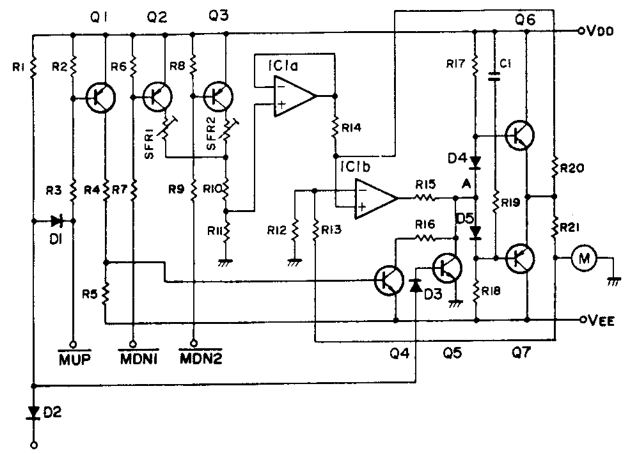


Fig. 1

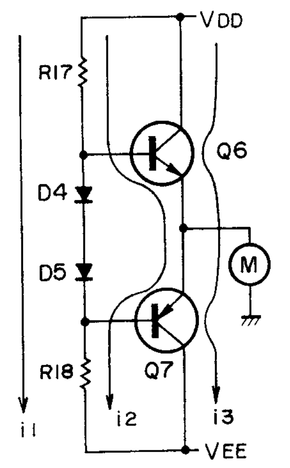


Fig. 2 Circuit without R19

1-1 Motor drive circuit and switching transistors from interface

When the tonearm UP and DOWN commands arrive from the interface to $\overline{MUP}$, $\overline{MDN1}$ and $\overline{MDN2}$, operation is as follows.

a) Tonearm UP command

When the tonearm UP command is issued, $\overline{MUP}$ goes to LOW (GND), Q1 goes to ON and Q4 goes to ON. The potential (point A) between D4 and D5 has hitherto been virtually zero but a negative voltage is formed when Q4 goes to ON, and Q6 goes to OFF and Q7 to ON, current flows to the motor from GND through the Q7 emitter and collector, and while $\overline{MUP}$ is at LOW, the motor reverses. (The motor terminal voltage is about 3.5V.)

b) Tonearm DOWN command

When the tonearm DOWN command is issued, both $\overline{MDN1}$ (33rpm) and $\overline{MDN2}$ (45 rpm) go to LOW, and Q2 and Q3 go to ON.

If the speed is set to 33 rpm, $\overline{MDN1}$ will go to LOW and Q2 to ON. The voltage split between SFR1, R10 and R11, or in other words the $\frac{R11}{R11 + R10 + SFR1}$ VDD (GND reference) voltage, is applied to the + side of IC 1a as the reference voltage. IC 1a is an emitter follower and so this voltage is fed out as the IC 1a output signal. This voltage is used to start the initial rotation of the motor. It passes through IC 1b, point A takes on a positive potential, Q6 goes to ON, Q7 to OFF, current flows to the motor GND via the Q6 collector and emitter, and the motor rotates in the forward direction.

The motor is kept at a constant speed by the IC 1b control (electric governor).

Furthermore, R19 has an idling resistance. Without this resistance, operation is as described below, and in extreme cases Q6 and Q7 may be damaged. Fig. 2 is part of the circuitry shown in Fig. 1 and it does not include R19. Normally, bias current i1 is flowing and the zero potential at point A is maintained but in addition current i2 flows at a very low level. Moreover, i3 = hfe x i2 flows and this causes i3 to rise and for i'3 = hfe x i'2 to be repeated. R19 is inserted in order to prevent this.

Upon completion of UP or DOWN, the IC 1a + side reference voltage becomes zero and this circuit functions so that the motor does not rotate. If the motor load is high, a brake current flows and this accelerates motor deterioration. To prevent this, Q5 goes to OFF only during the UP and DOWN operations. At all other times Q5 goes to ON and the motor is kept from deterioration.

C1 is provided to allow the electric governor (positive feedback loop system) to operate stably.

1-2 Electric governor

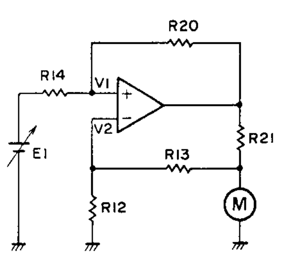


Fig. 3 Electric governor equivalent circuit

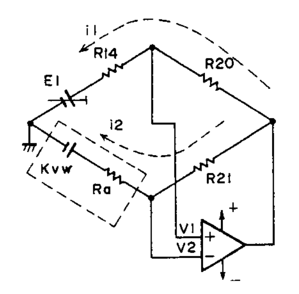


Fig. 4 Simplified equivalent circuit of electric governor

Fig. 3 eliminates the motor drive transistors shown in Fig. 1 and replaces the IC1 reference voltage by E1. Adjustments are performed with SFR1 or SFR2.

In Fig. 3 R12 is much greater than R13, and Fig. 4 is an equivalent circuit where:

Ra is the amateur resistance (Ω) (constant)

KV is the back electromotive force constant (V sec/rad) (constant)

ω is the angular velocity (rad/sec)

If i1 and i2 are set as in the figure for Fig. 4, they are equivalent to the following.

$$i_1 = \frac{V_1 - E_1}{R_{14}} \qquad i_2 = \frac{V_2 - K_v \cdot \omega}{R_a}$$

In other words, the balancing conditions for the servo system are:

$$R_{20}\left(R_a + \frac{K_v\omega \cdot R_a}{V_2 - K_v \cdot \omega}\right) \quad R_{21} \cdot \left(R_{14} + \frac{E_1 \cdot R_{14}}{V_1 - E_1}\right)$$

The servo system is actuated by the load fluctuations in the motor with ω as the only variable. Therefore, when the load is high, ω slows down, the IC2 output voltage increases, a high current is supplied and as a result ω is accelerated.

Conversely, when the motor load is low, ω is accelerated, IC2 output voltage drops, the current is reduced and ω slows down.

It is therefore possible to vary the speed of the motor in proportion to the value of E1.

Fig. 5 shows the waveform. The voltage changes with the mechanical load but period T does not vary.

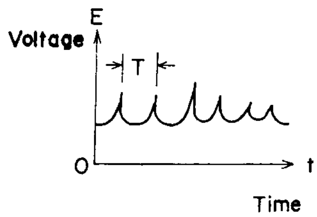


Fig. 5 Motor terminal waveform with electric governor

2. No-contact sensor system-based linear tracking and tone-arm left/right feed

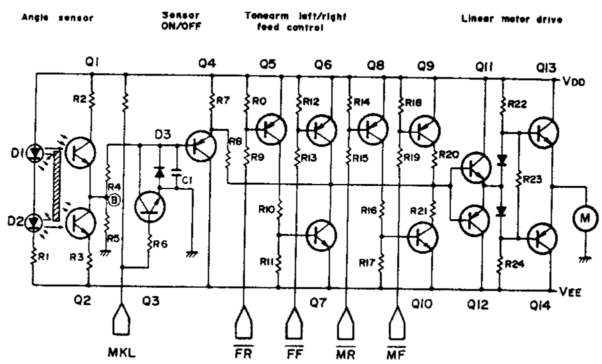


Fig. 6 Linear motor control and drive circuit

2-1 Linear tracing

Turntables which reproduce the sound on records in the same manner as the original cutting machines that cut the records are known as linear tracking turntables. They are characterized by a horizontal tracking error angle of zero and a great reduction in the second harmonic distortion.

This unit employs a no-contact differential sensor circuit which detects the angle of the tonearm, converts this angle into voltage and drives the feed motor.

The angle detection sensor consists of a pair of infrared light-emitting diodes, D1 and D2, and photo-transistors Q1 and Q2. The slanting plate between these parts operates in the same way as the tonearm, the light emitted from D1 and D2 is controlled and this light is made incident to Q1 and Q2.

Normally, when the tonearm completes its rising operation, the potential at point B is between about 1.5V and 2.0V. R2 and R3 are resistors which protect Q1 and Q2 and R5 represents the angle voltage conversion gain. The gain varies when this voltage is increased and reduced.

D3 is a diode for cutting the negative voltage. It prevents the motor from going too far – as may be the case with large fluctuations in the tonearm – by the integration action with R4 and C1. After this, the voltage is applied via emitter followers Q4, Q11 and Q13 to the motor, and these transistors also serve to compensate for the temperature.

Furthermore, when Q3 goes to ON, the sensor voltage is always at zero. This means that unless the tonearm is descending, Q3 is always at ON (MKL = HIGH).

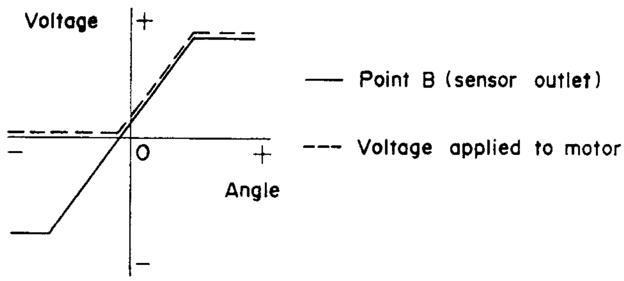


Fig. 7 Angle versus voltage characteristics

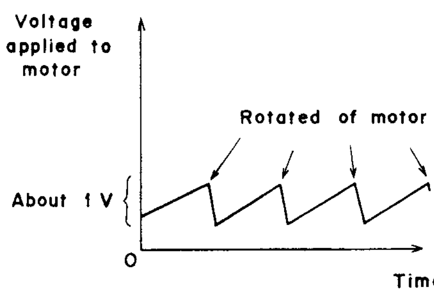


Fig. 8-a Linear tracing of sound grooves
(Rotation when the motor torque is high compared with the load consisting of the arm base and spiral tube)

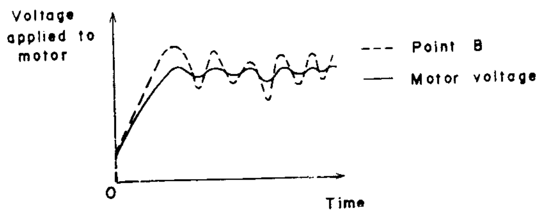


Fig. 8-b Linear tracing at the innermost diameter
(It takes some time for the motor rotation to start because of the high variation in the angle at which the tone-arm is tilting. Also, the value of the voltage depends on the load fluctuations)

2-2 Tonearm left/right feed control
When the tonearm is moving to the left or right, it is always in the UP position, and in this case the potential of the Q4 emitter is virtually zero. Operations are as in Table 1 in accordance with the interface command.

Tonearm	Interface command	Level	Operating transistor		Voltage applied to motor
Fast feed	$\overline{FF}$	LOW	Q6 ON	Q11 ON	Approx. +9.7V
Slight feed	$\overline{MF}$	LOW	Q9 ON	Q13 ON	Approx. 3V
Return	$\overline{FR}$	LOW	Q5, Q7 ON	Q12 ON	Approx. −9.7V
Slight return	$\overline{MR}$	LOW	Q8, Q10 ON	Q14 ON	Approx. −3V

<Table-1>

3. Disc sensor circuit and lamp display circuit

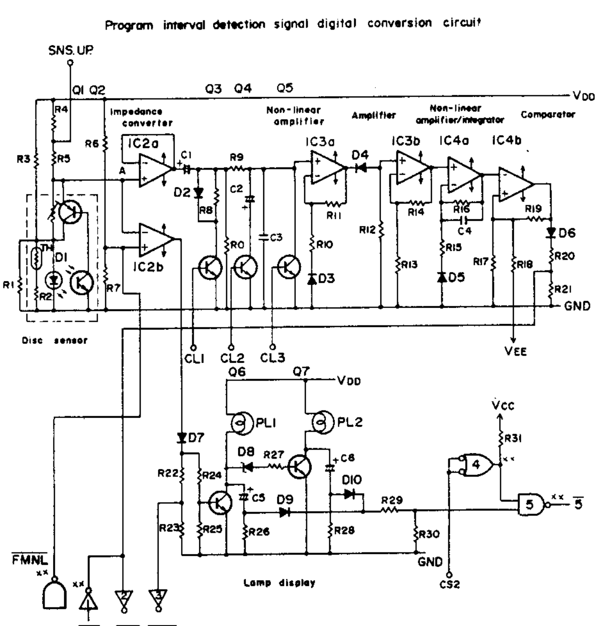


Fig. 9 Disc sensor circuit

In this circuit the ICs are numbered from 1 through 5. The 'XX' marks at the IC outputs indicate an open collector for the output and, as in Fig. 10, a pull-up resistor is absolutely necessary. ICs 1 through 3 are inverters, while ICs 4 and 5 are NAND gates.

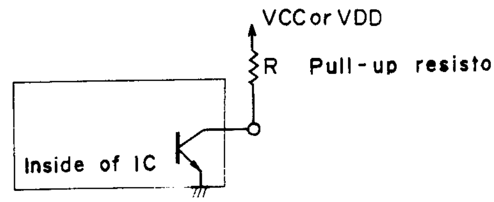


Fig. 10 Open collector IC

3-1 Block diagram of disc sensor circuit

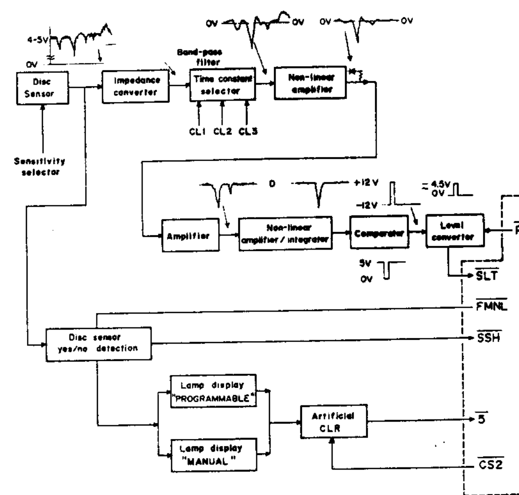


Fig. 11 Block diagram of disc sensor circuit

3-2 Description of circuitry

3-2-1 Disc sensor

The circuit within the dotted line boundary in Fig. 9 is incorporated into the end of the headshell. Light from the infrared LED and D1 is emitted onto the record and the reflection of this light is sensed by photo-transistor Q2. Refer to Fig. 12 for the difference between a program on the record and an interval between the programs.

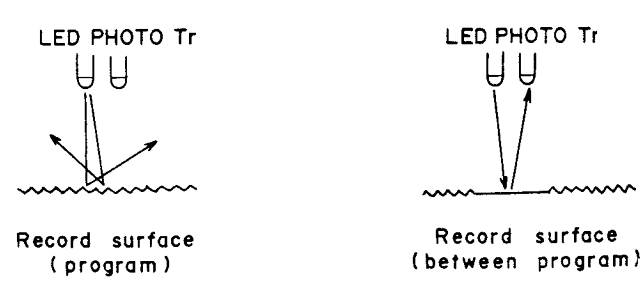


Fig. 12 Outline of disc sensor operation

Usually, when the amount of light made incident to Q2 is extremely low (record perimeter or program), the potential at point B is determined by i1 and this is about 4V or 5V. (Note: This potential varies according to the sensor elements, the state of the reflection and the surrounding brightness but it is usually 4V or 5V. However, it will increase to nearly 7V when the sensitivity is set to HIGH with SNS UP. There is no need to conduct a stringent check of the voltage itself. It increased by 2 ~ 3V with sensitivity selection. It is also acceptable for the voltage to vary about 0.3V when the tonearm is moved over the record. It is acceptable if the increase in the voltage variation with sensitivity selection is high (about 1.5 times the original voltage.)

When a great deal of light is made incident to Q2 between the record programs or on the record edge, Q1 base current IB flows, current IC flows corresponding to this current, and as a result the potential of point B is reduced to about 3.7 ~ 4.7V (a variation voltage of about 0.3V is normal).

R1 and R3 are bias resistors, TH (thermistor) and R2 are temperature-compensating resistors, and SFR1 is a variable resistor (initial setting) for adjusting the sensitivity. Refer to Fig. 11 for the waveforms of the disc sensor.

When the sensor key (S20) on the top panel is depressed, a signal enters SNS UP, R4 is shorted by the transistor switch, and the sensitivity is increased. (This is used for a record with narrow program intervals.)

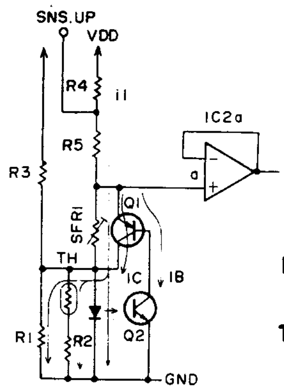


Fig. 13 Disc sensor circuit

3-2-2 Impedance converter, time constant selector

This signal provided by the disc sensor is impedance (IMP) converted by the IC2a voltage follower. Since the tonearm moves up and down (during play) and the left/right moving speeds differ, an identical output signal is obtained with the time constant selector (band-pass filters.) When the tonearm is in the UP mode, the control (CL1) is controlled and Q3 goes to ON and when in the DOWN mode, CL2 is controlled and Q4 goes to ON. Only during the times when the tonearm shifts from DOWN mode to the UP mode is CL3 controlled and does Q5 go to ON. The band-pass filters are shown in Fig. 14.

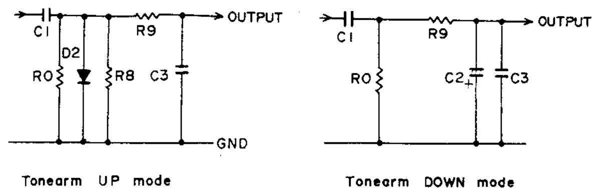


Fig. 14 Tonearm UP and DOWN mode band-pass filters

In this filter the DC components are suppressed and C1 discharges smoothly by D2. When shifting from a disc sensor UP mode, the CPU receives the signal and so CL3 is controlled and does not receive the input signal of the disc sensor automatically. Conversely, when shifting from the DOWN mode to the UP mode, the CPU receives the signal and so CL3 is controlled and Q5 is set to ON. Also, the output signal of the disc sensor is prevented from being applied to the CPU.

In other words, there is no need for the disc sensor output signal, unless the tonearm is in the UP or DOWN modes, and this serves to safeguard against otherwise possible malfunctions.

3-2-3 Non-linear amplifier, amplifier, non-linear amplifier/integrator, comparator, level converter

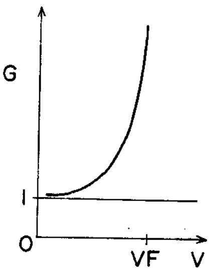


Fig. 15 Non-linear amplifier

This non-linear amplifier makes use of the diode's square response and so diode D3 is inserted into the circuit. As in Fig. 15, when a voltage exceeding VF (0.15 ~ 0.2V) of D3 enters the input (+ side) of IC3a, the effect is to cut out the noise. This passes through D4, the positive voltage is cut out, IC3b provides a slight amplification effect, the IC4a non-linear amplifier/integrator is utilized again, the high points in the level during record programs and the noise, etc. are completely eliminated and the waveforms are shaped by the comparator. Level conversion is provided as in Fig. 16. The negative voltage is cut by D6, the 12V voltage is converted into 5V by R20 and R21, it passes through the IC2 inverter and it is applied to the CPU.

The $\overline{PM}$ signal serves to cut $\overline{SLT}$ only when the tonearm is at the rest position. (Note: when SLT = LOW (IC12 output), the CPU detects the program number count record edge. A minimum of 10 msec is required for the SLT = LOW pulse width, because a single CPU period is 5 msec.)

Therefore, when the tonearm is at the rest position, PM = HIGH, the IC1 (inverter) output goes to LOW, SLT goes to HIGH and even if the disc sensor is actuated, this operation is not transmitted to the CPU.

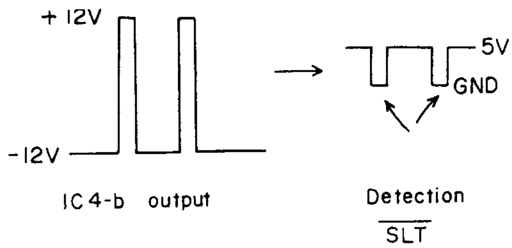


Fig. 16 Level conversion

3-2-4 Disc sensor yes/no detection and lamp display

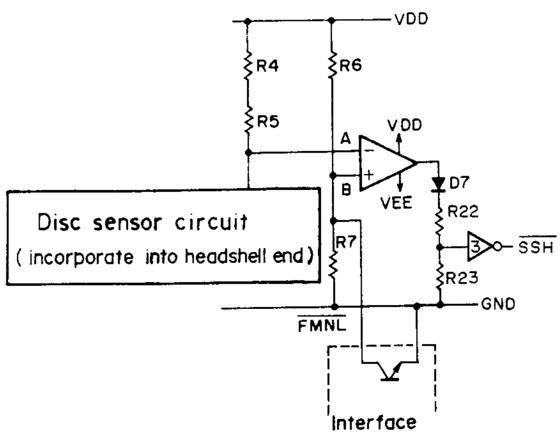


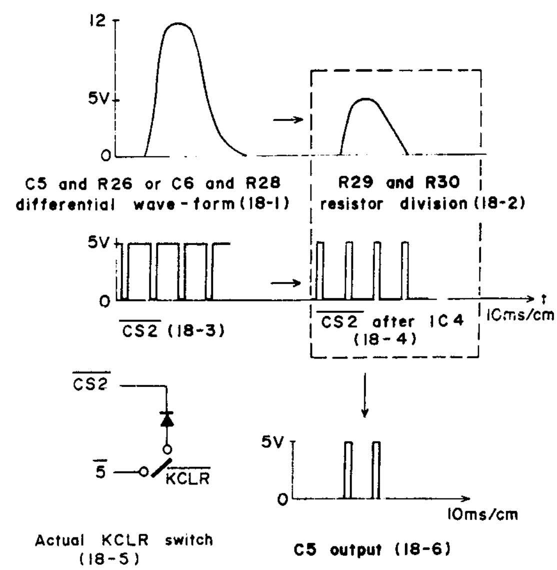
Fig. 17 Disc sensor yes/no detection circuit

Fig. 17 shows a circuit which is the disc sensor yes/no detection circuit taken from Fig. 9. When this circuit is mounted on the end of the headshell, the potential at point A is about 4 ~ 5V* but when an ordinary headshell is mounted without this circuit, VDD = 12V. The potential of IC2b point B is determined by the resistance division of R6 and R7 and is actually about 10V. IC2b functions as a comparator and so when the disc sensor is mounted, the IC2b output is VDD and when it is not mounted, VEE = −12V. The negative voltage is cut off by D7 and this potential enters the IC3 (inverter) input at the R22 and R23 resistance division. The output $\overline{SSH}$ signal is transmitted as LOW when the disc sensor is mounted and as HIGH = 5V when the disc sensor is not mounted, to the interface. The $\overline{SLT}$ signal is received by the CPU only when $\overline{SSH}$ = LOW. Furthermore, when the tonearm is in the rest position and the program ON/OFF switch is then depressed, the IC2b reference voltage (point B) goes to 10V or GND with the open collector IC, and $\overline{SSH}$ is inverted. These operations take place only when the disc sensor is mounted.

3-2-5 Lamp display

The output signal described under 3-2-4 is switched by transistors Q6 and Q7, and lamp PL1 or PL2 is lighted. Zener diode D8 serves to convert the lamp's resistance into pure resistance.

However, this gives rise to a problem. For instance, if the program is prepared with the PROGRAMMABLE display (the program NO. LED lights up) or it the record size is designated with the MANUAL display (SIZE LED lights up), and then the PROGRAM ON/OFF switch is operated before the tonearm is moved, the LED which has lighted with selection does not go off. In order to extinguish this LED, a circuit which functions as if to depress the KEY CLEAR is required.
In this circuit, C5 and R26 or C6 and R28 are used after the lamp has been selected, and differential wave forms of about 10ms to 20ms are shaped.



This voltage is a maximum of 12V (18-1) and so its level is converted to 5V by R29 and R30. (18-2)
Furthermore, if the pulse $\overline{CS2}$ available every 5ms is inverted (18-3) by IC4 (18-4), the NAND of (18-2) and (18-4) is taken and if this is entered into CPU $\overline{5}$, the operation is the same as that of (18-5).
D4 and D10 are diodes for preventing reverse current and R31 is a pull-up resistor.

3-2-6 Mask sensor code

All the mask sensor codes given here are the output signals of the IC12.

Tone-arm / Mask code	Rest position	Record edge			Record end	
		30cm	25cm	17cm	30, 25cm	17cm
$\overline{SMK1}$	0	1	1	1	0	0
$\overline{SMK2}$	1	0	0	1	0	0
$\overline{SMK\phi}$	1	0	1	0	1	0
$\overline{SPNT}$	0	0	0	0	0	0

Notes: 1 = 5 V(High)
0 =GND(Low)

<Table-2>

4. Motor Control block circuit

This circuit is made up of the quartz PLL controlled DD motor and it is composed of two ICs, MSM5817 and MSA111.
MSM5817 (CMOS) . . . . . . PLL IC
MSA111 (Bipolar) . . . . . . Motor drive IC

4-1 Quartz PLL servo control

The theory behind PLL servo control was developed over 10 years ago but a great many components and parts were required for its practical application which has become possible only with recent advances in IC technology. The ICs which have been developed from this technology have enabled the number of parts making up the control to be reduced and for the applications to be expanded.
Fig. 19 is a block diagram of the PLL servo control circuitry employed for motor control. The circuitry consists of a phase comparator, low-pass filter, voltage-controlled oscillator and other parts.

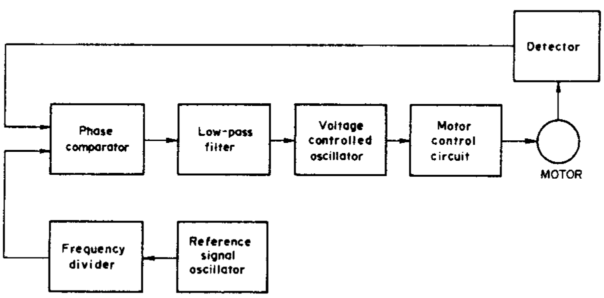


Fig. 19 Block diagram of PLL servo control

4-1-1 Phase comparator

This compares the phase of the 33 rpm or 45 rpm reference signal with the phase of the motor detector, and the difference between the phases is fed out as the error signal.

4-1-2 Low-pass filter

* This removes the noise and high-frequency components from the phase comparator's output signal.
* It determines the capture range.
* It functions as a holding circuit if, for some reason or other, the servo system lock disengages.

In all three functions, this filter contributes to stabilizing the servo system.

4-1-3 Voltage-controlled oscillator (VCO)

This is the most complex and important part in the PLL loop. It operates using the voltage output of the phase comparator which has passed through the low-pass filter and which has become DC components. For motor control this VCO is not used – the reference voltage oscillator (which generates a DC voltage corresponding to the phase comparator) is employed instead.

The motor control performance is determined by the PLL servo lock range, the capture range and the loop gain, etc. The principle behind the operation of the servo system is now described. If the motor is locked at a certain speed, the output signal of the phase comparator becomes uniform, and the DC output which has passed through the low-pass filter also becomes uniform.
Therefore, the motor is made to rotate at a constant speed by the uniform DC output. If for any reason the frequency of the detector shifts, the output signal of the phase comparator, which compares the phase of this frequency with the reference signal frequency, varies. The DC voltage of the low-pass filter output changes to a degree corresponding to the change in the output, and the motor is made to rotate. The VCO is made to function in synchronization with the input signal at all times in this servo system and so the overall effect is to return the error power component to its original form.

All that has to be done is to vary the reference frequency in order to change the motor speed. However, if a quartz oscillator is employed for the reference frequency oscillator, it is extremely difficult to vary the oscillation frequency of the oscillator in order to maintain the low drift characteristics of the quartz oscillator.
Therefore, a programmable frequency divider is used after the quartz oscillator and the speed is varied. This means that the drift of the reference oscillator is virtually expressed as the drift in the motor rotation.
Fig. 20 shows the quartz PLL servo control circuit used in this turntable. It is characterized by the single circuit which provides feedback to the servo circuit and motor control circuit from the motor position detector. Feedback is applied in order to further stabilize the PLL servo system. It differs from the basic circuit in that a VCO is not employed. A voltage comparator inside the MSA111 IC is employed instead of the VCO, a voltage corresponding to the voltage of the low-pass filter is generated, and the motor is controlled. When this voltage comparator is used, a reference voltage to start the motor must be supplied from an external source. This circuit is incorporated into the circuit board.

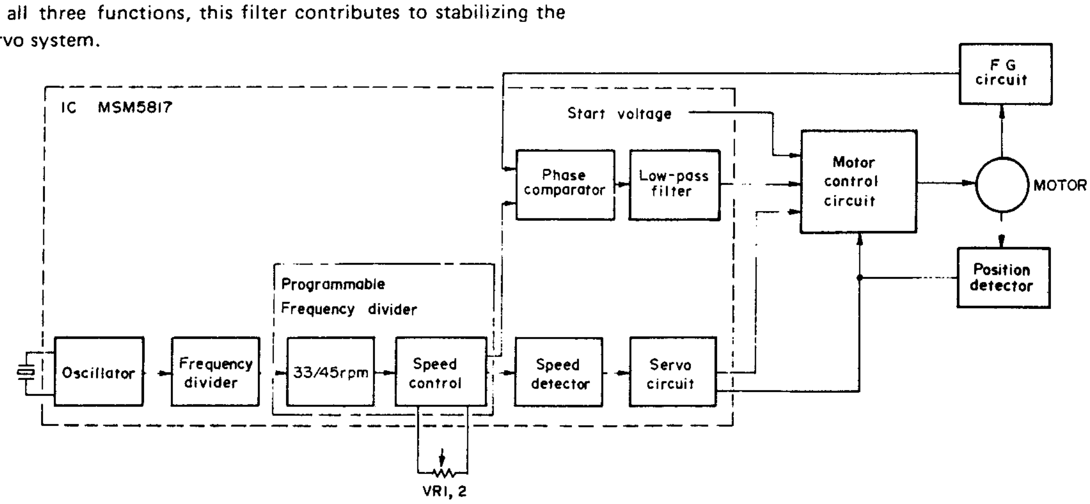


Fig. 20 Block diagram of quartz PLL servo control circuit

(If the VCO is used, it is accompanied by a free-running frequency and this is undesirable.) Table 3 gives a comparison between the PLL servo control circuit used in this turntable and a basic PLL servo control circuit.

Basic PLL servo control	AIWA PLL servo control
Motor control circuit	IC MSA111
Low-pass filter	CR filter (externally mounted)
Phase comparator	IC MSM5817
Frequency divider	IC MSM5817
Detector	FG circuit

<Table-3>

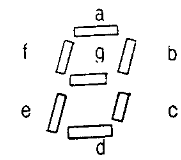
Adverse effects on the wow, signal-to-noise ratio and other characteristics of the PLL servo motor come from:
* Characteristics of the low-pass filter
* Feedback from position detector
* Voltage comparator characteristics

5. Display circuit

This circuit is composed of IC3 (MC14518) BCD counter, IC4, IC5 (SN74LS47N) and a 7-segment LED driver/decoder. The pulse periods differ according to whether the motor speed is 33rpm or 45rpm.
With the fine speed adjustment in this circuit, the Δf signal goes to a HIGH level at 0%. At 0.1% Δf is pulse 1 and at 0.1% Δf is pulse 10 so that pulses are entered corresponding to the percentages. This Δf signal has no dependence on a positive or negative display and so pulse 5 enters with both a +0.5% and a −0.5% display. These pulses are counted by IC3. Two BCD counters are used as decade counters.
The contents of the counter are reset (to 0) when a clock pulse enters and so counting begins again as soon as this pulse enters.

However, the LED display is faster than the re-counting operation of the counter and so it appears to the eye that a constant display is maintained despite the actual fact that the LED display varies. A HIGH level signal enters with a positive display and a LOW level signal with a negative display. These signals are fed out from the PLL motor circuit board, and they are unrelated to the Δf and clock signals. They are decoded by the next stage IC4 and IC5 (SN74LS47) to drive the 7-segment LED. R37, R38 and R39 through R53 are resistors for restricting the current of the LED.
The effect of SN74LS01 is that it is employed as an IC so that the +/− display does not appear with a 0.0% display. The outputs of IC4 and IC5 are given in Table 4.
A look at the 0 display shows that only the g output is "1". But a g output of "1" is given in three places (1, 7 and 0). This means that unless discrimination is made elsewhere, the +/− display will go off at 1, 7 and 0. A look at the other outputs shows that the LED display goes to 0 only when the g output is "1" and the e output is "0". If the IC4 and IC5 outputs e and g are processed, it is possible to erase the +/− display with a 0.0% display. Therefore, the output is set to the HIGH level with a 0.0% display and the transistor is switched. This now means that the LED display lights up with a negative display at all times except 0.0%.

LED	a	b	c	d	e	f	g
1	1	0	0	1	1	1	1
2	0	0	1	0	0	1	0
3	0	0	0	0	1	1	0
4	1	0	0	1	1	0	0
5	0	1	0	0	1	0	0
6	1	1	0	0	0	0	0
7	0	0	0	1	1	1	1
8	0	0	0	0	0	0	0
9	0	0	0	1	1	0	0
0	0	0	0	0	0	0	1



Notes:
1 ···LED OFF
0 ···LED ON

<Table-4>

DESCRIPTION OF SYMBOLS

1. Difference between positive and negative logic

If a bar is used over the symbol (such as $\overline{MR}$, $\overline{PM}$, $\overline{SLT}$), it refers to a negative logic (Low True) output signal. The absense of such a bar (such as MR, RS) indicates positive logic (High True) output signals. The significance of these symbols is transmitted to the rear circuits.

2. Description of symbols

2-1 Input/output signal relationship at CPU

2-1-1 **MR** (medium reverse) (operation during play)
When MR is at High True, the tonearm moves slightly to the rear. (Pin 3)

2-1-2 **MF** (medium forward) (operation during play)
When MF is at High True, the tonearm moves slightly to the front. (Pin 4)

2-1-3 **FR** (fast reverse) (operation during pause)
When FR is at High True, the tonearm moves quickly to the rear. (Pin 5)

2-1-4 **FF** (fast forward) (operation during pause)
When FF is at High True, the tonearm moves quickly to the front. (Pin 6)

2-1-5 **ADN** (arm down)
When ADN is at High True (S14 PLAY key), the tonearm descends. With other keys (such as PAUSE), ADN is set to LOW, and the tonearm rises. (Pin 18)

2-1-6 **$\overline{CK}$** (clock)
Clock pulses must be fed out one at a time for a CPU period of 5 msec, and the Low True time is 750 μsec.
When converting the size and program LED dynamic display into a static display, this signal is used with the interface. (Pin 12)

2-1-7 **RS** (rotation signal)
This is set to HIGH at a 33 rpm speed and to LOW at a 45 rpm speed. The SPEED key can be used for free conversion. The signal is always set to HIGH when the POWER switch is set to ON. (Pin 24)

2-1-8 **$\overline{PM}$** (phono motor)
PM is Low True and it is always at LOW except when the tonearm is in the rest position, and the phono motor rotates. (Pin 25)

2-1-9 **ϕ through 5** (pins 28 ~ 33) and **ϕ through 3** (pins 8 ~ 11)
ϕ through 3 are BCD converted (binary to decimal) by IC-9 and ϕ through 5 form a matrix, and with this timing the front panel and top panel switch and mask codes are entered into the CPU.
LED timing and static display are performed with synchronization between the IC-9 output (CS for chip select) and ϕ through 5. (Refer to Fig. 1)

2-1-10 $\overline{SLT}$ (sense leading trace) (Pin 14)
This signal is Low True and it enters this mode when the record edge and program intervals are detected.
During a program, the CPU sequentially counts and memorizes these pulses and performs the operations.

2-1-11 $\overline{SPT}$ (sense position) (Pin 15)
This signal is a LOW pulse when the tonearm is in the rest position, when it is at the edges (3) of the record sizes and at the end (2) of the records. It is a Low True signal.

2-1-12 $\overline{RST}$ (reset) (Pin 39)
When the power switch is turned on, this Low True signal resets the CPU in a certain time period.

2-1-13 MNL (manual)
This signal is always pulled up to HIGH because of the program.

2-2 Interface system signals
The differences between the HIGH and LOW states of the signals described under the CPU and its signals are omitted.

2-2-1 MKL (motor kill)
This is a High True signal which makes it impossible for the linear trace motor to operate when in the HIGH state.
(LA25-P1 ← motor name)

2-2-2 $\overline{MUP}$ (motor up)
This is a Low True signal which causes the up/down tonearm motor to raise the tonearm when it is in the LOW state.
(KCN-20BB4 ← motor name)

2-2-3 MUTE (muting)
This is a High True signal which mutes the audio signals when in the HIGH state.

2-2-4 $\overline{MD\ 1}$ (motor down 1)
This is a Low True signal which causes the up/down tonearm motor to lower the tonearm with a single turn of the record with a 33 rpm record speed and which compensates for eccentricity.

2-2-5 $\overline{MD\ 2}$ (motor down 2)
This is a Low True signal which causes the up/down tonearm motor to lower the tonearm with a single turn of the record with a 45 rpm record speed and which compensates for eccentricity.

2-2-6 $\overline{KMNL}$ (flip-flop manual)
This signal can be reversed (HIGH/LOW) every time the KMNL (S19 MANUAL key) switch is depressed. When this switch is depressed when programmable, this Low True signal can set the turntable to full auto (LOW state) only.

2-2-7 $\overline{SSH}$ (standard shell)
A standard headshell is defined as a headshell with the disc sensor mounted, and this signal is LOW when this headshell is attached, and HIGH when another headshell is attached. With a headshell with the disc sensor mounted, it can be set to SSH with KMNL.

2-2-8 $\overline{SM1}$ (sense mask 1)
$\overline{SM2}$ (sense mask 2)
$\overline{SM\phi}$ (sense mask ϕ)
These three signals are used as digital bits and, together with SPT, they form the record size and record end rest position signal.
All these signals are Low True.

3. Description of connector symbols

3-1 Power supply
The linear motor and the up/down motor rotate in both the forward and reverse directions, the GND reference VDD and VEE are used for operation, and a voltage of VEE reference VDD 24V is supplied for the phono motor operation.

3-2 CON 1 (connector 1)

3-2-1 $\overline{SMDN}$ (switch motor down)
The mode depends on the up/down motor and tonearm. When the tonearm is down, the $\overline{SMDN}$ signal is LOW, and at all other times it is HIGH.

3-2-2 $\overline{SMUP}$ (switch motor up)
The mode depends on the up/down motor and tonearm. When the tonearm is up, the $\overline{SMUP}$ signal is LOW and at all other times it is HIGH. The SMUP at the next pin is the reverse. The levels are HIGH VDD and LOW GND.

3-2-3 A SNS (angle sensor)
This refers to the angle sensor which performs the linear tracking during record play, and a voltage proportionate to this angle is fed out.

3-2-4 MSD (motor shield), **DMT** (down motor)
MSD is the shield wire of DMT (motor for tonearm raising and lowering).

3-3 CON 2 (connector 2)

3-3-1 **DS 1** (disc sensor 1) **DS 2** (disc sensor 2)
DS 1 output varies in accordance with the changes in the light-reflecting object. The reference for the $\overline{SLT}$ and $\overline{SSH}$ signals is thereby provided. DS 2 is added to increase the changes in DS 1 and there are no output variations.

3-3-2 LSD (left shield)
LS (left signal)
LE (left earth)
RE (right earth)
RS (right signal)
RSD (right shield)

3-4 CON 8, CON 9, CON 10, CON 11 (connectors 8, 9, 10, 11)

3-4-1 $\overline{CS}$ (chip select) ϕ through 8
CPU ϕ, 1, 2 and 3 are BCD (binary ↔ decimal) converted and the input and output display relationship is controlled.

3-4-2 $\overline{BU}$ (buffer) ϕ through 5
The program number, repeat and error displays are indicated dynamically with $\overline{CS\ 6}$, $\overline{CS\ 7}$ and $\overline{BU\phi}$ through $\overline{BU\ 5}$.

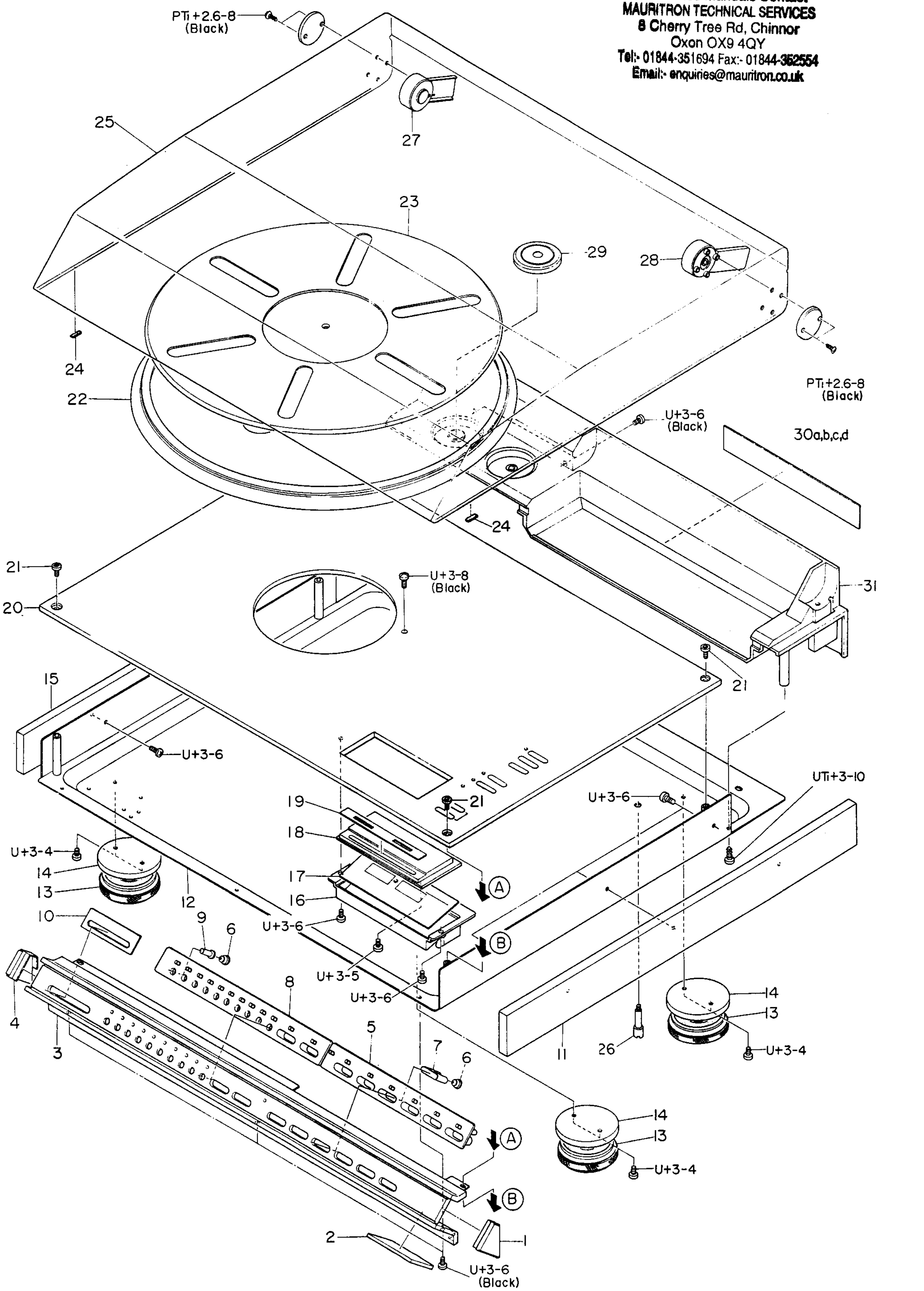
3-4-3 **$\overline{Key\ \phi}$ through $\overline{Key\ 5}$**
$\overline{CS\phi}$ through $\overline{CS\ 1}$ and $\overline{Key\ \phi}$ through $\overline{Key\ 5}$ are combined in matrix form, and all the rubber switches (except $\overline{KSNS}$, $\overline{KMNL}$) are synchronized in their timing and controlled.

3-4-4 SNS UP (sensor up)
This refers to an increase in the level of the disc sensor, and the sensitivity is improved. $\overline{KSNS}$ (key sensor S20) switches between normal sensitivity and increased sensitivity every time it is depressed.

3-4-5 $\overline{D17}$, $\overline{D25}$, $\overline{D30}$ . . . D (display)
$\overline{CS\ 8}$ is synchronized with the $\overline{CPU}$ $\overline{CK}$, and the SIZE display is operated statically with the combination of $\overline{Key\ \phi}$ through $\overline{Key\ 1}$.

3-4-6 $\overline{KMNL}$ (key manual S19)
Every time this key is depressed, the output is reversed and when $\overline{SSH}$ is Low True, the programmable function can be set on and off, in which case the CN12 PRG (program) and NML (manual) lamps light up.

EXPLODED VIEW-1



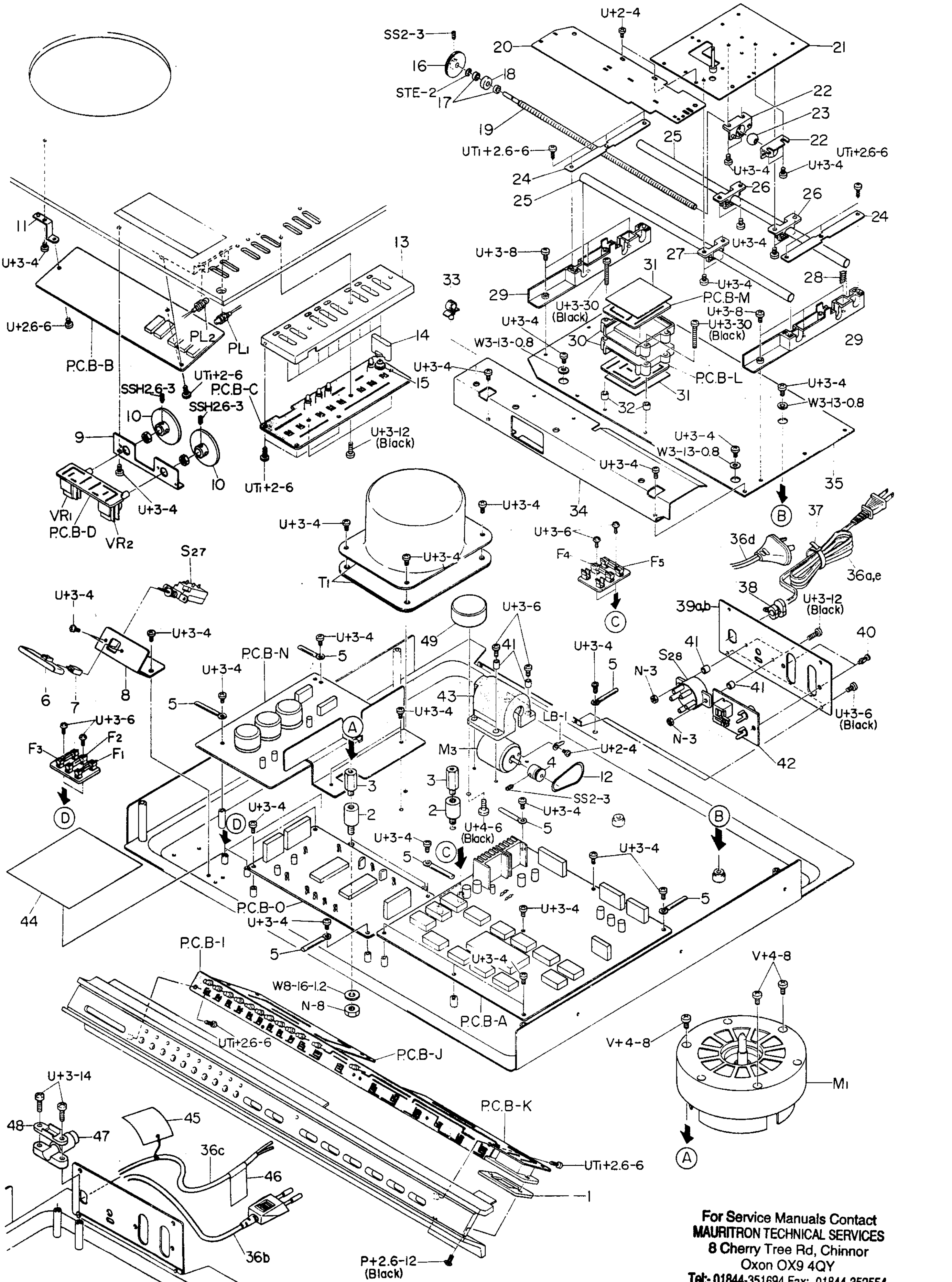
PARTS LIST

MECHANICAL PARTS

■ *mark in this part list shows exclusive part (which is used) for only Model LP-3000.

Ref. No.	Part No.	Part No. Changed to	Description	Common Model	Q'ty
1-1	84-195-004-01		Panel R, Side	*	1
1-2	84-195-057-01		Cover, Remote	*	1
1-3	84-195-003-01		Panel, Front	*	1
1-4	84-195-005-01		Panel L, Side	*	1
1-5	84-195-253-01		Holder B	*	1
1-6	84-195-251-01		Rubber switch	*	18
1-7	84-195-015-01		Button D	*	8
1-8	84-195-252-01		Holder A	*	1
1-9	84-195-013-01		Button B	*	10
1-10	84-195-206-01		Switch guide	*	1
1-11	84-195-008-01		Side plate R ass'y	*	1
1-12a	84-195-024-01		Back cover ass'y (H, U model only)	*	1
1-12b	84-195-061-01		Back cover ass'y (E, K, G model only)	*	1
1-13	84-195-016-01		Foot, Absorber ass'y	*	4
1-14	84-195-017-01		Case A, Foot absorber	*	4
1-15	84-195-050-01		Side plate L ass'y	*	1
1-16	84-195-255-01		Holder D	*	1
1-17	84-195-011-01		Mask, Indication	*	1
1-18	84-195-010-01		Window	*	1
1-19	84-195-021-01		Plate, Indication	*	1
1-20	84-195-058-01		Panel, Top	*	1
1-21	84-195-038-01		Screw, Top panel	*	4
1-22	84-195-023-01		Turntable	*	1
1-23	84-195-009-01		Rubber sheet	*	1
1-24	84-195-035-01		Rubber	*	2
1-25	84-195-001-01		Dust cover	*	1
1-26	84-195-954-01		Screw	*	1
1-27	84-195-033-01		Hinge ass'y L	*	1
1-28	84-195-032-01		Hinge ass'y R	*	1
1-29	84-184-953-01		45 adapter	AP-2500	1
1-30a	84-195-043-01		Name plate, Spec. (H model only)	*	1
1-30b	84-195-044-01		Name plate, Spec. (E model only)	*	1
1-30c	84-195-045-01		Name plate, Spec. (K model only)	*	1
1-30d	84-195-046-01		Name plate, Spec. (G model only)	*	1
1-30e	84-195-053-01		Name plate, Spec. (U model only)	*	1
1-31	84-195-048-01		Rear panel ass'y	*	1

EXPLODED VIEW-2



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MAURITRON TECHNICAL SERVICES
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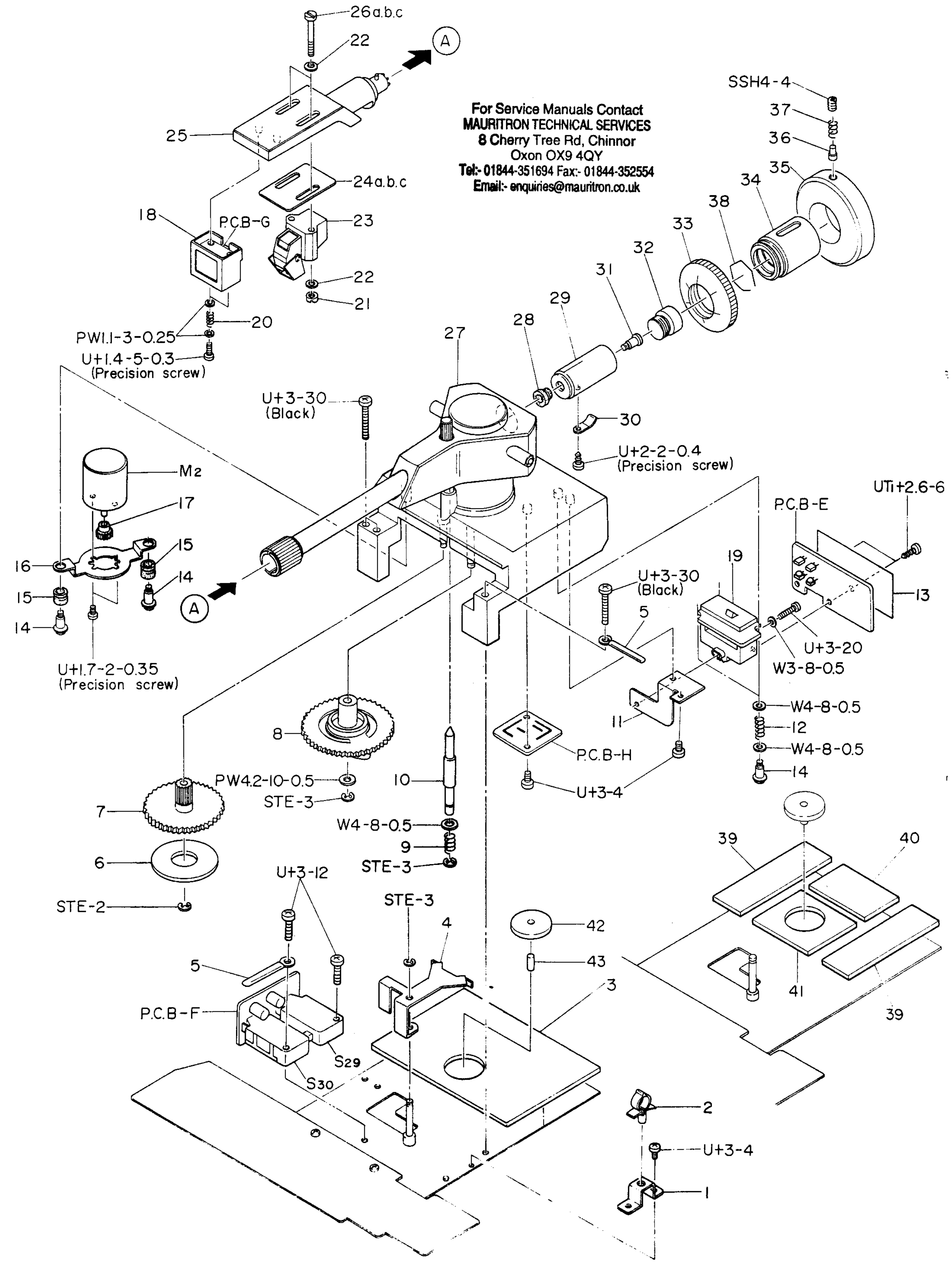
Oxon OX9 4QY
Tel:- 01844-351694 Fax:- 01844-352554
Email:- enquiries@mauritron.co.uk

Ref. No.	Part No.	Part No. Changed to	Description	Common Model	Q'ty
2-1	84-195-269-01		Spacer, REMOTE jack	*	1
2-2	84-195-216-01		Motor bass G	*	3
2-3	84-195-215-01		Motor bass F	*	3
2-4	84-195-221-01		Pulley B	*	1
2-5	87-038-039-01		Wire binder		7
2-6	84-195-012-01		Button A	*	1
2-7	84-195-214-01		Joint	*	1
2-8	84-195-213-01		Holder, Switch	*	1
2-9	84-195-209-01		Holder C, Circuit board	*	1
2-10	84-195-036-01		Adjuster knob ass'y	*	2
2-11	84-195-212-01		Holder B, Circuit board	*	1
2-12	82-260-331-01		Belt		1
2-13	84-195-254-01		Holder C	*	1
2-14	84-195-014-01		Button C	*	8
2-15	84-195-251-01		Rubber switch	*	8
2-16	84-195-220-01		Pulley A	*	1
2-17	84-195-271-01		Spacer, Shaft bearing	*	2
2-18	84-195-257-01		Holder screw	*	1
2-19	84-195-218-01		Drive screw	*	1
2-20	84-195-228-21		Mask plate	*	1
2-21	84-195-234-01		Moving chassis ass'y	*	1
2-22	84-195-227-01		Holder nut	*	2
2-23	84-195-226-01		Nut	*	1
2-24	84-195-223-01		Holder, Guide rail	*	2
2-25	84-195-219-01		Guide rail	*	2
2-26	84-195-225-01		Slider B	*	2
2-27	84-195-224-01		Slider A	*	1
2-28	84-184-361-01		C spring	AP-2500	1
2-29	84-195-222-01		Holder, Guide rail	*	1
2-30	84-195-229-01		Holder M, Sensor	*	2
2-31	84-195-230-01		Holder M, Cover	*	2
2-32	84-195-265-01		Collar A	*	2
2-33	87-064-050-01		Wire Clip E		1
2-34	84-195-232-01		Cable guide	*	1
2-35	84-195-217-01		Sub-chassis	*	1
2-36a	87-034-826-01		AC power cord (H model only)		1
2-36b	87-034-877-01		AC power cord (E model only)		1
2-36c	87-034-872-01		AC power cord (K model only)		1
2-36d	87-034-878-01		AC power cord (G model only)		1
2-36e	87-034-874-01		AC power cord (U model only)		1
2-37	87-058-023-01		Cord binder		1
2-38	87-085-101-01		Cord bushing (H, G. U model only)		1
2-39a	84-195-039-01		Holder C, Jack plate (U model only)	*	1
2-39b	84-195-022-01		Holder H, Jack plate (H, E, K, G model only)	*	1
2-40	87-085-102-01		Nylon rivet 3.5ϕ–5.5		2
2-41	87-085-134-01		Bushing		6
2-42	84-195-612-01		Jack plate ass'y	*	1
2-43a	84-195-210-01		Holder A, Motor (H, E, K, G model only)	*	1
2-43b	84-195-298-01		Holder U, Motor (U model only)	*	1
2-44	84-195-286-01		Sheet A, Insulater (K, G model only)	*	1
2-45	87-056-014-01		Tag, Main voltage (K model only)		1
2-46	87-056-008-01		Label, AC power cord (K model only)		1
2-47	87-085-094-01		Holder A, AC power cord (E, K model only)		1
2-48	87-085-095-01		Holder B, AC power cord (E, K model only)		1
2-49	84-195-281-01		Weight for anti-vivration	*	1

EXPLODED VIEW–3



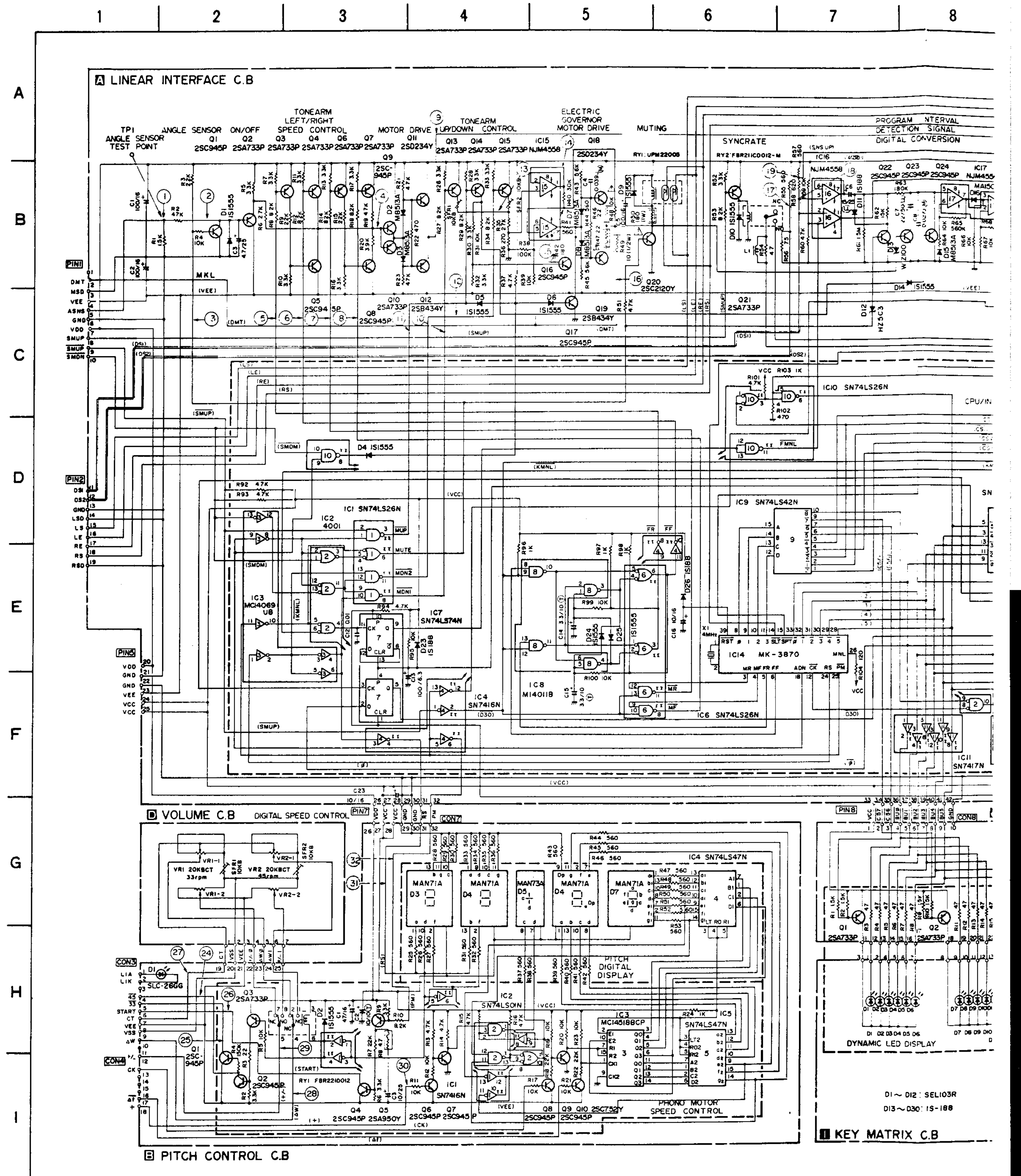
Ref. No.	Part No.	Part No. Changed to	Description	Common Model	Q'ty
3-1	84-195-256-01		Holder, Cable	*	1
3-2	87-064-050-01		Wire clip E		1
3-3	84-195-267-01		Chassis damper plate D (H, E, K, G model only)	*	1
3-4	84-195-238-01		Lever A, Micro switch	*	1
3-5	87-038-039-01		Wire binder		2
3-6	84-195-266-01		Gear damper plate C	*	1
3-7	84-195-245-01		Gear B	*	1
3-8	84-195-258-01		Gear C, Up-Down	*	1
3-9	84-195-247-01		C spring, Lifter	*	1
3-10	84-195-246-01		Lifter shaft	*	1
3-11	84-195-268-01		Holder E, A sensor	*	1
3-12	84-195-250-01		C spring, A sensor	*	2
3-14	87-081-483-01		Motor screw, M2.6		4
3-15	87-087-029-01		Rubber cushion		2
3-16	82-630-249-21		Holder A, Motor		1
3-17	84-195-244-01		Gear A	*	1
3-18	09-141-035-01		D sensor		1
3-19	84-195-242-01		Holder A, Sensor	*	1
3-20	84-190-059-01		C spring		2
3-21	84-184-955-01		Nut	AP-2500	2
3-22	84-184-956-01		Washer	AP-2500	4
3-23	84-184-957-01		Cartridge ass'y (H, E, G model only)	AP-2500	1
3-24a	84-195-961-01		Spacer A, Cartridge	*	1
3-24b	84-195-962-01		Spacer B, Cartridge	*	2
3-24c	84-195-963-01		Spacer C, Cartridge	*	1
3-25	84-195-951-01		Head shell ass'y	*	1
3-26a	84-195-955-01		Screw, Cartridge stopper	*	2
3-26b	84-184-961-01		Screw, Cartridge stopper	AP-2500	2
3-26c	84-184-954-01		Screw, Cartridge stopper	AP-2500	2
3-27	09-041-034-01		Tonearm ass'y		1
3-28	84-196-030-01		Shaft, Weight (Foot, Absorber)	AP-2600	1
3-29	84-195-112-01		Shaft, Weight	*	1
3-30	84-196-032-11		P spring, Weight	AP-2600	1
3-31	84-195-096-01		Screw, Weight shaft	*	1
3-32	84-195-141-01		Weight, Sub	*	1
3-33	84-195-110-11		Counter ring	*	1
3-34	84-195-108-01		Weight, Main	*	1
3-35	84-195-109-01		Weight, Counter	*	1
3-36	84-195-111-01		Pin, Weight	*	1
3-37	84-195-137-01		C spring, Counter weight	*	1
3-38	84-195-036-11		T spring	*	1
3-39	84-195-295-01		Plate D, Chassis damper U1 (U model only)	*	2
3-40	84-195-296-01		Plate D, Chassis damper U2 (U model only)	*	1
3-41	84-195-297-01		Plate D, Chassis damper U3 (U model only)	*	1
3-42	84-195-282-01		Oil sheet	*	1
3-43	84-195-283-01		Oil bar	*	1

ACCESSORIES/PACKAGE

Ref. No.	Part No.	Part No. Changed to	Description	Common Model	Q'ty
1a	84-195-860-01		Printed indiv., Packing (H1, E, E1, K, G1 model only)	*	1
1b	84-195-862-01		Printed indiv., Packing (U model only)	*	1
2	84-195-852-01		Cushion, Printed indiv.	*	1
3	84-195-853-01		Cushion, Printed indiv.	*	1
4	84-195-854-01		Cushion, Auxiliary	*	1
5	84-195-855-01		Auxiliary cushion, Front	*	1
6	84-195-856-01		Auxiliary cushion, Rear	*	1
7	84-195-857-01		Cushion, Auxiliary	*	1
8	84-195-858-01		Box, Accessory	*	1
9	84-184-860-01		Foamed mat	AP-2500	1
10	84-190-866-01		Poly-vinyl sack	Ap-2200	1
11	84-195-859-01		Cushion, Arm	*	1
12	87-051-131-11		Poly-vinyl sack (for AC power cord)		1
13	87-051-132-11		Poly-vinyl sack		5
14	87-051-133-11		Poly-vinyl sack		2
15	87-056-553-01		Poly-vinyl sack (for case)		1
16	87-056-564-01		Curl stopper		2
17	84-195-145-01		Caution label, Adjustment	*	1
18a	84-195-904-01		Instructions booklet (H1 model only)	*	1
18b	84-195-905-01		Instructions booklet (E1 model only)	*	1
18c	84-195-906-01		Instructions booklet (K model only)	*	1
18d	84-195-907-01		Instructions booklet (E, G1 model only)	*	1
18e	84-195-909-01		Instructions booklet (U model only)	*	1
19	87-056-008-01		Label, AC power cord (K model only)		1
20	87-056-009-01		Distributors list (H1, E, E1, K, G1 model only)		1
21	87-056-014-01		Tag, Main voltage (K model only)		1
22a	87-056-032-01		Guarantee card (G1 model only)		1
22b	87-056-036-01		Guarantee card (U model only)		1
23	87-056-608-01		Poly-vinyl sack		1
24	87-056-034-01		Service station list (U model only)		1
25	87-056-035-01		Card, Limited warranty		1
26	84-195-971-01		Stylus adjustment (H1, E, K, G1, U model only)	*	1
27	85-439-002-01		Syncrate cord CW-150k (H1, E, E1, K, G1 model only)		1
28	87-032-845-01		Siemens plug (H1 model only)		1
29	87-034-575-01		Pin cord (H1, E, E1, K, G1 model only)		1
30	87-058-023-01		Cord binder (H1, E, E1, K, G1 model only)		1

☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ SERVICE INFORMATION ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆ ☆

SCHEMATIC DIAGRAM −1



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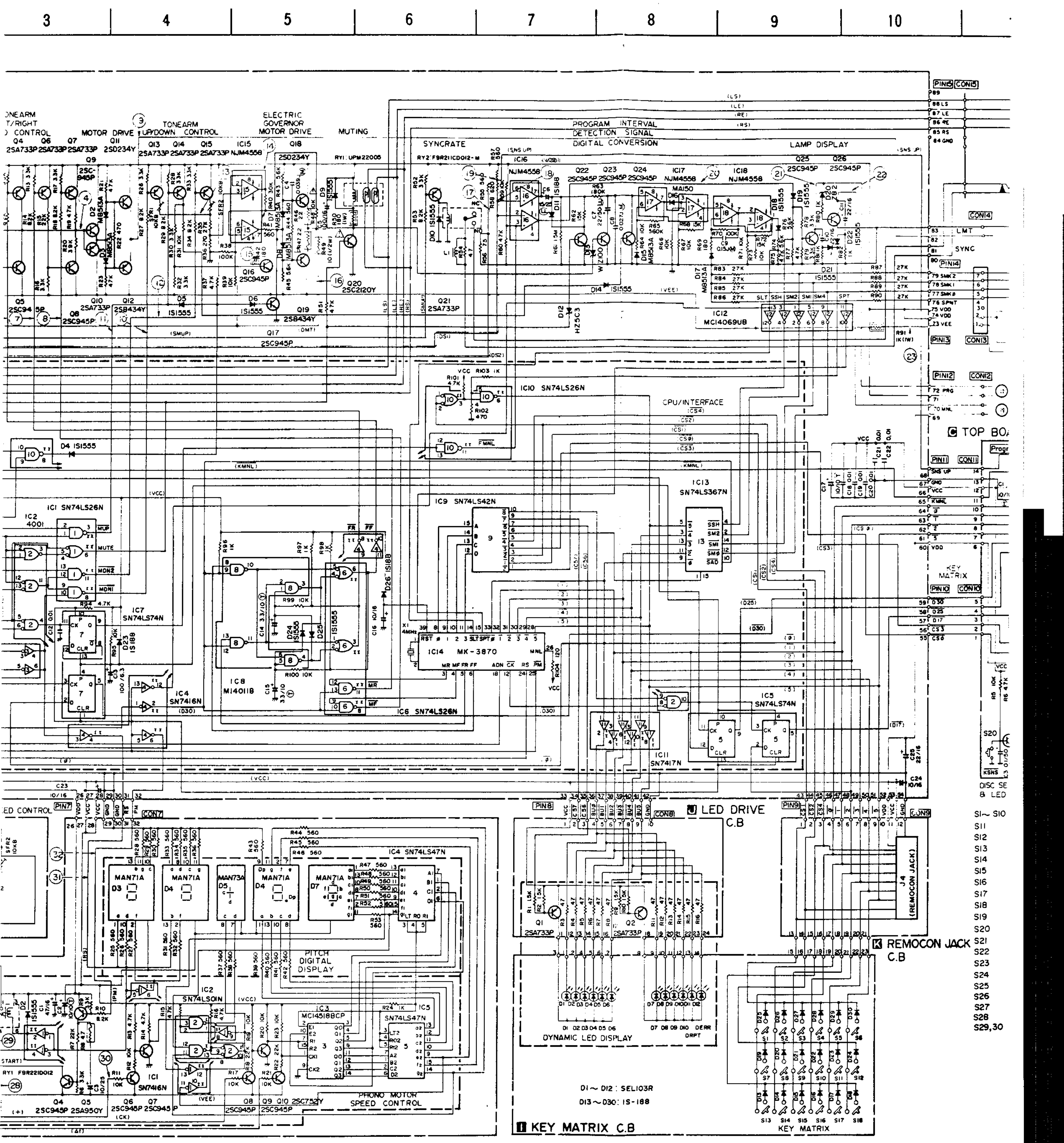
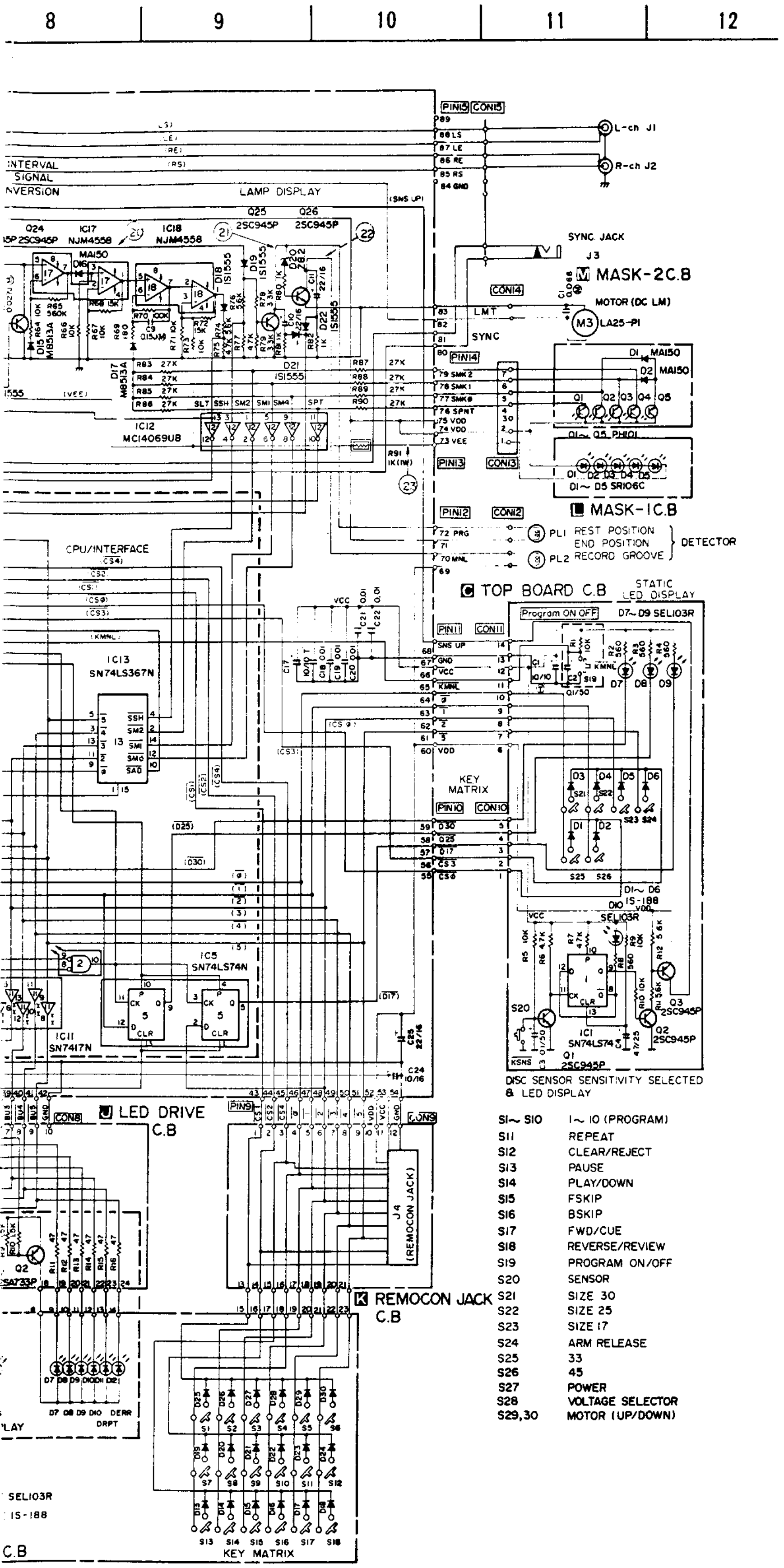


Other voltage refer to re' voltages of parts.

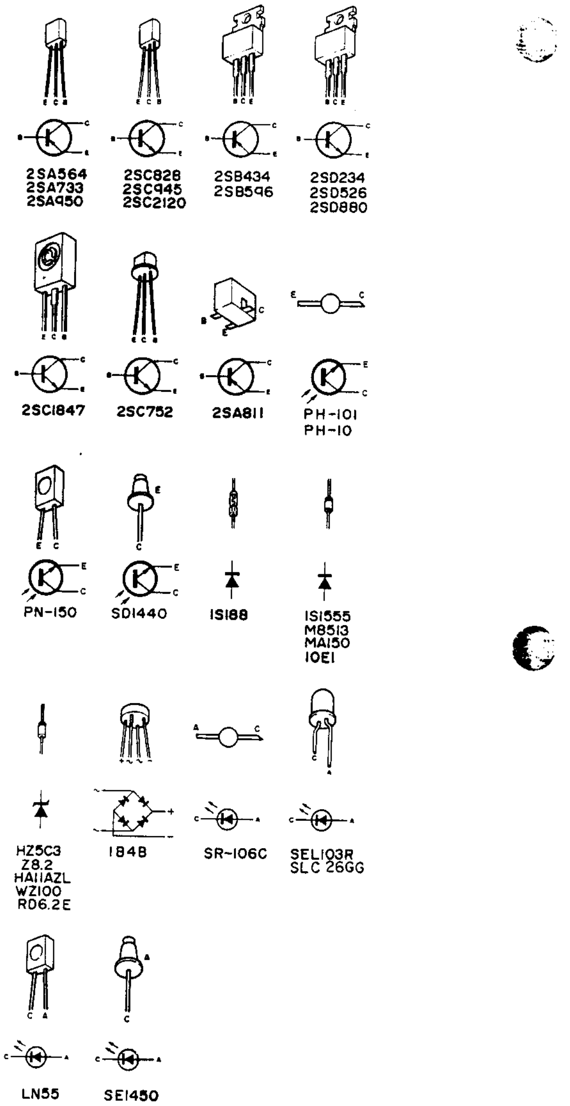


NOTES:

1) —— B (+) power supply
2) The voltage is the reference value measured with a tester (20 k-ohms/V DC) when there are no signals.
3) Resistors with no designation have a rated power of ¼W and a tolerance of ±5%.
4) Capacitors with no designation have a dielectric strength of less than 50WV.
5) The only capacitor tolerances indicated are ±5% (J) and ±10% (K).
6) Explanation of symbols
   - Ⓜ Mylar capacitor
   - Ⓛ Low-leakage capacitor
   - Ⓣ Tantalum capacitor
   - Fuse resistor
   - Nonflammable resistor
   - ⚠ Safety component symbol

This symbol is given to important parts which serve to maintain the safety of the product, and which are made to conform to special safety specifications. Therefore, when replacing a component with this symbol, make absolutely sure that you use a designated part.

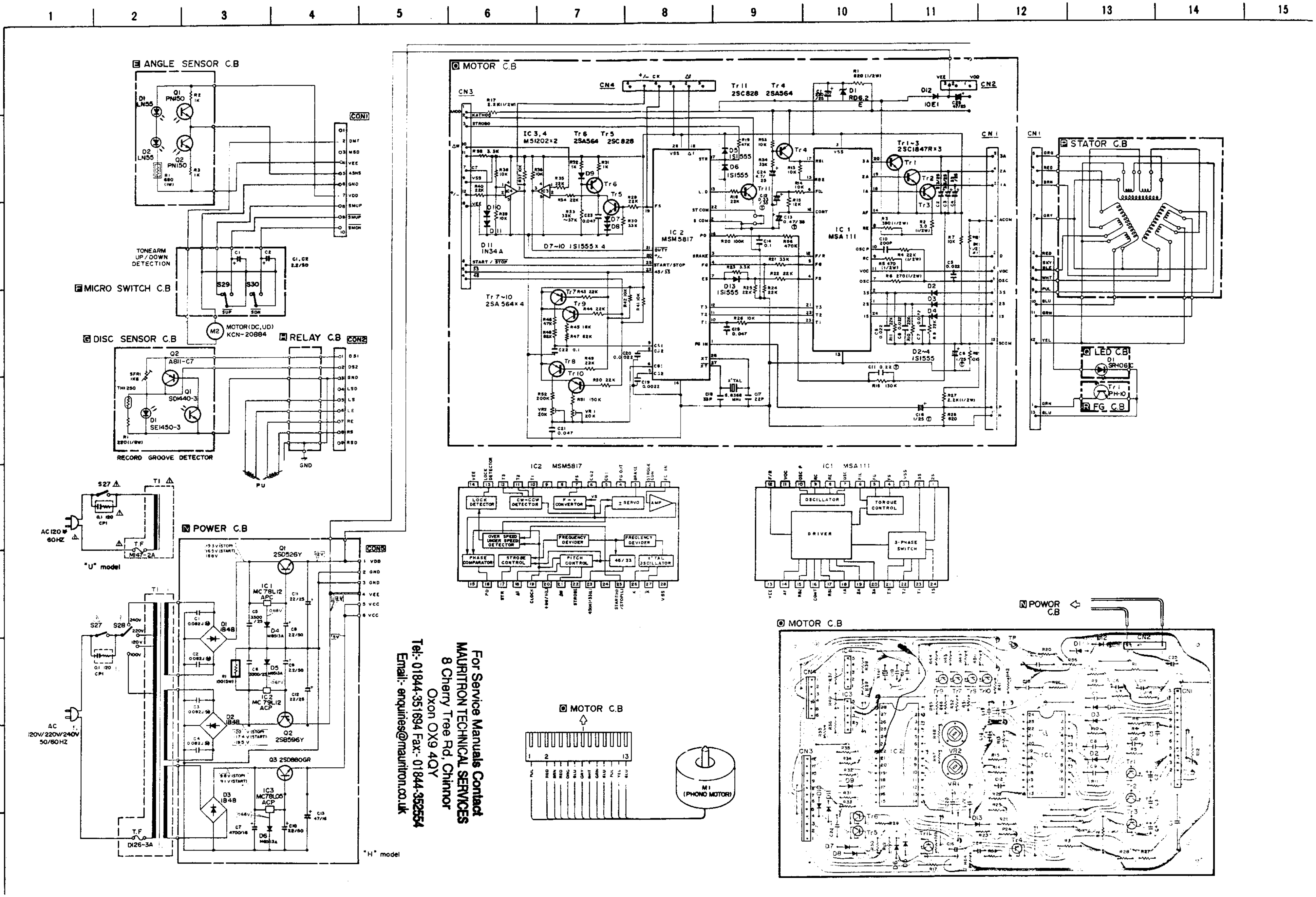
- This schematic diagram is subject to change without notice in the interests of improved performance.



Other voltage refer to reference voltages of parts.

Print Circuit Board Name	IC Symbol NO.	Voltage (IC PIN NO.)	GND (IC PIN NO.)
A LINEAR INTERFACE C.B	IC1,2,3 4,5,6,7 8,10,11,12	⑭ (VCC 5V)	⑦
	IC9,13	⑯ (VCC 5V)	⑧
	IC14	㊵ (VCC 5V)	⑳
	IC15~18	⑧ (VDD 12V) ④ (VEE -12V)	—
B PITCH CONTROL C.B	IC1,2	⑭ (VCC 5V)	⑦
	IC3,4,5	⑯ (VCC 5V)	⑧

SCHEMATIC DIAGRAM –2



ELECTRICAL MAIN PARTS LIST

≪LINEAR INTERFACE CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-A	84-195-651-11	Linear interface circuit board
IC1,6,10	87-027-345-01	IC, SN74LS26N
IC2	87-027-298-01	IC 4001
IC3,12	87-027-311-01	IC, MC14069UB
IC4	87-027-273-01	IC, SN7416N
IC5,7	87-027-306-01	IC, SN74LS74N
IC8	87-027-308-01	IC, MC14011B
IC9	87-027-303-01	IC, SN74LS42N
IC11	87-027-275-01	IC, SN7417N
IC13	87-027-276-01	IC, SN74LS367N
IC14	84-195-637-01	IC, CPU, MK3870
IC15	87-027-235-01	IC, NJM-4558D
IC16,17,18	87-027-183-01	IC, NJM-4558
Q1,5,8,9 16,17,22,23 24,25,26	89-309-456-01	Transistor, 2SC945L(P)
Q2,3,4,6 7,10,13,14 15,21	89-107-336-01	Transistor, 2SA733(P)
Q11,18	89-402-344-01	Transistor, 2SD234(Y)
Q12,19	89-204-344-01	Transistor, 2SB434(Y)
Q20	89-321-204-01	Transistor, 2SC2120(Y)
D1,4,5,6 9,10,14,18 19,21,22 24,25	87-027-097-01	Diode, 1S1555
D2,3,7,8 15,17	87-026-066-01	Diode, M8513A(O)
D11,23,26	88-052-188-11	Diode, IS188(FM)
D12	87-027-400-01	Zener diode, HZ5C3
D13	87-027-142-01	Zener diode, WZ-100
D16	87-027-219-01	Diode, MA150
D20	87-027-244-01	Zener diode, 05Z-8.2U
L1	82-346-611-31	Choke coil
RY1	87-045-128-01	Reed relay, UPM22005
RY2	87-045-125-01	Relay, FBR211CD012M
X1	87-030-057-01	Crystal
SFR1,2	87-021-366-01	Semi-fixed resistor, 10kΩ-B
PIN-12,14	87-032-904-01	Pin, 4P
PIN-10	87-032-915-01	Pin, 5P
PIN-5,15	87-032-906-01	Pin, 6P
PIN-13	87-032-907-01	Pin, 7P
PIN-7	87-032-917-01	Pin, 7P
PIN-11	87-032-919-01	Pin, 9P
PIN-2	87-032-909-01	Pin, 9P
PIN-1	87-032-910-01	Pin, 10P
PIN-8	87-032-920-01	Pin, 10P
PIN-9	87-032-941-01	Pin, 12P
	87-038-047-01	Heat sink
		<Resistors>
⚠R46,47	87-029-070-01	2.2Ω 1/4W Fuse resistor
⚠R49	87-029-077-01	10Ω 1/2W Fuse resistor
⚠R42	87-029-097-01	180Ω 1/4W Fuse resistor
R50	87-025-150-01	180Ω 1W Metal film resistor
R91	87-025-223-01	1kΩ 1W Nonflammable resistor
		<Capacitors>
C7	87-015-534-01	2.2µF 50V Electrolytic LL
C6	87-015-433-01	15µF 25V Electrolytic LL
C14,15	87-015-552-01	3.3µF 10V Tantalum
C17	87-015-401-01	10µF 10V Tantalum

≪PITCH CONTROL CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-B	84-195-663-11	Pitch control circuit board
IC1	87-027-273-01	IC, SN7416N
IC2	87-027-304-01	IC, SN74LSO1N
IC3	87-027-310-01	IC, MC14518B
IC4,5	87-027-333-01	IC, SN74LS47N
Q1,2,4,6,7 8,9	89-309-456-01	Transistor, 2SC945L(P)
Q3	89-107-336-01	Transistor, 2SA733(P)
Q5	89-109-504-01	Transistor, 2SA950(Y)
Q10	89-307-524-01	Transistor, 2SC752G(Y)
D1	82-497-638-01	Light emitting diode, SLC-26GG
D2	87-027-097-01	Diode, IS1555
D3,4,6,7	84-196-633-01	Light emitting diode, SP, MAN71A
D5	84-196-632-01	Light emitting diode, SP, MAN73A
RY1	87-045-126-01	Relay, FBR221D 012
CON-4	84-195-621-01	Connector ass'y, 6P
CON-7	84-195-623-01	Connector ass'y, 7P
CON-3	84-195-622-01	Connector ass'y, 12P
		<Resistor>
⚠ R8	87-029-089-01	4.7Ω ¼W Fuse resistor
		<Capacitor>
C2	87-015-401-01	10µF 10V Tantalum

≪TOP BOARD CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-C	84-195-658-01	Top board circuit board
IC1	87-027-306-01	IC, SN74LS74N
Q1,2	89-309-456-01	Transistor, 2SC945L(P)
Q3	89-107-336-01	Transistor, 2SA733(P)
D1,2,3,4,5,6	88-052-188-11	Diode, IS188(FM)
D7,8,9,10	87-026-102-01	Light emitting diode, SEL103R
CON-10	84-195-626-01	Connector ass'y, 5P
CON-11	84-195-628-01	Connector ass'y, 9P
		<Capacitor>
C1	87-015-401-01	10µF 10V Tantalum

≪VOLUME CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-D	84-195-664-11	Volume circuit board
VR1,2	84-196-634-01	Volume, 20kΩ-B (SPEED)
SFR1,2	87-021-557-01	Semi-fixed resistor, 10kΩ-B

≪ANGLE SENSOR CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-E	84-195-653-11	Angle sensor
Q1,2	84-195-639-01	Photo transistor PN 150
D1,2	84-195-638-01	Light emitting diode, LN-55
CON-1	84-195-631-01	Connector ass'y, 10P
		<Resistor>
R1	87-025-068-01	680Ω 1W Nonflammable resistor

≪MICRO SWITCH CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-F	84-195-657-11	Micro switch circuit board
S29,30	84-195-607-01	Micro switch, K3-443 (UP, DOWN)

≪DISC SENSOR CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-G	84-195-656-11	Disc sensor circuit board
Q1	84-195-641-01	Photo transistor, SD1440
Q2	84-195-643-01	Micro transistor, 2SA811C7
D1	84-195-640-01	Light emitting diode, SE1450
TH1	87-026-178-01	Thermistor,
SFR1	87-021-554-01	Semi-fixed resistor, 1kΩ-B
CON-2	84-195-630-01	Connector ass'y, 9P
		<Resistor>
R1	87-025-224-01	220Ω 1/8W Metal film resistor

≪RELAY CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-H	84-195-652-11	Relay circuit board

≪KEY MATRIX CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-I	84-195-659-01	Key matrix circuit board
D1,2,3,4,5,6,7, 8,9,10,11,12	87-026-102-01	Light emitting diode, SEL 103R
D13,14,15,16, 17,18,19,20, 21,22,23,24, 25,26,27,28, 29,30	88-052-188-11	Diode, IS188(FM)

≪LED DRIVE CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-J	84-195-660-11	LED drive circuit board
Q1,2	89-107-336-01	Transistor, 2SA733(P)
CON-8	84-195-632-01	Connector ass'y, 10P
	87-032-634-01	Pin, 4P
	87-032-635-01	Pin, 5P

≪REMOCON JACK CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-K	84-195-661-11	Remocon jack circuit doard
J4	84-195-617-01	Jack (REMOTE)
CON-9	84-195-633-01	Connector ass'y, 12P
	87-032-639-01	Pin, 9P

≪MASK-1 CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-L	84-195-654-11	Mask-1 circuit board
D1,2,3,4,5	87-026-158-01	Light emitting diode, SR106C

≪MASK-2 CIRCUIT BOARD SECTION≫

Symbol No.	Part No.	Description
PCB-M	84-195-655-11	Mask-2 circuit board
Q1,2,3,4,5	87-026-159-01	Photo transistor, PH101
D1,2	87-027-219-01	MA-150
CON-13	84-195-629-01	Connector ass'y, 7P

≪POWER CIRCUIT BOARD SECTION≫

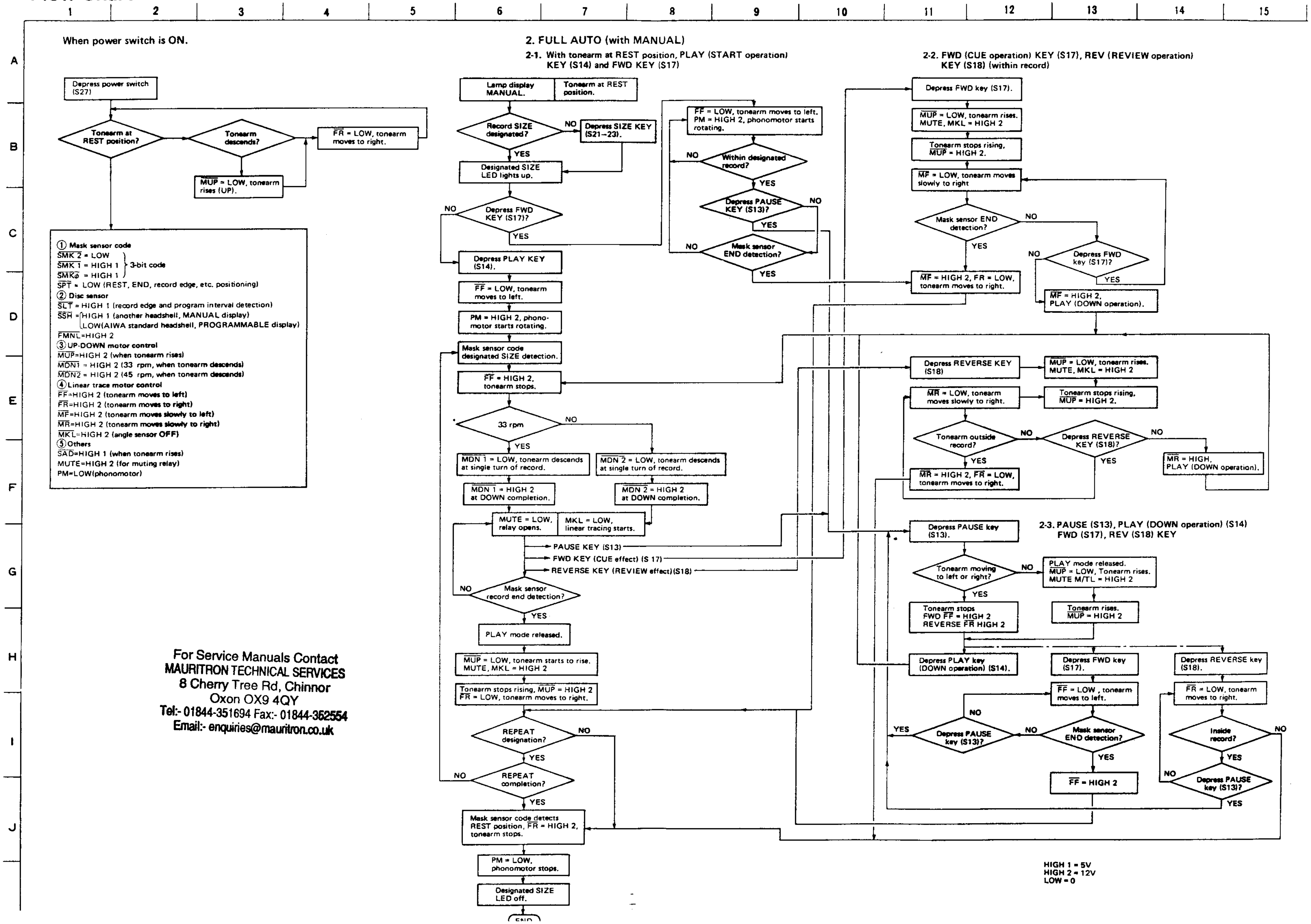
Symbol No.	Part No.	Description
⚠PCB-N	84-195-662-11	Power circuit board
IC1	84-195-644-01	IC, MC78L12ACP
IC2	84-195-645-01	IC,MC79L12ACP
IC3	84-195-646-01	IC, MC78L05ACP
Q1	89-405-264-01	Transistor, 2SD526(Y)
Q2	89-205-964-01	Transistor, 2SB596(Y)
Q3	87-026-179-01	Transistor, 2SD880(GR)
D1,2,3	87-027-163-01	Encapsulated diode, 1B4B1
D4,5,6	87-026-066-01	Diode, M8513A(O)
⚠CP1	87-028-035-01	Compound capacitor (H, U model only)
CON-5	84-195-624-01	Connector ass'y, 6P (H, U model only)
CON-5	84-195-665-01	Connector ass'y, 6P (E,K,G model only)
		<Resistor>
R1	87-025-226-01	150Ω 5W Nonflammable resistor
		<Capacitor>
⚠C14,15	84-190-622-01	0.1µF 250W Line capacitor (E,K,G model only)

≪MISCELLANEOUS≫

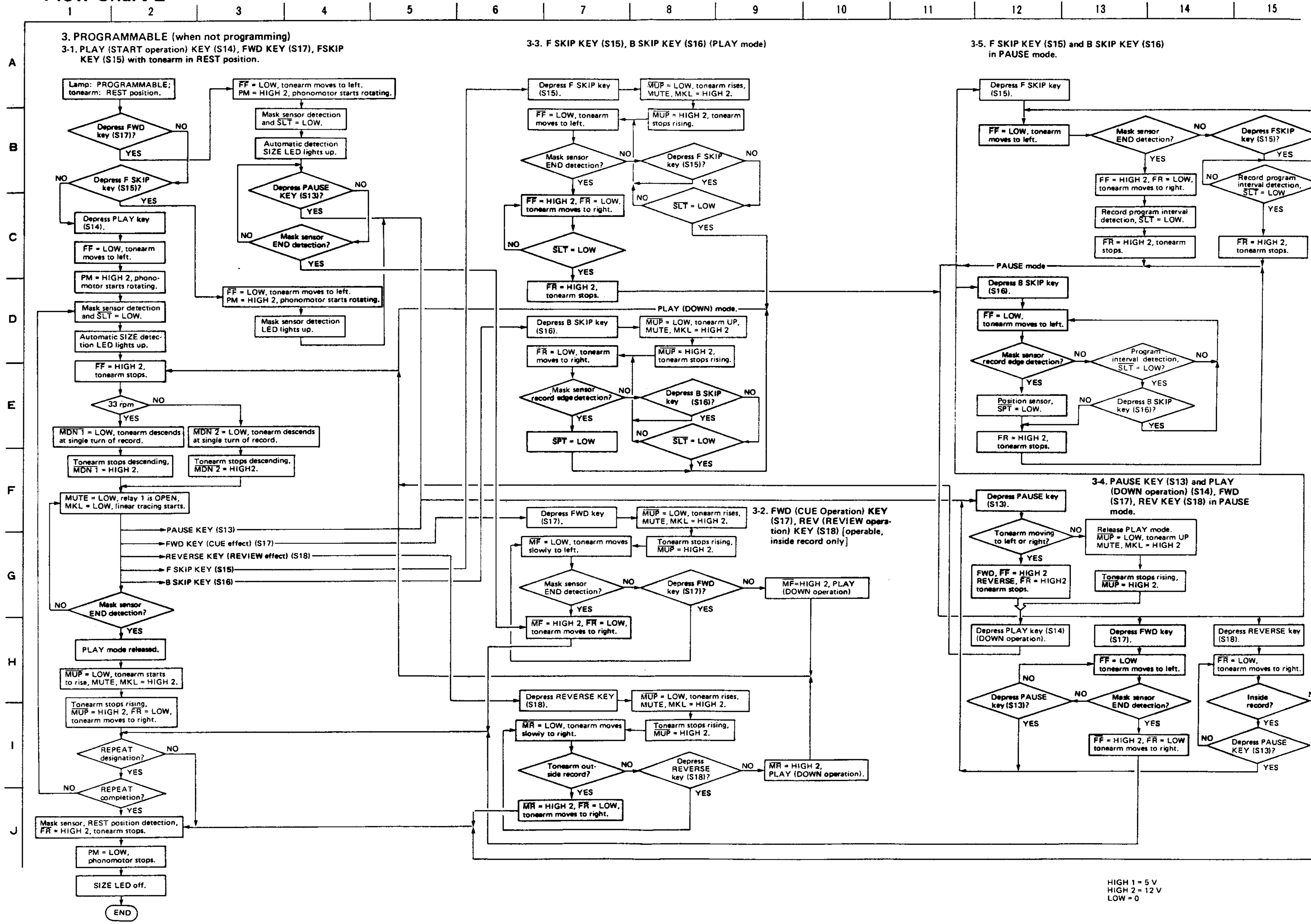
Symbol No.	Part No.	Description
⚠T1	84-195-608-01	Power transformer (H,E,K,G model only)
⚠T1	84-195-602-01	Power transformer (U model only)
PL1,2	84-195-634-01	Pilot lamp ass'y 15V-50mA (PROGRAM, MANUAL)
PCB-O,M1	84-196-631-01	Motor ass'y DC-EG PLL
M2	84-195-605-01	Motor, DC-UD
M3	84-195-606-01	Motor, DC-LM
J1,2,3	84-195-612-01	Jack plate ass'y (OUTPUT, REC, SYNC)
⚠S28	84-195-603-01	Rotary switch (VOLTAGE SELECTOR) (H,E,K,G model only)
⚠S27	87-031-400-01	Push switch (POWER) (H model only)
⚠S27	87-031-408-01	Push switch (POWER) (E,K,G model only)
⚠S27	87-031-480-01	Push switch (POWER) (U model only)
⚠	87-034-826-01	AC power cord (H model only)
⚠	87-034-877-01	AC power cord (E model only)
⚠	87-034-872-01	AC power cord (K model only)
⚠	87-034-878-01	AC power cord (G model only)
⚠	87-034-874-01	AC power cord (U model only)
⚠F1,2	87-035-060-01	Fuse, "T" 800 mA (E model only)
⚠F1,2	87-035-221-01	Fuse, "T" 800 mA (K,G model only)
	87-098-015-01	Fuse label, "T" 800 mA (E,K,G model only)
⚠F3	87-035-143-01	Fuse, 500 mA (F) (E model only)
⚠F3	87-035-231-01	Fuse, 500 mA (F) (K,G model only)
	87-098-037-01	Fuse label, 500mA (F) (E,K,G model onl
⚠F4,5	87-035-107-01	Fuse, "T" 315 mA (E model only)
⚠F4,5	87-035-217-01	Fuse, "T" 315 mA (K,G model only)
	87-098-011-01	Fuse label, "T" 315 mA (E,K,G model only)
⚠	87-033-085-01	Fuse holder, 3P (E,K,G model only)
CON-14	84-195-625-01	Connector ass'y, 4P
CON-15	84-195-627-01	Connector ass'y, 6P

⚠ This symbol is given to important parts which serve to maintain the safety of the product, and which are made to conform to special safety specifications. Therefore, when replacing a component with this symbol, make absolutely sure that you use a designated part.

Flow Chart 1

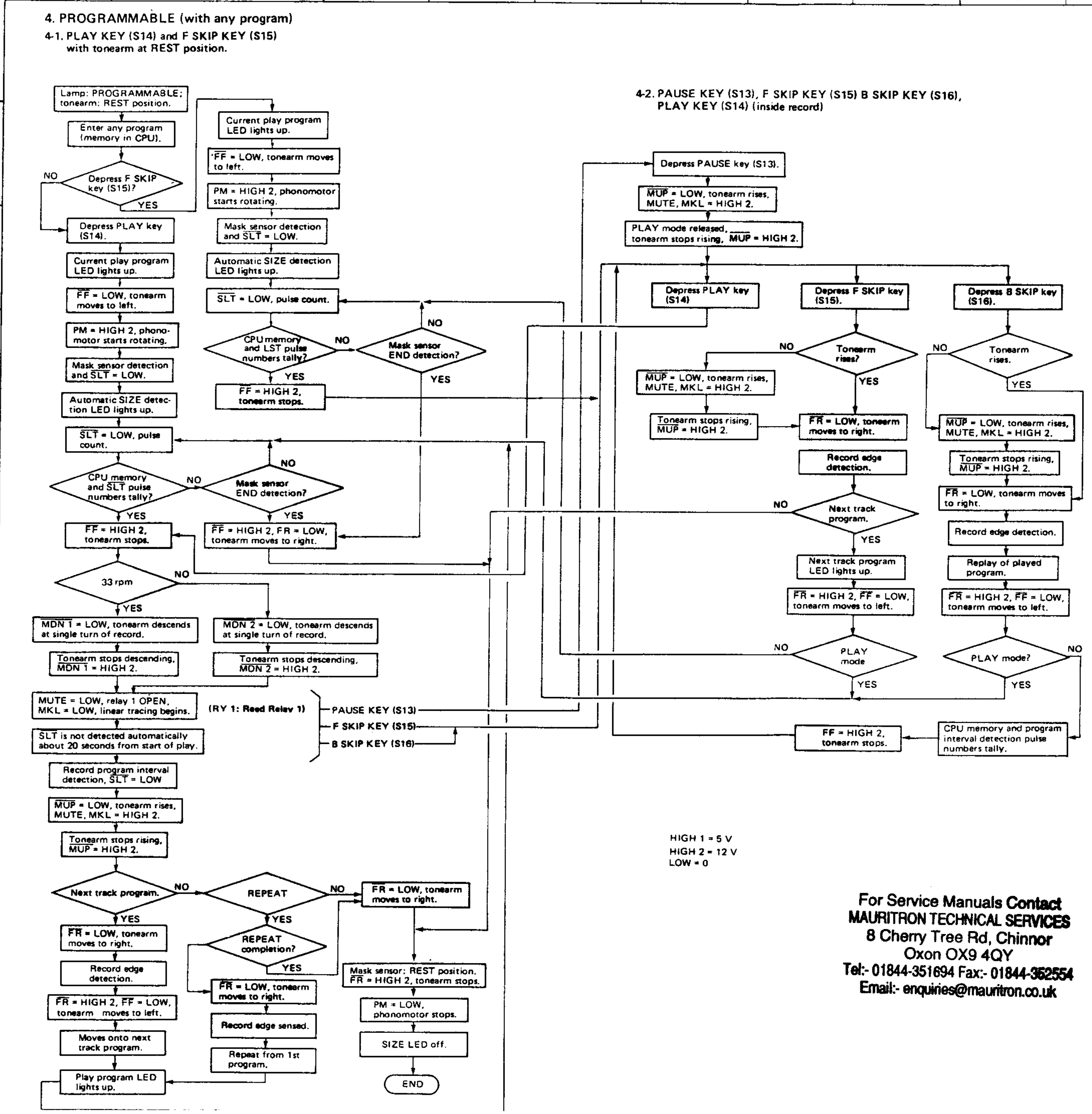

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
A B C D E F G H I J
When power switch is ON.
Depress power switch (S27)
Tonearm at REST position?
Tonearm descends?
FR = LOW, tonearm moves to right.
MUP = LOW, tonearm rises (UP).
① Mask sensor code
SMK 2 = LOW
SMK 1 = HIGH 1
SMKφ = HIGH 1
3-bit code
SPT = LOW (REST, END, record edge, etc. positioning)
② Disc sensor
SLT = HIGH 1 (record edge and program interval detection)
SSH = HIGH 1 (another headshell, MANUAL display)
LOW (AIWA standard headshell, PROGRAMMABLE display)
FMNL = HIGH 2
③ UP-DOWN motor control
MUP = HIGH 2 (when tonearm rises)
MDN1 = HIGH 2 (33 rpm, when tonearm descends)
MDN2 = HIGH 2 (45 rpm, when tonearm descends)
④ Linear trace motor control
FF = HIGH 2 (tonearm moves to left)
FR = HIGH 2 (tonearm moves to right)
MF = HIGH 2 (tonearm moves slowly to left)
MR = HIGH 2 (tonearm moves slowly to right)
MKL = HIGH 2 (angle sensor OFF)
⑤ Others
SAD = HIGH 1 (when tonearm rises)
MUTE = HIGH 2 (for muting relay)
PM = LOW (phonomotor)
2. FULL AUTO (with MANUAL)
2-1. With tonearm at REST position, PLAY (START operation) KEY (S14) and FWD KEY (S17)
Lamp display MANUAL.
Tonearm at REST position.
Record SIZE designated?
Depress SIZE KEY (S21-23).
Designated SIZE LED lights up.
Depress FWD KEY (S17)?
Depress PLAY KEY (S14).
FF = LOW, tonearm moves to left.
PM = HIGH 2, phonomotor starts rotating.
Mask sensor code designated SIZE detection.
FF = HIGH 2, tonearm stops.
33 rpm
MDN 1 = LOW, tonearm descends at single turn of record.
MDN 2 = LOW, tonearm descends at single turn of record.
MDN 1 = HIGH 2 at DOWN completion.
MDN 2 = HIGH 2 at DOWN completion.
MUTE = LOW, relay opens.
MKL = LOW, linear tracing starts.
PAUSE KEY (S13)
FWD KEY (CUE effect) (S 17)
REVERSE KEY (REVIEW effect) (S18)
Mask sensor record end detection?
PLAY mode released.
MUP = LOW, tonearm starts to rise. MUTE, MKL = HIGH 2
Tonearm stops rising, MUP = HIGH 2 FR = LOW, tonearm moves to right.
REPEAT designation?
REPEAT completion?
Mask sensor code detects REST position, FR = HIGH 2, tonearm stops.
PM = LOW, phonomotor stops.
Designated SIZE LED off.
END
FF = LOW, tonearm moves to left. PM = HIGH 2, phonomotor starts rotating.
Within designated record?
Depress PAUSE KEY (S13)?
Mask sensor END detection?
2-2. FWD (CUE operation) KEY (S17), REV (REVIEW operation) KEY (S18) (within record)
Depress FWD key (S17).
MUP = LOW, tonearm rises. MUTE, MKL = HIGH 2
Tonearm stops rising, MUP = HIGH 2.
MF = LOW, tonearm moves slowly to right
Mask sensor END detection?
Depress FWD key (S17)?
MF = HIGH 2, FR = LOW, tonearm moves to right.
MF = HIGH 2, PLAY (DOWN operation).
Depress REVERSE KEY (S18)
MUP = LOW, tonearm rises. MUTE, MKL = HIGH 2
MR = LOW, tonearm moves slowly to right.
Tonearm stops rising, MUP = HIGH 2.
Tonearm outside record?
Depress REVERSE KEY (S18)?
MR = HIGH, PLAY (DOWN operation).
MR = HIGH 2, FR = LOW, tonearm moves to right.
2-3. PAUSE (S13), PLAY (DOWN operation) (S14) FWD (S17), REV (S18) KEY
Depress PAUSE key (S13).
Tonearm moving to left or right?
PLAY mode released. MUP = LOW, Tonearm rises. MUTE M/TL = HIGH 2
Tonearm stops FWD FF = HIGH 2 REVERSE FR HIGH 2
Tonearm rises. MUP = HIGH 2
Depress PLAY key (DOWN operation) (S14).
Depress FWD key (S17).
Depress REVERSE key (S18).
FF = LOW, tonearm moves to left.
FR = LOW, tonearm moves to right.
Depress PAUSE key (S13)?
Mask sensor END detection?
Inside record?
Depress PAUSE key (S13)?
FF = HIGH 2
YES
NO
HIGH 1 = 5V
HIGH 2 = 12V
LOW = 0

Flow Chart 2

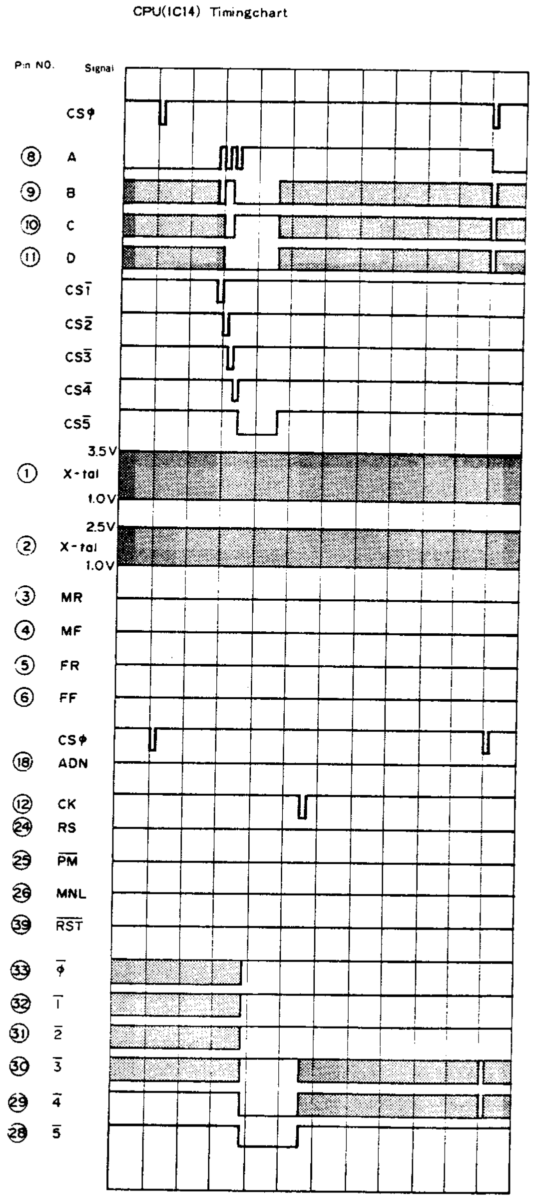


HIGH 1 = 5 V
HIGH 2 = 12 V
LOW = 0

Flow Chart 3



HIGH 1 = 5 V
HIGH 2 = 12 V
LOW = 0



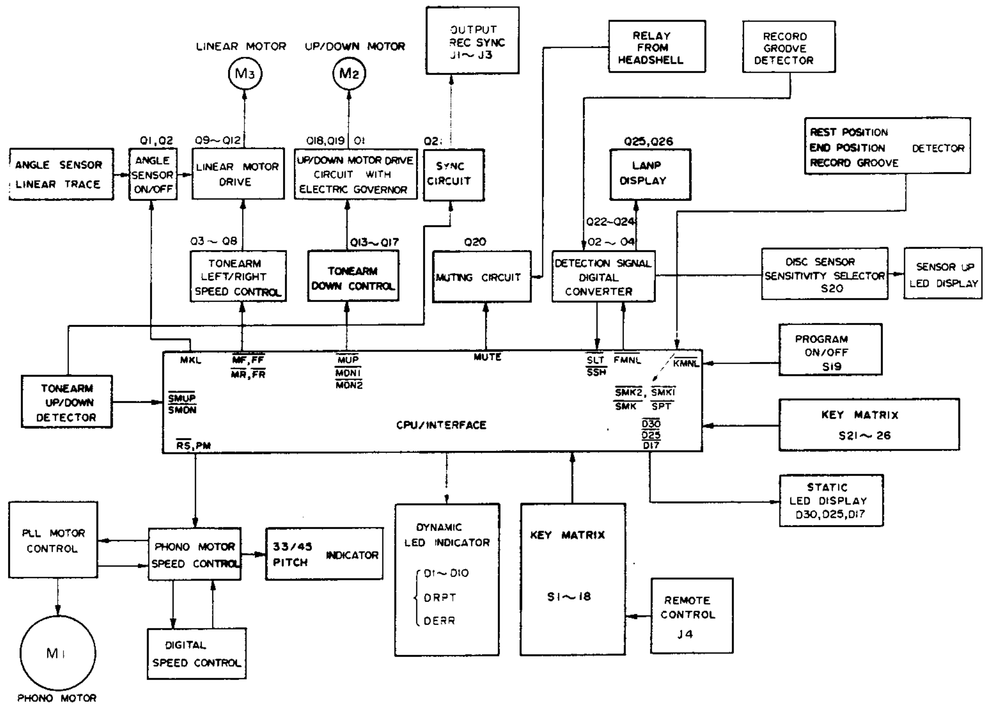
Timing of CPU pin signals with CSφ signal taken as reference. (shaded) indicates state where HIGH/LOW level is not determined.

REFERENCE VOLTAGES OF PARTS

Circuit board	Measurement position	Reference voltage and measurement state				
Ⓐ Linear interface circuit board	①	0.6~0.7V (Rest position, UPmode)				
	②	0 V (Rest position, UPmode) (PAUSE, UPmodes)				
	③	5.6V (Rest position, UPmode) 0.26V (Rest position, Down mode)				
		Rest position UP mode	PLAY	REVERS	CUE	REVIEW
	④	0.62V	11.8V	−11.8V	4.6V	−4.4V
	⑤	11.8V	11.8V	0	11.8V	11.8V
	⑥	11.8V	0 V	11.8V	11.8V	11.8V
	⑦	11.8V	11.8V	11.8V	11.8V	0 V
	⑧	11.8V	11.8V	11.8V	0 V	11.8V
	⑨	0 V	9.6V	− 9.9V	3.3V	−3.3V
	⑩	33rpm 11.8V (Rest position, UP, Down modes) 0 V (during state in which tonearm is about to descend, during release operation)				
	⑪	45rpm 11.8V (Rest position, UP, Down modes) 0 V (during state in which tonearm is about to descend, during release operation)				
	⑫	11.8V (Rest position, UP, Down modes) 0 V (during state in which tonearm is about to descend, during release operation)				
	⑬	33rpm 5.8V 45rpm 7.0V (during state in which tonearm is about to descend, during release operation) 0 V (Rest position, UP, Down modes)				
	⑭	33rpm 0.55V 45rpm 0.68V (during state in which tonearm is about to descend, during release operation) 0 V (Rest position, UP, Down modes)				
			UP operation	DOWN operation		
	⑮	33rpm 45rpm	negative voltage	0.82V 0.92V		
	⑯	33rpm 45rpm	negative voltage	1.15V 1.35V		
	⑰	1.3V (with disc sensor) 1.2V (without disc sensor)				
	⑱	4.2V (3~7Vrange) (with disc sensor) 11.8V (without disc sensor)				
	⑲	8.2V (7.5~9.5Vrange) (with disc sensor) 11.8V (without disc sensor)				
	⑳	10.4V (PROGRAM ON) −10.6V (PROGRAM OFF)				
	㉑	0.12V (PROGRAM ON) 11.8V (PROGRAM OFF)				
	㉒	11.8V (PROGRAM ON) 0.12V (PROGRAM OFF)				
	㉓	5.4V				

Circuit board	Measurement position	Reference voltage and measurement state
Ⓑ Pitch Control circuit board	㉔	−11.2V (33rpm±0%, 45rpm±0%) − 7.8V (+display with 33/45rpm)
	㉕	−11.2V (33rpm±0%) − 5.0V (45rpm±0%)
	㉖	−11.2V (with STOP) − 5.0V (with START)
	㉗	−11.2V (33rpm±0%, 45rpm±0%)
	㉘	−11.2V (33rpm±0%, 45rpm±0%) − 7.2V (33rpm±6.6%) − 7.9V (45rpm±6.6%)
	㉙	− 8.2V (33rpm±0%, 45rpm±0%) −11.2V (−display with 33/45rpm) − 5.0V (+display with 33/45rpm)
	㉚	−11.2V (33rpm±0%, 45rpm±0%) − 7.8V (+display with 33/45rpm)
	㉛	0.26V (33rpm±0%) 3.7V (45rpm±0%)
	㉜	0.13V (with STOP) 11.8V (with START)

BLOCK DIAGRAM

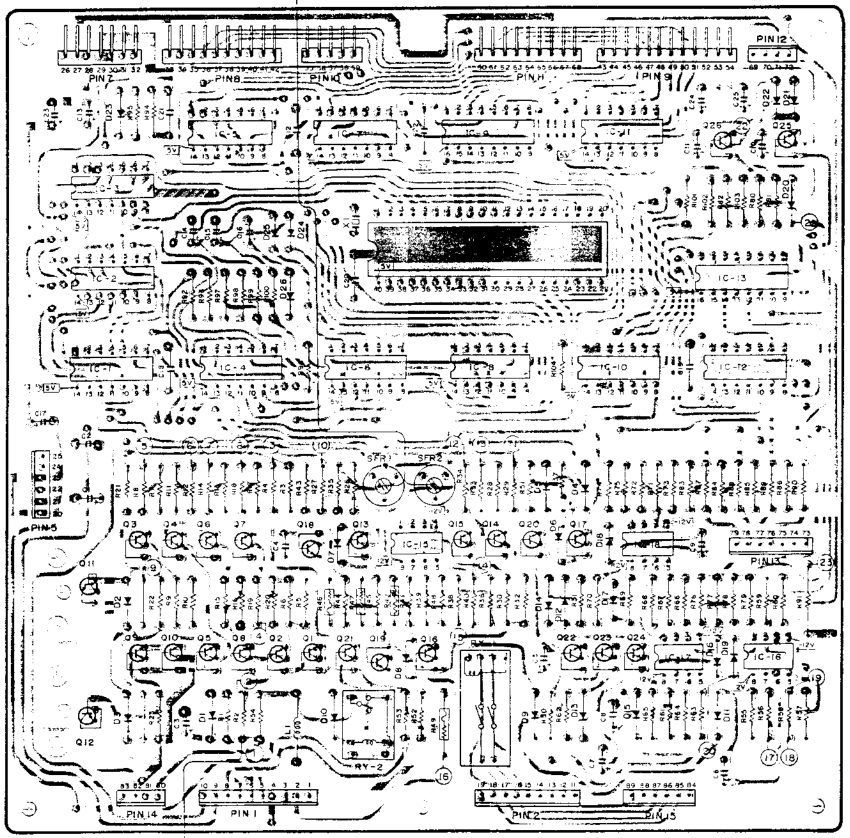


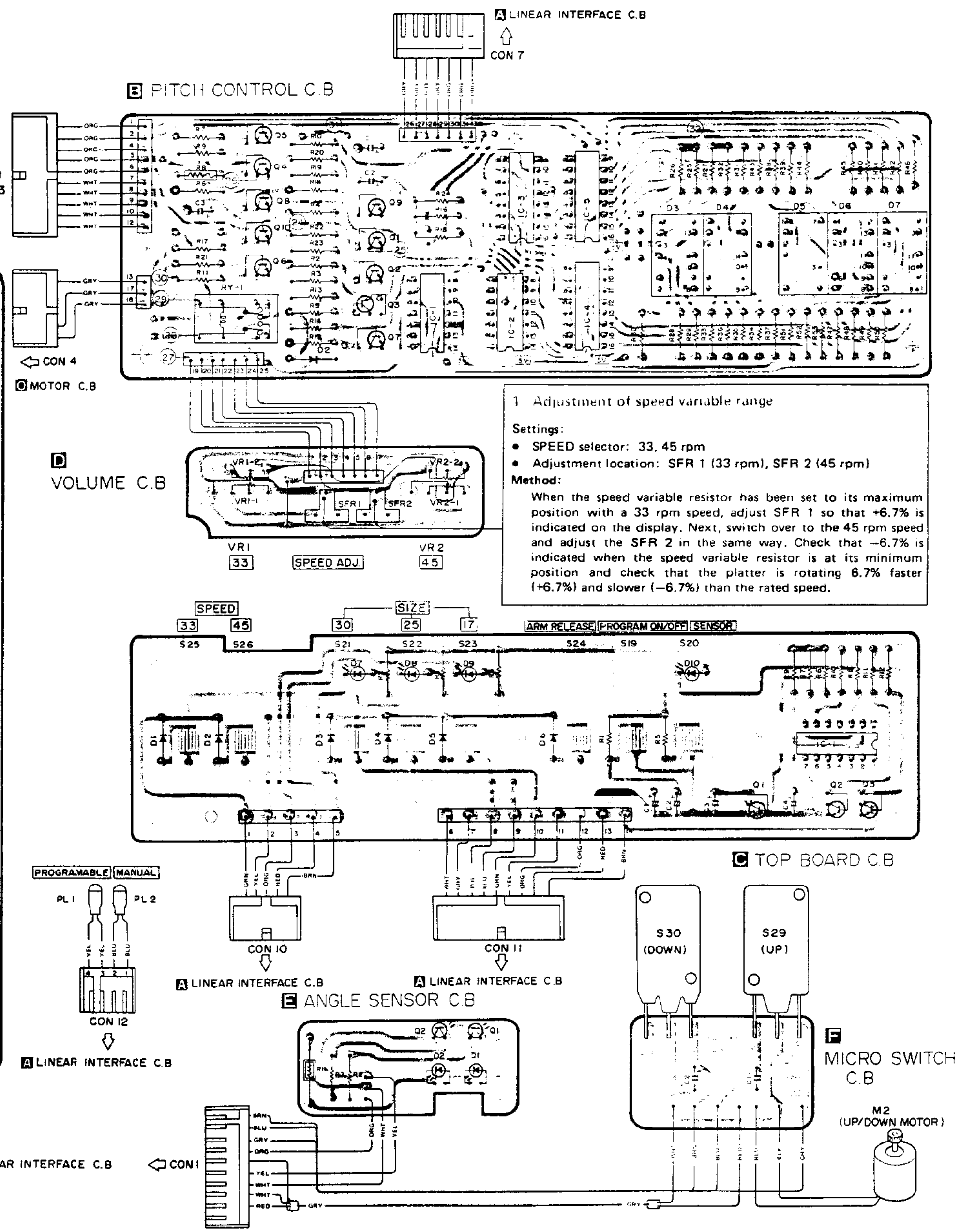
WIRING–1

2 Adjustment of tonearm UP/DOWN speed

Settings:
- SPEED selector: 33, 45 rpm
- SIZE selector: 30
- Tracking force and stylus tip height: 1.25g, 4.5 mm
- Test record: NEC ES-1008
- Adjustment location: SFR 1 (33 rpm) SFR 2 (45 rpm)

Method.
First, mount the cartridge and weight onto the tonearm, and adjust the tracking force and stylus tip height. Place the test record on the platter, set the turntable to the MANUAL mode (S19 PROGRAM key OFF) and set the speed display to 33 rpm ±0%. Now operate the tonearm so that it is brought to the edge of the record and depress the PAUSE key (S13). Then depress the PLAY key (S14) and adjust SFR 1 so that the stylus tip is made to touch the record in 1.8 seconds. In the same way, set the speed display to 45 rpm ±0% and adjust in 1.3 seconds.





1 Adjustment of speed variable range

Settings:
- SPEED selector: 33, 45 rpm
- Adjustment location: SFR 1 (33 rpm), SFR 2 (45 rpm)

Method:
When the speed variable resistor has been set to its maximum position with a 33 rpm speed, adjust SFR 1 so that +6.7% is indicated on the display. Next, switch over to the 45 rpm speed and adjust the SFR 2 in the same way. Check that −6.7% is indicated when the speed variable resistor is at its minimum position and check that the platter is rotating 6.7% faster (+6.7%) and slower (−6.7%) than the rated speed.

TP 1 | Angle sensor test point

CMOS IC handling precautions

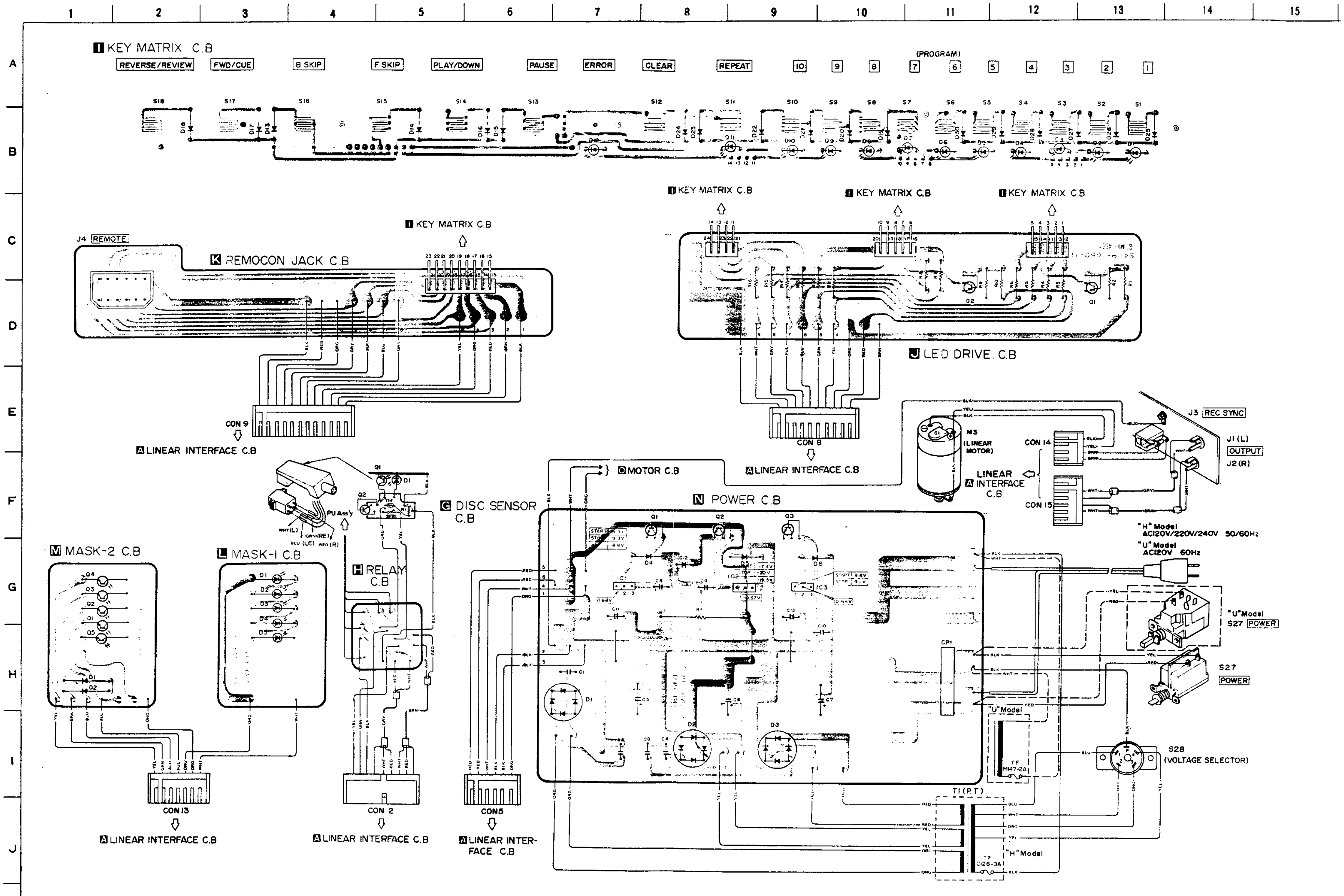
(1) The CMOS IC's construction makes this part susceptible to damage by static electricity and so take sufficient care.

(2) Do not perform a continuity test with a tester, etc. Refer to the circuit voltages of each part.

Other voltage refer to reference voltages of parts.

NOTES (1) B(+) Pattern B(−) Pattern Component side pattern Others pattern

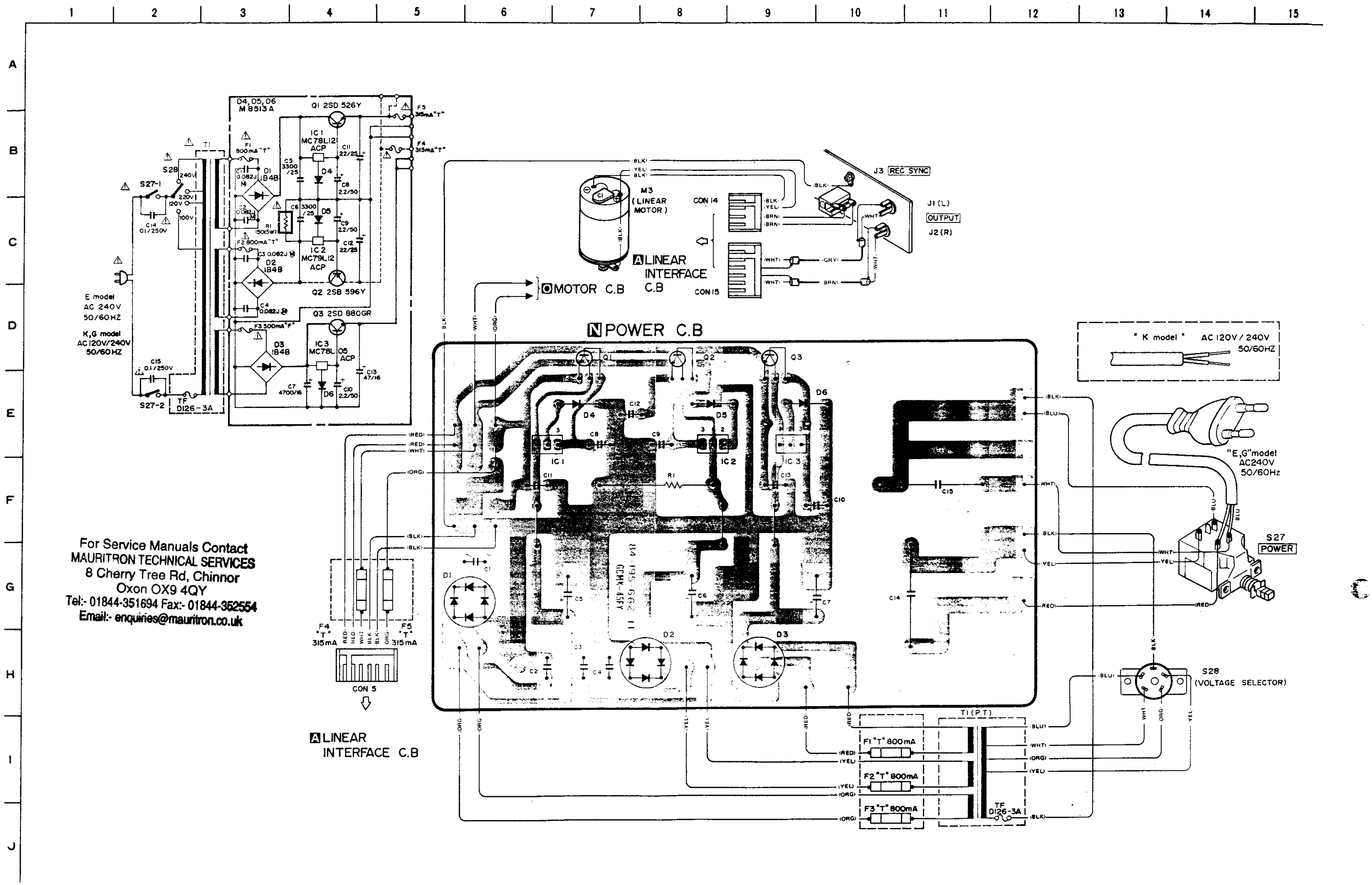
WIRING–2



NOTES (1) B(+) Pattern B(–) Pattern Component side pattern Others pattern

(2) The voltage is the reference value measured with a tester (20 K ohms/V DC) when there are no signals.

WIRING–3



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+B, –B pattern refer to "H model"