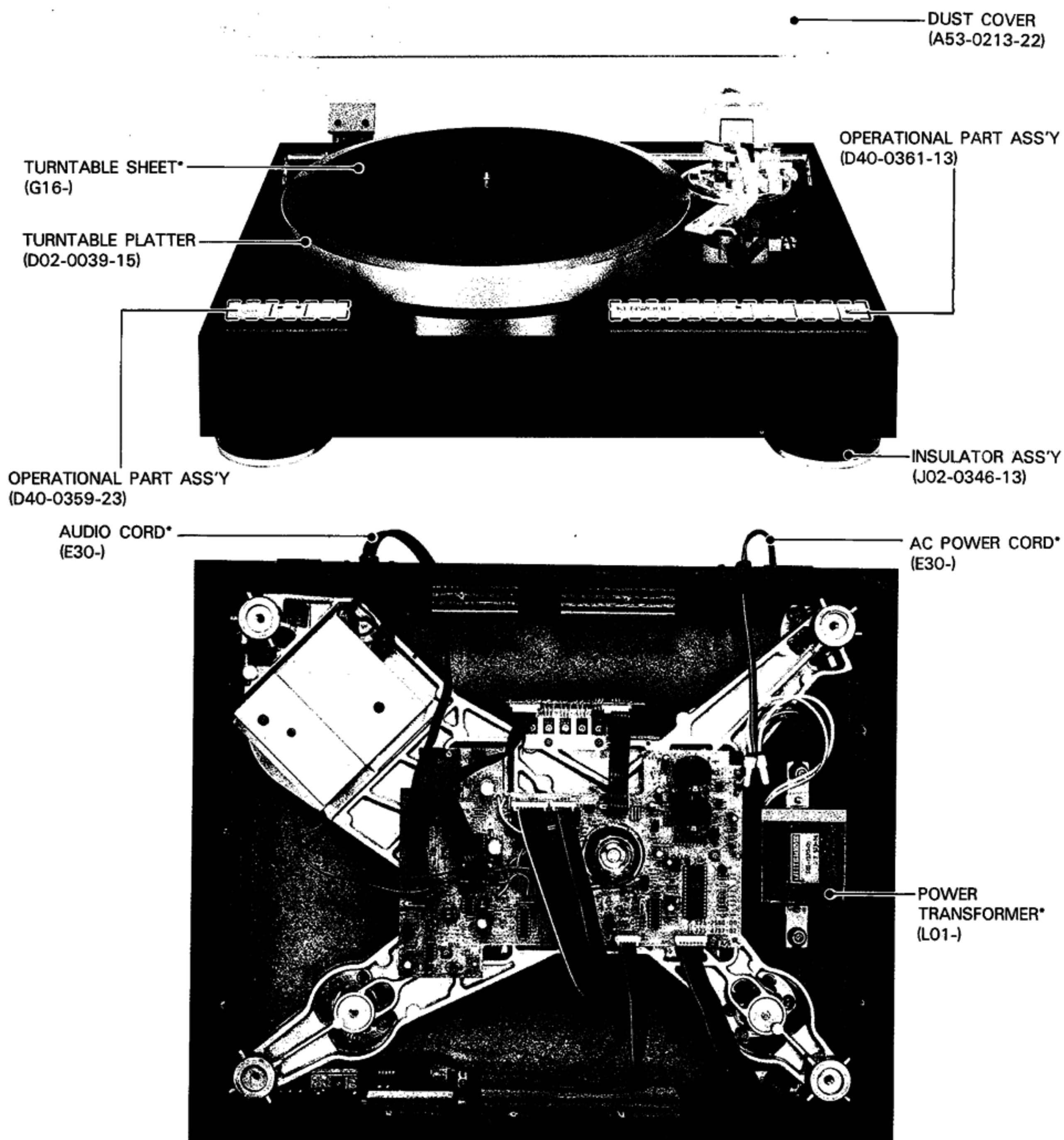


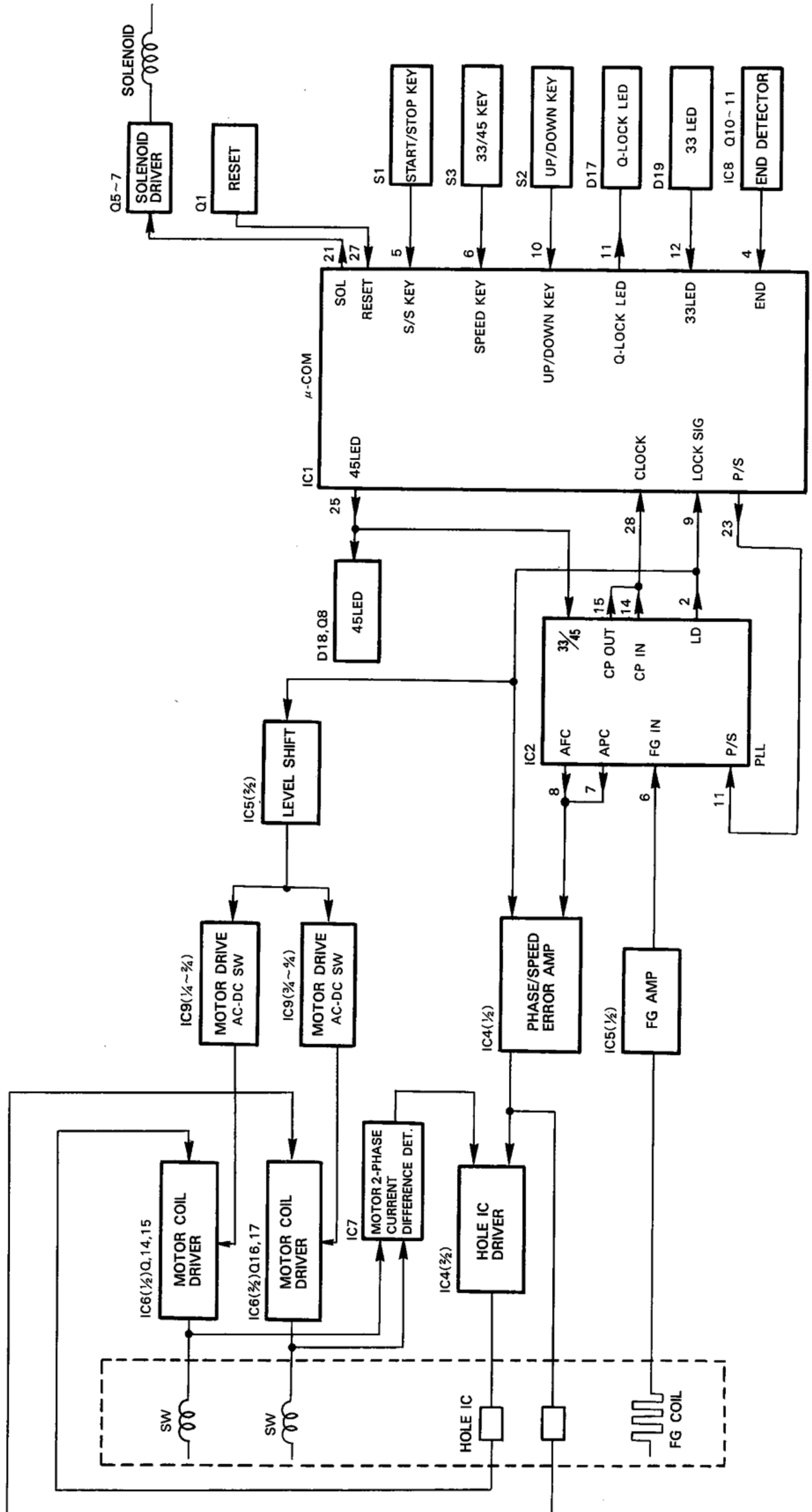
KENWOOD

KD-990

QUARTZ PLL DIRECT DRIVE AUTO LIFT UP TURNTABLE



BLOCK DIAGRAM



CIRCUIT DESCRIPTION

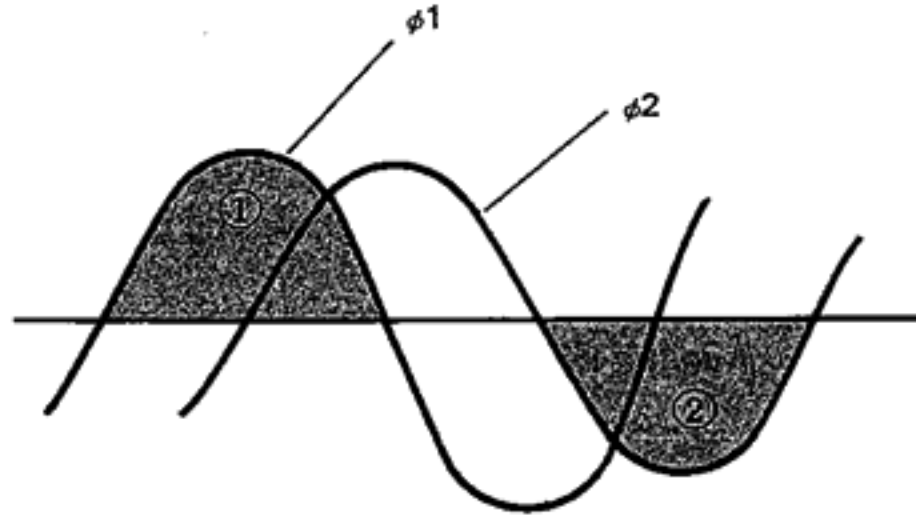
1. Functions of Semiconductors

ELECTRIC UNIT (X25-2580-00)

Element	Function	Operation, Condition & Interchangeability
IC1	Microprocessor	Refer to the description of μ PD7520.
IC2	PLL controller	For motor speed and phase control. Refer to the description of TC9142P.
IC3	Power ON/OFF	Each time Power SW S4 is pressed, the output from pin 2 switches between H and L, which controls Q5 to turn power ON and OFF.
IC4	Error amplifier, Hole IC driver	Drives the Hole ICs of the motor, based on the speed and phase error signals from IC2.
IC5	FG amplifier Level shifter	Amplifies the motor's FG output. Shifts the level of the IC2's Lock signal from (0 — 8 V) to (+10 — -10 V), and turns IC9 (analog SW) and Q9 ON and OFF.
IC6	Motor driver	Amplifies the motor's Hall IC output to drive the motor coil. Q14 to Q17 are output current boosters.
IC7	Difference detector for 2-phase motor coil current	Detects the difference values of the 2-phase current from the motor coil, and sends the signal to IC4 in order to eliminate the difference.
IC8	End detector	Amplifies the photo-reflector output, detects the tonearm position, differentiate the position detection output for conversion into speed, and compares it in order to detect the guide groove.
IC9	Analog SW, motor driver AC/DC coupling switch	The SW is OFF and the coupling is AC when the motor is quartz-locked, and the coupling is DC in other cases.
Q1	+8 V power supply	Increases the current of Zener diode D8.
Q2	Microprocessor reset	
Q3	Power ON/OFF	Q3 turns ON/OFF depending on the IC3's flip-flop output, controls the voltage at the base of Q1, and turns power ON and OFF.
Q4	IC3 reset	Detects the Zener current from Zener diode D9, and resets IC3. It is initialized so that the Power SW is OFF when the power cord is connected.
Q5	Q6 driver	Turned ON by microprocessor IC1 in solenoid drive operation (with microprocessor output "L").
Q6	Solenoid driver	ON when SOL is ON.
Q7	Solenoid driver	Turns ON for approx. 8 seconds from the solenoid kick operation.
Q8	LED driver	When the speed is set for 45 rpm, Q8 turns ON by "H" output from the microprocessor.
Q9	IC7 output OFF switch	Inhibits the operation of the 2-phase current difference detector circuit while the motor is not quartz-locked.
Q10, 11	End detector	Controls the photo-reflector output used for end detection.
Q12, 13	± 10 V power supply	Increases the current of Zener diodes D6 and D7.
Q14~17	Motor driver	Drives the motor coil for IC6 output current boost.

2. Two-phase current difference detector circuit

The wow & flutter of a two-phase motor deteriorates when there is a difference between the current values of the two phases, $\phi 1$ and $\phi 2$. With the KP-990, this difference is eliminated by using a circuit which detects the difference between the two phase currents and adjusts the drive current of the Hole ICs.

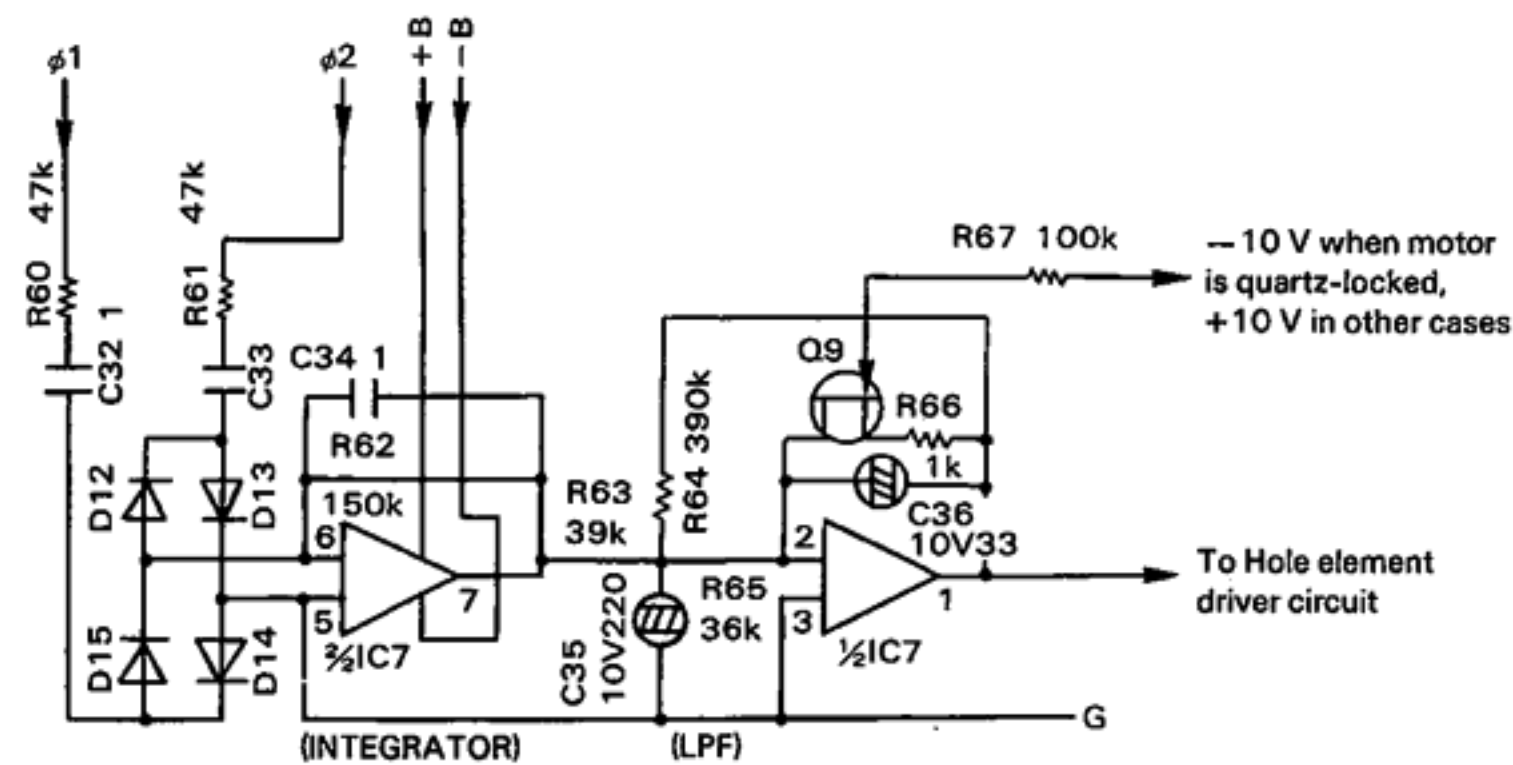


The positive side of $\phi 1$ and negative side of $\phi 2$ are input to the integrator, and the difference between $\phi 1$ and $\phi 2$ is output from it. (The difference between the ① and ② portions in the diagram on the left)

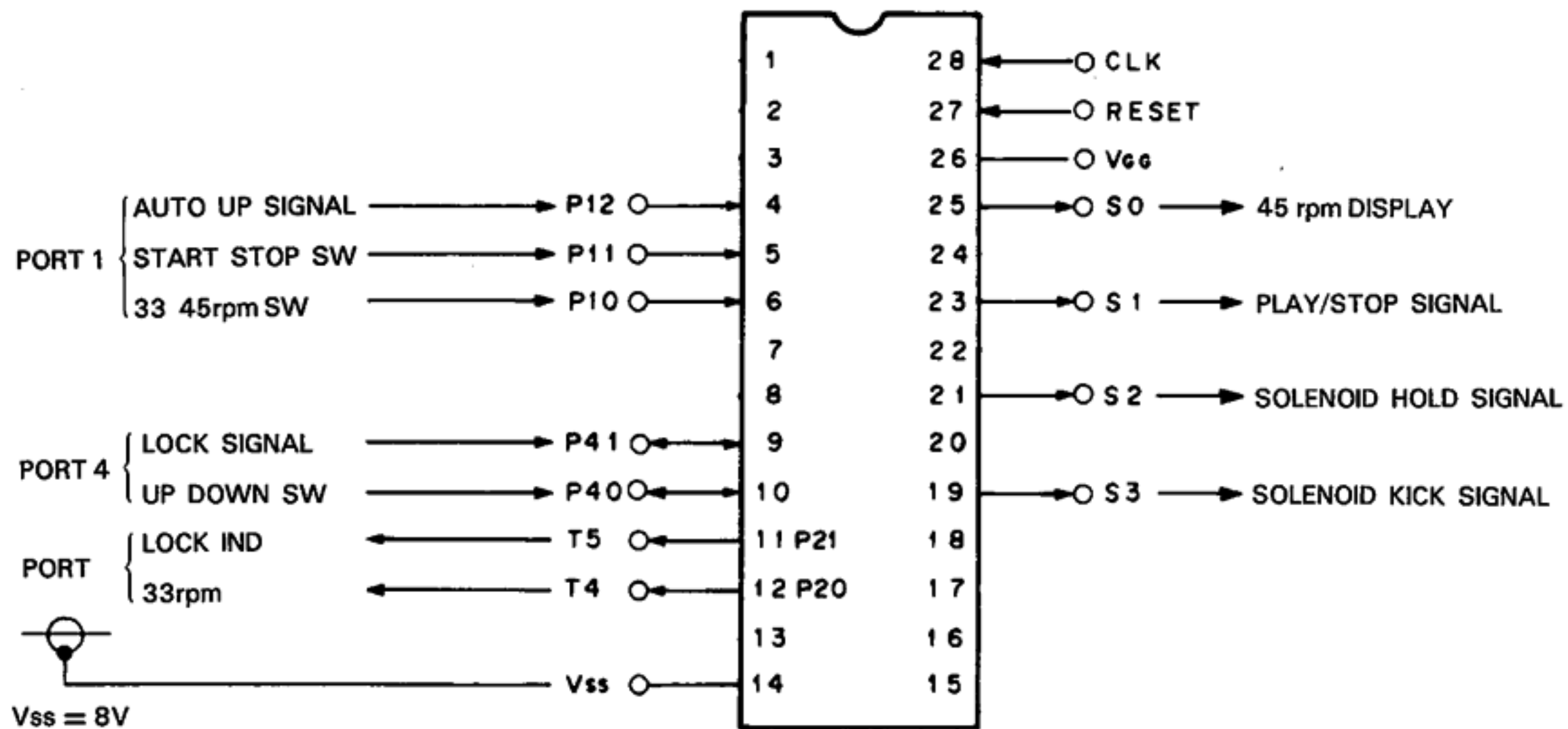
Then, the ripple incorporated in the output is eliminated by the low-pass filter, and its output is recognized as the difference between the two phase currents.

The Hole element drive circuit uses this signal to control the currents of the two Hole ICs so that $\phi 1$ and $\phi 2$ current values are equal.

When the motor is not quartz-locked, Q9 is ON, the output is fixed at about 0 V, and this circuit does not operate.

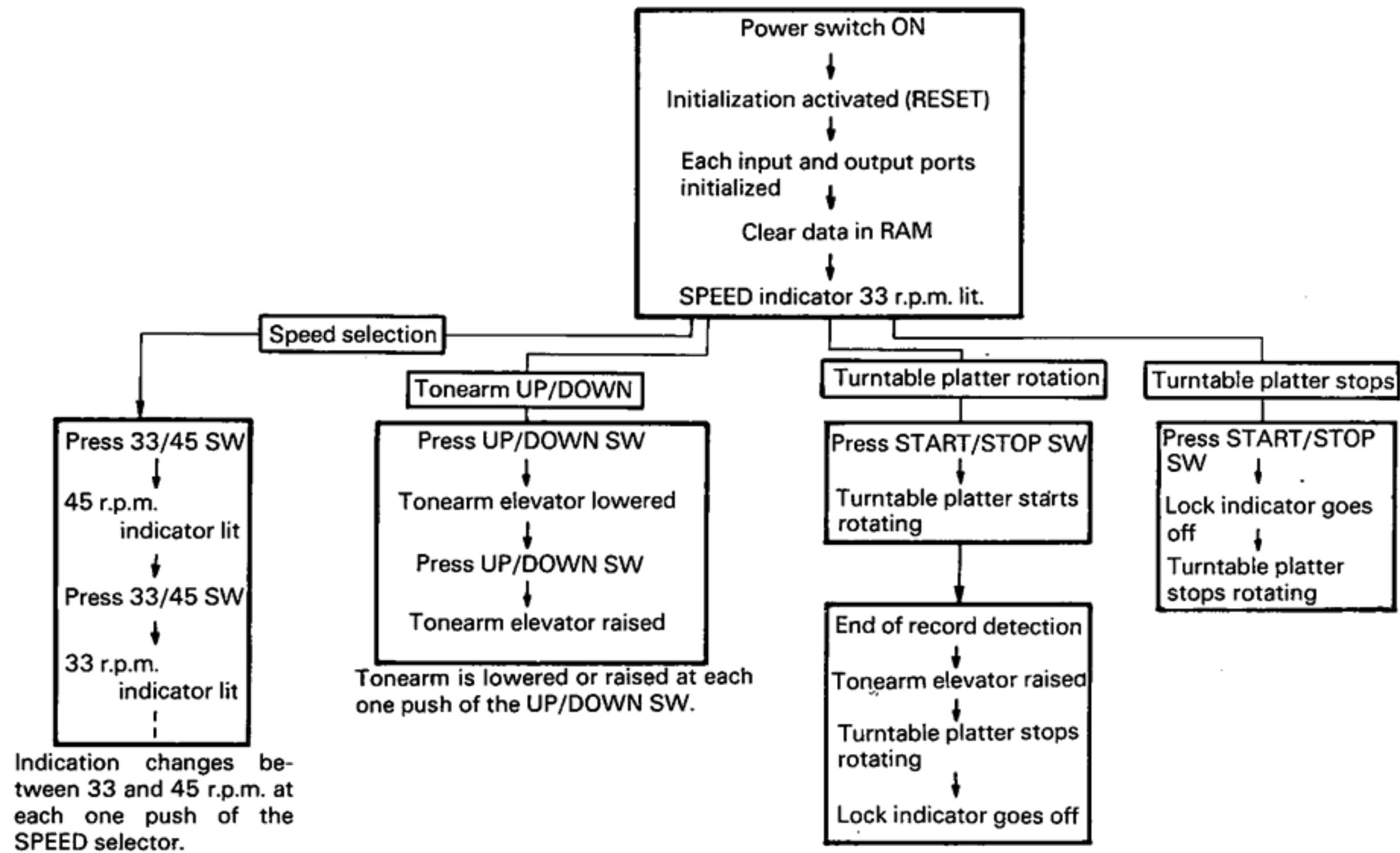


3. Microprocessor Operation Description



● Operation specifications of μ PD7520

The following diagram shows the operations of each section which occur at each operating point after power has been turned on.



Condition of each μ PD7520C-028 ports

- (1) Initialization (Power ON)
- (2) Speed selection (33/45 rpm)
- (3) Turntable platter starts rotating (START)
- (4) Tonearm auto up
- (5) Turntable platter stops rotating (STOP)

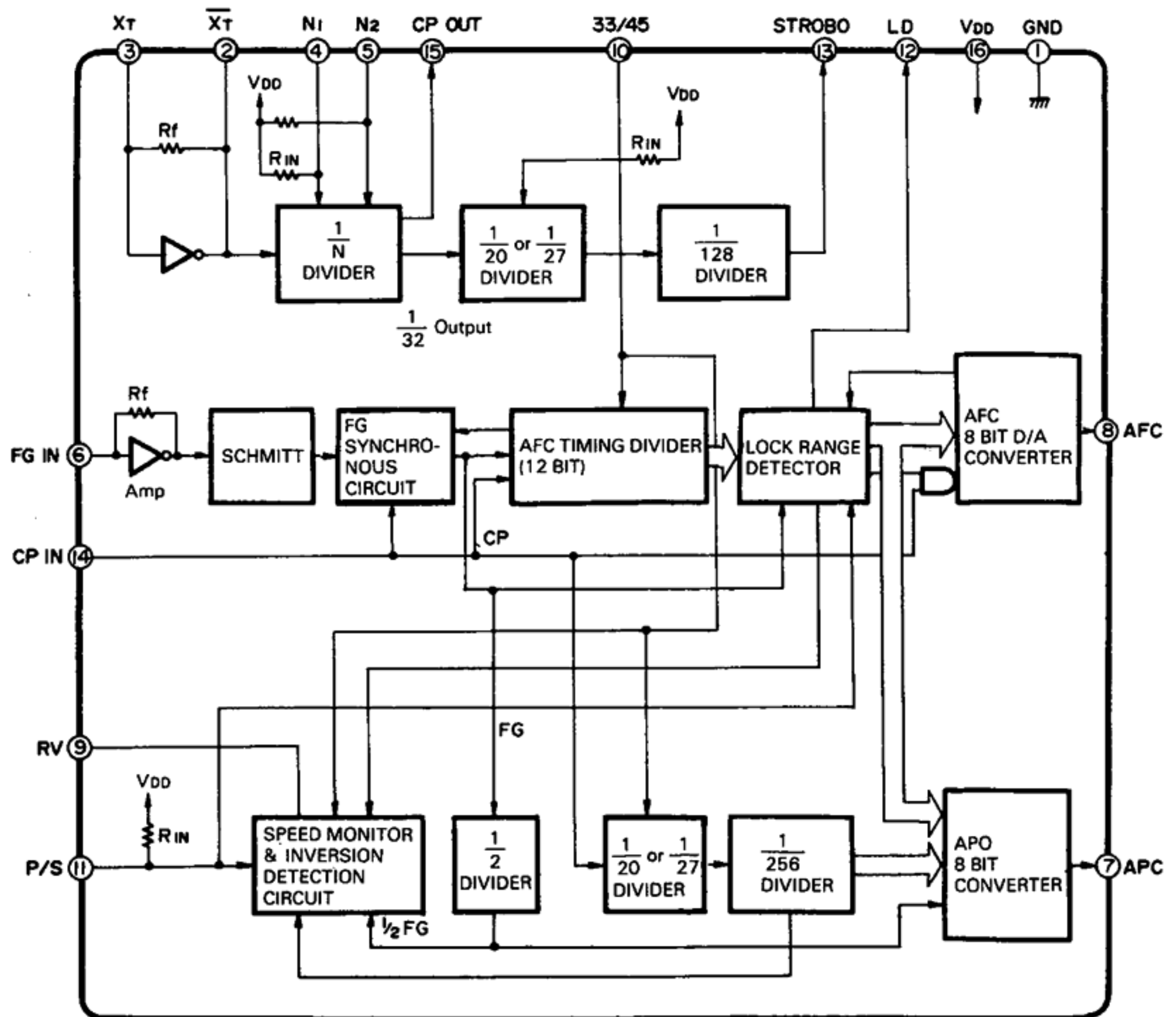
The above mentioned (1) ~ (5) are placed in the order of the functions described in “ μ PD7520C-028 Function description”. The conditions shown in the table below are also in that order so that functions can be confirmed while checking the IC’s ports.

		INPUT PORT						OUTPUT PORT					
PORT NO.		P 10	P 11	P 12	P 13	P 40	P 41	T 4	T 5	S 0	S 1	S 2	S 3
PIN NO.		6	5	4	3	10	9	12	11	25	23	21	19
PORT NAME		33/45 SW	START STOP SW	AUTO UP Signal	Not used	UP DOWN SW	LOCK Signal	33rpm LED	LOCK LED	45rpm LED	START STOP Signal	UP DOWN Signal	Kick Signal
(1)	Power ON RESET												
(2)	33/45 SW ON (45)												
	33/45 SW ON (33)												
(3)	START/STOP SW ON												
(4)	Auto up signal IN												
	START/STOP SW ON												
(5)	START/STOP SW ON												

4. Quartz PLL Motor Controller (C2-MOS LSI)

TC9142P is a motor controller for quartz lock type direct drive turntable motors. This IC employs 8-bit D/A converter for rotational speed control and phase control instead of the conventional capacitor type sampling hold circuit. This method will reduce the numbers of components and also gets free from adjustments.

• BLOCK DIAGRAM



ADJUSTMENT/REGLAGES/ABGLEICH

ADJUSTMENT

No.	ITEM	INPUT SETTINGS	OUTPUT SETTINGS	TURNTABLE SETTING	ALIGNMENT POINTS	ALIGN FOR	FIG.
1	END DETECT STARTING POSITION	—	Connect a DC voltmeter to TP1 (Pin 7 of IC8)	Set the stylus tip so that 57.5mm is obtained from the center of the turntable spindle.	VR1	0.9V	(a)
2	THRESHOLD VOLTAGE	—	Connect a DC voltmeter to TP2 (Pin 2 of IC8)	—	VR2	220mV	(b)

REGLAGES

N°	ITEM	REGLAGE DE L'ENTREE	REGLAGE DE LA SORTIE	REGLAGE DE TOURNE-DISQUE	POINTS L'ALIGNMENT	ALIGNER POUR	FIG.
1	POSITION DE DEPART LA TERMINASION DE DETECTEUR	—	Connecteur un voltmètre CC à TP1 (Fiche 7 de IC8)	Régler la crête de aiguille de façon de 57,5mm soit obtenir de centre de plateau à disques.	VR1	0,9V	(a)
2	TENTION DE SEUIL	—	Connecteur un voltmètre CC à TP2 (Fiche 2 de IC8)	—	VR2	220mV	(b)

ABGLEICH

NR.	GEGENSTAND	EINGANGS-EINSTELLUNG	AUSGANGS-EINSTELLUNG	PLATTEN SPIELER-EINSTELLUNG	ABGLEICH PUNKTE	ABGLEICHEN FÜR	ABB.
1	ENDE DETEKTS ANFANGS-STELLUNG	—	Einen Gleichspannungsmesser zum TP1 (Stift 7 von IC8) anschließen.	Der spitze von Tonabnehmer so einstellen, daß ein 57,5mm aus der mitte des Plattentellers erhält wird.	VR1	0,9V	(a)
2	SCHWELLEN-SPANNUNG	—	Einen Gleichspannungsmesser zum TP2 (Stift 2 von IC8) anschließen.	—	VR2	220mV	(b)

● **Functions of terminals**

CODE	NAME	FUNCTION DESCRIPTION	REMARKS
1 GND	Ground	Ground terminal for IC	
2 $\overline{XT}$, 3 XT	X'tal connection	Connect a crystal between these two pins.	Built-in feed back resistor
4 N1 5 N2	Reference dividing factor sw.	Dividing factor of 4,32 or 128 can be selected for reference crystal frequency by these ports.	Built-in pull-up resistor
6 FG-IN	FG pulse input	Pulses generated as motor rotates is input to this port for rotational speed detection.	
7 APC	APC output	Automatic phase controller output. (8-bit D/A converter output)	Built-in amp
8 AFC	AFC output	F-V converter output for rotational speed control. (8-bit D/A converter output)	
9 RV	Inversion signal output	Inversion signal output for turntable motor.	
10 33/45	Speed selector	Rotational speed selector port. (L: 33 1/3 r.p.m.) (H or NC: 45 r.p.m.)	Built-in pull-up resistor
11 P/S	PLAY/STOP input	Input port to select PLAY or STOP state of the turntable motor.	Built-in pull-up resistor
12 LD	Lock detection output	Outputs "H" when the rotational speed is in the lock range, otherwise "L".	
13 STROBO	STROBO output	Reference frequency output for stroboscope with the duty ratio of 1/8.	
14 CP-IN	CP-IN input	This port is normally connected oscillator input to this port will fine speed adjustment.	
15 CP-OUT	CP-OUT output	Divided frequency output of crystal oscillator for reference, normally connected to CP-IN.	
16 VDD	VDD	Feed power supply voltage of 5-9.5V.	

F



7 M3x6 (TP)
 8 M3x8
 T $\varnothing 4 \times 12$
 9
 E
 F $\varnothing 5$

: N09-1597-05
: N09-1648-05
: N87-4012-46
: N09-1375-08
: N09-1374-08
: N24-3050-41

C

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KD-990						
2	1A	*	A53-0213-22	DUST COVER		
6	2B, 3B		B09-0051-04	CAP		
7	1B		B19-0510-14	MIRROR		
-			B46-0092-03	WARRANTY CARD	K	
-			B46-0121-03	WARRANTY CARD	P	
-			B46-0122-13	WARRANTY CARD	E	
-		*	B50-6158-00	INSTRUCTION MANUAL (ENGLISH)		
-		*	B50-6159-00	INSTRUCTION MANUAL (FRENCH)	PE	
-		*	B50-6160-00	INSTRUCTION MANUAL (G, D, I)	E	
-			B58-0269-04	CAUTION CARD	K	
-			B58-0289-04	CAUTION CARD	KE	
-			B58-0290-04	CAUTION CARD	P	
-		*	B58-0386-04	CAUTION CARD		
-			B58-0518-04	CAUTION CARD	KE	
-			B58-0519-04	CAUTION CARD	P	
11	2A		D02-0039-15	TURNTABLE PLATTER		
12	1B		D10-0944-24	ARM		
13	1A		D21-1007-08	SHAFT ASSY		
15	2A		D39-0169-08	ANTI-SKATING DEVICE ASSY		
16	3A	*	D40-0361-13	OPERATIONAL PART ASSY (ST, UP)		
17	3A	*	D40-0359-23	OPERATIONAL PART ASSY (PWR)		
18	1A		D40-0511-23	AUTO-UP MECHANISM ASSY		
19	1A		D91-0069-08	MAIN WEIGHT		
△	24		E30-0459-05	AC POWER CORD	E	
△	24		E30-0780-05	AC POWER CORD	KP	
	25		E30-0800-05	AUDIO CORD	PE	
	25	*	E30-1465-05	AUDIO CORD	K	
-			E29-0114-05	WIRE CONNECTION CAP	K	
-			E29-0309-05	WIRE CONNECTION CAP	PE	
29	3B	*	F07-0483-03	COVER (MOTOR COVER)		
33	1A		G01-1057-08	TORSION COIL SPRING		
34	1A, 2B		G11-1127-04	CUSHION		
35	2A, 2B		G11-1128-04	CUSHION		
36	2A		G16-0355-13	TURNTABLE SHEET	PE	
36	2A		G16-0358-13	TURNTABLE SHEET	K	
37	1B		G01-1078-04	COMPRESSION SPRING		
-		*	H01-7157-04	ITEM CARTON CASE		
-			H10-1864-02	POLYSTYRENE FOAMED FIXTURE		
-			H10-1865-02	POLYSTYRENE FOAMED FIXTURE		
-			H10-1866-02	POLYSTYRENE FOAMED FIXTURE		
-			H12-0393-02	CARTON BOARD		
-			H20-0469-04	PROTECTION COVER		
-			H25-0029-04	PROTECTION BAG (60X110)		
-			H25-0232-04	PROTECTION BAG (235X350)		
40	2A		J02-0346-13	INSULATOR ASSY		
41	1A		J19-0812-08	HOLDER (TONEARM REST)		
43	1A		J19-0814-08	HOLDER (WIRE GUIDE)		
44	2A	*	J19-2580-08	TONEARM BASE ASSY		
46	1A		J19-2614-08	TONEARM REST		

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49	1A		J30-0183-05	SPACER (38X15X1.6)		
50	2B		J31-0263-05	COLLAR		
51	2B	*	J31-0273-05	COLLAR		
52	2B		J41-0033-05	POWER CORD BUSHING(AUDIO CORD)		
53	2B		J42-0078-05	POWER CORD BUSHING(AC PWR CORD)		
54	1A		J42-0317-08	BUSHING		
55	1A		J50-0314-25	HINGE		
56	1A		J50-0322-04	HINGE PLATE		
58	2A		J69-0035-05	RING		
59	1A	*	J91-0294-08	PICKUP ARM		
61	1A		J92-0053-15	SHELL		
62	1A		J99-0020-08	TONEARM LIFTER		
63	2A		J21-2302-05	HOLDER		
64	2A		J19-2656-08	LIFTER BASE		
-			J61-0054-05	WIRE BAND		
-			J61-0307-05	WIRE BAND		
△ 66	2B	*	L01-7121-05	POWER TRANSFORMER	KP	
△ 66	2B	*	L01-7122-05	POWER TRANSFORMER	E	
70	3A		N09-0850-04	CARTRIDGE MOUNT SCREW(M2.6X10)		
71	3A		N09-0851-04	CARTRIDGE MOUNT SCREW(M2.6X15)		
72	3A		N09-0852-04	CARTRIDGE MOUNT SCREW(M2.6X20)		
82	1B		N14-0164-05	HEXAGON NUT (M20)		
83	3A		N14-0412-04	CIRCULAR NUT (M2.6)		
84	3A		N19-0175-09	FLAT WASHER(CARTRIDGE MOUNTING)		
85	2B		N19-0965-05	FLAT WASHER (20X10XT0.6)		
87	2A	*	N19-0985-05	FLAT WASHER (FOR TRANSIT)		
88	1B		N29-0219-05	RETAINING RING (Ø2)		
89	1B		N19-0966-05	M TYPE WASHER (Ø40)		
A	1B		N09-1648-05	MACHINE SCREW (M3X8)		
E	1A		N09-1374-08	SET SCREW		
F	2B		N09-1565-05	MACHINE SCREW (M6X25)		
P	1A		N09-1376-08	SET SCREW (Ø2X8)		
S	1A		N09-1238-05	TAPTITE SCREW (Ø3X12)		
T	2A	*	N09-1645-05	MACHINE SCREW (M3X35)		
V	1A		N09-1311-08	STEPPED SCREW		
Z	2A		N09-1597-05	MACHINE SCREW (M6X22.2)		
92	3A		W01-0302-08	HEXAGON WRENCH KEY		
93	3A		W01-0329-04	EP ADAPTER		
ELECTRIC UNIT (X25-2580-00)						
D17	2A		B30-1012-05	LED(SLP-981C-50) Ø LOCK		
D18	2A		B30-1010-05	LED(SLP-281F-50U)45		
D19	2A		B30-1012-05	LED(SLP-981C-50) 33		
C1 ,2			C90-1358-05	ELECTRO 2200UF 25WV		
C3 ,4			CE04KW1C470M	ELECTRO 47UF 16WV		
C5 ,6			CE04KW1V100M	ELECTRO 10UF 35WV		
C7			CE04KW1H2R2M	ELECTRO 2.2UF 50WV		
C9			CE04KW1HR47M	ELECTRO 0.47UF 50WV		
C10			CK45FF1H103Z	CERAMIC 0.010UF Z		
C11			CK45FB1H102K	CERAMIC 1000PF K		
C12			CK45FF1H103Z	CERAMIC 0.010UF Z		
C13			CE04KW1V4R7M	ELECTRO 4.7UF 35WV		
C14 ,15			CK45FF1H103Z	CERAMIC 0.010UF Z		

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C16 ,17 C18 C19 C21 ,22 C23			CC45FSL1H470J CK45FF1H473Z CE04KW1HR47M CE04KW1V100M CF92FV1H222J	CERAMIC 47PF J CERAMIC 0.047UF Z ELECTR0 0.47UF 50WV ELECTR0 10UF 35WV MF 2200PF J		
C24 C25 -27 C28 -31 C32 -34 C35			CF92FV1H332J CK45FB1H102K CE04GW1C101M CF92FV1H105J C90-1395-05	MF 3300PF J CERAMIC 1000PF K LL-ELEC 100UF 16WV MF 1.0UF J ELECTR0 220UF 10WV		
C36 C37 C38 C39 C40		*	C90-1396-05 CK45FF1H103Z C90-1285-05 CK45FF1H103Z CK45FF1H473Z	ELECTR0 33UF 10WV CERAMIC 0.010UF Z ELECTR0 3.3UF 25WV CERAMIC 0.010UF Z CERAMIC 0.047UF Z		
C43 C44 C45		*	CK45FF1H103Z CE04KW1V100M C90-1352-05	CERAMIC 0.010UF Z ELECTR0 10UF 35WV ELECTR0 4.7UF 25WV		
95	1B		E23-0125-05	TERMINAL		
X1			L77-0580-05	CRYSTAL RESONATOR(4.6MHZ)		
R48 ,49 R50 ,51 R52 ,53 R54 ,55 VR1		*	RN14BK2C8251F RN14BK2C1963F RN14BK2C8251F RN14BK2C1963F R12-3097-05	RN 8.25K F 1/6W RN 196K F 1/6W RN 8.25K F 1/6W RN 196K F 1/6W TRIMMING P0T. (22K)END DEDETECT		
VR2			R12-1069-05	TRIMMING P0T. (4.7K)TH V0LT		
S1 -4	2A,2B		S40-1064-05	PUSH SWITCH		
D1 -5 D6 ,7 D8 D9 ,10 D11		*	DSM1A1 RD11ES(B) RD8.2JS(B) RD5.1JS(B) 1SS178	DI0DE ZENER DI0DE ZENER DI0DE ZENER DI0DE DI0DE		
D12 -15 D12 -15 D16 IC1 IC2			1SS133 1SS176 MA27T(A) UPD7520C-028 TC9142P	DI0DE DI0DE VARIST0R IC(MICR0PROCESS0R) IC(QUARTZ PLL M0T0R C0NTR0L)		
IC3 IC4 ,5 IC6 ,7 IC8 IC9			UPD4013BC M5218P M5218P-K AN6562 LC4066BH	IC(D FLIP-FL0P X2) IC(OP AMP X2) IC(OP AMP X2) IC(OP AMP X2) IC(BILATERAL SWITCH X4)		
PH1 Q1 Q3 ,4 Q3 ,4 Q3 ,4			NJL5141E-B 2SC3666 2SC1685(R,S) 2SC2320(E,F) 2SC945(A)(Q,P)	OPT0 ISOLATOR TRANSIST0R TRANSIST0R TRANSIST0R TRANSIST0R		
Q5 Q6 Q7 Q8 Q8		*	DTA124EN 2SC1384NC(R,S) 2SA1286 2SC1685(R,S) 2SC2320(E,F)	DIGITAL TRANSIST0R TRANSIST0R TRANSIST0R TRANSIST0R TRANSIST0R		

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Q8 Q9 Q10 ,11 Q12 Q13 Q14 Q15 ,16 Q17			2SC945(A)(Q,P) 2SK105(F,H) 2SC2320(F,G) 2SD1266 2SB941 2SD882*1(Q,P) 2SB772*1(Q,P) 2SD882*1(Q,P)	TRANSISTOR FET TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR TRANSISTOR		
MOTOR ASSY (X92-1100-00)						
- 121 123 129	 3B 3B 3B	 * * *	H25-0232-04 T50-1011-03 T50-1031-04 W02-0660-03	PROTECTION BAG (235X350) YÖKE RÖTOR ASSY ELECTRIC CIRCUIT MODULE		

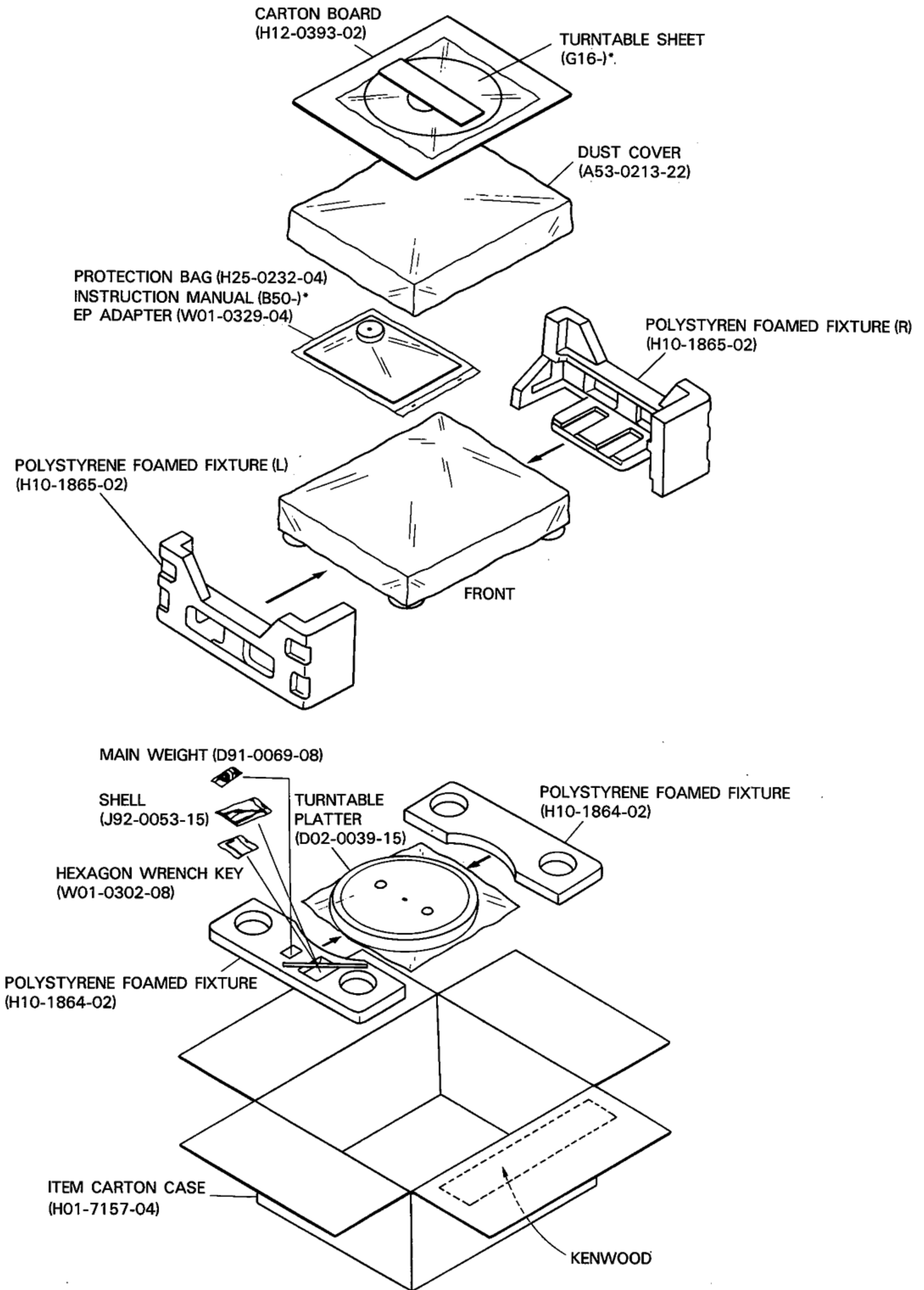
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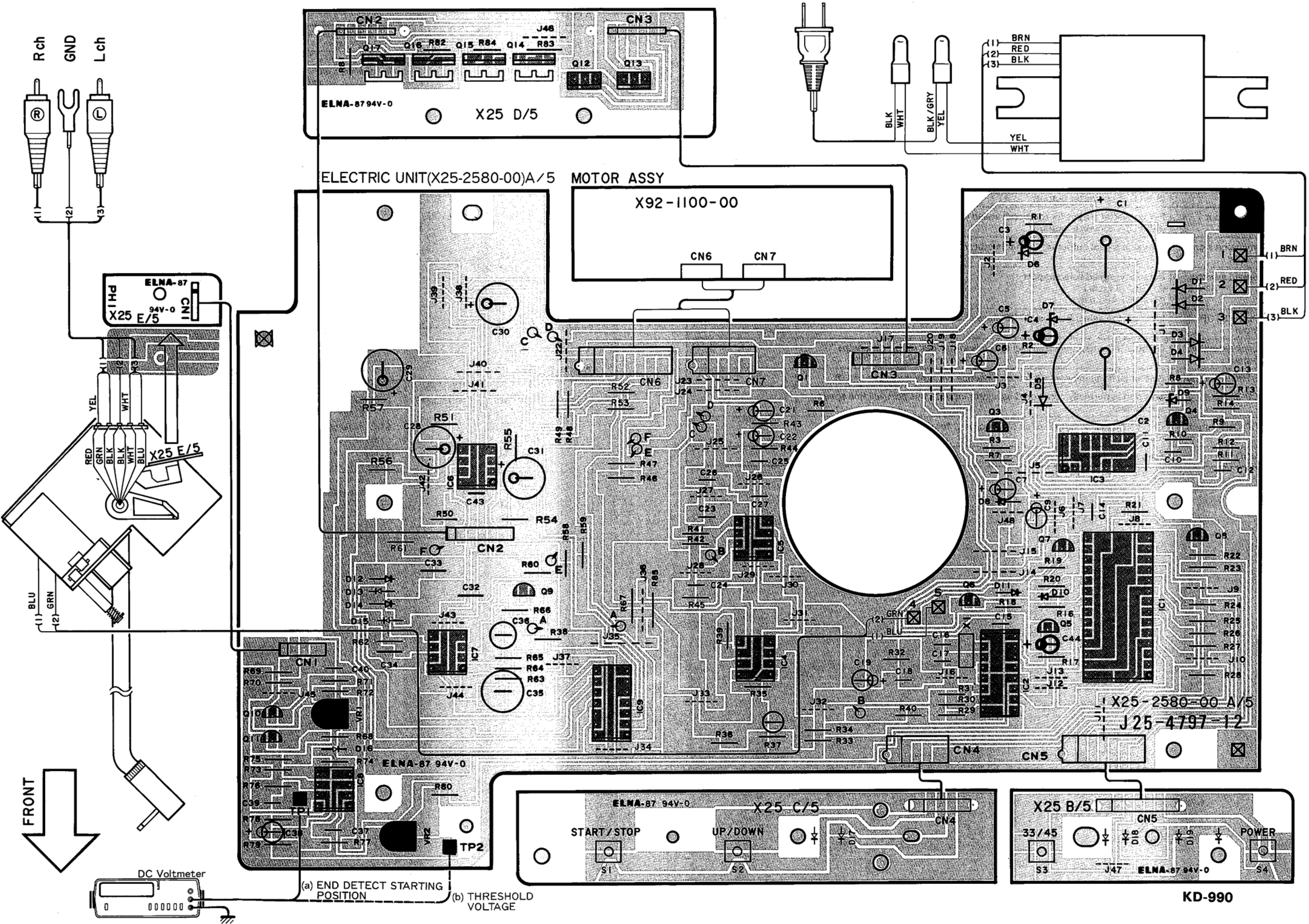
 indicates safety critical components.

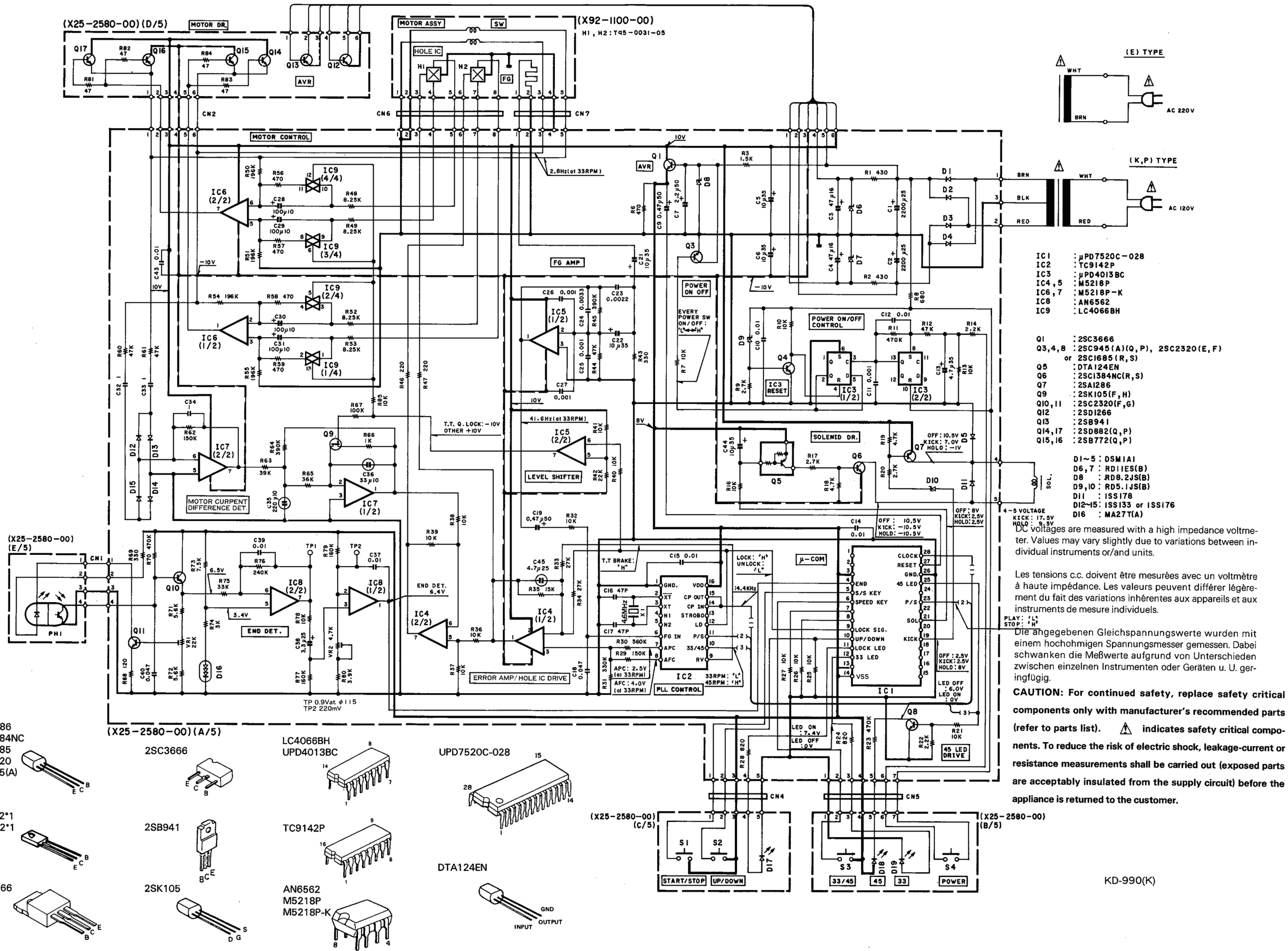
PACKING



PC BOARD

Refer to the schematic diagram for the values of resistor and capacitors.





SPECIFICATIONS

Motor and turntable

Drive System.....	Direct-drive system
Motor.....	Quartz PLL coreless & slotless DC servo motor
Turntable Platter.....	33 cm (13") diameter Aluminum alloy, Die-cast
Speeds.....	2 speeds, 33-1/3 and 45 rpm
Wow & Flutter.....	Less than 0.02% (WRMS) Less than 0.03% (DIN)
Rumble.....	DIN weighted better than -80 dB DIN unweighted better than -55 dB

Tonearm

Type.....	Static-balance type, J-shape tonearm
Effective Tonearm Length.....	245 mm (9-5/8")
Overhang.....	15 mm (9/16")
Tracking Error.....	+1.8° to -1.0°
Tracking Force Range.....	0 to 3 grams (0.1 g Step)
Usable Cartridge Weight.....	2.0 to 12 grams (with supplied head-shell)

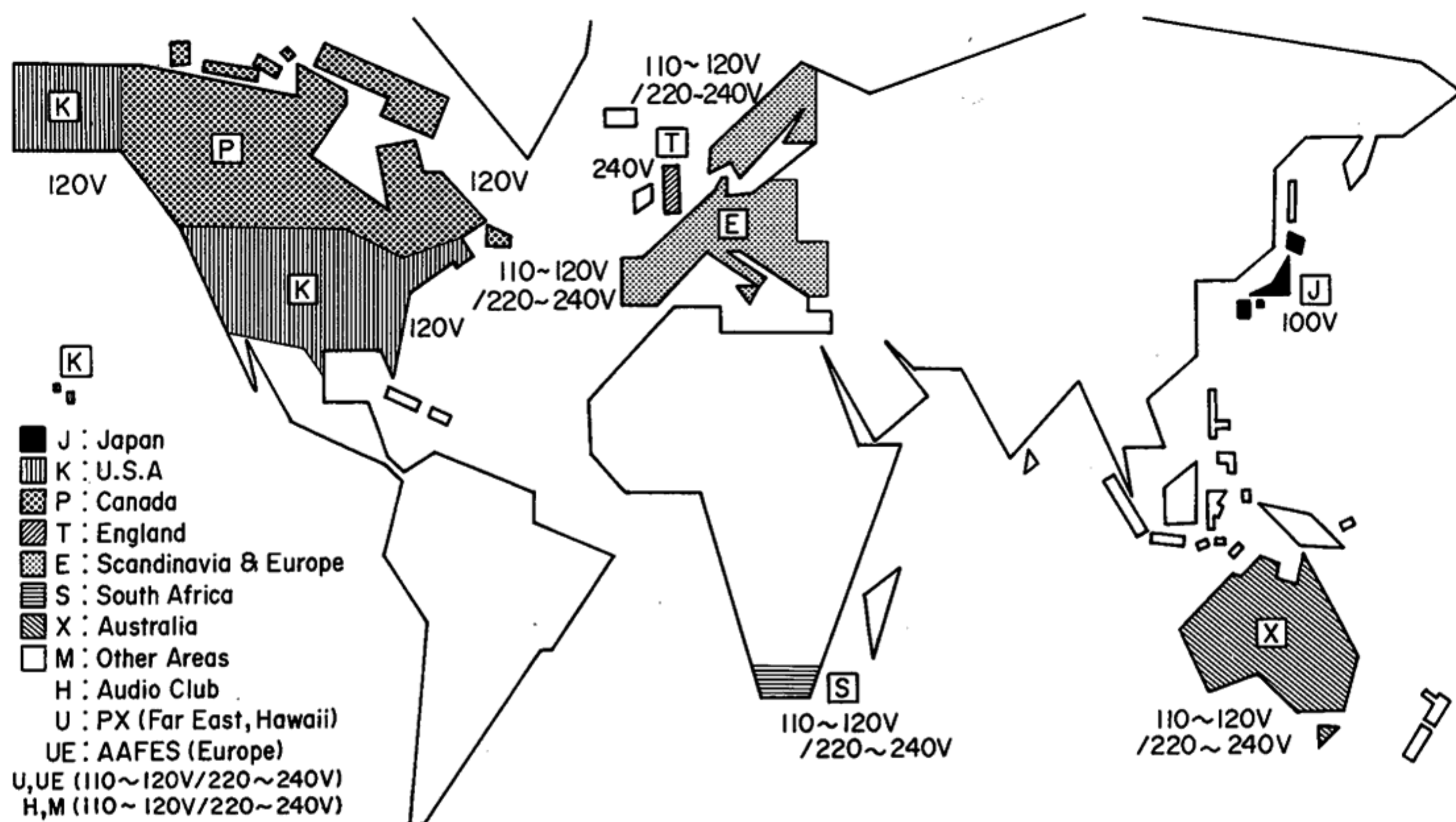
Miscellaneous

Power Consumption.....	25 watts
Dimensions.....	W 490 mm (19-5/16") H 182 mm (7-3/16") D 410 mm (16-5/32")
Weight (Net).....	13.7 kg (30.14 lb)
Supplied Accessory.....	45 rpm adaptor, Phono cable Hexagonal bar wrench

Note:

We follow a policy of continuous advancements in development. For this reason specifications may be changed without notice.

WORLD MAP & AREA CORD



Note:

Component and circuitry are subject to modification to insure best operation under differing local conditions. This manual is based on the U.S.A. (K) standard, and provides information on regional circuit modification through use of alternate schematic diagrams, and information on regional component variations through use of parts list.

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