

# DENON

Hi Fi Component / Record Player

## SERVICE MANUAL

SERVO-CONTROLLED  
AUTOMATIC ARM LIFT  
DIRECT DRIVE TURNTABLE SYSTEM

MODEL DP-31L SERIES



Model DP-31L

**NIPPON COLUMBIA CO., LTD.**

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### FEATURES

#### 1. Low mass straight tonearm

Full performance of a high compliance/high trackability cartridge is assured. The recent high grade disc can be traced most sufficiently.

#### 2. Floated tonearm newly developed

The tonearm is isolated from the base in view point of vibration. Sound deterioration caused by acoustic feedback is effectively eliminated.

#### 3. Newly developed linear drive MF motor

Magnetic floating bearing decreases the load consisting of weight of the platter and the motor rotor over the pivot by the attraction force between the magnet and the stator yoke. Friction at the pivot is decreased to maintain smooth rotation.

#### 4. Bi-directional servo control with DENON quartz system

Magnetic recording detection and quartz control system are combined with bi-directional servo control, resulting in an almost ultimate rotational precision.

#### WARNING:

Parts marked with  $\triangle$  are of importance in respect to the safety use the specified type without fail.

### MAIN SPECIFICATIONS

#### ● Phono motor section

<b>Drive system</b>	Servo controlled direct drive
<b>Speed</b>	33-1/3rpm and 45rpm
<b>Wow and flutter*</b>	Less than 0.012% wrms (JIS)
<b>S/N</b>	More than 78dB (DIN-B)
<b>Rise time</b>	Within 2 sec. to reach 33-1/3rpm nominal speed
<b>Platter</b>	Diecasted aluminum, 300mm diam.
<b>Motor</b>	Magne-float (MF) motor
<b>Speed control system</b>	Speed servo control with frequency detection and phase lock servo control
<b>Load influence</b>	0% (Tracking force of 80g at out-most groove)
<b>Brake system</b>	Electronic brake
<b>Speed deviation</b>	Less than 0.002%

\*Note: DENON measuring method using a magnetic pulse wheel.

#### ● Tonearm section

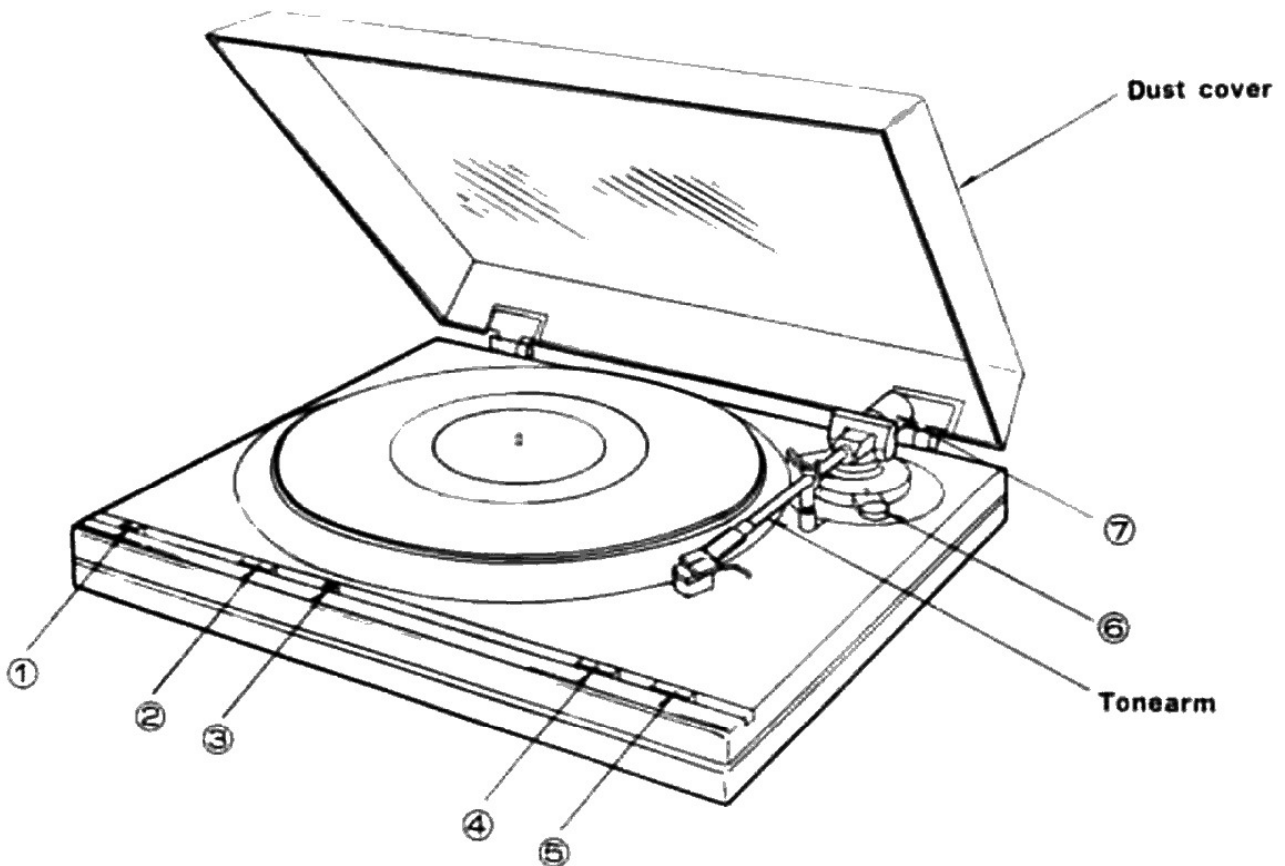
<b>Arm type</b>	Static type straight tube tonearm
<b>Effective length</b>	220mm
<b>Overhang</b>	16mm
<b>Tracking error</b>	Less than 3°
<b>Tracking force range</b>	0 to 2.5g/rot. (1 division is 0.1g)
<b>Acceptable weight of cartridge</b>	Approx 4.5 to 9g (including screws & nuts)
<b>Head shell</b>	Exclusive head shell made of special rigid design (Approx 3.3g)

#### ● General

<b>Power source</b>	50Hz/60Hz Voltage is shown on rating label.
<b>Power consumption</b>	6W
<b>Dimensions</b>	424(W) x 130(H) x 388(D) (mm)
<b>Weight</b>	Approx. 6 kg

Above specifications and outward appearance may be altered in future for improvement.

## NAMES OF PARTS AND FUNCTION



### **1 Power switch POWER**

Power is turned on ( **▲** ) and off ( **■** ).

### **2 Speed selector SPEED**

Select the suitable speed for the disc to be played.

33-1/3rpm disc ..... "33" ( **▲** )

45rpm disc. .... "45" ( **■** )

### **3 Lock Indicator LOCK**

The lamp lights when power is turned on.

The lamp flickers during play until the nominal speed of rotation is obtained when the lamp lights continuously again.

### **4 Start button START**

Press the button for starting play.

### **5 Stop button STOP**

Press the button to stop playing on the way.

### **6 Anti-skating knob**

Set the anti-skating force with this knob.

### **7 Counterweight**

Set the proper tracking force with this counterweight.

## PROCEDURE OF ADJUSTMENT

Provide a dual trace oscilloscope. The test point TP17 shall be used as reference point for grounding.

### ○ Adjustment of phonomotor part

Adjustment shall be carried out with the tonearm clamped at the arm rest.

#### 1. Adjustment of motor amplifier offset voltage

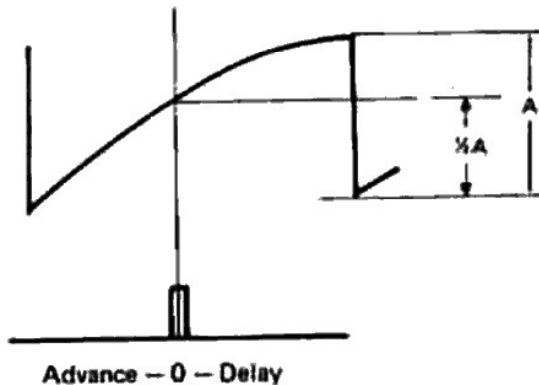
- (1) Connect the oscilloscope with the test points TP19 and TP20.
- (2) When using the test point TP19, turn the preset variable resistor VR4 while rotating the turntable by hand so that the oscillation will have its center at  $0 \pm 0.1V$ .
- (3) When using the test point TP20, turn the variable resistor VR3 in the same manner as above.

#### 2. Adjustment of motor torque

- (1) Ground the test point TP16.
- (2) Connect the oscilloscope to the test points TP19 and TP20.
- (3) Push the start switch S2 to put the phonomotor into high speed revolutions.
- (4) When using the test point TP19, turn the variable resistor VR6 so that the indication will give  $15V_{p-p} \pm 0.5V$ .
- (5) When using the test point TP20, turn the variable resistor VR5 so that the indication will give  $15V_{p-p} \pm 0.5V$ .

#### 3. Adjustment for 45rpm

- (1) Connect the dual trace oscilloscope to the test points TP14 and TP15.
- (2) Set the speed selector switch S1 to 45rpm.
- (3) Push the start switch S2 to put the phonomotor into rotation.
- (4) Adjust the preset variable resistor VR2 so that pulse from the test point TP15 will intersect the half of amplitude of the triangular wave at the test point TP14.



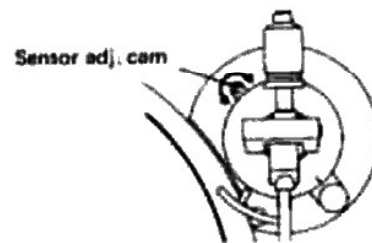
#### 4. Adjustment for 33rpm

- (1) Set the speed selector switch S1 to 33rpm.
- (2) Adjust the preset variable resistor VR1 in the same manner as that for 45rpm.

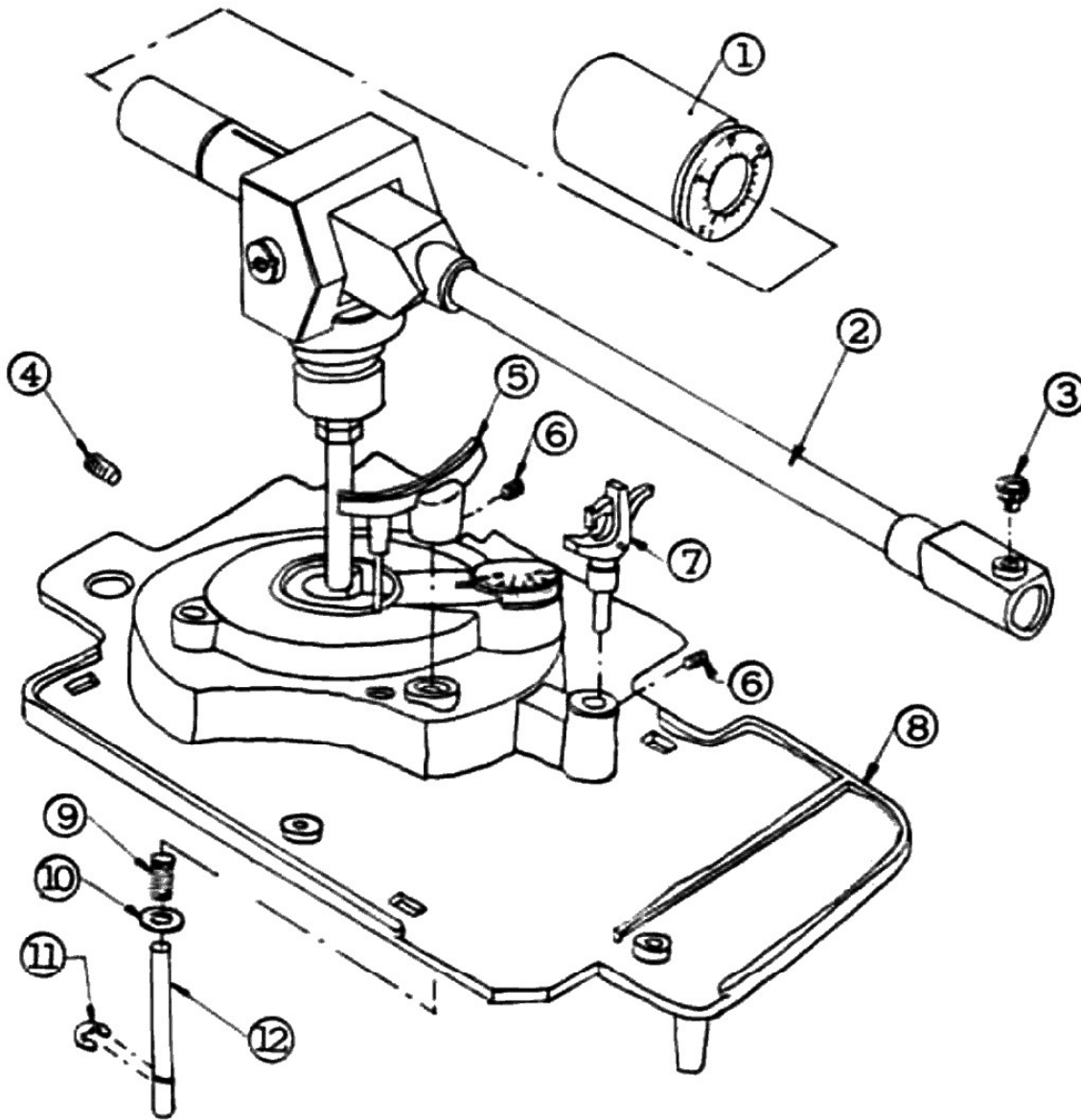
### ○ Adjustment of arm control part

#### 1. Adjustment of End Sensor

- (1) Connect the oscilloscope to the test point TP13.
- (2) Move the tone arm with the turntable at a standstill and locate the stylus at a point 60mm away from the center spindle.
- (3) Turn the sensor cam behind the arm base with a small screw driver so that the test point TP13 will give a voltage of  $0.8 \pm 0.05V$ .



# EXPLODED VIEW OF TONEARM



Ref. No.	Parts No.	Part Name	Remark
1	3158561003	MAIN WEIGHT ASS'Y	
2	3158565310	MAIN BODY ASS'Y	
3	3158567004	FINGER SCREW	
4	4744203017	3x10 BSS	
5	31585678001	ARM LIFTER ASS'Y	
6	4744003013	3x3 SS	
7	3158564000	ARM REST ASS'Y	
8	31585675002	ARM BASE ASS'Y	
9	4638065109	LIFTER SPRING	
10	4751005004	4W	
11	4761003009	3E RING	
12	3158541104	LIFTER SPRING	

## EXPLODED VIEW OF MAIN PARTS

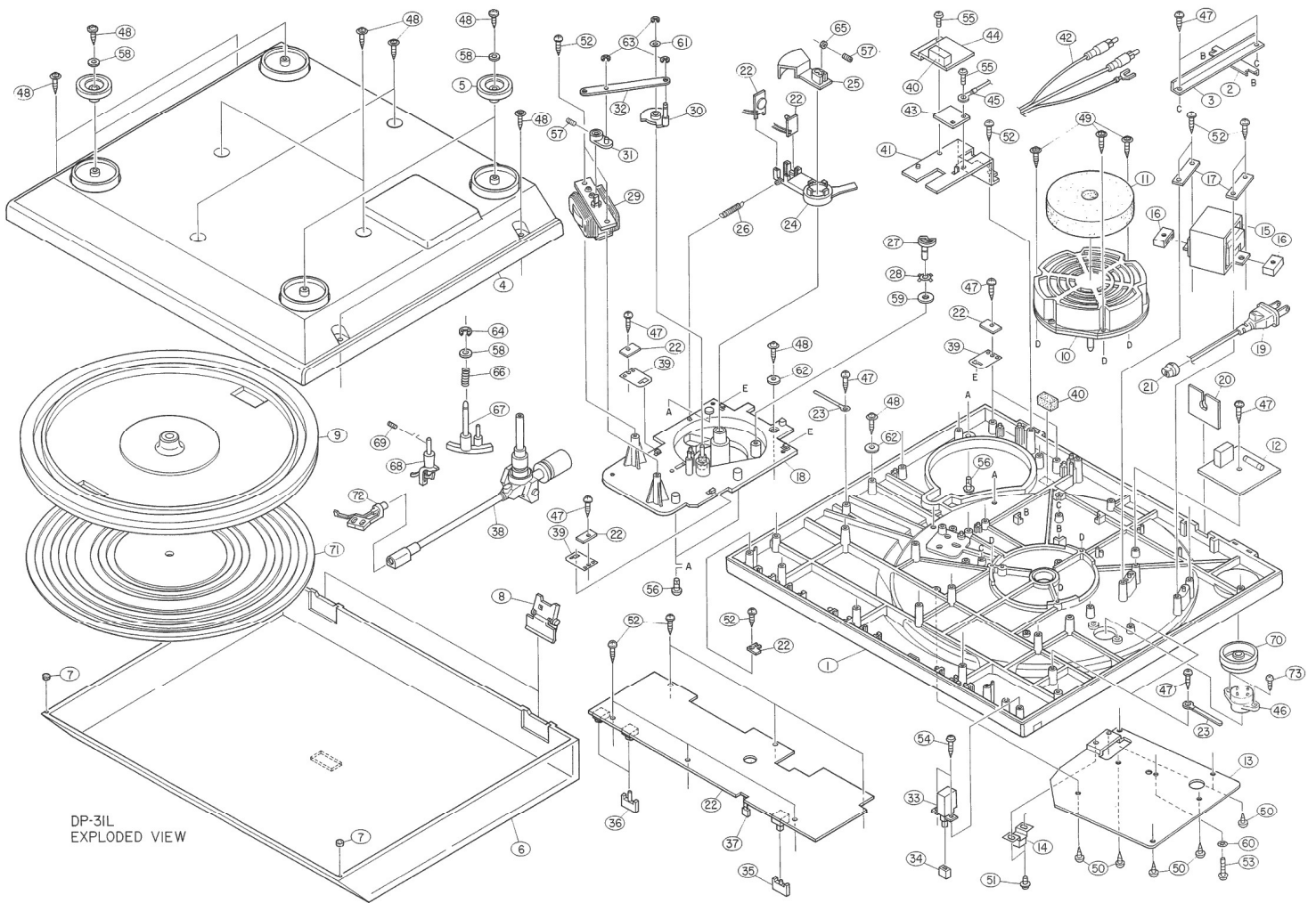
Ref. No.	Part No.	Part Name	Remarks
1	1038137106	CABINET ASS'Y	E1 only
	1038137119	CABINET ASS'Y	
2	4418772007	ANGLE (A)	
3	4418773006	ANGLE (B)	
4	1058057305	BOTTOM COVER	
5	1048066005	INSULATOR ASS'Y	
6	1468115206	DUST COVER ASS'Y	
7	4628023009	BUSHING	
8	4018041002	HINGE	
9	4218217209	RECORDED TURNTABLE	
10	FG-280	MOTOR UNIT	
11	4618031001	PAD	
12	PS-158	POWER SOURCE	
		UNIT	EU only
	PS-160	POWER SOURCE	
		UNIT	
	PS-161	POWER SOURCE	
		UNIT	E1 only
13	4348703102	SHIELD PLATE	
14	3918425004	MAGNETIC HEAD	
15	2334072003	POWER TRANS	EU only
	2339046005	POWER TRANS	E1 only
	2339045006	POWER TRANS	
16	4618101009	RUBBER	
17	4418710001	PLATE	
18	4450033005	WIRE CLAMP BAND	
19	2062019008	AC CORD	EU only
	2006031026	AC CORD	E1 only
	2062002031	AC CORD	E2, EF
	2062024006	AC CORD	EK only
	2006019307	AC CORD	EA only
20	4418314009	BUSH PLATE	EU, E1
	4418321005	BUSH PLATE	E2, EK, EA, EF
21	MD-3802	BUSHING	EU, E1
	4450020005	BUSHING	EK, E2
	MD-2982H	BUSHING	EA only
22	KU-400	SERVO AMP UNIT	EU only
	KU-425	SERVO AMP UNIT	
23	EP-4772	CORD HOLDER	
24	4218223109	SENSOR HOLDER	
25	4118157003	SHUTTER	
26	4638221008	SPRING	
27	4248015400	ADJUST CAM	
28	3158451003	FRICTION WASHER	
29	2178038313	MOTOR (C) ASS'Y	
30	4248009005	CAM	
31	4218121104	MOTOR ARM	
32	4418220203	CONNECTION PLATE	
33	2129136028	POWER SWITCH	EU only
	2129136015	POWER SWITCH	
34	1138110104	SW, KNOB	GL-9PR2
35	1138111103	PUSH SW. KNOB	
36	1138112102	MINI. SW. KNOB	
37	3939042000	LED	
38	FPU530	TONE ARM UNIT	
39	4418606102	SPRING PLATE	
40	4698008009	INSULATOR MAT	

Ref. No.	Part No.	Part Name	Remarks
41	4418704101	SHIELD COVER	
42	2033642103	OUTPUT CORD ASS'Y	
43	2228339108	OUTPUT P.C.B.	
44	4418708000	SHIELD PLATE	
45	2098019014	EARTH LEAD	
46	2123316023	VOLTAGE SELECTOR	E1 only
47	4730305013	3x10 CBRTS (1)	BKBW MBN1 II
48	4731803006	3x12 CPTS (=)	
49	4731803019	3x16 CPTS (=)	
50	4730303015	3x6 CBRTS (1)	
51	4700009019	3x6 CPS. W	
52	4730306012	3x12 CBRTS (1)	
53		3x15 CBS	
54	4730205016	2.6x10 CPTS (1)	
55	4713303016	3x6 CBS	
56	4730406035	4x12 CRTS	
57	4770032003	3x6 SS	
58	4751005004	4W	
59	4751006003	5W	
60	4753201000	3TWB	
61	4770090058	WASHER	
62	4770182005	WASHER	
63	4761001001	2E RING	
64	4761003009	3E RING	
65	4756006008	3N	
66	4638065109	LIFTER SPRING	
67	3158576001	ARM LIFTER ASS'Y	
68	3158564000	ARM REST ASS'Y	
69	4744003013	3x3 SS	
70	5298006002	45 ADAPTER	
71	4218220005	RUBBER SHEET	
72	3158553008	HEAD SHELL ASS'Y	
73	4730204017	2.6x8 CBRTS (1)	

Remark symbols in the parts list refer to the following countries and areas.

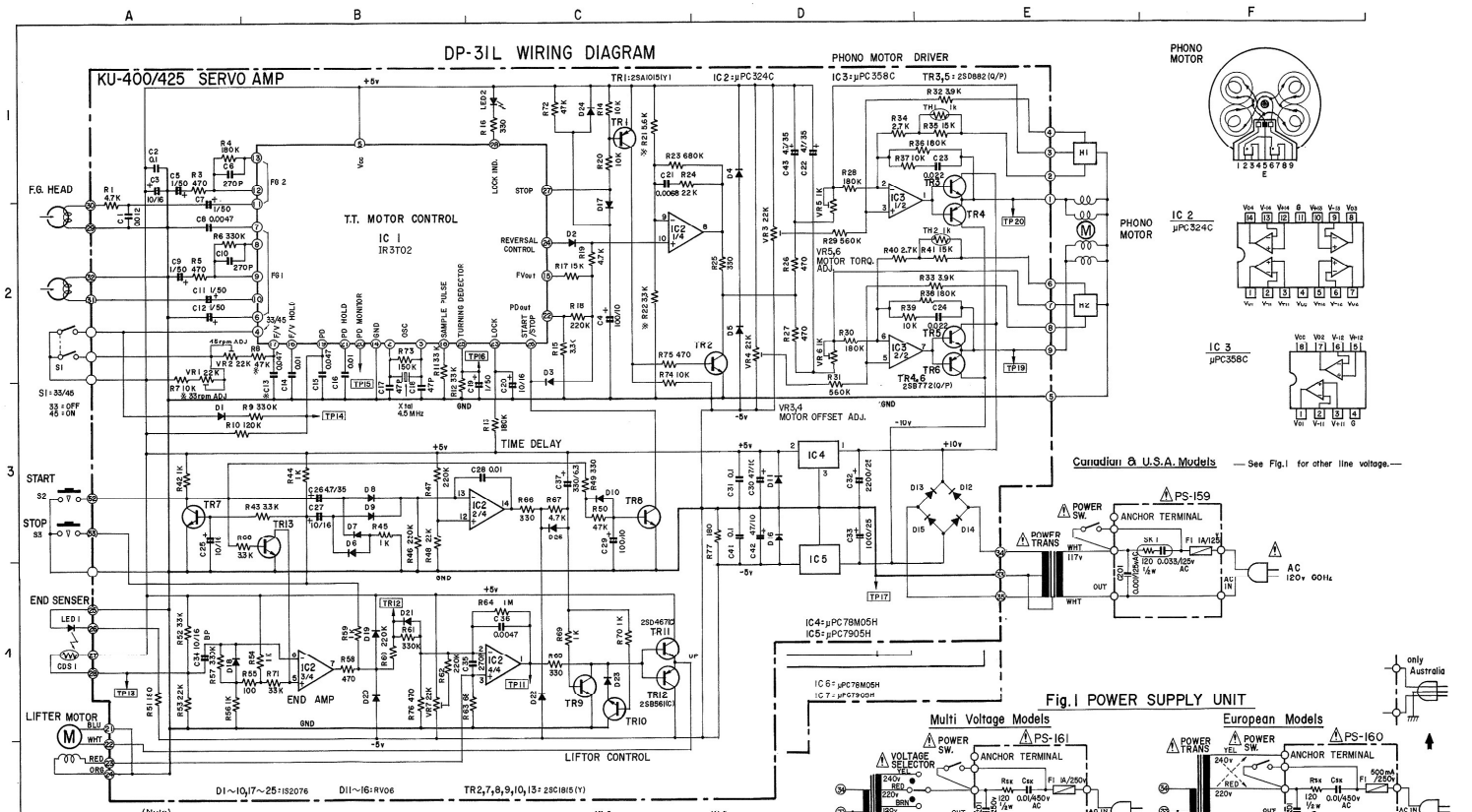
- EA: Australia
- EK: United Kingdom
- EU: U.S.A. and Canada
- E1: Multiple voltage model
- E2: European continent

EXPLODED VIEW

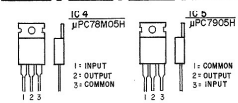


DP-3IL  
EXPLODED VIEW

CIRCUIT DIAGRAM



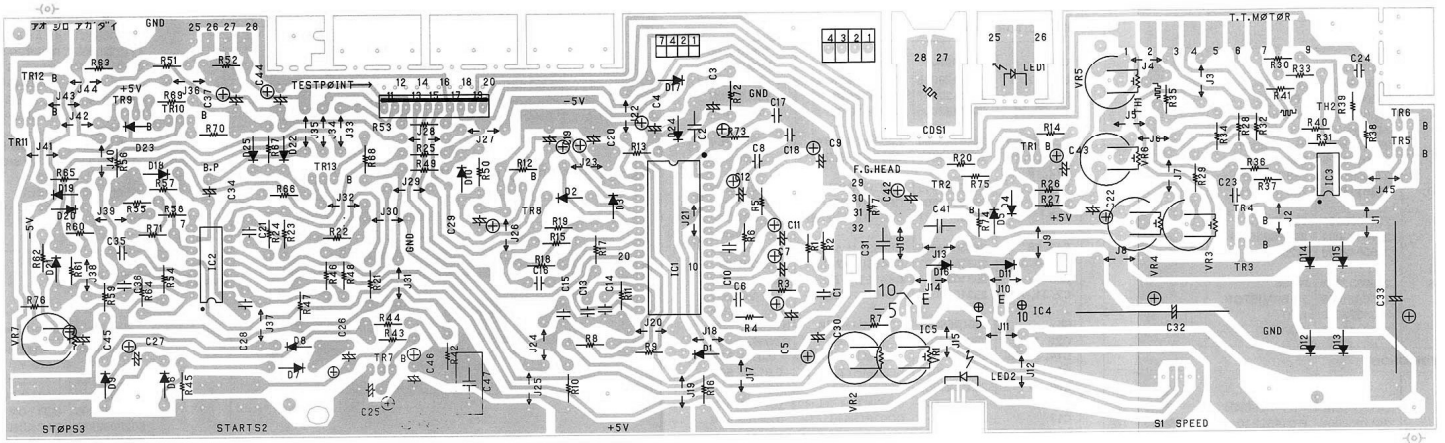
- (Notes)
1. Resistors are in  $\Omega$ . All the resistors without remarks are  $\frac{1}{4}W$ .
  2. All the capacitors without remarks are in  $\mu F$ .
  3. Specified components should be used for parts with "\*" marks. (Temperature compensating parts)
  4. All parts and components with "A" marks have special characteristics important to safety. Be sure to use the specified parts.



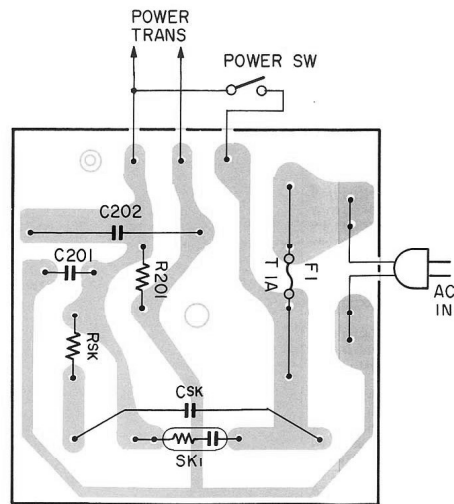


P. C. BOARD

SERVO AMP UNIT



POWER SUPPLY UNIT



**PARTS LIST**

**KU-400/425 SERVO AMP UNIT**

Ref. No.	Part No.	Part Name	Remarks
<b>SEMICONDUCTOR GROUP</b>			
IC1	2630173004	IR3T02	
IC2	2630146002	μPC324C	
IC3	2630161003	μPC389C	
IC4	2630147001	μPC78M05H	
IC5	2630160004	μPC7905H	
TR1	2710102005	2SA1015(Y)	
TR12	2720046009	2S8561(C)	
TR4, 6	2720095029	2S8772(Q/P)	
TR7~10,	2730198002	2SC1815(Y)	
13			
TR11, 2	2740038000	2SD467(C)	
TR3, 5	2740078031	2SD882 (Q/P)	
D1~10,	2760049008	IS2076	
17~25			
D11~16	2760237001	RV06	1KΩ
TH1, 2	2760311008	THERMISTOR	
LED1	3939023003	LED	
CD51	3939019101	CLS	
<b>RESISTOR GROUP</b>			
R63	2412064001	RD1482E650J	Carbon film 65ΩJ 1/4W
R55	2412068007	RD1482E101J	100ΩJ 1/4W
R51, 77	2412074004	RD1482E181J	180ΩJ 1/4W
R16, 25, 49,	2412080001	RD1482E331J	330ΩJ 1/4W
65, 66			
R3, 5, 26, 27	2412004007	RD1402C471J	470ΩJ 1/4W
58, 75, 76			
R42, 44, 45,	2412092002	RD1482E102J	1KΩJ 1/4W
54, 55, 59			
69, 70			
R53	2412100004	RD1482E222J	2.2KΩJ 1/4W
R34, 40	2412102002	RD1482E272J	2.7KΩJ 1/4W
R15, 43, 68	2412104000	RD1482E332J	3.3KΩJ 1/4W
R32, 33	2412106008	RD1482E392J	3.9KΩJ 1/4W
R1, 19, 67	2412108006	RD1482E472J	4.7KΩJ 1/4W
R14, 20, 37	2412116001	RD1482E103J	10KΩJ 1/4W
39, 74			
R17, 35, 41	2412120000	RD1482E153J	15KΩJ 1/4W
R24, 48	2412124006	RD1482E223J	22KΩJ 1/4W
R11, 12, 52	2412128002	RD1482E333J	33KΩJ 1/4W
71			
R50, 72	2412132001	RD1482E473J	47KΩJ 1/4W
R10	2412142004	RD1482E124J	120KΩJ 1/4W
R73	2412144002	RD1482E154J	150KΩJ 1/4W
R4, 13, 28,	2412146000	RD1482E184J	180KΩJ 1/4W
30, 36, 38			
R18, 46, 47,	2412148008	RD1482E224J	220KΩJ 1/4W
60, 62			
R6, 9, 57,	2412152007	RD1482E334J	330KΩJ 1/4W
61			
R29, 31	2412158001	RD1482E564J	560KΩJ 1/4W
R23	2412160002	RD1482E684J	680KΩJ 1/4W
R64	2412164008	RD1482E105J	1MΩJ 1/4W
			Metal film
R22	2452195008	RN14K2E332G	3.3KΩG 1/4W
R21	2452201002	RN14K2E662G	5.6KΩG 1/4W
R7	2452207006	RN14K2E103G	10KΩG 1/4W
R8	2452223006	RN14K2E473G	47KΩG 1/4W
			variable resistor
VR1~4, 7	EP-5462H15	SOLID VOLUME	22KΩ
VR5, 6	EP-5462H7	SOLID, VOLUME	1KΩ

Ref. No.	Part No.	Part Name	Remarks
<b>CAPACITOR GROUP</b>			
C37	2544005006	CE04W0J331=	Electrolitic 330μF 6.3V
C30, 42	2544129006	CE04W1A470=	47μF 10V
C4, 29	2544130007	CE04W1A101=	100μF 10V
C3, 20, 25	2544132005	CE04W1C100=	10μF 16V
27			
C22, 26, 43	2544140000	CE04W1V4R7=	4.7μF 35V
C5, 7, 9, 11	2544146004	CE04W1H010=	1μF 50V
12, 19			
C33	2542037005	CE02W1E102=	1000μF 25V
C32	2542038004	CE02W1E22=	2200μF 25V
C34	2543014027	CE04D1C100MBP	10μFBP 16V
C17, 18	2533619005	CC45SL1H470J	47PF 50V
C6, 10, 36	2533637003	CC45SL1H271J	270PF 50V
C36	2531023004	CK45F1H472Z	0.0047μF 50V
C2, 31, 41	2531027000	CK45F1H104Z	0.1μF 50V
			Film
C8	2561068007	CQ93M1H472K	0.004μF 50V
C21	2551070008	CQ93M1H682K	0.0068μF 50V
C14, 16, 28	2551072006	CQ93M1H103K	0.01μF 50V
C1	2551121038	CQ93MH123J	0.012μF 50V
C23, 24	2551121067	CQ93M1H223J	0.022μF 50V
C15	2551123001	CQ93M1H473J	0.047μF 50V
C13	2554194017	CQ93P1H473J	0.047μF 50V
<b>OTHER PARTS GROUP</b>			
	2228397001	SERVO AMP P.C.B.	KU-400 only
	2228455008	"	KU-425 only
	4178028101	HEAT SINK	
	4713303016	3 x 6 CBS	
	2129089007	MINI PUSH SW.	
	2129067003	PUSH SW.	
	2045391002	10P MINI SOCKET	
	3996023002	CRYSTAL	4.5 MHZ

**PS-159 POWER SOURCE UNIT**

Ref. No.	Part No.	Part Name	Remarks
C203	2228338219	P.C. BOARD	
	2538004000	CK45B2BAC102KW	0.001μF 125V AC
SK1	2618006009	SPARK KILLAR	
	EE-1656	BASE TERMINAL	
F1	2050087039	3P TERMINAL	
	2061024007	FUSE	1A/125V UL

**PS-161 POWER SOURCE UNIT**

Ref. No.	Part No.	Part Name	Remarks
CSK	2228338206	P.C. BOARD	
	2518001007	CP05C--AC103M	0.01μF 400V AC
C201	2518001049	CP05C--AC102M	0.001μF 450V AC
RSK	2410163001	RD1482H121J	120Ω 1/2W
F1	EP-72663	FUSE	1A/250V UL
	EE-1656	BASE TERMINAL	
	2050087042	4P TERMINAL	

**PS-160 POWER SOURCE UNIT**

Ref. No.	Part No.	Part Name	Remarks
CSK	2228338206	P.C. BOARD	
	2518001007	CP05C--AC103M	0.01μF 400V AC
C201	2518001049	CP05C--AC102M	0.001μF 450V AC
RSK	24101630u1	RD1482H121J	120Ω 1/2W
F1	2061015003	FUSE	500mA/250V
	FEP-1287	FUSE HOLDER	
	EE-1656	BASE TERMINAL	
	2050087042	4P TERMINAL	

**ACCESSORIES**

Ref. No.	Part No.	Part Name	Remarks
	5298037107	CAP	
	5298006002	45 ADAPTOR	
	4218220005	RUBBER SHEET	
	5118185100	INSTRUCTION MANUAL	English
	5118187001	INSTRUCTION MANUAL	French
	5138199008	LABEL	
	5138199031	RATING SHEET	
	3158553008	HEAD SHELL	
	3158547001	SHELL	EU only
		ACCESSORIES	EU only
	FFU950	CARTRIDGE UNIT	E1, E2, EK EA

**CARTON CASE GROUP**

Ref. No.	Part No.	Part Name	Remarks
	5018188155	CARTON CASE ASS'Y	
	5018189154	CARTON CASE	
	5028035007	UPPER PLATE	
	5028036006	BOTTOM PLATE	
	5028039207	PACKING ASS'Y	
	5028037306	PACKING (L)	
	5028038305	PACKING (R)	
	5058082010	LAMINATE	500x600x0.06
		ENVELOPE	30x200x0.03
	5058014055	ENVELOPE	60x100x0.03
	5058026006	ENVELOPE	350x40x0.05
	50480023018	SHEET	
	5048007002	SHEET	
	5048007028	SHEET	

Remark symbols in the parts list refer to the following countries and areas:  
 EA: Australia  
 EA: United Kingdom  
 EU: U.S.A. and Canada  
 E1: Multiple voltage model  
 E2: European continent