SERIAL NO. 3203

ONKYO SERVICE MANUAL

COMPACT DISC PLAYER
MODEL DX-150

Black and Silver models

UDN, UD	120V AC, 60Hz
UGV, UG	220V AC, 50Hz
UW	120/220V AC, 50/60Hz

SAFETY-RELATED COMPONENT WARNING!!

COMPONENTS IDENTIFIED BY MARK ⚠ ON THE SCHEMATIC DIAGRAM AND IN THE PARTS LIST ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE THESE COMPONENTS WITH ONKYO PARTS WHOSE PARTS NUMBERS APPEAR AS SHOWN IN THIS MANUAL.

MAKE LEAKAGE-CURRENT OR RESISTANCE MEASUREMENTS TO DETERMINE THAT EXPOSED PARTS ARE ACCEPTABLY INSULATED FROM THE SUPPLY CIRCUIT BEFORE RETURNING THE APPLIANCE TO THE CUSTOMER.

SPECIFICATIONS

Type:	Compact Disc player with optical pickup
Quantization:	16 bit linear
Channels:	2 (Stereo)
Frequency response:	10Hz ~ 20kHz ±2dB
Dynamic range:	Over 93dB
Total harmonic distortion:	0.005% (1kHz)
Channel separation:	87dB at 1kHz
S/N ratio:	Over 96dB
Wow and flutter:	Unmeasurable
Output:	2.0 volts
Pickup:	Semiconductor laser type
Power consumption:	26 watts (D), 29 watts (G/W)
Dimensions:	435 (W) x 92 (H) x 350 (D) mm
Weight:	5.0kg
Accessories:	Connection cables

Specifications are subject to change without notice.

ONKYO® AUDIO COMPONENTS

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PRECAUTIONS

1. The Pickup Attachment Screw

There is a pickup shipping screw on the bottom of the cabinet. Before playing a disc for the first time, this screw must be turned clockwise using a blade (–) screwdriver or coin. If the power is turned on with this screw attached, the unit will not operate properly.

2. Safety-check out (U.S.A. model)

After correcting the original service problem, perform the following safety check before releasing the set to the customer:
Connect the insulating-resistance tester between the plug of power supply cable and shassis.
Specifications: more than 10Mohm at 500V.

3. Replacing the fuses

For continued protection against fire hazard, replace only with same type and same rating fuse.

Only G/W models

Circuit no.	Part no.	Description
J801	252063	500mA-EAWK, Secondary
J802, J803	252070	1A-EAK, Secondary

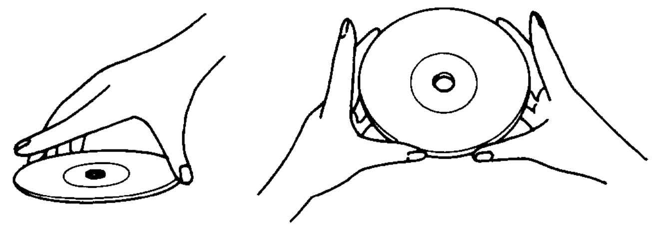
NOTE ON COMPACT DISC

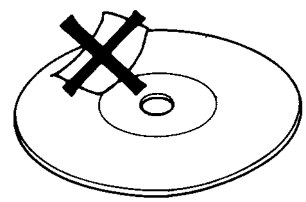
- **Holding Compact Discs**

Hold Compact Discs by the edges so that you do not touch the surface of disc. Remember that the side of the disc with the "rainbow" reflection is the side containing the audio information.
Do not attach tape or paper to the label side of the disc and always be careful not to leave fingerprints on the side that is played.

- **Storing Compact Discs**

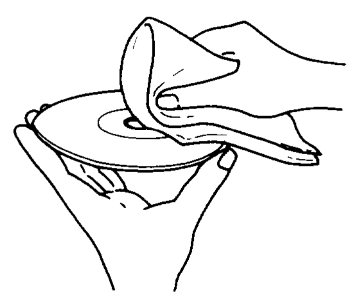
Store Compact Discs in a location protected from direct sunlight, high heat and humidity and extremely high and low temperatures. Discs should never be left in the trunk or interior of an automobile in the sun since the temperature can become very high in such a closed environment.
Always store Compact Discs in the holders in which they were sold. Never leave a disc in the player's disc holder for a long period of time.





- **Cleaning Compact Discs**

Before playing a disc wipe off the playing surface with a soft cloth to remove dust and other soil. Wipe the surface in straight lines from the center of the disc outward, not in a circular motion as you would with a phonograph record.
Do not use benzene, chemical cleansers or phonograph record cleaning solutions to clean Compact Discs. Also avoid static electricity prevention solutions since they can damage the surface of Compact Discs.



Problems Caused by Dew

Dew can form inside a Compact player when it is brought from a cold environment into a warm room, when a room is rapidly heated and if a player is left in a humid environment.
This dew can prevent the laser pickup from reading the data contained in the pits in the disc surface. If the player does not operate properly because of dew, remove the disc and leave the player's power switch on for about one hour to remove all moisture.

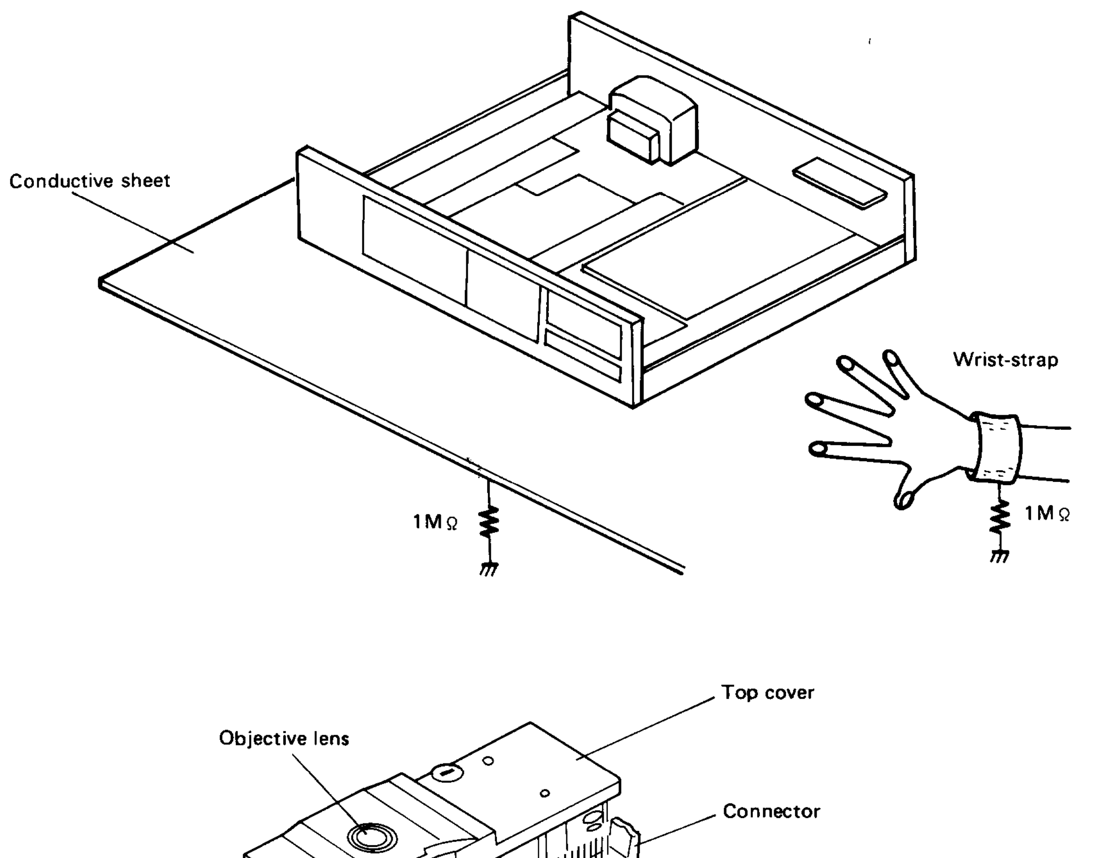
CAUTIONS ON REPLACEMENT OF PICK-UP

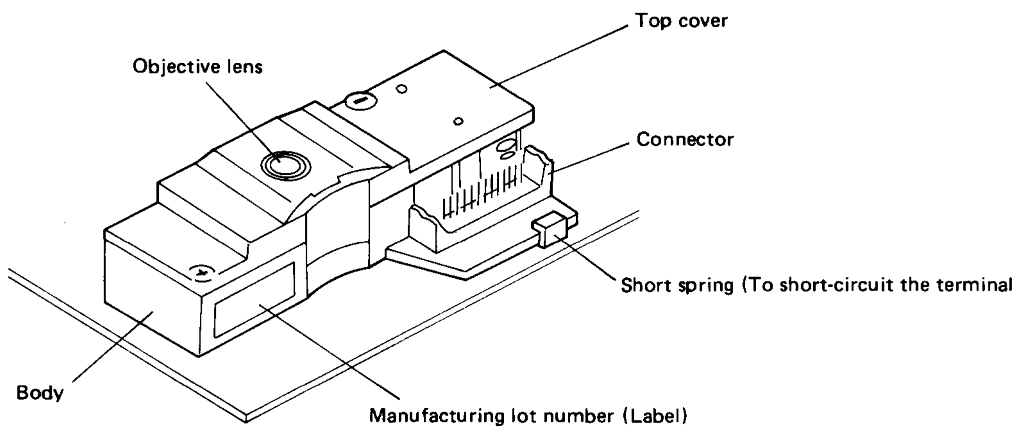
The laser diode in the optical pick-up block is so sensitive to static electricity, surge current and etc. that the components are liable to be broken down or its reliability remarkably deterioated.

During repair, carefulley take the following precautions.
(The following precautions are included in the service parts.)

PRECAUTIONS

1. **Ground for the work-desk.**
   Place a conductive sheet such as a sheet of copper (with impedance lower than $10^6\Omega$) on the work-desk and place the set on the conductive sheet so that the chassis.
2. **Grounding for the test equipment and tools.**
   Test equipments and toolings should be grounded in order that their ground level is the same the ground of the power source.
3. **Grounding for the human body.**
   Be sure to put on a wrist-strap for grounding whose other end is grounded.
   Be particularly careful when the workers wear synthetic fiber clothes, or air is dry.
4. **Select a soldering iron that permits no leakage and have the tip of the iron well-grounded.**
5. **Do not check the laser diode terminals with the probe of a circuit tester or oscilloscope.**





PROTECTION OF EYES FROM LASER BEAM DURING SERVICING

This set employs a laser. Therefore, be sure to follow carefully the instructions below when servicing.

WARNING!!

WHEN SERVICING, DO NOT APPROACH THE LASER EXIT WITH THE EYE TOO CLOSELY. IN CASE IT IS NECESSARY TO CONFIRM LASER BEAM EMMISION, BE SURE TO OBSERVE FROM A DISTANCE OF MORE THAN 30cm FROM THE SURFACE OF THE OBJECTIVE LENS ON THE OPTICAL PICK-UP BLOCK.

Laser Diode Properties

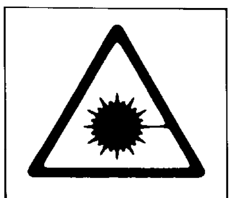
- Material: GaAs
- Wavelength: 780nm
- Emission Duration: continuous
- Laser output: max. 0.3mW*

  *This output is the value measured at a distance about 1.8mm from the objective lens surface on the Optical Pick-up Block.

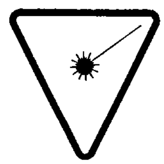
LASER WARING LABELS

The labels shown below are affixed.

1. **Warning labels**



(UG/UW models)

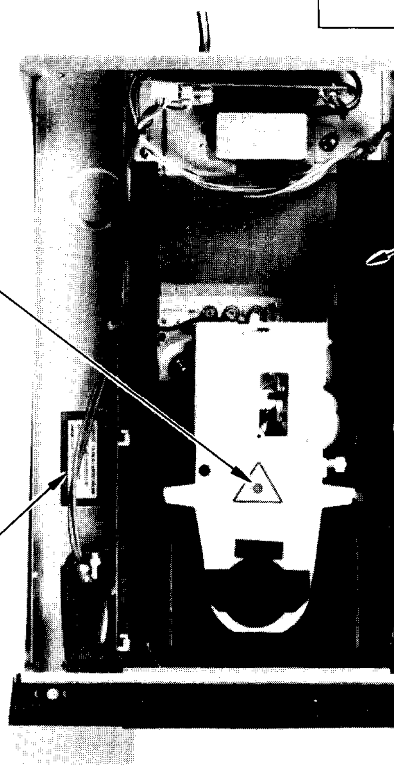


DANGER: INVISIBLE LASER RADIATION WHEN OPEN AND INTERLOCK FAILED OR DEFEATED. AVOID DIRECT EXPOSURE TO BEAM.

CAUTION: HAZARDOUS LASER RADIATION WHEN OPEN AND INTERLOCK DEFEATED.

ATTENTION: RAYONNEMENT LASER DANGEREUX SI OUVERT AVEC L'ENCLENCHEMENT DE SECURITE ANNULE.

(UD model)



ADVARSEL: USYNLIG LASERSTRÅLING VED ÅBNING, NÅR SIKKERHEDSAF-BRYDER ER UDE AF FUNKTION. UNDGÅ UDSÆTTELSE FOR STRÅLING.

(UG/UW models)

2. **Certification label (UD model only)**

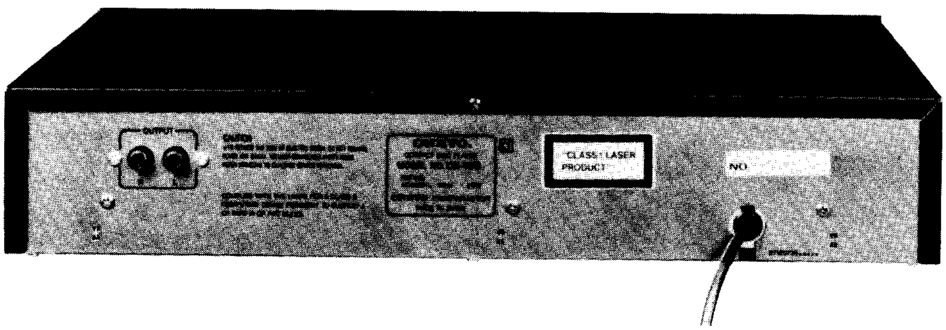
This label is located on the back panel.

PRODUCT IS CERTIFIED BY THE MANUFACTURER TO COMPLY WITH DHHS RULES 21 CFR SUBCHAPTER J APPLICABLE AT THE DATE OF MANUFACTURE.

MANUFACTURED: 1985

3. **Class 1 label (UG/UW model only)**

This label is located on the back panel.



ADVARSEL

"CLASS 1 LASER PRODUCT"

Denne mærkning er anbragt på apparatets højre side og indikerer, at apparatet arbejder med laserstråler af klasse 1, hvilket betyder, at der anvendes laserstråler af svageste klasse, og at man ikke på apparatets yderside kan blive udsat for utilladelig kraftig stråling.

APPARATET BØR KUN ÅBNES AF FAGFOLK MED SÆRLIGT KENDSKAB TIL APPARATER MED LASERSTRÅLER!

ADVARSEL: USYNLIG LASERSTRÅLING VED ÅBNING, NÅR SIKKERHEDSAFBRYDER ER UDE AF FUNKTION. UNDGÅ UDSÆTTELSE FOR STRÅLING.

Indvendigt i apparatet er anbragt den her gengivne advarselsmærkning, som advarer imod at foretage sådanne indgreb i apparatet, at man kan komme til at udsætte sig for laserstråling.

ADJUSTMENT PROCEDURES

Instrument Required

1. Laser power meter
2. Alignment jig
3. Frequency counter
4. Test Disc (YEDS7)
5. Oscilloscope
6. AC voltmeter
7. AF oscillator
8. Servo Analyzer
9. Jitter Meter

1. LASER POWER ADJUSTMENT

1) Turn power of unit off.
2) Turn SF601 semi-fixed resistor clockwise fully (Power min.)
3) Connect the alignment jig as shown fig 2. and set the FOC switch of alignment jig to on.
4) Turn power of unit on.
5) Apply laser power meter sensor to laser pick-up lens and slowly turn SF601 on pre. pc board counter-clockwise so that the laser power meter indictes 250μW ± 10μW.

2. V C.O ADJUSTMENT

1) Connect the frequency counter to test point TP-3 terminal. (See fig. 3)
2) Turn power of unit on and set to the stop mode.
3) Keep unit under the same condition for a minute.
4) Adjust L401 coil so that the frequency counter indicates 4.3218MHz (4.31 to 4.33MHz).

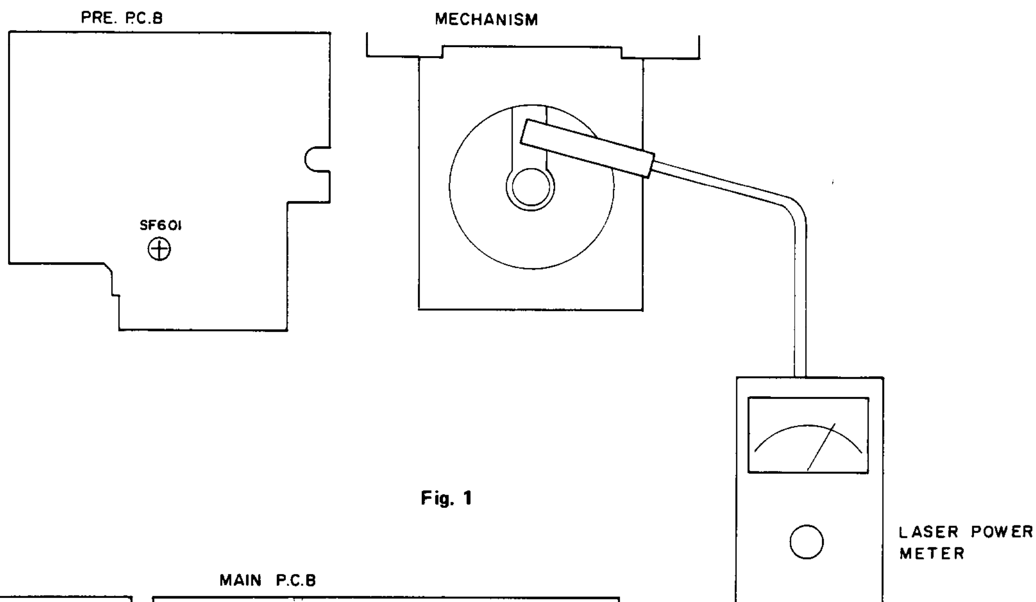


Fig. 1

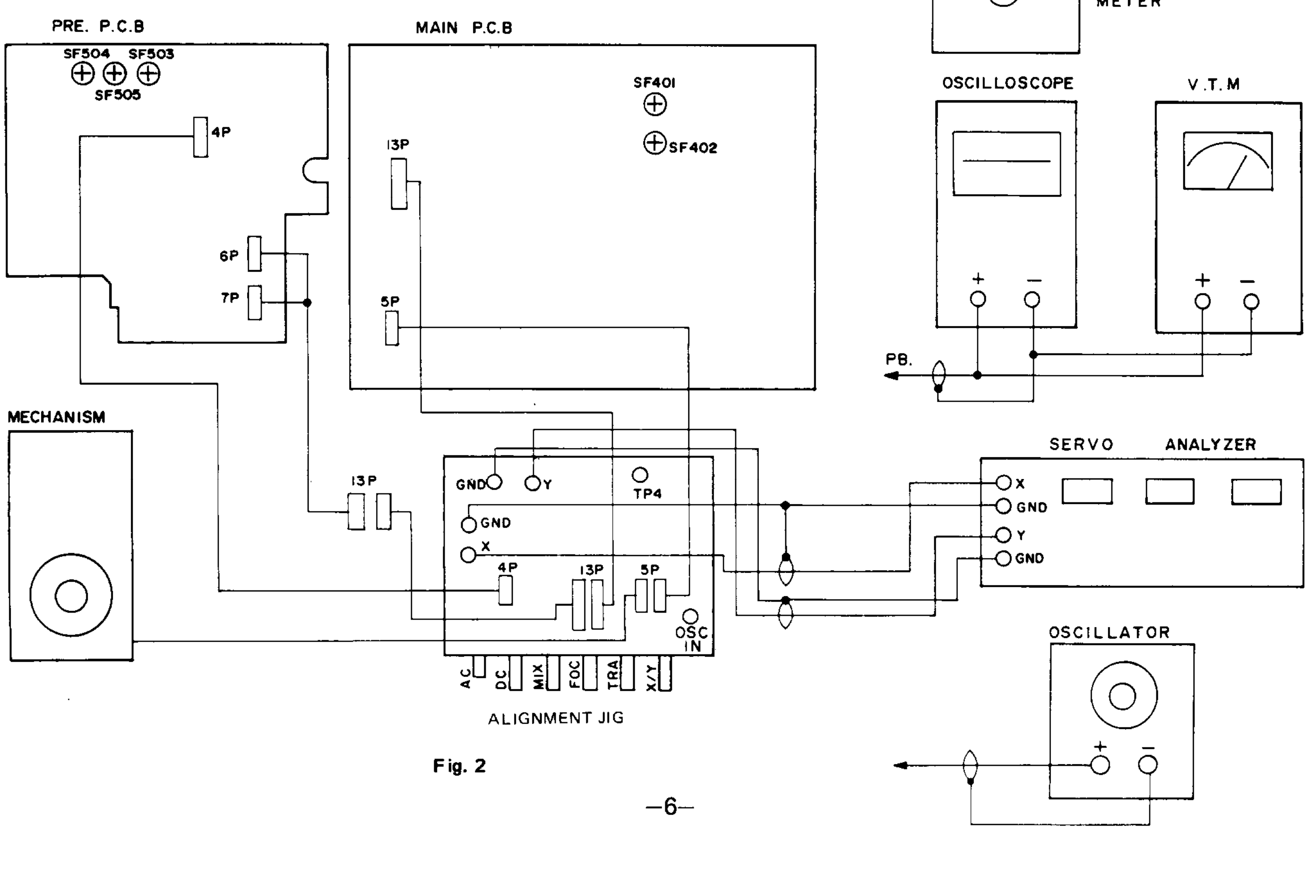


Fig. 2

3. SKEW ADJUSTMENT

Method 1 (See fig. 3)

1) Connect the jitter meter to test point TP-1 terminal.
2) Play the 80th track of test disc (YEDS-7).
3) Adjust the skew screw so that the jitter meter indicates minimum reading.
4) After adjustment, lock the screw with paint.

Method 2

1) Connect the oscilloscope to test point TP-1 terminal.
2) Play the 80th track of test disc (YEDS-7).
3) Adjust the skew screw by turning it so that the clearest waveform is obtained. (See fig. 4)
4) After adjustment, lock the screw with paint.

4. FOCUS OFFSET ADJUSTMENT

Method 1 (See fig. 3)

1) Connect the jitter meter to test point TP-1 terminal.
2) Play the 80th track of test disc (YEDS-7).
3) Adjust SF502 so that the jitter meter indicates minimum reading.

Method 2 (See fig. 3)

1) Connect the oscilloscope to test point TP-1 terminal.
2) Play the 80th track of test disc (YEDS-7).
3) Adjust SF502 by turning it so that the clearest waveform is obtained. (See fig. 4)

5. HF GAIN ADJUSTMENT

1) Connect the oscilloscope to test point TP-1 terminal. (See fig. 3)
2) Play the 80th track of test disc.
3) Adjust SF501 so that the amplitude level of signal HF becomes 2Vp-p.

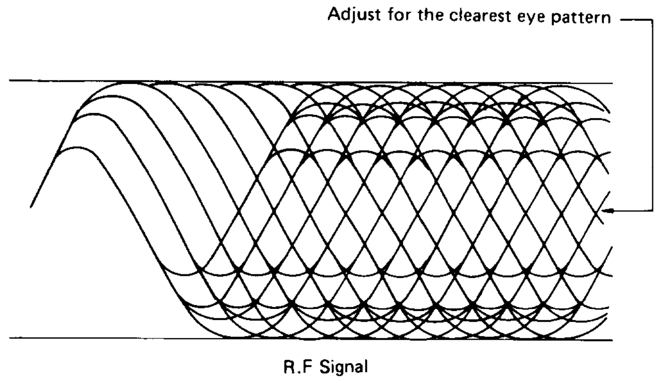


Fig. 4

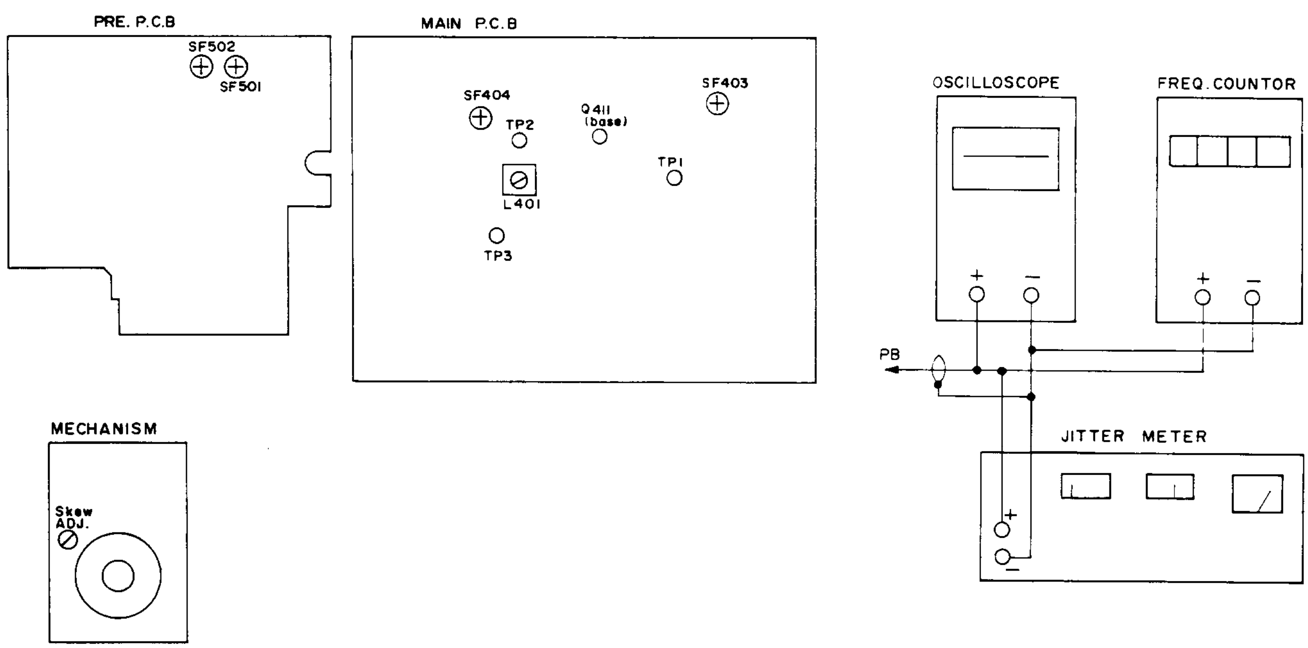


Fig. 3

6. AC PUSH-PULL ADJUSTMENT

1) Turn power of unit off.
2) Connect the alignment jig as shown fig. 6 and set the selector switch of alignment jig to the focus condition.
3) Turn power of unit on.
4) Set the selector switch of alignment jig to AC position.
5) Set the unit to playback mode.
6) Connect the oscilloscope to test point TP-4 terminal.
7) Adjust SF504 so that waveform becomes as shown fig. 5.

7. DC PUSH-PULL ADJUSTMENT

1) Set the selector switch of alignment jig to DC position.
2) Adjust SF503 so that waveform becomes as shown fig. 5.

8. PUSH-PULL MIXING RATIO ADJUSTMENT

1) Set the selector switch of alignment jig to MIX position.
2) Adjust SF505 so that 3Hz component becomes minimum output. (See fig. 6)

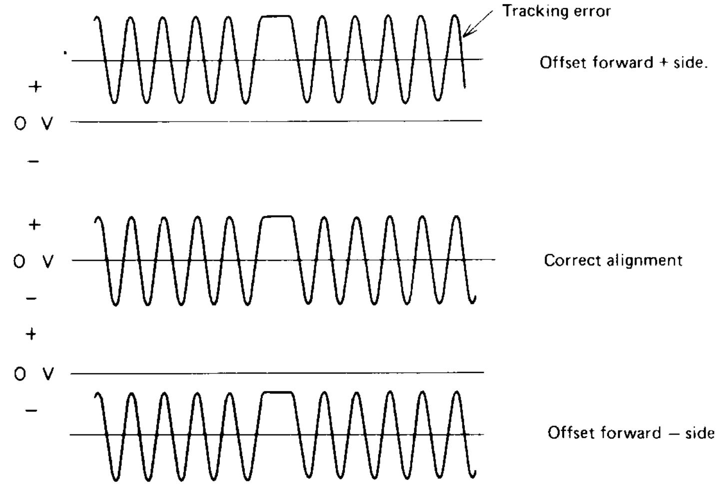


Fig. 5

9. FOCUS SERVO GAIN ADJUSTMENT

Method 1 (See fig. 6)

1) Set the servo analyzer to following manner.
   MODE . . . . . . XY
   DISPLAY . . . . LOG, R, θ
   OVT V . . . . . . 0.03V (Sine wave)
   Frequency 1.2kHz
2) Set the selector switch of alignment jig to FOC position.
3) Play the first track of test disc (YEDS-7).
4) Adjust SF401 so that the value R of servo analyzer indicates 0dB ± 1dB.

Method 2 (See fig. 6)

1) Connect the AF oscillator to OSC terminal of alignment jig.
2) Set the selector switch of alignment jig to FOC position.
3) Play the first track of test disc (YEDS-7).
4) Connect the AC voltmeter to TP-4 terminal.
5) Apply the sine wave 1.2kHz, 60mV from AF oscillator to OSC terminal.
6) Adjust SF401 so that diffrence between X and Y (Push Y) of selector switch of alignment jig become 0dB ±1dB.

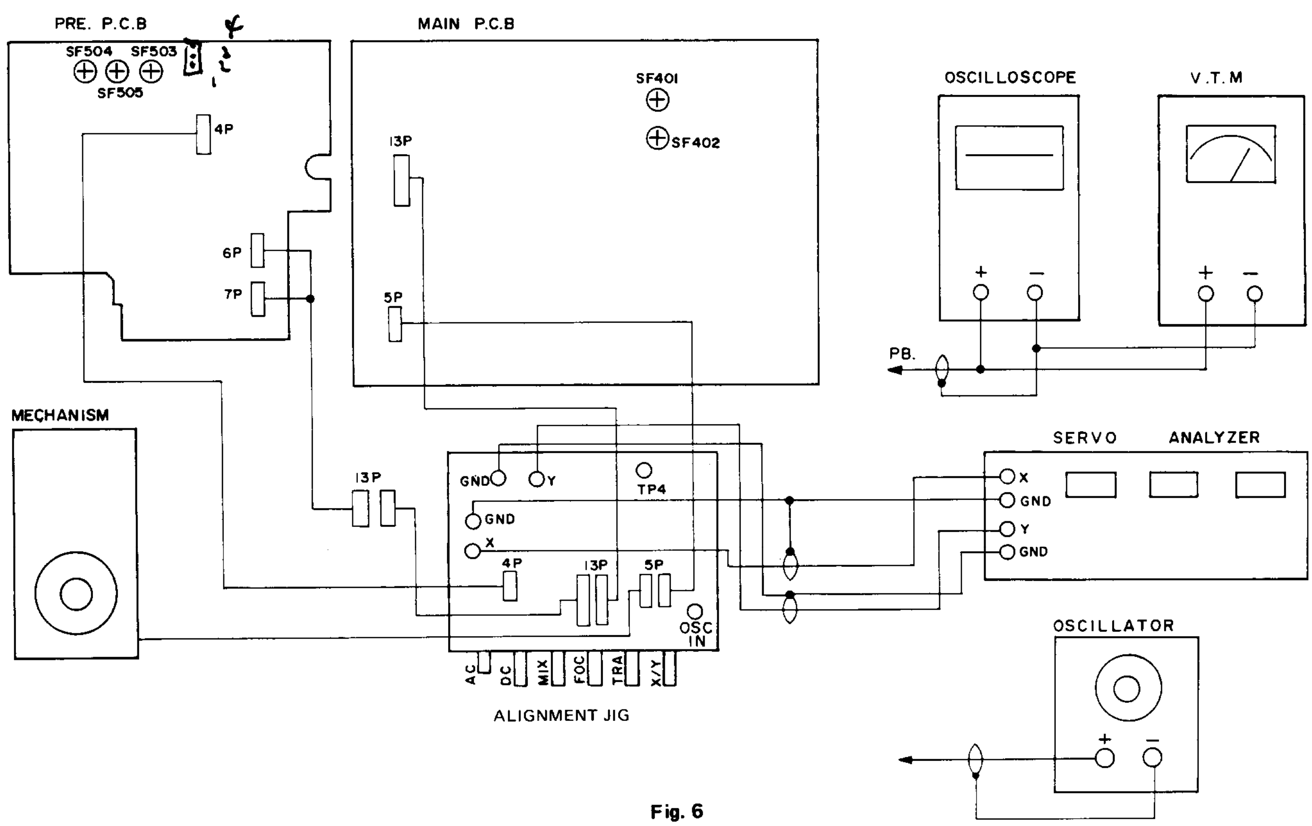


Fig. 6

10. TRACKING SERVO GAIN ADJUSTMENT

Method 1 (See fig. 6)

1) Keep unit under condition just finished focus servo gain adjustment.
2) Set the selector switch of alignment jig to TRA position.
3) Adjust SF402 so that value R of servo analyzer indicates 0dB ± 1dB.

Method 2 (See fig. 6)

1) Keep unit under condition just finished focus servo gain adjustment.
2) Set the selector switch of alignment jig to TRA position.
3) Play the first track of test disc (YEDS-7).
4) Connect the AC voltmeter to TP-4 terminal.
5) Apply the sine wave 1.2kHz, 60mV from AF oscillator to OSC terminal.
6) Adjust SF402 so that diffrence between X and Y (Push Y) of selector switch of alignment jig become 0dB ± 1dB.

11. KICK GAIN ADJUSTMENT (See fig. 9)

1) Connect the oscilloscope to test point TP-1 terminal.
2) Load the test disc and set the unit to PAUSE mode.
3) Adjust SF404 so that waveform on the oscilloscope becomes fig. 7.

Oscilloscope range 200μsec/div
500mV/div
HF REJ
NORM
SLOP–

12. TRACKING OFFSET ADJUSTMENT (See fig.9)

1) Connect the oscilloscope to test point TP-2 terminal.
2) Turn power of unit off.
3) Cover the pick-up with the paper so that external light does not shine upon.
4) Connect to base of transistor Q411 and GND terminal.
5) Turn power of unit on.
6) Press PLAY switch and adjust SF403 so that waveform on oscilloscope becomes fig. 8.

Oscilloscope range 0.2 sec/div
10mV/div

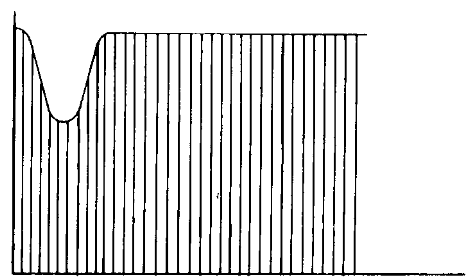


Fig. 7

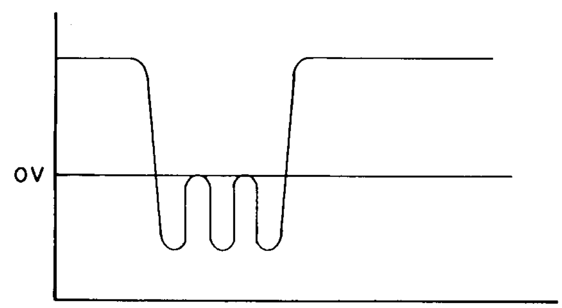


Fig. 8

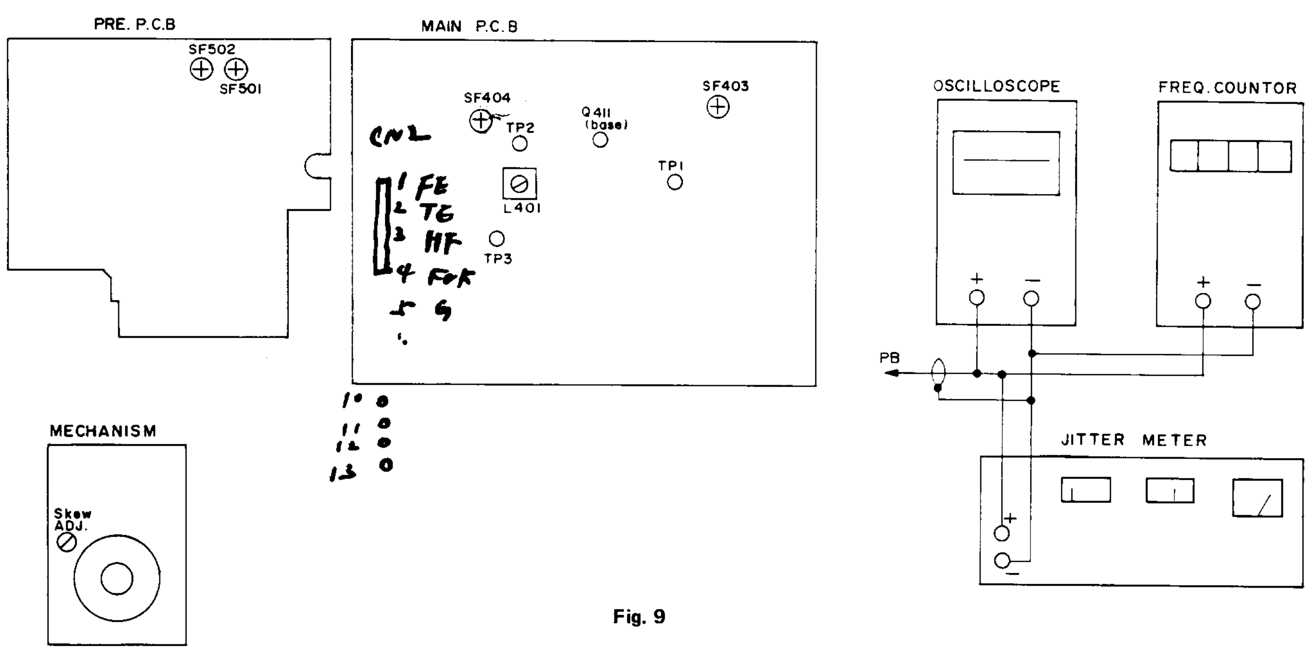
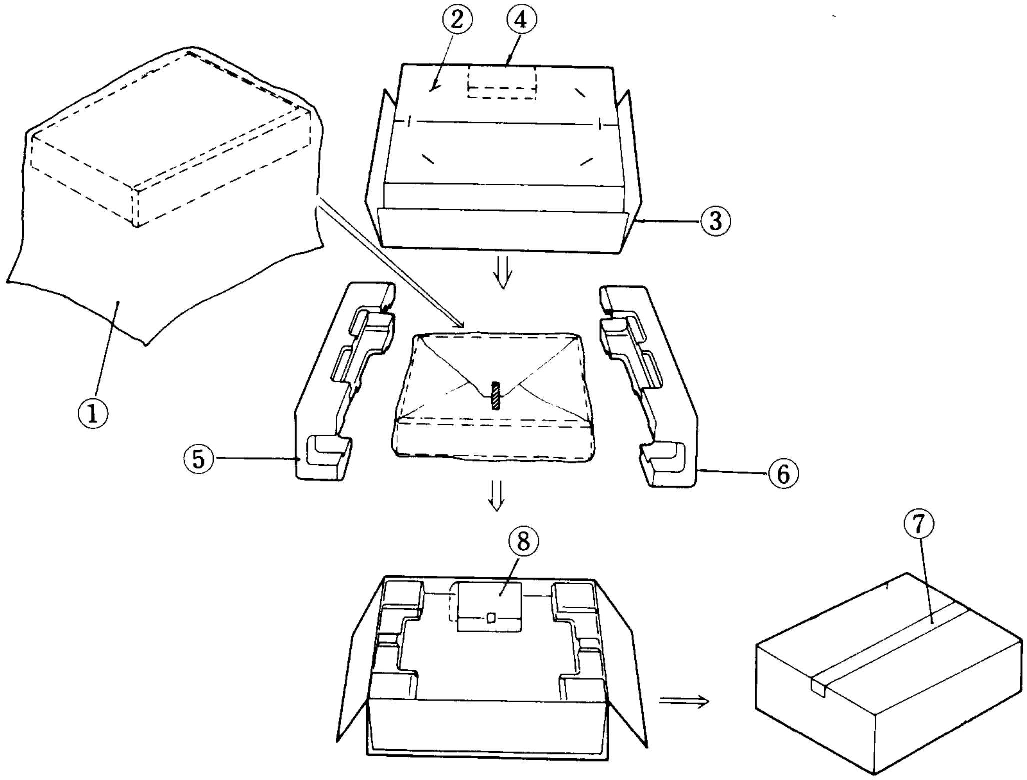


Fig. 9

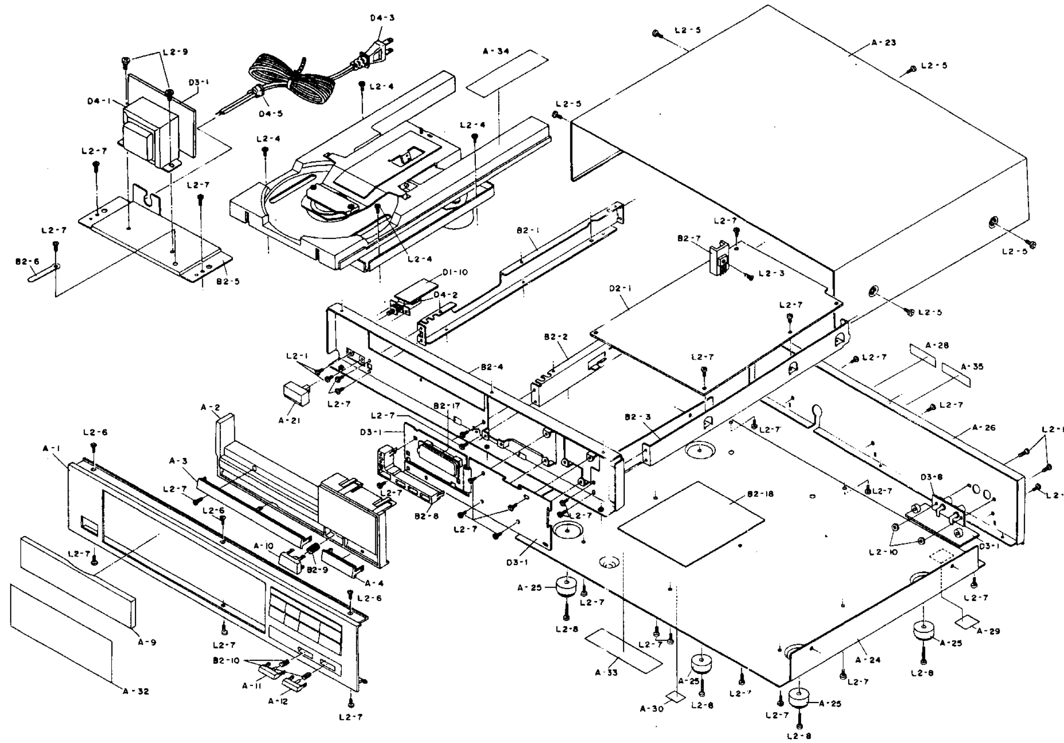
PACKING VIEW



REF. NO.	PART NO.	DESCRIPTION
1	29100083	Poly-vinyl bag
2	282301	Sealing hook
3	29051168	Master carton box (S)
	29051169	Master carton box (B)
4		Pad
5	29091009	Pad, right
6	29091008	Pad, left
7	260013	Damplon tape
8	Accessary bag ass'y	
	29340901	Instruction manual (D/W)
	29360779	Instruction manual (G)
	29365006-7	Warranty card (DN)
	29358002C	Service station list (DN)
	29340883A	Warranty card (GV)
	25055040	CV-K-2, Convertion plug (W)
	2010115	Connection cable
	29100006A	350 x 250mm, Poly-vinyl bag

Note (D) : Only 120V model
(G) : Only 220V model
(W) : Only 120/220V model
(S) : Only Silver model
(B) : Only black model
(DN) : Only U. S. A. model
(GV) : Only West Germany model

CHASSIS-EXPLODED VIEW



PARTS LIST

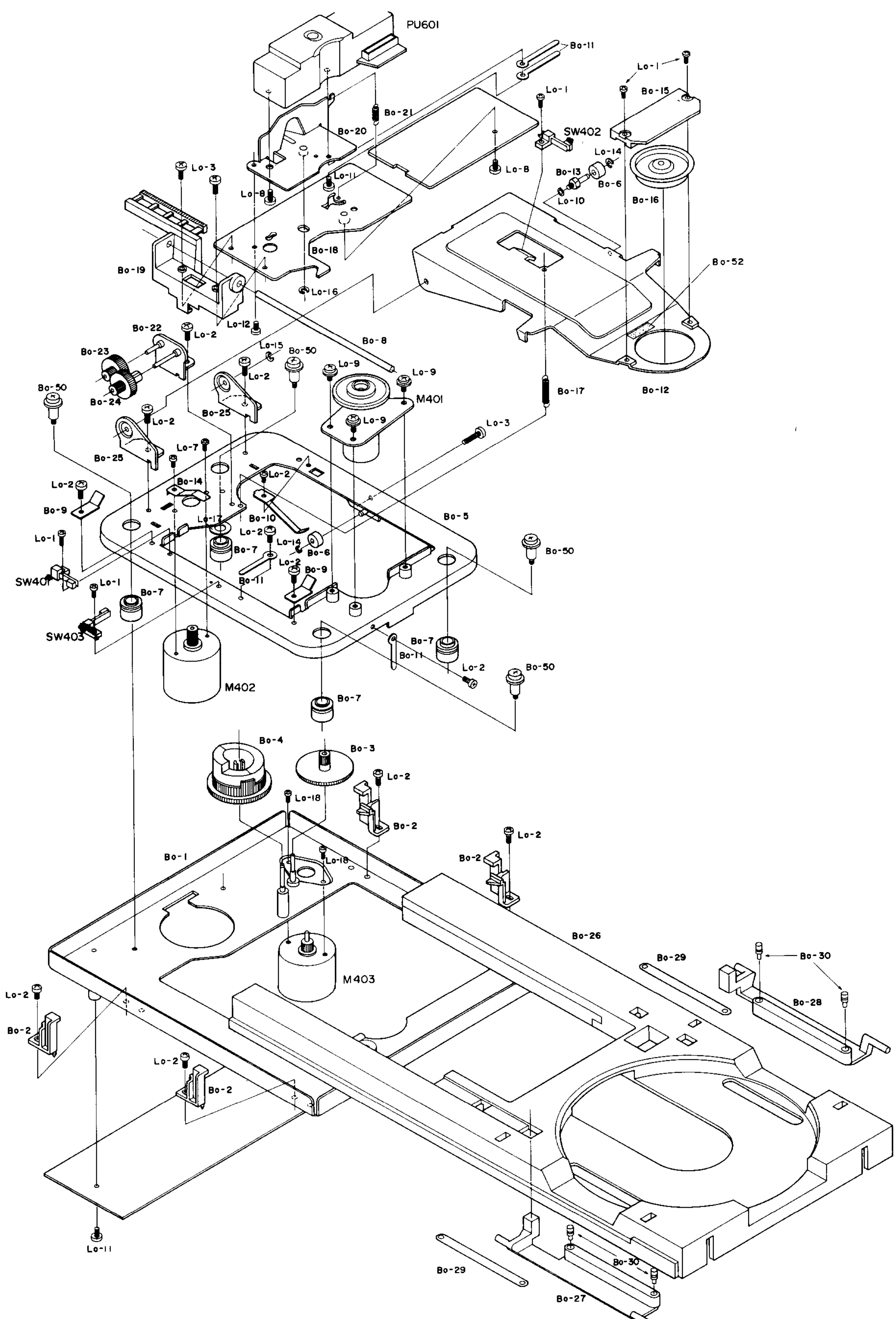
REF. NO.	PART NO.	DESCRIPTION
A1	27210614	Front panel ass'y (B)
	28322139	Guide, knob
	28191311	Plate, clear
	28322143	Knob FR
	28322144	Knob FF
	28322145	Knob, memory
	28322146	Knob, clear
	28322147	Knob, stop
	28322148	Knob, play
	28322149	Knob, down
	28322150	Knob, up
	28322207	Knob C
	27267389	Guide, power
A1	27210613	Front panel ass'y (S)
	28322195	Guide, knob
	28191311	Plate, clear
	28322199	Knob FR
	28322200	Knob FF
	28322201	Knob, memory
	28322202	Knob, clear
	28322203	Knob, stop
	28322204	Knob, play
	28322205	Knob, down
	28322206	Knob, up
	28322198	Knob C
	27266889	Guide, power
A2	27190395	Holder ass'y (B)
	27190396	Holder ass'y (S)
A3	27262347	Plate A, decoration (B)
	27262362	Plate A, decoration (S)
A4	27262348	Plate B, decoration
A8	28133140	Plate, back
A9	27210610	Tray panel
A10	28322140	Knob, open
A11	28322141	Knob, display (B)
	28322196	Knob, display (S)
A12	28322142	Knob, memory (B)
	28322197	Knob, memory (S)
A21	28321905A	Knob, power (B)
	28321928	Knob, power (S)
A23	28184287	Top cover (B)
	28184293	Top cover (S)
A24	28153083	Chassis
A25	27175065	Leg
A26	27120732	Back panel (D)
	27120738	Back panel (G)
	27120739	Back panel (W)
A28	29360792	Label
A29	29360793	Label, bottom
A30	29360794	Label
A33	29360796	Label
A34	29360797	Label, caution
A35		Label, back panel

REF. NO.	PART NO.		DESCRIPTION
B2-1	27115188		Bracket, left
B2-2	27115189		Bracket, center
B2-3	27115190		Bracket, right
B2-4	27110253		Bracket, front
B2-5	27141011		Bracket
B2-6	27141012		Clamp
B2-7	27160168		Radiator
B2-8	27190389		Holder, LED
B2-9	27180267		Spring, coil
B2-10	27180268		Spring, coil
B2-17			Stud
D1-10	10398582		NASW-2382, Power switch pc board ass'y
D2-1	10398584		NAMA-2384, Main pc board ass'y
D3-1	10398583A	△	NAPS-2383A, Power trans. pc board ass'y (D)
	10394583B	△	NAPS-2383B, Power trans. pc board ass'y (G)
	10390583C	△	NAPS-2383C, Power trans. pc board ass'y(W)
	10398586		NADIS-2386, Dispaly pc board ass'y
	10398587		NASW-2387, Switch pc board ass'y
D3-8	2504510		Terminal, output
D4-1	2300002	△	NPT-883D, Power transformer (D)
	2300003	△	NPT-883G, Power transformer (G)
	2300004	△	NPT-883DG, Power transformer (W)
D4-2	25035484	△	NPS-111-L446P, Power switch
D4-3	2010113		Power supply cord (D)
	2010114		Power supply cord (G/W)
D4-5	27300798	△	Strainrelief
L2-1			3 x 6, Bind screw
L2-3			3 x 6, Pan head sems screw
L2-4			3 x 6, Bind screw
L2-5			3 x 6, Bind screw
L2-6			3 x 6, Pan head screw
L2-7			3 x 6, Bind screw
L2-8			3 x 10, Bind screw
L2-9			4 x 6, Bind screw
L2-10			
	25030269	△	NRS-121-P, Voltage selectorswitch (W)

(D) : Only 120V model
(G) : Only 220V model
(W) : Only Universal model
(S) : Only Silver model
(B) : Only Black model

NOTE: THE COMPONENTS IDENTIFIED BY MARK △ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PARTS NUMBER SPECIFIED.

MECHANISM-EXPLODED VIEW



PARTS LIST

REF. NO.	PART NO.	DESCRIPTION
Bo-1	27100077	Chassis, main
Bo-2	27267425	Guide, tray
Bo-3	27300786	Gear
Bo-4	27300787	Gear, cam
Bo-5	27100078	Sub-chassis
Bo-6	27267426	Guide, roller
Bo-7	28140615	Cushion
Bo-8	27267427	Guide, shaft
Bo-9	27267428	Guide
Bo-10	27180263	Spring
Bo-11	27141009	Clamp
Bo-12	27130397	Bracket
Bo-13	27260186	Shaft B
Bo-14	27180264	Spring C
Bo-15	27190385	Holder
Bo-16	27300788	Disc, chuck
Bo-17	27180269	Spring, coil
Bo-18	27130398	Bracket
Bo-19	27300789	Gear, rack
Bo-20	27130399	Bracket, pick-up
Bo-21	27180265	Spring
Bo-22	27130400	Bracket
Bo-23	27300790	Wheel, worm
Bo-24	27300791	Gear
Bo-25	27130401	Bracket
Bo-26	27210608	Tray
Bo-27	27190386	Holder L
Bo-28	27190387	Holder R
Bo-29	27180266	Spring B
Bo-30	27300792	Bush
Bo-31	27130402	Arm
Bo-32	27260160	Spacer
Bo-33	27270161	Spacer
Bo-34	27260187	Shaft, gear
Bo-35	27260188	Shaft, cam
Bo-36	27260189	Shaft, roller
Bo-37	27260162	Spacer A
Bo-38	27260163	Spacer B
Bo-40	27260164	Spacer, pick-up
Bo-41	27130403	Bracket, motor
Bo-42	27300793	Turntable
Bo-43	27260190	Shaft, gear
Bo-44	27260191	Shaft, wheel
Bo-45	27260192	Shaft, arm
Bo-46	27300794	Gear, pinion
Bo-47	27300795	Gear, wheel
Bo-48	28140616	Cushion
Bo-49	27141010	Bracket
Bo-50	801352	Screw, special
Bo-52		Sheet

REF. NO.	PART NO.	DESCRIPTION
Lo-1	82132605	2.6P+5FN (CR), Pan head screw
Lo-2	82133006	3P+6FN (CR), Pan head screw
Lo-3	82133010	3P+10FN (CR), Pan head screw
Lo-8	801350	3SMP8W+4FN (CR), Sems screw
L0-9	801351	3SMP8W+6FN (CR), Sems screw
Lo-10	8711260706	SW26 (CR), Washer
Lo-11		3×6, Sems screw
Lo-12	825126080	2.6B+8FN (CR), Binding screw
Lo-14	893020	E-2SN, Ring E
Lo-15	893030	E-3ZN, Ring E
Lo-16	893040	E-4ZN, Ring E
Lo-17	8700941450	W9.4×13.5, Washer
Lo-18	82132604	2.6P+4FN (BC), Pan head screw
M401	24502185	Spindle motor ass'y
	24502183	Spindle motor
	27130403	Bracket
M402	24502186	Tray motor ass'y
	24502184	Motor
	27300795	Gear
M403	24502187	Pick-up motor ass'y
	24502184	Motor
	27260192	Shaft
	27300794	Gear
PU601	241053	Optical pick-up
SW401	25065262	NFL-1113, Leafswitch
SW402, SW403	25065263	NFL-1114, Leafswitch

PRINTED CIRCUIT BOARD-PARTS LIST

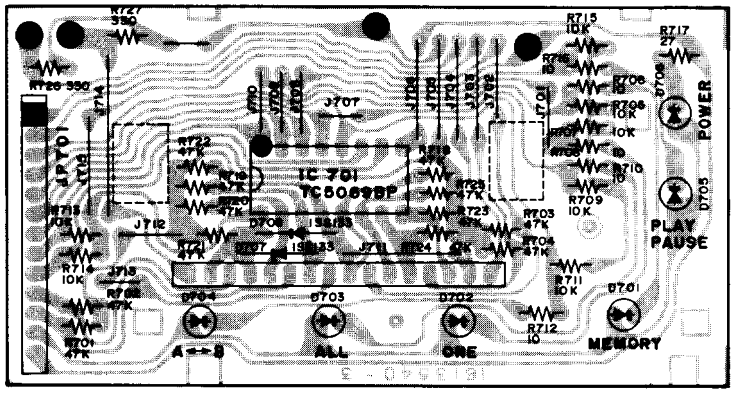
MAIN PC BOARD (NAMA-2384)

CIRCUIT NO.	PART NO.	DESCRIPTION
	ICs	
IC101	222758	NJM072D
IC102	222736	NJM4558S or
IC401-IC404		BA715
IC301	222706	HM6116-4
IC302	222893	YM2201
IC303	222896	PCM53JP
IC304	222895	TC4053BP or 4053
IC405	222894	BA6109
IC406	222891	CX-564-171
IC407	222892	YM3531
IC408	222766	NJM4560S
	Transistors	
Q101, Q201	2212285	2SC2878 (A)
Q102, Q202	2212720	2SD1469
Q301, Q401	2211182	2SC1740 (Q)
Q405, Q406		
Q409-Q416		
Q421		
Q423, Q806		
Q906-Q912		
Q302, Q402	2211454	2SA1015 (Y) or
Q424, Q807		2SA933
Q404, Q408	2212693	2SB1009 (Q)
Q804		
Q403, Q407	2212673	2SD1380 (P)
Q801, Q802		
Q417, Q419		2SD1227
Q418, Q420	2212703	2SB911M (Q)
Q422, Q803	2212683	2SC2060 (Q)
Q805	2212713	2SA934 (Q)
Q901-Q905	2201550	2SA790
	Diodes	
D302	2239632	RD12E-B2 or TZ12B
D404	2239452	RD5.1E-B2 or TZ5.1B
D801-D806	223893	1SR35-100
D411, D812	2239513	RD6.8E-B3 or TZ6.8C
D405, D807	2239472	RD5.6E-B2 or TZ5.6B
D406	225181	SVC211, Variable capacitor
D808, D810	2239652	RD13E-B2 or TZ13B
D809, D811	2239692	RD16E-B2 or TZ16B
D301, D401	223163	1S133
D407, D408		
D412, D413		
D813-D815		
D901-D904		
	Coils	
L101, L102	3010095	KH40200, Low pass filter
L401	233346	0204-120
	Capacitors	
C103, C203	352941006	10μF, 16V, Non-polar Elect.
C305, C307	352742209	22μF, 16V, Elect.
C309		
C308, C403	352734709	47μF, 10V, Elect.
C411, C823		
C818	352724709	47μF, 6.3V, Elect.
C310, C413	352744709	47μF, 16V, Elect.
C421	352980106	1μF, 50V, Non-polar Elect.
C424, C430	352731019	100μF, 10V, Elect.
C425	352780229	2.2μF, 50V, Elect.

CIRCUIT NO.	PART NO.	DESCRIPTION
	Capacitors	
C426	335011044	0.1μF, 25V, Semi-conductor ceramic
C431, C432	352732209	22μF, 10V, Elect.
C817		
C801	352744729	4,700μF, 16V, Elect.
C802	352741029	1,000μF, 16V, Elect.
C803	352751029	1,000μF, 25V, Elect.
C804	352752229	2,200μF, 25V, Elect.
C809-C812	352742219	220μF, 16V, Elect.
C813, C815	352741009	10μF, 16V, Elect.
C816, C824		
C814	352741019	100μF, 16V, Elect.
	Resistors	
SF401, SF402	5215044	N08HR5KBC, Semi-fixed
SF403	5215047	N08HR100KBC, Semi-fixed
SF404	5215049	N08HR500KBC, Semi-fixed
R801, R825	4000105	⚠ 2.2Ω, 1/2W, Fuse
R826-R828		
R803	4000106	⚠ 56Ω, 1/2W, Fuse
R808	4000106	⚠ 56Ω, 1/2W, Fuse
R831, R832	441726804	68Ω, 2W, Metal oxide film
	Plugs	
CN1	25055213	NPLG-4P197
CN2	25055216	NPLG-13P200
CN3	25055215	NPLG-6P199
CN4	25055214	NPLG-5P198

NOTE: THE COMPONENTS IDENTIFIED BY MARK ⚠ ARE CRITICAL FOR RISK OF FIRE AND ELECTRIC SHOCK. REPLACE ONLY WITH PARTS NUMBER SPECIFIED.

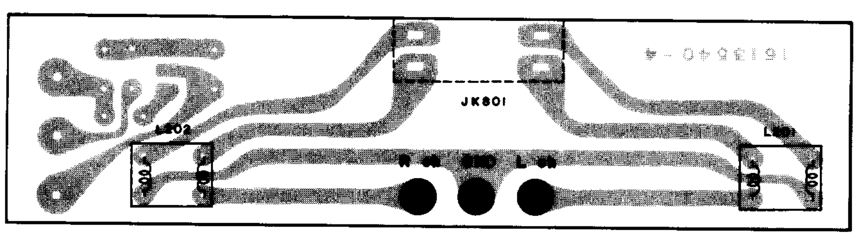
PRINTED CIRCUIT BOARD VIEW FROM BOTTOM SIDE



DISPLAY PC BOARD

DISPLAY PC BOARD (NADIS-2386)

CIRCUIT NO.	PART NO.	DESCRIPTION
	IC	
IC701	222890	TC5067BP
	Diodes	
D707, D708	223163	1S133
D709	224145	05Z3. 3Y
	L. E. Ds	
D701	225182	SLV-31DU
D702	225183	SLV-31MG
D705	225184	SLV-26MG
D706	225185	SLV-26DU
	Fluorescent indicator tube	
	212017	FG48EIC



JACK PC BOARD

JACK PC BOARD

CIRCUIT NO.	PART NO.	DESCRIPTION
L102, L202	231065	NCA-0117, Coil
JK801	25045170	NPJ-2PDBL, Output terminal

SERVICE GUIDE

Play

Step		Check point	Trouble place
Tray open	NO	IC406 13 IC405 6 , 10 . . . . H? IC406 14 IC405 5 , 2 . . . . L IC406 38 . . . . L? Motor voltage OK	IC406, IC405 SW708, IC406 M403
Automatically closes		SW401 (Tray out switch) ON? IC406 6 . . . . L?	SW401 IC406
Tray close	NO	IC406 13 IC405 6, 10 . . . . . L? IC406 14 IC405 5, 2 . . . . . H	IC406,IC405
Automatically opens		SW402(Tray in switch) ON? IC406 2 . . . . L?	SW401 IC406
Pick-up innermost circuit	NO	IC407 26 . . . . H? CN3 2 . . . . Negative voltage? M402 . . . . ON?	IC407 Feed circuit M402 (Feed motor)
Focus search	NO	IC407 12 . . . . H? Q401 . . . . ON? Q424 . . . . ON? Q402 . . . . ON? CN2 (11) (Focus drive) . . . ?	IC407 Q401 Q424 Q402 Focus search circuit
Disc motor starts	NO	IC407 14 (139mm) H? IC407 13 L? IC407 10 . . . . H? CN3 1 . . . . H?	Focus OK circuit Focus zero-cross circuit IC407 M401 (Disc motor)
Turns a little bit, then stops		TP1 (HF) Is there signal output? IC407 8 Is there signal output?	HF circuit
Disc motor runs wild, pick-up shifts to inner or outer circuit			HF gain adjustment miss Skew angle adjustment miss Focus offset adjustment miss Tracking error adjustment miss Tracking offset adjustment miss
PLL lock	NO	IC407 40 Is IC407 4.322MHz? (When stop) IC407 10 Is there output of PWM? IC407 11 modulation pulse? CN3 1 Is there output? TP1 Is there a distinct eye pattern?	L401 adjustment miss PLL circuit IC407 Disc servo circuit M401 (Disc motor) Skew angle/Focus offset adjustment miss

After an elapse of 4 seconds, pick-up shifts to the inner circuit

139msec after decent of FZC, if FRF is H, Focus is OK.

1

1

Selected music search — NO →

Check point			Trouble place
IC407	22 / 23	Is kick pulse output?	IC407
TP 2		Is kick pulse output?	Kick circuit
IC407	15	Is there pulse input?	HF envelope circuit
	16	Is there pulse input?	Tracking error zero-cross circuit
	18	Is there output?	IC407
	19	Is there output?	IC407
	21	Is there output?	IC407
	25 or 26	Is there output?	IC407
Q411		Does it go ON/OFF?	Q411
Q412		Does it go ON/OFF?	Q412
Q423		Does it go ON/OFF?	Q423
TP1		Is there a distinct eye pattern?	Skew angle adjustment miss
			Focus offset adjustment miss
			Tracking offset adjustment miss
			Tracking error adjustment miss
			Tracking servo adjustment miss

Sound output — NO →

Check point			Trouble place
IC302	5	Is there pulse input?	IC302
IC302	22 , 23	Is pulse output?	IC302, IC301
IC302	52	Is pulse output?	IC302
IC303	17	Is pulse output?	IC303
IC304	1 , 13	Is there output?	IC302, IC304
			Analog circuit

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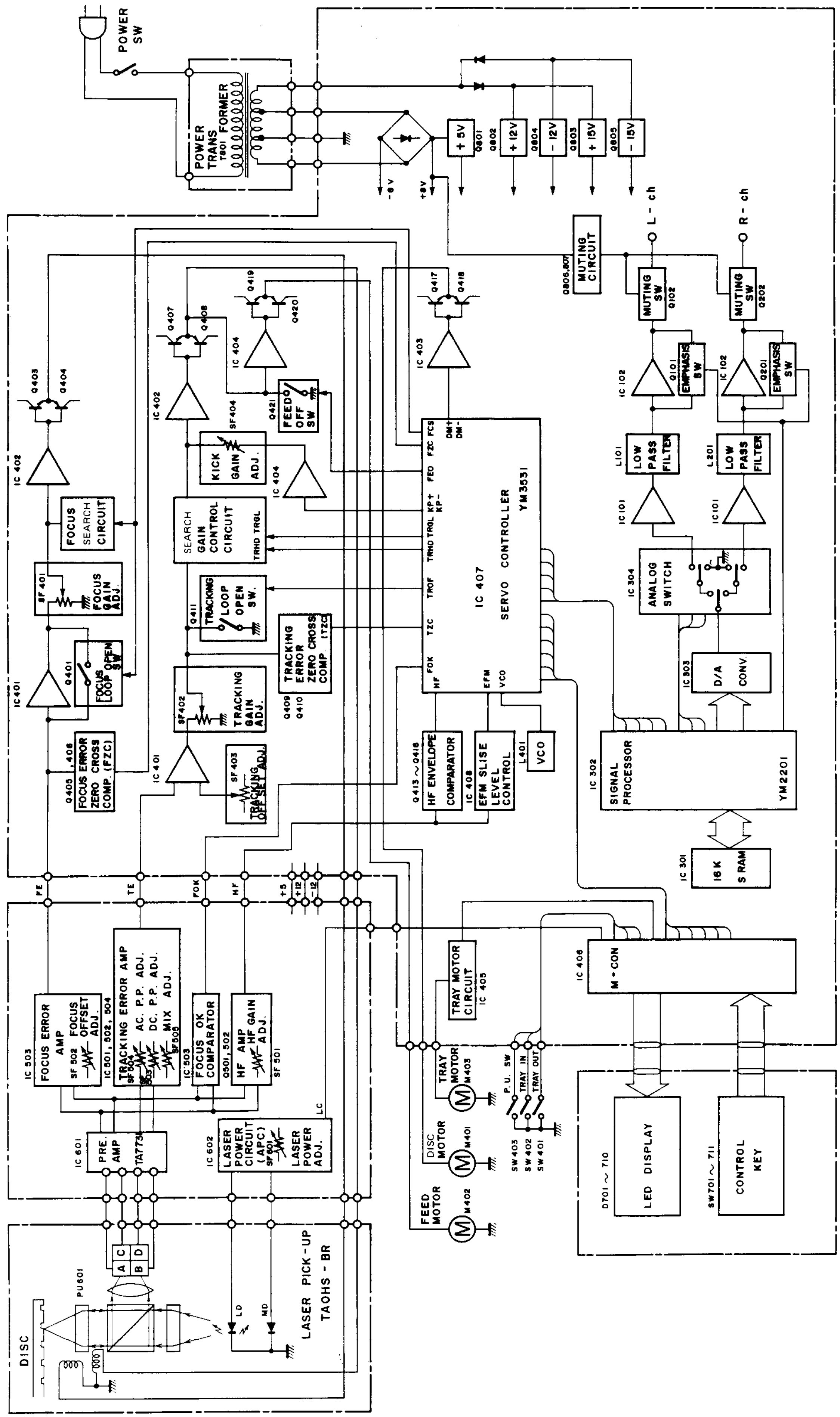
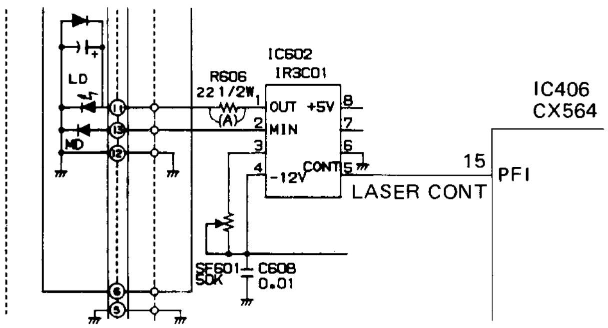
N506 Printed in Japan

BLOCK DIAGRAM



CIRCUIT DESCRIPTIONS

1. APC (Auto Power Control) Circuit



LD: Laser diode
MD: Monitor diode

Fig. 1 APC circuit

The APC circuit maintains the light intensity of a laser diode at a constant 0.25 milliwatts.

The laser is switched on and off by the LASER CONT (laser diode control) signal. When high, the LC signal turns on the laser; when low, the LC signal turns off the laser. When the LC goes high, IC602(5) goes from low level to high and IC602(1) goes high, so that current flows into the laser diode. Since the output of a laser diode is affected by its temperature and its physical condition, a monitor diode is added to keep the output of the laser diode constant. The monitor diode is activated by the laser beem. As the laser diode ages and its characteristics change, the diode requires more current to produce the same output. The current of laser diode can be determined by measuring the voltage drops across R606.

The ILD (laser diode current) is expressed as follows:

$$I_{LD} = \frac{(A)\ (\text{volts})}{22\ (\text{ohms})}$$

ILD will be 30 to 40mA when a diode is new, so determine when to replace the pick-up using this value.

2. Focus Error Circuit

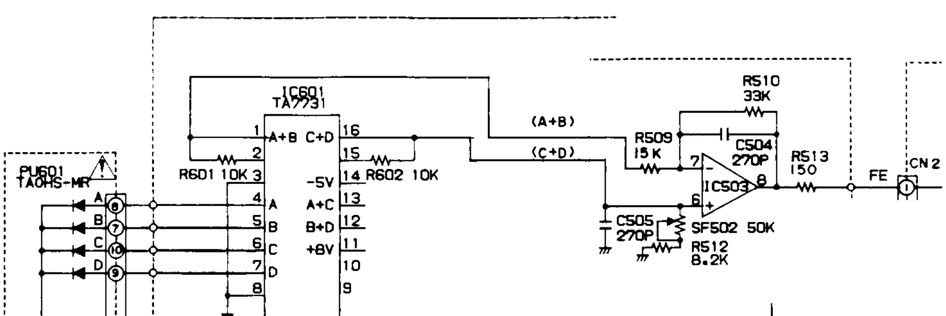


Fig. 2 Focus error circuit

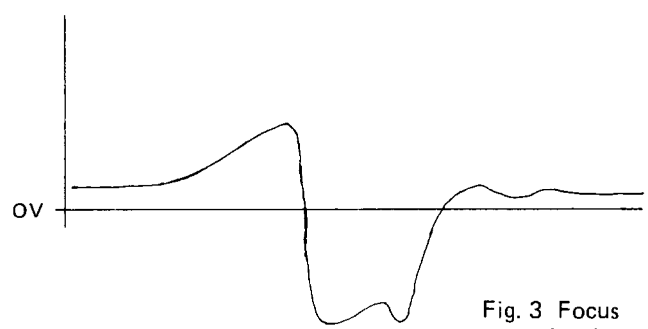


Fig. 3 Focus error signal

The focus error circuit detects displacement of the laser beam spot from the reflecting surface of the disc to ensure that the beam is maintained on that surface.

Signals output by the four-part photodetector are fed to TA7331P of the head amplifier. The head amplifier amplifies these four signals and outputs the various combinations of the signals (A+B) and (C+D).

These signals via R509 and R511 are applied to operational amplifier IC503 and the difference between (A+B) and (C+D) is detected.

3. Focus OK Circuit

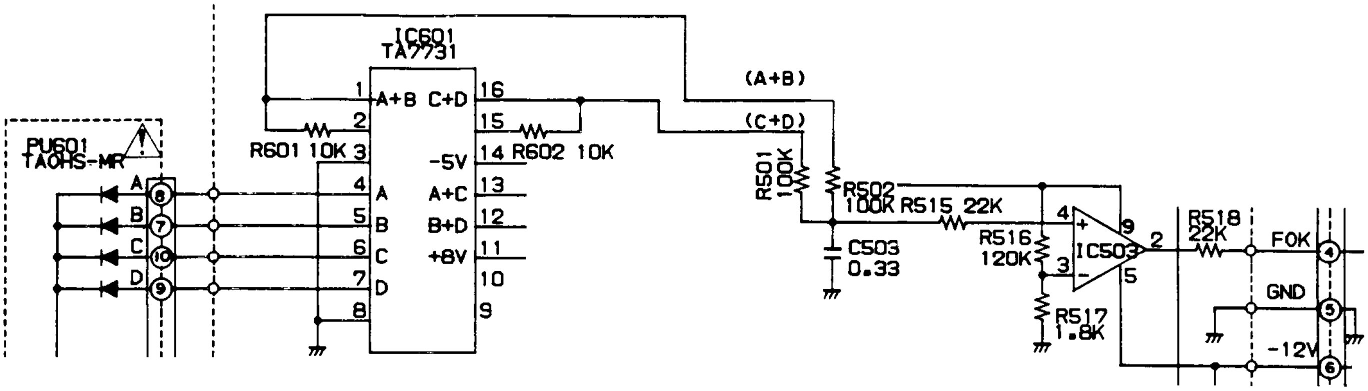


Fig. 4 Focus OK circuit

The focus OK circuit determines whether or not a disc has been loaded in the player.
When a disc is loaded, a laser diode is turned on and output signals are passed via a four-part photodetector from pins 1 and 16 of the TA7731 head amplifier. After being passed via the respective R502 and R501, these outputs are mixed, and the resultant low frequency components from C503 are passsed via R515 to the IC503 comparator.
This input is then compared with a voltage signal of approximately 180mV (determined by the R516 and R517 division ratio). The output obtained from pin 2 of IC503 is +12V if the comparator input is larger than the reference voltage, but –12V if smaller. This signal is then converted to TTL level by D401 and R456 to become an input signal applied to pin 14 of YM3531 – a servo control IC.
That is, when a focus serarch operation is executed with a disc loaded in the player, an H level input (from the signal obtained from disc reflection) is applied to pin 14 of YM3531.

4. Focus Zero-cross Circuit

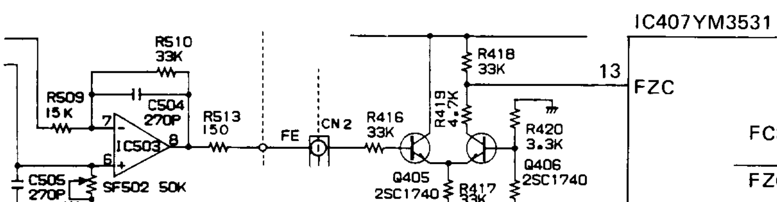


Fig. 5 Focus zero-cross circuit

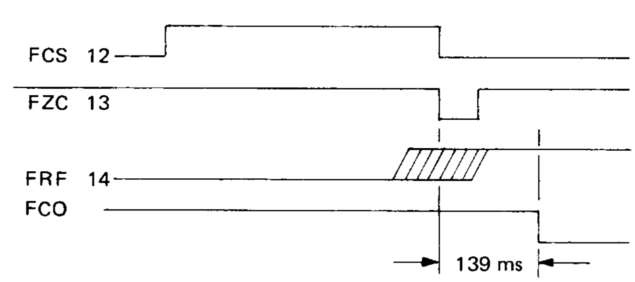


Fig. 6 Focus timing chart

The focus zero-cross circuit is an important circuit used to detrmine whether proper focus has been achieved by the servo control LSI (YM3531).
A signal from the four-part photodetector is obtained as an A+B output from pin 1 of the TA7731 head amplifier, and as a C+D output from pin 16, resulting in the formation of a focus error signal by the IC503 differential amplifier.
This signal is passed via R416 to the Q405 comparator where it is compared with the Q406 base potential of about –460mV. If the input voltage is larger than the base potential, Q405 is turned on and Q406 off with an H level input being applied to pin 13 of YM3531. But if the input voltage is smaller, Q405 is turned off and Q406 on with a L level input applied to pin 13.
This YM3531 measures the pin 14 FRF 139msec after the pin 13 FZC trailing edge (see Fig. 6), and judges that proper focus has been achieved if the level is H.

5. Focus Search Circuit

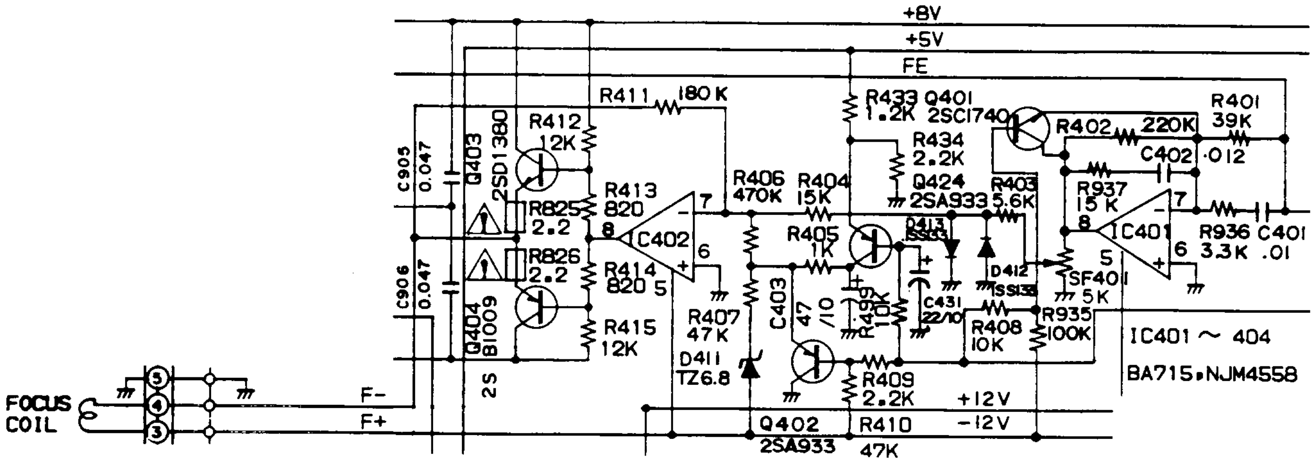


Fig. 7 Focus Search Circuit

The focus search circuit is used to keep the beam spot focussed onto the reflecting surface of the disc by perpendicular movement of the object lens.
When the disc is stationary Q424 and Q402 are on, and C403 is charged up via R433 and Q424 (see Fig. 7).
When a focus search instruction is received from the CX564 microcomputer (pin 9), YM3531 generates a focus search signal from pin 12 FCS at the timing indicated in Fig. 6. As a result, Q401 is turned on and the focus servo loop is opened. At the same time, Q402 and Q424 are turned off and C403 is discharged via R405. This discharge voltage signal is applied to pin 3 of IC402, and the object lens is up/down by Q403 and Q404.

6. Focus servo circuit

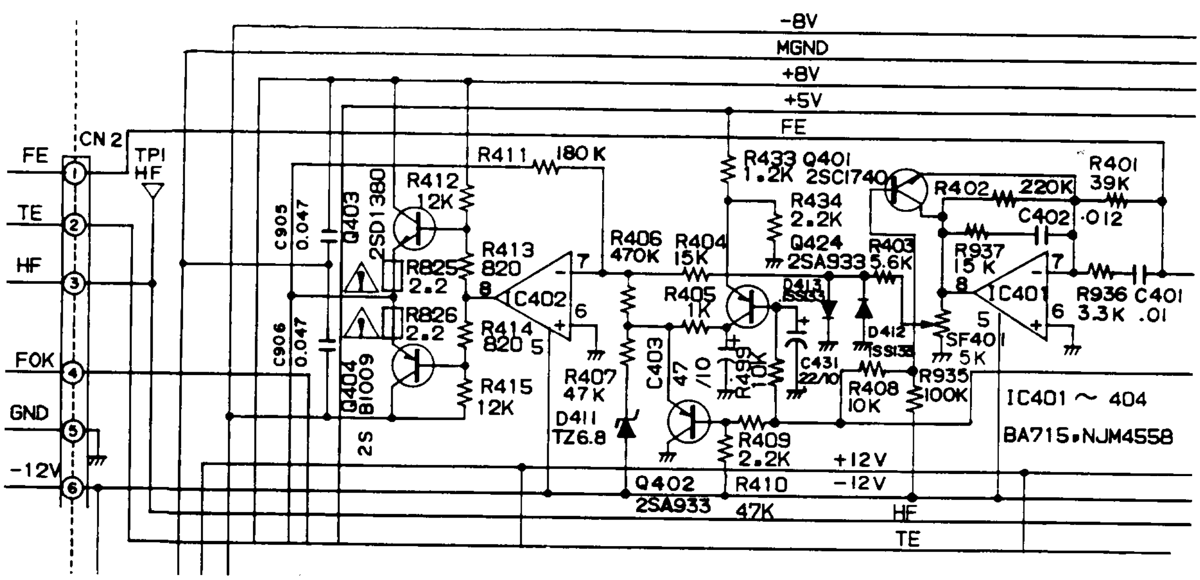


Fig. 8 Focus Servo Circuit

Under control of the focus servo circuit, the object lens is able to follow deflections in the disc reflecting surface, thereby keeping the beam spot focussed onto that surface at all times.
The four-part photodetector signal is obtained as an A+B output from pin 1 of TA7731 and as a C+D output from pin 16, resulting in formation of a focus error (FE) signal at the IC503 differential amplifier. After passing through the phase compensation amplifier IC401, the gain of this signal is adjusted by focus gain adjustment SF401. The object lens is moved up/down by Q403 and Q404 via IC402 to maintain the FE signal at zero.

7. Tracking Error Circuit

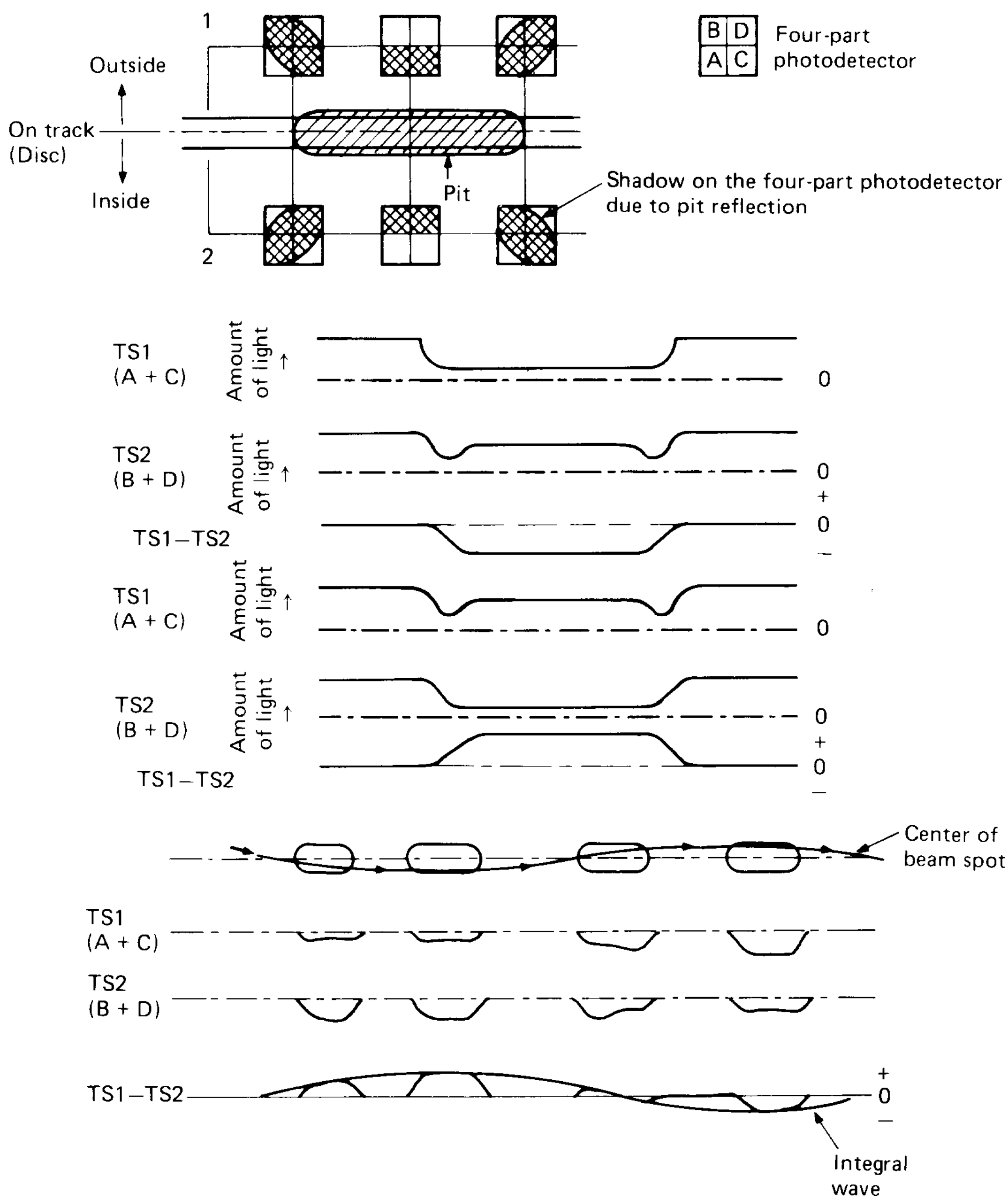


Fig. 9 Tracking error generation circuit by push-pull system

The purpose of the tracking error circuit is to generate an error circuit when the beam spot moves away from the center of the pits, thereby enabling the beam spot to correctly track the pits.

The above diagram shows how the push-pull system operates. (Fig. 9)
As the spot of light deviates from the pit, the amount of light striking on the photodetector varies and, as a result, the output of the amplifier also varies. If the track coil is moved in the direction opposite to the change of amplifier output by a tracking servo to return the output of the amplifier to 0, then the spot of light will always be positioned on the pit.
The advantages of the push-pull system are as follows:

- There is no offset in the tracking error signal.
- The tracking error signal is free from focus balance.
- The variation of offset in the tracking error signal caused by temperature changes is small.
- The circuit is simple and a general-purpose operational amplifier can be used.

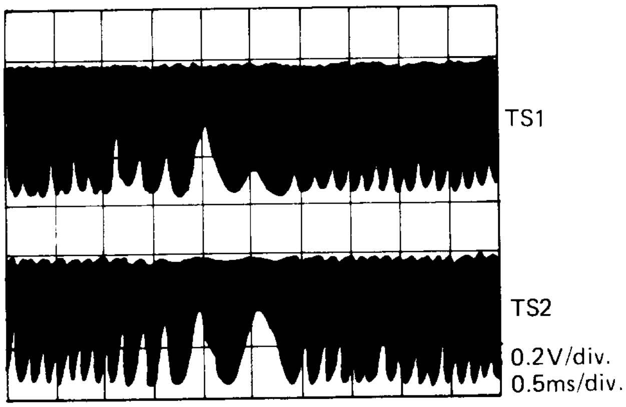


Fig. 10

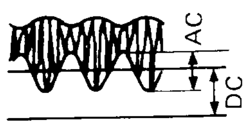


Fig. 11

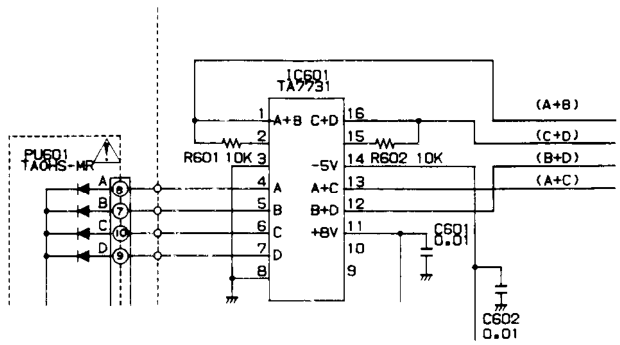


Fig. 12 Tracking error circuit

The tracking error signal consists of A+C and B+D components from the four-part photodetector. First, the condition where tracking servo is not applied will be considered. When only the focus servo is applied, the A+C and B+D output waveforms are as shown in Fig. 9 when a track is crossed. A phase difference is generated between these two output components, and this difference becomes the tracking error signal.

The DC push-pull circuit removes the HF component from the signal shown in Fig. 10, thereby eliminating the offset. And the AC push-pull circuit results in full-wave rectification of the signal shown in Fig. 11 by extracting only the AC components, again eliminating the offset. Since the DC push-pull circuit output (pin 2 of IC501) and the AC push-pull circuit output (pin 2 of IC502) are in opposite phase to each other, the offset generated when the object lens is moved can be eliminated by taking the difference between these two outputs at a suitable level.

8. Tracking Servo Circuit

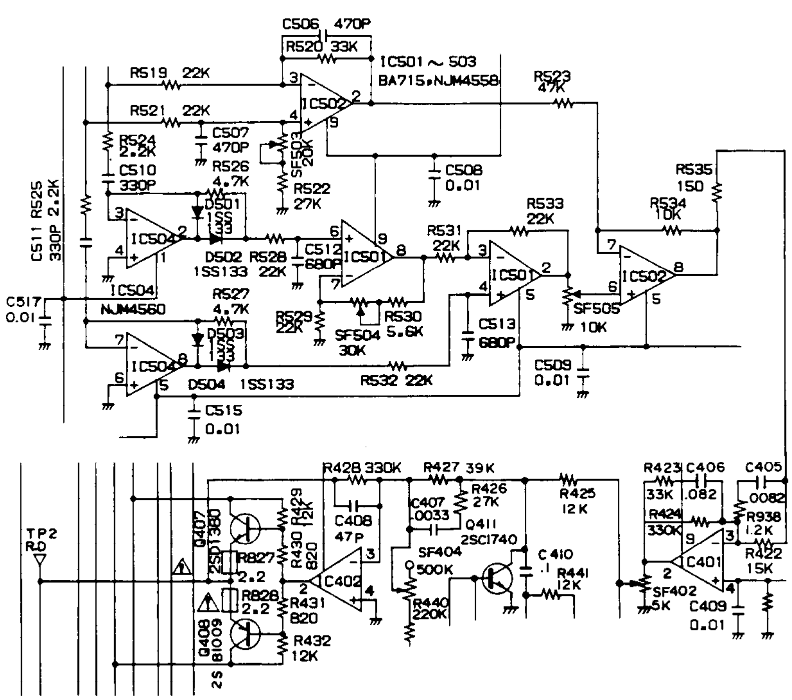


Fig. 13 Tracking servo circuit

The object lens is also controlled by the tracking servo circuit. This enables the beam spot to stay in the center of the pits despite lateral disc fluctuations due to eccentricity.

The four-part photodetector output signal applied to TA7731 appears as an A+C component at pin 13 and as a B+D component at pin 12. These components are applied to the tracking error circuit to obtain a tracking error (TE) signal from pin 8 of IC502.

After being passed through the phase compensation amplifier (IC401), the gain of this output is adjusted by the tracking gain adjustment SF402. The signal is then applied to IC402, and the object lens is moved in the tracking (lateral) direction to obtain a TE signal of zero by Q407 and Q408.

9. Tracking Search Circuit

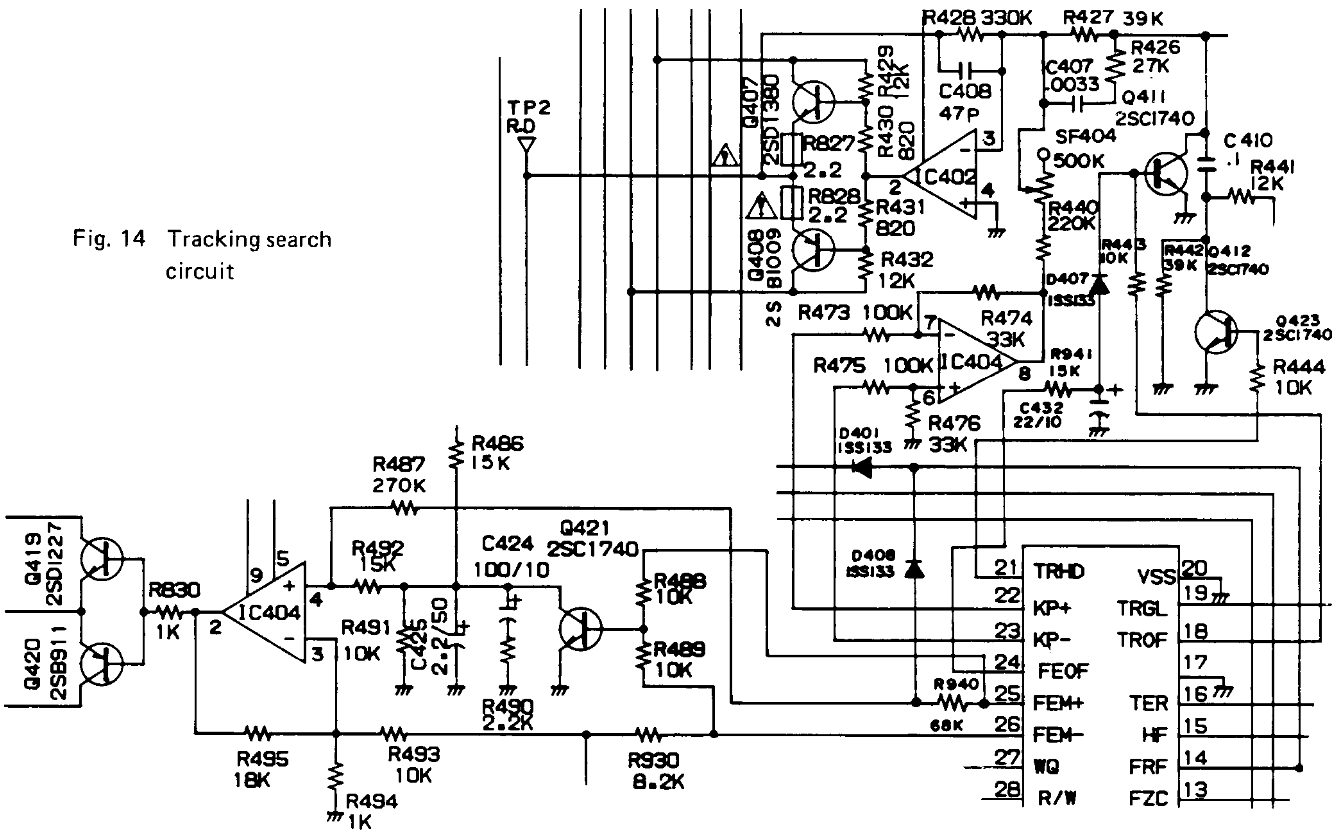


Fig. 14 Tracking search circuit

The track search circuit is used to reach the target position smoothly when searching for the beginning of a particular section or a particular time, or when pause, FF, or FR operation is employed.
When search mode is started, the CX564 microcomputer compares the difference between the target time and the time data currently being read by the pick-up. If the time difference is small, output of KP+ or KP– is instructed by YM3531, but if the time difference is large, an FEM+ or FEM– output is also added to the above output. Whereas the KP+ and KP– outputs only move the object lens in the tracking directing, the FEM+ and FEM– outputs move the entire pick-up.
That is, the KP+ and KP– signals are passed to a differential amplifier in IC404 where a corresponding positive or negative pulse is generated. In addition to be passed via SF404 (kick gain adjustment) to IC402, this pulse is also passed via Q407 and Q408 to drive the tracking coil. FEM+ is passed via R940 and R487 to pin 4 of IC404, and FEM– is passed via R930 and R493 to pin 3 of the same IC.
These signals are then converted to a positive or negative pulse which drive the feed motor M402 via Q419 and Q420 in either forward or reverse to move the pick-up. When the FEM+ or FEM– output is generated, Q423 is turned on and the feed servo circuit is switched off to prevent unwanted inputs being applied to the feed motor circuit from the tracking servo circuit.
When the KP+ or KP– output is obtained from YM3531, the laser beam spot naturally cuts across the track. The tracking servo circuit forms a negative feedback loop, and since the TE inclination at the disc mirror section is reversed from that when the beam is "on track", thereby resulting in oscillation, the loop must be switched off at the mirror section. This is achieved by the TROF signal from pin 18 of YM3531, the tracking loop being switched off when Q411 is turned on.
The TRHD signal from pin 21 of YM3531 is used to temporarily hold the object lens position during the kick operation. When Q423 is turned on, an integrating circuit (R425/C410) is formed in the tracking loop to hold the DC voltage.
And the purpose of the TRGL output from pin 19 of YM3531 is to return the beam spot to the track as quickly as possible following track jumping. Q412 is normally on, but is turned off when the TRGL signal is changed to L level, and the tracking gain is increased (see Fig. 14).

10. Auto Slice Level Control Circuit

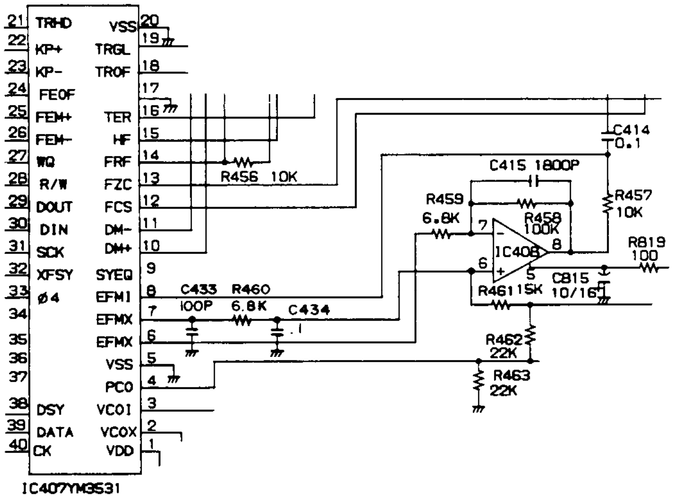


Fig. 15 Auto slice level control circuit

The purpose of this circuit is to set optimum slice level for the HF signal when that signal is converted to a digital signal.

The HF signal applied to buffer amplifiers Q501 and Q502 from the TA7731 head amplifier is adjusted to 2Vp-p by SF501, and passed to C414 resulting in only the AC component being applied to the EFMI pin 8 input of YM3531.

If the slice level is kept at a constant value at this stage, signals generated by pits of identical length result in different pulse widths when converted digital signals (see Fig. 16). Therefore, to obtain identical pulse widths from identical pit lengths, the HF signal is integrated by a suitable time constant with the integrated value being applied at the same time to pin 8 of YM3531.

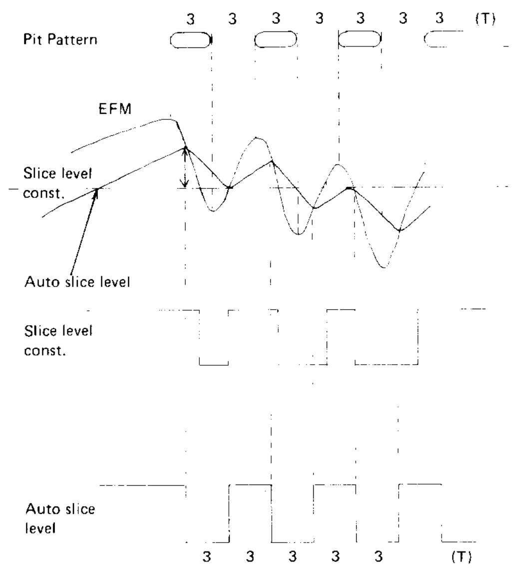


Fig. 16 Slice level

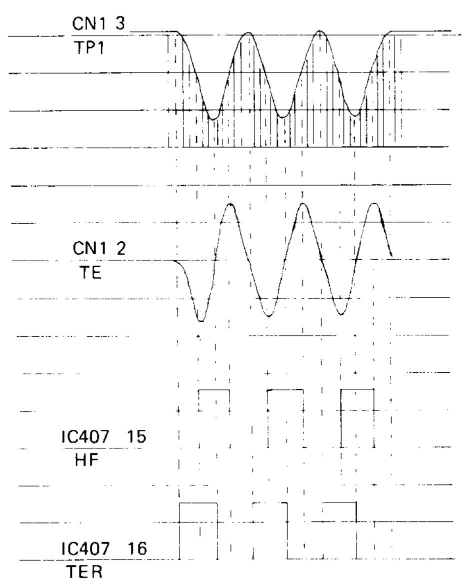


Fig. 17

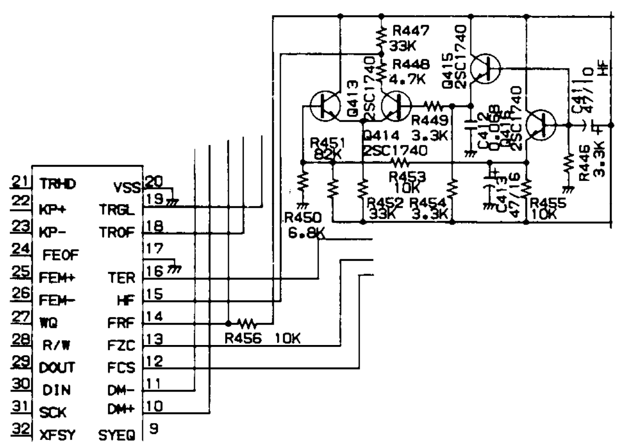


Fig. 18 HF envelope circuit

11. HF Envelope Circuit

The HFI envelope circuit judges whether the beam spot is directed onto a track or onto the mirror section.

When the beam spot crosses over a track, the waveform of the HF signal changes as shown in Fig. 17. A fall in the top half of the HF waveform indicates that the beam is directed onto the mirror section.

The DC component is removed from the HF signal by C411, and an integrating circuit with a small time constant is formed by Q415, C412, and R454. An integrating circuit with a large time constant is formed by Q416, C413, and R455, and the purpose of the circuits is achieved by applying the respective levels to the comparator circuit consisting of Q413 and Q414.

That is, Q414 is turned off and an H level signal is applied to pin 15 of YM3531 if the Q413 base potential is lower than the Q414 base potential. And if the base potential relationship is reversed, Q414 is turned on and an L level signal is applied to pin 15.

12. Tracking Error Zero-cross Circuit

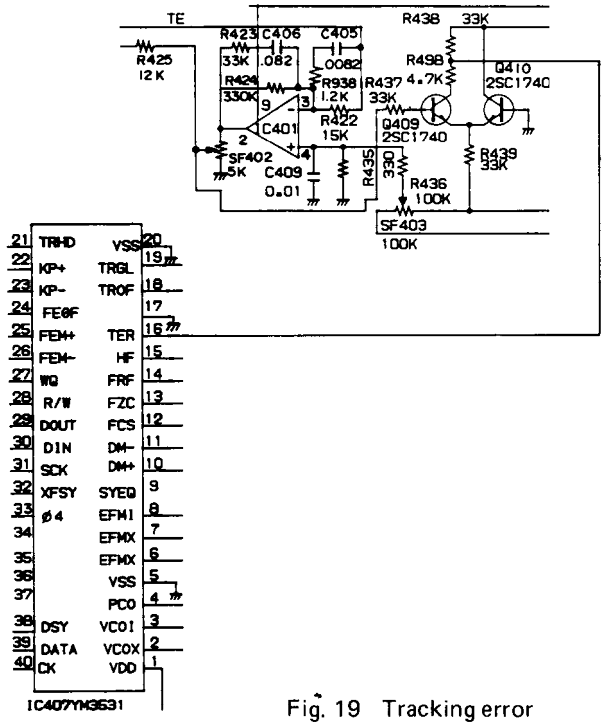


Fig. 19 Tracking error zero-cross circuit

The tracking error zero-cross circuit which detects the point where the tracking error signal reaches zero level is required for output of the TROF signal from YM3531. The four-part photodetector signal is passed to TA7731, and through the tracking error circuit to the phase compensation circuit. The signal is also passed via SF402 and R437 to the base of Q409 which forms a comparator circuit together with Q410. Q409 is turned on if its base potential is above OV, and an L level signal is subsequently applied to pin 16 (TER) of YM3531. If the base potential is below OV, on the other hand, Q409 is turned off and an H level signal is applied to pin 16.

13. Feed Motor Servo Circuit

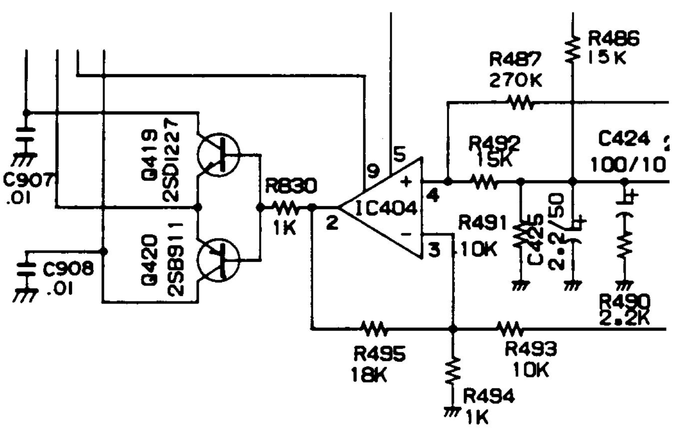


Fig. 20 Feed motor servo circuit

The purpose of the feed motor servo circuit is to keep the object lens near the center of the light beam axis. If the lens is displaced from the axis by a large margin as a result of the tracking servo, the feed motor servo circuit returns the lens to the beam axis by shifting the entire pick-up. While the object lens is tracing the pits and gradually moving towards the outside under control of the tracking servo, the tracking drive output (TP2) DC voltage is gradually increased. This voltage is passed via R486 and R492 to C404, and the feed motor is driven by Q419 and Q420 resulting in the pick-up being moved outwards. This operation ensures that the object lens is maintained at the center of the light beam axis.

14. Disc Motor Servo Circuit

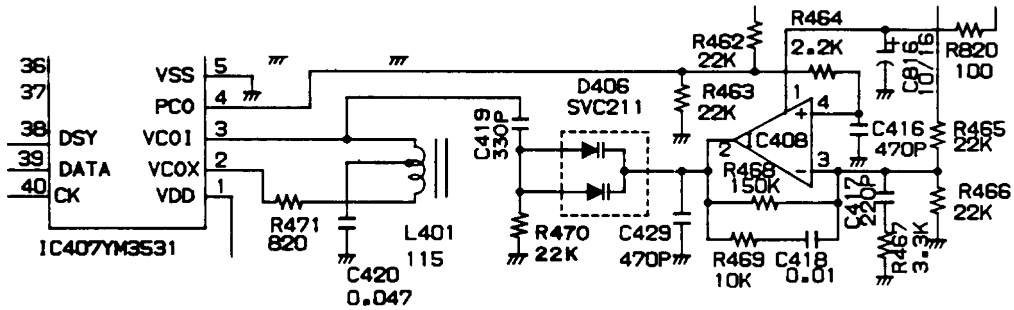


Fig. 21 Disc motor servo circuit

The disc motor servo circuit is used to control disc motor rpm speed by PLL to ensure that the disc rotates at constant linear velocity (CLV).
When a focus serarch is executed with an L level at pin 13 (FZC) of YM3531 and an H level at pin 14 (FRF), YM3531 assumes that proper focus has been attained and generates an H output at pin 10 (DM+). This signal is applied to the IC403 differential amplifier, and the low frequency components passed by R481 and C421 are passed via the phase compensation amplifier IC403 to drive the disc motor by Q417 and Q418.
Disc motor rotational control is initially handled by an auto frequency control (AFC) stage where the YM3531 pin 10 DM+ output serves to accelerate the motor at PWM, and the pin 11 DM− output serves to decelerate it. When YM3531 detects 11T which is the longest pit imprinted in the disc with a period of 136μsec (and which is within the PLL capture range), control is switched to PLL mode to maintain CLV.
To ensure that the switch from AFC to PLL is smooth, and also to ensure that the quartz crystal clock (4.3218MHz) is in the center of the PLL lock range and the capture range, it is important to adjust the VCO self-oscillating frequency to 4.3218MHz by L401.

15. Key Control Circuit

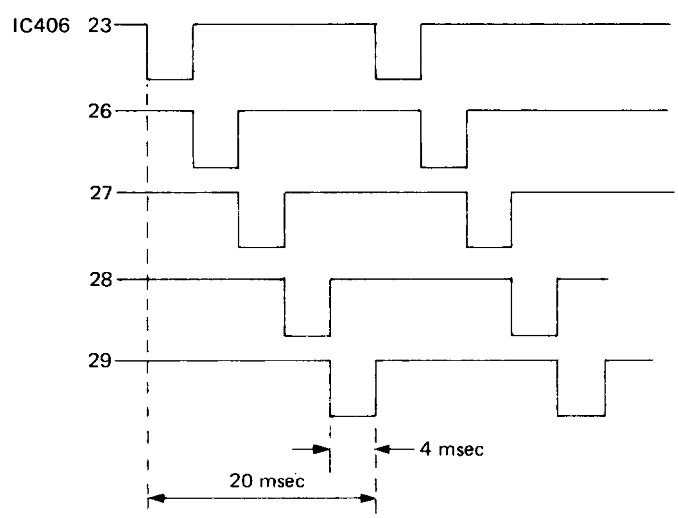


Fig. 22 Scan pulse timing chart

This circuit controls operation keys of the DX-150-PLAY/PAUSE, STOP, REPEAT/MEMORY, OPEN/CLOSE, FF, FR, UP, DOWN, STORE, CANCEL, and TRACK/TIME – and three switches – pick-up switch, tray-in switch, and tray-out switch.
The microcomputer outputs key scan pulses through terminals PD0 to PD2. The timing of the pulse is shown in diagram figure 22. When a key is pressed, a key scan pulse is applied to one of the key sense terminal, PG1 to PG3 indicating which key is pressed.

And to ensure that the 7-segment and other LEDs also come on, Q901 thru Q906 are turned on according to the timing shown in Fig. 22 with power supplied to the LED anodes. At this stage, an H level output is applied to PA_0 thru PA_3 and PB_0 thru PB_2 at suitable timing to turn Q907 thru Q912 on for the desired LED or segment to light up.

16. Tray Open/Close Circuit

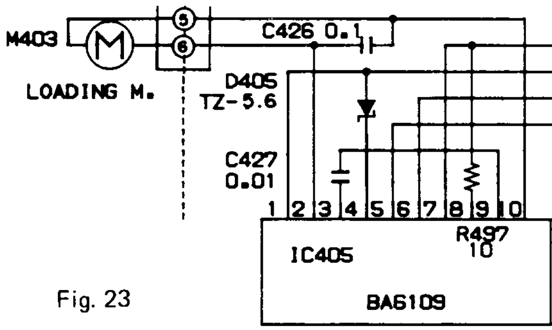


Fig. 23

This circuit is involved in loading and unloading discs in/from the player.
When an L input is applied to CX564 pin 38 at the key scan timing indicated in Fig. 22, the loading motor is controlled by IC405 (see following table) depending on the CX564 pin 13 and pin 14 output conditions.

IC406 CX564						TRAY OPERATION
13	14	Fin 5	Rin 6	Vout 1 2	Vout 2 10	
H	H	H	H	L	L	STOP
H	L	L	H	L	H	CLOSE
L	H	H	L	H	L	OPEN
L	L	L	L	L	L	STOP

17. Analog Circuit

Conversion of digital signals recorded on the disc to the original analog signals.
Digital signals demodulated by YM2201 are stored temporarily in a RAM (HM6116) before being transferred to YM2201 synchronized with the quartz crystal clock. These signals are then passed from Q_1 thru Q_{16} (pins 33 thru 50) to the D/A converter (PCM53JP) to become analog signals. These analog output signals are obtained from pin 17 (A.OVT) as alternate left and right channel signals alternating at a rate of 88.2kHz, the signals being separated into left and right channels by IC304 according to the timing indicated in Fig. 22. Then following removal of the distortion (generated during the D/A conversion) by the deglitching amplifier (IC101), the signal components below 20kHz are passed by L101 and L201 to the de-emphasis amplifier (IC102).
And if emphasis has been applied to the audio signal, an H level signal is obtained from pin 33 of YM2201, resulting in Q301, Q302, Q101, and Q201 being turned on to include the de-emphasis equalizer circuit in the negative feedback portion of the amplifier.

18. Power On/Off Muting Circuit

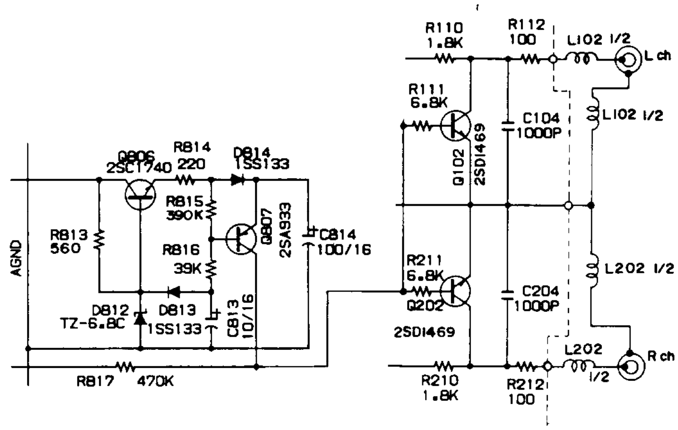
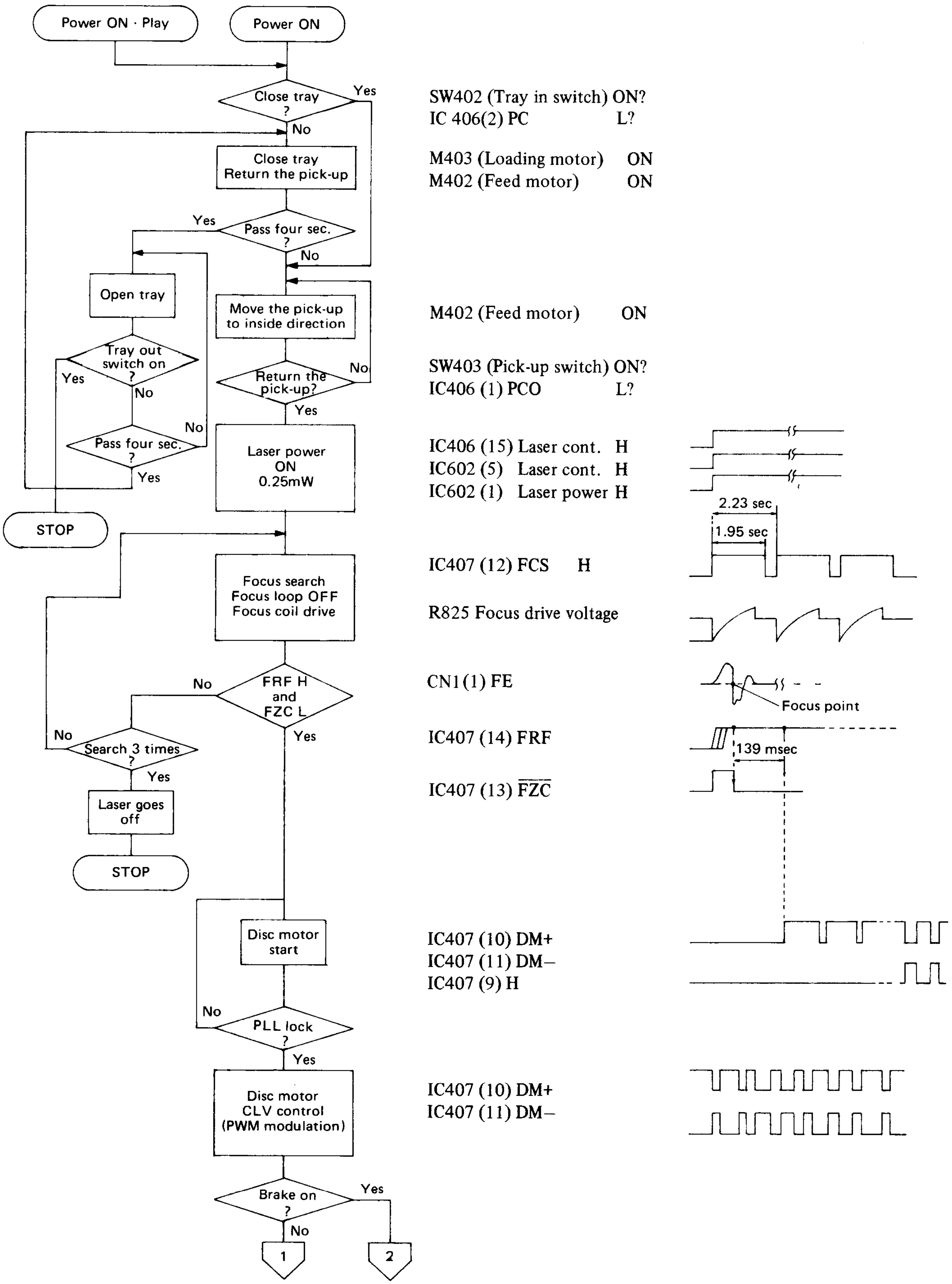
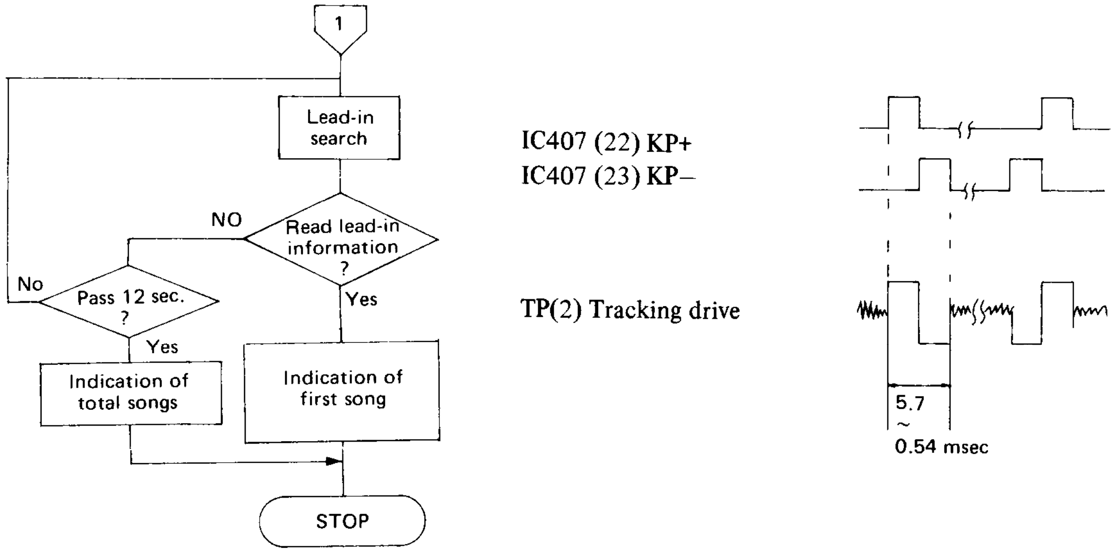


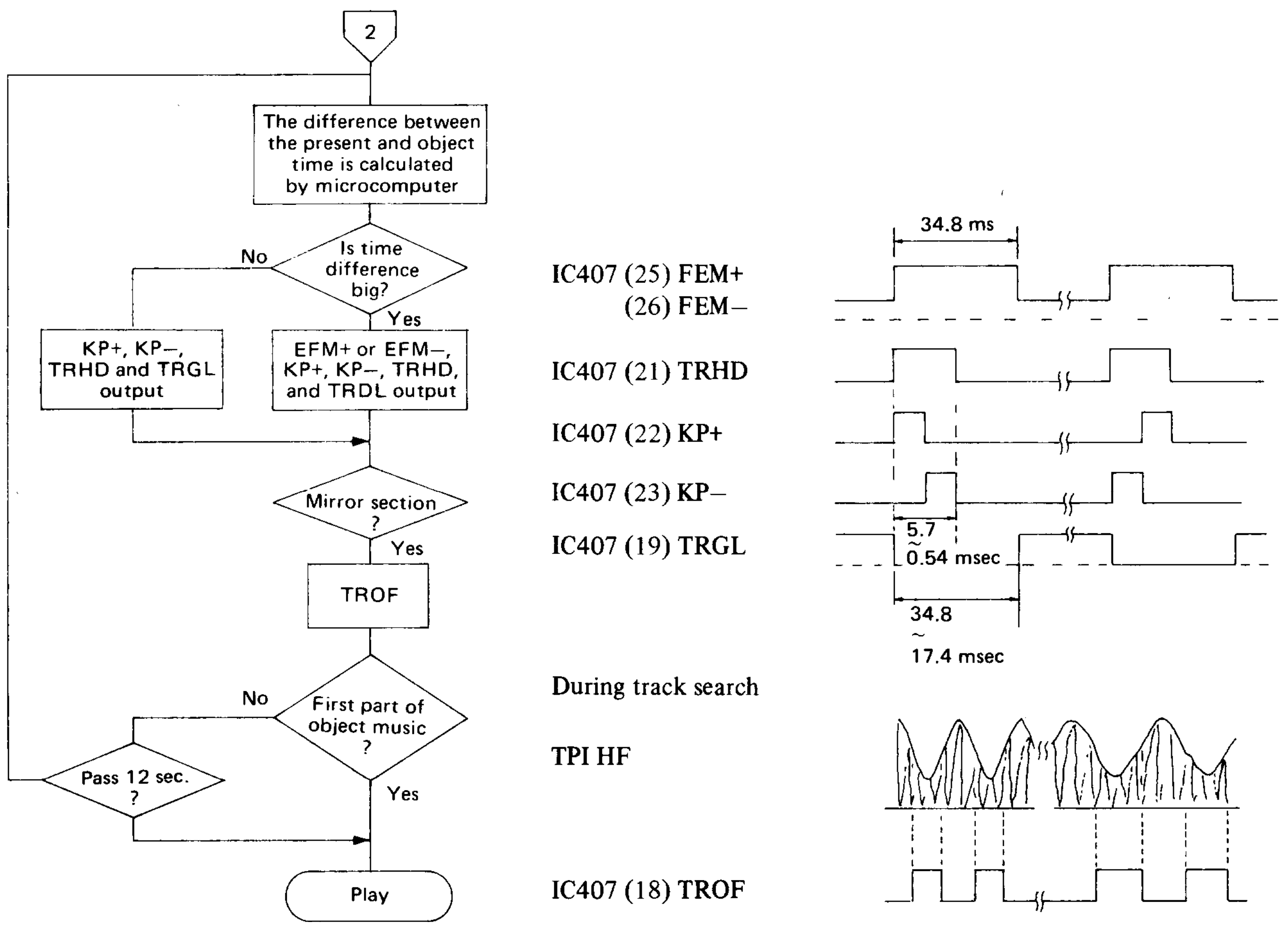
Fig. 24 Power on/off muting circuit

When the power is switched on, Q806 is turned on and C814 is charged up by the +8V leading edge in the diode bridge consisting of D801 thru D804. At the same time, C813 is charged up according to the R815/R816/C813 time constant. As a result, Q807 is turned on, followed by Q102 and Q202 being turned on via R111 and R211 to mute the signal line. Q807 is turned off when C813 is fully charged up, resulting in a negative voltage being applied to the base of Q102 and Q202 via R817, and subsequent cancellation of the mute condition.
When the power is switched off and the Q806 collector potential drops below the base potential, Q806 is turned off, and discharging of the charge on C813 via D813 and R813 is commenced. The Q807 base potential starts to drop as a result, but since the emitter voltage is kept at a constant level by C814 Q807 is turned on, followed by Q102 and Q202 being turned on to again mute the signal line.

FLOWCHART FOR OPERATION







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