KENWOOD

CD PLAYER SERVICE GUIDE

This document describes the concept of actions of the CD PLAYER using SONY-made devices and also describes the techniques for easier repairing. The items headed with "(SP)" indicates items of such descriptions. The software of the μ-com varies depending on the model; therefore, flexibility is somewhat needed in actual application.

Models Used:

DP-05	DP-722	DP-1000	DP-3030	DP-6020	DP-8020	DP-DP-M6630
DP-07	DP-911	DP-1100D	DP-3040	DP-7000	DP-X9010	DP-M7730
DP-3R	DP-940	DP-1100SG	DP-4030	DP-7010	D-3300P	
DP-3J	DP-950	DP-2000	DP-5010	DP-7020	DP-R791	
DP-3I	DP-880SG	DP-1030	DP-5020	DP-7030	DP-R891	
DP-5R	DP-990D	DP-2030	DP-5030	DP-7040	DP-M991	
DP-5E	DP-990SG	DP-2040	DP-5040	DP-8010	DP-R4430	

Devices Used:

RF Amplifier	→	CX20109, CXA1081M/S/Q, CXA1271Q, CXA1421P/M, CXA1571S
Servo Amplifier	→	CX20108, CXA1244S, CXA1082BQ/BS, CXA1182Q/S, CXA1272Q/R, CXA1372Q/S
DSP	→	CXD1125Q/QZ, CXD1130Q/QZ, CSC1135Q/QZ, CXD1241Q/QZ, CXD1242Q/QZ, CXD1246Q/QZ, CXD1247Q/QZ, CXD1167Q/QZ/R, CXD2500AQ/AQZ

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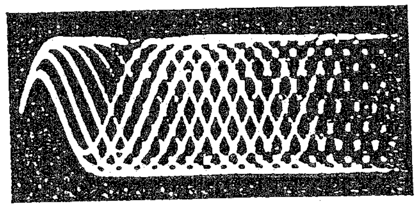
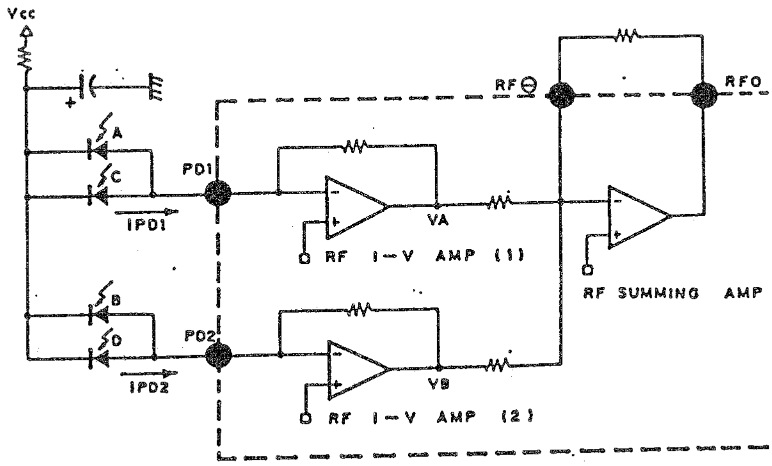
BASIC COMPONENTS

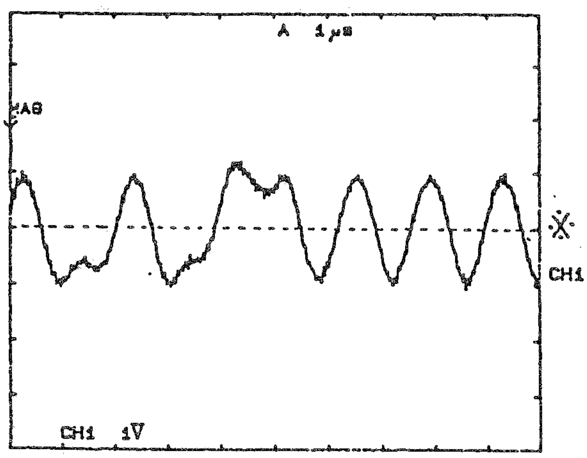
1) RF Amplifier

The electric current inputted to the input pints (PD1, PD2) is converted in the RF I-V Amplifiers, further added up in the RF Summing Amplifier, and then outputted from RFO. The output from RFO has such a waveform as in the photograph on the right. The pit length on the Disc is expressed in 9 kinds of lengths -- 3T to 11T -- when 1/4.32MHz is equal to 1T; therefore, it is observed as eyepatterns with 1T-intervals on an oscilloscope.



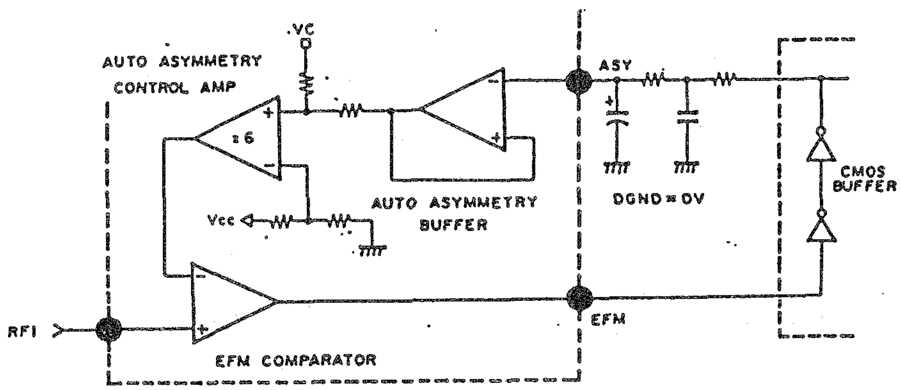


(SP) Usually, in the NF section of the Summing Amplifier, the eyepattern is equalized by CR. It is the f-characteristics adjustment of the high range up to about 3T to 5T shown on the left side in the photograph. For a CD Player to read data from a disc, this high-range waveform up to about 3T to 5T is very important. The figure on the left shows the RF waveform observed in a certain unit of time. The portion marked with "※" in the figure is the crosscenter; EFM data is sampled at the rising and falling of this point. That is, if a high-range waveform turns vague, the threshold level of the data becomes different, and therefore, the accurate information cannot be obtained.



2) ASY (Auto Asymmetry)

Due to errors in manufacturing of discs, the pit length on the signal side is longer or shorter than the length specified in the standards. Accordingly, the standard unit of data taken from the signal turns longer or shorter. That is, the length of every pit is affected with the same volume, and it causes a phenomenon that the crosscenter of the eyepattern is positioned differently from the center. The circuit to adjust this phenomenon is shown in the following figure.

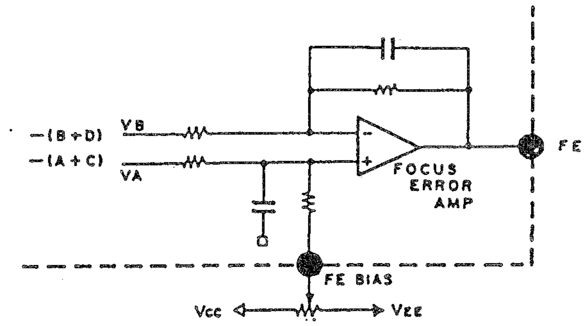


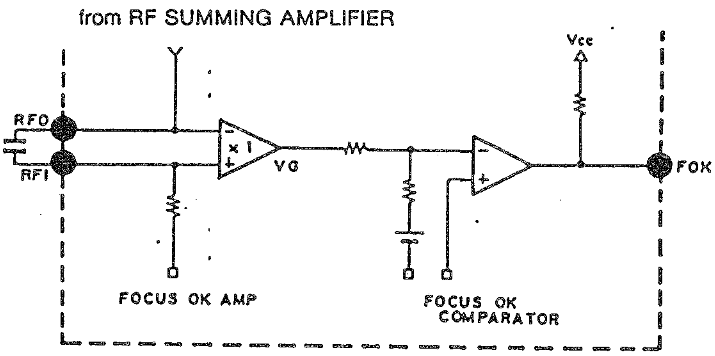
(SP) When ASY does not function normally, the center of the eyepattern cannot obtained accordingly. Therefore, frame-synchronization cannot be performed, the disc turns but TOC cannot be read. Or, TOC is sometimes read but PLAY cannot function.

(Action) To turn the RF signal into a binary signal, let the EFM signal go through LPF which is composed of CRs, and obtain (V_{CC} + Gnd) / 2(v). By adding this voltage to the ASY Buffer, set the comparator level of EFM to (V_{CC} + Gnd) / 2(v).

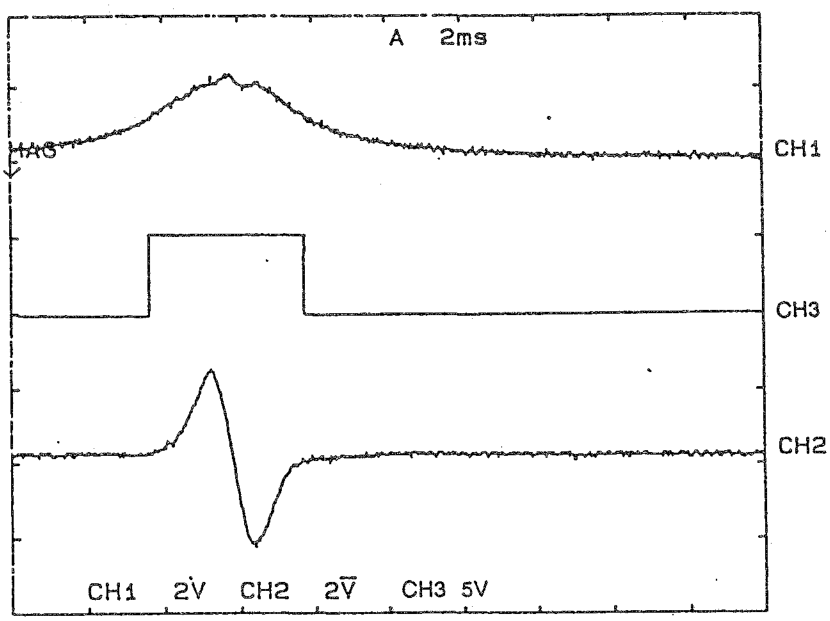
3) Focus Error Amplifier

It is an error signal generating circuit to keep the distance between the lens and the signal side of the disc constant. First, turns off the Servo Loop and moves the Actuator up and down to find the FZC (Focus Zero Cross). When the Intensity Signal of RF has reached a certain level, watches the zero cross of FE (Focus Error) and turns on the Servo Loop. The signal indicating "the Intensity Signal of RF has reached a certain level" is FOK. Its generation is shown in the figure below.





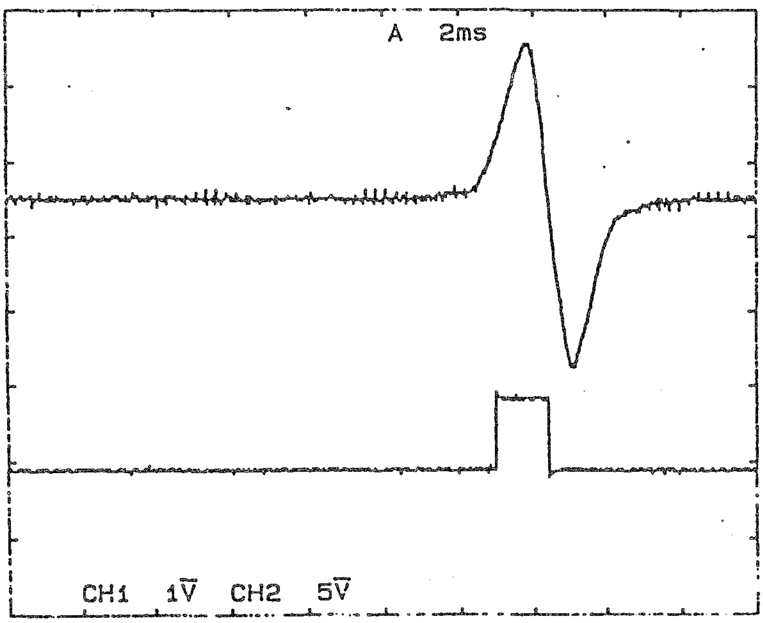
While the RF signal exceeds a certain level, a condition signal named "FOK" rises. At FE also, an error signal rises due to focus difference in accordance with up-and-down of the lens.
(FE S-shaped Curve)



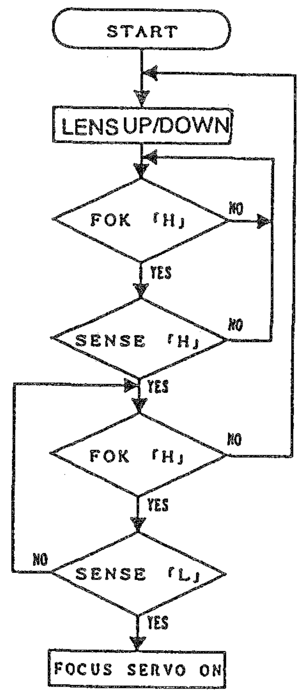
CH1 : RF CH2 : FE CH3 : FOK

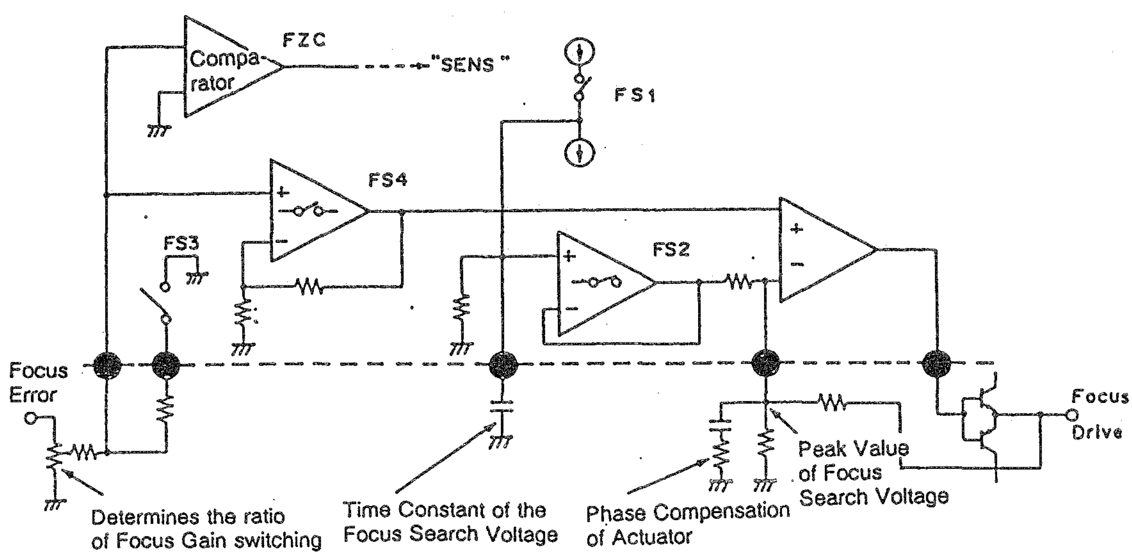
NOTE 1: This is the normal waveform. However, as an actual action of a player, the Servo Loop turns closed; therefore, FOK remains "H" and a waveform such as described before is outputted at RF.
NOTE 2: "A certain level of the RF signal" is the level determined inside the IC to confirm that there is a DISC mirror side. The level of most SONY-made ICs is approximately 0.4V.

To turn on the Servo Loop of the focus system, the FZC (Focus Zero Cross) must be recognized. This FZC is outputted from the Servo IC using the SENSE signal. The waveforms in the following figure indicate the S-shaped curve of the focus and the timing of the SENSE signal.



CH1 : FECH2 : SENSE





(SP) The routine of the focus system has been described above. By the way, unless the Servo Loop of the focus system is not closed, the disc will not turn. (There are some models in which this rule is not applied due to programming.) Then, in what cases the loop will not be closed?

Case 1) FOK does not turn "H":

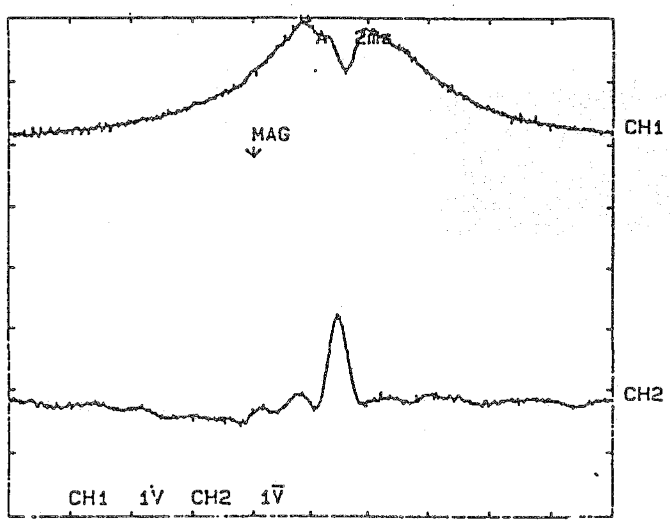
The fact that FOK does not turn "H" means that "no light returns" to the Photo Detector even when the Pick Up emits a laser beam, and the μ-com judges it to be "NO-DISC" status. That is, FOK = L indicates that the RF signal cannot keep a certain level.

→ • Is the LD (Laser Diode) of the Pick Up emitting an enough output?
- Does the Photo Detector have an enough sensitivity?
- Does the RF Amplifier have a normal amplification?

Case 2) SENSE Signal does not turn from "H" to "L":

In this case, the μ-com cannot confirm the FZC. That is, it is judged that the disc is too near or too far.

→ • Does an S-shaped curve appear as the Focus Error signal?



CH1 : RF CH2 : FOK

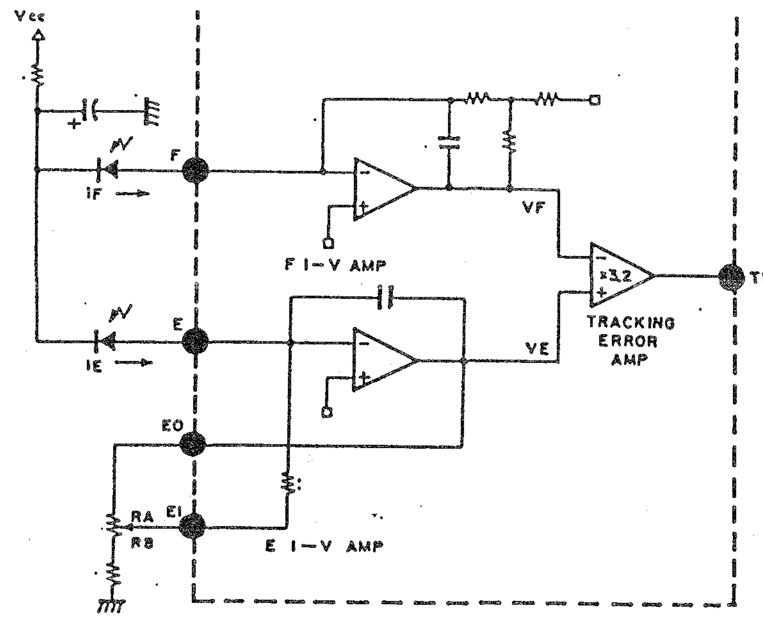
The figure shows the simulation when the Photo Detector in the Pick Up is made to be inactive.

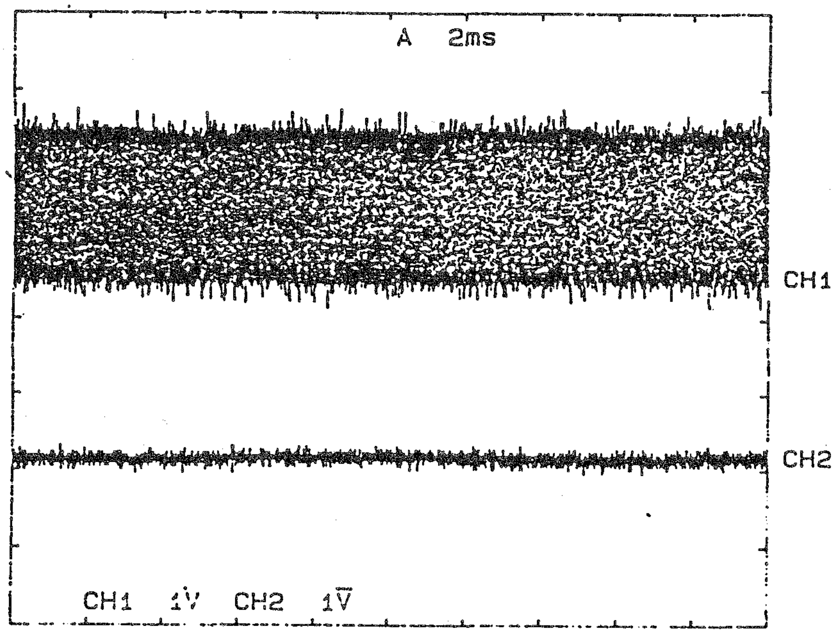
An S-shaped curve cannot be confirmed on the FE waveform of CH2. (Neither does an accurate S-shaped curve appear when the up-and-down movement of the Actuator is not smooth.)

(SP) An S-shaped curve can be confirmed when the Focus Servo is ON in Test Mode by forcing FOK to the GND level.

4) Tracking Error Amplifier

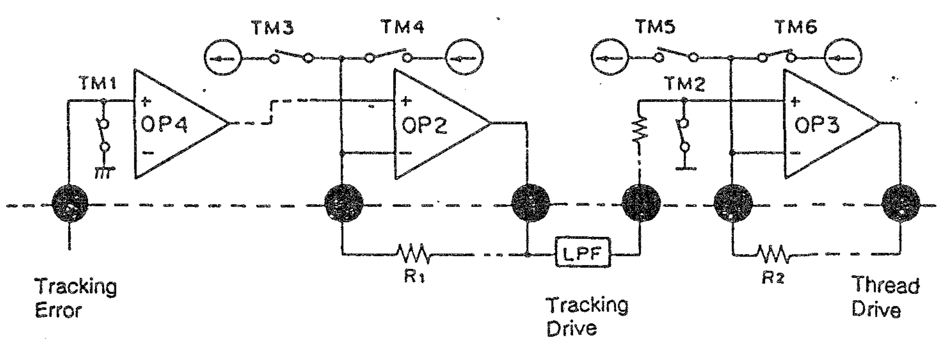
In the normal PLAY mode, one track must be traced in order, to read data consecutively. At present, the 3-beam Pick Up is mainly used. In this case, by comparing the beam volume lighting the Sub-detectors of E and F and controlling the error factor to be zero, the Servo is activated so that the main beam may be positioned on the same track.





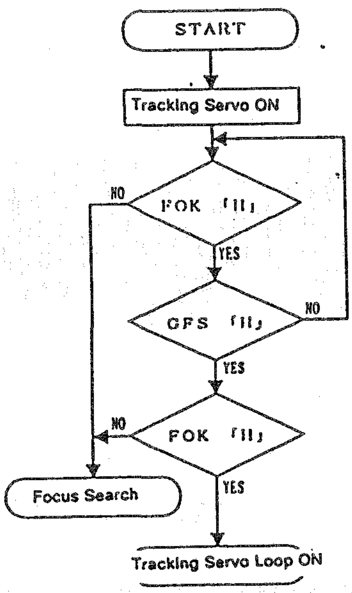
CH1 : RF CH2 : TE

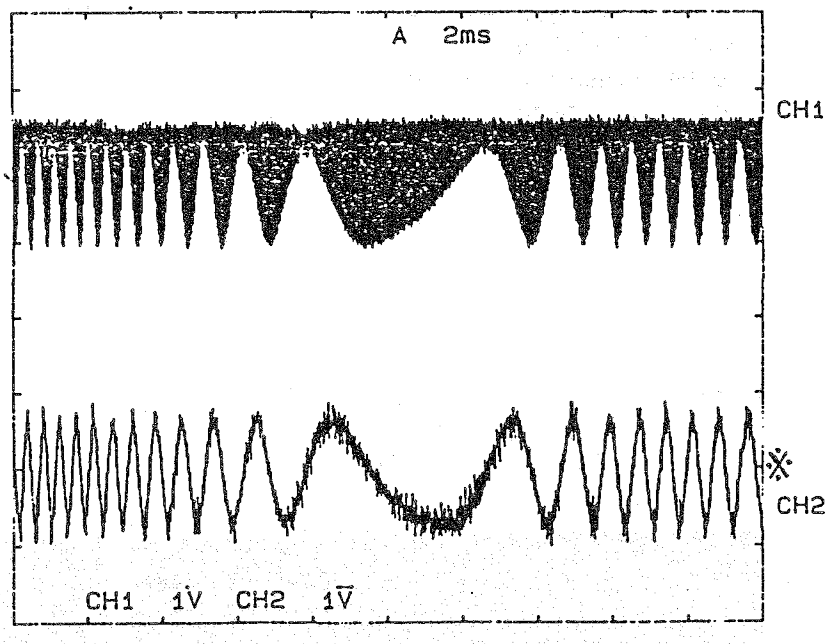
The fact that the Tracking Servo is turned ON means that data taking-in is basically possible. That is, it means that data frame synchronization can be detected. Therefore, if EFM can be synchronized with the standard clock of 4.32MHz, DSP (Digital Signal Process) outputs the information of GFS (Guard Frame Sync.) and the μ-com recognizes it.



(SP) The routine of the tracking system is shown on the left below. When the tracking system does not function well, no correct reading of data can be expected. Also, its follow-up capability is almost determined by the Gain of the loop. (Naturally, in the designing aspect, the Gain, the Phase, etc. are set mechanically and electrically.)

When the loop of the Tracking Servo is not closed, the waveform will be as in the figure below.

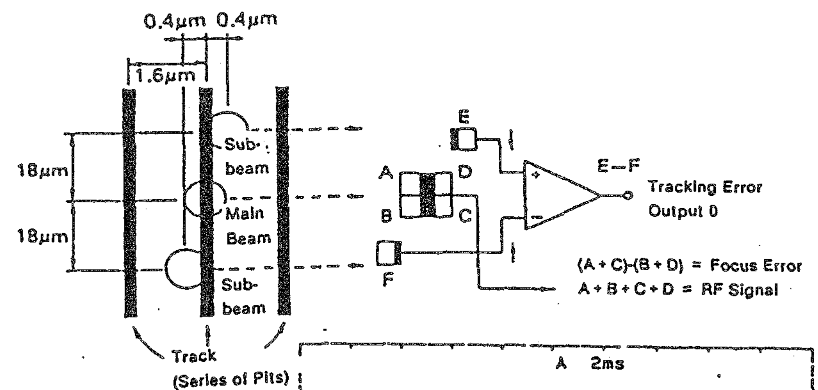


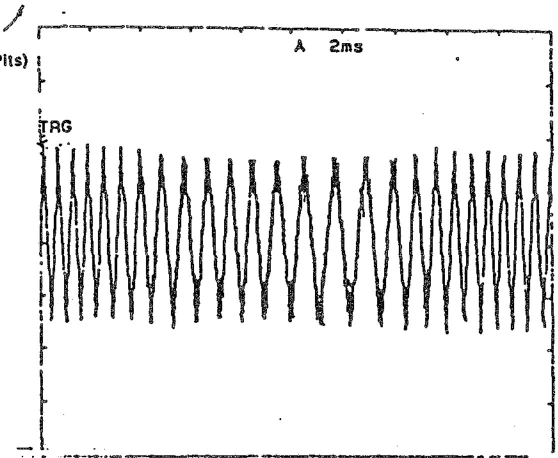


CH1 : RF CH2 : TE

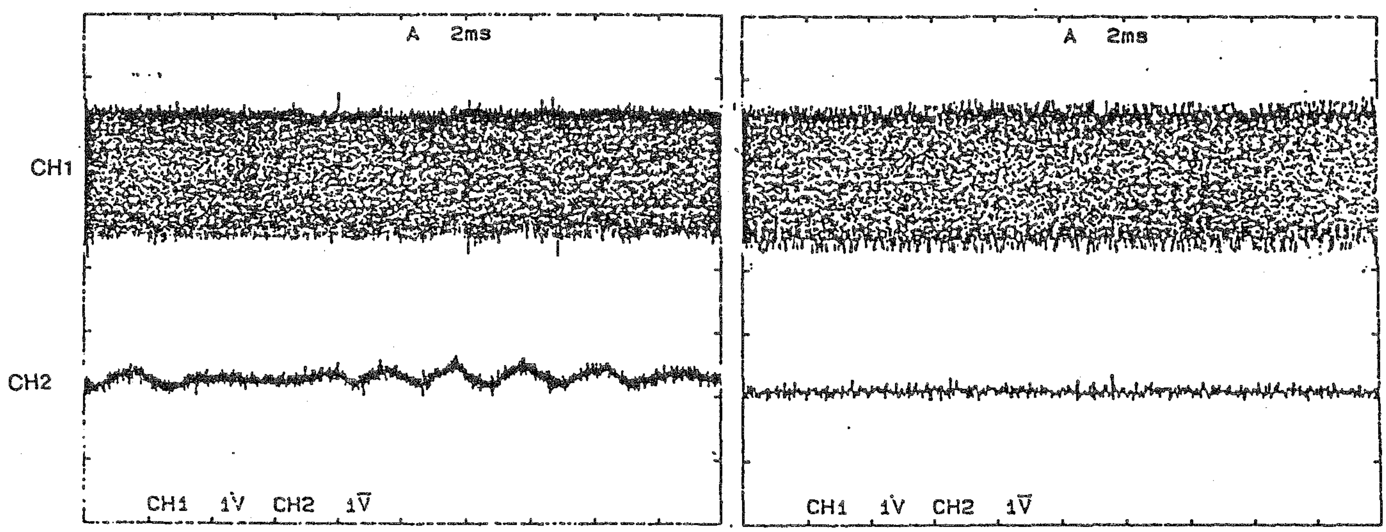
The portion marked with "※" in the TE (Tracking Error) waveform is the center (DC 0V). In case of an open loop, the E and F volumes of the Photo Detector is expressed with it. That is, by the TE Balance Adjustment, the top and bottom portions should be adjusted to be symmetrical with the center inbetween. When it is not well-balanced, the capability to shift to the objective position will be unstable in Pause status or in operating a Track Jump though it seems to be normally tracing.

In case of 3-beam system, a mechanical unit called "diffraction grating", which generates three laser beams from one LD (Laser Diode), is provided in the Pick Up. When its positioning is wrong, the wave form appears to be distorted as in the figure on the right. In this case, also, it is in a very unstable status. Therefore, it needs to be adjusted or the part should be replaced.





CH1 : RF
CH2 : TE

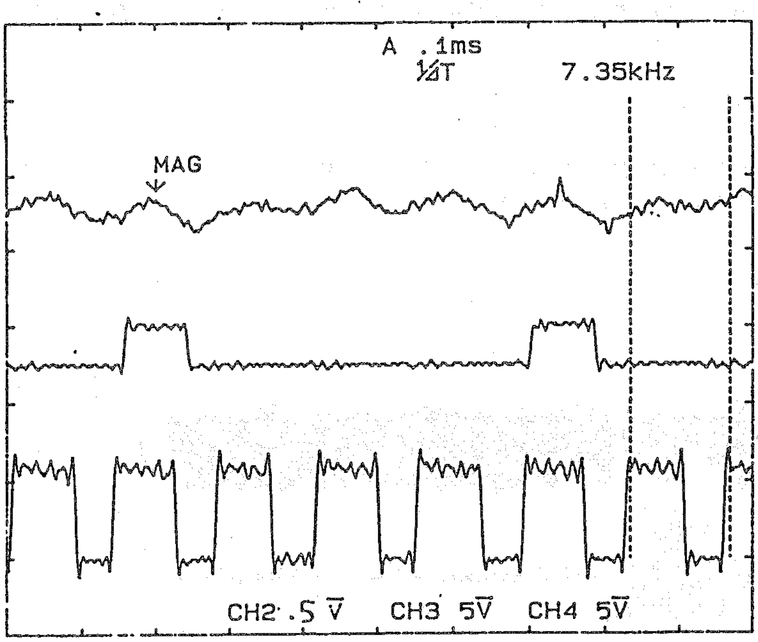


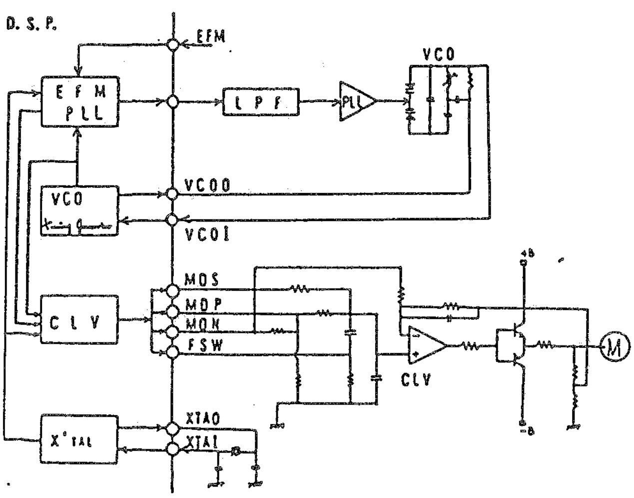
The waveforms in the two figures above show difference of Gains in the tracking system. The figure on the left shows a low-gain status, in which there are more low-range factors, and it easily catches outer vibrations to detach the loop easily. The figure on the right shows a high-gain status, in which there are more high-range factors, and it becomes too sensitive to scratches on the disc or transformation of the pits. Both of the two figures are examples of bad statuses, and a Gain Adjustment will be needed for a good balance, as described in the preceding page.

5) CLV (Constant-Linear-Velocity) Servo

The Data Speed inputted to the Jitter Memory is proportional to the Disc Motor Speed. Therefore, it functions to make that speed same with the speed of reading to the D/A Converter. At starting of the motor, MDS turns "H" and the motor is driven with the maximum power. During PLAY, the Automatic Phase Control for phase lock of RFCK and WFCK functions as well, and both MDS and MDP will be locked with an output of average value 50% of voltage.

NOTE: The waveform changes even when the motor is defective. Therefore, it is necessary not to misjudge.





Mode	D3~D0	MDP Pin	MDS Pin	FSW Pin	MON Pin
STOP	0000	L	Z	L	L
KICK	1000	H	Z	L	H
BRAKE	1010	L	Z	L	H
CLV-S	1110	CLV-S	Z	L	H
CLV-H	1100	CLV-H	Z	L	H
CLV-P	1111	CLV-P	CLV-P	Z	H
CLV-A	0110	CLV-S or CLV-P	Z or CLV-P	L or Z	H
CLV-A'	0101	CLV-S' or CLV-P	Z or CLV-P	L OR Z	H

Z: high impedance

6) SENSE

It is the pin to output the status inside the Servo IC corresponding to the μ-com, DSP address.

6-1) Focus Control

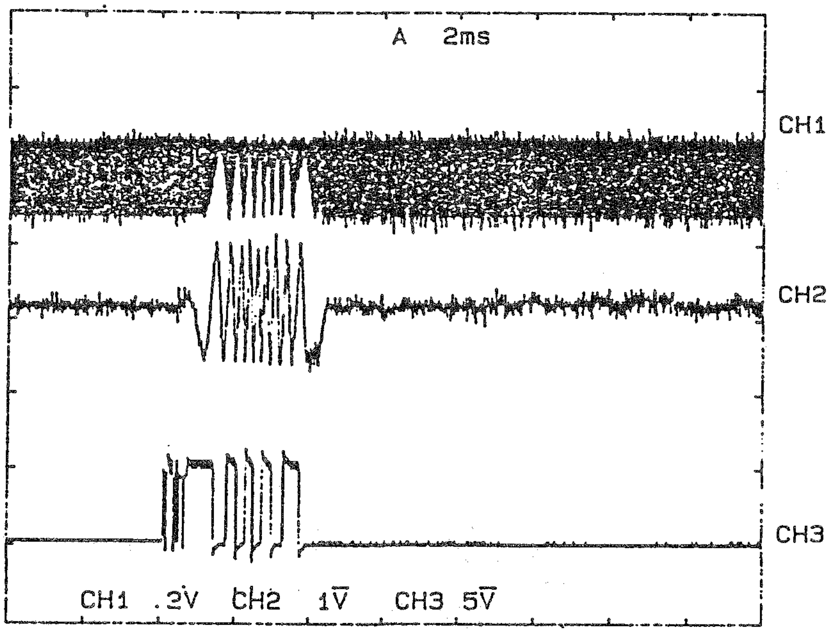
It is "High" when the Focus Error Voltage is 0V or higher, and "Low" at Focus Zero Cross.

6-2) Anti-shock

When a mechanical shock is added to the player, it turns "High" when the level exceeds the Comparator Level.

6-3) Tracking Control

Positive/Negative Judgment of TZC, TE. At the time of Track Jump, counts the number of tracks to jump and determines the Jump Pulse Width.



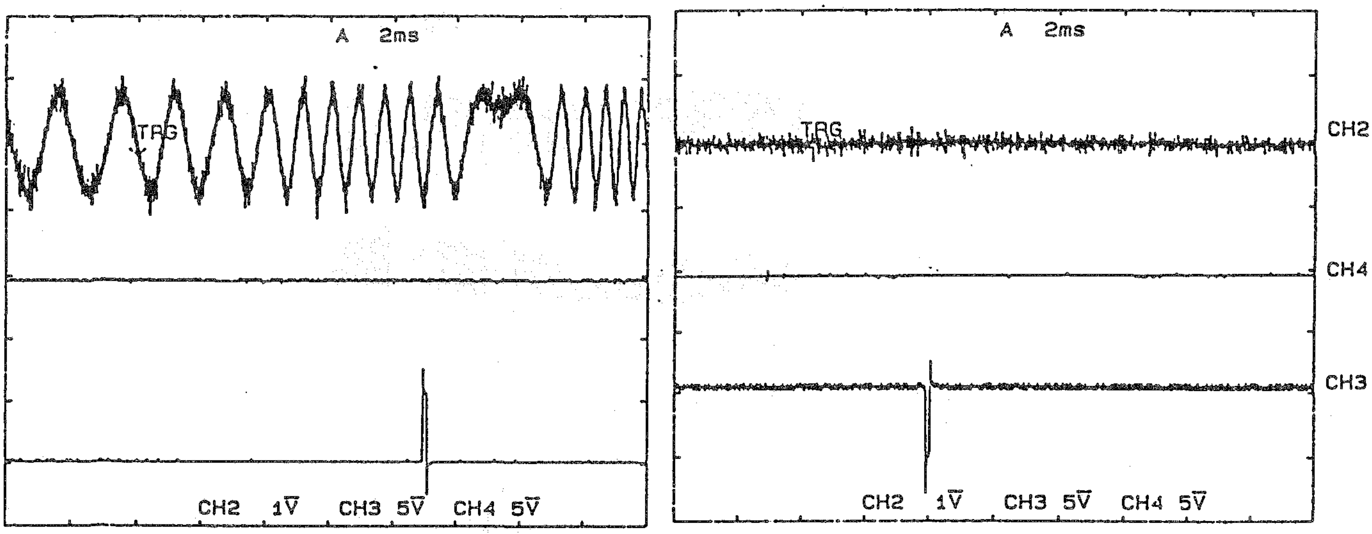
CH1 : RF

CH2 : TE

CH3 : SENSE

7) GFS (Guard Frame Sync.)

If the top-access signal (sync. signal) of EFM is confirmed in the EFM Decoder, data reading becomes possible. This frame-sync.-OK signal is GFS. Usually, when the tracking loop is closed, the level is "H"; when open, the level is "L".

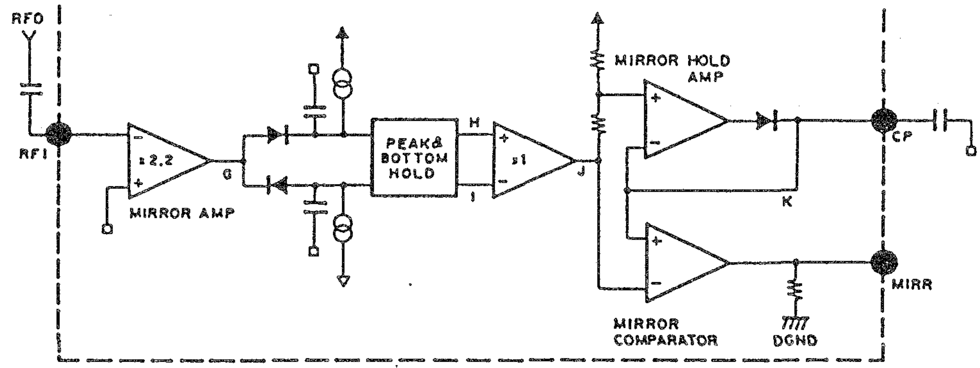


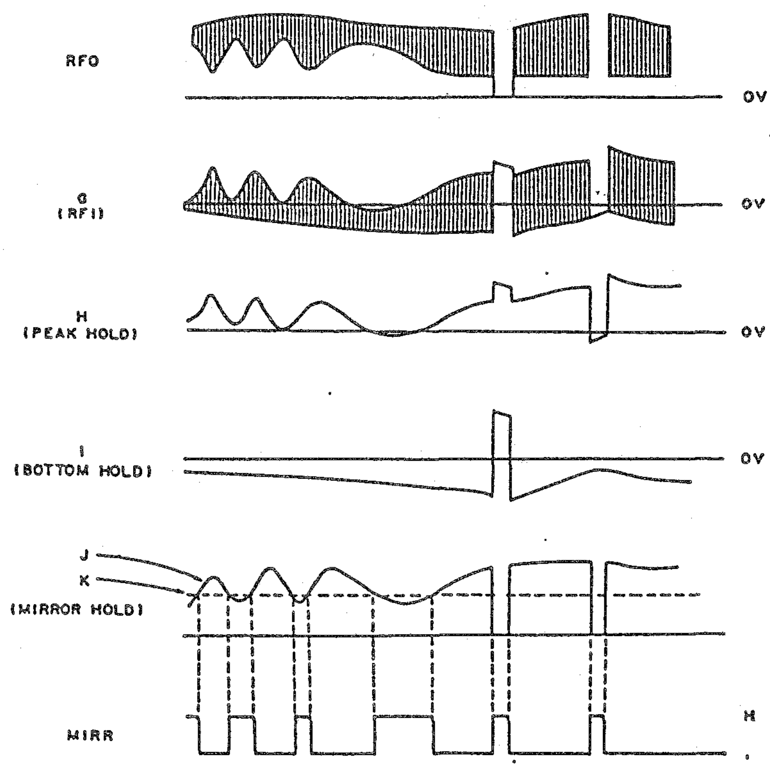
CH2 : TE
CH3 : GFS
CH4 : FOK

When Tracking is OPEN: FOK = H but GFS = L
When Tracking is CLOSED: FOK = H and GFS = H

NOTE: On both of the waves, a pulse is outputted at GFS. It means a momentary Lock or Unlock status. It is taken by simulating for an easy seeing of the H and L ranges on the waves.

8) MIRR





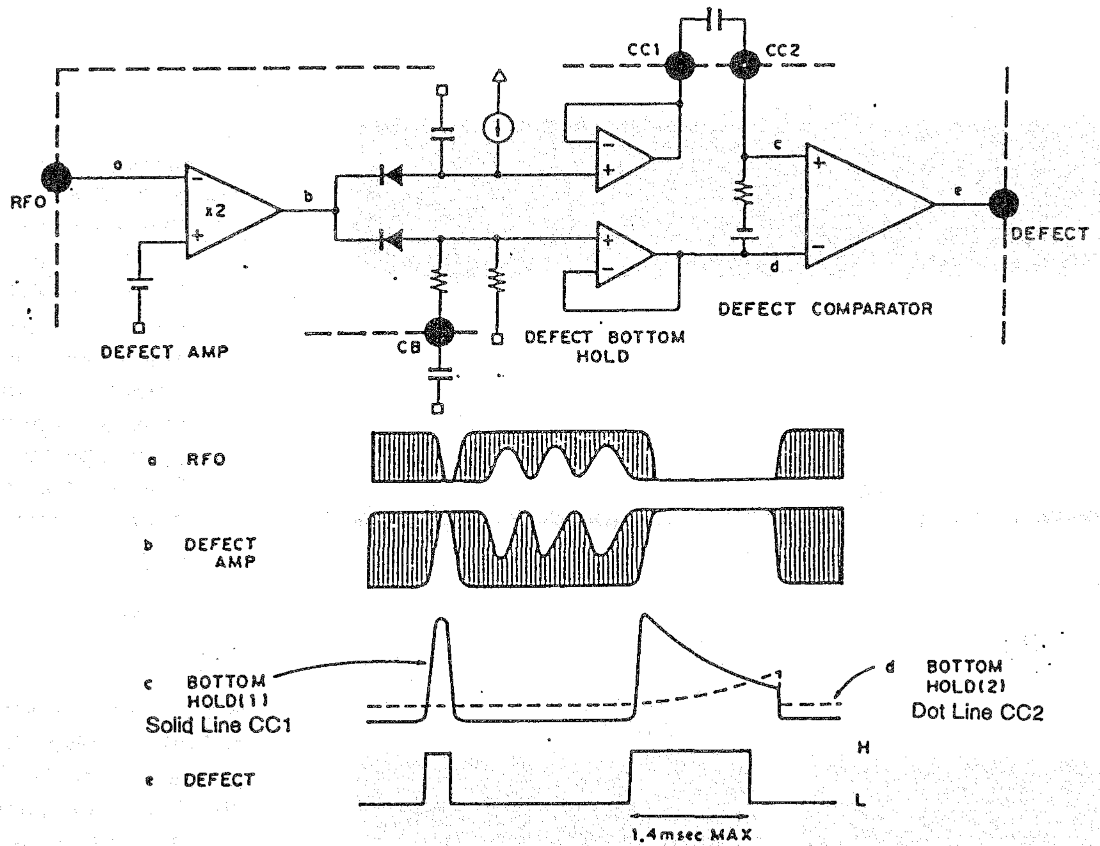
The DC factor of the played RF signal is removed by C-joint and the signal is reverse-amplified (G in the figure above).

Holds the Peak Level Envelope and the Bottom Level Envelope of this waveform ("H" and "I" respectively in the figure) and subtracts the Bottom Level form the Peak Level ("J" in the figure).

By comparing the signal that has gone through subtraction with the 2/3 level of that signal ("K" in the figure), the MIRR signal is obtained.

That is, it is the defect-detect circuit of the RF signal, and outputs "High" between tracks or at a mirror-side defect.

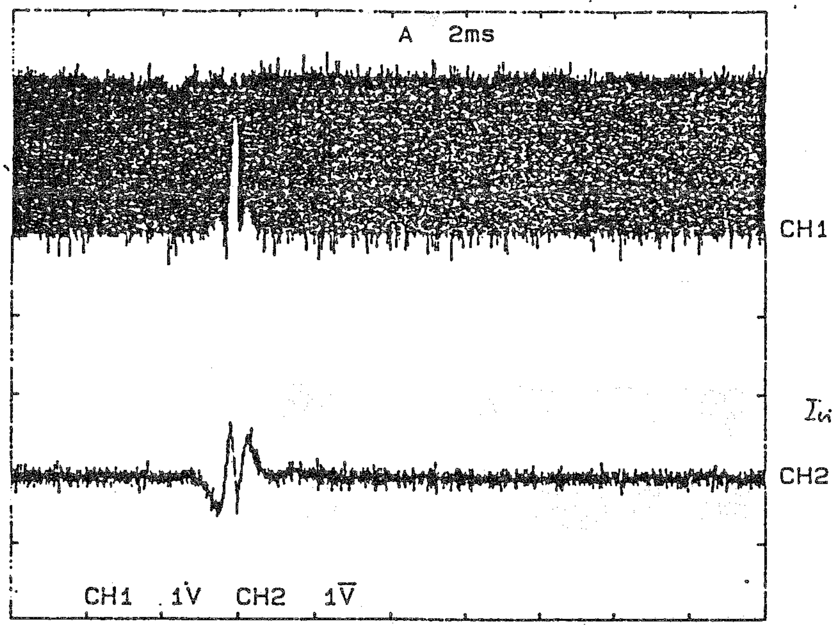
9) DEFECT



It reverse-amplifies the played RF signal ("b" in the figure above) and holds the Bottom Level Envelope of that signal. ("c", "d" in the figure). At this time, two responses -- long and short -- are used for the held time constant. By comparing those two, a mirror-side defect is detected.

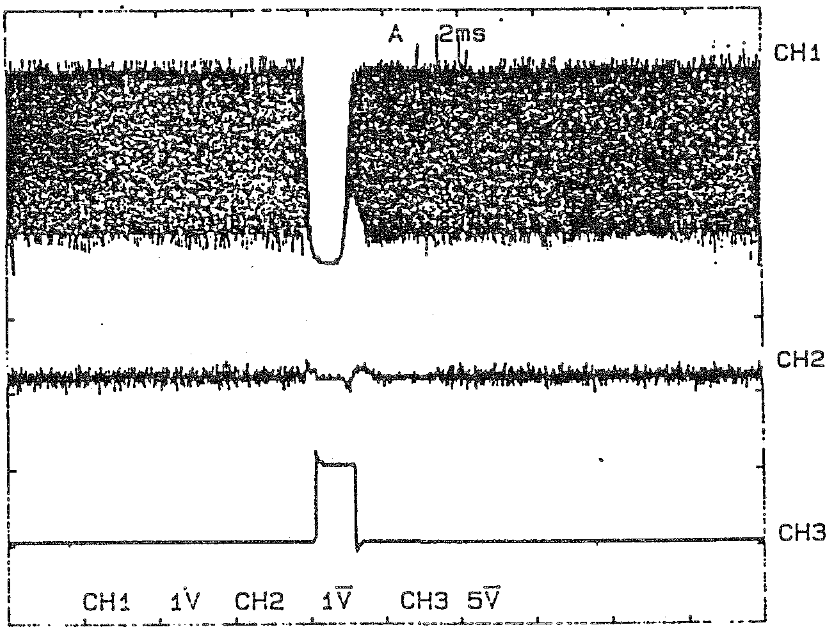
Scratches on Discs

When there are scratches on a disc, capability to read data correctly turns lower. The figures below show how RF and TE will change according to the type of scratches. (CH1: RF, CH2: TE, CH3: MIRR)



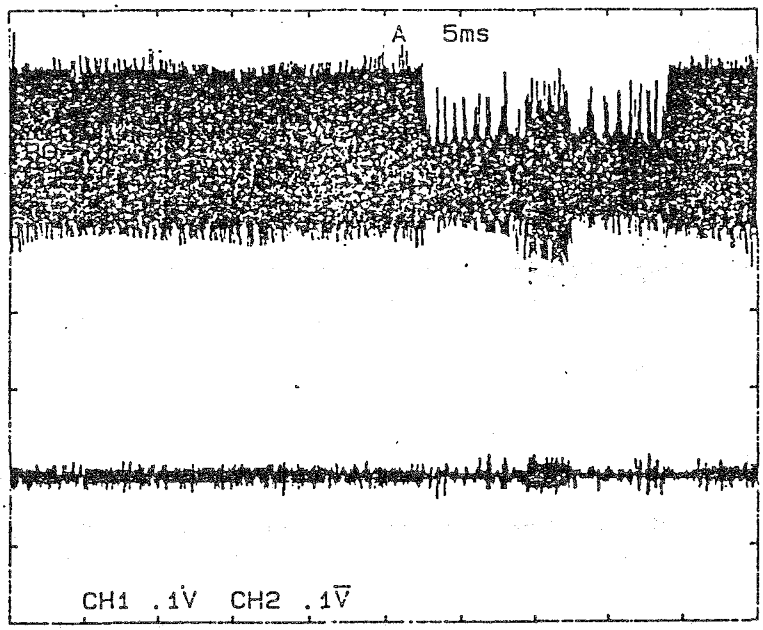
Interruption → Missing of Pit Side of the Disc.

(SP) The hold-down capability of Interruption means the PLAY capability of the player. However, the hold-down capability of defects on discs is in inverse proportion to that of mechanical vibrations. That is, this capability is quite different between home-use models and portable or car-use models.



Black Dot → Means alien material or black spot on the reading side of the Disc.

(SP) It can be confirmed that an output appears on MIRR at a defective part.



Finger Print → It is obtained by simulating a fingerprint placed on the reading side of a disc.

Error Rate of Data

The Error Correction Block corrects up to double errors of C1 Correction and C2 Correction.

NOTE: The error rate counts scratches and dirt of a disc; therefore it is desirable to perform checking using a certain disc of high quality.

Requests from the Correction Block to the RAM Interface Block for data.

↓

The RAM Interface Block accepts the request considering the activating condition of the entire system. Rises the address of the data that has been requested for to the external RAM.

↓

R/W of the Correction Block and the RAM Data becomes possible.

C1F1	C1F2	C1 Correction Status
0	0	No Error
1	0	Single-error correction
0	1	Double-error correction
1	1	Irretrievable error

C2F1	C2F2	C2FL	C2 Correction Status
0	0	0	No Error
1	0	0	Single-error correction
0	1	1	Double-error correction
1	1	1	Irretrievable error

CIRC (Cross Interleave Read-Solomon Code)

1. Factors of Signal Fading

Burst Mode:
- Defects existing on the disc from the first (rises in manufacturing the disc)
- Defects rising in handling the disc (fingerprint, scratches, dust)
- Changes or trouble occurring in the PLAY Mechanism

Random Mode:
- Time difference error of Play Signals (jitter)
- Interference between signals.

2. Countermeasure for Signal Fading

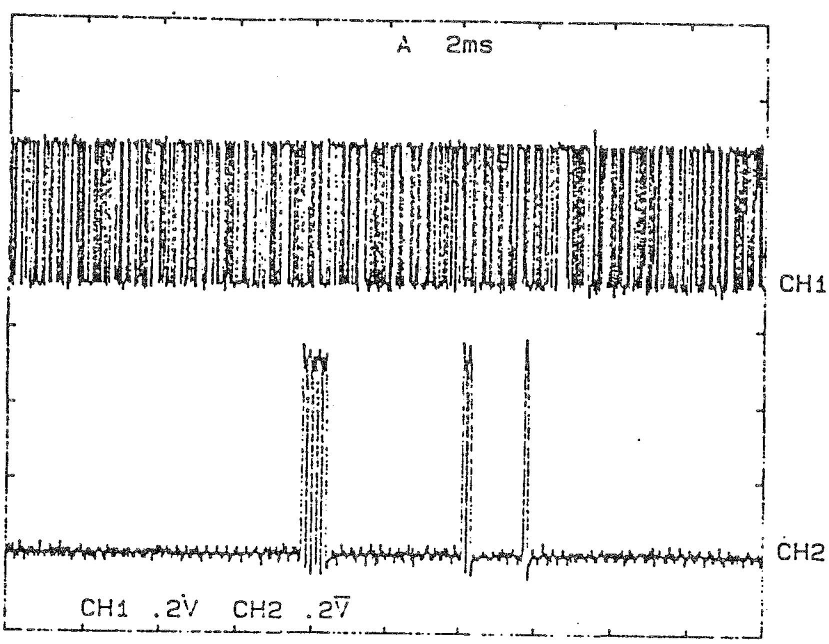
- Delay one frame so that a Symbol (8-bit) Error may not cause a Word (16-bit) Error.
- To make the Interpolation Length longer, place the parity at the center of the series of signals.
- To make the Interpolation Length longer, separate the even-number data and odd-number data of the Play signals.

3. Correction and Interpolation Establishment

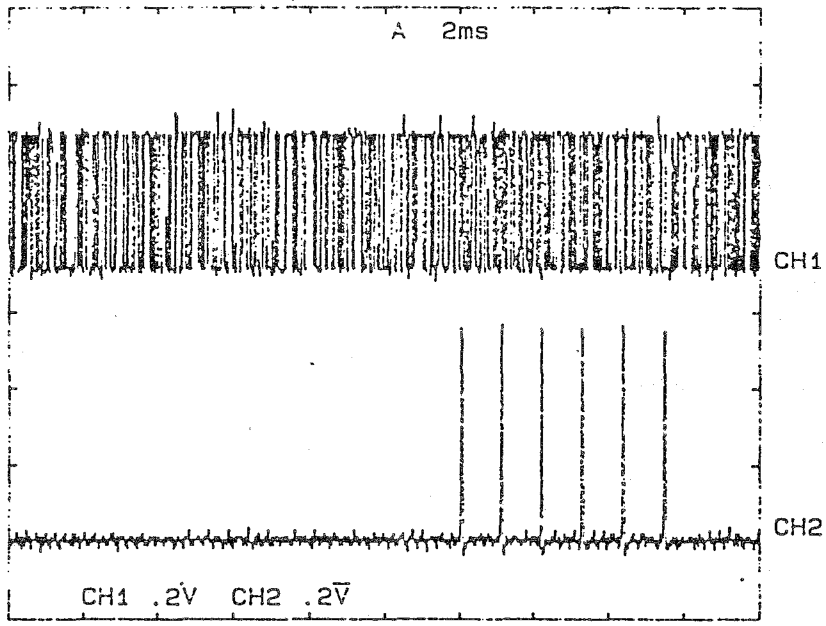
- In case of Single-error only, correction is made unconditionally.
- In case of Double-error, it is handled with presumption that a mistake correction basically exists.

C1 System → Performs a Double-error Correction, and turn on the flag that symbols are all errors.

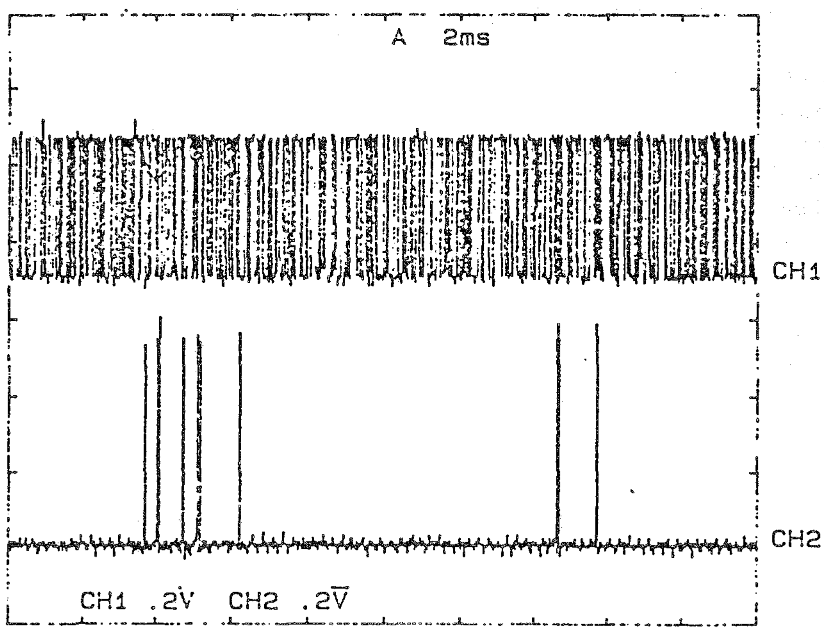
C2 System → Always checks the size of the error seen from the C2 system, and checks the flag of symbol unit of C1.



EFM and C1F2
Monitor output of Error Correction status in decoding
C1F2 → C1



EFM and C2F2
Monitor output of Error Correction status in decoding C2F2 → C2



EFM and C2P0
C2P0 → Correction status output.
When the C2 system cannot be corrected during correction, it turns "H".

10) Actual Circuitry (DP-7020)

= = Devices Used and Main Functions = =

★ RF Amplifier CXA1081S (X32-1500 ; IC104)

- RF Amplifier
- Focus Error Amplifier
- Tracking Error Amplifier
- APC Circuit
- Auto Asymmetry Control Amplifier
- Focus OK Detect Circuit
- Mirror Detect Circuit
- Defect Detect Circuit
- EFM Comparator

★ Servo IC CXA1244S (X32-1500 ; IC103)

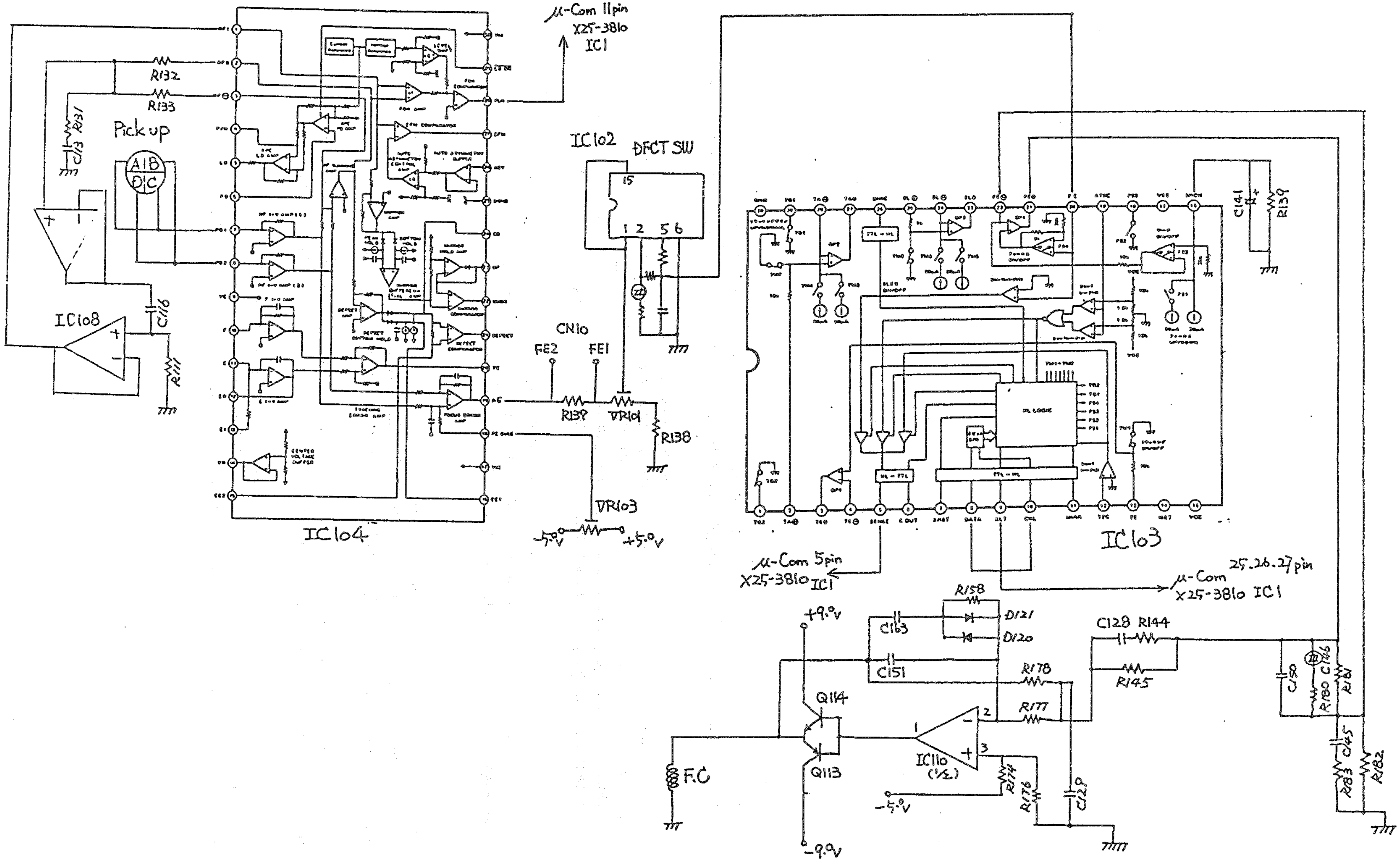
- Focus Control
- Tracking Control
- Thread Control

★ Digital Signal Process IC CXD1165Q (X32-1500 ; IC11)

- Bit Clock Regeneration in EFM-PLL Circuit
- EFM Data Demodulation
- Frame Sync. Signal Detection, Protection, and Insertion
- Error Detection and Correction
- Sub-code Signal Demodulation, Error Detection
- CLV Servo of Spindle Motor
- Tracking Counter
- CPU Interface
- Register for Sub-code Q
- Register for D/A Interface
- RAM Built-in

Focus Servo

DP-7020 X32-1500 (B/8)



= = = Focus Servo = = =

1) When a Focus Drive command is inputted from the μ-com to Pins 8, 9, and 10 of IC103, the Servo IC turns on FS 1 and 2, turns off FS3 and 4, and moves the Focus Coil up and down using the C141 charge/discharge of Pin 16 of IC103.

2) At that time, the Pick Up is emitting the LD. Since the Focus Coil moves up and down, the reflecting light is inputted to Pins 7 and 8 of IC104 by the Photo Detector A + B and B + D.

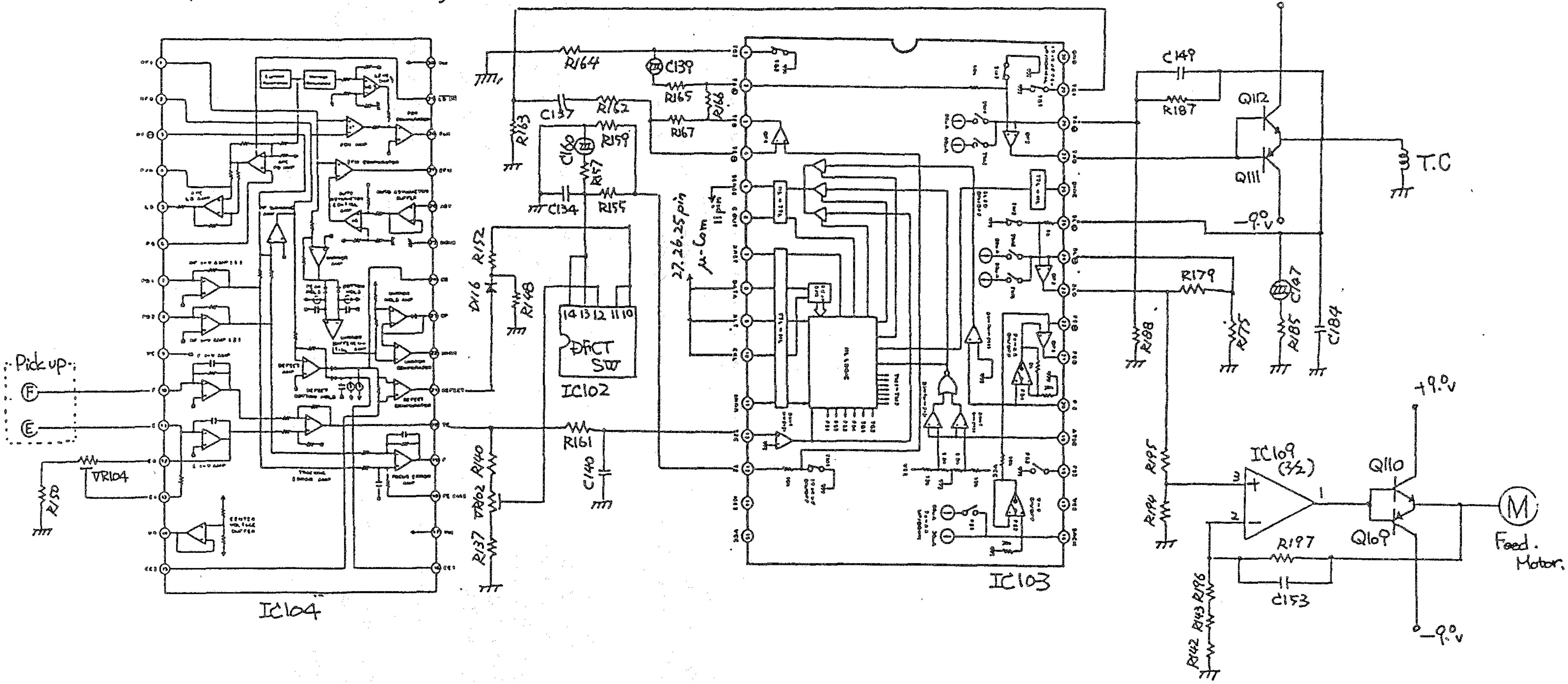
3) PD1 and PD2, inputted from the Photo Detector, are added up by the RF Summing Amplifier, and that RF signal and the (HP BAFF) RF signal are inputted to the FOK Amplifier. If a certain Intensity signal is obtained by the FOK Comparator there, the "H" level is inputted from Pin 28 to the μ-com.

4) PD1 and PD2, inputted almost at the same time with 3), are inputted to the FE Amplifier of IC104 and subtracted. At that time, the difference error signal (S-shaped curve) is outputted from Pin 19 and inputted to Pin 20 of IC103 via the SW circuit.

5) Out of the FE signal (S-shaped curve) inputted to the Servo IC, FZC is detected by the comparator in the Servo IC. The "H" signal is sent to μ-com when Coil Drive is started from the SENSE output pin (Pin 5) by the ILL IC, or the "L" signal is sent to μ-com when FZC is detected, to make recognition that the Pick Up has obtained the FZC. Naturally, when FZC is detected, the conditions are not satisfied unless FOK is "H".

6) Then data is sent from the μ-com, FS1, 2 are turned off and FS3, 4 are turned on inside the Servo IC, and the Servo Loop of the Focus system is closed.

== TRACKING Servo == DX-7020 X32-1500(58)



- 21 -

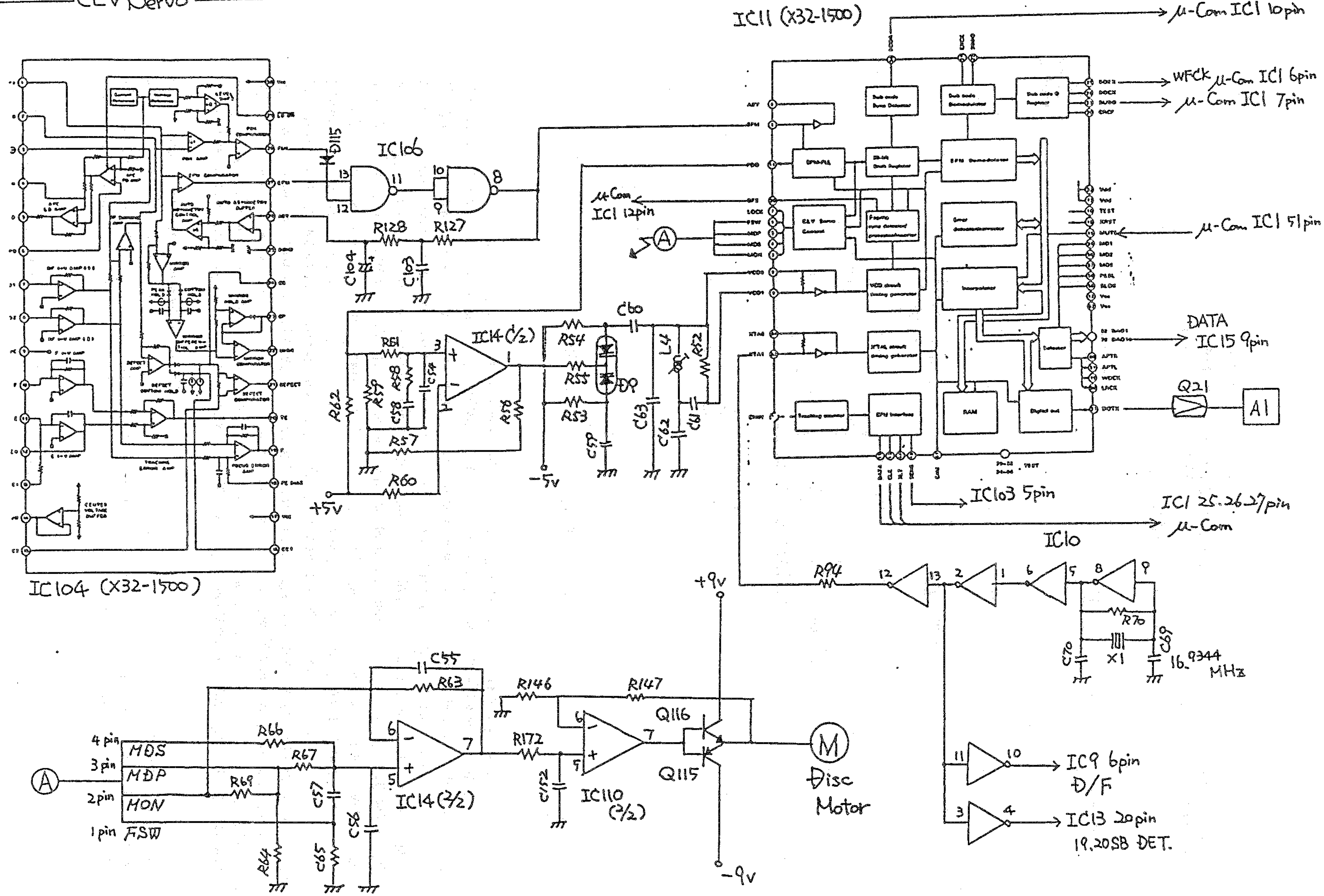
= = = Tracking Servo = = =

1) When the disc starts turning, the reflection light current is inputted from the Photo Detector E, F in the Pick Up to respective Pins 10 and 11 of the RF Amp IC104. There, each of them is voltage-converted by the I-V Amplifier. At that time, the incidence volumes of E and F should be equal to each other by adjusting NF of the I-V Amplifier of Side Beam E so that the Main Beam of the Pick Up may correctly be on track. Thereafter, E and F are inputted to the Differential Amplifier, subtracted, and the Tracking Error voltage is outputted from Pin 20.

2) The TE signal outputted from Pin 20 of IC104 goes through VR102 (for GAIN adjustment) and is inputted to Defect SW IC102. This IC detects scratches on the disc by missing of RF Envelope, sends the DFCT signal from Pin 21 of IC104, and temporarily cancels TE. That is, when the missing part is too large, it will not be forced to follow it but traces in the blind status to lighten the sound skip. The TE signal outputted from IC102 is inputted to Pin 13 of IC103. Then it receives gains and phase compensation, is outputted from Pin 27, and the Tracking Coil is driven by Q111 and Q112.

3) On the other hand, the TE signal outputted from Pin 20 of IC104 is inputted to Pin 12 of IC103 via a different route. Here, for the Track Count, etc. at the time of Track Jump, by the control of IIL LOGIC, SENSE of Pin 5 is sent to the μ-com and C.out of Pin 6 is sent, to convey the Tracking Servo status and receive the command of each action from IC103 Pins 8, 9, 10.

CLV Servo



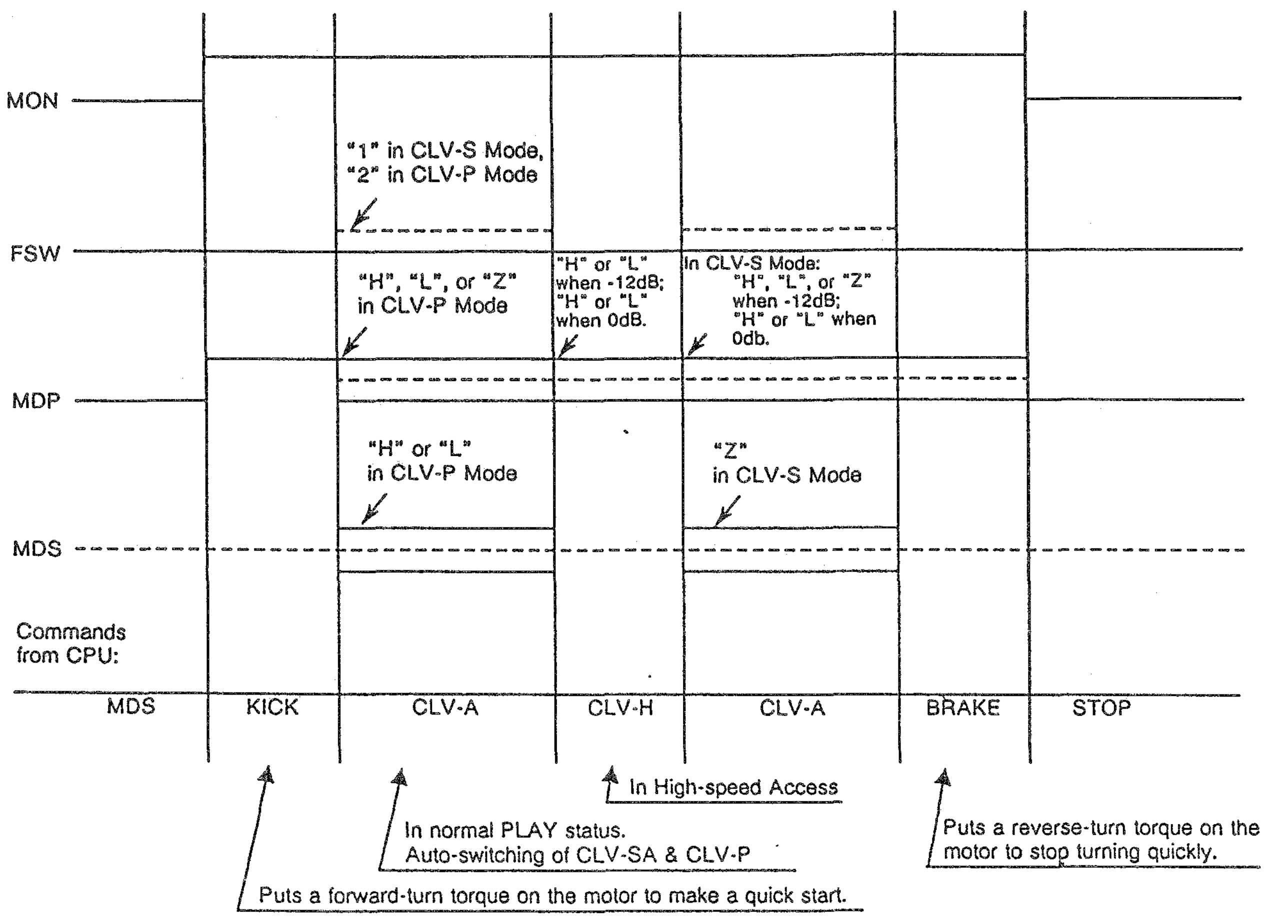
IC11 (X32-1500)
μ-Com IC1 10pin
WFCK μ-Com IC1 6pin
μ-Com IC1 7pin
μ-Com IC1 12pin
μ-Com IC1 51pin
DATA IC15 9pin
Q21
A1
IC103 5pin
IC1 25.26.27pin μ-Com
IC10
IC106
D115
R128
R127
C104
C103
IC14 (1/2)
R51
R62
R57
R58
C54
R59
R60
+5V
R54
R55
R53
C60
D9
L4
R52
C63
C62
C61
C59
-5V
IC104 (X32-1500)
R94
R70
X1
C70
C69
16.9344 MHz
+9V
-9V
IC9 6pin D/F
IC13 20pin 19.20SB DET.
C55
R63
R146
R147
Q116
Q115
R66
R67
R69
R172
C152
IC14 (2/2)
IC110 (2/2)
4pin MDS
3pin MDP
2pin MON
1pin FSW
C57
C58
R64
C65
Disc Motor
M
A

= = = CLV (Constant-Linear-Velocity) Servo = = =

Since the length of a pit on the disc is formed on the basis of a certain unit (T = 1/4.32MHz) specified by the standards, the disc must be turned in a constant linear speed for playing the disc. Therefore, clocks for VCO data and PB EFM, as well as the standard clock, are necessary; using them, the Disc Motor is turned.

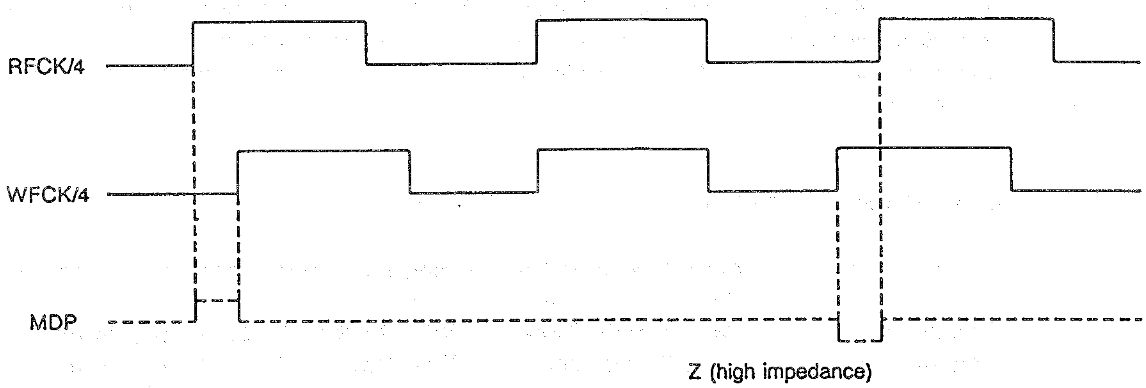
First, when the Disc Motor is in the Stop status, no drive voltage should arise at the emitters of Q115 and Q116 by turning Pin 1 (FSW), Pin 2 (MON), and Pin 3 (MDP) of IC11 "L"-level. Then when the Focus Servo is turned on, serial data is sent from the μ-com to Pins 13, 14, and 15 of IC11 and tries to turn the Disc Motor. At first, the MON (Motor-drive ON) signal turns "H"-level to obtain the forward-turn mode and IC14 (2/2) starts being activated. When the disc starts turning, FEM is inputted to DSP (IC11) and how many cycles of Frame Sync. come up in a certain unit of time is calculated, and "L", "Z", or "H" is outputted from MDP (Pin 3). Accordingly, the voltage added to the Motor Driver is controlled so that the Frame Sync. may be locked (GFS = H). That is, depending on the speed of data to be taken in by DSP, the clock factor in the data, and the phase difference from the standard clock, the mode of CLV-P and CLV-S is switched and MDS and MDP output the signals of "L", "Z", and "H" so that the linear speed may become constant. In addition, when the STOP key is pressed, MDP turns "Z" to turn on Brake. At the time of a high-speed access, the Rough Servo Mode is obtained.

Example of Spindle Motor Control



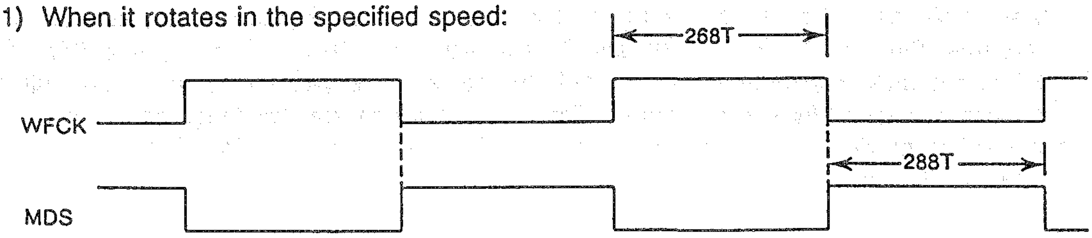
Timing Chart in CLV-P Mode

MDP Pin

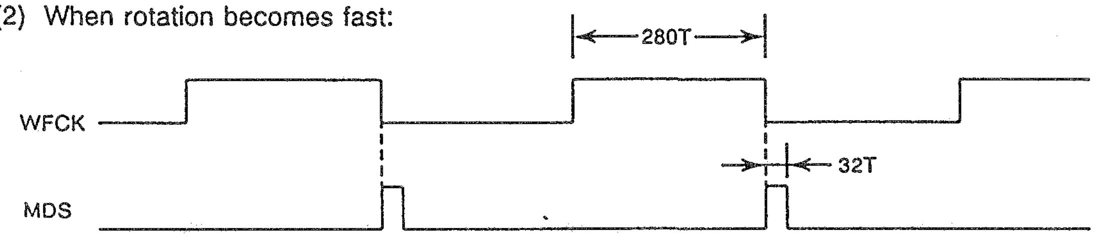


MDS Pin (Presumed that the cycle of 4.2336MHz is "T")
The time of MDS Pin = "H" will be: (time of WFCK = "H" − 279T) x 32.

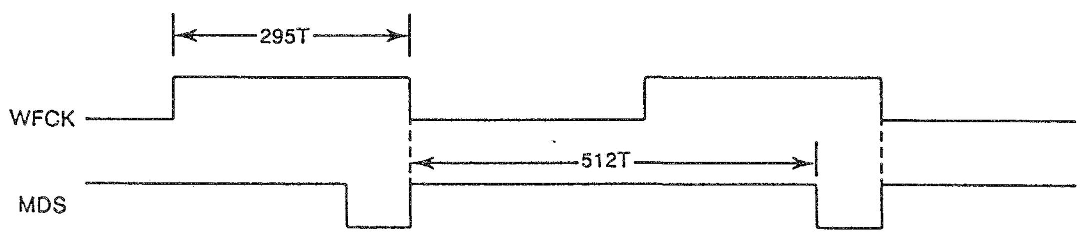
(1) When it rotates in the specified speed:



(2) When rotation becomes fast:



(3) When rotation becomes slow:



* DSP Master Clock

As the Master Clock, X1;16.9344MHz is used. This oscillation is waveformed by IC10 and inputted to Pin 53 of IC11. At that time, the same crystal oscillator is used for IC9 Digital Filter Pin 6 and IC13 19,20SB Detector Pin 20 as the standard oscillation. However, the standard oscillation of each IC is delayed by active elements, and the same number of elements are used so that the entire system may not cause a mislatching. This is the most fundamental part in composing a digital circuit.

* Clocks divided in DSP and used (IC11 CXD1165Q)

Pin 51	C4M	-	A clock obtained by dividing the Master Clock by 4, used as the system clock of the μ-com (f = 4.236MHz).		
Pin 68	RFCK	-	Read Frame Clock.	X'tal System 7.35KHz	(not in use)
Pin 69	WFCK	-	Write Frame Clock.	X'tal System 7.35KHz	(not in use)
Pin 70	PLCK	-	VCO/2 Output.	When locked to EFM 4.32MHz	(Test Point)
Pin 75	C4LR	-	Strobe Signal	176.4KHz	(not in use)
Pin 76	BLCK	-	Bit Clock	2.1168MHz	(IC9 Digital Filter Pin 2)
Pin 77	BLCK	-	Bit Clock	2.1168MHz	(not in use)
Pin 79	WDCK	-	Strobe Signal	88.2kHz	(not in use)
Pin 80	LRCK	-	Strobe Signal	44.1KHz	(IC9 Digital Filter Pin 28)

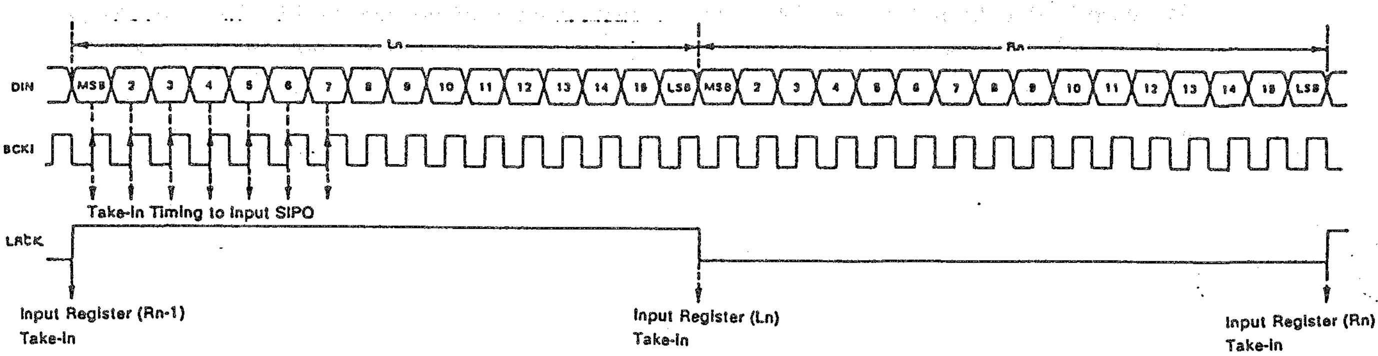
Please note here that, in the status at the time of composing the circuit as described in this document, Pins 68, 69, 70, 75, 76, and 77 are outputted when PSSL = L. Also, this SONY-made DSP can change the mode of the IC itself into 13 ways. Depending on the mode difference, the standard oscillation frequency varies. That is, as a rough idea for judgment in case "f" of each pin is different, defects in soldering of the five pins -- MD1, MD2, MD3, PSSL, and SLOB of DSP -- may be the cause.

Mode Selection Table

Input Pins					Functions (NOTE 1)					
MD1	MD2	MD3	PSSL	SLOB	8M/16M	DO OFF/ON	DF OFF/ON	P/S	OB/2'S	CD ROM/AUDIO
L	L	L	L	L	16M	DO ON	DF ON	Serial	2's	AUDIO
L	L	L	H	H			↓	Parallel	OB	
L	L	H	L	L		↓	DF OFF	Serial	2's	
L	H	L	L	L		DO OFF	DF ON	↓	↓	
L	H	L	H	H			↓	Parallel	OB	
L	H	H	L	L			DF OFF	Serial	2's	
L	H	H	H	H	↓		↓	Parallel	OB	
H	L	L	L	L	8M		DF ON	Serial	2's	
H	L	L	H	H			↓	Parallel	OB	
H	L	H	L	L			DF OFF	Serial	2's	
H	L	H	H	H	↓	↓	↓	Parallel	OB	↓
H	H	H	L	L	16M	DO ON	DF OFF	Serial	2's	CD ROM
H	H	H	H	L	8M	DO OFF	↓	↓	↓	↓

NOTE 1:
- 8M/16M; With Clock Selection of XTAI or XTAO, 8.4672MHz/16.9344MHz
- DO OFF/ON: Digital Out OFF/ON
- DF OFF/ON: Digital Filter OFF/ON
- P/S: Parallel mode / Serial mode
- OB/2's: Offset Binary / 2's Complement
- CD ROM / Audio: CD ROM corresponding / Audio corresponding

NOTE 2: If 16M clock is inputted to an 8M activating mode, a double-speed PLAY mode is obtained.



* VCO (PDO Pin 11, VCOO Pin 8, VCOI Pin 9)

The played EFM signal is inputted to the DSP Pin 5. Here, the EFM signal is sent to the PLL circuit in the IC. Since the EFM signal contains the clock factor of 2.16MHz, the bit clock of 4.32MHz which synchronizes to the former clock can be taken out. Also, the external VCO is activated with the 8.6436MHz free-run, compares this VCO/2 with PBCK, outputs the error factor from PDO (Pin 11), and controls VCO. When synchronizing, the average value of the PDO pin becomes VDD/2. And if the rotating speed of the disc goes up, the average value of PDO goes up; if the rotating speed goes down, the average value of PDO goes down.

* Fame Sync. (GFS Pin 28)

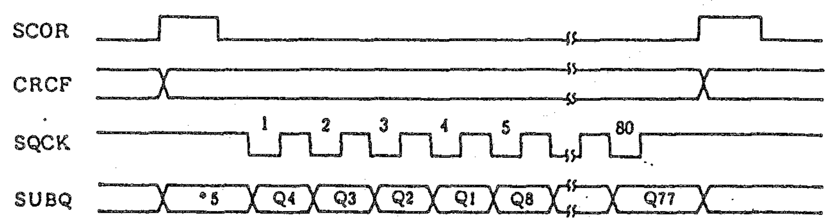
On the disc, data is recorded with 588-channel bits in one frame. In each frame, a sync. signal is inserted so that the border of the block can be identified. Also in DSP, WINDOW is provided to protect Frame Sync. and is inserted with a signal generated by a 588-carry counter (4.32MHz/588 = 7.35KHz). That is, when Frame Sync. from the disc synchronizes with the signal generated by the 588-carry counter, the condition to read data correctly is satisfied. At that time, the DSP Pin 28 GFS turns "H" and it is inputted to the μ-com IC1 PIN 12.

* SUB CODE

Following the Frame Sync. in one frame of data on the disc., there is a portion called "User's Bits", which is composed of 14-channel bits. Naturally, it has been modulated; therefore, it is demodulated from 14-bit to 8-bit. Ninety-eight frames of the User's Bits form one block. That is, it is called a "Q-data" of a disc. and it plays a role of table of contents in the disc.

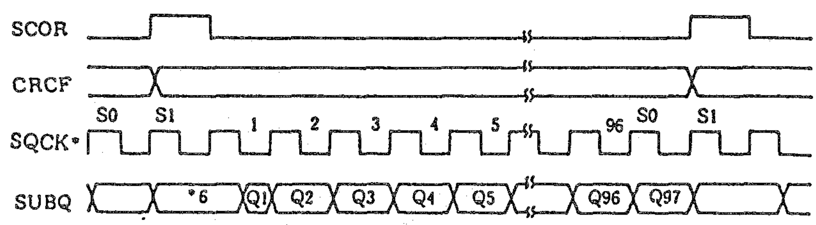
In those User's Bits, a 2-bit sync. pattern is provided. By detecting it, data is read. This Q-data, after being demodulated, is registered with the timing synchronized with WFCK (7.35KHz), is outputted from SUBQ (Pin 23), and is inputted to μ-com IC1 Pin 7. By this data, the μ-com recognizes what kind of disc has been set. Also, as described above, SUBQ is not inserted into Memory but is loaded in the status of jitter included. And it even detects errors of scratches on the disc, defective forming of pits, etc. This status can be monitored by CRCF (Pin 20). When an error is detected, the level turns "L".

When SQEX = "H"



*5: When CRCQ Flag is "1", CRCF.
When "0", undetermined.

When SQEX = "L"

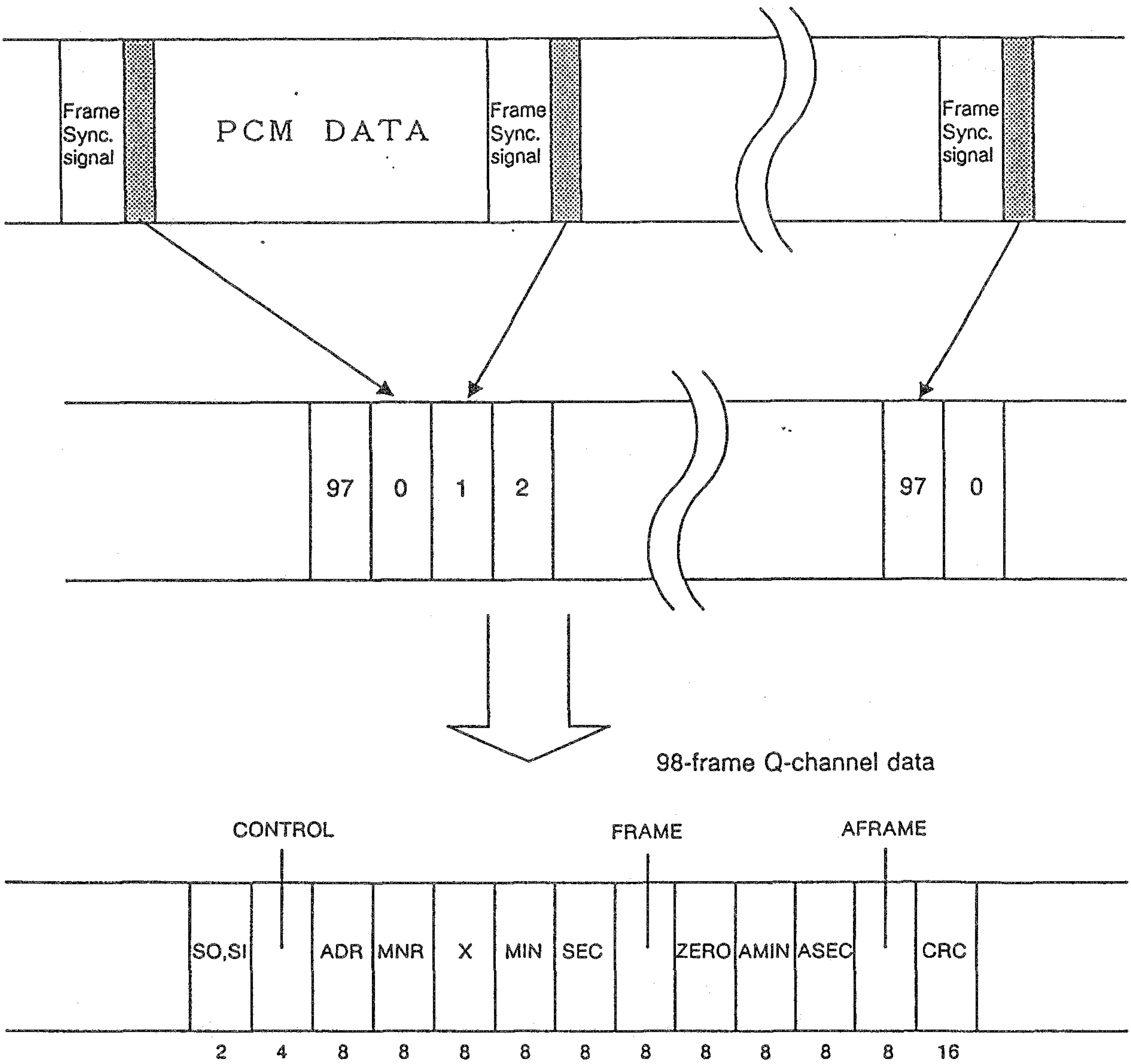


*6: When CRCQ Flag is "1", CRCF.
When "0", Q98, Q1.

*To SQCK, $\overline{\text{WFCK}}$ is outputted.

SQEX "H" → Synchronizes to the μ-com clock, and outputs SUBQ.
SQEX "L" → synchronizes to WFCK(SQCK), and outputs SUBQ.

USER'S BITS (Q-DATA)



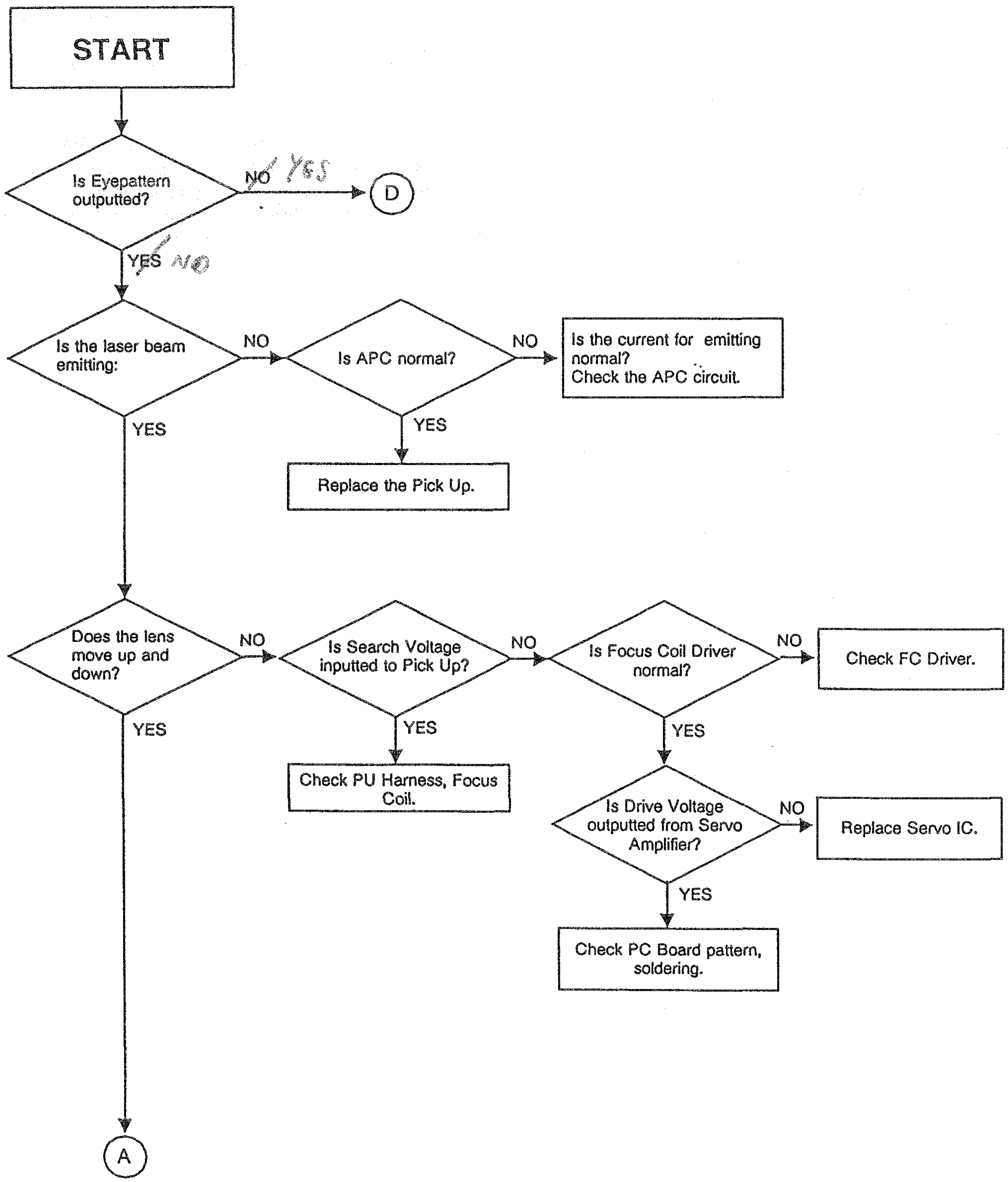
SO, SI: Sync. pattern of 2-bit address signal
CONTROL: 4-bit control data
ADR: Mode data
MNR: Music No.
X: Index for each music
MIN: Elapsed time of music (minutes)
SEC: Elapsed time of music (seconds)
FRAME: Elapsed time of music (1 frame = 1/75 sec.)
ZERO: *Not in use*
AMIN: Elapsed time in disc (minutes)
ASEC: Elapsed time in disc (seconds)
AFRAME: Elapsed time in disc
CRC: Error Correction Code data for CONTROL~AFRAME

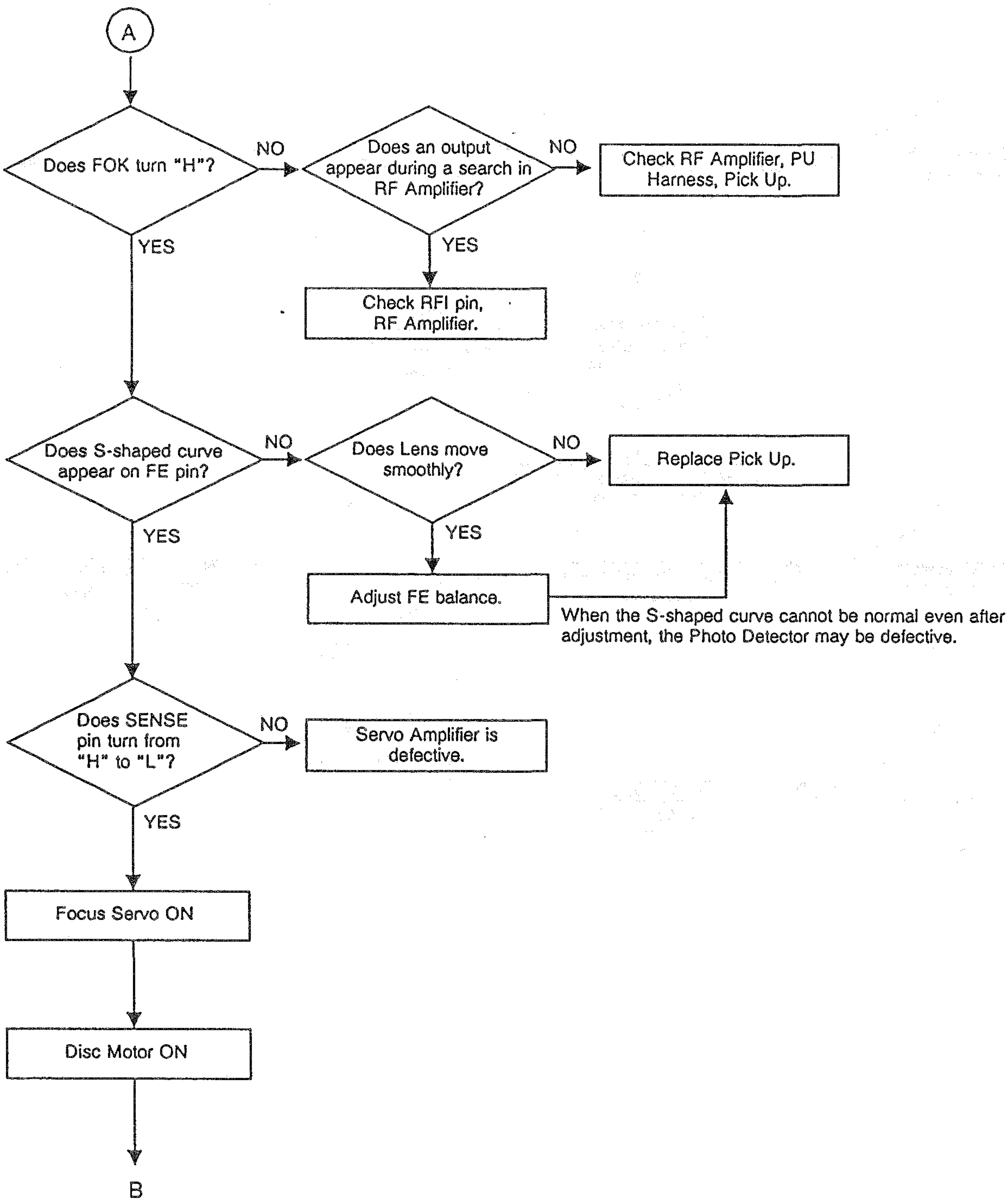
* Error Correction

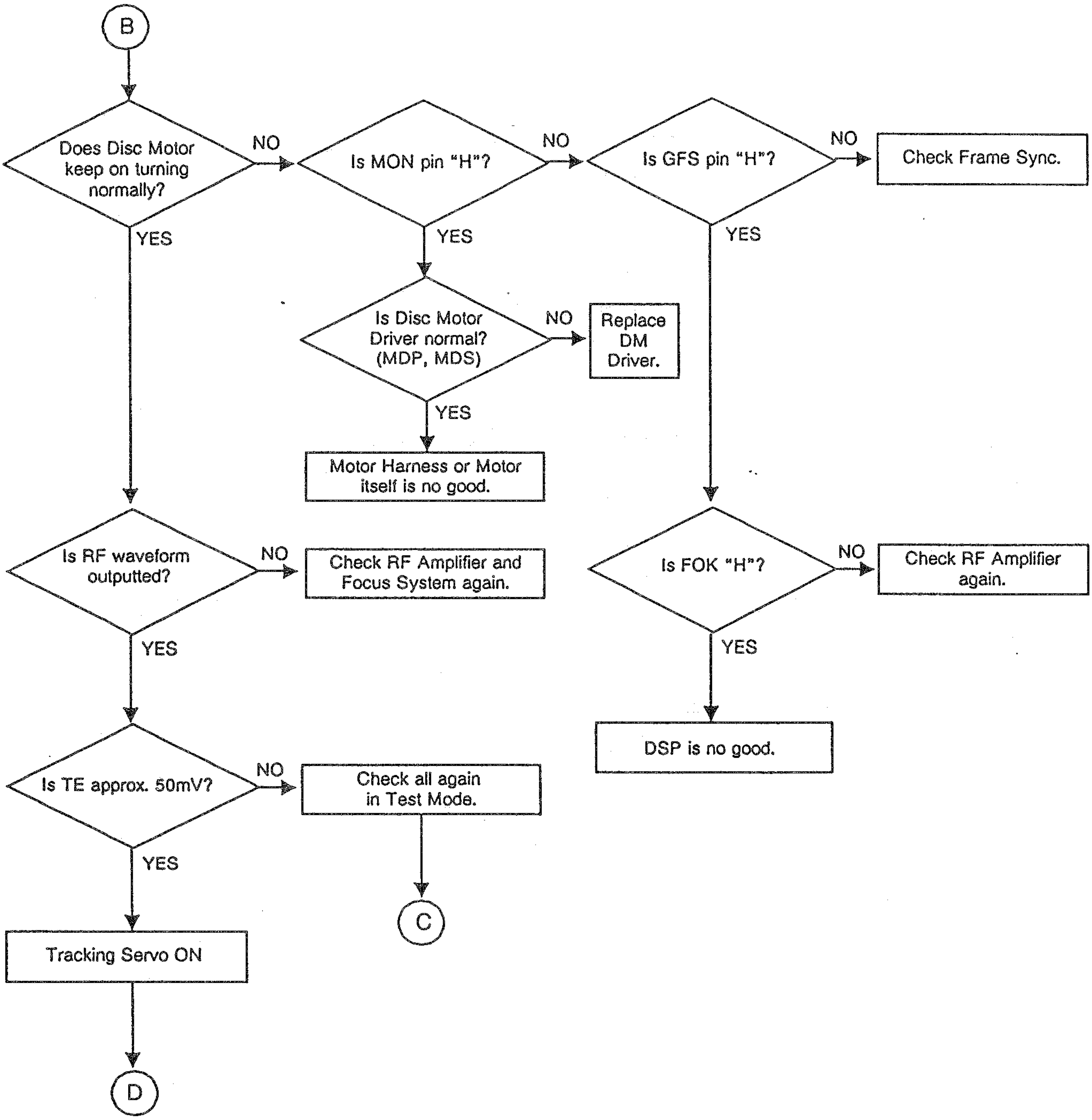
When the PB EFM signal is demodulated and written to the internal RAM, it is read with the constant standard clock and is sent as digital data without wow and flutter. However, errors of such as scratches and defective pit forming naturally occur and they must be corrected strongly. They are to be processed by CIRC (Cross Interleave Read-Solomon Code) in the IC, and the status can be monitored.

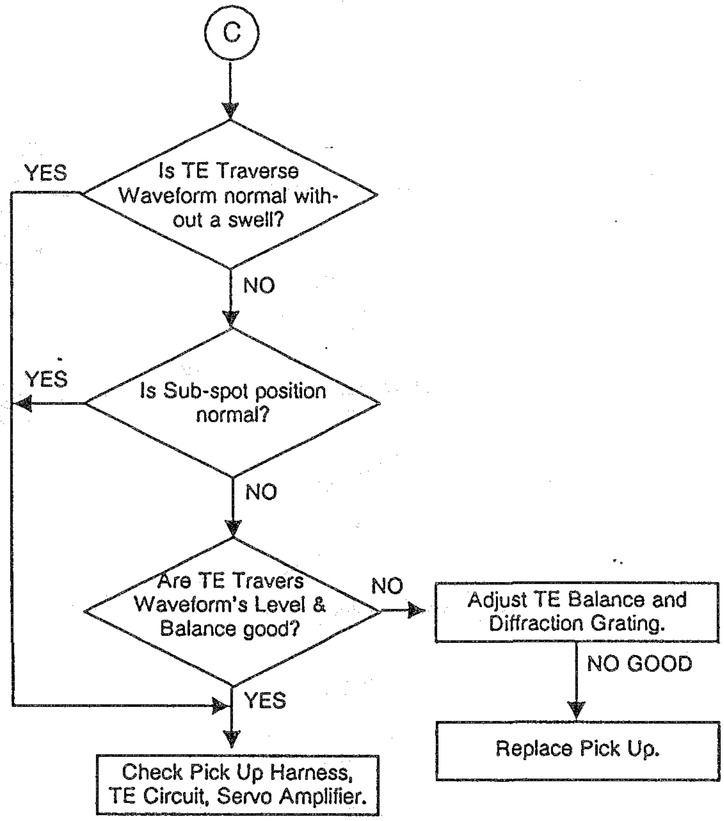
Pin 63 (C1F2), Pin 65 (C2F2), and Pin 66 (C2PO) of IC11 are the monitor pins. When many flags are turned ON on those pins, it indicates that many errors have occurred and results in statuses of "Reading Not Possible", "Sound Blurring", "Synchronizing Unstable", etc. The cause of such phenomena is, in many cases, defective soldering of DSP, defective Disc Motor, frequency difference error of VCO, etc., thus mainly affected by the servo becoming defective in reading EFM.

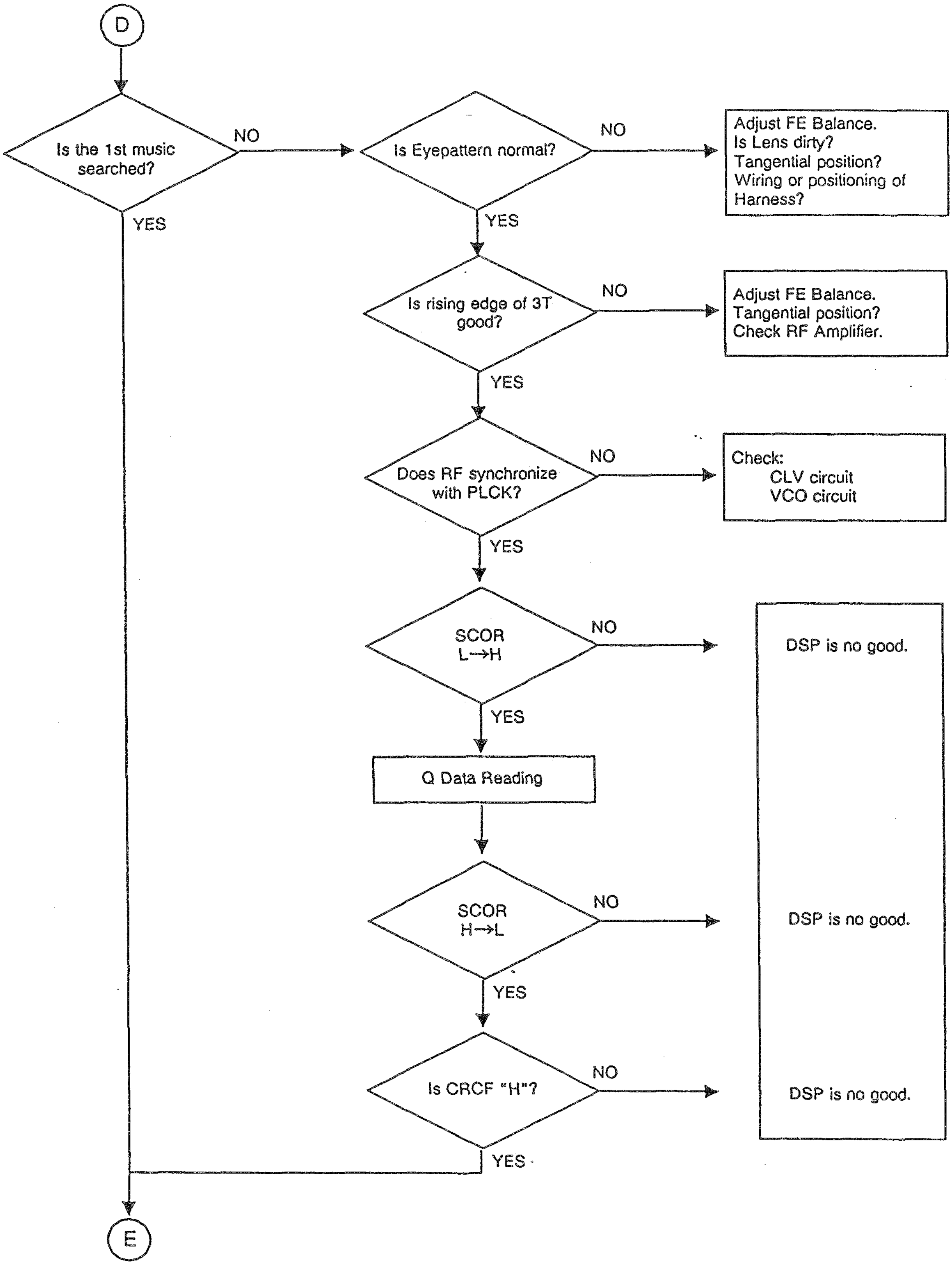
TROUBLE-SHOOTING

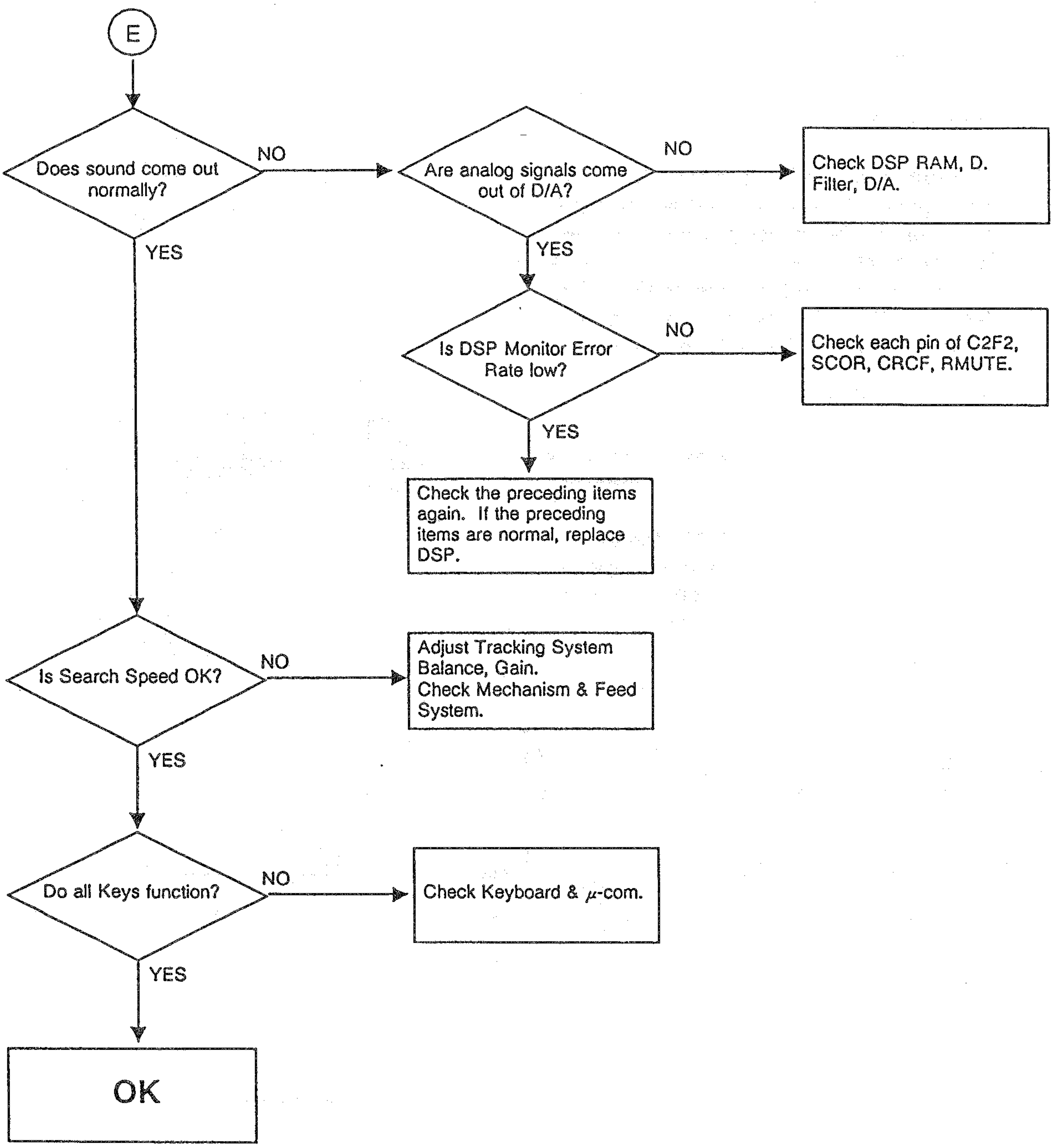



A
Does FOK turn "H"?
NO
Does an output appear during a search in RF Amplifier?
NO
Check RF Amplifier, PU Harness, Pick Up.
YES
Check RFI pin, RF Amplifier.
YES
Does S-shaped curve appear on FE pin?
NO
Does Lens move smoothly?
NO
Replace Pick Up.
YES
Adjust FE balance.
When the S-shaped curve cannot be normal even after adjustment, the Photo Detector may be defective.
YES
Does SENSE pin turn from "H" to "L"?
NO
Servo Amplifier is defective.
YES
Focus Servo ON
Disc Motor ON
B


B
Does Disc Motor keep on turning normally?
NO
Is MON pin "H"?
NO
Is GFS pin "H"?
NO
Check Frame Sync.
YES
YES
YES
Is Disc Motor Driver normal? (MDP, MDS)
NO
Replace DM Driver.
YES
Motor Harness or Motor itself is no good.
Is RF waveform outputted?
NO
Check RF Amplifier and Focus System again.
Is FOK "H"?
NO
Check RF Amplifier again.
YES
YES
DSP is no good.
Is TE approx. 50mV?
NO
Check all again in Test Mode.
YES
C
Tracking Servo ON
D


C
Is TE Traverse Waveform normal with-out a swell?
YES
NO
Is Sub-spot position normal?
YES
NO
Are TE Travers Waveform's Level & Balance good?
NO
YES
Adjust TE Balance and Diffraction Grating.
NO GOOD
Replace Pick Up.
Check Pick Up Harness, TE Circuit, Servo Amplifier.


D
Is the 1st music searched?
NO
YES
Is Eyepattern normal?
NO
YES
Adjust FE Balance.
Is Lens dirty?
Tangential position?
Wiring or positioning of Harness?
Is rising edge of 3T good?
NO
YES
Adjust FE Balance.
Tangential position?
Check RF Amplifier.
Does RF synchronize with PLCK?
NO
YES
Check:
CLV circuit
VCO circuit
SCOR L→H
NO
YES
DSP is no good.
Q Data Reading
SCOR H→L
NO
YES
DSP is no good.
Is CRCF "H"?
NO
YES
DSP is no good.
E

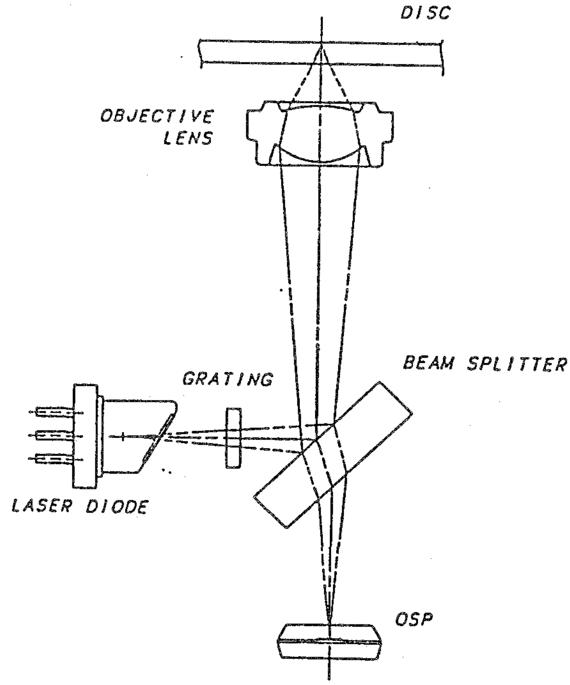

E
Does sound come out normally?
NO
Are analog signals come out of D/A?
NO
Check DSP RAM, D. Filter, D/A.
YES
Is DSP Monitor Error Rate low?
NO
Check each pin of C2F2, SCOR, CRCF, RMUTE.
YES
Check the preceding items again. If the preceding items are normal, replace DSP.
YES
Is Search Speed OK?
NO
Adjust Tracking System Balance, Gain.
Check Mechanism & Feed System.
YES
Do all Keys function?
NO
Check Keyboard & μ-com.
YES
OK

ONE-POINT ADVICE

= = = PICK UP = = =

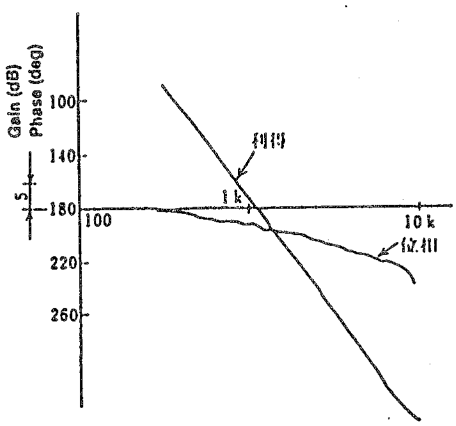
1) Laser Diode (LD)

The output of the LD is 100~300μW just after going through the Objective Lens. However, at the focusing point, it reaches approximately 7 x 10^3 μW/cm^2. If a strong current (static electricity, etc.) flows to the LD, its own strong light hastens fatigue or it is even destroyed.

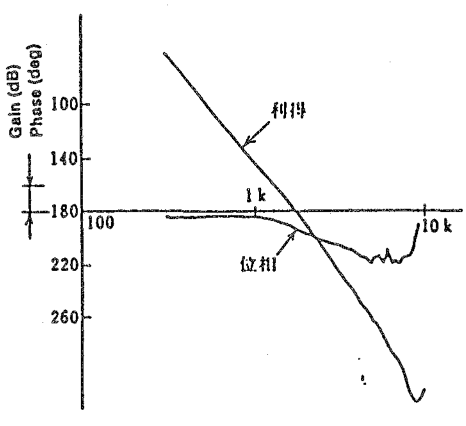


2) Two-axis Actuator

Since it has a strong magnetic circuit, its characteristics will change if a magnetic material comes near. Also, its DC resistance value is about 7Ω; therefore it may be regarded as a low-range speaker of very low cut-off frequency (approx. 1.5KHz) in the aspect of circuitry.



(a) Focus Direction



(b) Tracking Direction

3) Bearing of Shaft

Most of the bearings of the Pick Up shafts these days are made of a special kind of sintered copper-alloy with no oiling required. Therefore, only cleaning is needed for the shaft and bearing and no lubrications are necessary.

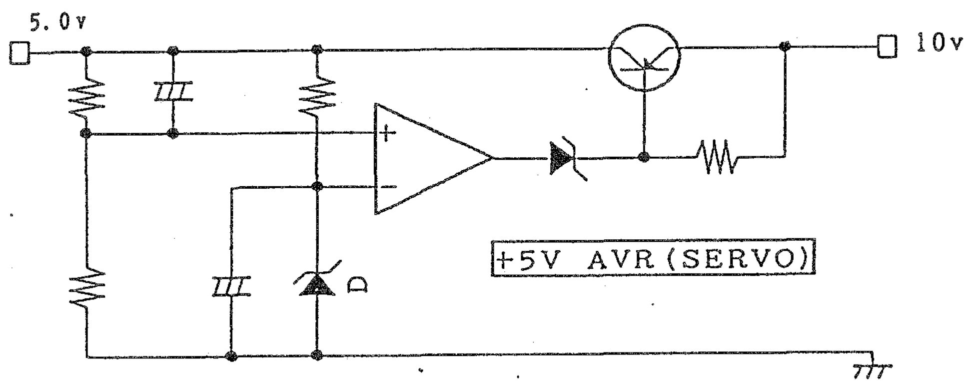
= = = Actual Procedure of Repair = = =

1) Not to spend too much time for repair ...

- Grasp the situation of the trouble accurately.
- When the trouble condition cannot be confirmed, change the power voltage, change the temperature, give some stress to the PC board or mechanism, etc. (When the power voltage is to be changed using a voltage-variable transformer, it is recommended to operate within the range of the standard voltage ±10%.)
- Do not miss fundamental parts or points.
  - → Is the Power Supply Circuit normal? (Especially in a digital machine, the AVR actions are very important.)
  - → Check the actions of the μ-com, Reset Circuit, Standard Oscillator, etc. carefully.
  - → Check if soldering defects are found by eyeview checking or using a tester.
  - → Are wiring and positioning of the Wire Harness or other parts in the specified condition?
  - → Use the flowchart to confirm the actions and specify the part in trouble.
  - → Is there any electric leakage?

2) Tendency of Trouble In Past

- The Pick Up rattles on the inner/outer circle.
  - → In many cases, the Power Supply Circuit is defective. (For example, soldering defect, leakage of the part marked with "D" in the figure below, etc.)



- Does not read TOC, the disc does not turn.
  - → Servo IC Focus Search Circuit Time Constant Count Condenser is defective. (The movement of the Pick Up lens is too fast.)
  - → From Servo IC Focus Drive pin, a voltage is always outputted. (The Pick Up lens keeps up and does not come down.)
  - → No output from the Pick Up, or the output is too low. (FOK is not outputted.)
  - → The Pick Up Cable is cut (no output from the Pick Up).
  - → The laser beam is not emitted. (The Pick Up is defective, APC Circuit is not normal.)

- Does not read TOC, the disc turns.
  - → PLCK is not correctly positioned, or it sways. (Adjust it, or VCO or DSP is defective.)
  - → The RF Amplifier is defective. (While FOK is outputted, the RF waveform is not outputted.)
  - → The Asymmetry is not correctly positioned. (RF Amplifier or DSP is defective.)
  - → The TE waveform is not focused, GFS does not turn "H". (Servo IC, DSP).

- Sound skips.
  - → The TE Balance is not accurate. (Adjustment)
  - → The Pick Up Rail is dirty. (Cleaning and lubrication with grease)
  - → The TE Gain is small. (Adjustment, or Servo IC is defective.)
  - → The mechanism is defective. (Feed Gear is dirty, missing of cogs, Disc Motor is defective.)

The examples of trouble above are merely a part. Please learn the activating procedure of CD players thoroughly for repairing operations.

KENWOOD

TECHNICAL TRAINING SECTION

SERVICE DIVISION

JAN.1992