
TECHNICAL MANUAL

LASER DISC PLAYER

DOOMNKE

LD PLAYER MODEL CHART

MODEL	DATE	S.OUT	RF	OPT.	SYNCR0	TBC	PICK UP	FTS IC	VIDEO DET.	DSP	DISC SERVO	REMOCON
LVD-07	FEB.1988	×	○	×	×	ANALOG	8-848-090-11	LA9200NM	M51481P	LC7863A	MB89795	1-463-897-31
LVD-9E	NOV.1988	×	○	○	○	ANALOG	HY3424581	HA11529	HA11528	CXD1135QZ	HD49403NT	HY2970801
LVD-7E	FEB.1989	×	×	×	○	ANALOG	J91-0374-05	HA11529	HA11528	CXD1135QZ	HD49403NT	A70-0254-05
LVD-7000	FEB.1989	×	×	○	○	ANALOG	J91-0374-05	HA11529	HA11528	CXD1135QZ	HD49403NT	A70-0254-05
LVD-7J	SEP.1989	×	×	○	○	ANALOG	J91-0374-05	HA11529	HA11528	CXD1135QZ	HD49403NT	A70-0305-05
LVD-05	OCT.1989	×	×	×	○	ANALOG	J91-0374-05	HA11529	HA11528	CXD1135QZ	HD49403NT	A70-0254-05
LVD-7i	AUG.1990	×	※ 1	×	※ 2	ANALOG	T25-0012-08	HA11529	HA11528	CXD1167Q	HD49403NT	A70-0370-05
LVD-300	AUG.1990	○	※ 1	○	○	DIGITAL	T25-0012-08	HA11529	HA11528	CXD1167Q	HD49403NT	A70-0368-05
LVD-700	AUG.1990	○	×	○	○	DIGITAL	T25-0012-08	HA11529	HA11528	CXD1135QZ	HD49403NT	A70-0369-05
LVD-V7	NOV.1991	×	×	×	※ 2	ANALOG	X93-1000-01	HA11529	HA11528	CXD2500AQ	HD49403NT	A70-0541-05
LVD-310	NOV.1991	○	※ 1	○	○	ANALOG	X93-1000-01	HA11529	HA11528	CXD2500AQ	HD49403NT	A70-0543-05
LVD-710	NOV.1991	○	×	○	○	DIGITAL	T25-0017-05	HA11529	ML1495L	CXD2500AQ	HD49403NT	A70-0565-05
LVD-V5	SEP.1992	×	×	×	※ 2	ANALOG	X92-1000-02	HA11529	HA11528	CXD2500AQ	HD49403NT	A70-0902-05
LVD-320	SEP.1992	○	×	×	○	DIGITAL	X93-1000-02	HA11529	YM3558	CXD2500AQ	YVL151	A70-0905-05
LVD-820R	SEP.1992	○	※ 1	○	×	ANALOG	T25-0025-08	IR3R47	HA11528N	LC7866E	LR38164	A70-0904-08
LVD-Z1	NOV.1992	○	×	○	×	DIGITAL	X93-1000-02	HA11529	YM3558	CXD2500BQ	HD49403NT	A70-0914-05
LVD-K101	DEC.1990	×	※ 1	○	×	ANALOG	T25-0012-08	HA11529	HA11528	CXD1167Q	HD49403NT	A70-0503-05
LVK-1000	DEC.1990	×	※ 1	○	×	ANALOG	T25-0012-08	HA11529	HA11528	CXD1167Q	HD49403NT	A70-0503-05
LVD-K70	SEP.1991	×	※ 1	×	○	ANALOG	X93-1000-01	HA11529	HA11528	CXD2500AQ	HD49403NT	A70-0556-05
LVD-K7000	SEP.1991	×	※ 1	×	○	ANALOG	X93-1000-01	HA11529	HA11528	CXD2500AQ	HD49403NT	A70-0554-05
LVD-K7100	SEP.1992	×	※ 1	×	○	ANALOG	X93-1000-02	HA11529	HA11528	CXD2500AQ	HD49403NT	A70-0555-05
LVD-K9100	JAN.1993	○	×	×	×	ANALOG	T25-0025-08	IR3R47	HA11528N	LC7867E	LR38164	A70-0915-08
LVD-K5100	APR.1993	×	×	×	×	ANALOG	X93-1000-02	HA11529	HA11528N	CXD2500AQ	HD49403NT	NONE

LVD-07 → SONY made

LVD-9E → HITACHI made

LVD-820R → SHARP made

LVD-K9100 → SHARP made

Other models are produced by KENWOOD.

※ 1 ; with only RF modulator terminal

※ 2 ; 16 bits syncro. terminal

※ 3 ; marks in the chart indicate the same mechanism.

【INTRODUCTION】

The LASER (Light Amplification by Stimulated Emission of Radiation) is invented in 1960. Since then, it has been utilized for various purposes such as a high performance oscillator or as a carrier wave power for optical communications. The Laser Pick Up used in laser disc players is one of those that apply this technology, which is inevitable in the CD and LD fields. Five years have passed since we developed the LD technology and released its products, and we have already released almost 20 models.

The circuitry has changed from analog to digital system, and functions of higher performance are now expected. This technical manual is provided for educations at all stages, including the those for beginners, covering descriptions on the fundamental of the TV system, the video system, and also technical reports and service notes issued up to now for use in actual repair works. We sincerely hope that this manual will contribute to your better services by keeping it nearby.

July, 1993

Service Division,

Technical Training Section

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THE STAGE 1

THE FUNDAMENTALS OF TV . LASERDISC

Chapter 1: TV Signals

【Standard Systems for Broadcasting】

The TV system varies from nation to nation. It is divided into three main types, and further divided into about 20 types in details. The three types are the NTSC System, the PAL System, and the SECAM System. The NTSC System is adopted mainly in U.S.A., Japan, Canada; the PAL System in most European nations, Australia; the SECAM System in France, Russia, and Eastern European Nations. The following table shows the TV system in each nation. Each system differs in the number of frames (number of pictures per second), the number of scanning lines, and the color system. There is no compatibility between those systems. For example, if you buy a videotape in the PAL System sold in Australia and bring it back to Japan, you cannot play it in the NTSC System. Or, if a LD Player in the NTSC System is connected to a TV in the PAL system, the pictures will not appear.

System	Standard	Nation
M / N T S C	M system 525 lines/60 fields Video bandwidth 4.5MHz Video modulation VSB negative modulation Sound carrier frequency Video+4.5MHz Sound modulation FM	Japan, Korea, U.S.A., Canada, Mexico, Panama, Ecuador, Peru, Chile
B, G, H / P A L	B system 625 lines/50 fields Video bandwidth 5MHz Video modulation VSB negative modulation Sound carrier frequency Video+5.5MHz Sound modulation FM	India, Singapore, Malaysia, Australia, New Zealand Germany, Italy, Austria, Netherlands, Spain, Belgium
I / P A L	I system 625 lines/50 fields Video bandwidth 5.5MHz Video modulation VSB negative modulation Sound carrier frequency Video+6MHz Sound modulation FM	Hong Kong, South Africa, U.K., Ireland
D, K / P A L	D system 625 lines/50 fields Video bandwidth 6MHz Sound carrier frequency Video+6.5MHz Sound modulation FM	China, Rumania
M / P A L	Refer to M/NTSC	Brazil
N / P A L	Conforms to M system except: 625 lines/50 fields	Argentina, Uruguay
B, G, H / S E C A M	Refer to B,G,H/PAL	Iran, Saudi Arabia, Egypt, Greece, old East Germany
D, K, K1 / S E C A M	Refer to D,K/PAL	Vanuatu, Mongolia, Tahiti, Congo, Zaire, Togo, Poland
L / S E C A M	L system 625 lines/50 fields Video bandwidth 6MHz Video modulation VSB positive modulation Sound carrier frequency Video+6.5MHz Sound modulation AM	France, Monaco, Luxembourg

【NTSC System】

This is the system adopted in Japan, developed in 1953 by the U.S. Television System Committee as the first system compatible with the black- and- white TV system in the world.

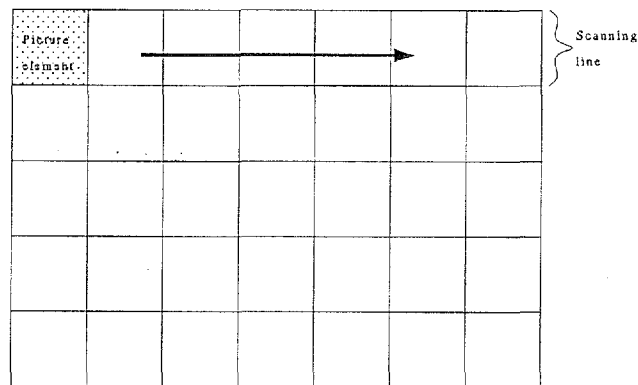
Black-and-White Broadcasting in NTSC System

The NTSC System is made on the basis of the black- and- white broadcasting system. Therefore, the standards of the black- and- white broadcasting system should be described first as follows.

Vertical Synchronization Frequency	60Hz
Horizontal Synchronization Frequency	15.75KHz
Aspect Ratio	3:4 (height : width of the screen)
Interlaced Scanning	2:1

Next, the bandwidth of video signals indicates the frequency in the sense of how wide of frequency band can realize the required fine picture. Naturally, the more this frequency is, the more fine picture can be realized. However, relating to the occupying bandwidth, compromising to some extent is necessary. Thus the frequency obtained is a band of about 4.2MHz.

The figure on the right roughly shows the picture elements on the TV screen. These picture elements compose the TV screen image. The frequency of the picture elements i.e., the video signal bandwidth 4.2MHz, can be expressed by the following equation:



$$f = \frac{K(525 - N_{VBLK}) \times 4/3}{2(1/f_H - t_{HBLK})}$$

K : Kel Coefficient 0.7

N_{VBLK} : 20×2 lines (Number of scanning lines of Vertical Blanking)

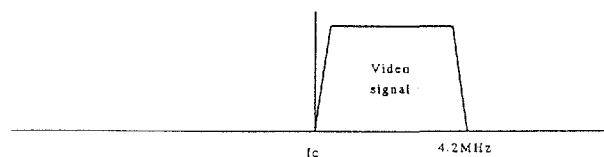
t_{HBLK} : $10.6 \mu S$ (Scanning time of the Horizontal Blanking section)

The numerator of the equation indicates the number of picture elements in the horizontal direction. The number of scanning lines is 525 per frame. Actually, a time is, however, necessary to return to top, when the scanning line reaches to bottom. Therefore, not all of the 525 scanning lines are reproduced on the screen. This portion, not reproduced on the screen, is the Vertical Blanking, and its period is called Vertical Blanking Time or Vertical Retrace Time. The Kel Coefficient is the

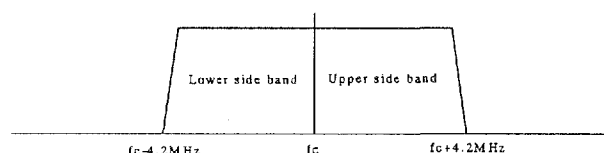
value obtained from the result of the research that the Vertical Resolution will be about 0.7 times when Interlaced Scanning is performed. Then $4/3$ is multiplied since the Aspect Ratio is 3:4. The denominator indicates the scanning time per 1H. Here in horizontal scanning, a time is required to return to the left after scanning from left to right. This is the Horizontal Blanking, and the time due is called Horizontal Blanking Time or Horizontal Retrace time. Dividing it by 2 means that the 2 picture elements, black and white, should be expressed within one cycle of the luminance signal produced; therefore, division by 2 is necessary to convert into frequency.

For sending this video signal of 4.2MHz bandwidth on a TV wave, a carrier wave of a certain frequency is sent with the video signal by amplitude modulation (AM). After modulation, the bandwidth would be $\pm 4.2\text{MHz}$ centralizing the carrier wave, finally it has a bandwidth of 8.4MHz. A sound must also be combined as a TV wave, and the bandwidth would further be expanded. As the same information is contained in the upper and lower side band, part of the lower-side band of all can be eliminated in transmitting as a Fig.(B) and the receiving side still can restore the single side TV wave transmitted easily using only a small device. This kind of modulation is known as "vestigial-sideband" system, or VSB for short. Fig. (D) shows the frequency spectrum of broadcasting wave including the sound. The FM signal, which is the sound signal 4.5MHz higher than the carrier wave, is multiplexed by frequency deviation of $\pm 250\text{KHz}$. The whole frequency bandwidth becomes 6MHz.

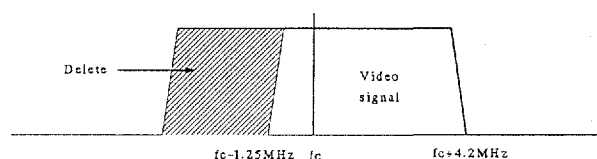
A) Bandwidth of Video signal



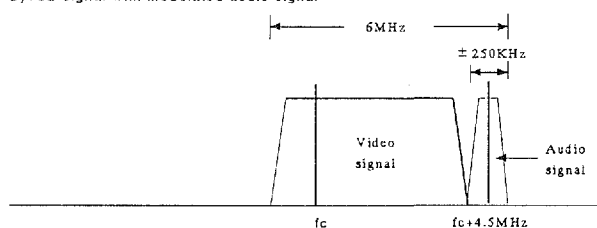
B) Amplitude modulated Video signal



C) Vestigial side band system (VSB)



D) VSB signal with modulated audio signal



Frequency Spectrum of TV Broadcasting

【Colorization of TV Broadcasting】

Color informations are to be added to the information of black-and-white, i.e., the brightness signals, described before. However, the luminance signal contains the higher harmonic wave factors of the horizontal synchronizing signal, and it decreases as the frequency becomes higher. Therefore, the frequency of the color subcarrier wave should be an odd multiple of $1/2$ of the horizontal synchronizing signal and as high as possible so that interference between the luminance and the color signal will be

infrequent. In order not to appear an interference beat on the screen, resulted from the interference between the luminance and the color signal, the difference between the two frequencies should be an odd multiple of the horizontal synchronizing frequency. Furthermore, the horizontal and vertical synchronizing frequencies for the black-and-white broadcasting should be an approx.value of those for the color broadcasting. Therefore, the standards of the NTSC system were changed as follows when the color broadcasting started:

Horizontal Synchronizing Frequency	$\frac{4.5\text{MHz}}{286} = 15.734\text{KHz}$
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Vertical Synchronizing Frequency	$\frac{2f_H}{455} = 59.94\text{Hz}$
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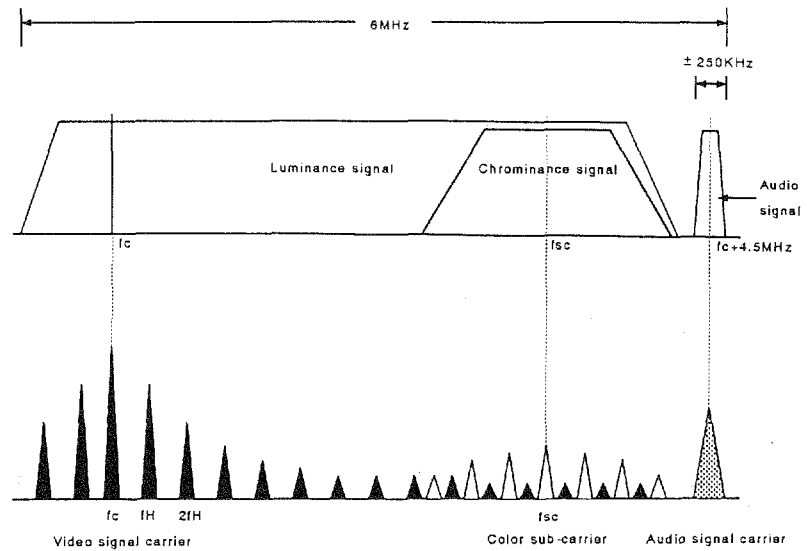
Color Sub-carrier Wave	$\frac{f_H \times 455}{2} = 3.579545\text{MHz}$
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【Frequency Interleave】

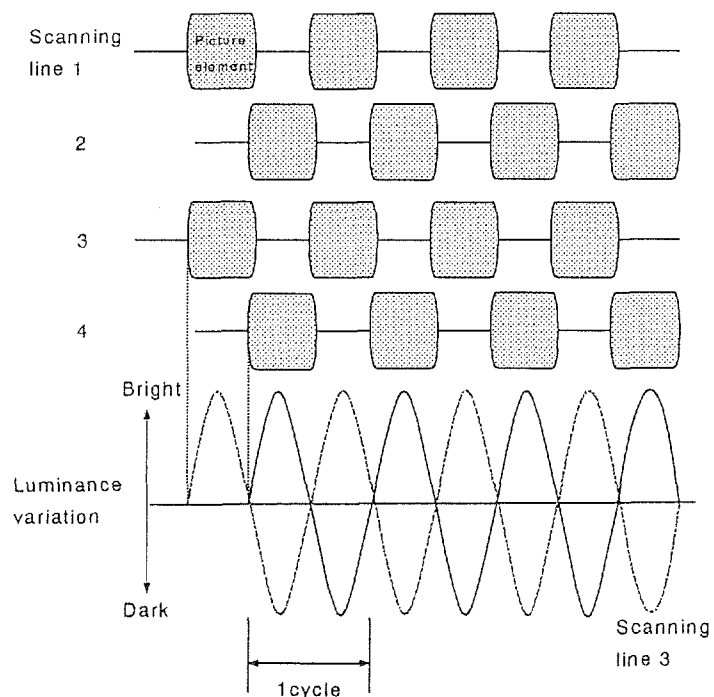
The luminance signal has a frequency bandwidth from DC to 4.2MHz. However, its signal energy is not distributed equally in the range of DC to 4.2MHz, as in the figure on the right, higher harmonics of f_H exist with the f_H intervals. Around those higher harmonics, the luminance signal energy exists.

Between those distributed luminance signal spectra, gaps exist. Using those gaps, Color Signals are inserted. The frequency of the Color Sub-carrier Wave is selected to be an odd multiple of $1/2$ of the Horizontal Synchronizing Frequency, because the phase difference of the Color Sub-carrier Wave between one scanning line and the next is 180 degrees, which causes a checkered pattern but not vertical lines on the screen. This will prevent visually to interfere with the black and white TV screen even though the Color Sub-carrier Wave affects it. In addition, when scanning occurs on the same scanning line after one frame, the phase of the color signal, which is the luminance alteration of the scanning line by the color signal, reverses from the previous one and they negate each other.

The figure on the right shows the luminance alteration corresponding to the picture elements or color signals on the screen. The picture elements are located like a checkered pattern, as described before, the gaps



Frequency spectrum of color TV signal



between picture elements will not illuminate and remain dark. The neighboring scanning lines, Scanning 3 and Scanning 4 for example, differs in phase by 180 degrees. Because of this phase difference, the luminance alteration negate each other, causing to decrease affect to the luminance due to the color signal interference.

【PAL System and SECAM System】

Let's explain briefly on the PAL System and the SECAM System.

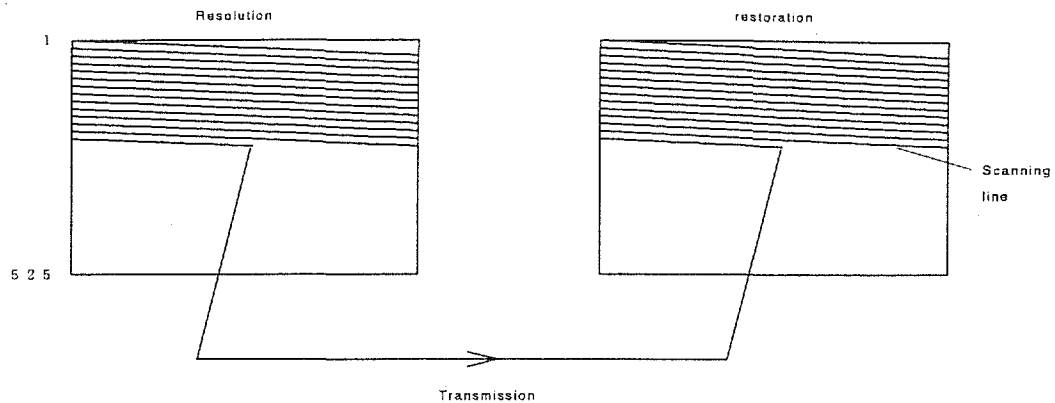
While affects to color distortions due to the distortions of transmission network is quite large in the NTSC System, a main feature of the PAL System to improve the demerit is that the phase of one of the two color difference signals is alternated for every 1H in transmitting and the receiving side synthesizes it with one delayed for 1H. Accordingly, the color distortions caused in the transmission network will become errors of small sizes and be negated. For others, the PAL System is almost the same system as the NTSC. For this reason, this sysytem is called “ PAL ” System, standing for “ Phase Alternation by Line ” meaning that it alternates the phase of the Color Sub-carrier Wave for every 1H.

The SECAM System is the system developed in France, and its main feature is that two color differencial signals (R- Y)and (B- Y)are transmitted every other 1H by FM modulation of the sub- carrier wave. By delaying the signal for 1H for each, the color on the same scanning line is reproduced. This system is called, as it uses 1H- delayed scanning lines, “SE'QUENTIEL COULEUR'A MEMOIRE” (French) or “SECAM” FOR short.

Chapter 2: Theory of TV

【Scanning Line】

If you look at a screen of Braun tube closely, you can see many horizontal lines. A TV camera decomposes the object sequentially into fine horizontal lines for sending, and the TV assembles them sequentially. "Decompose or assemble" the screen is called "scan" and these horizontal lines are called "scanning lines". The more the scanning lines, the better the resolution will be. The NTSC System adopts 525 scanning lines.

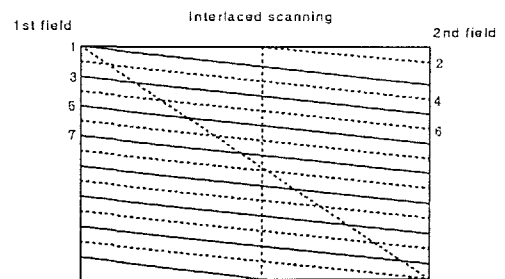


【Interlaced Scanning】

Decomposing and assembling the picture is performed by the Horizontal Scanning and Vertical Scanning operations. As in the figure above, the picture is decomposed serially from the left top to the bottom, and it returns to the left top again when reaching the right bottom. In this way, one picture is decomposed into 525 lines and 30 pictures are sent in one second. Therefore, repetition of scanning in the horizontal direction per second is:

$$525 \text{ (lines)} \times 30 \text{ (pictures)} = 15,750 \text{ (items)}$$

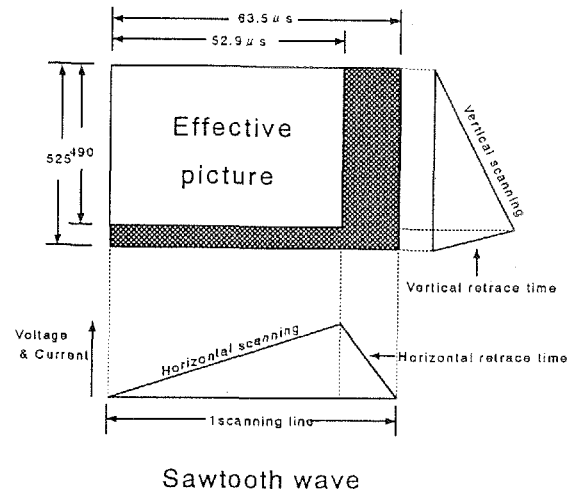
And 30 times of scanning in the vertical direction is performed. However, this "30" times must be actually 60 times to make one screen because the Interlaced Scanning is adopted. It means, as in the figure on the right, the first scanning is operated in a rough pitch with lines 1,3,5,7... down to the bottom, then next scanning is operated with lines 2,4,6... to fill the space resulted in the first scanning operation, to compose one picture. As 30 rough images are sent twice in one second, a number of scanning in the vertical direction is 60 and the picture will not have a flickering. One time of a rough scanning is called a "field", and one screen is composed of two fields and known as a "frame".



1 picture = 2 field
1 frame = 2 field

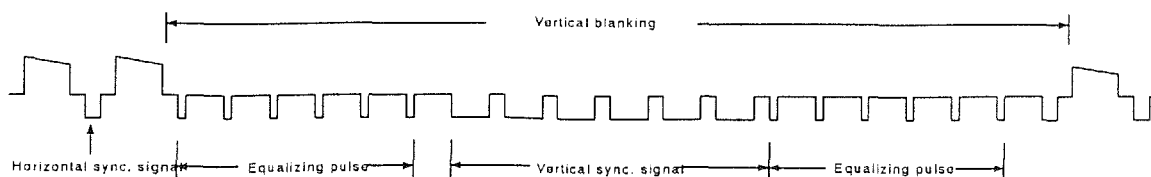
【Retrace Blanking】

When the scanning is operated in the horizontal and vertical directions and the scanning reaches the rightmost of the screen, it must return to the leftmost start point again. It is called "Retrace". If the scanning line during retrace illuminates on the screen, it will affect the picture glarely. Therefore, a Retrace Blanking signal is added to make this line invisible, and a synchronizing signal is piled in this period. Since this period does not include a video signal, actual scanning line to make an effective picture will be shorter than it's original.



【Synchronizing Signal】

To regenerate the image taken by a camera, the horizontal and vertical synchronization will be required. To take these synchronizations, synchronizing signals are added to the video signal. as the synchronizing signal is taken out from the video signal, a sawtooth wave signal will be generated and then, this sawtooth wave signal is applied to the deflecting coil of the Braun tube. Its screen image can be observed by using an oscilloscope. If the sawtooth signal synchronized to the Horizontal Synchronizing Signal is applied to the X input pin of an oscilloscope, the swatooth wave synchronized to the Vertical Synchronizing Signal to the Y input pin, and the video signal to the Z input pin on the rear side, a black-and-white image can be monitorable. At this time, please note that if a tooth wave produced by a function generator, etc.is applied, it is difficult to synchronize and the screen image will be easy to run off. The "Equivalent Pulse" is the pulse to be inserted in the vertical blanking. It performs interlaced scanning correctly by shifting it's phase at 180°.

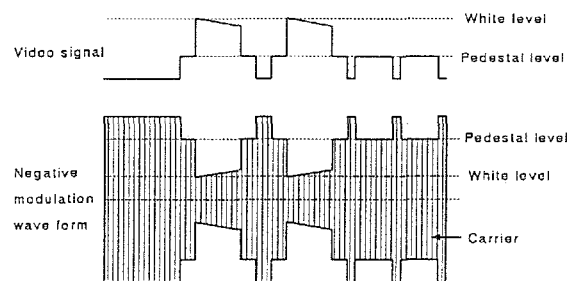


【Effective Use of Vertical Blanking Time】

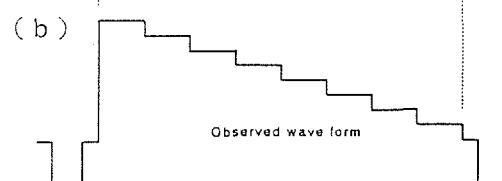
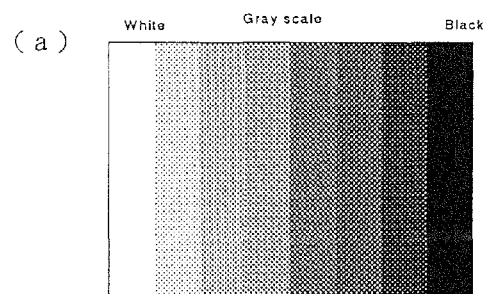
The Vertical Blanking Time of the NTSC signals exist as many as 20 lines per field. A TV uses this time as a reset time of vertical deflection. As a TV, at least a synchronizing signal must exist in this time, and any kinds of signal can exist in the rest of this time. Accordingly, in some cases, the VITS signal to be used for Text Broadcasting or correcting distortion (inserted at Line 17 and Line 280), the GCR Signal to be used for eliminating ghost (inserted at Line 18 and Line 281), etc. are inserted in this portion. Similarly for Laser Disks, a 24-bit Phillips Code or 4-bit MCA Code is inserted in the Vertical Blanking Time as CLV/CAV information, CX information, or Chapter Number information.

【Negative Modulation】

The way to change the carrier wave amplitude in accordance with the signal amplitude is called "amplitude modulation (AM)". The video signal is modulated in this way, then the lower sideband is eliminated by the vestigial-side amplitude modulation (VSB-AM). In the amplitude modulation operation, a modulation that makes the carrier wave amplitude width largest at the synchronizing signal and smallest at the largest video signal is adopted. It is called "negative modulation".



Negative modulation wave form



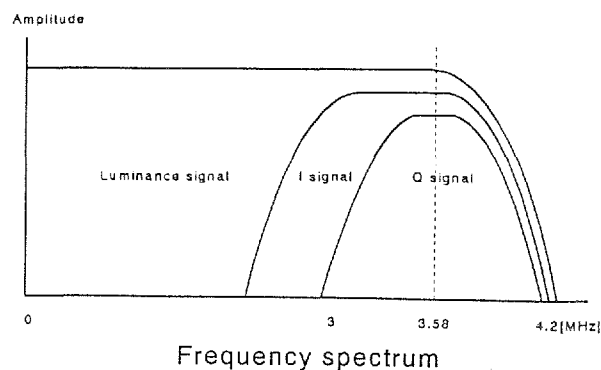
Luminance signal wave form

【Video Signal】

The Brightness signal is high in voltage at a bright place on the screen and low at a dark place. Fig.(a) shows the gray scale of the NTSC Pattern Generator, and Fig.(b) shows the observation of the video signal in Fig.(a). You can see that the white is high in voltage and the black is low.

The Brightness Control attached to a TV set is to adjust this voltage. The frequency factors contained in the video signal is from 0 to 4.2MHz. The "0" is DC

and indicates a screen with a equal brightness with no changes. The more detailed the picture is, the higher the frequency of the video signal becomes. In the NTSC System, 4.2MHz is the mazimum.



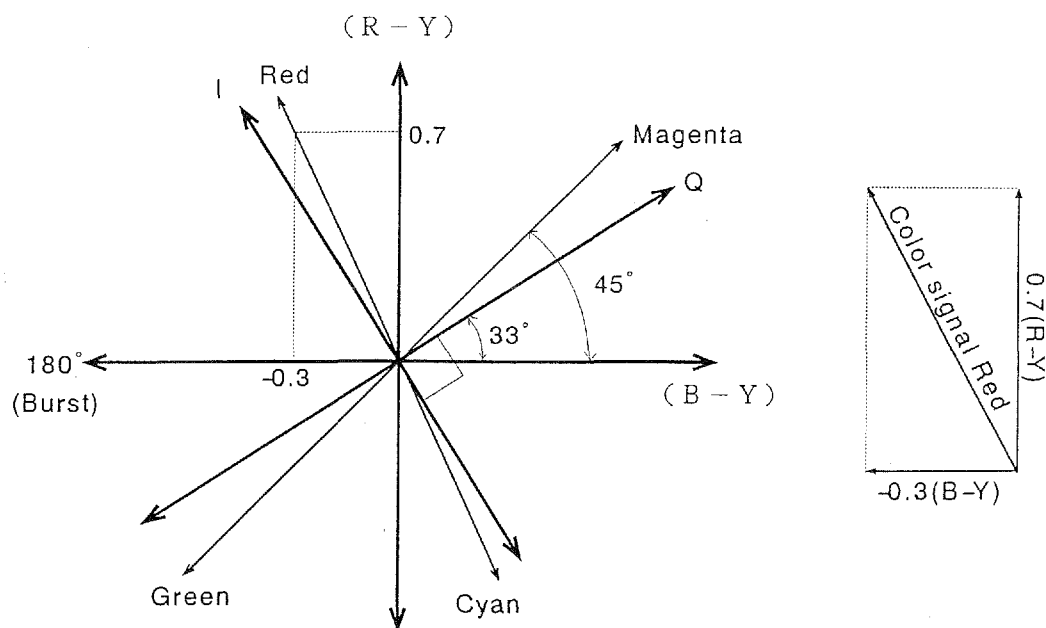
【Color Signal】

• Color Difference Signal

The characteristics of our eyes is that as the size of an object becomes smaller the colors of orange and cyan groups will remain, and finally no identification of colors will be possible and only brightness can be identified. Therefore, the NTSC System assigns the bandwidth of 1.5MHz to the i Signal (orange- cyan group axis) which has a high color difference visual acuity and the bandwidth of 0.5MHz to the Q Signal (green- magenta group axis) which has a low color difference visual acuity. That is it provides a larger bandwidth for the i Signal of high color sensitivity. For sending, these two are sent with orthogonal two- phase modulation (vector sum). However, in actual TV sets, the re- generating circuit would be complex. Therefore, 0.5MHz is given to the color signal bandwidth, and the color difference signal of (R- Y) and (B- Y) is re- generated. Here, the brightness signal " Y " is indicated as follows:

$$Y = 0.3R + 0.59G + 0.11B$$

R:Red Signal G:Green Signal B:Blue Signal



Vectors of color signal

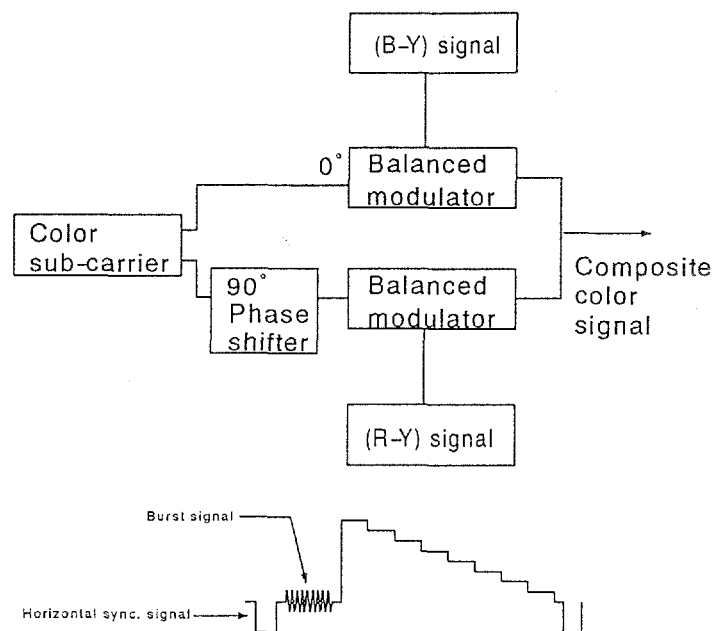
So, if the two signals (R-Y) and (B-Y) are known, R, G, and B can be expressed. By

changing the ratio of these color signals, the color to be expressed will also be changed. The video signal is composed of these color signals and the brightness signal, and its frequency spectrum is as in the figure above.

For expressing the red color with color difference signal vectors, vectors are synthesized in ratio of $(R-Y) 0.7$ and $(B-Y) - 0.3$. To take this vector sum will be an orthogonal two- phase modulation. In the figure, the farther from the center, the brighter the screen will be. And by changing the angle, the TV hue is adjusted. Also, the amplitude limit if the color signal amplitude may not goes over the brightness signal white peak or goes under the black level.

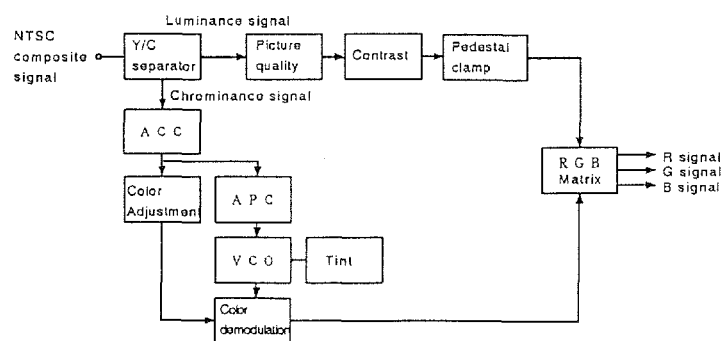
【Orthogonal Two- phase Modulation of Color Difference Signal】

As in the figure on the right, what is obtained by combining a color sub-carrier wave (3.58MHz) with its phase difference of 90° ($R-Y$) and one with 0° ($B-Y$) using balance modulation (suppressed-carrier modulation) is composite color signal. To demodulate these color difference signals on a TV set, the phase to indicate the hue unknown. Therefore, color sub- carrier wave to be the standard is inserted after sync tip . It is called " color burst".



【Separation of Color Signal and Luminance Signal】

Let's explain on how to make the R.G.B. signals, which are the compoment signals, out of the NTSC signal. First, let's think about signal separation that prevents deterioration of the picture quality. The Y/C separation makes separation of the brightness signal and the color signal, and the resolution is determined here. Since the color signal is plied inside the brightness signal



NTSC Composite Signal Process Block Diagram

bandwidth 4.2MHz in case of the NTSC System, separating the frequency using only the trap or bandpass filter will result in undesirable frequency characteristics. In actual cases, the frequency characteristics may be deteriorated or contouring emphasis may be desired. Therefore, a video quality correction circuit to change the resolution in the horizontal direction and a contrast adjustment circuit to set the contrast in accordance with the brightness by adjusting the brightness signal amplitude will be necessary. In addition, by the C- combination, the DC portion is lost, the brightness signal level changes, and the brightness cannot be expressed faithfully. Therefore, the pedestal portion of the brightness signal is clamped in form of DC regeneration to transmit the DC factor. What is needed for this purpose is the Pedestal Clamp Circuit.

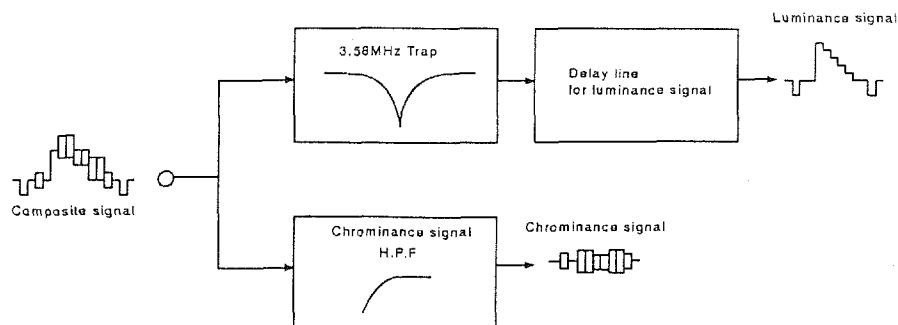
【Concept of Color Signal Process】

For color signal processing, the color signal obtained by the Y/C separation, and the following circuitry will be necessary to process this color signal.

First, demodulation of the inputted color signal is always performed on the basis of the burst signal, so faithful conveyance of level and phase up to the demodulation is necessary. Accordingly, the ACC (Auto Color Control) amplification is performed so that the R.G.B. output voltage may not change even when the burst signal level changes. Furthermore, a VCO (Voltage Controlled Oscillator) and an APC (Auto Phase Control) circuits are necessary to make a color sub-carrier wave synchronizing to the frequency and phase of the burst signal. Using this color sub-carrier wave, the color difference signal of (R- Y), (B- Y) is demodulated, and (G- Y) is re-generated by vector combination of (R- Y) and (B- Y). Then, the R.G.B. signal is re-generated by adding the brightness signal Y to each signal.

【Y/C Separation by the Ordinary Filter】

The figure below shows the Y/C separation circuit using a high-pass filter and a trap, which is the ordinary separation filter circuit used in the past. The " Delay Line " is used to correct the time delay of the color signal resulted in the color signal demodulation circuit, etc.

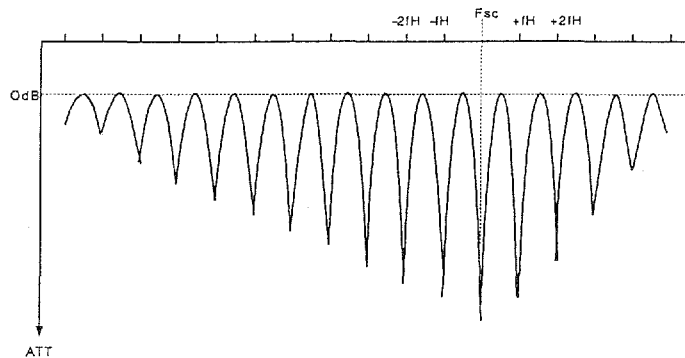


【Theory of Comb Filter】

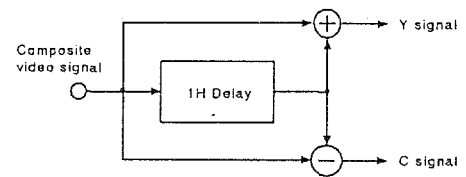
The color- TV signal has an energy in the frequency spectrum distribution, already described. Therefore, if the brightness signal is wanted, only the portion with color signal should be removed. That is, if a filter with the attenuation characteristics as in the figure below is provided, the brightness factor even with high frequency can enough remain. As the wave form of this characteristics looks like a comb, it is called a " comb filter ". The comb filter requires the following conditions:

- (1) The phase of color signal must alternate for every 1H (Frequency Interleave).
- (2) The signals before and after 1H must be similar.

If operation in Fig.(b) is performed using these conditions, the added brightness signals remain before and after 1H because of the same phase. However, the color signals are reverse-phased, and therefore, they deny each other and disappear. On the contrary, in the subtracter, only the brightness signal with the same phase will disappear. As a result, Y and C are separated from each other.



(a) Characteristics of Comb Filter



(b) Theory of Comb Filter

The table below shows comparison in performance between respective filters.

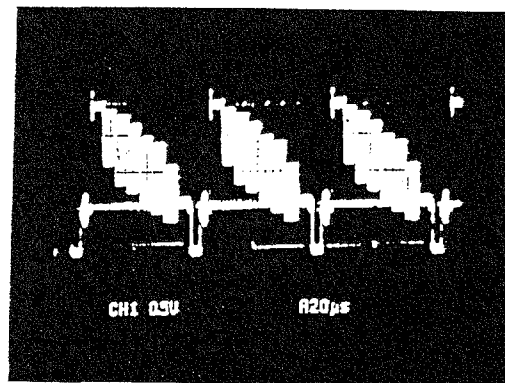
Comparison table of Y/C separator

	Dot interference to horizontal contouring	Dot interference to vertical contouring	Cross color on vertical stripes	Cross color on slant stripes	Improvement of S/N
B.P.F.	○	×	×	×	×
2-dimensional 2-line comb filter	×	×	○	×	△
2-dimensional 3-line comb filter	○	×	○	×	△
3-dimensional digital filter	○	○	○	○	○

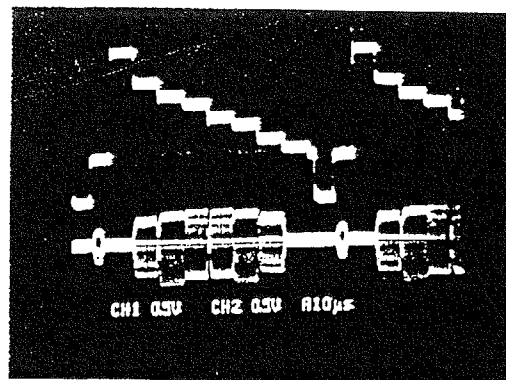
B.P.F.	To separate color signal and luminance signal, 3.58MHz B.P.F. is placed to extract color signal. 3.58MHz trap is placed to eliminate color signal from composite signal. The disadvantage of this system is that the luminance signal remains in the color signal, and the color signal remains in the luminance signal. Due to this reason, resolution deteriorates by elimination trap.
2-dimensional 2-line comb filter	Composed of scanning delay line and adding operation. If only one scanning line is delayed and add with the next line: $(Y+C)+(Y-C)=2Y$. On the contrary, if subtracted: $(Y+C)-(Y-C)=2C$. Thus luminance signal and color signal can be taken out respectively as individual signals. This filter system can decrease cross color and improve resolution. However, a problem still remains on dot interference on the color borders in the vertical direction.
2-dimensional 3-line comb filter	The difference from the 2-line system is that two delay lines are used in this system. Adding one more scanning lines to the 2-line system, and two operations are executed. The one is preceding and current scanning line, and the other one is current and next scanning line. More appropriate operation is selected. Dot interference is decreased in this system, but still remains problems against any interference of the video signal which contains large volume of information.
3-dimensional digital filter	Different from the ordinary way to separate Y/C on one picture, this system is to separate Y/C across two pictures. It has added an arithmetic process between frames to the ordinary 2-dimensional process by arithmetic between scanning lines.

Actual Composite Signal and Signal Wave after Y/C Separation

The following shows the re-generation of color bars with a test disk. The model used is The LVD-Z1, the re-generated composite signal is 3-dimensional- Y/C- separated, and its output is terminated by 75 Ω .



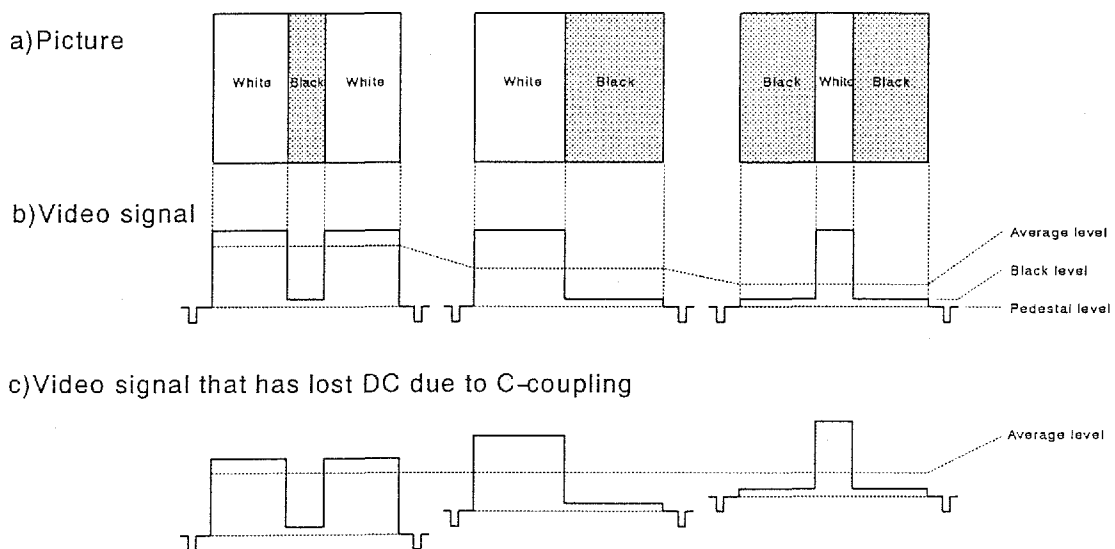
Composite signal



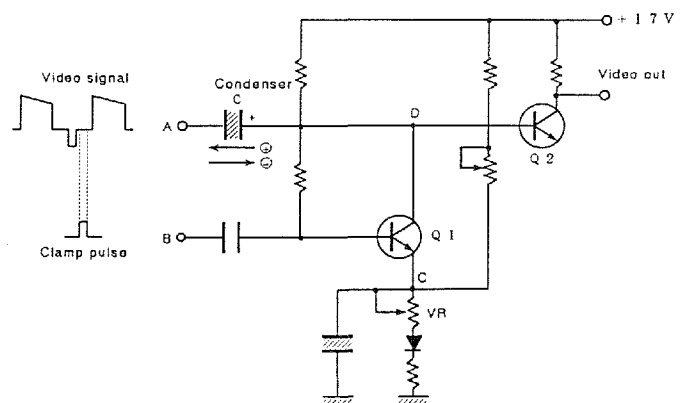
Luminance signal separated by Y/C separator, above, and chrominance signal, below.

【DC Re-generation Circuit (Pedestal Clamp Circuit)】

This is the circuit to re-generate the DC portion once lost by the C- combination. Generally, it performs by using a horizontal pulse $5\ \mu\text{s}$ delayed from the Horizontal Synchronizing Signal and aligning the pedestal level of the brightness signal. On a screen as in Fig.(a) below, if the DC portion is lost due to the C- combination, the zero level of its AC signal is aligned to the average level as in Fig.(c), and the pedestal level, which should be the standard of the video signal, becomes misaligned. Accordingly, the part to be white would be darker to be gray or the part to be black would be brighter to be gray, and a faithful picture re-generation could not be performed. Therefore, this pedestal level should be aligned to a certain potential before adding the video signal. Besides, there are some that clamps at the bottom of the synchronizing level, and it is called " Sync. Tip Clamp ". The machines for broadcasting use a pedestal clamp that will not be affected by the length of the synchronizing signal.



Q1 turns ON in the period when a clamp pulse is added, the collector current of Q1 is saturated, and the collector voltage is fixed to the voltage of the " C " point of the emitter. At this time, a re-charge current immediately flows to Condenser C, but the potential of the " D " point is almost the same as that of the " C " point. When there is no clamp pulse, Q1 is turned OFF and the electric charge that has



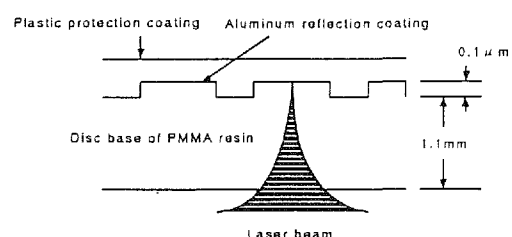
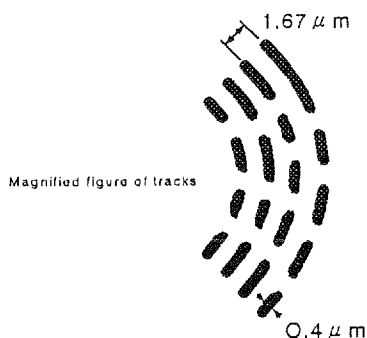
been charged in Condenser C is discharged. However, a large coefficient is selected for its discharging, the potential of the " D "point is kept almost constant until the next pulse comes. If the video signal is piled on the base of Q2 with the potential of the " D "point kept constant, the volume or polarity to be recharged to C in accordance with the potential of the " D " point will change and work to make misalignment of the pedestal level constant. VR, inserted to the emitter of Qa, is the brightness adjustment volume. By changing the potential of the " C "point, the pedestal level can be set.

Chapter 3: Discs

【Disc】

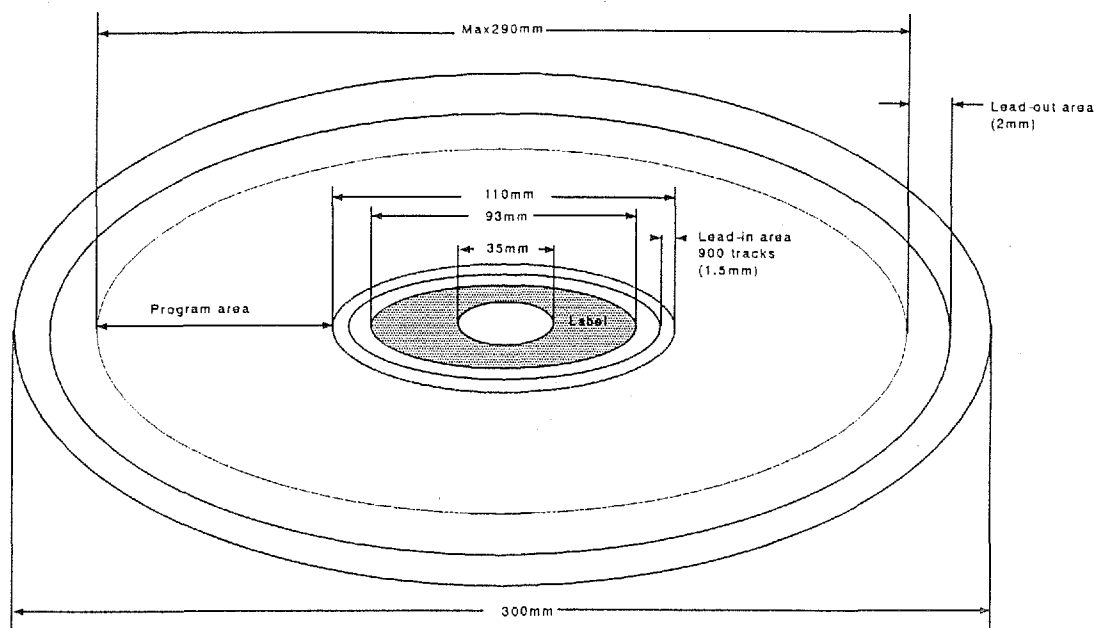
The outer diameter of a Laser Disc is 12 inches (30cm) or 8 inches (20cm), according to the size type. Also, there are two recording types— CAV and CLV. Other types of disks are Video Signal Disc of 12cm, CD that can output pictures called “ CDV ” of 12cm with 5 minutes' picture data. The revolution of a CAV disc is 1800rpm so that one revolution may be just one TV screen (one frame). The linear velocity for a CLV disc corresponds about the linear velocity at the inmost track on a CAV disc. The program i recorded at this linear speed anywhere on the disc, the revolutions goes from 1800rpm at the inmost track down to about 600 rpm as moving out to the outer tracks. As a feature of the Laser system, the program starts at the inmost track and ends at the outmost track, which is different from the old analog record disc system. Accordingly, the Laser system has such a merit as playing on the disc, regardless of the diameter size, is always started a the same radium position. Before and after the program record portion, a Read-in Track and a Read-out Track are respectively provided to enable automatic start and end of plauing. The track pitch (space between tracks) is usually $1.67\text{ }\mu\text{m}$. However, depending on the length of the program to be

recorded, selection is possible in the range from 1.4 to $2.0\text{ }\mu\text{m}$. Disks, Plastic-forming products, are easy to be transformed or distorted in various ways due to the conditions of forming and condition of storage thereafter. It affects the playing capability on the player, and in the worst case, playing will never be possible. Therefore, the maximum values for unbalance, disc surface swing, track swing, and time-base error are also specified. For example, if the “ unbalance ” is too large and the disc is turned at 1800rpm, a big vibration will occur to disable playing, and it may also shorten the life of the player. If the “ surface swing ” is too large, the object lens cannot trace the up and down movement of the disk, it will go out of focus, and normal playing will not be possible. If “ track swing ” is too large, the laser beam cannot trace the track and it will jump off the track. If “ time- base error ” is too frequent, unequal distributions and changes of colors will occur and the normal color re- generation will be impossible. The optical parameter, as well as the thickness of the disc base, will largely affect the reading performance by the optical pick- up on the player. If the reflectance ratio is too low, the servo sensitivity of focusing or tracking will decrease to cause off- focus or track jumping.



Magnified figure of disc structure

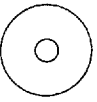
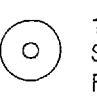
【Dimensions】



Dimensions of disc

Disc	Material Diameter Thickness Programmable limits inner outer Track pitch Revolution per minute Playable time	Acryl 300mm 2.6mm 110mm 290mm 1.67 μ m 1800~600 Double faced 120min
Signal spec	Video Modulation Sync. tip White peak Color system Audio Modulation CH-1 CH-2 Deviation	FM 7.6MHz 9.3MHz NTSC FM 2.3MHz 2.8MHz $\pm$ 100KHz

Specifications of disc

	L V	C D V	C D
Dimension	 30cm, 20cm DOUBLE FACED	 12cm SINGLE FACED	 12cm SINGLE FACED
Audio part	×	20min PCM	74min PCM
Video signal	30cm 20cm CLV 120min 40min CAV 60min 28min	CLV 5min	×
Revolution per minute	CLV 1800~600 CAV 1800	Audio 600~340 Video 2700~1800	600~200

Comparison table of discs

【Record Signals on Disc】

In addition to the Video Signal, two different signals are recorded on the disc as Audio Signals, which are FM (frequency modulation) signals of $\pm 100\text{KHz}$. It makes re-generation of stereo- sound or voice- multiplexed re- generation possible, and the it can have sound bandwidth from 40Hz to 20KHz with S/N ratio of 60dB. To further widen the Dynamic Range, the CX Noise Reduction method is adopted, it has better sound quality that the FM broadcasting sound, and its S/N ratio will be 70dB or more. These two FM carrier wave is obtained by PWM- modulating the main carrier wave corresponding to the video signal, and it is multiplexed to the main carrier wave. Therefore , no tracks are specially provided exclusively for audio but the audio (sound) signals are also recorded in the track used for video signal.

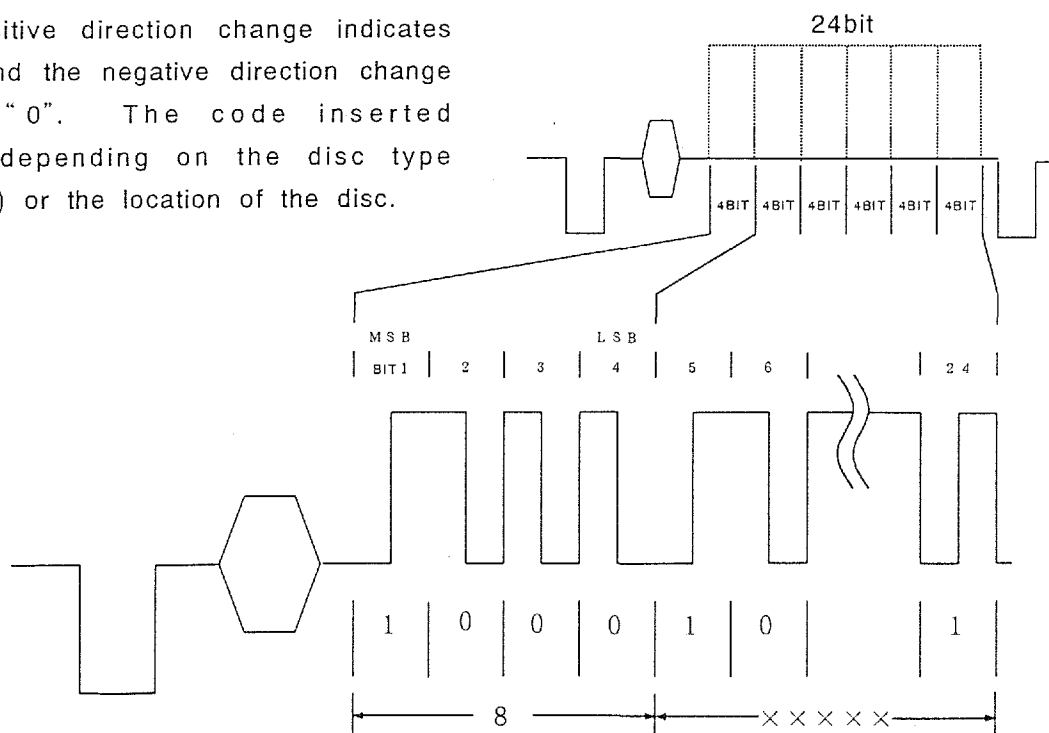
• Phillips Code and MCA Code

Data such as Chapter No.and Frame No.are inserted in the Vertical Retrace Time.

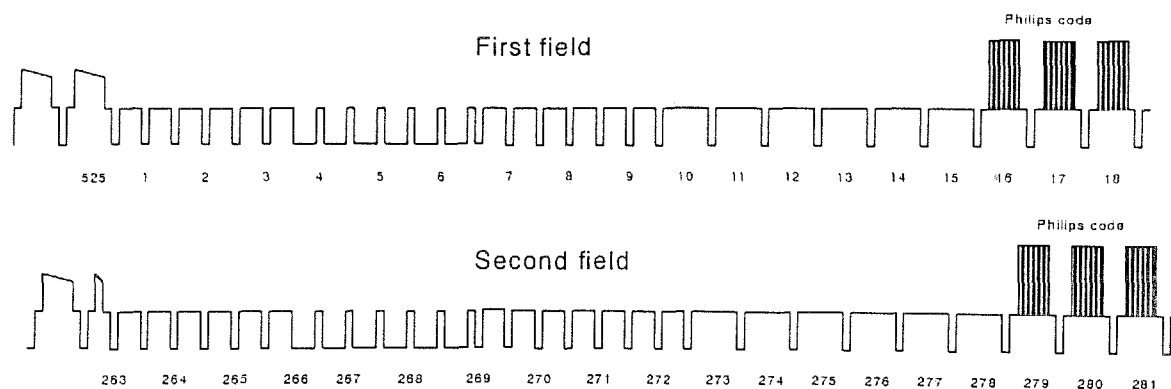
For the code signal for Laser disks, two kinds of codes are used — Phillips Code and MCA Code. The Phillips Code contains data of Frame No., Chapter No., CX Noise Reduction presence/absence, etc. The MCA Code contains Frame No.only. This Frame No.of the MCA Code is also included in the Phillips Code; therefore, the information volume in the Phillips Code is larger. These codes are inserted within are 16th, 17th, 18th and 279th, 280th, 281st Vertical Retrace Times. These signals are composed of 24 bits, divided into units of 4 bits, each expressing a 6- digit hexadecimal value.

• Phillips Code

The positive direction change indicates " 1 " and the negative direction change indicates " 0". The code inserted various depending on the disc type (CAV/CLV) or the location of the disc.



Structure of 24bit philips code



Position of Philips code

CAV

Scanning line	16H(279H)	17H(280H)	18H(281H)	279H(16H)	280H(17H)	281H(18H)
Lead-in area	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-in code 8 8 F F F F	Lead-in code 8 8 F F F F	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-in code 8 8 F F F F	Lead-in code 8 8 F F F F
Program area	Status code 8 X ₁ X ₂ X ₃ X ₄ X ₅	Picture No. F X ₁ X ₂ X ₃ X ₄ X ₅	Picture No. F X ₁ X ₂ X ₃ X ₄ X ₅	Status code * 8 X ₁ X ₂ X ₃ X ₄ X ₅	Chapter No. * 8 X ₁ X ₂ D D D	Chapter No. 8 X ₁ X ₂ D D D
Lead-out area	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-out code 8 0 E E E E	Lead-out code 8 0 E E E E	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-out code 8 0 E E E E	Lead-out code 8 0 E E E E

* Picture stop code(82CFFF)is given priority if this code is recorded.

CLV

Scanning line	16H(279H)	17H(280H)	18H(281H)	279H(16H)	280H(17H)	281H(18H)
Lead-in area	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-in code 8 8 F F F F	Lead-in code 8 8 F F F F	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-in code 8 8 F F F F	Lead-in code 8 8 F F F F
Program area	Status code 8 X ₁ E X ₃ X ₄ X ₅	Picture No. F X ₁ D D X ₄ X ₅	Picture No. F X ₁ D D X ₄ X ₅	Status code 8 X ₁ X ₂ X ₃ X ₄ X ₅	CLV code 8 7 F F F F	Chapter No. 8 X ₁ X ₂ D D D
Lead-out area	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-out code 8 0 E E E E	Lead-out code 8 0 E E E E	User's code 8 X ₁ D X ₃ X ₄ X ₅	Lead-out code 8 0 E E E E	Lead-out code 8 0 E E E E

CAV/CLV DISC PHILIPS CODE

† User's code:Disc control code
0 0 0 0 ≤ X₁X₃X₄X₅ ≤ 7 F F F

† Lead-in code:Beginning of program
8 8 F F F F

† Status code:CX on/off information
8 B A X₃X₄X₅ :CX OFF
8 D C X₃X₄X₅ :CX ON
X₃X₄X₅ :Disc size,A side or B side

† Picture number:Frame number of CAV disc
0 0 0 0 1 ≤ X₁X₂X₃X₄X₅ ≤ 7 9 9 9 9

† Chapter number
0 1 ≤ X₁X₂ ≤ 6 9 *

† Picture stop code:Freeze frame automatically
8 2 C F F F

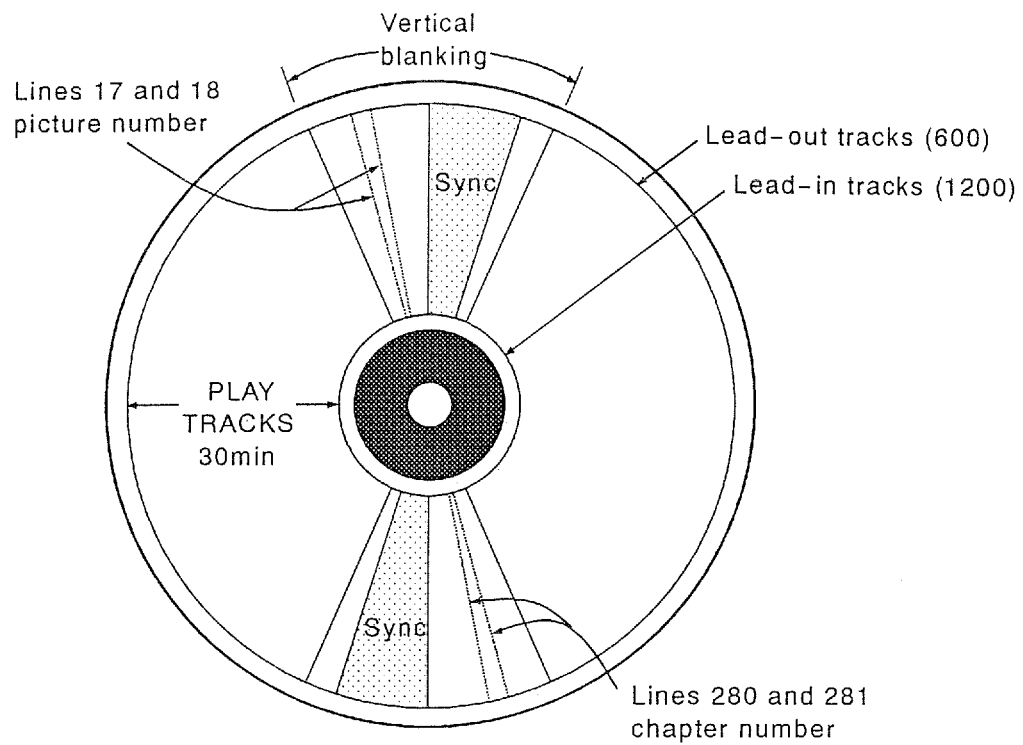
† Time number:Play time(CLVS only)
0(hour) ≤ X₁ ≤ 9(hour)
0 0(min) ≤ X₃X₄ ≤ 5 9(min)

† CLV picture number:Time or frame number
A 0(00sec) ≤ X₁X₂ ≤ F 9(59sec)
0 0(frame number) ≤ X₃X₄ ≤ 2 9(frame number)

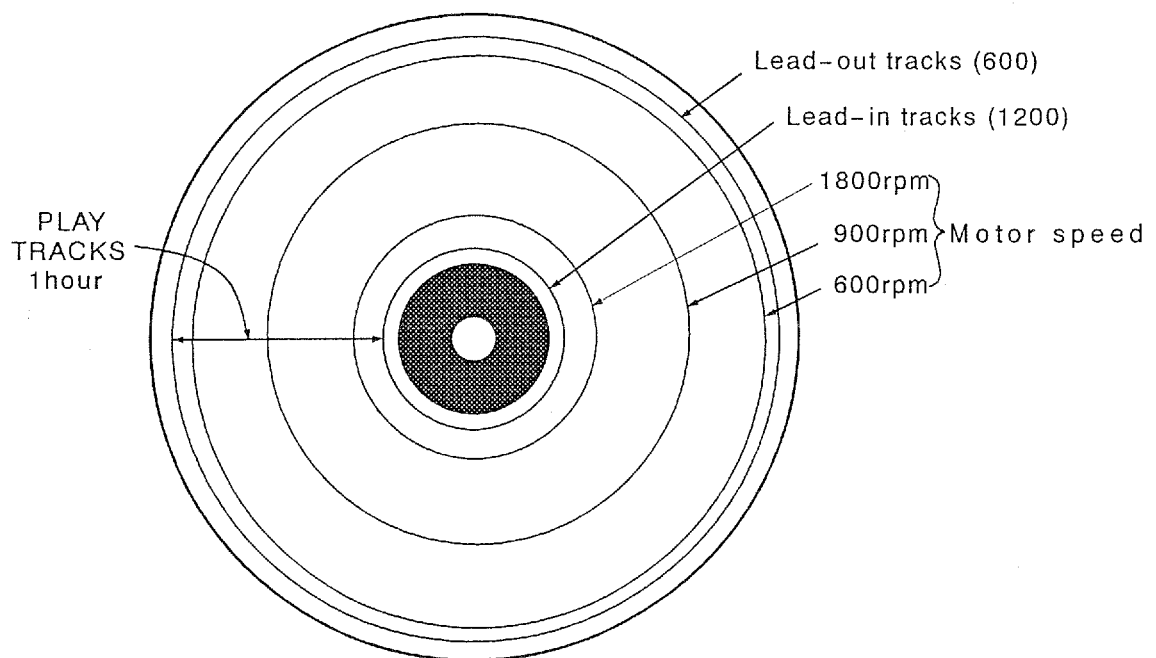
† CLV code:CLV disc
8 7 F F F F

† Lead-out code:End of program
8 0 E E E E

CAV DISC

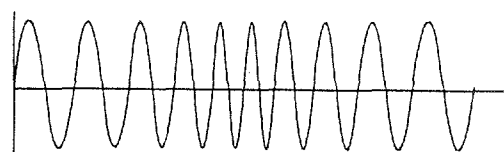


CLV DISC

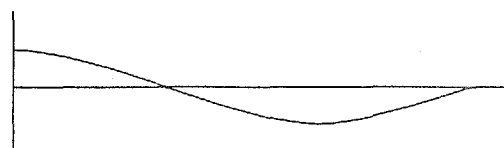


【Record Signal Spectrum】

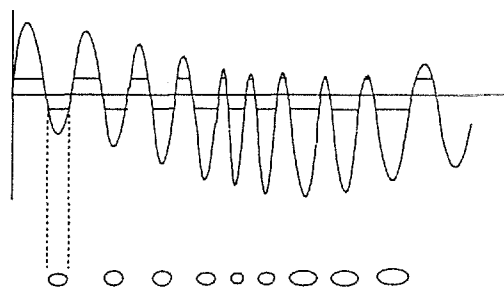
The video signal is added to the Frequency Modulator and is modulated into FM waves of Sync. Tip Frequency 7.6MHz and White Peak Frequency 9.3MHz (frequency deviation $\pm 100\text{KHz}$). The two-channel sound signals are modulated into FM signals of center frequencies 2.3MHz and 2.8MHz respectively (frequency deviation $\pm 100\text{KHz}$). As the sound signal changes to the positive or negative directions centering the 0V level, the FM carrier wave frequency with no sound will be the center, and its frequency will be 2.3MHz or 2.8MHz. On the contrary, the video signal has only the positive level, changing in the range from the black level to the white-peak level. Accordingly, as for the video signals to be frequency-modulated, the center frequency is seldom indicated. However, as a rare case, the FM carrier wave frequency 8.1MHz, which is the standard at the pedestal level, may be indicated as the center frequency. The frequency-modulated video signal and sound signal go through a combining circuit, and are further formed into square waves which are amplitude-limited by the limiter. Consequently, it will be a multiplexed signal with the respective frequency indicating the video signal and the duty ratio change indicating the sound data. The adding ratio of the video FM signal to sound FM signal is set to 20:1, considering the modulation distortion, the cross modulation ratio, and the S/N ratio.



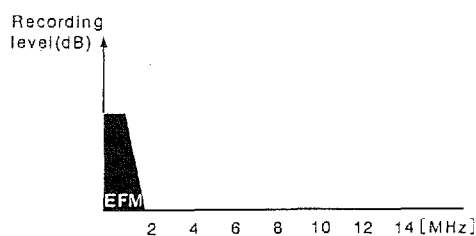
Video FM signal



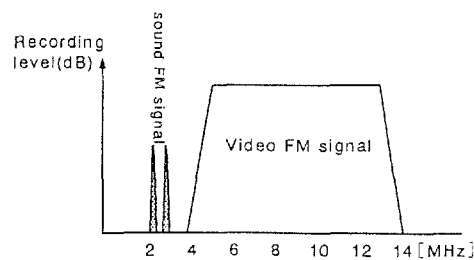
Sound FM signal



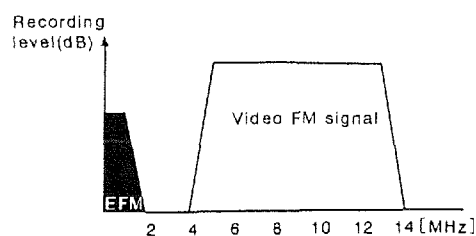
Pit spacing



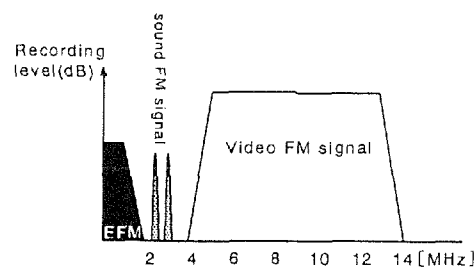
CD



LD without digital sound



CDV



LD with digital sound

Frequency spectrum

【Trick Plays】

With a CAV disk recorded regularly with one picture per track, various trick plays can be enjoyed, such as still- picture play, frame- to- frame play, and multi- speed play. In normal playing, the laser beam traces the spiral tracks continuously from the inner to outer tracks. In trick plays, the laser beam is jumped with the suitable timing to the neighboring track. The jump is performed in the Vertical Blanking Time between pictures; therefore, the re-generated screen will not be disordered.

【Still-Picture Play】

At the moment the " STILL " button is pressed, the picture being played becomes still. In this case, after playing one round (one frame) on a track, the laser beam jumps to the inner side to return to the former position, then plays the same track again. By repeating this cycle, one same picture is repeatedly played to show a clear still picture.

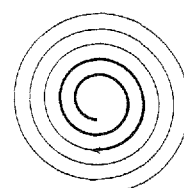
【Frame-to-Frame Play】

By advancing or reversing still pictures, frame by frame, the frame- to- frame play is realized.

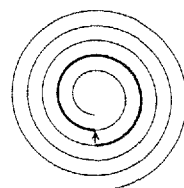
【Multi- speed Play】

The multi- speed play can freely change the speed in playing, such as the slow- speed play, double- speed play, and triple- speed play. For example, if each track is played twice, it will be the 1/2- speed slow play. If the number of times to play each track is changed, the playing speed is freely changed into 1/4- speed, 1/8- speed, etc.

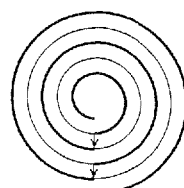
On the contrary, to perform the double- speed play, the laser beam jumps to every beam jumps to the inner tracks, multi- speed plays in the reverse direction will be performed.



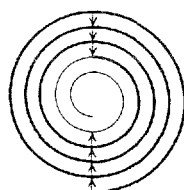
Normal play



Freeze frame



Double speed play

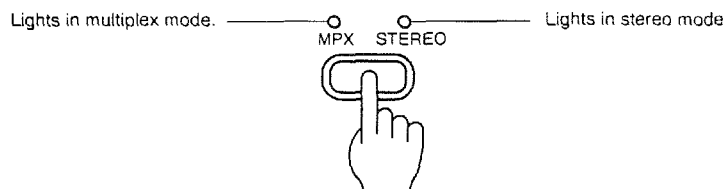


Reverse play

Trick plays

Karaoke disc types and audio modes

Most karaoke discs fall into one of the three categories listed below. When a disc is loaded, the audio mode usually switches automatically to the mode framed by bold lines in the following table. To switch to a different mode, press the audio mode key.



Audio mode		Multiplex mode		Stereo mode
		Assist vocal function		Assist vocal function cannot be used
		ASSIST key OFF	ASSIST key ON	
Disc type	Sound multiplexed karaoke discs (analog audio only)	Accompaniment only (monaural)	Accompaniment + vocals (monaural)	L: Accompaniment only R: Accompaniment + vocals
	HiFi multiplexed karaoke discs (analog audio + digital audio)	Accompaniment only (stereo)	Accompaniment + vocals (stereo)	Accompaniment only (stereo)
	Stereo karaoke discs (analog audio only)	Accompaniment only (monaural)	Accompaniment only (monaural)	Accompaniment only (stereo)

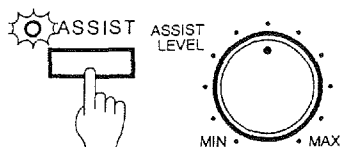
- There are two sound multiplex modes: normal multiplex mode and HiFi multiplex mode. If a HiFi multiplexed karaoke disc is played in sound multiplex mode, the player automatically enters HiFi multiplex (digital audio, stereo reproduction) mode and the display's DIGITAL SOUND indicator lights.
- In addition to the major disc types listed above, it is possible that you may come across a different disc type. Always carefully read the contents of the disc jacket.

Using the assist vocal function

When the **ASSIST** key is pressed in multiplex mode, both accompaniment and vocals are played.

This function is particularly useful for practicing songs you do not know very well.

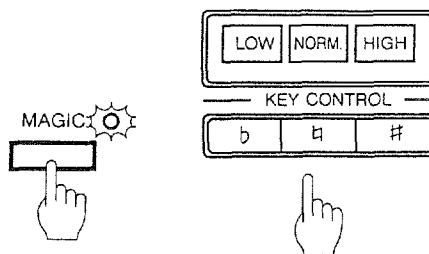
Adjust the level of the recorded singer's voice as you like with the assist level control knob.



- This function can be used only with sound multiplexed karaoke discs and HiFi multiplexed karaoke discs.
- The **ASSIST** key does not function in stereo mode.
- Refer to the "Karaoke disc types and audio modes" section above.
- With sound multiplexed CDs where one channel contains only vocals, the assist vocal function cannot be used.

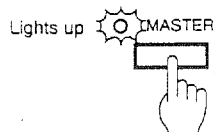
Using the magic voice function

By using the **MAGIC** key with the key control keys, the pitch of the sound from the microphone can be varied over a range of 16 steps. After pressing the **MAGIC** key so that the indicator lights, adjust the pitch as desired using the key control keys.



- Key control for the accompaniment cannot be carried out while the magic voice function is activated.
- The assist vocal, hit master, mic echo and karaoke surround functions cannot be used simultaneously with the magic voice function.

Turn on the hit master function.



- The vocals are reduced to a low level.
- The vocals may remain with some discs.

Hit master function

Use this function when you want to enjoy karaoke using general music sources. With most sources, this function reduces the recorded vocals to a low level, allowing you to sing along with the accompaniment.

- This function can be used with general stereo discs as well as with other general music sources input through the auxiliary input jacks.
- The hit master key does not function in normal multiplex mode or HiFi multiplex mode.
- CD multiplexed discs cannot be used.

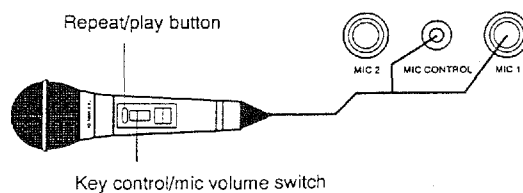
Multi-function microphone

The separately sold Kenwood multi-function microphone (MC-K500) enables you to control the following functions from the microphone. This microphone is convenient for karaoke operation with this unit.

Repeat/play button..... Use this button to return to the beginning of the current tune during playback or to start playback from a mode other than play mode (stop, pause, open).

Key control..... Use to adjust the pitch of the tune to match your voice.

Mic volume..... Use to adjust the microphone sound volume.



- For details, refer to the instructions supplied with the microphone (MC-K500).

Mic volume

If this unit is used with its audio output connected to the audio input of a TV or VCR, the sound may be adversely affected by distortion, etc., if the mic input signal is too large. If this occurs, lower the mic volume level.

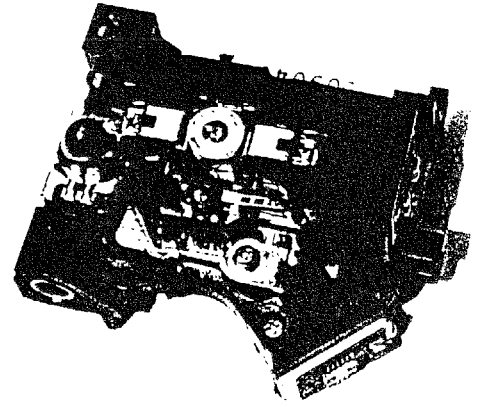
Chapter 4: Outline of Pick Up

【Structure of Laser Pick Up】

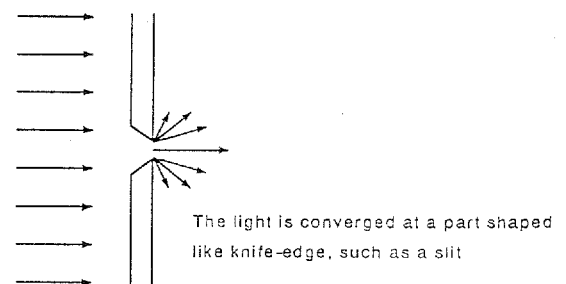
The 3mW straight polarized light emitted from the Laser Diode is divided into three beams by the Diffraction Grating. The two beams on both sides are used for tracking detection, the center beam is used for focus detection and record signal detection. The three beams reflected by the Half-Mirror becomes parallel by the collimating lens, and they rise up to the vertical direction to the disc by the Mirror.

These beams are always converged into a fine spot on the pit side of the disc by the Object Lens moving in the disc radius direction and up-and-down direction, and they are diffracted by the pit in the disc. The beams totally reflected by the disk reflecting surface return to the Object Lens, trace the optical path backward, then go through the Half-Mirror, and reach the Photo-Diode(detector). The Piano-concave Lenses widens space between the three beams, and works to make the two beams for tracking detection enter the respective Photo-Diode. Since the light output of the laser Diode greatly varies depending on the environmental temperature, it is monitored by the Photo-diode at the rear for monitoring the output to feed it back to the laser power and control the output to be constant. A focus coil and a tracking coil are attached to the Object Lens, which are installed in the Pick Up. It has a structure similar to a loud speaker, composed of a magnet and a coil. This movement is controlled by the Focus Servo Circuit and it can correctly converge the beams onto the pit even if the disc vibrates up and down as it revolves.

Also, in proportion to the amperage of the current flowed to the track coil, the Object Lens moves sideways. Consequently, it works to move the laser spot position in the disk radius direction. It is controlled by the Tracking Servo Circuit.



Laser pickup



Light convergence

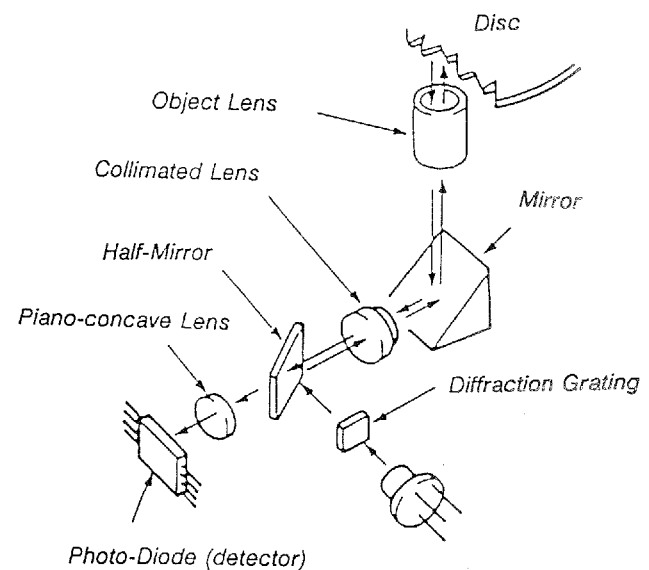
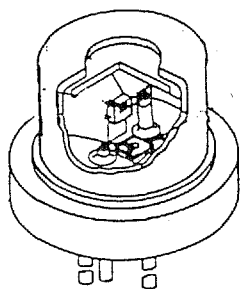


Figure for optical theory

One of the figures below shows the characteristics of the Laser Diode by temperature difference. It is visible that the characteristics will be changed by the temperature.

Other figures show an appearance and the pattern of the photodetector. The beam is divided into three by the Grating, as already described, and each beam is $25\text{ }\mu\text{m}$ away from the others on the pit surface of the disk and they are converged as three reading spots. The center spot is for signal reading, which will return to the 4-division elements(A to D) at the center of the Photo-Diode. The two spots on both sides are for tracking detection, which will return to the elements on the sides(E, F) of the Photo-Diode.



Laser diode

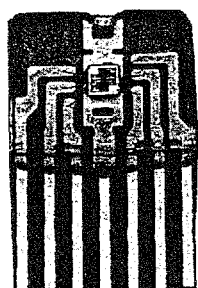
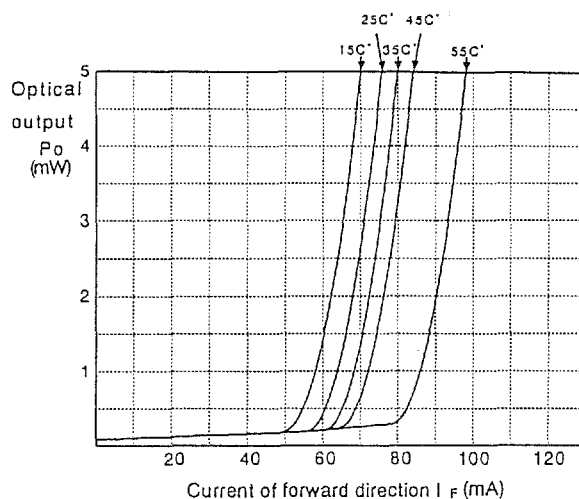


Photo diode



Characteristics of Laser diode

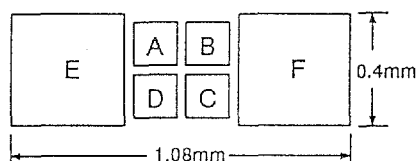


Photo detector

【Focus and Tracking Control Signal Detection】

The Half-Mirror not only divides the beam but also works to generate the non-focus aberration. Fig. 1 shows the theory to detect the Focus Control Signal. The beam passed through the Half-Mirror reaches the photodetector surface of the Photo-Diode. When the disk is too close to or far from the focus position determined by the Object Lens, an elliptic shape of light such as in (a) is cast on the photodetector surface and a focus-error voltage is detected as in (b).

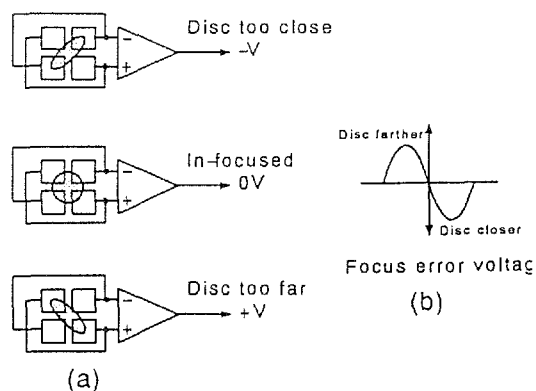
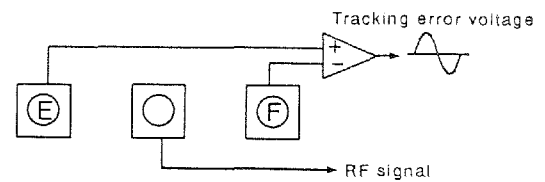


Fig 1 Focus control signal detection

Also, the two beams on the sides divided by the Diffraction Grating are focused on the same track, with spots slightly displaced from each other, by the Object Lens. And each reflection beam is detected by each side of the Photo-Diode, and the difference value between the track and the spot is detected by the difference between the two beams.



【Outline of Pick Up for LDs】

The basic structure of the pick up for LDs is almost the same as that of the pick up for CDs. However, the LD player has a disk diameter of 30cm, larger than a CD disk. Furthermore, the linear velocity is faster, and data is recorded in analog signals. Therefore, the LD pick up requires more severe reading accuracy than the CD pick up.

	LD	CD
DISC Dimension mm	300	120
DISC Thickness mm	2.5	1.2
Revolution (CAV) rpm	1800	—
(CLV) rpm	600~1800	200~600
Linear velocity m/s	11	1.2~1.4
Track pitch μm	1.67	1.6
DISC Deflection mm	MAX ± 1.025	MAX ± 0.5
Track Deflection μm	MAX ± 80	MAX ± 70

Specifications of CD/LD

【Object Lens】

On the recording side of LDs, video signals are recorded in forms of analog signals. They are recorded by pits whose length continuously changes. To read this length of a pit accurately, the LD pick up needs to make the spot on the disk surface very small. By making the spot diameter small, the MTF (Modulation Transfer Function) can be graded up to high frequencies to read more detailed information accurately.

【MTF】

The MTF indicates how detailed the laser pick up can read, by unit of lines per mm, which relates to the capability of the Object Lens. The unit of the MTF frequency is usually expressed as lp (line pairs) / mm or lines / mm.

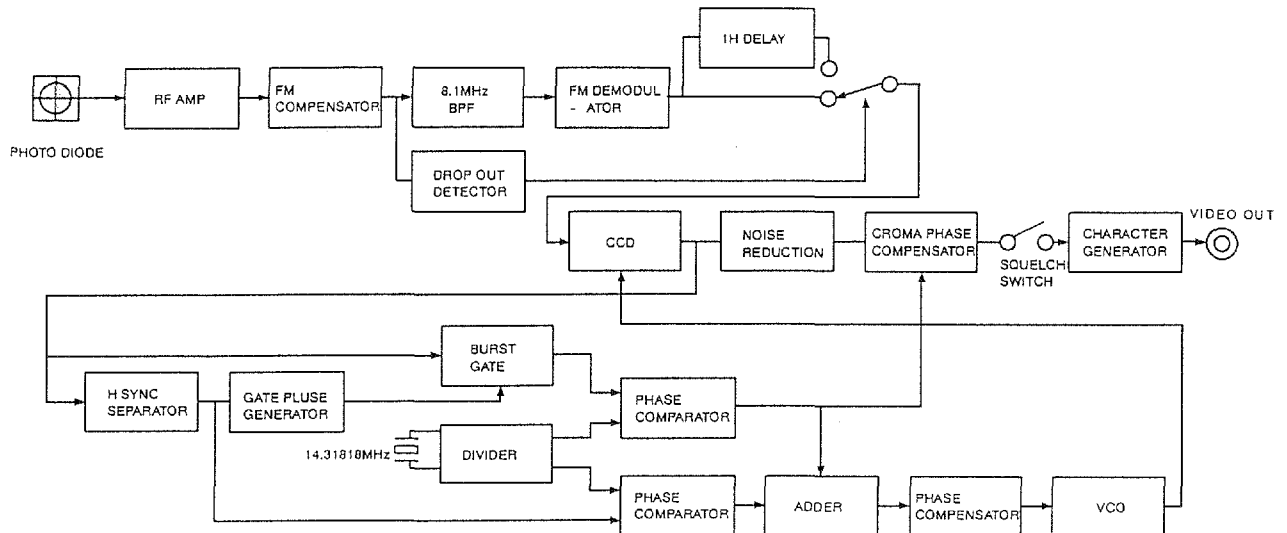
【Actuator】

The linear speed in playing LDs is so fast that the drive sensitivity of the Actuator must be higher than that in playing CDs. Also, in normal playing and special playing, unnecessary resonance must be controlled.

Chapter 5: Outline of Laser Disk Player

【Re-generation of Video Signal】

The video signal is read by the center beam of the three laser beams. The photodetector for this center beam is divided into four elements to detect focus error. Therefore, the four signals are first combined to take out the RF signal.



Block diagram of laserdisc player

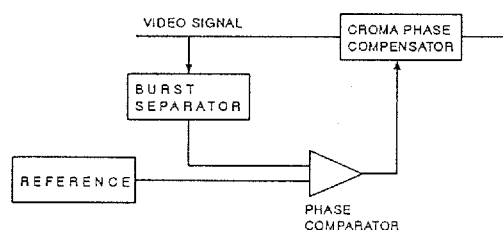
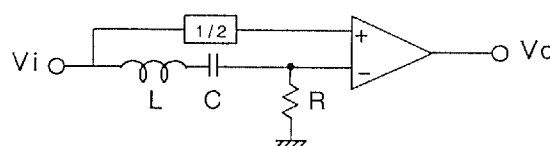
In case of a CAV disc, the pit length is different between the disk inner tracks and outer tracks; therefore, the RF signal level would be smaller for the inner tracks than the outer tracks. So, in the FM Compensator (EQ Switch), the high-frequency gain of the amplifier is raised more for the inner tracks than the outer tracks, to correct the RF level. The RF signal taken from the pick up contains the video signal factor and the sound signal factor. Therefore, after correcting the RF signal, only the video signal is taken out by the BPF (Band Pass Filter) for 3MHz to 15MHz. Next, frequency demodulation is performed to take out the video signal. Using a pick up of non-contact type as in a Laser Player, there are some cases that the RF signal is missing due to dirt or scratches on the disc. At this time, the video signal is also missing and it appears as noise on the screen. It is called a "drop-out", and it is necessary to correct the drop-out. On the screen, one picture is composed of 525 scanning lines, and the actual video signal is similar compared to the preceding or following scanning line. If the signal for the current scanning line is replaced by that for the preceding scanning line, it will hardly cause any trouble. When a drop-out has occurred, only that part is replaced by the signal 1H before. Detection of a drop-out is judged by whether there was an RF signal or not, the signal is outputted via the delay line of $220\ \mu\text{S}$ to correct the time gap with the video signal. Also, between the video signal 1H before and the signal being re-generated, the signal level itself is similar but the phase of the color carrier wave differs by 180 degrees. Accordingly, if the drop-out is merely replaced by the signal 1H before, the

phase change may be too apparent. Therefore, in case of a drop-out, the signal 1H before for replacing is the signal of only the brightness signal without color signal. Since the color of a fine dot cannot be judged by our eyes, it will be enough to replace by the brightness level only if a drop-out occurs for only a short time.

【Chroma Phase Compensation】

By going through the drop-out Compensator circuit, then through the CCD circuit, and going on to the Chroma Phase Compensator circuit, the jitter factor of the video signal can be as little as possible. For the color signal, the signal of frequency 3.58MHz is used. But if the phase difference is 140ns, the phase would reverse and result in a completely different color. Therefore, the correction of the time base error should be performed quite accurately.

By the Disc Servo and the CCD Variable Delay Line, time base correction enough to re-generate the color on the screen can be performed. However, there is still color irregularity before calling it a high-quality image. And it should be corrected. The video signal passed through the CCD Servo contains a residual phase difference of about 40° to 50° p-p at 3.58MHz, which can be lowered to about 8° p-p by the Chroma Phase Compensation circuit. Since the color carrier wave has been added in the video signal as color burst signal, the Chroma Phase Compensation circuit compares the phase between the standard 3.58MHz and this re-generated color burst signal to eliminate the phase error of the color burst signal. To correct this phase error, a circuit to change the phase will be necessary, and the circuit placed on the right is used. The feature of this circuit is that only the phase will change with a constant amplitude even if any of L, C, and R is changed. Actually, the C is composed of a variable-capacitor diode, the voltage of its terminals is changed by jitter error for correction.



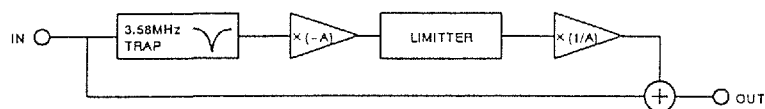
Equivalent circuit
of chrominance phase compensation

【Video Noise Cancel Circuit】

The purpose of this circuit is mainly to decrease the sound beat and the cross talk. First, the video signal of 0.5MHz or more is taken out by the HPF (High Pass Filter) and it is amplified. Then by limiting its amplitude by the limiter, the signal with small level, i.e., noise, is taken out. By reversing it and adjusting the level, then adding it to the original video signal, noise is removed. The video signal contains the color signal. Therefore, if it is directly inputted to the Noise Cancel circuit,

the limiter would respond and noise could not be taken out because the amplitude of the color signal is large at thick color portions. On the contrary, at the thin color portions, the color signal is small and the color signal is processed as noise; therefore, distortion would arise in color density variation. Accordingly, before amplifying and limiting the video signal, only the color signal of the video signal should be decreased. So, a trap of 3.58MHz is inserted in the circuit.

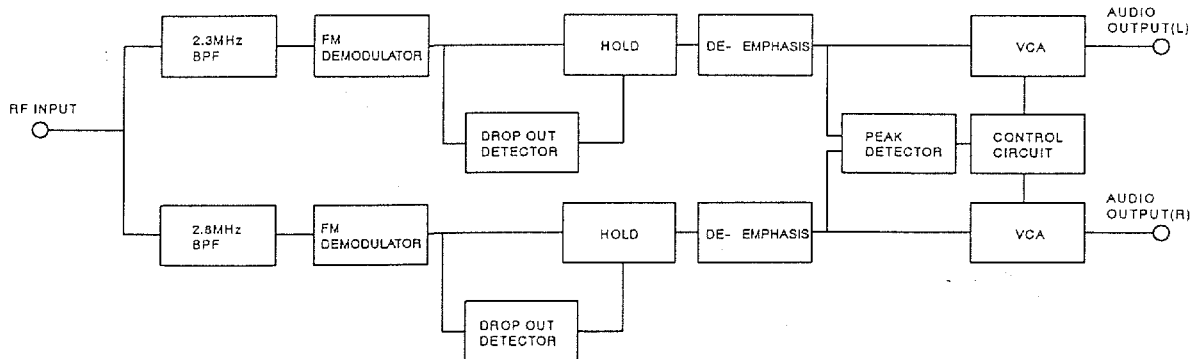
The video signal after the Chroma correction could be connected to the monitor as it is. However, in the Laser Disk player, the Squelch circuit is provided to switch the screen into a color background at the time of play start-up or pause. Also, the Character Generator generates the characters of Chapter No., Frame No., etc. to be cast on the screen. The image is composed of 525 scanning lines for one picture; therefore, it is necessary to give the signal steadily synchronized to the video signal for adding any characters.



Video noise canceller

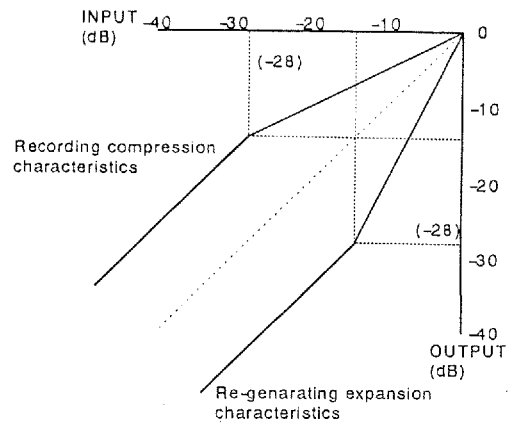
【FM Sound Signal Re-generation】

The sound FM signal taken out of the FM signal by each Band Pass Filter of 2.3MHz and 2.8MHz is demodulated, goes through the Previous Value Hold circuit and the De-emphasis circuit VCA (Voltage Control Amplifier: can vary the gain by the control voltage), and is outputted from the output pin. If there is any drop-out, it is detected by the Drop-out Detector, the signal level is held to the value just before the drop-out occurrence by the Previous Value Hold circuit throughout the period to prevent noise occurrences. For the sound system, the Laser Disc player adopts the CX system of compression (recording side) - expansion (re-generating side) method, to wide the dynamic range and improve the S/N ratio. The following shows its characteristics.



FM audio demodulation circuit

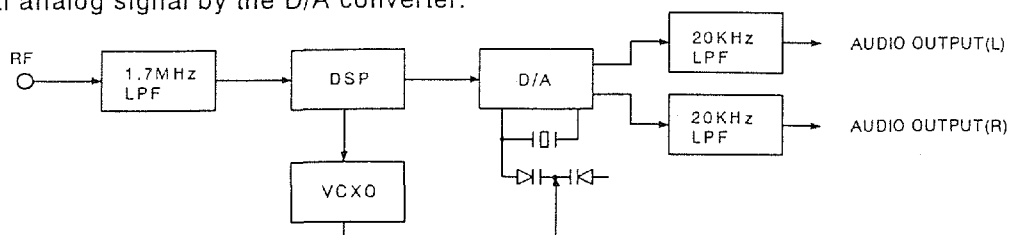
In recording, any signal with level larger than -28dB is compressed in ratio of 2:1. On the contrary, in re-generation, it is regained to the original status by expanding it. Since this system expands almost all the frequency bandwidth, its feature is that tone quality change is very little. The control voltage is made by peak-detecting the sound signal outputted from the De-emphasis circuit of combining various time constants, and is designed to make the sound most natural. Expanding is made with this voltage by changing the VCA gain for both channels at the same time, the normal feeling of stereo will never be damaged.



CX characteristics

【Digital Sound Demodulation】

Some CD have PCM signals, encoded by the CD format, compressed and inserted in the vacant frequency bandwidth less than 2MHz in the Laser Disc. They are discs with digital sound. The FM signal picked up from such a disc is made into only the EFM signal of PCM by the LPF of 1.7MHz . The lower side band of this signal is flattened by the De-emphasis circuit, and it is made into pulse wave form by the wave shaper, then it is demodulated in the decoder and recorded in the RAM in the correct order. By the clock re-generated in PLL from the re-generated EFM signal and the frame synchronizing signal separated from data, the RAM address for recording is controlled. To read digital sound data thus recorded in the RAM, jitter would be accompanied in the re-generated sound signal unless reading is performed in accordance with an accurate and constant clock. However, if reading is made with a clock not relating to writing to the RAM, the RAM data would be overflowed sometime. Accordingly, the VCXO output, which is synchronized to the average frequency of the re-generated EFM signal, is used for the reading clock. The read digital sound data is regained into the original analog signal by the D/A converter.



Digital audio circuit

Discs which can be played with this unit

Disc types



1. With this unit, use discs which bear one of the logos shown at the left.
2. This unit cannot be used with CED or VHD type video discs.
3. This unit conforms to the NTSC system. Discs indicated for use with other television systems (PAL, SECAM) cannot be used with this unit.
4. When using a video single disc, the unit will stop playing approximately 10 seconds after the visuals end.

Disc sizes

CD single
8 cm



One side only.
Audio:
20 minutes max.

CD
12 cm



One side only.
Audio:
74 minutes max.

CDV
12 cm



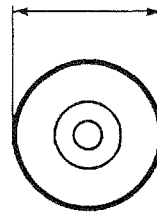
One side only.
Audio: 20 minutes
max.
Video: 5 minutes
max.

Video Single
12 cm



One side only.
Video: 5 minutes
max.

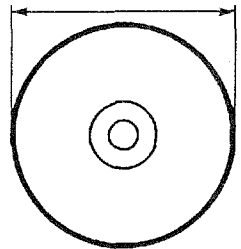
LD single
20 cm



CAV: One side
14 minutes max.
CLV: One side
20 minutes max.

(This unit can play even thin-type 20 cm LD single without requiring an adaptor.)

LD
30 cm



CAV: One side
30 minutes max.
CLV: One side
60 minutes max.

CAV discs (Standard Play discs)

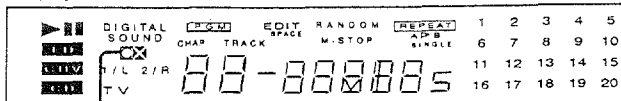
Discs of this type spin at a fixed rotational speed (Constant Angular Velocity) of 1800 rpm. Each revolution is equivalent to one video frame, and each frame is assigned its own frame number. Special video playback functions such as still frame, frame advance, and multi-speed playback are available with this disc type.

CLV discs (Extended Play discs)

When a CLV disc is played, the rotational velocity is varied as the playback position moves from the inside to the outside of the disc, thus maintaining a Constant Linear Velocity. Discs of this type are recorded with the time numbers which indicate the elapsed play time from the beginning of the disc. Although special video playback functions are not possible with CLV discs, CLV discs offer longer playback time compared to CAV discs.

CX Noise Reduction System

Display area



indicator



This unit realized low-noise, powerful sound reproduction through the use of the CX Noise Reduction System. When a disc bearing the mark is played, this system automatically operates and the indicator lights in the display.

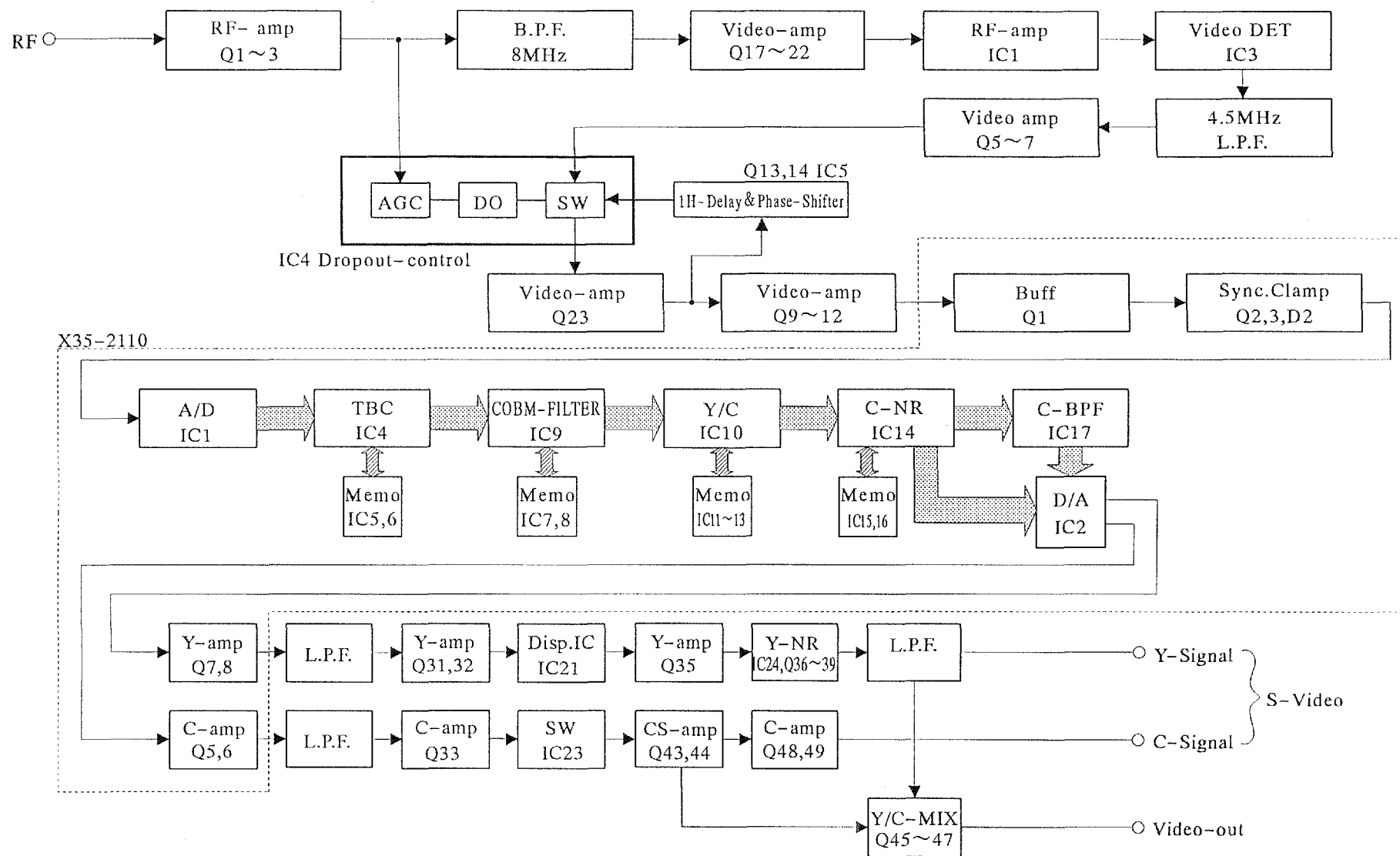
- If the indicator does not light when playing a disc which bears the mark, press the key on the remote control unit so that the indicator appears.

THE STAGE 2

LASER DISC PLAYER

ACTUAL CIRCUIT

L V D - Z 1 VIDEO CIRCUIT
(X35-2100,2110)

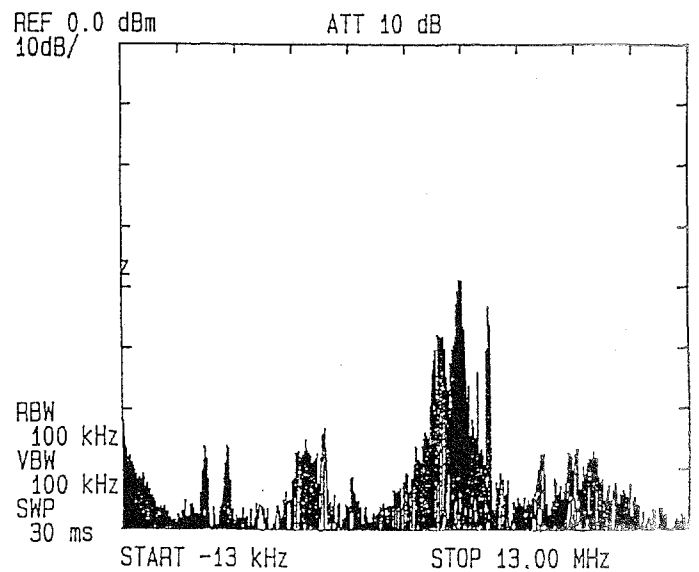
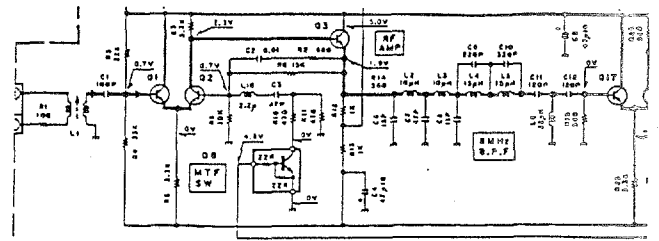


VIDEO CIRCUIT

The Video Circuit is the circuit to generate the video signal from the re-generated RF signal. It is mainly composed of Video FM Signal Detector section, Drop-out Compensator, Pedestal Clamp circuit, Time Base Correction circuit, Video Signal Noise Elimination circuit, and Synchronous Separator/Divider VCXO circuit. Here, let's see some new systems adopted for the LVD-Z1 as well as describing on the basic circuits and blocks.

① RF-Amp

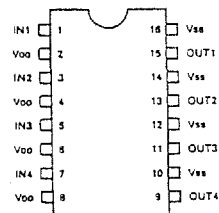
The RF signal from the pick up is inputted to the circuit composed of Q1 to Q3, where it is amplified and phase-compensated. Also, in case of CAV disk inner tracks (Frame No. less than 800), CLV and CDV disks, Q8 (MTF-SW) turns ON to process peaking of the high-band characteristics of the RF signal and the frequency characteristics is corrected. The compensated RF signal is led to the band pass filter and the drop-out detection circuit on the next row.



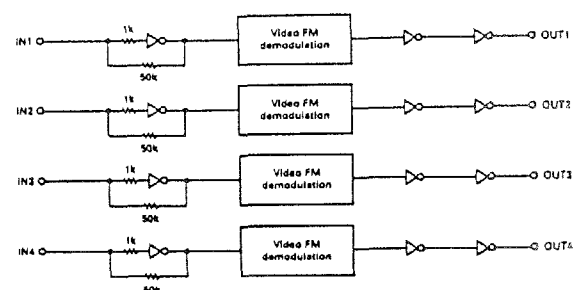
② B.P.F.

The FM video signal has been demodulated in the RF signal so that the white peak may be 9.3MHz and the frequency may be 1.7MHz in the bandwidth from 3.5 to 13.5MHz. Therefore, only the necessary signals should be taken out here for video demodulation.

Pin connection



Block diagram



③ Video RF-Amp

It is composed of Q17 to 22 and IC1, and it amplifies the video band signal and shapes the wave of the RF signal.

④ Wave Detection of Video Signal

The RF signal (video FM signal) is converted into video signal by the demodulator IC3. This IC is a Video FM Signal Demodulation LSI exclusive for laser disks of Pulse Count type. Its

inside is composed of 4 channels of same circuits and purposed to improve the relative S/N ratio, and it can obtain the demodulated wave only by attaching a low pass filter (4.5MHz) outside.

⑤ DROP OUT COMPENSATION

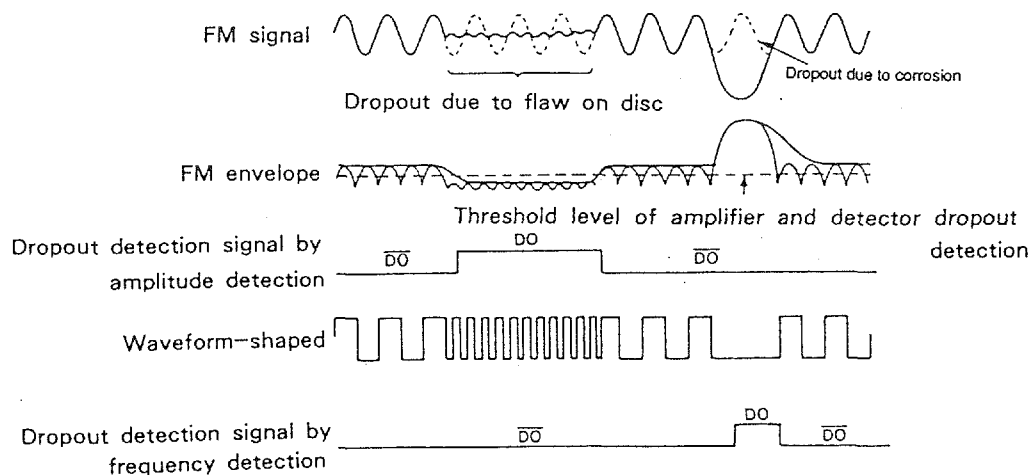
The demodulated video signal is inputted to the Drop-out Compensation circuit. Here, the video signal is corrected in accordance with the amplitude and frequency of the RF signal on the preceding row.

a) Drop-out Detection

There are two types of detection. One is the type to detect missing of the video FM signal for type to detect due to scratches or alien materials on the disk. The other is the type to detect missing of one or multiple pits due to corrosion of the disk or defective manufacturing process.

b) Correction

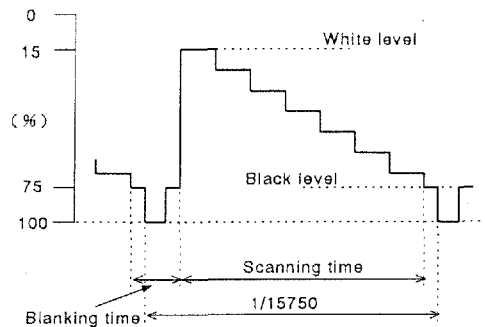
As the timing shown below, the switch inside the video IC is alternated by combining the signals detected due to differences between the RF signal amplitudes or frequencies. To the inputs of this switch, the video FM signal being re-generated and the signal delayed for 1 line after correction are inputted.



⑥ SYNC. CLAMP-CIRCUIT

The video signal after drop-out correction is given a pedestal clamp process before being inputted to the Time Base Corrector circuit. This process is to determine the standard position of the synchronizing signal added beforehand so that the image synchronization may not go out of order at the time of input of the video signal to the TV set. As in the circuit drawing, when the re-generated Horizontal Synchronizing

Signal is inputted to Q3, this transistor turns activated to turn the electric potential of the Q2 base 0V (absolute ground level). Accordingly, the Horizontal Synchronizing Signal is certainly inserted in the video signal.

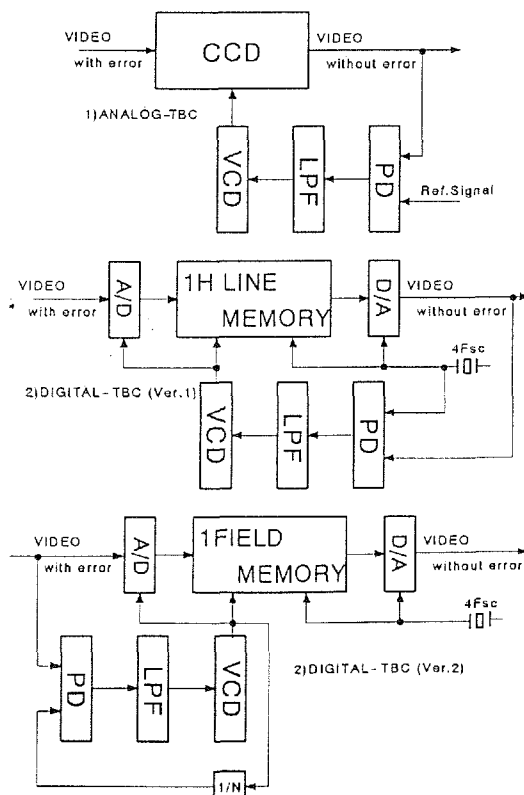


【Video Signal】

When you take a picture with a TV camera, the image pick-up tube converts the light or dark status of each part in the picture into a strong or weak electric signal. This signal is called video signal. As in the figure on the left, such a wave is obtained as the lighter portion is larger and the darker portion is smaller in amplitude. Also, the scanning period contains a signal that never appears on the screen called the Retrace Blanking Period and the synchronizing signal to express one picture accurately. These are set to the lower than the Black Level of the picture.

⑦ TIME BASE CORRECTOR (TBC)

The Time Base Corrector circuit is a circuit to correct and re-generate the signal recorded in the disk to make the signal as it was recorded. It is composed of Spindle Servo and a circuit to eliminate time-base changes in high frequencies that cannot be eliminated by the Spindle Servo only. There are three different types of specifications at present, and the block diagram for each is shown below.

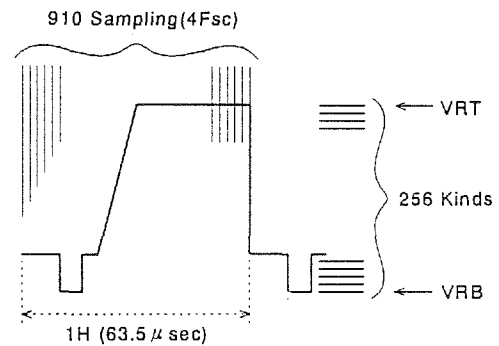


In the TBC of analog type, the video signal containing a time-base error is transferred sequentially in the CCD delay element, and the time-base error is absorbed by varying the clock and changing the transfer speed in accordance with the time-base error. However, the signal will be more or less deteriorated, such as the frequency characteristics of the video signal changes by the frequency of the clock to set the delay time. In the video signal containing a large time-base error, the color signal is particularly affected, and it may appear as a flicker on some TV sets. On the contrary, in case of the digital system, basically there are two possible types as in the figure. Naturally, as the delay element to absorb a time-base error, it is general to use the Field Memory after using the Digital Data Line Memory. The digital data with the A/D-converted time-base error is written to the memory by the clock with

the same time-base error. For reading, the time-base error is absorbed in this memory by using a constant clock. If digital data is used for time-base error correction, no signal deterioration occurs in the step of delay element and a stable video signal is obtained.

【A/D Converter】

In the LVD-Z1, an 8-bit CMOS A/D Video-use Converter CXD1176Q, which has a synchronizing clamp function, is used. For the sampling frequency, $4F_{sc}$ (14.31818MHz) is used ($4F_{sc}$ is VCXO that changes in accordance with the re-generated video signal). The figure on the right shows the relations between the A/D converter and the video signal to be inputted. The video signal to be inputted is sync-tip-clamped by Q3, and the signal is set to +0.7V to +2.7V (Sync. Tip to White 100% Level). Also, as it is an 8-bit quantization, it is expressed as data in 256 ways.



【Memory Control】

For the field memory, two chips of CXK1206M made by SONY are used. One chip of CXK1206M has a memory of $960 \times 306 \times 4$ bits, and by using two chips, a picture as much as 8 bits 1 field can be stored. The following are descriptions on the five pins for the control system.

• CKW (17 pin)

Inputs the sampling clock of $4F_{sc}$ matching to the video signal for writing.

• VCLR0 (14 pin)

It is the reset clock for writing, and moves the write address(0, 0) in the memory when it is latched with the writing clock.

• WE (13 pin)

When this pin is L-level, data is written synchronizing to CKW. When H-level, it stops the action of the shift register without accepting the input data.

• CKR1 (4 pin)

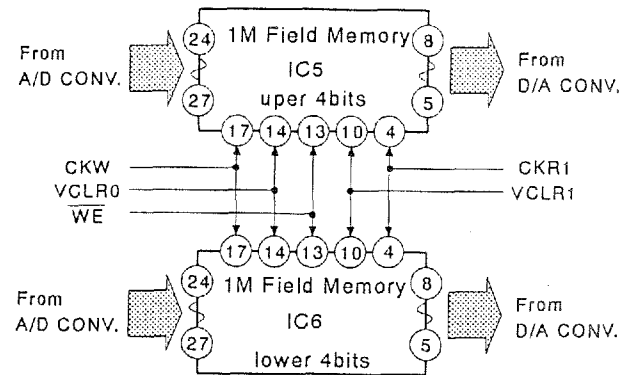
It is the input pin for the standard clock for reading, and it inputs the signal of the $4F_{sc}$ (14.31818MHz) frequency

• VCLR1 (10 pin)

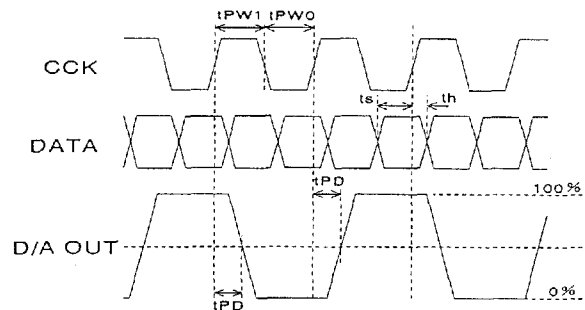
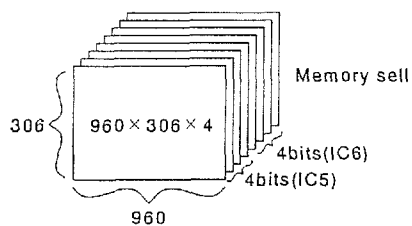
It is the reset clock for reading. When it is latched with the reading clock, it reads starting the data delayed 64 clocks (0, 0) from that moment.

【 D/A Converter】

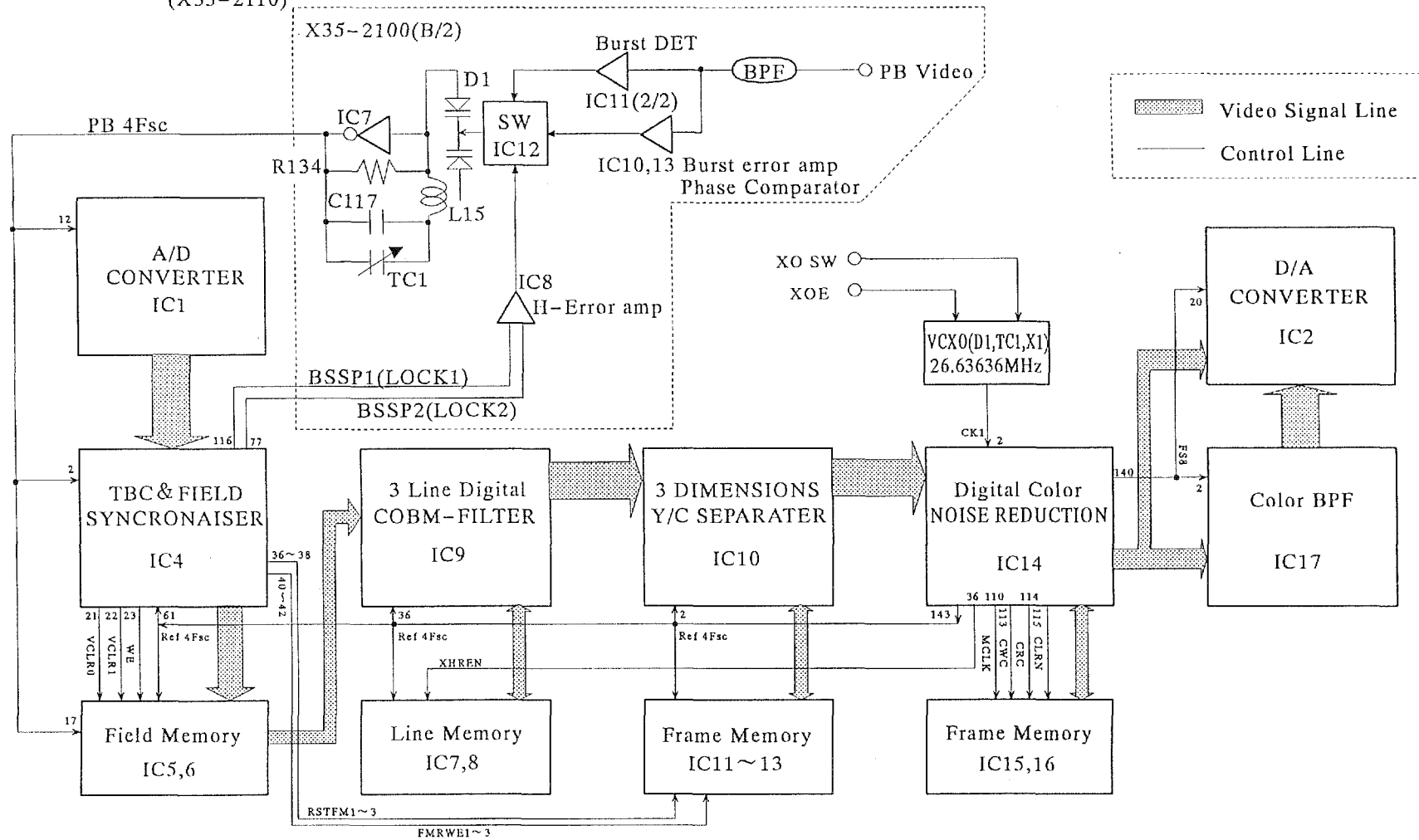
In the LVD-Z1, the SONY-made CXD1177Q is used, which is an 8-bit high-speed D/A converter for video bandwidth and has two channels of input/output. For the clock frequency, 8Fsc (26.63636MHz) is used, and the timing of each signal will be as in the figure on the right.



An ordinary digital TBC is composed of A/D, Memory, A/D devices. The memory portion could be Line Memory, Field Memory, etc., depending on each model, but the basic composition and action are the same as describes above. However, the LVD-Z1 has a slightly different circuit composition. So, in the next section, let's describe a little on Movement Adaotive 3 Dimensions Y/C Separater, Digital Color Noise Reduction, and Premium Control Digital TBC. In actual repairing works, check patiently if each input/output data, clock, standard power, etc. is normal and work referring to the block diagram in the next section.

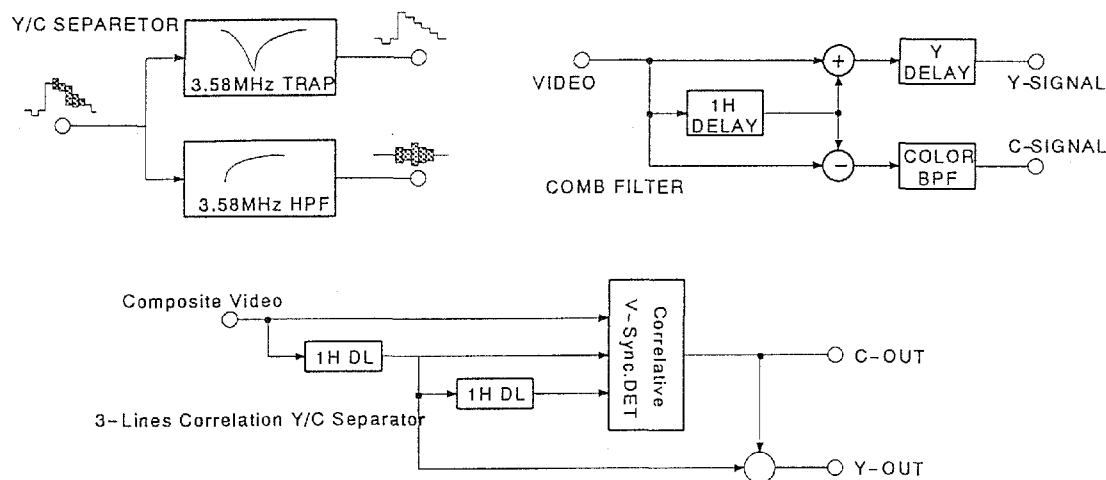


L V D - Z 1 VIDEO CIRCUIT(TBC)
(X35-2110)



【2- dimensional Y/C Division vs. Movement Adaptive 3 Dimensions Digital Y/C Separator】

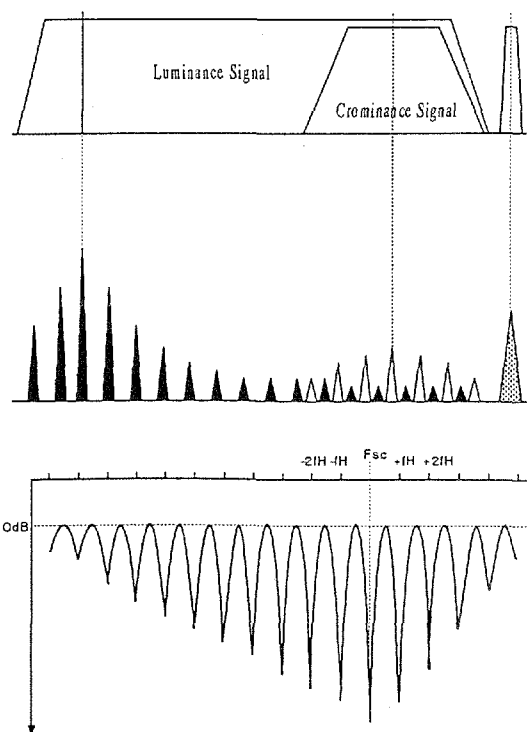
As for the composition of the digital TBC video process circuit, refer to the block diagram in the previous section. This video circuit installs a 7- Mbit frame memory in total, and process is made between two frames for the 3-dimensional Y/C division. Therefore, the stability against the dot trouble or noise trouble of jitter, etc. that was not able to be eliminated by the 2- dimensional Y/C division (3- line logical comb filter).



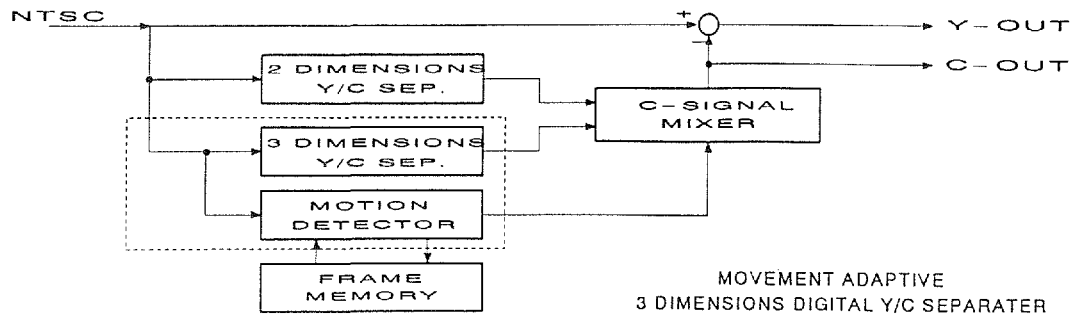
As in the figure above, the ordinary Brightness / Color Division circuit is composed utilizing the feature of the combined video signal that has been made by inserting the energy of color signal between the energy spectra of video bright signals. However, as described before, the color signal is distributed within the bandwidth of the brightness signal. Therefore, the characteristics of the brightness signal is determined by the way to divide the signal into brightness signal and color signal. Up to today, many video machines (TV, videotape player, etc.) have adopted Y/C Divider called the " Comb Filter ". The Comb Filter requires the following conditions.

- (1) The phase of the color signal is reversed 180 degrees for every 1H.
- (2) The neighboring video signals are similar.

Under the conditions above, the brightness signal can be obtained by adding together the signal with the time difference of one horizontal scanning period, and the color signal can be obtained by subtracting each other of



signals with time difference of 1H.



The Movement Adaptive 3 Dimensions Y/C Separator not only performs arithmetic of the information of neighboring scanning lines on the same field (3-line logical comb filter), but also by performing arithmetic of the most appropriate value from the two fields including the current one, it eliminates cross color or dot disturbance that occurs on the slant stripes and cannot be separated due to imperfect separation by the ordinary 3-line logical comb filter, and in addition, it shows a wide range of noise reduction effect by the large-scale inter-frame signal process.

However, the 3 Dimensions Separator with the perfect characteristics in still pictures will show after-image on

motion pictures, especially on pictures with quick motions.

Accordingly, the Movement Adaptive Digital 3 Dimensions Y/C Separator performs the process on the same line (1H) process by its own algorithm, detects each motion of the color signal and the brightness signal, and by making the 3-dimension process on the portion with less motions such as the background and making the 2-dimension process on only the objects lively moving in the background, it executes a high-accuracy Y/C separation. Furthermore, it can alternate the speed of the 3-dimension motion mode in accordance with the software status.

• 3 Dimensions Y/C Separator Digital Filter (KAG05) Function

This IC is a 3 Dimensions Y/C Separator Filter corresponding to the NTSC system installed in the LVD-Z1. By combining it with the Digital Comb Filter (KAG04), it can separate the brightness signal and the color signal with little dot disturbance and cross color.

• Process for Motion Pictures

For the Y/C separation for motion pictures, the result processed by the Logical Comb Filter (KAG04) is outputted as it is because the correlation between frames is small.

• Process for Still Pictures

For still pictures, utilizing the factor that the phase of the Chroma signal is reversed between frames, the Chroma signal is separated by the Frame Comb Filter.

- Motion Detector

It detects each motion of the brightness low- band factor and Chroma high- band factor in one frame, it outputs the larger absolute value as the motion volume.

- Brightness Low- band Factor Motion Volume Set Pins

YLTH0 to YLTH3

- Brightness High- band Factor Motion Detective Sensitivity Set Pins

GCTM1, GCTM0(for brightness)

GCTCS1,GCTCS0(for Chroma)

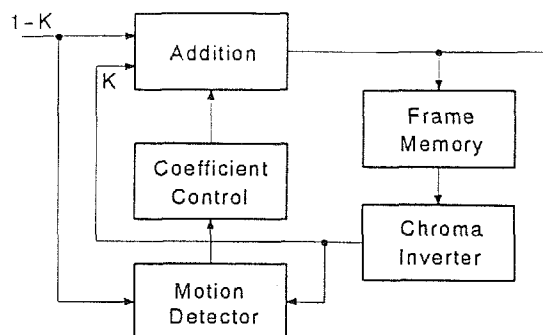
- Motion Sensitivity Set Pins

GCTY0, GCTY1(for brightness)

GCTC0, GCTC1(for Chroma)

【Digital Color Noise Reduction】

The LVD- Z1 has a Digital Color Noise Reduction of frame- circular type using a large capacity of frame memory to the Chroma signal to obtain high- quality pictures, in addition to the 3 Dimensions Y/C Separator adoption. To detect correlation in units of picture cells and process noise reduction in accordance with each motion, it performs noise elimination faithful to the original signal.



• Memory Control (KAM01) Function

This Digital Color Noise Reduction System reduces the amplitude and phase noise of the NTSC signal and extracts the frequency factor of 3.58MHz and brightness signal factor, by the combination of the Memory Control (KAM01) and the Band Pass Filter (KAN01) for color signal.

• CNR of Frame-circular Type

The color signal samples with 4Fsc is converted into 8Fsc signal by the interpolating LPF. The signal converted into 8Fsc is sampled by a 8/3Fsc clock, and is inputted to the filter of frame-circular type. The noise depression degree is decided by the size of the frame correlation.

$$R = \log \left[\frac{(1+K)}{(1-K)} \right] \text{ dB}$$

The color signal after noise elimination is inputted to KAN01 (BPF for color) to eliminate the aliasing noise. For the memory for frame correlation, 2Mbits are necessary.

• Standard Signal Generator

It generates the information of 1h, 262H, 263H, field, and color by the counter of one frame from the 8Fsc clock, and takes interface with the TBC.

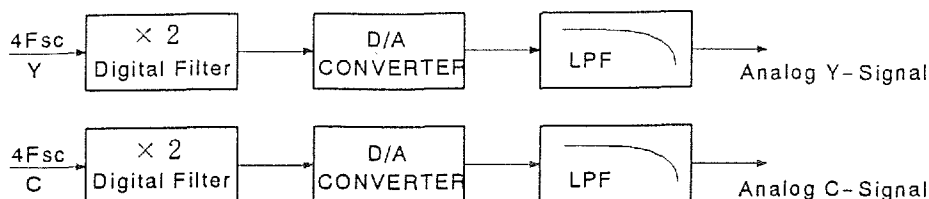
• YLPF

The brightness signal sampled by 4Fsc is oversampled by the interpolating LPF, converted into an 8Fsc signal, then is outputted.

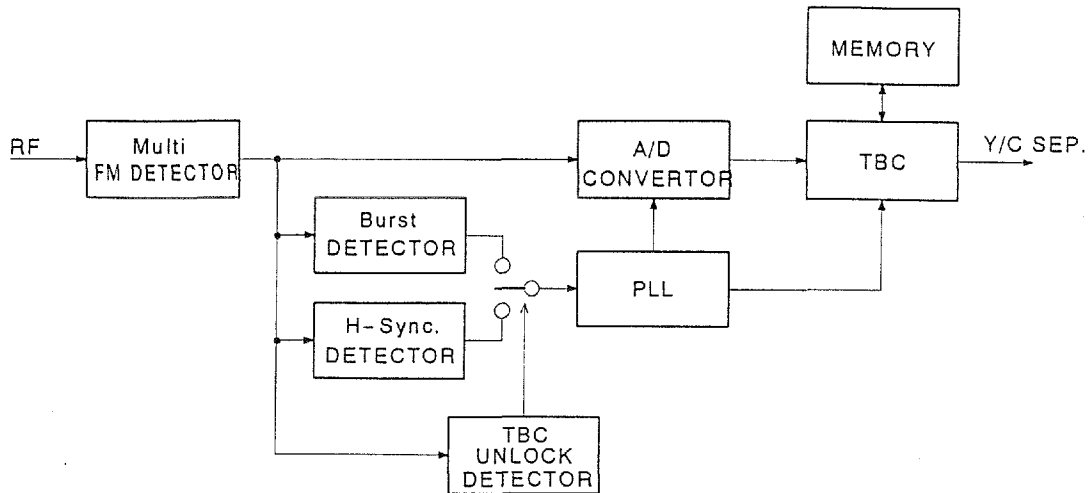
• Mode Setting (NR Effect Setting)

CNRT0	CNRT1	NR EFFECT	AFTER IMAGE
H	L	★	★
L	H	★★	★★
H	H	★★★	★★★
L	L	×	×

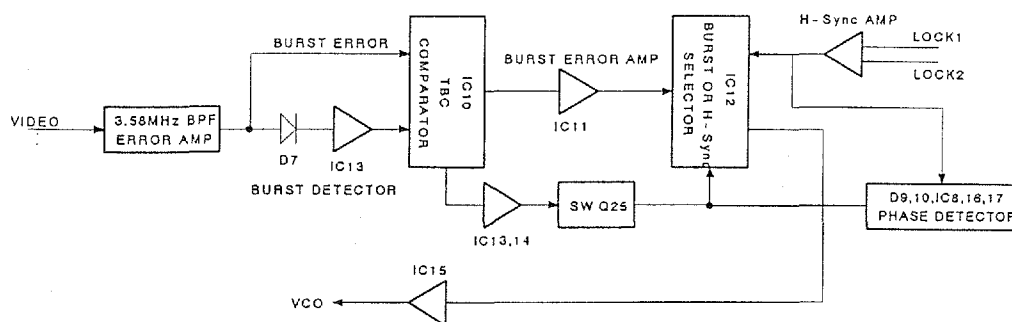
THLE0 and THLE1 is for minute adjustment. The NR effect will be large with L, L; and small with H, H.



【Digital TBC- VCO Error Voltage Switching】



The digital TBC has performed controls by adding the error voltage of the Horizontal Synchronizing Signal type to the error voltage of the burst type. This system may generate color irregularity caused by the interference of the error voltage of the Horizontal Synchronizing Signal, and it has been regarded difficult to eliminate it. Therefore, the LVD- Z1, utilizing the high- speed switching action, controls the TBC of LC playing with only the error voltage of the burst type. Consequently, in addition to elimination of signal interference due to error voltage addition of the Horizontal Synchronizing Signal type, the frequency interleave (interpolation) is correctly performed and pictures with less color irregularity can be obtained. However, for disks without burst signal or fast forward or rewinding operation from the ordinary playing mode, the burst signal cannot be detected. In this case, the TBC is controlled by the error voltage of the Horizontal Synchronizing Signal type. For this reason, a burst signal detector is provided in the circuit, the TBC control voltage is alternated by presence/absence of this signal.



The above figure shows the block diagram of the Color Burst Signal Detection circuit. The video signal, obtained by detecting the re-generated RF signal, is separated from the main line for the TBC circuit and led to the Color Burst Signal Separation circuit. The color burst signal sampled here goes through the Error Amplifier, etc. and is inputted to the switch of IC12.

Similarly, the color burst signal is rectified by the diode D7, and is converted into

a DC voltage. This DC voltage detects playing of a monochrome disc with no color burst signal recorded. Also, a Horizontal Synchronizing Signal is generated out of the phase difference signals LOCK1, LOCK2 between the Horizontal Synchronizing Signal (PBHD) for playing and the Horizontal Synchronizing Standard Signal (BSHD) for TBC from the Memory Control (KAG03) in the TBC circuit, and it is inputted to the switch of IC12. At the same time, this phase difference signal for Horizontal Synchronization generation goes through D9 and D10, and is inputted to the phase-difference detector of IC16 and IC17. By that timing, it is judged whether the disc is normally being played or searched, to switch IC12.

【Video Signal Process YVL151】

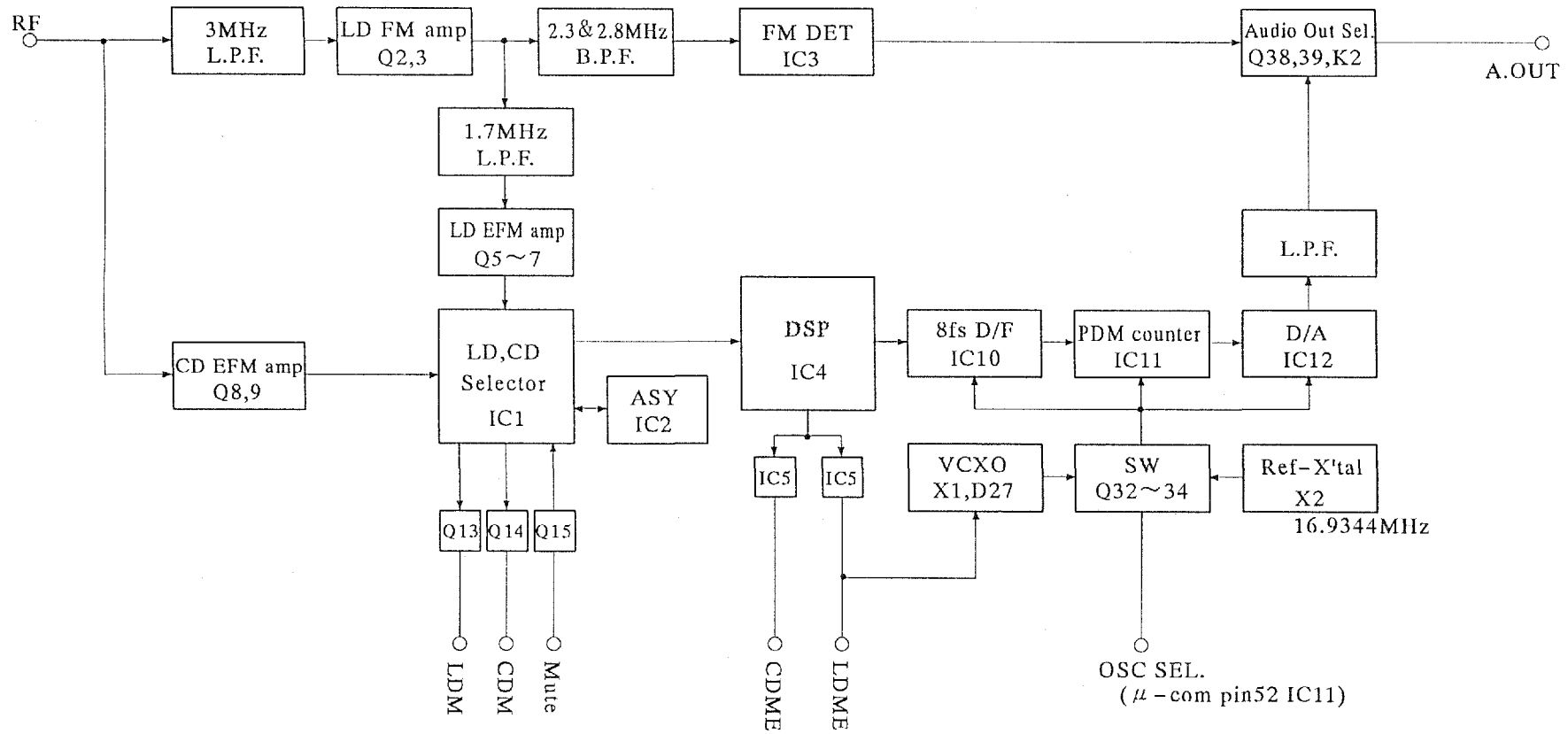
The YVL151, a video signal processing IC installed in the LVD-320, is a device made by YAMAHA for optical full-compatible players. Only one chip of this IC performs various video signal processes, such as Time Base Control, Drop-out Correction, and Noise Reduction, and Spindle Servo Control of the disk motor. The following are its features.

- The video signal is in perfect digital process of 8 bits, 4Fsc.
- It has a video A/D- D/A converter built in, and the composite signal can directly be inputted/outputted. An interface for A/D is also built in, and the result of the A/D converter can be taken in.
- A timing generator is built in for phase comparison output necessary for the PLL circuit. A digital TBC circuit is built in, which activates the PLL circuit by the 4Fsc clock and performs reading controls by the standard clock signal.
- Re-generates the Horizontal and Vertical Synchronizing Signals from the video composite signal, protects them inside, and supply them to each block.
- Performs controls of the disk motor most suitable for each play mode based on the re-generated synchronizing signal and the external FG sensor.
- Outputs the Drop-out Compensation after a color-phase correction by the internal 1H-delay circuit. Also, a video noise reduction circuit is installed to reduce picture deterioration using a digital filter.
- A character generator is built in to output various time information and characters in serial data from the microcomputer.
- 5V Single, Silicon Gate CMOS Process
- 80pin Plastic QFP

[illegible]

49

LV D - Z 1 PROCESSOR UNIT
(X32-2350)



PROCESSOR UNIT

The Processor Unit is the circuitry to generate the audio (sound) signal from the re-generated RF signal. It is mainly composed of Sound Factor Extractor section, Analog Sound Re-generator section, and Digital Sound Re-generator section. Here are descriptions for basic circuits and blocks.

① 3MHz LPF

Extracts only the sound bandwidth necessary for audio demodulation out of the spectrum distributions of the data in the laser disc.

② 2.3 & 2.8MHz BPF

To demodulate the FM Analog Sound, the FM sound carrier waves of L- channel (CH- 1) and R- channel (CH- 2) from the RF signal.

③ FM DET

The Analog Sound Demodulator IC (CA002AM) demodulates the analog FM sound. This IC also has a Noise Reduction circuit, a TBC circuit, and Stereo/ Mono Switching circuit built in, and is perfectly free from adjustment. In addition, in the LVD- Z1, for playing the digital sound, the power supply to this IC is stopped to prevent interference to the digital sound.

④ 1.7MHz LPF

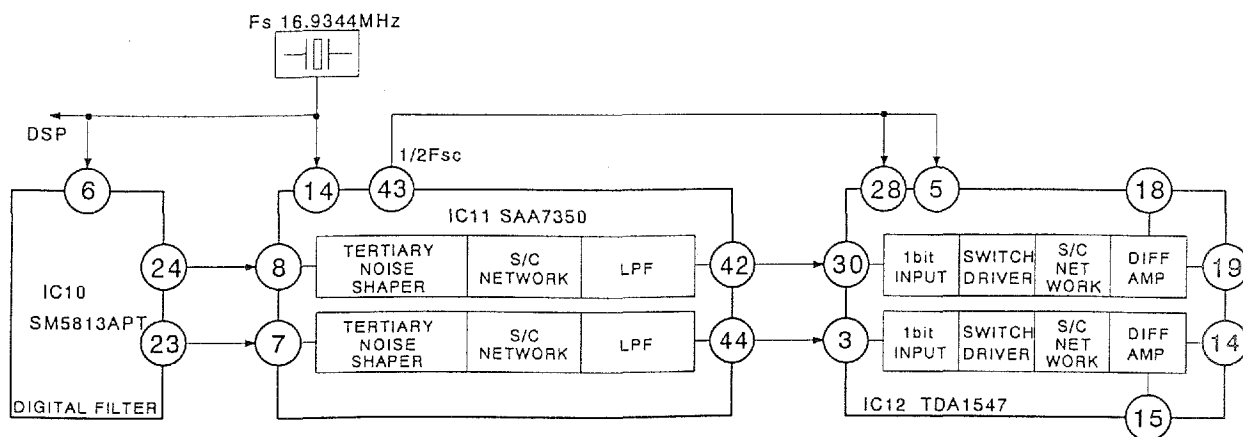
Extracts the digital sound factor in the LD. A wave shaping is given to this digital sound RF signal, then inputted to the signal processor. The RF signal of CDs directly enters the DSP circuit.

⑤ DSP UNIT

It signal- processes the inputted digital sound signal EFM, corrects the error, and leads it to the D/ A Converter circuit on the next row.

⑥ 1-bit DAC

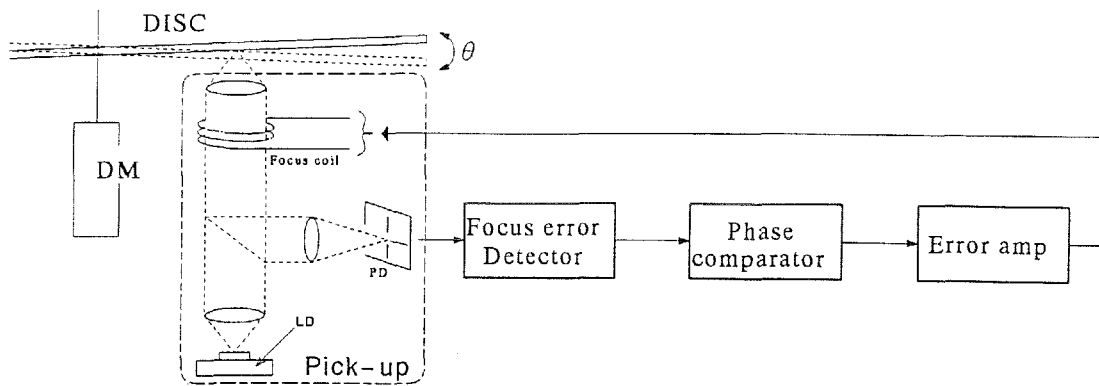
The digital signal demodulated by the Signal Processor IC is converted into 8Fs 20- bit digital sound data and outputted parallel. This data of each channel is inputted to PDM- IC, is given digital processes of Noise Shaper, Dithering, etc., and is converted into PDM signal, and is outputted as analog signal differential by Capacitor D/ A.



⑦ AUDIO OUTPUT SELECTOR

It inputs each musical signal demodulated to the Digital Sound or Analog Sound Switch circuit via the Emphasis Switch circuit. Here, it is switched to the mode determined by the microcomputer. Some models have a Sound Equalizer circuit (Midnight Theater circuit) set on the preceding row to the Sound Switch circuit.

FOCUS SERVO

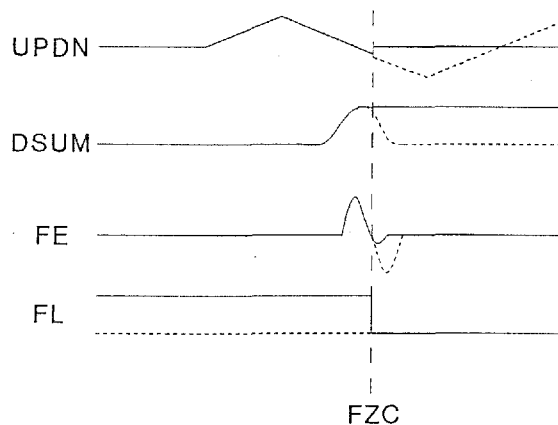


(Basic Operation)

Some pick-up units have a photodetector inside, which receives the returned beam (data) from the disk. The laser beam irradiated to this photodetector is converted into an electric signal and a Focus Error signal is generated. By correcting and amplifying Error signal and making it as the drive signal for focus coil, the laser beam emitted from the pick-up will correctly focus on the disk.

(Operation Description)

a) Focus Pull-in Action

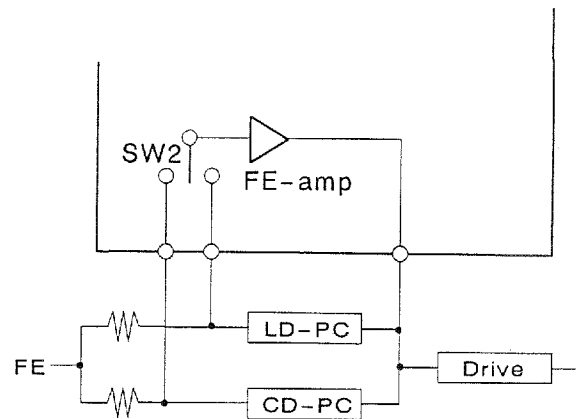


When the PLAY key is pressed with a disk set in the LD player, the pick-up goes for reading the disk. At this time, to collect data accurately, the laser beam must correctly focus on the disk. To obtain this Focus Zero Cross point (FZC), first the Object Lens in the pick-up moves up and down. This action is performed by the UPDN wave form generated by the Time Constant circuit composed of the Servo IC and a condenser externally attached. As the laser

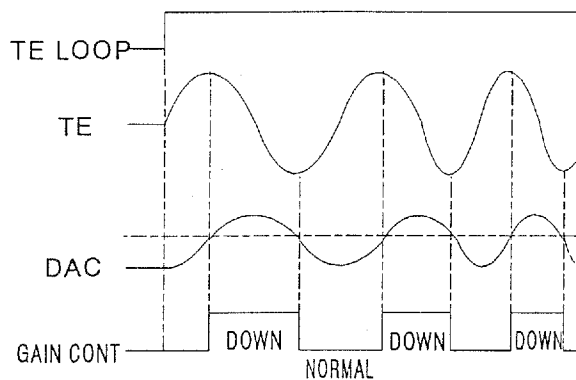
beam is naturally emitted from the diode in the pick-up at the same time, the returned beam from the disk changes in accordance with movement of this lens. The reflected beam is converted into an electric signal and is led to the Servo IC. And when certain conditions are satisfied as in the figure above (DSUM, FE), the loop of the Focus Servo is closed. When the action has been performed normally in this way, the fact that the Servo Loop is closed is informed to the microcomputer, and the operation will be moved to the next action (FL pin). This action is also conveyed as a command from the microcomputer via the three signal lines of DATA, CLK, and LACH. In addition, when the DSUM signal is missing due to scratches on the disk or external vibrations, the focus pull-in action as above will automatically be performed.

b) CD/LD Alternation

As our Laser Disk Players are all full-compatible players, they can naturally play CDs and LDs. Accordingly, depending on whether the disk to be played is a CD or LD, switching the characteristics of the Servo phase compensation is necessary. As in the figure on the left, the circuit suitable for each disk is assembled, and the appropriate phase compensation circuit is automatically selected by the instruction from the microcomputer.



c) Focus Gain Alternation



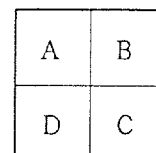
For example, when the laser beam goes across multiple tracks with the tracking loop open, the loop gain of the Focus Servo would change due to the difference of the reflecting rate between tracks (mirror surface). Therefore, at this time, the servo gain to change equivalently must be corrected. So, matching to the timing in the figure on the left, the gain is automatically alternated inside the IC.

(Actual Circuit)

We have covered the basic theory and actions of the Focus Servo. Next, let's analyze the actual circuit operation using the model LVD-Z1.

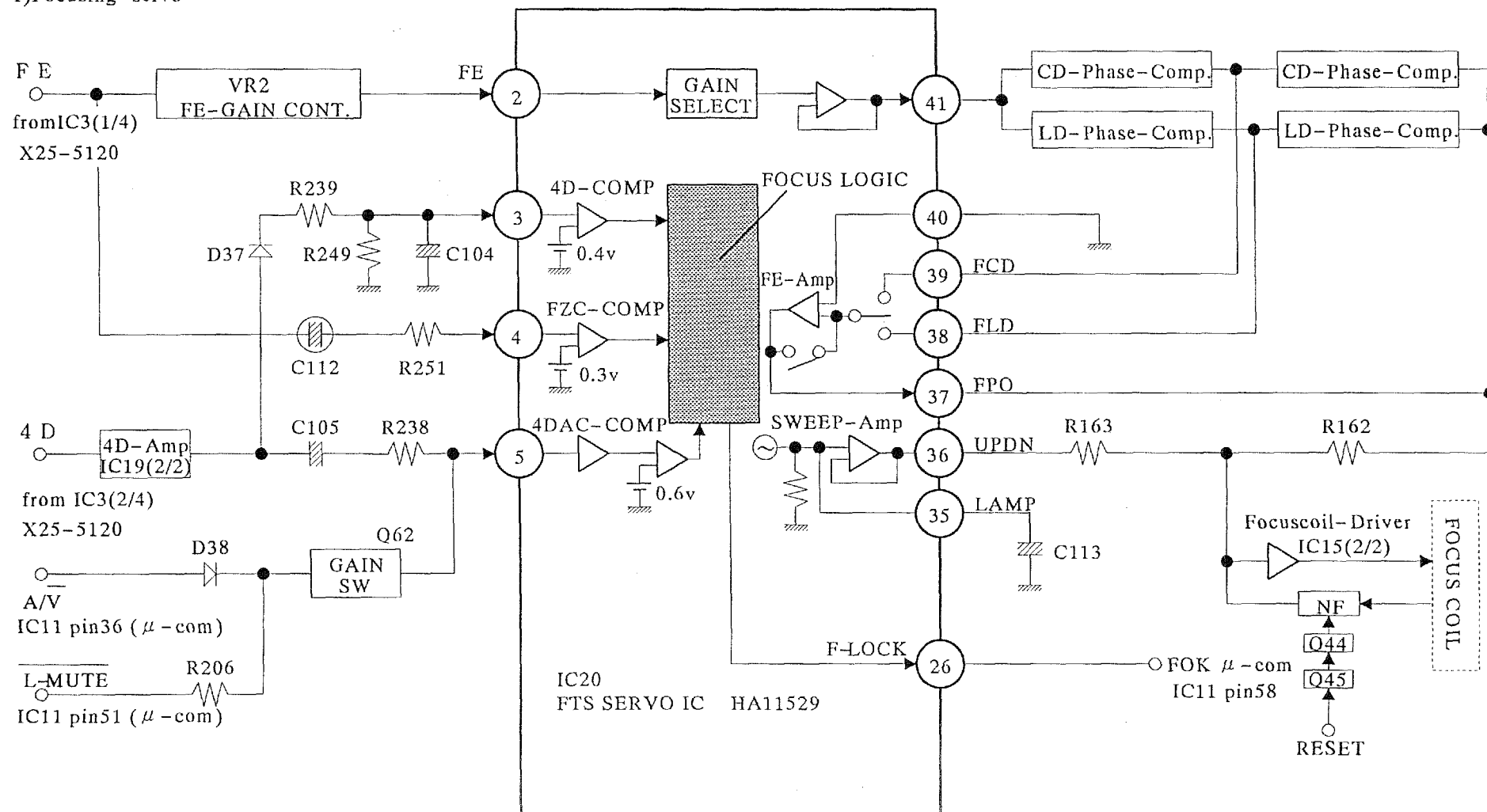
First, let's explain a little on the Focus Error Signal Generation circuit. Just as in a CD player, the laser beam returned from the disk is irradiated to the 4-division photodetector inside the pick-up, and it is converted from a light signal to an electric signal. At this time, if we name the respective detector piece A, B, C, and D, the Focus Error Signal is expressed as: $FE = (A + C) - (B + D)$. Most of our CD or LD players adopt this method, except that the LVD-Z1,320 adopts: $FE = 2(B + D) - (A + B + C + D)$. It is a method newly adopted to keep stability on the electric circuitry and decrease the damage on disk (contacting of the lens to disks). Anyway, the FE signal is thus generated and is led to the Servo Circuit on the next row.

$$\begin{aligned}
 FE &= 2(B + D) - (A + B + C + D) \\
 &= 2B + 2D - A - B - C - D \\
 &= B + D - A - C \\
 &= (B + D) - (A + C)
 \end{aligned}$$



L V D - Z 1 FTS DISC SERVO (X29-2380)

1) Focusing-servo



- ① We have taken out a block diagram of the Focus Servo section. First, the Focus Search command is transmitted from the microcomputer to the FTS-SERVO IC. On receiving this command, inside the IC, the input selection switch of FE- Amp is alternated according to the disk size, and the SWEEP- Amp is activated. For the input of this amplifier, a Time Constant circuit composed of a resistor inside the IC and a condenser C123 attached outside is installed. Using this recharge/discharge current of this C113, the SWEEP- Amp outputs a sawtooth wave. By amplifying it and leading it to the Focus Coil, the lens in the pick-up moves up and down. At this time, the laser beam has already irradiated. So, according to the up- and- down movement of this lens, the returned light volume of the laser beam will change. The changing returned light volume is converted into an electric signal by the photodetector, and the A, B, C, and D signals are generated.
- ② These A,B,C, and D signals are resistance- added to generate a 4D signal (almost the same as the RF signal), it goes through the amplifier (IC19, 2/2), and one side goes through D37, R239 and is inputted to the 3 pin. And the other side goes through C105, R238 and to the 5 pin. The signal inputted to the 3 pin is called " 4D signal", used as detect signal for the RF level at the time of focus pull- in. The signal inputted to the 5 pin is called " 4DAC signal", used as control signal for the focus servo gain at the time of searching.
- ③ The FE signal goes through the semi- fixed resistor (VR2) for gain control and is inputted to the 2 pin of the Servo IC. The FE signal goes through a different route (B.P.F. composed of C112 and R251) and is inputted to the 4 pin. Here, the Focus Zero Cross point (FZC) is recognized from the FE signal and the FZC of the laser beam is obtained on the disc.
- ④ When both the 4D signal and the FZC signal above satisfy certain condition, the loop of the Focus Servo is closed, the FE signal is sent to the Focus coil, and the lens in the pick- up is properly controlled. Also, the microcomputer is to recognize that the loop is closed by the F- LOCK pin (26 pin) turning L- level. The " certain condition " here means that the 4D signal is 0.4V or more and the FZC is recognized by a correct Focus S- shaped Curve being inputted to 4 pin. It can be said to be a similar condition for the Focus Servo routine RF, FOK, FE, SENSE signal 1s in a CD player (using a SONY device).
- ⑤ After Focus System Lock, the FE signal goes via the Characteristics Correction circuit preset for each disk, amplified, goes through R162, and becomes a drive signal by the Focus Coil Driver IC15 (2/2).
- ⑥ The input of the Control Signal (4DAC) for focus gain setting to the Servo IC is limited by the externally- attached switch (Q62). The purpose is that Q62 should be turned OFF only at the time of Video Mode, Disc Motor Unlock (for example, during

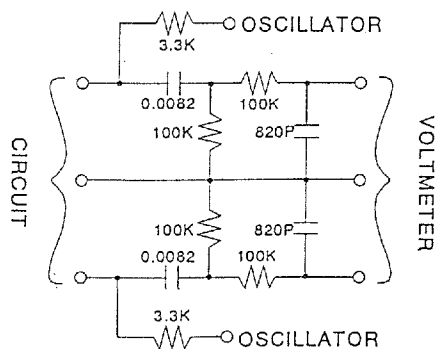
searching) to make the 4DAC signal input to the IC. In other cases, Q62 is turned ON not to input the 4DAC signal.

【Wave Form and Adjustment of Focus Servo System】

There are two basic adjustment in the Focus System. One is the Focus Balance Adjustment so that the laser beam may obtain a correct Focus Zero Cross point on the disk, and the other is the Focus Gain Adjustment to determine the current to be added to the Focus Coil so that the pick-up lens keeps its Focus Zero Cross point to the Focus Axis direction. For the way of each adjustment, refer to the Service Manual for each model. Here, let's think about the way to adjust quickly and correctly, and as simply as possible.

§ 1. Focus Balance Adjustment

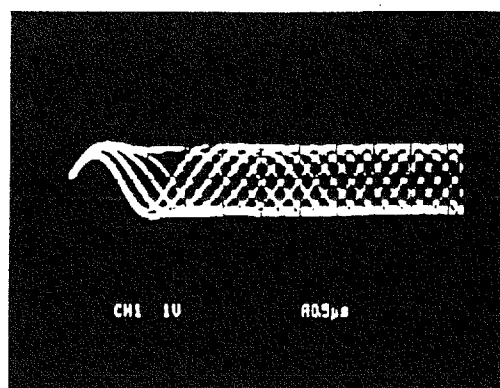
Usually in Service Manuals tell to connect an oscilloscope to the test point, observe the RF signal, and adjust it so that the amplitude of the signal may be the maximum. It is no doubt a good way of adjustment recommended by the designer. However, for those in charge of repairing, it is sometimes difficult to judge whether the RF wave form is the best or not in obtaining the maximum amplitude point. So, prepare a **disk with digital sound recorded**, play it, and try to adjust using the digital sound signal recorded on the disk. This signal is the RF signal you have well known in the field of CD players (refer to the photo below). The EFM signal in the disk is recorded at the level of - 26dB to the video FM signal, as described before. That is, as the change value in proportion to the large-level signal is applied, as it is, to the small-level signal; therefore, the change of the small-level signal naturally shows apparently.



Let's try Focus Balance Adjustment using the RF signal of Digital Sound.

§ 2. Focus Gain Adjustment

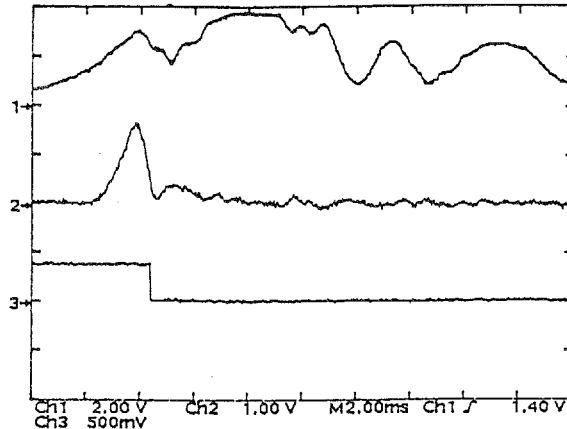
As instructed in manuals, it is most desirable to adjust using a Sine-wave Generator and two AC Voltmeters. At this time, it is recommended to use a simply Low Pass Filter, which will be enough if one as shown below is provided. If you are somewhat used to adjustment, it is adjustable by listening to the white noise from the pick-up.



【 Pick-up and Focus System 】

★Focus lock

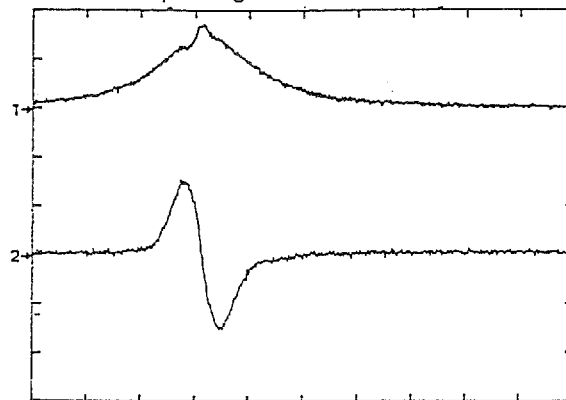
The moment of Focus Lock will be the timing as in the figure below.



CH1 4D SUM
CH2 FE
CH3 F-LOCK

★Focus S-shaped Curve

It is quite significant to measure the Focus S- shaped Curve in confirming the dynamic characteristics of the pick- up. This S- shaped Curve tells us a lot of information to us who revolves in repairing works.

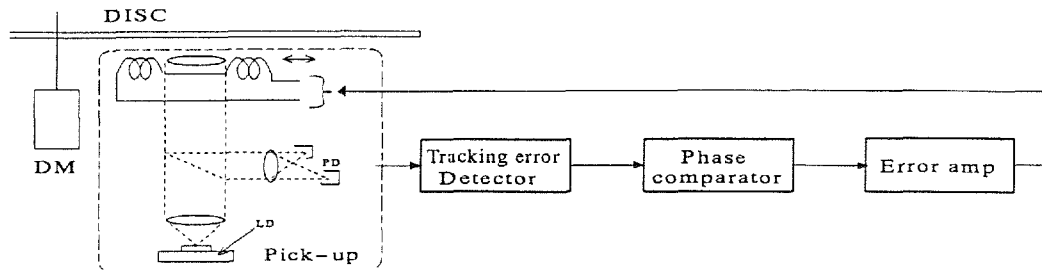


CH1 RF
CH2 FE

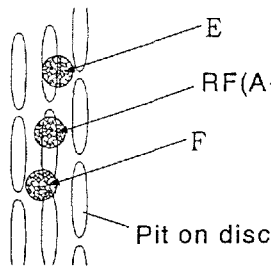
1. The S-shaped Curve is the correct sine curve as in the figure above.
2. The amplitude of this signal is always symmentric in up and down direction.
(sensitivity of the photodetector)
3. The cycle of this wave form must be enough.
($T > 4.00\text{ms}$, interlocks with the lens movement)

This S-shaped Curve cannot be verified in the normal paying condition, becaouse the Focus Lock is turning ON at the moment the disk play mode is obtained. If checking is possible without turning on the Focus Lock, the correct S- sharped Curve as in the figure above can be obtained. The way is:

TRACKING SERVO



(Basic Operation)



In the pick-up unit, a "Sub-detector" is installed, besides the Main Detector which receives the returned light (data) from the disc. The laser beam is divided into one mainbeam and two sub-beams by a beam splitter called Diffraction Grating. These sub-beams are reflectioned by the disc and irradiated to two sub-detectors (E, F). By detecting and comparing the

returned light volumes to these detectors, the main beam can be controlled to trace the desired track correctly. This is the tracking system. If the sub-beams are named E and F, the Tracking Error Signal can be expressed as in the following:

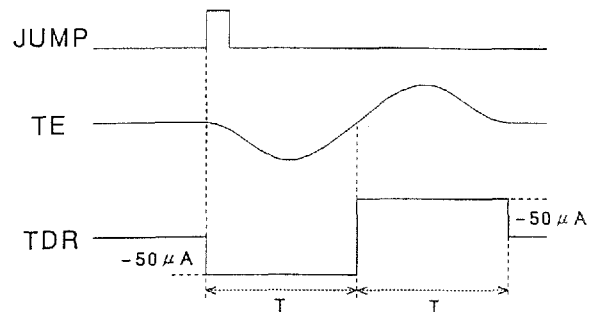
$$TE = E - F \quad (TE = F - E)$$

As in the figure above, the sub-beam position to the main beam position is correctly adjusted. So if the main beam comes to a position off the desired track, the sub-beam volumes that have been equally irradiated to E and F will lose the balance and the result of the expression above will not be a zero. The difference signal of these sub-beams is the very Error Signal (difference signal). Therefore, controlling is performed to make the result to be zero using this error signal.

(Basic Operation)

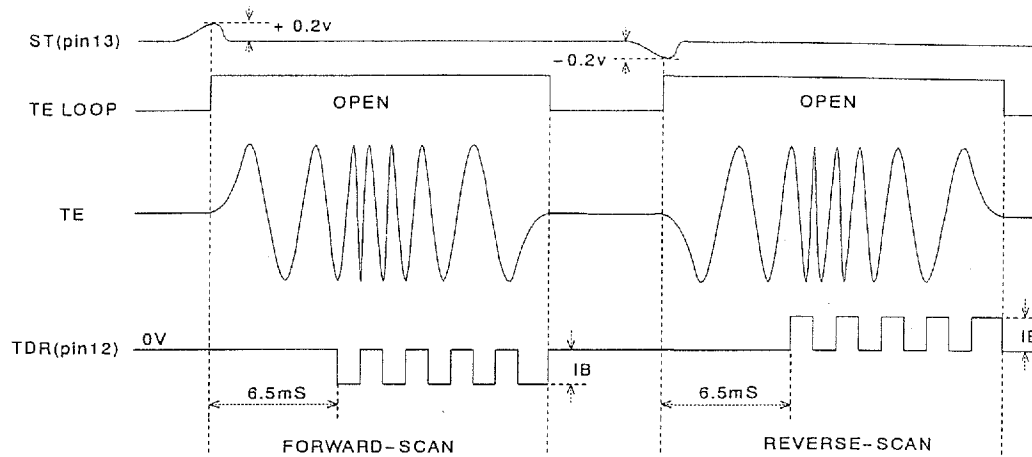
a) Pause (Momentary Stop)

Immediately after the Pause (momentary stop) command is transmitted from the microcomputer, the JUMP pulse is also inputted from the microcomputer to the Servo IC. On receiving the rising edge of this jump trigger input, the operation is started, the adjustable speed pulse is generated by being synchronized to the zero cross point of the tracking error. At this time, the internal switch is automatically alternated to lower the characteristics of the tracking group or the gain in the high band, the time delay in the logic, analog circuit is compensated, and the jump pulse is correctly conveyed to the actuator in the pick-up.



b) Scanning Operation

When the pick-up itself is moved to the destination, the tracking servo detects the displaced value of the pick-up actuator, and opens the Servo loop. And when the frequency of the TE signal becomes less than the specified value, the loop is controlled to be closed again.



The tracking loop is opened by the actuator displacement signal inputted to ST (pin 13), and the TE signal will be a traverse wave as in the figure above. And with the timing in the figure, a brake signal is generated from the TDR (pin 12). Its polarity is decided by the polarity of the signal inputted to the ST pin, and the duty ratio of the brake pulse is set in the range of 5 steps (50 to 100%) according to the displacement value of the actuator.

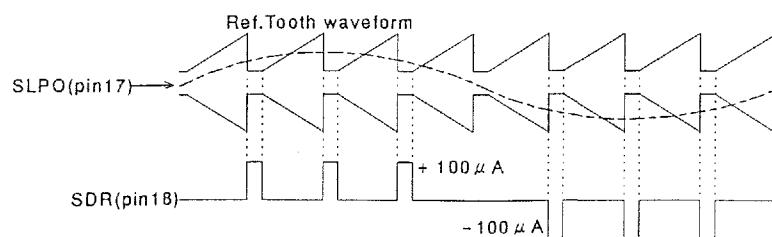
c) CD/LD Alternation

Just as the Focus System, the proper selection is automatically set inside the IC according to the disk size, and the compensation circuit for tracking that matches the disk will be selected.

FEEDING SERVO

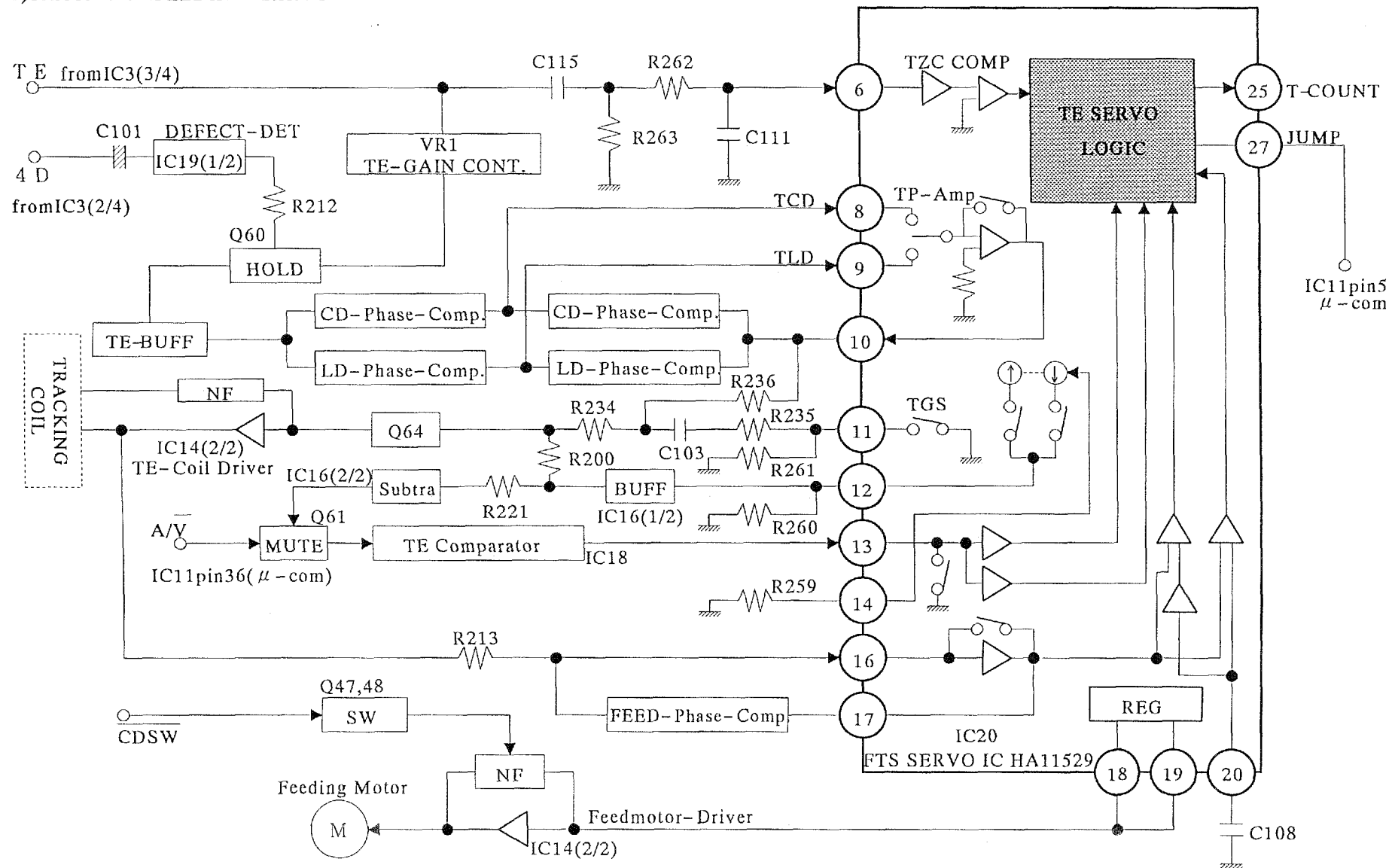
a) Normal Playing Mode

In normal playing mode, the DC factor of the drive current of the tracking actuator is PWM-modulated, and the switch inside the IC and the constant current source are driven by this PWM pulse. Also, a condenser is connected to the SLP pin (pin 20) to set the standard triangle wave.



L V D - Z 1 FTS DISC SERVO(X29-2380)

2) TRACKING & FEEDING - SERVO



(Actual Operation of LVD-Z1 Tracking and Feeding Servo)

- ① The TE signal (F- E) generated in the RF circuit goes through the semi- fixed resistor for tracking gain adjustment, then goes through the compensation circuit for each disk, and is inputted to the FTS- SERVO IC. Since the disk type is already identified by this time, the TP- Amp switch inside the IC has been selected and the TE signal is properly corrected.
- ② At the same time, the TE signal goes on another route, the BPF composed of C115, R262, R263, C111, and is inputted to the 6 pin of the Servo IC. It is for finding out the Zero Cross Point from the tracking signal, and various pause actions and scanning actions are controlled at this Zero Cross Point.
- ③ The TE signal that has gone through the characteristic correction is amplified, goes through R236, R234, Q64, and is led to the Tracking Coil to control the main beam to trace the desired track correctly.
- ④ During a track jump, the switch inside the 11 pin is turned ON to lower the gain in the high band for the tracking system. This operation is performed using only the signal in the low and medium band so that the Tracking Zero Cross point can be collected correctly during a search (Open Loop Status).
- ⑤ The tracking system is controlled as described above; however, the pick- up lens itself has a mechanically unmovable range. Therefore, to read data continuously, the pick- up itself must move. So, by inputting part of the Coil Drive Signal to the 13 pin via the Window Comparator (300ms STOP TE LIMITER) of IC18, the displacement value of the actuator is detected. By this displacement value and the TE Traverse Wave From, the brake pulse to the pick- up lens is generated and outputted from the 12 pin.
- ⑥ When the lens reaches the mechanical unmovable point, a DC-type change occurs on the TE signal. Therefore, the DC factor of this drive current is PWM- modulated to activate the constant current source inside the IC. This generated current controls the feed motor. In addition, C108 connected to the 20 pin generates the standard triangle wave for the PWM.
- ⑦ The CD/LD alternation by IC is set at the time of focus turbo driving. Besides, other functions are provided, such as muting by Q61 in case the TE stopper mode does not functions during playing a CD, adjustment for the servo gain of the feed motor by Q47, Q48, etc.
- ⑧ The status information for the tracking system is always monitored and controlled in serial data by the microcomputer. For example, for the number of track jumps during searching, a corresponding pulse is transmitted from the T- CONT pin (25 pin).

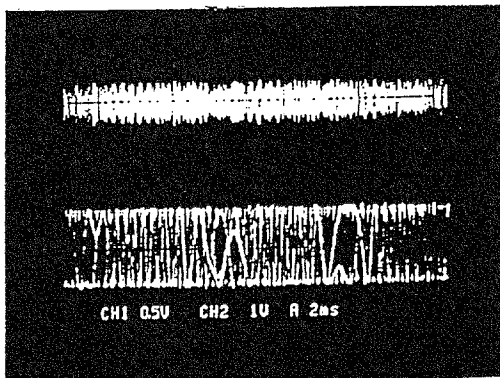
- ⑨ Scratches on the disc being played are detected by the change of the change of the envelope of the 4DAC signal. Wherever a scratches is located, the 4DAC signal amplitude becomes narrow and a pulse is generated at this position. C101 and IC19(1/2) perform this process. By turning OFF Q60 during detecting a scratch, the tracking signal is temporarily held; and when the pick-up track tracing condition is bad, the servo is not forced to follow.

【 Wave Form and Adjustment for Tracking Servo System 】

There are two basic adjustments for the Tracking System. One is the Tracking Error Balance Adjustment to correct the laser beam so that it may accurately trace the pits on the disk. The other is the Tracking Error Gain Adjustment to move the pick-up lens so that the laser beam may accurately trace the signal track in the tracking direction. For the ways of these adjustments, refer to the Service Manual for each model. Here, let's think about the way to adjust accurately, quickly, and as simply as possible.

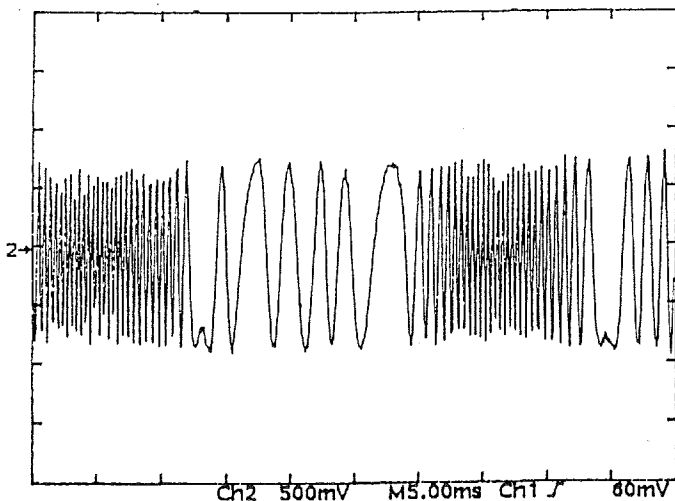
§ 1. Tracking Balance Adjustment

This adjustment is to equalize the beam quantity to be irradiated to each of the two sub- photodetectors in the pick- up. It naturally has a purpose to absorb dispersion of accuracy of the pick- up detector itself as well. Since data recorded in the spiral direction on the disc is to be serially read, actually the pick- up lens must move gradually. In other words, a certain error is always occurring to the tracking direction. To correct this error firmly, the irradiation quantity of the respective beams to the two sub- detectors must be adjusted to be equal.



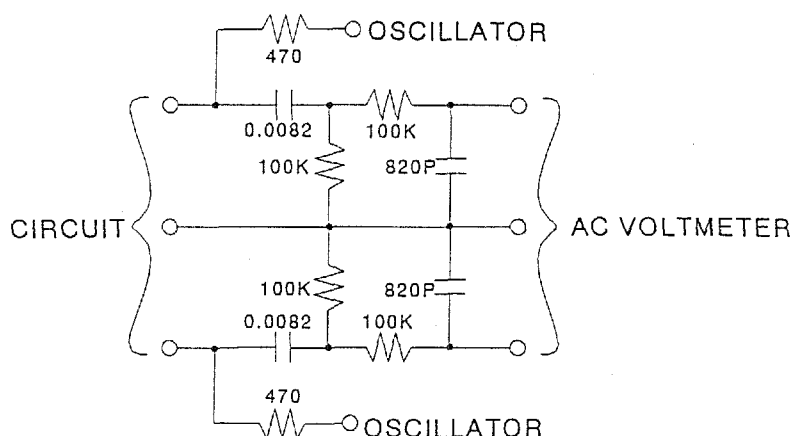
The photofrag on the left shows the RF signal (CH1) and the TE signal (CH2) when the Tracking Servo is not activated. The TE signal at this time is called Traverse Signal. Adjust the Traverse Signal to be symmetric in up-and-down direction centralizing the DC 0V line.

Also, a Diffraction Grating is installed in the pick- up body, which makes three beams out of one beam. If this Diffraction Grating makes a position difference, the Traverse wave will be a wave just like an AM-modulated one, as in the figure below.

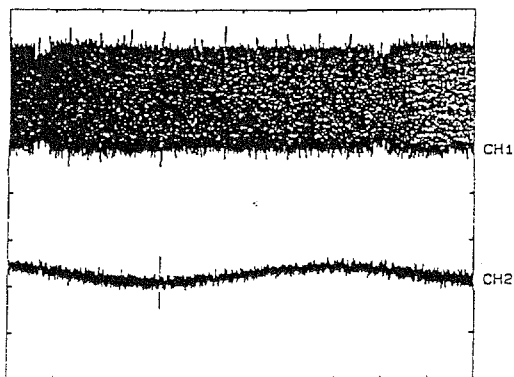


§ 2. Tracking Gain Adjustment

As instructed in the manuals, it is the most desirable way to adjust it using a Sine-wave Oscillator and two Voltmeters. At this time, a simple Low Pass Filter, such as shown in the figure below, will be necessary. When you are somewhat used to adjustment, it is possible to judge whether the tracking gain is good or not from the wave form on an oscilloscope.

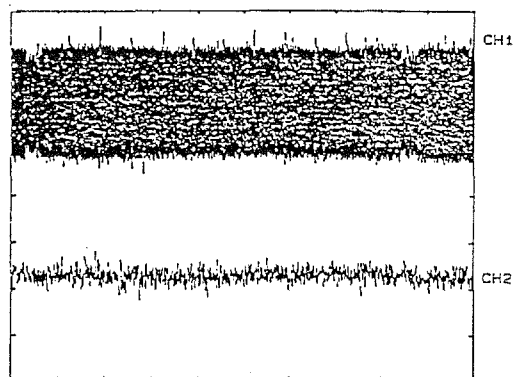


The figure below shows the RF signal (CH1) and the TE signal (CH2) observed on an oscilloscope. Depending on the difference of the TE signal, the response to scratches on the disk or the vibration-proof characteristics will vary.



★When the gain is low:

When the gain of the Tracking Servo Amplifier is low, as in the figure above, many low-band factors are seen the TE signal (swells are on the signal). In such a status, the play is too sensitive to shocks from outside and sound-skipping, picture-skipping, etc. will occur too easily.

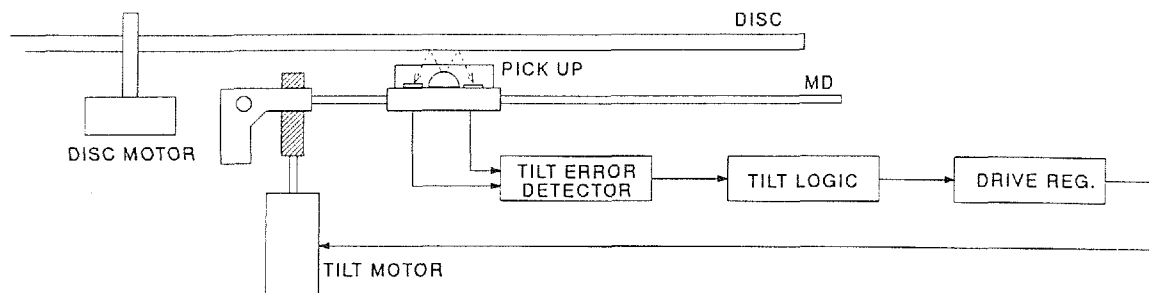


★When the gain is high:

When the gain of the Tracking Servo Amplifier is as high as in the figure above, many high-band factors are seen the TE signal (in some cases, oscillations have occurred). In such a status, the player is abnormally sensitive to scratches on the disk, causing flickers, noises, etc. on the screen.

To adjust the tracking gain, it will be most appropriate to set it to the intermediate value between those values of the TE signals in the two figures above.

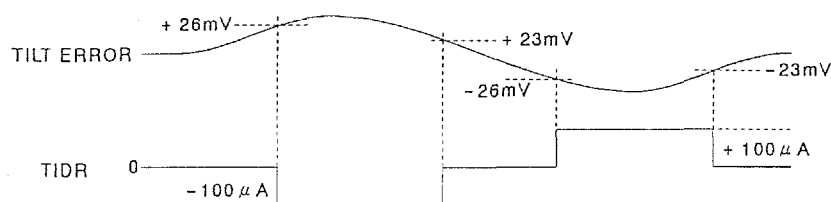
TILT SERVO



(Basic Operation)

A unit called "Tilt Sensor" is installed in the pick-up body. It is a system that a luminous element emits a beam, two photo-receiving sensors receive the beam, and the disk and pick-up are positioned parallel to each other by comparing the quantities of the two. Especially, in case of an LD, the disc diameter is large, and even a little warp or distortion will greatly affect the playing operation.

(Description on Operation)



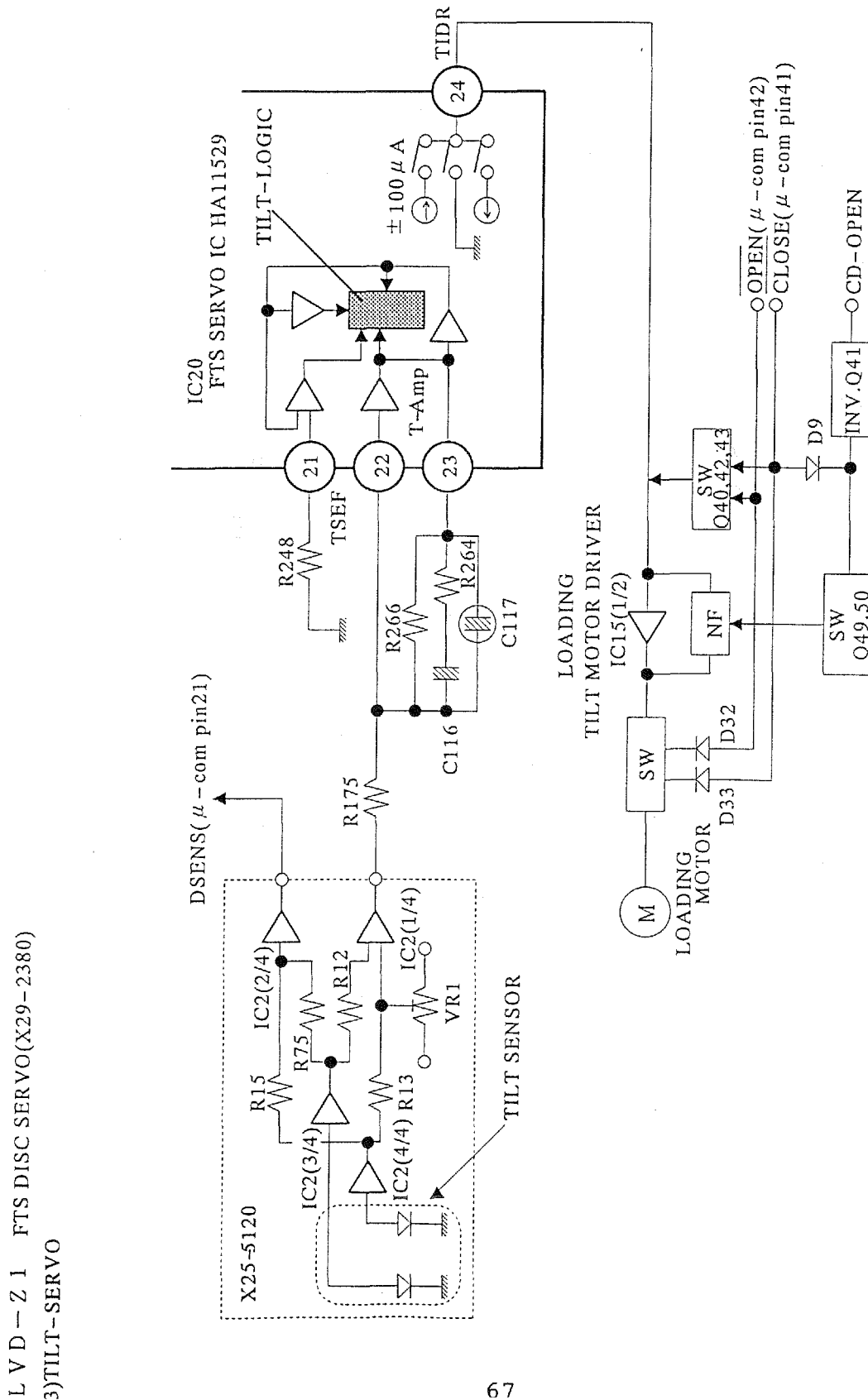
When a Tilt Error signal is inputted to the FTS Servo IC, it is monitored by the comparison standard voltage for Servo ON/OFF inside the IC, and the Tilt Monitor Drive current is generated (see the figure above). Around outer tracks of a disc (after about 4,000 frames on a 12 inch CAV disc, after about 40 minutes on a 12-inch CLV disc, after about 12 minutes on an 8 inch CLV disc, after about 2 minutes on a CDV video part), the Tilt Servo being opened. In case of a CD, the Tilt Servo is first activated just after focus is turned ON, tilt of the pick-up is corrected, then the action is finished.

(Actual Operation of the Circuit)

① In case of the LVD- Z1, a Tilt Error signal is generated by voltage-converting the two sensors, then taking the difference signal. And this signal goes through R175, one part of it is inputted directly to the Servo IC 22 pin, and the other part goes through the BPF and is led to the 23 pin.

②Also, inside the IC, the Servo OFF standard voltage is set by R248 (for deciding hysteresis) connected to the 21 pin. By comparing the inputted error signal with the the ON/OFF- standard voltage and matching to its timing, the Tilt Motor Drive current is generated.

③The Tile Motor is commonly used as the disk Loading Motor. The two Tilt Error currents are added on one hand and is used as the Disc Detection Signal.



【Tilt Servo Balance Adjustmen】

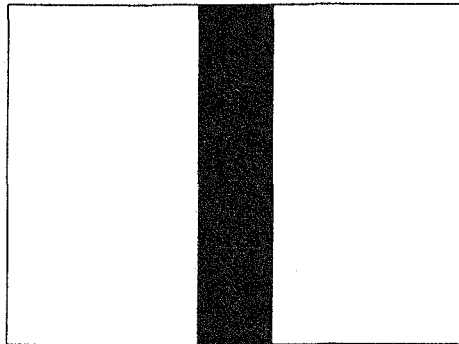
For adjusting the Tilt Balance, the two ways stated below are generally accepted. Either way enables adjustment. However, the way in § 2 will be easier to check the condition and more appropriate if you get used to it.

§ 1. Adjusting Using an Oscilloscope

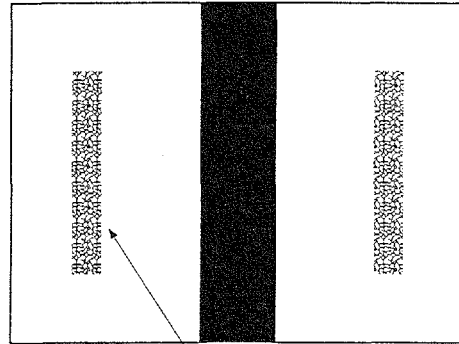
Re-generate Frame No. 20000 of a CAV disc with digital sound recorded. Adjust the wave form observed there (eye pattern) so that the amplitude may be maximum.

§ 2. Adjustment Using a Monitor TV Set

Connect a monitor TV set to the video output. Here, re-generate frame No. 19001 of a LD TEST DISC. You will see a picture as those below. Adjust it so that no black cross talk called " moire " may appear in the white parts on both sides.

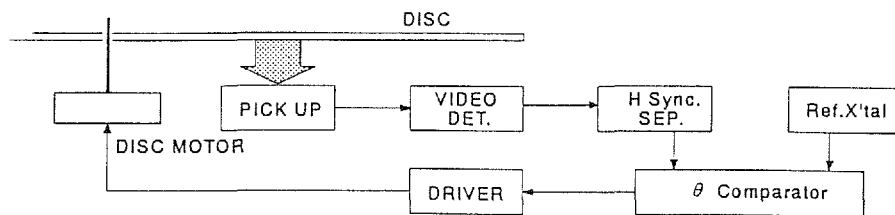


〔WELL ADJUSTED〕



CROSSTALK

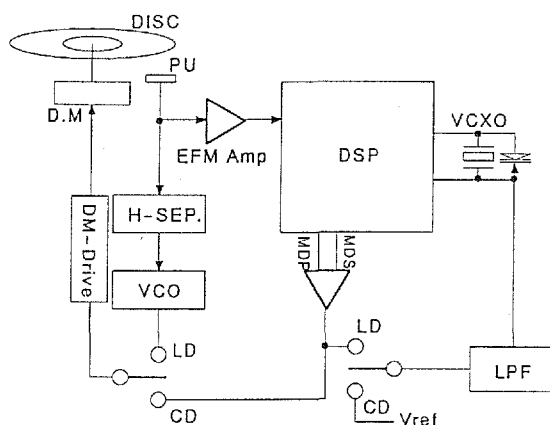
DISC MOTOR SERVO



Basic Operation)

A disc is started up to 1800 rpm, a Synchronizing Signal is separated from the Re-generation Video Signal to perform a constant control even with a high-speed revolution, it is compared with the standard crystal oscillation output in the player, and as Error Signal is generated. By this Error Signal, the Disk Motor is controlled.

(Descriptions on Operation)



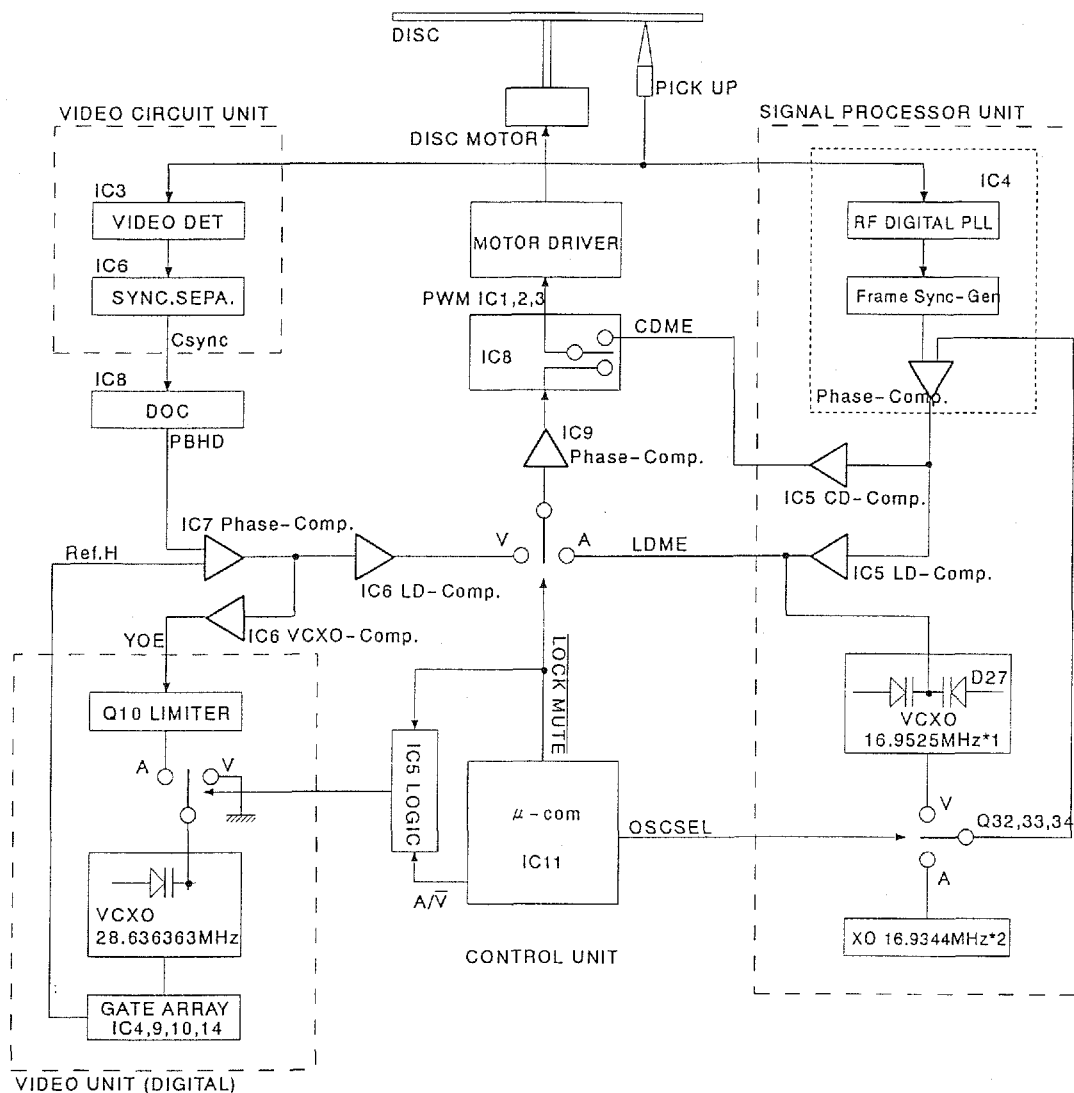
As described above, the revolution of the Disc Motor in the normal LD playing mode is controlled by the Horizontal Synchronizing Signal (H-Sync.= 17.75KHz). Accordingly, in case of a disc with digital sound recorded, the re-generation clock (4.32MHz) of the sound signal cannot be synchronized to the disc motor revolution cycle. That is, the sound will not go along with the picture in the long run. Therefore, a VCXO unit is provided in the sound re-

generation system, and the system clock is made to be variable to synchronize the sound system to the video system. As for the way, data of the sound system is taken in with the frequency (controlled by the video system) different from the ordinary system clock; therefore, the Disc Motor Error signal (MDS, MDP) naturally includes many errors. By controlling the standard crystal (VCXO) with this error signal, the sound system is synchronized to the video system. In other words, the Sound in LDD playing is re-generated in a form including time differences more or less. The VCXO is fixed to 16.9344MHz.

★ACCURATE LD REFERENCE MASTER CLOCK OPERATION

As described above, the disc revolution control in LD playing is demodulated on the basis of the control signal of the video system. Accordingly, the sound jitter to occur by varying the standard re-generation frequency for audio has been a problem.

So, in the LVD- Z1, the disc revolution is designed to be controlled even for an LD with digital sound recorded. Also, the video re-generation standard clock is changed into VCXO and a highly capable TBC circuit is provided, to eliminate the video jitter and control its noise due onto the screen. However, in case the Disc Servo is controlled in the sound system, such a servo bandwidth large enough as that for CDs cannot be obtained. So for play start-up, etc., it is alternated to control it by the video re-generation standard clock.

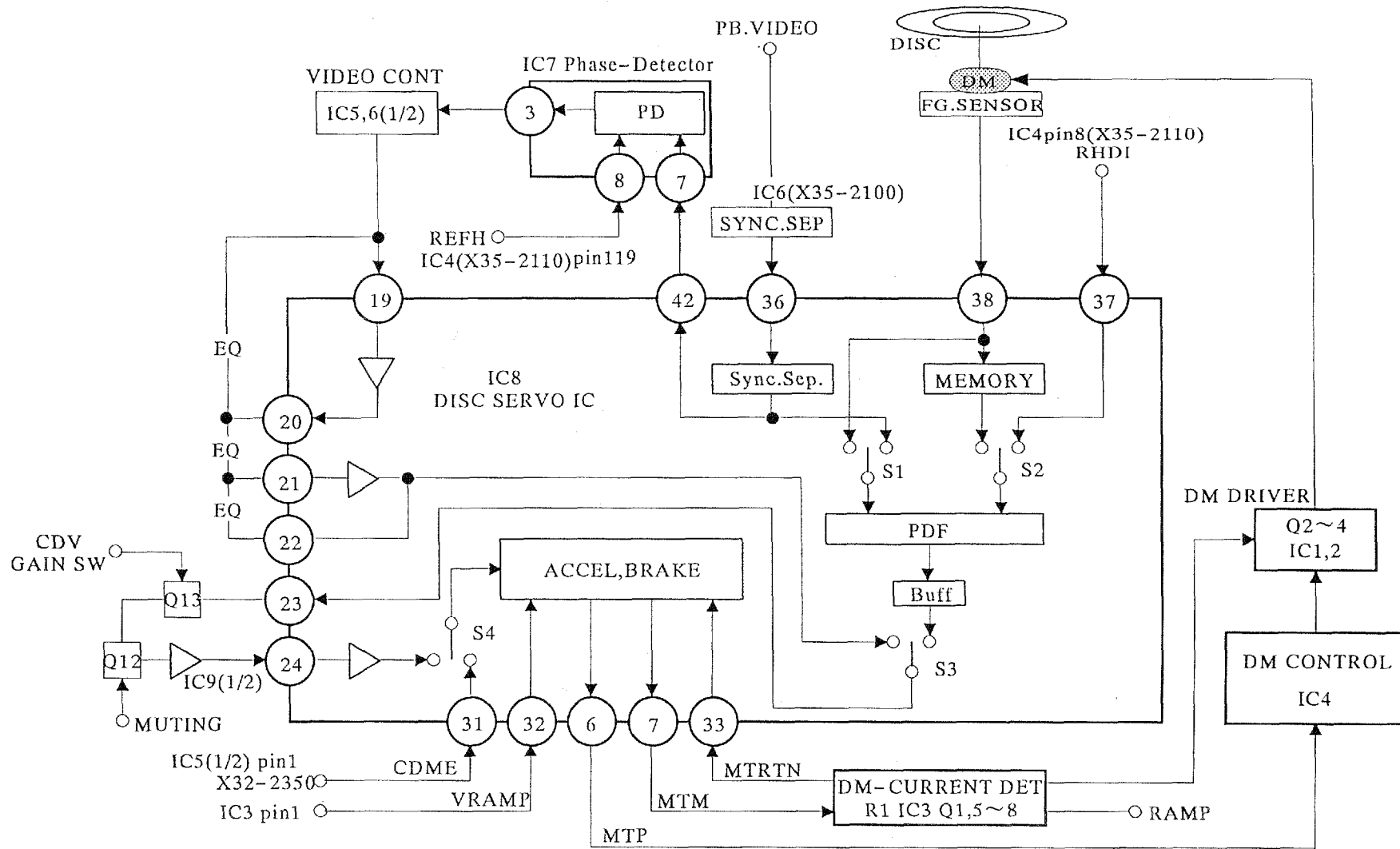


In the Signal Process Unit, two circuits — a crystal oscillator of fixed type and a VCXO — are separately provided, and each of them is alternated for use. The standard oscillation of the video unit is controlled by alternating the error voltage to be added to the variable-capacitor diode of the VCXO.

The LOCK MUTE signal of the main microcomputer turns H-level only at playing an LD

L V D - Z 1 FST DISC SERVO(X29-2380)

4)DISC MOTOR SREVO



with digital sound, and turns L- level in other cases (turns L- level in the V LOCK mode also). Also, the OSCSEL signal turns H- level for a CD or a LD with digital sound, and a fixed type of crystal oscillation circuit is activated for the oscillation of the Signal Processor Unit (the OSCSEL signal turns L- level and the VCXO circuit is activated for others). In addition, the OSCSEL signal does not change at searching.

As described above, when a disk with digital sound is being played, the fixed oscillator is activated for the standard oscillation of the playing system. However, to cope with such cases as the disk is defective (frequency difference in video signal output, etc.) or more beautiful pictures are desired, the master clock of the playing system can be alternated. The operational procedure is: Set the disc, then press the three buttons of STOP, 《,》, and KEY simultaneously, and the mode is switched.

①When the power is turned OFF, the VRAMP voltage (triangle wave) for Disc Motor start-up is inputted to the Disc Servo IC 32 pin. Therefore, the information that the Focus Servo is locked is received in serial data. Then this IC alternates its internal switch to utilize the VRAMP voltage and start up the Disc Motor. The Disc Servo gain has been set for driving LDs, therefore, it would be quite large for driving CDs. However, identification of the disc is controlled by automatically varying the VRAMP in accordance with the disc type.

②In case of a CD, the CDME signal is inputted from the 31 pin and the Disc Servo is controlled. That is the same operation with ordinary CD players. In case of a CDV disc, the disk start-up itself is the same as the CD operation, but the operation is shifted to the playing action of the video part at the time the TOC is read.

③In case of an LD (accurately, for playing a video system), first the disc revolution is started up to 1800 rpm using the FG sensor (38 pin input) attached to the Disc Motor. As the FG sensor is of 24 pulses per round, it is controlled by the microcomputer unit the FG revolution reaches 720Hz.

④When the disk revolution reaches 1800 rpm, data reaching becomes basically possible. At this moment, the Servo IC alternates the internal switch, the Horizontal Synchronizing Signal for the Re- generation Video Signal inputted to the 36 pin is outputted from the 42 pin and inputted to the phase comparator of IC7. The Standard Horizontal Synchronizing Signal (REFH) is also led to the phase comparator and both are compared each other.

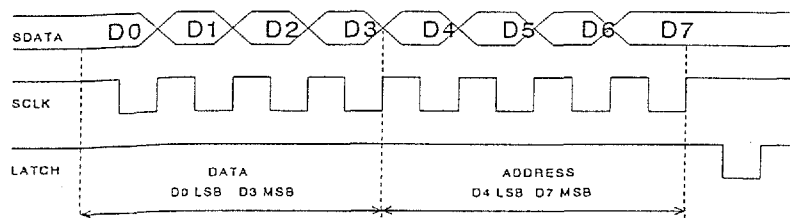
⑤The compared Horizontal Synchronizing Signal becomes an Error Signal for Disk Motor driving, processed with phase compensation and amplification, then is sent to the Disc Motor.

⑥If the disc being playing at this time is one with digital sound, the TOC information called " Phillips Code " is read from the disc on reaching the disc revolution of 1800 rpm. By a command from the microcomputer, the Error Signal of this disk servo is switched to the signal of the sound system (same as CDs).

⑦A resister R1 ($0.47\ \Omega$, 1W) is in the Disc Motor Drive Current Detection Circuit. The Disc Motor Drive current is controlled by the current flowed through this resister.

【DISC MOTOR IC HD49403】

Here, descriptions are added on main specifications of STBC Control IC. The command from the System Control Circuit is input through the Data Signal (1 pin), the Clock Signal (2 pin), and the Latch Signal (3 pin), and the internal status of the STBC device is outputted from the Sense Signal (4 pin). Data is an 8-bit serial data, and the relations with the Clock and Latch signals are shown in the figure below. The data contents are common with the FTS circuit, and are distinguished by the difference of its address.



①Basic Signal Generation

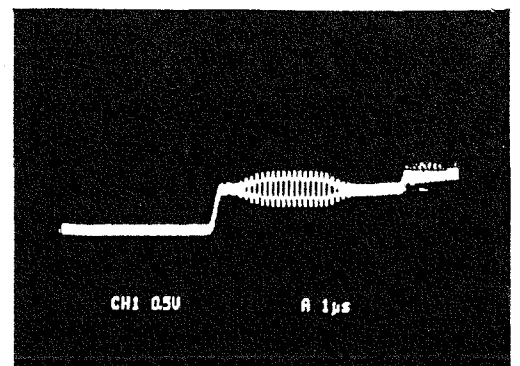
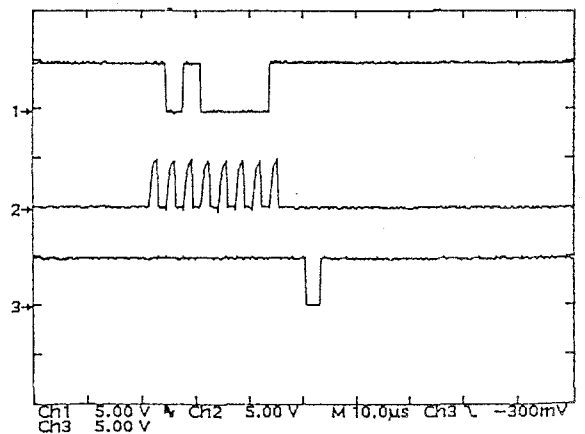
The Fsc generated by the System Control Circuit is inputted to the 10 pin, the standard Horizontal Synchronizing Signal from the 8 pin, 2Fsc from the 40 pin, Fsc from the 41 pin, 500KHz from the 39 pin are generated and output.

②Burst Signal Detection

The Burst Signal portion of the video signal is inputted from the 15 pin, is compared with the internal Fsc, and is output from the 15 and 28 pins.

③FG System

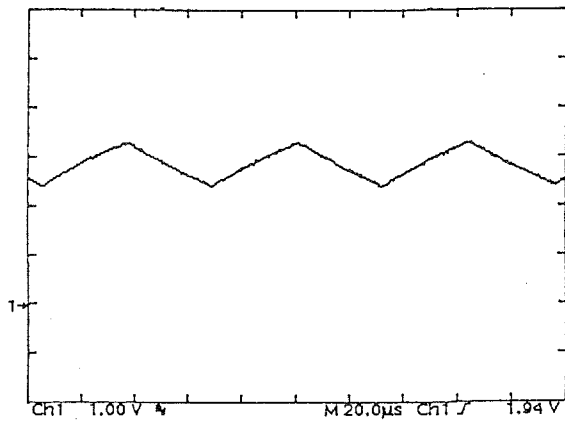
If the Re-generation Synchronizing Signal becomes missing due to a focus-down status, scratches on the disk, etc., the Disc Motor revolution cannot be controlled. Therefore, the FG system is used. The FG signal inputted through the 38 pin is inputted to the Memory circuit and its value is stored. When missing of the Synchronizing Signal has occurred,



the disc revolution before the missing of the Synchronizing Signal is kept by comparing the FG value in memory with the re-generated FG value.

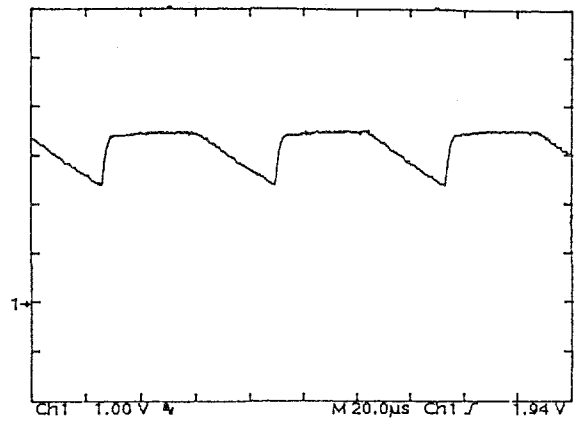
④ Disc Motor Control Circuit

Disc Motor Drive Signal is compared with the 32-pin Standard Triangle Wave, PWM-modulated, and output from the 7 pin. The 6 pin is the pin to instruct the motor revolution direction. This standard triangle wave is alternated according to the disc type, as in the figure below.



⑤ CD Playing

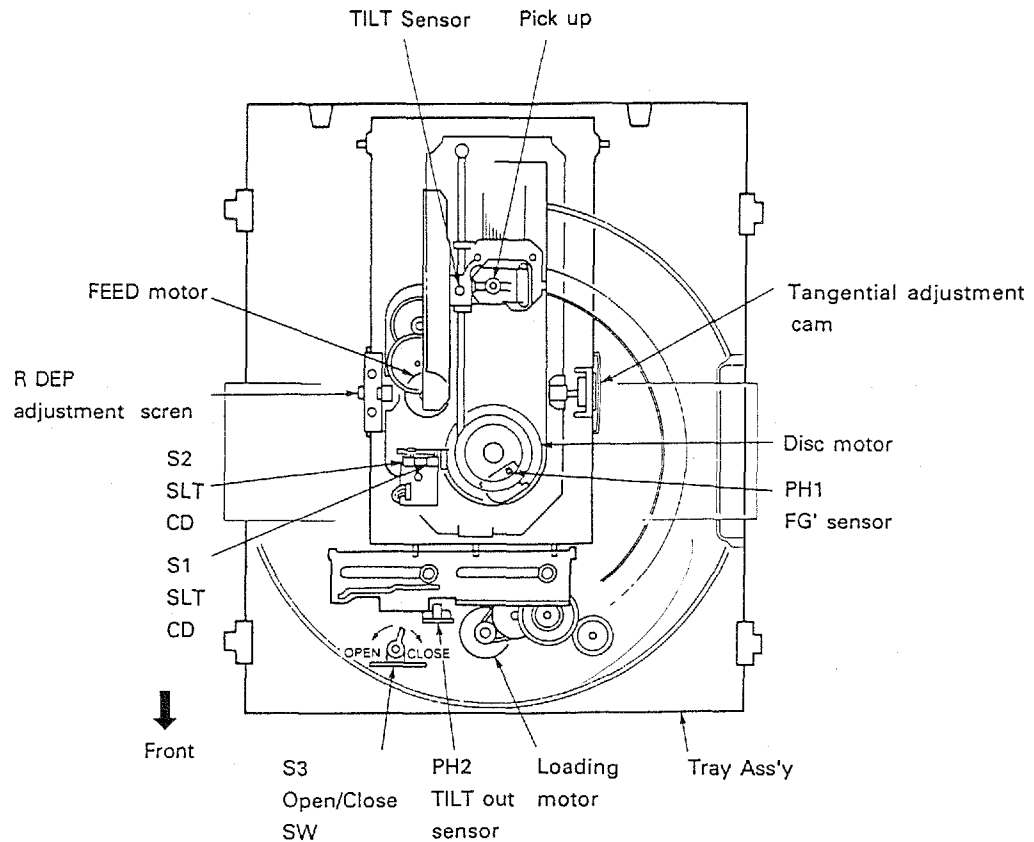
IN playing the audio part of a CD or CDV, the Error Signal is inputted from the Digital Audio Circuit to the 31 pin, and it is activated as the Disc Motor Drive Signal. To the 33 pin, the voltage is inputted in proportion to the current flowed to the motor, forming a current feedback circuit.



This RAMP voltage is above DC 2.5V (Standard Voltage for Disc Motor Start-up).

THE STAGE 3
MECHANISM . LSI

MECHANISM OPERATION DESCRIPTION



1. TRAY OPEN

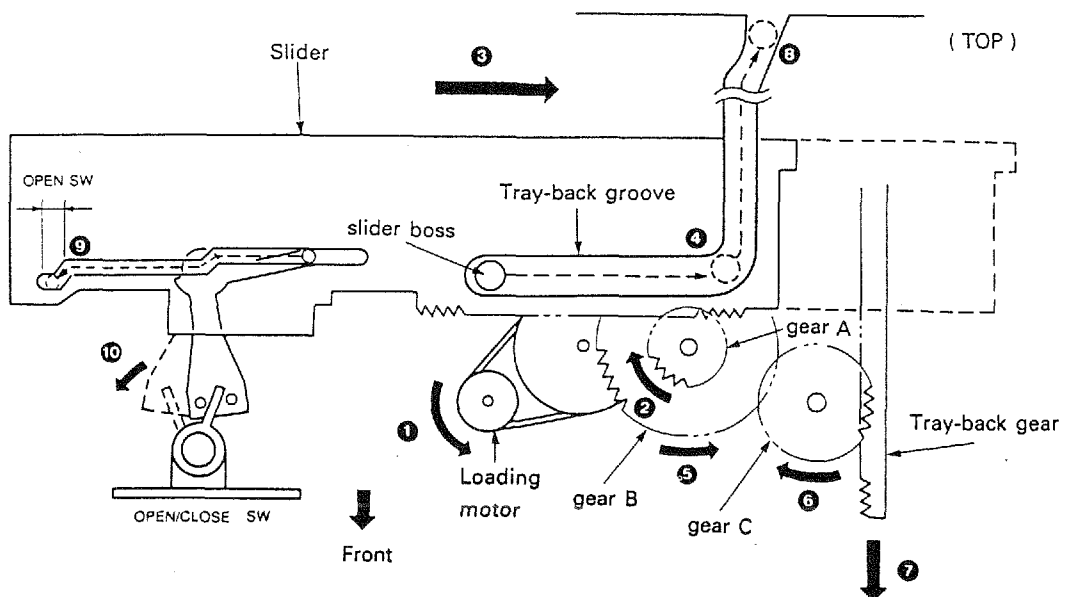
The loading motor turns to the arrow direction (1) when pushing Tray-open button on the front panel.

The gear (A or B), which is not locked, starts to turn. In this case, the gear A turns to arrow direction (2) because the tray is locked by slider boss.

The slider starts to move to arrow direction (3) by the gear A. The Slider boss moves rightwards along the groove of the tray-back. The gear A and the slider stop when slider boss at the groove-end of the right side (4).

At this time, the tray-lock function is free because slider boss is in front and backwards. The gear B starts to turn to arrow direction (5) and the gear C (6), too. The tray-open function (7) starts when the gear of the tray-back moves.

The slider boss moves rightwards slightly (8). This movement (9) changes switch to arrow direction (10) and tray-open function is finished perfectly.

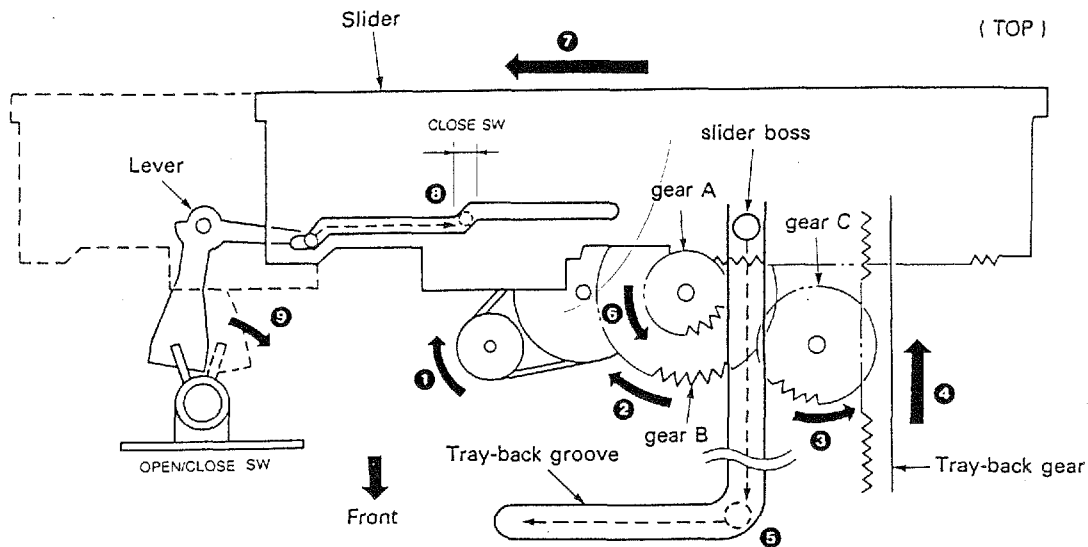


MECHANISM OPERATION DESCRIPTION

2. TRAY CLOSE

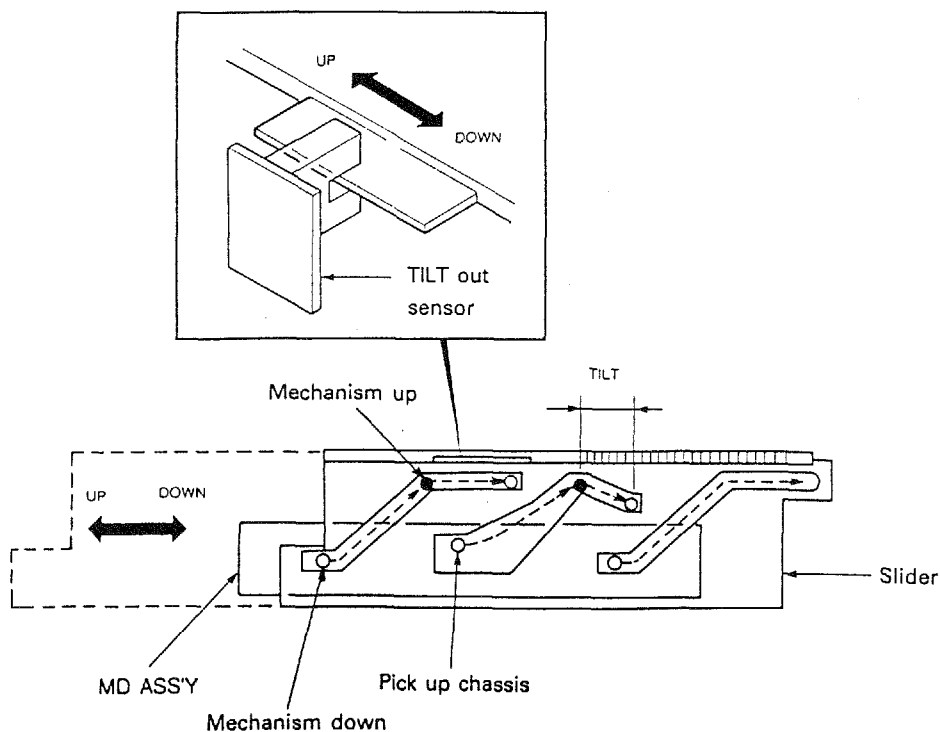
The loading motor turns to the arrow direction (①) when pushing Tray-close button on the front panel. Both gear B and C start to turn to arrow direction (②) (③). The tray-close function (④) starts by the gear of the tray-back. The gear B stops to turn when slider

boss moves at the point (⑤) from front and backwards to right and leftwards. The slider moves to arrow direction (⑦) when the gear A starts to turn (⑥). The slider moves the lever (⑧) and the lever changes switch to arrow direction (⑨), and the tray-close function is finished perfectly.

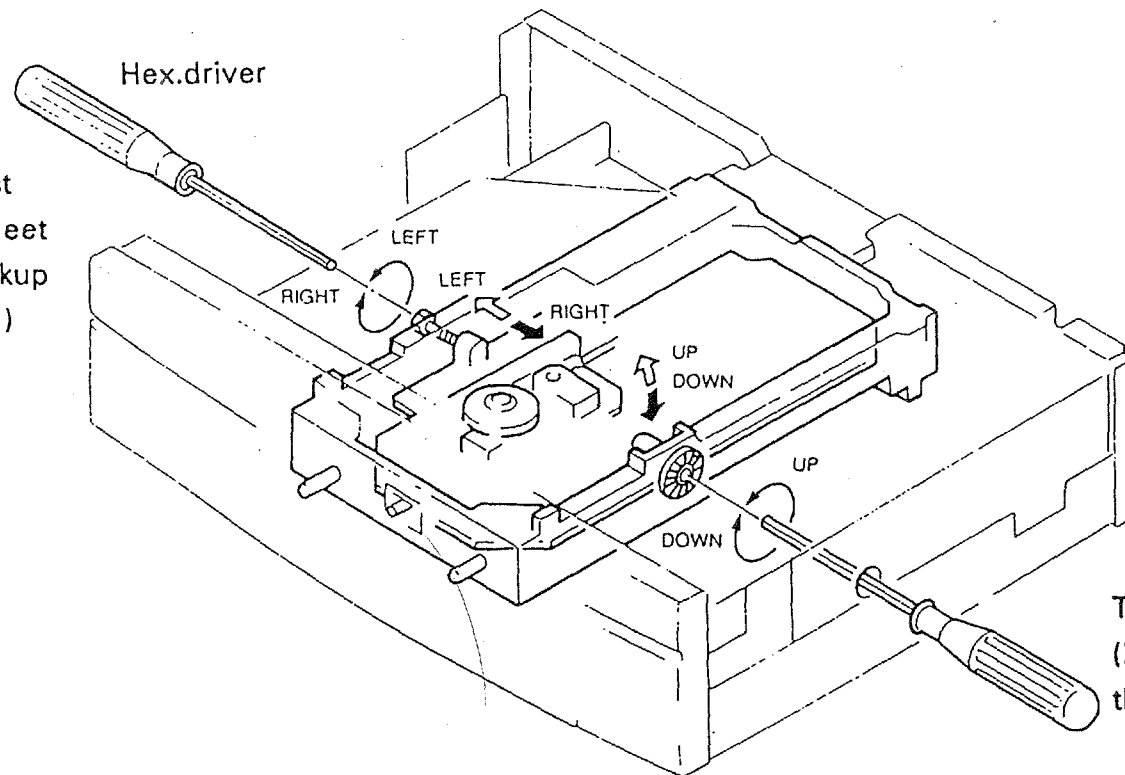


3. TILT

The slant of slider-center groove holds up position leads the tilt function after the pickup ass'y holding up position.



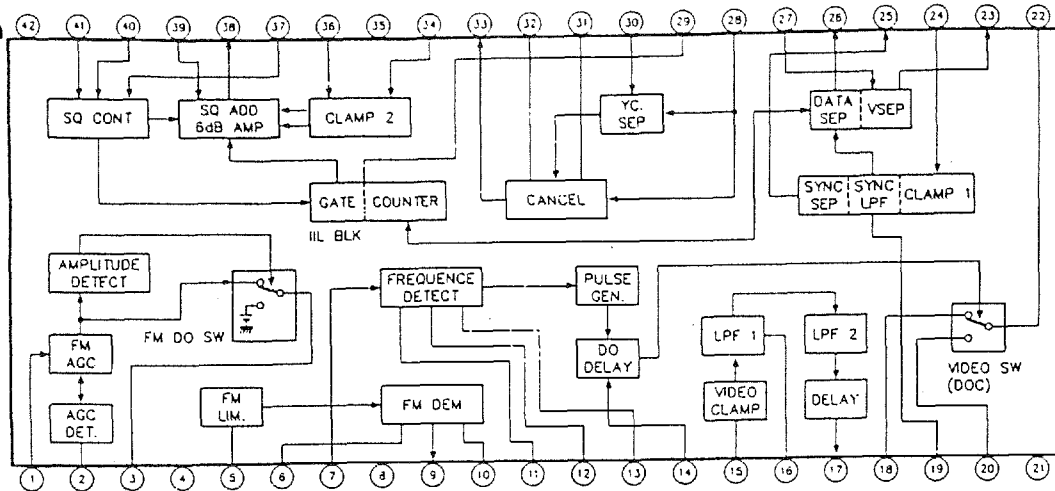
Radial-Dependence adjust
(slide the pickup to meet
with the center of the pickup
and that of the turntable.)



Tangential adjust
(Keep the disc horizontally for
the pickup)

Video Signal Processor: HA11528NT

Block Diagram

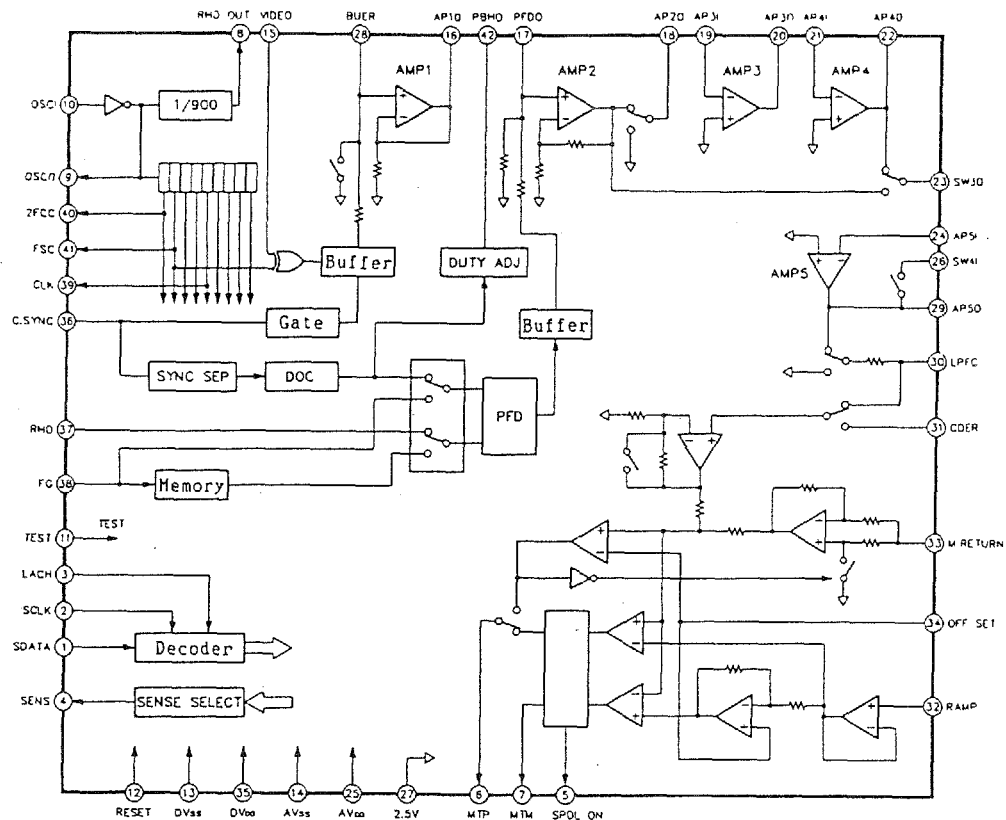


pin functions

Pin No.	Name	I/O	Description	Pin No.	Name	I/O	Description
1	FM IN	I	FM AGC circuit input pin	22	VDO OUT	O	Video signal output pin after DO compensation
2	AGC filter	I	AGC gain/frequency characteristic set pin	23	VD	O	Vertical sync separator output pin
3	AGC OUT	O	FM AGC circuit output pin	24	SEPA IN	I	Sync separator input pin
4	FM GND	-	FM signal system ground (GND) pin	25	C-SYNC	O	Sync separator output pin
5	FM IN	I	FM demodulator input pin	26	DATA	O	Disk data separator output pin
6	GAIN	I	FM demodulator output amplitude adjustment pin	27	V IN	I	Vertical sync separator input pin
7	DO DET IN	I	DO detector circuit input pin	28	NCY	I	Noise canceler Y signal input pin
8	Vcc	-	FM signal system Vcc supply pin	29	INJ	I	Internal I ² L circuit injection pin
9	DEM.OUT	O	FM demodulator output pin	30	NC	I	Noise canceler video signal input pin
10	SENS ADJ.	I	FM demodulator sensitivity set pin	31	NC.ATT	I	Noise cancel attenuation set pin
11	DO DET. filter	I	Capacitor connection pin for DO detector filter	32	HPF	I	Noise cancel frequency characteristic set pin
12	DO ADJ	O	DO detector frequency adjustment pin	33	OUT	O	Noise cancel video signal output pin
13	DO DET filter	I	Capacitor connection pin for DO detector filter	34	IN	I	6-dB amplifier output pin
14	DO INH	I	DOC function inhibit control pin. Inhibit when high	35	Vcc	-	Video signal system Vcc supply pin
15	IN	I	Internal delay circuit input pin	36	EXT VIDEO	I	Video signal input pin for screen display
16	for ADJ	I	Internal delay fo adjustment pin	37	SQ	I	FM demodulation video signal squelch pin. Squelch when high. (An external video signal at pin 36 is output.)
17	Filter OUT	O	Internal delay output pin	38	VIDEO OUT	O	6-dB amplifier output pin
18	OH	I	Video signal input pin before DO compensation	39	NFB	I	6-dB amplifier negative-feedback input pin
19	SYNC Filter	I	Filter for sync-separation slice level setting	40	BACK	I	Character black frame signal input pin for screen display. The black frame is displayed when high.
20	1H	I	One horizontal line delay video signal input pin for DO compensation	41	CHARA	I	Character signal input pin for screen display. Display when high; no display when low.
21	GND	-	Video signal system ground pin (before TBC and CCD)	42	GND	-	Video signal system ground pin (after TBC and CCD)

Disk Servo HD4903NT

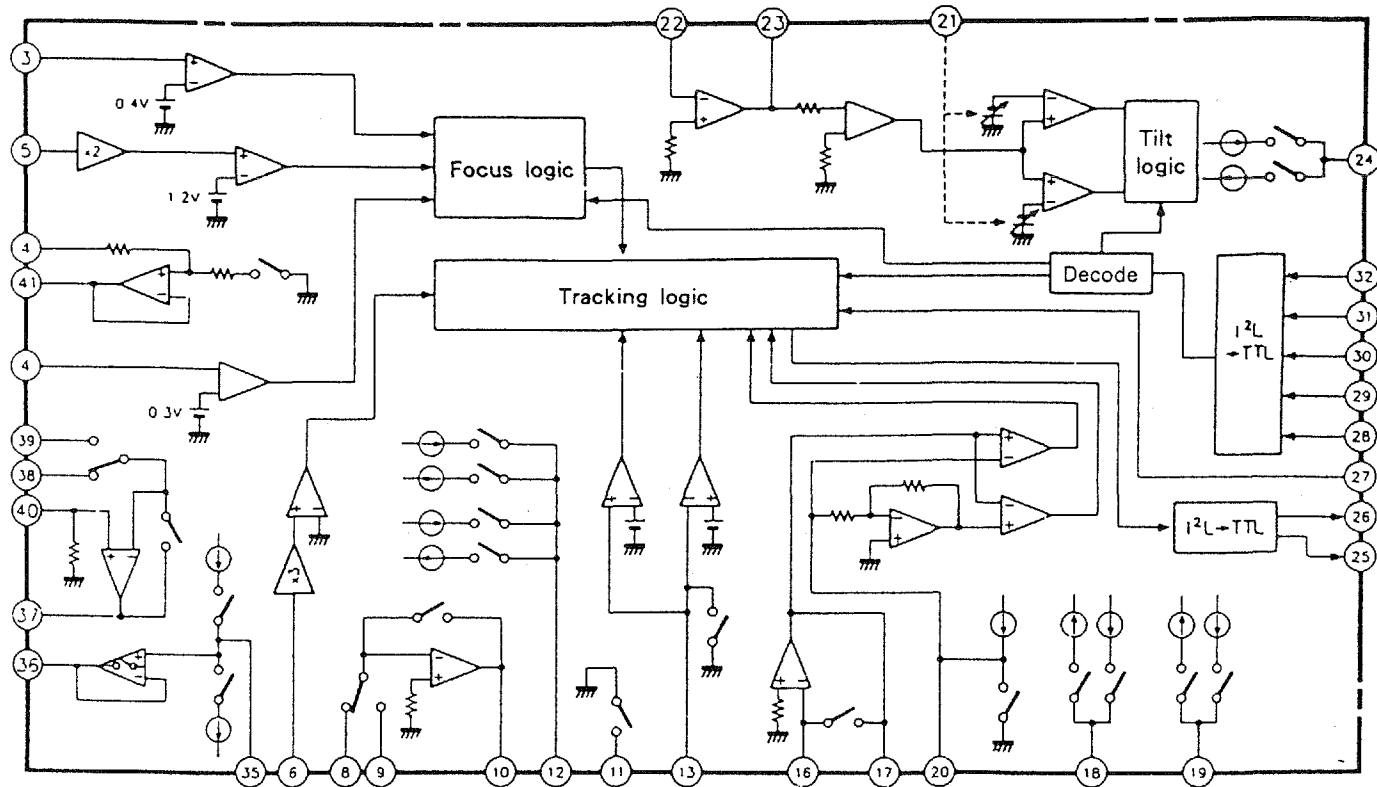
Block Diagram



Pin Functions

Pin No.	Name	I/O	Description	Pin No.	Name	I/O	Description
1	SDATA	I	Serial data input from CPU	22	AP40	O	Operational amplifier 4 output
2	SCLK	I	Serial data clock input from CPU	23	SW30	O	Analog switch output
3	LACH	I	Serial data latch pulse input from CPU	24	AP51	I	Operational amplifier 5 inverting input
4	SENS	O	IC internal state sense output	25	AV	—	Analog system power supply (5 V)
5	SPDL ON	O	Spindle motor ON output	26	SW41	—	Analog switch
6	MTP	O	Spindle motor rotation direction output. Low: Forward, High: Reverse	27	2.5V	I	Reference voltage 2.5-V input
7	MTM	O	Spindle motor rotation control PWM output	28	BUER	O	Burst detection LPF pin
8	RHD OUT	O	Reference HD signal output	29	AP50	O	Operational amplifier 5 output
9	OSCO	O	4-Fsc reference signal output	30	LPFC	—	Gain control LPF pin
10	OSCI	I	4-Fsc reference signal input	31	CDER	I	Spindle motor control signal input pin during CD play
11	TEST	I	Test pin (Usually high.)	32	RAMP	I	PWM lamp signal input
12	RESET	I	Reset input. Reset when low.	33	M.RTRN	I	Spindle motor feedback input pin
13	D.Vss	—	Digital system ground	34	OFF SET	I	Operational amplifier offset adjustment input
14	A.Vss	—	Analog system ground	35	D.VDD	—	Digital system power supply (5 V)
15	VIDEO	I	Burst signal input	36	C.SYNC	I	Sync signal input
16	AP10	O	Operational amplifier 1 output	37	RHD	I	Reference HD signal input pin
17	PFDO	O	Detection output LPF capacitor pin	38	FG	I	FG signal
18	AP20	O	Operational amplifier 2 output	39	CLK	O	FTS clock output pin
19	AP31	I	Operational amplifier 3 inverting input pin	40	2FSC	O	2-Fsc clock output pin
20	AP30	O	Operational amplifier 3 output	41	FSC	O	Fsc clock output
21	AP41	I	Operational amplifier 4 inverting input	42	PBHD	O	Play HD signal output

Servo IC : HA11529 (IC3 : X29-2340)
Block diagram



Pin functions

Pin No.	Name	Description
1	V _{EE}	Power supply pin (Usually -5V)
2	FEG	Operational amplifier FAMP noninverting input
3	DSUM	Comparator 4DCOMP input. 4D sum signal detection. (V _{th} =+0.4V)
4	FE	Comparator FZCOMP input. Used for focus error zero-cross Detection (V _{th} =+0.3V)
5	DAC	Input through 4DACBUF buffer to 4DACCAMP comparator. (V _{th} =+0.6V)
6	TE	Input through TZBUF buffer to TZCOMP comparator. Used for tracking error zero-cross detection. (V _{th} =+0V)
7	GND	Ground pin
8	TCD	Operational amplifier TRAMP inverting input. CD tracking servo phase compensation pin.
9	TLD	Operational amplifier TPAMP inverting input. LD tracking servo phase compensation pin.
10	TPO	Operational amplifier TPAMP output
11	TGS	Tracking amplifier gain selection pin. Set to open or ground level.
12	TDR	12TDRTrack jump and scan brake pulse output. ±50μA current is output during jump, and ±15μA current during brake.
13	ST	Comparator STCOMP1 and STCOMP2 inputs. Detects the tracking actuator displacement. (V _{th} =+0.2V)
14	BSET	Scan brake current value ±15μA adjustment pin
15	ISET	Current value adjustment pin for current source except scan brake

Pin No.	Name	Description
16	SLPI	Operational amplifier SAMP inverting input.
17	SLPO	Operational amplifier SAMP output. Comparator SCOMP1 and SCOMP2 inputs. Compared with a triangular reference wave by the two comparators to perform PWM modulation.
18	SDR1	Slider feed signal output during normal play and high-speed scan. A current value of $\pm 100\mu\text{A}$ is output.
19	SDR2	Slider feed pulse output during low to medium-speed scan. A current value of $\pm 10\sim\pm 110\mu\text{A}$ (by SDATA speed setting) is output by means of a pulse with a 50% duty cycle.
20	SLP	Allows connection of a capacitor that determines the slope of the reference triangular wave.
21	TSEF	Adjustment pin for comparator TCOMP1 reference comparison voltage (Hysteresis characteristic adjustment when tilt loop is on)
22	TIPI	Operational amplifier TAMP1 inverting input
23	TIPO	Operational amplifier TAMP1 output. Operational amplifier TAMP2 inverting input.
24	TIDR	Tilt motor drive signal output. A current value of $\pm 100\mu\text{A}$ is output
25	TCNT	Tracking error count pulse output during scan. A 256-frequency division signal can be output by SDATA setting.
26	FL	Focus lock state monitor signal output. (Low during focus lock; high during focus unlock.)
27	JUMP	Track jump trigger signal input. (Triggered on the rising edge. Low when normal.)
28	RST	Reset input. The internal register is completely cleared when low.
29	LACH	CPU to HA11529 serial data latch input. Latched on the falling edge.
30	SDATA	CPU to HA11529 serial data input
31	SCLK	CPU to HA11529 serial data transfer clock input. Data is loaded on the falling edge.
32	CLK	Internal logic operation clock input. ($f_{\text{max}}=500\text{kHz}$)
33	TEST	Test mode set pin. Low when normal.
34	INJ	Injection current adjustment pin for internal I ² L logic block
35	LAMP	Allows connection of a capacitor that determines the time constant of the lens sweep wave when the focus is pulled in.
36	UPDN	Operational amplifier SWEEP AMP output. The lens sweep voltage is output.
37	FPO	Operational amplifier FPAMP output.
38	FLD	Operational amplifier FPAMP inverting input. LD focus servo phase compensation pin.
39	FCD	Operational amplifier FPAMP inverting input. CD focus servo phase compensation pin.
40	FOST	Operational amplifier FPAMP noninverting input. Offset adjustment pin.
41	FEGA	Operational amplifier FPAMP output
42	V _{cc}	Power supply pin. (Usually +5V)

THE STAGE 4

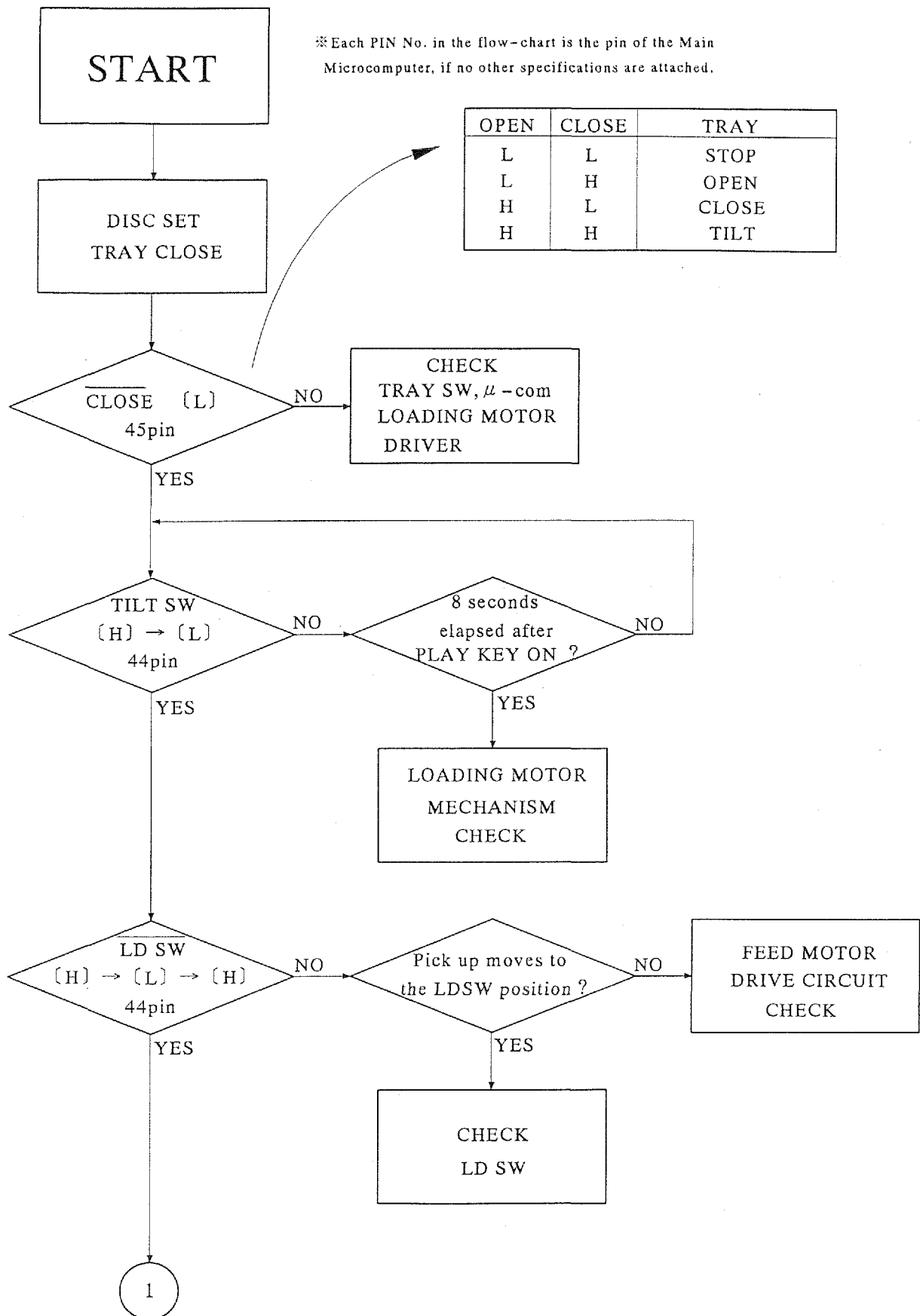
ONE POINT ADVICE

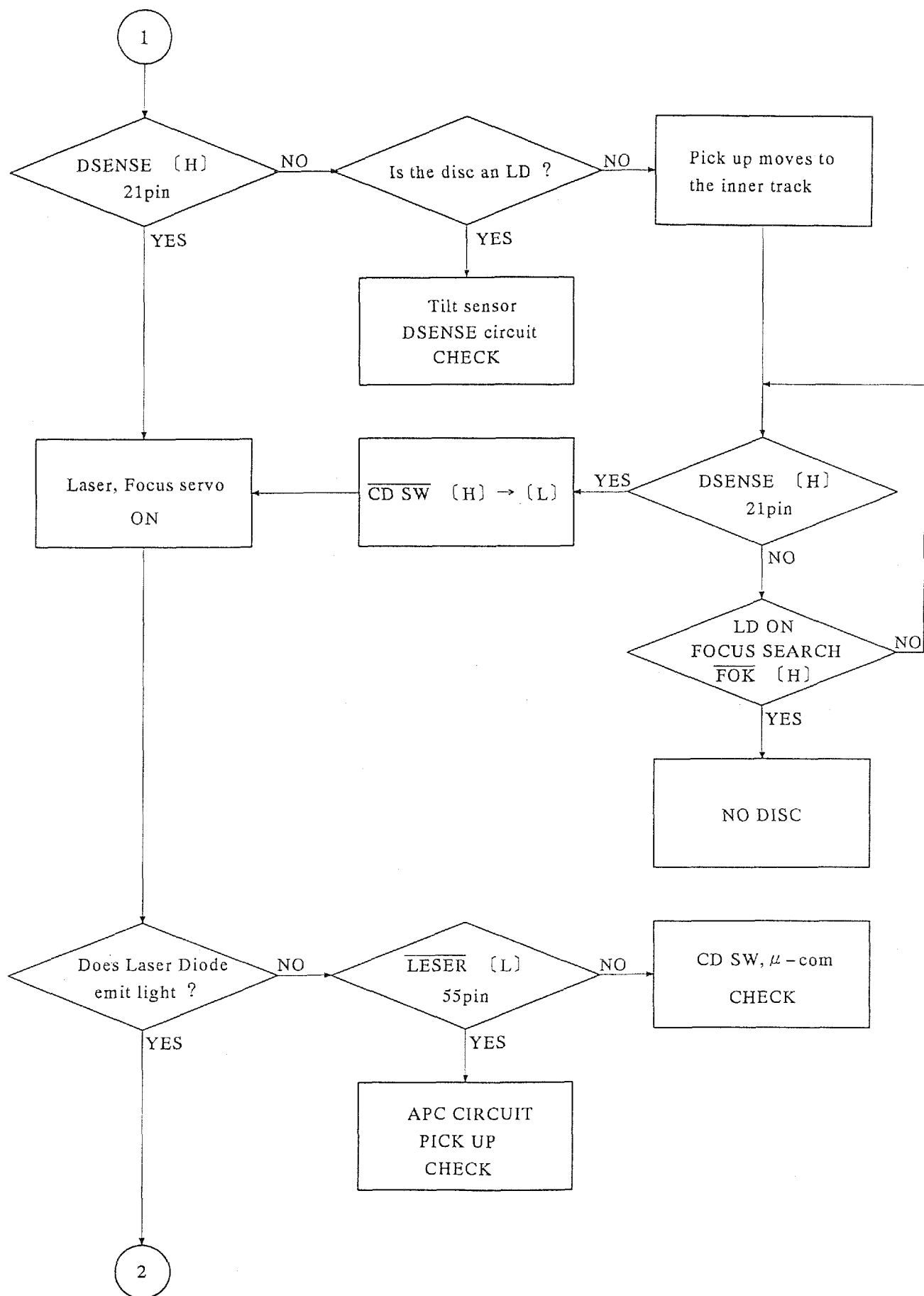
TROUBLE SHOOTING

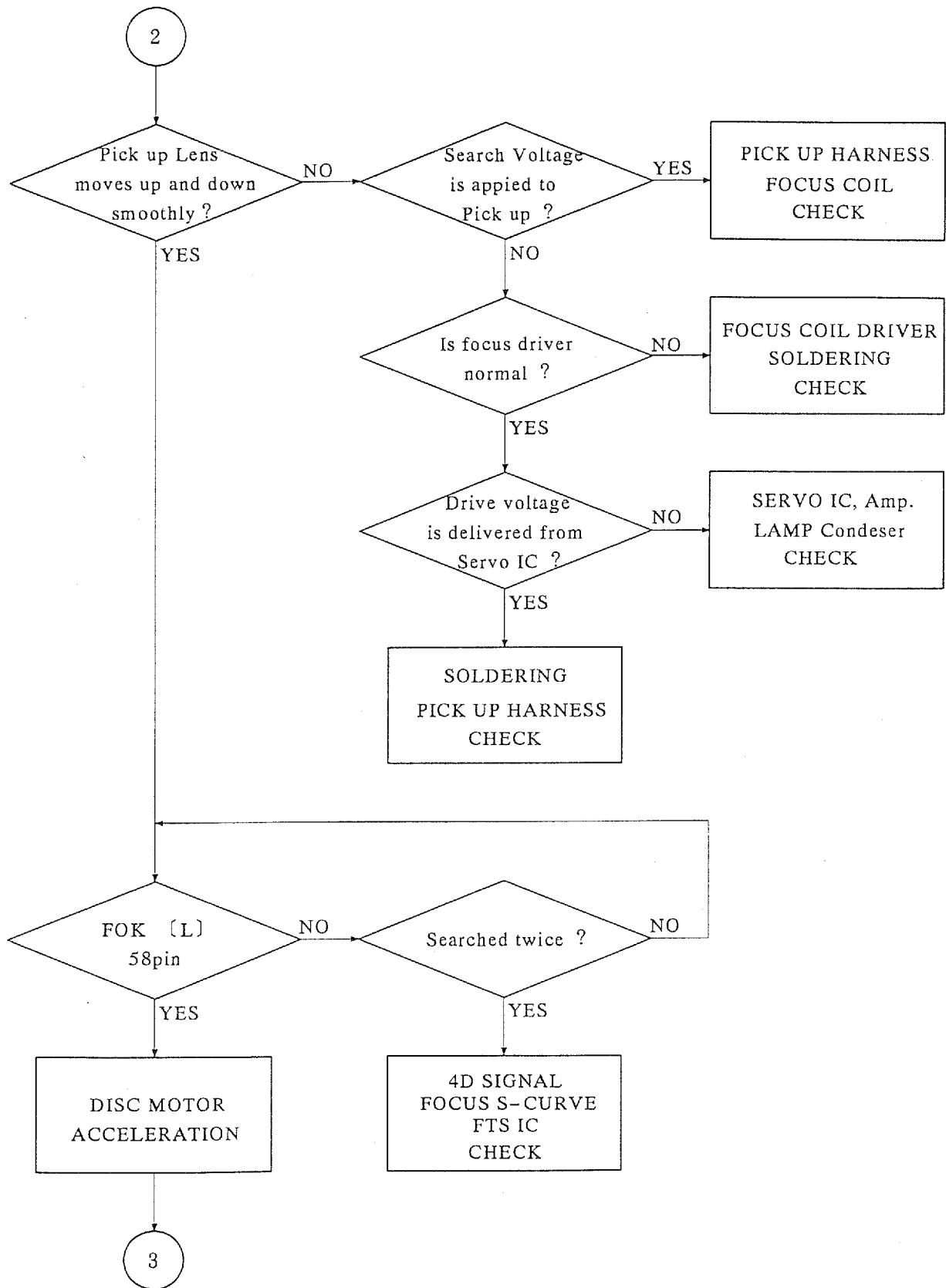
SERVICE TECHNICAL REPORT

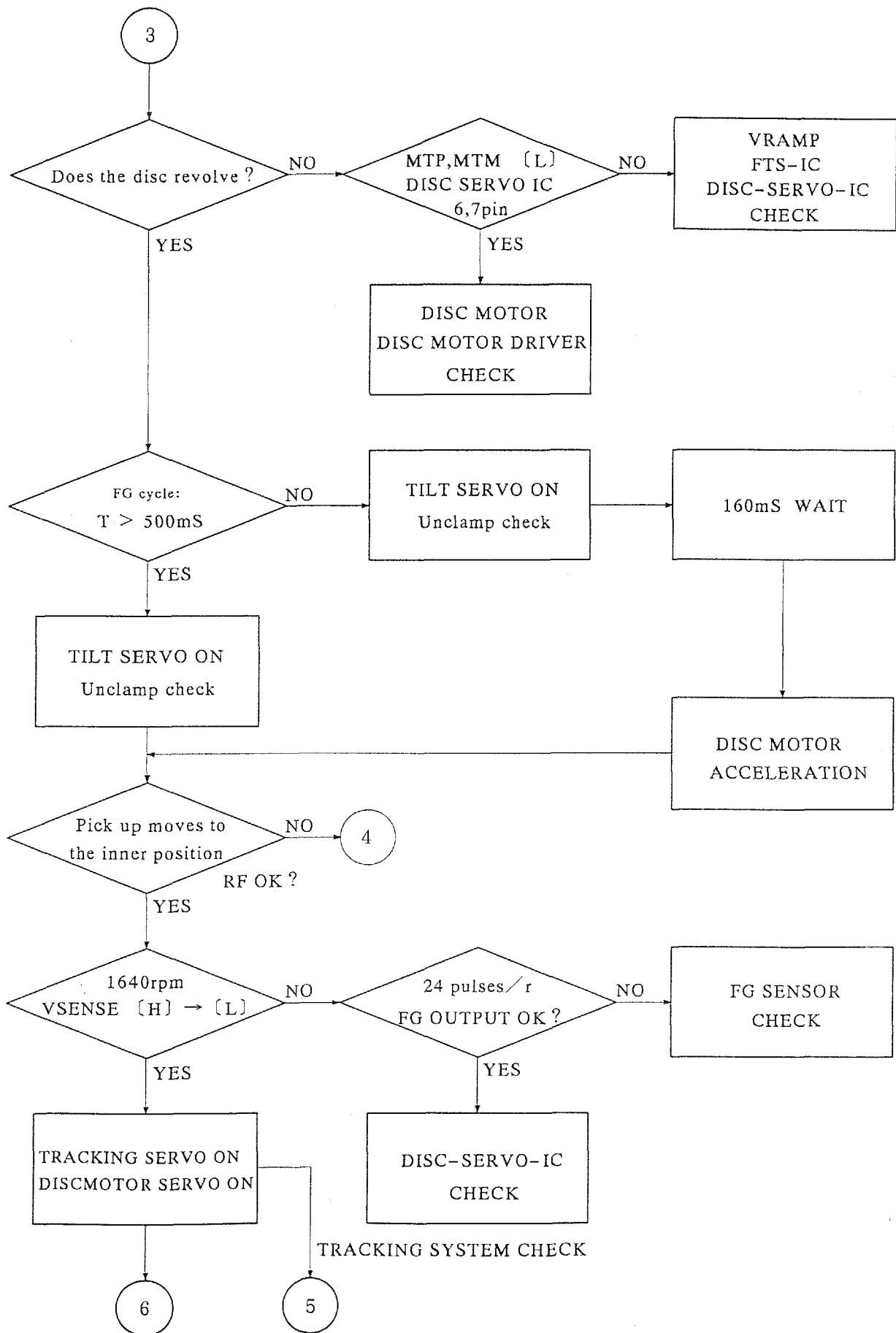
QUICK REPAIR INFORMATION

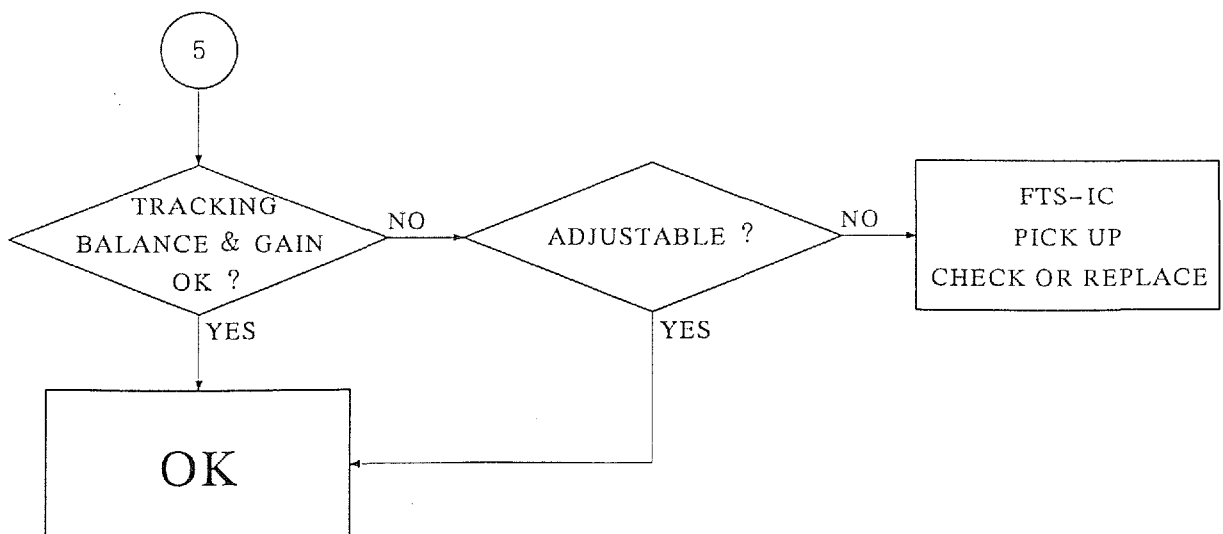
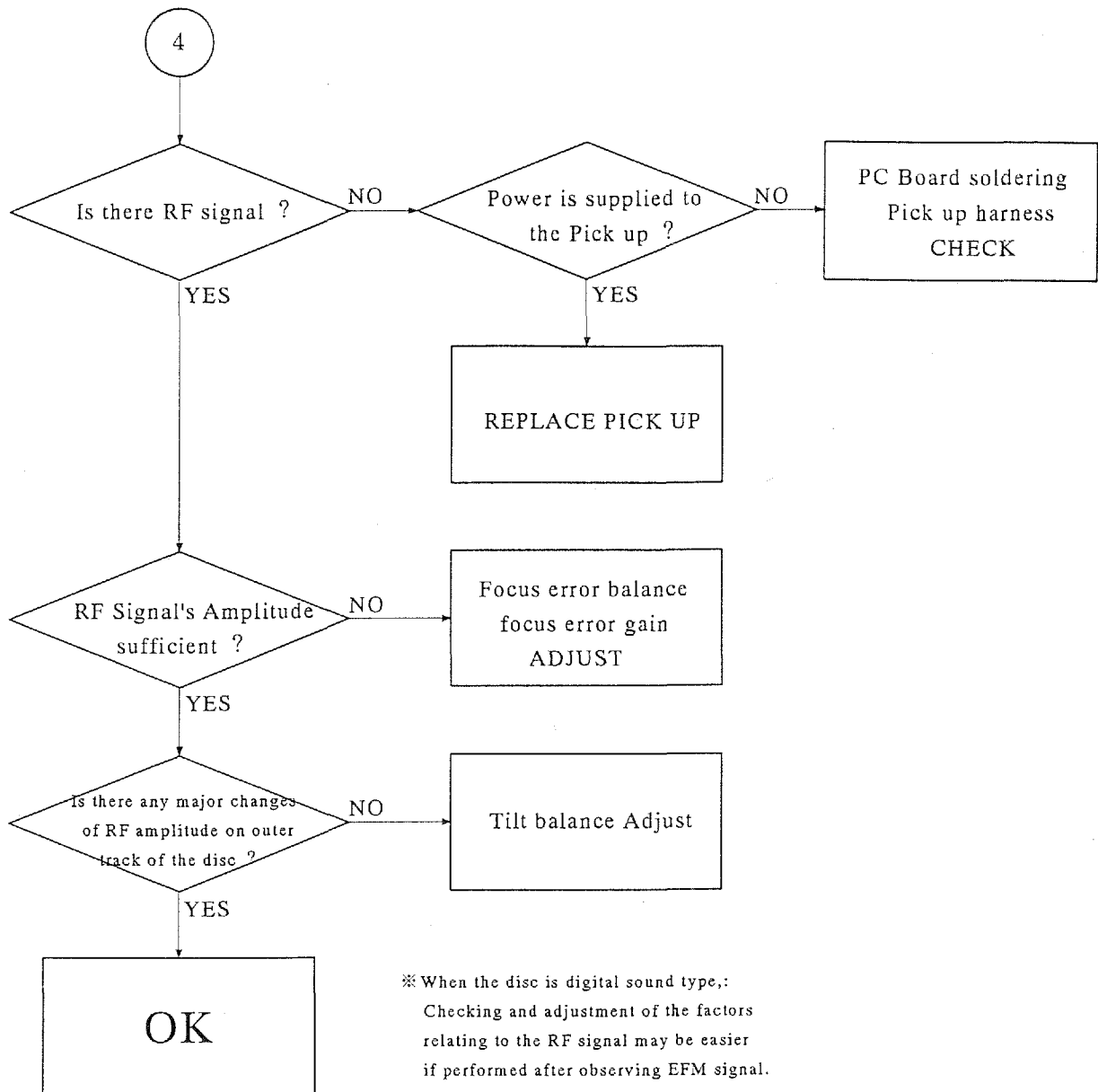
FLOW-CHART(TROUBLE SHOOTING)

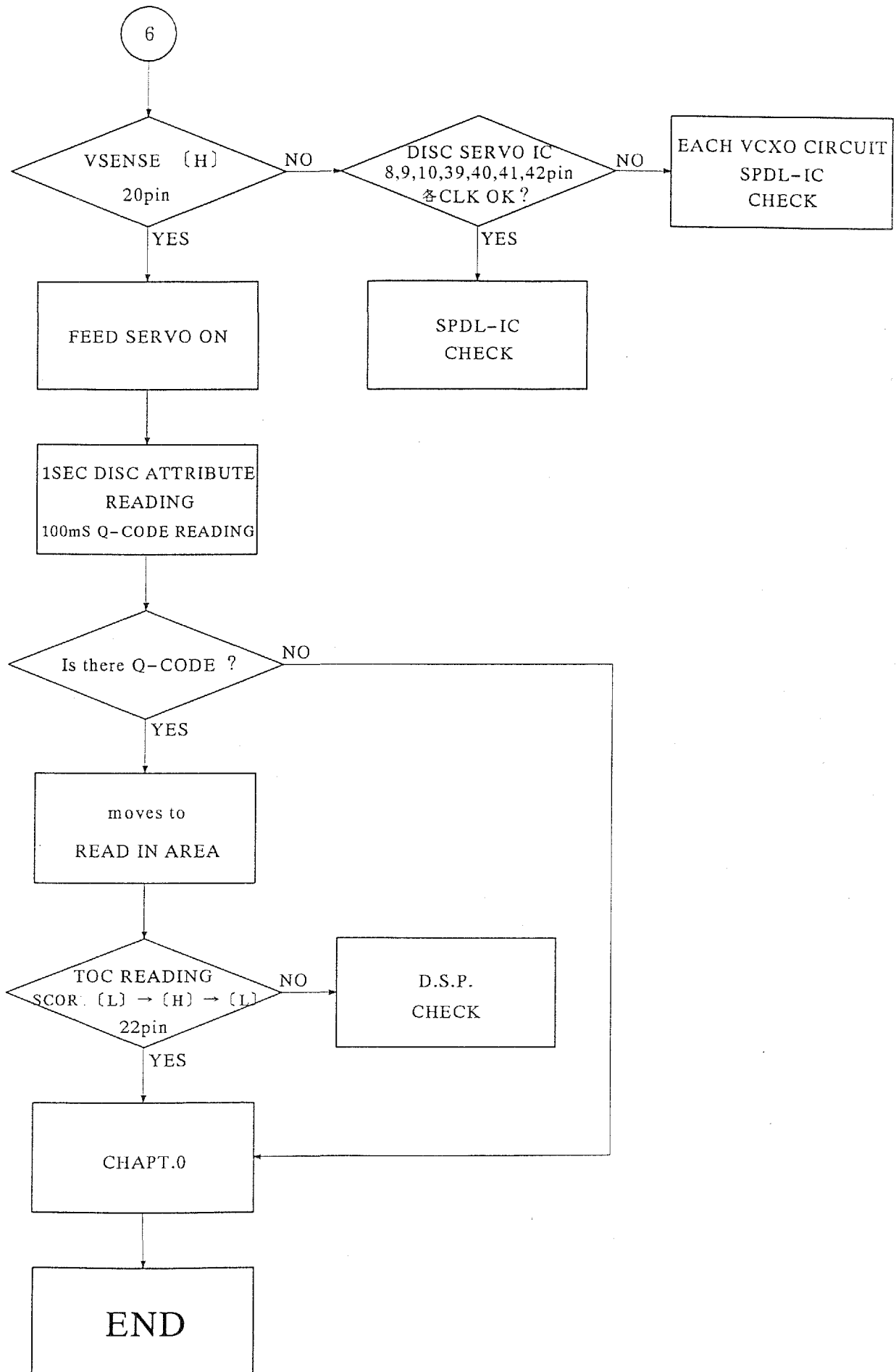










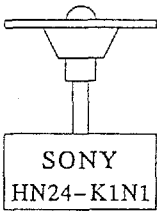
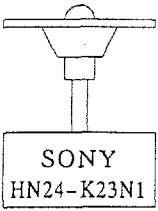


SERVICE TECHNICAL REPORT

REF. No.	MODEL	
B14-89-001	LVD-07	Cannot play CD/LD.
B14-89-004	LVD-07	Control Cam Gear
B14-89-008	LVD-07	Improving the revolving noise during LD playing
B14-89-009	LVD-07	Improving HUE (irregular coloring) in playing video part of a CDV
B14-89-027	LVD-07	Operation does not start for only certain discs.
B14-89-013	LVD-7E	Playing is not possible (as to the marking of Carton Box No. 1)
B14-89-059	LVD-7J	Playing of LD (digital voice input disc) is not possible but not other types of discs
B14-90-018	LVD-7J	Add a Turntable Sheet as a service part.
B14-90-031	LVD-7J	Certain discs cannot be played.
B14-90-004	LVD-7J	Neither LD nor CD can be played.
B14-90-028	LVD-300	Changing of Sub-microcomputer
B14-90-029	LVD-700	The sound becomes distorted in playing an LD with scratches (digital voice).
B14-91-001	LVD-700	There are times Disc Detection is not activated for LDs.
B14-91-003	LVD-700	In playing certain discs, dropouts show up in the images.
B14-91-028	LVD-700	Changing of Loading Mechanism (Part 1)
B14-93-005	LVD-700	Replacing of the Main Microcomputer
B14-93-002	LVD-820R	Cannot select the Digital Voice on certain discs.

As to the "MODEL", only the main model is indicated here.

SERVICE TECHNICAL REPORT

MODEL LVD-07		REF. No. B14-89-001 DATE 6th JAN 1989
REF. Cannot play CD/LD.		
(Phenomenon)	It can play LDs, but cannot play CD/CDVs. It successfully makes focus-locking, but the Disc Motor is hard to revolve and playing is not possible.	
(Cause)	Inside the Disc Motor, the Brush makes short-circuiting with the Motor chassis.	
(Measure)	Replace the Disc Motor by the new measured product. The brush of the new measured part is plated with gold and durability is improved. • CD SP Carriage Assembly A-6415-182-A • CD SP Motor 1-541-564-11	
(Differences Between Non-measured Part and Measured Part):		
Non-measured Part		
 ← "HN24-K1N1" is printed on the label.		
Measured Part		
 ← "HN24-K23N1" is printed on the label.		

SERVICE TECHNICAL REPORT

MODEL
LVD-07

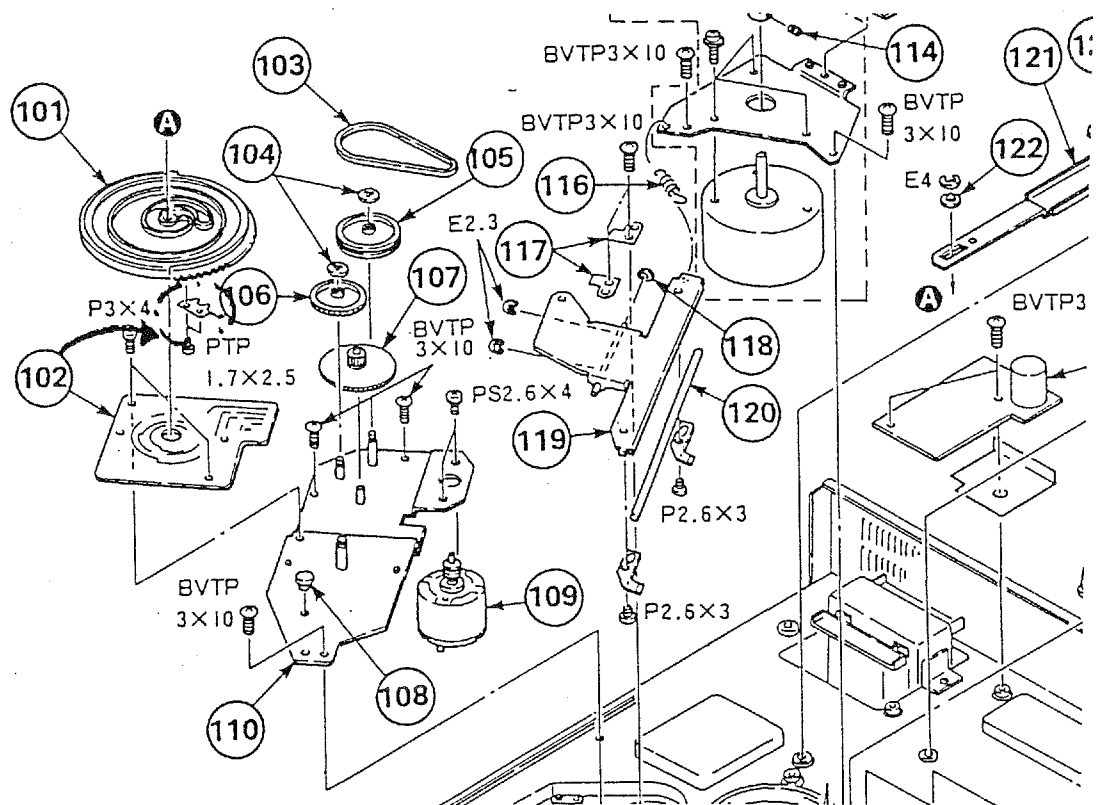
REF. No. B14-89-004
DATE 19th JAN 1989

REF. Control Cam Gear

- The brush attached at the lower part of the Control Cam Gear is included in the REF. No. 102 Rotary Switch Encoder S906. (Refer to the Service Manual, page 141.)

When the brush is defective, order a Ref. No. 102 Rotary Switch Encoder S906. (When this Rotary Switch Encoder becomes defective, the action of the mechanism cannot be detected and the normal operation cannot be kept. In repairing, check this part thoroughly.)

- REF. No. 101 Control Cam Gear 3-720-422-01
- REF. No. 102 Rotary Switch Encoder (S906) 1-571-189-11



SERVICE TECHNICAL REPORT

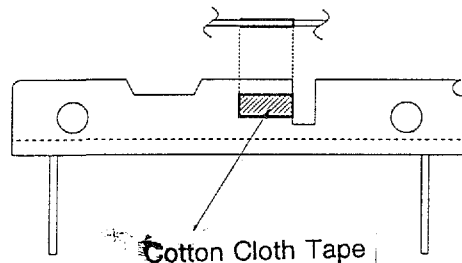
MODEL
LVD-07

REF. No. B14-89-008
DATE 2nd FEB 1989

REF. Improving the revolving noise during LD playing

(Phenomenon) When an LD with a large eccentric load or warp is played, a revolving noise (not the ordinary wind noise) occurs. Pressing the Chuck Plate Ass'y with a hand will improve the noise.

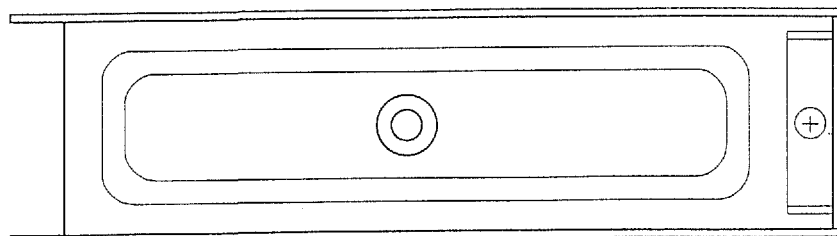
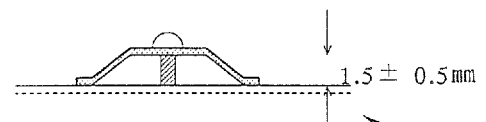
- (Measure)
- 1) Replace the Chuck Plate Ass'y. (PART No. A-6415-253-E)
 - 2) When the Guide R Ass'y is not applied with a Cotton Cloth Tape, apply one.



- 3) If the Chuck Plate Ass'y has been replaced, perform a Mis-Chuck Adjustment:

- * As in the figure, adjust the gap between the upper side of the Adjust Spring and the upper side of the Check Plate may be $1.5 \pm 0.5\text{mm}$.

Confirm that an LD can be played.



SERVICE TECHNICAL REPORT

MODEL

LVD-07

REF. No. B14-89-009

DATE 2nd FEB 1989

REF. Improving HUE (irregular coloring) in playing video part of a CDV

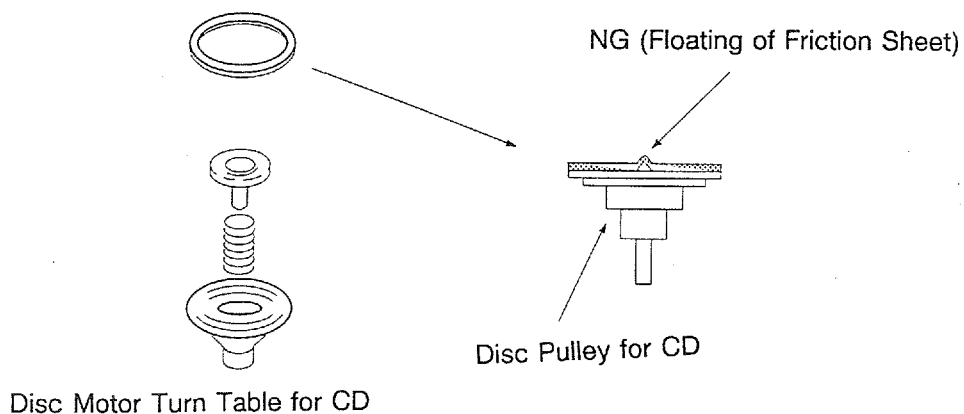
(Phenomenon) In playing the video part of a CDV, HUE (irregular coloring) occurs.

(Measure) Apply a Friction Sheet on the Disc Motor Turn Table for CD/CDV to prevent slipping.

(Replacing Procedure)

- 1) Set the CD Spindle Motor to the CD Play position, and detach the CD Chuck Plate.
- 2) Apply a Friction Sheet (3-729-880-01).
In applying the sheet, be careful not to have any wrinkles or floating.
- 3) After the mechanical assembly, adjust the CD Focus Offset.

(Part No.) Friction Sheet 3-729-880-01



SERVICE TECHNICAL REPORT

MODEL

LVD-07

REF. No. B14-89-027

DATE 26th April 1989

REF. Operation does not start for only certain discs.

(Phenomenon) It first activates focusing; revolving a little then it stops, or repeats focus searching while revolving to a certain extent.

(Cause) The RF signal changes on the plated disc. Though the focus is locked, the FOCUS OK signal turns L and the microcomputer misjudges that the it is off focus.

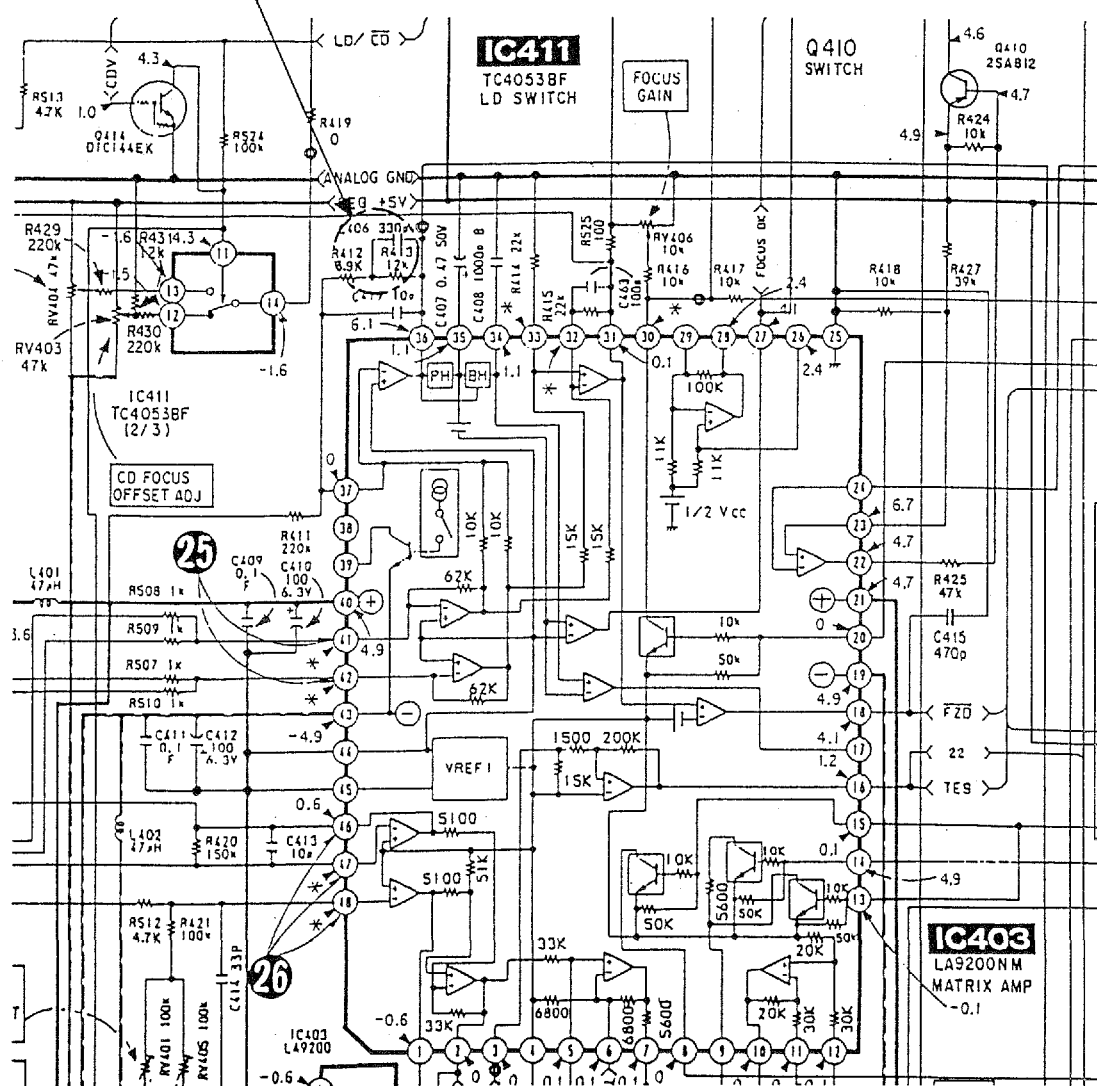
(Measure) Increase the amplification degree of the focus circuit where the FOCUS OK signal is generated.

LV-5 PC Board (Manual, page 95)

1, R412 3.9K Ω $\rightarrow$ 10K Ω (RK73FB2A101J)

2, R413 12K Ω $\rightarrow$ 30K Ω (RK73FB2A303J)

3, C405 33pF $\rightarrow$ 120pF (CC73FCH1H121J)



SERVICE TECHNICAL REPORT

MODEL LVD-7E, 7000		REF. No. B14-89-013 DATE 27th FEB 1989
REF. Playing is not possible (as to the marking of Carton Box No. 1)		
(Phenomenon)	While a disc is revolving, the Disc Tray lifts up to scratch the disc and the tray.	
(Cause)	The Print Pattern on the FG PC board for the Spindle Motor touches the Motor Holder section. At the same time, the FG signal is grounded and thus the FG Sensor does not work; therefore, the disc revolution cannot be detected.	
(Measure)	1) Provisional Measure → Add a Spacer between the FG Sensor and the Motor Holder. * This Spacer is not available at present; therefore, make an insulation process with a Cotton Cloth Tape. 2) Perpetual Measure → Modify the print pattern on the FG Sensor PC board. * Period for Mass Production (S/No. 9030~)	
	The diagrams illustrate the mechanical components and the proposed fix. The top view shows the SPDL Motor, FG Sensor, and Motor Holder. The side view shows the Motor Holder, a Spacer, the PC Board for FG, and the Pattern Side.	
(Working Procedure)	(1) Open the Bonnet Case. (2) Let the tray lift up, and draw it to the front side. (3) Remove the two screws on the Clamper side, and detach the Clamper. (4) Remove a screw of the PC Board for FG at one position from a hole of the Clamper, and add a Spacer between the PC Board and the Motor Holder. (5) Fix the PC Board for FG with a screw. (6) Attach the Clamper, and fix it with two screws. (7) Return the Tray to the normal position, and close the Bonnet Case. (8) Check if an LD can be played.	

SERVICE TECHNICAL REPORT

MODEL		REF. No.	B14-89-059
LVD-7J		DATE	17th NOV 1989
REF. Playing of LD (digital voice input disc) is not possible but not other types of discs			
(Phenomenon)	Only LDs (digital voice input discs) cannot be played. Or, takes a while until playing starts.		
(Cause)	Due to the VCO free-run frequency slipping of the Signal Process Unit (X32-1350), LD (digital void input disc) playing is not possible.		
(Way to Check)	After turning ON the power, measure the frequency of TP2 (PLCK) of the Signal Process Unit (X32-1350). In case the frequency at this time is 4.326MH z or more, the phenomenon above occurs.		
(Measure)	Adjust the VCO free-run frequency. (L23, X32-1350) In the meantime, confirm that the VCO free-run frequency is 4.30MHz $\pm$ 10KHz. In addition, modify the items to be adjusted in "1. VCO Free run" in the Service Manual.		

SERVICE TECHNICAL REPORT

MODEL

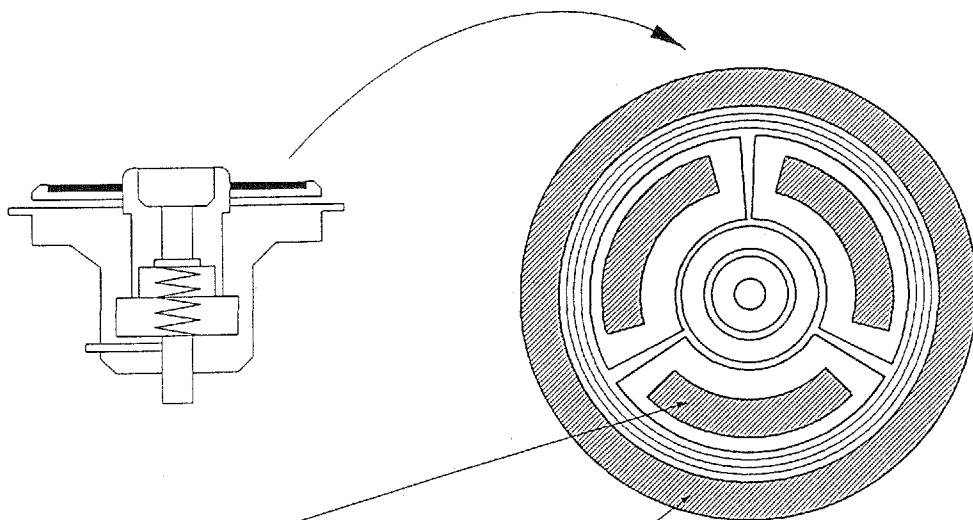
LVD-7J, 05, 7E, 7000

REF. No. B14-90-018

DATE 26th JULY 1990

REF. Part Addition of Turntable Sheet

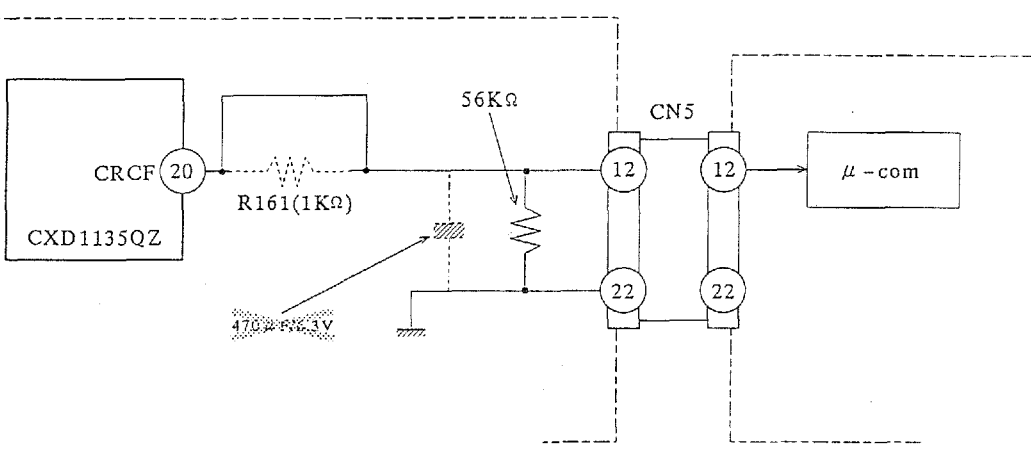
Add a Turntable Sheet as a service part.



PART No. G16-0710-04 (INNER SHEET)

PART No. G16-0709-04 (OUTER SHEET)

SERVICE TECHNICAL REPORT

MODEL LVD-7J, 05	REF. No. B14-90-031 DATE 24th OCT 1990
REF. Certain discs cannot be played.	
(Phenomenon)	It occurs on an LD discs with many Chapter Nos.; the TOC cannot be read and playing is not possible.
(Cause)	In the aspect of the software of the microcomputer, the program can only read up to 43 chapters. Also, for those discs with a low level of the digital voice EFM and many jitters, the Q data may not be taken in when data is read.
(Measure)	(1) Replace the microcomputer by the measured part. (Image Unit X35-2010 IC13) TC54256AP (old) → W05-0336-00 (new) (2) Add a resistor of 56KΩ between the 12 pin and 22 pin of CN5 of the Signal Process Unit (X32-1350), and remove R161 and short-circuit the two ends.
	

SERVICE TECHNICAL REPORT

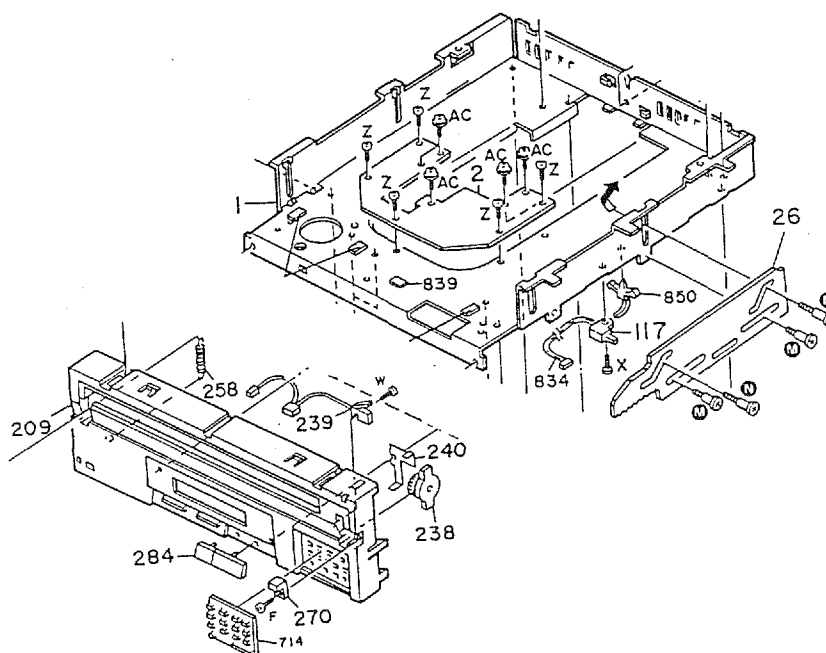
MODEL	LVD-7J	REF. No.	B14-90-004
		DATE	26th FEB 1990
REF.	Neither LD nor CD can be played.		

(Phenomenon) The tray can be opened or closed, but the Pick Up will not move and playing is not possible. Neither the Laser Diode be illuminated.

(Cause) The lead wire (red) of the Door Switch (refer to Disassembly Drawing REF 239) touches the Slider Right (refer to Disassembly Drawing REF 26), and this lead wire becomes cut.
Accordingly, the microcomputer misjudges that the door is open and it will not accept the Play command.

(Measure) Replace the Door Switch or re-solder this lead wire, and change the styling so that the lead wire may not hit the Slider Right.

Door Switch Part No.: E31- 4794-05 (REF No. 239)



SERVICE TECHNICAL REPORT

MODEL		REF. No.	B14-90-028
LVD-300, 700		DATE	18th OCT 1990
REF. Changing of Sub-microcomputer			
(Phenomenon)	LD playing will not automatically stop by a certain operation pattern.		
	(Phenomenon Confirming Procedure)		
	(1) Play an LD.		
	↓		
	(2) Set the Still Picture mode, and do a Manual Reverse.		
	↓		
	(3) Then do a Forward Search.		
	↓		
	(4) The automatic stop function is not activated at the LD Disc Read Out position. (Normally, it automatically stops at the Read Out position.)		
(Cause)	Mistake in the program of the Sub-microcomputer		
(Measure)	Replace the Sub-microcomputer.		
	μPD75216ACW-A95 (old) → μPD75216ACW-B76 (new)		
	PART REF No.:		
	For LVD-300 ... IC18		
	For LVD-700 ... IC1		
	* The phenomenon above is the bug to occur only in the exact procedure above. In case a complaint has arisen from a customer, replace the Sub-microcomputer.		
	It is under a mass-production line from Serial No. 0120 on.		

SERVICE TECHNICAL REPORT

MODEL

LVD-700

REF. No. B14-90-029

DATE 22th OCT 1990

REF. The sound becomes distorted in playing an LD with scratches (digital voice).

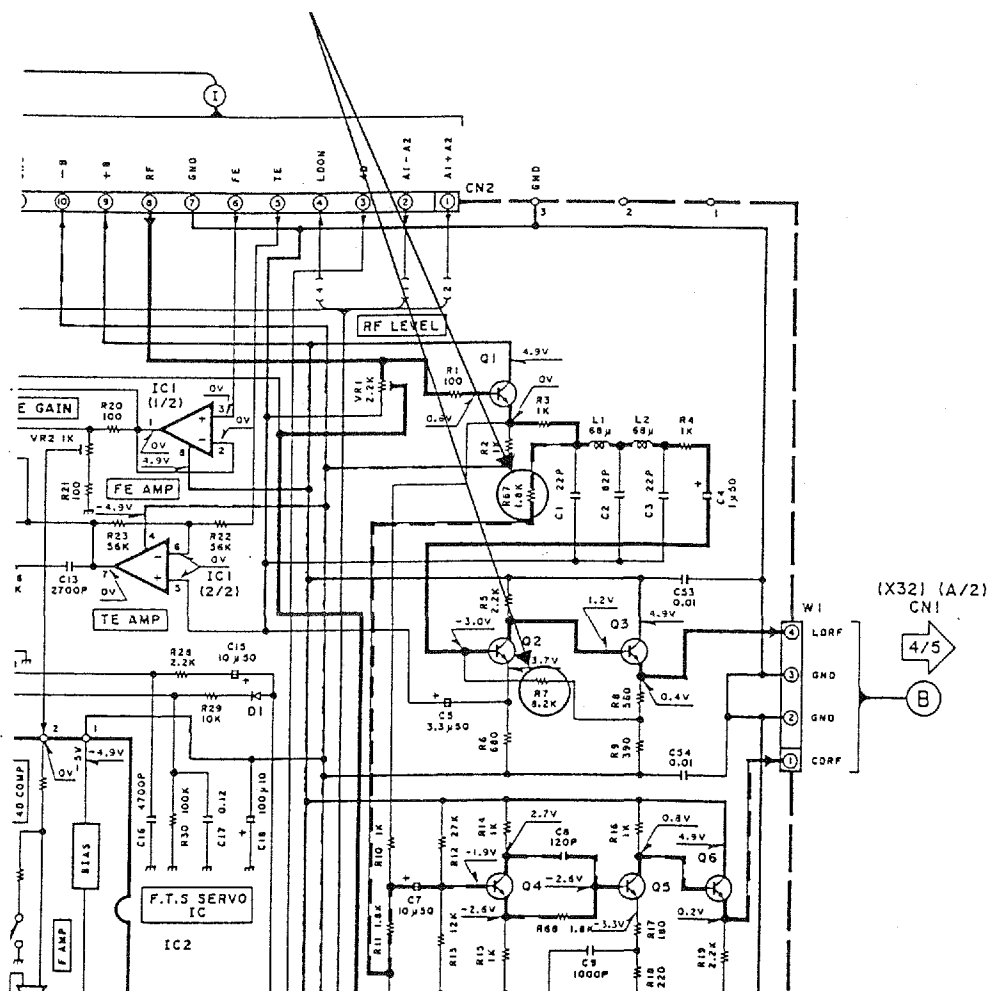
(Phenomenon) When an LD with scratches is played, only the digital voice is distorted. There is no problem on the analog voice or CD playing.

(Cause) When an LD with scratches is played, the RF signal to enter the ASY circuit becomes dirty and smooth noises are outputted (in the MIX circuit of EFM Signal and 4D Signal).

(Measure) Only for LD playing, change the mix value in the MIX circuit into 1/10 of the current value.

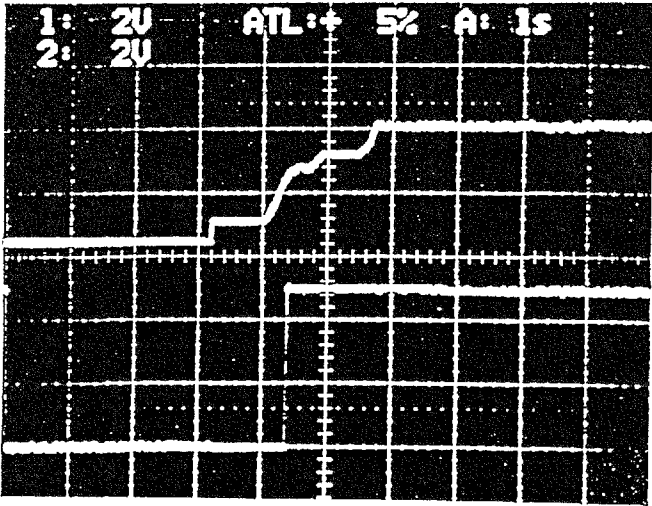
X29-2140 R67 1.8K Ω $\rightarrow$ 18K Ω
R7 8.2K Ω $\rightarrow$ 4.7K Ω

It is under a mass-production line from Serial No. 01110 on.



SERVICE TECHNICAL REPORT

MODEL LVD-700, 300, 7i, K101, K1000	REF. No. B14-91-001 DATE 24th JAN 1991
REF. There are times Disc Detection is not activated for LDs.	
(Phenomenon)	Disc Detection is not activated for LDs only, and "No DISC" display appears. It is normally activated for CDs.
(Cause)	Due to dispersion of the sensitivity of the Pick Up Tilt Sensor, the Tilt Current is not generated as rated. (The tilt level (A1 + A2) goes down 2V or less.) The comparator level of the Disc Detection Circuit has been set to +2.0V. Accordingly, Disc Detection is not activated and the Pick Up moves to the CD Detection position.
(Measure)	Change the comparator level of the Disc Detection Circuit from +2.0V to +1.6V. Also, clean the Tilt Sensor. LVD-700 Control Unit (X29-2140) R94 (3.3KΩ) $\rightarrow$ 4.7KΩ LVD-300 Control Unit (X32-1680) R216 (36KΩ) $\rightarrow$ 47KΩ (This change for LVD-300 is also applied to LVD-7i, K101, and K1000.)



SERVICE TECHNICAL REPORT

MODEL LVD-700

REF. No. B14-91-003
DATE 28th OCT 1991

REF. In playing certain discs, dropouts show up in the images.

(Phenomenon) In playing certain discs, many dropouts are found in the images.
(around Frame No. 8000 to 12000)

(Cause) The disc is defective.
(Due to pit forming defects on the disc, defects occur on the Play RF signal.)

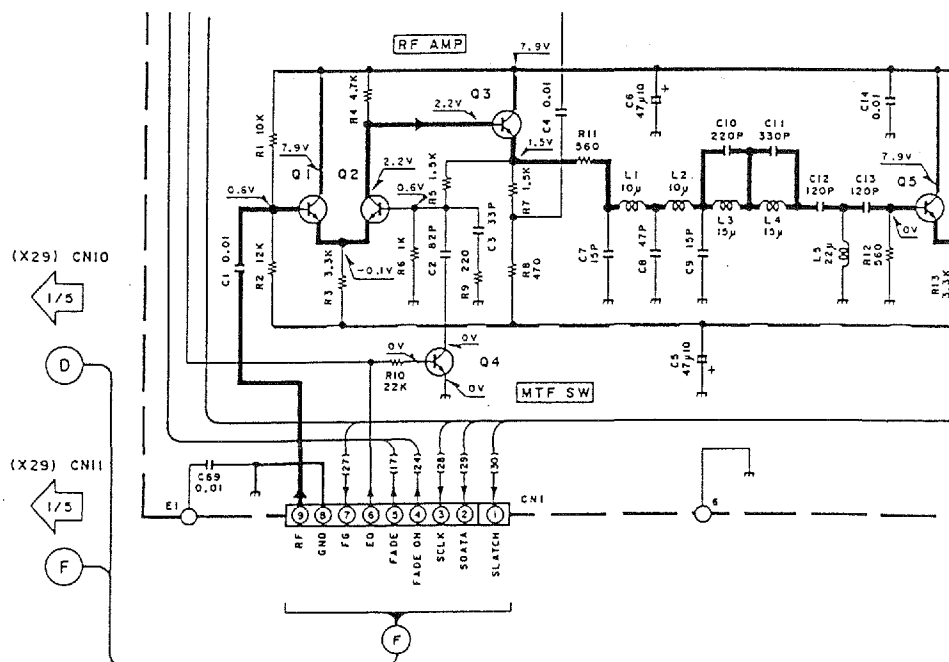
(Measure) (1) Re-adjust the Drop Out Compensating Circuit.
(Refer to the Service Manual, page 6, No. 6: DOC GAIN, and No. 7: DOC Phase.)

(2) Replace C2 and C3 of the Video Unit (X32-2040):

C2: 82pF → 56pF (CC45FSL1H560J)

C3: 33pF → 47pF (CC45FSL1H470J)

(3) Re-adjust the video level.
(Refer to the Service Manual, page 6, No.8: Video Level.)



SERVICE TECHNICAL REPORT

MODEL LVD-700, 300, 7i, K101, K1000		REF. No. B14-91-028 DATE 29th NOV 1991								
REF. Changing of Loading Mechanism (Part 1)										
(Phenomenon)	The Tray does not move normally. (The movement is too slow, and the torque cannot be felt.) Discs (especially LDs) cannot normally be played.									
(Cause)	Due to slipping of the belt used on the Loading Motor in the Loading Mechanism, the Tray does not operate normally. This motor is also used as a tilt motor; therefore, the disc is not correctly clamped to the Disc Motor due to the slipping of the belt.									
(Measure)	(1) Delete the measure in the Service Technical Report (B14-91-024). (2) Change the Loading Mechanism in the following procedure. (Order the part kit.)									
	Part Kit D40-1217-03 Contents of the kit: <table border="1"> <tr> <td>I . Drive Mechanism Assembly</td> <td>1 set</td> </tr> <tr> <td>II . Motor Pulley</td> <td>1 piece (D15-0316-04)</td> </tr> <tr> <td>III . Loading Belt</td> <td>1 piece (d16-0199-04)</td> </tr> <tr> <td>IV . Screws</td> <td>2 pieces (N35-2604-46)</td> </tr> </table>		I . Drive Mechanism Assembly	1 set	II . Motor Pulley	1 piece (D15-0316-04)	III . Loading Belt	1 piece (d16-0199-04)	IV . Screws	2 pieces (N35-2604-46)
I . Drive Mechanism Assembly	1 set									
II . Motor Pulley	1 piece (D15-0316-04)									
III . Loading Belt	1 piece (d16-0199-04)									
IV . Screws	2 pieces (N35-2604-46)									
(Measuring Procedure)	1) Works on Mechanism Section - Detach the Loading Motor Pulley, Medium Pulley (REF. 15), Washer (REF. 52), Loading Belt (REF. 17), and Screw (REF. 43). (Fig. 1) - Install the Drive Mechanism Assembly in the kit as in Fig. 2, and fix it with the screw in the kit. This Drive Mechanism Assembly is fixed commonly with the Loading Motor. - Attach the Motor Pulley in the kit to the Loading Motor. The height of the Motor Pulley should be the same as the height of Gear A in Fig. 1. - Place the Loading Belt in the kit around the Motor Pulley and Gear A. - Apply a small amount of grease to the Gear section of the Drive Mechanism Assembly. 2) Circuit Replacement - In case of LVD-700: Replace 33KΩ of R59, 60 of the Control Unit (X29-2140) → 27KΩ (RD14BB2C273J) - In case of LVD-300, 7i, K101, K1000: Replace 18KΩ of R82, 87 of the Control Unit (X29-21**) → 15KΩ (RD14BB2C153J)									

SERVICE TECHNICAL REPORT

MODEL	LVD-700, 300, 7i, K101, K1000	REF. No.	B14-91-028
		DATE	29th NOV 1991
REF.	Changing of Loading Mechanism (Part 2)		

3) Others

Depending on each mechanism, there may occur an abnormal noise during loading. The cause is that the Stopper on the right side of the tray hits Gear A. In this case, shave a 1/3 portion of the right side Stopper to lower the height.

Fig. 1

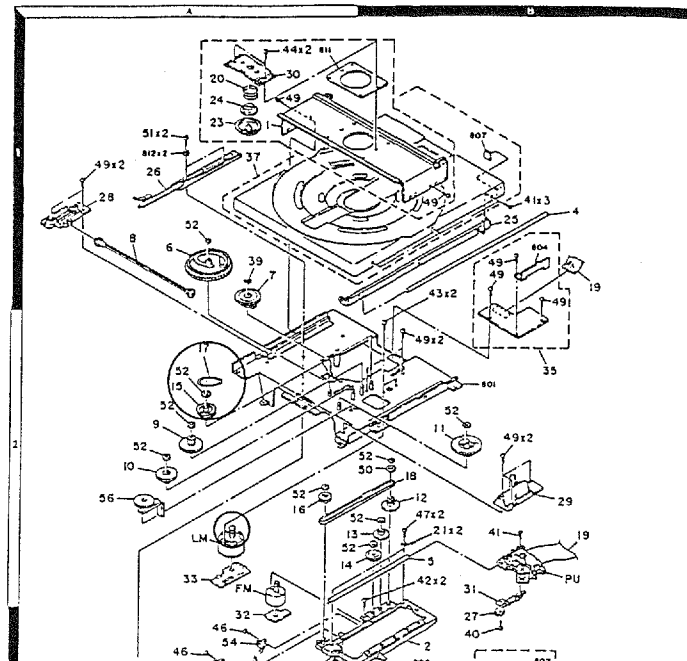
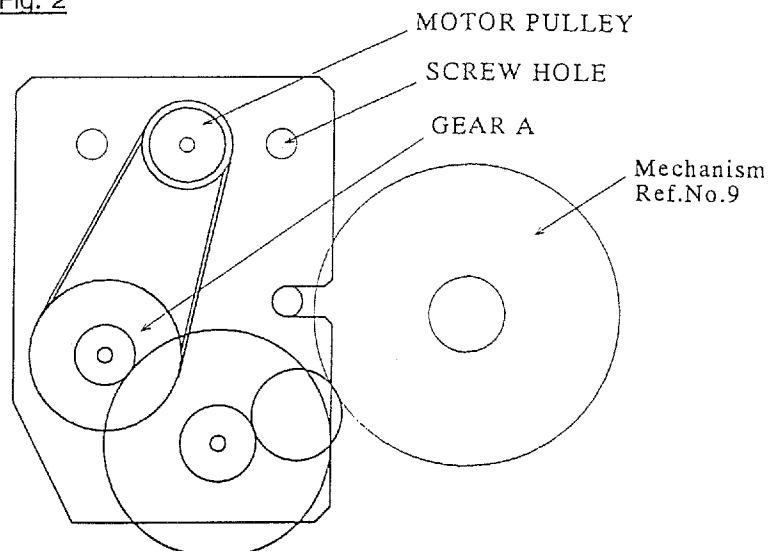


Fig. 2



SERVICE TECHNICAL REPORT

MODEL		REF. No.	B14-93-005
LVD-700, 300, 78, K101, K1000		DATE	16th FEB 1993
REF. Replacing of the Main Microcomputer			
(Phenomenon)	Certain discs cannot be played.		
(Cause)	In the aspect of the microcomputer program, reading has been possible only up to Chapter No. 23. Since the information pits in the TOC area of certain discs are smaller than the specifications, and data reading has not been possible.		
(Measure)	Replace the Main Microcomputer.		
	LVD-700:	Control Unit (X29-2140) IC10	
	LVD-300, 7i, K101, K1000:	Control Unit (X32-1680) IC14	
	[Part No.] M37451M8-307SP		
(Notes)	- Abandon the Service Technical Report issued before. This report is the final measure. - As for the types of LVC-700, 300, 7i of Serial No. 0110 and thereafter, please make the following processes as well: - Detach the Mini PC Board (X25-4410). - Add a resistor of 33KΩ to the place specified below. For LVD-700: R49 (X29-2140) For LVD-300, 7i: R40 (X29-2150)		

SERVICE TECHNICAL REPORT

MODEL	LVD-820R	REF. No.	B14-93-002
		DATE	7th JAN 1993
REF.	Cannot select the Digital Voice on certain discs.		
(Phenomenon)	When a disc of Digital Voice without a chapter is played, selection of Digital/Analog Voice cannot be switched by the Remote Controller. The Digital Voice cannot be selected.		
(Cause)	Program Error in the Main Microcomputer.		
(Measure)	Replace the Main Microcomputer: SERVO & DSP UNIT IC103 [PART No.] μPD75518GF-066 The mass-production line is under way from Serial No. 20900001 on.		

QUICK REPAIR INFORMATION

REF. No.	MODEL	
N14-89-002	LVD-07	The power cannot be turned ON.
N14-90-009	LVD-07	CDs cannot be played. (No problems for LD playing.)
N14-90-029	LVD-07	Colors do not show up. (The image itself is OK and the sound is also normal.)
N14-91-028	LVD-07	Suggestion for a jig to adjust the Tracking Balance
N14-89-022	LVD-9E	The Tray will not open, or is hard to open.
N14-89-020	LVD-9E	The CD CDV LD for the display FL tube is illuminated always dimly.
N14-89-027	LVD-9E	The Protection Circuit is activated and the power is not turned ON
N14-89-028	LVD-9E	The TOC of CD cannot be read.
N14-90-008	LVD-9E	There are times the TOC cannot be read.
N14-90-012	LVD-9E	There are times the power cannot be turned ON.
N14-91-020	LVD-9E	Playing is not possible. (The Pick Up will not move, nor will the Laser Diode illuminate.)
N14-89-021	LVD-7E	The disc does not revolve, the revolutions of the disc does not increase.
N14-92-030	LVD-7E	No key operations are accepted.
N14-90-001	LVD-05	The Tray action is not normal. (The open/close actions are not constant.)
N14-91-042	LVD-05	There are times the Tray will not open or close.
N14-90-007	LVD-7J	The OPEN/CLOSE key of the Tray does not work.
N14-92-011	LVD-7J	When a CLV LD is played, the screen image becomes disordered.
N14-91-010	LVD-700	TOC cannot be read, and the disc will stop after several revolutions.
N14-91-017	LVD-700	The image quality is defective (the screen image trembles).
N14-90-013	LVD-700	In playing discs of digital voice (CD, CDV, CLV-LD), no voice is outputted.
N14-91-037	LVD-300	LDs cannot be played.
N14-92-017	LVD-300	In LD playing, the revolution speed of the disc will not go up.
N14-91-056	LVD-7i	Discs cannot be played.
N14-92-008	LVD-7i	Runs out of control on turning ON the power.
N14-92-016	LVD-7i	LD reading does not operate.
N14-92-027	LVD-7i	The Tray G goes in and out.
N14-93-011	LVD-7i	Cannot play LDs.
N14-91-057	LVD-V7	No images appear in the screen.
N14-92-048	LVD-V7	In CD playing, the revolutions of the disc is too fast.
N14-93-007	LVD-710	Cannot read LDs/CDVS.
N14-93-016	LVD-710	The screen goes out of control in the horizontal direction in certain screens of LDs.
N14-92-032	LVK-1000	Cannot read LD TOC.
N14-92-031	LVD-K70	Cannot play LDs.
N14-92-036	LVD-K70	Both external input and CD voices are sounded with something like noises.
N14-92-043	LVD-K70	Noises are generated.
N14-93-006	LVD-K70	No operations will occur.

QUICK REPAIR INFORMATION

MODEL LVD-07	REF. No. N14-89-002 DATE 27th FEB 1989
(Phenomenon of Defect) The power cannot be turned ON. (Defective Part) Fusing of the power fuses F101, F102 on PS-160 (Power, Spindle PC Board). The Disc Motor Drive IC (IC204) on PS-160 (Power, Spindle PC Board) is defective (Treatment, Measure) Replace the defective parts (on PS-160 PC Board): F101, 102 1-532-581-00 IC204 STK455C	

QUICK REPAIR INFORMATION

MODEL LVD-07	REF. No. N14-90-009 DATE 6th JUNE 1990
(Phenomenon of Defect) CDs cannot be played. (No problems for LD playing.) (Defective Part) In the Mechanism, the Worm Gear REF. No. 172 is detached from the metal shaft and the gear slips. (Treatment, Measure) Replace the defective parts (CD Feed Base section in the Mechanism): REF. No. 172 X-3720-328-1	

QUICK REPAIR INFORMATION

MODEL LVD-07	REF. No. N14-90-029 DATE 20th DEC 1990
(Phenomenon of Defect) Colors do not show up. (The image itself is OK and the sound is also normal.) Monochrome Status (The error voltage of the Color Phase Correction section D103 is disordered and not converged.) REF 3.58MHz on IC109 5 pin is normal. (Defective Part) The TBC Error Oscillation Device in the Video Process is defective. (Treatment, Measure) Replace the defective parts: IC112 CXA1018S	

QUICK REPAIR INFORMATION

MODEL LVD-07	REF. No. N14-91-028 DATE 26th FEB 1991
(Suggestion for a jig to adjust the Tracking Balance) By connecting the circuit as shown below to 4 and 5 pins of CHECK PIN (LV-5, CN402), tracking and thread-servo can be released and the Tracking Balance can be adjusted very easily. Connect the jig, then adjust the Tracking Balance.	

QUICK REPAIR INFORMATION

MODEL LVD-9E	REF. No. N14-89-022 DATE 27th FEB 1989
(Phenomenon of Defect) The Tray will not open, or is hard to open. (Defective Part) The Lock Pin of REF. 315 of the Mechanism does not move smoothly. Also, the Spring of REF. 308 is slightly transformed. (Treatment, Measure) After cleaning the Lock Pin REF. 315, apply grease. Transform the Spring, or replace it. (PART No. HY3334591)	

QUICK REPAIR INFORMATION

MODEL LVD-9E	REF. No. N14-89-020 DATE 20th OCT 1989
(Phenomenon of Defect) The CD CDV LD for the display FL tube is illuminated always dimly. (Defective Part) The Zener Diode D925 in the Power Circuit is short-circuited. (Treatment, Measure) Replace the defective parts (in the Power Circuit): D925 HZ9A2 (9.2V ZENER DIODE)	

QUICK REPAIR INFORMATION

MODEL LVD-9E	REF. No. N14-89-027 DATE 23rd DEC 1989
(Phenomenon of Defect) The Protection Circuit is activated and the power is not turned ON. (Defective Part) The Transistor for bias setting in the Abnormal Power Detection Circuit is short-circuited between B and E. (Treatment, Measure) Replace the defective parts (FTS Circuit) Q961 2SC1740	

QUICK REPAIR INFORMATION

MODEL LVD-9E	REF. No. N14-89-028 DATE 25th DEC 1989
(Phenomenon of Defect) The TOC of CD cannot be read. In case of an LD of digital voice, it takes too much time for searching. (Defective Part) Due to the characteristics defect of the Phase Compensating Amplifier IC4 on the DA PC Board (Voice Process Circuit, Voice Circuit II), X001 16.9344MHz will be stable after loading the DC. (Treatment, Measure) Replace the defective parts (Voice Process Circuit, Voice Circuit II on DA PC Board): IC4 BA4558	

QUICK REPAIR INFORMATION

MODEL LVD-9E	REF. No. N14-90-008 DATE 29th MAY 1990
(Phenomenon of Defect) There are times the TOC cannot be read. Even when the TOC is read, a Disc Error occurs on an attempt of searching and operation will stop. (Defective Part) Soldering of PSL No. ① pin on the Print Circuit for the Feed Motor is defective. (Treatment, Measure) Re-soldered PSL No. ① pin.	

QUICK REPAIR INFORMATION

MODEL LVD-9E	REF. No. N14-90-012 DATE 7th SEP 1990
(Phenomenon of Defect) There are times the power cannot be turned ON. Or even when the power is turned ON, it immediately turns OFF. (Defective Part) The Photo Coupler IC924 on the Main PC Board (Power Circuit) is defective. (Treatment, Measure) Replace the defective parts (Main PC Board Power Circuit): IC923 ON3111Q	

QUICK REPAIR INFORMATION

MODEL LVD-9E	REF. No. N14-91-020 DATE 25th FEB 1991
(Phenomenon of Defect) Playing is not possible. (The Pick Up will not move, nor will the Laser Diode illuminate.) (Defective Part) The holder of the IN/OUT switch for REF. 318 Tray has been detached. (Treatment, Measure) Re-attached the REF. 318.	

QUICK REPAIR INFORMATION

MODEL LVD-7E, 7000	REF. No. N14-89-021 DATE 20th OCT 1989
(Phenomenon of Defect) On the models listed above, defects have occurred that the disc does not revolve, the revolutions of the disc does not increase, searching is not possible, etc. (Defective Part) Soldering has been defective at large transistors of Focus Driver, Disc Motor Driver, etc. in the Control Unit X29-2000. (Treatment, Measure) Re-solder the defective parts (especially at large parts, connectors, etc. in the Control Unit X29-2000). Judging from the phenomenon, check the soldered parts of the relating circuits.	

QUICK REPAIR INFORMATION

MODEL LVD-7E	REF. No. N14-92-030 DATE 24th SEPT 1992
(Phenomenon of Defect) No key operations are accepted. (Defective Part) In the Video Unit, a noise is on the data line between the Main Microcomputer and the Data Decoder IC. (Treatment, Measure) Replace the defective part (Video Unit X35-2010 Data Decoder) IC8 PD0031	

QUICK REPAIR INFORMATION

MODEL LVD-05	REF. No. N14-90-001 DATE 25th DEC 1989
(Phenomenon of Defect) The Tray action is not normal. (The open/close actions are not constant.) The Pick Up moves to the outer tracks without control, and makes rattling noises. (Defective Part) As the Shift Register in the Control Unit X29-2000 is defective, the position of each switch in the mechanism cannot be detected. (Treatment, Measure) Replace the defective parts (Control Unit X29-2000) IC8 74HC165AP	

QUICK REPAIR INFORMATION

MODEL LVD-05	REF. No. N14-91-042 DATE 24th JUNE 1991
(Phenomenon of Defect) There are times the Tray will not open or close. (Defective Part) The lead wire connected to the Tray Motor is cut. (Treatment, Measure) Replace the lead wire.	

QUICK REPAIR INFORMATION

MODEL LVD-7J	REF. No. N14-90-007 DATE 17th April 1990
(Phenomenon of Defect) The OPEN/CLOSE key of the Tray does not work. (Defective Part) Due to a wrong positioning of the REF. No. 26 Slider Gear in the mechanism, the UP/DOWN switch of the Tray does not operate. (Treatment, Measure) Re-attach the Slider Gear correctly.	

QUICK REPAIR INFORMATION

MODEL LVD-7J	REF. No. N14-92-011 DATE 1st April 1992
(Phenomenon of Defect) When a CLV LD is played, the screen image becomes disordered. There is no problem for playing CAV LDs. (Defective Part) In the Video Unit X35-2010, the output voltage of the IC7 2/2 TBC ERROR Phase Compensating Circuit has not been constant in the range from DC1.8V to 2.2V. (In case of a CAV disc, the disc revolution speed is constant; therefore, no problem arises.) (Treatment, Measure) Replace the defective part (Video Unit X35-2010) IC7 M5218P	

QUICK REPAIR INFORMATION

MODEL LVD-700	REF. No. N14-91-010 DATE 12th FEB 1991
(Phenomenon of Defect) TOC cannot be read, and the disc will stop after several revolutions. (Defective Part) A DC voltage occurs on each pin of IC1 in the Control PC Board X29-2140. Accordingly, the lens of the Pick Up cannot be activated normally. (Treatment, Measure) Replace the defective part (Control PC Board X29-2140) IC1 NJM4560D-N	

QUICK REPAIR INFORMATION

MODEL LVD-700	REF. No. N14-91-017 DATE 20th FEB 1991
(Phenomenon of Defect) The image quality is defective (the screen image trembles). (Defective Part) In the Video Unit X35-2040, noises of pulse type have been piled up at the data output pins of IC27. (Treatment, Measure) Replace the defective part (Video Unit X35-2040) IC27 CXD1175AM	

QUICK REPAIR INFORMATION

MODEL LVD-700	REF. No. N14-90-013 DATE 20th SEP 1990
(Phenomenon of Defect) In playing discs of digital voice (CD, CDV, CLV-LD), no voice is outputted. (Defective Part) As the IC15 1 bit DAC on the Processor Unit X32-1670 PC Board is defective, the digital signals are not converted. (Treatment, Measure) Replace the defective part (Processor Unit X32-1570) IC15 SM580BF	

QUICK REPAIR INFORMATION

MODEL LVD-300	REF. No. N14-91-037 DATE 5th JUNE 1991
(Phenomenon of Defect) Playing is not possible for CDs. No problem for other discs. As LDs of digital voice can be played, operation for DSP or PLL type is normal. The FOK signal is inputted to the microcomputer. By turning the disc by hand, the RF signal can be confirmed. There is no change on the Error signal CDME for Disc Drive. (Defective Part) In the Processor Unit X32-1680, the print pattern of the Emitter pin of Q37 has been broken. (Treatment, Measure) Correct the print pattern connections.	

QUICK REPAIR INFORMATION

MODEL LVD-300	REF. No. N14-91-055 DATE 22nd AUG 1991
(Phenomenon of Defect) LDs cannot be played. The disc does turn, but the speed will not increase. (Defective Part) In the Processor Unit X32-1680, D37 NO is defective. Accordingly, the LD signal is not piled up on the MTM signal. (Treatment, Measure) Replace the defective part (Processor Unit X32-1680) D37 1SS133	

QUICK REPAIR INFORMATION

MODEL LVD-300	REF. No. N14-92-017 DATE 28th MAY 1992
(Phenomenon of Defect) In LD playing, the revolution speed of the disc will not go up. (Defective Part) The Servo System circuit operates normally. When the Disc Motor is turned manually, an abnormal noise is generated. (Treatment, Measure) Replace the defective part (Disc Motor in the mechanism) REF. No. DM T42-0580-08	

QUICK REPAIR INFORMATION

MODEL LVD-7i, 300	REF. No. N14-91-056 DATE 22nd AUG 1991
(Phenomenon of Defect) Discs cannot be played. The Disc Out display appears, and the Tray opens. (Defective Part) Soldering on the PC boards for LVD-7i, 300, 700 series is defective. Especially, the defects are often found at large transistors, IC, and connectors. (Treatment, Measure) Re-solder the defective soldering places correctly. In repairing, be sure to check all the soldering places.	

QUICK REPAIR INFORMATION

MODEL LVD-7i	REF. No. N14-92-008 DATE 21st FEB 1992
(Phenomenon of Defect) Runs out of control on turning ON the power. (Defective Part) Due to leakage of Diode D12 in the Disc Motor Control Circuit, bias is not turned ON to the base of Q11. (Treatment, Measure) Replace the defective part (Disc Motor Control Circuit X29-2150) REF. No. D12 1SS133	

QUICK REPAIR INFORMATION

MODEL LVD-7i	REF. No. N14-92-016 DATE 28th APR 1992
(Phenomenon of Defect) LD reading does not operate. (Defective Part) The FG Sensor in the mechanism is not parallel to the Disc Motor Turntable. (Treatment, Measure) Re-attach the FG Sensor (REF. No. 34)	

QUICK REPAIR INFORMATION

MODEL LVD-7i	REF. No. N14-92-027 DATE 7th OCT 1992
(Phenomenon of Defect) The Tray G goes in and out. (Defective Part) Due to a contacting defect of the Rotary Encoder in the mechanism. (Treatment, Measure) Replace the defective part (Rotary Encoder in the mechanism) REF. No. 56 T99-0506-08	

QUICK REPAIR INFORMATION

MODEL LVD-7i	REF. No. N14-93-011 DATE 26th FEB 1993
(Phenomenon of Defect) Cannot play LDs. (Defective Part) The Data Decoder in the Processor Unit is generating noises. (Treatment, Measure) Replace the defective part (Processor Unit X32-1680) REF. No. IC15 PD0011A	

QUICK REPAIR INFORMATION

MODEL LVD-V7	REF. No. N14-91-057 DATE 19th SEP 1991
(Phenomenon of Defect) No images appear in the screen. (Defective Part) Short-circuiting exists between the base and the emitter of Q28 on the Video PC Board X35-2080. (Treatment, Measure) Replace the defective part (Video PC Board X32-2080) Q28 2SC1740	

QUICK REPAIR INFORMATION

MODEL LVD-V7	REF. No. N14-92-048 DATE 18th DEC 1992
(Phenomenon of Defect) In CD playing, the revolutions of the disc is too fast. (Defective Part) Measuring the Crystal Oscillator (X51) of DSP IC, it is about 25MHz. Even in this condition, playing is operated (with the speed twice as fast as normal). (Treatment, Measure) Replace the defective part (Crystal Oscillator in Control Circuit Unit) REF. No. X51 L77-1129-05	

QUICK REPAIR INFORMATION

MODEL LVD-710	REF. No. N14-93-007 DATE 5th FEB 1993
(Phenomenon of Defect) Cannot read LDs/CDVS. Synchronization of the V signal after recovering the image goes out of range. The basic oscillation of 4Fsc is normal, but unstable amplitudes are seen as if the wave form were affected by AM modulation. The power of 1/910 Counter in the Video Unit is not constant. (Defective Part) The electrolyte solution of Condenser C93 in the Video Unit is leaked. (Treatment, Measure) Replace the defective part (Condenser in Video Unit) REF. No. C93 CE04KW1A101M	

QUICK REPAIR INFORMATION

MODEL LVD-710	REF. No. N14-93-016 DATE 18th MAR 1993
(Phenomenon of Defect) The screen goes out of control in the horizontal direction in certain screens of LDs. In the screens where this phenomenon appears, the Disc Motor voltage goes out of control and noises appears in the screen just as a group of small fish swimming in a river. (Defective Part) The capacity of the input condenser in the Video Amplifier is no good. (Treatment, Measure) Replace the defective part (Electrolyte Condenser in Video Circuit (X35-2090)) REF. No. C50 CE04KW1A101M	

QUICK REPAIR INFORMATION

MODEL LVK-1000	REF. No. N14-92-032 DATE 28th SEP 1992
(Phenomenon of Defect) Cannot read LD TOC. (Defective Part) Due to shortage of torque of the Feed Motor in the mechanism. (Treatment, Measure) Replace the defective part (Feed Motor in the mechanism) REF. No. FM T42-0578-08	

QUICK REPAIR INFORMATION

MODEL LVD-K70	REF. No. N14-92-031 DATE 24th SEP 1992
(Phenomenon of Defect) Cannot play LDs. (Defective Part) No voltage is on the Video Amplifier Transistor on the Video PC Board. The coil on the power line is cut. (Treatment, Measure) Replace the defective part (Video PC Board X35-2080) REF. No. L8 L40-1001-17	

QUICK REPAIR INFORMATION

MODEL LVD-K70	REF. No. N14-92-036 DATE 14th OCT 1992
(Phenomenon of Defect) Both external input and CD voices are sounded with something like noises. (Defective Part) Even with no external inputs, a sine wave of 40KHz is outputted. The bit clock of the digital filter is distorted. (Treatment, Measure) Replace the defective part (Processor Unit X32-2010) REF. No. IC58 SM5840CP	

QUICK REPAIR INFORMATION

MODEL LVD-K70	REF. No. N14-92-043 DATE 30th OCT 1992
(Phenomenon of Defect) Noises are generated. (Defective Part) Only as much as +7V is on the +8V AVR power line. (Treatment, Measure) Replace the defective part (Karaoke Processor Unit X25-4560) REF. No. IC20 μPD7808HF	

QUICK REPAIR INFORMATION

MODEL	REF. No. N14-93-006
LVD-K70	DATE 29th JAN 1993
(Phenomenon of Defect) No operations will occur. (Defective Part) The 22 and 63 pins of the Signal Process IC of the Main Microcomputer are open-circuited. Accordingly, the SCOR data (Q data synchronizing interrupt signal) is not transmitted and the Main Microcomputer is latched up. (Treatment, Measure) Correct the soldering on the 63 pin of IC57 in the Processor Unit X32-2010.	

[A]

ACC Circuit (Automatic color Control)

A circuit for automatically controlling the phase of carrier wave color signals.

Actuator

The lens drive mechanism in an optical pick-up, having free angles in direction of two axis of up-and-down and sideways.

A/D(Analog/Digital)Conversion

To convert sampled analog signals into codes corresponding to the respective sampled value,i.e.,to convert into digital signal

ALPC Circuit

A drive-current control circuit for automatically controlling the laser beam quantity of the pick-up.

AM(Amplitude Modulation)

The system to modulate the amplitude of a carrier wave of a certain frequency with the required re-generative signals.

Angular Velocity

The velocity of revolution with a certain revolved angle advancement kept per unit time when a disc,etc.is revolved.

APC Circuit(Automatic Phase Control)

A circuit for automatically controlling advancement and delay of the phase of a signal.

Aspect Ratio

The ratio of the TV screen dimensions of height to width.

[B]

Bit

The minimum unit of digital signals.

BPF(Band Pass Filter)

A filter with characteristics to pass a certain bandwidth. In many cases, a low-pass filter and a high-pass filter are combined to form this type of filter.

[C]

Carrier Wave

A signal to transmit electric signals, etc.

CAV(Constant Angular Velocity)

To keep the revolution constant in playing a disc, etc.

CCD(Charge Coupled Device)

A device to store electric charges of analog signals and output the stored charges by a certain standard clock.

CDV

A kind of video disc. The size is the same as a CD(Compact disc). Its sound part is 20 minutes, and its video part is 5 minutes. It is labeled in golden color.

CED System

A video disc system, released by RCA,U.S. On one side of the disc of 30cm diameter, data of 20 minutes is recorded. It is played with the stylus pressure of 0.75g and the disc revolution of 450rpm. Four frames of video signals are recorded in one round of a disc.

Chapter No.

The number assigned to a music piece or a certain scene in the video disc, corresponding to an individual chapter in an novel.

CLV(Constant Linear Velocity)

A system to record data in the same density from start to end the disc, and accordingly to read the data in playing in the same linear velocity from start to end. To enable the constant linear velocity, the disk revolution is controlled to vary as the date recording or reading goes on.

Color Burst Signal

Color Synchronizing Signal (Signal with the same frequency as the Color Sub- carrier Wave, to synchronizing-detect the Carrier Color Signal)

Color Differece Signal

The color information signal that actually realizes the color TV broadcasting, obtained by subtracting the Brightness Signal from the color signals of red or blue such as R-Y,B-Y.

Color Sub-carrier Wave

The carrier wave to transmit the color signal in the TV broadcasting system.

Comb Filter

A way to separate the interleave Brightness Signal and Color Signal of the TVsignal from each other

Composite Signal

The signal combined with all the information of TV signal (Brghtness Signal, Color Signal,Synchronizing Signal,Burst Signal,Sound signal).

Contrast

In the TV or video technology,it means the ratio of the white part and the black part on the screen.

Cross Color

Phenomenon that detailed picture factors on a TV screen and color signals are interfered with each other, which appears as stripe of rainbow colors.

Cross Talk

A leak of signal output to a non-desired channel in stereo music playing or broadcasting.

CX(Compress-Expand)

A kind of noise-reduction circuit for FM sound signals. It compresses signals with a level larger than that specified for recording, and expands them for playing.

C Signal

The color signal contained in the Composite Video Signal.

[D]

D/A(Digital/Analog)Conversion

To convert the quantizing signals (digital signals) into analogs based on the sampling frequency.

DATA

A command signal to make the control device activate the non-control device. It is usually realized by being accompanied by a Clock signal and a Latch signal.

Diffraction

Phenomenon that sound or light turns round an obstacle.

Diffraction Grating

A plate with slits, to diffract the laser beam and make three beams out of one, installed in an optical pick-up, etc.

Digital

One obtained by replacing the value of a voltage or current by a numeric value and converting it into presence/absence of an electric signal.

Dot Disturbances

When the TV signals are divided into Brightness Signals and Color Signals and they are not separated well, small spots appear on the screen. They are called Dot Disturbances.

Drop-out

A status that a signal is missing.

Duty Ratio, Duty Factor

The value of square wave frequency expressed in %.

Dynamic Range

The width between the maximum and the minimum of a signal or sound.

[E]

EFM(Eight-Fourteen Modulation)

A kind of modulation system for digital sound signals, used for CDs and LDs.

Emphasis

The operation in a FM modulation system, to lift up a high frequency factor in modulation to improve the S/N ratio and to regain the original status in demodulation.

Error

Indicates an electrical or mechanical error or difference that occurs in an electronic circuit. It is often utilized for various controls.

[F]

FE(Focus Error)Signal

A control signal to focus the laser beam from the pick-up accurately on the disc, in playing an optical disc.

Feed Servo

A component to move the pick-up in the tracking direction.

Flicker(s)

Flickering(blinking)trouble on the screen.

FM(Frequency Modulation)

A modulation system to express required re-generative signals in from of frequency changes of signals in a certin amplitude.

Focus Servo

A device to control the pick-up laser beam to fouds accurately on the disc.

Frame-to-Frame Playing

A special playing operation to play independent still pictures in a series by skipping some of the 60 pictures that are to be played per second in the normally playing mode.

Frequency

The number of times sound or air vibrates second.

Fsc

Indicates the frequency of a Color Burst signal. The frequency is 3.57945MHz.

FZC(Focus Zero Cross)

The positino to indicate the accurate focusing point in a Focus Error signal.

[G]

GCR Signal

The signal to eliminate a ghost,to be inserted during the Vertical Blanking Time in the NTSC System.

Ghost

The image to appears beside the original image on the screen due to trouble in wave transmission or processes, or the signal to cause such an image.

[H]

Harmonic(s),Higher Harmonic

A frequency factor to occur when a pure sine-wave passes through a circuit. Such a factor has a frequency of multiple value the original(pure)wave.

Height Servo

A component adopted in a dual-faced playing laser disc player, for automatically adjusting the height of the pick-up body.

Hi-Fi(High-Fidelity)

Playing with high fidelity.

Hi-Fi Sound-multiplexed

One of the disc types with LD karaoke music,recorded with stereo sound.

Horizontal Synchronizing Signal

The times signal to enable the video signal to scan accurately in the horizontal direction,and it is contained in the Video Signal.

HPF(High Pass Filter)

A filter with characteristics to pass only a high frequency bandwidth.

[I]

IC

Integrated Circuit.

Interlaced Scanning

In the NTSC TV system, one picture on the screen is composed of 525 scanning lines. The Interlaced Scanning is the way to improve the picture quality by dividing those 525 scanning lines into two scanning sequences.

Interpolation

To store data temporarily in a digital signal process.

[J]

Jitter

Wow and Flatter to occur due to a change on a signal in a time.

I Signal

The color signal with the higher color difference visual acuity.

[L]

Linear Velocity

Refer to "CLV".

LPF(Low pass Filter)

A filter with characteristics to pass only a low frequency bandwidth.

LSI

Large Scale Integration.

Laser Pick-up

A unit in which Laser Diode, Reflecting Plate, Photo-Diode, etc. are assembled. It converts the return beam into electric signals.

[M]

MCA Code

Data to indicate a Frame No. in a Laser Disc.

MTF(Modulation Transfer Function)

One of the characteristics relating to the object lens of the pick-up, indicating how many tracks per 1mm the optical pick-up can read.

Multi-bit DAC

The Ladder-type DAC is on the main stream at present, however the Multi-bit DAC is also used. It is a multi-bit D/A converter of 16-bit type or 18-bit type.

[N]

Negative Modulation

A modulation system of video signals, to assign a smaller amplitude to a brighter picture signal and assign a larger amplitude to a darker picture signal.

Noise Shaper

A negative feedback type of converter to reduce the re-quantized noise that has occurred at the time of bit compression.

Noise Suppress Ratio

The ratio to suppress noise.

NR(Noise Reduction)Circuit

A circuit to reduce noises. The Dolby NR attached to many audio cassette tape players is an example of this.

NTSC(National Television System Committee)

A TV system, the first TV technology in the world that is compatible for both color and monochrome, developed in the U.S. and adopted in Japan, etc.

[O]

Orthogonal 2-phase Modulation

A system to modulate the color sub-carrier wave based on the I Signal and the Q Signal.

[P]

PAL

A TV system, the TV technology mainly used in Europe.

Pedestal

The black level of a video picture.

Phase

The term to indicate the position of a wave from, the relative position from the standard point with one cycle counted as 360 degrees.

Phase Shifter

An electric circuit to shift the phase of a signal wave to a required position.

Phillips Code

Data of Frame No., Chapter No., CX Code, etc. in an LD disc.

Picture Cell(Picture Element, Pixel)

The minimum unit to compose a video picture.

Pit

The hollow spots on the optical disc surface, by which data is expressed.

PLL(Phase Locked Loop)

A closed-loop servo component composed of electronic circuits, consisting of Phase Detector, Voltage Control Oscillator, and LPF(Low Pass Filter).

Pulse Count Modulation

If FM signals are converted into pulses of equal width, the density of pulses becomes larger at a higher frequency and smaller at a lower frequency. By converting the number of these pulses into a voltage change, signals are modulated.

PWM(Pulse Width Modulation)

A modulation system to sample the required re-generative signal and to make the sampled value corresponded to the pulse width.

[Q]

Q Signal

The color signal with the weaker color difference visual acuity.

Quantization, Quantizing

To make the sample signals discontinuous in the amplitude axis direction. To combine it with sampling is called "digitization".

[R]

RAM(Random Access Memory)

A memory chip or circuit of temporary data storage, allowing data input/output freely at any address.

Resolution

The fidelity for re-generate TV pictures, usually expressed in the number of scanning lines.

Retrace Blank Time, Retrace Time

The period when the screen is not illuminated between scanning cycles

RF Signal

A wireless signal of 3000GHz or lower. In CD or LD technology, it means the main signal from the pick-up.

ROM(Read Only Memory)

A memory chip or circuit that allows reading only, usually stored with ID codes, etc.

[S]

Sampling

To make signals discontinuous in the time axis direction.

Scanning Lines

The beam lines to show the image on the TV screen, and one picture is composed of 525 scanning lines in the NTSC system.

SEAM

A TV system, the TV technology adopted in France and Eastern European nations.

Servo

A system or circuit to activate self-reflection controls, such as the PLL circuit.

Sideband

The modulated frequency band to occur on the up and down sides centralizing the carrier wave, in case of AM(amplitude modulation).

Single-bit DAC

Also called "1-bit DAC". An analog-digital converter for 1-bit quantizing.

Sound-Multiplexed Karaoke

An analog-sound karaoke software(disc or tape) in which only karaoke(orchestra with no vocal) sound in the left channel and karaoke plus vocal sound in the right channel recorded.

S/N(Signal-to-Noise) Ratio

Index to indicate how much of noise level is included in proportion to the required signal level.

Sound Carrier Wave

The signal wave modulated by sound (audio) signals to transmit those sound signals.

S Signal

A method of TV signal transmission, having an independent transmission route for each of the brightness signal and the color signal which are perfectly separated.

Still Picture

One of Trick Plays, to fix one-frame picture on the screen.

[II]

TBC(Time Base Corrector)

A circuit to correct the time base of the video signal used in video-signal players.

TE(Track Error)Signal

A control signal, enabling the pick-up of optical-disc players, etc. to trace the required track accurately.

Text Broadcasting

A system to send text(characters) multiplexed on the TV signals.

Tilt Servo

A servo component adopted in an LD player. It is a system to move the pick-up up and down and keep the distance to the disc within the specified value.

Tracking Servo

A device to control the pick-up to trace accurately on the data recorded in the disc.

TZC(Tracking Zero Cross)

The point to indicate the on-track status in the tracking signal.

[IV]

VCO(Voltage Controlled Oscillator)

A circuit of voltage controlled oscillator.

VCXO(Voltage Controlled Crystal Oscillator)

Voltage Controlled Crystal Oscillator.

Vertical synchronizing Signal

The timing signal to enable the video signal to scan accurately in the vertical direction, and it is contained in the Video Signal.

VHD System

A video disc playing system of an electrostatic capacity detection method, developed by Victor Japan.

Video Signal

Generally, it indicates the Composite Signal in which the Brightness Signal and Color Signal to re-generate the TV pictures are combined.

VITS Signal

Text broadcasting signals or distortion correction signals to be inserted during the Vertical Retrace Time in the NTSC TV system.

VSB

The vestigial-sideband transmission modulation, adopted for TV broadcasting, etc.

[Y]

Y Signal

The brightness signal contained in the Composite Video Signal.