

**Pioneer**

# **Service Manual**

**ORDER NO.  
CRT2624**

**CD MECHANISM MODULE**

# **CX-977**

- This service manual describes the operation of the CD mechanism module incorporated in models listed in the table below.
- When performing repairs use this manual together with the specific manual for model under repair.

Model	Service Manual	CD Mechanism Module
DEH-P630/X1N/UC	CRT2648	CXK5500
DEH-P7300R/X1N/EW	CRT2649	
DEH-P730/X1N/UC	CRT2650	
DEH-P7350/X1N/ES	CRT2651	

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# 1. CIRCUIT DESCRIPTIONS

From divisional viewpoint, the CX-977 is roughly divided into four sections, namely, Preamplifier, Servo, Power Supply and Loading Control.

This LSI realizes eight types of automatic adjustments (controls) through cooperative work between Preamplifier and Servo unit.

Because the system uses the single power source (+ 5v) specification, reference voltages used in the servo system (Preamplifier, Servo DSP and Pickup) are all Vref (2.1V).

## 1.1 PREAMPLIFIER (TA2153FN; IC101)

The Preamplifier processes output signals sent from the Pickup and generates signals to supply to each unit of the next stage, that is, Servo, Demodulator or Control. It also performs power control of Pickup's laser diode. Signals from the Pickup are I-V-converted by the Preamplifier, which is built-in in Pickup's photo detector, and then added-up by the RF amplifier to obtain signals such as RF, FE and TE.

Reference voltage, Vref (2.1v), is output from #19 pin of the IC, and 2Vref (4.2v) is supplied to the Servo DSP as the reference voltage to determine its D range of A/D input.

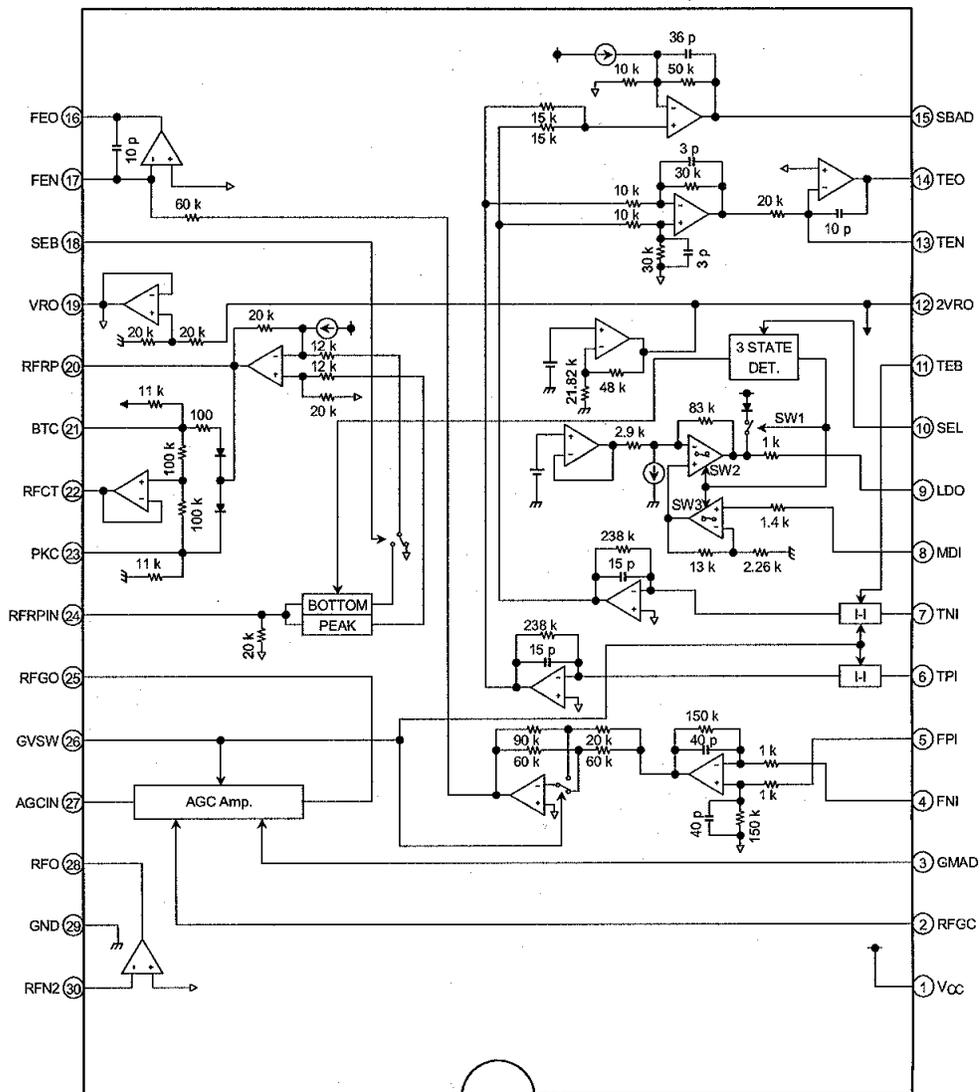


Fig. 1: TA2153FN circuit

**1) Focus Error Amplifier unit**

In this sub-unit, outputs from the photo detector, namely, (A+C) and (B+D), are processed in the differential amplifier and further in the error amplifier, and then, (A+C-B-D) is output as FE signal from #16 pin of IC101 (TA2153FN).

Low frequency component of voltage FE is expressed as:

$$FE = (A+C-B-D) \times (150k/(51k+1k)) \times (60k/60k) \times (120k/60k) = 5.77 \text{ times}$$

In FE output, "S" curve of approximately 1.45 Vpp on the basis of Vref is obtained. The cutoff frequency of the succeeding amplifier is 11.4 kHz.

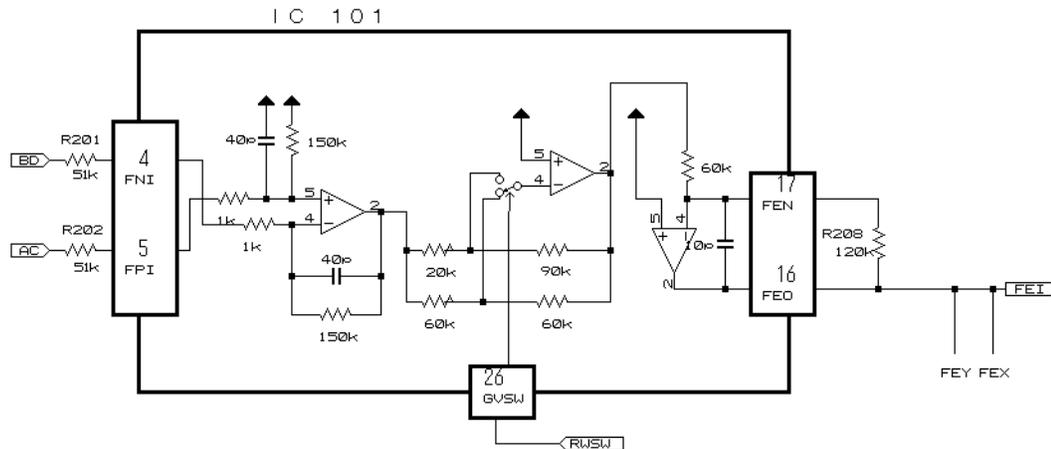


Fig. 2: FE circuit

**2) Tracking Error Amplifier unit**

In this sub-unit, outputs from the photo detector, namely, E and F, are processed in the differential amplifier and further in the error amplifier, and then, (E-F) is output as TE signal from #14 pin of IC101 (TA2153FN).

Low frequency component of voltage TE is expressed as:

$$TE = (E-F) \times 300k/100k \times 82k/20k = 5.8 \text{ times}$$

In TE output, "TE" waveform of approximately 1.51 Vpp on the basis of Vref is obtained. The cutoff frequency of the succeeding amplifier is 20 kHz.

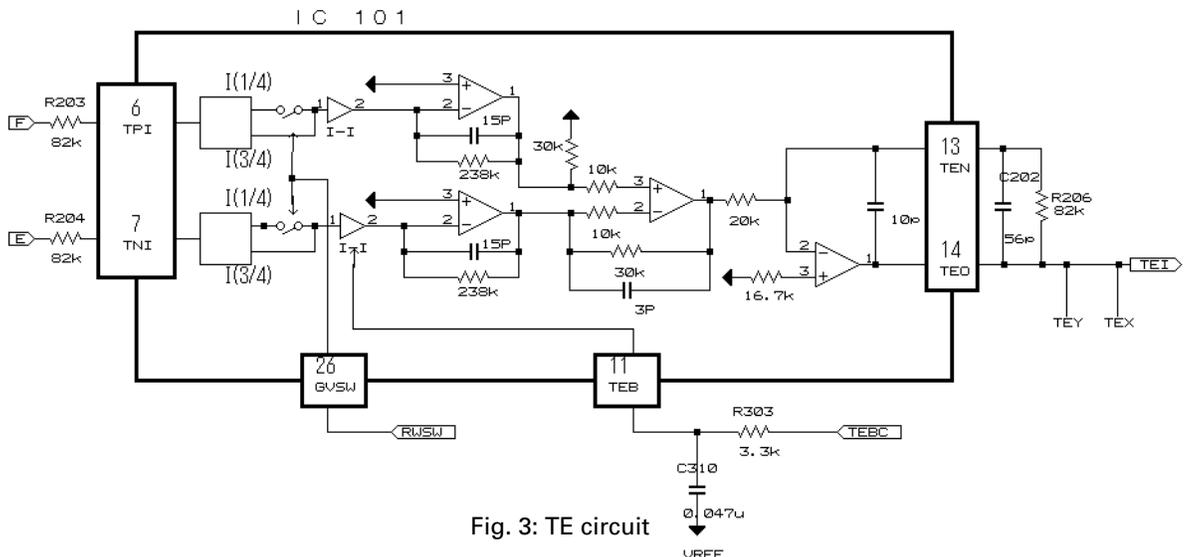


Fig. 3: TE circuit



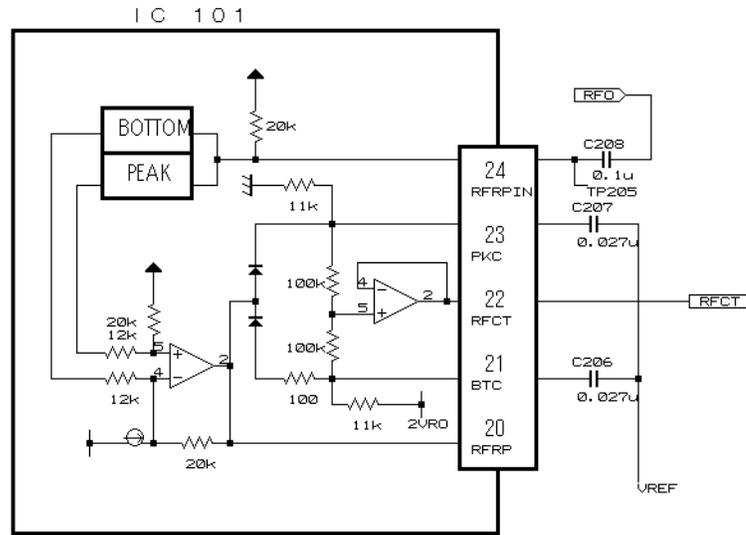


Fig. 5: RFRP and RFCT circuit

**5) SBAD Signal Circuit unit**

In this unit, outputs from the photo detector, namely, E and F are processed through the addition amplifier. That is, E and F are added together and (E+F) signal is output from #15 pin of IC101 (TA2153FN), as SBAD signal.

This SBAD signal, along with Focus Error signal, is used as one of the conditions that the system uses to internally judge Focus ON/OFF based on them.

Also, SBAD signal is used to detect defects: defects that may be detected when the Pickup passes a scratch on the disk, for instance.

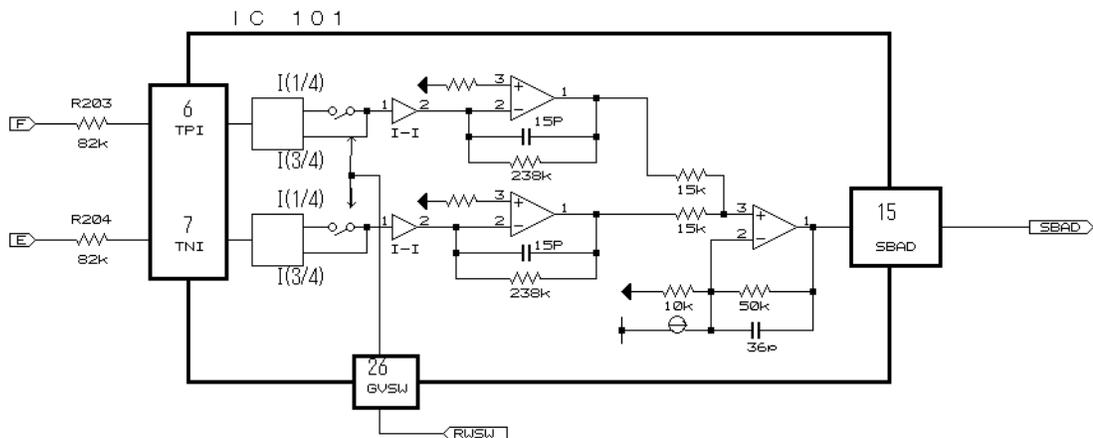


Fig. 6: SBAD circuit

**6) APC Circuit unit**

If a laser diode is driven at constant current, its optical output comes to have high level negative-characteristics, and this may cause it out-of-control drive because of the heat. So, driving current must be controlled, through use of a monitoring diode, so that optical output remains within the specific degree. This is exactly where APC circuit works. LD current can be obtained by measuring the voltage between LD1 and GND. The value is approximately 35 mA at room temperature.

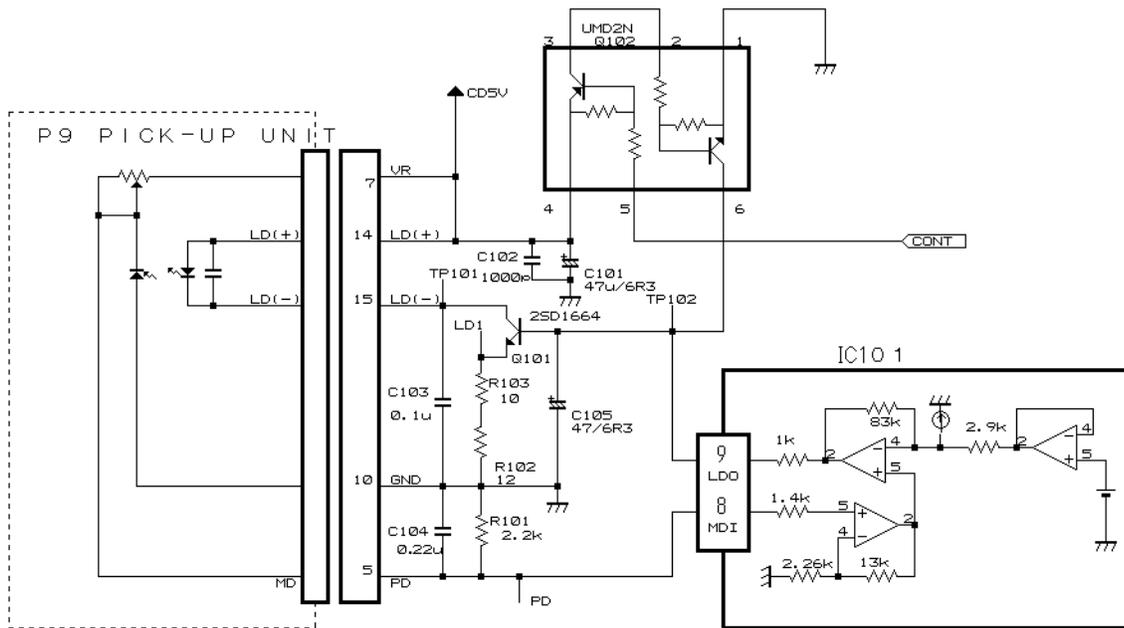


Fig. 7: APC circuit

## 1.2 SERVO DSP (TC9495F2; IC201)

### 1) Focus Servo system

The main equalizer of the Tracking Servo is comprised with a digital equalizer unit. Fig. 8 shows the block diagram of the Tracking Servo.

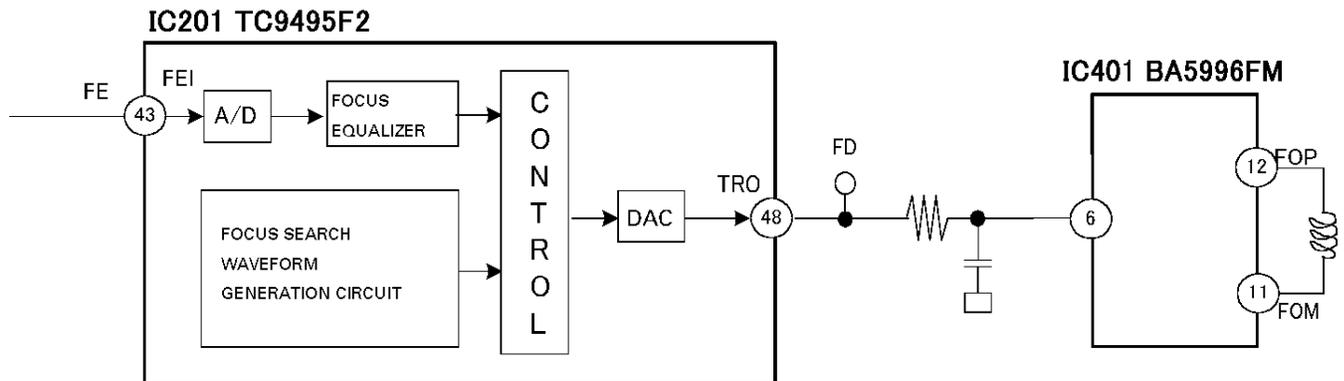


Fig. 8: Block diagram of Focus Servo circuit

A series of actions of detecting in-focus point and switching on the Focus Servo upon such detection are called "focus search." In Focus Servo system, the system needs to move the lens to in-focus point so that it performs "Focus Close." So, the system detects in-focus point moving the lens up and down, which it performs by changing focus search voltage of a triangle wave. During these operations, the spindle motor maintains offset mode and keeps constant rotating speed.

The Focus Servo is switched on through three steps shown below.

1. FOK=H
2. The Focus Error signal exceeds "Focus Standby" level threshold
3. The Focus Error signal reaches "Zero Cross"

Here are descriptions of the three steps.

While there is enough distance between the lens and the in-focus point, the system cancels SBAD offset, and defines this level (distance) as SBOFF. Then, starting from this SBOFF standard, SBAD level moves toward FOK threshold, reaches it, and finally exceeds the threshold. Upon this passing over the threshold, the condition of the lens becomes FOK ="H."

As the lens moves up and down, the focus error signal changes at the in-focus point. CD-LSI (IC201) analog/digital-converts such signal, and then, let the signal pass through the high-pass filter to remove the offset component of the signal. The signal so processed is called FEHPF signal. When the level of the FEHPF signal (internal signal of the LSI) exceeds "Focus Standby" level, because it means the lens has come to close to the in-focus point, the system sets the condition of the lens to "Servo-ON Standby." Finally, the FEHPF signal matches the value of the in-focus point, and the system triggers ON of the Focus Servo.

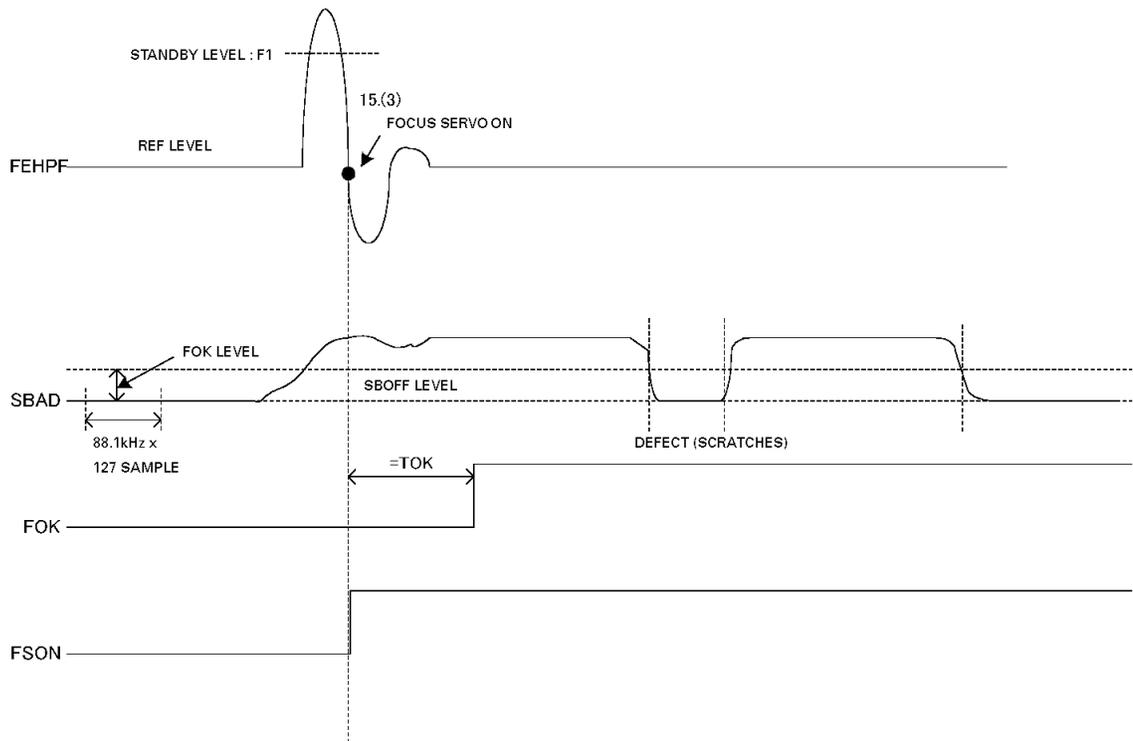
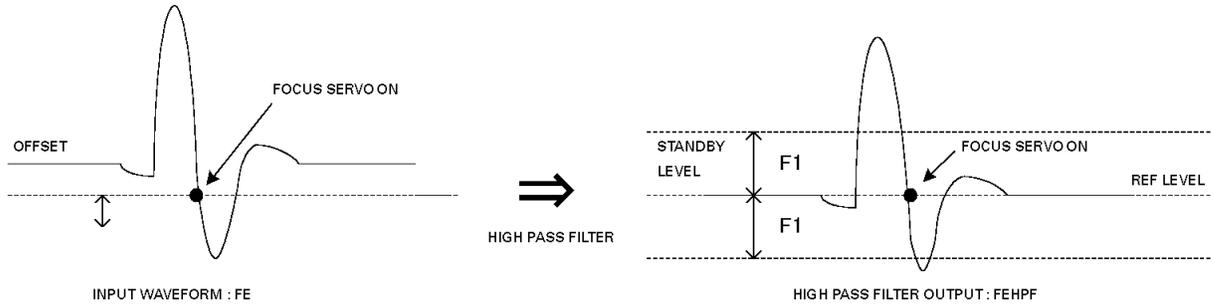


Fig. 9: Focus Search Timing

The microcomputer monitors FOON signal while the system is performing focus search, and starts monitoring of FOK signal from the point when 40 ms has passed after FOON signal became active (The signal is active when the condition is "Servo ON." It shows "L" in a test with a probe). If the microcomputer judges that FOK is not active, it performs necessary actions such as protection.

When, under Test mode, you press the Focus Close button, with the "Mode Select" of the focus set to "Display 01," you can check Focus Error signals, search-voltage and actual actions of the lens.

## 2) Tracking Servo system

The main equalizer of the Tracking Servo is comprised with a digital equalizer unit. Fig. 10 shows the block diagram of the Tracking Servo.

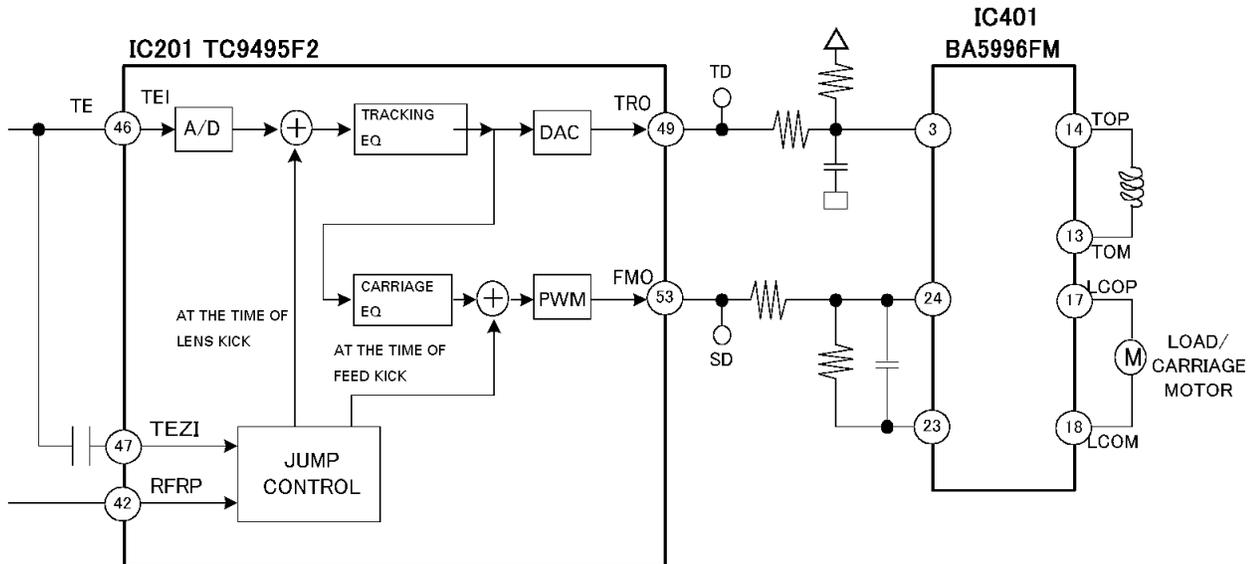


Fig. 10: Block diagram of the Tracking Servo

### Track jump

Track jump is automatically performed with a command issued by the microcomputer. It is performed through Auto-Sequence function that the LSI has in it.

The CX-977 has two types of track jump as those used for searching. Namely, the "Lens Kick" mode used for 1, 4, 10, 32 and 100 track, and the "Carriage Move" mode used for jumping of more than 1,000 tracks. Under Test mode, you can use, to check the track position, 1, 32 and 100 jump as Lens Kick jump and Carriage Move jump according to mode selection.

#### • Lens Kick jump

A Lens Kick jump is performed when the LSI receives a Lens Kick command from the microcomputer. Direction of jump and number of tracks are specified by the command. When the LSI receives a Lens Kick command, it applies kick pulses to the tracking EQ, and the jump occurs.

The LSI controls travelling speed of the lens by referring to the table it holds in it. In such way, the lens travels faster when there are a good number of tracks to go, while travelling speed gets slower as the number of remaining tracks decreases.

When track count is completed, Tracking Close is performed. During jump, the LSI observes RFRP signals, and based on the signals, performs track count. It detects the direction of the jump based on phases of RFRP and TEZI signals.

To prepare for good servo-feed in next time track jump, the system performs operations to increase Tracking Servo's gain and hysteresis operations for 50 ms after completion of Tracking Close. The system realizes FF/REV actions under Normal mode by continuously performing single jumps. The speed of FF/REV is approximately 10 to 20 times faster than "Play" (varies depending on the direction).

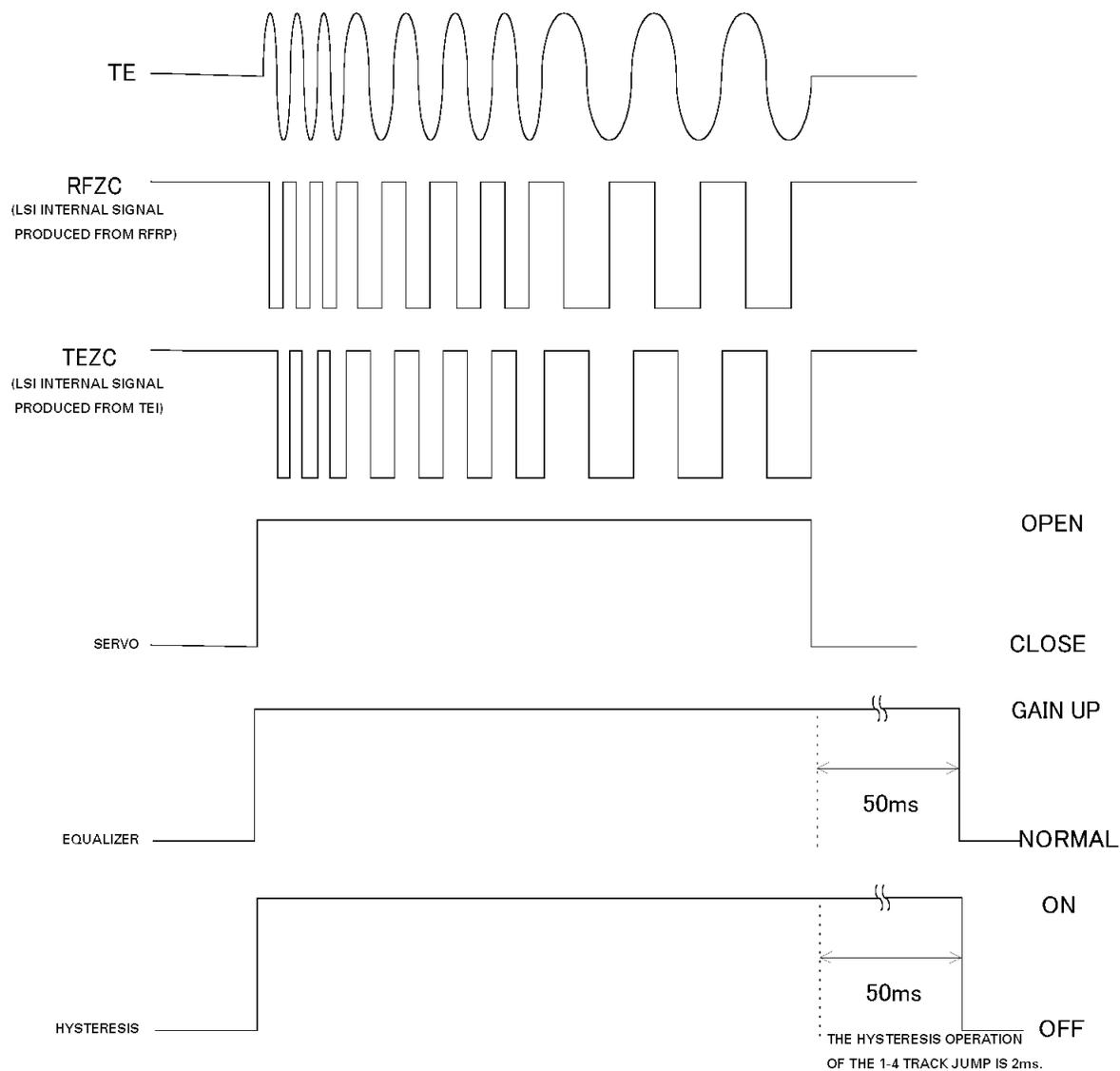


Fig. 11: Lens Kick

• Carriage Move jump

A Carriage Move jump is performed when the LSI receives a Carriage Move command from the microcomputer. Direction of move and number of tracks are specified by the command. When the LSI receives a Carriage Move command, it makes the Tracking Servo "Open," applies kick signals to the Carriage EQ and make the carriage motor drive. Thus, a track jump occurs.

The profile of the kick signals so applied to the EQ has the specific constant given to it at the starting-up of the jump operations. So, as the number of remaining tracks decreases, voltage is lowered so that travelling speed of the carriage becomes slower. In this way, by reducing speed just before the jump terminates, the servo-feed at the end of the jump is improved.

Also, to prepare for good servo-feed in next time track jump, every time a jump is completed, the system performs operations to increase the gain of the Tracking Servo and hysteresis operations for 60 ms after the completion of the jump.

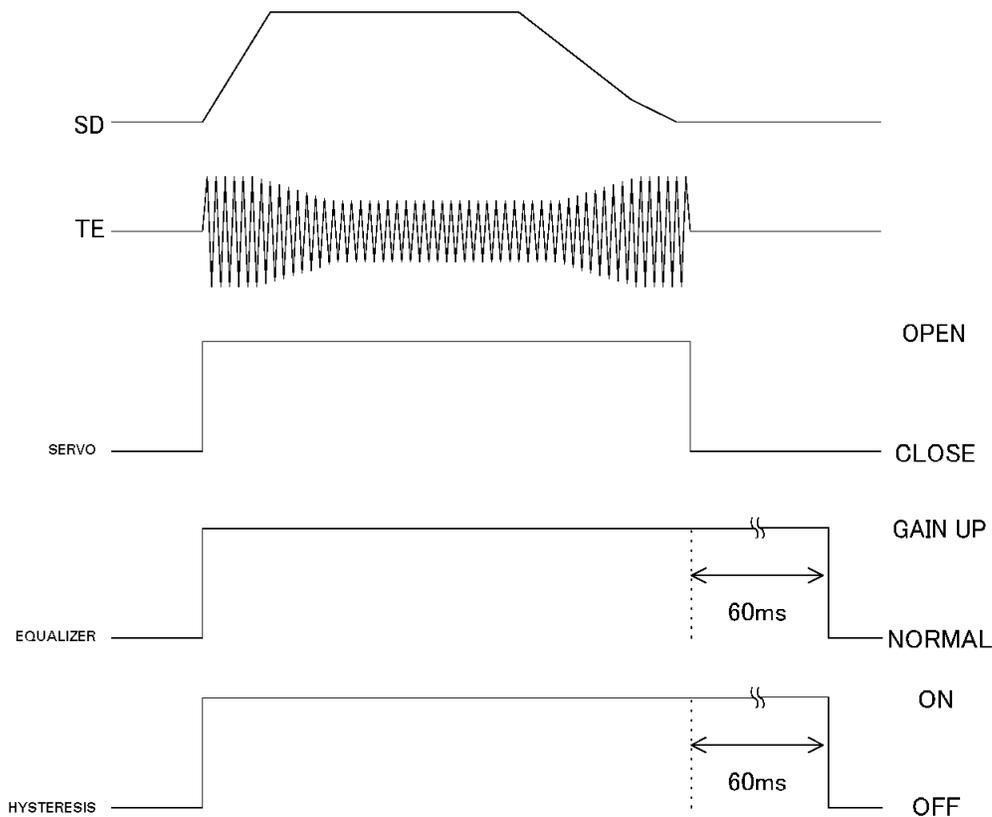


Fig. 12: Carriage Move

- Hysteresis operations

In certain operation, such as Setup or jump, servo-feed tends to be deteriorated during operations. Hysteresis is the operation to keep stable feed to servo-loop under such conditions. It acts in such manner that it holds a TE signal when each beam spot comes to off-track position, so that convergence of the Tracking Servo can be improved.

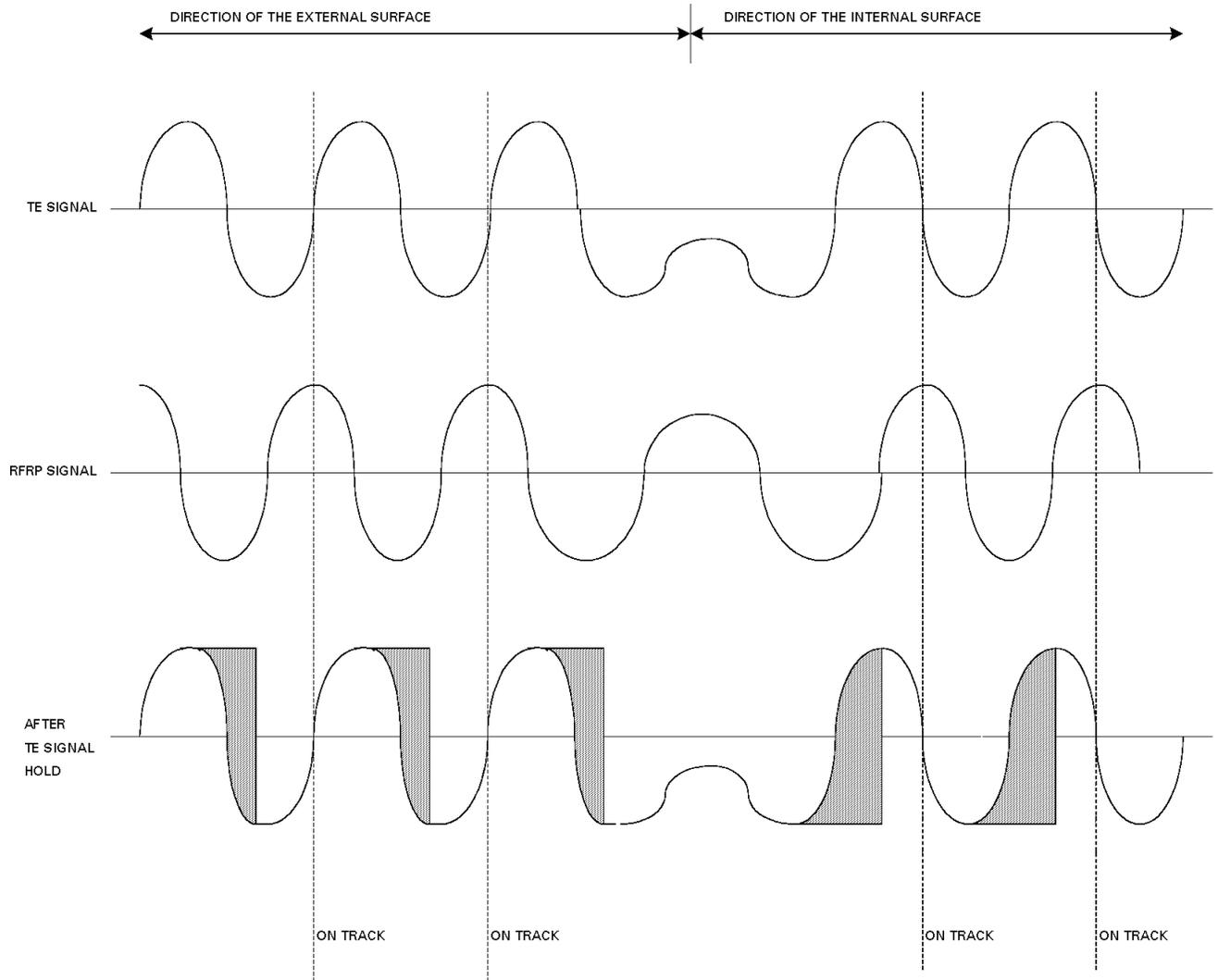


Fig. 13: Hysteresis operations

### 3) Carriage Servo system

The Carriage Servo inputs low-frequency-component output (lens position information) of the tracking equalizer into the carriage equalizer, then, after it has earned certain amount of gain, it outputs a drive signals from the LSI. Further, such drive signals are applied to the carriage motor via the driver.

Specifically, the system works as follows. That is, entire body of the pickup needs to move to the forward direction when the lens offset reaches certain level during Play. So, the gain of the equalizer is set in such manner that the equalizer constantly outputs higher voltage than the starting-up voltage of the carriage motor when such condition occurs. Practically, the system satisfies such requirement in such manner that the Servo LSI outputs the drive voltage only when the equalizer's output exceeds the specific level of threshold.

To minimize power consumption, and to stabilize operations, the level of threshold is pre-set slightly higher than the starting-up voltage of the motor. Waveforms of output of this drive voltage take pulse shape.

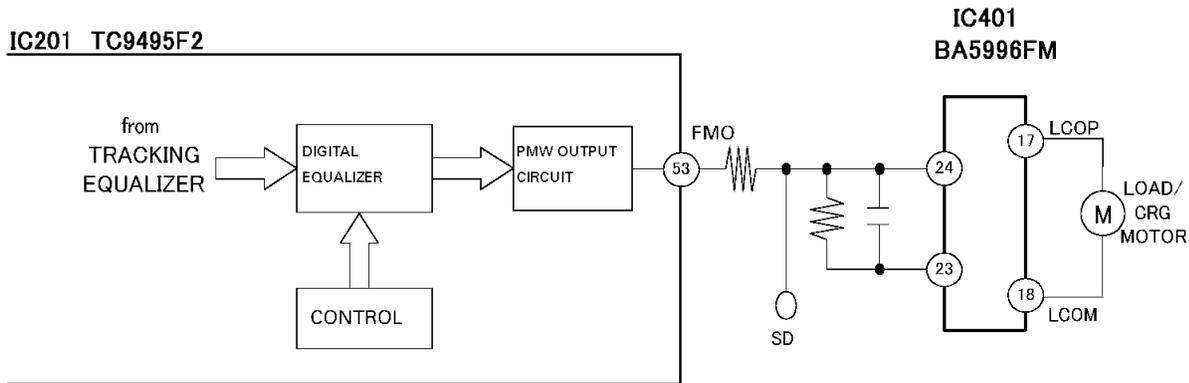


Fig. 14: Block diagram of Carriage Servo circuit

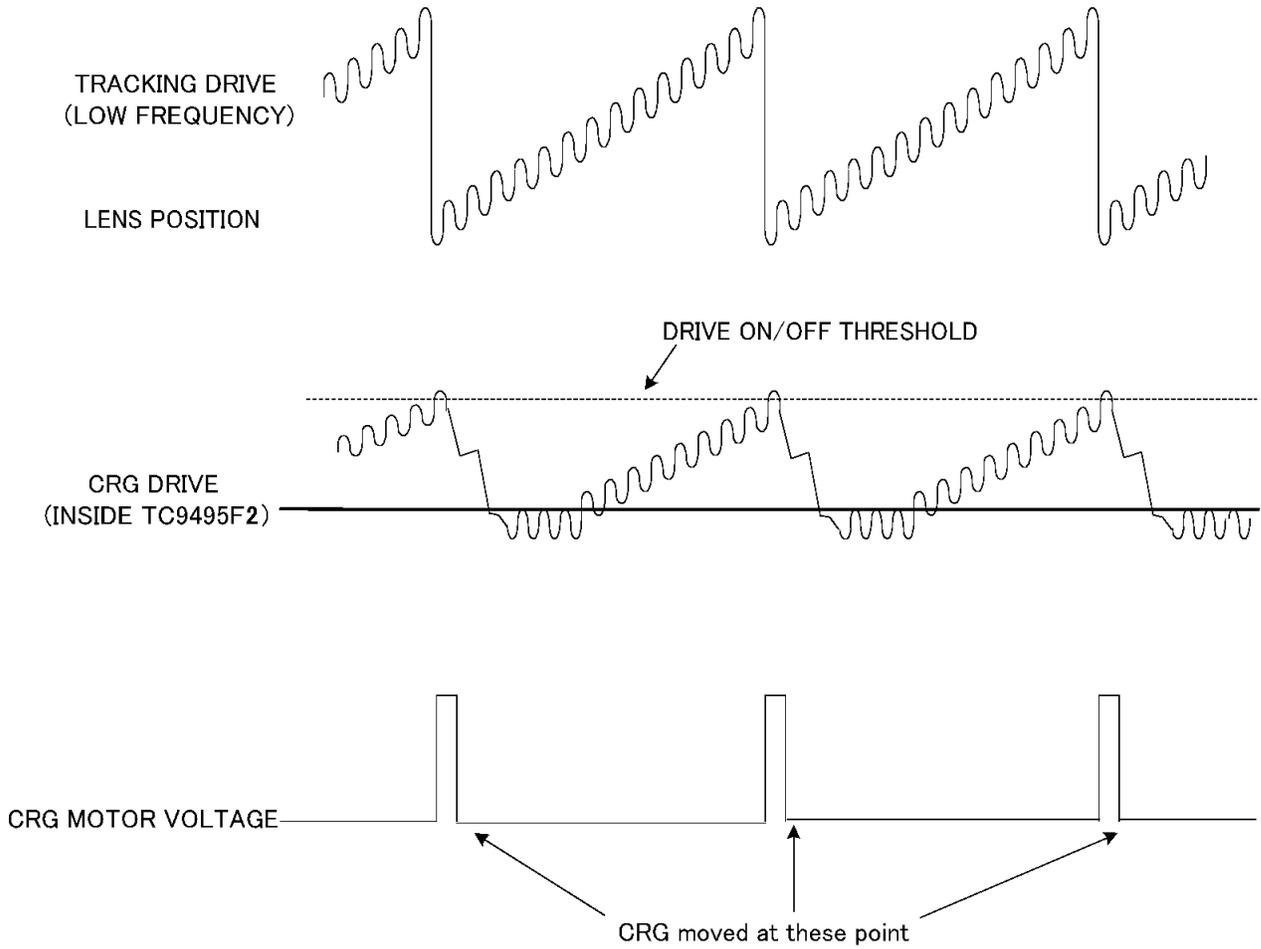


Fig. 15: Carriage signal waveform

**4) Spindle Servo system**

Fig.16 shows the block diagram of the Spindle Servo.

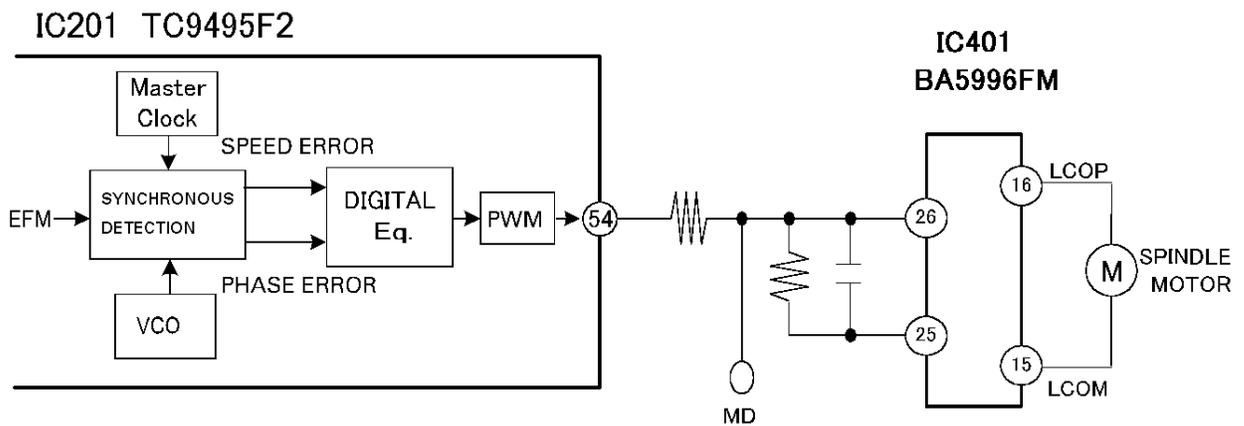


Fig. 16: Block diagram of the Spindle Servo circuit

Spindle Servo has the following modes

- CLV Servo mode

This is the mode the system uses for such span as "after Focus Close and before it applies brake to the motor to stop the disk." Before Tracking Close and during normal Play, the system operates under this mode.

During this mode, the system performs synchronous detection in EFM demodulation block in the CD-LSI (IC201) so that the disk keeps predefined rotating speed. To realize synchronous detection before Tracking Close the system adopts such method that it applies to PLL circuit the same speed control by VCO that is performed in the LSI.

On the other hand, as to speed control after Tracking Close, control by VCO is muted and the method is switched to speed/phase control through the master clock (a ceramic oscillator).

- Offset Servo mode

(a) After the kick is over in the setup, this mode is turned on until changing to rough servo mode.

(b) When focus is lost during play, this mode is turned on until the focus is restored.

Both of the above are used for maintaining the disc rotation rate near to the specified rate.

- Brake mode

The mode is for use to stop the spindle motor.

Brake Sequence starts up when the microcomputer sends the command to CD-LSI. Then, the LSI, watching disk's rotating speed, sets the flag when it detects that the speed comes to approximately one twentieth (1/20). On the other hand, the microcomputer, also monitoring such flag, switches off the servo when it catches the flag.

In case the microcomputer cannot catch such flag within the specific period after starting-up of the Brake Sequence, it changes the mode to Stop, and monitoring FG pulses, keep the mode until it confirms that the speed has become slow.

In case such change to Stop mode occurs at Eject time, the microcomputer moves the operations to Eject operations after Timeout time elapses.

- Stop mode

This is the mode used for Power-On and Eject operations. Drive's output is "0."

### 1.3 AUTOMATIC ADJUSTMENT FUNCTION

In this CX-977 system, all circuit adjustments are automatically performed in CD-LSI (IC201: TC9495F2). Adjustments are automatically performed every time a disk is inserted into the unit, or a CD mode is selected through the Source Key.

#### 1) Automatic TE offset/FE offset adjustment

This is the adjustment performed at POWER ON time. It adjusts both TE and FE amp- offsets of the Preamplifier to the target value defined for each signal (TE and FE), using Vref as the reference. The target values are (TE, FE) = (0, 0) [V]

Adjustments are performed as follows.

- (1) Servo LSI reads each offset value under the condition of "Laser Diode is OFF."
- (2) The LSI, based on the value so read, calculates the voltage to be reversed, and assigns the revised value to the location specified for use for such adjustment.

If you want to observe changes of voltage to examine actual offset voltage shown as error (focus error or tracking error), you cannot see such changes, even after adjustment, because such adjustment is made inside the digital filter.

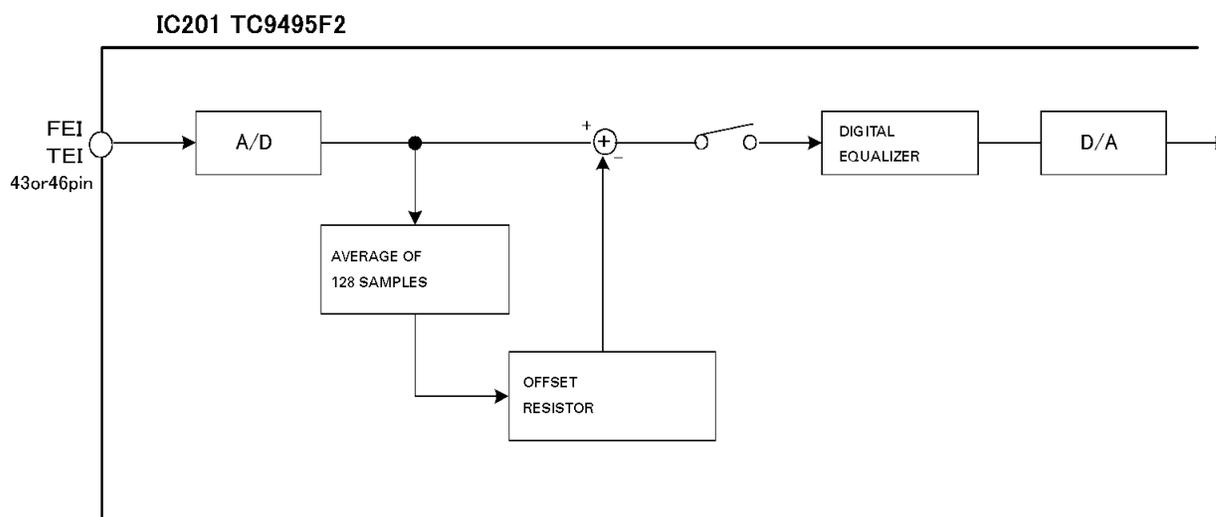


Fig. 17: Offset adjustment

#### 2) Automatic Tracking Balance (T, BAL) adjustment

This is the control that eliminates the difference between pickup's Ech and Fch output by changing the gain in the Preamplifier. In practice, the LSI realizes the control in such manner that it makes a TE waveform vertically symmetric against the Servo Reference level.

Adjustments are performed as follows.

- (1) After Focus Close
- (2) The system switches on the spindle servo.
- (3) The LSI fetches the level of TE signal and the level of TE offset, and based on these values, calculates the TE center value.
- (4) The LSI changes RF amp's gain so that such center value comes to close to the Servo Reference level.

Servo Reference level is set as follows.

In case offset adjustment is made, the level is set to:

The level of TEI input (i.e. TF offset level) at "Servo = OFF."

In case offset adjustment is not made, the level is equal to:

Vref level.

In this case, the adjustment is repeated several times to improve adjustment accuracy.

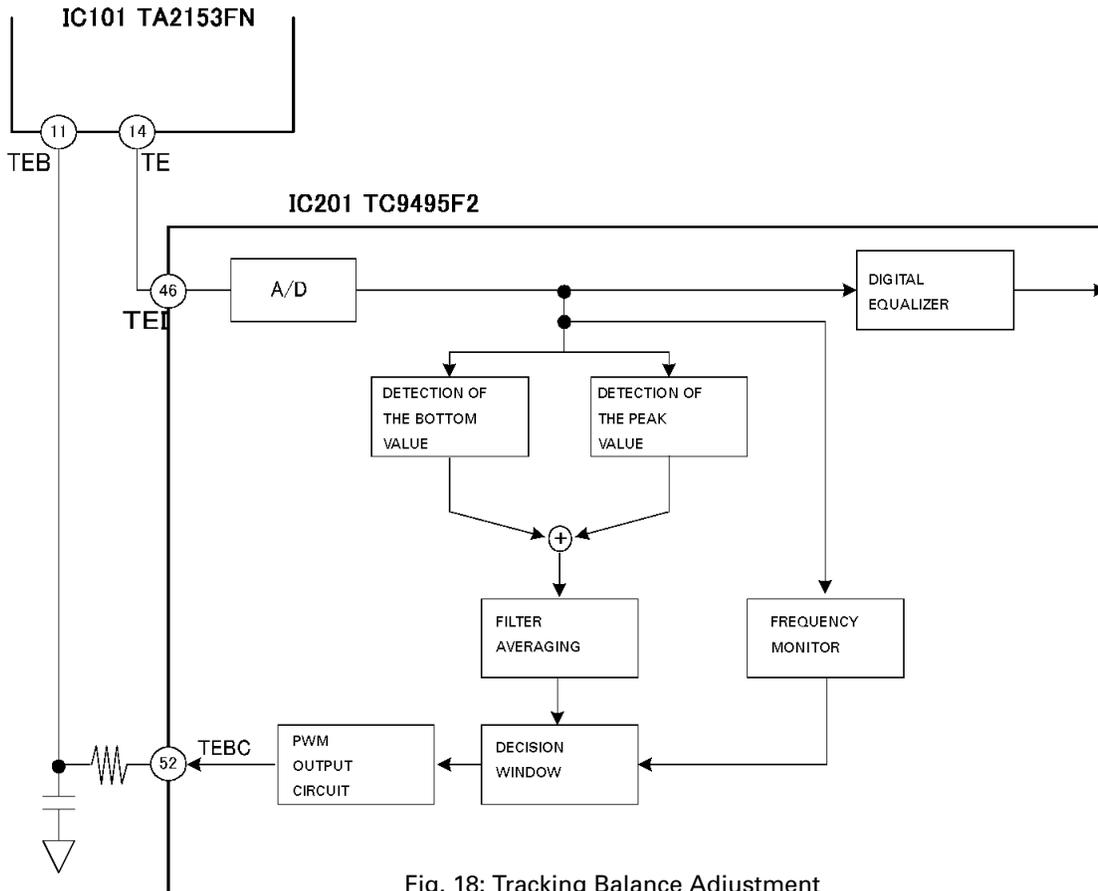


Fig. 18: Tracking Balance Adjustment

### 3) Focus/Tracking AGC

This is the control that automatically adjusts servo loop gain of the Focus Servo and Tracking Servo. The adjustment is performed in the following manner.

- (1) The system (microcomputer) injects a disturbance into servo loop.
- (2) Then, caused by such injection, error signals (FE and TE) are generated, and the system samples such error signals through BPF.
- (3) Then, inside the LSI, comparison of the difference of phase between the error signal and the disturbance is performed.
- (4) Finally, the system adjusts the gain so that the difference of phase accords to the target value preset by the microcomputer.

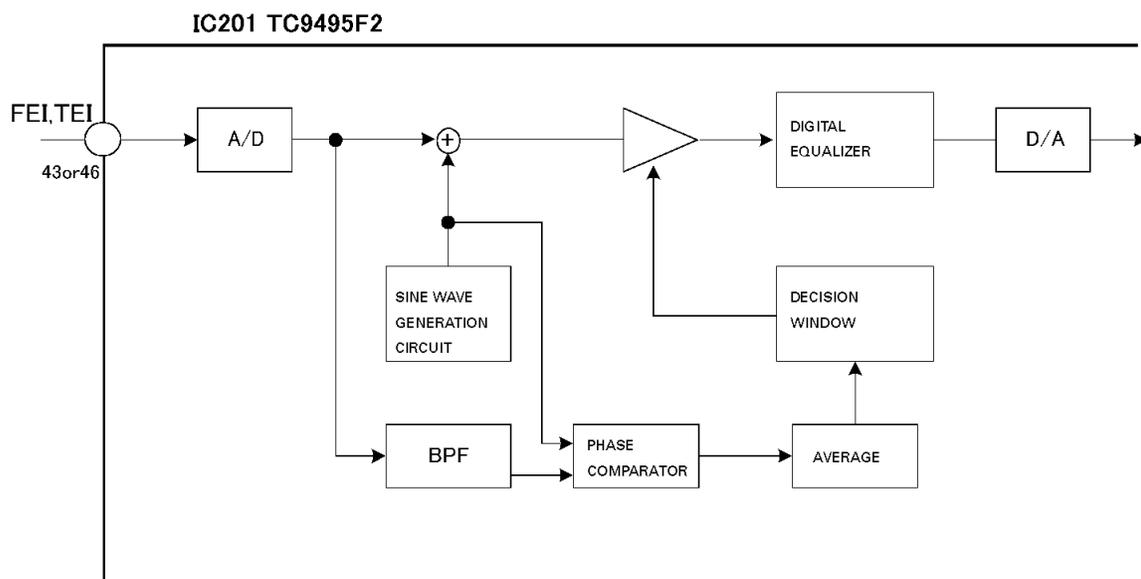


Fig. 19: Loop gain adjustment

### 4) FE Bias automatic adjustment

The task of this adjustment is to maximize RFI level by optimizing the focus point during Play. The adjustment is performed by examining RFRP level and phase-difference as of the time when a disturbance to generate focus errors is injected into focus loop.

Steps of the adjustment are shown below.

- (1) A disturbance is injected into focus loop based on the command issued by the microcomputer. (The session is performed in the Servo LSI.)
- (2) In the LSI, level of RFRP signal is detected.
- (3) Also in the LSI, the relation between such RFRP signal and the disturbance is examined, and through such examination the degree and direction of focus misalignment is detected.
- (4) Then, the system substitutes the detected-result for the value in the "Bias Adjustment" item (field).

As to this FE Bias automatic adjustment, as similar to cases of automatic gain control, the system repeats a series of adjustments several times to maximize accuracy of adjustments.

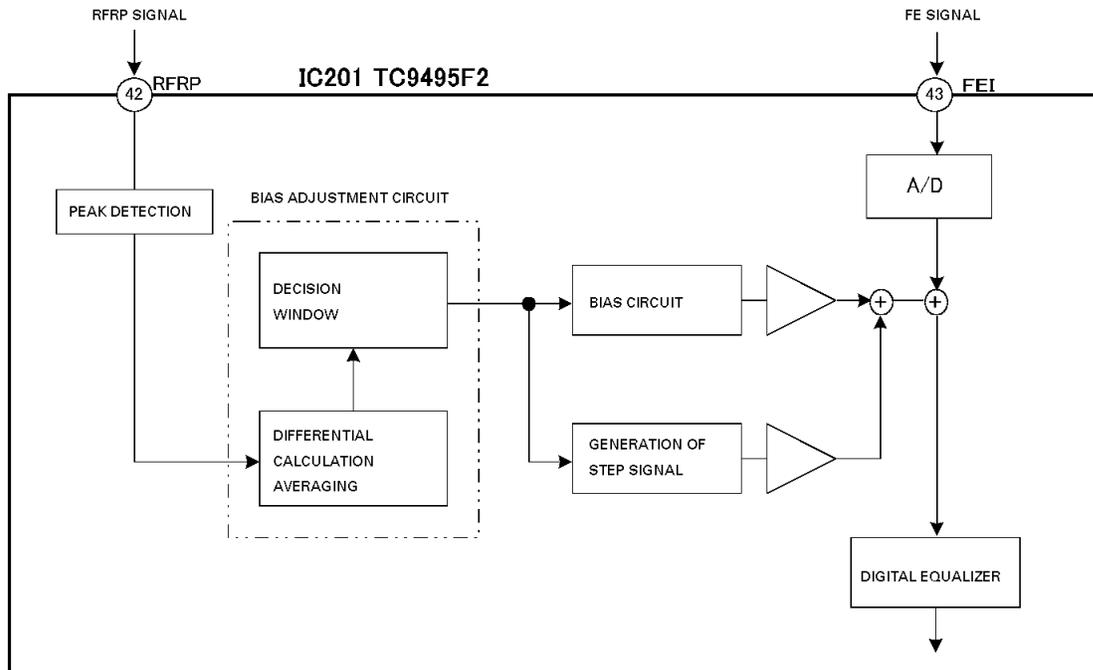


Fig. 20: FE Bias adjustment

**5) RF Level automatic adjustment (RFAGC)**

The aim of this adjustment is to adjust the variance of signals' level (RFO signals), which may be caused by mechanical factors or those factors derived from the disk, and keeps such variant levels to the specific value so that stable and accurate signal transfer can be secured. The adjustment is realized by varying amplifier-gains between RFI and RFO.

The following steps are taken.

- (1) Based on the peak and bottom value of RFRP level inside the Servo LSI, RFRP 's PP level is calculated.
- (2) The system compares this PP level with the standard level and catches the difference between the two. Then, based on this difference, it sets such amount of amplifier-gain, inside the LSI, as it needs to accord RFO signals with the target RFO level, so that RF amp's gain can be controlled.

These adjustments are performed in the following timing.  
 Just before the completion of Setup (i.e. just before "Play")  
 After restoration of correct focus, in case focus point comes to out of focus.

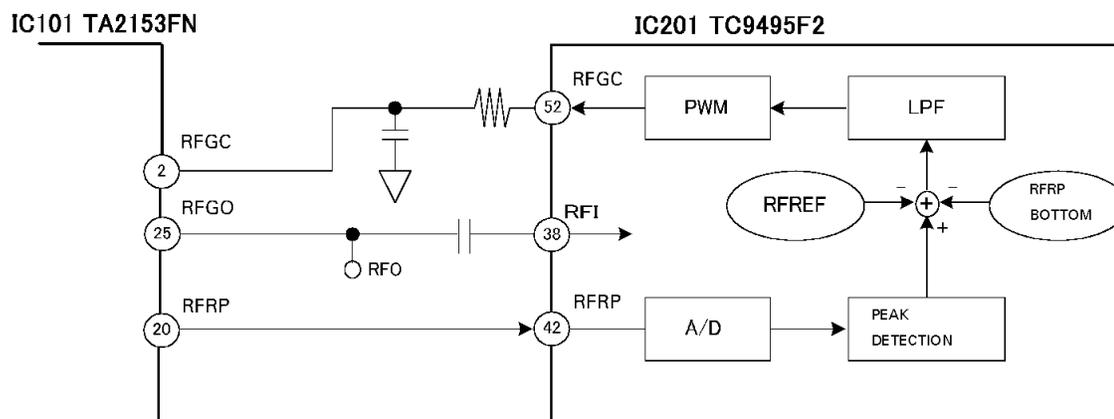


Fig. 21: RF level adjustment

## 6) Gain adjustment at Preampifier-Stage

This adjustment increases the gain of entire RFAMP (FE, TE and RE amp.) by +13 dB through the specific setting on GVSW terminal. The adjustment occurs in such occasion that the lens is stained, or there is remarkably little reflection (light), during CD-RW replay operations, for instance.

The adjustment is performed as follows.

During Setup operations, if the system judges that there is remarkably little reflection of the disk, it switches the value of GVSW terminal from "H" to "L." Then, the gain of entire RFAMP increases by 13 dB.

For reference, if the system so changes the gain, it performs Setup operations over again from the beginning.

## 7) Comments for initial values of the foregoing adjustments

In principle, every and each automatic adjustment uses previous adjustment-value as the initial value unless microcomputer's power is switched off (That is, unless backup power is switched off.) (There are several exceptions.) In case backup power is switched off, or the value of CVSW terminal is "L," default initial value is used instead of such previous adjustment-value.

## 8) Function to display coefficient of the adjustment-result

In some automatic adjustments (FE Offset/TE Offset, Tracking Balance, Focus/Tracking AGC, FE Bias and RF AGC) you can display the result of the adjustment, that is, display the coefficient, under Test mode, to confirm the result. Below, details of coefficient-display function for each automatic adjustment are shown.

### (1) FE Offset/TE Offset adjustment

Standard value = 32 (Value "32" indicates that no adjustment was required, and this value-definition applies to every case described in this section.) The unit of value representation of coefficient is 46 mV.

Example: Coefficient of FE offset = 35

$$35 - 32 = 3 \quad 3 \times 46 \text{ mV} = 138 \text{ mV}$$

This means, that FE offset before the adjustment was 138 mV.

**(2) T. BAL (Tracking Balance) adjustment**

Standard value = 32

Coefficient = 33 to 63 ----- TE: Top side - Bottom side < 0

Coefficient = 31 to 0 ----- TE: Top side - Bottom side >0

Every time the value moves by "1" misalignment changes by approximately 0.71 to 4.97 %.

Maximum misalignment of minus side (<0) = When coefficient is 63

This is the misalignment of [TYP - 45 %].

Maximum misalignment of plus side (>0) = When coefficient is 0

This is the misalignment of [TYP + 45 %].

**(3) Focus/Tracking AGC adjustment**

Standard value: Focus/Tracking = 32 The unit of value representation of coefficient is approximately 0.375 dB.

Example: Coefficient of AGC = 48

$$48 - 32 = 16 \quad 16 \times 0.375 \text{ dB} = 6 \text{ dB}$$

The meaning is, the system performed adjustment of "+6 dB" (i.e. 2 times).

In other words, servo-loop's gain before adjustment was "1/2 times" (a half) so the system doubled the entire gain to obtain the target value.

**4) FE Bias adjustment**

Standard value = 32 The unit of value representation of coefficient is approximately 21.5 mV.

Example: Coefficient of FE Bias = 35

$$35 - 32 = 3 \quad 3 \times 21.5 \text{ mV} = 64.5 \text{ mV}$$

Thus, you can see that misalignment of FE Bias before the adjustment was "+ 64.5 mV."

**5) RF Level adjustment (RFAGC)**

Standard value = 32

Coefficient = 33 to 63 ..... Adjustment of level-variance is being made to the direction of raising RF level  
(Direction of increasing gain)

Coefficient = 31 to 0 ..... Adjustment of level-variance is being made to the direction of lowering RF level  
(Direction of decreasing gain)

Every time the value move by "1" gain changes by approximately 0.07 to 0.15 dB.

Maximum gain = When coefficient is 63

This is the gain of [TYP - 2.69 dB].

Minimum gain = When coefficient is 0

This is the gain of [TYP - 3.93 dB].

**1.4 POWER SUPPLY AND LOADING CONTROL SECTION**

CX-977 uses power sources of two systems. One is the VD (8.3 ± 0.5V) supplied by the motherboard. This system of power source ("Drive system" power source) is supplied to the 4-CH CD Driver IC and the 5V Regulator IC. The second is V+5 power source ("Control system" power source).

ON/OFF switching of the CD driver, except those for Load and Eject, is controlled by the microcomputer through "CONT" control terminal. ON/OFF switching of 5V is controlled through "CD5VON" control terminal. As to ON/OFF switches of the loading drive (Load/Eject), there is no control terminal specifically provided for such use. However, "LOEJ," which is an input signal, performs similar task. Also, at LCO Output part, switching of LOADING and CARRIAGE mode is performed through "CLCONT."

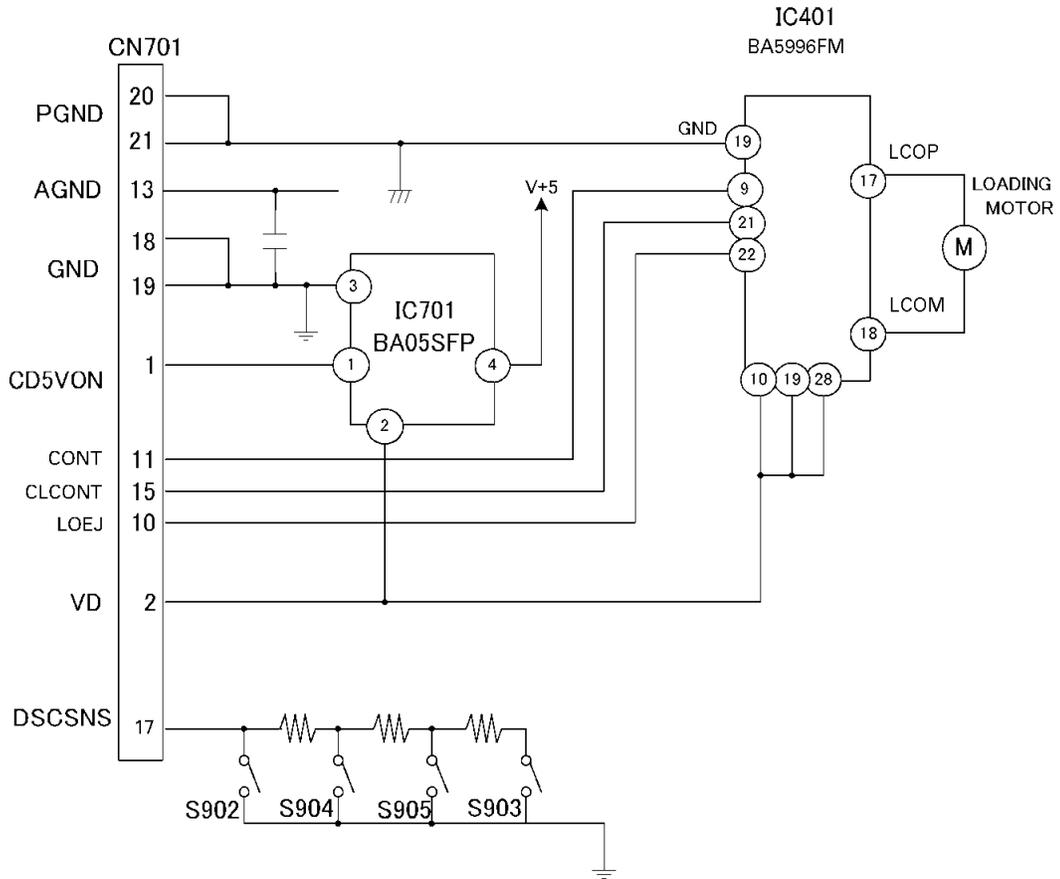


Fig. 22: Block diagram of circuits in Power supply/Loading system

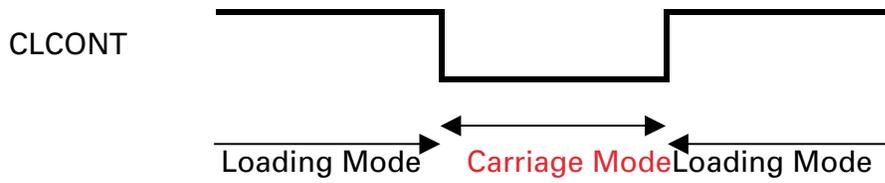


Fig. 23: Switching of LOADING/CARRIAGE mode

LOAD/EJECT actions are controlled through condition-changes of four switches, namely, the Clamp switch on the mechanical unit and three switches on the Control unit (Combination of ON/OFF conditions of each one of these 4 switches is called "status" as a whole). That is, DSCSNS voltage changes according to ON/OFF conditions of these switches, and controls are performed through such change of voltage. Accordingly, to control this voltage, the microcomputer judges each status (A to E) using its A/D port. Also, it judges whether the disk is 8cm-disk or 12cm-disk through such change of status, too.

Fig. 24 shows each status and Fig. 25 shows transition of status.

DETECTION SWITCH STATUS AT THE TIME OF LOAD EJECTION

STATUS	A	B	C	D	E
SW1(S903)	ON	OFF	OFF	OFF	ON
SW2(S905)	OFF	OFF	ON	ON	OFF
SW3(S904)	OFF	OFF	OFF	ON	OFF
SW4(S902)	OFF	OFF	OFF	OFF	ON
MECH. STATUS	NO DISK			CLAMP	

Fig. 24: DSCSNS status

LOAD EJECTION OPERATING STATUS TRANSITION DIAGRAM

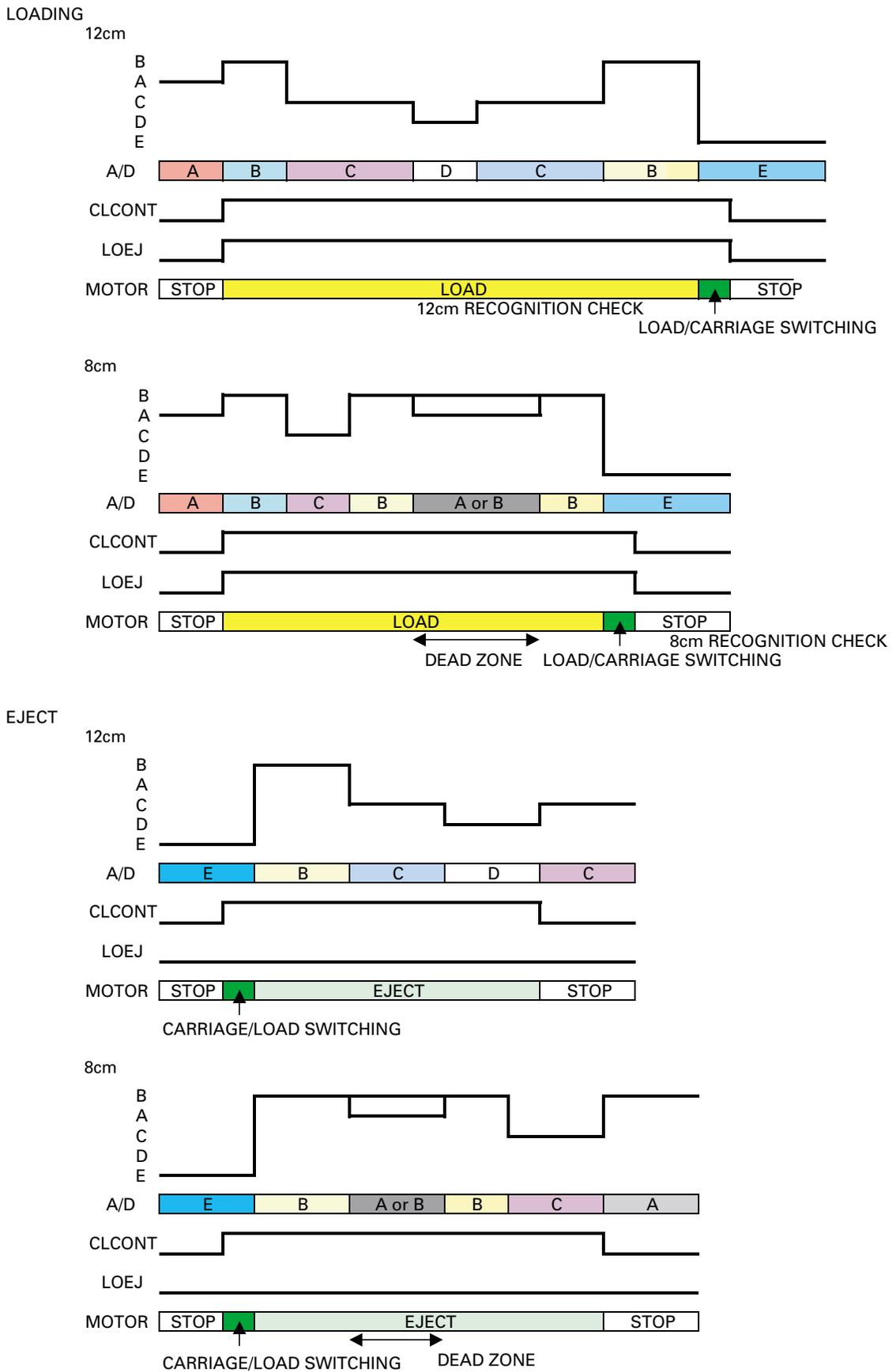
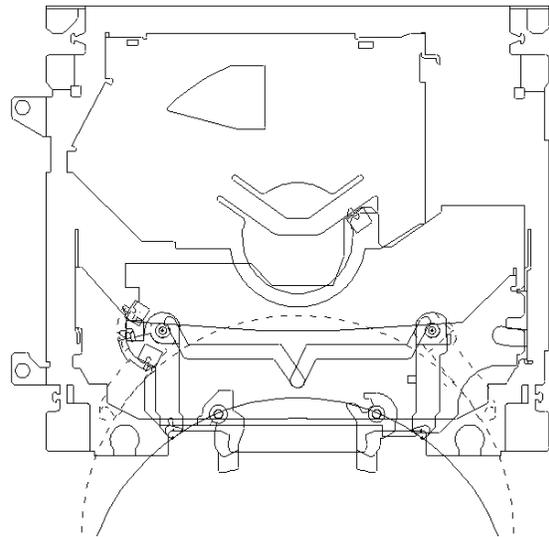
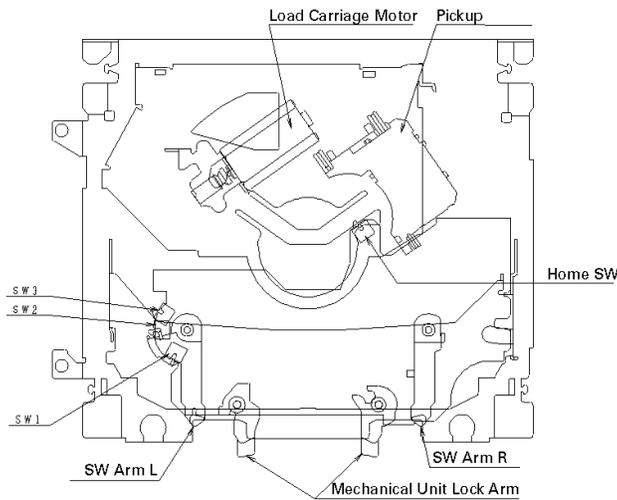


Fig. 25: Transition of loading actions in correlation to status-change

## 2. MECHANISM DESCRIPTIONS

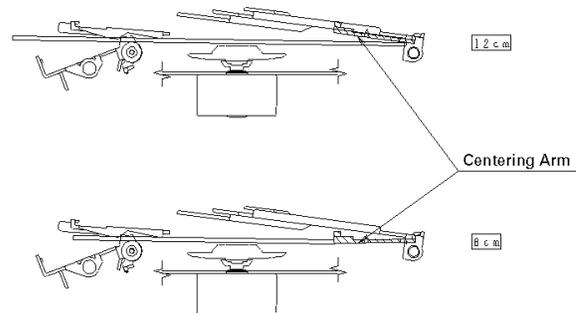
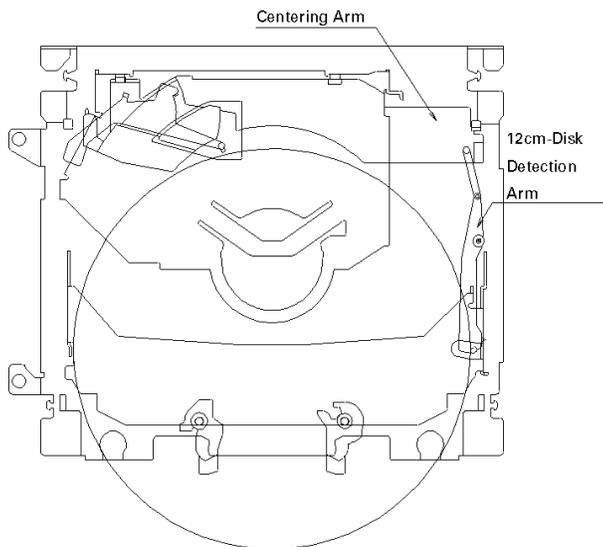
### ● Loading actions

1. When a disk is inserted, SW Arm L and R rotate. Due to the rotation of Arm L, SW1 is switched from ON to OFF and the Load Carriage Motor starts.
2. If the disk is 12cm-disk, when it is carried to the position shown with the dotted line in the drawing, SW 3 switches to ON due to such rotation of Arm L. Then, the microcomputer judges that the disk is 12cm-disk.
3. In case of 8cm-disk, the disk cannot reach such dotted line position, and from such limitation of approach, the microcomputer judges that the disk is 8cm-disk and simply triggers clamp actions.  
(Movement of SW Arm L and R are connected together. So, if pushing force is fed to only one arm, the distance between tow arms cannot be widened beyond the specific degree, because the coupling part is locked in such case.)



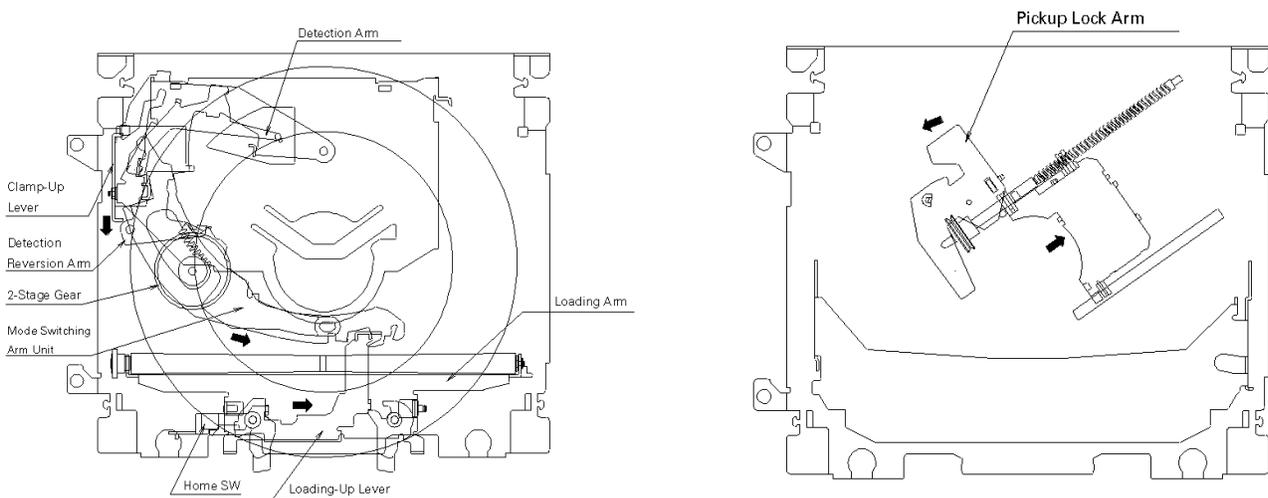
### ● Disk centering mechanism

1. In case of 12cm-disk, the 12cm-Disk Detection Arm rotates, and with such rotation, it raises the Centering Arms to retreat the arms from disk's trace. The disk passes through under the arms, and at the inner part, it is centered.
2. In case of 8cm-disk, it is just centered at the position where its edge touches the front portion of the Centering Arm.



### ● Clamp actions

1. When centering of 12 or 8cm-disk onto the Spindle is completed, the Detection Arm starts driving.
2. Then, the Detection Arm, via the Detection Reversion Arm, triggers driving of the Plunging Rack, which is on the Mode Switching Arm unit, in order to engage the rack with the 2-Stage Gear.
3. With such engaging, the Mode Switching Arm rotates, and with the rotation, slides the Clamp-Up Lever and pushes down the Clamp Arm. At the same time, the Mode Switching Arm slides the Loading-Up lever, and separates the Loading Arm from the disk. Also, the Loading-Up Lever rotates the Mechanics Lock Arm, releases the Mechanics Lock, and switches on the Clamp SW. Now, at this position (the position where the disk is situated when the Clamp SW is switched on), clamping actions are completed.
4. Then, upon the completion of clamping actions, the Plunging Rack lets the Pickup Lock Arm start rotating, and this Pickup Lock Arm, with such rotation, feeds the Pickup to Feed Screw's screw portion. Now, Carriage actions start.



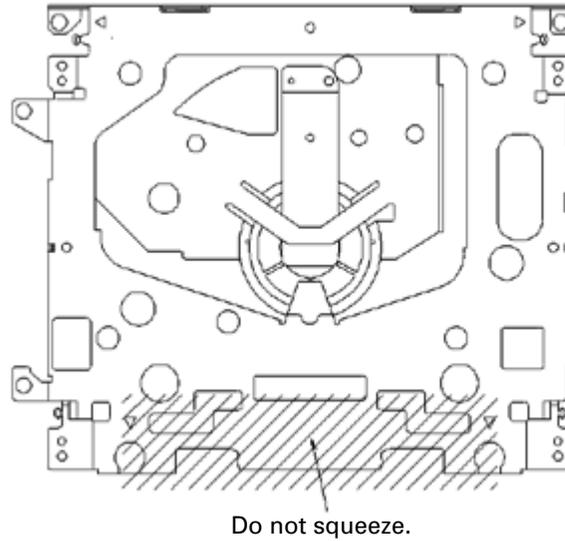
### ● Eject actions

1. Eject actions start when the Pickup is fed to the position inner than "Home SW ON" point in the internal circumference of the circle, caused by backward rotation of the Load Carriage Motor. Eject actions follow the foregoing procedures (steps taken in loading, centering and clamping actions), but each action in those steps is performed in reversed manner.
2. In case of 12cm-disk, Eject is completed when SW3 completes its condition- transition of OFF → ON → OFF.
3. For 8cm-disk, Eject is completed when SW2 completes its condition-transition of OFF → ON → OFF.

### 3. DISASSEMBLY

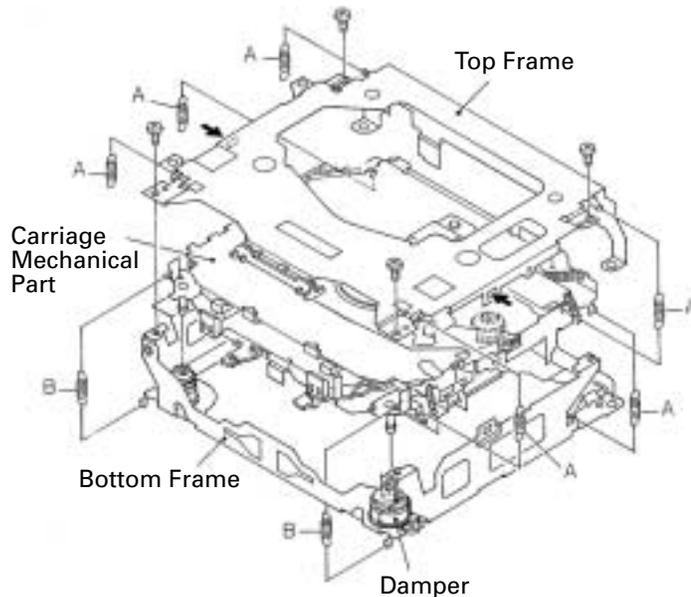
#### ● How to hold the Mechanical Unit

1. Hold the top and bottom frame.
2. Do not squeeze top frame's front portion too tight, because it is fragile.



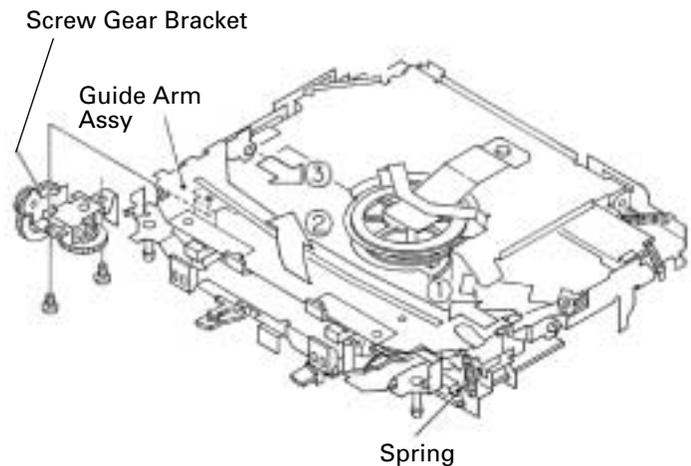
#### ● How to remove the Top and Bottom Frame

1. When the disk is "clamp" state, unlock Spring A (6 pieces) and Spring B (2 pieces), and unscrew screws (4 pieces).
2. Unlock each 1 of pawl at the both side of the frame, then remove the top frame.
3. Remove the Carriage Mechanical part in such way that; you remove the mechanical part from 3 pieces of Damper while slowly pulling up the part.
4. Now, the top frame has been removed, and under this state, fix the genuine Connector again, and eject the disk.  
(Caution)  
When you reassemble the Carriage Mechanical part, apply a bit of alcohol to Dampers.



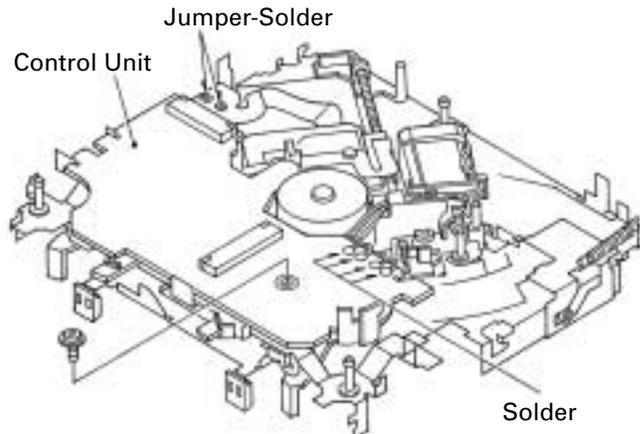
#### ● How to remove the Guide Arm Assy

1. Unlock the spring (1 piece) at the right side of the assembly.
2. Unscrew screws (2 pieces), then remove the Screw Gear Bracket.
3. Shift the Guide Arm Assy to the left and slowly rotate it to the upper direction.
4. When the Guide Arm Assy rotates approximately 45 degree, shift the Assy to the right side direction and remove it.



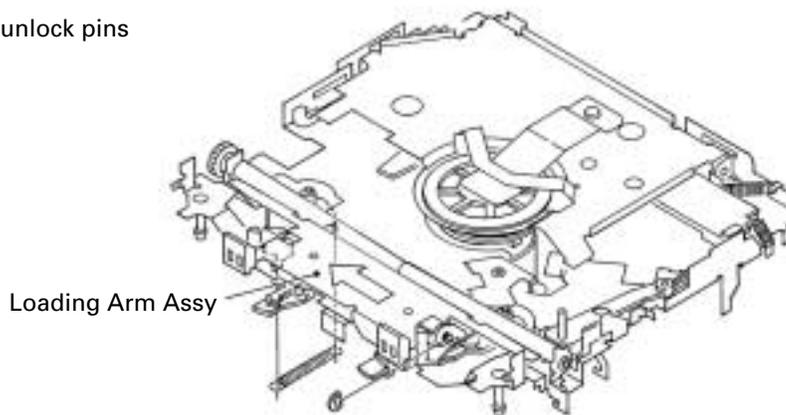
### ● How to remove the Control Unit

1. Give jumper-solder treatment to the Flexible Wire of the Pickup unit, then remove the wire from the Connector.
2. Remove all 4 points of solder-treatment on the Lead Wire. Also, unscrew the screw(1 piece).
3. Then, Remove the Control unit.  
(Caution)  
Be careful not to damage SW when you reassemble the Control Unit into the device.



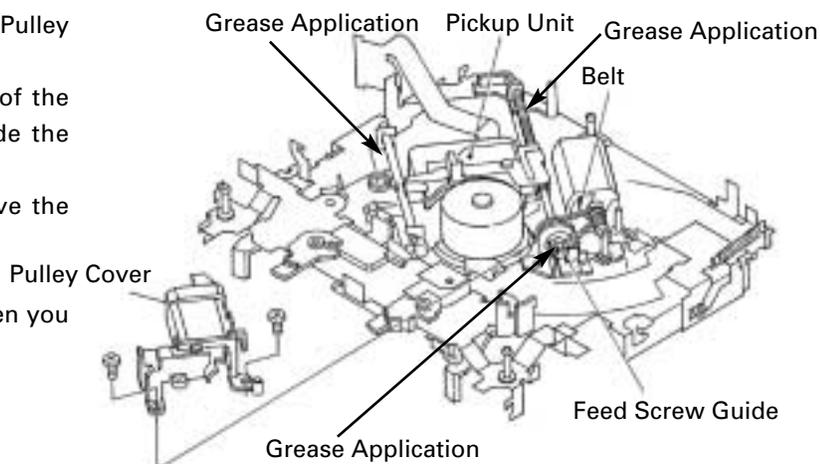
### ● How to remove the Loading Arm Assy

1. Unlock the spring (1 piece) and remove the E ring (1 piece) of the Fulcrum Shaft.
2. Shift the arm to the left side direction and unlock pins (2 pieces).



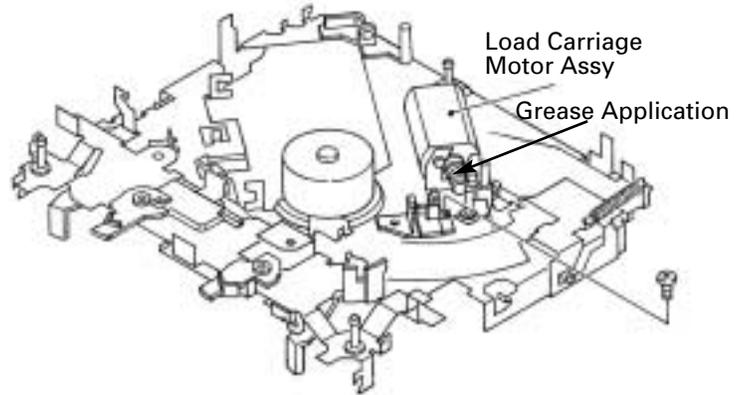
### ● How to remove the Pickup Unit

1. Unscrew 2 pieces of screws, then remove the Pulley Cover.
2. Remove the Feed Screw unit from the pawl of the Feed Screw Guide (The pawl is located inside the guide).
3. Remove the belt from the Pulley, then remove the Pickup unit.  
(Caution)  
Make sure not to stain the belt with grease when you fix the belt.



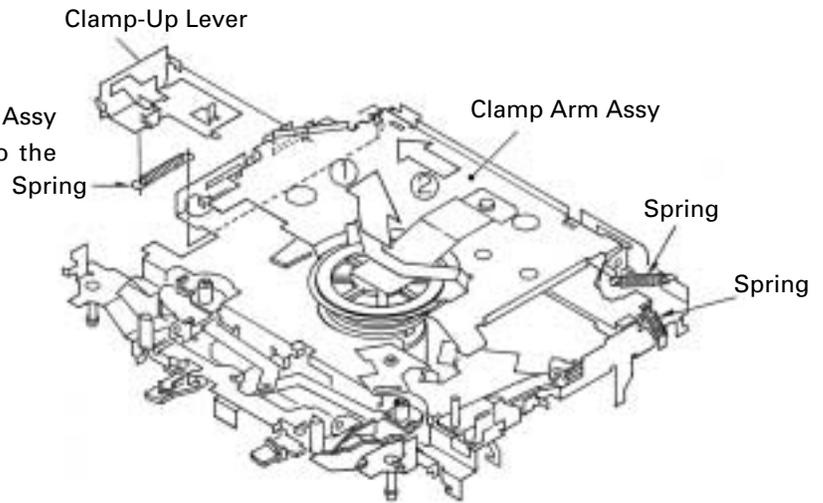
● **How to remove the Load Carriage Motor Assy**

1. Unscrew the screw (1 piece).
2. Remove the Load Carriage Motor Assy.



● **How to remove the Clamp Arm Assy**

1. Unlock springs (3 pieces).
2. Remove the Clamp-Up Lever.
3. Remove the Assy in such way that; you shift the Assy to the left side direction while you rotate it to the upper direction slowly.



● **How to remove the Spindle Motor**

1. Unscrew 2 pieces of screws. Then you can remove the motor.

