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# Service Manual

ORDER NO.
**CRT3467**

## CD MECHANISM MODULE(G3)

# CX-3168
# CX-3116

**X-3168 : TOYOTA**
**X-3116 : FORD**

**● 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 |
|---|---|---|
| AVIC-XD1057ZF/UC<br>AVIC-XD1557ZF/UC<br>AVIC-XD1957ZF/UC | CRT3458 | CXK7300 |
| DEH-MG2057ZF/XU/UC | CRT3480 | CXK7300 |
| DEX-MG8157ZT/UC<br>DEX-MG8057ZT/XU/UC | CRT3486 | CXK7310 |
| DEH-MG8257ZT/UC | CRT3487 | CXK7310 |

## CONTENTS



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# 1. CIRCUIT OVER VIEW

Concerning CD LSI, beside the core DSP, LSI which unifies DAC once used as peripheral circuit or RF amp is the mainstream, and UPD63763AGJ,UPD63761AGJ is a multifunction LSI which has a plenty of functions such as existing CD and replay CD-ROM storing MP3/WMA file by embedding CD-ROM decoder or MP3/WMA decoder.
*X-3116 has built-in WMA decoder by each LSI function, but is not corresponded to its specification.

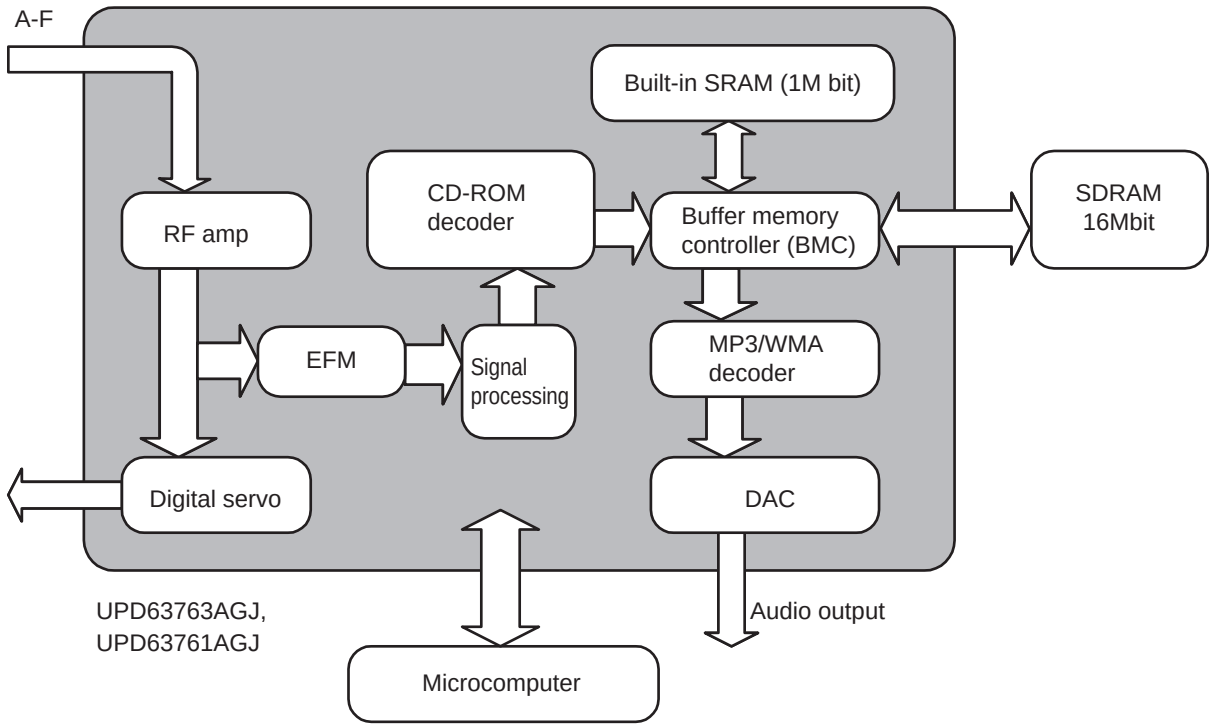



Fig.1 UPD63763AGJ(X-3168),UPD63761AGJ(X-3116) block diagram

## 1.1 PREAMP SECTION

The preamp section is processing pick-up output signal and generating signal to servo section, demodulator section and control section of the next stage. The signal from pick-up is I-V converted by photodetector-built-in preamp in the pick-up, then added by RF amp and created RF, FE, TE, TE empty cross signal. This preamp section is embedded in CD LSI UPD63763AGJ,UPD63761AGJ (IC201), and each section of it is explained below. Since the spec of this LSI is single power supply (+3.3V), reference voltage of this LSI and pick-up should be all REFO (1.65V). REFO is the output from REFOUT in the LSI through buffer amp, and its output comes from the number 133 pin of the LSI. All measurement is based on the REFO.
NOTE: Never short-circuit REFO and GND.

### 1.1.1 APC circuit (Automatic Power Control)

Since light output has large minus temperature characteristics when laser diode is operated under constant current, it is necessary to control current by monitor diode so that constant output is maintained. This is APC circuit. LD current is generated by measuring current between LD1 and V3 R3 and dividing the value by 7.5 , and its current value should be about 30mA.

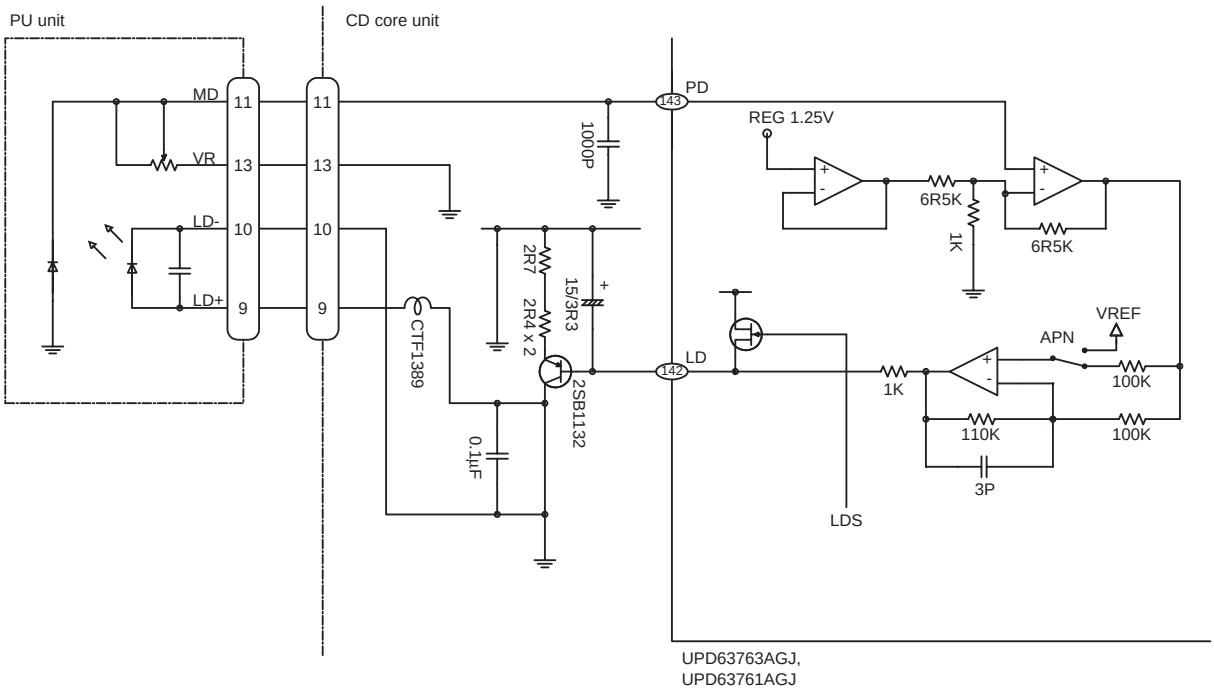



Fig.2 APC

### 1.1.3 Focus error amp

The photodetector output (A+C), (B+D) comes from the number 91 pin as FE signal which is (A+C-B-D) through differential amp and then error amp. The low frequency of voltage FE is showed in the following formula.
FE=(A+C-B-D) X 8.8k / 10k X 111k / 61k X 160k / 64k =(A+C-B-D) X 4
The FE output generates 1.5Vpp of S curve based on REFO. The cut-off frequency of the amp in back stage is 14.6kHz.

### 1.1.4 RFOK circuit

This circuit is signal expressing timing of focus-close and focus-close condition during playing, and output from the number 55 pin as RFOK signal output. During playing at focus-close, "H" is output as signal.
Since RFOK signal holds a peak of DC level of RFAGCI at digital section in back stage and is converted and generated by certain threshold level, RFOK is "H" without a bit. Therefore, focus-close is also performed in disc mirror surface. This signal is supplied to a microcomputer via LPF as FOK signal and used for protection and switching gain of RF amp.

### 1.1.5 Tracking error amp

The photodetector output E, F comes from the number 139 pin, taking (E-F) as TE signal through a differential amp and then an error amp. The low frequency of TE is showed in the following formula.
TEO=(E-F) X 63k / 112k X 160k / 160k X 181k / 45.4k X 160k / 80k = (E-F) X 4.48

TE output generates 1.15Vpp level TE waveform based on REFO. The cut-off frequency of the amp in back stage is 21.1kHz.

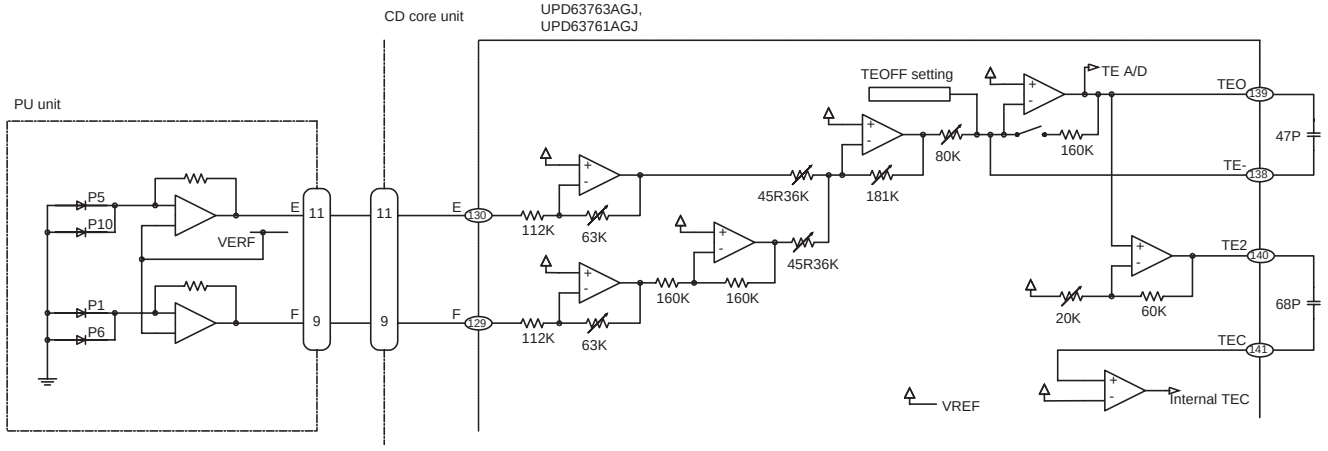



Fig.3 TE

### 1.1.6 Tracking empty cross amp

The tracking empty cross signal (hereafter, TEC signal) is the signal amplifying TE signal for 4 times and used to find an empty cross point of tracking error. The purpose for finding the empty cross point is;
① To use for track count at carriage movement and track jump
② To use for detecting direction of lens movement at tracking close (used in a tracking brake circuit described later)
The frequency range of TEC signal is 300 Hz - 20kHz, and voltage TEC=TE level X 4.
That is, TEC level is 4.62V as calculated, and this level is over D range of an operation amp and so that the signal is clipped, but only empty cross point is used in CD LSI, so there is no problem.

### 1.1.7 EFM circuit

EFM circuit is the circuit for converting RF signal into "0" "1" digital signal. AGCO signal output from the number 116 pin is AC-combined, input to the number 114 pin, and supplied to EFM circuit.
Since RF vertical asymmetry occurred because of the lack of RF signal by a scratch or dirt on a disc, and quality variation of disc production is not deleted only by AC-combination, reference voltage ASY of EFM comparator is controlled, taking advantage of the fact that the occurring rate of "0" "1" in EFM signal is 50%. In this way, the comparator level is always around the center of RFO signal. This reference voltage ASY is generated with passing EFM comparator output through LPF. EFM signal is output from the number 111 pin.

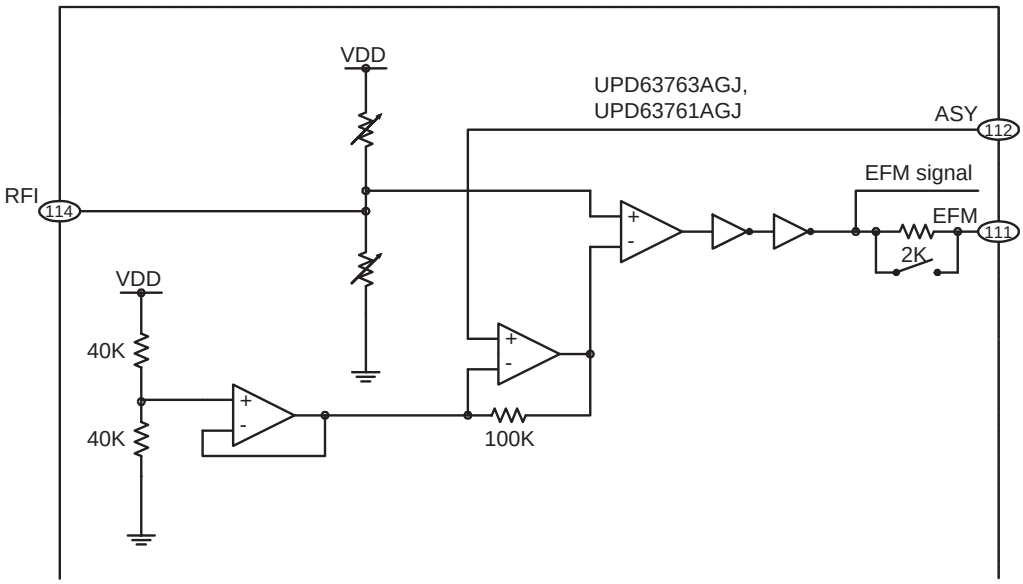



Fig.4 EFM

## 1.2 SERVO SECTION (UPD63763AGJ,UPD63761AGJ: IC 201)

The servo section operates servo control such as equalizing of error signal, in-focus, track jump, carriage move, etc. DSP is section for signal processing and operates data decoding, error correction, interpolation processing, etc. FE, TE signal generated in preamp stage is A/D converted and outputs drive signal of focus, tracking, and carriage system via servo block. And EFM signal is decoded in the signal processing section and outputs audio signal after D/A convert via D/A converter finally. In addition, in this decoding process, error signal of a spindle servo is generated, and supplied to the spindle servo section, and outputs drive signal for the spindle. Each drive signal of focus, tracking, carriage and spindle is amplified by the driver IC BD7962FM (IC302) after that and supplied to each actuator and motor.

### 1) Focus servo system

The main equalizer of focus servo is made up of digital equalizer section. The fig 10 shows a block diagram of focus servo.
In the focus servo system, it is necessary to bring a lens within in-focus range to focus-close. In order to do that, triangle wave of focus search voltage moves a lens up and down to find in-focus point. During that time, a spindle motor is kicked to maintain rotation at the fixed speed. The servo LSI monitors FE signal & RFOK signal, and operates focus-close automatically in appropriate point. The focus-close is performed when following 3 conditions are set;
① A lens is moving from away to near toward a disc.
② RFOK= "H"
③ Just at the moment when FZC signal is once over the threshold of FZD register and latched to "H" again (the edge of FDZ). As the result, FE converges "0" (=REFO).

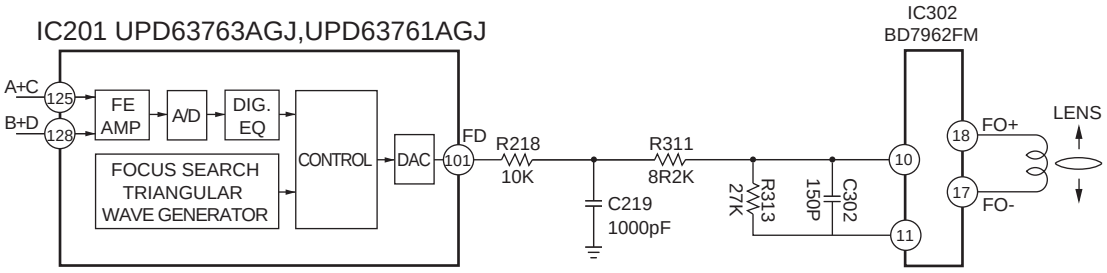



Fig.5 Focus servo block diagram

When the conditions described above are set and focus-close is performed, XSI terminal becomes "H" -> "L" and after 40ms, the microcomputer starts to monitor RFOK signal through LPF.
When RFOK signal is detected as "L", the microcomputer takes a various action such as protection.
Fig 11 shows a series of action concerning focus-close (this figure shows a case when focus-close is impossible).
If pressing focus-close button in condition that a select of focus mode is "display 01" in the test mode, it is possible to check S curve, search voltage and actual lens operation.

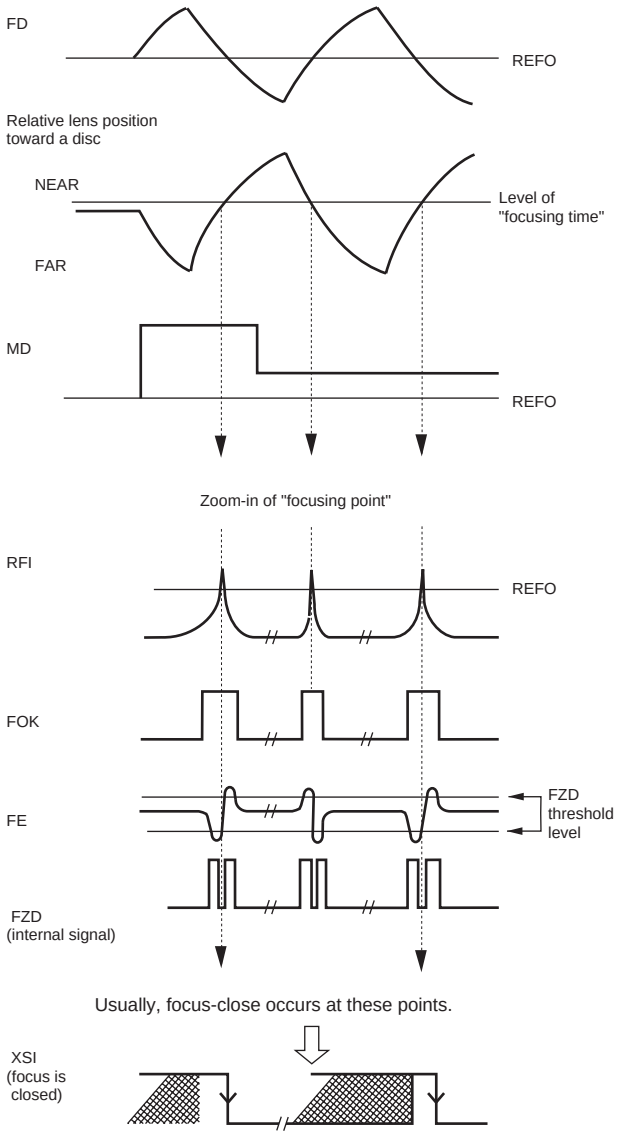



Fig.6 Focus-close sequence

## 2) Tracking servo system

The main equalizer of tracking servo is made up of digital equalizer section. A block diagram of tracking servo is showed in Fig 12.

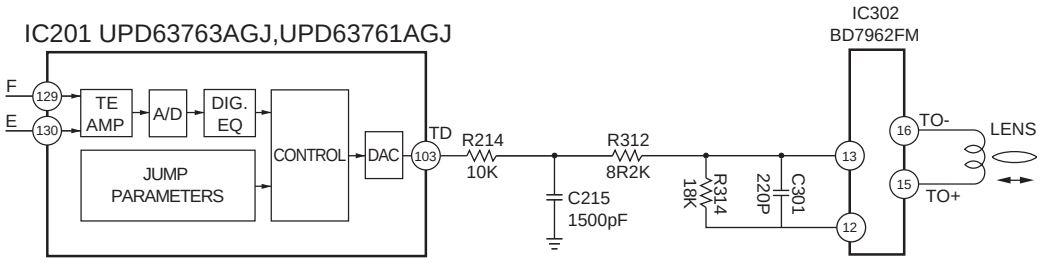



Fig.7 Tracking servo block diagram

### a) Track jump

Track jump is performed automatically by the command of the microcomputer according to the auto-sequence function inside LSI. In this system, up to 100 tracks of multi-jump is prepared for using as track jump at the search time. In the test mode, 1, 4, 10, 32, 32 X 3 jump of it and carriage move can be checked by mode selection. For jumps up to 4 tracks, about half number of total jumps (e.g., about 2 tracks are set for 4 tracks) are set by microcomputer. The speed control (which counts the length of TEC interval and controls TD so as to keep a constant frequency) is conducted for any jump up to 5-100 tracks and a target number of total tracks is set by microcomputer. The established number of tracks is counted by using TEC signal.

From the moment when the set number is counted, brake pulse is output for defined period of time, and a lens is stopped. In this way, it is possible to close tracking and continue normal play.

In addition, gain up of a tracking servo in the brake circuit ON is performed for 50ms after stopping brake pulse in order to increase lead-in of servo during track jump.

FF/REW operation in normal mode is carried out with executing a single jump continuously. The speed is varied according to place of destination and is about 10 or 20 times of normal mode.

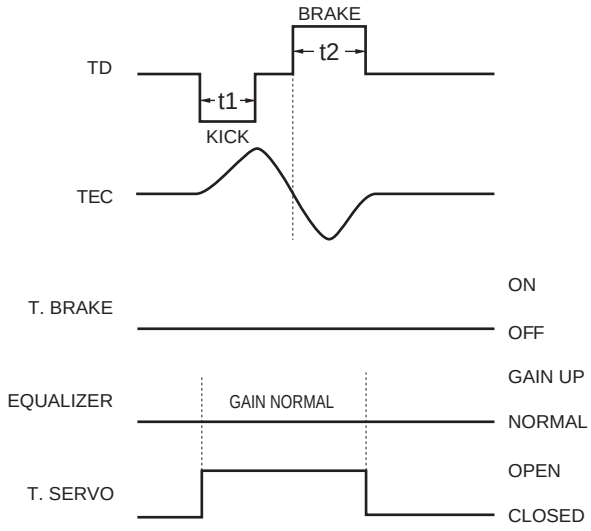



Fig.8 Single track jump

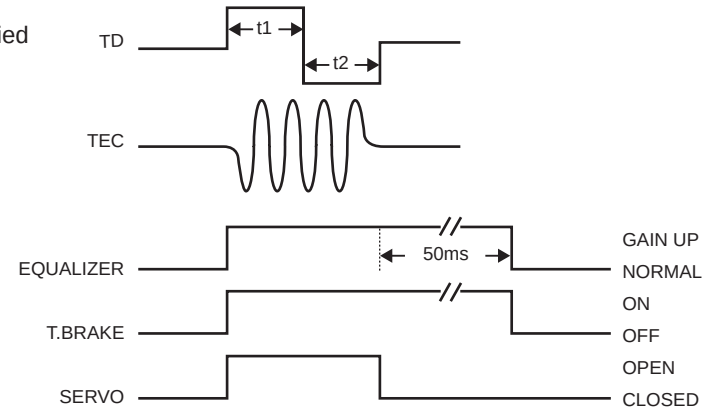



Fig.9-1 Multi-track jump

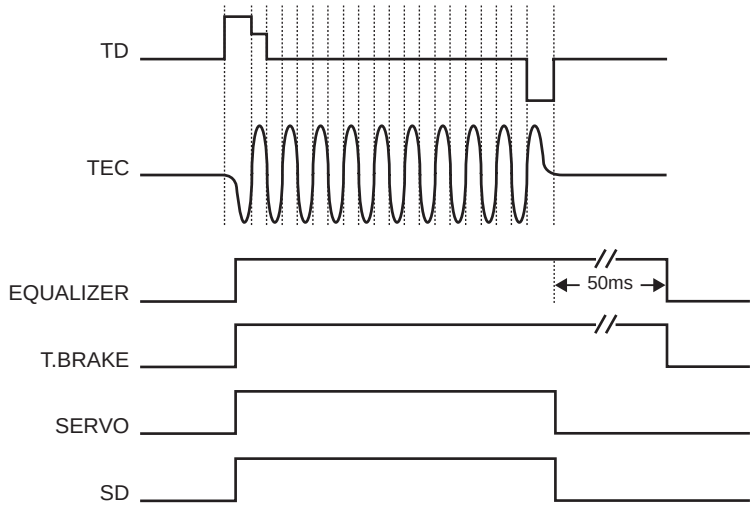
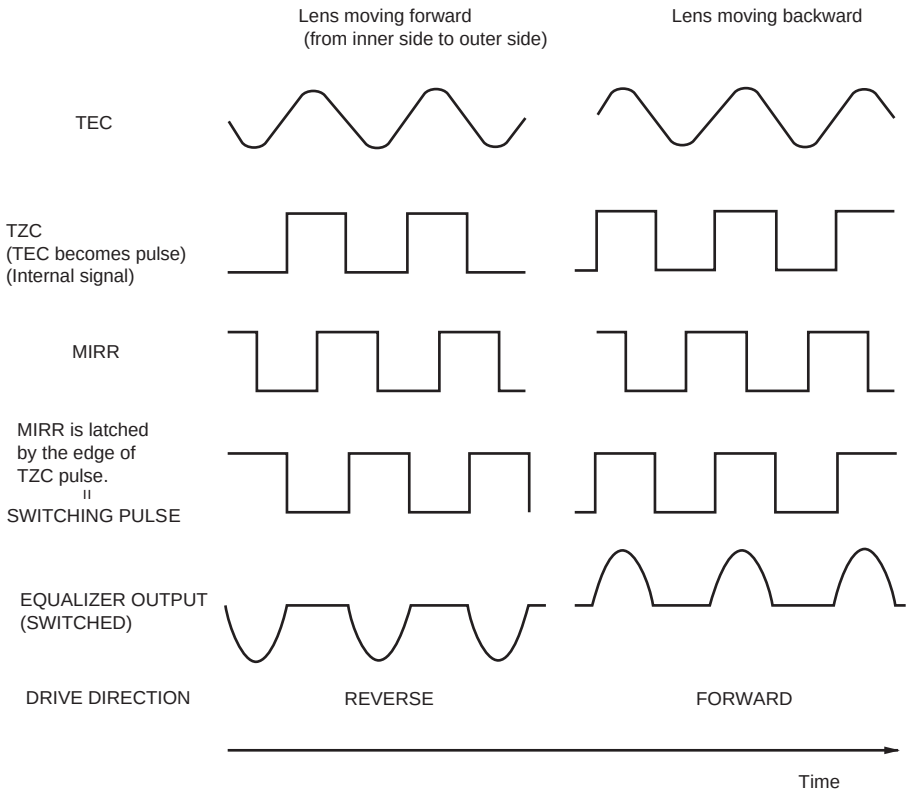



Fig.9-2 Multi-track jump(Speed control)

b) Brake circuit

Since lead-in of servo is weakened during set-up or track jump, stable lead-in to servo loop is performed, using a brake circuit. The brake circuit detects the direction of a lens and outputs only the drive signal of the cross direction toward its operation to slow the lens speed down and performs stable lead-in to the tracking servo. In addition, the direction for sliding a track is determined by TEC signal, MIRR signal and its phase relation.




(NOTES) The phase of equalizer output is written as the same as TEC phase.

Fig.10 Tracking brake circuit

### 3) Carriage servo system

The carriage servo is input the output from low frequency number composite of tracking equalizer (position information of lens) to carriage equalizer, and after acquiring fixed gain, it outputs drive signal from LSI. The signal is impressed to carriage motor via driver IC.
To be more precise, since it is necessary to move the entire pick-up to forward direction when lens off-set during playing reaches to certain level, the gain of equalizer is set to generate higher voltage than start-up voltage of carriage motor at that time. In addition, actual operation is set to fix a certain threshold for equalizer output inside servo LSI, and to output the drive voltage only when the level of equalizer output is over that fixed level. In that way, power consumption is reduced. Moreover, according to decentering of a disc, the level of equalizer output voltage may cross threshold level several times before the entire pick-up starts to move. At that time, output waveform of drive voltage from LSI is pulse state.

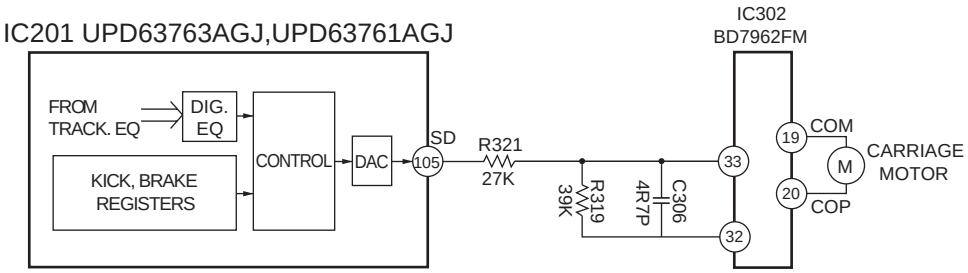



Fig.11 Carriage servo block diagramFig 16: Carriage servo block diagram

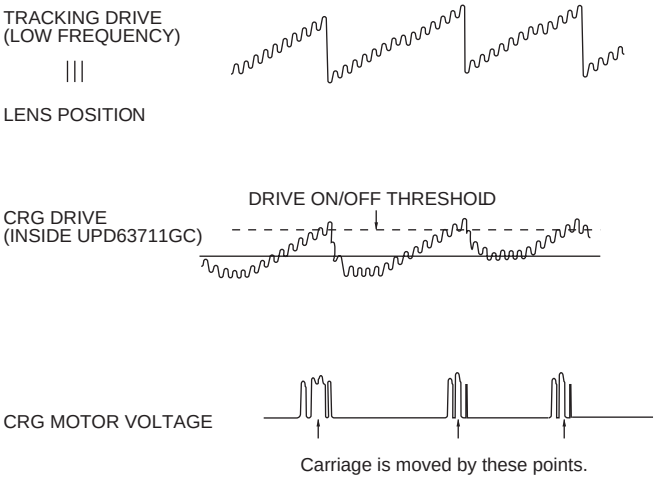



Fig.12 Carriage signal waveform

4) Spindle servo system

There are following modes for spindle servo.

① Simple FG servo:
It is for maintaining the rotation of a disc to be in closer condition of regular rotation.
The microcomputer monitors FG signal output pulse according to the rotation of a spindle motor and controls the drive voltage of the spindle motor.
This is used in following situation.
a) At set-up time, it is used during transition from power ON with focus-close to rough servo.
b) It is used until recovering from out-of-focus during playing.

② Adaptation servo:
It is CLV servo mode of normal operation.
It takes a sample of WFCK/16 at EFM demodulation block to check whether frame synchronized signal and internal frame counter output agree, then generates signal showing "agree" or "disagree". When this signal shows "disagree" 8 times continuously, it is considered as asynchronous and otherwise, it is considered as synchronous. This adaptation servo selects lead-in servo in asynchronous, and regular servo in synchronous automatically.

③ Brake:
It is a mode for stopping a spindle motor. The microcomputer monitors FG pulse and applies the brake fully to certain interval (speed) and decreases the brake level and stops it when the speed is under that.

④ Stop:
It is a mode used at the time of POWER ON and eject.
Both ends of voltage of a spindle motor is 0V at this time.

⑤ Rough servo:
It is a mode used at the time of carriage feed (carriage move of long search, etc.).
It inputs which one of H level or L level to a spindle equalizer after calculating line speed according to EFM waveform.
Also this mode is to confirm the grating in test mode.

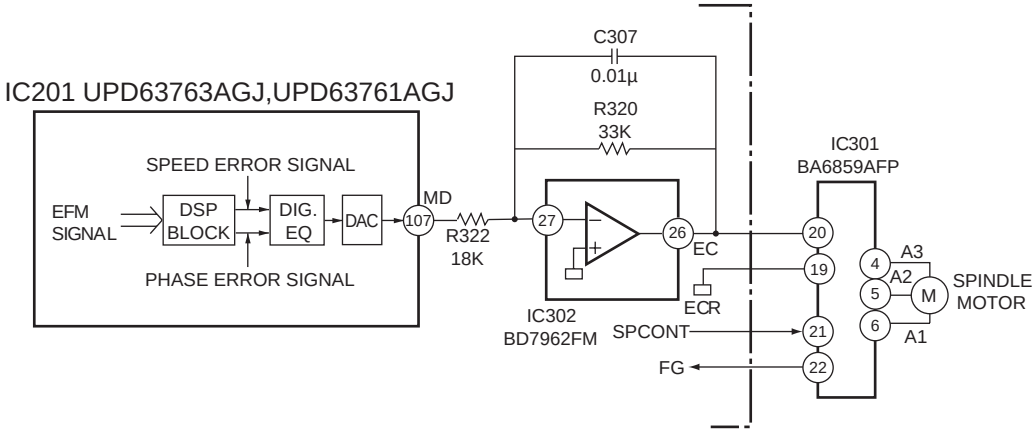



Fig.13 Spindle servo block diagram

## 1.3 AUTOMATIC ADJUSTMENT FUNCTION

In this system, all circuit adjustment is automatically operated inside CD-LSI.
All adjustment is performed every time of inserting disc or selecting CD mode by source key.
The contents about each automatic adjustment are in the following;

1) FZD cancellation setting
It makes focus-closing performed certainly. FE offset level at the time of POWER ON is read, and the reverse voltage of offset value is written into CRAM inside IC, then the offset is cancelled. In this way, FZD threshold level can be set to fixed value (+240mV) and one of focus-close conditions inside IC such as "FZD signal is latched to H" is certainly carried out.

2) TE, FE, RF offset automatic adjustment
With this adjustment, TE, FE, RF amp offset of preamp at the time of POWER ON are adjusted to each desired value with REFO reference.
(The desired value: TE, FE, RF) = (0, 0, -1) [V])
Adjustment steps are;
(1) The microcomputer reads each offset during LDOFF condition via servo LSI.
(2) The microcomputer calculates voltage to be corrected from read value in step (1), and substitutes the corrected value in the given place.

3) Tracking balance (T.BAL) automatic adjustment
With this adjustment, output difference between Ech and Fch is equalized by changing gain of LSI internal amp. Actually, TE waveform is adjusted to be vertical symmetry to REFO.
Adjustment steps are;
(1) After focus-close,
(2) Kicking a lens toward radial direction to generate TE waveform certainly.
(3) The microcomputer reads offset volume of TE signal calculated inside LSI at that time via servo LSI.
(4) The microcomputer detects offset volume as which one of 0, positive or negative.
If offset volume = 0, adjustment is finished.
If offset volume = positive or negative, change amp gain of Ech or Fch according to certain rule.

Then, repeat step 2) - 4) until reaching "offset volume = 0" or "limit number" and adjustment is finished.

4) FE bias automatic adjustment
With this adjustment, RFI level is maximized by making focus point during playing optimal. Adjustment is performed by utilizing phase difference between 3T level waveform of RF waveform and disturbance input of focus error. Since disturbance is input to focus loop, the adjustment is performed at the same timing as automatic gain control described later.
Adjustment steps are;
(1) Filling disturbance into focus loop by microcomputer commands (internal servo LSI)
(2) Detecting jiggle of 3T components in RF signal inside LSI.
(3) Processing relation between 3T components described above and disturbance inside LSI to find misalignment of focus and its direction.
(4) The microcomputer reads out the result found above by a command from servo LSI.
(5) The microcomputer calculates the required correction volume and substitutes the result into bias adjustment items inside servo LSI.
In addition, a series of adjustment steps is repeated several times (same as automatic gain control) to increase adjustment accuracy.

5) Focus, tracking AGC
With this adjustment, servo loop gain of focus and tracking is adjusted automatically.
Adjustment steps are;
(1) Filling disturbance into servo loop.
(2) Acquiring G1, G2 signal by extracting error signal at the time of filling disturbance (FE, TE) via B.P.F.
(3) Reading signal of the microcomputer, G1 and G2 via servo LSI.
(4) The microcomputer calculates the required correction volume and performs loop gain adjustment inside servo LSI.
In addition, a series of adjustment steps is repeated several times to increase adjustment accuracy.

### 6) RF level automatic adjustment (RFAGC)

This adjustment is performed in order to adjust variation of RF signal (RFO) level to fixed value and to realize reliable signal transmission. The adjustment is performed with changing amp gain between RFI and RFO.

Adjustment steps

(1) The microcomputer reads out output from RF level detect circuit inside servo LSI by a command.
(2) The microcomputer calculates desired RFO level of amp gain volume from read value.
(3) The microcomputer sends an appropriate command to servo LSI to reach to the gain volume of (2).
This adjustment is performed at the following timing,
- During set-up, only focus-close is finished
- At the point of set-up completion (just before playing)
- During playing, after recovering from out-of-focus

### 7) Adjustment of gain of preamp stage

If there is lens dirt, or reflected light of a disc is notably small during CD-RW replaying, gain of entire RFAMP(FE, TE, RF amp) should be +6dB, +12dB according to the situation.

Adjustment steps

When reflected light of a disc is notably small during set-up, the entire RFAMP should be +6dB, +12dB. In addition, when changing gain, perform again the set-up procedure from the start. When it is considered that "the entire gain of RFAMP is always played at +6dB", perform the set-up at +6dB in advance from the next time.
See the figure below.

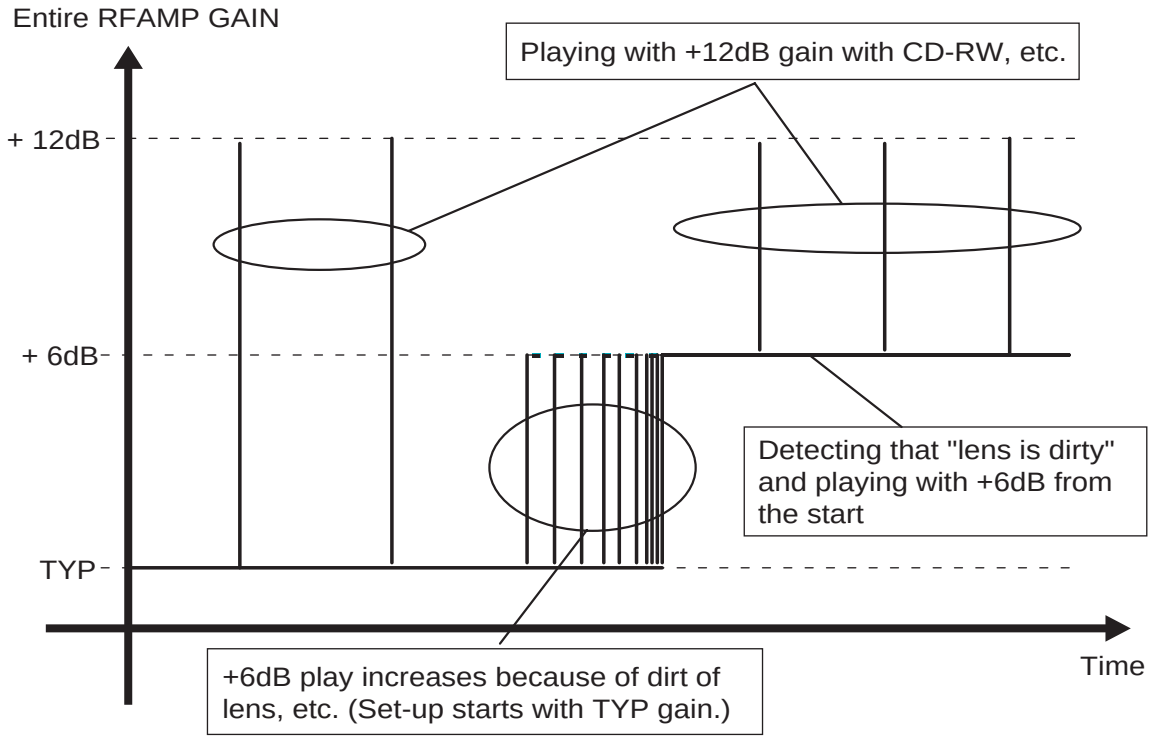



Fig.14 Conceptual diagram of gain of preamp stage

8) Adjustment initial value
All adjustment is performed based on the latest adjusted value that is considered as initial value unless the power of the microcomputer is off (back up is stopped). (There is an exception, though.) If back up is stopped, automatic adjustment is done by the initial value, not by the latest adjusted value.

9) Coefficient indication of adjustment result
It is possible to display and check certain automatic adjusted (FE, RF offset, FZD cancel, FT, and RFAGC) in test mode.
Coefficient indication of each automatic adjustment is showed below:

(1) FE, RF offset, FZD cancel
Reference value = 32 (Coefficient 32 means no adjustment was required.)
Indication is every approx. 40mV.
Example: FZD cancel coefficient = 35
35-32=3X40mV=120mV
Since corrected volume is about +120mV, FE offset before correction is -120mV.

(2) F.T gain adjustment
Reference value: focus, tracking = 20
Coefficient indication / reference value express adjusted volume.
Example: AGC coefficient = 40
40 / 20 = 2 times (+ 6dB) adjustment was performed. (It means "since it was originally 1/2 time of loop gain, the entire gain was doubled to make it to the desired value.")

(3) RF level adjustment (RFAGC)
Reference value = 8
Coefficient = 9 - 15 .....Increasing RF level
(Increasing gain)
Coefficient = 7 - 0 .....Decreasing RF level
(Decreasing gain)
If a coefficient moves 1, 0.7 - 1dB of gain changes accordingly.
Maximum gain = when a coefficient is 15, TYP +6.5dB
Minimum gain = when a coefficient is 0, TYP -6.0dB

## 1.4 POWER SUPPLY SECTION

VD 8V: Power supply for mechanism servo. It supplies to driver directly and also generates 3.3V and 1.5V (compression model) with a regulator in the unit.

VDD 5V: Power supply for microcomputer. If back up (+B) is connected, it is always supplied from a product.

GND: There are 3 systems (servo system, digital system and reference GND of audio described in the next section). They are divided in the core unit.

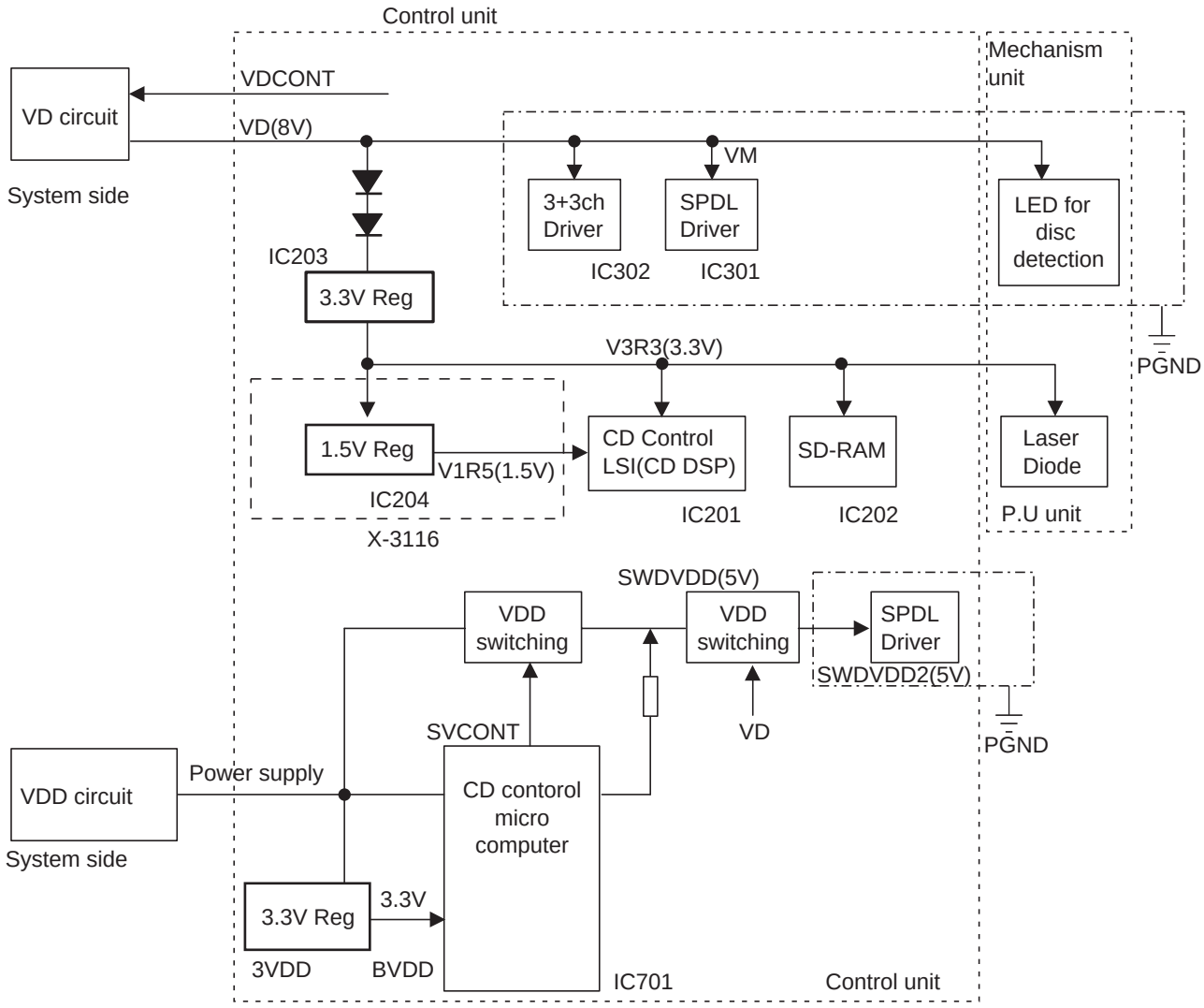
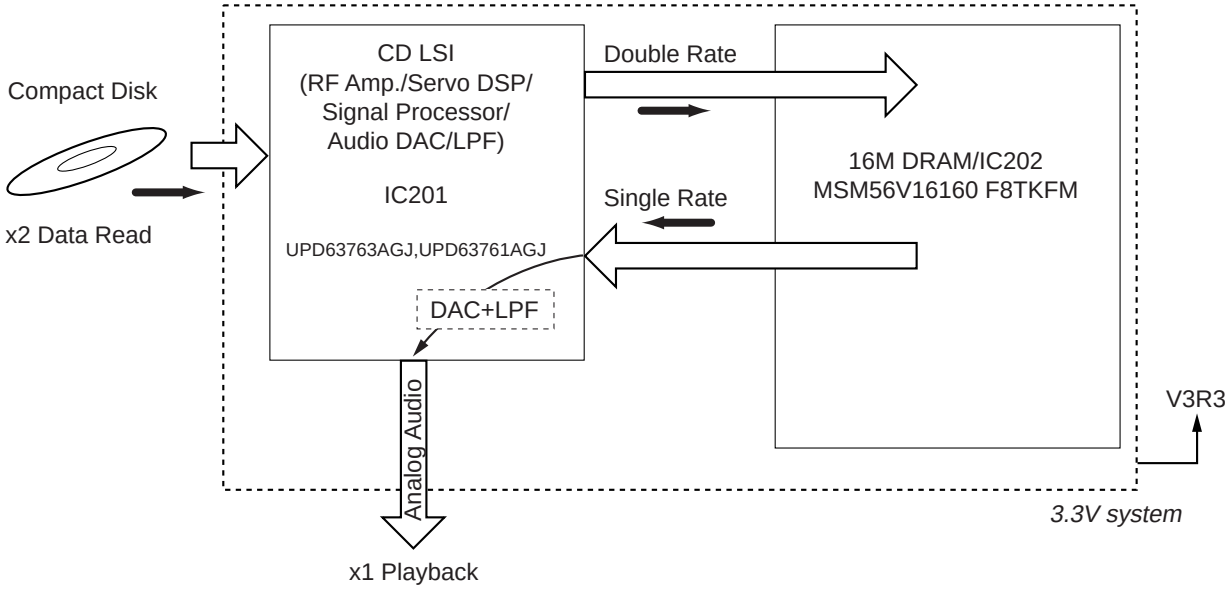



Fig.15 Power supply section

## 1.5 STS CIRCUIT EXPLANATION

Sure Track System circuit pools music data read from CD, and when pick up is out of the track by some reasons, it outputs data from memory during recovery and prevents sound break effectively.




### Operation theory

STS circuit is controlled by uPD63761AGJ (IC201) having a built-in shockproof memory controller. Signal read from CD with double rate is demodulated to data in CDLSI, and the built-in memory controller memorizes SDRAM audio data, then reads out SDRAM data with single rate based on the output clock from C33M port of the LSI (33.86MHz) as reference clock, and outputs DAC.
Since the writing speed is faster than the reading speed from SDRAM, the memory may overflow soon. However, if it overflows, reading is stopped temporarily and to be in pause. Reading data from SDRAM continues and when empty space is available, writing data is restarted. (Remaining RAM can be monitored by "RAM0, RAM1 and RAM2" terminal.)
By repeating this process, SDRAM is always utilized effectively and data during 12 seconds (at the time of CD-DA) can be stored. For example, pick up is out of the track because of vibration, sound break is avoided if recovery is performed within 12 seconds by using memory.

# 1.6 MECHANISM CONTROL

● Overview

The combination of load/eject operation, camgear motor (operation mode) operation, elevation operation and clamp operation enables the operation as changer mechanism module.

1) Loading system

Disc position is detected with 3 switches attached to mechanism unit, photo, and LED, and load/eject is performed by driving an E/L motor. *E/L is abbreviation of Elevation/Loading. (G3 mechanism shares a motor, unlike G2 mechanism.)

1.1) Detect system

The 3 switches, photo and LED operate load start/load end, disc form detection and watching disc eject.

1.2) Drive system

Controlling an E/L motor by the control unit enables the following function:

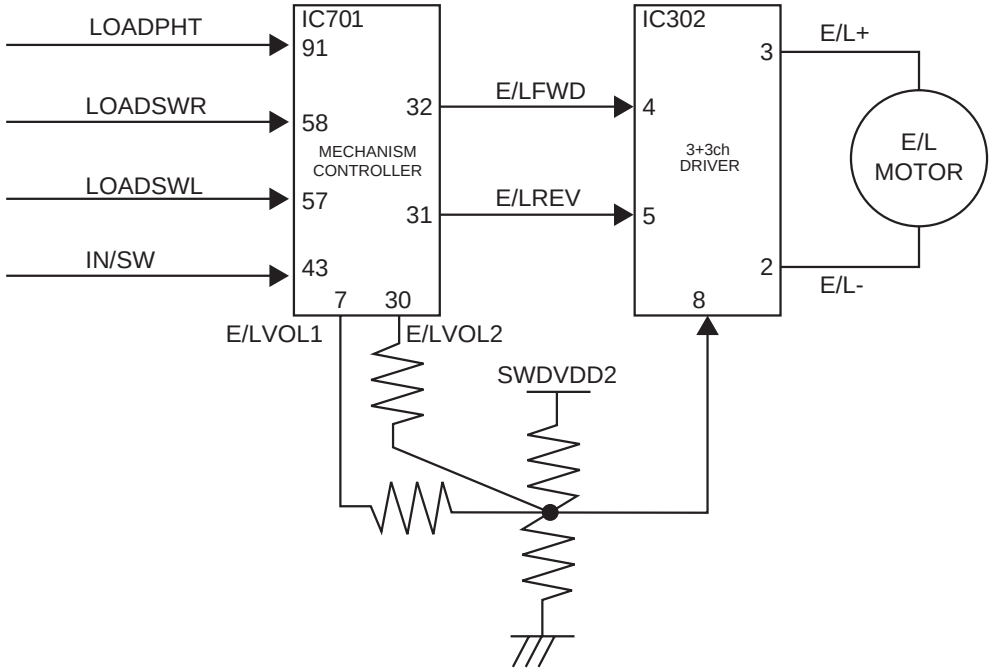
Loading of disc
Ejecting of disc

a) Drive system

It controls drive direction by output E/LFWD, E/LREV from the microcomputer (IC701), and 3 values of drive voltage by Hi-Z/L of ELVVOL1,ELVVOL2.

At the time of loading E/L+<E/L- ; (E/LFWD; L, E/LREV; H)
At the time of ejecting E/L+>E/L- ; (E/LFWD; H, E/LREV; L)

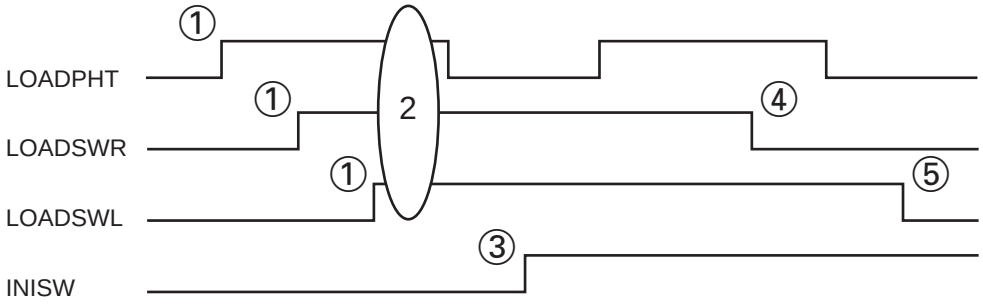
Drive voltage (E/LVOL1=Hi-Z, E/LVOL2=Hi-Z) ; 8V
Drive voltage (E/LVOL1=L, E/LVOL2=Hi-Z) ; 7V
Drive voltage (E/LVOL1=Hi-Z, E/LVOL2=L) ; 4.4V



b) Drive sequence

At the time of loading:

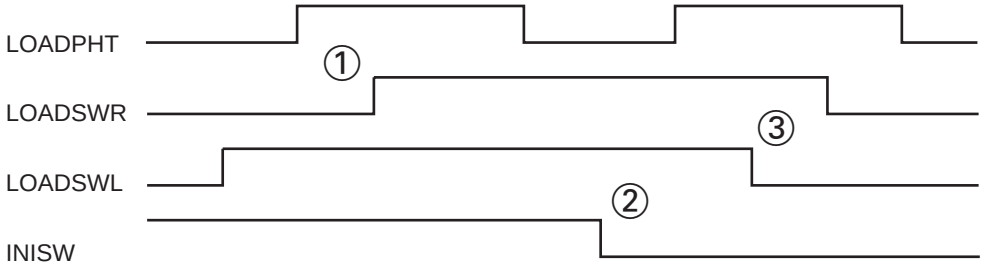
① One of LOADPHT, LOADSWR, LOADSWL starts driving with H. ② All of LOADPHT, LOADSWR, LOADSWL detect H at the same time. ③ Detecting H of INISW. ④ Detecting L of LOADSWR. ⑤ Detecting L of LOADSWL and stopping E/L motor.




At the time of ejecting:

① Starting driving H of LOADSWR. ② Detecting L of INISW.

③ Detecting L of LOADSWL and after reverse brake (16ms), stopping E/L monitor.

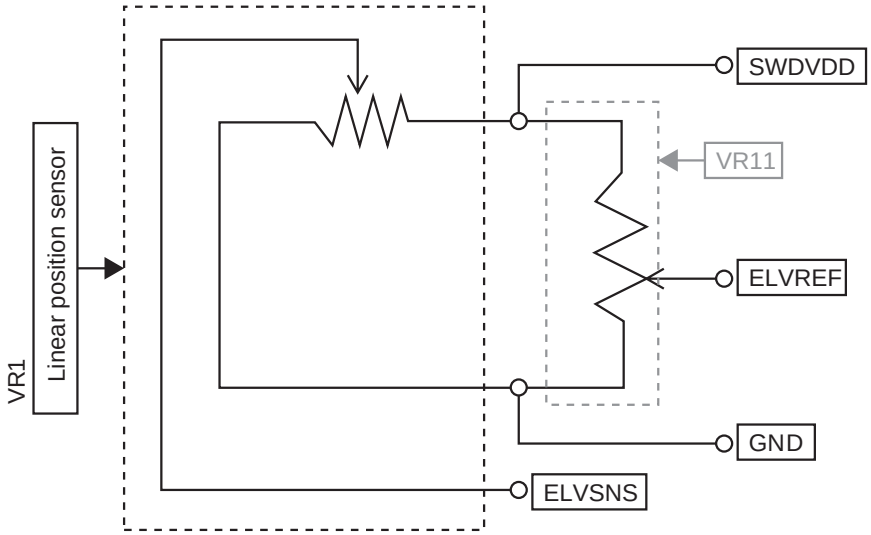



2) Elevation system

2.1) Detect system

It uses a linear position sensor (VR1), converts stage chassis level to voltage value and captures it by a microcomputer A/D to detect absolute position.

Detect circuit




2.2) Drive system

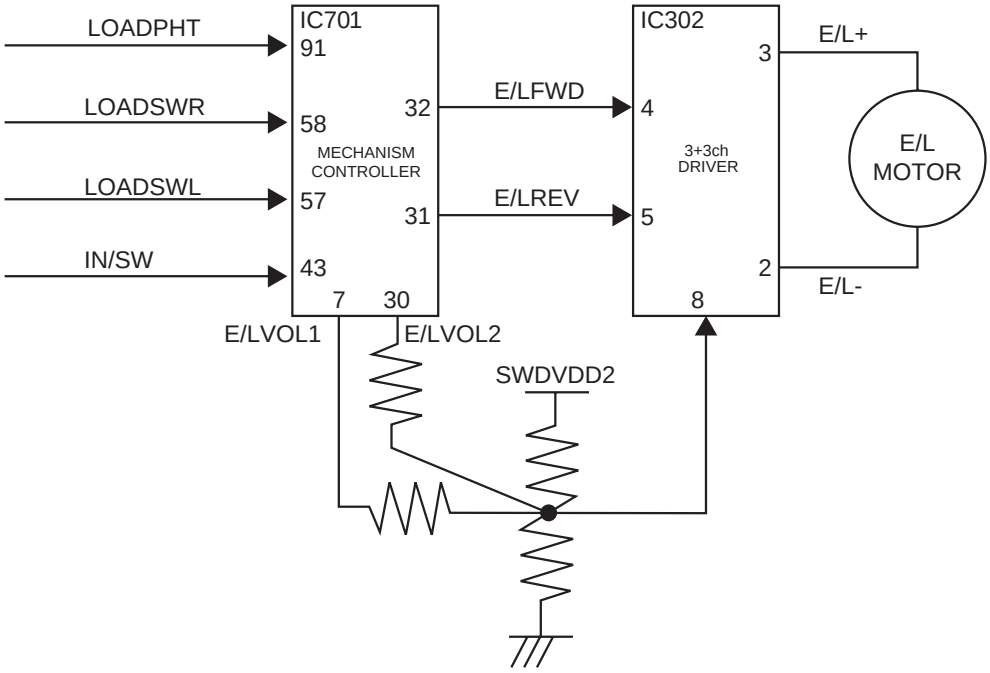
Controlling an E/L motor by the control unit enables the following function.

Elevation function

a) Drive circuit

t controls drive direction by output E/LFWD, E/LREV from the microcomputer (IC701), and 3 values of drive voltage by Hi-Z/L of ELVVOL1,ELVVOL2.

Driving upper direction E/L+>E/L- , (E/LFWD; H, E/LREV; L)
Driving lower direction E/L+<E/L- , (E/LFWD; L, E/LREV; H)
Drive voltage CAMVOL=Hi-Z, 8VCAMVOL=L, 7V
CAMVOL=L, 7V




b) Drive sequence

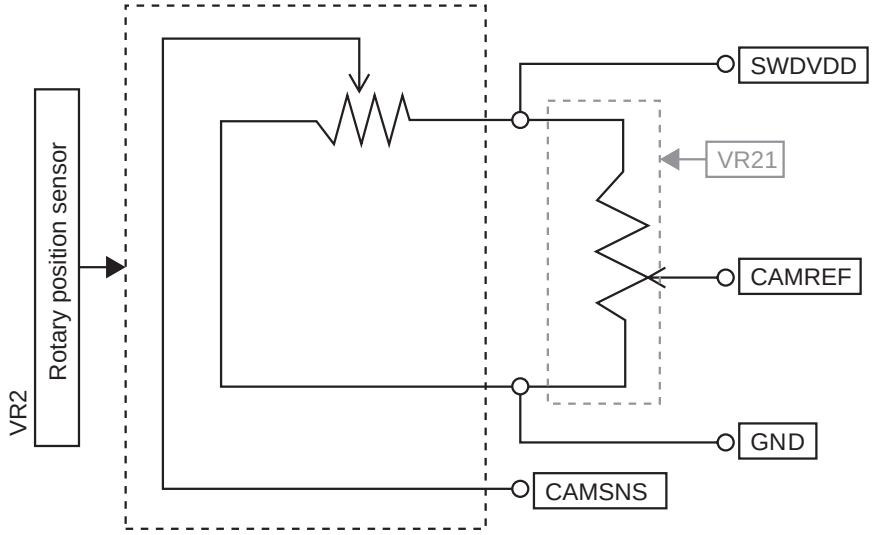
1 Driving continuously to the position of brake start.
2 Detecting of passing the position of brake start and starting short brake.
3 Starting of driving pulse to reach OK range. After confirmation of entering OK range, it is completed.

## 2)Camgear motor system

### 2.1) Detect system

It uses a rotary position sensor (VR2), converts a camgear rotation angle to voltage value and captures it by a microcomputer A/D to detect absolute position.

Detect circuit




### 2.2) Drive system

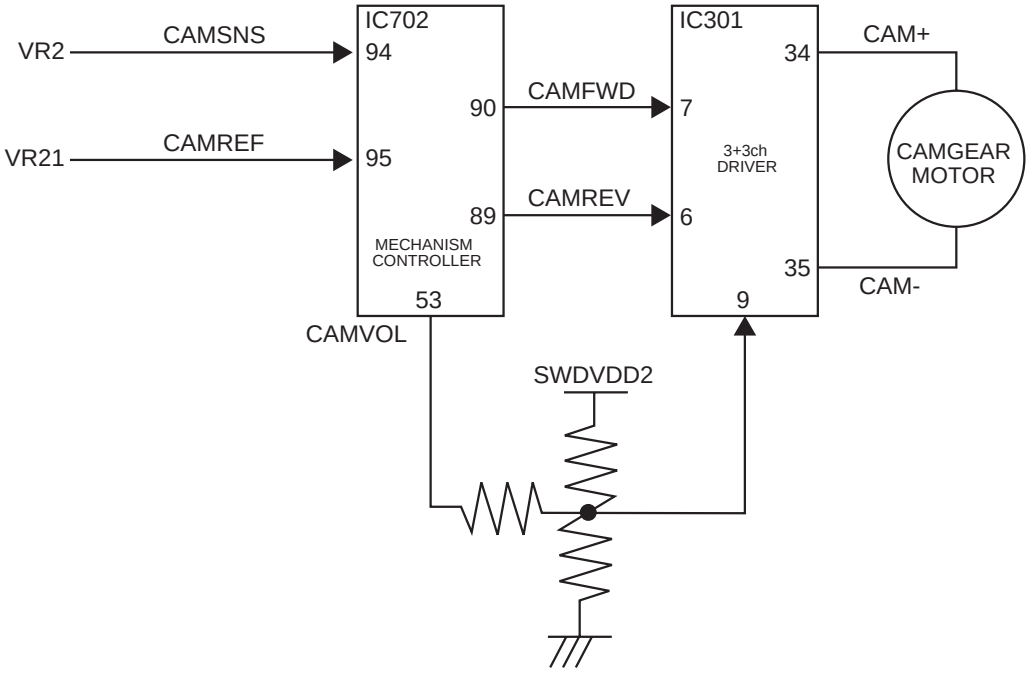
Controlling a cam gear motor by the control unit enables the following function:

- Open/close of shutter
- Open /close of tray tab
- Division of tray
- Rotation operation of CRG chassis (moving to the play position)
- Release of mechanism lock
- Drive of eject arm

a) Drive circuit

It controls drive direction by output CAMFWD and CAMREV from the microcomputer (IC701), and two values of drive voltage by Hi-Z/L of CAMVOL.

Driving CRG chassis to the outer direction (direction of EJECT position)
AM+>CAM-; (CAMFWD; H, CAMREV; L)
Driving CRG chassis to the inner direction (direction of PLAY position)
CAM+<CAM-; (CAMFWD; L, CAMREV; H)
Drive voltage CAMVOL=H; 8V
CAMVOL=L; 7V




b) Drive sequence

1 Driving continuously to the position of brake start.
2 Detecting of passing the position of brake start and starting short brake or reverse brake.
3 Starting of driving pulse to reach OK range. After confirmation of entering OK range, it is completed.

4) SPDL clamp system

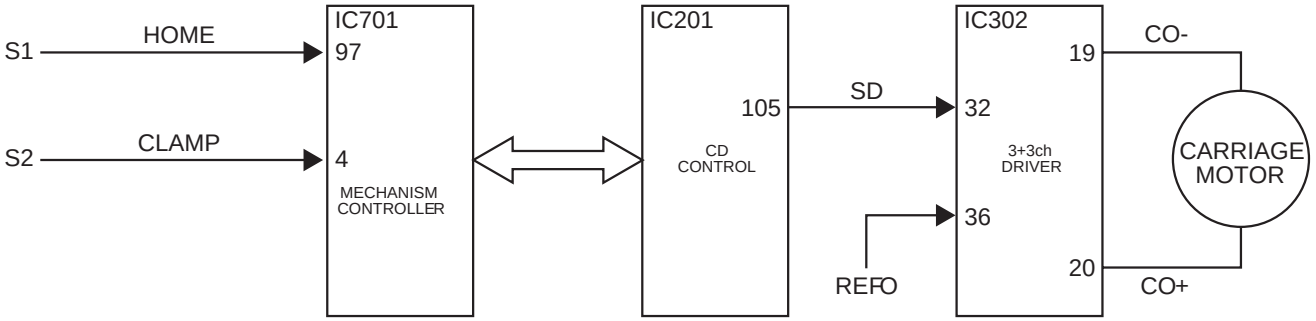
4.1) Detect system

It is composed of two switches such as HOME switch used in servo system (S1) and CLAMP switch (S2) for checking a shutter of the tab inside it.

4.2) Drive system

It operates a pickup unit to move to inner side from normal replay position and moves clamp mechanism of a DISC.

a) Drive circuit



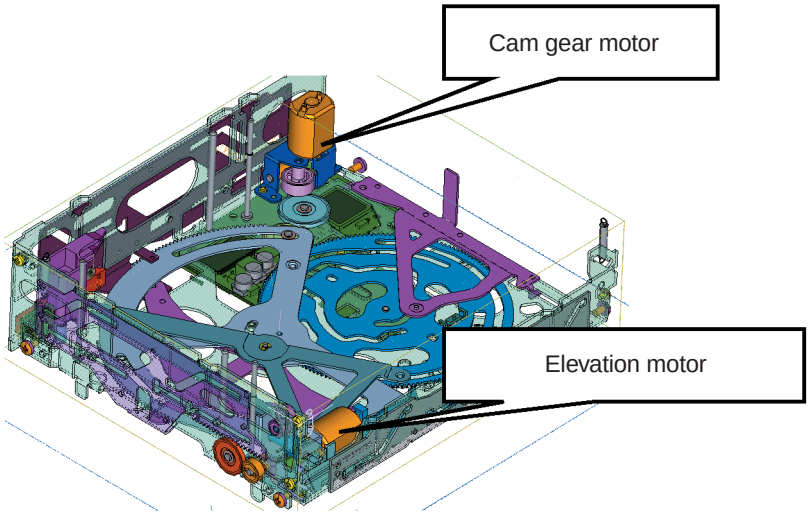
# 2. MECHANISM OVER VIEW

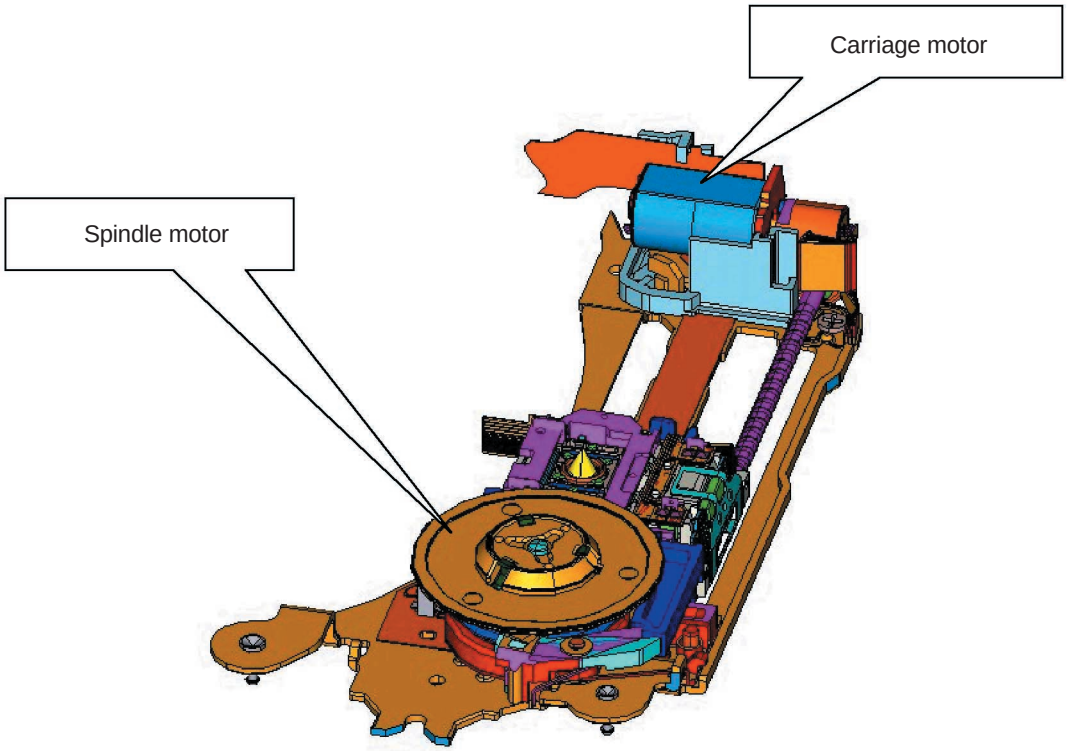
## 2.1 STRUCTURE OF MECHANISM AND OPERATION OF COMPONENTS

The mechanism consists of three blocks, i.e., a main chassis, which is the base of the entire mechanism, stage and tray. Various kinds of operations are performed according to how those blocks are positioned in relation to one another.
The stage block consists of CRG, stage and loading unit; and the loading unit moves up and down with the stage block. The stage block is joined to the main chassis section with a stair and link lever. Sliding the stair moves the entire stage block moves up and down. Moving the link lever allows the CRG to rotate to play a disc. The tray block consists of six trays. Similarly to the stage block, the tray block moves up and down as the stair slides.
To play the disc, the stage block moves toward the tray block at a location where the disc can be played. Then, the tray group is separated by the action of cylindrical cams, the CRG is inserted and the disc is clamped.
To load or eject the disc, the stage block moves to its lower end. Then, the tray block moves the target disc to a location where the disc can be loaded or ejected. The tray group is separated by the action of cylindrical cams. Then, the disc is loaded or ejected.

To carry out the aforementioned operation, the mechanism is provided with four motors. The operations listed in the table below are carried out by using the motors as a motive power.

| | |
|---|---|
| Cam gear motor | Tray separation operation<br>Carriage mechanism assembly rotation operation<br>Eject arm operation<br>Shutter opening/closing operation<br>Tray claw opening/closing operation |
| Elevation motor | Elevation operation<br>Loading/ejection rollers rotation operation |
| Carriage motor | Search operation |
| Spindle motor | Disc clamp claw opening/closing operation<br>Disc rotation operation |



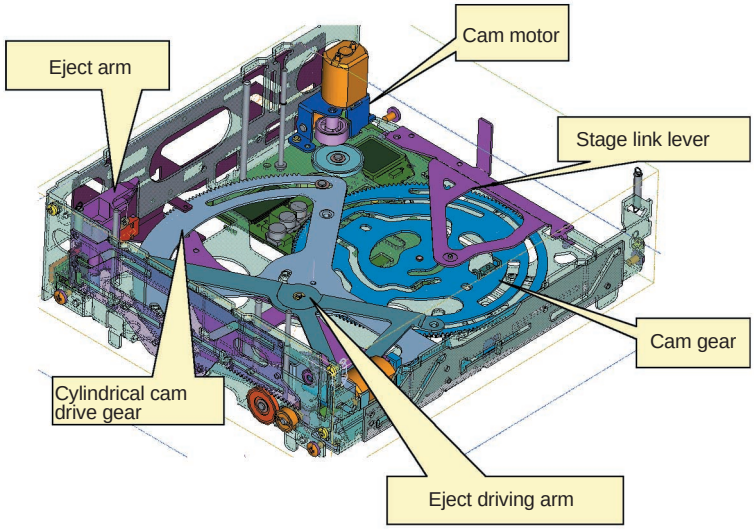




The operations carried out using the motors as a motive power are described below.

## 2.2 CAM GEAR MOTOR (OPERATION OF THE CAM)

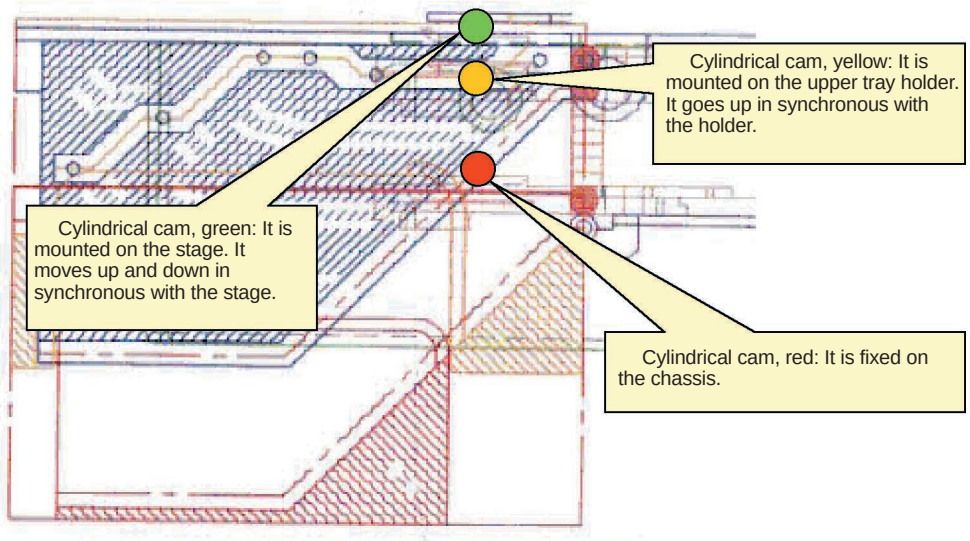
The following five operations are carried out by using the rotary motions of the cam gear motor as a motive power.

a.Tray separation operation
b.Tray claw opening/closing operation
c.Carriage mechanism assembly rotation operation
d.Eject arm operation
e.Shutter opening/closing operation



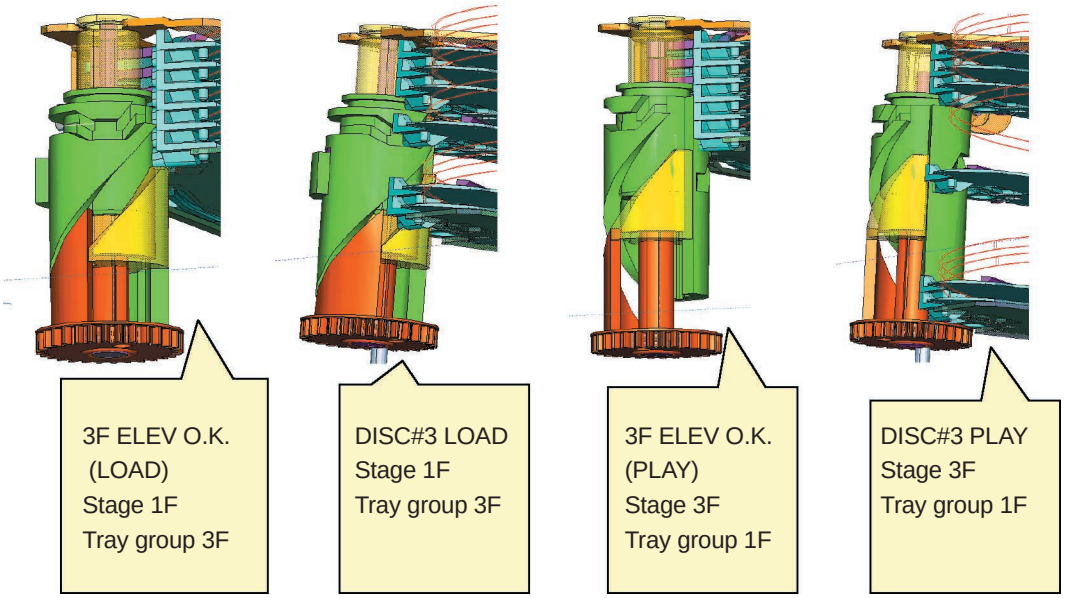
a.Tray separation operation

The rotary motion of the cam gear motor is transferred to the cylindrical cams by way of its cam. The tray is separated by rotations of the cylindrical cams. This makes a space into which the CRG is inserted when playing the disc. The mechanism of the cylindrical cams to separate the tray is as shown below.



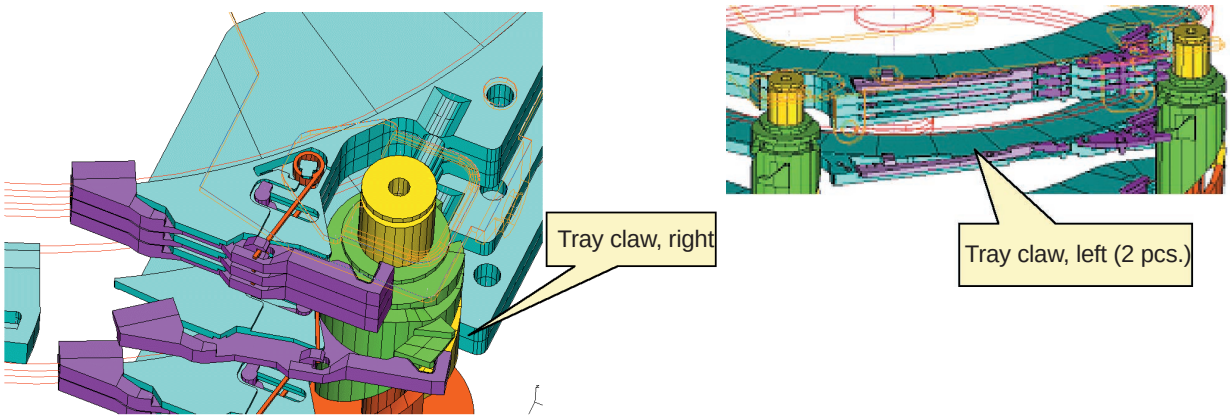

Cylindrical cam, green: Used to select a target tray
Cylindrical cam, yellow: Used to support the tray at the time of loading a disc
Cylindrical cam, red: Used to support the tray at the time of playing a disc

In addition, the appearance of trays being separated at the time of loading or playing disc #3 is shown below as an example.



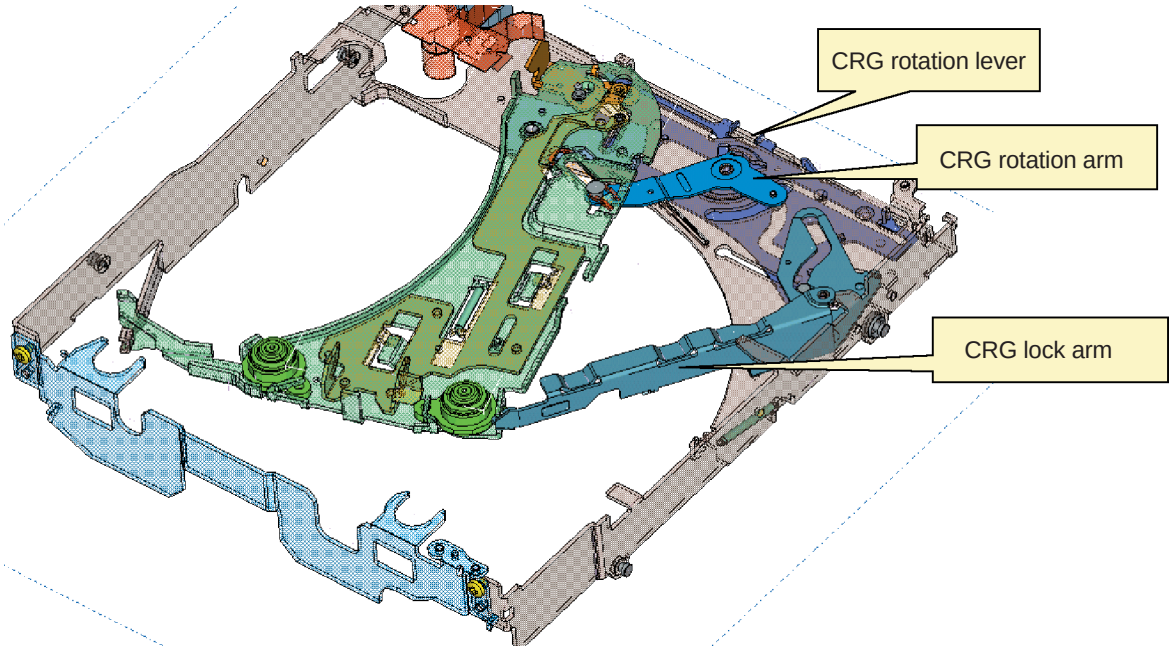
b.Tray claw opening/closing operation

To prevent a disc from dropping, each tray is provided with three claws for clamping the disc. When the cylindrical cams rotate, the tray is separated and tray claws are simultaneously opened/closed




c.Carriage mechanism assembly rotation operation

D stage link lever and CRG rotating lever are in mesh with each other. The CRG block rotates to travel to the disc playing position in synchronous with the stage link lever movements. The CRG block is fixed with the CRG lock arm and other components at the disc playing position.

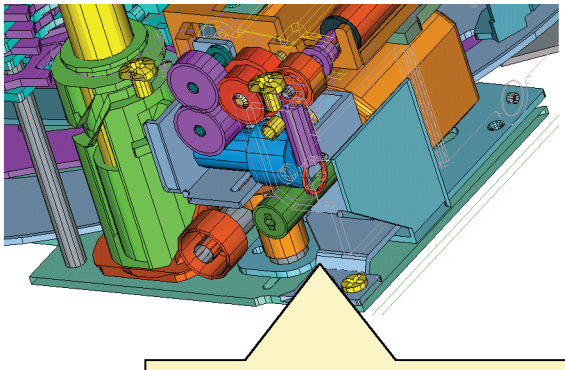


d.Eject arm operation

At the time of ejecting a disc, the eject arm is rotated by the force transferred from the eject driving arm to push the disc out.

e.Shutter opening/closing operation

ELEV 2 gear is slid by the force transferred from the eject driving arm. At the same time, the shutter, which protects the disc insertion slot engaged with the ELEV 2 gear unit, opens/closes.



ELEV 2 gear unit :
It slides by the force transferred from the eject driving arm.

## 2.3 ELEVATION MOTOR

The following two operations are carried out using rotations of the elevation motor as a motive power.

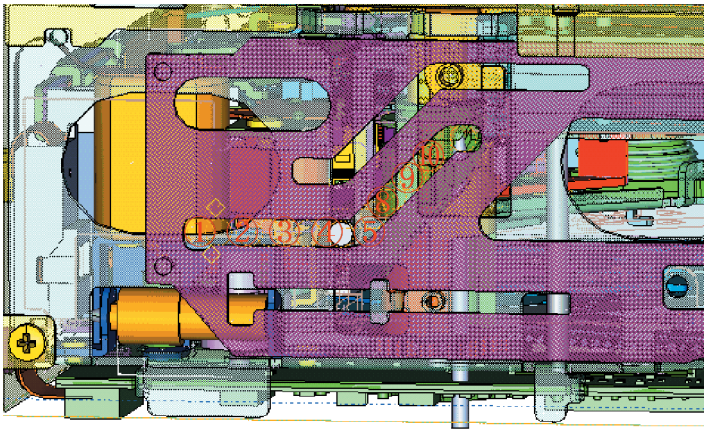
a.Elevation operation
b.Load/eject roller rotation

a.Elevation operation

Where the ELEV O.K. state, the stair is slid by rotations of the elevation motor. The stair is in mesh with the tray block and stage block. Therefore, the tray block and stage block move up and down in synchronous with the stair sliding.

The tray block and stage block change their positions among the following 11 ones according to a change in the stair position. The stair position is detected by the linear position sensor.

| Stair position | Stage block | Tray block |
|---|---|---|
| ① | 1F | 6F |
| ② | 1F | 5F |
| ③ | 1F | 4F |
| ④ | 1F | 3F |
| ⑤ | 1F | 2F |
| ⑥ | 1F | 1F |
| ⑦ | 2F | 1F |
| ⑧ | 3F | 1F |
| ⑨ | 4F | 1F |
| ⑩ | 5F | 1F |
| ⑪ | 6F | 1F |



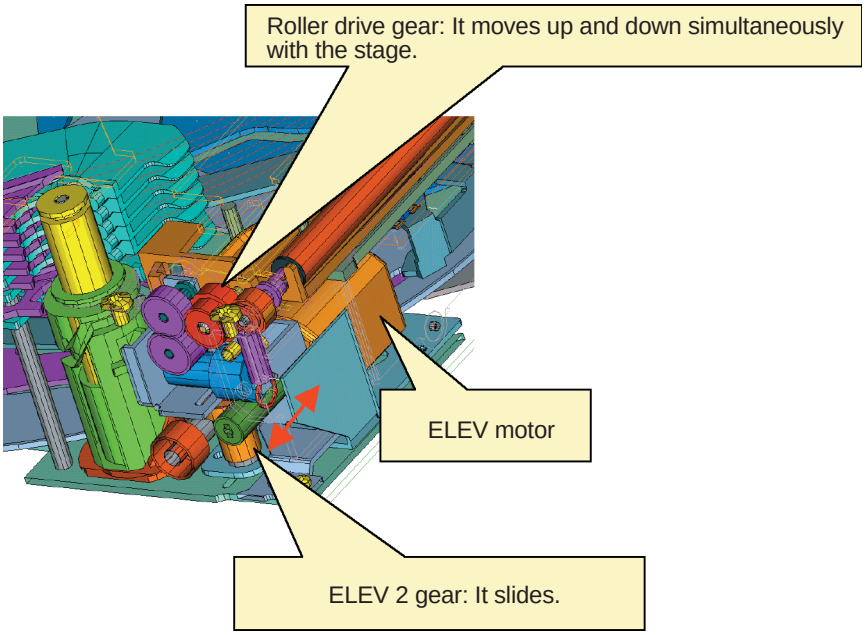
When the stair is located at one of positions ① to ⑥ the stage does not move up and down but stays at 1F. In this case, the tray group moves up and down to select a disc. To load or eject a disc, the stair should be located at one of those positions.

When the stair is located at one of positions ⑥ to ⑪ the tray group does not move up and down but stays at 1F. In this case, the stage moves up and down to select a disc. To play a disc, the stair should be located at one of those positions.

a.Elevation operation

When the stage is on its lowest layer, the roller drive gear joins the row of gears of the elevation motor. As a result, the load/eject roller rotates as the elevation motor rotates. This draws/ejects a disc.

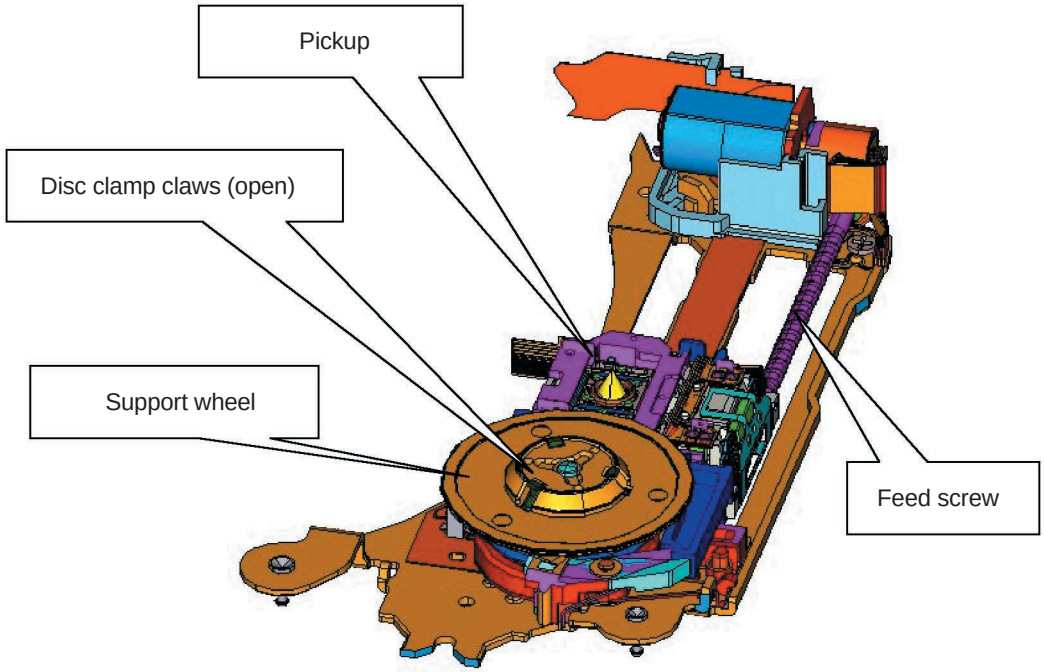
At the time of loading/ejecting a disc, the ELEV 2 gear slides to separate the row of gears which transfers the stair force. Therefore the stair does not move.



## 2.4 CARRIAGE MOTOR AND SPINDLE MOTOR

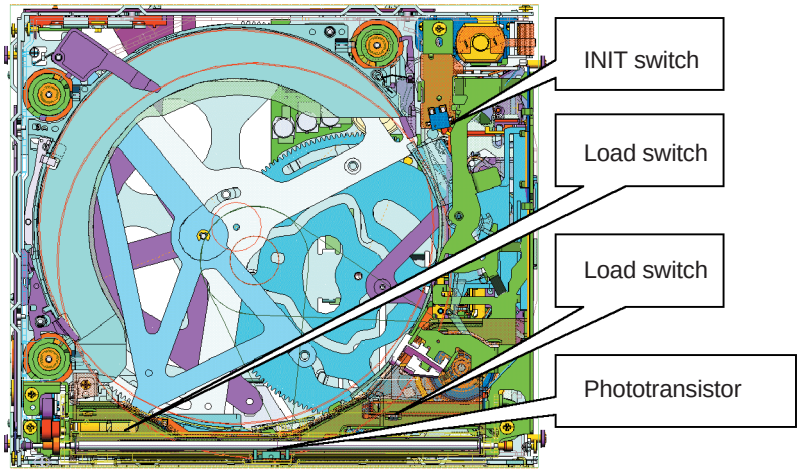
When playing a disc, the spindle motor works to rotate the disc. Search operation is carried out by reducing the rotating speed of the carriage motor with a worm and driving the feed screw.

At the time of playing, the disc is clamped with the three claws. The claws open to unclamp the disc when the support wheel mechanism shifts the pickup to the support wheel, or the claws close to clamp it for the search operation.

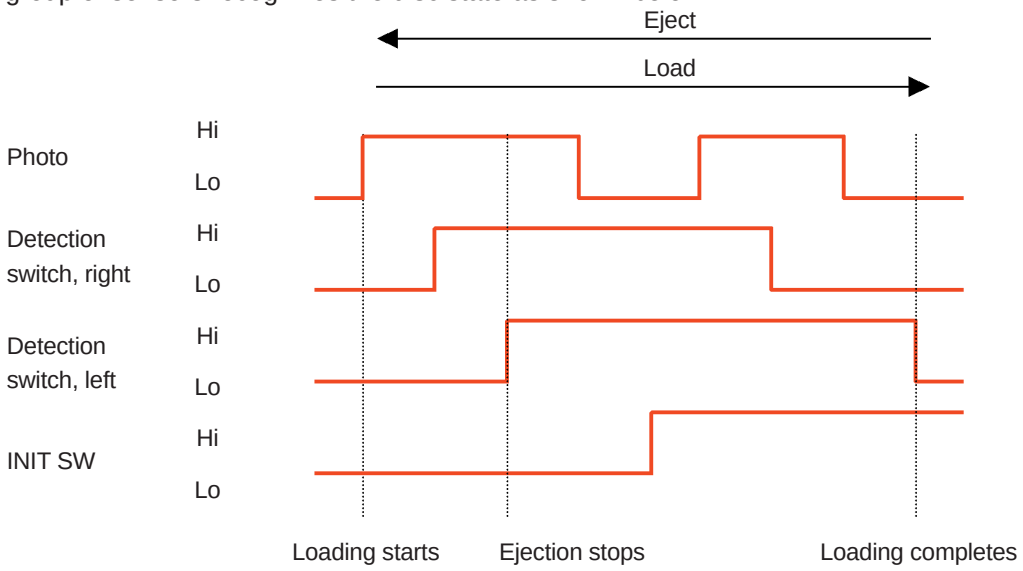


## 2.5 DETECTION OF A DISC BY SENSORS AT THE TIME LOADING

A disc is detected by a phototransistor, right and left load switches and INIT switch.
Phototransistor: Light emitted by the LED mounted on the underside of the roller is reflected by the lighting conductor on the shutter. When the light is shielded by the disc, the phototransistor is brought to its Hi status.
Load switch, right: It is mounted on the right side of the disc insertion slot. When the white resin lever is pressed to the right by the disc, the switch is brought to its Hi status.
Load switch, left: It is mounted on the left side of the disc insertion slot. When the white resin lever is pressed to the left by the disc, the switch is brought to its Hi status.
INIT switch: It is mounted at the right back of the stage. When the resin arm moves from its home position, the switch is brought to its Hi status.




The group of sensors recognizes the disc state as shown below.



## 2.6 OPERATIONS OF THE MECHANISM

The following operations are described below based on the explanation of a series of combined operations of the elements given above.

Initial operation of the mechanism
Loading operation
Ejection operation
Play operation

### 2.5.1 Initial operation of the mechanism

When the power is turned on, the mechanism starts initialization. It checks all trays starting from #6 for the presence of discs. The mechanism recognizes the tray(s) which currently has a disc.

### 2.5.2 Loading operation

Operation sequence from the ELEV O.K. state to the loading of a disc is carried out as described below:

① Tray into which a disc is to be ejected is selected by moving the tray group up and down by the elevation operation.
② Tray separation and shutter opening actions are taken simultaneously by the cam operation.
③ When the user inserts a disc into the selected tray, the phototransistor detects the inserted disc.
④ The disc is drawn inside by rotary motions of the roller.
⑤ The disc drawn into the predetermined position is detected.

### 2.5.3 Ejection operation

Operation sequence from the ELEV O.K. state to the ejection of a disc is carried out as described below:

① Tray from which a disc is to be inserted is selected by moving the tray group up and down by the elevation operation. The tray from which the disc is to be ejected moves to the disc insertion slot.
② Tray separation and shutter opening actions are taken through the cam operation. Then, the eject arm actuates to push the disc forward. At the same time, the roller starts rotating.
③ The disc is ejected by rotary motions of the roller.
④ It is detected that the user draws out the disc from the slot.
⑤ The steps ① and ② are carried out in reverse order by the cam operation. This closes the shutter.

### 2.5.4 Play operation

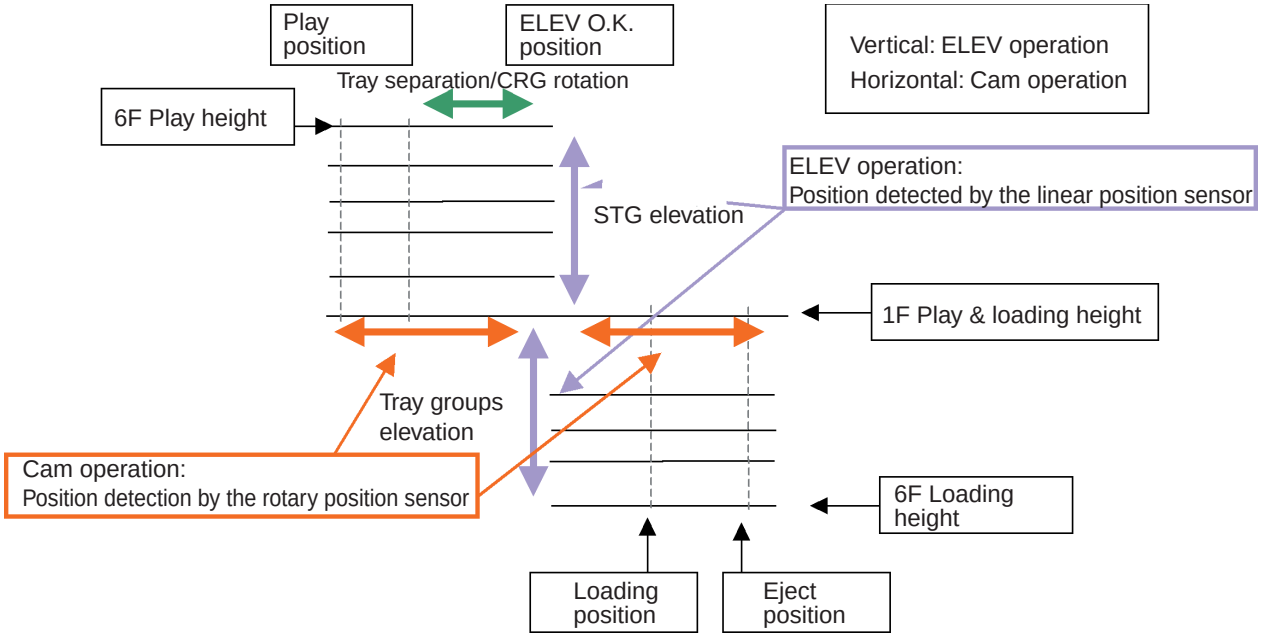
Operation sequence from the ELEV O.K. state to the play state is carried out as described below:

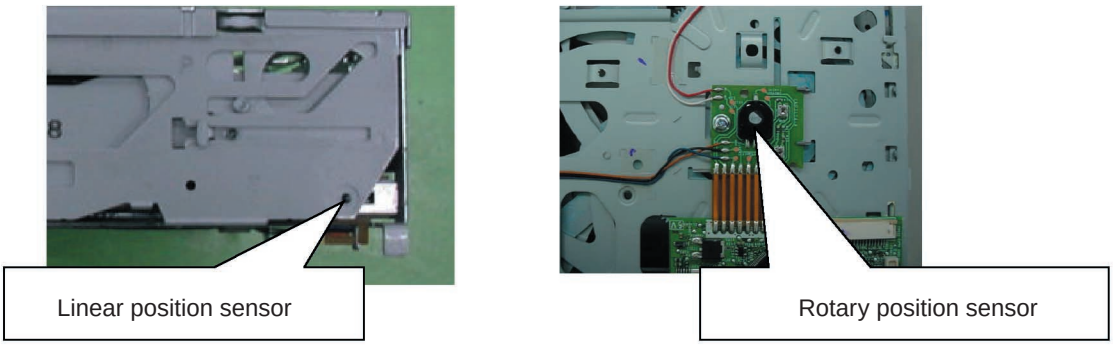
① The stage moves to the position of the tray which has the disc to be played by the ELEV operation.
② Tray separation and CRG rotation actions are taken by the cam operation.
③ The disc is clamped.

The aforementioned operation sequence is reversed to shift from the play state to the ELEV O.K. state.

Disc changing is carried out by shifting from the current play state to the ELEV O.K. state once, then shifting to the next play state. For example, to change the disc 1 to disc 6, the disc 1 play status is shifted to the ELEV O.K. status first, then the ELEV O.K. state is shifted to the disc 6 play state.

The mechanism state transition diagram is given below. Transition of the state of stage and tray group by the elevation operation is presented in vertical direction of the diagram. Transition of the state of tray separation and CRG position by the cam operation is presented in horizontal direction of the diagram. As shown in the diagram, the position of tray group and stage at the time of loading and ejection is same with that at the time of play only in the case of the disc 1.

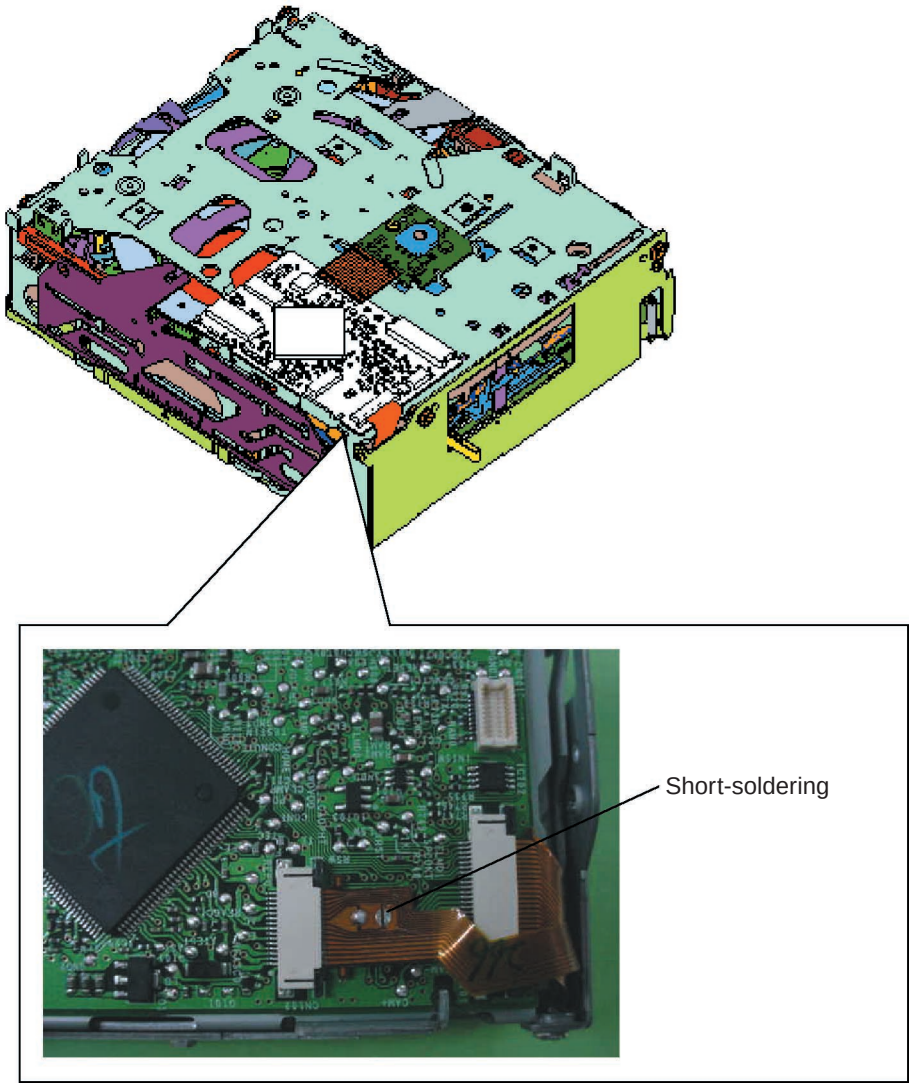


# 3. DISASSEMBLY

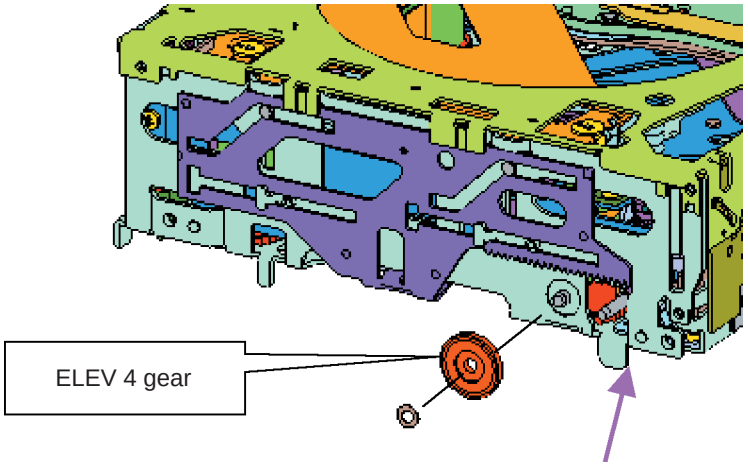
## 3.1 PREPARATION FOR REMOVAL

① Place the mechanism in the ELEV O.K. state.
② Eliminate static electricity with a wrist band, etc.
③ Carry out short-soldering. (There are two points to be short-soldered. It is enough to solder one of them.)
④ Slide the lock section of the connector to fix a flexible cable and remove a flexible cable. (2 points)



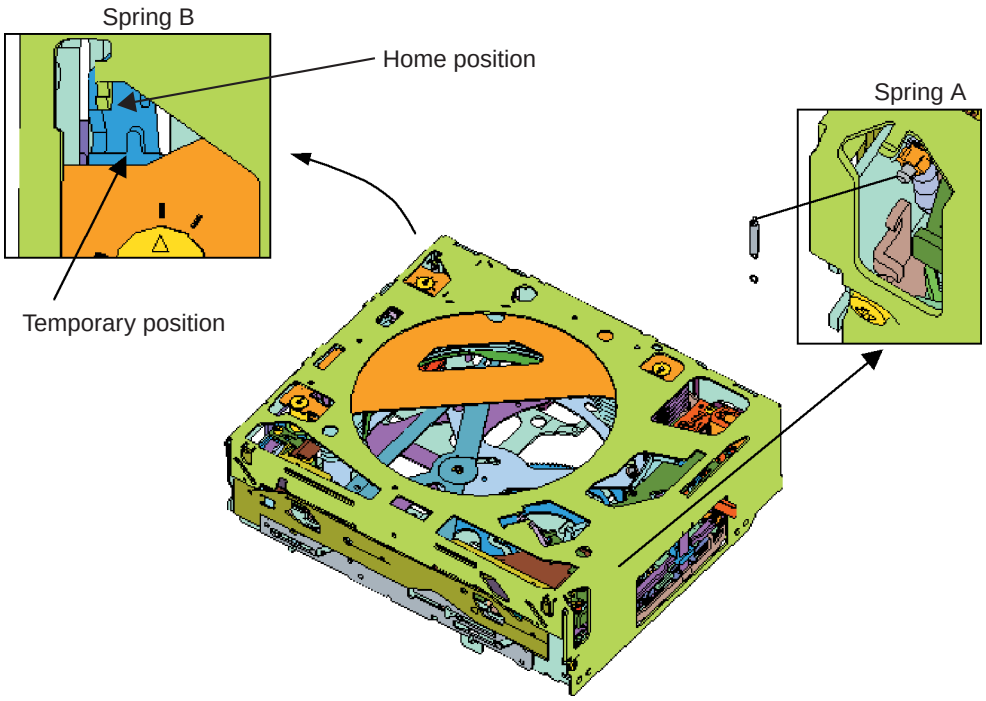
## 3.2 HOW TO REMOVE THE UPPER CASE

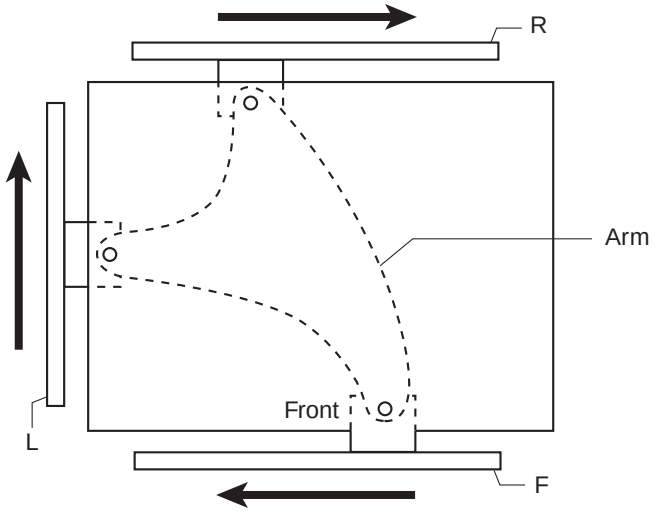
① Remove poly washer. Remove the ELEV 4 gear.
Once the ELEV 4 gear is removed, the stair can be slid as desired.




*In the illustration above, the ELEV 3 gear is removed. But the ELEV 3 gear is not required to be removed.

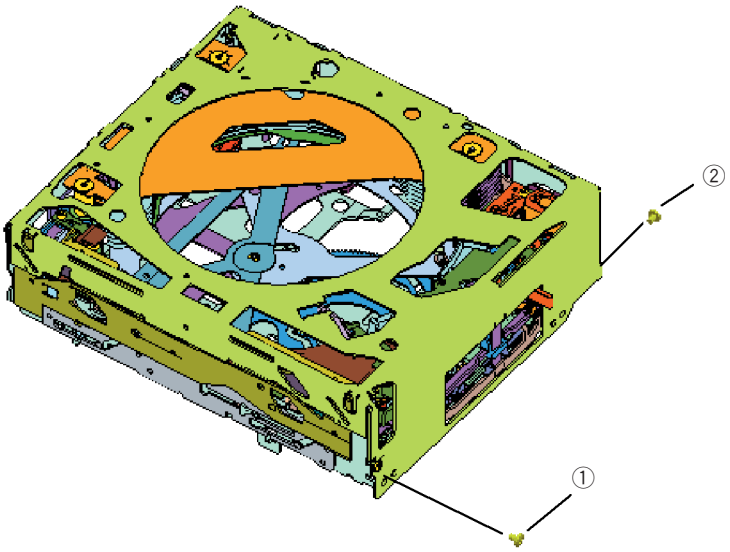
① Manually slide the stair (clockwise) to raise the stage block to the uppermost floor.
② Remove front right spring A.
③ Change the position of the back left spring B from the home position to a temporary position. (The hook at the temporary position is fixed on the stage. This means that the stage needs to be raised to the uppermost floor to enable easy re-positioning of the spring.)

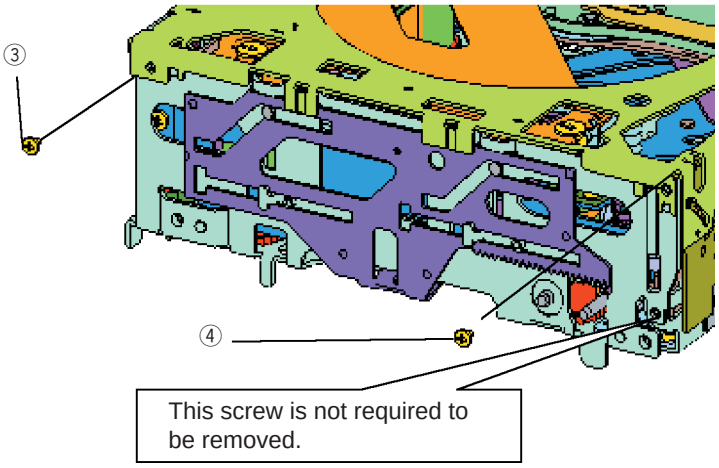


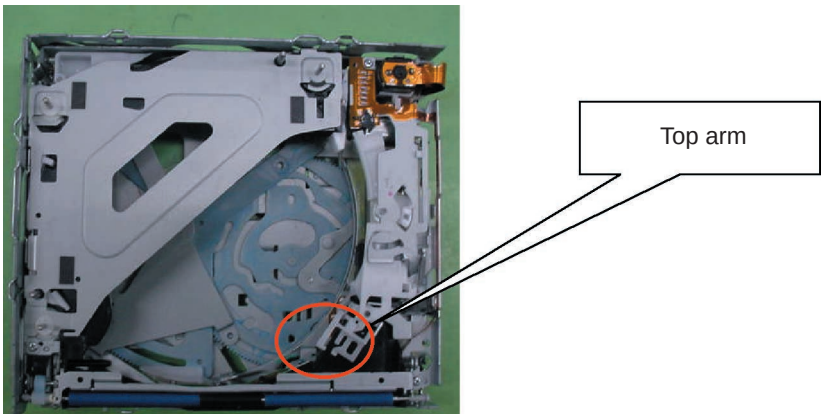




In a stair, 3 of F (front), L (left) and R (right) are linked by an arm at the bottom of mechanics, and when moving it to <- direction, a stage moves to the top. (clockwise when looking from upward)

④ Manually slide the stair to lower the stage.
⑤ Remove four screws which are used to secure the upper case. Remove the upper case.
⑥ Lightly slide the snap-fitted top arm to remove it.

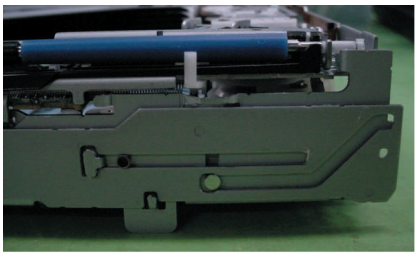


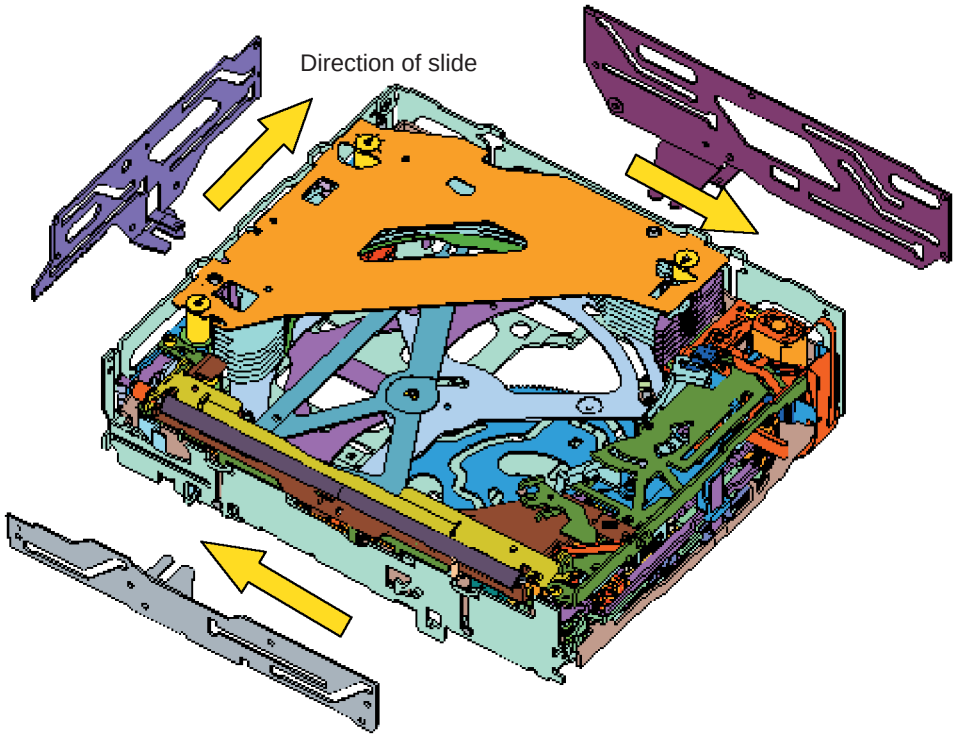



## 3.3 HOW TO REMOVE THE STAIR

① Slide the stair in the direction for lowering the tray block until it will go no further. (See the photo shown below.)

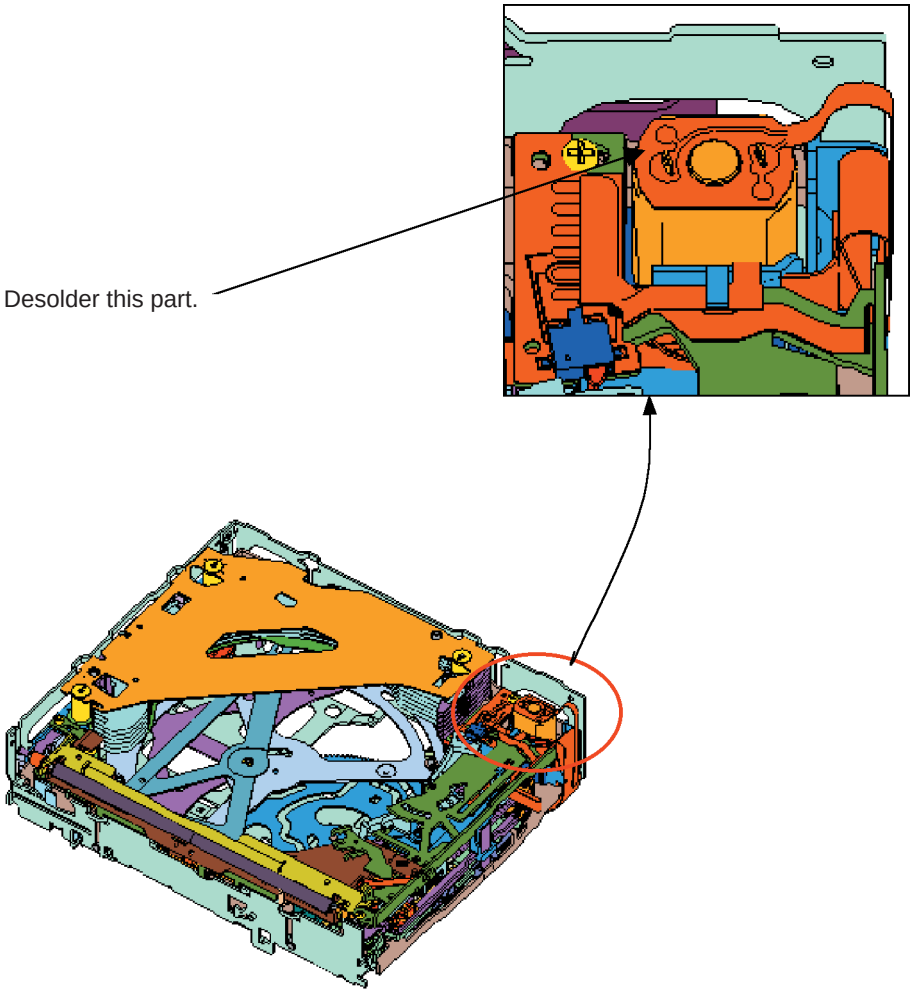


② Remove three stairs.

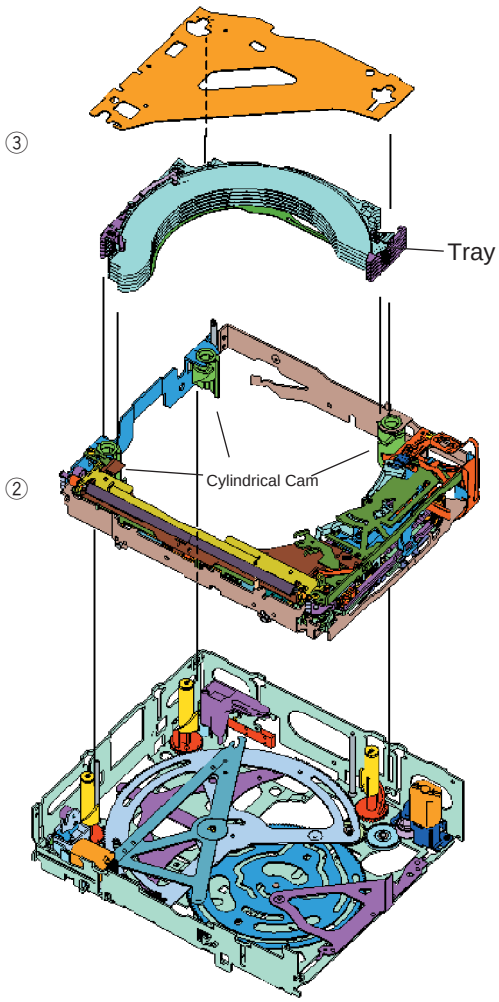


## 3.4 HOW TO REMOVE THE STAGE

① Desolder the back right cam motor. Then, remove the flexible cable.

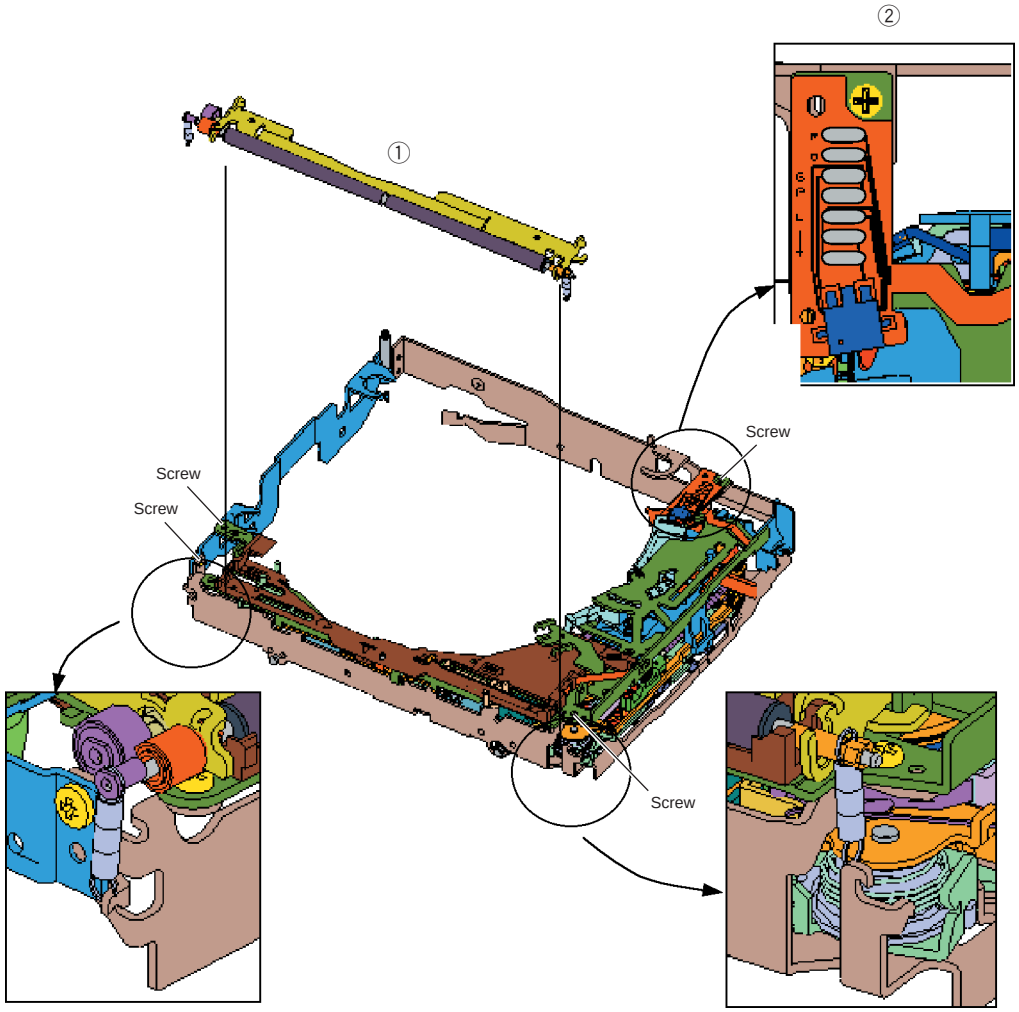


② Draw out the stage block in vertical direction.
③ Lift up the triangular top plate in the vertical direction, then slide it away from you until it comes off.
④ Remove the tray and cylindrical cam from the stage.



## 3.5 HOW TO REMOVE THE LOAD FRAME

① Remove the springs from both sides of the roller. Remove the roller.
② Desolder and remove the flexible cable.
③ Remove the screws which are used to secure the load frame at four points. Remove the load frame.
Note: Remove springs from metal plate hook, but not necessarily from the resin collar.

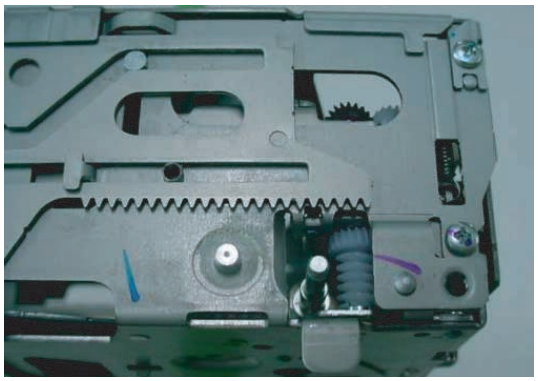



## 3.6 HOW TO REMOVE THE CRG (ONLY FOR REFERENCE SINCE THIS PROCEDURE IS HARD TO BE COVERED BY OUR SERVICE)

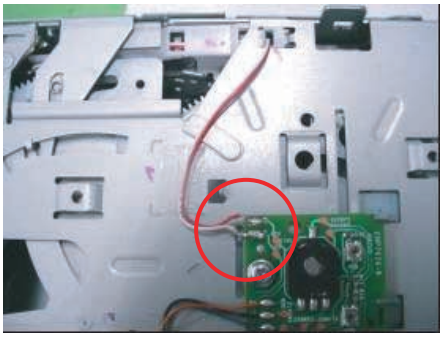
① Slide the part with which the stage link lever is in mesh toward you. Turn the CRG to move it to the play position.
② Remove the resin part and springs.
③ Remove the CRG.

## 3.7 HOW TO REMOVE THE ELEV MOTOR

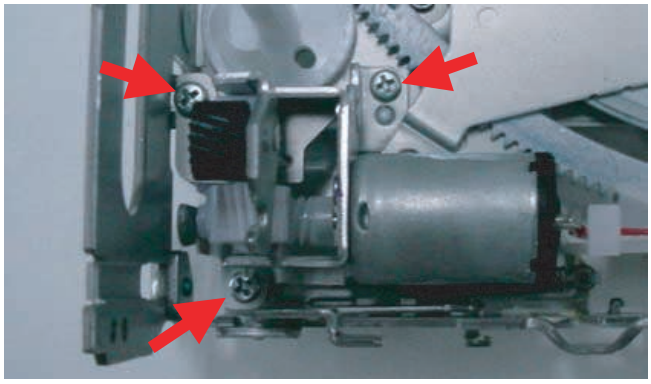
① Check that the ELEV3 gear is removed



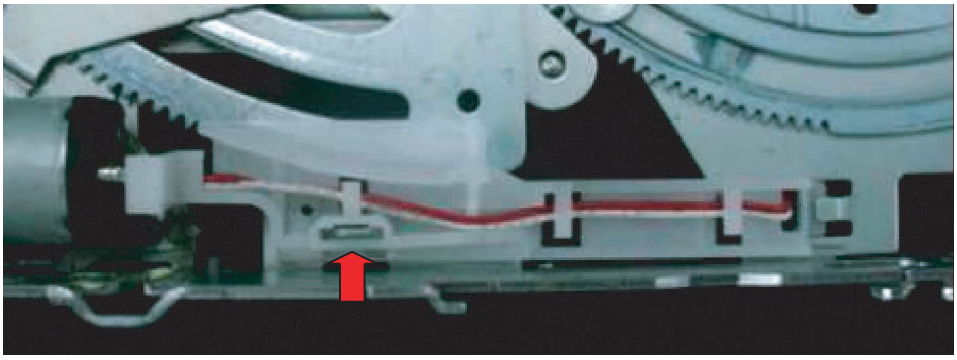
② Remove the solder of two lines (red and white) on the rear side of main chassis



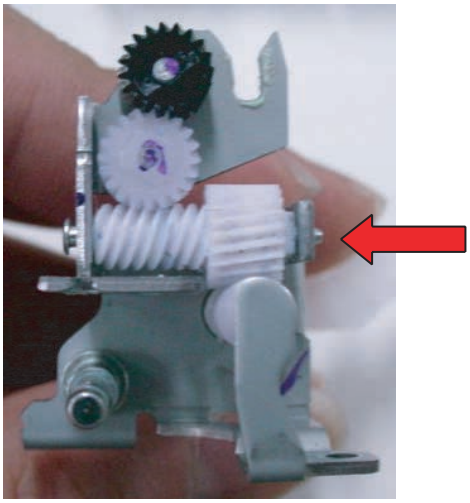
③ Unscrew the three screws shown in the figure



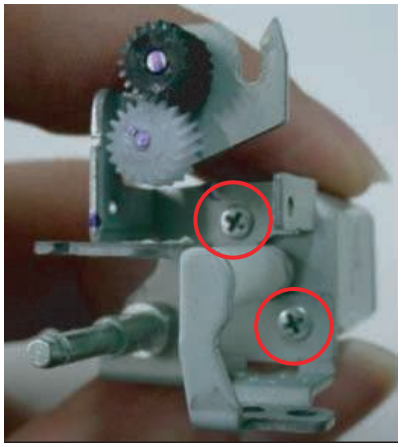
④ Remove the resin part. At this time, it can be removed easily by applying edgewise pressure to the point shown in the figure using the straight slot screwdriver



⑤ Pull out the gear shaft, and remove the gear



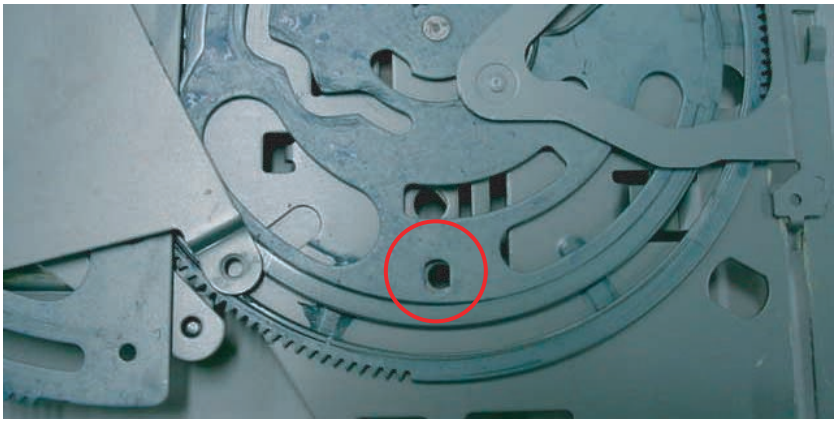
⑥ Unscrew the two screws fixing the motor and remove the wire lead



# 4. HOW TO ASSEMBLE

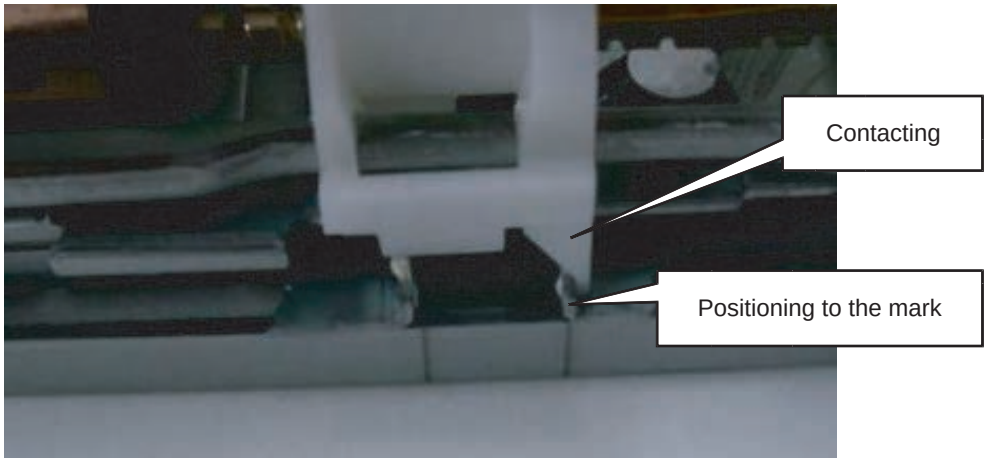
## 4.1 CHECK BEFORE ASSEMBLING

· Check the location of CAM gear of main chassis.
As shown in the photo below, check that the hole of main chassis can be seen from the hole of cam (it is not necessary to match it perfectly).



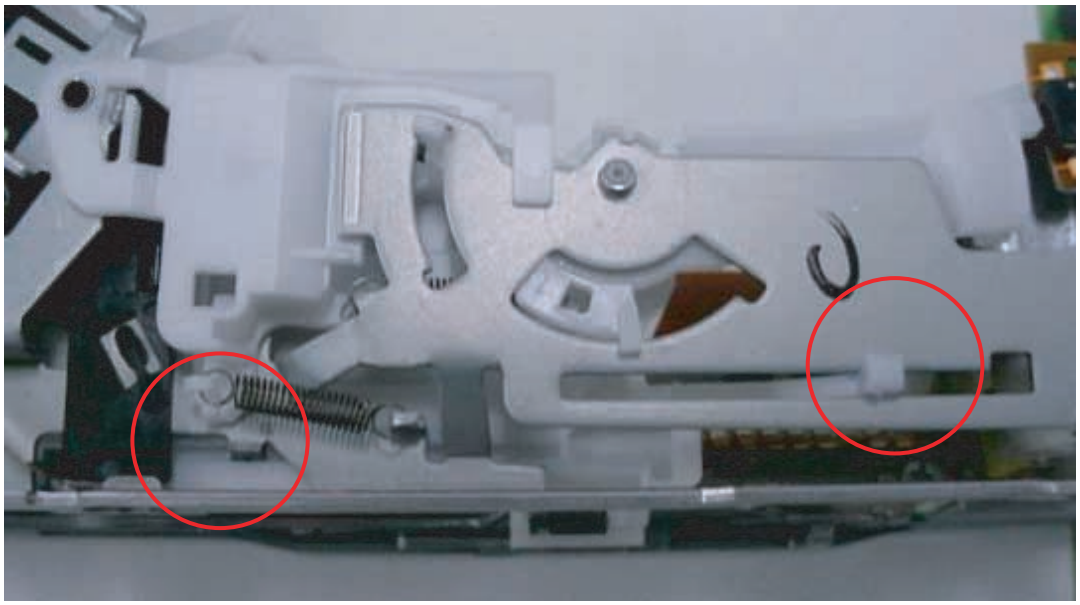
Location of CAM gear

· Check the location of stage lock arm of STG. It is not like as shown in the figure below, move the arm to the position of mark. In a similar way, for the white resin part, move the arm to the position as shown in the photo below.




Location of STG lock arm

At this time, check the part pointed in the figure does not drop off the groove.
When it is dropping off the groove, set it paying attention to the position shown in the photo below.



Location to attach the white resin

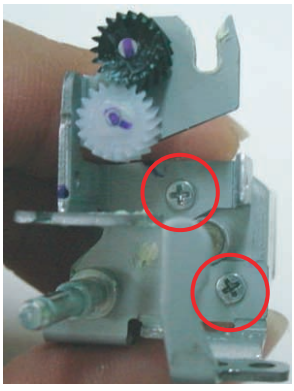
## 4.2 ASSEMBLING THE ELEV MOTOR
## (When the ELEV motor is not removed, this step is not necessary)

· Press the gear into motor, and attach the wire lead.
Connect the white wire lead to the white mark side on bottom panel of motor.

Mark on bottom panel of motor

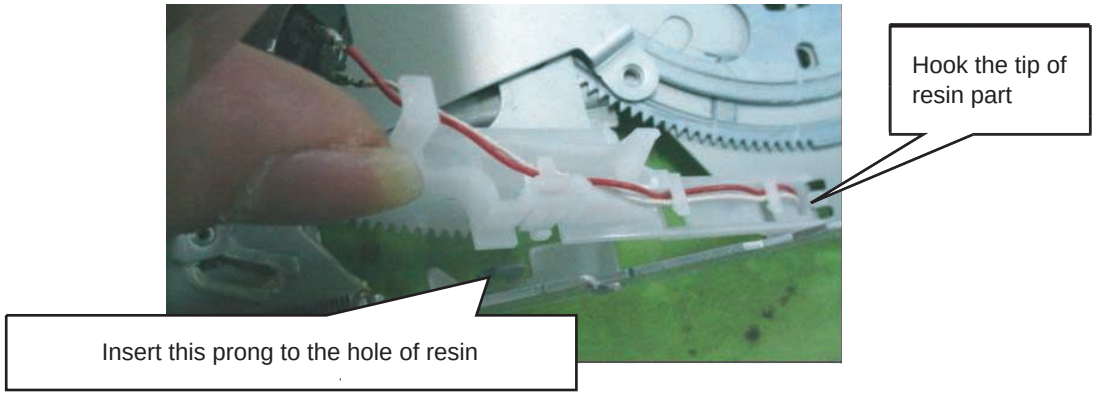
How to connect the wire lead

· Fix the motor to the bracket with screws



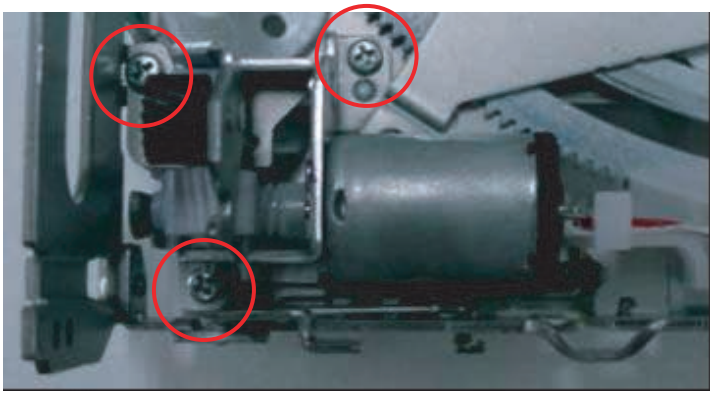
How to fix the bracket

· Fix the resin part to the main chassis



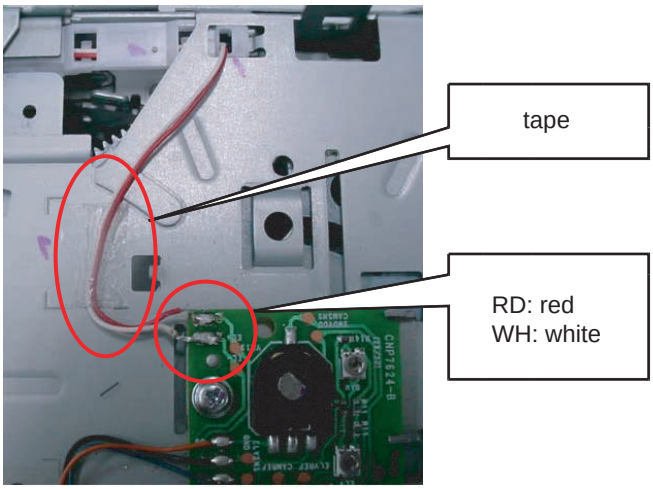

How to fix the resin part

· Secure the three screws



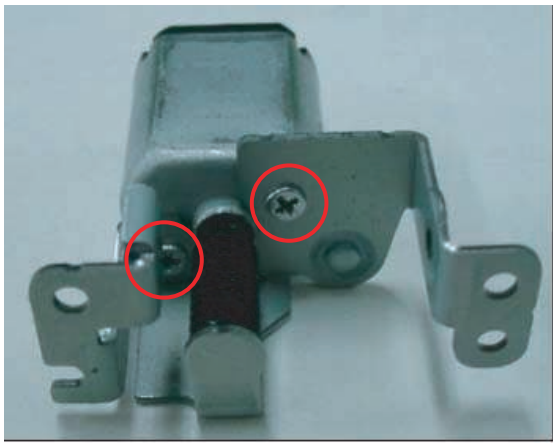
How to fix the ELEV motor unit

· Solder the wire lead to the board on the rear side of main chassis, and fix it with tape.

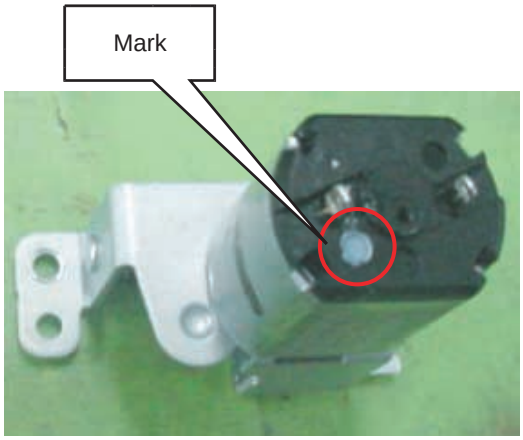


## 4.3 ASSEMBLING THE CAM MOTOR

· Press the gear into motor, and fix it to the bracket with two screws
At this time, take care of the direction to fix the gear. Check the location of mark is as shown in the photo shown in lower right.

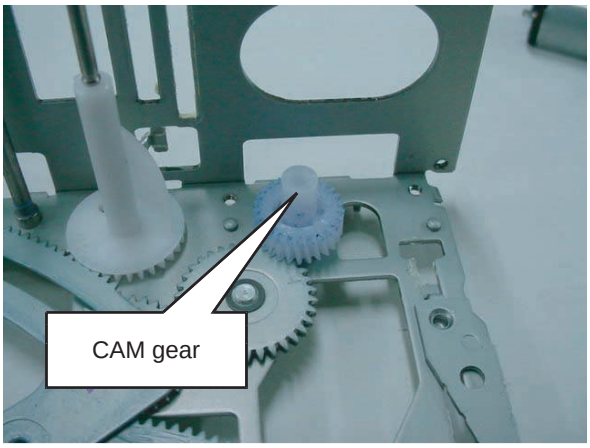


How to fix the motor

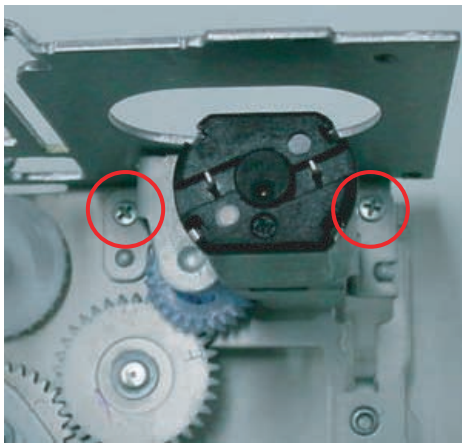



Mark for attaching the motor

· Attach the CAM gear, and fix the CAM motor unit with two screws




Location to attach the CAM gear



Location to attach the CAM motor unit

## 4.4 ASSEMBLING THE STAGE UNIT

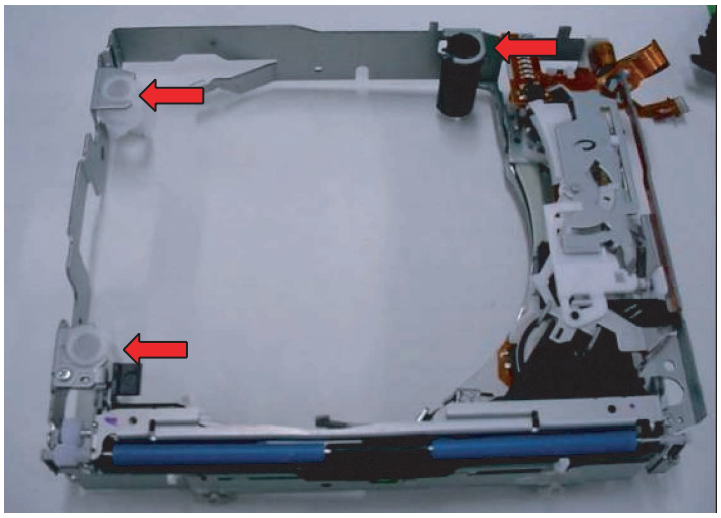
① Prepare the tray

Pile the 6 trays so that the tray with steel plate is at the bottom

Tray (6-pile)

② Prepare the STG

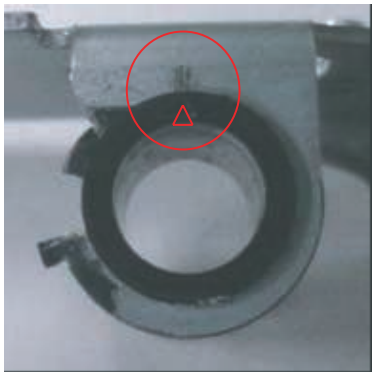
Attach the cylinder cam OUT to the stage.
At this time, attach the black cylinder cam at the right back.



Location to attach the cylinder cam OUT

Rotate the matched cylinder cam and match the marks of STG and cam (for all cams).

Left back

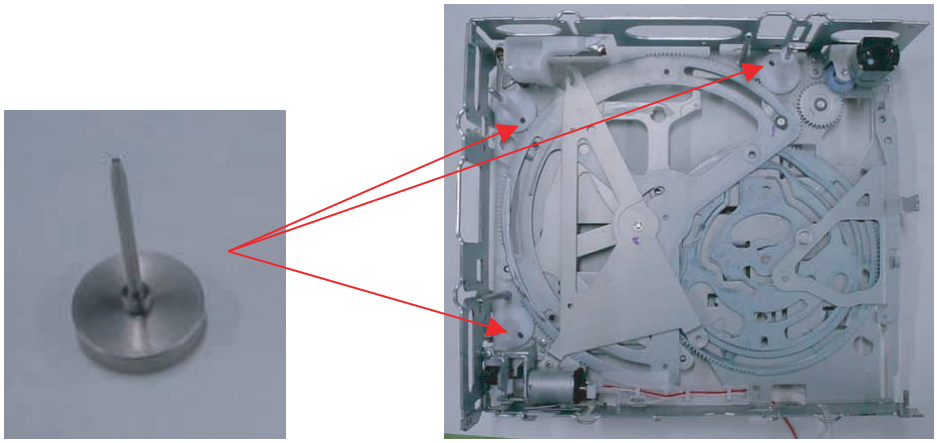


Right back

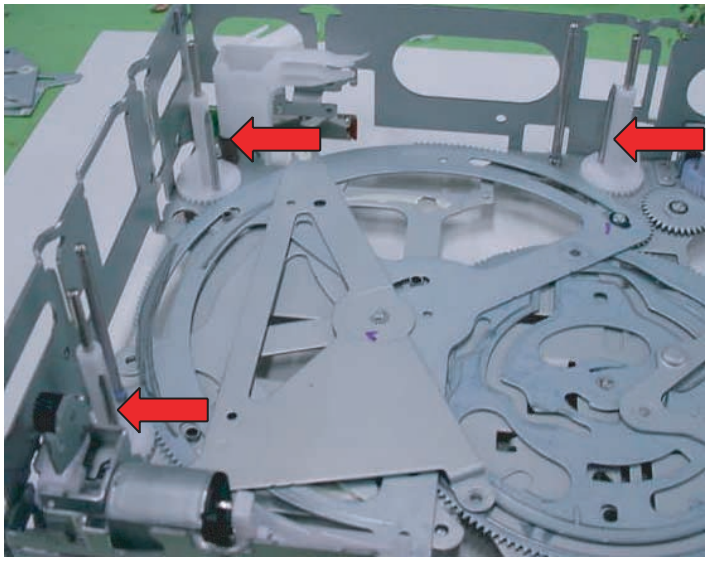
Left front

Location of mark of cylinder cam OUT

③ From rear side of main chassis, insert the assembly jig to the cylinder cam gear (x3).

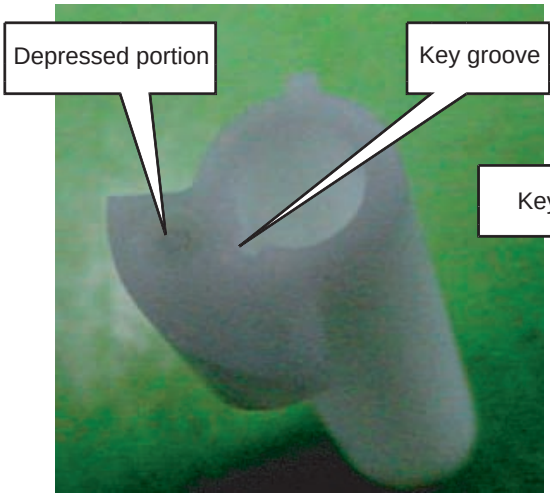


Assembly jig
GGF1538*3



After inserting the assembly jig

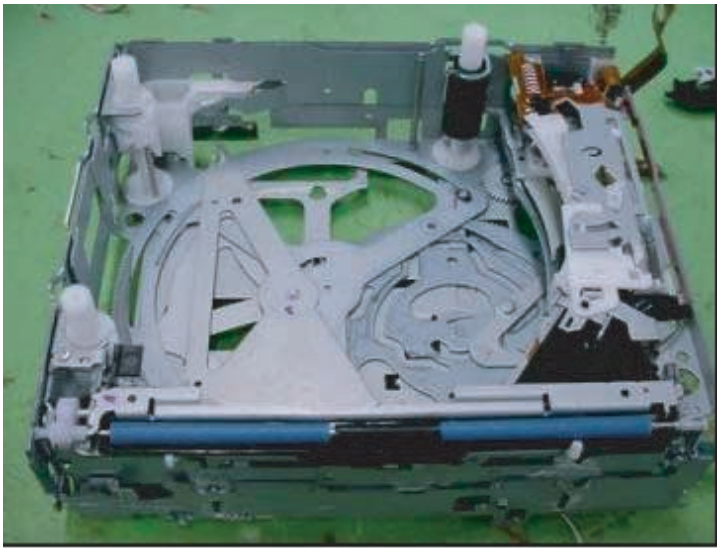
④ Insert the cylinder cam IN (x3)
At this time, set the key part of cylinder cam gear to the key groove of inside of cylinder cam IN.
Match the tip of assembly jig to the depressed portion on the bottom panel of cylinder cam IN.




Cylinder cam IN

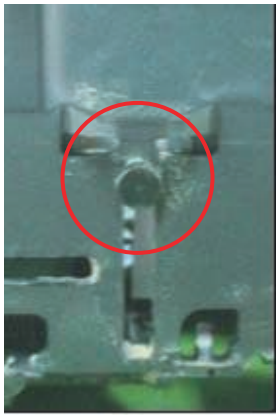

Cylinder cam gear

⑤ Attaching the STG
At this time, as the right front part does not have a bracket, support it with something.

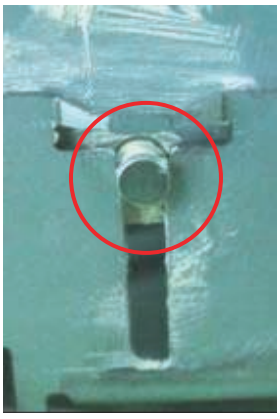


After attaching the STG

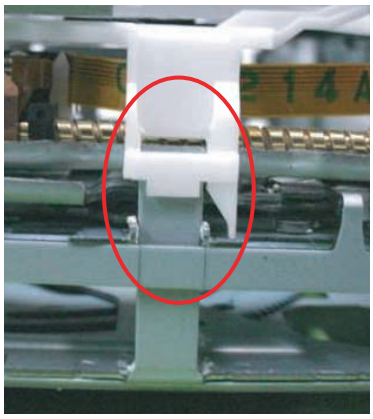
At this time, check the three parts shown in the figure below fit.
Especially, for the right panel, take care so that the metallic bar protruding from the main chassis fits the both of stage link lever and white resin part.



Left front



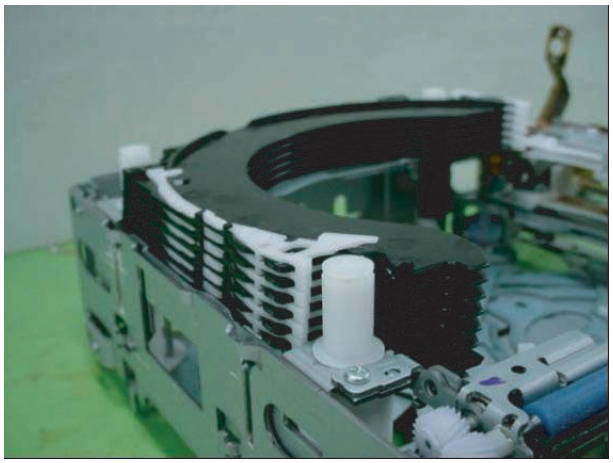
Right front

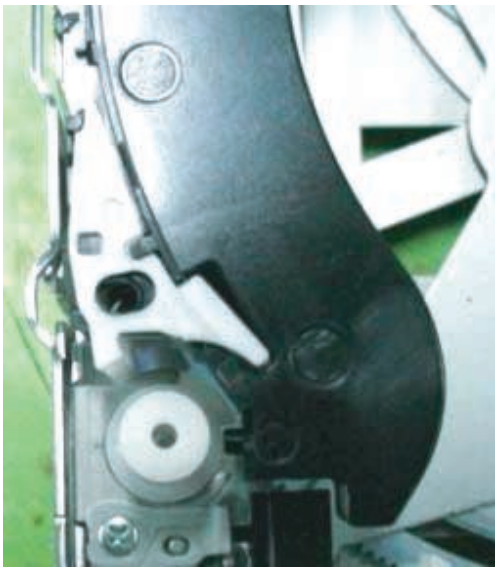


Right panel

* In this operation, take notice that the cylinder cam whose mark is matched in step ② may jolt out of alignment. If it jolts out of alignment, reposition the key groove and mark.

⑥ Place the tray. At this time, the tray pin should be inserted to the location shown in the figure.

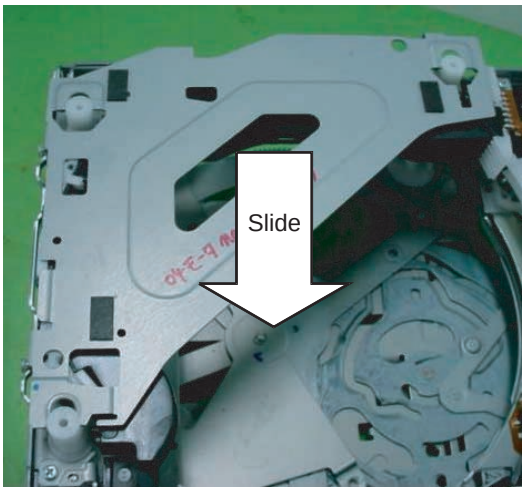




State of attached tray

⑦ Insert the tray holder

Insert the tray holder to the tip of cylinder cam IN, and then slide it to forward and fix it. At this time, take notice that the black sheet on the rear side of tray holder sticks easily in the tray.
Check it is properly set (3 parts) as shown in the figure at lower right.




Direction to slide the tray holder

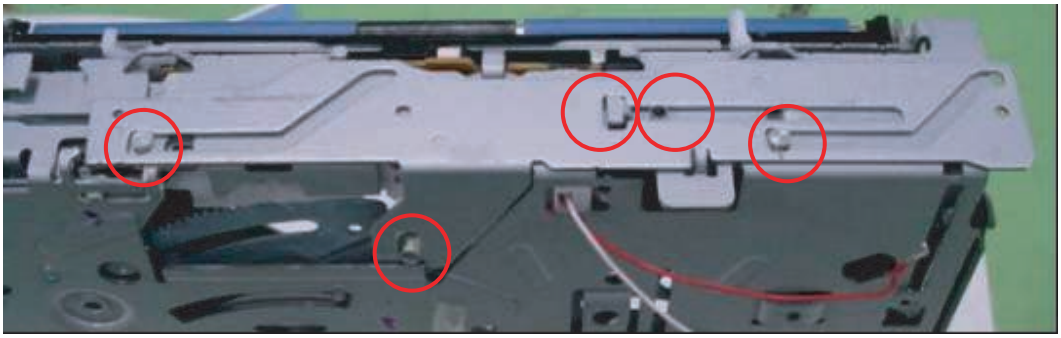
Tray holder rigid part

⑧ Pick up the main chassis slowly, and pull out the jig

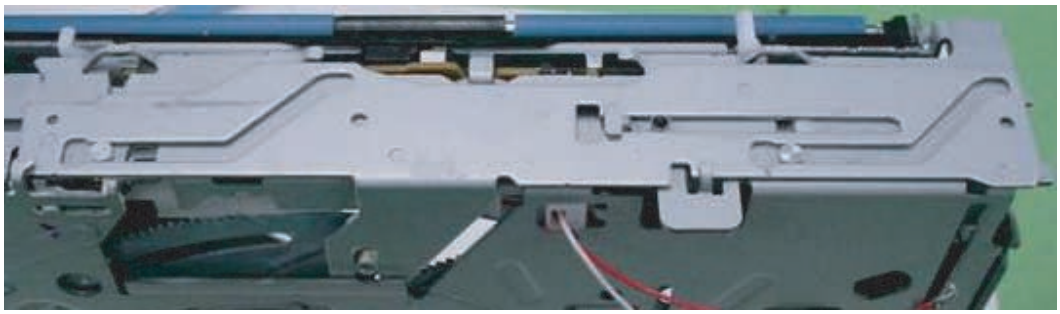
The STG unit is properly assembled

## 4.5 FROM ATTACHING THE CASE ABOVE TO COMPLETION

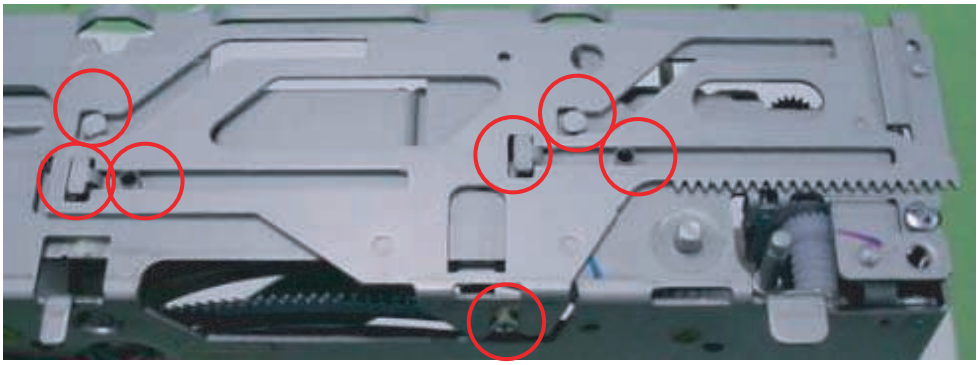
① Attach the front stair
Check that is properly set (5 parts) as shown in the figure below.



Next, slide the attached stair to left side slightly (figure below).

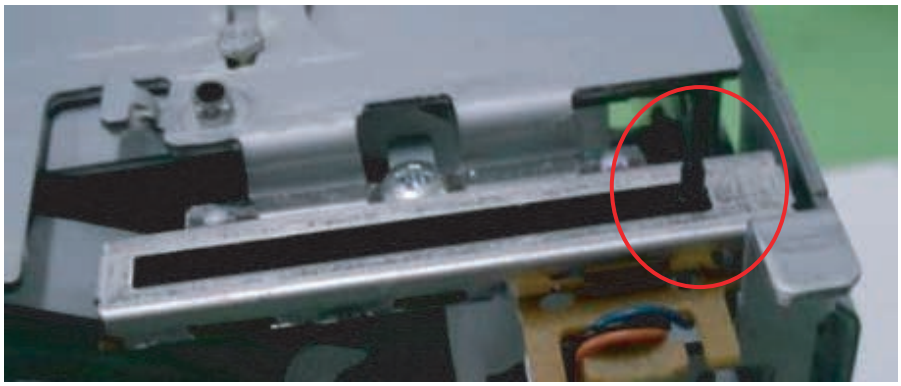


② Attach the stair on left side safe.
Check that is properly set (6 parts) as shown in the figure below.



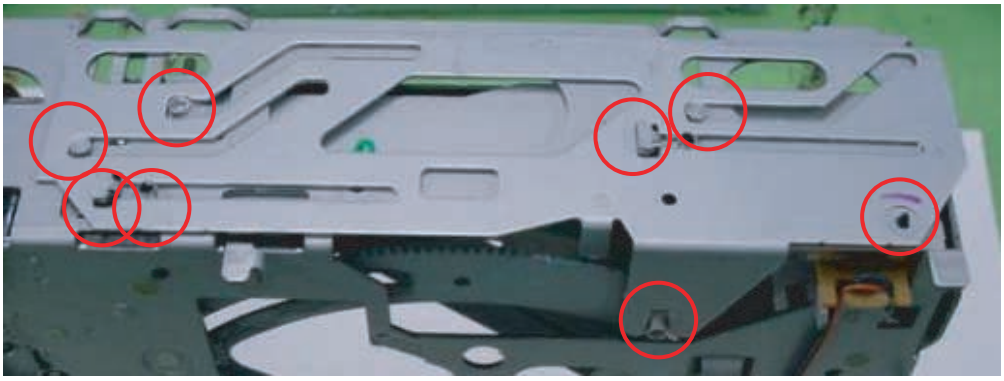
③ Attach the rear stair

Before attaching the rear stair, slide the Potentiometer on the rear panel to the location shown in the figure below.



Attach the stair.

Check that the eight positions shown in the figure below are properly set.

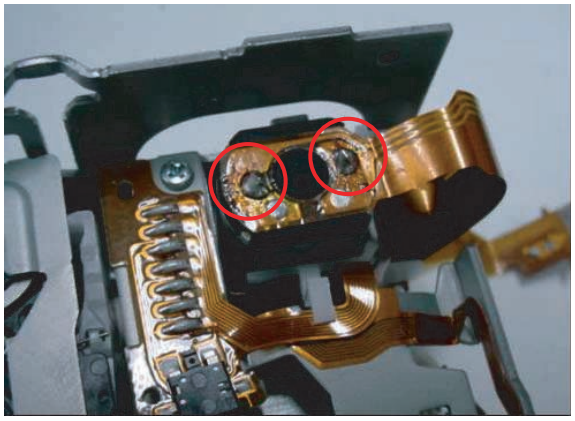


* When attaching the front stair, fix the front side to the upper panel, and when attaching the left panel stair and rear panel stair, fix the side panel to the upper panel.

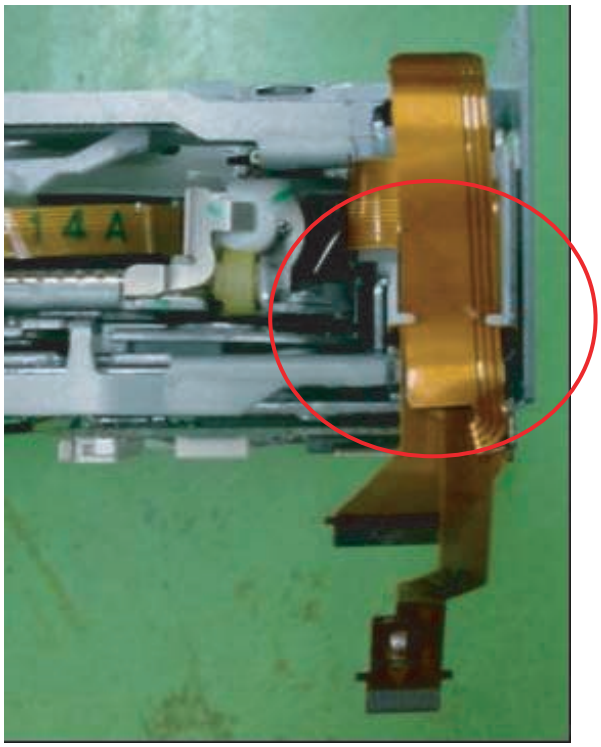
· Slide the stair to the left

Check the all stairs are fitted in the groove, and slide the stairs to the left.

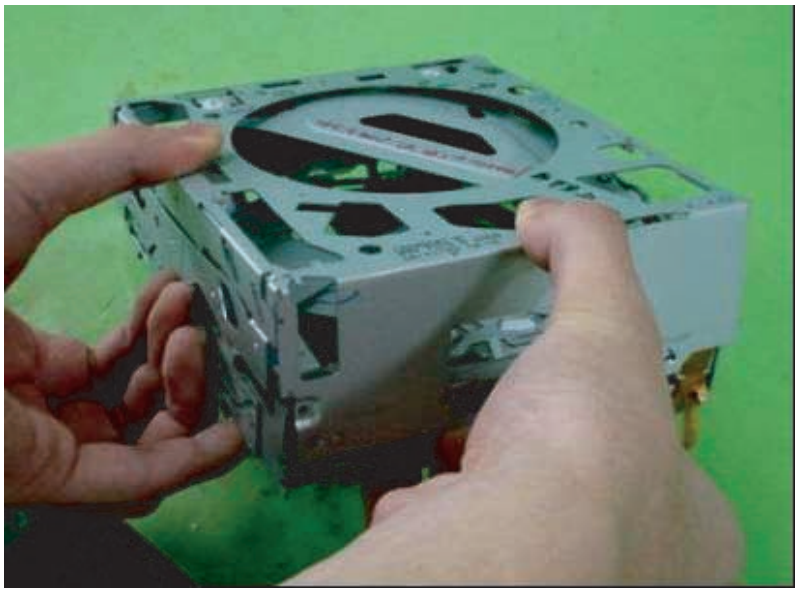
④ Solder the two cam motors



⑤ Check the side panel flexible cable is not removed.



⑥ Fit the shutter and upper case, and attach it to the mechanism unit.
* As shown in the figure below, it is easy to assemble the unit by fitting the right side opening the shutter and right side after fitting the left side. The state of mechanism is recommended to be at 1F play position.



How to attach the upper case

Hook the detection lever to the rear side of front panel of shutter.
* Push the detection lever to the left side lifting the left part of upper case

Abnormal

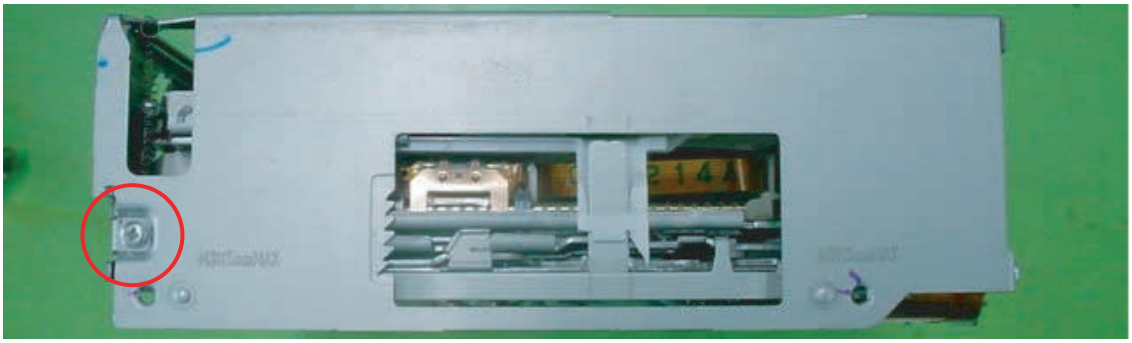
Normal

Location of detection lever

⑦ Secure the screws
Secure the four screws on the panels below.

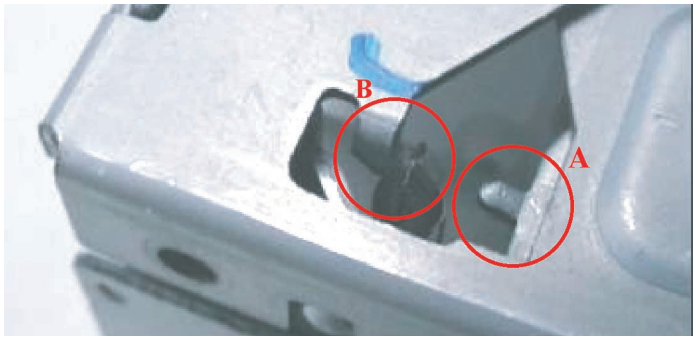
Left panel

Rear panel



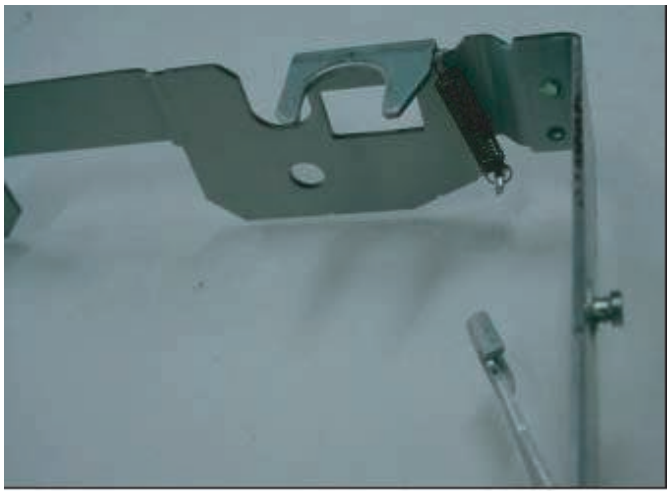
Right panel

⑧ Lift the stage to the top floor by sliding it, and hook the spring at left back
Hook the spring which is temporarily hooked to the A part to B part.



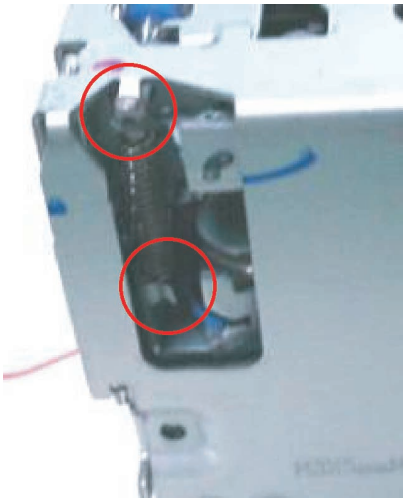

Spring of left back part

* If failing to hook the spring, remove the STG again, and hook the spring again as shown in the photo below.



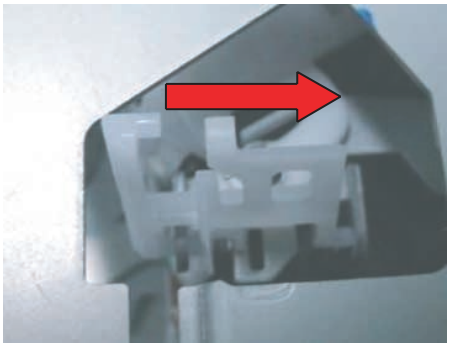
Left back part of stage frame

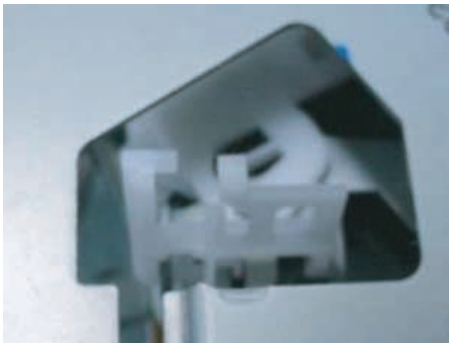
⑨ Hook the right front spring
Hang the spring on the hook shown in the figure below.



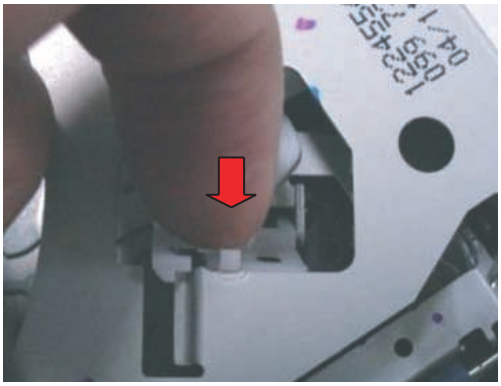
Right front spring

⑩ Attach the top arm
As shown in the figure, attach it sliding it aside after insert it vertically from above

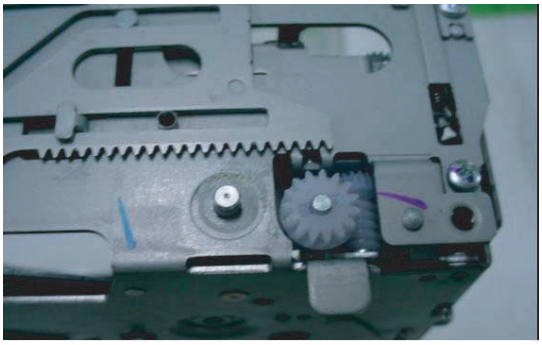




As shown in the photo below, press it with a finger, and set it as shown in the right figure.

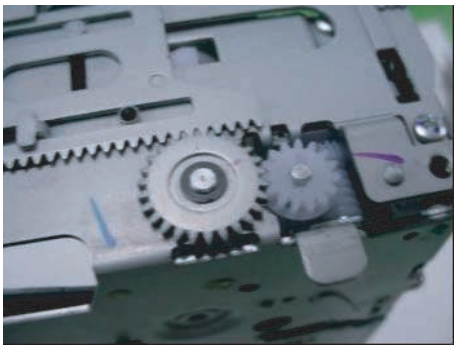


⑪ When the ELEV3 gear is removed, set it by pressing as shown below.



ELEV3 gear

Attach the ELEV4 gear, and fix it with poly washer.



⑫ Insert the two flexible cable as shown in the figure below, and slide and lock the claw, and then remove the short-soldering.