

R341

2793

# Service Manual



ORDER NO.  
ARP2000

# ADJUSTMENT FOR CD PLAYERS VOL. 1

- This service manual explains compact disc player adjustment methods. The compact disc (CD) players covered by this service manual can be divided into three types: Single CD type, Twin-tray CD type, and Multi-play CD type. Typical models are:

Single CD type	Model PD-5500
Twin-tray CD type	Model PD-T505
Multi-play CD type	Model PD-M530

- For details on items other than adjustment methods, see the respective service manual.
- These adjustment methods can sometimes be used for models other than the typical models listed above. In such a case, follow the instructions in the respective service manual.
- Ce manuel pour le service comprend les explications de réglage en français (voir page 20).
- Este manual de servicio trata del método ajuste escrito en español (consulte la página 38).

## 1. Adjustment Methods

If a disc player is adjusted incorrectly or inadequately, it may malfunction or not work at all even though there is nothing at all wrong with the pick up or the circuitry. Adjust correctly following the adjustment procedure.

### 1-1 Adjustment items/verification items and order

Step	Item	Test point	Adjustment location
1	Focus offset adjustment	TP 1, Pin 6 (FCS. ERR)	VR103 (FCS. OFS)
2	Grating adjustment	TP 1, Pin 2 (TRK. ERR)	Grating adjustment slit
3	Tracking error balance adjustment	TP 1, Pin 2 (TRK. ERR)	VR102 (TRK. BAL)
4	Pick up radial/ tangential direction tilt adjustment	TP 1, Pin 1 (RF)	Radial tilt adjustment screw, Tan- gential tilt adjustment screw
5	RF level adjustment	TP 1, Pin 1 (RF)	VR1 (RF level)
6	Focus servo loop gain adjustment	TP 1, Pin 5 (FCS. IN) TP 1, Pin 6 (FCS. ERR)	VR152 (FCS. GAN)
7	Tracking servo loop gain adjust- ment	TP 1, Pin 3 (TRK. IN) TP 1, Pin 2 (TRK. ERR)	VR151 (TRK. GAN)
8	Focus error signal verification	TP 1, Pin 6 (FCS. ERR)	—

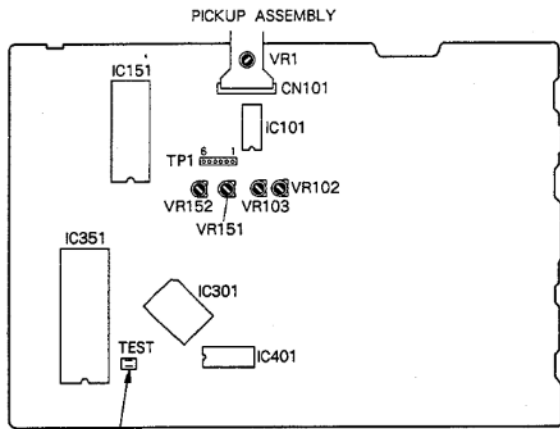
• Abbreviation table

FCS. ERR : Focus Error  
 FCS. OFS : Focus Offset  
 TRK. ERR : Tracking Error  
 TRK. BAL : Tracking Balance  
 FCS. IN : Focus In  
 TRK. IN : Tracking In

### 1-2 Measuring instruments and tools

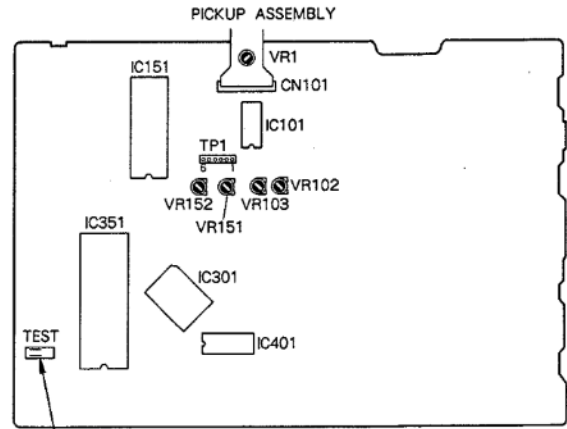
1. Dual trace oscilloscope (10:1 probe)
2. Low-frequency oscillator
3. Test disc (YEDS-7)
4. 12-cm disc (with at least about 70 minutes of recording)  
 For Twin-tray CD type, an 8-cm disc (with at least about 20 minutes of recording) can also be used.  
 For Multi-play CD type, use only the YEDS-7 test disc.
5. Low-pass filter (39 k $\Omega$  + 0.001  $\mu$ F)
6. Resistor (100 k $\Omega$ )
7. Hexagonal wrench (M3 mm) (not used for Multi-play CD type)
8. Standard tools

### 1-3 Test point and adjustment variable resistor positions



TEST MODE jumper wires

Figure 1 Single CD type Adjustment Locations



TEST MODE jumper wires

Figure 1 Multi-play CD type Adjustment Locations

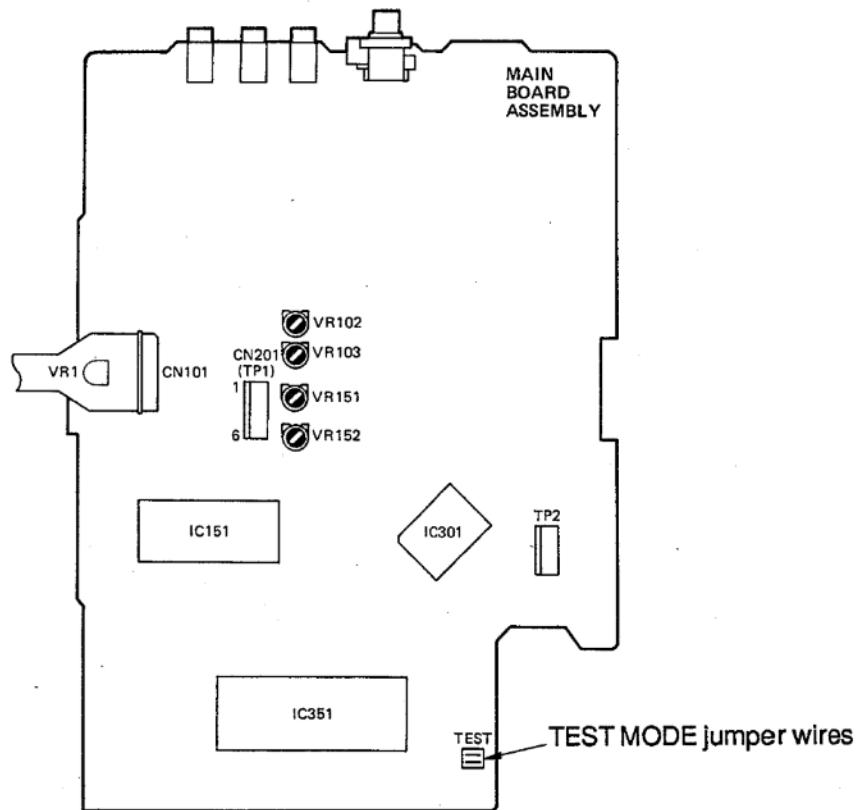


Figure 1 Twin-tray CD type Adjustment Locations

## 1-4 Notes

1. Use a 10:1 probe for the oscilloscope.
2. All the knob positions (settings) for the oscilloscope in the adjustment procedures are for when a 10:1 probe is used.

## 1-5 Test mode

These models have a test mode so that the adjustments and checks required for service can be carried out easily. When these models are in test mode, the keys on the front panel work differently from normal. Adjustments and checks can be carried out by operating these keys with the correct procedure. For these models, all adjustments are carried out in test mode.

[Setting these models to test mode]

How to set this model into test mode.

1. Turn off the power switch. For Multi-play CD type, unplug the power cord from the AC socket.
2. Short the test mode jumper wires. (See Figure 1.)
3. Turn on the power switch. For Multi-play CD type, plug the power cord back into the AC socket.

When the test mode is set correctly, the display is different from what it usually is when the power is turned on. If the display is still the same as usual, test mode has not been set correctly, so repeat Steps 1-3.

[Release from test mode]

Here is the procedure for releasing the test mode:

1. Press the STOP key and stop all operations.
2. Turn off the power switch on the front panel.  
For Multi-play CD type, unplug the power cord from the AC socket.

[Operations of the keys in test mode]


Code	Key name	Function in test mode	Explanation
▷▷	TRACK FWD	Focus servo close	<p>For Twin-tray CD type only, if Disc Tray 1 is closed, Disc Tray 1 is moved to the play position. For Multi-play CD type only, Disc 1 is pulled out of the CD magazine and loaded. Then, no matter what the type, the laser diode is lit up and the focus actuator is lowered (*1), then raised slowly (*2) and the focus servo is closed at the point where the objective lens is focused on the disc.</p> <p>With the player in this state, if you lightly rotate the stopped disc by hand, you can hear the sound the focus servo makes when it operates.</p> <p>If you can hear this sound, the focus servo is operating correctly. If you press this key with no disc mounted, the laser diode lights up, the focus actuator is pulled down (*3), then the actuator is raised and lowered twice (*4) and returned to its original position.</p> <p>Note : For Multi-play CD type, the operations are reversed this way.</p> <p>*1: The focus actuator is lifted up. *2: Lowered slowly *3: Pulled up *4: Lowered and raised twice</p>
▷	PLAY	Spindle servo ON	<p>Starts the spindle motor in the clockwise direction and when the disc rotation reaches the prescribed speed (about 500 rpm at the inner periphery), sets the spindle servo in a closed loop.</p> <p>Be careful. Pressing this key when there is no disc mounted makes the spindle motor run wild.</p> <p>If the focus servo does not go correctly into a closed loop or the laser light shines on the mirror section at the outermost periphery of the disc, the same symptom is displayed.</p>

Code	Key name	Function in test mode	Explanation
□□	PAUSE	Tracking servo close/open	Pressing this key when the focus servo and spindle servo are operating correctly in closed loops puts the tracking servo into a closed loop, displays the track number being played back and the elapsed time on the front panel, and outputs the playback signal. If the elapsed time is not displayed or not counted correctly or the audio is not played back correctly, it may be that the laser is shining on the section with no sound recorded at the outer edge of the disc, that something is out of adjustment, or that there is some other problem. This key is a toggle key. Pressing this key when the tracking servo is closed opens it and pressing this key when the tracking servo is open closes it. This key has no effect if no disc is mounted.
◀◀	MANUAL SEARCH REV	Carriage reverse (inwards)	Moves the pickup position toward the inner periphery of the disc. When this key is pressed with the tracking servo in a closed loop, the tracking servo automatically goes into an open loop. Since the pickup does not automatically stop at the mechanical end point in test mode, be careful with this operation.
▶▶	MANUAL SEARCH FWD	Carriage forward (outwards)	Moves the pickup position toward the outer periphery of the disc. When this key is pressed with the tracking servo in a closed loop, the tracking servo automatically goes into an open loop. Since the pickup does not automatically stop at the mechanical end point in test mode, be careful with this operation.
□	STOP	Stop	Switches off all the servos and initializes. For Multi-play CD type, Disc 1 is stored into the magazine, then the player stops. The pickup remains where it was when this key was pressed.
△	OPEN/CLOSE DISC 1	Disc tray open/close	Opens/closes the disc tray. This key is a toggle key. Pressing this key when the tray is closed opens it and pressing this key when the tray is open closes it. Pressing this key when the disc is turning stops the disc, then opens the tray. This key operation does not affect the position of the pickup.
	..... For Multi-play CD type .....		
	EJECT	CD magazine eject	Stores Disc 1 in the CD magazine, then ejects the CD magazine. However, even though the CD magazine is ejected, the pickup does not return to the park position. Even if the CD magazine is mounted again, the pickup remains where it is.

[How to play back a disc in test mode]

In test mode, since the servos operate independently, playing back a disc requires that you operate the keys in the correct order to close the servos in order.

Here is the key operation sequence for playing back a disc in test mode.

TRACK FWD 


Lights up the laser diode and closes the focus servo.



PLAY 

Starts the spindle motor and closes the spindle servo.



PAUSE 

Closes the tracking servo.

Wait at least 2-3 seconds between each of these operations.

# 1. Focus offset adjustment

<ul style="list-style-type: none"> <li>• Objective</li> <li>• Symptom when out of adjustment</li> </ul>	Sets the DC offset for the focus error amp to 0 V. The player does not focus in and the RF signal is dirty.		
<ul style="list-style-type: none"> <li>• Measurement instrument connections</li> </ul>	Connect the oscilloscope to TP1, Pin 6 (FCS ERR). [Settings]    5 mV/division 10 ms/division DC mode	<ul style="list-style-type: none"> <li>• Player state</li> <li>• Adjustment location</li> <li>• Disc</li> </ul>	Test mode, stopped (just the Power switch on) VR103 (FCS OFS) None needed

[Procedure]

Adjust VR103 (FCS OFS) so that the DC voltage at TP1, Pin 6 (FCS ERR) is  $0 \pm 50$  mV.



## 2. Grating adjustment

<ul style="list-style-type: none"> <li>• Objective</li> </ul>	To align the tracking error generation laser beam spots to the optimum angle on the track		
<ul style="list-style-type: none"> <li>• Symptom when out of adjustment</li> </ul>	Play does not start, track search is impossible, tracks are skipped.		
<ul style="list-style-type: none"> <li>• Measurement instrument connections</li> </ul>	Connect the oscilloscope to TP1, Pin 2 (TRK ERR) via a low pass filter. (See Figure 2)	<ul style="list-style-type: none"> <li>• Player state</li> </ul>	Test mode, focus and spindle servos closed and tracking servo open
	[Settings] 50 mV/division 5 ms/division DC mode	<ul style="list-style-type: none"> <li>• Adjustment location</li> <li>• Disc</li> </ul>	Pickup grating adjustment slit  12-cm disc. For Twin-tray CD type, an 8-cm disc can also be used. (YEDS-7 can not be used.) For Multi-play CD type, use the YEDS-7 test disc.

### [Procedure]

- When adjusting Twin-tray CD type using a 12-cm disc, always remove the disc tray1. (\*)
1. Move the pickup to the outer edge of the disc with the MANUAL SEARCH FWD  $\blacktriangleright$  or  $\blacktriangleleft$  key so that the grating adjustment slit is at the outer edge of the disc where it can be adjusted.  
 Note : For Multi-play CD type, use the MANUAL SEARCH FWD  $\blacktriangleright$  or  $\blacktriangleleft$  key to move the pickup to half-way across the disc (R = 35 mm).
  2. Press the TRACK FWD  $\blacktriangleright$  key, then the PLAY  $\blacktriangleright$  key in that order to close the focus servo then the spindle servo.
  3. Insert an ordinary screwdriver into the grating adjustment slit and adjust the grating to find the null point. For more details, see the next page.
  4. If you slowly turn the screwdriver counterclockwise (clockwise for Multi-play CD type) from the null point, the amplitude of the wave gradually increases, then if you continue turning the screwdriver, the amplitude of the wave becomes smaller again. Turn the screwdriver counterclockwise (clockwise for Multi-play CD type) from the null point and set the grating to the first point where the wave amplitude reaches its maximum.  
 Reference : Figure 3 shows the relation between the angle of the tracking beam with the track and the waveform.  
 Note : The amplitude of the tracking error signal is about 3 Vp-p (when a 39 k $\Omega$  + 0.001  $\mu$ F low pass filter is used). If this amplitude is extremely small (2 Vp-p), then the objective lens may be dirty or the pickup malfunctioning. If the difference between the amplitude of the error signal at the innermost edge and outermost edge of the disc is more than 10%, the grating is not adjusted to the optimum point, so adjust it again.
  5. Return the pickup to more or less midway across the disc with the MANUAL SEARCH REV  $\blacktriangleleft$  key, press the PAUSE  $\square$  key and check that the track number and elapsed time are displayed on the front panel. If they are not displayed at this time or the elapsed time changes irregularly, check the null point and adjust the grating again.

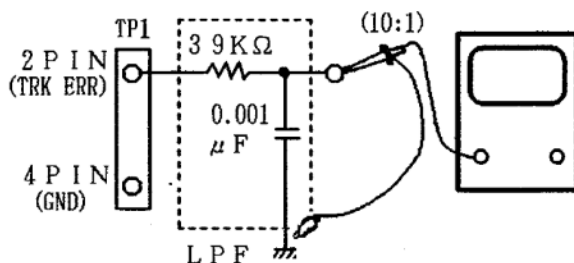
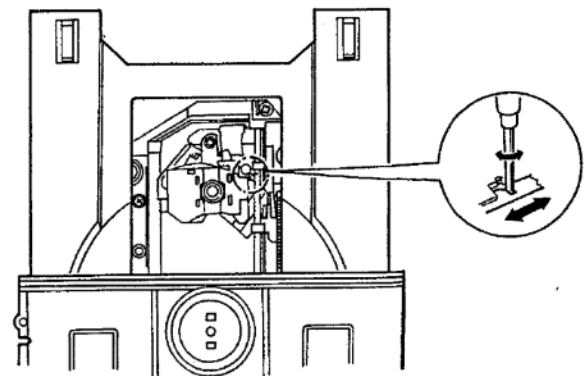
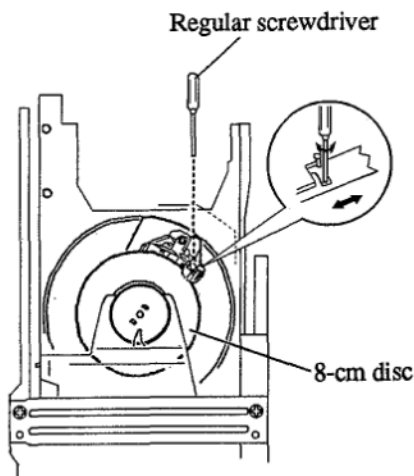


Figure 2

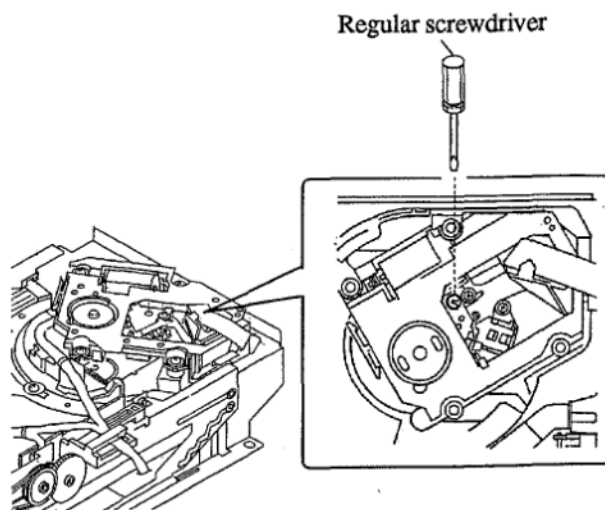


Single CD type adjustment locations

\* : See Page 18.



Twin-tray CD type adjustment locations



Multi-play CD type adjustment locations

[How to find the null point]

When you insert the regular screwdriver into the slit for the grating adjustment and change the grating angle, the amplitude of the tracking error signal at TP1 Pin 2 changes. Within the range for the grating, there are five or six locations where the amplitude of the wave reaches a minimum. Of these five or six locations, there is only one at which the envelope of the wave form is smooth. This location is where the three laser beams divided by the grating are all right above the same track. (See Figure 3.)

This point is called the null point. When adjusting the grating, this null point is found and used as the reference position.

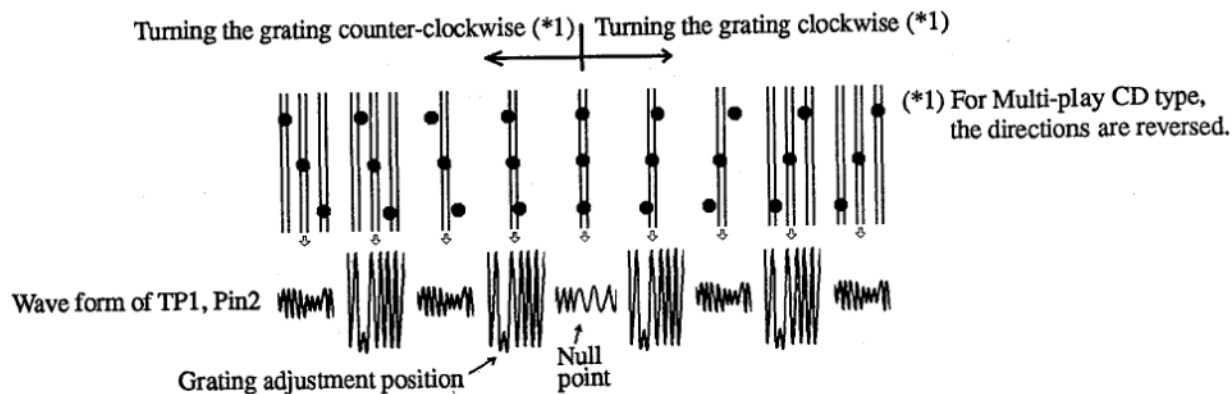
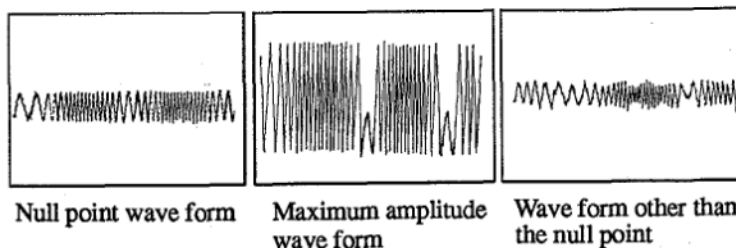


Figure 3

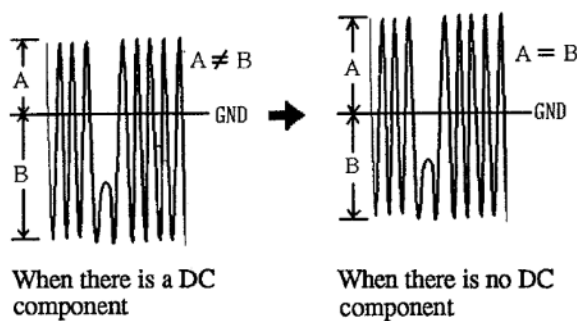


### 3. Tracking error balance adjustment

<ul style="list-style-type: none"> <li>• Objective</li> <li>• Symptom when out of adjustment</li> </ul>	To correct for the variation in the sensitivity of the tracking photodiode Play does not start or track search is impossible		
<ul style="list-style-type: none"> <li>• Measurement instrument connections</li> </ul>	Connect the oscilloscope to TP1, Pin 2 (TRK ERR). This connection may be via a low pass filter. [Settings]    50 mV/division 5 ms/division DC mode	<ul style="list-style-type: none"> <li>• Player state</li> <li>• Adjustment location</li> <li>• Disc</li> </ul>	Test mode, focus and spindle servos closed and tracking servo open  VR102 (TRK BAL)  YEDS-7

[Procedure]

1. Move the pickup to midway across the disc (R = 35 mm) with the MANUAL SEARCH FWD  $\gg$  or  $\ll$  key.
2. Press the TRACK FWD  $\gg$  key, then the PLAY  $\triangleright$  key in that order to close the focus servo then the spindle servo.
3. Line up the bright line (ground) at the center of the oscilloscope screen and put the oscilloscope into DC mode.
4. Adjust VR102 (TRK BAL) so that the positive amplitude and negative amplitude of the tracking error signal at TP1 Pin 2 (TRK ERR) are the same (in other words, so that there is no DC component).



## 4. Pickup radial/tangential tilt adjustment

<ul style="list-style-type: none"> <li>Objective</li> </ul>	To adjust the angle of the pickup relative to the disc so that the laser beams are shone straight down into the disc for the best read out of the RF signals.		
<ul style="list-style-type: none"> <li>Symptom when out of adjustment</li> </ul>	Sound broken; some discs can be played but not others.		
<ul style="list-style-type: none"> <li>Measurement instrument connections</li> </ul>	Connect the oscilloscope to TP1, Pin 1 (RF). [Settings]    20 mV/division 200 ns/division AC mode	<ul style="list-style-type: none"> <li>Player state</li> <li>Adjustment location</li> <li>Disc</li> </ul>	Test mode, play Pickup radial tilt adjustment screw and tangential tilt adjustment screw 12-cm disc. For Twin-tray CD type, an 8-cm disc can also be used. (YEDS-7 can not be used.) For Multi-play CD type, use the YEDS-7 test disc.

### [Procedure]

- When adjusting Twin-tray CD type using a 12-cm disc, always remove the disc tray. (\*)
- Move the pickup to the outer edge of the disc with the MANUAL SEARCH FWD  $\gg$  or  $\ll$  key so that the radial/tangential tilt screws can be adjusted.  
 Note : For Multi-play CD type, use the MANUAL SEARCH FWD  $\gg$  or  $\ll$  key to move the pickup to half-way across the disc (R = 35 mm).  
 Press the TRACK FWD  $\gg$  key, the PLAY key, then the PAUSE  $\triangleright$  key in that order to close the focus servo then the spindle servo and put the player into play mode.
  - First, adjust the radial tilt adjustment screw with an M 3-mm hexagonal wrench so that the eye pattern (the diamond shape at the center of the RF signal) can be seen the most clearly. For Multi-play CD type, use a Phillips screwdriver.
  - Next, adjust the tangential tilt adjustment screw with an M 3-mm hexagonal wrench so that the eye pattern (the diamond shape at the center of the RF signal) can be seen the most clearly (Figure 5). For Multi-play CD type, use a Phillips screwdriver.
  - Adjust the radial tilt adjustment screw and the tangential tilt adjustment screw again so that the eye pattern can be seen the most clearly. As necessary, adjust the two screws alternately so that the eye pattern can be seen the most clearly.  
 Note : Radial and tangential mean the directions relative to the disc shown in Figure 4.

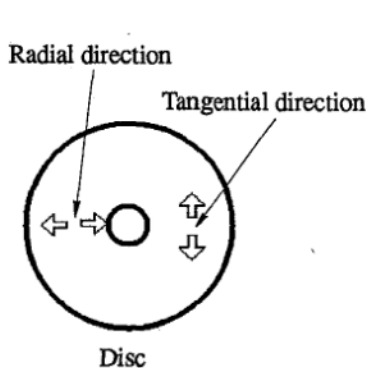
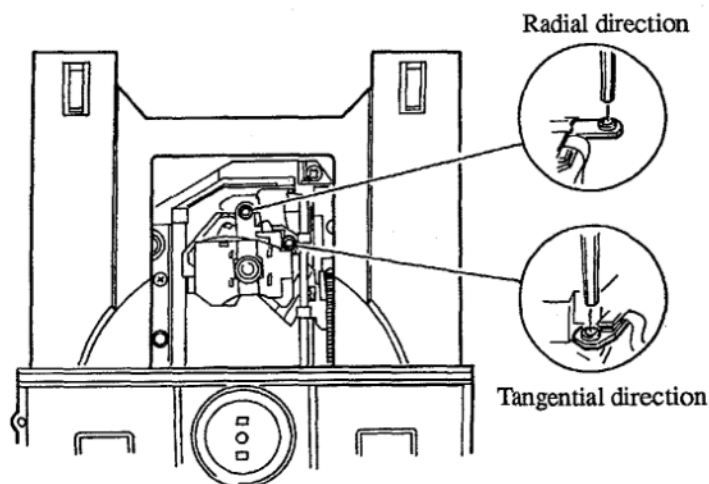
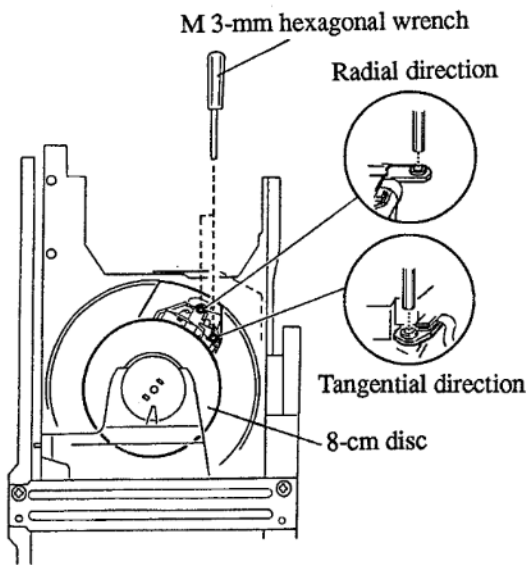


Figure 4

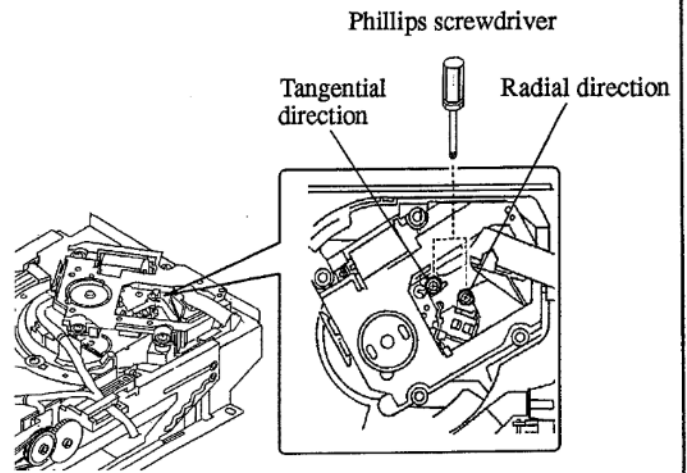


Single CD model adjustment locations

\* : See Page 18.



Twin-tray CD type adjustment locations



Multi-play CD type adjustment locations

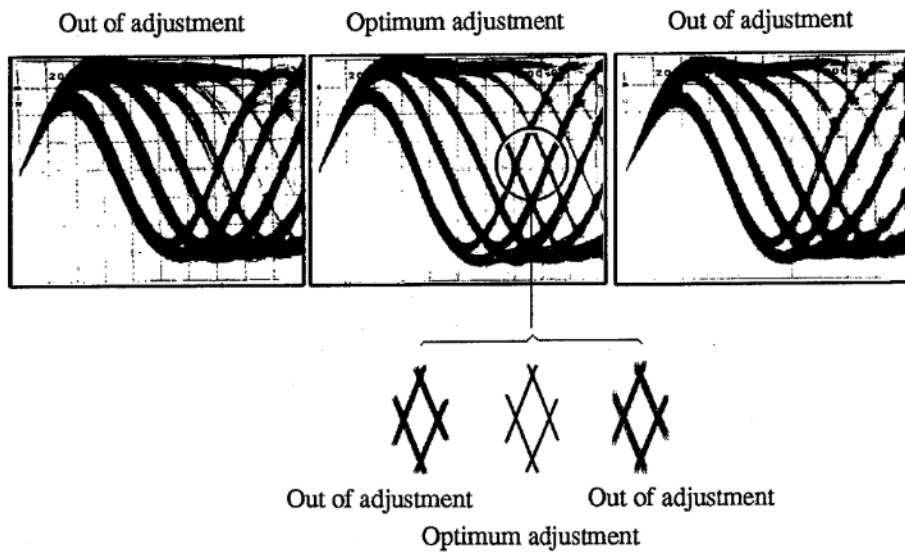


Figure 5 Eye pattern

## 5. RF level adjustment

• Objective	To optimize the playback RF signal amplitude		
• Symptom when out of adjustment	No play or no search		
• Measurement instrument connections	Connect the oscilloscope to TP1, Pin 1 (RF).	• Player state	Test mode, play
	[Settings]    50 mV/division 10 ms/division AC mode	• Adjustment location	VR1 (laser power)
		• Disc	YEDS-7

### [Procedure]

1. Move the pickup to midway across the disc ( $R = 35 \text{ mm}$ ) with the MANUAL SEARCH FWD  $\blacktriangleright\blacktriangleleft$  or  $\blacktriangleleft\blacktriangleright$  key, then press the TRACK FWD  $\blacktriangleright\blacktriangleleft$  key, then the PLAY  $\blacktriangleright$  key in that order to close the respective servos and put the player into play mode.
2. Adjust VR1 (laser power) so that the RF signal amplitude is  $1.2 \text{ V}_{p-p} \pm 0.1 \text{ V}$ .

## 6. Focus servo loop gain adjustment

• Objective	To optimize the focus servo loop gain		
• Symptom when out of adjustment	Playback does not start or focus actuator noisy		
• Measurement instrument connections	See Figure 6.	• Player state	Test mode, play
	[Settings] CH1 20 mV/division X-Y mode	• Adjustment location • Disc	VR152 (FCS GAN) YEDS-7

### [Procedure]

1. Set the AF generator output to 1.2 kHz and 1 Vp-p.
2. Press the MANUAL SEARCH FWD  $\blacktriangleright\blacktriangleright$  or  $\blacktriangleleft\blacktriangleleft$  key to move the pickup to halfway across the disc (R = 35 mm), then press the TRACK FWD  $\blacktriangleright\blacktriangleright$  key, the PLAY  $\blacktriangleright$  key, then the PAUSE  $\square\square$  key in that order to close the corresponding servos and put the player into play mode.
3. Adjust VR152 (FCS GAN) so that the Lissajous wave form is symmetrical about the X axis and the Y axis.

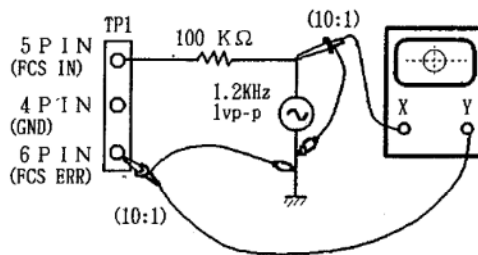
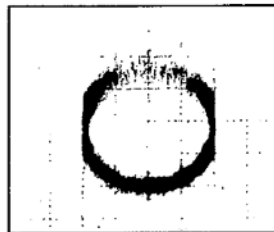


Figure 6

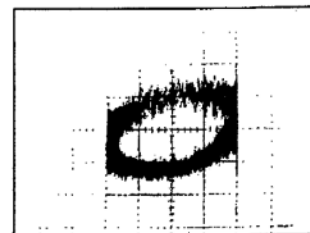
### Focus Gain Adjustment



Large gain



Optimum gain



Minimum gain

## 7. Tracking servo loop gain adjustment

<ul style="list-style-type: none"> <li>• Objective</li> </ul>	To optimize the tracking servo loop gain		
<ul style="list-style-type: none"> <li>• Symptom when out of adjustment</li> </ul>	Playback does not start, during searches the actuator is noisy, or tracks are skipped.		
<ul style="list-style-type: none"> <li>• Measurement instrument connections</li> </ul>	See Figure 7.	<ul style="list-style-type: none"> <li>• Player state</li> </ul>	Normal mode, play
	[Settings]  CH1                      CH2 50 mV/division      5 mV/division X-Y mode	<ul style="list-style-type: none"> <li>• Adjustment location</li> <li>• Disc</li> </ul>	VR151 (TRK GAN) YEDS-7

### [Procedure]

1. Set the AF generator output to 1.2 kHz and 2 Vp-p.
2. Press the MANUAL SEARCH FWD  $\blacktriangleright$  or  $\blacktriangleleft$  key to move the pickup to halfway across the disc (R = 35 mm), then press the TRACK FWD  $\blacktriangleright$  key, the PLAY  $\blacktriangleright$  key, then the PAUSE  $\square$  key in that order to close the corresponding servos and put the player into play mode.
3. Adjust VR151 (TRK GAN) so that the Lissajous wave form is symmetrical about the X axis and the Y axis.

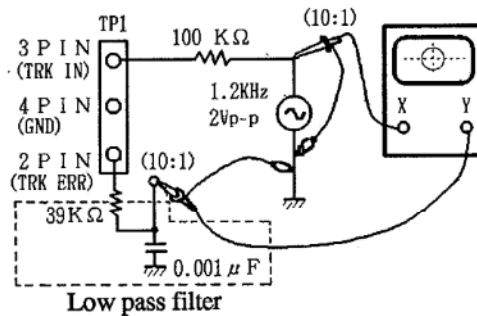
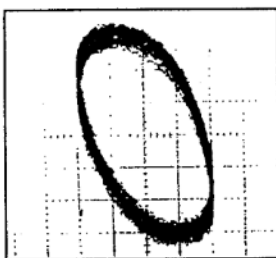
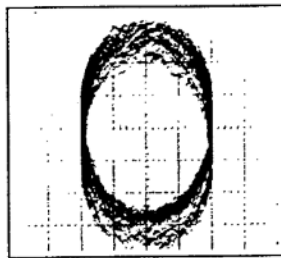


Figure 7

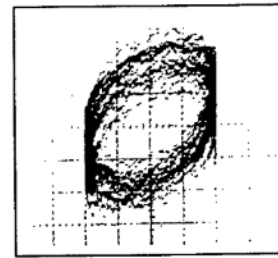
### Tracking Gain Adjustment



Large gain



Optimum gain



Minimum gain



## 8. Focus error signal (focus S curve) verification

<ul style="list-style-type: none"> <li>• Objective</li> <li>• Symptom when out of adjustment</li> </ul>	To judge whether the pickup is ok or not by observing the focus error signal. The pickup is judged from the amplitude of the tracking error signal (as discussed in the section on adjusting the tracking error balance) and the wave form for the focus error signal.		
<ul style="list-style-type: none"> <li>• Measurement instrument connections</li> </ul>	Connect the oscilloscope to TP1, Pin 6 (FOCS ERR). [Settings]    100 mV/division 5 ms/division DC mode	<ul style="list-style-type: none"> <li>• Player state</li> <li>• Adjustment location</li> <li>• Disc</li> </ul>	Test mode, stop  None  YEDS-7

### [Procedure]

1. Connect TP1 Pin 5 to ground.
2. Mount the disc.
3. While watching the oscilloscope screen, press the TRACK FWD key and observe the wave form in Figure 8 for a moment. Verify that the amplitude is at least 2.5 Vp-p and that the positive and negative amplitude are about equal. Since the wave form is only output for a moment when the TRACK FWD key is pressed, press this key over and over until you have checked the wave form.

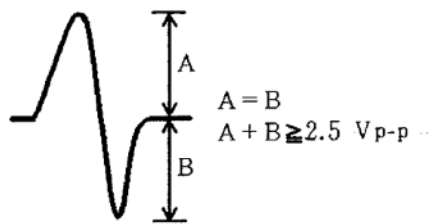


Figure 8

### [Judging the pickup]

Do not judge the pickup until all the adjustments have been made correctly. In the following cases, there may be something wrong with the pickup.

1. The tracking error signal amplitude is extremely small (less than 2 Vp-p).
2. The focus error signal amplitude is extremely small (less than 2.5 Vp-p).
3. The positive and negative amplitudes of the focus error signal are extremely asymmetrical (2:1 ratio or more).
4. The RF signal is too small (less than 0.8 Vp-p) and even if VR1 is adjusted (laser power), the RF signal can not be brought up to the standard level.

[How to remove Tray 1 for Twin-tray CD type]

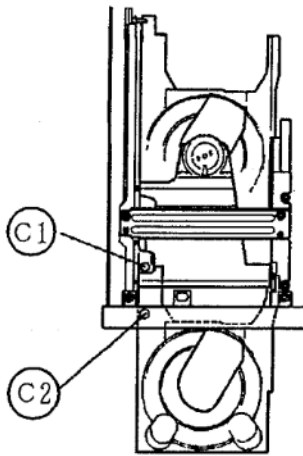


Figure 9

1. Put Tray 1 in the Open position.
2. Remove screws C1 and C2 holding Tray 1. (See Figure 9.)
3. Move Tray 1 in the direction of the arrow in Figure 10 and while removing the protruding section B of Tray 1, remove the A section where Tray 1 and the Slide angle U unit catch.
4. Lift up the Tray 1 Slide angle U unit side slightly and remove it.

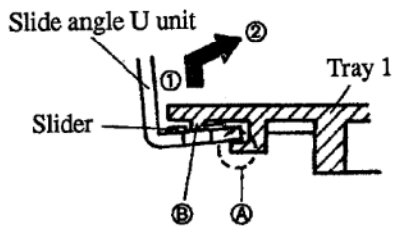


Figure 10

[How to install Tray 1 for Twin-tray CD player]

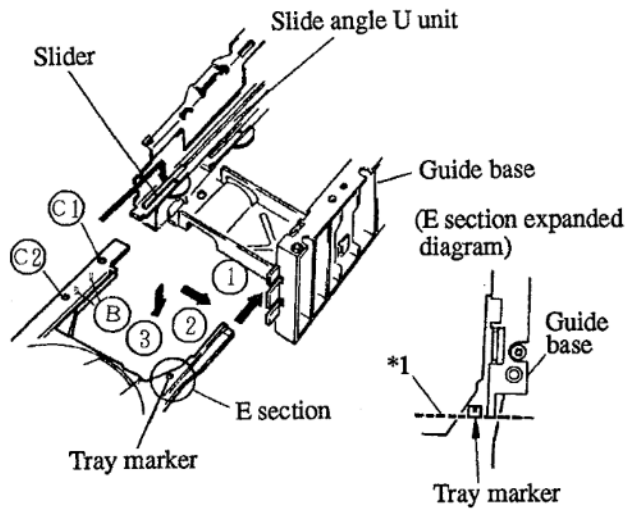


Figure 11

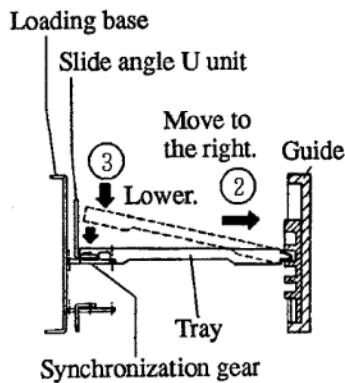


Figure 12

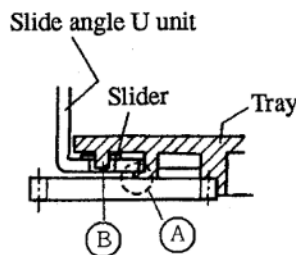


Figure 13

When installing Tray 1, first remove the front panel to make the work easier.

1. Put the slide angle U unit to the very front (the position when Tray 1 is completely open).
2. Put the slider in the very front as shown in Figure 11.
3. With Tray 1 at a slight angle as indicated by the dotted lines in Figure 12, insert Tray 1 until the slider and Tray 1 screw holes are lined up, being careful that the slider does not move to the rear.
4. While moving Tray 1 to the right (the guide side), lower it. Support the slider from below by hand.
5. Setting the catch section A of Tray 1 so that it catches on the Slide angle U unit as shown in Figure 13, insert the protruding section B of Tray 1 into the hole of the slider. At the same time, mesh the synchronization gear and the gear section of Tray 1.
6. After double checking that the screw hole of the slider is positioned at the center of the screw hole of Tray 1 as shown in Figure 14, fasten with Screws C1 and C2 in that order.
7. After installing Tray 1, double check that when Tray 1 is completely open, the position relations are as shown in the E section expanded diagram. If they are not, repeat the installation of Tray 1 from the start.

\*1 : The tip of the guide base and the tray marker are lined up. When Tray 1 is installed poorly, they are about 2 mm apart.

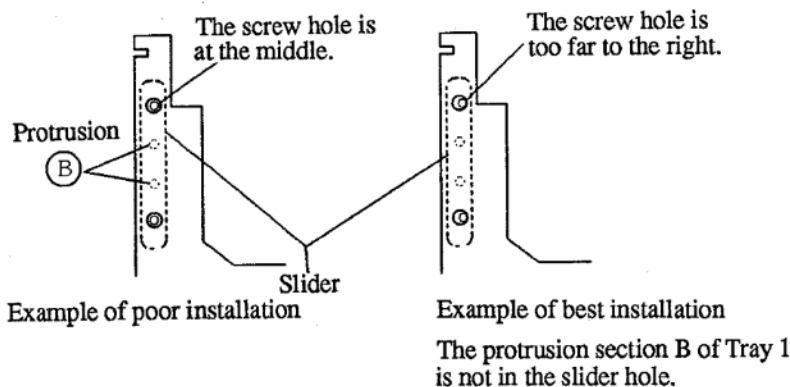


Figure 14