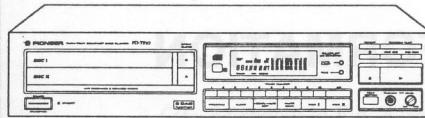
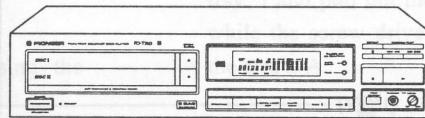


Service Manual



PD-T510



PD-T310 (European model)

ORDER NO.
ARP2473

TWIN-TRAY COMPACT DISC PLAYER

PD-T510 PD-T310

PD-T510 AND PD-T310 HAVE THE FOLLOWING:

Type	Model		Power Requirement	Remarks
	PD-T510	PD-T310		
KC	○	○	AC120V only	
RD	○	○	AC110-127V, 220-240V (switchable)	
WPW	○	○	AC220-240V	
WEMXK	○	○	AC220-240V	

- This manual is applicable to KC, WEMXK, WPW and RD types.
- For the following: PD-T510/WEMXK, WPW and RD; PD-T310/WEMXK, WPW and RD, refer to pages 68 – 70.
- Ce manuel pour le service comprend les explications de réglage en français.
- Este manual de servicio trata del método ajuste escrito en español.

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8. ADJUSTMENTS

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 pickup 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	TP1, Pin 6 (FCS. ERR)	VR103 (FCS. OFS)
2	Grating adjustment	TP1, Pin 2 (TRK. ERR)	Grating adjustment slit
3	Tracking error balance adjustment	TP1, Pin 2 (TRK. ERR)	VR102 (TRK. BAL)
4	Pickup radial/tangential direction tilt adjustment	TP1, Pin 1 (RF)	Radial tilt adjustment screw, Tangential tilt adjustment screw
5	RF level adjustment	TP1, Pin 1 (RF)	VR1 (RF level)
6	Focus servo loop gain adjustment	TP1, Pin 5 (FCS. IN) TP1, Pin 6 (FCS. ERR)	VR152 (FCS. GAN)
7	Tracking servo loop gain adjustment	TP1, Pin 3 (TRK. IN) TP1, Pin 2 (TRK. ERR)	VR151 (TRK. GAN)
8	Focus error signal verification	TP1, Pin 6 (FCS. ERR)	—

● Abbreviation table

FCS ERR	: Focus Error
FCS OFS	: Focus Offset
TRK ERR	: Tracking Error
TRK BAL	: Tracking Balance
FCS GAN	: Focus Gain
TRK GAN	: Tracking Gain
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)
5. Low-pass filter (39 kΩ + 0.001 μF)
6. Resistor (100 kΩ)
7. Hex. wrench (L-shaped type, Size: 1.5 mm)
8. Standard tools

1-3 Test point and adjustment variable resistor positions

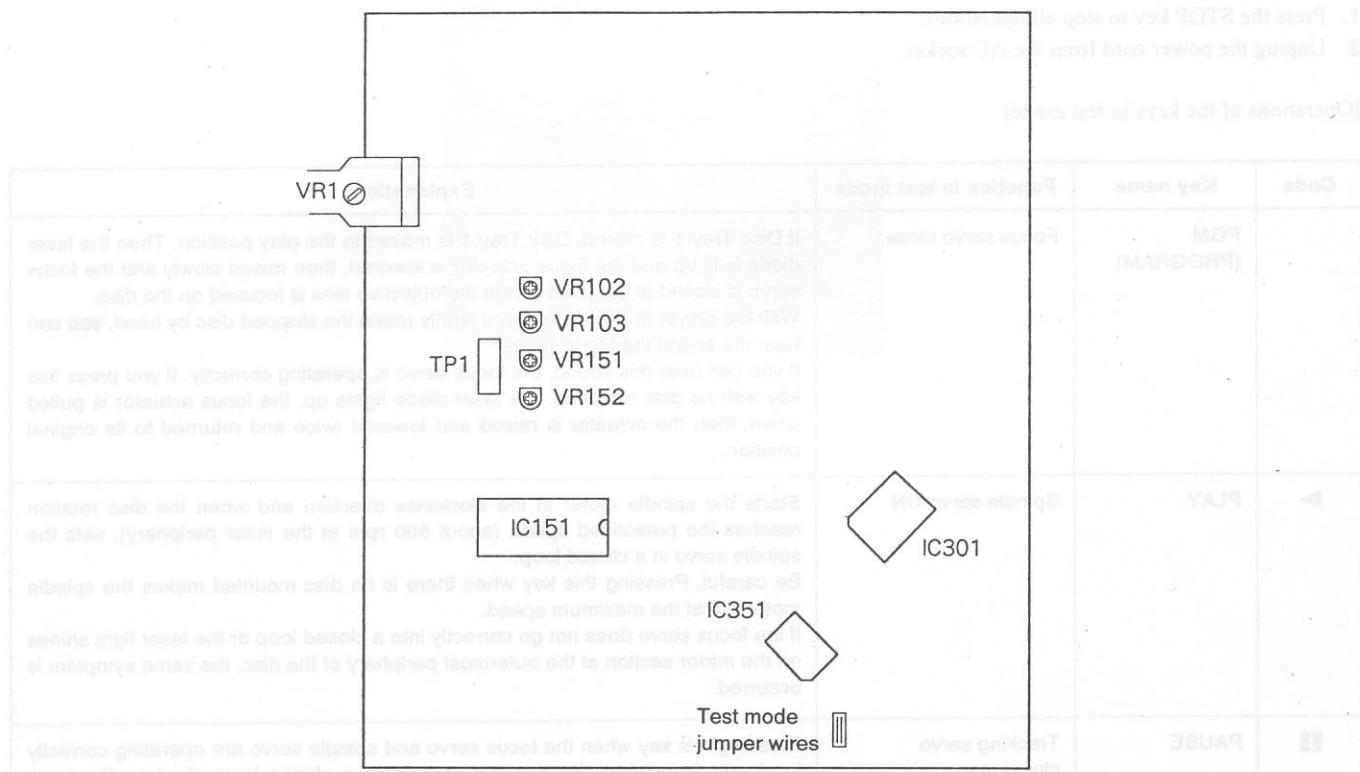


Figure 1 Adjustment Locations

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. Unplug the power cord from the AC socket.
2. Short the test mode jumper wires. (See Figure 1.)
3. 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]

[Release from test mode]

Here is the procedure for releasing the test mode:

1. Press the STOP key to stop all operations.
2. Unplug the power cord from the AC socket.

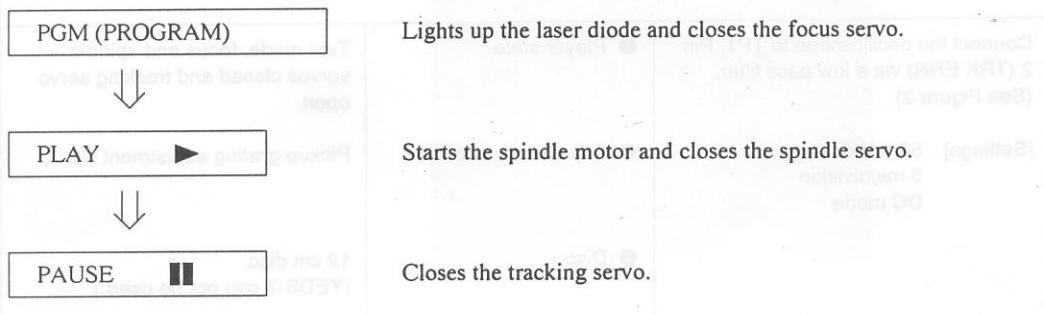
[Operations of the keys in test mode]

Code	Key name	Function in test mode	Explanation
	PGM (PROGRAM)	Focus servo close	If Disc Tray 1 is closed, Disk Tray 1 is moved to the play position. Then the laser diode is lit up and the focus actuator is lowered, then raised slowly and the focus servo is closed at the point where the objective lens is focused on the disc. With the player in this state, if you lightly rotate the stopped disc by hand, you can hear the sound the focus servo. 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, then the actuator is raised and lowered twice and returned to its original position.
▶	PLAY	Spindle servo ON	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. Be careful. Pressing this key when there is no disc mounted makes the spindle motor run at the maximum speed. 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 occurred.
■	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 and open/close the tracking servo alternately. This key has no effect if no disc is mounted.
◀◀/ ◀◀	TRACK/ 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.
▶▶/ ▶▶	TRACK/ 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. 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 and open/close tray alternately.

[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.

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



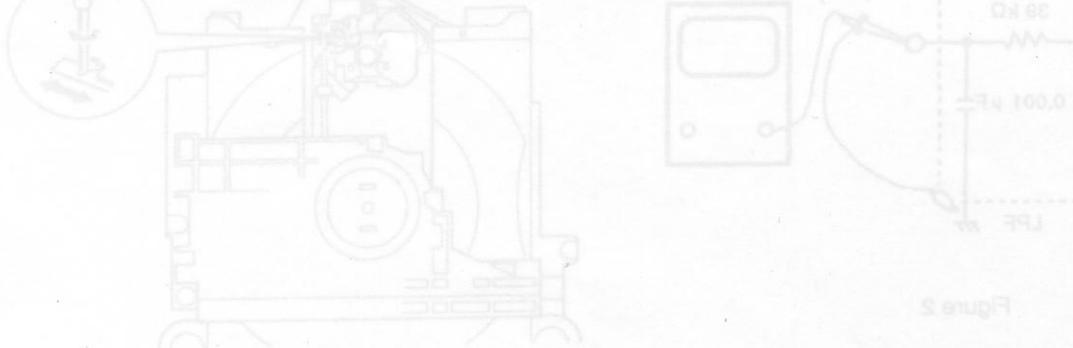
Wait at least 2-3 seconds between each of these operations.

1. Focus offset adjustment

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

[Procedure]

Adjust VR103 (FCS OFS) so that the DC voltage at TP1, Pin 6 (FCS ERR) is -150 ± 50 mV.



2. Grating adjustment

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

[Procedure]

1. Move the pickup to the outer edge of the disc with the TRACK/MANUAL SEARCH FWD $\blacktriangleright\blacktriangleright$ or REV $\blacktriangleleft\blacktriangleleft$ key so that the grating adjustment slit is at the outer edge of the disc where it can be adjusted.
2. Press the PGM (PROGRAM) key, then the PLAY \blacktriangleright key in that order to close the focus servo then the spindle servo.
3. Insert a 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 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 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 $39 \text{ k}\Omega + 0.001 \mu\text{F}$ low pass filter is used). If this amplitude is extremely small (2 Vp-p or less), the objective lens or the pickup malfunction may be the cause. 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 TRACK/MANUAL SEARCH REV $\blacktriangleleft\blacktriangleleft$ key, press the PAUSE \blacksquare 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.

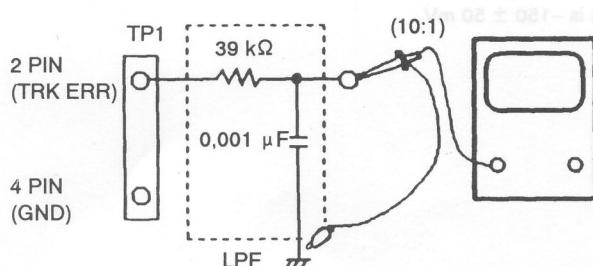
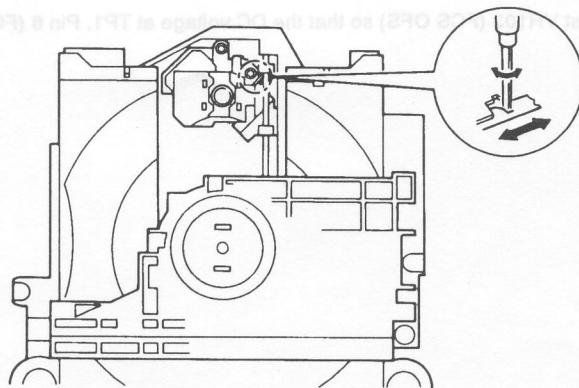


Figure 2



Adjustment Locations

[How to find the null point]

When you insert the 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 waveform 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.

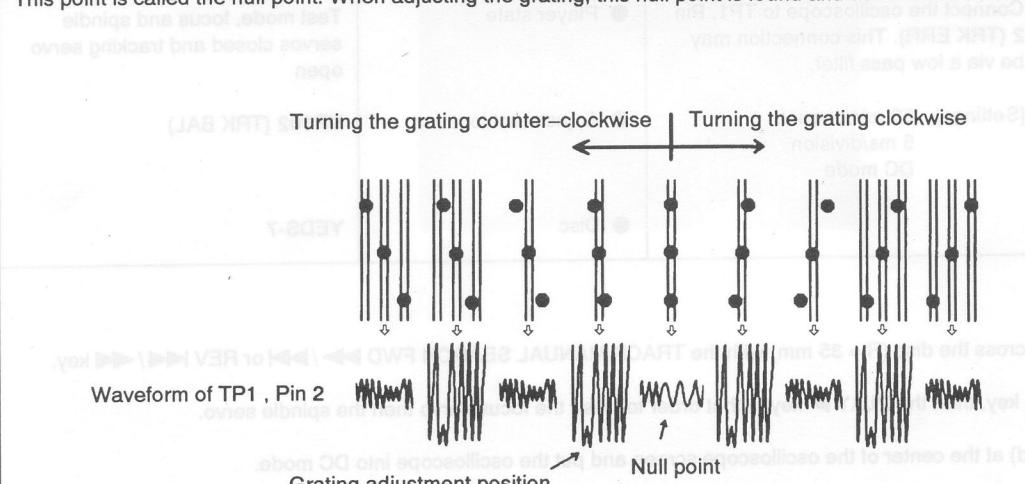
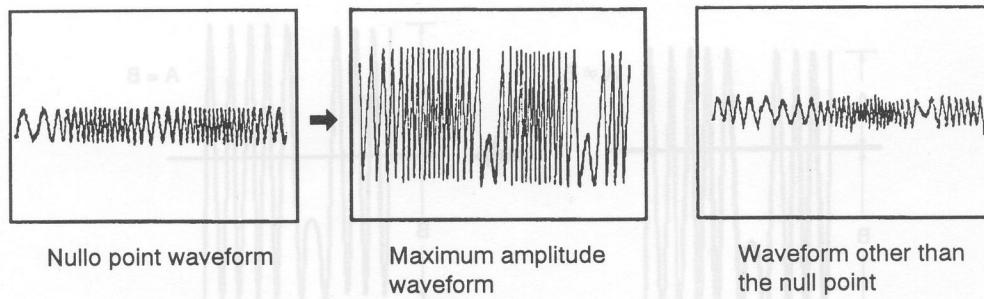


Figure 3



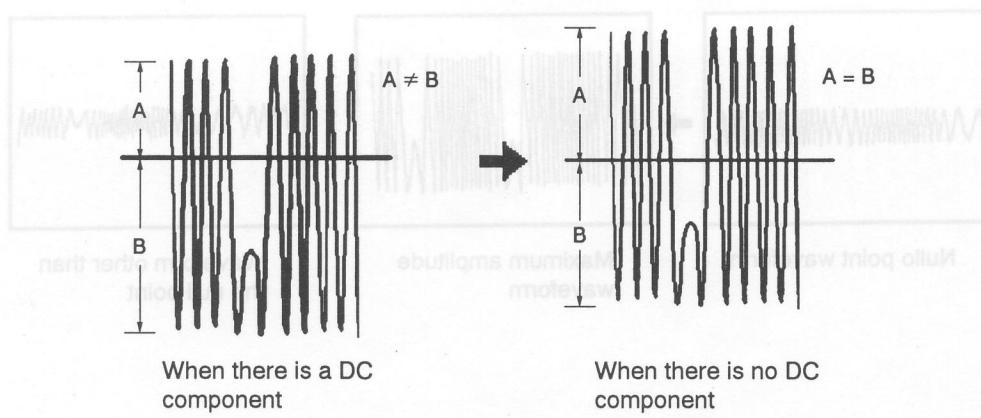
3. Tracking error balance adjustment

[Ineq ilan ent bnt of wH]

● Objective	To correct for the variation in the sensitivity of the tracking photodiode		
● Symptom when out of adjustment	Play does not start or track search is impossible		
● Measurement instrument connections	<p>Connect the oscilloscope to TP1, Pin 2 (TRK ERR). This connection may be via a low pass filter.</p> <p>[Settings] 50 mV/division 5 ms/division DC mode</p>	<p>● Player state</p> <p>● Adjustment location</p> <p>● Disc</p>	<p>Test mode, focus and spindle servos closed and tracking servo open</p> <p>VR102 (TRK BAL)</p> <p>YEDS-7</p>

[Procedure]

1. Move the pickup to midway across the disc ($R = 35$ mm) with the TRACK/MANUAL SEARCH FWD $\blacktriangleright\blacktriangleright$ or REV $\blacktriangleleft\blacktriangleleft$ key.
2. Press the PGM (PROGRAM) key, then the PLAY \blacktriangleright 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 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

● Objective	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.		
● Symptom when out of adjustment	Sound broken; some discs can be played but not others.		
● Measurement instrument connections	<p>Connect the oscilloscope to TP1, Pin 1 (RF).</p> <p>[Settings] 20 mV/division 200 ns/division AC mode</p>	<p>● Player state</p> <p>● Adjustment location</p> <p>● Disc</p>	<p>Test mode, play</p> <p>Pickup radial tilt adjustment screw and tangential tilt adjustment screw</p> <p>12 cm disc. (YEDS-7 can not be used.)</p>

[Procedure]

1. Move the pickup to the outer edge of the disc with the TRACK/MANUAL SEARCH FWD $\blacktriangleright/\blacktriangleright$ or REV $\blacktriangleleft/\blacktriangleleft$ key so that the radial/tangential tilt screws can be adjusted.
Press the PGM (PROGRAM) key, the PLAY \blacktriangleright key, then the PAUSE \blacksquare key in that order to close the respective servos and put the player into play mode.
2. First, adjust the radial tilt adjustment screw with a hex. wrench (L-shaped type, Size: 1.5 mm) so that the eye pattern (the diamond shape at the center of the RF signal) can be seen the most clearly.
3. Next, adjust the tangential tilt adjustment screw with a hex. wrench (L-shaped type, Size: 1.5 mm) so that the eye pattern (the diamond shape at the center of the RF signal) can be seen the most clearly (Figure 5).
4. 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.
5. When the adjustment is completed, lock the radial and tangential adjustment screw.

Note: Radial and tangential mean the directions relative to the disc shown in Figure 4.

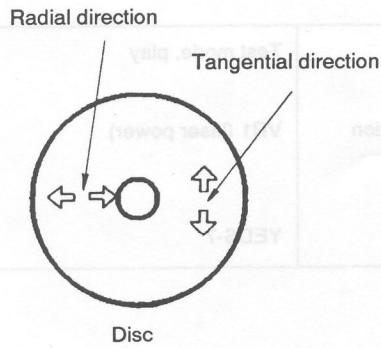
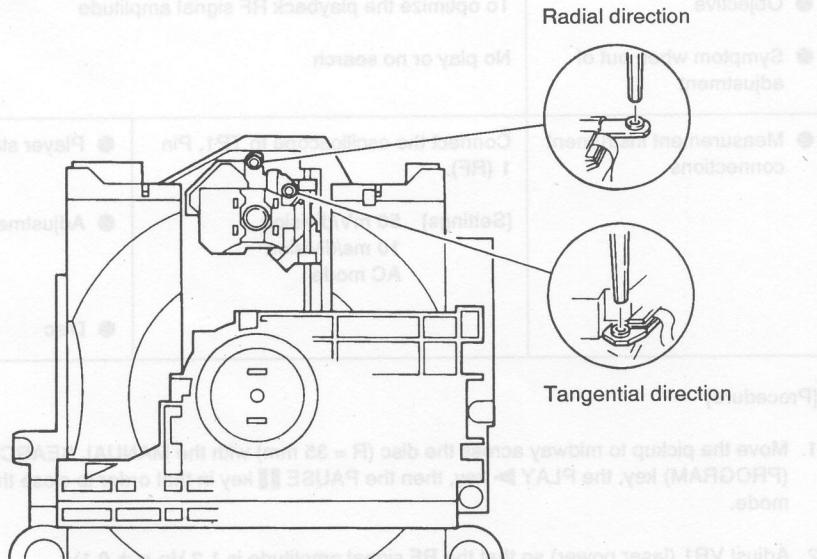


Figure 4



Adjustment Locations

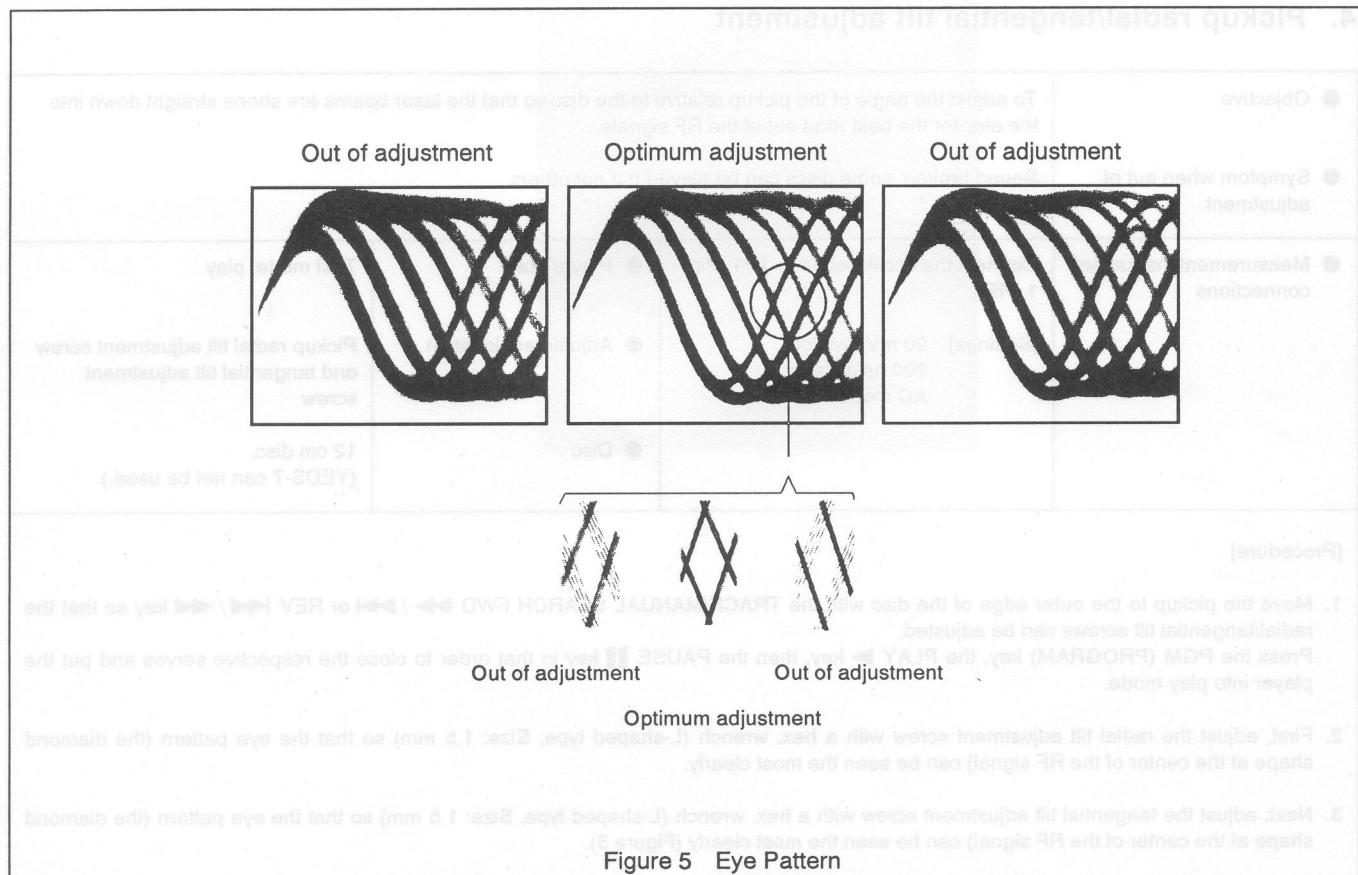


Figure 5 Eye Pattern

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	<p>Connect the oscilloscope to TP1, Pin 1 (RF).</p> <p>[Settings] 50 mV/division 10 ms/division AC mode</p>	<p>● Player state</p> <p>● Adjustment location</p> <p>● Disc</p>	<p>Test mode, play</p> <p>VR1 (laser power)</p> <p>YEDS-7</p>
[Procedure]			
<ol style="list-style-type: none"> Move the pickup to midway across the disc ($R = 35$ mm) with the MANUAL SEARCH FWD \blacktriangleright or REV \blacktriangleleft key, then press the PGM (PROGRAM) key, the PLAY \blacktriangleright key, then the PAUSE \blacksquare key in that order to close the respective servos and put the player into play mode. Adjust VR1 (laser power) so that the RF signal amplitude is 1.2 Vp-p ± 0.1V. 			

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	<p>See Figure 6.</p> <p>[Settings]</p> <p>CH1 20 mV/division CH2 5 mV/division X-Y mode</p>	<ul style="list-style-type: none"> ● Player state ● Adjustment location ● Disc 	<p>Test mode, play</p> <p>VR152 (FCS GAN)</p> <p>YEDS-7</p>

[Procedure]

1. Set the AF generator output to 1.2 kHz and 1 Vp-p.
2. Press the TRACK/MANUAL SEARCH FWD $\blacktriangleright\blacktriangleright$ or REV $\blacktriangleleft\blacktriangleleft$ key to move the pickup to halfway across the disc ($R = 35$ mm), then press the PGM (PROGRAM) key, the PLAY \blacktriangleright key, then the PAUSE \blacksquare 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 waveform is symmetrical about the X axis and the Y axis.

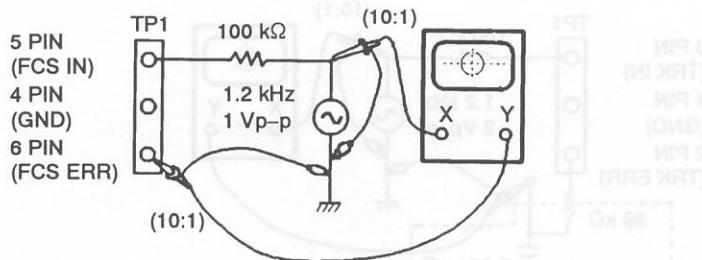
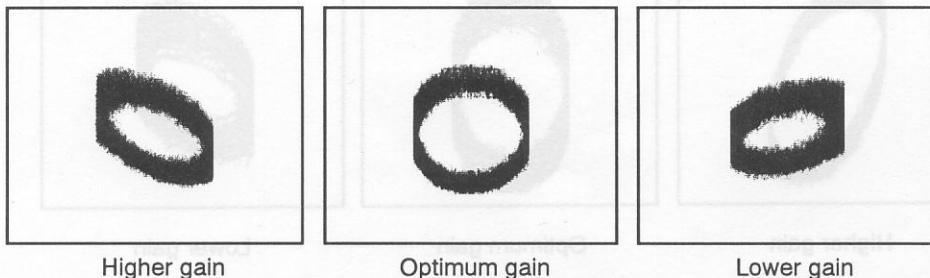


Figure 6

Focus Gain Adjustment



7. Tracking servo loop gain adjustment

● Objective	To optimize the tracking servo loop gain								
● Symptom when out of adjustment	Playback does not start, during searches the actuator is noisy, or tracks are skipped.								
● Measurement instrument connections	<p>See Figure 7.</p> <p>[Settings]</p> <table> <tr> <td>CH1</td> <td>CH2</td> </tr> <tr> <td>50 mV/division</td> <td>20 mV/division</td> </tr> <tr> <td>X-Y mode</td> <td></td> </tr> </table>	CH1	CH2	50 mV/division	20 mV/division	X-Y mode		<p>● Player state</p> <p>● Adjustment location</p> <p>● Disc</p>	<p>Test mode, play</p> <p>VR151 (TRK GAN)</p> <p>YEDS-7</p>
CH1	CH2								
50 mV/division	20 mV/division								
X-Y mode									

[Procedure]

1. Set the AF generator output to 1.2 kHz and 2 Vp-p.
2. Press the TRACK/MANUAL SEARCH FWD $\blacktriangleright/\blacktriangleright$ or REV $\blacktriangleleft/\blacktriangleleft$ key to move the pickup to halfway across the disc ($R = 35$ mm), then press the PGM (PROGRAM) key, the PLAY \blacktriangleright key, then the PAUSE \blacksquare 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 waveform is symmetrical about the X axis and the Y axis.

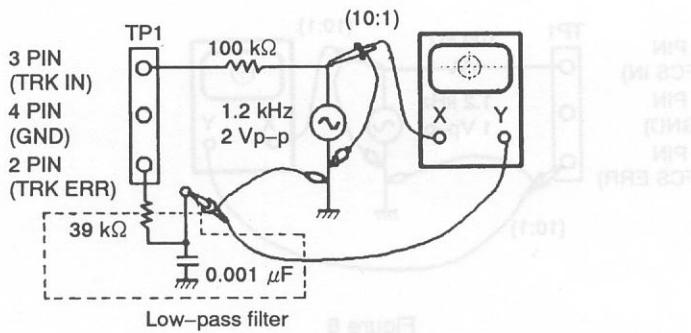
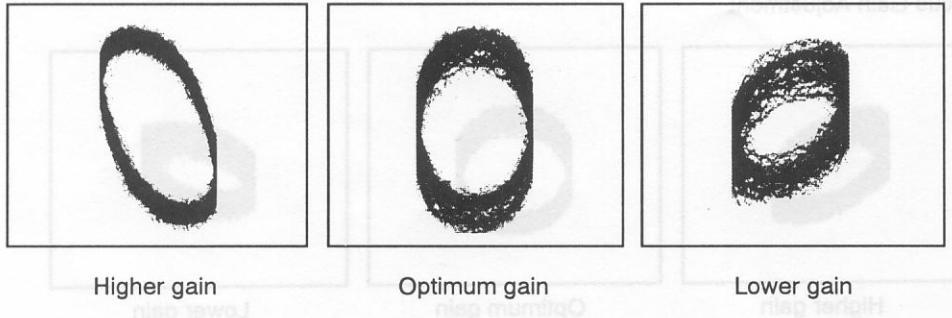


Figure 7

Tracking Gain Adjustment



8. Focus error signal (focus S curve) verification

● Objective	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.		
● Symptom when out of adjustment			
● Measurement instrument connections	Connect the oscilloscope to TP1, Pin 6 (FCS ERR). [Settings] 100 mV/division 5 ms/division DC mode	● Player state ● Adjustment location ● Disc	Test mode, stop

[Procedure]

1. Connect TP1 Pin 5 to ground.
2. Mount the disc.
3. While watching the oscilloscope screen, press the PGM (PROGRAM) key and observe the waveform 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 waveform is only output for a moment when the PGM (PROGRAM) key is pressed, press this key over and over until you have checked the waveform.

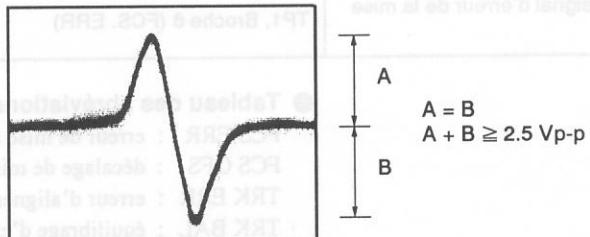


Figure 8

[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.