

## 10. ADJUSTMENTS

The adjustments for this unit are given below. Adjustments must be made in the order in which they are listed.

### ● ADJUSTMENTS

1. Tracking error offset, focus offset and RF offset adjustment
2. LD (laser diode) power check
3. Focus lock and spindle lock check
4. Grating adjustment
5. Tracking balance adjustment
6. Tangential adjustment
7. RF level check
8. Focus gain adjustment
9. Tracking gain adjustment
10. VCO free run frequency adjustment

### ● REQUIRED EQUIPMENT

1. Dual trace oscilloscope
2. Optical power meter
3. Test disc (YEDS-7)
4. Loop gain adjustment filter
5. Signal generator
6. Frequency counter
7. Other regular measuring equipment

### ● ABOUT THE TEST MODE

All adjustments must be carried out with the unit in the test mode.

#### How to activate and release the test mode

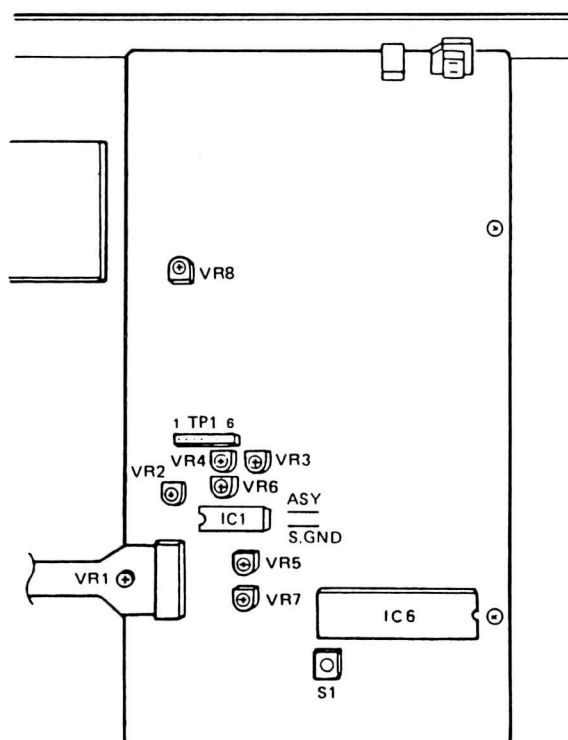
- ① To activate the test mode, turn ON the power switch (S301) with the test mode switch (S1) in the ON position.
- ② The test mode is released by turning the power switch OFF.


The functions of the keys in the test mode are outlined in Table 10-1.

### ● ADJUSTMENT VRs AND THEIR NAMES

- VR1: Laser power  
 VR2: RF offset (RF.OFS)  
 VR3: Focus gain (FCS.GAN)  
 VR4: Tracking gain (TRK.GAN)  
 VR5: Tracking balance (TRK.BAL)  
 VR6: Focus offset (FCS.OFS)  
 VR7: Tracking offset (TRK.OFS)  
 VR8: VCO adjust (VCO.ADJ)

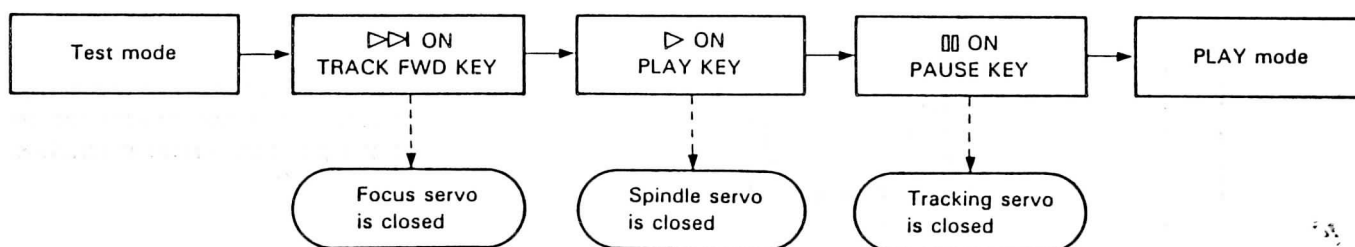
Adjustment Point



In the test mode, the servos must be closed and opened individually. Consequently, the servos must each be closed in the proper sequence (serial sequence) in order to put the machine into the play mode. Note also that the machine will not enter the play mode when the PAUSE (  ) key is pressed.

For example, in order to change from the stop to the play mode, the function keys must be pressed in the following order:

\* In the test mode, the servos must be operated in serial sequence.



### ● KEY FUNCTIONS IN THE TEST MODE









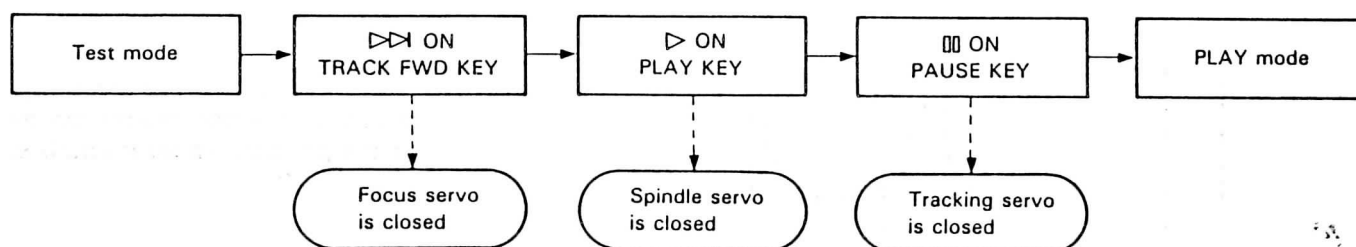
Symbol	Key name	Function in test mode	Description
	TRACK FWD	Focus servo close	Turns ON the laser diode, and raises and lowers the focusing actuator to close the focus servo.
	PLAY	Spindle servo close	Closes the servo in the CLV-A mode after kicking the spindle motor.
	PAUSE	Tracking servo close/open	Acts as a toggle: closes the tracking servo and activates play mode when pressed (provided the focus and spindle servos are closed), at which time the PAUSE indicator illuminates; opens the tracking servo when pressed again.
	MANUAL SEARCH REV	Carriage reverse (moves inward)	Moves carriage quickly (3cm/s) toward innermost track. Be careful not to move too far as there is no safety device to stop the carriage.
	MANUAL SEARCH FWD	Carriage forward (moves outward)	Moves carriage quickly (3cm/s) toward outermost track. Be careful not to move too far as there is no safety device to stop the carriage.
	STOP	Stop	Stops all servos and returns system to its initial state.
	OPER/CLOSE	Disc tray open/close	Opens and closes the disc tray. However, pickup does not return to rest on OPEN, and it remains stationary on CLOSE.

Table 10-1.

In the test mode, the servos must be closed and opened individually. Consequently, the servos must each be closed in the proper sequence (serial sequence) in order to put the machine into the play mode. Note also that the machine will not enter the play mode when the PAUSE (  ) key is pressed.

For example, in order to change from the stop to the play mode, the function keys must be pressed in the following order:

\* In the test mode, the servos must be operated in serial sequence.



### ● KEY FUNCTIONS IN THE TEST MODE








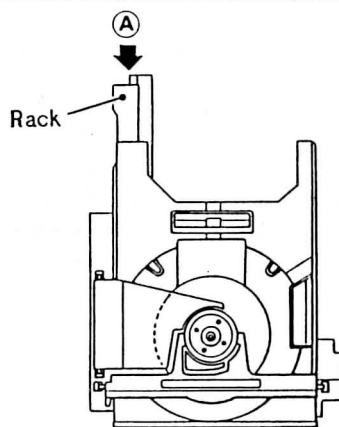
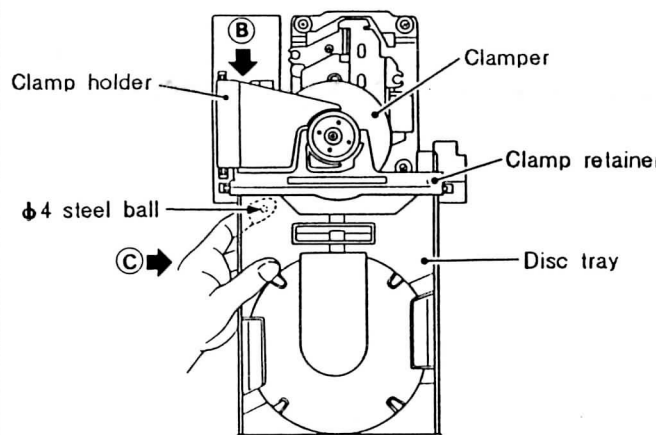
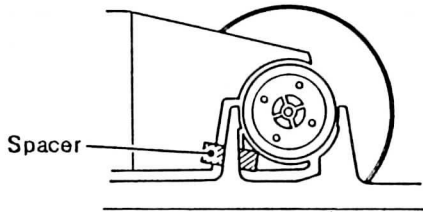
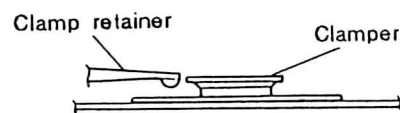
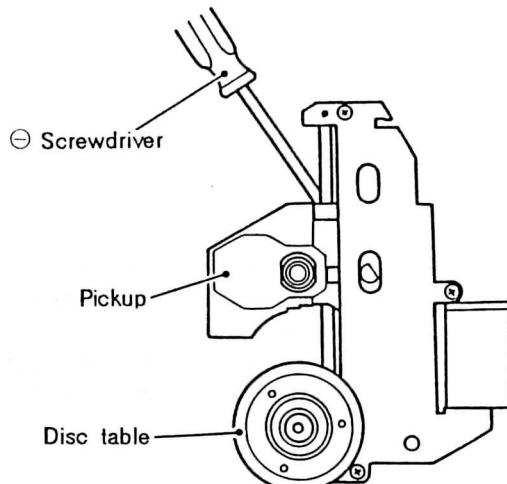
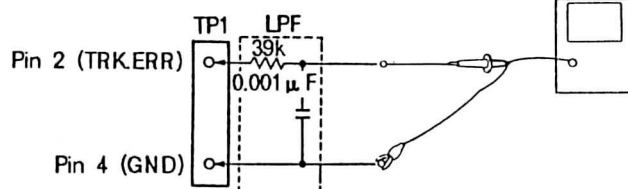
Symbol	Key name	Function in test mode	Description
	TRACK FWD	Focus servo close	Turns ON the laser diode, and raises and lowers the focusing actuator to close the focus servo.
	PLAY	Spindle servo close	Closes the servo in the CLV-A mode after kicking the spindle motor.
	PAUSE	Tracking servo close/open	Acts as a toggle: closes the tracking servo and activates play mode when pressed (provided the focus and spindle servos are closed), at which time the PAUSE indicator illuminates; opens the tracking servo when pressed again.
	MANUAL SEARCH REV	Carriage reverse (moves inward)	Moves carriage quickly (3cm/s) toward innermost track. Be careful not to move too far as there is no safety device to stop the carriage.
	MANUAL SEARCH FWD	Carriage forward (moves outward)	Moves carriage quickly (3cm/s) toward outermost track. Be careful not to move too far as there is no safety device to stop the carriage.
	STOP	Stop	Stops all servos and returns system to its initial state.
	OPER/CLOSE	Disc tray open/close	Opens and closes the disc tray. However, pickup does not return to rest on OPEN, and it remains stationary on CLOSE.

Table 10-1.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
1	Tracking error offset, focus offset and RF offset adjustment					
			TP1 Pin 2 (TRK. ERR)	VR5 (TRK. BAL) VR7 (TRK. OFS)	Tracking error offset 45° 0V±50mV	<ul style="list-style-type: none"><li>● Put unit in the test mode (see page 30).</li><li>● Set VR5 TRK.BAL (tracking balance) to the position about 45° to the left of center.</li><li>● Adjust VR7 TRK.OFS(tracking offset) so that the TRK.ERR (tracking error) voltage at TP1 pin 2 becomes 0V ± 50mV.</li></ul>
			TP1 Pin 6 (FCS. ERR)	VR6 (FCS.OFS)	Focus offset 0V ± 50mV	<ul style="list-style-type: none"><li>● Adjust VR6 FCS.OFS (focus offset) so that the FCS.ERR (focus error) voltage at TP1 pin 6 becomes 0V ± 50mV.</li></ul>
			TP1 Pin 1 (RF. OUTPUT)	VR2 (RF.OFS)	RF offset 100mV ± 50mV	<ul style="list-style-type: none"><li>● Adjust VR2 RF.OFS (RF offset) so that the RF output voltage at TP1 pin 1 becomes 100mV ± 50mV.</li></ul> <p>Note: When adjusting the tracking error offset, always perform "5. Tracking Balance Adjustment."</p>
2	LD (laser diode) power check					
				VR1	Specification: 0.13mW ± 0.01mW	<ul style="list-style-type: none"><li>● Put unit in the test mode (see page 30).</li><li>● Press the TRACK FWD (▷▷) key to turn ON the laser diode.</li><li>● Place the sensor of the optical power meter directly above the objective lens and confirm that LD power is 0.13mW ± 0.01mW.</li><li>● If the reading is not conforms specification, adjust VR1 (LD power adjust) so that the laser diode power conforms to specification.</li></ul>
3	Focus lock and spindle lock check					
	V 0.5V/div	H 100msec/ div	TP1 pin1 (RF output)		RF signal is output  Forward (clockwise) rotation	<ul style="list-style-type: none"><li>● Set the test disc.</li><li>● Put unit in the test mode (see page 30).</li><li>● Press the MANUAL SEARCH FWD (▷▷) key to move the pickup to the center of the disc.</li><li>● Observe the output of TP1 pin 1 (RF output) on the oscilloscope. Confirm that the RF signal is output after the TRACK FWD (▷▷) key is pressed.</li><li>● Press the PLAY (▷) key and confirm that the disc rotates at constant speed (approx. 30 rpm near center of disc) in the forward (clockwise) direction; disc may not run away or rotate counterclockwise.</li></ul>

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
4	Grating adjustment (1)					
	<div><p>Fig. 10-1</p></div>				<p>Remove the disc tray before beginning this adjustment.</p> <ul style="list-style-type: none"><li>● Removal of the disc tray</li></ul> <p>1. Press the rear edge of the rack, marked ① in Fig. 10-1, while pulling the disc tray out to the position where it catches, illustrated in Fig. 10-2.</p>	
	<div><p>Fig. 10-2</p></div>				<p>2. While pulling the clamp holder ② (see Fig. 10-2) upward with the right hand, hold the tray as indicated by ③ in the left hand and pull it outward. Take care not to allow the <math>\phi 4</math> steel ball to fall (we recommend holding the ball in place with the left index finger while extracting the tray).</p>	
	<div><p>Fig. 10-3</p></div>					
	<div><p>Fig. 10-4</p></div>					

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/Adjustment specifications	Adjustment procedure										
	V	H														
						 <p>Fig.10-5</p>  <p>Fig. 10-6</p> <table border="1"> <tr> <td>0.5V/div</td> <td>5ms/div</td> <td>TP1 Pin 2 TRK. ERR</td> <td>Grating adjusting screw</td> <td>Null point</td> </tr> <tr> <td></td> <td></td> <td></td> <td>Grating adjusting screw</td> <td>Max. amplitude</td> </tr> </table> <ul style="list-style-type: none"> <li>● Put unit in the test mode (see page 30).</li> <li>● Press the <b>MANUAL SEARCH FWD</b> ( <math>\triangleright \triangleright</math> ) key to move the pickup to the vicinity of what would be the center of the disc. Position the pickup so its grating adjusting screw is visible through the elongated hole on the spindle motor side of the servo mechanism base plate.</li> <li>● As shown in Fig. 10-5, insert a (slotted) screwdriver from the rear of the mechanism and check that the grating adjusting screw can be rotated.</li> <li>● Mount the test disc; be sure to insert a 3 — 5 mm spacer (if no spacer is available, use a hex wrench) between the clamp holder and clamp retainer, as shown in Fig. 10-3.</li> <li>● Confirm that the clamper and the clamp retainer are not contacting one another (Fig. 10-4).</li> <li>● Press the <b>TRACK FWD</b> ( <math>\triangleright \triangleright</math> ) and the <b>PLAY</b> ( <math>\triangleright</math> ) keys sequentially to close the focus and spindle servos (do not close the tracking servo).</li> <li>● Insert a 4kHz-cutoff low pass filter between the oscilloscope and TP1 pins 2 (TRK.ERR) and 4 (GND) as shown in Fig. 10-6 and observe the waveform of TP1 pin 2 (tracking error) on the oscilloscope.</li> <li>● Turn the grating adjusting screw with the <math>\ominus</math> screwdriver to find the null point (see Photo 10-1).</li> <li>● Next, slowly rotate the screw clockwise and adjust to the point where the waveform (tracking error signal) first achieves its maximum amplitude (see Photo 10-3).</li> </ul> <p>Note: Avoid applying pressure to the <math>\ominus</math> screwdriver while adjusting the screw. Doing so causes the pickup to move inward, making adjustment more difficult.</p> <ul style="list-style-type: none"> <li>● Lastly, remove the low pass filter and confirm that the tracking error signal p-p voltage does not greatly vary when the pickup is moved to the inner-most and outer-most tracks of the disc. If the levels diverge by <math>\pm 10\%</math> or more, re-adjust the maximum error amplitude point by rotating the grating adjusting screw.</li> </ul>	0.5V/div	5ms/div	TP1 Pin 2 TRK. ERR	Grating adjusting screw	Null point				Grating adjusting screw	Max. amplitude
0.5V/div	5ms/div	TP1 Pin 2 TRK. ERR	Grating adjusting screw	Null point												
			Grating adjusting screw	Max. amplitude												

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
						<p>Re-mount the disc tray according to the following procedure when the grating adjustment is complete.</p> <ol style="list-style-type: none"> <li>1. Remove the disc and the spacer.</li> <li>2. While lifting the clamp holder [marked ③ in Fig. 10-2] with the right hand, hold the tray in the left hand as indicated by ② and slide the slide base into the hard resin fittings on the loading base as shown in Fig. 10-7 to re-insert the disc tray. At this time, be sure to hold the steel ball in place with the index finger of the left hand. Also, be careful that the front panel is not damaged by the slide base and bearing of the steel ball's bearing (in the slide base) coming into contact with the panel.</li> <li>3. Insert the slide base so that it fits into the two hard resin fittings at the rear of the loading base (see Fig. 10-8).</li> <li>4. Insert the tray all the way.</li> </ol>

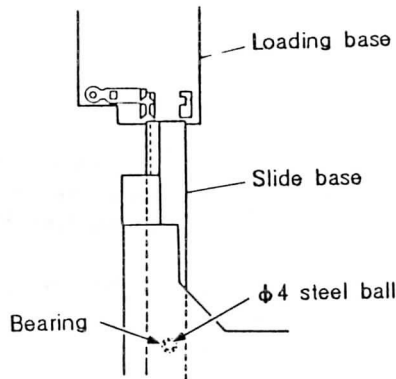


Fig. 10-7

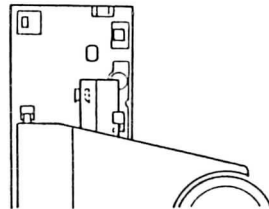


Fig. 10-8

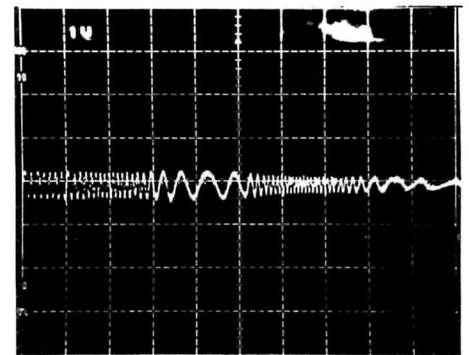


Photo 10-1 Null point

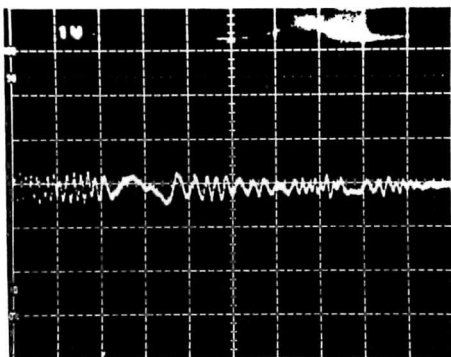


Photo 10-2 This is not the null-point waveform.

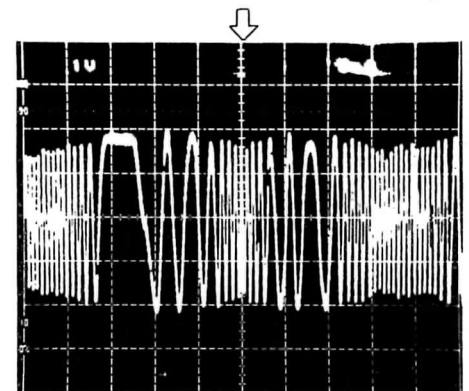
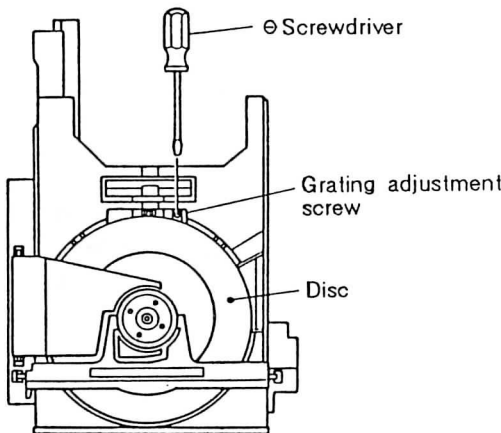
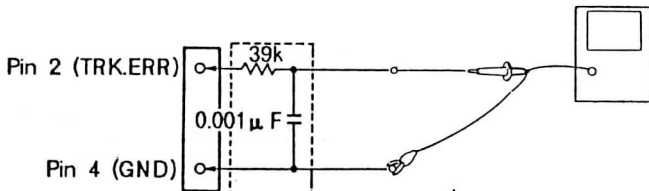
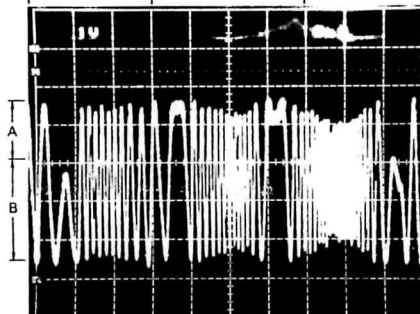
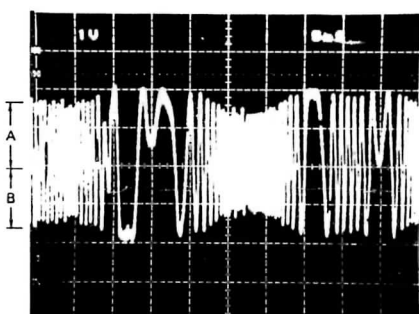
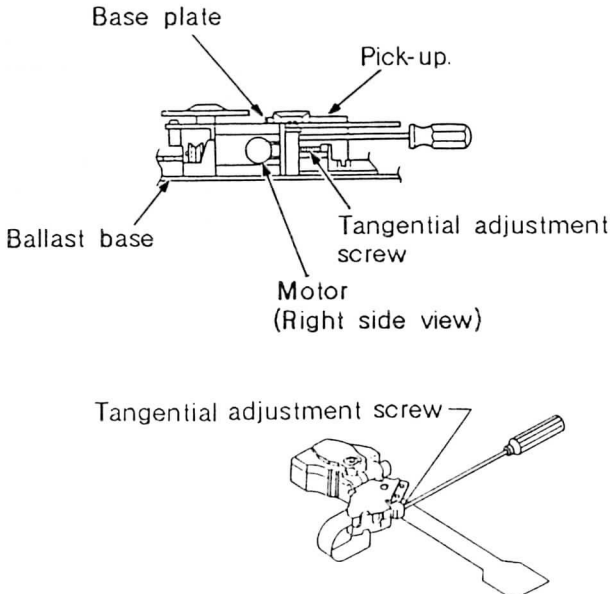


Photo 10-3 Maximum amplitude



Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
4	Grating Adjustment (2) (using discs with a recording time of 60 min. or more)					
	 <p>Fig.10-9</p>					<p>Note: This adjustment can only be performed with a disc having pits up to R115mm, not with the Test Disc (YEDS-7).</p> <ul style="list-style-type: none"> <li>● Put unit in the test mode (see page 30).</li> <li>● Load the test disc, shift the pickup to the outer periphery so that the pickup grating adjustment hole is visible from the pit surface of the disc or from the hole in the servo mechanism (see Fig. 10-9).</li> <li>● Press the TRACK FWD key (▷▷) and PLAY key (▷) in sequence to turn on the focus servo and spindle servo (do not turn on the tracking servo).</li> <li>● Observe the TRK.ERR (tracking error) waveform at TP1 pin 2 on an oscilloscope, inserting a 4kHz low-pass filter (see Fig. 10-10).</li> </ul>
	0.5V/div	5ms/div	TP1 Pin 2 (TRK.ERR)	Grating Grating	Null point Maximum amplitude	<ul style="list-style-type: none"> <li>● Insert a ⊖ screwdriver into the grating hole, turn and find the null point (see Photo 10-1).</li> <li>● Next, slowly turn the screwdriver clockwise from the null point and adjust until the waveform (tracking error signal) reaches maximum amplitude (see Photo 10-3).</li> </ul> <p>Note: Use caution since inserting the ⊖ screwdriver forcefully will cause the pickup unit to float upward.</p>
	 <p>Fig.10-10</p>					<ul style="list-style-type: none"> <li>● Finally, make sure that there is no major fluctuation in the p-p voltage of the tracking error signal (do not insert the cutoff 4kHz low-pass filter) when the pickup is shifted to the inner periphery and when the pickup is shifted to the outer periphery. If there is a difference of more than ±10% again rotate the grating adjustment screw and adjust the tracking error signal to maximum.</li> </ul>



Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
5	Tracking balance adjustment					
	0.5V/div	5ms/div	TP1 Pin 2 (TRK. ERR)	VR5 (TRK.BAL)		<ul style="list-style-type: none"><li>● Load the test disc.</li><li>● Put unit in the test mode (see page 30).</li><li>● Press the MANUAL SEARCH FWD (▷▷) key to position the pickup near the center of the disc.</li><li>● Press the TRACK FWD (▷▷) and PLAY (▷) keys sequentially to cause the disc to rotate.</li><li>● Observe TP1 pin 2 TRK.ERR (tracking error) on the oscilloscope and adjust VR5 TRK.BAL(tracking balance) to eliminate the DC elements from the tracking error signal.</li></ul>
						
			Photo 10-4 DC elements mixed in signal			Photo 10-5 DC elements eliminated
6	Tangential adjustment					
						<ul style="list-style-type: none"><li>● Put unit in the test mode (see page 30).</li><li>● Open the tray and load the test disc.</li><li>● Press the MANUAL SEARCH FWD (▷▷) key to position the pickup near the center of the disc.</li><li>● Insert a hex wrench into the tangential adjustment screw section from the rear of the mechanism.</li><li>● Close the tray.</li></ul> <p>Note: Do not use an L-shaped hex wrench. Use one such as shown to the left. Using an L-shaped hex wrench can cause the tray to come loose (see page 33 4. Grating Adjustment (1)).</p>
	Fig.10-11					

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
		200ns	TP1 Pin 1 RF output	Tangential adjustment screw	Sharpest possible eye pattern	<ul style="list-style-type: none"> <li>● Press the TRACK FWD (▷), PLAY (▷), and PAUSE (⏏) keys sequentially to close the all servos (pause indicator will illuminate).</li> <li>● Observe TP1 pin 1 (RF output) on the oscilloscope and adjust the tangential adjustment screw to achieve the sharpest possible eye pattern.</li> <li>● The point to which the adjusting screw should be set lies about halfway between the points at which the eye pattern becomes most blurred when the screw is rotated clockwise and counterclockwise. When the whole waveform becomes clear, concentrate on sharpening the fine lines forming the diamond at the center of the eye pattern (see Photo 10-8). Adjust until the fine lines on all four sides of the diamond are both sharply defined and dense, as shown in Photo 10-6.</li> </ul>

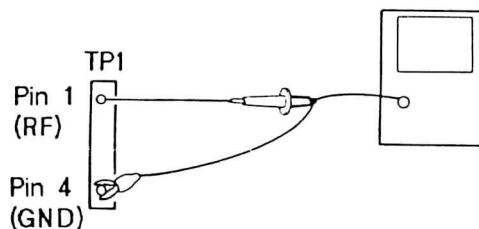
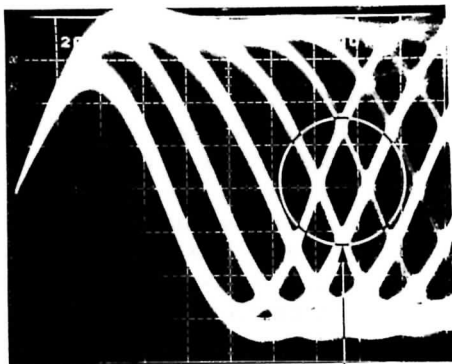


Fig. 10-12

Note: Use a hex wrench to raise the pickup somewhat while making this adjustment.



Part to be observed

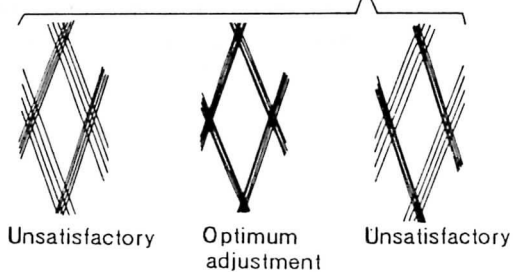


Photo 10-6

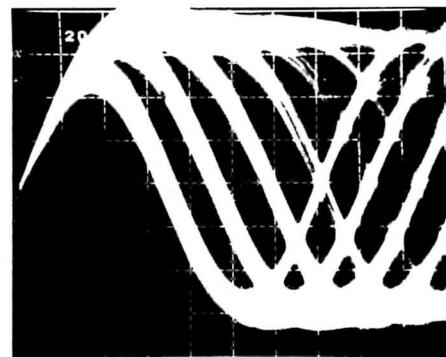


Photo 10-7



Photo 10-8

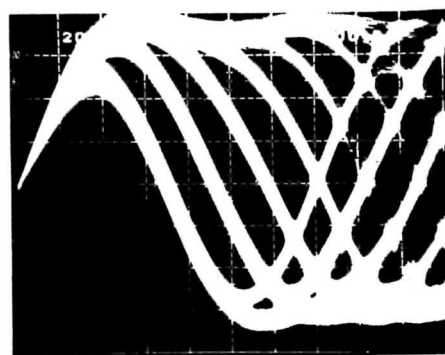
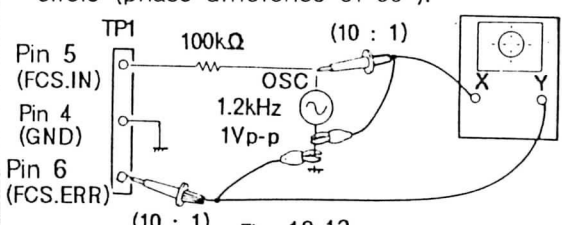
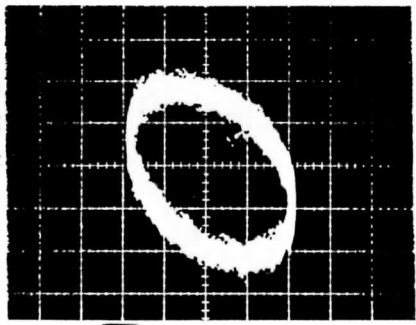
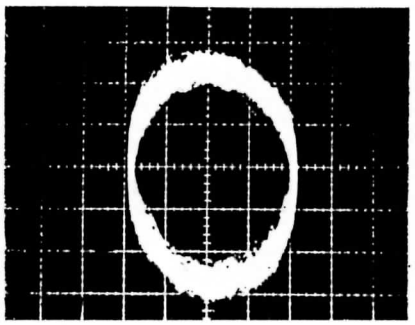
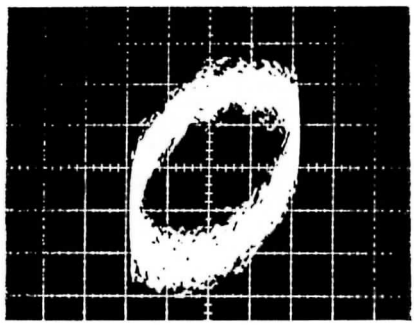


Photo 10-9

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
7	RF level check					
				VR1 (Laser power)	2.0V ± 0.6V	<ul style="list-style-type: none"><li>● Put unit in the test mode (see page 30).</li><li>● Connect the oscilloscope to TP1 pin 1 (RF output), play the test disc, and measure the P-P voltage of the RF waveform.</li><li>● Check that voltage is 2.0V ± 0.6V.</li><li>● When 2.6V is exceeded, adjust VR1 so that 2.0V ± 0.6V is obtained.</li></ul>
8	Focus gain adjustment					
	50mV/div CH1(X), CH2(Y) (probe 10:1)	20mV/div CH1(X), CH2(Y) (probe 10:1)	X-axis TP1 Pin 5 (FCS. IN) Y-axis TP1 Pin 6 (FCS. ERR)	VR3 (FCS. GAN)	Phase difference of 90°	<ul style="list-style-type: none"><li>● With the oscillator power turned OFF, connect the oscilloscope and oscillator as shown in Fig. 10-13.</li><li>● Put unit in the test mode (see page 30).</li><li>● Press the TRACK FWD (▶▶), PLAY (▶), and PAUSE (⏏) keys sequentially to activate the focus, spindle, and tracking servos.</li><li>● Turn ON the power to the oscillator and set it to output a 1.2kHz 1Vp-p signal.</li></ul> <p>Note: Some oscillators discharge a DC voltage when turned on. It is therefore recommended that the oscillator be connected after it has been turned on.</p> <ul style="list-style-type: none"><li>● Adjust VR3 FCS.GAN(focus gain) so that the Lissajous's figure becomes a horizontal circle (phase difference of 90°).</li></ul> <div></div> <p style="text-align: right;">Fig. 10-13</p>
<div><div><p>Gain overcompensated Photo 10-10</p></div><div><p>Gain optimal Photo 10-11</p></div><div><p>Gain undercompensated Photo 10-12</p></div></div>						

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
9	Tracking gain adjustment					
	50mV/div <sup>2.50</sup> 5mV/div CH1(X), CH2(Y) (prove 10:1)	X-axis TP1 Pin 3 (TRK. IN)  Y-axis TP1 Pin 2 (TRK. OUT)	VR4 (TRK.GAN)	Phase difference of 90°	<ul style="list-style-type: none"><li>With the oscillator power turned OFF, connect the oscilloscope and oscillator as shown in Fig. 10-14.</li><li>Put unit in the test mode (see page 30).</li><li>Press the TRACK FWD (▶▶), PLAY (▶), and PAUSE (⏏) keys sequentially to activate the focus, spindle, and tracking servos.</li><li>Turn ON the power to the oscillator and set it to output a 1.2kHz 2Vp-p signal.</li></ul> <p>Note: Some oscillators discharge a DC voltage when turned on. It is therefore recommended that the oscillator be connected after it has been turned on.</p> <ul style="list-style-type: none"><li>Adjust VR4 TRK.GAN (tracking gain) so that the Lissajous's figure becomes a horizontal circle (phase difference of 90°).</li></ul>	

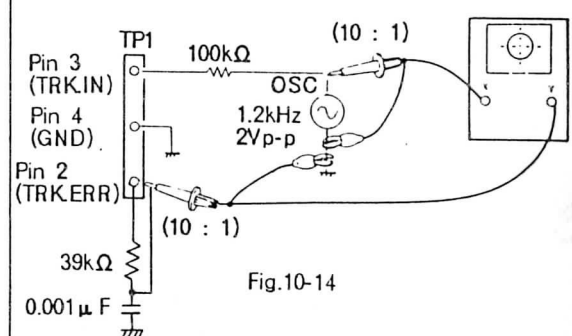
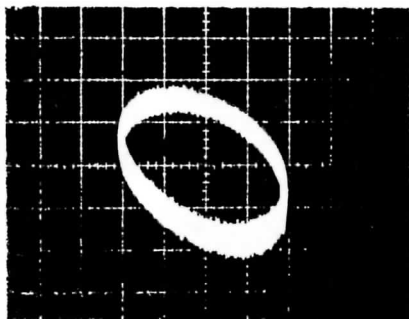
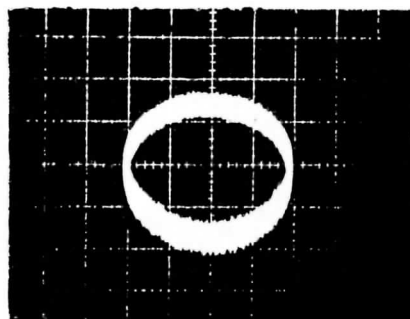


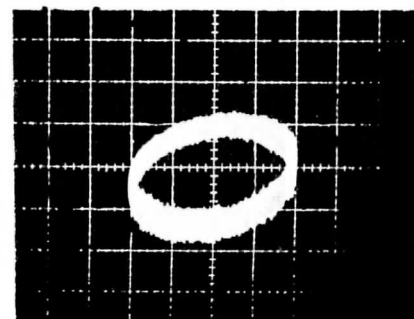
Fig.10-14



Gain overcompensated  
Photo 10-13



Gain optimal  
Photo 10-14



Gain undercompensated  
Photo 10-15

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check items/ Adjustment specifications	Adjustment procedure
	V	H				
10	VCO free-run adjustment					
			TP2 Pin 2	VR8 (VCO.ADJ)	4.375 ±0.025MHz	<ul style="list-style-type: none"><li>● Put unit in the test mode (see page 30).</li><li>● Short the ASY and GND jumper with a screwdriver or similar tool (see Fig. 10-15).</li><li>● Connect a frequency counter capable of measuring frequencies of 10MHz and above to TP2 pin 2.</li><li>● Adjust VR8 (VCO adjust) so that the frequency counter reading becomes 4.375 ± 0.025MHz.</li></ul>
11	Method for confirming focus error					
			TP1 Pin 6 (FCS. ERR)			<ul style="list-style-type: none"><li>● Put unit in the test mode (see page 30).</li><li>● Ground TP1 pin 5 FCS.IN (focus in) to GND.</li><li>● Observe the waveform output by TP1 pin 6 FCS.ERR (focus error) when the TRACK FWD (⏏) key is pressed.</li></ul>

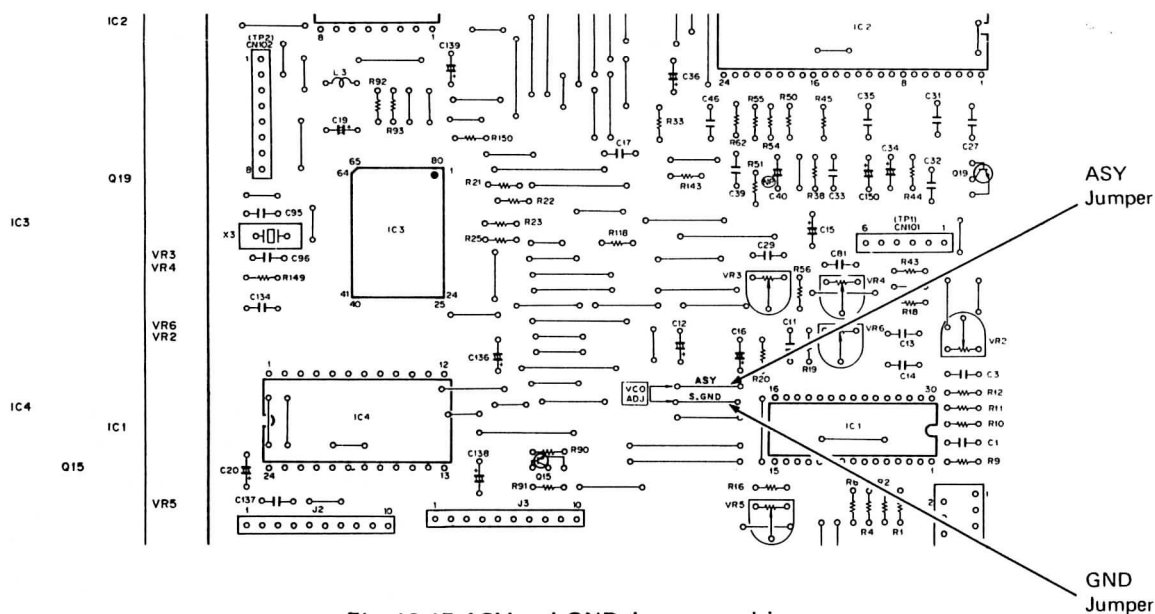


Fig. 10-15 ASY and GND Jumper position