

## 8. ADJUSTMENTS

The adjustment items for this unit are shown below. Adjustments must be made in the order in which they are listed. As OPEN/CLOSE operation for disc tray 2 cannot be performed during test mode, use tray 1 for adjustments.

### • Adjustment and check items

1. Tracking offset, focus offset and RF offset adjustments
2. RF level adjustment
3. LD (Laser Diode) power check
4. Focus lock and spindle lock check
5. Grating adjustment
6. Tracking adjustment
7. Tangential adjustment
8. Focus gain adjustment
9. Tracking gain adjustment
10. VCO free-run frequency adjustment
11. Confirmation of S character (focus error)

### • Measuring Equipment

1. Dual trace oscilloscope
2. Laser power meter
3. Test disc (YEDS-7) and an 8cm disc
4. Loop gain adjustment filter
5. Signal generator
6. Frequency counter
7. Other general tools

### • Test Mode

#### Test mode setting and cancellation procedures

- (1) To set the test mode, turn ON the power switch (S301) while short circuit the J1 and J2 jumpers.
- (2) The test mode is cancelled by turning the power switch OFF.

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

### • Adjustment VRs (Variable Resistors) and 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 free-run adjustment (VCO. ADJ)

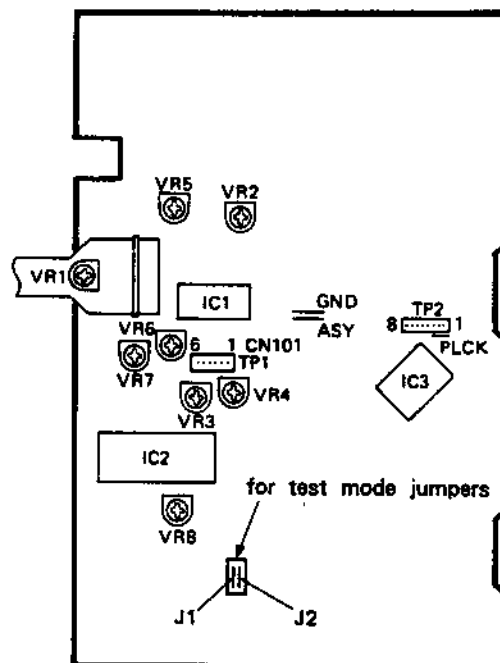
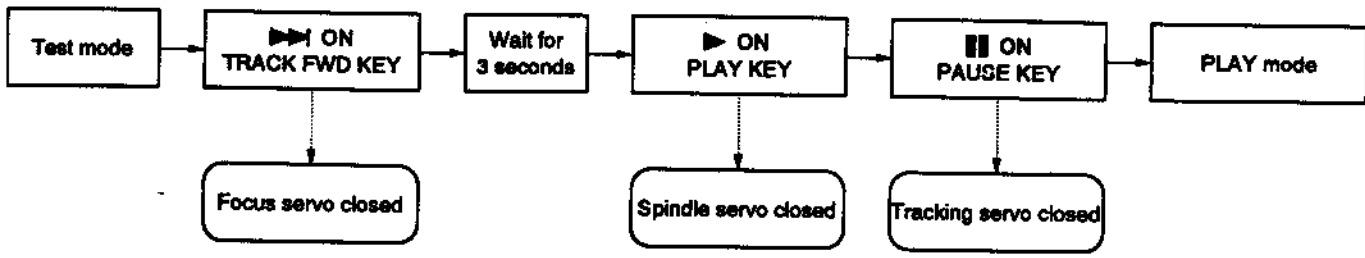


Fig. -1 Adjustment points

In the test mode, the servos are closed and opened individually. Consequently, the servos must each be closed one at a time (in serial sequence) in order to set the unit to normal PLAY mode. Note also that during test mode the unit will not enter the PLAY mode when the PAUSE (■) key is pressed alone.

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

Example: Switching from STOP to PLAY mode.



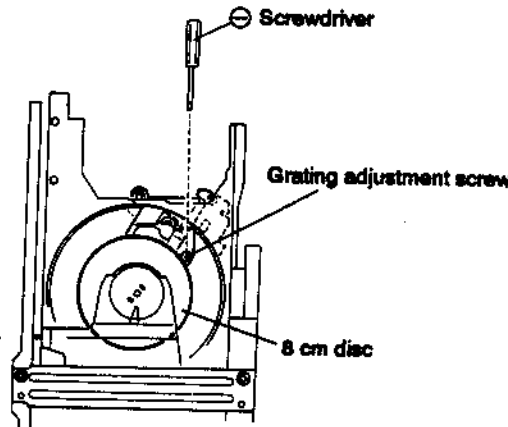
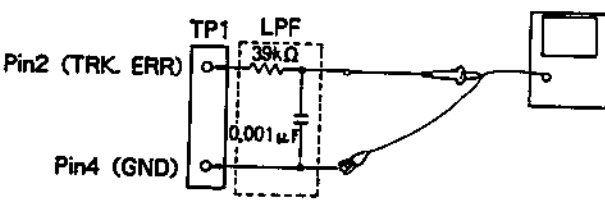
• Key Functions in the Test Mode

Symbol	Key name	Function during test mode	Description
▶▶	TRACK FWD	Focus servo close	Turns ON the laser diode, and raises/lowers the focusing actuator to close the focus servo. After closing disc tray 1, the tray is moved to PLAY position.
▶	PLAY	Spindle servo close	Closes the servo in the CLV-A mode after starting the spindle motor.
■	PAUSE	Tracking servo close/open	Performs toggle operation: closes the tracking servo and sets to 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 reversal (inward movement)	Moves carriage rapidly (3 cm/s) toward the center. Because there is no safety mechanism for stopping the carriage, release the key when the carriage reaches the innermost track.
▶	MANUAL SEARCH FWD	Carriage advance (outward movement)	Moves carriage rapidly (3 cm/s) toward the outer edge. Because there is no safety mechanism for stopping the carriage, release the key when the carriage reaches the outermost track.
■	STOP	Stop	Stops all servos and returns system to its initial state.
▲	OPEN/CLOSE Disc I	(Disc tray) open/close	Opens and closes the disc tray. However, pickup does not return to rest when opening, and remains stationary when closing the tray.

Table -1.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				
1	<b>TRACKING OFFSET, FOCUS OFFSET, RF OFFSET ADJUSTMENT</b>					
			TP1 Pin 2 (TRK. ERR)  TP1 Pin 6 (FCS. ERR)  TP1 Pin 1 (RF output)	VR5 (TRK. BAL)  VR7 (TRK. OFS)  VR6 (FCS. OFS)  VR2 (RF. OFS)	Tracking offset 45°  0V ± 50 mV  Focus offset 0V ± 50 mV  RF offset 100 mV ± 50 mV	<ul style="list-style-type: none"> <li>• Set to test mode (※).</li> <li>• Turn VR5 TRK. BAL (tracking balance) counterclockwise about 45° from center position.</li> <li>• Adjust VR7 TRK.OFS (tracking offset) so that the TRK. ERR (tracking error) voltage at TP1 Pin 2 becomes 0V ± 50 mV.</li> <li>• Adjust VR6 FCS.OFS (focus offset) so that the FCS.ERR (focus error) voltage at TP1 Pin 6 becomes 0V ± 50 mV.</li> <li>• Adjust VR2 RF.OFS (RF offset) so that the RF output voltage at TP1 Pin 1 becomes 100 mV ± 50 mV.</li> </ul> <p>Note: After performing tracking offset adjustment, be sure to perform "6. TRACKING BALANCE ADJUSTMENT."</p>
2	<b>RF LEVEL ADJUSTMENT</b>					
			TP1 Pin 1 (RF output)	VR1 (laser power)	1.5V +0.2V -0V.	<ul style="list-style-type: none"> <li>• Set to test mode (※).</li> <li>• Play the test disc, connect the oscilloscope to TP1 Pin 1 (RF output), and measure the P-P voltage of the RF waveform.</li> <li>• Adjust so that the voltage becomes 1.5V +0.2V -0V.</li> </ul>
3	<b>LD (LASER DIODE) POWER CHECK</b>					
					Less than 0.13 mW	<ul style="list-style-type: none"> <li>• Set to test mode (※).</li> <li>• Press the TRACK FWD (▶▶) key to turn ON the LD (laser diode).</li> <li>• Place the sensor of the laser power meter directly above the objective lens and confirm that the output power of the LD does not exceed 0.13 mW.</li> </ul>

※ : See page 27.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				
<b>4 FOCUS LOCK AND SPINDLE LOCK CHECK</b>						
	V 0.5V/div	H 100 msec /div	TP1 Pin 1 (RF output)		RF output exists  Normal (clockwise) rotation	<ul style="list-style-type: none"> <li>• Set test disc.</li> <li>• Set to test mode (※).</li> <li>• Press the MANUAL SEARCH FWD (▶▶) key to move the pickup close 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 pressing the TRACK FWD (▶▶) key.</li> <li>• Press the PLAY (▶) key and confirm that the disc rotates at constant speed (approx. 300 rpm near center of disc) in the normal (clockwise) direction; make sure that the disc does not rotate too fast or counter-clockwise.</li> </ul>
<b>5 GRATING ADJUSTMENT (1) (using an 8 cm disc)</b>						
	 <p style="text-align: center;">Fig. -2.</p>				<p>Note: This adjustment can only be performed using an 8 cm disc having pits over a diameter of 75 mm.</p> <ul style="list-style-type: none"> <li>• Set to test mode (※).</li> <li>• Set the 8 cm disc. Shift the pickup to the outermost track so that it is positioned over pits and the pickup grating adjustment hole is visible from the hole in the servo mechanism (see Fig. -2).</li> <li>• Press the TRACK FWD (▶▶) and PLAY (▶) keys in sequence to close the focus servo and spindle servo (do not close the tracking servo).</li> <li>• Observe the waveform output of TP1 Pin 2 TRK.ERR (tracking error) on the oscilloscope, inserting a 4 kHz low-pass filter (see Fig. -3).</li> </ul>	
	 <p style="text-align: center;">Fig. -3.</p>					

※ : See page 27.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				
	0.5V/div	5 msec/div	TP1 Pin 2 (TRK. ERR)	Grating  Grating	Null Point  Maximum amplitude	<ul style="list-style-type: none"> <li>• Insert ⊖ screwdriver into the grating adjustment hole, and turn to find the null point (see Photo -1.).</li> <li>• Next, slowly turn ⊖ screwdriver in counterclockwise direction from the null point and adjust until the waveform (tracking error signal) reaches maximum amplitude (see Photo -2.).</li> </ul> <p>Note: Use caution since inserting ⊖ screwdriver forcefully will cause the pickup unit to float upward.</p> <ul style="list-style-type: none"> <li>• Finally, confirm that there is no major fluctuation in the P-P voltage of the tracking error signal (do not insert the cutoff 4 kHz low-pass filter) when the pickup is shifted to the innermost track and when the pickup is shifted to the outermost track. If there is a difference of more than ± 10%, re-adjust by turning the grating adjustment screw to the maximum amplitude point of the tracking error signal.</li> </ul>

**5 GRATING ADJUSTMENT (2) (without 8 cm disc)**

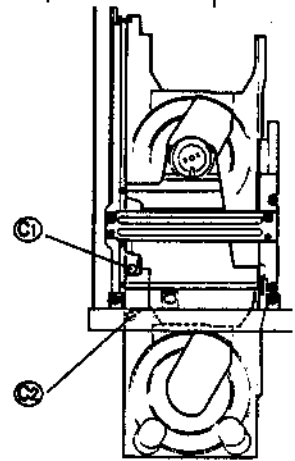


Fig. -4.

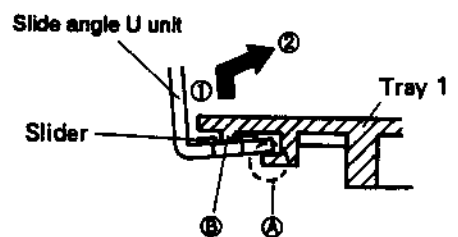


Fig. -5.

Perform this adjustment when an 8 cm disc is not available and Grating adjustment (1) cannot be performed.  
Remove the tray 1 before performing this adjustment.

- Removal of tray 1
1. Set tray 1 to OPEN position.
  2. Remove screws C1, C2 holding tray 1 in Fig. -4.
  3. Move tray 1 in the direction of arrow in Fig. -5, and as detaching projection B of tray 1, free slide angle U unit from hook A of tray 1.
  4. Pull out tray 1 as raising its side of slide angle U unit slightly.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				
						<p>Note: This adjustment can only be performed using a disc having pits up to a diameter 115 mm. The test disc (YEDS-7) cannot be used.</p> <ul style="list-style-type: none"> <li>• Set to test mode (※).</li> <li>• Set a disc. Shift the pickup to the outermost track so that it is positioned over pits and the pickup grating adjustment hole is visible from the hole in the servo mechanism (see Fig. -6.).</li> <li>• Press the TRACK FWD (▶▶) and PLAY (▶) keys in sequence to close the focus servo and spindle servo (do not close the tracking servo).</li> <li>• Observe the waveform output of TP1 Pin 2 TRK. ERR (tracking error) on the oscilloscope, inserting a 4 kHz low-pass filter (see Fig. -7.).</li> </ul>
	0.5V/div	5 msec/div	TP1 Pin 2 (TRK. ERR)	Grating Grating	Null Point Maximum amplitude	<ul style="list-style-type: none"> <li>• Insert ⊖ screwdriver into the grating adjustment hole, and turn to find the null point (see Photo -1.).</li> <li>• Next, slowly turn ⊖ screwdriver in counterclockwise direction from the null point and adjust until the waveform (tracking error signal) reaches maximum amplitude (see Photo -2.).</li> </ul> <p>Note: Use caution since inserting ⊖ screwdriver forcefully will cause the pickup unit to float upward.</p> <ul style="list-style-type: none"> <li>• Finally, confirm that there is no major fluctuation in the P-P voltage of the tracking error signal (do not insert the cutoff 4 kHz low-pass filter) when the pickup is shifted to the innermost track and when the pickup is shifted to the outermost track. If there is a difference of more than ± 10%, re-adjust by turning the grating adjustment screw to the maximum amplitude point of the tracking error signal.</li> </ul>

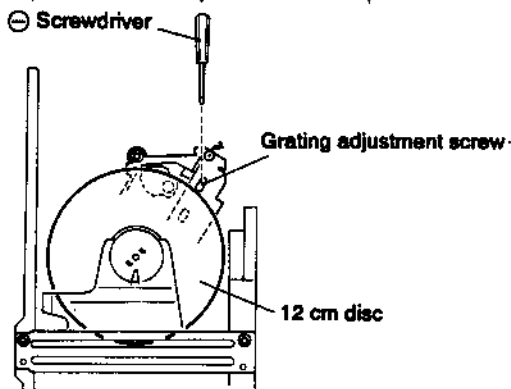


Fig. -6.

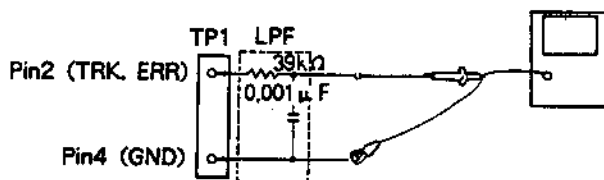


Fig. -7.

※ : See page 27.

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				

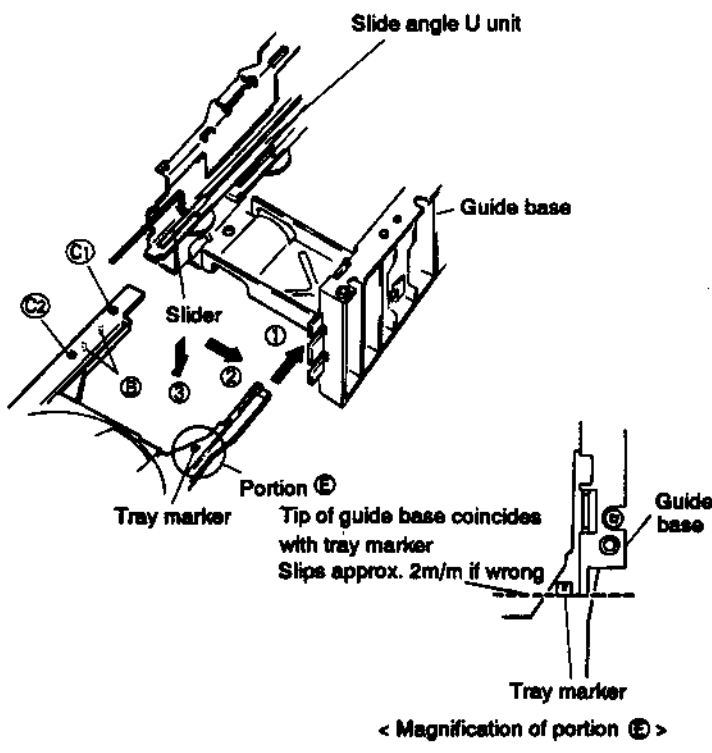


Fig. -8.

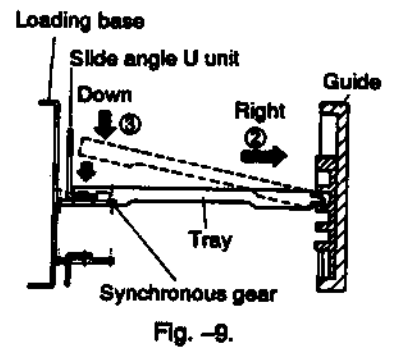


Fig. -9.

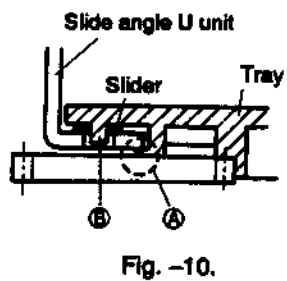


Fig. -10.

After completing adjustments, attach tray 1 in the following process.  
Remove front panel previously as it disturbs attachment of tray 1.

1. Set slide angle U unit to the foremost position (where opening of tray 1 is completed).
2. Set slider to the foremost position as shown in Fig. -8.
3. As shown by dotted line in Fig. -9, insert tray 1 aslant to the position that mounting holes of slider and tray 1 coincide (make sure that slider does not move backward).
4. Down tray 1 as pulling it to the right (toward guide). Do it as holding slider from below with finger.
5. Adjust position of tray 1 so that hook (A) and projection (B) are properly fixed as shown in Fig. -10. Also do it so that to engage synchronous gear with gear of tray 1.
6. Make sure that mounting holes of slider are being positioned in the center of tray 1's screw holes, and tighten screws in order of (C1), (C2).
7. After completing attachment of tray 1, with tray 1's complete-open state, make sure that mutual position shown in the portion (E)'s enlarged illustration is being satisfied. If it does not, the adjustment must be made again from the beginning.

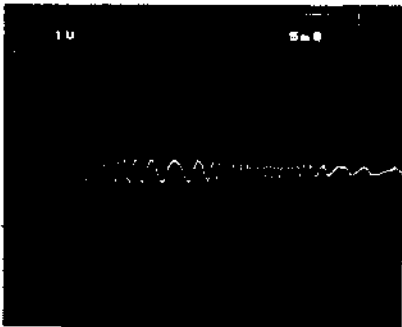


Photo-1 Null point

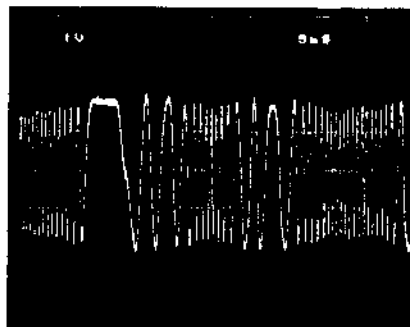


Photo-2 Maximum amplitude

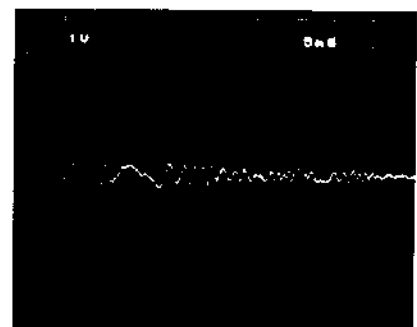


Photo-3  
This is not the null-point waveform

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				

**6 TRACKING BALANCE ADJUSTMENT**

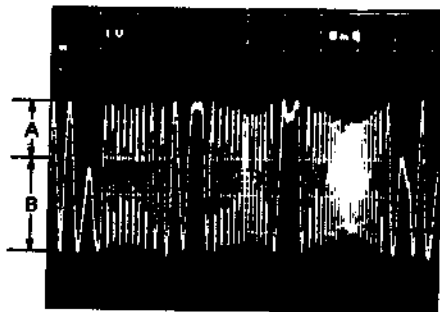
0.5V/div

5 msec/div

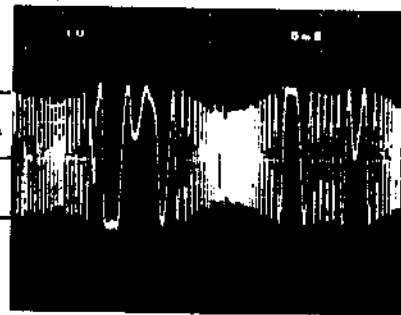
TP1 Pin 2  
(TRK. ERR)

VR5  
(TRK. BAL)

- Set the test disc.
- Set to test mode (※).
- Press the MANUAL SEARCH FWD (▶▶) key to position the carriage near the center of the disc.
- Press the TRACK FWD (▶▶|) key and then the PLAY (▶) key to cause the disc to rotate.
- Observe the waveform output by TP1 Pin 2 TRK.ERR (tracking error) on the oscilloscope and adjust VR5 TRK. BAL (tracking balance) so that the DC component disappears from the tracking error signal.



A=B



A=B

Photo-4 DC elements mixed in signal

Photo-5 DC elements eliminated

**7 TANGENTIAL ADJUSTMENT**

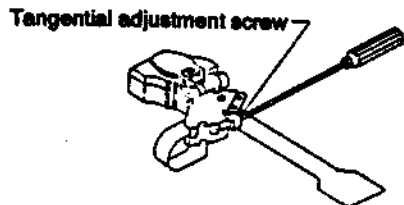
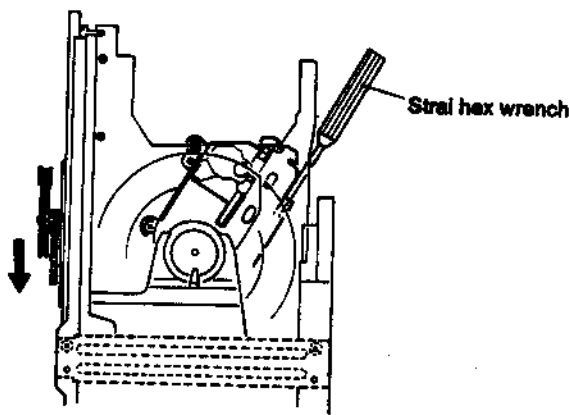


Fig. -11.

- Set to test mode (※).
- Open tray 1 and set the disc.
- Close tray 1.
- Press the MANUAL SEARCH FWD (▶▶) key to position the pickup at the outermost track.
- Rotate gear-pulley by hand in the direction indicated by the arrow and move tray 2 up so that the tangential adjustment screw section becomes visible.
- Insert a hexagonal wrench into the tangential adjustment screw section from the right-slant in the rear of mechanism.
- Press the MANUAL SEARCH REV (◀◀) key to position the pickup somewhere at the middle of the tracks.
- Press the TRACK FWD (▶▶|) key, PLAY (▶) key, and PAUSE (■) key in that order to close all the servos (the pause indicator will illuminate).

※ : See page 27.



Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				
		200 ns/div	TP1 Pin 1 (RF output)	Tangential adjustment screw	Sharpest possible eye pattern	<ul style="list-style-type: none"> <li>Observe the waveform output by TP1 Pin 1 (RF output) on the oscilloscope and adjust the tangential adjustment screw to achieve the sharpest possible eye pattern.</li> <li>The correct adjustment point is halfway between the two points where the eye pattern becomes blurred when rotating the tangential adjustment screw clockwise and then counterclockwise. When the whole waveform becomes clear, concentrate on sharpening the fine lines forming the diamond shape at the center of the eye pattern (see Photo -7.). Adjust until the diamond shape consists of single thin lines.</li> </ul>

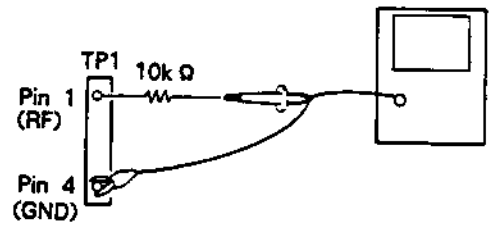


Fig. -12.

Note: Use a hexagonal wrench to keep the pickup in raised position while performing this adjustment.

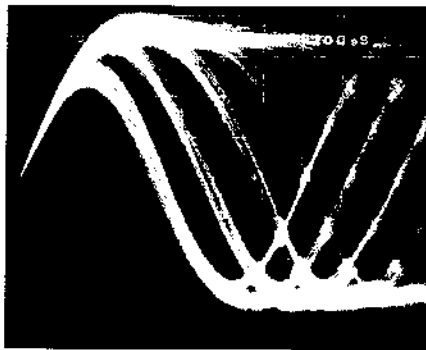


Photo-6

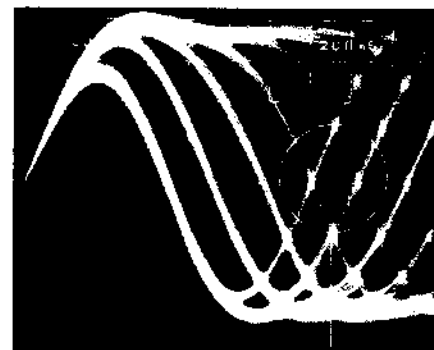
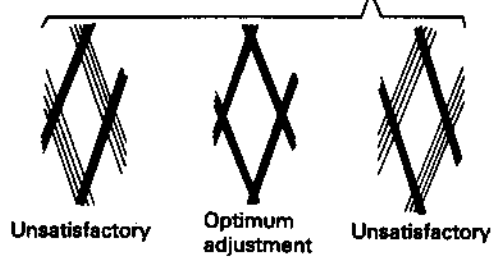


Photo-7

Part to be observed



Photo-8



Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				

**8 FOCUS GAIN ADJUSTMENT**

	CH1 (X) , CH2 (Y) 20 mV/div, 5 mV/div (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. -13.</li> <li>• Set to normal PLAY mode.</li> <li>• Turn ON the power of the oscillator and set it to output a 1.2 kHz 1 Vp-p signal.</li> </ul> <p>Note: Some oscillators discharge a DC voltage when power is turned on. In that case it is recommended to connect the oscillator after it has been turned on.</p> <ul style="list-style-type: none"> <li>• Adjust VR3 FCS.GAN (focus gain) so that the Lissajous figures form a horizontal circle on the oscilloscope (phase difference of 90°).</li> </ul>
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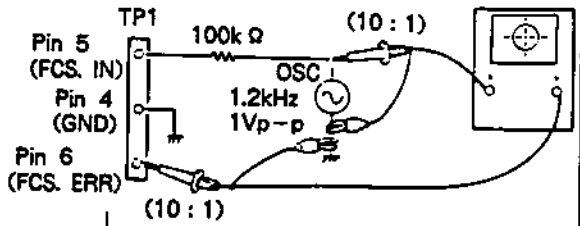


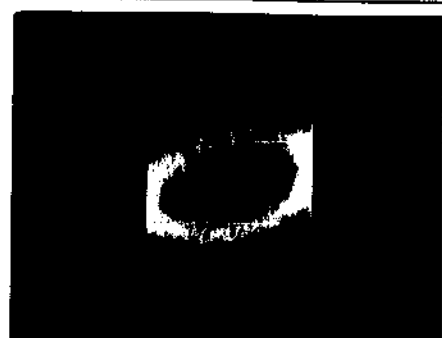
Fig. -13.



Gain overcompensated  
Photo-9



Gain optimum  
Photo-10



Gain undercompensated  
Photo-11

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				

**9 TRACKING GAIN ADJUSTMENT**

CH1 (X) , CH2 (Y)  
50 mV/div, 5 mV/div  
(probe: 10:1)

X-axis  
TP1 Pin 3  
(TRK. IN)

Y-axis  
TP1 Pin 2  
(TRK. OUT)

VR4  
(TRK. GAN)

Phase difference  
of 90°

- With the oscillator power turned OFF, connect the oscilloscope and oscillator as shown in Fig. -14.
  - Set to normal PLAY mode.
  - Turn ON the power of the oscillator and set it to output a 1.2 kHz 2 Vp-p signal.
- Note: Some oscillators discharge a DC voltage when power is turned on. In that case it is recommended to connect the oscillator after it has been turned on.
- Adjust VR4 TRK. GAN (tracking gain) so that the Lissajous figures form a horizontal circle on the oscilloscope (phase difference of 90°).

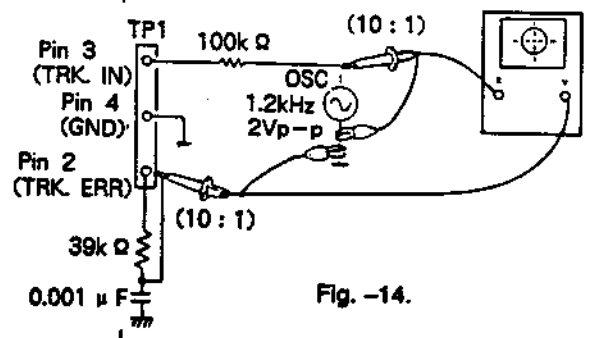
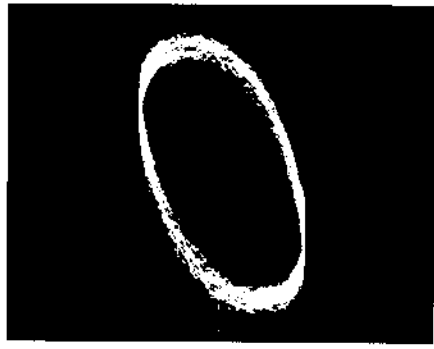
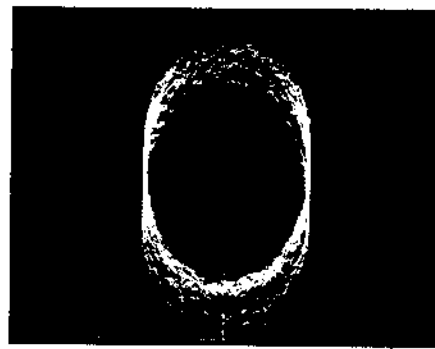


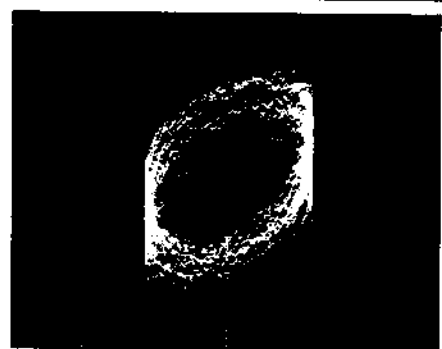
Fig. -14.



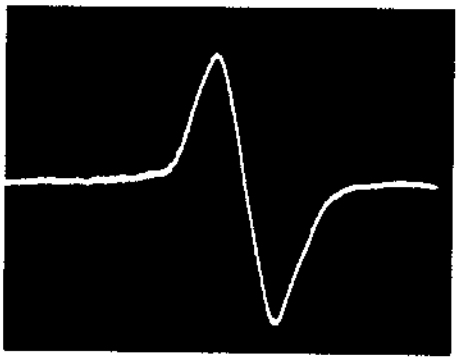
Gain overcompensated  
Photo-12



Gain optimum  
Photo-13



Gain undercompensated  
Photo-14

Step No.	Oscilloscope Setting		Test Points	Adjusting Points	Check Items/ Adjustment Specifications	Adjustment Procedure
	V	H				
10	<b>VCO FREE-RUN FREQUENCY ADJUSTMENT</b>					
			TP2 Pin 2 (PLCK)	VR8 (VCO. ADJ)	4.275 ± 0.025 MHz	<ul style="list-style-type: none"> <li>• Set to test mode (※).</li> <li>• Short-circuit the ASY and GND jumpers with ⊖ screwdriver or similar tool (see Fig. -1.).</li> <li>• Connect a frequency counter capable of measuring frequencies of 10 MHz and above to the PLCK jumper.</li> <li>• Adjust VR8 VCO. ADJ (VCO free-run adjustment) so that the frequency counter reading becomes 4.275 ± 0.025 MHz.</li> </ul>
11	<b>CONFIRMATION OF S CHARACTER (FOCUS ERROR)</b>					
			TP1 Pin 6 (FCS. ERR)			<ul style="list-style-type: none"> <li>• Set to test mode (※).</li> <li>• Short-circuit TP1 Pin 5 FCS. IN (focus in) and Pin 4 GND.</li> <li>• Observe the waveform output by TP1 Pin 6 FCS. ERR (focus error) when pressing the TRACK FWD (▶▶) key.</li> </ul>
						<p>Focus error Photo-15</p>

※ : See page 27.