REPAIR MANUAL

ISSUED ........ AUG. 2003
REVISED ........

SLIT LAMP

SL-D7

TOPCON CORPORATION
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1. INTRODUCTION

1-1 How to Use This Repair Manual

(1) Follow the procedure described in the flowchart below.
1-2 Precautions for Repairs

(1) Disassemble, assemble, repair or adjust the optical system in the clean area where no dust or foreign matter will affect the instrument.
(2) For assembly and inspection, refer to the assembly and instruction manual of SL-D7.
(3) When repairing this instrument, use proper materials and tools correctly according to this manual.
(4) As a rule, a metallic part should be replaced as a single part and an optical part as a unit in this manual.
(5) Refer to the service parts list for the disassembly or assembly of the component not mentioned in this manual.
(6) Don’t use other lubricating oils or adhesives except those specified.
(7) Order repair parts according to the service parts list.
① Control lever
② Chin rest base plate
③ Cross slide fixing knob
④ Rail cover
⑤ Cross slide
⑥ Table
⑦ Accessory drawer
⑧ Brightness control dial
⑨ Power switch
⑩ Pilot lamp
⑪ Up-and-down balance spring
⑫ Microscope arm fixing knob
⑬ Angle scale
⑭ Click stop roller
⑮ Illumination arm fixing knob
⑯ Arm cover
⑰ Chin rest up-and-down handle
⑱ Eyepiece
⑲ 12.5x eyepiece (with click)
⑳ Magnification change handle
⑴ Eyepiece tightening knob
⑵ Barrier filter unit
⑶ Objective lens
⑷ Slit width adjusting handle
⑸ Inclination stop lever
⑹ Centering knob
⑺ Mirror
⑻ R/L lock switch
⑼ Aperture/slit change handle
⑽ Filter selection lever
⑾ Aperture/slit display window
⑿ Lamp house cover
⒀ Chin rest
⒁ Forehead rest
⒂ Diffusion lens
⒃ Connector for light adjustment (5P)
⒄ Connector for image taking-in operation (8P)
⒅ Color temperature conversion filter

Note: Refer to the instruction manual for the functions.
1. Control lever
2. Chin rest base plate
3. Cross slide fixing knob
4. Rail cover
5. Cross slide
6. Table
7. Color temperature conversion filter
8. Brightness control dial
9. Power switch
10. Pilot lamp
11. Up-and-down balance spring
12. Microscope arm fixing knob
13. Angle scale
14. Click stop roller
15. Illumination arm fixing knob
16. Arm cover
17. Chin rest up-and-down handle
18. Eyepiece
19. 12.5× eyepiece (with click)
20. Magnification change handle
21. Eyepiece tightening knob
22. Barrier filter unit (depending on destination, TE)
23. Objective lens
24. Slit width adjusting handle
25. Inclination stop lever
26. Centering knob
27. Mirror
28. Fixation target
29. Aperture/slit change handle
30. Filter selection lever
31. Aperture/slit display window
32. Lamp house cover
33. Chin rest
34. Forehead rest
35. Diffusion lens
36. Connector for optical adjustment (5P)
37. Connector for image taking-in operation (8P)

Note: Refer to the instruction manual for the functions.
1-4 Optical Arrangement

(1) Illumination system

Filament position

Slit position

(2) Observation system

Magnification unit

Eyepiece unit
<table>
<thead>
<tr>
<th>Names of optical units</th>
<th>Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>① Condenser lens</td>
<td>Adjusts the condensing position for the main bulb filament.</td>
</tr>
<tr>
<td>② Filter</td>
<td>Selects the blue, red-free, ND, heat absorbing, UV cut, IR cut or exciter filter according to the clinical purpose.</td>
</tr>
<tr>
<td>③ Projection lens</td>
<td>Projects and focuses the slit image.</td>
</tr>
<tr>
<td>④ Diffusion lens</td>
<td>Widens the illumination field when photographing the anterior eye section.</td>
</tr>
<tr>
<td>⑤ Reflection mirror</td>
<td>Reflects the slit image to project it into the anterior eye section.</td>
</tr>
<tr>
<td>⑥ Microscope objective lens</td>
<td></td>
</tr>
<tr>
<td>⑦ Magnification drum lens</td>
<td></td>
</tr>
<tr>
<td>⑧ Eyepiece objective lens</td>
<td>Used to focus the observed image in the eyepiece and to align the optical axis.</td>
</tr>
<tr>
<td>⑨ Image erecting prism</td>
<td>Changes the inverted image in the microscope to the erect one and adjusts the rotation centering axis to prevent the image from moving due to the pupillary distance shift.</td>
</tr>
<tr>
<td>⑩ Eyepiece</td>
<td>Magnifies the observed image in the microscope and adjusts the diopter to the patient's eye.</td>
</tr>
<tr>
<td>⑪ Color temperature conversion filter</td>
<td></td>
</tr>
<tr>
<td>⑫ Barrier filter</td>
<td>By combining with the exciter filter installed to the illumination system, observes and photographs the anterior eye section in fluorescent light.</td>
</tr>
</tbody>
</table>
## 2. REPAIR GUIDE

### 2-1 Accuracy Check

<table>
<thead>
<tr>
<th>No.</th>
<th>Item</th>
<th>How to check and allowance</th>
<th>How to adjust and repair</th>
<th>Tools and No.</th>
</tr>
</thead>
</table>
| 1   | Same focal point due to magnification | Focus at the maximum magnification and then decrease the magnification in turn, 25×, 16×, 10× and the minimum. Measure the diopter difference at each magnification. | Focus setting of microscope | Dioptr telescope
|     |      |                             |                          | [2]           |
| 2   | Image shifts when adjusting the pupillary distance. | Place the standard scale on the object. Set the pupillary distance at the minimum and then at the maximum and measure the maximum shift width of the optical axis. [within 0.05mm] | Accuracy setting of pupillary distance prism box | Eyepiece with scale (2) Standard scale (3) |
|     |      |                             |                          |               |
| 3   | The slit width narrows of itself. | Check if the frictional force of handle is too weak to obtain the desired position when changing the slit width. | Adjustment of slit width adjusting force | P. 12 |
|     |      |                             |                          |               |
| 4   | When releasing the inclination unit, it inclines too quickly. | Check if the slit illumination inclines too quickly when removing the stopper. | Adjustment of inclination unit rotary force | P. 16 |
|     |      |                             |                          |               |
| 5   | Difference between the aperture and slit image. | Measure the difference of the center in the slit open/close direction. |
|     |      | Aperture φ0.2: Within 0.03 | Center setting of aperture and slit image | P. 16 |
|     |      | Aperture φ1, φ2: Within 0.1 |                        |               |
| 6   | The slit image shifts due to the slit rotation. | Set the aperture to φ0.2. Rotate the slit vertically and then horizontally and measure the maximum shift distance of the slit image on the focusing rod. | Slit image shift setting when rotating the slit | Eyepiece with scale (2) Standard scale (3) |
|     |      |                             |                          |               |
| 7   | The slit image is out of focus. | Even after setting the same focal point in the microscope, the slit image is out of focus. | Focus setting of slit image | P. 17 |
|     |      |                             |                          |               |
| 8   | The slit image shifts when rotating the illumination unit horizontally (in 30° right and left each). | Rotate the illumination arm in 30° right and left each and measure the shifting distance of the slit image. [Within 0.1mm] | Slit image shift setting when rotating the slit illumination unit horizontally | Eyepiece with scale (2) Standard scale (3) |
|     |      |                             |                          |               |
| 9   | The slit image shifts due to inclination. | Project the slit image on the focusing rod horizontally and incline it. Measure the vertical shifting distance of the slit image. [Within 0.05mm] | Slit image shift setting when inclined | Eyepiece with scale (2) Standard scale (3) |
|     |      |                             |                          |               |
| 10  | Trouble of click power of small and large arms | Check the click power by placing the small and large arms at stops on the same line. | Adjustment of click power of small and large arms | P. 18 |
|     |      |                             |                          |               |
| 11  | Inclination of slit image | Project the slit image on the focusing rod and measure its inclination with the eyepiece. [Within 0.24mm at the slit length 14mm] | Adjustment of inclination of slit image | Eyepiece with scale (2) Focusing rod (3) |
|     |      |                             |                          |               |

* The width of a line provided on the eyepiece with scale is 0.02mm. When checking the accuracy, use this line as a guideline.
2-2 Adjustment

* Before carrying out adjustment, if the screw lock has been applied to a screw, dissolve it using Isoamyl acetate.

<table>
<thead>
<tr>
<th>Illustration</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| ![Illustration](image1.png) | **1. Focus setting of microscope**
① Loosen the screws 6S4×12S SUS (3 pcs.) fixing the microscope on the arm.
② Change magnification as looking into the diopter telescope. Move the microscope back and forth, tighten the screws 6S4×12S SUS where it is in focus and apply the screw lock. |

<table>
<thead>
<tr>
<th>Displayed magnification</th>
<th>Diopter difference (dpt)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>0.5</td>
</tr>
<tr>
<td>16</td>
<td>0.6</td>
</tr>
<tr>
<td>10</td>
<td>0.15</td>
</tr>
<tr>
<td>(Minimum)</td>
<td>0.35</td>
</tr>
</tbody>
</table>
2. **Focusing**

When the microscope unit does not well focus and the slit image is not clear (with magnification drum unit at 16x):

1. Remove the eyepiece unit.
   - Place the diopter telescope and sight a target as far as possible to check for diopter zero setting. The “0” on the diopter adjusting ring should be at the zero marker with 0.5 diopter allowance. If not, correct it.
2. Put into or put out the image lens frame (44670 1501) so that the finest focus is obtained at the “0” diopter on the scale. After adjustment, apply the screw lock.
3. Mount the eyepiece unit on the magnification unit.
   - Turn the magnification unit clamp knob clockwise to couple the eyepiece unit with the magnification unit, and then set the magnification drum at 25.6x. Focus each unit by moving the magnification lens frame (44670 1016) forward and backward.
4. Apply the screw lock after focusing.
3. Optical axis setting

1. Put the eyepiece with scale on the eyepiece unit and turn the diopter adjusting ring to adjust diopter.
2. Project a slit as narrow as possible (length: 9mm) on the standard scale.
3. Judge which is wrong, the magnification unit or eyepiece unit.

Set the magnification unit at 16× where no lens is set. Then, check the difference of images between when placing the slit vertically and horizontally to determine that the eyepiece is correctly adjusted.

When something is wrong with the eyepiece unit:

- Use the 6SV3×5S, 3 pcs. each on left and right sides, to move the objective lens frame (44670 1501) and adjust the difference within the standard.
- After adjustment, tighten the screws well and apply the screw lock.

When the eyepiece unit is normal:

Set the magnification unit at 40× and 25.6× and give the same checks in 1 above.

See the table at left for the difference levels.

When something is wrong with the magnification unit:

- Move the image lens frames (44670 1013, 44670 1016) with each 3 pcs. of CQ2×5S at 40× and 25.6× to be within the standard.
- After adjustment, tighten the screws well and apply the screw lock.
<table>
<thead>
<tr>
<th>Illustration</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| ![Diagram](image-url) | 4. Accuracy setting of pupillary distance prism box  
1. Remove the nut (44770 1511), loosen the screws CR3×8SUS (2 pcs. each) and remove the covers (44770 1503, 44770 1504).  
2. Put the eyepiece with scale into the microscope unit.  
3. Bring the standard scale to the front focal point of the microscope unit.  
4. Adjust the eyepiece with scale and then move the pupillary distance prism box from the minimum to the maximum to check the difference from the standard scale.  
5. Move the eyepiece holder (44670 1521) with the screws 6SV3×6S (3 pcs. each) until the image does not move even when moving the pupillary distance prism box from the minimum to the maximum (in both right and left).  
6. Tighten the screws 6SV3×6S (3 pcs. each) fully after setting the accuracy. |
### Illustration

<table>
<thead>
<tr>
<th>Illustration</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Illustration" /></td>
<td><strong>5. Adjustment of inclination unit rotary force</strong>&lt;br&gt;Release the inclination stop lever and incline the illumination unit. If the illumination unit falls by itself while the stop lever is not applied to the stopper, make adjustment with the screws T4×8S (2 pcs.) on both sides of the rotary unit for the proper weight and tighten them.</td>
</tr>
<tr>
<td><img src="image2.png" alt="Illustration" /></td>
<td><strong>6. Center setting of aperture and slit image</strong>&lt;br&gt;When the slit does not close evenly from the periphery toward the center at aperture φ0.2:&lt;br&gt;① Put the eyepiece with scale into the microscope unit and adjust the diopter with the dipoter adjusting ring.&lt;br&gt;② Project the slit size of φ0.2 on the focusing rod.&lt;br&gt;③ Check the amount of off-center by moving the slit change handle.&lt;br&gt;④ Loosen the screws 6S3×16SUS (4 pcs.) and make adjustment by moving the slit unit right and left or up and down.&lt;br&gt;⑤ Tighten the screws fully after adjustment.</td>
</tr>
</tbody>
</table>

* The above adjustment should be accompanied with Procedure 7 in the next page.
### Illustration

**7. Slit image shift setting when rotating the slit**

When the rotational center of φ0.2 moves if the aperture of φ0.2 is projected on the slit rod screen and the slit change handle is moved:

1. Put the eyepiece with scale into the microscope unit and adjust the dioptr with the dioptr adjusting ring.
2. Project the aperture of φ0.2 on the focusing rod.
3. Check the amount of movement by turning the slit change handle in 180°.
4. Adjust the eccentric axis (44630 2529) to effect “0” in up and down and “0.1” in right and left by loosening the screw V3×6S on the head of the aperture/filter unit.

* The above adjustment should be accompanied with Procedure 6 in the previous page.

### Procedure

**8. Focus setting of slit image**

1. Adjust the dioptr of the microscope unit with the dioptr adjusting ring.
2. Project the aperture of φ1.4 on the focusing rod.
3. Loosen the screws U3x3S (4 pcs.) and set the focus by moving the illumination objective lens frame in and out.
4. After focusing, tighten the screws U3x3S (4 pcs.) fully and then apply the screw lock.
9. Slit image shift setting when rotating the slit illumination unit horizontally (in 30° right and left each)

① Put the eyepiece with scale into the microscope unit and adjust the diopter with the diopter adjusting ring.
② Project the aperture of φ0.2 on the focusing rod.
③ Watch the deviation as moving the illumination arm in 30° right and left and, after loosening the screws V3x8S (2 pcs.) of the mirror bracket, adjust to keep the right and left movement within 0.1.
④ After adjustment, tighten the screws fully and apply the screw lock.

10. Slit image shift setting when inclined

① Put the eyepiece with scale into the microscope unit and adjust the diopter with the diopter adjusting ring.
② Project the aperture of φ0.2 on the focusing rod.
③ Watch the amount of movement as moving the inclination unit as shown by the arrow.
④ Make adjustment with the screws V3x8S (2 pcs.) and U3x3S (2 pcs.) of the mirror bracket.
11. Adjustment of click power of small and large arms
Adjust the click power for the proper weight with the screws 6SV3×8S (2 pcs.) and 6SU3×6S (1 pc.) and then tighten them fully.

* When the illumination arm is rotated, the click stop should be firmly sensed and it should be possible to prevent the microscope arm from rotating.

12. Adjustment of inclination of slit image
① Put the eyepiece with scale into the microscope unit and adjust the diopter with the diopter adjusting ring.
② Project the slit image after inserting the focusing rod for checking balance.
   (Project the slit image as narrow as possible to obtain the maximum length.)
③ Loosen the eccentric tightening screw (6SU5×6SUS). Adjust the inclination to be within 1° with the eccentric screw (44670 3513). After adjustment, apply the screw lock.

13. Adjustment of slit width adjusting force
When the slit width adjusting knob operation becomes too light and slit narrows the width by itself, adjust it by tightening the screw (U4×4S) in the center of slit width adjusting knob on the right.
2-3 Repairing Order

Precautions for repairs

1. The following sections describe the disassembly and assembly of units.
   For correctly repairing these components, a wide experience in assembly and adjustment of medical equipment is required. Only suitably qualified persons should carry out the following work.

2. The special tools for repair are as follows:
   • White whetstone for slit
   • Slit holder tool
   If these tools are required, order them from TOPCON.

3. Before loosening screws, if the screw lock has been applied to them, dissolve it using Isoamyl acetate. When retightening them after repair, apply the fresh screw lock.
2-3-1 Disassembly and assembly of illumination unit

<table>
<thead>
<tr>
<th>Illustration</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| ![Diagram](image1.png) | **1. Removing the slit unit**  
① Disconnect the plug of the lamp house.  
② Remove the lamp house by turning in the arrow direction.  
③ Apply the amyl solvent to the top of the screw.  
④ Remove the screws 6S3×16SUS (4 pcs.).  
⑤ Remove the slit unit by pulling up.  

| ![Diagram](image2.png) | **2. Removing the aperture/filter change lever unit**  
① Remove the screws CR2×6SUS (2 pcs.).  
② Remove the filter handle cover (44770 2601).  
* For TAC (44675 2524)  
③ Loosen the screws U2.6x2.5S (2 pcs.).  

---

R-SLD7-0-0308-11
1. When the slit does not close:
The slit must always close on the screen of the focusing rod. If not, check the slit unit for dust or foreign matters. If there is no dust or a foreign matter, carry out as follows.

- Make sure that the slit blade spring works correctly.
  (Move it in the opening direction by hand right and left.)
- Make sure that the slit width control link spring works correctly.
  (Move the slit width control link up and down with your finger.)
- Make sure that the slit width control link is tightly connected with the plate. If not, move the link up and down by turning the rod pin for adjustment.
- In case of the wedge-shaped slit blade, (after applying the amyl solvent to the top of the screws for dissolving the screw lock,) adjust it by loosening the screws CQ3×8S (2 pcs.) a little against the main blade to close completely.
<table>
<thead>
<tr>
<th>Illustration</th>
<th>Points</th>
</tr>
</thead>
</table>
| ![Illustration Points](image) | In case of the broken slit blade:  
(a) Make a marking line before disassembly to set the slit blade into the original position.  
(b) Remove the slit blade set screws.  
(c) First, whet the main blade. (Refer to the illustration on the previous page.)  
* Place the slit blade on the slit holder tool perpendicularly and evenly and whet it uniformly and horizontally. After whetting, remove burrs. When removing burrs, be careful not to damage the slit edge and scoop only the burred part lightly by hand. After whetting, wipe off the machine oil with ether and apply it thinly to the whetstone again. |

2. Stiffness and unevenness of the aperture/slit change handle  
If the aperture change handle has stiffness, unevenness or play, remove the screws CR2×6SUS (2 pcs.), remove the cover (44770 2601), loosen the set screws U2.6x2.5S (2 pcs.) of the aperture change gear (40310 2518) and adjust the tooth clearance to move smoothly.
### 2-3-2 Disassembly and assembly of power supply unit

<table>
<thead>
<tr>
<th>Illustration</th>
<th>Procedure</th>
</tr>
</thead>
</table>
| ![Diagram](image) | **1. Removing the plug P7**  
   1. Remove the screw ①.  
   2. Remove the upper and lower covers.  
   3. Remove the screws ② and ③ and then remove the socket.  
   2. Removing the plug P1  
   1. Remove the two screws ④.  
   2. Remove the screw ⑤.  
   3. Remove the clamp from the plug by turning.  
   4. Remove the cords.  
   * For TE, the earth terminal is prepared. |

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---
### 2-3-3 Trouble shooting (Main body)

<table>
<thead>
<tr>
<th>No.</th>
<th>Trouble</th>
<th>Cause</th>
<th>Remedy</th>
<th>Tool</th>
<th>Reference page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The slit does not close.</td>
<td>Dust is stuck to the slit.</td>
<td>Wipe off dust with ether many times.</td>
<td>• Eyepiece with scale</td>
<td>P.22, 23</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The slit is wedge-shaped.</td>
<td>Adjust the slit blade.</td>
<td>• Eyepiece with scale</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>There is a difference between the aperture of φ0.2 and the slit center.</td>
<td>The accuracy is not good in the incorporation of the slit unit and illumination unit.</td>
<td>Loosen the slit box tightening screws (4 pcs.) to position them accurately.</td>
<td>• Standard scale • Eyepiece with scale</td>
<td>P.16</td>
</tr>
<tr>
<td>3</td>
<td>Difference between the slit center and microscope center.</td>
<td>The reflection mirror in the illumination unit is not positioned correctly.</td>
<td>Position the reflection mirror in the illumination unit accurately.</td>
<td>• Standard scale • Eyepiece with scale</td>
<td>P.17, 18</td>
</tr>
</tbody>
</table>
2-3-4 Trouble shooting (Power supply unit)

Does the pilot lamp light when the power switch is ON?

- NO: The pilot lamp does not light. → Inspection 1
- YES: The pilot lamp blinks. → Inspection 7

Does the halogen lamp light?

- NO: The halogen lamp does not light. → Inspection 2
- YES: The light intensity of the halogen lamp change continuously by using the light adjusting volume? → Inspection 3

Is the brightness of the halogen lamp normal?

- NO: The halogen lamp is dark. → Inspection 4
- YES: 

Does the external fixation lamp light?

- NO: The external fixation LED does not light. → Inspection 5

Is R/L detected?

- NO: R/L is not detected. → Inspection 6
- YES: Normal
**Inspection 1**

<table>
<thead>
<tr>
<th>Inspection Procedure</th>
<th>Inspection Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The pilot lamp does not light.</strong></td>
<td></td>
</tr>
<tr>
<td>Have the fuses blown?</td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td>Replace the fuses ①, ② and ③</td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td></td>
</tr>
<tr>
<td>Is the power switch turned ON/OFF?</td>
<td></td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td>The power switch is faulty. Replace ①.</td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td></td>
</tr>
<tr>
<td>Is the output voltage of the SW power supply normal (5.1V/15V)?</td>
<td></td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td>The SW power supply is faulty. Replace the power supply unit.</td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td></td>
</tr>
<tr>
<td>Is the pilot lamp broken?</td>
<td></td>
</tr>
<tr>
<td><strong>YES</strong></td>
<td>The pilot lamp is faulty. Replace ②.</td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td>Wiring check (1)</td>
</tr>
</tbody>
</table>

**Inspection 7**

<table>
<thead>
<tr>
<th>Inspection Procedure</th>
<th>Inspection Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The pilot lamp blinks.</strong></td>
<td></td>
</tr>
<tr>
<td>Is the connector for light adjustment (5P) or the illumination connector set correctly?</td>
<td></td>
</tr>
<tr>
<td><strong>NO</strong></td>
<td>Connect it correctly.</td>
</tr>
</tbody>
</table>
Inspection 2

The halogen lamp does not light.

- Has the halogen lamp burned out?
  - YES: The halogen lamp is faulty. Replace.
  - NO: Wiring check (2)

Inspection 3

The light intensity of the halogen lamp does not change continuously.

- Does the light adjusting volume change?
  - NO: The light adjusting volume is faulty. Replace.
  - YES: Wiring check (3)
**Inspection 4**

**Inspection Procedure**

- The halogen lamp is dark.
  - Is the inside of the halogen lamp soiled with white or black materials? **YES**
    - The halogen lamp is faulty. Replace 🔄.
  - NO
  - Is the output voltage of the SW power supply normal (5.1V/15V)? **NO**
    - The SW power supply is faulty. Replace 🔄.
  - YES
    - Is the resistance of the light adjusting volume normal (0~30kΩ)? **NO**
      - The light adjusting volume is faulty. Replace 🔄.
    - YES
      - Wiring check (4)

**Inspection Details**

**Inspection 5**

**Inspection Procedure**

- The external fixation LED does not light.
  - Is the external fixation LED broken? **YES**
    - The external fixation LED is faulty. Replace 🔄.
  - NO
  - Is the rectifying diode broken? **YES**
    - The diode is faulty. Replace 🔄.
  - NO
    - Wiring check (5)
R/L is not detected.

Is the R/L lock switch set to "A" (auto)?

- NO: Set it to "A" (auto).
- YES: Does the microswitch operate (sound "click")?

- NO: Adjust the height of the microswitch.
- YES: Wiring check (6)
### 2-3-5 Wiring check

This section describes the special checks that are required when the problem is diagnosed as “Wiring check” in the flowcharts of “2-3-4 Trouble shooting”. The number in parentheses for the wiring check in “2-3-4 Trouble shooting” corresponds to “No.” in the following table.

Use the tester to check between “From” and “To” in “Area for checking”. If the wire passes through a part on the way, such a part is shown in “Via”. Check it at the same time. Refer to “Electric parts arrangement”.

<table>
<thead>
<tr>
<th>No.</th>
<th>Remarks</th>
<th>Area for checking</th>
<th>From</th>
<th>Via</th>
<th>To</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Disconnection</td>
<td></td>
<td>Inlet (L)</td>
<td>Fuse holder (F1)</td>
<td>SW power supply (P1-3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Power switch (SW1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Inlet (N)</td>
<td>Fuse holder (F2)</td>
<td>SW power supply (P1-1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>- Power switch (SW1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (P52-1)</td>
<td></td>
<td>Pilot lamp (PL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (P52-2)</td>
<td></td>
<td>Pilot lamp (PL)</td>
</tr>
<tr>
<td>(2)</td>
<td>Disconnection/Short circuit</td>
<td></td>
<td>Connector (P2-1)</td>
<td></td>
<td>Halogen lamp (HL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (P2-2)</td>
<td></td>
<td>Halogen lamp (HL)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (J1-3)</td>
<td>Connector (P2-3-P1-1)</td>
<td>Volume (CN1-1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (J1-4)</td>
<td>Connector (P2-4-P1-2)</td>
<td>Volume (CN1-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (J1-5)</td>
<td>Connector (P2-5-P1-3)</td>
<td>Volume (CN1-3)</td>
</tr>
<tr>
<td>(3)</td>
<td>Disconnection/Short circuit</td>
<td></td>
<td>Connector (J1-3)</td>
<td>Connector (P2-3-P1-1)</td>
<td>Volume (CN1-1)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (J1-4)</td>
<td>Connector (P2-4-P1-2)</td>
<td>Volume (CN1-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (J1-5)</td>
<td>Connector (P2-5-P1-3)</td>
<td>Volume (CN1-3)</td>
</tr>
<tr>
<td>(4)</td>
<td>Disconnection/Short circuit</td>
<td></td>
<td>Same as Wiring check (2).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5)</td>
<td>Disconnection</td>
<td></td>
<td>Connector (P2-1)</td>
<td>Diode (D2)</td>
<td>External fixation LED (LED2-A)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (P2-3)</td>
<td>Resistor (R1)</td>
<td>External fixation LED (LED2-K)</td>
</tr>
<tr>
<td>(6)</td>
<td>Disconnection</td>
<td></td>
<td>Connector (CN2-4)</td>
<td></td>
<td>Switch (SW2-4)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Connector (CN2-8)</td>
<td></td>
<td>Switch (SW2-3)</td>
</tr>
</tbody>
</table>
2-3-6 Electric parts arrangement

(1) PS-70/PS-70A/PS-70E Power supply
   * PS-70E (for TE) is equipped with the insulation plate and fireproof plate.
(2) Halogen lamp cord
(3) Halogen lamp and socket
(4) External fixation target

(5) Cross slide unit
## 2-3-7 List of electric part numbers

<table>
<thead>
<tr>
<th>No.</th>
<th>Part name</th>
<th>Symbol</th>
<th>Order No.</th>
<th>Rating</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Power switch</td>
<td>SW1</td>
<td>44770 60520</td>
<td>SF-W201A-30BB (Echo Denshi)</td>
<td></td>
</tr>
<tr>
<td>②</td>
<td>Pilot lamp</td>
<td>LED1</td>
<td>40416 51260</td>
<td>DB-1 (Green) (Sato Parts)</td>
<td></td>
</tr>
<tr>
<td>③</td>
<td>Fuse</td>
<td>F1, F2</td>
<td>44655 60030</td>
<td>3TT1 (Bell Fuse)</td>
<td>Japan/TMS</td>
</tr>
<tr>
<td>④</td>
<td>Fuse</td>
<td>F1, F2</td>
<td>44770 63510</td>
<td>5TT750 (Bell Fuse)</td>
<td>TE/TS/General</td>
</tr>
<tr>
<td>⑤</td>
<td>Connector</td>
<td>J1</td>
<td>44680 60020</td>
<td>RM12BRD-6S (Hirose)</td>
<td></td>
</tr>
<tr>
<td>⑥</td>
<td>Inlet</td>
<td>J2</td>
<td>40420 55330</td>
<td>MAB3 (Harshmann)</td>
<td></td>
</tr>
<tr>
<td>⑦</td>
<td>Inlet</td>
<td></td>
<td>44630 67730</td>
<td>AP-340 (YAMATE DENKEN)</td>
<td></td>
</tr>
<tr>
<td>⑧</td>
<td>Receptacle</td>
<td>CN2</td>
<td>T22000316A</td>
<td>HR12-10R-8SD (Black) (Hirose)</td>
<td></td>
</tr>
<tr>
<td>⑨</td>
<td>Receptacle</td>
<td>CN1</td>
<td>44642 31520</td>
<td>HR12-10R-5SD (Black) (Hirose)</td>
<td></td>
</tr>
<tr>
<td>⑩</td>
<td>Plug</td>
<td>P2</td>
<td>44680 41520</td>
<td>RM12BPG-6P (Hirose)</td>
<td></td>
</tr>
<tr>
<td>⑪</td>
<td>Plug</td>
<td>P3</td>
<td>40420 55320</td>
<td>MAS30 (Harshmann)</td>
<td></td>
</tr>
<tr>
<td>⑫</td>
<td>Power cord set</td>
<td></td>
<td>42364 51100</td>
<td>(Hanai Densen)</td>
<td>Japan</td>
</tr>
<tr>
<td>⑬</td>
<td>Power cord set</td>
<td></td>
<td>44681 65010</td>
<td>(Hanai Densen)</td>
<td>TMS</td>
</tr>
<tr>
<td>⑭</td>
<td>Power cord set</td>
<td></td>
<td>40130 50041</td>
<td>(Hanai Densen)</td>
<td>TE/TS/General</td>
</tr>
<tr>
<td>⑮</td>
<td>Socket pin</td>
<td></td>
<td>44680 41580</td>
<td></td>
<td></td>
</tr>
<tr>
<td>⑯</td>
<td>Plug</td>
<td>P1</td>
<td>44642 41510</td>
<td>HR10LAPS600 (Black) (Hirose)</td>
<td>TMS</td>
</tr>
<tr>
<td>⑰</td>
<td>Diode</td>
<td>D2</td>
<td>06510 20760</td>
<td>IS2076A (Hitachi)</td>
<td></td>
</tr>
<tr>
<td>⑱</td>
<td>External fixation LED</td>
<td>LED2</td>
<td>44670 42060</td>
<td>HBR5566X (Stanley)</td>
<td></td>
</tr>
<tr>
<td>⑲</td>
<td>Halogen lamp</td>
<td>H.L.</td>
<td>44680 25700</td>
<td>(LIFEEREX)</td>
<td>12V 30W</td>
</tr>
<tr>
<td>⑳</td>
<td>Halogen lamp socket</td>
<td>H.L.</td>
<td>44680 25900</td>
<td>990/245 (BENDA &amp; BIRUTS)</td>
<td></td>
</tr>
<tr>
<td>⑴</td>
<td>Light adjusting volume</td>
<td>VR1</td>
<td>44642 31540</td>
<td>RV16YNB303 (TOCOS)</td>
<td>30kΩ</td>
</tr>
<tr>
<td>⑵</td>
<td>Connector</td>
<td>J3</td>
<td>40414 49100</td>
<td>HR10A-7R-4S (Hirose)</td>
<td></td>
</tr>
<tr>
<td>⑶</td>
<td>Switch</td>
<td>SW3</td>
<td>44770 38010</td>
<td>SRRN134300 (Alps Denki)</td>
<td></td>
</tr>
<tr>
<td>⑷</td>
<td>Microswitch</td>
<td>SW1</td>
<td>T20000203A</td>
<td>AVL325561 (Matsushita Denki)</td>
<td></td>
</tr>
</tbody>
</table>
### 2-4 List of Repair Tools

#### 2-4-1 List of special repair tools

<table>
<thead>
<tr>
<th>Tool No.</th>
<th>Name</th>
<th>Illustration</th>
<th>Function/accuracy</th>
<th>Application</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Diopter telescope</td>
<td><img src="image1" alt="Illustration" /></td>
<td>Observation magnification (3.4x)</td>
<td>• Setting the same focus by magnification</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Eyepiece with scale</td>
<td><img src="image2" alt="Illustration" /></td>
<td>Eyepiece magnification (12.5x) Thickness of scale line (0.02mm)</td>
<td>• Setting the parallelism of the slit image • Slit width change by slit image rotation • Image shift by pupillary distance adjustment</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Standard scale</td>
<td><img src="image3" alt="Illustration" /></td>
<td>Thickness of scale line (0.02mm) Interval of one graduation (0.1mm)</td>
<td>• Image shift by pupillary distance adjustment • Difference between aperture and slit • Slit image shift by slit rotation • Slit image shift by inclination • Slit image shift when rotating the slit illumination unit horizontally (in 30° right and left each)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Focusing rod (with vertical marking line)</td>
<td><img src="image4" alt="Illustration" /></td>
<td></td>
<td>• Inclination of slit image</td>
<td></td>
</tr>
</tbody>
</table>

#### 2-4-2 List of general repair tools

- Tester (that can measure voltage, current and resistance)
- Radio pliers
- Set of six slotted screwdrivers
- Nippers
- Set of four Phillips screwdrivers
- Tweezers
- Wooden handle Phillips screwdriver for 3mm
- Soldering iron
- Tweezers
- Wooden handle Phillips screwdriver for 3mm
- Solder