

7109-C-244E-R1

Field Installation of HeNe Laser
in B, C, and D-Type Auto Gain
Ellipsometers



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INTRODUCTORY NOTES

This document does not contain instructions for the removal of the Microspot Optics for the purpose of HeNe laser replacement in Series L116B/C/D and L115B/C/D Ellipsometers. *If your ellipsometer is equipped with the Microspot Optics*, then first refer to document no. 7109-C-244F for the Microspot Optics removal procedure before proceeding with the instructions that follow.

1.0 REMOVING DEFECTIVE LASER

- 2.1 Turn key-operated Power Switch to OFF and disconnect the line cord from the AC Voltage outlet.
- 2.2 For L116B/C and L115B/C Series Ellipsometers:
Detach instrument power supply from the rear of the index plate (Figure 1) by removing four screws, one at each corner of power supply base plate. Carefully lower the instrument power supply to surface of the work area.
For L116D and L115D Ellipsometers:
On the rear of the index plate (Figure 1), locate the large knurled screw at the top center of the power supply base plate. Loosen the knurled screw sufficiently to enable the top of the instrument power supply to swing free from the backside of the index plate. Gently lay the power supply down.

WARNING

Exercise care in performing Step 2.3 as residual high voltage can be present.

- 2.3 Disconnect the laser cable from the laser power supply module by pulling apart at the 2-pin white connector. Discharge laser voltage by placing a 1K-to-2K resistor between the two exposed pins of the white connector.
- 2.4 Loosen screw at the center of incidence angle indicator (Figure 1) and move indicator counterclockwise to allow access to the laser cable. Remove all laser cable clamps and cut any plastic ties that secure the laser cable to other wires or cables. Withdraw the laser cable (with attached connector) through the opening located at the bottom of the index plate.
- 2.5 Using a 3/32-inch hex key, loosen only the top screw of the set of three adjust screws (Figure 1) on the laser mount. Then, loosen only the top and front hex screws of the set of four adjust screws (Figure 1).
- 2.6 Withdraw the defective laser head from the mounting arm (laser mount).

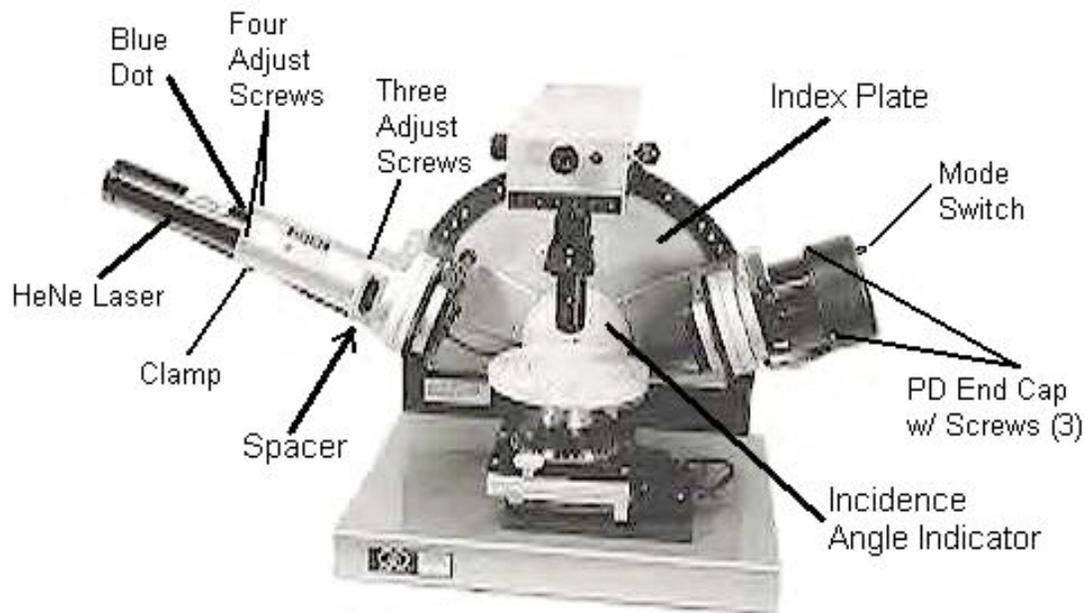


Figure 1. Laser Removal and Installation

3.0 INSTALLING NEW LASER

- 3.1 If so equipped, remove the protective plastic cap from the output end of the new HeNe laser head.
- 3.2 Insert new laser, with blue (decal) dot up, into the mounting arm until the forward end of blue dot (Figure 1) is at the edge of the laser mounting arm.
- 3.3 Hold the laser in position and lightly tighten the top screw of the set of three adjust screws (Figure 1), and also lightly tighten the top and front screws of the set of four adjust screws (Figure 1) loosened earlier in Step 2.5.
- 3.4 Route the laser cable (with attached connector) through the opening at the bottom of the index plate. Re-install the laser cable clamps and replace plastic ties (removed in Step 2.4) as needed. Set incidence angle indicator back to its original position and secure screw at center of indicator.

CAUTION

Some of the older instrument power supplies are equipped with a current set jumper (CSJ). This should be connected for the new laser.

- 3.5 Connect the laser cable to the laser power supply and then re-attach the instrument power supply to the rear of the index plate.

4.0 LASER BEAM CHECK

- 4.1 Plug the line cord back into the available AC Voltage outlet. Turn key-operated Power Switch to ON. Do not look into laser beam exit aperture (polarizer pinhole) (Figure 2).
- 4.2 Place a small sheet of white paper near the sample table (Figure 2) in the expected optical path of the laser beam. Look to see if any laser beam emission through the polarizer pinhole is being imaged on the white paper. If no laser beam emission is seen, then adjust the (set of) three screws (Figure 1) until some beam emission is seen. Maintain the screws in light contact with the laser assembly.

5.0 LASER ALIGNMENT

- 5.1 Position polarizer and analyzer arms at 90° angle of incidence like shown in Figure 2. Be sure that black knurled screw clamp on the back of each arm is snug tight.
- 5.2 Set polarizer drum at 45° (if not already at that position). Lower the sample table to assure that the laser beam is not obstructed by it.
- 5.3 Fasten P/N 10026-100 Alignment Lens (Figure 2) over the aperture of the polarizer pinhole using the captive screw. (The captive screw goes into the threaded hole that is about 20 mm. away from the polarizer pinhole near the “10 o’clock” position.)
- 5.4 Rotate the alignment lens downward in contact with the aperture of the polarizer pinhole. On the sheet of white paper (Figure 2), observe the projected image of the polarizer pinhole (magnified approximately 25 times). See View B-B as in Figure 2. Use the three adjust screws (Figure 1 and Figure 2) to center the laser beam within the polarizer aperture.
- 5.5 Rotate the alignment lens upward (away from the laser beam) and remove the white paper from the optical path of the beam.
- 5.6 Using the four adjust screws (Figure 1 and Figure 2), center the laser beam spot on the aperture of the analyzer pinhole, as in View A-A (Figure 2).

NOTE

Each adjustment step will reduce the misalignment by

approximately one-half. Repeat Steps 5.4 through 5.6 until the laser beam is centered as shown in View A-A and View B-B, concurrently.

- 5.7 Detach the Alignment Lens from the polarizer plate and set it aside. *If your ellipsometer is equipped with the Microspot Optics*, then refer to Sections 6.0 and 7.0 of Document #7109-C-244F for installation of the Microspot Optics before proceeding.

NOTE

When a new laser is installed in an (auto gain) ellipsometer, the low gain trigger of the photodetector will usually be a little off of the level desired for optimum operation. This can be compensated for by adjustment of a variable attenuator and/or gain pots (potentiometers). The following sections will explain how to accomplish the adjustment(s).

6.0 LASER POWER ADJUST TO SET GAIN TRIGGER

- 6.1 If not already done, the dedicated computer should be powered-off, and the interface cable should be disconnected at the place where it plugs into the ellipsometer. Polarizer and analyzer arms must remain at 90° angle of incidence. The Mode Switch (Figure 1) should be set in the “**AS**” (middle) position.
- 6.2 Set the Analyzer Drum (Figure 2) to **105°**. (If your drum is not fully labeled for 100°, 110°, 120° and so on; then just locate the place on the drum that is 15 scale divisions beyond the 90° mark.)
- 6.3 Determine if the laser has the adjustable variable attenuator. If it is present, the variable attenuator will be accessible at the spacer (Figure 1) on the laser mount. Inside the cavity of the spacer there should be visible a push/pull set of two 1/16-inch hex screws (set screw and cap screw). If both of these hex screws are not visible, then you probably have a laser with the fixed-version attenuator or no attenuator at all, and you should skip to **Section 7.0**. Otherwise, proceed as follows.
- 6.4 The push/pull (set of) screws for the variable attenuator have a maximum travel of at least 10 full turns which yields a total change in laser beam intensity of about 40%. To increase laser output, loosen the set screw (counter-clockwise) one or two full turns at a time, and then tighten the cap screw (clockwise) to pull attenuator into contact with the set screw. To reduce laser output, begin instead by loosening the cap screw, and then tightening the set screw. The attenuator is to be adjusted such that an

output of about 90 is observed on the LED gain meter.

- 6.5 If there was sufficient range of adjustment in the attenuator to set the output as directed above, then proceed (skip) to **Section 8.0** for closing remarks. If the required output could not be achieved solely by adjustment of the attenuator, then continue on to the next section to adjust the gain pot(s).

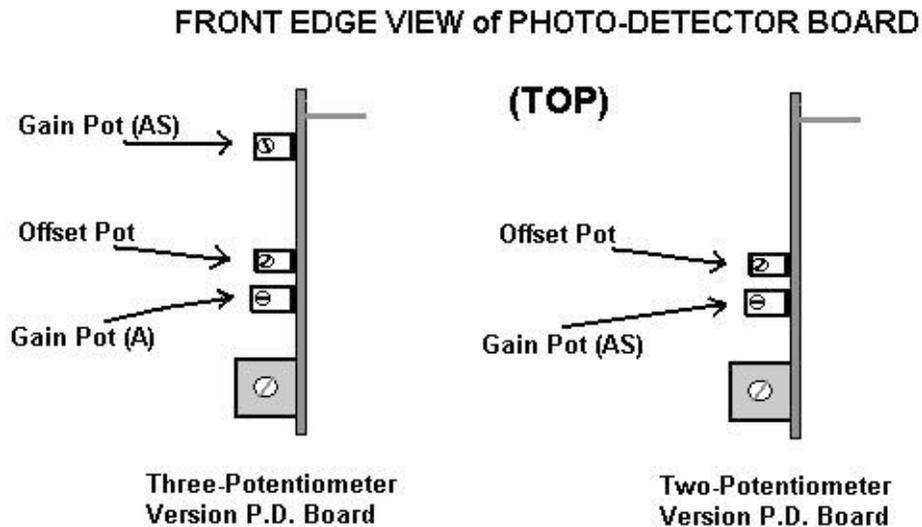


Figure 1a. Gain Pot Location for Two Versions of the P.D. Board

7.0 GAIN POT ADJUST TO SET GAIN TRIGGER

- 7.1 Loosen and remove the two screws on either side of the Mode Switch toggle. Locate the three screws (120° apart) along the rim of the PD End Cap (Figure 1). Loosen these screws a few turns and pull the PD End Cap away from the end of the analyzer/ellipsometer.
- 7.2 With the PD End Cap removed, one of the two versions of the P.D. Board will be visible to you. Identify the version you have in Figure 1a, above. If your P.D. Board is the “two-potentiometer” version with the single gain pot, then continue to the next step. Otherwise, skip down to Step 7.4.
- 7.3 Using a small-bladed screwdriver adjust the single gain pot (Figure 1a, right-hand side) until an output of about 90 is observed on the LED gain meter. Check to make sure that the Analyzer Drum has not shifted from the **105°** setting. Once you have successfully completed this step, skip down to Step 7.7.

- 7.4 If you have the “three-potentiometer” version P.D. board (Figure 1a) you must adjust the gain as follows. Put the Mode Switch in the “**A**” position. If the analyzer drum starts rotating and it does not immediately stop, then gently grasp the edge of the drum to stop the rotation. With your hand, turn the Analyzer Drum so that it is set at **45°**, just as the polarizer drum is. Using a small-bladed screwdriver adjust the lowermost gain pot (Figure 1a, left-hand side) until an output of about 90 is observed on the LED gain meter.
- 7.5 Now set the Analyzer Drum to **105°**. The output observed on the LED gain meter should now be about 20 – 25. Put the Mode Switch in the “**AS**” position and the LED gain meter output should jump back up toward 90. If not, adjust the uppermost gain pot (Figure 1a, left-hand side) until an output of 90 is achieved.
- 7.6 Adjustments made on the lowermost and uppermost gain pots do tend to affect one another, so it is usually necessary to repeat Steps 7.4 and 7.5 until the required outputs on the LED gain meter are balanced and stable.
- 7.7 Re-mount the PD End Cap onto the analyzer taking care to align the two screw holes on the Mode Switch’s mounting bracket with the two holes in the outer surface of the PD End Cap. Tighten all screws loosened or removed in Step 7.1. While securing and tightening the two screws on either side of the Mode Switch toggle you should work the toggle through the three switch positions (A, AS, M) to assure that the switch does not bind once the screws are tightened.

8.0 CLOSING REMARKS

Reconnect the interface cable, power-on the computer, and return the polarizer and analyzer arms to 70° angle of incidence. Place a known reference film sample on the sample table and perform the pre-measurement sample stage alignment procedure for tilt and table height. Take a measurement of the reference film to confirm restored operation of the ellipsometer. If any problems remain you should consult the Service Department of Gaertner Scientific using contact information provided on the cover page of these instructions.

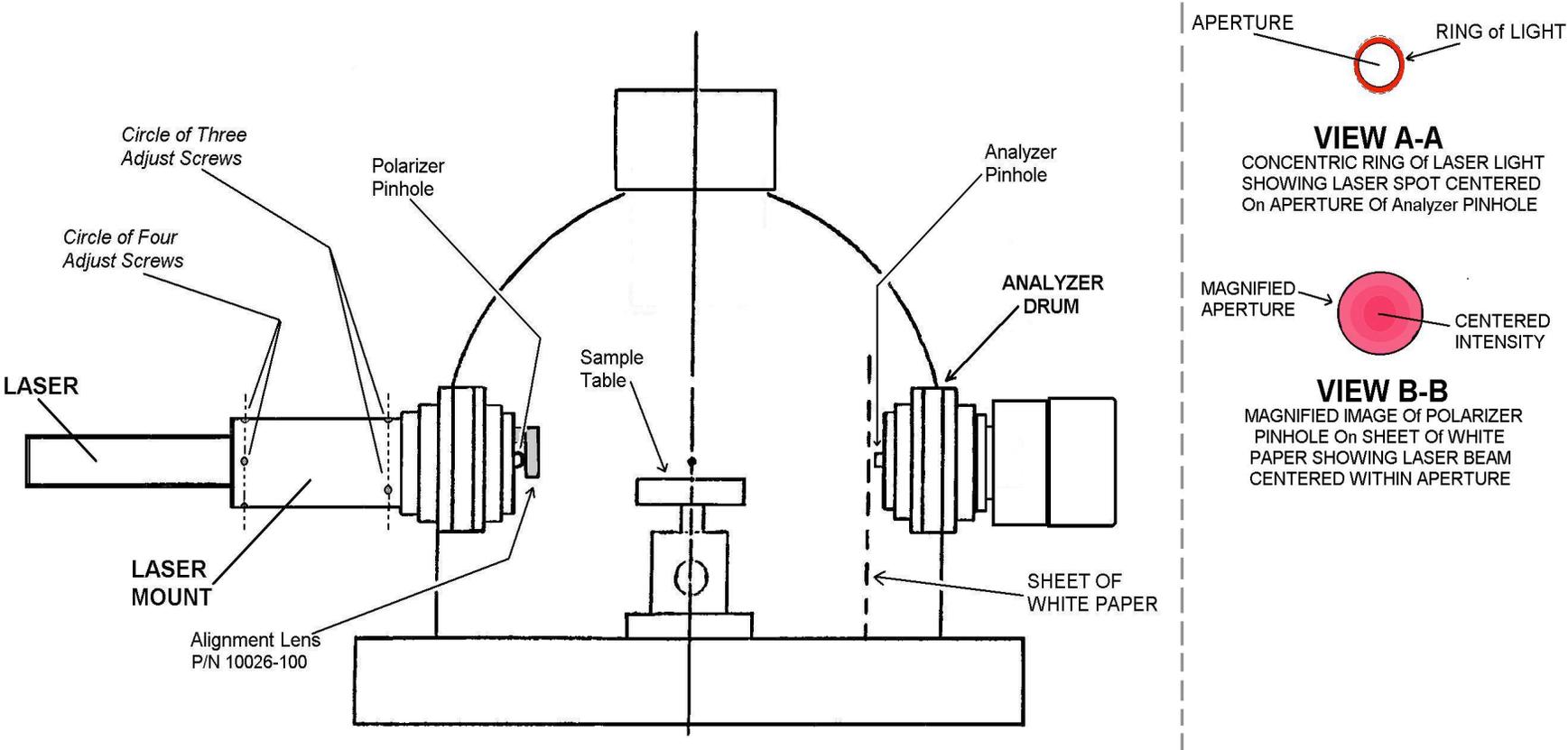


Figure 2. Laser Alignment