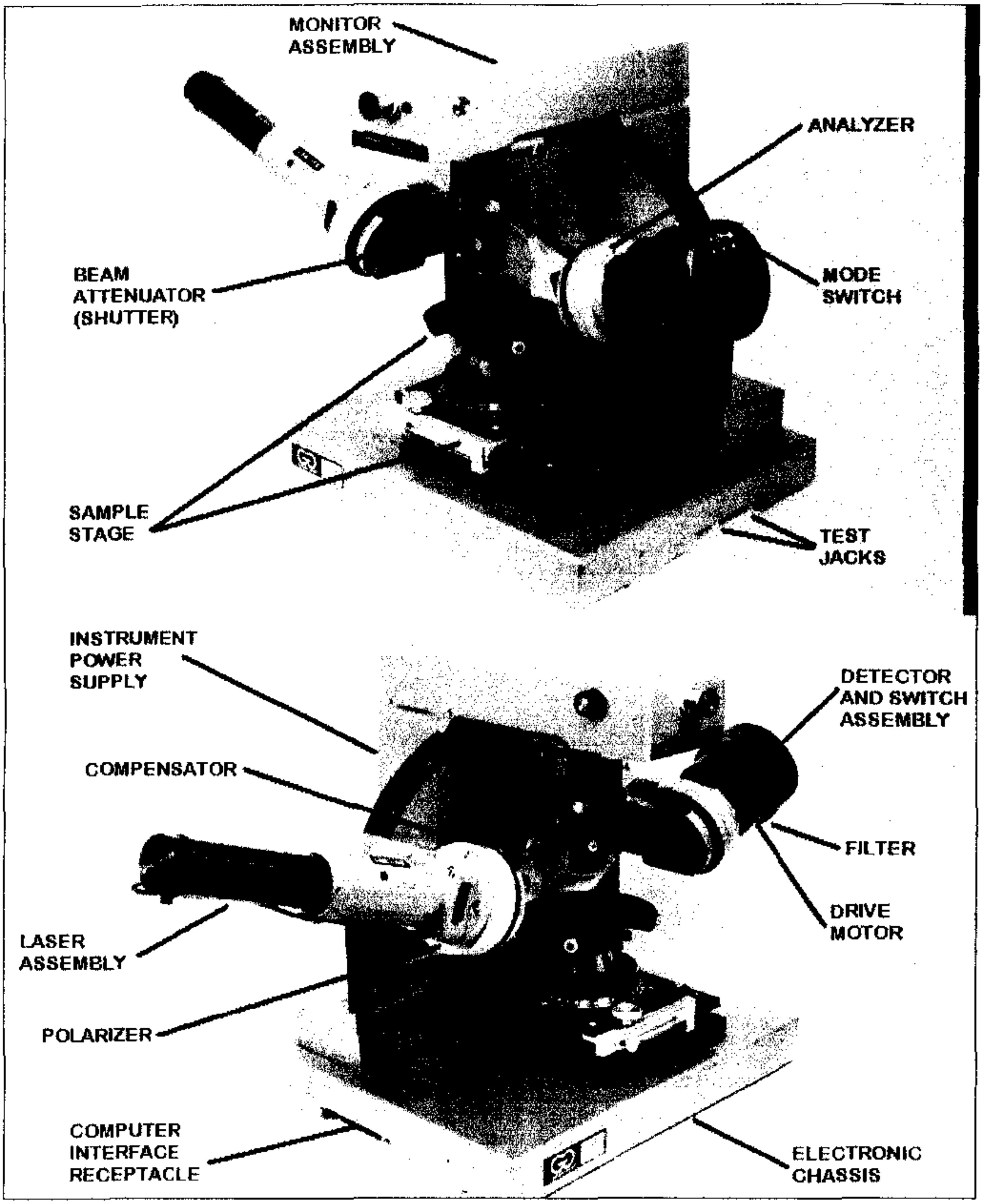
L116B/C Labeled



1.8 TROUBLE ANALYSIS

This ellipsometer should have long-life, trouble-free operation. In the event of a malfunction, symptoms are readily traceable by the use of built-in test jacks and intermediate check points. This should be done by qualified service personnel. Fault isolation involves trouble-shooting to identify the cause of failure only to a component or assembly readily removable for further fault isolation and repair or replacement. During automatic operation, a malfunction is usually shown by no measurement data, inconsistent measurements, or even operator-induced errors.

1.1 Measurement System

During automatic operation, the analyzer drum (with the prism inside) rotates at a speed regulated by a closed-loop, motor-speed control system. (See Figure 7-1, next page.) Motor pulses originating at discrete intervals from an encoder are amplified and applied to the input of a motor speed controller. Within the encoder, the pulses are derived from a phototransistor circuit activated by a light emitting diode (**LED**). Actual motor speed is determined by frequency-to-voltage conversion of the input. This voltage is compared to an externally preset reference voltage. The result of the comparison controls the drive voltage to the motor, keeping the motor speed constant. A " **stall timer** " prevents motor burn-out in the event of a mechanical stall.

Intensity readings of the reflected light, as sensed by the photodetector, are taken at **5°** intervals during one revolution of the analyzer prism, beginning at **0°** and ending at **355°**. The readings are taken in the dual mode, sequenced under program control via input from the computer. One set of readings (**72 data points**) is taken with the **+90°** compensator in the optical path. The other set of readings is taken with the compensator withdrawn from the optical path.

The output current of the photodetector is converted to an analog voltage varying sinusoidally in amplitude and proportional to the intensity of the reflected light. The analog output is amplified and applied to the input of an analog-to-digital (**A / D**) converter. A zero offset adjustment in the photodetector circuit is factory preset to ensure optimum accuracy in measurement, especially for very thin films. After each set of readings, the maximum analog output is checked by the computer software. If measurement accuracy can be improved by changing the gain, the **CTL 1** input logic will switch the gain range and a repeat set of readings will be taken. A logic " **0** " closes the switch, decreasing the gain; a logic " **1** " opens the switch, increasing the gain.

A reference pulse from an optical switch and between **356°** and **359°** of the analyzer drum rotation, initiates the measurement cycle. The reference pulse is derived from a phototransistor circuit activated by a **LED**. If a peripheral control (**PCTL**) signal from the computer is present during the period of the reference pulse, indicating that the computer is ready to accept a reading, a timer is activated (turned on).

(section 1.1 continued on page 7-4)

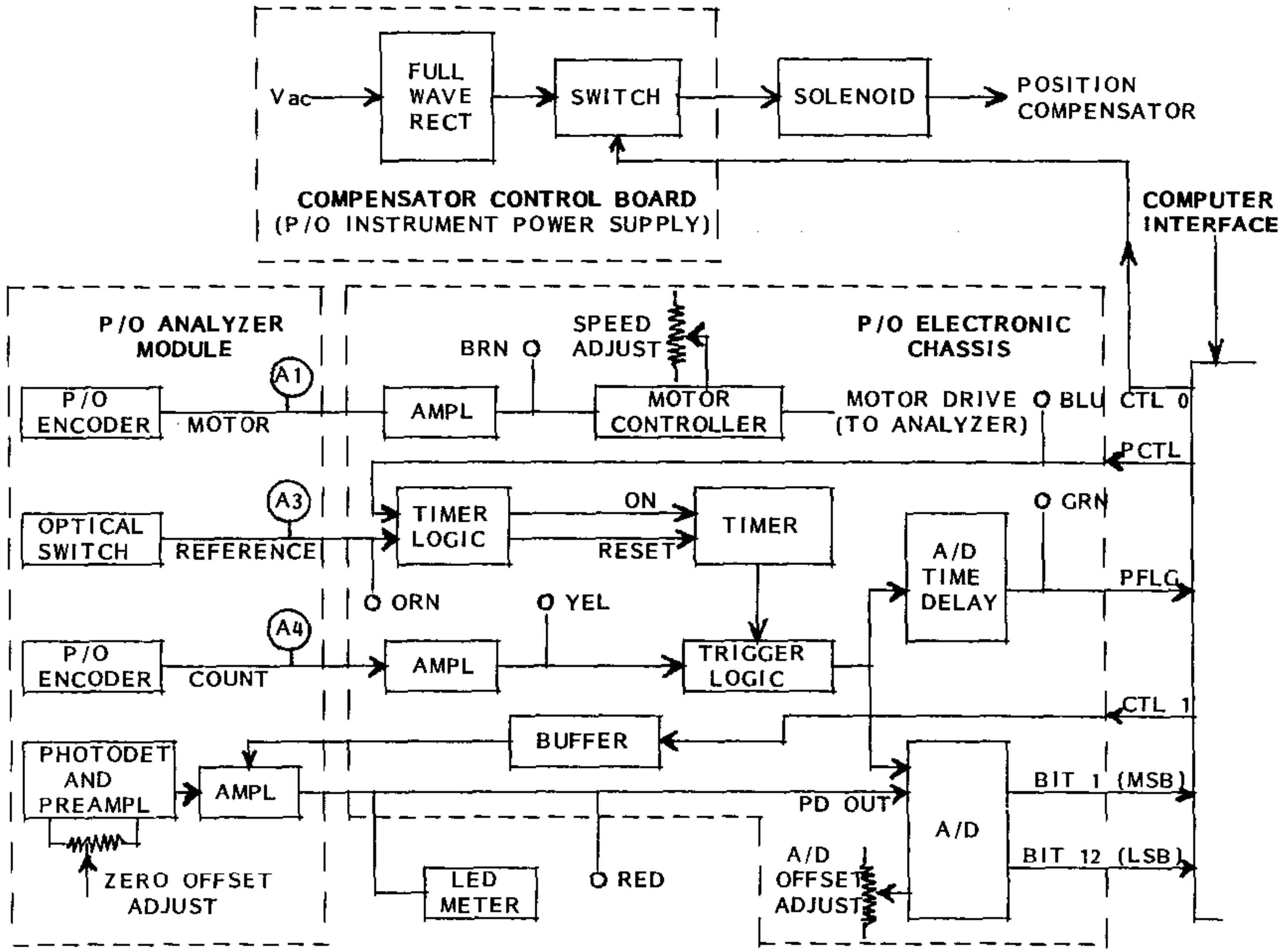
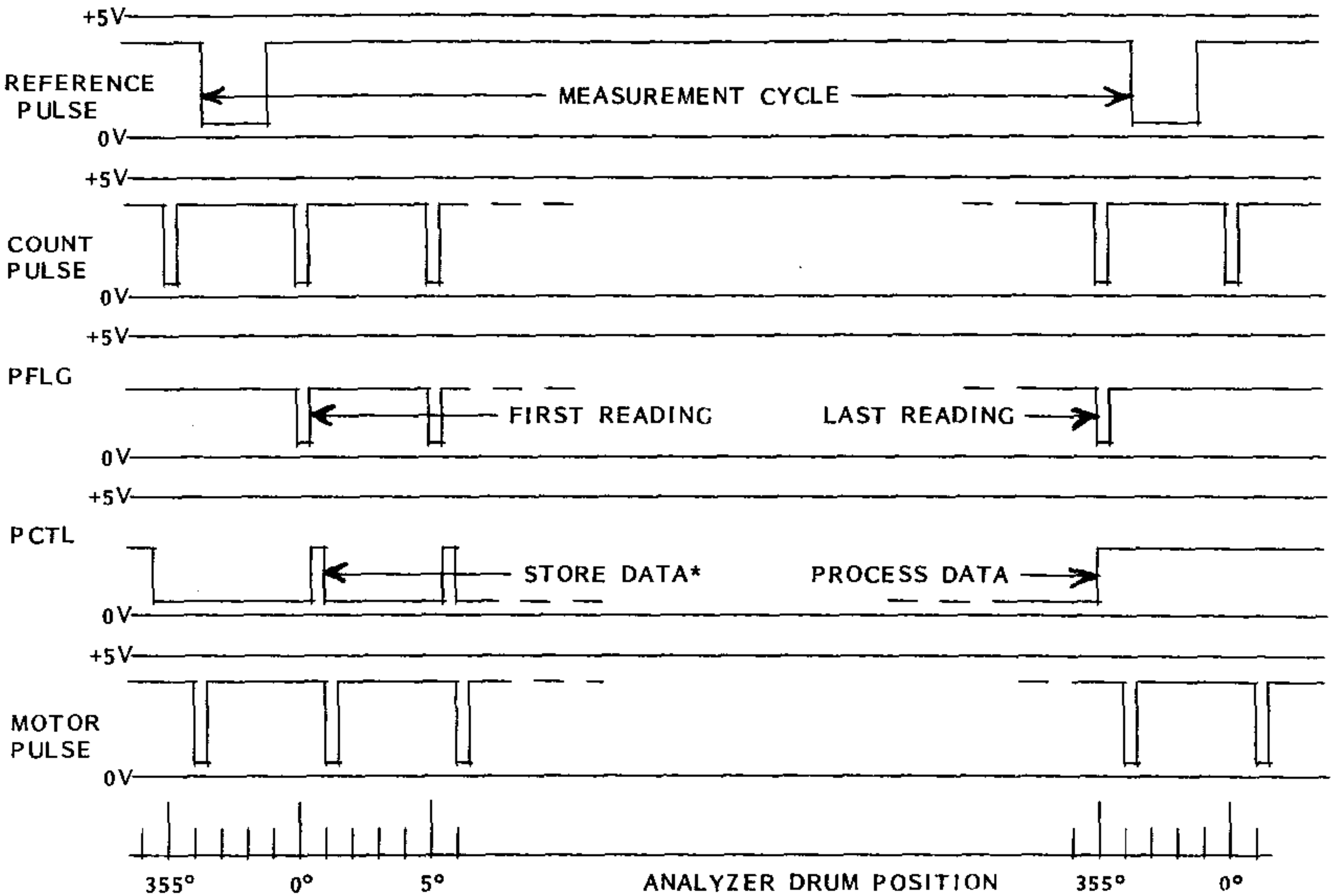


Figure 7-1. This is the Measurement System Functional Diagram.



* The STORE DATA pulses will not appear in some makes of computers.

Figure 7-2. These are typical pulses during the Measurement Cycle.

1.1 Measurement System (Continued)

For the first set of readings count pulses, starting at the **0°** position of the analyzer rotation, trigger the **A / D** converter to accept the photodetector analog output. The count pulse is derived from a phototransistor circuit activated by a **LED** in the encoder, in the same manner as previously described for the motor pulse. About **30 microseconds** later, allowing time for **A / D** conversion, a peripheral flag (**PFLG**) signal Is sent to the computer. Indicating that a set of readings is ready for the computer.

The reading, in **12-bit** digital format, is then accepted by the computer. The cycle is repeated for each subsequent count pulse, occurring every **5°**, until **72** readings have been processed and stored by the computer. The next reference pulse resets the timer and terminates the measurement cycle.

Under program control, the compensator position is changed and a second set of **72** readings is taken in the same manner as previously described. An external **PD** zero offset adjust is factory preset to set zero light level of the **A / D** conversion such that measurements are insensitive to changes in gain of the photodetector output, ensuring minimum distortion.

A solenoid-operated slide places the **+90°** compensator in the laser-light path and then removes it from the light. When a " **control zero** " (**CTL 0**) signal from the computer is applied to a switching transistor circuit on the compensator control board, the solenoid Is energized to insert the compensator in the optical path. When the **CTL 0** signal is at logic **0**, the solenoid is de-energized to remove the **+90°** compensator from the optical path.

1.2 Test Jacks

Seven color-coded test jacks (including a common ground) are on the right side of the electronic chassis at the base of the ellipsometer. These test jacks are useful in trouble-shooting to identify symptoms of malfunction and to isolate faults without first requiring access to the interior of the ellipsometer. These test points (with a trimpot on each end) are identified as follows:

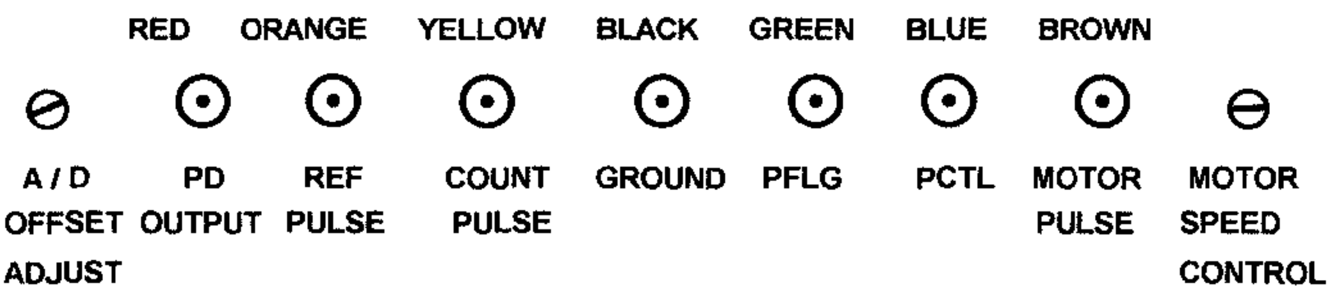


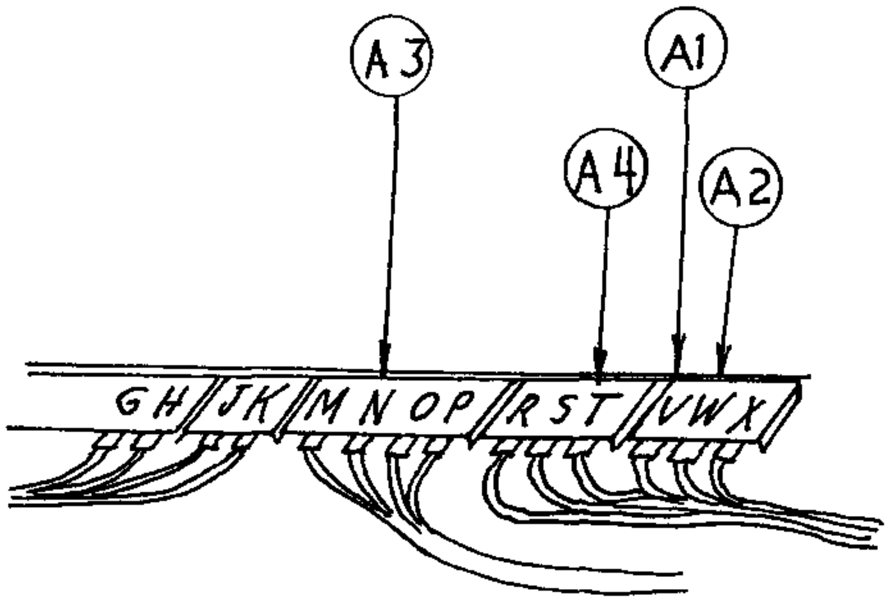
Figure 7-3. These are seven test jacks and two trimpots on the right side of the ellipsometer base.

1.2 **Test Jacks** (Continued)

NOTE: Logic 1 is less than one (1) volt. Logic **0** for reference, count and motor pulses is greater than **4.0 volts**. Logic **0** for **PCTL** and **PFLG** is greater than **3.0 volts**.

- **PD Output** The photodetector / amplifier output is sinusoidal with an amplitude of up to 10V, peak to peak and a period of **180°** of the analyzer drum rotation.
- **Ref Pulse** This pulse occurs between **356°** and **359°** of the analyzer drum rotation. These pulses are always present as long as the drum is rotating (in automatic, with the Mode switch at **A**). Logic **1** starts the automatic measurement cycle if the logic **1 PCTL** (peripheral control) signal is also sent by the computer.
- **Count Pulse** These pulses occur within ½ ° of the analyzer drum position readings evenly divisible by five, between **0°** and **355°** of the analyzer drum rotation. Logic **1** triggers an **A / D** converter to accept the photodetector output during the measuring cycle.
- **Ground** This is the common ground for any measurement at each test jack and check point.
- **PFLG** These pulses are the logic **1** peripheral flag signals to the computer (only during the measurement cycle) and occur about **30** microseconds after the leading edge of each count pulse. They indicate that a reading is ready for the computer. The pulses end at trailing edge of count pulse.
- **PCTL** These are the logic **1** peripheral control pulses from the computer (only during the measurement cycle). They signal the system that the computer is ready to accept a reading. When the pulses are coincident with the reference (**ref**) pulse, a timer is activated for the duration of the measurement cycle.
- **Motor Pulse** These pulses occur ½ ° to **1**- ½ ° after each count pulse.

Typical outputs at these test jacks (except the **PD** output) are shown in Figure 7-2. The use of an oscilloscope with a high -persistancy screen or a storage cathode-ray tube would display the waveforms clearer because of the slow sweep across the screen when the reference pulses are observed. An oscilloscope with two or more traces is needed to compare the pulses. It may be necessary to use the oscilloscope's external trigger on the reference pulse for a more stable pulse display.



Fiqure 7-4. These are the four Check Points (A1 to A4) in Figure 7-1 (which does not show A2). In order to observe the waveform or measure the voltage, carefully pull out the appropriate connector just enough to carefully insert a sharp probe (with the common probe at the black test jack).

1.3 Troubleshooting

Table 7-1, starting on the next page, lists the symptoms of malfunction, possible causes and corresponding actions relative to fault isolation. The symptoms are listed in a sequence generally reflecting the operating procedure, i.e., premeasurement setup and measurement procedure. As a troubleshooting guide, the listing assumes all **dc** power supplies are operative and no discontinuity in wiring. Certain fault isolation actions are keyed to intermediate check points **A1** to **A4**. The check points are shown in Figures 7-1 and 7-4 and are just below the photodetector board in the detector/switch assembly section of the analyzer module. Remove the detector/switch assembly cover for access to these four check points.

Table 7-1. TROUBLESHOOTING GUIDE

SYMPTOM	POSSIBLE CAUSE	FAULT ISOLATION
No power to the ellipsometer (Key switch at **ON**)	No line voltage	Verify that the ellipsometer power cord is seated in an **ac** power outlet.
		Check the fuse; replace if defective. It is **.75A**, Slow blow (Figure 7-6).
Emission indicator does not Illuminate at power turn-on	Lamp burned out	Replace the lamp. If the problem is still present, the instrument power supply transformer or Monitor assembly transformer may be at fault.
No light is emitted from the polarizer aperture	The Beam attenuator is closed	Check the position of the attenuator; if it is closed, **PULL TO OPEN IT**.
	Defective laser or laser power supply	Need the replacement / alignment of a laser or removal of instrument power supply for repair (contact **Gaertner**).
No **LED** meter reading during the sample table alignment	No **PD** output (verify at red test jack on electronic chassis)	If the **PD** output is correct, the LED meter may be defective.
		If the **PD** output is incorrect, the **PD** board may be defective. Remove the PD board for analysis / replacement.

Table 7-1. TROUBLESHOOTING GUIDE (Continued)

SYMPTOM	POSSIBLE CAUSE	FAULT ISOLATION
The analyzer drum does not rotate (the Mode is at **A**)	There is no motor drive output (assumes no	Observe the motor pulse output at the brown test jack (Figure 7-3). If it is proper, the motor board may be defective.
		If the motor pulse is incorrect, observe the encoder output at check point **A1** (Figure 7-4). If the pulse is correct at **A1**, the **EBT** board may be defective.
		If the pulse is improper at **A1**, measure the voltage at check point **A2**. If the voltage (**+3V dc**) is incorrect at **A2**, the regulator on the buffer / count board may be defective. If it is proper, the encoder may be defective (contact **Gaertner**).

NOTE:
If the EBT board or motor board is found to be defective, remove the chassis assembly for further fault isolation, repair or replacement.

Table 7-1. TROUBLESHOOTING GUIDE (Continued)

SYMPTOM	POSSIBLE CAUSE	FAULT ISOLATION
No binary (**A / D**) data output (all zeros)	The measurement cycle is not initiated	Reset and reload the program. Initiate the measurement. If the symptom persists, observe the reference pulse output at the orange test jack. With the Mode switch at **A**, stall the motor; and look for a pulse around **357°** to **359°** on the analyzer drum. If it is present, verify that the **PCTL** logic **1** (**0** to **1V**) is proper at the blue test jack. If the **PCTL** voltage is correct, the cycle timer may not have turned on. Remove the electronic chassis for trouble analysis of logic board. If the **PCTL** is incorrect, the problem may be in the computer.
		If the reference pulse output is not present (above) at the orange test jack, observe the reference pulse output at check point **A3** (Figure 7-4). If the pulse is present, the Mode switch may be defective.
		If the reference pulse output is not at **A3**, the Optical switch may be defective (contact **Gaertner**).

Table 7-1. TROUBLESHOOTING GUIDE (Continued)

SYMPTOM	POSSIBLE CAUSE	FAULT ISOLATION
No binary data (**A / D**) output	No **PD** output conversion	Observe the count pulse output at the yellow test jack. If the pulses are present, check the **PFLG** pulses at the green test jack. If the **PFLG** pulses are not present, the logic board may be defective. If the pulses are present, the trouble may be in the computer or the interface cable.
		If the count pulses are not present at the yellow test jack, observe the check point **A4** signal (Figure 7-**4**). If the pulses are present, the **EBT** board may be defective. Remove the electronic chassis for analysis / repair.
		If the signal is not proper at **A4**, the encoder may be defective (contact **Gaertner**).
Inconsistent or inaccurate Measurements	Mechanical misadjustment	Verify that the polarizer drum is fixed at **45°**. Check that the polarizer / analyzer settings are in precise agreement. Recheck the table's vertical position.

Table 7-1. TROUBLESHOOTING GUIDE (Continued)

SYMPTOM	POSSIBLE CAUSE	FAULT ISOLATION
Inconsistent or inaccurate measurements (continued)	Irregularity of count pulses	Refer to the count pulse measurement procedure (next page).
	Analyzer drum speed of rotation	Refer to the motor speed adjustment procedure (Subsection 2.5).
	Loss of dual mode operation (the solenoid is not activated to insert the +90° compensator into the optical path)	This requires the verification of the **CTL 0 logic 1** (**0** to **1V**) at the input of the instrument power supply. If the voltage is **3 volts** or more, the trouble is in the computer or the computer interface. If the voltage is less than **one volt** the compensator control board may be defective. The output voltage to the solenoid should be **21** to **24.5V dc** steady state while **CTL 0** is at **logic 1** (to energize the solenoid, with the compensator " **in** "). If the voltage is not correct, remove the power supply for further analysis. If the voltage is proper, then the solenoid is in an " **overheated** " condition or else defective.

1.4 COUNT PULSE MEASUREMENT

a. Place the Mode switch at **A**, and stop the drive motor by a gentle pressure of the hand on the analyzer drum, and then set the analyzer drum to **359°**.

b. Observe the count pulses at the yellow test jack (Figure 7-3) while manually rotating the analyzer drum slowly. The first count pulse should start within ½° of **0°** and have a duration of no less than **0.4°** or greater than **1.2°**. During the period of the pulse, the voltage should be less than **0.2 volt**, and jump to at least **4 volts** at the end of the pulse. The pulse should repeat at **5°** intervals of the analyzer rotation (a total of **72 pulses** during one revolution of the (drum). Missing and abnormal pulses are an indication of a possible defect in the encoder.

c. To start the automatic analyzer drum rotating, momentarily set the Mode switch at **AS**; and then set it at **A**.

2.0 ADJUSTMENTS

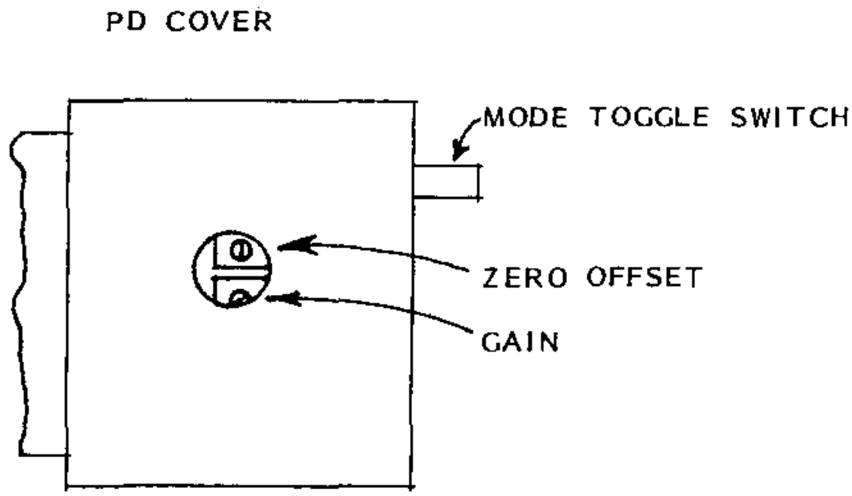
These adjustment should be made by only service personnel.

These adjustments are to be made on two of the three trimpots on the photodetector circuit board in the analyzer. See Figure 7.5 (**A**). The lowest trimpot involves only manual operation.

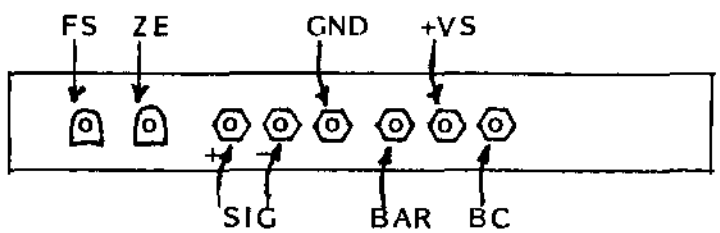
The **PD Zero Offset**, **LED Meter** and **PD Gain** adjustments are preset at **Gaertner**, but may require readjustment if the photodetector board is replaced.

NOTE

Check the **PD Zero Offset** adjustment before adjusting for the **LED** meter.



(A)



(B)

Figure 7-5. The upper diagram (A) shows the photodetector circuit board in the analyzer module. The lower diagram (B) shows the two trimpots (FS and ZE) and the six voltage test points at the rear of the LED meter.

2.1 PD Zero Offset

This adjustment can be made by removing the black plug from the side of the PD cover.

a. Close the beam attenuator to block the laser light, and set the Mode switch at **AS**.

b. Connect the measuring probe of a voltmeter (that reads **10V** or **20V**, **dc**) to the **PD Output** (**red**) test jack (and the common probe to the **black** common jack in Figure 7-3). Adjust the **Zero Offset** trimpot Figure 7-5 (**A**) as needed so that the voltmeter reads **0.0** volts, dc.

c. Disconnect the voltmeter and reinstall the plug in the **PD** cover unless the gain trimpot adjustment is next.

2.2 PD Amplifier Gain

Turn **OFF** and disconnect the computer from the ellipsometer. (If the ellipsometer has optional Microspot optics and the **8"** table, see the next Subsection 2.3.)

a. Set the Mode Switch to **A**. Gently stop the motor with your hand on the analyzer drum.

b. Set the polarizer and the analyzer arms to **90°**, and open the beam attenuator.

c. Slowly rotate the analyzer drum for the maximum **LED** meter reading (should be at **45°**).

d. Adjust the **GAIN** trimpot (**CW** for more gain), Figure 7-5 (**A**), for **93** on the **LED** meter.

e. If the **LED** meter was pegged in the last step, decrease the gain; and rotate the drum for another maximum reading.

2.3 PD Amplifier Gain (With both the Microspot Optics and the 200 mm diameter Table)

Use the **780Å** film layer sample wafer or one of a known film thickness. Set the two arms at **70°**, and adjust the table as needed.

a. Set the Mode Switch to **AS**. Slowly turn the analyzer drum for the maximum **LED** meter reading.

b. Adjust the **GAIN** trimpot (**CW** for more gain), Figure 7-5 (**A**), for **93** on the **LED** meter.

c. Set the Mode Switch to **A**. The drum should turn while the **LED** meter reads **23**, maximum.

2.4 LED Meter

With the beam attenuator closed, and the polarizer and analyzer arms at **90°** and the Mode Switch at **AS**, follow these four steps:

a. The **LED** display should show one to three red light dots for the **zero** reference. If the meter does not, adjust the **ZE** trimpot, Figure 7-5 (**B**), so that there is a two-dot display.

b. Open the beam attenuator.

c. Connect a voltmeter common probe to the **ground** (**black**) test jack in Figure 7-3, and connect the measuring probe to the **PD** Output (**red**) test jack. Slowly rotate the analyzer drum until the voltmeter reads **10V, dc**.

d. Adjust the **FS** trimpot as needed so that the **LED** meter reads **100** (as the voltmeter reads **10V**).

2.5 Motor Speed

This adjustment is just to the right of the Motor Pulse (brown) test jack (Figure 7-3). The motor speed control trimpot is preset at the factory, but may require a fine adjustment if the electronic chassis is replaced, to ensure accurate measurements of very thin films. A silicon substrate with a silicon oxide film layer of around **200Å** (**20 nm**) is recommended for this adjustment.

a. With the polarizer and analyzer arms set at **70°** angle of incidence and a sample in place, adjust table vertical position according to Subsection 1-3, " Sample Table Vacuum and Alignment " in Section 2, Operation.

b. Refer to the " The Sample Table Vacuum and Alignment " section in the **STD** instructions, and use the same program or subprogram.

c. Adjust the motor speed trimpot **¼ -turn** counterclockwise, and rerun the program (or subprogram) to obtain a second set of measurements.

d. Adjust the motor speed control **¼ -turn** clockwise from the initial setting used to obtain measurements obtained in step **b**, and rerun the program to obtain a third set of measurements.

e. Compare the measurement data obtained in step **c** and **d** with the measurement data obtained in step **b**. The differences should not vary more than **3** to **5Å** (**.3** to **.5 nm**).

2.5 Motor Speed (Continued)

f. If the difference is greater than **3Å** to **5Å**, repeat the variation of speed adjustment and measurements until the measurements are within **3Å** to **5Å**.

g. When the adjustments are complete, the motor should run smoothly.

CAUTION

A void changes in the motor speed that would induce excessive vibration.

2.6 A / D Offset

This adjustment is just to the left of the **red** (**PD** Output) test jack on the electronic chassis. The **PD ZERO** offset is preset at the factory but may require adjustment if the electronic chassis is replaced, to ensure measurement insensitivity to **PD** output changes in gain level. An indication of sensitivity is apparent when repeated thickness measurements on the same sample, particularly one with a very thin film, vary more than **3Å** to **5Å** (**.3** to **.5 nm**). A silicon substrate with silicon oxide film of about **550Å** (**55 nm**) is recommended for this adjustment.

2.7 Optical Orientation Checks*

Periodically perform an optical orientation check as follows:

a. Set the Mode Switch (on the analyzer module) to **M**.

NOTE

If the ellipsometer is equipped with the Optional Microspot Optics, remove the Two microspot stops. See Figure 7-6.

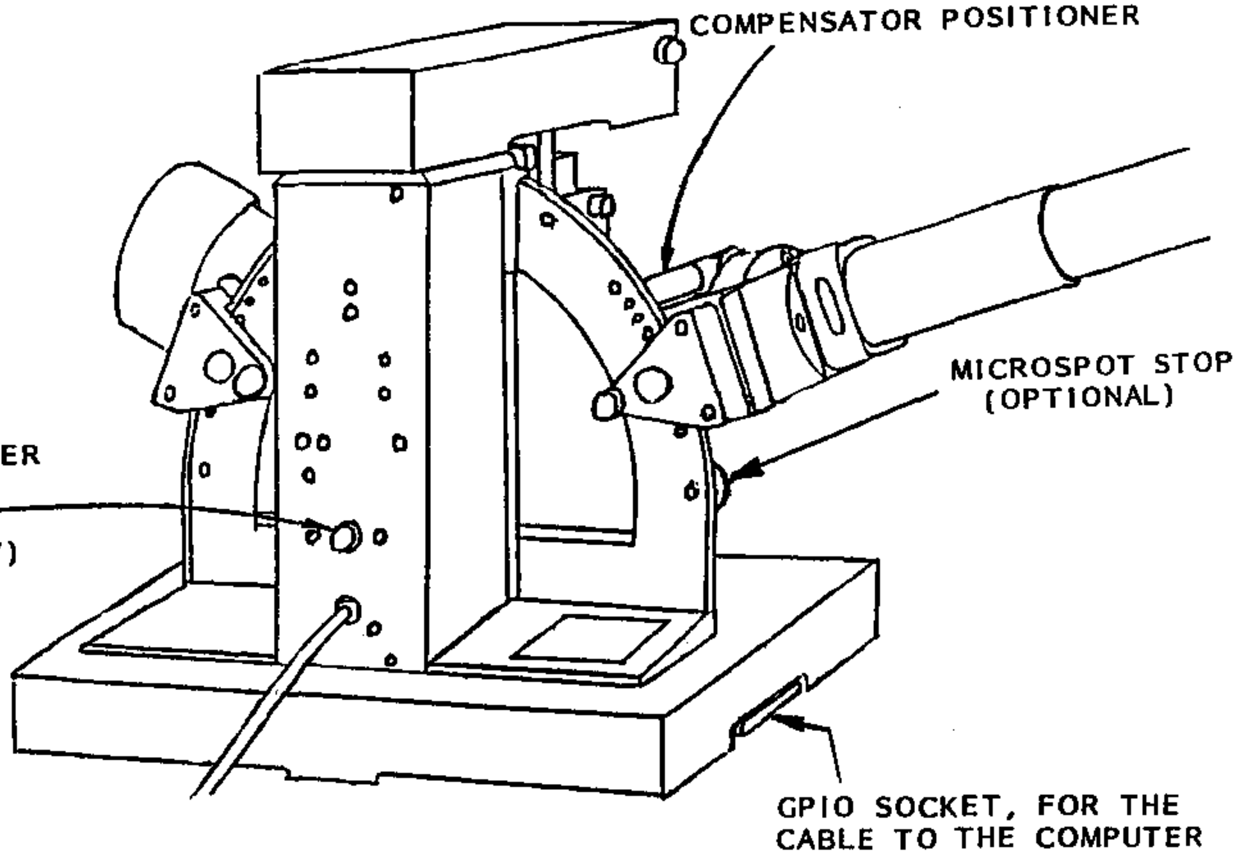
b. Close the beam attenuator, and lower the sample table fully.

* **These checks cannot be used with an instrument with both the 200mm diameter table and the Microspot Optics, because the table cannot be moved out of the way of the optics to set the arms at 90°.**

(Section 2-7 continued on page 7-19)

CAUTION (For 90° Angle of Incidence)*

If the ellipsometer has Mocrospot Optics, turn the table so that its notch (lifting slot) is under the analyzer arm. Move the table to the left and down so that neither Microspot Optic will touch the table when the arms are at 90°.



* The optional 200 mm dia. table cannot be moved out of the way of the optional Microspot Optics. Thus, the arma cannot be set at 90° with both options.

Figure 7-6. This is the rear and left view of the L116C.

2.8 Optical Orientation Checks (Continued)

c. Place the polarizer and analyzer arms at a **90°** angle of incidence.* Clamp the arms in place.

d. Remove the **45°** locking screw from the polarizer drum. Open the beam attenuator.

NOTE: **Push in and hold the automatic compensator positioner for steps e through g. The +90° compensator is in the optical path. See Figure 7-7, next page.**

e. Set the polarizer drum exactly at **180°** and the analyzer drum precisely at **90°**.

f. Observe the **LED** meter, and rotate the analyzer drum slowly to a setting at which the LED meter indicates the lowest reading. This occurs when the analyzer drum setting is at **90° ±0.4°**.

g. Set the analyzer drum exactly at **90°**. With the polarizer drum set precisely at **180°**, observe the **LED** meter, and rotate the polarizer drum slowly to a setting at which the **LED** meter indicates the lowest reading. This should occur when the polarizer drum setting is **180° ±0.4°**.

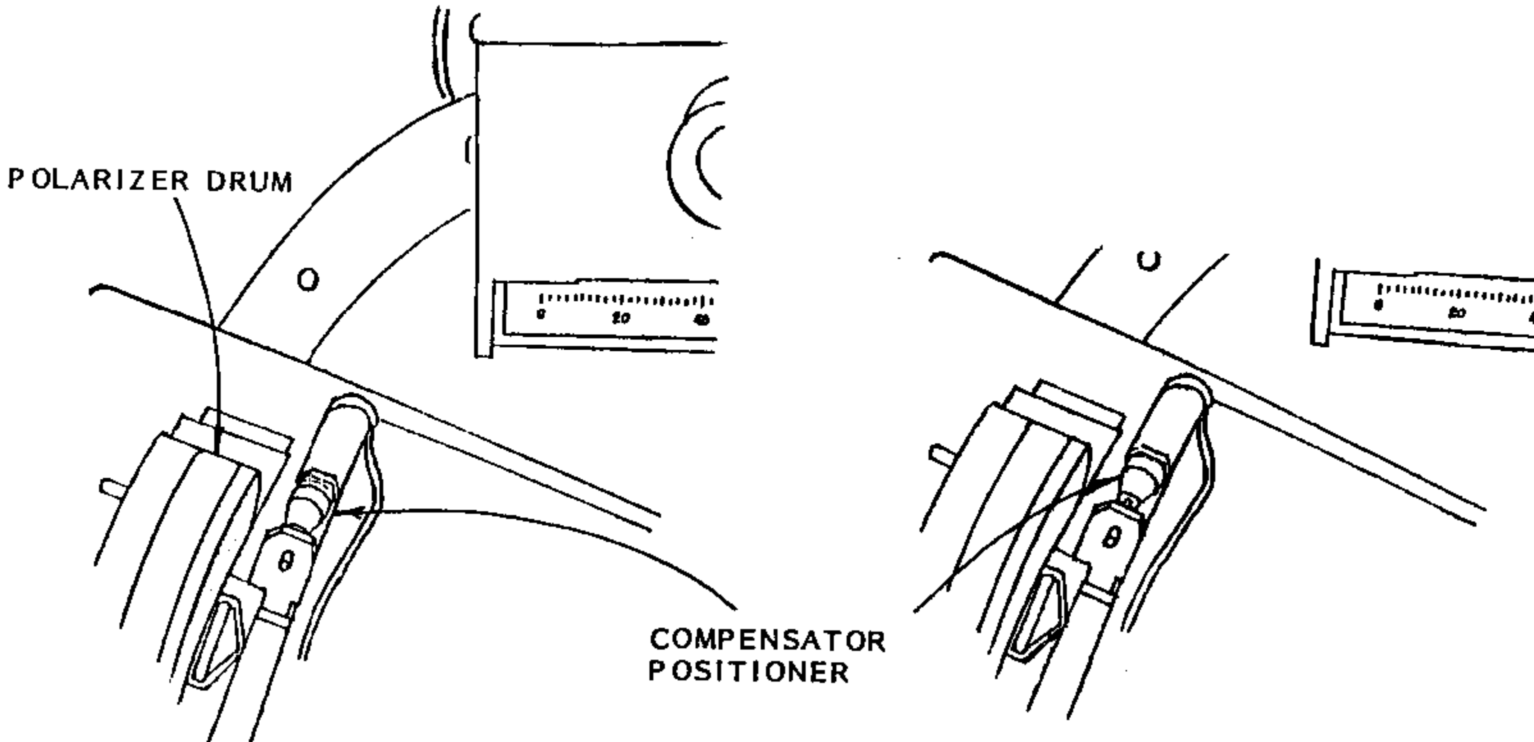
NOTE: **If the drum settings in steps f and g are within the specified limits, the compensator is properly oriented.**

h. Set the polarizer drum at **45°**; then insert and tighten the drum locking screw.

i. Set the analyzer drum to the position where the **LED** meter has the lowest reading. This should occur where the analyzer drum setting is **135° ±0.4°** or **315° ±0.4°**. If the analyzer drum setting is within either of these limits, the analyzer prism is properly oriented.

j. Close the beam attenuator, and fix the polarizer and analyzer arms at a **70°** incidence angle.

*** If the ellipsometer has both the Microspot Optics and an 8" diameter table, the table can't be moved out of the way to set the arms at 90°. Thus, ignore this Subsection " Optical Orientation Checks ".**



(A) The positioner's normal position has the +90° compensator out of the light path

(B) The positioner pulled back has the +90 compensator in the light path.

Figure 7-7. This is the automatic compensator positioner on the right end of the polarizer arm.

2.7 Optical Orientation Checks (Continued)

k. Set the Mode Switch to **AS**, and open the beam attenuator.

NOTE:

Reinstall the two optional microspot stops.
See Figure 7-6.

l. Adjust the table to the proper vertical position according to the " **Sample Table Vacuum and Alignment** " procedure, in the Operation Section (**2**) of this manual.

3.0 COMPONENTS REMOVAL FOR REPAIR / REPLACEMENT

The removal instructions are limited to service personnel. These instructions apply to components requiring either direct replacement or lower-level fault isolation and repair. Removal of components other than those covered herein should be performed only by **Gaertner** personnel.

3.1 Instrument Power Supply

The ellipsometer power supply consists of the following:

- **Laser Power Supply**
- **+5V dc Power Supply for the LED Meter**
- **Compensator Control Board**
- **Multi- Purpose Transformer:**

  115V ac for the Sample Monitor Assembly

  115V ac for the Instrument dc Power Supply and Laser Power Supply

  28V ac for the Compensator Control Board

The stansdard instrument power supply accepts **115V ac rms** line voltage, but can be modified to operate with **100V**, **220V**, **230V** or **240V ac** input line voltage.

a. Turn **OFF** the computer and ellipsometer. Unplug the ellipsometer line cord from the **ac** power.

b. Detach the instrument power supply from the vertical support panel of the ellipsometer by removing four mounting screws, one at each corner of the power supply base plate. Lower the power supply horizontally on a padded support block. The padding helps avoid damage to painted surfaces.

WARNING

Exercise care in performing step **c**, as high voltage (up to **10,000 volts**) is in the **632.8 nm** laser assembly.

c. Unplug the white laser plug from the laser power supply receptacle. Discharge the laser voltage by shorting out the two-prong plug with a **1K-to-2K** resistor.

3.2 LED Meter Assembly

Remove the LED meter and the 8-inch cable at the rear of the meter by performing the following:

a. Turn **OFF** computer and ellipsometer. Unplug the line cords from the ac power outlet.

b. Remove four screws from the top cover of the sample monitor assembly housing, and remove the cover for access to the cable connection.

c. Disconnect the **LED** meter cable from **4"** monitor-to-power supply extension cable connector.

d. Support the **LED** meter while removing two screws that secure the meter to the underside of the Sample Monitor Assembly.

e. Remove the meter while removing the cable through the hole in the Sample Monitor Assembly Base.

f. To replace or reinstall an **LED** meter assembly, reverse the procedure of steps **b** through e.

g. Support meter assembly while removing three mounting screws that secure meter assembly to support arm. This completes removal of the meter assembly and interconnecting wiring.

h. To replace a meter assembly, reverse the procedure of steps **b** through **g**.

3.3 Electronic Chassis

The electronic chassis contains the following:

- **Motor Board**
- **EBT Board**
- **Logic Board**
- **Analog-to-Digital (A/D) Board**
- **±15V dc Power Supply for the A/D Board and Photodetector Board**
- **+5V dc Power Supply for the A/D Board, Logic Board and Count Board**
- **+1-V dc Power (two 5V supplies in series) for the Motor Board**

3.3 Electronic Chassis (Continued)

Color-coded test jacks and motor speed and **A / D** offset adjustments are on the right side of the chassis. (See Figure 7-3.) The computer Interface Cable receptacle is on the chassis left side. The removal of the electronic chassis requires the removal of the instrument power supply for access to the connections of the chassis Interface Wiring.
Perform the following:

a. Turn **OFF** the computer and ellipsometer. Unplug the ellipsometer line cord from the **ac** power.

b. Disconnect the computer **GPIO** Interface Cable from the Electronic Chassis.

c. Detach the instrument power supply from the support panel, as instructed in step **b** of the instrument power supply removal procedure (above).

d. Disconnect the **3** - and **4** – pin electronic chassis Interface Wiring connectors in the power supply.

e. Remove the two screws from each side of the ellipsometer base to detach the electronic chassis from the base.

3.4 Photodetector Board

The removal of the photodetector board requires access to the detector and switch assembly. Perform the following:

a. Turn **OFF** computer and ellipsometer. Unplug line cord from **ac** power outlet.

b. Remove the two screws that secure Mode switch to cover of detector and switch assembly.

c. Loosen the three screws that secure the cover. Pull the cover outward to remove it from the assembly.

d. Withdraw the switch assembly from retainer slots and disconnect the two black / white plugs from the receptacles above the photodetector board.

e. Remove the four screws that secure the photodetector board, and lift out the board carefully.

f. To install a photodetector board, reverse the procedure of steps **b** through **e**.

3.5 Beam Attenuator

This procedure applies to both the removal and reinstallation (or replacement) of the beam attenuator.

Perform the following:

a. Loosen table clamp screw, and lower the table fully.

NOTE: Remove the optional microspot stops from the vertical plate (Figure 7-6). Observe the **NOTE** at the top of the figure.

b. Position the polarizer and analyzer arms at **90 degrees** angle of incidence.

c. Using a **5/32-inch** hex key, remove the two cap screws that secure polarizer pin-hole plate to the inner support of polarizer arm.

3.5 Beam Attenuator (Continued)

d. Pull the pin -hole plate (with the optional microspot optics) from support. Remove the inoperative beam attenuator from the slotted back surface of plate and install new beam attenuator in slot, noting that orientation is the same as for the one removed. (The end with a hole toward the front.)

e. Install the pin-hole plate (with the optional microspot optics) on the support, using the locating pins as a guide and ensuring that the silver reference dots on pin-hole and polarizer inner support are aligned.

f. Insert the two cap screws (removed in step **c** above) into the holes in the pin- hole plate. Turn them until they are almost finger tight. Check the plate and locating pins for firm seating and then tighten the screws, using **5/32-inch** hex key.

g. Slide the attenuator **in** and **out** to verify that there is no binding. (If it is too loose, bow the slide slightly.)

h. Position the polarizer and analyzer arms at the **70°** angle of incidence. Reinstall the optional microspot stops.

i. Adjust the table for the desired vertical position in accordance with the Sample Stage or Table Alignment procedure (in the Operation Section).

4.0 COMPUTER INTERFACE CABLE DATA

Computer interface cable data for the ellipsometer is contained in **Table 7-2**.

5.0 REPLACEMENT PARTS

A replacement parts list is in the **Table 7-3**.

Table 7-2. L116C Computer Interface Cable Data

Pin No.	Input	Output	Logic Level	Function
1,18,24,26,43,49	——	——	——	Ground
3		X	1	A/D, Bit 1(MSB)
4		X	1	A/D, Bit 2
5		X	1	A/D, Bit 3
6		X	1	A/D, Bit 4
7		X	1	A/D, Bit 5
8		X	1	A/D, Bit 6
9		X	1	A/D, Bit 7
10		X	1	A/D, Bit 8
11		X	1	A/D, Bit 9
12		X	1	A/D, Bit 10
13		X	1	A/D, Bit 11
14		X	1	A/D, Bit 12 (LSB)
19		X	1	A/D Done, (reading ready)
44	X		1	Initiate Measuring Cycle*
44	X		0	Terminate Measuring Cycle*
47	X		1	Compensator In
47	X		0	Compensator Out
48	X		1	Increase PD Gain
48	X		0	Decrease PD Gain

* **The Period of the measurement cycle is one revolution of analyzer drum, with the duration settable from 0.25 to 1.5 seconds.**

Logic Levels (TTL): Logic 1=0 to 1 volt; Logic 0=3 to 5 volts.

Table 7-3. L116C Replacement Parts List

Nomenclature	GSC Part No.
Electronic Chassis	10161-KB
Interface Connector (Chassis)	A-7108-E118B
Mating Connector (Cable)	A-7108-E118A
Test Jack	7108-E127 (Specify Color)
Instrument Power Supply	10026-KF with 10161-B15
Meter and Cable Assembly	10257-21
Photodetector Board	10257-10E
Mode Switch (Includes Cables and Connectors)	10257-30
Beam Attenuator	10026-21
A/D Offset Potentiometer	A-7108-E121
Motor Speed Potentiometer	A-7108-E121
Emission Indicator Lamp	7108-E266
Lock Switch (Includes key)	7108-E231A
Ellipsometer Fuse, ¾ Amp, SLO-BLO	B-7108-E138
Clamp Screw (Sample Table)	10026-A5
Clamp Screw (Polarizer / Analyzer Arm)	10026-15P
Clamp Screw (Polarizer Drum)	10161-C8 with 10161-C10-RE1
Illuminator Bulb (Sample Monitor)	M230-F46
Transformer, Monitor Assembly	7108-E230A
Cable, Monitor / Power Supply Extension	10259-23M
Laser Assembly (632.8 nm)	C-10026-20EN