

TB 9-6650-233-35

DEPARTMENT OF THE ARMY TECHNICAL BULLETIN

CALIBRATION PROCEDURE FOR OPTICAL POWER TEST SET, TS-4358/G

Headquarters, Department of the Army, Washington, DC
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**SECTION I
IDENTIFICATION AND DESCRIPTION**

1. Test Instrument Identification. This bulletin provides instructions for calibration of the Optical Power Test Set TS-4358/G. Purchase Description/Specification TEMOD-91-01, dated 12 November 91, TM 9-6650-906-12, and TM 9-6650-906-40 were used as the prime data sources in compiling these instructions. The equipment being calibrated will be referred to as the Optical Power Meter (OPM) or Stabilized Light Source (SLS) throughout this bulletin.

a. Model Variations. None

b. Time and Technique. The time required for this calibration is approximately 1 hour, using the dc and low frequency technique.

2. Forms, Records, and Reports

a. Forms, records, and reports required for calibration personnel at all levels are prescribed by TB 750-25.

b. Out-of-tolerance conditions to be reported are designated (R) at the end of the sentence in which they appear. When these conditions are in tables, the (R) follows the designated adjustment. Report only those out-of-tolerance-conditions designated with (R).

3. Calibration Description. OPM and SLS parameters and performance specifications which pertain to this calibration are listed in table 1.

Table 1. Calibration Description

Optical Power Meter (OPM)	
Test instrument parameter ¹	Performance specifications
850 nm, 1310 nm, 1550 nm	Range ^{2,3} : -50 to -6 dBm Accuracy: -10 dBm: ±0.35 dB -50 to -6 dBm: ±0.50 dB
Stabilized Light Source (SLS)	
850 nm, 1300 nm (multimode)	Range: -20 dBm Accuracy: ± 2.5 dB
1310 nm, 1550 nm (singlemode)	Range: -26 dBm Accuracy: ± 2.5 dB

¹OPM not tested at 1300 nm

²Not tested below -50 dBm and above -6 dBm

³Not tested above -10 dBm at 850 nm.

**SECTION II
EQUIPMENT REQUIREMENTS**

4. Equipment Required. Table 2 identifies the specific equipment to be used in this calibration procedure. This equipment is issued with Secondary Transfer Calibration Standards Set AN/GSM-286. Alternate items may be used by the calibrating activity. The items selected must be verified to perform satisfactorily prior to use and must bear evidence of current calibration. The equipment must meet or exceed the minimum use specifications listed in table 2. The accuracies listed in table 2 provide a four-to-one ratio

between the standard and OPM or SLS. Where the four-to-one ratio cannot be met, the four-to-one accuracy will be listed and the actual accuracy of the equipment selected is shown in parenthesis.

5. Accessories Required. The accessories listed in table 3 are issued as indicated in paragraph 4 above and used in this calibration procedure. When necessary, these items may be substituted by equivalent items, unless specifically prohibited.

Table 2. Minimum Specifications of Equipment Required

Common name	Minimum use specifications	Manufacturer and model (part number)
FOCUS-SWCM	Range ¹ : -50 to -10 dBm Accuracy: ±0.125 dB	Nichols Research Corp. Model 202-60018-02 (202-60018-02)
FOCUS-LWCM	Range ¹ : -50 to -6 dB Accuracy: ±0.125 dB	Nichols Research Corp. Model 202-60018-01 (202-60018-01)
LIGHTWAVE MULTIMETER	Range: -50 to -6 dBm Accuracy: ±0.0875 dB (±0.13 dB)	Hewlett Packard Model 8153A (8153A) with plug-in 81531A (81531A) and FC connector adapter PN 81000FI (81000FI)

¹Accuracy at -10 dBm is ± 0.0875 dB

Table 3. Accessories Required

Common name	Description (part number)
RS232 Cable	TS4358-RS232
TS4358 Calibration Software	Version 1.10: 11/22/94
FC Connector Adapter	EXFO FOA-22 NTT-FC

SECTION III CALIBRATION PROCESS

6. Preliminary Instructions

a. Instructions outlined in paragraphs 6 and 7 are preparatory to the calibration process. Personnel should become familiar with the entire bulletin before beginning calibration.

b. Items of equipment used in this procedure are referenced within the text by common name as listed in table 2.

c. Unless otherwise specified, verify the result of each test and, whenever the test requirement is not met, take corrective action before continuing with the calibration. Additional maintenance information is contained in TM 9-6650-906-12 and TM 9-6650-906-40 for the OPM or SLS.

d. Unless otherwise specified, all controls and control settings refer to the OPM or SLS.

7. Equipment Setup

WARNING

Always keep end of optical fiber cable 1 foot away from eyes.
Never look into end of an energized optical fiber cable.

NOTE

Ni-Cad rechargeable batteries should be in fully charged state prior to performing calibration.

a. Press OPM **ON/OFF** pushbutton to **ON** and allow 10 minutes warm up for stabilization.

b. Ensure **COVER** is snug on **DETECTOR PORT**.

c. Press and release **shift** pushbutton.

d. Press and hold **CALIBRATE** pushbutton (about 3 seconds) until **CAL** appears on display. **CAL** will last about 20 seconds.

NOTE

Optical fiber connectors used with this equipment have precision optical surfaces. Periodically clean ends of optical fiber jumper cables with reagent grade alcohol using an optical grade lintless tissue. Connector should be carefully handled to avoid contamination or damage when unprotected by its dust cap. Replace connector dust cap when optical fiber jumper cable is not connected to equipment. Small amounts of dirt, dust, oil or other foreign matter on connector ends can cause attenuation or damage to connector. Avoid touching connector ends with unwashed hands as this deposits oil which acts as a sticky surface to attract dust, etc.

NOTE

FC connectors are keyed. Key on connector must be aligned with key slot on connector receptacle.

e. Perform (1) through (7) below:

(1) Set FOCUS-SWCM **POWER OFF ON** key control switch to **ON**.

(2) Press lightwave multimeter power pushbutton to **ON**.

(3) Allow 15 minutes for test equipment to warmup and stabilize.

(4) Set FOCUS-SWCM **LD BIAS CURRENT** switch to **LD CW**.

(5) Set FOCUS-SWCM **SWITCHED ATTN** switch to **OUT**.

- (6) Set FOCUS-SWCM **WAVELENGTH** switch to **850 nm**.
- (7) Zero lightwave multimeter.

8. Optical Power Meter Accuracy

a. Performance Check

NOTE

When taking 850 nm measurements with lightwave multimeter, use Hewlett-Packard, Model 81530A plug-in when available in place of Hewlett-Packard, Model 81531A plug-in to increase accuracy.

- (1) Connect equipment as shown in figure 1, CONNECTION A. Connect optical fiber jumper cable from FOCUS-SWCM OPTICAL I-O to FC CONNECTOR ADAPTER attached to OPTICAL INPUT of LIGHTWAVE MULTIMETER (fig. 1).

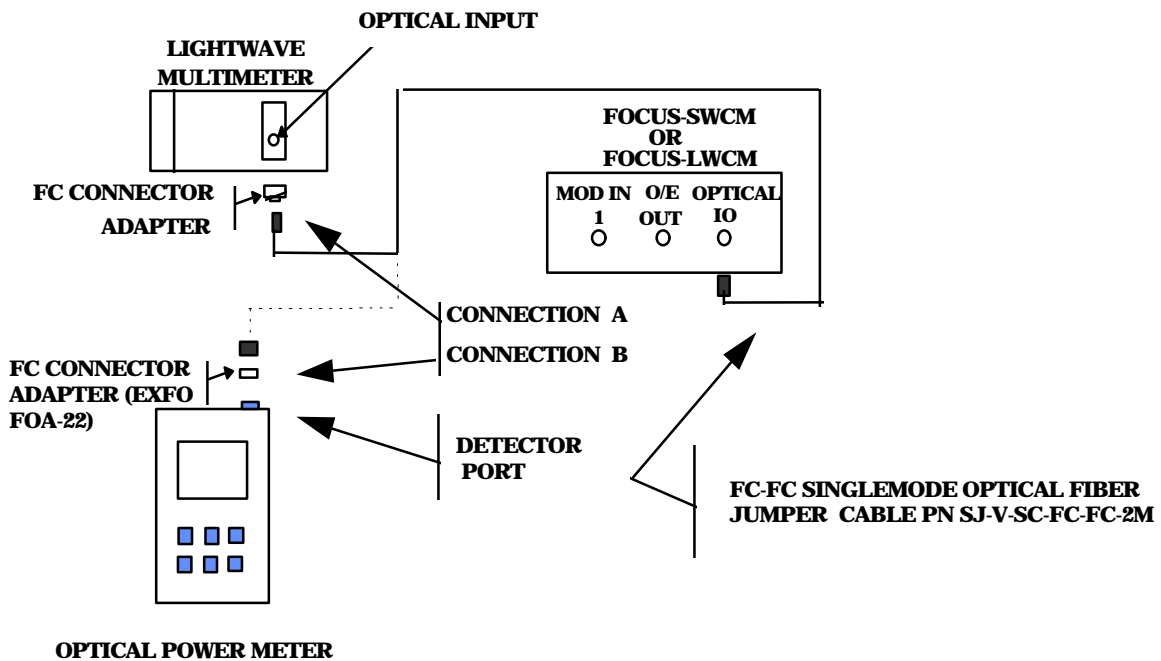


Figure 1. Optical Power Meter test setup.

- (2) Set lightwave multimeter to measure optical power in dBm at 850 nm wavelength.
- (3) Adjust FOCUS-SWCM **VAR ATTN 1** knob for **-10.00 dBm** indication on lightwave multimeter display.

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- (4) Remove cover from OPTICAL POWER METER DETECTOR PORT (fig. 1).

NOTE

Take care not to disturb optical fiber jumper cable when making measurements or disconnecting fiber connectors. Excess optical fiber jumper cable length should be coiled in 6 inch (approximate) diameter loops and taped temporarily to bench top to avoid unnecessary movement of the cable.

- (5) Carefully remove optical fiber jumper cable connector from lightwave multimeter and connect to OPTICAL POWER METER DETECTOR PORT, CONNECTION B (fig. 1).

- (6) Press OPM λ **select** pushbutton as necessary to set wavelength to 850 nm.

- (7) Press OPM **dBm/W** pushbutton if necessary to measure dBm.

- (8) Optical power meter will indicate between -09.65 and -10.35 dBm; if not, perform **b** below.

- (9) Press and hold **ref** pushbutton for **00.00** indication on display.

- (10) Carefully remove optical fiber jumper cable connector from OPTICAL POWER METER DETECTOR PORT (fig. 1) and connect to LIGHTWAVE MULTIMETER (fig. 1).

- (11) Adjust FOCUS-SWCM **VAR ATTN 1** knob for **-15.00 dBm** indication on lightwave multimeter display.

- (12) Carefully remove optical fiber jumper cable connector from LIGHTWAVE MULTIMETER (fig. 1) and connect to OPTICAL POWER METER DETECTOR PORT, CONNECTION B (fig. 1).

- (13) OPM will indicate between -04.50 and -05.50 dB.

- (14) Press **dBm/W** pushbutton to return OPM to measure dBm.

- (15) Repeat technique of (1) through (8) above for settings and indications in table 4. OPM will indicate as specified; if not, perform **b** below.

- (16)

Table 4. OPM Test Limits

Wavelength (nm)	Lightwave multimeter	OPM indications (dBm)	
		Min	Max
850	-20	-20.50	-19.50
850	-50	-50.50	-49.50
1310 ¹	-6	-06.50	-05.50

See footnotes at end of table.

Table 4. OPM Test Limits - Continued

Wavelength (nm)	Lightwave multimeter	OPM indications (dBm)	
		Min	Max
1310	-10	-10.35	-09.65
1310	-20	-20.50	-19.50
1310	-50	-50.50	-49.50
1550 ²	-50	-50.50	-49.50
1550	-20	-20.50	-19.50
1550	-10	-10.35	-09.65
1550	-6	-06.50	-05.50

¹Remove FOCUS-SWCM from test setup and install FOCUS-LWCM. Position **WAVELENGTH** switch to **1310 nm**.

² Position FOCUS-LWCM **WAVELENGTH** switch to **1550 nm**.

b. Adjustments

CAUTION

Use ESD precautionary procedures when touching, removing or installing circuit card assemblies.

- (1) Ensure OPM power is turned **OFF**.
- (2) Remove six screws from back of OPM case.
- (3) Carefully lift **BACK ASSEMBLY** up and away from **MAIN BOARD** and **KEYPAD ASSEMBLY** (fig. 2).

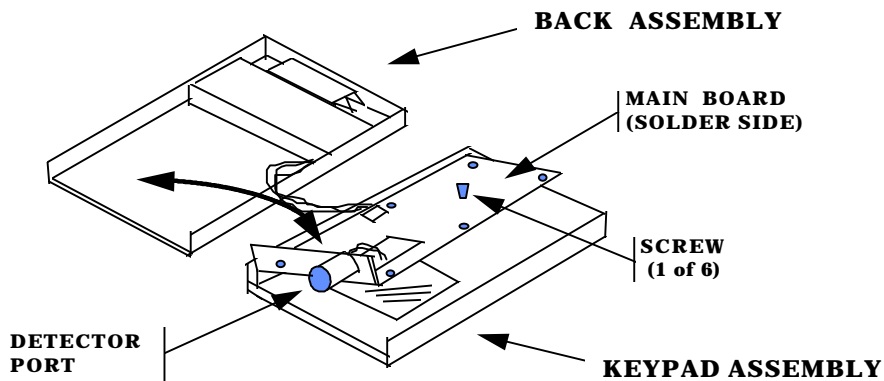


Figure 2. OPM back assembly removal from main board and keypad assembly.

- (4) Remove six screws from **MAIN BOARD** (fig. 3).

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(5) Carefully lift MAIN BOARD (fig. 2 and 3) and place on BACK ASSEMBLY (fig. 2); leave RIBBON CABLE connected (fig. 3).

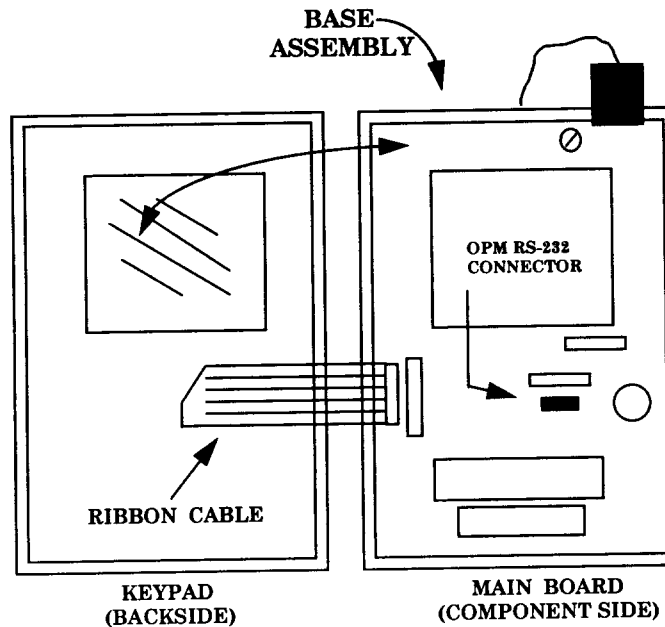


Figure 3. OPM RS-232 connector location.

(6) Connect RS-232 cable to OPM RS-232 CONNECTOR (fig. 3) and other end of RS-232 cable to serial port on computer.

(7) Place floppy disk containing calibration software in disk drive (obtain **A:** prompt) and type **TS4358**, then press **ENTER** key on computer keyboard.

(8) Press **ON/OFF** pushbutton to **ON**.

(9) Follow instructions which appear on screen.

NOTE

Use wavelength recorded on FOCUS Insertion Delay Measurement Worksheet for SWCM and LWCM when calibration software calls to input wavelength on reference power meter (lightwave multimeter). **Align (ZERO) the Reference Power Meter**, in the calibration software means zero the lightwave multimeter. When calibration software mentions **FOT-90A**, this statement refers to the OPM.

(10) After completion of software calibration, press **ON/OFF** pushbutton to **OFF**.

- (11) Remove RS-232 cable from main board.
- (12) Assemble main board to keypad.
- (13) Install six screws in main board and keypad.
- (14) Assemble keypad and main board to back assembly.
- (15) Place OPM face down and replace six screws (R).

9. Stabilized Light Source Accuracy

a. Performance Check

- (1) Remove SLS from rubberized case and record actual output wavelengths as indicated by manufacturer label located on back of case.
- (2) Connect SLS to LIGHTWAVE MULTIMETER as shown in figure 4, CONNECTION A.

NOTE

Multimode optical fiber jumper cables are not provided with FOCUS. Use multimode optical fiber jumper cable provided with TS-4358/G, optical power test set.

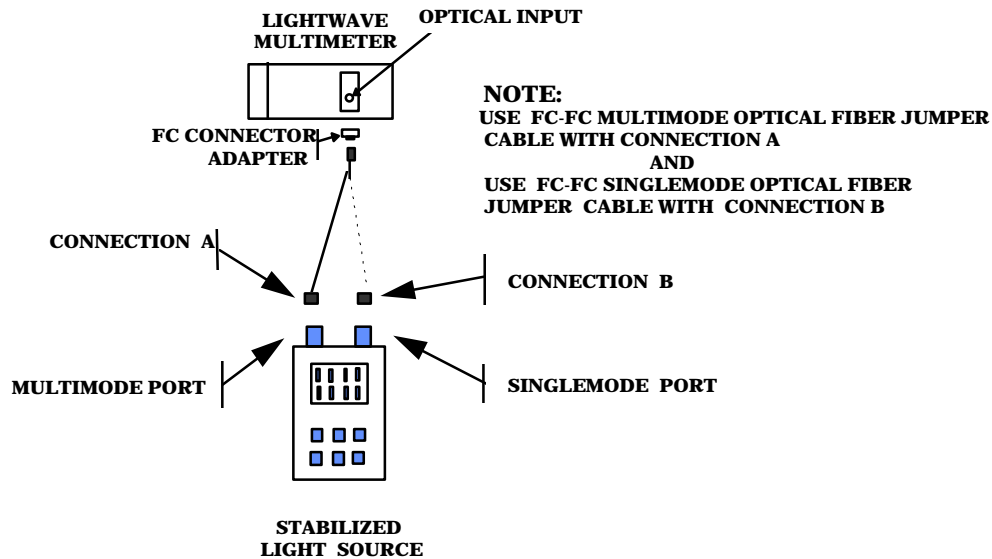


Figure 4. SLS test setup.

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NOTE

When taking 850 nm measurements with lightwave multimeter use Hewlett-Packard, Model 81530A plug-in if available in place of Hewlett-Packard, Model 81531A plug-in to increase accuracy.

- (3) Press **ON/OFF** pushbutton to illuminate **SUPPLY NiCd** annunciator.

NOTE

Allow 10 minutes for SLS to warm-up and stabilize.

- (4) Set lightwave multimeter to measure dBm at actual output wavelength recorded in paragraph **9a**(1) for 850 nm.

- (5) Press **MULTIMODE 850/1300** pushbutton. **MULTIMODE 850 nm** annunciator will illuminate.

- (6) Lightwave multimeter will indicate between -22.50 and -17.50 dBm; if not, perform **b**(1) through (11), and (19) through (24) below.

- (7) Set lightwave multimeter to measure dBm at actual output wavelength recorded in paragraph **9a**(1) for 1300 nm.

- (8) Press **MULTIMODE 850/1300** pushbutton. **MULTIMODE 1300 nm** annunciator will illuminate.

- (9) Lightwave multimeter will indicate between -22.50 and -17.50 dBm; if not, perform **b**(1) through (9), (12), (13), and (19) through (24) below.

- (10) Press **MULTIMODE 850/1300** pushbutton (all annunciators except **SUPPLY NiCd** will extinguish).

- (11) Connect equipment as shown in figure 4 CONNECTION B.

- (12) Set lightwave multimeter to measure dBm at actual output wavelength recorded in paragraph **9a**(1) for 1310 nm.

- (13) Press **SINGLEMODE 1310/1550** pushbutton. **SINGLEMODE 1310 nm** annunciator will illuminate.

- (14) Lightwave multimeter will indicate between -28.50 and -23.50 dBm; if not, perform steps **b**(1) through (8), (14), (15), (16), and (19) through (24) below.

- (15) Set lightwave multimeter to measure dBm at actual output wavelength recorded in paragraph **9a**(1) for 1550 nm.

(16) Press **SINGLEMODE 1310/1550** pushbutton. **SINGLEMODE 1550 nm** annunciator will illuminate.

(17) Lightwave multimeter will indicate between -28.50 and -23.50 dBm; if not, perform **b**(1) through (7), (14), (9), and (17) through (24) below.

b. Adjustments

CAUTION

Use ESD precautionary procedures when touching, removing or installing circuit card assemblies.

- (1) Ensure SLS power is **OFF**.
- (2) Remove six screws from back of SLS case.
- (3) Turn SLS face up.
- (4) Carefully separate **KEYPAD ASSEMBLY** from **BASE** and **END ASSEMBLY** (fig. 5).

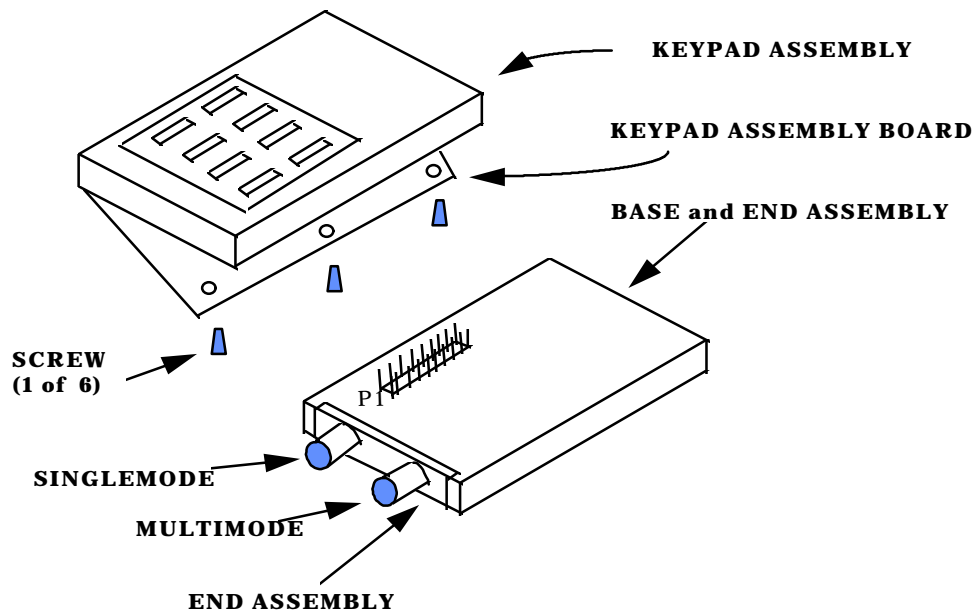


Figure 5. SLS keypad assembly, base and end assembly separation.

(5) Place **KEYPAD ASSEMBLY** face down and remove six screws from back of **KEYPAD ASSEMBLY BOARD** (fig. 5).

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(6) Carefully reconnect KEYPAD ASSEMBLY BOARD to BASE and END ASSEMBLY (fig. 5). Ensure P1 pins are straight before connecting KEYPAD ASSEMBLY BOARD (fig. 5).

(7) Carefully lift keypad from KEYPAD ASSEMBLY BOARD (fig. 5) to gain access to adjustments.

(8) Ensure SLS is connected to LIGHTWAVE MULTIMETER as shown in figure 4 CONNECTION A

(9) Press **ON/OFF** pushbutton to **ON**.

(10) Press **MULTIMODE 850 nm/1300 nm** pushbutton for output of 850 nm.

(11) Adjust R31 850 nm MULTIMODE for -20.00 dBm indication on lightwave multimeter (fig. 6) (R).

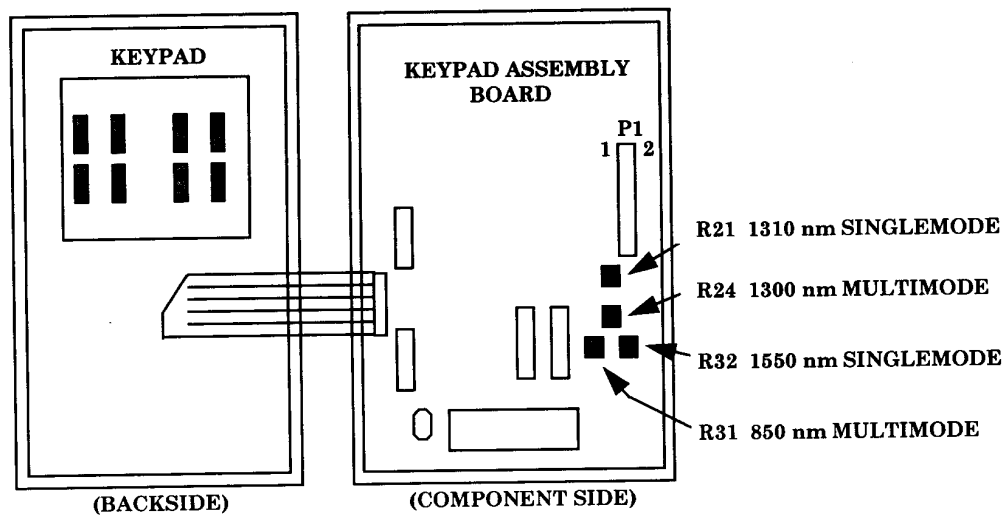


Figure 6. Keypad and keypad assembly board – adjustment locations.

(12) Press **MULTIMODE 850 nm/1300 nm** pushbutton as necessary for 1300 nm output.

(13) Adjust R24 1300 nm MULTIMODE (fig. 6) for -20.00 dBm indication on lightwave multimeter (R).

(14) Ensure SLS is connected to LIGHTWAVE MULTIMETER as shown in figure 4, CONNECTION B.

- (15) Press **SINGLEMODE 1310 nm/1550 nm** pushbutton for 1310 nm output.
- (16) Adjust R21 1310 nm SINGLEMODE (fig. 6) for -26.00 dBm indication on lightwave multimeter (R).
- (17) Press **SINGLEMODE 1310 nm/1550 nm** pushbutton for 1550 nm output.
- (18) Adjust R32 1310 nm SINGLEMODE (fig. 6) for -26.00 dBm indication on lightwave multimeter (R).
- (19) Remove fiber optic cable from SLS.
- (20) Press SLS **ON/OFF** pushbutton to **OFF**.
- (21) Carefully remove KEYPAD ASSEMBLY BOARD from BASE and END ASSEMBLY (fig. 5).
- (22) Assemble keypad to KEYPAD ASSEMBLY BOARD (fig. 6) and replace six screws.

CAUTION

Take care to ensure fiber optic cables in SLS do not protrude between edges of keypad assembly and base or end assemblies when tightening the last six screws or fiber optic cables will be damaged or broken.

- (23) Carefully assemble KEYPAD ASSEMBLY to BASE and END ASSEMBLY (fig. 5) and replace six long screws.
- (24) Repeat technique of paragraph **9a** above to ensure fiber optic cables inside SLS have not been pinched or damaged.

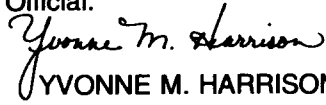
10. Final Procedure

- a.** Deenergize and disconnect all equipment.
- b.** Annotate and affix DA label/form in accordance with TB 750-25

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By Order of the Secretary of the Army:

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