

Errata

Title & Document Type: 809C Universal Probe Carriage Operating Note

Manual Part Number: 00809-90001

Revision Date: May 1969

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

Support for Your Product

Agilent no longer sells or supports this product. You will find any other available product information on the Agilent Test & Measurement website:

www.agilent.com

Search for the model number of this product, and the resulting product page will guide you to any available information. Our service centers may be able to perform calibration if no repair parts are needed, but no other support from Agilent is available.

OPERATING NOTE

**UNIVERSAL PROBE
CARRIAGE**

809C

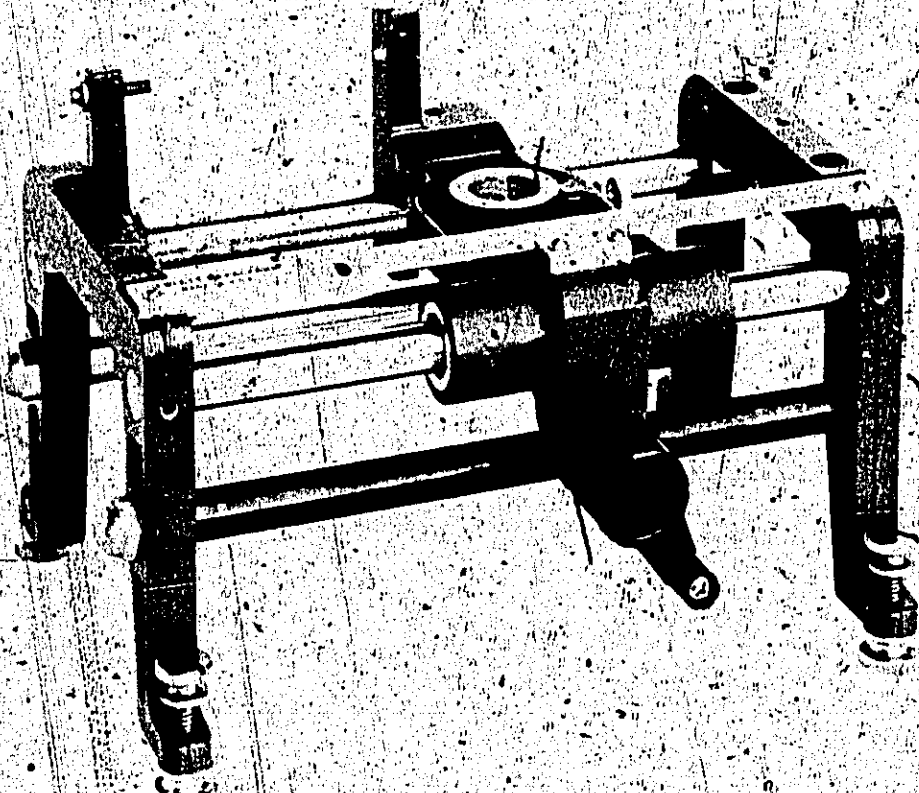


Table 1. Specifications

Carriage: Mounts all HP 810B Waveguide Slotted Sections and HP 806B and 816B Coaxial Slotted Sections.

Probe Required: HP 447B Untuned Probe or HP 448A Slotted Line Sweep Adapter for the 816A Slotted Line; HP 444A Untuned Probe or 442B Broadband Probe for 810B Waveguide Slotted Sections or HP 806B Coaxial Slotted Section.

Probe Travel: 10 cm.

Calibration: Metric. Vernier permits readings to 0.1 mm. Provision for dial gauge installation.

Leveling Screws: Knurled thumbscrews provided on all four carriage legs.

Accuracy: When used with waveguide sections, standing wave ratios to 1.02 can be read easily. Slope error of slotted sections can be eliminated by adjustment.

Dimensions (maximum envelope): 8-7/8 in. long, 6-13/16 in. wide, 5-13/16 in. high (226 x 174 x 148 mm).

Weight: Net, 4 lb. (1,8 kg).

1. DESCRIPTION

2. The Model 809C Universal Probe Carriage is a precision mechanical assembly which mounts HP slotted sections and detector probes for precision slotted line measurements. The carriage accepts either coaxial or waveguide slotted sections. These slotted sections can be easily interchanged, and their slope error eliminated with simple setscrew adjustments. Hewlett-Packard waveguide slotted sections, used in conjunction with HP detector probes, permit measurements across the frequency range of 3.95 to 18 GHz. A single Hewlett-Packard coaxial slotted section, used in conjunction with HP detector probes, permits measurements across the frequency range of 1.8 to 18 GHz. Table 2 lists the HP slotted sections, probes, and detectors which can be used with the 809C.

3. For making probe-position measurements, such as wavelength, high SWR, or impedance, the carriage has a centimeter scale with a vernier that reads to an accuracy of 0.01 cm. There is also a provision for mounting a dial indicator when more precise probe-position measurements are required.

4. The probe mount moves on ground stainless steel rods. Its three point suspension system includes two permanently lubricated linear-motion bushings and a conventional ball bearing. Specifications for the Model 809C are given in Table 1.

5. ITEMS FURNISHED

6. Four (4) socket head cap screws (HP part number 3030-0024) are supplied for mounting HP slotted sections to the Model 809C.

7. ACCESSORIES AVAILABLE

8. SLOTTED SECTIONS, PROBES, AND DETECTORS. HP slotted sections, probes, and detectors which can be used with the Model 809C are listed in Table 2.

Table 2. HP Slotted Sections, Probes, and Detectors for Use with the 809C

| Slotted Section | Compatible HP Probes and Detectors |
|---|--|
| Coaxial: 816A (1.8 - 18 GHz) | 447B Untuned Probe 448A Slotted Line Sweep Adapter ¹ |
| 806B (3 - 12 GHz) | 440A/442B Detector Mount and Broadband Probe 423A/442B Crystal Detector and Broadband Probe 444A Untuned Probe |
| Waveguide: 810B Series (3.95 - 18 GHz) | Same as for 806B |
| ¹ For swept slotted line measurements. | |

9. DIAL INDICATORS. Any standard dial indicator (e.g., L. S. Starrett Co., Model 25-881; Federal Products Corp., Model P61-S) which meets the following requirements can be used with the Model 809C.

a. Spindle housing with a diameter of 3/8".

b. Spindle travel of 2.54 cm (1 inch).

c. Dial display of 0.001 cm.

10. INITIAL INSPECTION

11. VISUAL.

12. If external damage to the shipping container is evident, ask the carrier's agent to be present when the carriage is unpacked.

13. UNPACKING AND MECHANICAL INSPECTION.

14. Check the cushioning material and note any signs of severe stress as an indication of rough handling in transit. Check the carriage for external damage, such as broken controls, dents, or surface scratches. If external damage is evident, refer to paragraph 17 for the recommended claim procedure and packaging information.

15. MECHANICAL CHECK.

16. **CARRIAGE ALIGNMENT CHECK.** Incoming inspection should check carriage alignment using the procedures given in Figure 4 (Check and Adjustment Procedures).

17. CLAIMS.

18. If the carriage is damaged or a deficiency is noted, notify the nearest Hewlett-Packard office immediately. HP regional sales and service offices are listed in Table 5. The HP office will arrange for repair or replacement without waiting for the claim against the carrier to be settled. In the event of mechanical damage, retain the shipping container and packing material for the carrier's inspection.

19. PACKAGING FOR RESHIPMENT.

20. **PREPACKAGING INFORMATION.** When the Model 809C carriage is being returned to HP for claims or servicing, the probe mount (16) should be properly secured before packaging. (See Figure 7 for identification of parts mentioned in paragraphs 20 and 21).

21. To secure probe mount:

- a. Move the probe mount to the extreme right of its travel and secure it with the moveable stop (9).
- b. Wrap a piece of 4" wide corrugated cardboard around the bearing rods (6, 37). Tape one end of the cardboard to the left-end frame (1) and the other to the probe mount.

NOTE

Do not apply tape to the rods. The adhesive will stick to the rod and interfere with the sliding action of the probe mount.

22. **USING ORIGINAL PACKAGING.** The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard offices. HP regional sales and service offices are listed in Table 5.

- a. If the Model 809C carriage is being returned to HP for servicing, attach a tag indicating the type of service required, return address, and model number. Also, mark the container FRAGILE to assure careful handling.
- b. In any correspondence, refer to the carriage by its model number.

23. **USING OTHER PACKAGING.** The following general instructions should be used when packaging with commercially available materials:

- a. Wrap the carriage in heavy paper or plastic. If shipped to a Hewlett-Packard service office or center, attach a tag indicating the type of service required, the return address, and full model number.
- b. Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.
- c. Use enough shock-absorbing material (3 to 4 inch layer) around all sides of the carriage to provide a firm cushion and prevent movement inside the container.
- d. Seal the shipping container securely, and mark it FRAGILE to assure careful handling.
- e. In any correspondence refer to the carriage by its full model number.

24. OPERATION.**25. FEATURES.**

26. Carriage operating features are shown and described in Figure 1. Description numbers match the numbers on the illustration.

27. PREPARATION FOR USE.

28. The carriage operating features mentioned in paragraphs 29 and 30 are identified in Figure 1.

CAUTION

Avoid damaging the detector probe; always mount it AFTER the slotted section has been mounted.

29. **MOUNTING/A SLOTTED SECTION.** To mount a slotted section:

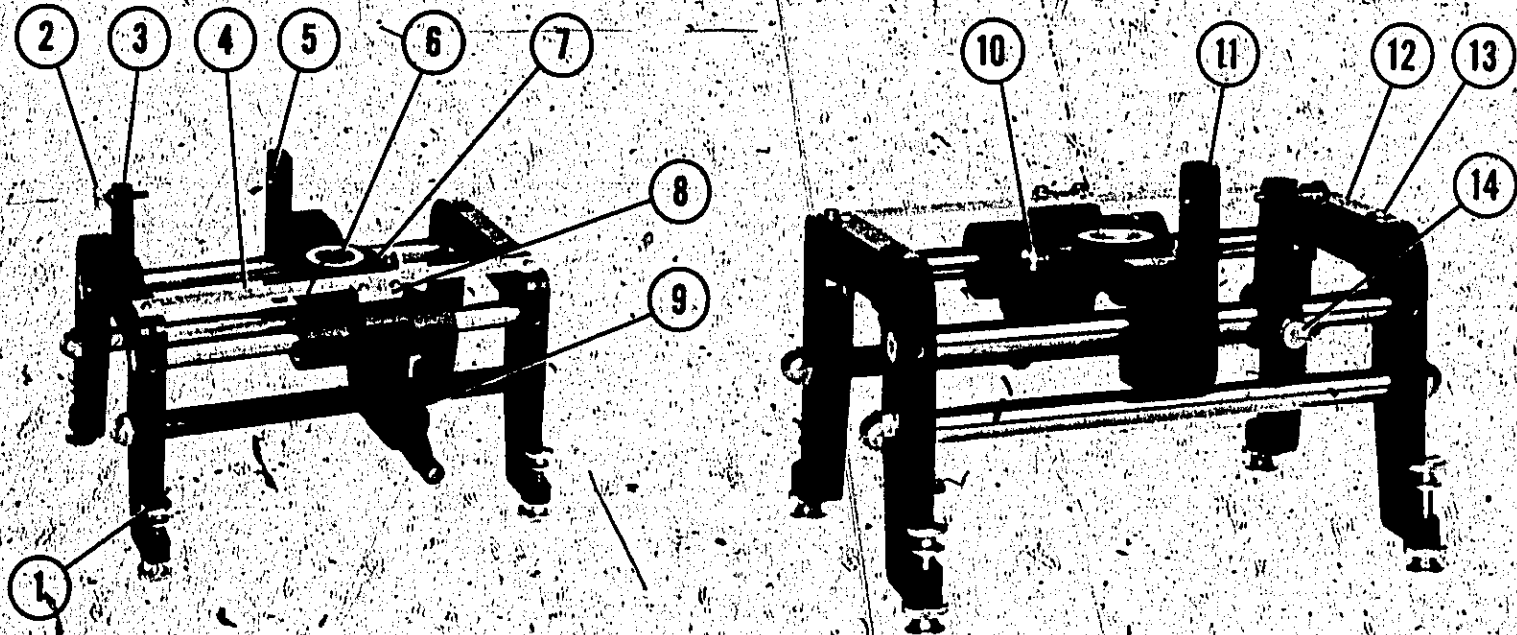
- a. With tool #1 (Table 3), loosen both slope adjust setscrews, so that the leveling blocks can slip into the slots on the end frames.
- b. With the slot-side of the slotted section up and the four mounting holes aligned with the four mounting holes of the carriage, carefully slide the slotted section into the end frame shoulders. The end frame shoulders normally have a clearance of about 0.001" so the slotted section will fit snugly.

CAUTION

Do NOT force the slotted section into the end frame shoulders. The end frame and/or the slotted section may be damaged (nicked, burred, scratched, etc.).

- c. Four socket head cap screws are provided for fastening the slotted section to the main carriage. With tool #2 (Table 3), tighten these screws in a cross-diagonal order taking care not to bind the slotted section in the carriage as the screws are set.

CARRIAGE OPERATING FEATURES

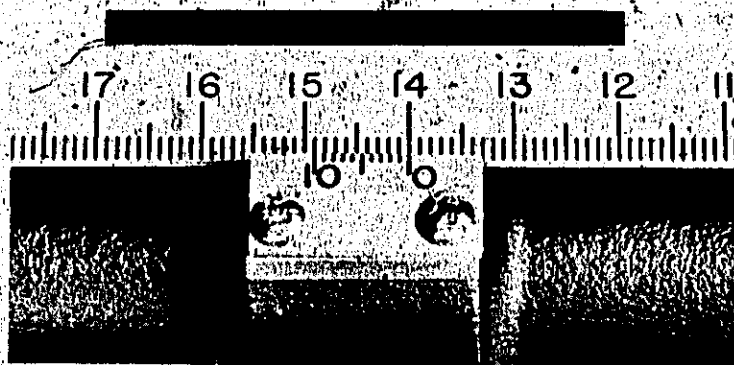


1. **LEVELING SCREW.** Adjusts the height of the 809C so that it is level with respect to the interconnecting equipment. For lowest reflection connection, it is important that the connectors/flanges mate precisely.
2. **VERNIER STOP THUMBSREW.** Fine adjust for the moveable stop.
3. **MOVEABLE STOP.** A moveable stop which sets the reference for dial indicators when making probe position measurements.
4. **SCALE.**¹ Graduated in centimeters and tenths of centimeters, the scale is primarily used for making probe position measurements over a physical range of 10 cm (8.5 to 18.5 on scale). The right flange face of HP waveguide slotted sections (810B series) is the reference plane for this scale. This enables the scale to be used to measure the distance, in centimeters, that the probe is from the reference plane.
5. **DIAL INDICATOR RECEPTACLE.** Dial indicator holder.
6. **PROBE RECEPTACLE.** Refer to Table 2 for a list of the recommended probes.
7. **PROBE MOUNT.** Mounts the probe detector and enables it to detect SWR peaks over a physical range of 10 cm.
8. **VERNIER SCALE.** Used in conjunction with the main scale for making higher resolution probe position measurements.
9. **CRANK KNOB.** Moves probe mount over its travel.
10. **PROBE MOUNT THUMBSREW.** Secures probe in probe receptacle.
11. **CLAMP SCREW.** Adjusts diameter of dial indicator receptacle.
12. **SLOPE ADJUST SETSCREW.** Compensates for slope error in slotted section.
13. **SLOTTED SECTION MOUNTING SCREWS.** Four socket head cap screws that secure slotted section to the 809C Carriage.
14. **STOP THUMBSREW.** Secures moveable stop at desired position for setting the dial indicator reference.

¹ Information on how to read the scales is given in Figure 2.

Figure 1. Carriage Operating Features

READING THE CARRIAGE SCALES



As shown in the photograph above, the main scale is graduated in centimeters (1 cm/division) and tenths of centimeters (0.1 cm/minor division). Ten divisions on the vernier scale occupy the same space as 9 minor divisions on the main scale (0.9 cm). This means that each division on the vernier scale is equal to 0.09 cm, and the difference between a main scale minor division and a vernier scale division is 0.01 cm.

This difference is accumulative and over the 10 divisions of the vernier scale reaches a maximum of 0.1 cm. That is, with the vernier 0-line set opposite a major division on the main scale, the first line to the left of the vernier 0-line differs from the first line to the left of the main scale major division by 0.01 cm, the second line to the left of the vernier 0-line differs from the second line to the left of the main scale major division by 0.02 cm, and so on until the 10th line to the left of the vernier 0-line coincides exactly with the 9th line to the left of the

main scale major graduation, indicating a difference of 0.1 cm.

To read carriage position:

a. Note how many centimeters and tenths of centimeters the vernier 0-line indicates on the main scale.

b. Add the number of hundredths, indicated by the line on the vernier scale which coincides exactly with a line on the main scale. In the picture below, the vernier 0-line indicates a reading of 14.2 plus cm. The number of hundredths is 3, because the 3rd line of the vernier scale exactly coincides with a line on the main scale. Therefore, the carriage position is 14.2 cm plus the 0.03 cm, or 14.23 cm.

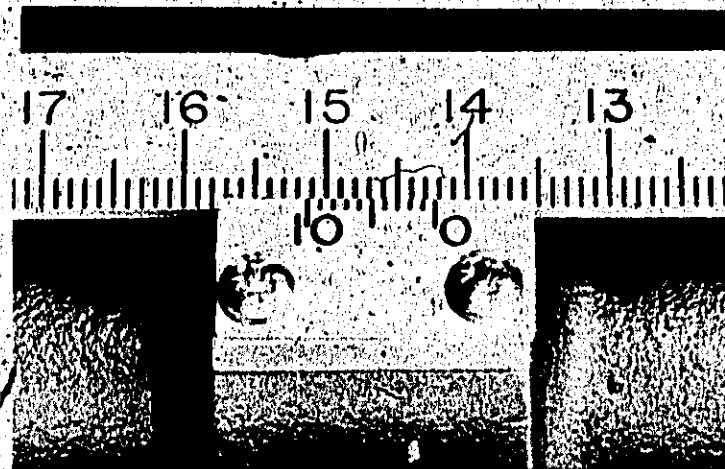


Figure 2. Reading the Carriage Scales

30. MOUNTING A PROBE. To mount a probe:

CAUTION

When handling probes, always take hold of the probe body first. This enables the probe body to acquire the same static charge as the person handling it and eliminates the possibility of the static charge discharging through the detector and burning it out.

- Loosen the probe's knurled locknut and retract the probe tip until it is shielded by the probe body.
- Loosen the probe mount thumbscrew and insert the probe into the probe receptacle.

Static Charge is an electric charge accumulated on an object or person, usually due to friction.

c. Finger tighten the probe mount thumbscrew to secure probe.

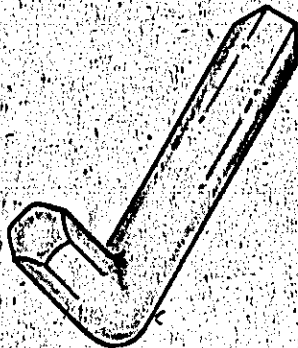
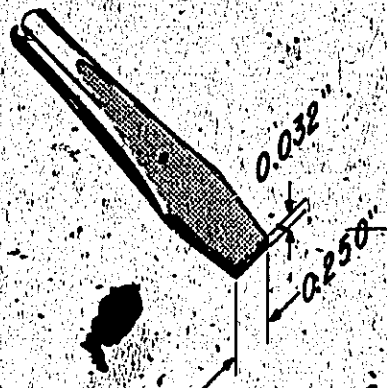
d. Check slotted section's slope and irregularities specification with the procedure given in the operating note for the slotted section being used (Coaxial or Waveguide).

31. MOUNTING A DIAL INDICATOR. The recommended procedure for mounting and using a standard dial indicator is given in Figure 3.

32. MAINTENANCE.

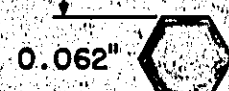
33. PREVENTIVE MAINTENANCE. To ensure smooth operation of the 809C Universal Probe Carriage, the bearing rods and gear rack should be kept clean. All bearings are permanently lubricated and no routine lubrication is required.

Table 3. Tools Required for Adjustments and Repair

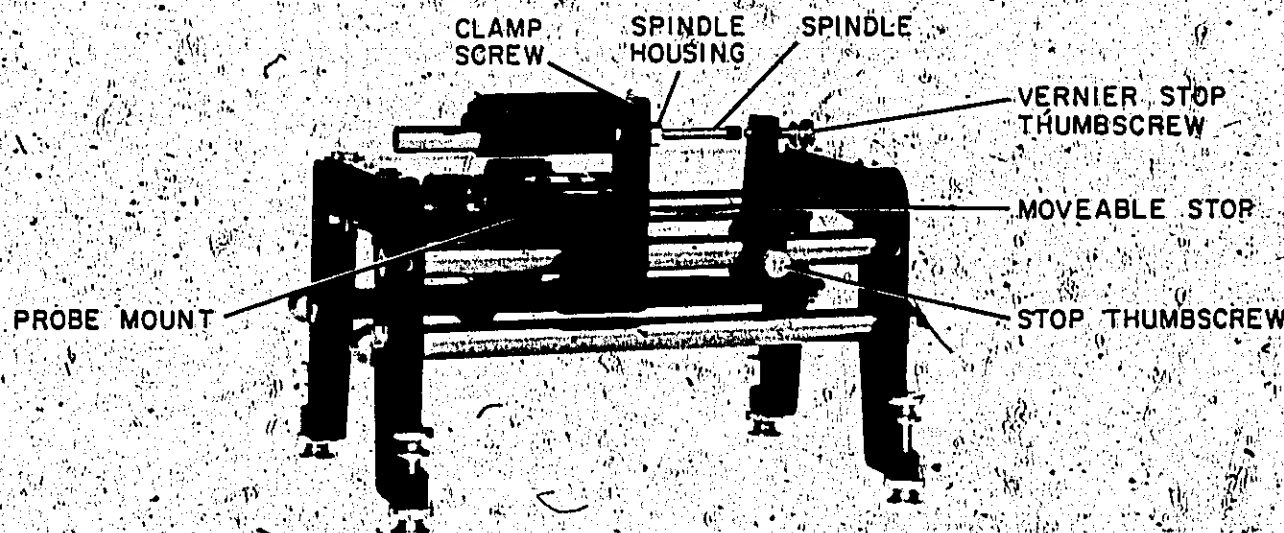
| Tool # | Tool Name | Use ¹ | Qty. | Description |
|--------|--|--|------|--|
| 1 | Hex (Allen) wrench 0.062" AF ² | Loosen/tighten slope adjust setscrews (3) | 1 |  |
| 2 | Hex (Allen) wrench 0.140" AF ² | Loosen/tighten slotted section mounting screws (2) and clamp screws (17) | 1 | |
| 3 | Hex (Allen) wrench 0.078" AF ² | Loosen/tighten a. Bearing rod setscrews (22, 26) b. Eccentric bushing setscrew (5) c. Ball bearing axle setscrews (5) d. Crank knob setscrews (30) | 1 | |
| 4 | Slot screwdriver | a. Adjusting ball bearing axles (5) b. Removing scale (13) | 1 |  |
| 5 | Hex (Allen) wrench 0.109" AF ² | Loosen/tighten ball-bearing-holder screws (20) | 1 | Same as tools 1, 2, and 3 |
| 6 | Mallet | a. End frame adjustment b. End frame removal | 1 | Rubber, plastic, leather, etc. |
| 7 | Long nose pliers | Adjust eccentric bushing (4) | 1 | |
| 8 | Wrench | Adjust rear bushing (32) | 1 | 1/2" open-end. |
| 9 | Wrench | Loosen/tighten cap nuts (23) | 2 | 9/16" open-end or box-end type. |
| 10 | Feeler Gauge | Checking uniform clearances between probe mount and slotted section | 1 | Thickness: 0.003" to 0.020" |

¹ Part numbers given in USE column are identified in Figure 7.

² AF, across the flats, is the physical length between any two opposite flats of the Hex (Allen) wrench. (The sketch shows an expanded view of the AF dimension for tool #1.)



USING A DIAL INDICATOR



MOUNTING A DIAL INDICATOR. A fitting to the rear of the carriage is designed to mount a dial indicator. (See Paragraph 9 for the recommended dial indicator features.)

1. To mount a dial indicator, proceed as follows:
 - a. Loosen the clamp screw with tool #2 (Table 3) and slide the spindle housing into the dial indicator receptacle.
 - b. Tighten the clamp screw for a snug fit of the spindle housing.

CAUTION

Overtightening the clamp screw will pinch the spindle housing, causing it to interfere with the sliding action of the spindle.

MAKING PROBE POSITION MEASUREMENTS. Due to the normal 1-inch (2.54 cm) range of standard dial indicators, precise probe position measurements are normally restricted to frequencies above 8 GHz.

1. To use a dial indicator, proceed as follows:
 - a. Find a standing wave peak nearest the center of the probe mount travel.
 - b. Loosen the stop thumbscrew and slide the moveable stop over until the vernier stop thumbscrew is about $1/32$ " from the dial indicator spindle.
 - c. Finger tighten the stop thumbscrew to secure the moveable stop in place.
 - d. Adjust the vernier stop thumbscrew until it just makes contact with the spindle. Check that the standing wave peak obtained in step a is at a maximum at the precise point of contact. Set the dial indicator for a zero indication.
 - e. Move the probe mount toward the moveable stop until the adjacent standing wave peak is obtained on the SWR meter.
 - f. Read the dial indicator directly. This measurement is the physical length for half a wavelength of test frequency. Actually, the guide wavelength is approximately 1% longer in a slotted waveguide section than in unslotted guide.¹

¹ C. G. Montgomery, Technique of Microwave Measurements, Vol. II, Rad. Lab. Series, 1947, pp 480-483.

Figure 3. Using a Dial Indicator

34. PERIODIC CHECK. A periodic check of three 809C Carriage characteristics is recommended for determining whether it's operating properly. Due to wear, mechanical shock, and/or severe stress or strain, one or more of these carriage characteristics may require adjustment: end frame alignment, probe mount tilt and probe mount slope. Procedures for checking and adjusting these characteristics are given in Figure 4, Check and Adjustment Procedures.

35. REPAIR.

36. DRIVE GEAR REPLACEMENT. The recommended replacement procedure for replacing the drive gear is given in Figure 6.

37. END FRAME REPLACEMENT. The recommended replacement procedure for replacing the end frame is given in Figure 5.

PERFORMANCE CHECK

CHECK AND ADJUSTMENT PROCEDURES

Parts and tools mentioned in these procedures are shown and listed in Figure 7 and Table 3.

A. End Frame Alignment.

This procedure ensures that the end frame shoulders, which make contact with the slotted line, lie on the same horizontal plane. This alignment prevents distortion of the slotted section when it is mounted in the carriage.

1. CHECK.

- a. Loosen both slope adjust setscrews (3) with tool #1.
- b. Slip an HP waveguide slotted section¹ onto the main carriage. (An HP Model X810B is preferred because it enables more standing wave peaks to be observed over its length.)

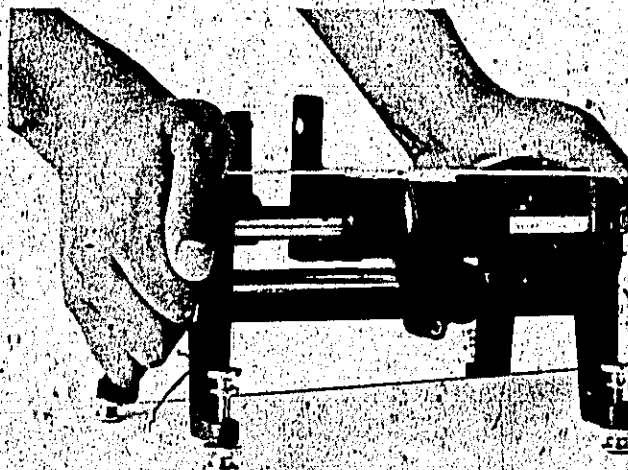
CAUTION

Do NOT force the slotted section into the end frame shoulders. The slotted section will fit snugly because of tight machining tolerances.

- c. The slotted section should rest flush with all four end frame shoulders. Alternately squeeze diagonally opposite corners; there should be no tendency for the slotted section to wobble.
- d. If the slotted section does not wobble, secure it to the main carriage per paragraph 29 and proceed with procedure B, Probe Mount Tilt. If the slotted section does wobble, continue on with the adjustment section of this procedure.

2. ADJUSTMENT.

- a. Loosen front and rear bearing rod setscrews (22, 26) and eccentric bushing setscrew (5) with tool #3.
- b. Apply a downward pressure to both end frame corners where slotted section wobble was observed. (See photograph below). Recheck for wobble and repeat pressure as necessary.



¹ All HP slotted sections are machined very flat, but coaxial slotted sections have a center conductor. These center conductors may have minor irregularities that can make probe mount slope seem out of tolerance. Therefore, a waveguide slotted section is recommended for this procedure.

(Continued)

CHECK AND ADJUSTMENT PROCEDURES (Continued)

- c. If the adjustment in step "b" does not eliminate the wobble, proceed as follows:
- 1) Loosen the lower ball bearing axle setscrew (5) with tool #3.
 - 2) Adjust the lower ball bearing axle (21) with tool #4, until the lower ball bearing (18) moves away from the rear bearing rod (6).
 - 3) To prevent gouging of the rear bearing rod (6) remove the ball bearing holder (19) by removing two screws (20) with tool #5.
 - 4) To prevent the probe mount from striking and marking the rear bearing rod (6), move the probe mount to the extreme right of its travel and secure it there with the moveable stop (9). This will suspend the rear portion of the probe mount about 1/4" away from the rear bearing rod (6).²
 - 5) With tool #6, strike either of the end frame corners that needs lowering, until the wobble is no longer evident.³
 - 6) Replace the ball bearing holder (19) removed in step 3.
 - 7) Adjust the lower ball bearing axle (21) with tool #5, until the lower ball bearing (18) just touches the rear bearing rod (6) and begins to roll when the probe mount is moved back and forth. Check that the probe mount does not bind as it is moved over its full travel. If it binds, adjust the lower ball bearing axle slightly to eliminate the bind.
 - 8) Tighten the lower ball bearing axle setscrew (5) with tool #3.
- d. Leave the eccentric bushing setscrew (5) loose and tighten the other three bearing rod setscrews (22, 26) with tool #3.
- e. Secure the slotted section to the main carriage using paragraph 29 and continue with procedure B, Probe Mount Tilt.

B. Probe Mount Tilt.

This procedure ensures that there is uniform front-to-back clearance between the probe mount and the slotted section so that the probe moves vertically in the slot.

1. CHECK.

- a. With tool #10, check that the front-to-back clearance between the bottom of the probe mount and the top of the slotted section is uniform over the full travel of the probe mount.
- b. If the front-to-back clearance is uniform, continue with procedure C, Probe Mount Slope.
- c. If the front-to-back clearance is not uniform, proceed with the adjustment section of this procedure.

² A protective piece of plastic or foam rubber should be inserted between the probe mount and the rear bearing rod. Do not apply tape to the rods; any adhesive left on the rod will interfere with the smooth sliding action of the probe mount.

³ If an end frame has been replaced and the carriage cannot be aligned, contact the nearest HP office for assistance.

(Continued)

CHECK AND ADJUSTMENT PROCEDURES (Continued)

2. ADJUSTMENT.

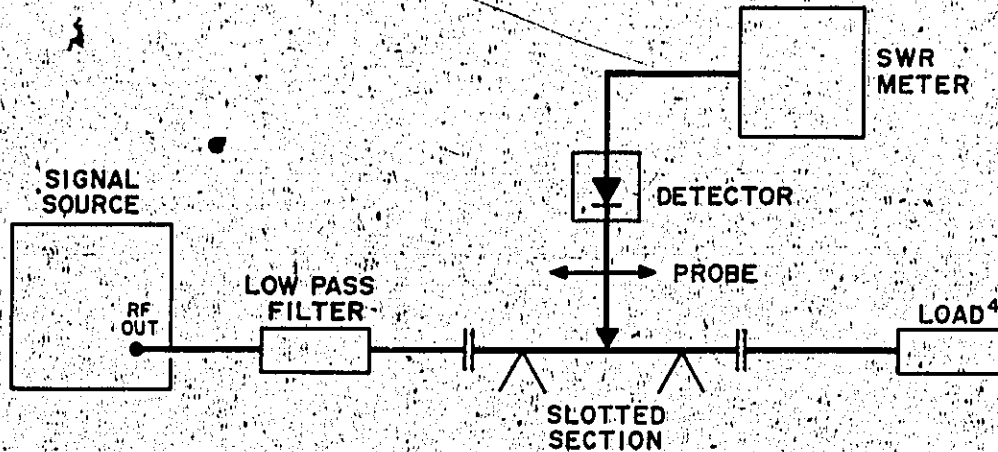
- a. Remove the drive gear (27) using the procedure in Figure 6.
- b. Place the carriage in an end-on position so that the crank knob side is to your right. Keep the carriage in this position throughout this adjustment procedure.
- c. Loosen both ball-bearing axle setscrews (5) with tool #3.
- d. Rotate the lower ball-bearing axle (21) with tool #4, until the lower ball bearing (18) moves away from the rear bearing rod (6).
- e. Apply a slight downward pressure on the ball bearing holder (19) and with tool #4, adjust the upper ball bearing axle (21) for uniform front-to-back clearance between the probe mount and the top of the slotted section.
- f. Tighten the upper ball-bearing axle setscrew (5) with tool #3.
- g. While moving the probe mount back and forth, adjust the lower ball bearing axle (21) until the lower ball bearing (18) just begins to roll on the rear bearing rod (6).
- h. Move the probe mount over its full travel. It should ride smoothly and not bind. If it binds, adjust the lower ball bearing axle (21) to eliminate the bind.
- i. Replace the drive gear using procedure given in Figure 6.
- j. Continue on with procedure C, Probe Mount Slope.

C. Probe Mount Slope

This procedure ensures that the probe mount travels parallel to the slotted section and that the probe penetration is uniform across the full travel of the probe mount.

1. CHECK.

- a. Connect equipment as shown below.



⁴ The Load's SWR should be > 1.1 . HP waveguide loads can be degraded temporarily to obtain a SWR of greater than 1.1, as follows:

- a. Remove the load element and tape a 1/8" piece of solder to it.
- b. Keep the solder in back of the load tip (about 1"). The load is very fragile and the load tip breaks very easily.

(Continued)

CHECK AND ADJUSTMENT PROCEDURES (Continued)

- b. Set the signal source as follows:

Output power 1 - 10 mW
 Internal AM frequency same as tuned frequency
 of SWR meter
 Output frequency highest frequency of slotted
 section range

c. While measuring a standing wave peak, adjust the probe depth for an on-scale indication on the SWR meter. Probe penetration should be adjusted to operate the detector in its square law region.

d. Find the standing wave peak nearest the left extreme of probe mount travel and adjust the SWR meter for 0.5 dB reference setting on the expand scale.

e. Find the standing wave peak nearest the right extreme of probe mount travel. The difference in amplitude between this standing wave peak and the reference setting should not exceed 0.1 dB.

f. Check that all standing wave peaks observed along the probe mount travel do not deviate more than 0.1 dB from the reference set in step "d". If the maximum deviation is less than 0.1 dB then tighten the eccentric bushing setscrew (5), if previously loosened, and recheck probe mount slope.

g. If the maximum deviation is still less than 0.1 dB, then the probe mount slope is properly adjusted. The 809C Carriage is now aligned properly and can be used for making slotted line measurements.

h. If the maximum deviation is greater than 0.1 dB, proceed with the adjustment section of this procedure.

2. ADJUSTMENT.

a. Find the standing wave peak nearest the left extreme of probe mount travel and adjust the SWR meter for a 0.5 dB reference setting on the expand scale.

b. Adjust the eccentric bushing (4) with tool #7, to obtain a deviation of less than 0.1 dB between any standing wave peak along the probe mount travel and the reference setting.

c. Tighten the eccentric bushing setscrew (5) with tool #3, and recheck the probe mount slope.

NOTE

Tightening the setscrew may change the eccentric bushing setting. Therefore a little offset may be necessary when initially adjusting the eccentric bushing.

d. The 809C is now aligned and can be used for making slotted line measurements.

END FRAME REPLACEMENT

Adjustments should be made only on the carriage end requiring an end frame replaced.

Refer to Figure 7 for identification of the parts mentioned in this procedure. The tools required for the necessary adjustments in this procedure are listed in Table 3.

Remove and replace end frame as follows:

1. Remove the scale (13) with tool #4.
2. Loosen the appropriate front and rear bearing rod setscrews (5, 26) or (22, 26) with tool #3.
3. Remove both appropriate cap nuts (23) with tool #9.
4. Hold the good end frame and probe mount with one hand and tap the bad end frame with tool #6, until the bearing rods (6, 37) spacing rod (7), and gear rack (34) slip out. If the left end frame is being replaced, proceed with step 5. If the right end frame is being replaced, proceed with step 6.
5. Remove the eccentric bushing (4) from the end frame and insert it into the new left end frame.
6. Put the new end frame on. A slight tapping with tool #6 may be necessary.
7. Thread on the cap nuts previously removed in step 3.
8. Tighten the spacing rod cap nut with tool #9.
9. Place a flat object across the gear rack (34) and the rear spacing rod (7). (Note that the flat object's bottom surface and the gear rack's top surface are flush). To prevent the gear rack from twisting, apply a simultaneous tightening pressure to both gear rack cap nuts with two #9 tools. If the gear rack has not twisted, the surfaces will still be flush. Otherwise, repeat the adjustment until the surfaces are flush. (Refer to illustration).
10. Tighten the bearing rod setscrews (22, 26) or (5, 26) with tool #3.
11. Replace the main scale removed in step 1.
12. Perform the necessary checks and adjustments per Figure 4, Check and Adjustment Procedures.

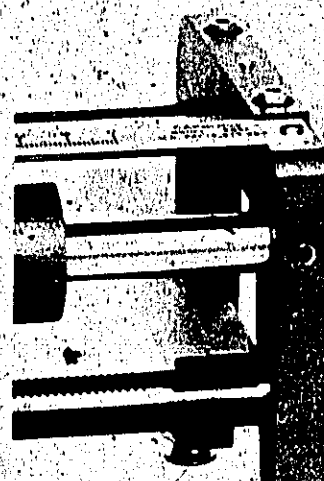


Figure 5. End Frame Replacement

DRIVE GEAR REPLACEMENT

Refer to Figure 7 for identification of the parts mentioned in this procedure. The tools required for the necessary adjustments in this procedure are listed in Table 3.

Remove and replace drive gear as follows:

1. Loosen both crank knob setscrews (30) with tool #3. Remove the crank knob (31) and three washers (28, 33).
2. Loosen the rear bushing setscrew (5) using tool #3.
3. Rotate rear bushing (32) using tool #9 until drive gear (27) raises slightly from rear rack (34), then slip drive gear out.¹
4. Replace the drive gear. Adjust the rear bushing with tool #9, until the drive gear meshes with the gear rack.
5. Pull the probe mount over its travel, a slight drag should be evident.
6. Tighten the rear bearing setscrew with tool #3.
7. Replace the crank knob and washers removed in step 1. Compress the spring washer (28) somewhat before tightening the crank knob setscrews (30) with tool #3.

¹ The nylon gear on the drive gear (27) may fall off, but it can be glued back on. (Use Eastman 910 or an equivalent glue.)

Figure 6. Drive Gear Replacement

38. REPLACEABLE PARTS.

39. PARTS IDENTIFICATION.

40. Figure 7 is an exploded view of the Model 809C. The numerical designations given to parts in Figure 7 correspond to the numbers given in the reference designation column of Table 4.

41. ORDERING INFORMATION.

42. When ordering a replacement part listed in Table 4:

- a. Quote the Hewlett-Packard stock number for the part.
- b. Address the order or inquiry to the nearest Hewlett-Packard office. (HP regional sales and service offices are listed in Table 5.)

PARTS LIST

Table 4. Replaceable Parts

| Item Number | HP Stock Number | Description | Total Quantity | Note |
|---|-----------------|----------------------------------|----------------|------|
| Numbers correspond to callouts on Figure 7. | | | | |
| 1 | 00809-2001 | END FRAME | 2 | |
| 2 | 3030-0024 | SOCKET HD CAP SCREW 8-32 X 1" | 4 | |
| 3 | 3030-0006 | SET SCREW 6-32 X 1/4" | 2 | |
| 4 | 809B-17C | ECCENTRIC BUSHING | 1 | |
| 5 | 3030-0021 | SET SCREW 8-32 X 1/8" | 4 | |
| 6 | 00809-2007 | REAR BEARING ROD | 1 | |
| 7 | 809B-37B | SPACING ROD | 1 | |
| 8 | 0570-0092 | KNURLED SCREW 8-32 X 3/4" | 2 | |
| 9 | 809B-77C | MOVEABLE STOP | 1 | |
| 10 | 2200-0137 | SLOT SCREW RD HD 4-40 X 3/16" | 2 | |
| 11 | 2200-0143 | SLOT SCREW RD HD 4-40 X 3/8" | 2 | |
| 12 | 809B-40B | VERNIER SCALE | 1 | |
| 13 | 00809-2004 | SCALE | 1 | |
| 14 | 0570-0003 | KNURLED SCREW 8-32 X 3/8" | 1 | |
| 15 | 809B-77B | VERNIER SCALE SPACER | 1 | |
| 16 | 00809-6001 | PROBE MOUNT ASSY | 1 | 1 |
| 17 | 3030-0019 | SOCKET HD CAP SCREW 8-32 X 3/8" | 1 | |
| 18 | 1410-0007 | BALL BEARING | 2 | |
| 19 | 809B-77A | BALL BEARING HOLDER | 1 | |
| 20 | 3030-0049 | SOCKET HD CAP SCREW 6-32 X 7/8" | 2 | |
| 21 | 809B-37E | BALL BEARING AXLE | 2 | |
| 22 | 3030-0005 | SET SCREW 8-32 X 1/8" | 1 | |
| 23 | 0590-0008 | CAP NUT 5/16"-18 | 4 | |
| 24 | 0570-0020 | SLOT SCREW RD HD 0-80 X 3/8" | 2 | |
| 25 | 00809-2002 | LEVELING BLOCK | 2 | |
| 26 | 00809-2010 | SOFT SET SCREW 8-32 X 1/8" | 2 | |
| 27 | 809B-37F | DRIVE GEAR | 1 | |
| 28 | 5020-0392 | SPRING WASHER | 1 | |
| 29 | 809B-17A | FRONT BUSHING | 1 | |
| 30 | 3030-0001 | SET SCREW 8-32 X 3/16" (P/O #31) | 2 | |
| 31 | 0370-0149 | CRANK KNOB | 1 | |
| 32 | 809B-17B | REAR BUSHING | 1 | |
| 33 | 3050-0032 | FLAT WASHER BRZ. 195" ID | 2 | |
| 34 | 809B-24B | GEAR RACK | 1 | |
| 35 | 0590-0009 | KNURLED NUT 1/4"-20 | 4 | |
| 36 | 0570-0001 | KNURLED SCREW 1/4"-20 X 1" | 4 | |
| 37 | 00809-2006 | FRONT BEARING ROD | 1 | |

NOTES: 1. The probe mount assembly is preassembled at the factory and the bushings (item c below) are burnished to size. Therefore, items b and c should not be replaced separately.

a. Probe mount: 00809-2008

b. Spacer: 00809-2009

c. Bushing: 1410-0186

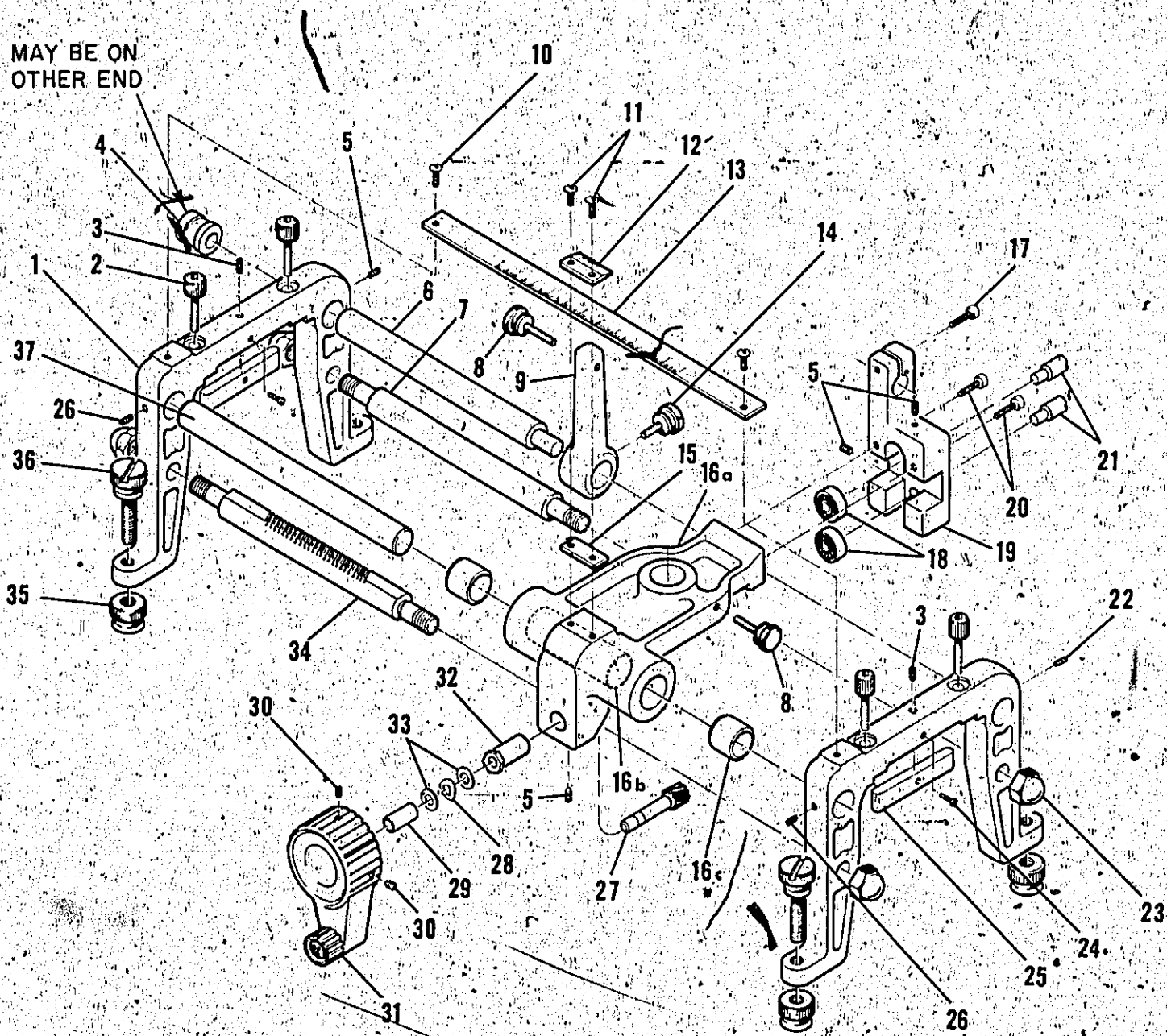


Figure 7. Exploded View of Model 809C

Table 5. HEWLETT-PACKARD REGIONAL SALES AND SERVICE OFFICES

To obtain servicing information and order replacement parts, contact the nearest Hewlett-Packard Sales and Service Office in HP Catalog, or contact the nearest regional office.

IN THE UNITED STATES:**CALIFORNIA**

3939 Lankershim Blvd.
North Hollywood 91604

GEORGIA

P. O. Box 28234
450 Interstate North
Atlanta 30328

ILLINOIS

5500 Howard Street
Skokie 60076

NEW JERSEY

W. 120 Century Road
Paramus 07652

IN CANADA:**QUEBEC**

Hewlett-Packard (Canada) Ltd.
275 Hymus Blvd.
Pointe Claire

IN EUROPE:**SWITZERLAND**

Hewlett-Packard (Schweitz) A. G.
Rue du Bois-du-Lan 7
1217 Meyrin-Geneva

IN AFRICA, ASIA AND AUSTRALIA:

Hewlett-Packard Export Marketing
3200 Hillview Ave.
Palo Alto, California 94304

IN CENTRAL AND SOUTH AMERICA:

Hewlett-Packard Inter-Americas
3200 Hillview Ave.
Palo Alto, California 94304

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

WARRANTY AND ASSISTANCE

All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office.