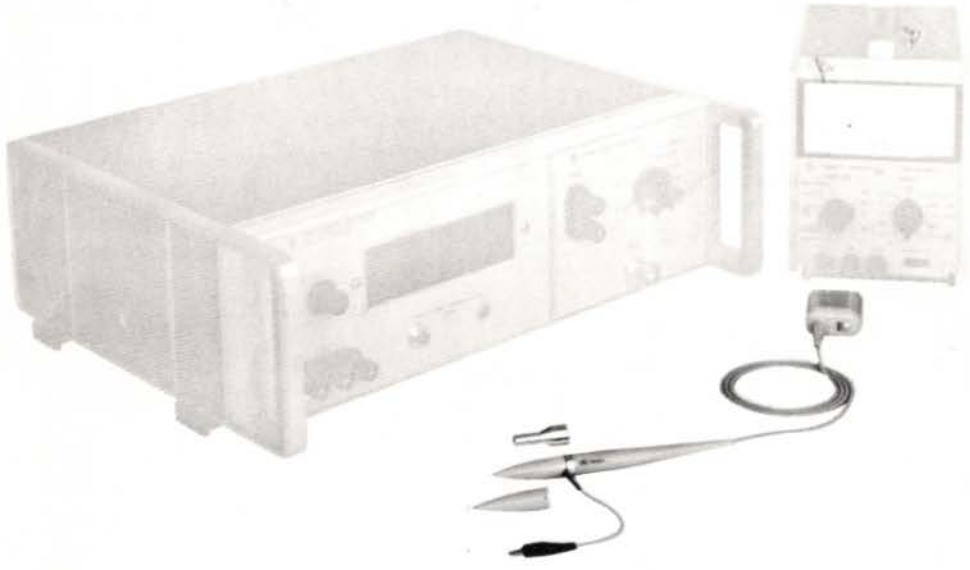
OPERATING NOTE

HIGH FREQUENCY PROBE

11096A



HEWLETT hp PACKARD

Table 1. Model 11096A Specifications

VOLTAGE RANGE: 0.25 V to 30 V.

RESPONSE: Responds to peak value of input. Calibrated to read rms value of a sine wave input.

AC TO DC TRANSFER ACCURACY: *Loaded with 10 megohms ± 10%.

	100 kHz	100 MHz	500 MHz
+ 10° C to + 30° C	± 0.5 dB	± 1.2 dB	

< ± 3 dB at 10 kHz and 700 MHz.

INPUT IMPEDANCE: 4 megohms shunted by 3 pF max.

The High Frequency Adapter adds 1 pF to the 3 pF specifications.

MAXIMUM INPUT: 30 volts rms AC, 200 volts DC.

CABLE CONNECTION: Shielded dual banana plug. Fits all standard 3/4 inch dual banana connectors.

CABLE LENGTH: 4 ft. (121, 9 cm) minimum.

WEIGHT: 3-1/2 oz net.

ACCESSORIES SUPPLIED:
Ground Lead
Straight Tip
Hook Tip
High Frequency Adapter

ACCESSORIES AVAILABLE:
11063A 50 Ohm Tee
11536A 50 Ohm Tee
10218A BNC Adapter
10219A Type 874 Adapter
10220A Microdot Adapter

*The AC to DC Transfer Accuracy specification is with the 11096A probe operating into a dc voltmeter with input resistance of 10 MΩ ± 10%.

1. DESCRIPTION.

2. The -hp- Model 11096A High Frequency Probe converts a dc voltmeter into a high frequency ac voltmeter. The probe is used for ac voltage measurements of 0.25 volts to 30 volts over a frequency range of 100 kHz to 500 MHz. The accuracy of measurement is 0.5 dB 100 kHz to 100 MHz and ± 1.2 dB to 500 MHz over a temperature range of + 10° C to + 30° C. Additional specifications for the 11096A Probe are listed in Table 1. The front cover shows the 11096A Probe with two compatible dc voltmeters. Compatible dc voltmeters are described in the following paragraph.

3. COMPATIBLE DC VOLTMETERS.

4. The -hp- 11096A High Frequency Probe operates into any dc voltmeter with an input resistance of 10 megohms ± 10%. Directly compatible Hewlett-Packard voltmeters are listed below. The shielded dual-banana plug on the probe permits direct connection to voltmeter input.

-hp- Model 427A Voltmeter.
-hp- Model 3440A Digital Voltmeter with any plug in.
-hp- Model 3439A Digital Voltmeter with any plug in.
-hp- Model 3430A Digital Voltmeter.

5. OPERATION.

6. To extend the use of the -hp- Model 11096A Probe three probe-tip accessories are supplied. The Straight Tip or Hook Tip with the ground lead can be used for measurements up to 100 MHz. For measurements above 100 MHz the High Frequency Adapter permits the probe to be used with a 50 Ohm Tee, a BNC Adapter or other available accessories illustrated in Figure 1.

7. For proper operation the 11096A Probe must be connected to a dc voltmeter with 10 MΩ ± 10% input resistance. The Probe may be used directly with any one of the voltmeters listed under Paragraph 4.

NOTE

To use the Probe with 100 MΩ dc voltmeter, connect a 11 MΩ shunt resistor across the voltmeter input before attaching the Probe.

8. Since the 11096A Probe converts the ac input to a positive dc voltage equivalent to the rms value of a sine wave, set the dc voltmeter for a + VDC reading. Connect shielded dual banana plug to voltmeter dc input with the GND Plug connected to the common input terminal. Attach the desired probe tip to the probe body, and connect probe to circuit under test.

NOTE

The ground lead is required with Straight Tip or Hook Tip. The High Frequency Adapter does not require the ground lead when used with one of the accessories shown in Figure 1.

9. USE OF TIPS.

10. The Hook Tip or Straight Tip can be used for measurements up to 100 MHz. Above 100 MHz use the High Frequency Adapter with one of the accessories shown in Figure 1.

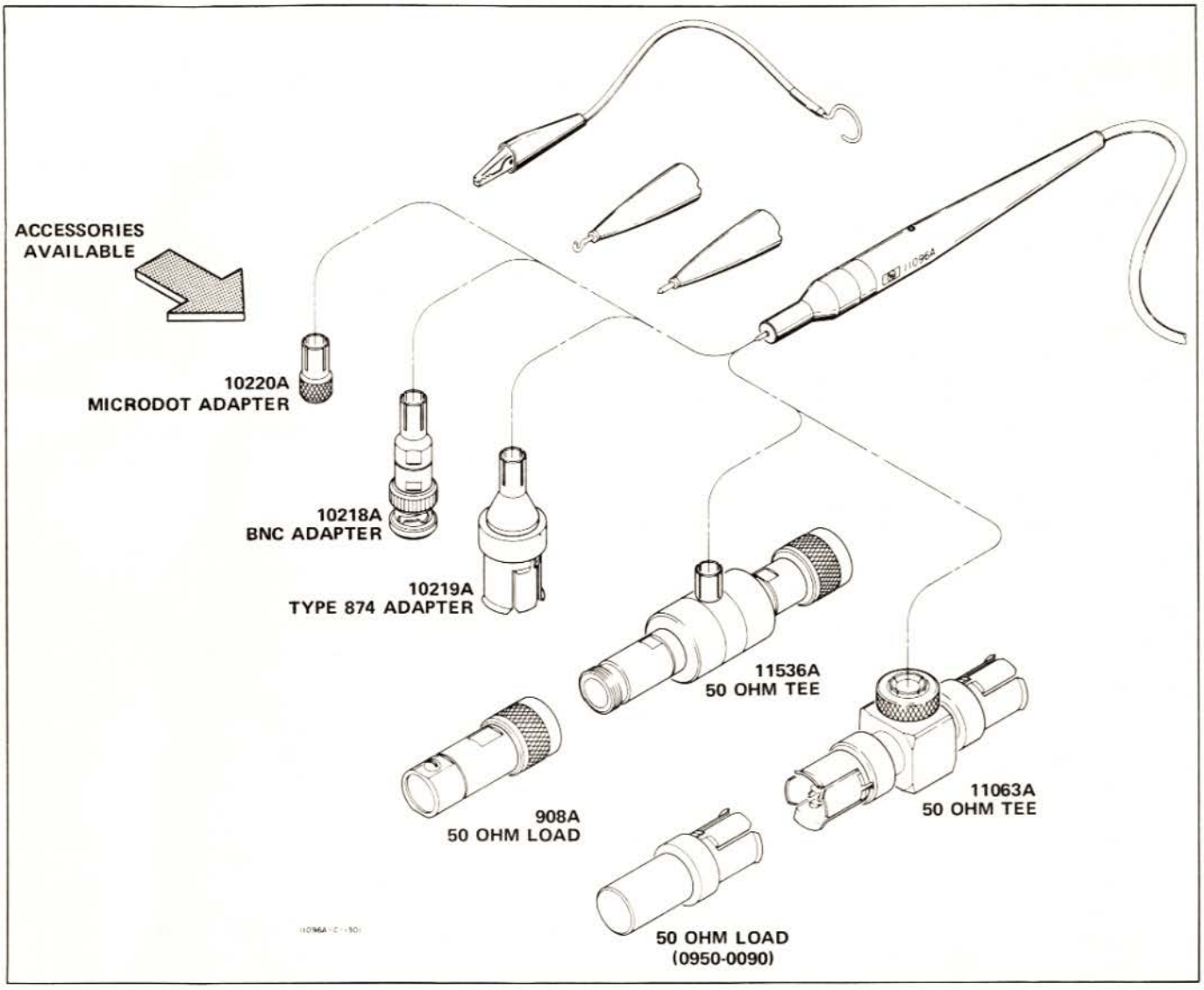


Figure 1. 11096A Probe Accessories

11. MAXIMUM INPUT.

12. The maximum input voltage with any probe tip is 30 volts rms ac, or 200 volts dc. An ac signal superimposed on a dc level up to 200 volts may be measured if desired.

CAUTION

WHEN MEASURING AN AC VOLTAGE SUPERIMPOSED ON A DC LEVEL, DO NOT CHANGE THE DC LEVEL BY MORE THAN 200 VOLTS WITH THE PROBE CONNECTED TO THE CIRCUIT UNDER TEST; OTHERWISE A VOLTAGE TRANSIENT WILL DAMAGE THE DIODES WITHIN THE PROBE.

13. COMPATIBLE DC VOLTMETERS.

14. -hp- Model 427A.

15. With the 11096A Probe attached to -hp- Model 427A Voltmeter the upper end of the 427A frequency range is extended from 1 MHz to 500 MHz. Voltage levels from 0.25 volts to 30 volts can be measured within the specified accuracy of the probe plus the dc accuracy of the 427A Voltmeter.

16. -hp- Model 3440A or 3439A.

17. With the 11096A Probe attached to the input of the -hp- Model 3440A, or 3439A, the magnitude of the ac signal being measured is displayed directly on the front panel digital display as a + dc voltage. When using the Probe with the 3440A or 3439A Digital Voltmeter any one of the available plug-in units may be used (-hp- Model 3441A thru 3446A). With the 3443A and 3444A Plug-in Units a 100 microvolt resolution is available on the 1000 mV range.

18. -hp- Model 3430A.

19. When using the Probe with the -hp- Model 3430A Four Digit Digital Voltmeter, a 60% overranging is available on all usable ranges, and a 1 mV resolution is available on the 1000 mV range. The magnitude of the ac signal being measured is displayed directly on the front panel digital display as a + dc voltage.

20. THEORY OF OPERATION.

21. The 11096A High Frequency Probe is a peak detector with a voltage divider. The probe converts the ac input signal into a positive dc voltage equal to the rms value of the input. The schematic for the 11096A Probe is shown in Figure 2.

22. The 11096A Probe includes a dc blocking capacitor C1, detection diode CR1, resistive divider R1, R3, CR2, R2, and R_{in} of the dc voltmeter. Capacitor C1 charges through diode CR1 during negative cycle of the input to produce a positive dc voltage at junction of CR1 and R1. This positive voltage is equal to the negative peak value below the dc level of the input signal. The resistive voltage divider consisting of R1 and R3 in series with CR2, R2 and 10 MΩ input resistance of the dc voltmeter divides the peak voltage down to an rms value. A 10 MΩ input resistance, R_{in} is required to provide the proper division ratio.

23. At low voltage levels the non-linearity of the detector diode characteristic curve is compensated by diode CR2. On the linear portion of the detector diode characteristic curve the division ratio of the voltage divider, (R1, R3, CR2, R2 and R_{in}) remains constant, and results in 0.707 of the peak at the junction of R3 and CR2. On the non-linear portion of the diode curve, low voltage levels, diode CR2 compensates for non-linearity of CR1 by proportionally changing the division ratio of the divider.

24. Resistor R3* is selected to calibrate the division ratio of the voltage divider. R3* value range is 50 kΩ to 100 kΩ. Refer to Paragraph 43 for selection of R3*. The value of R3* must result in an accuracy of 0% to + 3% with an input of 3 volts at 1 MHz at room temperature.

25. MAINTENANCE.

26. PERFORMANCE CHECKS

27. The following Performance Checks verify proper operation of the 11096A High Frequency Probe over its entire frequency range. The performance checks compare the Model 11096A Probe with its published accuracy specification. These checks may be incorporated in periodic maintenance, post repair, and incoming inspection.

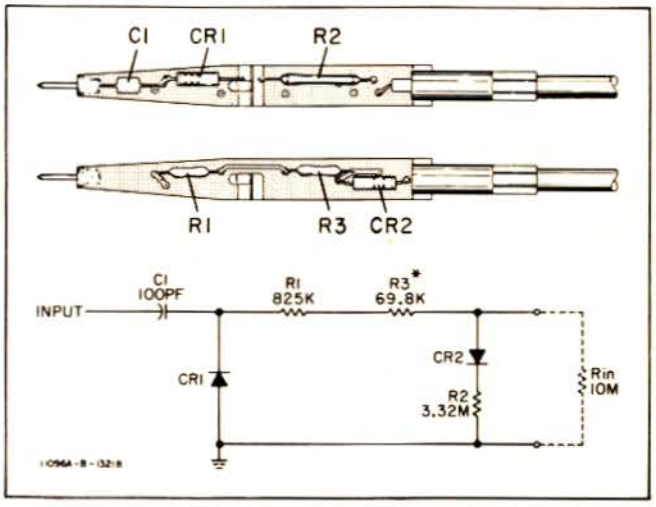


Figure 2. Schematic and Component Location

28. The test equipment required for the performance checks is listed in Table 2. Table 2 includes the type of equipment required, critical specification, and the recommended model. If the model recommended is not available, equipment which meets or exceeds the required characteristics listed may be substituted.

NOTE

The following performance checks must be performed under an ambient temperature of + 10°C to + 30°C (+ 50°F to + 86°F).

29. Low Frequency Response Check.

30. This check verifies 11096A AC to DC Transfer Accuracy of ± 0.5 dB from 100 kHz to 10 MHz. 3 volts at 100 kHz is used as a reference to establish a reference level indication on test oscillator.

31. The following test equipment listed in Table 2 is required for the low frequency response check:

Test Oscillator
AC Voltmeter
DC Voltmeter
50 Ohm Feed-Thru Termination

a. Connect a cable between test oscillator and digital voltmeter as illustrated in Figure 3, connection "A".

b. Set digital voltmeter to measure 3 volts ac.

c. Set oscillator frequency to 100 kHz, and adjust the output for 3.000 volt indication on digital voltmeter.

d. Adjust the REF SET control on oscillator for a reference level indication on output monitor meter. Do not adjust the amplitude control to set the reference. Note the reference level indication.

e. Disconnect connection "A"; set digital voltmeter function to measure dc, and connect the 11096A Probe to test oscillator output as illustrated in Figure 3.

f. Observe dc voltmeter indication between 3.168 and 2.832 volts.

NOTE

The following steps verify AC to DC Transfer Accuracy with 0.95 and 0.3 volt input.

g. Using test oscillator attenuator decrease output by 10 dB (0.95 volts).

h. Observe voltmeter indication between 1.006 and 0.894 volts (10 dB down from 3 volts).

i. Using test oscillator attenuator, decrease output an additional 10 dB (0.3 volts).

j. Observe voltmeter indication between 0.3168 and 0.2832.

k. Return test oscillator attenuator to + 20 dB. (3 V output).

l. Continue to check the Model 11096A Probe by repeating Steps f thru k with oscillator frequency set at 500 kHz, 1 MHz and 10 MHz. Readjust oscillator amplitude to reference level indication established in Step d each time the frequency is changed.

32. High Frequency Response Check.

33. This check verifies 11096A AC to DC Transfer Accuracy of ± 1.2 dB from the 100 MHz to 500 MHz.

34. The following test equipment listed in Table 2 is required for the high frequency response check:

VHF Signal Generator
DC Voltmeter
Power Meter with Thermistor Mount
50 Ohm Tee

Table 2. Test Equipment Required

INSTRUMENT TYPE	REQUIRED CHARACTERISTICS	RECOMMENDED MODEL
Test Oscillator	Range: 100 kHz to 10 MHz Output: 3 volts to 0.3 volts Flatness: Adjustable to 0.5%	-hp- Model 652A Test Oscillator
AC Voltmeter	Voltage Range: 3 volts Frequency Range: 100 kHz Accuracy: ± 0.5% of full scale	-hp- Model 3469B Multimeter
DC Voltmeter	Input Resistance: 10 MΩ ± 10% Voltage Range: 3, 1, and .3 volts full scale Accuracy: ± 0.5% of full scale	-hp- Model 3469B Multimeter
VHF Signal Generator	Frequency Range: 100 MHz to 480 MHz Output Level: 1 volt	-hp- Model 608E VHF Signal Generator
Power Meter	Frequency Range: 100 MHz to 480 MHz Power Range: 10 milliwatts Accuracy: ± 1%	-hp- Model 432A/478A Power Meter and Thermistor Mount
50 Ohm Tee	Frequency Range: 100 MHz to 480 MHz VSWR: < 1.15	-hp- Model 11063A 50 Ohm Tee
50 Ohm Feed-Thru Termination	-----	-hp- Model 11048C 50 Ohm Feed-Thru
Adapter	BNC to Probe Adapter	-hp- Model 10218A BNC Adapter

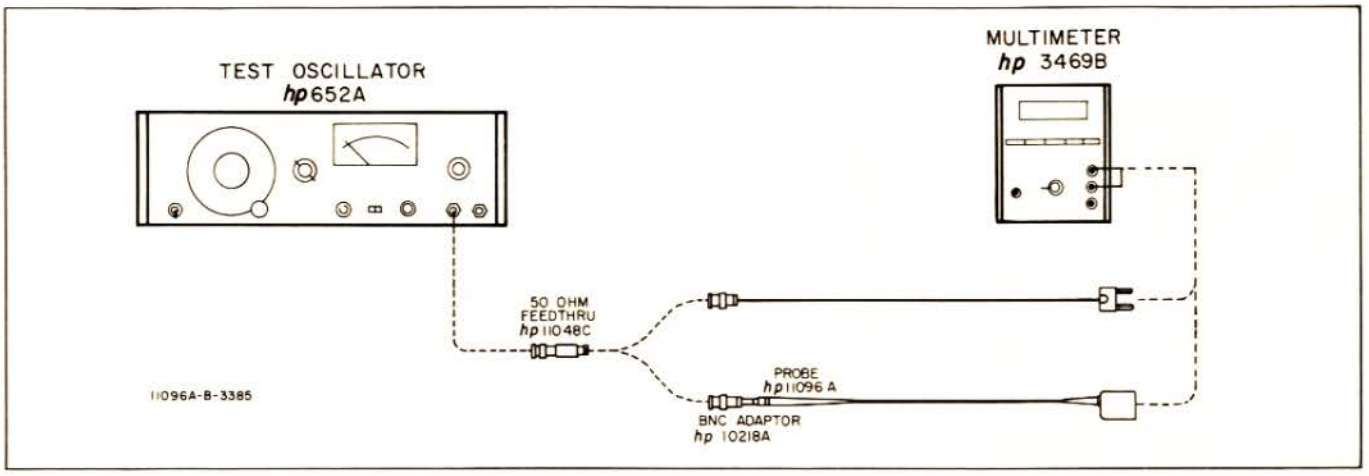


Figure 3. Low Frequency Response Check and Calibration

a. Connect the test equipment to 11096A Probe as illustrated in Figure 4; set dc voltmeter on 10 volt range.

b. Set signal generator frequency to 100 MHz and adjust output for 10 milliwatt indication on the power meter.

NOTE

Monitor the power meter indication for a few minutes to assure that the signal generator has stabilized.

c. Observe dc voltmeter indication between 0.749 and 0.668 volts. Note: 0.707 volts = 10 milliwatts dissipated across 50 ohms.

d. Repeat Step b with signal generator set at 200 MHz, 300 MHz, 400 MHz and 480 MHz. Observe dc voltmeter indication between 0.812 and 0.616 volts.

35. TROUBLESHOOTING.

36. If the 11096A Probe is not within its published specifications or if the probe becomes inoperative, perform the procedures outlined in Paragraphs 37 and 39. The procedures outlined in Paragraphs 37 and 39 will isolate the trouble to a component or connection. Before performing any troubleshooting, an investigation should be made to ensure that the trouble is not a result of conditions external to the probe and dc voltmeter in use. If a 50 ohm tee is being used with 11096A Probe verify proper connection between the tee and the probe.

37. SUBSTITUTE VOLTMETER.

38. The first step in troubleshooting the 11096A Probe is to verify that the trouble is in the probe and not the dc voltmeter. This may be done by substituting another dc voltmeter in place of the one that was connected to the probe when the trouble occurred. Any dc voltmeter with 10 MΩ input resistance may be used as a substitute. If available, any one of the Hewlett-Packard voltmeters listed in Paragraph 3 may be used as a substitute.

39. CHECK DIODES.

40. If the trouble appears to be in the probe, proceed with the following steps:

a. Remove probe tip or High Frequency Adapter.

b. Loosen set screw on the probe, and slide the probe housing toward the shield connector.

NOTE

The probe ground continuity is disconnected with printed circuit board outside of probe housing.

c. Check diodes CR1 and CR2 for open or short. Refer to Figure 2 for diode location. If the probe is completely inoperative (no voltage out) the trouble is most likely an open or shorted CR1. If the probe is within specified accuracy at 3 volts and above, but reads low with input below 3 volts the trouble is most likely a shorted CR2. If the probe reads high, 0.25 volts to 30 volts the trouble is most likely an opening in the CR2, R2 branch.

NOTE

It is not necessary to disconnect the diodes from the circuit when checking for open or short.

d. If both diodes check good, check resistance from cathode of CR1 to the appropriate banana plug on shield connector. Check continuity from cable crimp to GND banana plug on shield connector.

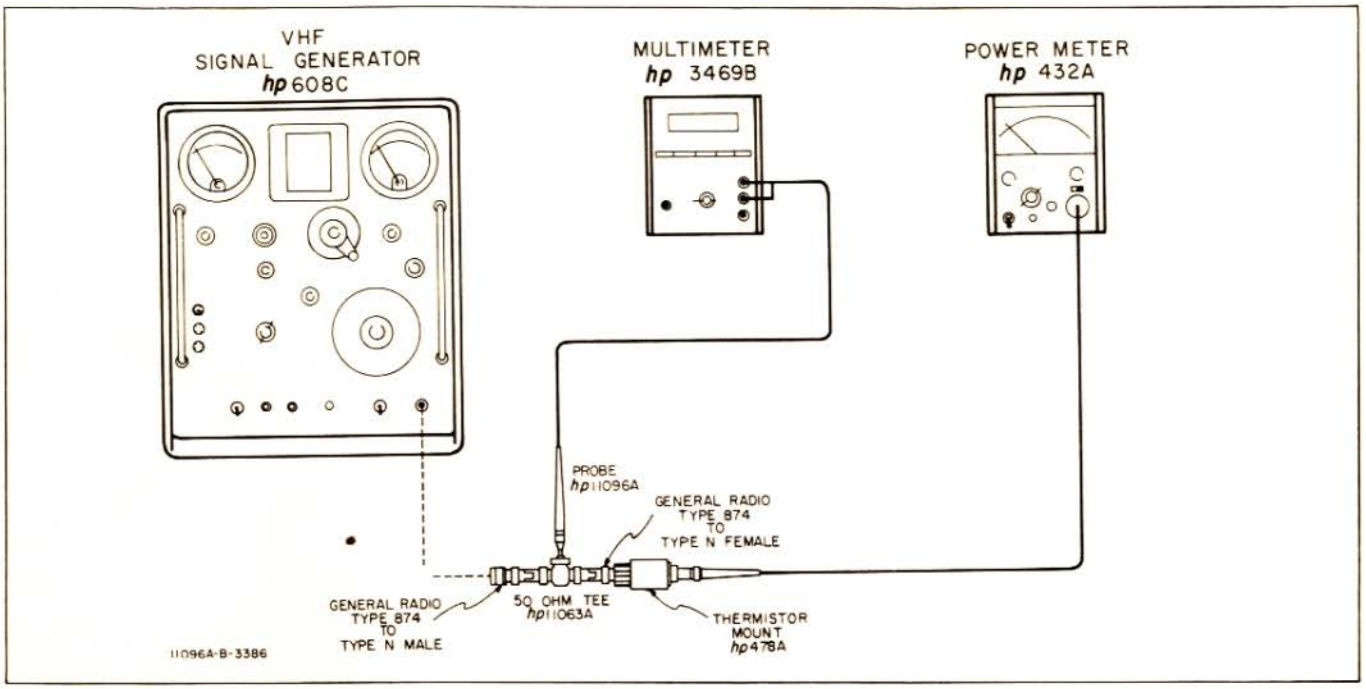


Figure 4. High Frequency Response Check

e. Visually check capacitor C1 for open lead or loose connection.

41. REPLACING DIODES.

42. Diodes CR1 and CR2 may be replaced separately. However, if replacement of CR1 causes too large of a change in frequency response, it may be necessary to replace CR1 again.

CAUTION

BOTH DIODES ARE HOUSED IN GLASS. ANY FORCE APPLIED TO THE DIODE BODY COULD CAUSE BREAKAGE.

43. CALIBRATION AFTER REPAIR.

44. After replacing the diodes verify proper value of Resistor R3* by performing the following steps:

a. Perform Steps a thru e outlined under Paragraph 29.

b. Set oscillator frequency to 1 MHz, and readjust oscillator amplitude to reference level established in Step d, Paragraph 29.

c. Observe dc voltmeter indication between 3.000 and 3.090 volts. 0% to + 3% high.

NOTE

Adjusting the 11096A Probe for a high reading (0% to 3%) at 1 MHz ensures a more ideal response over the entire frequency range of probe.

d. If dc voltmeter indicates below 3 volts, decrease value of R3*. If dc voltmeter indicates above 3.09 volts, + 3%, increase value of R3*.

NOTE

Resistor R3* should be a good 1/8 W metal film resistor. A 30 kΩ change in R3* will give approximately 1% change in reading. R3* may be replaced with any one of the foliowing resistors:

100 kΩ -hp- Part No. 0757-0465
49.9 kΩ -hp- Part No. 0698-3228

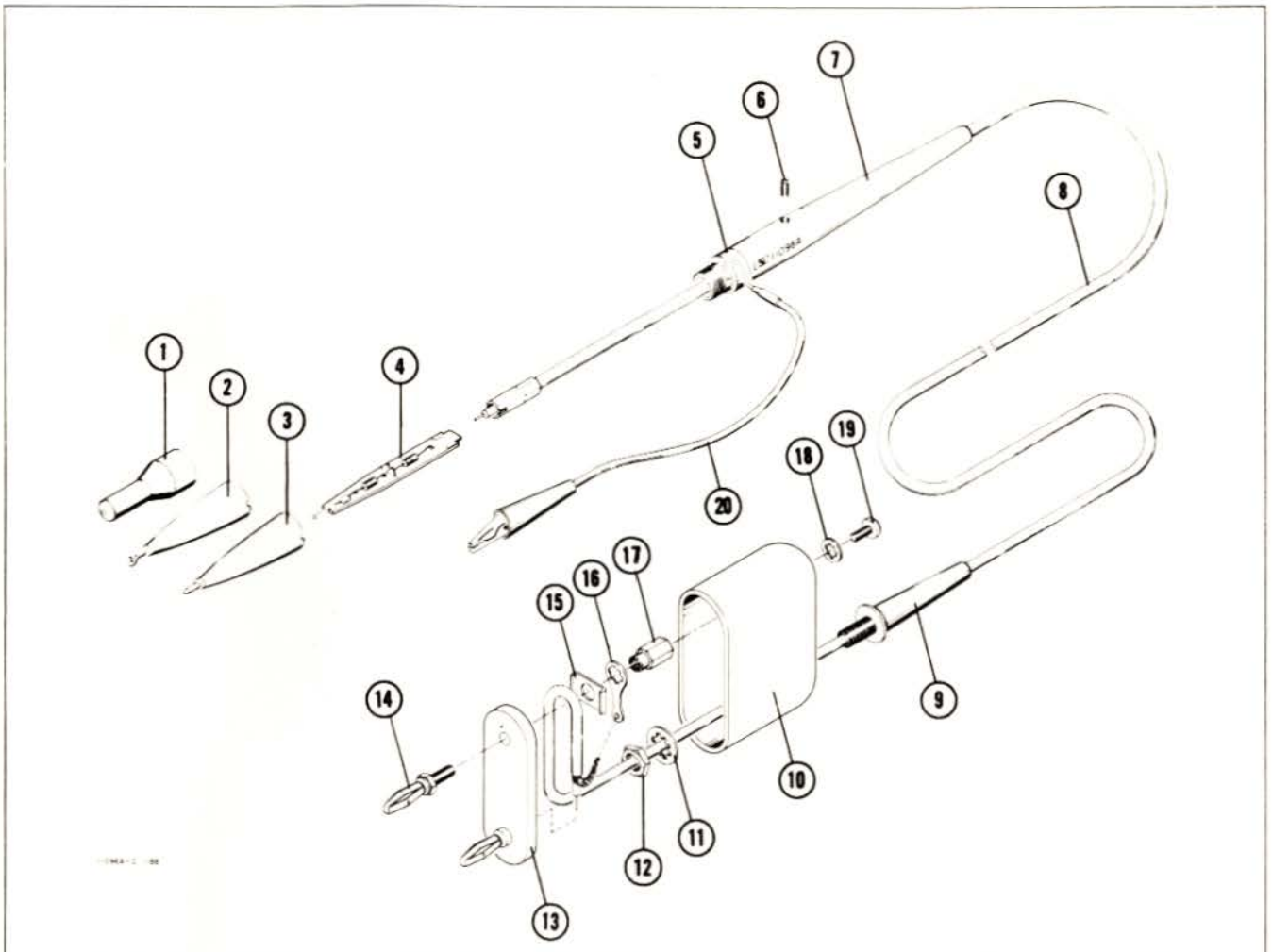
45. REPLACEMENT PARTS.

46. Replacement parts for 11096A High Frequency Probe are listed in Figure 5, and Table 3. Figure 5 is an exploded view of the probe with all mechanical parts and the printed circuit assembly keyed to an -hp- Part No. Table 3 lists all components mounted on printed circuit assembly A1.

HP Archive

Table 3. Replacement Parts Printed Cirucit Assembly

REFERENCE DESIGNATOR	DESCRIPTION	-hp- PART NO.	TQ
A1	Assembly: Printed Circuit	11096-66501	
C1	C: fxd cer 100 pF ±10% 200 vdcw	0160-2343	1
R1	R: fxd car flm 825kΩ ±1% 1/8 W	0757-0487	1
R2	R: fxd 3.32MΩ ±1% 1/4 W	0698-6765	1
R3*	R: fxd prec met flm 69.8kΩ ±1% 1/8 W	0698-4504	1
---	Clip: board ground	03406-22108	1
---	Tip: board	11096-22110	1
CR1	Diode: Si	1910-0016	1
CR2	Diode: Si	1901-0033	1



INDEX NO.	DESCRIPTION	-hp- PART NO.	INDEX NO.	DESCRIPTION	-hp- PART NO.
1	Assembly: high frequency adapter	11096-62103	12	Nut: 1/4"	2950-0006
2	Assembly: front body - hook tip	11096-62105	13	Connector: male, with cer spacer	1251-0175
3	Assembly: front body - straight tip	11096-62104	14	Connector: male	1251-0174
4	Assembly: printed circuit, A1	11096-66501	15	Clamp: cable	1400-0081
5	Ring: rear body	11096-22106	16	Tie Point: ground	0360-0053
6	Set screw	3030-0007	17	Spacer	0380-0048
7	Assembly: rear body	11096-42101	18	Washer: lock	2190-0007
8	Assembly: cable, includes crimped sleeves	11096-69501	19	Bolt: No.6-32	2460-0002
9	Boot cover	11096-42103	20	Assembly: ground lead	11096-62106
10	Shield: connector	456A-55A	- -	Lable: connector shield	7120-0896
11	Washer: lock	2190-0027	- -	Operating Note	11096-90000

Figure 5. Exploded View