Errata

Title & Document Type: **8472A Crystal Detector Operating and Service Manual**

Manual Part Number: **08472-90001**

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HP References in this Manual

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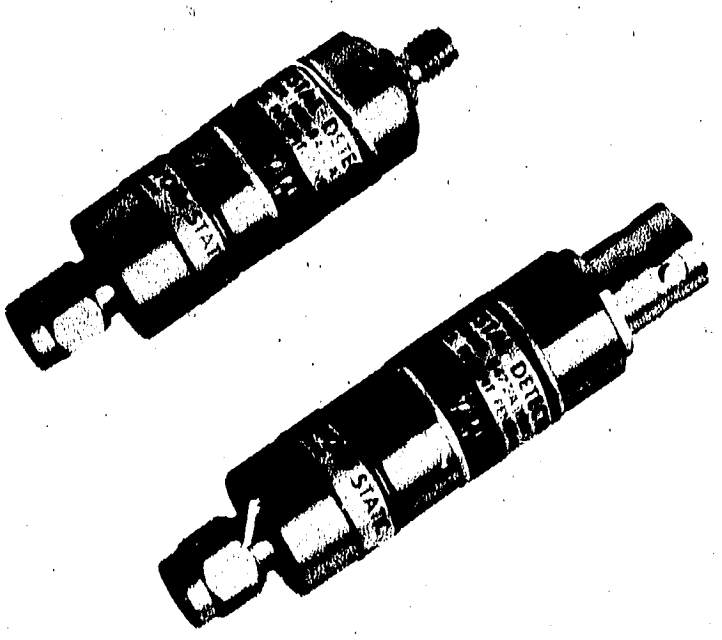
HP 8472A

OPERATING AND SERVICE MANUAL

8472A
CRYSTAL DETECTOR



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1. GENERAL INFORMATION

2. This manual contains operating instructions for the Hewlett-Packard Model 8472A Crytal Detector. Included in the manual is the information required to install and test the crystal detector.

3. On the rear cover of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order a 4 x 6-inch microfilm transparency of the manual.

4. Specifications

5. Instrument specifications are listed in Table 1. These specifications are the performance standards, or limits against which the instrument may be tested.

6. Description

7. The Hewlett-Packard Model 8472A Crystal Detector is a 50Ω (nominal) device designed for measurement use in coaxial systems. The instrument converts RF power levels applied to the 50Ω input connector into proportional values of dc voltage. The instrument measures relative power up to 100 mW and has a BNC female connector for the output jack which allows the detected output to be connected to a SWR meter. The output voltage polarity is negative, unless Option 003 is selected. The frequency range of the 8472A is 10 MHz to 18 GHz.

8. Options

9. The 8472A Crystal Detector is available with the following options (see Table 1 for further descriptions):

Option 001:	Matched pair of detectors
Option 003:	Positive polarity output
Option 100:	Female OSSM type output connector.

10. INSTALLATION

11. Initial Inspection

12. Inspect the shipping container for damage. If the shipping container or cushioning material is damaged, it should be kept until the contents of the shipment have been checked for completeness and the instrument has been checked mechanically and electrically.

13. The procedures for checking electrical performance are given under PERFORMANCE TESTS. If the contents are incomplete, if there is mechanical damage or defect, or if the instrument does not pass the electrical performance test, notify the nearest Hewlett-Packard office. If the shipping container is damaged, or the cushioning material shows signs of stress, notify the carrier as well as the Hewlett-Packard office. Keep the shipping materials for the carrier's inspection. The HP office will arrange for repair or replacement at Hewlett-Packard's option without waiting for claim settlement.

14. Mat g Connectors

15. The mating output connector used with the crystal detector must be a male BNC connector for the standard output connector or an OSSM male connector for Option 100. The mating RF input connector must be a female SMA connector.

CAUTION

SMA connectors have a limited life in applications that require repeated connecting and disconnecting. In series adapters should be used for such applications.

16. Operating Environment

17. The operating environment of the crystal detectors should be within the following limitations:

a. Temperature: 0°C to +55°C
b. Altitude: <4572 metres (15,000 feet)
c. Humidity: <95% relative

18. STORAGE AND SHIPMENT

19. Environment. The instrument should be stored in a clean, dry environment. The following environmental limitations apply to both storage and shipment:

a. Temperature: −20°C to +55°C
b. Humidity: <95% relative
c. Altitude: <7620 metres (25,000 feet)

20. Original Packaging. Containers and materials identical to those used in factory packaging are available through Hewlett-Packard offices. If the instrument is being returned to Hewlett-Packard for servicing, attach a tag indicating the type of service required, return address, model number, and serial number. Also, mark the container FRAGILE to

Table 1. Specifications

Frequency Range: 10 MHz to 18 GHz.

NOTE

RF may leak through the output connector, especially below 1 GHz. It can be reduced, if objectionable, with a suitable low-pass filter.

Frequency Response:[1]

±0.2 dB over any octave 10 MHz to 8 GHz;
±0.5 dB 10 MHz to 12.4 GHz;
±1.0 dB 10 MHz to 18 GHz.

Maximum Operating Input Power: 100 mW, peak or average.

Maximum Short Term Input Power: 100 mW (typical) peak or average for <1 minute.

Sensitivity:
High Level: <0.35 mW produces 100 mV output.
Low Level: >0.4 mVdc/μW CW.

SWR:
10 MHz to 4.5 GHz, 1.20; 4.5 GHz to 7.0 GHz, 1.35; 7.0 GHz to 12.4 GHz, 1.50; 12.4 GHz to 18 GHz, 1.70.

Input Impedance: 50Ω (nominal).

Output Impedance: 15 kΩ maximum, shunted by 10 pF.

Output Polarity: Negative (refer to Options for positive polarity units).

Detector Element: Supplied (refer to Table 2 for replacement elements).

Bias: Not required.

Noise: <200 μV p-p with CW applied to produce 100 mV output.

Options:

Option 001: Matched detector pair. Frequency response characteristics (exclusive of basic sensitivity) track within ±0.2 dB from 10 MHz to 8 GHz; ±0.3 dB 8 GHz to 12.4 GHz, ±0.6 dB from 12.4 GHz to 18 GHz.

Option 003: Positive polarity output.

Option 100: Female OSSM-type output connector.

General:
Weight: Net 57 g (2 oz.)
Dimensions: 64 mm long, 14 mm diameter (2.50 in. long, 0.56 in. diameter).

[1] As read on a meter calibrated for square-law detectors (such as HP 415E SWR Meter).

STORAGE AND SHIPMENT (Cont'd)

assure careful handling. In any correspondence, refer to the instrument by model number and serial number.

21. OPERATION

CAUTIONS

Static discharge can damage the detector element. A 100 pF capacitor (1.2 m [4 ft.] of coax cable) charged to 14 volts stores 0.1 erg, the maximum pulse rating of the detector element. Connect cables to test equipment and discharge the center conductor before connecting to the detector.

DO NOT NEEDLESSLY HANDLE DETECTOR ELEMENT USED IN CRYSTAL DETECTOR. Static electricity which builds up on a person, especially on a cold dry day, must never be allowed to discharge through the crystal detector. Avoid exposed leads to or from the crystal detector, since these are often touched accidentally.

22. Operating Information

23. The crystal detector can be used as a demodulator to obtain a pulse envelope which can then be observed on an oscilloscope. It can also be used as a general purpose detector.

24. When using the crystal detector with an oscilloscope, and the waveshapes to be observed have rise times of less than 5 μs, the coaxial cable connecting oscilloscope and detector should be as short as possible and shunted with a resistor. Ideally, this resistor should be 50Ω to terminate the coaxial cable properly. However, with 50Ω resistance, the

Operating Information (Cont'd)

output video pulse may be too small to drive some oscilloscopes. Therefore, the cable should be shunted with the smallest value of resistance that will obtain suitable deflection on the oscilloscope; typically the value will lie between 50Ω and 20 kΩ. The larger the resistance the more degradation of rise time.

25. The power applied to the detector can be either modulated or continuous wave (CW). If modulated at a 1000 Hz rate, an SWR meter can be used as an indicator. For CW detection, a dc milliammeter or millivoltmeter can be used as the indicator.

26. Operator's Checks

27. Peak Power Measurement. The arrangement of equipment for peak power measurement is shown in Figure 1. The procedure involves calibration of an oscilloscope which, in turn, is used to calibrate a CW generator. The output of the calibrated CW generator is measured with a power meter; the peak power of a pulse is thereby measured. The procedure is as follows:

a. Connect equipment as shown in Figure 1, step a. Observe pulse on a dc-coupled oscilloscope. Using a marking pencil, mark on the graticule the base-to-peak amplitude of the pulse envelope.

b. Replace the pulse source with a CW generator. While observing the oscilloscope trace, adjust amplitude of CW generator output to make detector's output equal to that of pulse generator, as indicated by markings on graticule (step a).

c. Leave CW generator at setting obtained in step b. Disconnect detector from CW generator. Connect output of CW generator to power meter. Measure adjusted levels (set in step b) of CW generator output. The peak power of the pulse envelope observed in step a is equal to the output power of the CW generator.

28. Reflectometer Application. For information about reflectometer systems and measurements, see HP Application Note Index, copies of which are available upon request.

29. Harmonic Frequency Comparison Measurement Application. The detector can be used as a mixer in harmonic-frequency comparison measurements (see HP Application Note Index for further information).

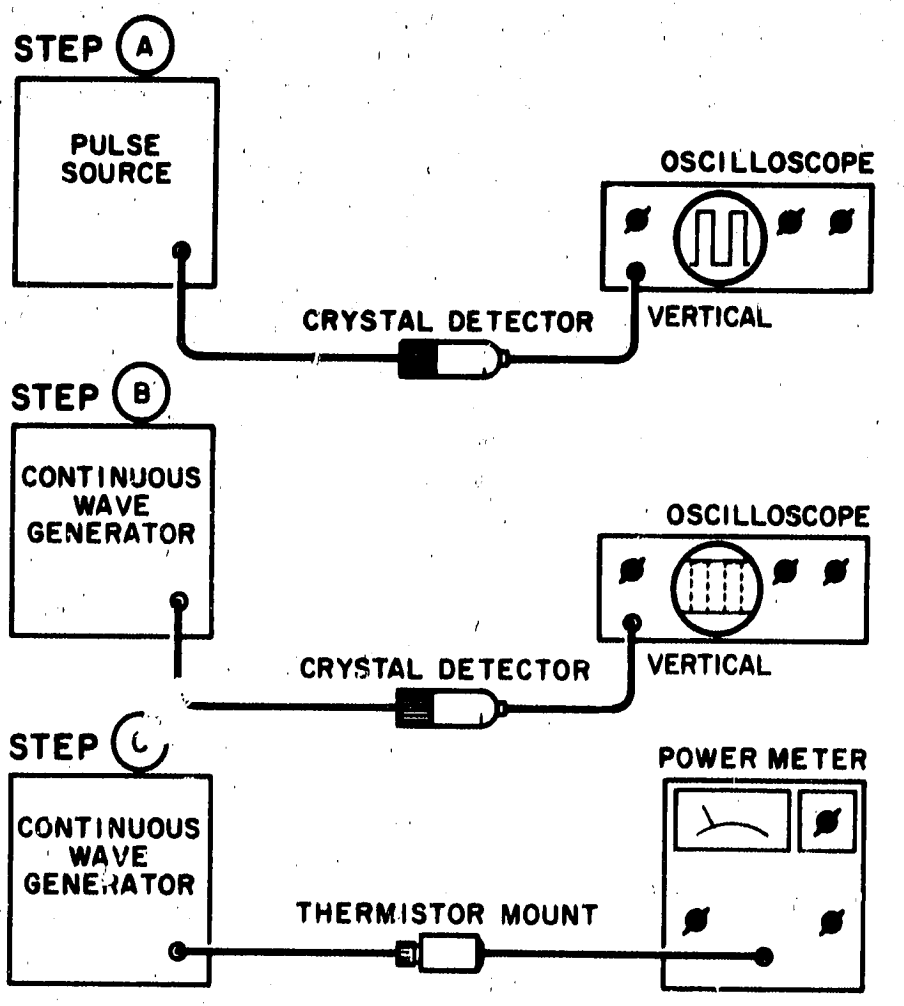

Figure 1. Peak Power Measurement

30. PERFORMANCE TESTS

31. The following paragraphs suggest methods to use for testing detector specifications. For these tests refer to the manuals of the equipment involved for operating instructions.

32. Frequency Response Test

a. Using signal sources covering 10 MHz to 18 GHz with a 10 dB isolating attenuator and a power meter, connect power sensor to attenuator. Adjust RF power level to −20 dBm input to power sensor.

b. Without changing RF power level of signal source, disconnect power sensor.

c. Connect detector to attenuator. Measure dc voltage output from detector and record measurement.

d. Change frequency of signal source and repeat steps a through c.

e. Since the detector follows a square-law response at this power level, its output is proportional to power ($P_{dB} = 10 \log V_o$). Total variation of detector readings should meet specifications (see Table 1) for all frequencies of interest across the band.

Frequency Response Test (Cont'd)

NOTE

Multiple mismatch errors caused by attenuator SWR, power meter SWR, and detector SWR should be taken into account, as well as the accuracy of the indicator used to measure the detector's output.

33. High Level Sensitivity Test

a. Using signal sources covering 10 MHz to 18 GHz and a dc voltmeter or oscilloscope as the indicator, connect detector to signal source. Adjust RF power level for a 100 mV detected output from detector.

b. Disconnect detector from signal source and measure RF output level. The RF output level should be ≤ 0.35 mW.

c. Repeat steps a and b for all frequencies of interest across the band.

34. Low Level Sensitivity Test

a. Using a signal source (covering 100 MHz to 2 GHz), a 10 dB attenuator, and a power meter, connect attenuator to signal source and power sensor to attenuator. Adjust RF power level for —20 dBm output from attenuator. Verify the ambient temperature.

b. Disconnect power sensor from attenuator and connect detector. Measure the dc voltage output from detector. The output should be >4.0 mV at 25°C. The sensitivity slope is typically —0.015 dB/°C from 0° to +55°C.

NOTE

Multiple mismatch errors caused by attenuator SWR, power meter SWR, and detector SWR should be taken into account, as well as accuracy of indicator used to measure detector's output.

35. Match Test (SWR)

36. To verify the detector's SWR specifications, use any system whose measurement accuracies for SWR (residual SWR) are known.

37. ADJUSTMENTS

38. The detectors have no internal adjustments.

39. REPLACEABLE PARTS

40. The succeeding paragraphs contain information pertaining to replaceable parts (see Table 2) and the ordering of replaceable parts for the Model 8472A.

41. To order a replacement part, address order or inquiry to the nearest Hewlett-Packard office (see list in back of manual). Include the following information for each part: model number, Hewlett-Packard part number, and description.

42. SERVICE

43. The succeeding paragraphs give instructions for repair of the Model 8472A Crystal Detector. Additional maintenance information can be obtained from the local Hewlett-Packard office. Part numbers for replaceable parts are given in Table 2.

44. Detector Element Replacement

45. The new detector element assembly includes a detector element, capsule spacer, and capacitive washer. All other internal parts are to be retained for re-use in the detector.

CAUTION

The special detector element (see Figure 2) contained in the detector can be damaged in handling, removal, or installation if certain precautions are not taken. The handling precautions which follow should be read before performance of any operation with the detector element when it is out of either the housing or the detector element shipping container.

a. Before installing diode into mount, touch exposed metal on mount with your hand to discharge static electricity. Then insert diode into mount.

b. When handing diode to another person, touch hands first to ensure there is no difference in static electricity potential between you.

c. Ohmmeters should not be used to measure forward- and back-resistance since it is easy to damage these diodes. The difficulty arises because of the ohmmeter's open-circuit voltages and short-circuit currents.

46. Replacing Detector Element

47. Parts mentioned in the following procedure are identified in Figure 2.

Table 2. Replaceable Parts, Model 8472A and 8472A Option 100

Description	Part No.	Description	Part No.
8472A Output Connector Assembly	08472-60003	8472A Opt. 100 Output Connector Assembly	08472-60004
1 Connector, BNC Female	1250-0251	13 Connector, OSSM, Female	
2 Washer		14 Plug, Sleeve } Sleeve Assembly	
4 Contact Spring		15 Contact Spring	
5 Tubular Resistor 40—70Ω		16 Tubular Resistor 40—70Ω	
8472A and 8472A Opt. 100		Replacement Diode Assemblies	
3 Cap	08472-2007	7 Single Diode Negative Polarity	08472-60001
6 Retainer	08472-2003	7 Single Diode Positive Polarity (Option 003)	08472-60002
8 Capsule Spacer	5020-0208	7 Matched Pair Diodes Negative Polarity (Option 001)	08472-60005
9 Polyiron Spacer	5020-0209	7 Matched Pair Diodes Positive (Option 001, 003)	08472-60006
10 Capacitive Washer	2190-0377		
11 Body	08472-2001		
12 RF Pin Replacement Assembly	08472-60013		

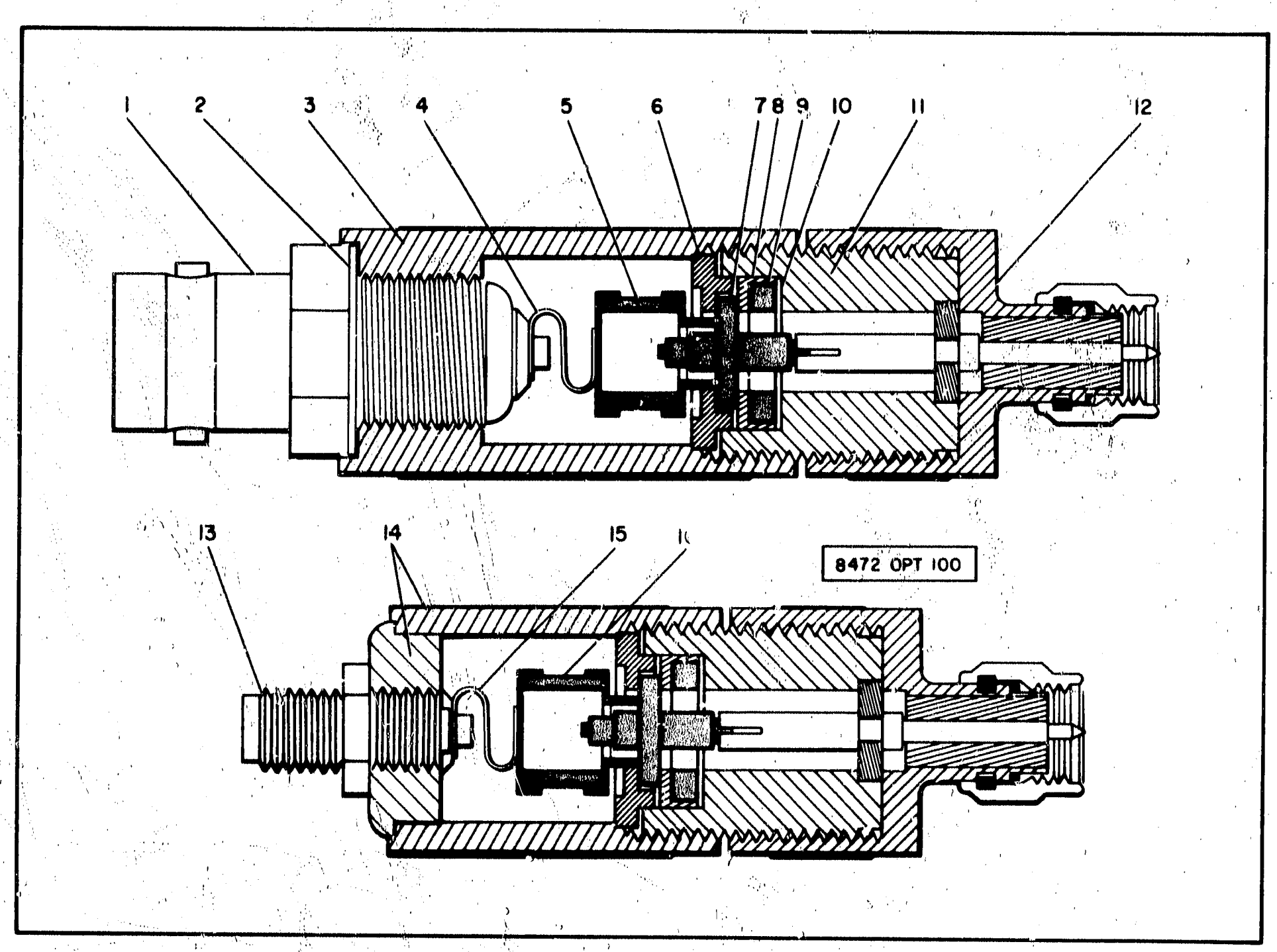

Figure 2. Model 8472A and 8472A Option 100, Cutaway View (Refer to Table 2 for Callout Identification)

Replacing Detector Element (Cont'd)

a. Remove connector cap from body. To remove connector cap, use a pair of pliers with plastic jaws or protect body with heavy paper or tape.

b. Remove old crystal diode, capsule spacer, and capacitive washer.

c. Install the new capacitive washer, capsule spacer and crystal diode. Install the washer first, then the spacer with its polyiron side against the washer. Finally, install the crystal diode by inserting the resistive end into the center contact inside the detector body.

CAUTION

When inserting the crystal detector, do not force the tip (resistive end) into the center conductor in the body as the fingers of the center conductor might be damaged.

d. Replace connector cap and *tighten firmly with the fingers.*

48. Replacing Female BNC Connector

49. Parts mentioned in the following procedure are identified in Figure 3.

a. Remove female BNC connector. To remove or install BNC connector, use a BNC wrench or use a male BNC connector as a wrench to prevent damage to the connector.

b. Unsolder contact spring.

c. Prepare replacement female BNC connector:

(1) Cut center conductor lead to approximately 0.79 mm (1/32 in.)

(2) With flat file, smooth end of lead; remove burr with tweezers or similar metal instrument.

d. Slip contact spring over center conductor lead, and solder.

CAUTION

Use solder sparingly or it will creep back on spring. Solder on spring destroys its usefulness and is difficult to remove.

e. Let contact spring cool and then screw connector into mount.

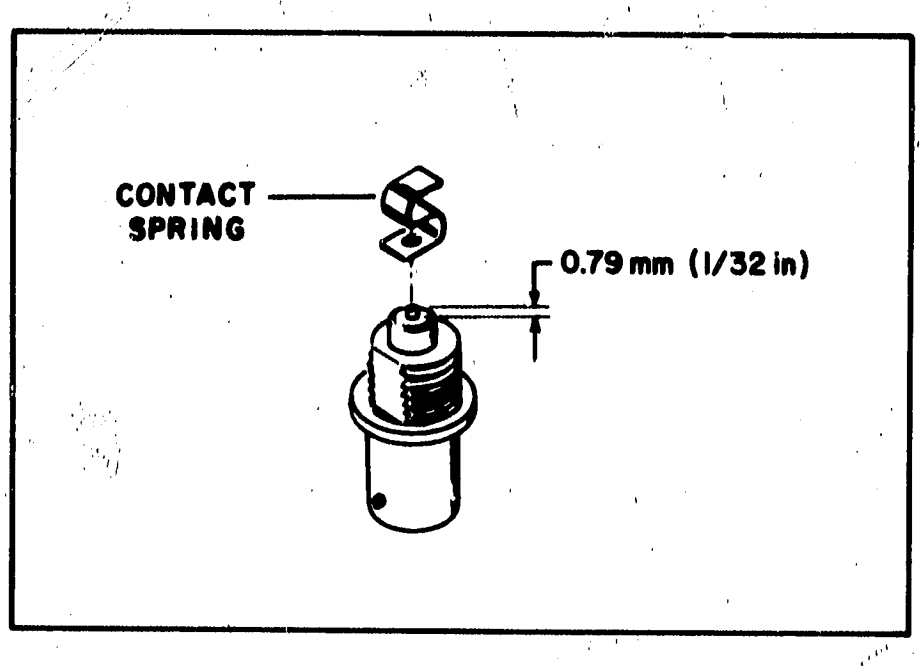

Figure 3. Cutting Center Conductor Lead to Accommodate Contact Spring