# **MIXER AND ADAPTERS** 11517A 11518A 11519A 11520A



MAY 1971

HP 11517A

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Figure 1. Model 11517A Mixer and Models 11518A, 11519A and 11520A Adapters (Flange Cap and Coaxial Cable not Shown)



#### Table 1. Specifications, Model 11517A Mixer

# DESCRIPTION

The Model 11517A Mixer (see Figure 1) can be used to mix signals from 12.4 to 40 GHz with frequencies in the 2- to 4- GHz range. The 11517A was designed as a first mixer for use with HP Spectrum Analyzers. However, when supplied with a mixing frequency within the rated 2- to 4-GHz range, and suitable adapters and output filters, the 11517A can be used for other, P-, K- and R-band applications. Sensitivity of the mixer varies with frequency range; typical minimum input powers are given in Table 1. Saturation of the mixer is -15 dBm, though the device can withstand RF powers up to 1 mW average (0.1 erg) without burnout. Adapters (see Table 2) are available for connecting the mixer to P-, K- and R-band systems and signal sources.

The 11517A Mixer has a waveguide port (the RF input) and a coaxial port. The coaxial port, a female BNC connector, serves both as the input for the mixing frequency and the output for the modulation products. The mixer is a silicon diode, the output of which is rich in harmonics. In the mixer output circuit (see Figure 2) there is a filter which passes diode modulation products and bypasses RF input frequencies to ground; it

Table 2. Specifications, Adapters for Model 11517A Mixer





Figure 2. Model 11517A Mixer, Schematic Diagram

is the frequency characteristics of the filter that limit mixing frequencies to the 2- to 4-GHz range. Guide used in the waveguide section is ridged to give the mixer its broadband characteristics, and the waveguide flange is keyed to ensure proper mating of the ridged-guide sections of the mixer and adapter bodies. The waveguide flange is tapped for 4-40 x 5/16 inch machine screws.

#### **OPERATION**

#### CAUTION

Burn-out level of the 11517A is low, and the diode can be burned out by discharge through it of more than 0.1 erg static charge on operator or connected equipment as well as by application of powers above rated level. Since the diode is not fieldreplaceable burn-out entails the inconvenience of returning the mixer to the factory for diode replacement. Therefore when using the mixer it is profitable to observe the following:

- NEVER apply more than 1 milliwatt average (0.1 erg), when using mixer with spectrum analyzer.
- ALWAYS so handle connections that static charge on the opera-

tor or charge built up in associated equipment is discharged through the cable *before* connection to the mixer is completed; see Figure 3.

When using the mixer with the spectrum analyzer, make connections exactly in the order given under Operation with Analyzer. Further, start cable connections to mixer connector as shown in Figure 3 to ensure that any charge present on operator or equipment discharges through the cable, not the mixer diode.

If using mixer with equipment other than analyzer, connect cable to mixer as the last step in the coaxialline connection, and use technique indicated in Figure 3 to discharge cable *before* connecting it to mixer.

#### **Operation with Analyzer**

When mixer is used with the 8551 or 8555 spectrum analyzer RF sections, mixing frequency in the 2- to 4-GHz range is supplied by analyzer via coaxial cable between analyzer and mixer. Mixing products are carried back to analyzer in the same cable, and filter networks in the analyzer separate the two.



Figure 3. Discharging Cable before Connecting to Mixer

To avoid damaging mixer diode, always make connections in the following order.

#### CAUTION

Discharge of stored electrical energy can damage the mixer diode. A fourfoot coaxial cable, the equivalent of a 100-pF capacitor, when charged to 14 volts stores 0.1 erg of energy; this is the maximum amount of static charge that can be applied to mixer. Always connect cable first to associated equipment then discharge the cable (see Figure 3), and then connect cable to mixer.

a. Connect cable supplied with the 11517A first to the external mixer input on the spectrum analyzer. Then, first touching edge of male BNC to edge of female BNC to discharge the cable (see Figure 3), connect cable to 11517A Mixer.

b. Select adapter appropriate to measurement system or signal source being used, and connect adapter to mixer:

11518A adapter for P-band (flange drilled for  $6-32 \ge 1/2$  inch screws)

11519A adapter for K-band (flange drilled for  $4-40 \ge 1/2$  inch screws)

11520A adapter for R-band (flange drilled for  $4-40 \ge 1/2$  inch screws).

c. Connect adapter-mixer to signal source or measurement system.

d. For linear presentation on analyzer CRT, signal level at mixer RF input should be no higher than -15 dBm (0.03 mW). Minimum level that can be used depends on IF bandwidth for which the analyzer is set; sensitivities for the 10-kHz IF bandwidth are given in Table 1. In general, the narrower the analyzer's IF bandwidth, the better the sensitivity of the system.

#### CAUTION

To prevent crystal burn out, when using mixer with spectrum analyzer, apply no more than 1 mW average (0.1 erg), to mixer waveguide input.

# Operating in P-, K-, or R-Band Systems

With a source of mixing frequency in the 2- to 4-GHz range, an adapter for the band of interest,

and output filters for discarding the mixing frequency and selecting the desired set of modulation products, the 11517A can be used with indicators other than the analyzer. Mixing frequency should be between 2- and 4-GHz, and for CW signals, total of input powers should be between 1 and 10 mW average.

# MIXER MAINTENANCE

#### Preventive Maintenance

A flange cap is supplied with the mixer. When mixer is not connected in a system, always keep cap on flange to prevent dirt from entering waveguide.

Protect machined surface of waveguide coupling flange from damage. Scoring, burring or other defacement of flange surface causes coupling discontinuity and results in increased SWR.

#### **Connector Replacement**

If connector gets damaged, its replacement is simple. Arrangement of mixer and numbers for parts are shown in Figure 4. For parts ordering procedure, see Ordering Parts.

a. Using a BNC wrench or mating male connector, uscrew BNC jack.

#### CAUTION

If discharged through the diode, static charge on operator can burn out the mixer diode. The BNC pin assembly which is exposed when the BNC jack has been removed is a conductor directly in contact with anode of diode. To prevent accidental application of voltage across diode, always hold body of mixer in one hand while performing replacement procedures with the other.

b. If BNC pin assembly is damaged, remove damaged pin and set replacement assembly firmly down over crystal mount stud.

c. Fit replacement jack over pin assembly and screw jack down into mixer body.

#### **Diode Replacement**

The diode cannot be replaced in the field. If diode burnout occurs, send mixer to your nearest



Figure 4. BNC Connector and/or Pin Assembly Replacement, 11517A Mixer

Hewlett-Packard Sales and Service Office. A list of sales and service offices is given at the end of this Operating Note.

# ADAPTERS

Adapters for the 11517A Mixer are shown in Figure 1 and listed in Table 2. Each adapter is a transition from ridged R-band size waveguide to standard unridged P-, K-, or R-band waveguide.

### Adapter Preventive Maintenance

The information given for the mixer applies equally to the adapters. Be sure to keep flange caps on when adapters are not in use and be careful not to mar waveguide flange faces.

#### **ORDERING PARTS**

To order a replacement part, address order or inquiry to your nearest Hewlett-Packard Sales and Service Office. Addresses are given at the end of this note.

Specify the following for each part:

- a. Model number and name
- b. Hewlett-Packard part number (see Figure 4)
- c. Name and description of part.

# 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. Addresses are provided at the back of this manual.

# **HEWLETT-PACKARD SALES AND SERVICE OFFICES**

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