

1. GENERAL INFORMATION

2. This Operating and Service Manual contains information required to install, operate, test, adjust, and service the Hewlett-Packard 11720A 2–18 GHz Pulse Modulator. Figure 1 shows the 11720A and all supplied accessories.

3. Listed on the title page of this manual (below the manual part number) is a Microfiche part number. This number can be used to order 10 x 15 cm (4 x 6 inch) microfilm transparencies of the manual. Each microfiche contains up to 96 photoduplicates of the manual pages. The microfiche package also includes the latest Manual Changes supplement as well as pertinent Service Notes.

4. SPECIFICATIONS

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

6. SAFETY CONSIDERATIONS

7. The 11720A is a Safety Class I instrument (provided with a protective earth terminal). This instrument and all related documentation must be reviewed for familiarization with safety markings and instructions before operation. Safety information pertinent to the task at hand (installation, operation, performance testing, adjustments, or service) is found throughout this manual.

8. INSTRUMENTS COVERED BY MANUAL

9. Attached to the instrument is a serial number plate. The serial number is in the form: 0000A00000. It is in two parts; the first four digits and the letter are the serial prefix and the last five digits are the suffix. The prefix is the same for all identical instruments; it changes only when a change is made to the instrument. The suffix, however, is assigned sequentially and is different for each instrument. The contents of this manual apply to instruments with the serial number prefix(es) listed under SERIAL NUMBERS on the title page.

10. An instrument manufactured after the printing of this manual may have a serial number prefix that is not listed on the title page. This unlisted serial number prefix indicates the instrument is different from those described in this manual. The manual for this newer instrument is accompanied by a yellow Manual Changes supplement. This supplement contains “change information” that

explains how to adapt the manual to the newer instrument.

11. In addition to change information, the supplement may contain information for correcting errors in the manual. To keep this manual as current and accurate as possible, Hewlett-Packard recommends that you periodically request the latest Manual Changes supplement. The supplement for this manual is identified with the manual print date and part number, both of which appear on the manual title page. Complimentary copies of the supplement are available from Hewlett-Packard.

12. For information concerning a serial number prefix that is not listed on the title page or in the Manual Changes supplement, contact your nearest Hewlett-Packard office.

13. DESCRIPTION

14. The Hewlett-Packard 11720A 2–18 GHz Pulse Modulator is a broadband, fully integrated, microwave PIN diode pulse modulator. Complete control of the PIN modulator is self-contained. This includes proper impedance matching as well as supplying the appropriate modulation wave shapes and bias levels for fast rise and fall times and the rated on/off ratio. The high level of performance is complemented by the ease with which an RF pulse generation system can be assembled. The 11720A requires a CW microwave signal source to furnish the RF input and a standard pulse generator to supply the video input (50 Ω , TTL compatible). In addition, a NORM/COMPL function is provided to adapt the 11720A to positive true, or negative true logic video inputs.

15. EQUIPMENT AVAILABLE

16. Accessories and equipment may be ordered or information about them may be obtained by contacting your nearest Hewlett-Packard office. Refer to the HP model number.

17. **Microwave Signal Source, 2–18 GHz.** The HP Model 8672A Synthesized Signal Generator is a highly stable, leveled RF source suitable for use with the Pulse Modulator. This synthesizer provides both calibrated AM and FM.

18. **Microwave Signal Source, 2–6.2 GHz.** The HP Model 8671A Synthesizer is a highly stable, unleveled RF source suitable for use with the Pulse Modulator. This synthesizer provides calibrated FM.

Table 1. Specifications

Frequency Range: 2 to 18 GHz

On/Off Ratio: >80 dB.

Insertion Loss:

2 to 12.4 GHz: <6 dB.

2 to 18 GHz: <10 dB.

Rise (T_R) and Fall (T_F) Times: <10 ns.

Maximum RF Input Power: +20 dBm.

Minimum RF Pulse Width¹ (T_{RF}): < 50 ns.

Pulse Width Compression ($T_V - T_{RF}$): < 20 ns.

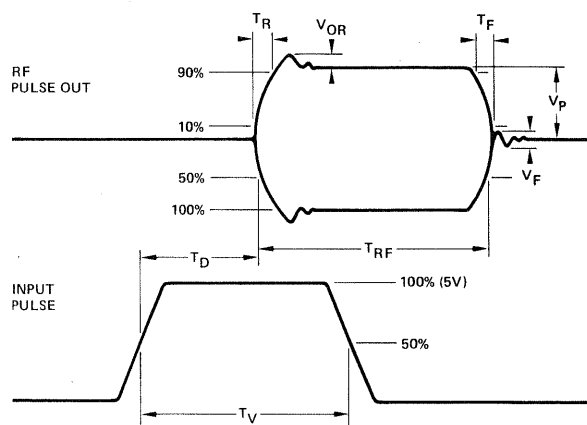
Maximum Pulse Repetition Rate: > 5 MHz.

Maximum Delay Time (T_D): < 60 ns.

Video Feedthrough (V_F): <50 mV peak-to-peak.

Overshoot, Ringing² (V_{OR}/V_P): < 0.2.

Pulse Definitions:



- T_D — Delay Time
- T_F — RF Pulse Fall Time
- T_R — RF Pulse Rise Time
- T_{RF} — RF Pulse Length
- T_V — Input Pulse Length
- V_F — Video Feedthrough
- V_{OR} — Overshoot and Ringing
- V_P — RF Pulse Amplitude

Pulse Input

Normal Mode: >3V (on), <0.5V (off).

Complement Mode: <0.5V (on), >3V (off).

Impedance: 50Ω nominal.

Damage Levels

RF Input: ac: 2 watts (+33 dBm).

dc: 40 volts.

Pulse Input: ±6V peak from ≥50Ω Source. +6V peak, -0.5V peak from <50Ω Source.

Connectors

RF (IN and OUT): Type N, Female.

Pulse Input: BNC Female.

General

Operating Temperature: 0°C to +55°C.

RF Leakage³: Meets Radiated and Conducted Limits of MIL-I-6181D.

Power: 100, 120, 220 and 240V, +5%, -10%

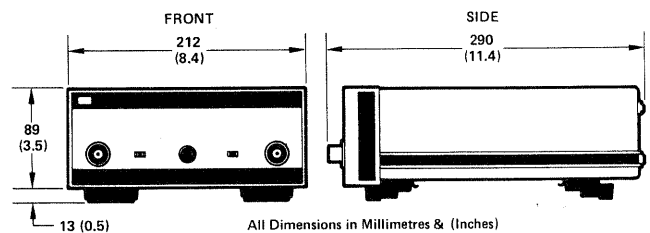
100 and 120 volts, 48 to 440 Hz.

220 and 240 volts, 48 to 66 Hz.

25 VA max.

Weight: Net, 2.6 kg (5 lb, 12 oz); shipping, 3.6 kg (8 lb)

Dimensions⁴:



¹ Off time must be ≥ 140 ns.

² Overshoot and ringing may be reduced by operating at <10 dBm RF input and >+15°C ambient temperature.

³ For pulse repetition rates <1 MHz.

⁴ Dimensions are for general use only. If dimensions are required for building special enclosures, contact your HP office.

19. Pulse Generator. The HP Model 8013B Pulse Generator is a 50 MHz pulse source that meets or exceeds all of the modulation input requirements of the Pulse Modulator. This generator is capable of operation in either the normal or complementary mode and may be triggered by a sine wave.

20. RECOMMENDED TEST EQUIPMENT

21. Test equipment required to maintain the Model 11720A is listed in Table 2. Equipment other than the recommended models can be used provided the minimum specifications are satisfied.

Table 2. Recommended Test Equipment

Instrument Type	Critical Specifications	Suggested Model	Use*
Adapter, Tee	BNC Tee, Male to two Females	HP 1250-0781	P, A, T
Adapter, SMA (3 req.)	SMA Male to Type N Female	HP 1250-1562	P, A, T
Amplifier, 22 dB	Frequency Range: 100 kHz to 1300 MHz Gain (Mean): 22 dB $\pm$ 1.5 dB	HP 8447E	P, A, T
Attenuator (2 req.)	6 dB; 2–18 GHz SWR: <1.5	HP 8491B Option 006	P, A, T
Attenuator	10 dB; 2–18 GHz SWR: <1.5	HP 8491B, Option 010	P, A, T
Digital Multimeter	DC Volts Range: to 20V Current Range: $\leq$ 100 mA	HP 3455A	A, T
Mixer, Double Balanced	Frequency Range: 2 to 18 GHz	RHG DM1–18	P, A, T
Power Meter and	Frequency Range: 2–18 GHz Input Level: +10 to –15 dBm Resolution: <0.5 dB	HP 436A/8481A	P, T
Oscilloscope	Dual Channel, triggerable Bandwidth: $\geq$ 200 MHz Risettime: <1.75 ns	HP 1715A	P, A, T
Probe, divide by 10	Compatible with HP 1715A	HP 10018A	A, T
Pulse Generator	Variable Delay Pulse Width: <50 ns to >100 μ s Amplitude: 5V into 50 Ω Rise Time: <5 ns	HP 8013B	P, A, T
Signal Generator (2 req.)	Frequency Range: 2–18 GHz Output Level: +3 dBm	HP 8672A	P, A, T
Spectrum Analyzer	Frequency Range: 2–18 GHz Input Sensitivity: better than –80 dBm Maximum Input: >+10 dBm Resolution Bandwidth: $\leq$ 1 GHz	HP 141T/8552B/8555A	P, A, T
Type N to APC-7® Adapter (2 req.)	Type N Female to APC-7	HP 11524A	P, T
* P = Performance, A = Adjustment, T = Troubleshooting ® A registered trademark of the Bunker Ramo Corp.			

22. INSTALLATION

23. Initial Inspection

24. Inspect the shipping container for damage. If the shipping container or packaging material is damaged it should be kept until the contents of the shipment have been checked mechanically and

electrically. If there is mechanical damage or if the instrument does not pass the performance tests, notify the nearest Hewlett-Packard office. Keep the damaged shipping materials (if any) for the carrier and a Hewlett-Packard representative to inspect. The HP office will arrange for repair or replacement at HP option without waiting for claim settlement.