OPERATING AND SERVICE MANUAL

8900D
PEAK POWER METER

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed 2131A.

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL in Section I.

HEWLETT PACKARD

1501 PAGE MILL ROAD, PALO ALTO, CALIFORNIA, U.S.A.

MANUAL PART NUMBER. 08900-90224
Microfiche Part No. 08900-90225

Printed: FEBRUARY 1982

CERTIFICATION

Hewlett-Packard Company certifies that this product met its published specifications at the time of shipment from the factory. Hewlett-Packard further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY

This Hewlett-Packard instrument product is warranted against defects in material and workmanship for a period of one year from date of shipment. During the warranty period, Hewlett-Packard Company will, at its option, either repair or replace products which prove to be defective.

For warranty service or repair, this product must be returned to a service facility designated by HP. Buyer shall prepay shipping charges to HP and HP shall pay shipping charges to return the product to Buyer. However, Buyer shall pay all shipping charges, duties, and taxes for products returned to HP from another country.

HP warrants that its software and firmware designated by HP for use with an instrument will execute its programming instructions when properly installed on that instrument. HP does not warrant that the operation of the instrument, or software, or firmware will be uninterrupted or error free.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by Buyer, Buyer-supplied software or interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance.

NO OTHER WARRANTY IS EXPRESSED OR IMPLIED. HP SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

EXCLUSIVE REMEDIES

THE REMEDIES PROVIDED HEREIN ARE BUYER'S SOLE AND EXCLUSIVE REMEDIES. HP SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, WHETHER BASED ON CONTRACT, TORT, OR ANY OTHER LEGAL THEORY.

ASSISTANCE

Product maintenance agreements and other customer assistance agreements are available for Hewlett-Packard products.

HEWLETT-PACKARD SERVICE OFFICES

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

UNITED STATES

NO. CALIFORNIA (San Francisco Area)
333 Logue Ave.
Mt. View, CA 94043
SO. CALIFORNIA (Los Angeles Area)
5400 West Rosecrans Blvd.
Lawndale, CA 90260
GEORGIA
450 Interstate N. Parkway
Atlanta, GA 30348
ILLINOIS
5201 Tollview Dr.
Rolling Meadows, IL 60008
NEW JERSEY
W. 120 Century Rd.
Paramus, NJ 07652

AUSTRALIA

Hewlett-Packard Australia Ltd.
31-41 Joseph Street
Blackburn, Victoria 3130

CANADA

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
Mississauga, Ontario
Canada L4V 1M8

ITALY

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio, 9
20063 Cernusco
Sul Naviglio (MI)

FRANCE

Hewlett-Packard France
Quartier de Courtaboeuf
Boite Postale No. 6
F-91401 Orsay Cedex

GERMAN FEDERAL REPUBLIC

Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Bernerstrasse 117
Postfach 560 140
D-6000 Frankfurt 56

NETHERLANDS

Hewlett-Packard Benelux N.V.
Van Heuven Doedhartlaan 121
P.O. Box 667
NL-Amstelveen 1134

UNITED KINGDOM

Hewlett-Packard Ltd.
King Street Lane
GB-Winnersh, Wokingham
Berks, RG11 5AR

AFRICA, ASIA, CENTRAL AND SOUTH AMERICA

Hewlett-Packard Intercontinental
3200 Hillview Avenue
Palo Alto, CA 94304

SAFETY CONSIDERATIONS

GENERAL

This product and related documentation must be reviewed for familiarization with safety markings and instructions before operation.

This product is a Safety Class I instrument (provided with a protective earth terminal).

BEFORE APPLYING POWER

Verify that the product is set to match the available line voltage and the correct fuse is installed.

SAFETY EARTH GROUND

An uninterruptible safety earth ground must be provided from the main power source to the product input wiring terminals, power cord, or supplied power cord set.

WARNINGS

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection). In addition, verify that a common ground exists between the unit under test and this instrument prior to energizing either unit.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

If this instrument is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to neutral (that is, the grounded side of the mains supply).

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.

SAFETY SYMBOLS

Instruction manual symbol: the product will be marked with this symbol when it is necessary for the user to refer to the instruction manual (see Table of Contents for page references).

Indicates hazardous voltages.

Indicates earth (ground) terminal.

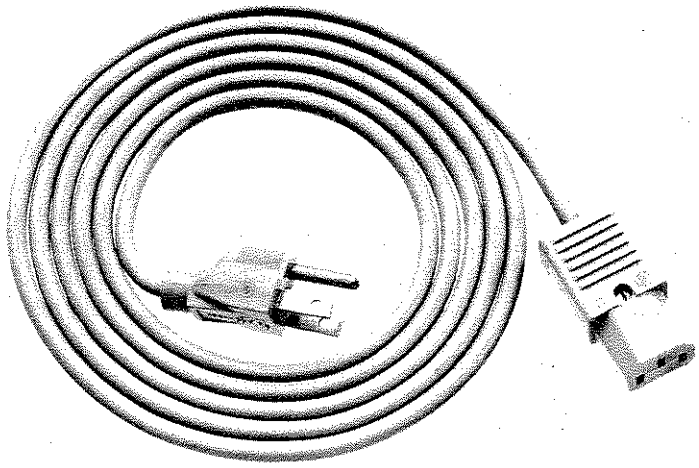
WARNING

The WARNING sign denotes a hazard. It calls attention to a procedure, practice, or the like, which, if not correctly performed or adhered to, could result in personal injury. Do not proceed beyond a WARNING sign until the indicated conditions are fully understood and met.

CAUTION

The CAUTION sign denotes a hazard. It calls attention to an operating procedure, practice, or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product. Do not proceed beyond a CAUTION sign until the indicated conditions are fully understood and met.

MODEL 8900D



POWER CORD

Figure 1-1. 8900D Peak Power Meter

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

This manual contains operating and service information for the Hewlett-Packard Model 8900D Peak Power Meter. The Peak Power Meter is shown in Figure 1-1 with all of its externally supplied accessories.

This section of the manual describes the instruments documented by this manual and covers instrument description, specifications and other basic information. The other sections provide the following:

Section II — Installation
Section III — Operation
Section IV — Performance Tests
Section V — Adjustments
Section VI — Replaceable Parts
Section VII — Manual Changes
Section VIII — Service

Listed on the title page of this manual is a "Microfiche" part number. This number can be used to order 4 x 6 inch microfilm transparencies of the manual. Each microfiche contains up to 96 photo duplicates of the manual's pages. The microfiche package also includes the latest Manual Changes supplement as well as all pertinent Service Notes.

1-2. SPECIFICATIONS

Instrument specifications are listed in Table 1-1. These specifications are the performance standards or limits against which the instrument can be tested.

1-3. INSTRUMENTS COVERED BY MANUAL

This instrument has a two-part serial number. The first four digits and the letter are the serial number prefix which identifies the instrument configuration. The last five digits form the suffix that is unique to each instrument. The contents of this manual apply directly to instruments having the same serial number prefix(es) as listed under SERIAL NUMBERS on the title page.

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 prefix indicates that the instrument is different from those documented in this manual. The manual for this instrument is supplied with a Manual Changes supplement that contains change information that documents the differences.

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 keyed to this manual's print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available from Hewlett-Packard.

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

Table 1-1. Specifications (1 of 2)

Frequency range: 100 MHz to 18 GHz.
Dynamic range: 20 dB (0 to +20 dBm).
Range: 2 ranges of 10 and 100 mW full scale.
Operating Temperature: 0 to 55°C.
Pulse Response
Direct Mode
Pulse width: 1 μs to CW.
Repetition rate: 100 Hz to 100 kHz.
Compare mode
Pulse width: minimum width limited by rise time.
Repetition rate: 0 to 100 kHz.
Rise time: 75 ns.
Fall time: 125 ns (as measured on video output).

Meter Accuracy[1]	CW	Pulse	Transfer Accuracy CW to Pulse[3]
Direct[2]	±0.2 dB	±0.35 dB	±0.2 dB
Compare	±0.2 dB	±0.25 dB	±0.1 dB

[1] Specifications only apply in combination with specifications of 84811A sensor.

[2] Does not include errors due to source harmonics.

[3] Error in reading pulsed power when meter is first calibrated with a known CW level. Eliminates sensor calibration error. (Mismatch errors and oscilloscope errors are not included.)

Table 1-1. Specifications (2 of 2)

General

Supply: 100, 120, 220 or 240 Vac +5, −10% 48 to 66 Hz.

Power: 15W, 15 V·A maximum. (6.5W typical).

Weight: net, 2.7 kg (6 lb).

Dimensions: 165H x 130W x 292 mmD (6.5 x 5.1 x 11.5 in.).

Table 1-2. Supplemental Characteristics

Recorder output: 0—1 Vdc linearly proportional to the indicated power on each range. Output impedance 1 kΩ, BNC connector.

Video output: provides detected input signal and reference line used in compare mode. Not linear with power. Nominal impedance 50Ω, BNC connector. Typical output voltage for 1 mW input 30 mV, dc coupled.

Scope trigger output: provides trigger signal for test oscilloscope. Typical output voltage >0.1V. Nominal impedance 50Ω, BNC connector.

1-4. DESCRIPTION

The Hewlett-Packard Model 8900D Peak Power Meter directly displays the peak power of RF pulses over a 100 MHz to 18 GHz frequency range. Measurements can be made on pulses with widths from 1 μs (100 ns in COMPARE mode) to CW, and repetition rates from 100 Hz (0 Hz in COMPARE mode) to 100 kHz. The dynamic range of the 8900D is 20 dB (0 to +20 dBm).

The 8900D has two modes of operation, DIRECT and COMPARE. In the DIRECT mode the Power Meter automatically captures and displays the peak power of the pulse. In the COMPARE mode an oscilloscope is used with the 8900D to measure power at any desired point on the pulse waveform.

1-5. WARRANTY

The Peak Power Meter is warranted and certified as indicated on the inner front cover of this manual. For further information contact the nearest Hewlett-Packard Sales and Service office; addresses are provided at the back of this manual.

1-6. TEST EQUIPMENT REQUIRED

Table 1-3 lists the test equipment and accessories required to check, adjust and repair the Peak Power Meter. If substitute equipment is used it must meet the listed critical specifications.

1-7. SAFETY CONSIDERATIONS

This product is a Safety Class I instrument (provided with a protective earth terminal). The Peak Power Meter and all related documentation must be reviewed for familiarization with safety markings and instructions before operation. Refer to the Safety Considerations page found at the beginning of this manual for a summary of general safety information.

Safety information for installation, operation, and servicing is found in appropriate places throughout this manual.

Table 1-3. Recommended Test Equipment (1 of 2)

Instrument Type	Critical Specifications	Suggested Model	Use*
Digital Voltmeter	0.1 mV Resolution & Accuracy 10 Volt Range	HP 3455A	A
Pulse Generator	Square wave, 0.5V P-P, 1 kHz Repetition Rate Rise time 35 ns maximum	HP 8013B	A, P
Oscilloscope	100 MHz Bandwidth	HP 1740A	A, P
Power Supply	Regulation-load effect 5 mV Source effect 3 mV Range 0—1.5V minimum Periodic and Random Deviation 200 μV rms	HP 6203B	A
50Ω Potentiometer	Non-wirewound 0.25W	HP 2100-0671	A
Sweep Oscillator Mainframe	0.1—18 GHz	HP 8620C	P
RF Plug-in	0.1—18 GHz	HP 86290A	P
Microwave Amplifier	Full band coverage to 18 GHz or Frequency of interest 200 mW output	HP 489A, 491C, 493A, 495A	P
Dual Directional Coupler	20 dB attenuation on reflected and incident ports. 2—18 GHz frequency >26 dB directivity	HP 11692D	P
Power Meter	0.1—18 GHz, 1 mW to 100 mW	HP 436A	P
Power Sensor	0.1—18 GHz, 1 mW to 100 mW	HP 8481A	P
Coaxial Attenuator	10 dB attenuation 2W 100W peak	HP 8491B (Opt. 010)	P
Coaxial Step Attenuator	0.1—18 GHz 1 dB step, 11 dB total	HP 8494B	P
Power Splitter	Dc—18 GHz 0.5W input	HP 11667A	P
Power Sensor	0.1—18 GHz, 0.1 mW—3W 100W Peak	HP 8481H	P
Coaxial Crystal Detector	0.1—18 GHz 0.5 mV/μW minimum 200 mW input	HP 8470B	P

P = Performance; A = Adjustments; T = Troubleshooting

Table 1-3. Recommended Test Equipment (2 of 2)

Instrument Type	Critical Specifications	Suggested Model	Use*
Pulse Modulator	2—18 GHz Rise and fall time <10 ns	HP 11720A	P
System Voltmeter	0.001V resolution 1.0V full scale Settling time = 1.5 μs Delay 0.1 μs	HP 3437A	P
Type N Coaxial Short	Type N 50Ω	HP 11512A	P
Peak Power Sensor	No substitution	HP 84811A	P
Low Pass Filter	Cut-off frequency in GHz 2.8 4.4 6.8 9.5 13.0	 HP 11688A HP 11689A HP 11684A HP 11685A HP 11686A	P

P = Performance; A = Adjustments; T = Troubleshooting

SECTION II
INSTALLATION

2-1. INTRODUCTION

This section provides information about incoming inspection, selecting the input line voltage, operating environment, and information applicable to bench mounting.

2-2. INITIAL INSPECTION

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. The contents of the shipment are shown in Figure 1-1 and the procedures for checking electrical performance are given in Section IV. If the contents are incomplete, if there is mechanical damage or defects, 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.

2-3. PREPARATION FOR USE

2-4. Power Requirements

The Peak Power Meter requires a power source of 100, 120, 220 or 240 Vac +5% −10%, 48 to 66 Hz single phase. Power consumption is less than 15 VA.

2-5. Line Voltage and Fuse Selection

Verify that the line voltage selection card and the fuse are matched to the power source. Figure 2-1 provides instructions for line voltage selection.

CAUTION

Before plugging this instrument into the mains (line) voltage, be sure the correct voltage and fuse have been selected, otherwise damage can occur to the instrument.

NOTE

The correct fuse rating for the line voltage is shown on the fuse compartment. More information is given in Table 3-1 Power Line Fuse Information.

2-6. Power Cable

In accordance with international safety standards, this instrument is equipped with a three-wire power cable. When connected to an appropriate ac power receptacle, this cable grounds the instrument cabinet. The type of power cable plug shipped with each instrument depends on the country of destination. Refer to Figure 2-2 or the part numbers of the power cable plugs available.

WARNINGS

Any interruption of the protective (grounding) conductor (inside or outside the instrument) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two conductor outlet is not sufficient protection). In addition, verify that a common ground exists between the unit under test and this instrument prior to energizing either unit.

Whenever it is likely that the protection has been impared, the instrument must be made inoperative and be secured against any unintended operation.

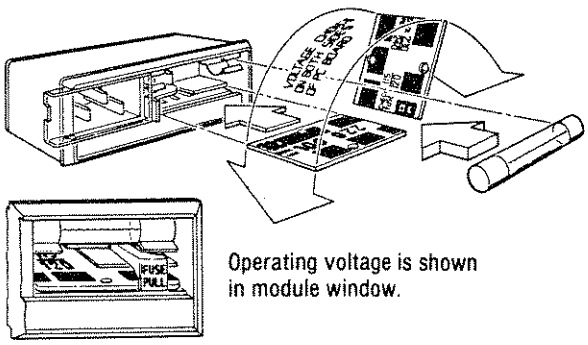
If this instrument is to be energized via an auto-transformer (for voltage reduction), make sure the common terminal is connected to neutral (that is, the grounded side of the mains supply).

Servicing instructions are for use by service-trained personnel only. To avoid dangerous electric shock, do not perform any servicing unless qualified to do so.

Adjustments described in the manual are performed with power supplied to the instrument while protective covers are removed. Energy available at many points may, if contacted, result in personal injury.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

For continued protection against fire hazard, replace the line fuse(s) only with 250V fuse(s) of the same current rating and type (for example, normal blow, time delay, etc.). Do not use repaired fuses or short circuited fuseholders.



Operating voltage is shown in module window.

SELECTION OF OPERATING VOLTAGE

1. Open cover door, pull the FUSE PULL lever and rotate to left. Remove the fuse.
2. Remove the Line Voltage Selection Card. Position the card so the line voltage appears at top-left corner. Push the card firmly into the slot.
3. Rotate the FUSE PULL lever to its normal position. Insert a fuse of the correct value in the holder. Close the cover door.

WARNING

Do not operate this instrument with frequencies greater than 66 Hz. Line frequencies greater than 66 Hz with line voltages greater than 126.5 Vac will cause a potential shock hazard that could result in personal injury (leakage current at these settings may exceed 3.5 mA). In addition, damage to the instrument may result.

Figure 2-1. Line Voltage Selection

2-7. Interconnections

The Power Meter and a power sensor are integral parts of this measurement system. Before measurements can be performed, the Power Meter and sensor must be connected together with the power sensor cable.

2-8. Mating Connectors

Mating connectors used with the Peak Power Meter should be one of the following:

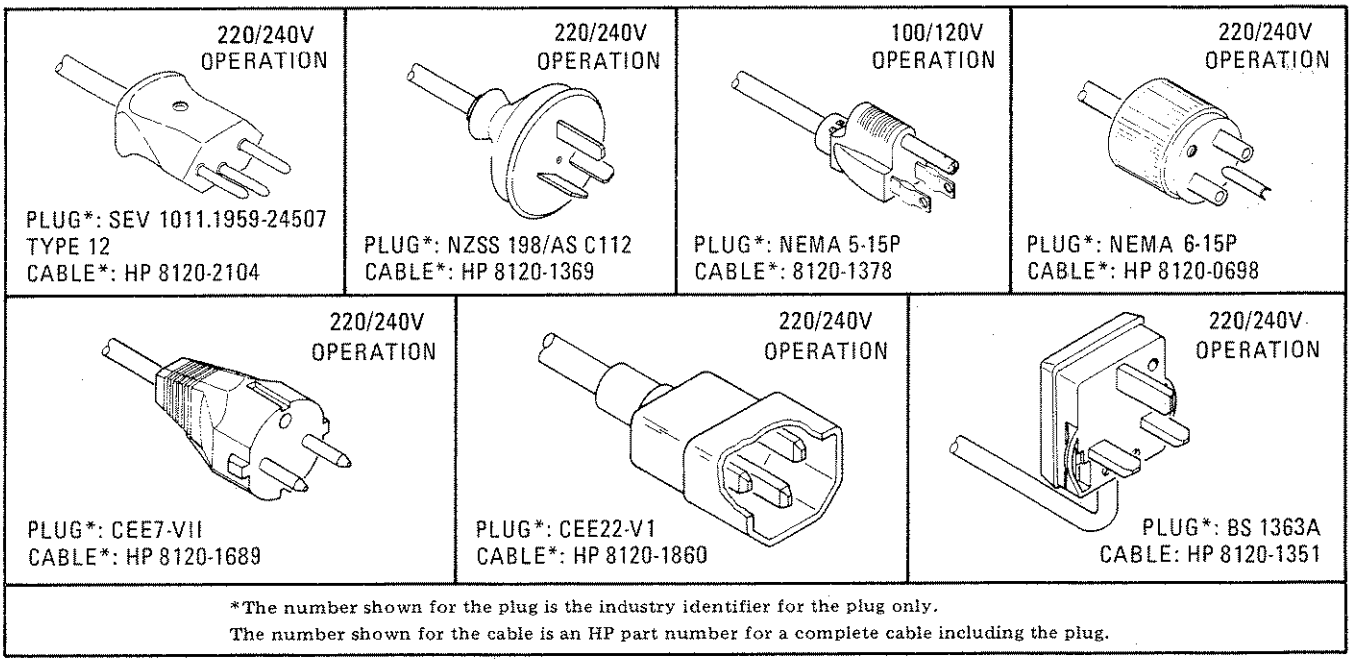
1. 50 ohm type BNC male
2. Five pin lock-ring male
3. 50 pin micro ribbon male.

The part number for the 50 pin connector is; HP 1251-0086 (CD6) (Amphenol and Cinch part number 57-30500-375).

2-9. Operating Environment

The operating environment should be within the following limitations:

Temperature ..... 0 to +55°C
Humidity ... <95% relative humidity at 40°C
Altitude ..... <4600 metres (15 000 feet)



*The number shown for the plug is the industry identifier for the plug only.
The number shown for the cable is an HP part number for a complete cable including the plug.

Figure 2-2. Power Cables Available

2-10. Bench Operation

The instrument cabinet has plastic feet and foldaway tilt stand for convenience in bench operation. The plastic feet are shaped to ensure self-aligning of the instruments when stacked. The tilt stands raise the front of the instrument for easier viewing of the control panel.

2-11. STORAGE AND SHIPMENT

2-12. Storage Environment

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

Temperature	−40 to +75°C
Humidity	<95% relative humidity at 40°C
Altitude	<7600 metres (25 000 feet)

2-13. Packaging

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 blue tag (found at the back of this manual), indicating the type of service required, return address, model number, and full serial number. Also mark the container FRAGILE to assure careful handling. In any correspondence, refer to the instrument by model number and full serial number.

Other Packaging. The following general instructions should be used for re-packaging with commercially available materials:

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett—Packard office or service center, attach a blue tag indicating the type of service required, return address, model number, and full serial 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 instrument to provide a firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

SECTION III
OPERATION

3-1. INTRODUCTION

This section describes the functions of the controls and indicators of the Peak Power Meter. It describes how to set the front and rear panel controls, and covers such operator maintenance as fuses and indicator lamp replacement.

3-2. PANEL FEATURES

Front panel controls, indicators, and connectors are shown and described in Figure 3-1. Rear panel controls and connectors are shown and described in Figure 3-2.

3-3. OPERATOR'S CHECKS

Use the operator's checks in Figure 3-3 to verify proper operation of the Peak Power Meter's main functions.

3-4. OPERATING INSTRUCTIONS

Figure 3-4 explains how to use the Peak Power Meter.

3-5. POWER MEASUREMENT ACCURACY

A power measurement is never free from error or uncertainty. Any RF system has RF losses, mismatch losses, harmonics, mismatch uncertainty, instrumentation uncertainty and calibration uncertainty. Measurement errors as high as 50% are not only possible, they are highly likely unless the error sources are understood and, as much as possible, eliminated.

3-6. SOURCES OF ERROR AND MEASUREMENT UNCERTAINTY

3-7. RF Losses

Some of the RF power that enters the power sensor is not dissipated in the power sensing elements. This RF loss is caused by dissipation in the center conductor of coaxial power sensors, in the dielectric of capacitors, in radiation losses and connections within the sensor diode caused by shunt conductance and junction capacitance.

3-8. Mismatch

The result of mismatched impedance between the device under test and the power sensor is that some of the power fed to the sensor is reflected before it is dissipated in the load. Mismatches affect the measurement in two ways. First, the initial reflection is simple loss and is called mismatch loss. Second, the power reflected from the sensor mismatch travels back up the transmission line until it reaches the source. There, most of it is dissipated in the source impedance, but some of it is re-reflected by the source mismatch. The re-reflected power returns to the power sensor and adds to, or subtracts from, the incident power. For all practical purposes, the effect the re-reflected power has upon the power measurement is unpredictable. This effect is called mismatch uncertainty.

3-9. Instrumentation Uncertainty

Instrumentation uncertainty describes the ability of the metering circuits to accurately measure the dc output from the power sensor's power sensing device. In the Peak Power Meter, this error is less than ±0.35 dB. It is important to realize, however, that a ±0.35 dB meter does not automatically give ±0.35 dB overall measurement accuracy.

3-10. Specified Uncertainties

The specified uncertainties which account for part of the total power measurement uncertainty are:

a. 8900D instrumentation uncertainty

Meter Accuracy	CW	Pulse	Transfer Accuracy CW to Pulse
Direct	±0.2 dB	±0.35 dB	±0.2 dB
Compare	±0.2 dB	±0.25 dB	±0.1 dB

b. 84811A calibration uncertainty

(+10 to 40°C)
±0.7 dB 0.1 GHz to 12 GHz
±1.0 dB 12 GHz to 18 GHz
(0—10°C and 40—55°C add ±0.2 dB).

3-11. Calculating Mismatch Uncertainty

Mismatch uncertainty is the result of the source mismatch interacting with the power sensor mismatch. The magnitude of uncertainty is related to the magnitudes of the source and power sensor reflection coefficients, which can be calculated from

Calculating Mismatch Uncertainty (Cont'd)
SWR. Figure 3-6 shows how the calculations are made and Figure 3-7 illustrates mismatch uncertainty and total calculated uncertainty for two cases. In the first case, the power sensor's SWR is 1.5, and in the second case, the power sensor's SWR is 2.0. In both cases the source has an SWR of 2.0. The example shows the effect on power measurement accuracy a poorly matched power sensor will have as compared to one with low mismatch.

A faster, easier way to find mismatch uncertainty is to use the HP Mismatch Error (uncertainty) Limits/ Reflectometer Calculator. The calculator may be obtained, on request, from your nearest Hewlett-Packard office by using HP part number 5952-0948.

The method of calculating measurement uncertainty from the uncertainty in dB is shown by Figure 3-8. This method would be used when the initial uncertainty calculations were made with the Mismatch Error/Reflectometer Calculator.

3-12. CORRECTIONS FOR ERROR

3-13. Correction Factor

The peak power sensor used with the Peak Power Meter has an individually calibrated correction factor table printed on its cover. To correct for sensor frequency response, simply find the power sensor's correction factor at the measurement frequency from the table that is supplied with the power sensor, and set the CORRECTION switch to this value.

3-14. Transfer Function of the Diode Current versus Input Voltage

At low levels the output current is proportional to the square of the applied voltage. At high levels the output current is directly proportional to the input voltage. Each diode varies slightly in the precise transfer function uncertainty. The Peak Power Meter's response is shaped for the average diode. The maximum error for an 84811A diode transfer function is ±0.7 dB to 12 GHz; ±1.00 dB to 18 GHz.

Transfer uncertainty can be reduced by calibrating the meter and sensor at the frequency and power of interest.

Meter and sensor are connected to an rf source of known frequency and precise power level at CW. The CORRECTION switch is then adjusted until the Peak Power Meter displays the known power level. The meter is now calibrated to measure a pulsed signal at the CW frequency and the known power level.

The transfer uncertainty from CW to pulse is <0.2 dB for the Peak Power Meter and 84811A peak power sensor. The overall CW to pulse transfer uncertainty must also include the level uncertainty of the CW calibration source, the mismatch error between the sensor and CW source and the mismatch error between the sensor and pulsed rf source.

3-15. OPERATOR'S MAINTENANCE

CAUTION

Be sure to select the correct fuse rating for the selected line voltage (see LINE VOLTAGE SELECTION in Section II and Power Line Fuse information in Table 3-1.

3-16. Power Line Fuse

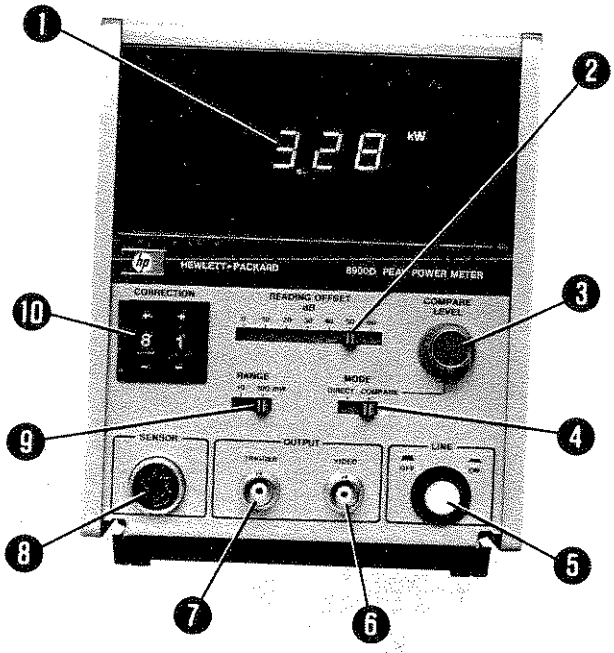
The main ac line fuse is located on the rear panel next to the line power cable jack. To remove the fuse, first remove the line power cable from its jack. Slide the fuse compartment cover to the left, then pull the handle marked FUSE PULL and remove the fuse. See Table 3-1 for replacement fuse information.

Table 3-1. Power Line Fuse Information

Operation	Description	HP Part Number
100—120V	.15A 250V	2110-0320
200—240V	.1A 250V	2110-0234

3-17. Lamp Replacement

The lamp is contained in a plastic lens which doubles for a pushbutton on the LINE switch. When the Power Meter LINE switch is ON and is being operated by the available line power, the lamp should be illuminated. If the lamp is defective, remove the lens by pulling it straight out. Order lamp (3131-0434) CD6 and replace the old pushbutton-lamp assembly with the new one. To replace the assembly, align the pins with the notch in the receptacle and push straight in.



1 Digital Panel Meter. Normally indicates peak rf power in mW. Power can be displayed in watts and kilowatts when the READING OFFSET is used.

2 READING OFFSET dB. The READING OFFSET compensates the Peak Power Meter reading for external couplers or attenuators to indicate the true power at the source. The amount of external attenuation is indicated on the slide switch.

CAUTION

The READING OFFSET does not allow the operator to read higher power levels. The maximum power level is determined by the power sensor. For additional information refer to the power sensor manual.

3 COMPARE LEVEL. When in compare mode the COMPARE LEVEL is used to measure power at user selected points on the pulse waveform. This is accomplished by adjusting the COMPARE LEVEL which in turn moves a reference line up or down on the pulse waveform as seen on an oscilloscope.

4 MODE switch. Selects either DIRECT or COMPARE mode. In DIRECT mode the meter automatically displays the maximum rf power with no user adjustments and no external instruments. In COMPARE mode, the meter is disconnected from the peak detecting circuit and instead indicates power corresponding to the position of a reference line.

5 LINE switch. Connects the line power to the Power Meter circuits when the LINE switch is on. The lamp contained within the LINE switch will be illuminated when the instrument is on. Both sides of the mains line goes through the switch.

6 VIDEO OUTPUT. Provides detected input signal and reference line used in compare mode. Not linear with power. Nominal impedance 50Ω. BNC connector. Typical output voltage for 1 mW input is 30 mV. Dc coupled.

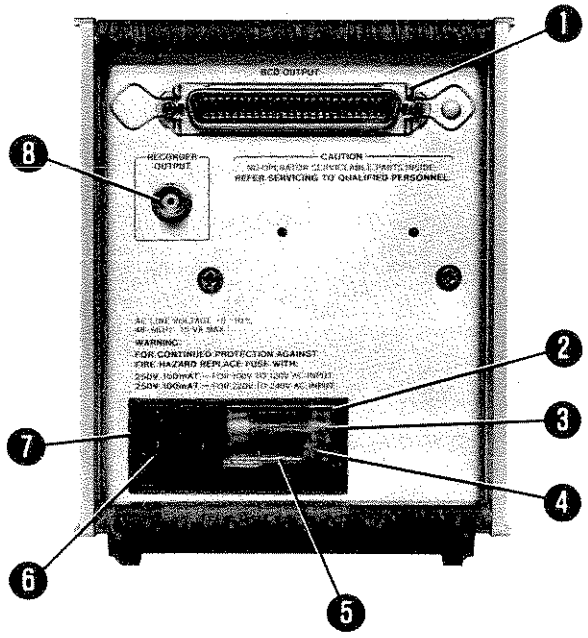
7 TRIGGER OUTPUT. Provides the trigger signal for the test oscilloscope. Typical output voltage >0.1V peak. Nominal impedance 50Ω. BNC connector.

8 SENSOR Input. Five pin lock-ring connector which serves as the input to the Power Meter from the power sensor. This connector also serves as the supply for the plus and minus five (5) volts to the sensor.

9 RANGE switch. Sets the range of the Power Meter to either 10 mW or 100 mW maximum range.

10 CORRECTION switch. Used to set the correction factor of the frequency where the measurement is to be taken. The correction factor data versus frequency is found on the peak power sensor.

Figure 3-1. Front Panel Controls, Indicators and Connectors



1 BCD OUTPUT. The front panel reading is reproduced in BCD format (Binary Coded Decimal). The BCD output is useful for remote monitoring of the meter reading. The TTL level for a 1 is typically >+3.5 ±1V and a 0 is typically <+0.2 ±0.4V.

BCD Output at J5

Decimal	Binary			
	$10^{N}D$	$10^{N}C$	$10^{N}B$	$10^{N}A$
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1

(Connector J5 is found on service sheet 3)

2 Window. Safety interlock; fuse cannot be removed while power cable is connected to Power Meter.

3 Fuse. Refer to Table 3-1 for values.

4 Fuse Pull Handle. Mechanical interlock to guarantee fuse has been removed before line voltage selection card can be removed.

5 Line Voltage Selection Card. Matches transformer primary to available line voltage.

6 Receptacle. For power cable connection to available line voltage.

7 Power Module Assembly.

8 RECORDER OUTPUT. 0—1 Vdc linearly proportional to the indicated power on each range. Output impedance 1 kΩ, BNC connector.

Figure 3-2. Rear Panel Features

OPERATING INSTRUCTIONS

BEFORE SWITCHING ON THIS INSTRUMENT, check that the power transformer primary is matched to the available line voltage, the correct fuse is installed and safety precautions are taken. See Power Requirement, Line Voltage Selection, Power Cables and associated warnings and cautions in Section II.

WARNING

BEFORE CONNECTING LINE POWER TO THE INSTRUMENT, ensure that all devices connected to this instrument are connected to the protective (earth) ground.

BEFORE SWITCHING ON THIS INSTRUMENT, ensure that the line power (Mains) plug is connected to a three-conductor line power outlet that has a protective (earth) ground. (Grounding one conductor of a two-conductor outlet is not sufficient.)

CAUTION

Do not twist the body of the power sensor when connecting or disconnecting it. This can cause major damage to the sensor.

Direct Mode

1. Connect the power sensor to the Power Meter with the power sensor cable.
2. Connect the power cable to the power outlet and power module receptacles. Set the LINE switch to ON; the lamp within the switch lens should be lit.
3. Set the MODE switch to DIRECT.
4. Set the READING OFFSET to zero (0) dB or to the appropriate value to compensate for in-circuit attenuation.
5. Set the CORRECTION switch to the value of the correction factor found on the peak power sensor for the frequency where the measurement is to be taken.
6. Set the RANGE switch to 100 mW. If after a reading has been taken and the power level is less than 10 mW change the RANGE to 10 mW to get better resolution.
7. Connect the power sensor to an rf source. Read the power level in mW. If external coupling or attenuation is used, set the offset to the amount of in-circuit attenuation. The Power Meter will then read the power level at the source in mW, W, or kW.

CAUTION

See Operating Precautions in the power sensor Operating and Service Manual for maximum power levels which may be safely coupled to this system. Levels which exceed the limits may damage the power sensor, Power Meter, or both.

Compare Mode

1. Perform steps 1 and 2 as stated above under DIRECT MODE.
2. Set the MODE switch to COMPARE.
3. Set the READING OFFSET to zero (0) dB or to the appropriate value to compensate for in-circuit attenuation.
4. Set the CORRECTION switch to the value of the correction factor found on the peak power sensor for the frequency where the measurement is to be taken.
5. Set the RANGE switch to 100 mW. If after a reading has been taken and the power level is less than 10 mW, change the RANGE to 10 mW to get better resolution.
6. Connect the TRIGGER OUTPUT to the external trigger of an oscilloscope.
7. Connect the VIDEO OUTPUT to the vertical input of a dc coupled oscilloscope.
8. Connect the power sensor to an rf source. Read the power level in mW. If external coupling or attenuation is used, set the offset to the amount of in-circuit attenuation. The Peak Power Meter will then read the power level at the source in mW, W, or kW.
9. Adjust the scope for a clear display of the pulse waveform and the reference line.
10. It is now possible to measure power at any point on the pulse waveform. Adjust the COMPARE LEVEL to move the reference line, as seen on the scope, to the position on the pulse waveform that is of interest. The Power Meter will then display the power at that point.

Figure 3-4. Operating Instructions