HEWLETT PACKARD

Operating
and
Service
Manual

HP 8481H/82H
Power Sensor

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Note: If test and measurement equipment is operated with unshielded cables and/or used for measurements in open setups, the user must ensure that under these operating conditions, the radio frequency interference limits are me at the border of his premises.

General Information

This Operating and Service Manual contains information about initial inspection, performance tests, adjustments, operation, troubleshooting and repair of the HP Model 8481H and 8482H Power Sensors.

Instruments Covered by Manual

This instrument has a two-part serial number. The first four digits and the letter comprise the serial number prefix. The last five digits form a sequential suffix which is unique to each instrument. The contents of this manual apply directly to instruments having the serial number prefix 2703A and 2704A.

If your instrument has a serial number prefix less than 2703A or 2704A additional information is located in the "Backdating" section at the end of this manual. If your instrument has a serial number prefix greater than 2703A or 2704A look for a yellow "Manual Changes" supplement that documents the difference.

In addition to change information, the supplement may contain information for correcting errors in the manual. The supplement is keyed to the manual print date and part number, both of which appear on the front cover.

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

Description

The Power Sensors are used for measuring the average power supplied by an RF source to a 50-ohm load. In use, the Power Sensor is connected to the RF source and to a compatible power meter. (Suitable meters are the HP 435A or 436A Power Meter.) The Power Sensor places a 50-ohm load on the RF source, and the power meter indicates the power dissipated in this load. The power is determined from the RF voltage developed across the Power Sensor load, and is expressed in μW (or W) and dBm. The HP 436A Power Meter can also provide readings, in dB, relative to a previous RF input to the Power Sensor.

The Power Sensors measure power levels from -10 dBm to $+35$ dBm (10 μW to 3W), at frequencies from 10 MHz to 18 GHz (HP 8481H) or 100 kHz to 4.2 GHz (HP 8482H).

The physical configuration of both sensors is the same. However, because of the different frequency ranges covered, there are some changes in page numbers and component values.

Calibration data is provided by a table on the Power Sensor. The table, individually prepared for each Power Sensor, shows the calibration factor (CAL FACTOR) at 17 frequencies. This calibration factor is used to adjust the power meter to suit the particular Power Sensor and RF frequency. For meter accuracy, a table showing the calibration factor to three significant digits is supplied with each Power Sensor.

Specifications for the Power Sensor are provided in table 1.

Recommended Test Equipment

Table 2 lists the test equipment recommended to check, adjust, and troubleshoot the Power Sensor. If substitute equipment is used, it must meet or exceed the critical specifications.

Table 1. Specifications

Frequency Range: 10 MHz to 18 GHz (HP 8481H) and 100 kHz to 4.2 GHz (HP 8482H)

Power Measurement Range: 30 μW to 3W

Maximum Permissible RF Power, Average: 3.5W

Maximum Permissible RF Power, Peak: 100W

Maximum Energy Pulse: 100 W/μs

Maximum SWR (Reflection Coefficient) of Power Sensor:

HP 8481H	HP 8482H
1.20 (0.091) 10 MHz to 8 GHz	1.20 (0.091) 100 kHz to 4.2 GHz
1.25 (0.112) 8 to 12.4 GHz	
1.30 (0.130) 12.4 to 18 GHz	

Power Linearity:±5% for CW from 300 mW to 3W[1]

RF Impedance: 50Ω nominal

RF Connector: Type N Male (meets military specifications)

Calibration: Individual calibration graph and table, traceable to NBS, provided with each Power Sensor

Dimensions, Including RF Connector:30 mm wide, 38 mm high, 149 mm long (1-3/16 x 1-1/2 x 5-7/8)

Weight: Net, 0.2 kg (8 oz)

[1]Negligible deviation below 300 mW.

Table 2. Recommended Test Equipment

Instrument Type	Critical Specifications	Suggested Model	Use*
Power Meter	No substitute	HP435B	A
Digital Voltmeter	Input Impedance: 10 MΩ Resolution: 4-digit Accuracy: ±0.05% ± 1 digit	HP 3478A	T,A
Oscilloscope;	Bandwidth: dc to 50 MHz Vertical Sensitivity: 0.2 V/div Horizontal Sensitivity: 1 ms/div	HP 54200A	A,T
10:1 Divider Probe	10 MΩ 10 pF	HP 10004D	A
Ohmmeter	Range: 1Ω to 100 kΩ Accuracy: ±5%	HP 3478A	T
dc Power Supply	Range: 0–20 Vdc Load Regulation: 0.01% + 4 mV	HP 6204B	T

*A = Adjustment, T = Troubleshooting

Installation

Initial Inspection

Inspect the shipping container. If the container or packing 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 perfornnance tests, notify the nearest Hewlett-Packard office. Keep the damaged shipping materials (if any) for inspection by the carrier and a Hewlett-Packard representative.

Storage and Shipment

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

Temperature	−40 to +75°C
Relative humidity	< 95%
Altitude	< 7,600 metres (25,000 feet).

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 ensure careful handling. In any Correspondence, refer to the instrument by model number and serial number.

Interconnections

Refer to the power meter operating and service manual for interconnecting instructions.

Operation

Environment

The operating environment for the Power Sensor should be as follows:

Temperature	0° to 55°C
Relative humidity	< 95%
Altitude	< 4,572 metres (15,000 feet).

Operating Precautions

Before the Power Sensor is connected, the following precautions must be observed.

Cautions

BEFORE CONNECTING THE POWER SENSOR TO ANOTHER INSTRUMENT, ensure that the instrument and power meter are connected to the protective earth ground.

Exceeding the energy and power levels shown in Table 1 may result in damage to the power meter system.

To avoid internal damage to the Power Sensor, connect or disconnect by turning the Type N RF connector only. Do not turn the Power Sensor's plastic body.

The absolute maximum RF signal level that may be coupled to the Power Sensor is:

Maximum Average Power	3.5W
Maximum Peak Power	100W
Maximum Energy Per Pulse	100W/μs.

Power Meter Calibrations

The procedure for calibrating one power meter may be different for another power meter. Follow the calibration directions given in your power meter manual.

Table 3. HP 8481H/82H Calibration Factor Uncertainty at 1 W

HP 8481H Frequency(GHz)	(RSS) Probable Uncertainty (%)	HP 8482H Frequency(MHz)	(RSS) Probable Uncertainty (%)
1.0 GHz	1.9%	0.1 MHz	1.6%
2.0 GHz	1.7	0.3 MHz	1.6
4.0 GHz	1.8	1.0 MHz	1.6
6.0 GHz	1.8	3.0 MHz	1.6
8.0 GHz	2.0	10.0 MHz	1.6
10.0 GHz	2.2	30.0 MHz	1.7
12.0 GHz	2.4	50.0 MHz	0 (ref)
14.0 GHz	2.8	100.0 MHz	1.9
16.0 GHz	3.0	300.0 MHz	1.9
18.0 GHz	3.1	1000.0 MHz	1.7
		2000.0 MHz	1.7
		4000.0 MHz	1.8

Power Measurements

To correct for varying responses at different frequencies a cal factor chart is included on the Power Sensors. To use the cal factor at the frequency of interest, adjust the power meter's CAL FACTOR control according to the instructions in your power meter's operating manual.

SWR (Reflection Coefficient) Performance Test

The maximum SWR and reflection coefficient or the Power Sensor are listed in Table 4. For making these measurements, use equipment which has measurement uncertainties not exceeding those shown in the table.

Table 4. SWR and Reflection Coefficient

Frequency	Measuring System Reflection Coefficient Uncertainty	Actual Measurement	Maximum SWR (Reflection Coefficient)
	HP 8481H		
10 MHz to 8 GHz	±0.025	_____	1.20 (0.91)
8 GHz to 12.4 GHz	±0.030	_____	1.25 (0.112)
12.4 GHz to 18 GHz	±0.035	_____	1.30 (0.130)
	HP 8482H		
100 kHz to 4.2 GHz	±0.025	_____	1.20 (0.91)

Adjustments

FET Balance Adjustment

Warning **The following procedure exposes high voltage areas within the power meter. Use extreme care while working around these areas or personal injury could occur.**

Equipment

Oscilloscope	HP 54200A
Power Meter	HP 435B
Multimeter	HP 3478A

The sampling gate balance is affected by the relative positions of the wires in the Power Sensors, which connect to pins G and H of connector J1. One wire is black and white; and the other is brown and white. Moving the black and white wire will adjust the switching transient amplitude (spike). Moving the brown and white will change the offset. Once positioned, care must be used not to displace these wires. To correctly position these wires, after replacement of A2U1, or if the wires have been moved so as to affect the sampling gate balance, perform the following procedure:

Note If the Power Sensor printed circuit board A2 has been removed for repair, make sure all surfaces are thoroughly clean and free of flux residues before attempting the following adjustments.

1. Set the multimeter controls as follows:
   FUNCTION Voltage
   RANGE 20 mV, full scale
2. Set oscilloscope controls as follows:
   SENSITIVITY 0.2 V/DIV
   SWEEP 1 ms/DIV
   TRIGGER INT
   Display A
3. Set the Power Meter CAL FACTOR to 100%. Set the Power Meter RANGE to 1 mW (0 dBm).
4. Open the Power Sensor (see "Disassembly Procedure", steps 1 through 3). Zero and calibrate the Power Meter. Leave the opened Power Sensor connected to the Power Meter POWER REF output. Heat can affect the adjustments so handle the sensor as little as possible.
5. Turn OFF the POWER REF switch on the rear panel of the Power Meter.
6. Remove the HP 435B bottom panel. This will expose the circuit side of the A5 printed circuit board. On A5 you will see a long double row of soldered terminals numbered 1 to 44.

7. Connect a probe from pin 40 (the number "902" is printed on the board next to pin 40) to the multimeter input.
8. Lay the HP 435B on its left side and remove the right panel. This will expose th A4 assembly.
9. Connect a 1:1 probe from TP4 to channel A on the oscilloscope.
10. **Offset.** Read the multimeter and adjust the position of the brown and white wire until the reading is between −7.0 mV and −2.0 mV. *Helpful hint:* the relative position of the brown and white wire to C4 will adjust the offset.
11. **Switching transients.** Read the oscilloscope and adjust the position of the black and white wire until the switching transients are less than 0.8V peak to peak. *Helpful hint:* the relative position of the black and white wire to the collector of Q1 will adjust the switching transients.

You will find that positioning the wire for switching transients affects the offset. Go back and forth between the two wires, positioning and repositioning, until both adjustments are within specifications.

Replaceable Parts

Table 5 is a list of replaceable parts. Figure 1 and Figure 2 illustrate the major parts. To order a part, quote the Hewlett-Packard part number and check digit (CD), specify the quantity required, and address the order to the nearest Hewlett-Packard office. To order a part not listed in table 4, give the instrument model number, instrument serial number, the description and function of the part, and the quantity of parts required.

Note

Within the USA, it is better to order directly from the HP Parts Center in Roseville, California. Ask your nearest HP office for information and forms for the "Direct Mail Order System". Also your nearest HP office can supply toll free telephone numbers for ordering parts and supplies. A list of HP Sales and Service Offices is printed inside the cover of this manual.

Service

Test equipment which meets or exceeds the critical specifications in table 2 may be used in place of the recommended instruments for troubleshooting the Power Sensor.

Figure 1 and Figure 2 show the locations of the assemblies and components. Figure 3 is the schematic diagram.

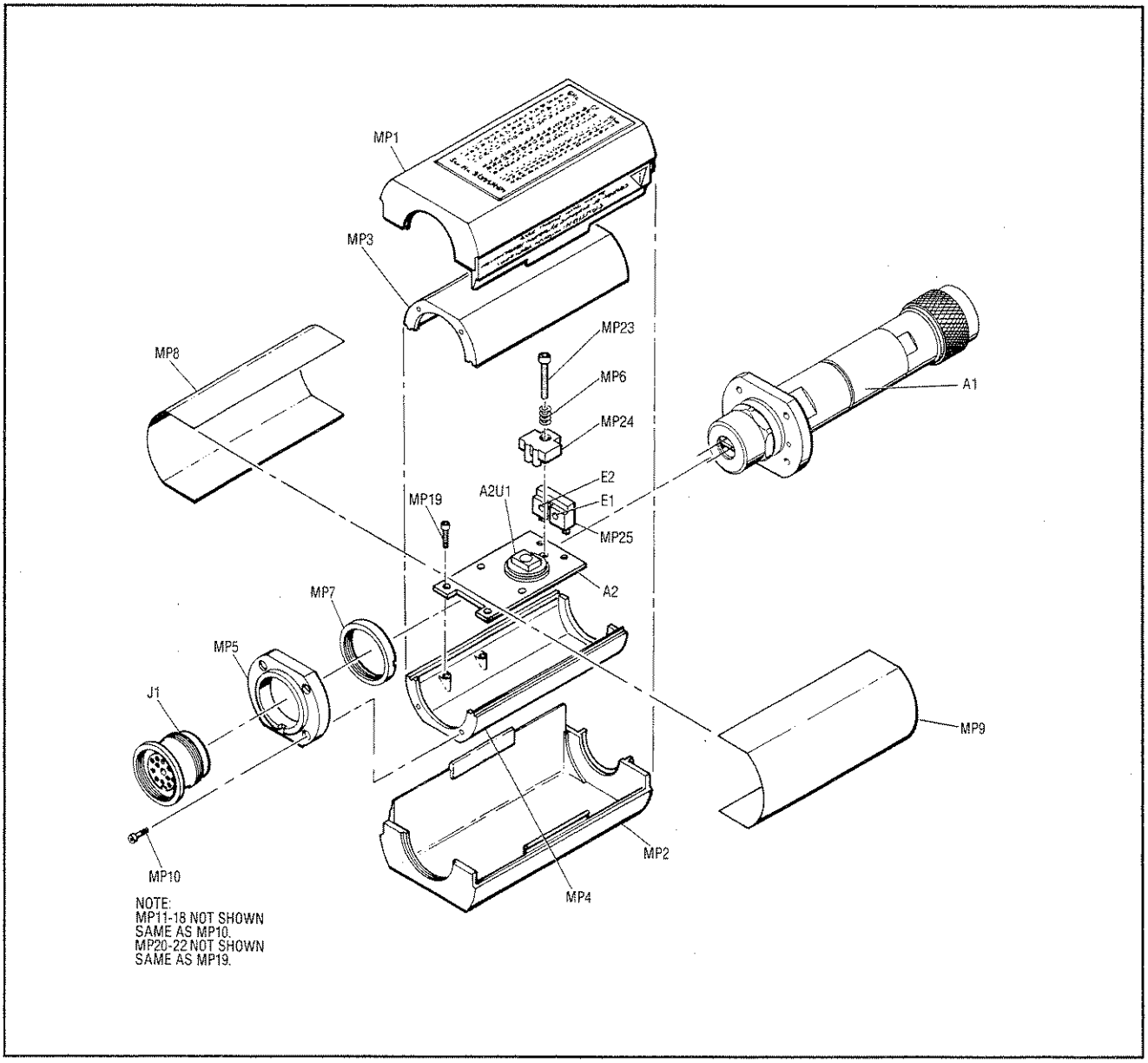

Figure 1. Illustrated Parts Breakdown

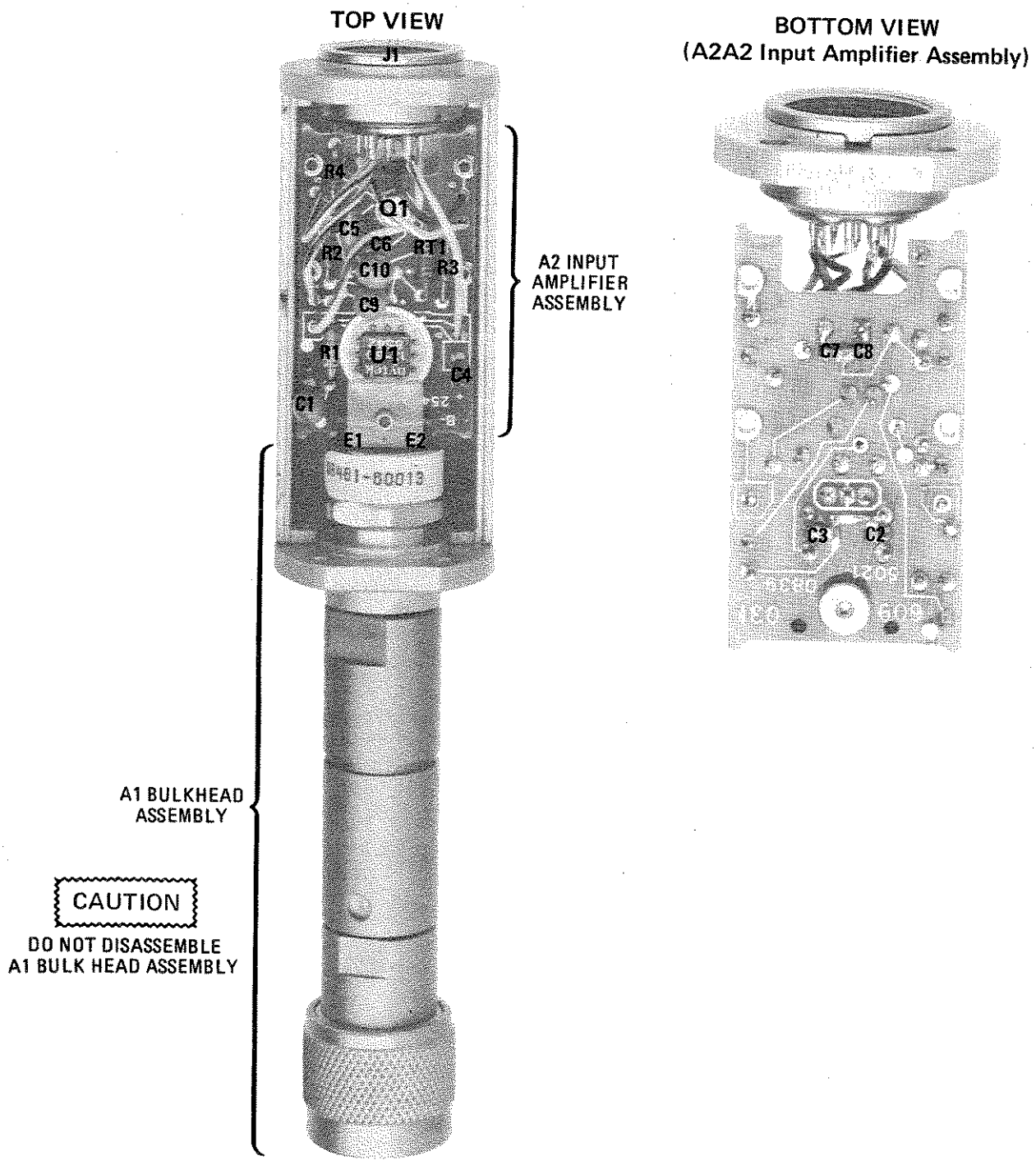

Figure 2. Component and Assembly Locations

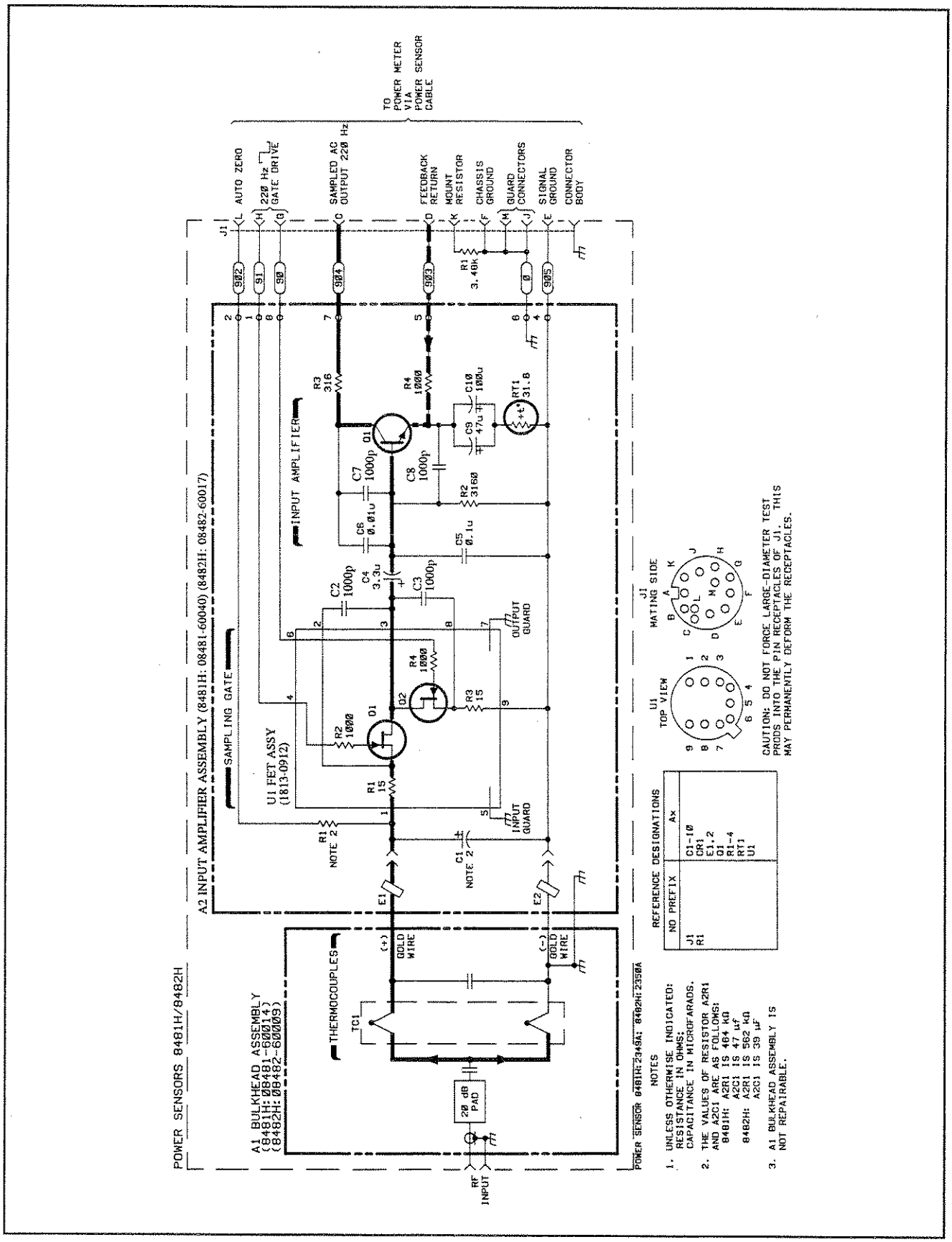

Figure 3. Schematic Diagram

Table 5. Replaceable Parts

Reference Designation	HP Part Number	CD	Qty	Description	Mfr Code	Mfr Part Number
A1	08481-60014	5	1	20 DB BULKHEAD TYPE N (FOR 8481H ONLY)	28480	08481-60014
A1	08482-60009	9	1	20 DB BULKHEAD TYPE N (FOR 8482H ONLY)	28480	08482-60009
A2	08481-60040	8	1	BOARD ASSEMBLY, POWER SENSOR (FOR 8481H ONLY)	28480	08481-60040
A2	08482-60017	5	1	BOARD ASSEMBLY, POWER SENSOR (FOR 8482H ONLY)	28480	08482-60017
A2C1	0180-2515	8	2	CAP-FXD 47UF 6 V TA (FOR 8481H)	12344	T355F476M006AS
A2C1	0180-2781	0	1	CAP-FXD 39UF 10 V TA (FOR 8482H)	12344	T355G396K010AS
A2C2	0160-5947	7	4	CAP-FXD 1000PF 50V		
A2C3	0160-5947	7		CAP-FXD 1000PF 50V		
A2C4	0180-0594	9	1	CAP-FXD 3.3UF 15 V TA	12344	T350A335M016AS
A2C5	0160-3094	8	1	CAP-FXD 0.1UF 100 V	06383	FD22X5R2A104K
A2C6	0160-3879	7	1	CAP-FXD 0.01UF 100 V	09969	RPE121-105X7R103M100V
A2C7	0160-5947	7		CAP-FXD 1000PF 50V		
A2C8	0160-5947	7		CAP-FXD 1000PF 50V		
A2C9	0180-2515	8		CAP-FXD 47UF 6 V TA	12344	T355F476M006AS
A2C10	0180-2545	4	1	CAP-FXD 100UF 4 V TA	01766	202L6301-107-M6-552
A2Q1	1854-0610	0	1	TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A2R1	0698-3260	9	1	RESISTOR 464K +-1% .125W TF TC=0+-100 (FOR 8481H ONLY)	12498	CT4
A2R1	0757-0483	8	1	RESISTOR 562K +-1% .125W TF TC=0+-100 (FOR 8482H ONLY)	19701	5033R
A2R2	0698-7248	1	1	RESISTOR 3.16K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-3161-F
A2R3	0698-7224	3	1	RESISTOR 316 +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-316R-F
A2R4	0698-7236	7	1	RESISTOR 1K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-1001-F
A2RT1	0811-3210	1	1	RESISTOR 31.6 +-5% .05W PN TC=+5040+-250	01686	R342
A2U1	1813-0912	8	1	IC MISC TO-8 PKG	28480	1813-0912
				A2 MISCELLANEOUS		
	0590-1040	1	1	THREADED INSERT-NUT 0-80 .06-IN-LG SST	46384	YC3-1505
	5040-6938	6	1	SPACER	28480	5040-6938
				CHASSIS PARTS		
J1	08481-60024	7	1	CONNECTOR, 12-PIN FEMALE MULTICONTACT	28480	08481-60024
MP1	5040-6998	9	2	SHELL, PLASTIC	28480	5040-6998
MP2	5040-6998	9		SHELL, PLASTIC	28480	5040-6998
MP3	08481-20011	8	2	CHASSIS	28480	08481-20011
MP4	08481-20011	8		CHASSIS	28480	08481-20011
MP5	08481-20008	3	1	END BELL	28480	08481-20008
MP6	1460-1978	0	1	SPRING-CPRSN .088-IN-OD .188-IN-OA-LG	84830	C1-012B-2-SS
MP7	1251-3363	8	1	NUT-AUDIO CONN	05876	91-T-1335-6-9
MP8	08481-00002	5	2	SHIELD	28480	08481-00002
MP9	08481-00002	5		SHIELD	28480	08481-00002
MP10-MP18	3030-0954	1	9	SCREW-SKT HD CAP 0-80 .188-IN-LG SST-304	00000	ORDER BY DESCRIPTION
MP19-MP22	3030-0422	8	4	SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP23	3030-0436	4	1	SCREW-SKT HD CAP 0-80 .5-IN-LG SST-300	00000	ORDER BY DESCRIPTION
MP24	5040-6939	7	1	CLAMP	28480	5040-6939
MP25	5040-6940	0	1	BLOCK	28480	5040-6940
MP26-MP27				NOT USED		
MP31	08482-80001	3	1	LABEL-ID (FOR 8482H ONLY)		
MP32	08486-80001			LABEL-CAL FACTOR (BLANK) (8481H AND 8482H)		
MP33	08486-80005			LABEL-INFO (SIDE)		
MP34	7121-2422			LABEL-WARNING (SIDE)		
MP35	00435-60030			KNOB ASSEMBLY (OPTION 002 ONLY)		
MP36	8710-0055			WRENCH-SPLINE (OPTION 002 ONLY)		
MP37	0460-1151			TAPE IND. (OPTION 002 ONLY)		
R1	0698-7249			RESISTOR 3.48K +-1% .05W TF TC=0+-100	12498	C3-1/8-T0-3481-F

Table 6. Code list of Manufacturers

Mfr Code	Manufacturer Name	Address		Zip Code
00000	ANY SATISFACTORY SUPPLIER			
00843	HOFFMAN ENG CO DIV OF FED CARTRIDGE	ANOKA	MN	55303
01686	RCL ELECTRONICS INC	NORTHBROOK	IL US	60062
01766	INTL CRYSTAL MFG CO INC	OKLAHOMA CITY	OK	73102
05876	U S POLYMERIC INC	STAMFORD	CT	06904
06383	PANDUIT CORP	TINLEY PARK	IL US	60477
09969	DALE ELECTRONICS INC	YANKTON	SD US	57078
12344	TALLY CORP	KENT	WA	98031
12498	CRYSTALONICS, DIV TELEDYNE	CAMBRIDGE	MA	02140
19701	MEPCO/CENTRALAB INC	RIVIERA	FL US	33404
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO	CA	94304
46384	PENN ENGINEERING & MFG CORP	DOYLESTOWN	PA US	18901
84830	LEE SPRING CO	BROOKLYN	NY US	11219

Principles of Operation

Bulkhead assembly A1 presents a 50-ohm load to the RF signal applied to the power sensor. The RF signal absorbed by the thermocouples generates a dc voltage that is proportional to the RF input power.

Components A2E1 and A2E2 are ferrite beads situated in the black plastic block through which the wires from A1 pass to A2. Each ferrite bead increases the self-inductance of the wire passing through the bead, causing this portion of wire to act as an RF choke. The result is to minimize RF feedthrough to the A2 input amplifier assembly.

The dc output from the bulkhead assembly is applied to the two field-effect transistors (FET's) in A2U1. These transistors function as a sampling gate (or chopper). The sampling rate is controlled by a 220 Hz square wave supplied by the power meter. The sampling gate output (at pin 3 of A2Ul) is a 220 Hz square wave having a voltage proportional to the RF power input.

The output of A2U1 is amplified about 700 times by an operational amplifier made up of A2Q1 and the first amplifier stage in the power meter. Figure 4 is a simplified diagram of the complete operational amplifier.

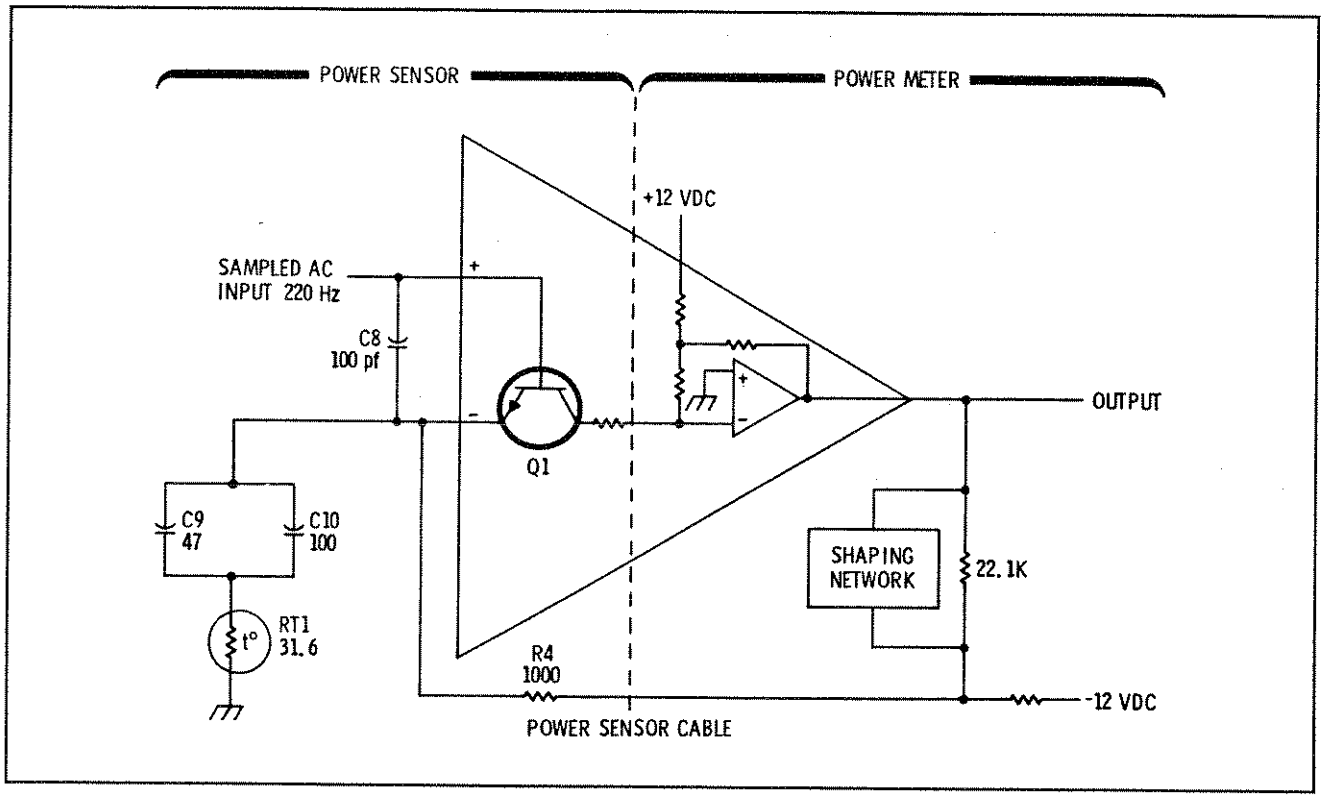

Figure 4. Operational Amplifier

The Auto Zero Feedback circuit is coupled to the Power Sensor from the Power Meter. The dc voltage used to set the zero level is applied to the input of FET A2U1Q1 by using A2R1 and the series resistance of the thermocouple A1TC1 as a voltage divider.

When the Power Sensor is used with the HP 436A Power Meter, the resistance of R1 indicates the type of power sensor in use. As a result, the power meter automatically selects the proper measurement range. The 3.48K ohm resistance of R1 causes selection of the −15 to +35 dBm range. With the HP 435A Power Meter, R1 serves no function.

Troubleshooting

The troubleshooting information which follows is intended to isolate a problem to a stage. The defective component can then be identified by voltage and resistance checks. The field-effect transistors (FET's) in A2U1 are slightly light sensitive. As a result, dc levels are shifted slightly when the FET's are exposed.

Caution

Be extremely careful when measuring accross the gold wires. They are delicate and can be damaged easily.

The A1 bulkhead assembly normally supplies +3.79 ±1 mV when the RF input is 3W. Measure this voltage at A2U1 pin 1. This dc voltage will vary somewhat if the A2 input amplifier is inoperative, or if the bulkhead assembly is disconnected from the input amplifier.

Resistance measured across the two gold wires leading to the A2 assembly should be 200 ±10 ohms (HP 8481H) or 245 ±12.5 ohms (HP 8482H). Note that excessive power will damage either the 20 dB pad or the thermocouples. If the 20 dB pad is damaged it will present an open circuit to the input signal. If the thermocouples are damaged their resistance will increase. If the A1 Bulkhead Assembly is defective, the entire Bulkhead Assembly must be replaced.

The FET's in A2U1 may be checked by the following procedure:

1. Disconnect the cables from the Power Sensor.
2. Remove the upper chassis from the Power Sensor. (Refer to "Disassembly Procedures").
3. Measure the resistance between pins 1 and 2 of the A2U1. The resistance should be 15 ± 0.75 ohms. The same resistance should be found between pins 8 and 9 of A2U1.
4. Short pins 4, 6, and 9 of A2U1. While the pins are shorted, measure the resistance between pins 2 and 3, and between pins 3 and 8, of A2U1. The resistance should be less than 40 ohms.
5. Set a power supply to 10 Vdc.
6. Connect the positive side of the power source to the Power Sensor signal ground. Connect the negative power supply lead to pins 4 and 6 of A2U1.
7. Measure the resistance between pins 2 and of A2U1. Also measure the resistance between pins 3 and 8 of A2U1. In both cases, the resistance should be several hundred times the resistance found in step 4.

The 220 Hz drive from the power meter should have the following levels:

a. -0.05 ± 0.05 Vdc (top of square wave).

b. > -9 Vdc (bottom of square wave).

In most cases it may be assumed that the operational amplifier (made up of A2Q1 and the first amplilier in the power meter) is operating correctly if the dc voltage on the metal cover of A2Q1 (collector) is -70 ± 30 mVdc.

Repair

Cleanliness

Do not handle the A2 input amplifier circuit board more than necessary. Dirt or moisture from the hands may make the circuits inoperative. Keeping in mind its highly flammable nature, a solution of pure isopropyl or ethyle alcohol can be used to clean printed circuits and connectors. It is particularly important to keep the area around A2U1 clean.

Caution

The RF connector bead inside the Type N connector deteriorates when contacted by hydrocarbon compounds such as acetone, trichlorethylene, carbon tetrachloride, benzene, ...

Soldering Techniques

The Power Sensor is a high-sensitivity device, and is affected by very small differences in temperature between its components. Therefore, after the performance of any soldering in the unit, severol hours must be allowed for the unit to reach thermal equilibrium before it is used or tested

Capacitors A2C2, A2C3, A2C7, and A2C8 (figure 2) require low-temperature soldering techniques. The connections to these capacitors are a gold film deposited on a ceramic base. Molten solder results in the gold forming an amalgam with the solder, and the consequent removal of the gold from its ceramic base. Soldering must be done quickly, and a low-temperature soldering iron and solder must be used. The capacitors must be discarded if unsoldered. If integrated circuit A2U1 or transistor A2Q1 is replaced, two of these capacitors must be removed, and therefore must be replaced with new ones.

a. Use a temperature controlled 600°F (311°C) soldering iron with a zero crossover tip.

b. Low-temperature solder RMA flux, SN62.

Disassembly Procedures

CAUTIONS

Disassembly must be performed in the sequence described below, otherwise damage may be caused to the two gold wires between the A1 bulkhead assembly and the A2 input amplifier assembly. If these wires are damaged, the A1 bulkhead assembly must be returned to the factory for repair.

Each Power Sensor has an individually prepared graph on the housing. If more than one Power Sensor is disassembled, be sure to use the proper housing for each when they are reassembled.

Disassemble the Power Sensor by performing the following steps:

Caution

The gold wires connecting the A1 Bulkhead Assembly and the A2 Input Amplifier Assembly are extreme;ly delicate and may be easily broken. Be careful when working around them.

1. Insert the blade of a large screwdriver between the two-piece plastic shell at the rear of the Power Sensor. Gently pry the sections apart. (See figure 5.)
2. Proceed to the other side of the connector and again pry the cover sections apart. Remove the shells and magnetic shields.

3. Position the Power Sensor as shown in figure 6 (top). The small hole **5** should be on the left side of the RF input connector. Remove the allen cap screws **1**, **2**, **10**, and **13**. Loosen **11** and **12**. Remove the upper chassis from the Power Sensor.
4. Remove the spring clamp cap screw **7** to free the gold leads which come from the Bulkhead Assembly.
5. Remove cap screws.
6. Slide the Bulkhead Assembly straight out from the chassis.
7. Remove cap screws **8**, **9**, **11**, **12**, **14**, and **15**.
8. Lift the A2 Input Amplifier and J1 connector out of the chassis.

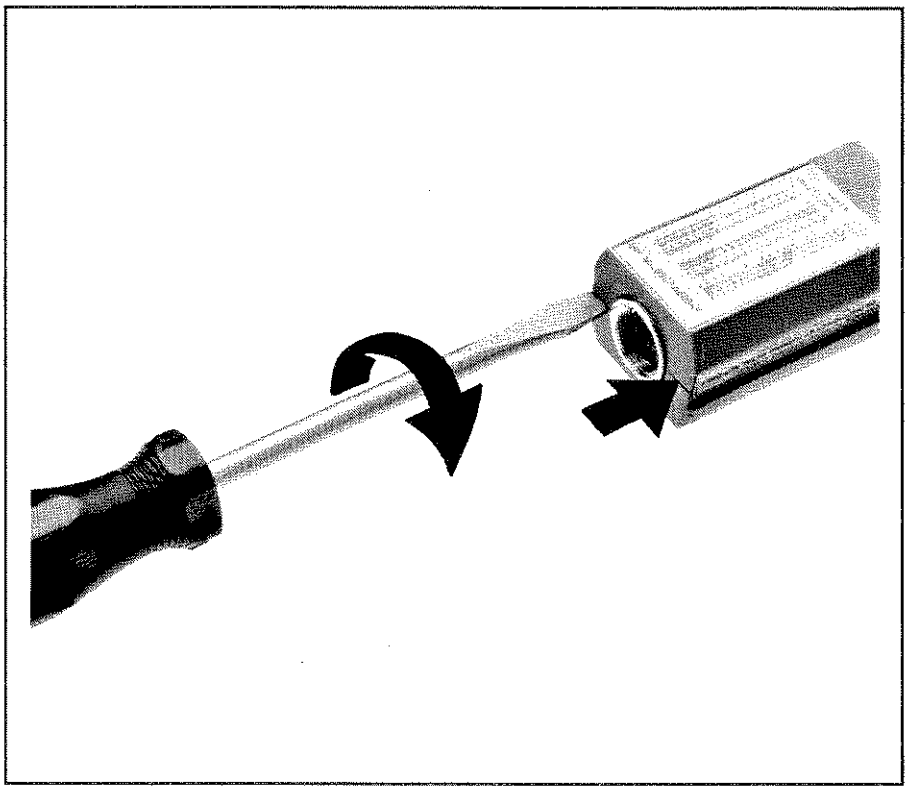

Figure 5. Removing the Power Sensor's Cover

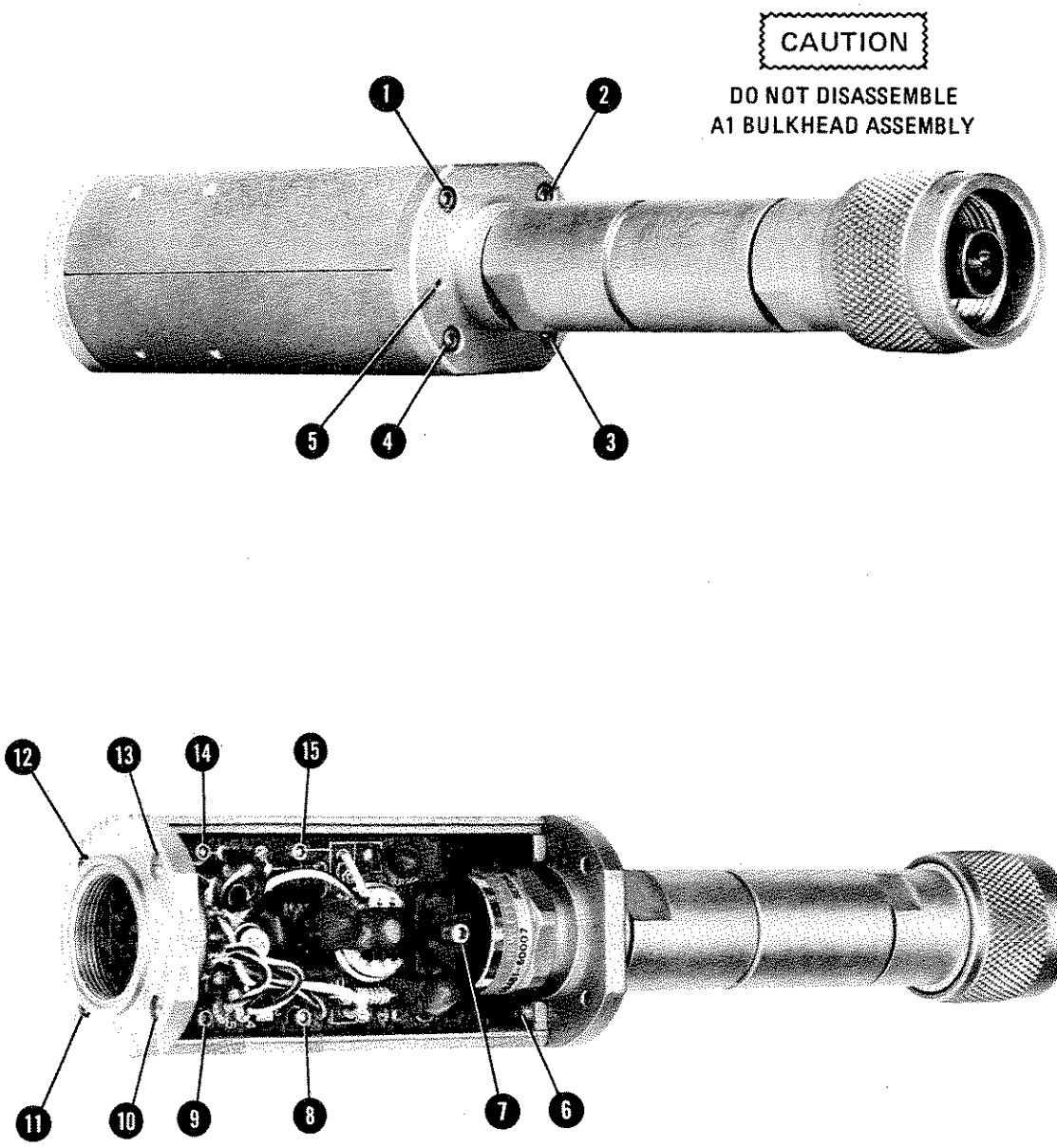

Figure 6. Power Sensor Hardware Locations

Reassembly Procedures

Caution 

The gold wires connecting the A1 Bulkhead Assembly and the A2 Input Amplifier Assembly are extremely delicate and may be easily broken. Be careful when working around them.

1. Place the printed circuit board and connector into place.
2. Cap screws **8**, **9**, **11**, **12**, **14**, and **15** must be inserted but not tightened. Refer to figure 6.
3. Center the circuit board so there is equal air gap between each side and the chassis. Tighten **8**, **9**, **14**, and **15**.
4. With small hole **5** to the left, carefully insert the gold leads on A1 bulkhead assembly through the holes in the black plastic guide on A2 input amplifier.
5. Insert screw **3**, 4, and **6**. Tighten only screw **6**.
6. Position the ends of the gold wires over he pads on A2U1. The wires should not pass over the hole in the pad. Lightly clamp the leads in place with screw **7**. DO NOT fully compress the spring.
7. Place the upper chassis in position and insert cap screws **1**, **2**, **10**, and **13**.
8. Tighten **1**, **2**, **3**, and 4.
9. Tighten **10**, **11**, **12**, and **13**.
10. Place the plastic shells, magnetic shields, and the chassis together as shown in figure 1. Snap the plastic shells together.

Backdating

This section contains information for adapting this manual to instruments for which the content does not directly apply.

How to use this section.

If the serial prefix of your HP 8481H is 2604A or below, this section applies to you. If the serial prefix of your HP 8482H is 2609A or below, this section applies to you. Find the serial prefix that applies to your instrument and make the changes described below.

2604A, 2609A

1. Replace Figure 2 Component and Assembly Locations with the Figure 2 in this section.

2349A, 2350A

1. Replace Figure 2 as described above.
2. The appearance of the labels changed. The preferred replacements are listed in the parts list.

2237A

1. Changes listed above apply to this prefix.
2. Compression spring MP6 and screws MP10 through MP18 were changed. The preferred replacements are listed in the parts list.
3. In Power Sensors with this prefix number pin A was added to J1. Pin A was connected to the junctions of F, M and J. When servicing Power Sensors with this prefix we recommend removing this connection, isolating pin A.

1925A, 1926A

1. With the exception of the addition of pin A to J1, all the changes listed above apply to instruments with these prefixes.
2. Four capacitors were added to connector J1. The partial schematic of Figure 3, showing their placement, is in this section. When servicing Power Sensors with these prefixes, we recommend removing these capacitors.

1545A

1. With the exceptions of changes to J1 (J1 is schematically the same as depicted in this manual) all changes listed above apply to instruments with this prefix.
2. The part number for J1 was 1251-3228. The part number currently listed in the parts list is the preferred replacment.
3. The part number for A2 Assembly was 08481-60017 for the HP 8481H, and 08481-60005 for the HP 8482H. The part numbers currently listed in the parts list is the preferred replacement.

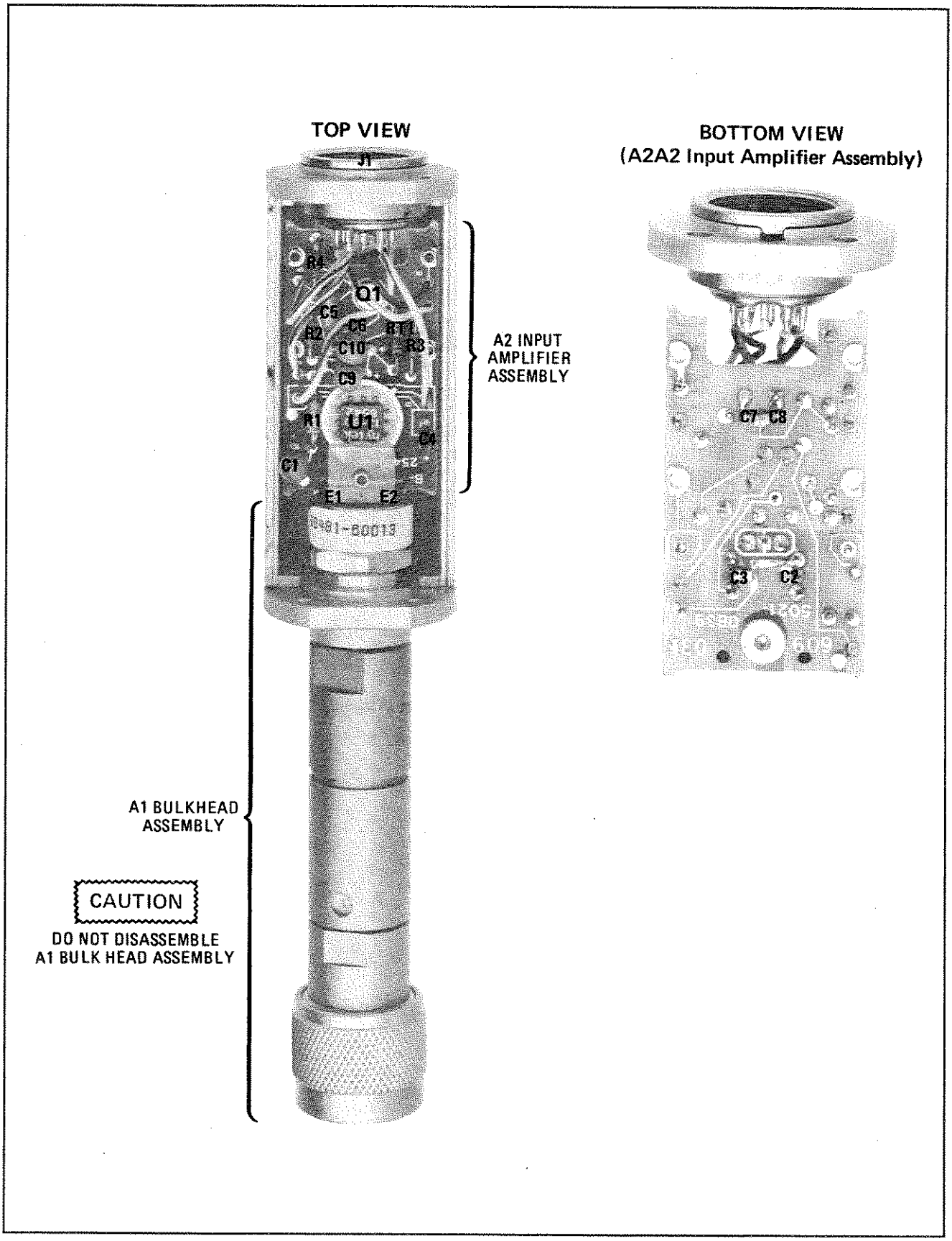

Figure 2. Component and Assembly Locations (1545A through 2609A)

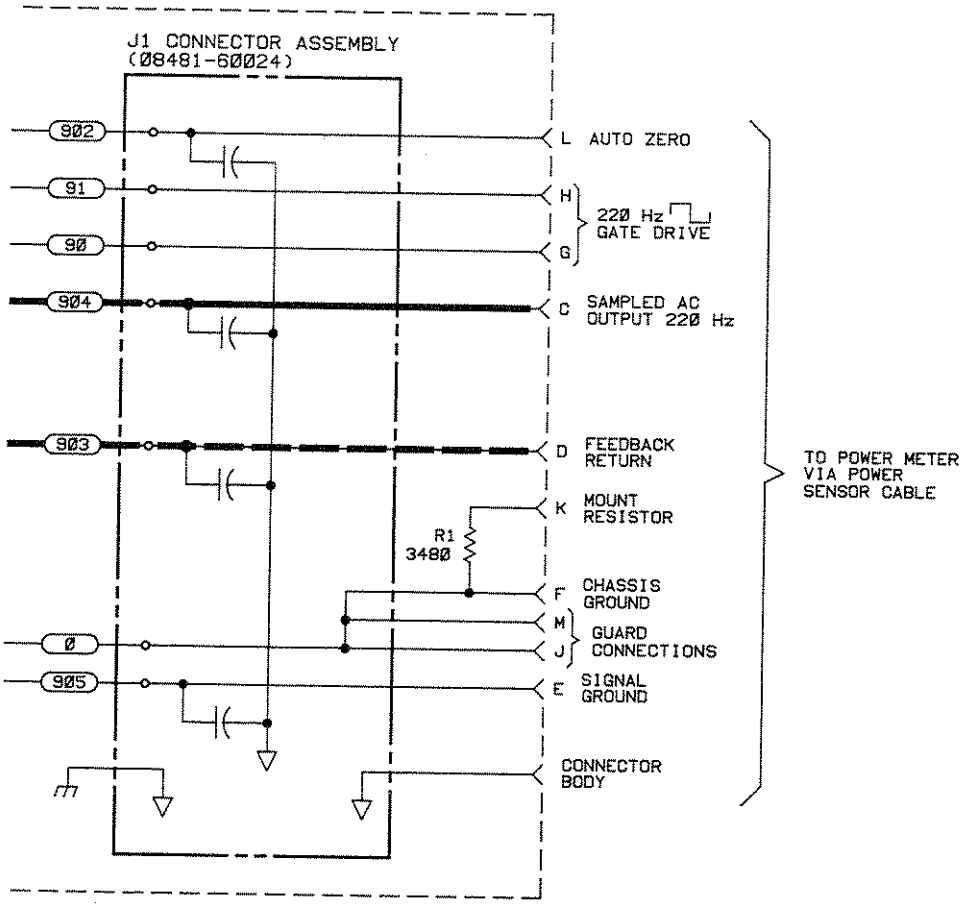

Figure 1-1. P/O Figure 3. Schematic Diagram (1925A, 1926A)

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