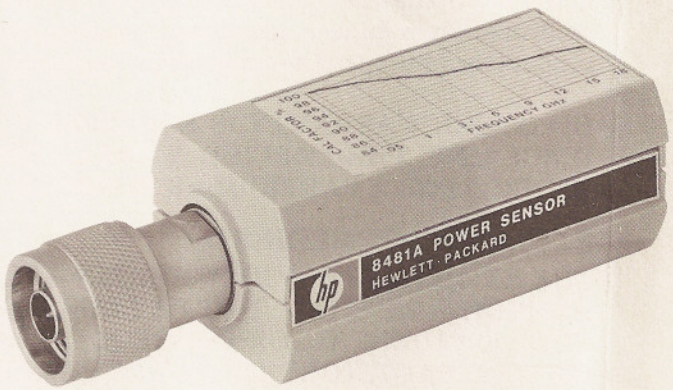
HP 8481A
HP 8482A
HP 8483A

OPERATING AND SERVICE MANUAL

8481A
8482A
8483A
POWER SENSOR



HEWLETT PACKARD

HP 8481A
HP 8482A
HP 8483A

OPERATING AND SERVICE MANUAL

8481A
8482A
8483A
POWER SENSOR

SERIAL NUMBERS

This manual applies directly to instruments with serial numbers prefixed: 8481A: 1926A
8482A: 1925A
8483A: 1925A

With the changes in the Appendix this manual also applies to instruments with serial numbers prefixed:
8481A: 1550A
8482A: 1551A
8483A: 1602A

For additional important information about serial numbers, see INSTRUMENTS COVERED BY MANUAL on page 2.

HEWLETT PACKARD

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

MANUAL PART NUMBER 08481-90063
Microfiche Part Number 08481-90064

Printed: OCTOBER 1980

1. GENERAL INFORMATION

2. This Operating and Service Manual contains information about initial inspection, performance tests, adjustments, operation, troubleshooting and repair of the Model 8481A, 8482A, and 8483A Power Sensors.

3. On the title page of this manual is a "Microfiche" part number. This number can be used to order a 4 x 6-inch microfilm transparency of the manual.

4. Instruments Covered by Manual

5. 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 listed under SERIAL NUMBERS on the title page.

6. An instrument manufactured after the printing of this manual may have a serial prefix that is not listed on the title page. This unlisted serial prefix indicates that the manual for this instrument is supplied with a yellow Manual Changes supplement that documents the differences.

7. 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 is keyed to the manual print date and part number, both of which appear on the title page. Complimentary copies of the supplement are available on request from your nearest Hewlett-Packard office.

8. 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.

9. Description

10. The Power Sensors are used for measuring the average power supplied by an RF source. In use, the Power Sensor is connected to the RF source and to a compatible power meter. (Suitable meters are the HP 435 series or 436A Power Meter.) The 8481A and 8482A Power Sensors place a 50-ohm load on the RF source (8483A has a 75-ohm load). The power meter indicates the power dissipated in this load in μW (or mW) and dBm. The HP 436A Power Meter can also provide readings, in dB, relative to a previous RF input to the Power Sensor.

11. The Power Sensors measure power levels from −30 dBm to +20 dBm (1 μW to 100 mW), at frequencies from 10 MHz to 18 GHz (8481A), or 100 kHz to 4.2 GHz (8482A), or 100 kHz to 2 GHz (8483A).

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

13. CAL FACTOR data is provided on a label attached to the Power Sensor's cover. Maximum uncertainties of the CAL FACTOR data are listed in Table 1.

14. Specifications for the Power Sensor are provided in Table 2.

15. Option 001 (8481 only)

16. A precision 7 mm RF connector (APC-7) is substituted for the type-N connector.

17. Accessories Supplied

18. The Model 8483A is supplied with an adapter (HP 1250-0597, shown in Figure 1) for joining the Power Sensor's 75-ohm Type N connector to the 50-ohm power reference connector on the power meter. This accessory is a mechanical adapter only, not an impedance transformer. Therefore, an impedance mismatch exists and the meter should be calibrated to 96% of the power reference level at 50 ohms (e.g., 0.96 mW for the HP Model 435 series).

CAUTION

Remove mechanical adapter from the Power Sensor before connecting the sensor to a 75-ohm source.

19. Recommended Test Equipment

20. Table 3 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.

21. INSTALLATION

22. Initial Inspection

23. 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 performance tests, notify the nearest Hewlett-Packard office. Keep the damaged shipping materials (if any) for inspection by the carrier and a Hewlett-Packard representative.

Table 1. Uncertainty of Calibration Factor Data[3]

8481A					
Frequency (MHz)	Sum of Uncertainties ±(%)[1]	Probable Uncertainties ±(%)[2]	Frequency (GHz)	Sum of Uncertainties ±(%)[1]	Probable Uncertainties ±(%)[2]
			1.0	2.7	1.4
			2.0	2.7	1.4
			4.0	2.8	1.5
			6.0	2.8	1.5
10.0	2.5	1.3	8.0	3.2	1.7
30.0	2.6	1.4	10.0	3.6	1.9
100.0	3.1	1.6	12.4	4.4	2.3
300.0	3.1	1.6	14.0	4.8	2.6
			16.0	5.2	2.9
			18.0	5.8	3.2

8482A			8483A		
Frequency (MHz)	Sum of Uncertainties ±(%)[1]	Probable Uncertainties ±(%)[2]	Frequency (MHz)	Sum of Uncertainties ±(%)[1]	Probable Uncertainties ±(%([2]
0.1	2.3	1.3	0.1	2.6	1.5
0.3	2.2	1.2	0.3	2.5	1.4
1.0	2.2	1.2	1.0	2.5	1.4
3.0	2.2	1.2	3.0	2.5	1.4
10.0	2.5	1.3	10.0	3.0	1.6
30.0	2.6	1.4	30.0	3.1	1.6
100.0	3.1	1.6	100.0	3.9	2.0
300.0	3.1	1.6	300.0	3.9	2.0
1000.0	2.7	1.4	1000.0	3.7	2.0
2000.0	2.7	1.4	2000.0	3.7	2.0
4000.0	2.8	1.5			

[1] Includes uncertainty of reference standard and transfer uncertainty. Directly traceable to NBS.

[2] Square root of the sum of the individual uncertainties squared (RSS).

[3] Uncertainties are for sensors with type N connectors. Values will be slightly less for sensors with APC-7 connectors.

Table 2. Specifications

Model 8481A
Power Range: −30 dBm to +20 dBm (1 μW − 100 mW)
Frequency Range: 10 MHz − 18 GHz
Nominal Impedance: 50Ω
Maximum SWR (Reflection Coefficient): 10 MHz to 30 MHz < 1.4 (0.166)
30 MHz to 50 MHz < 1.18 (0.083)
50 MHz to 2 GHz < 1.10 (0.048)
2 GHz to 12.4 GHz < 1.18 (0.083)
12.4 GHz to 18 GHz < 1.28 (0.123)
Maximum Power: 300 mW Average − **Maximum Peak Power:** 15W Peak − **Maximum Energy/Pulse:** 30W·μs
RF Connector: Type N Male

Model 8482A
Power Range: −30 dBm to +20 dBm (1 μW − 100 mW)
Frequency Range: 100 kHz − 4.2 GHz
Nominal Impedance: 50Ω
Maximum SWR (Reflection Coefficient): 100 kHz to 300 kHz < 1.60 (0.231)
300 kHz to 1 MHz < 1.20 (0.091)
1 MHz to 2 GHz < 1.10 (0.048)
2 GHz to 4.2 GHz < 1.30 (0.130)
Maximum Power: 300 mW Average − **Maximum Peak Power:** 15W Peak − **Maximum Energy/Pulse:** 30W·μs
RF Connector: Type N Male

Model 8483A
Power Range: −30 dBm to +20 dBm (1 μW − 100 mW)
Frequency Range: 100 kHz − 2 GHz
Nominal Impedance: 75Ω
Maximum SWR (Reflection Coefficient): 100 kHz to 600 kHz < 1.80 (0.286)
600 kHz to 2 GHz < 1.18 (0.083)
Maximum Power: 300 mW Average − **Maximum Peak Power:** 10W Peak − **Maximum Energy/Pulse:** 30W·μs
RF Connector: Type N Male (75Ω)

Dimensions, Including RF Connector: 30 mm wide, 38 mm high, 105 mm long (1-3/16 in. x 1-1/2 in. x 5-7/8 in.).

Weight: Net, 0.2 kg (8 oz.).

Figure 1. Mechanical Adapter (8483A Only)

24. Storage and Shipment

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

a. Temperature, −40 to +75° C
b. Relative humidity, less than 95%
c. Altitude, less than 7,600 metres (25,000 feet).

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

Table 3. Recommended Test Equipment

Instrument Type	Critical Specifications	Suggested Model	Use*
Digital Voltmeter	Range: 100 mVdc to 100 Vdc Input Impedance: 10 megohms Resolution: 4-digit Accuracy: ±0.05% ±1 digit	HP 3465A/B	T
Oscilloscope	Bandwidth: dc to 50 MHz Sensitivity: Vertical, 0.2V/div Horizontal, 1 ms/dv	HP 180C/1801A/1821A or HP 1740A	A, T
10:1 Divider Probe	10 Megohms 10 pF	HP 10004D	A
Ohmmeter	Range: 1 ohm to 100,000 ohms Accuracy: ±5%	HP 3465A/B	T
DC Power Supply	Range: 5 to 15 Vdc	HP 6214A	T

*A = Adjustment, T = Troubleshooting.

27. INTERCONNECTIONS

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

29. OPERATION

30. Environment

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

a. Temperature, 0° to 55°C
b. Relative humidity, less than 95%
c. Altitude, less than 4,572 metres (15,000 feet).

32. Operating Precautions

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

WARNING

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 paragraph 34 may result in damage to the power meter system.

Do not apply torque to the Power Sensor's body while connecting or disconnecting the Type N RF connector.

NOTE

When using the Power Sensor with the 435 series Power Meter make sure the correct scale is mounted on the Power Meter RANGE switch. Refer to Section II of the 435 series Power Meter Operating and Service Manual.

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

a. Maximum Average Power: 300 mW
b. Maximum Peak Power: 15W (10W 8483A only)
c. Maximum Energy Per Pulse: 30W · μs.

35. Operating Procedures

36. Calibration is performed as follows:

a. For the HP 435 series Power Meter, set the RANGE switch to 1 mW, and adjust the CAL ADJ control to bring the needle on the meter to the CAL position.

b. For the HP 436A Power Meter, adjust the CAL ADJ control to obtain a reading of 1 mW on the digital display.

37. Instructions for use of the Power Sensor are provided in the power meter manual. Note, however, the different calibration procedure described in paragraph 36 above. During operation, the precautions in paragraph 33 must be observed.

38. SWR (REFLECTION COEFFICIENT PERFORMANCE TEST

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

40. FET BALANCE ADJUSTMENT

41. The sampling gate balance is affected by the relative positions of the wires in the Power Sensor which connect to pins G and H of connector J1. One wire is black and white, and the other is brown and white. Once positioned, care must be used not to displace these wires.

42. To correctly position these wires, after replacement of A2U1, connect an oscilloscope as follows to display switching transients:

a. Test point A4TP4 in the HP 435 series Power Meter, or

b. Test point A2TPAC (e) in the HP 436A Power Meter.

43. Adjust the black-and-white and brown-and-white wires until the switching transient amplitude is less than 0.8 Vp-p.

44. REPLACEABLE PARTS

45. Table 5 is a list of replaceable parts. Figure 2 illustrates the major parts. To order a part listed in the Replaceable Parts table, quote the Hewlett-Packard Part Number with Check Digit (CD), indicate the quantity required, and address the order to the nearest Hewlett-Packard office.

NOTE

Within the USA, it is better to order directly from the HP Parts Center in Mt. View, California. Ask your nearest HP office for information and forms for the "Direct Mail Order System".

Table 4. SWR and Reflection Coefficient

Frequency	System SWR Uncertainty	Actual Measurement	Maximum SWR (Reflection Coefficient)
	8481A		
10 to 30 MHz	±0.030	_____	< 1.40 (0.166)
30 to 50 MHz	±0.020	_____	< 1.18 (0.083)
50 MHz to 2 GHz	±0.020	_____	< 1.10 (0.048)
2 to 12.4 GHz	±0.020	_____	< 1.18 (0.083)
12.4 to 18 GHz	±0.025	_____	< 1.28 (0.123)
	8482A		
100 kHz to 300 kHz	±0.08	_____	< 1.60 (0.231)
300 kHz to 1 MHz	±0.04	_____	< 1.20 (0.091)
1 MHz to 2 GHz	±0.02	_____	< 1.10 (0.048)
2 GHz to 4.2 GHz	±0.02	_____	< 1.30 (0.130)
	8483A		
100 kHz to 600 kHz	±0.08	_____	< 1.80 (0.286)
600 kHz to 2 GHz	±0.02	_____	< 1.18 (0.083)

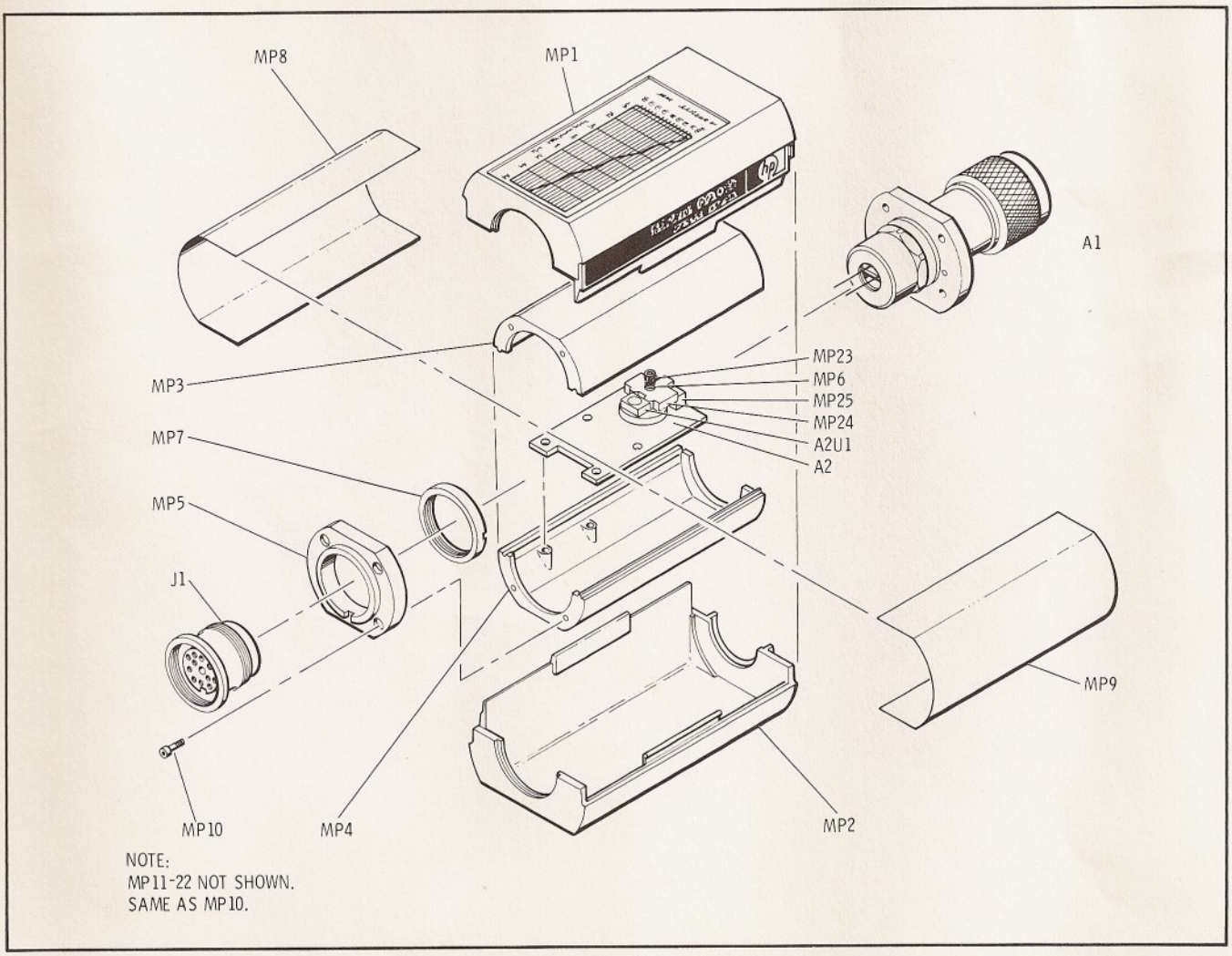


Figure 2. Illustrated Parts Breakdown

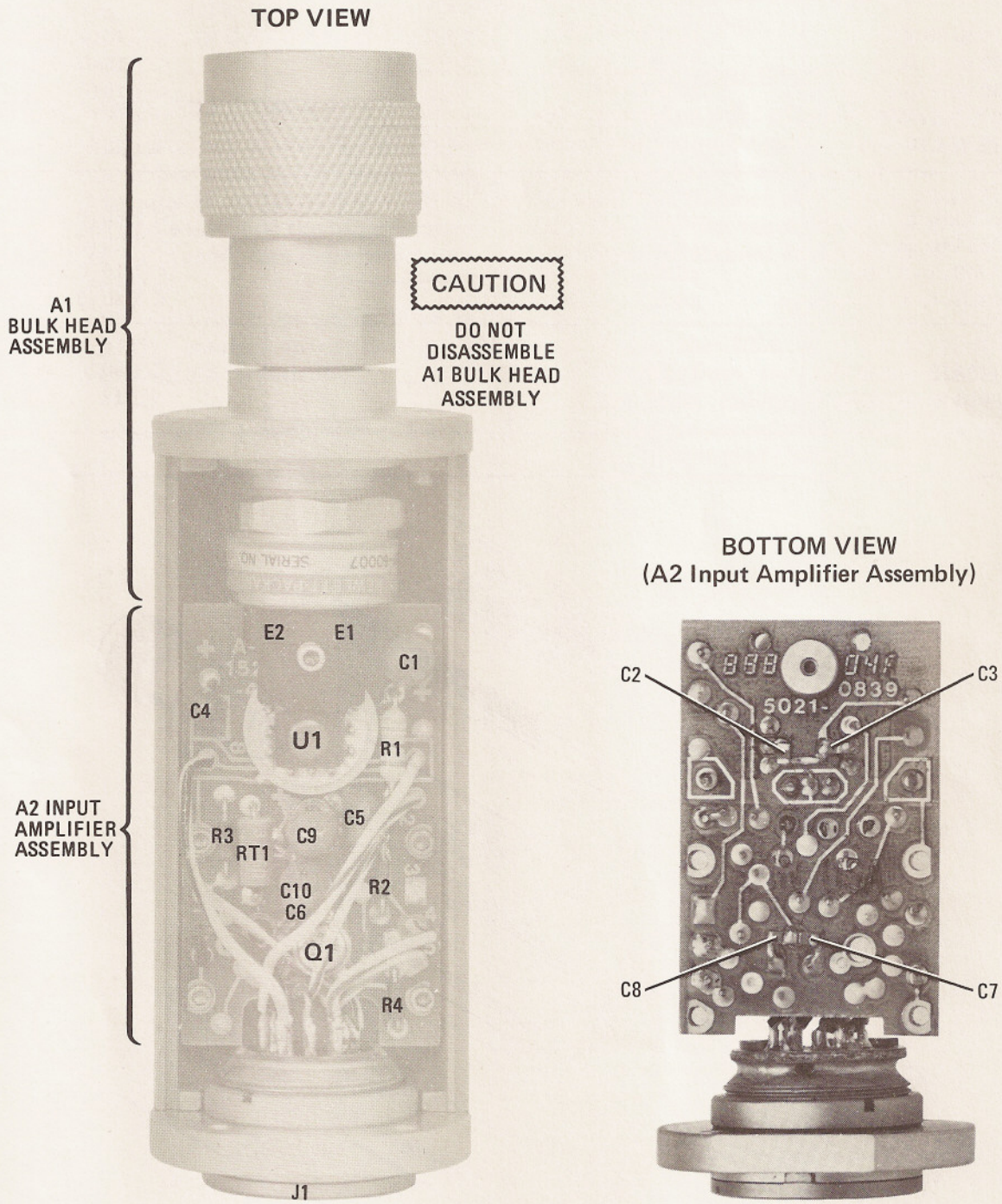


Figure 3. Component and Assembly Locations

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	08481-60004	3	1	BULKHEAD, TYPE N (FOR 8481A ONLY)	28480	08481-60004
A1	08481-60005	4	1	BILKHEAD, APC-7(FOR 8481A OPT 001 ONLY)	28480	08481-60005
A1	08482-60003	3	1	BULKHEAD, TYPE N (FOR 8482A ONLY)	28480	08482-60003
A1	08483-60003	4	1	BULKHEAD, TYPE N (FOR 8483A ONLY)	28480	08483-60003
A2	08481-60025	8	1	POWER SENSOR BOARD ASSEMBLY (FOR 8481A)	28480	08481-60025
A2	08482-60013	5	1	POWER SENSOR BOARD ASSEMBLY (FOR 8482A)	28480	08482-60013
A2	08483-60007	8	1	POWER SENSOR BOARD ASSEMBLY (FOR 8483A)	28480	08483-60007
A2C1	0180-2515	8	2	CAPACITOR-FXD 47UF+-20% 6VDC TA (FOR 8481A ONLY)	28480	0180-2515
A2C1	0180-0555	2	1	CAPACITOR-FXD 39UF+-20% 10VDC TA (FOR 8482A ONLY)	28480	0180-0555
A2C1	0180-0556	3	1	CAPACITOR-FXD 27UF+-20% 15VDC TA (FOR 8483A ONLY)	28480	0180-0556
A2C2	0160-4306	7	4	CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-4306
A2C3	0160-4306	7		CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-4306
A2C4	0180-0594	9	1	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	14433	TAG-10-3.3/16-20
A2C5	0160-3094	8	1	CAPACITOR-FXD .1UF +-10% 100VDC CER	28480	0160-3094
A2C6	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A2C7	0160-4306	7		CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-4306
A2C8	0160-4306	7		CAPACITOR-FXD 100PF +-10% 100VDC CER	28480	0160-4306
A2C9	0180-2515	8		CAPACITOR-FXD 47UF+-20% 6VDC TA	28480	0180-2515
A2C10	0180-2545	4	1	CAPACITOR-FXD 100UF+-20% 4VDC TA	28480	0180-2545
A2Q1	1854-0610	0	1	TRANSISTOR NPN SI TO-46 FT=800MHZ	28480	1854-0610
A2R1	0698-3260	9	1	RESISTOR 464K 1% .125W F TC=0+-100 (FOR 8481A ONLY)	28480	0698-3260
A2R1	0757-0483	8	1	RESISTOR 562K 1% .125W F TC=0+-100 (FOR 8482A ONLY)	28480	0757-0483
A2R1	0698-8352	0	1	RESISTOR 787K 1% .125W F TC=0+-100 (FOR 8483A ONLY)	28480	0698-8352
A2R2	0698-7248	1	1	RESISTOR 3.16K 1% .05W F TC=0+-100	24546	C3-1/8-T0-3161-G
A2R3	0698-7224	3	1	RESISTOR 316 1% .05W F TC=0+-100	24546	C3-1/8-T0-316R-G
A2R4	0698-7236	7	1	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-G
A2RT1	0811-3210	1	1	RESISTOR 31.6 5% .05W PWW TC=+5040+-252	14140	1409-1/20-31R6-J
A2U1	1813-0060	8	1	TO-8	28480	1813-0060
				A2 MISCELLANEOUS PARTS		
	0590-1040	1	1	THREADED INSERT-NUT 0-80 .06-LG SST	28480	0590-1040
	5040-6938	6	1	SPACER	28480	5040-6938
				CHASSIS PARTS		
J1	08481-60024	7	1	CONNECTOR ASSEMBLY, 12-PIN	28480	08481-60024
MP1	08481-40002	9	2	SHELL, PLASTIC	28480	08481-40002
MP2	08481-40002	9		SHELL, PLASTIC	28480	08481-40002
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	1460-1224	9	1	SPRING, CPRSN .1-OD,.15-LG MUW	28480	1460-1224
MP7	1251-3363	8	1	NUT, CONNECTOR MOUNTING	28480	1251-3363
MP8	08481-00002	5	2	SHIELD	28480	08481-00002
MP9	08481-00002	5		SHIELD	28480	08481-00002
MP10	3030-0422	8	13	SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP11	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP12	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP13	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP14	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP15	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP16	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP17	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP18	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP19	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP20	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP21	3030-0422	8		SCREW-SKT HD CAP 0-80 .188-IN-LG SST-302	00000	ORDER BY DESCRIPTION
MP22	3030-0422	8		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	7120-3117	9	1	LABEL, ID-RIGHT	28480	7120-3117
MP26	7120-3118	0	1	LABEL,ID-LEFT (FOR 8481A ONLY)	28480	7120-3118
MP27	7120-4179	5	1	LABEL, ID (FOR 8482A ONLY)	28480	7120-4179
MP28	1250-0597	2	1	ADAPTER, COAX M-N F-N	28480	1250-0597
MP28	1250-4204	6	1		28480	1250-4204

See introduction to this section for ordering information
*Indicates factory selected value

Table 6. Code List of Manufacturers

Mfr. No.	Manufacturer Name	Address	Zip Code
00000	ANY SATISFACTORY SUPPLIER		
14140	EDISON ELEK DIV McGRAW-EDISON	MANCHESTER NH	03130
14433	ITT SEMICONDUCTORS DIV OF ITT CORP	PALM BEACH FL	33401
24546	CORNING GLASS WORKS (BRADFORD)	BRADFORD PA	16701
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304

46. SERVICE

47. Test equipment which meets or exceeds the critical specifications in Table 3 may be used in place of the recommended instruments for troubleshooting the Power Sensor.

48. Figure 3 shows the locations of the assemblies and components. Figure 4 is the schematic diagram.

49. Principles of Operation

50. Bulkhead assembly A1 presents either a 50-ohm load (8481A and 8482A) or a 75-ohm load (8483A) 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.

51. 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.

52. 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 A2U1) is a 220 Hz square wave having a voltage proportional to the RF power input.

53. 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 5 is a simplified diagram of the complete operational amplifier.

54. 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.

55. When the Power Sensor is used with the HP 436A Power Meter, the short at J1-K (MOUNT RESISTOR) indicates the type of power sensor in use. As a result, the power meter automatically selects the proper measurement range (—30 to +20 dBm). With the HP 435 series Power Meter, this short serves no function.

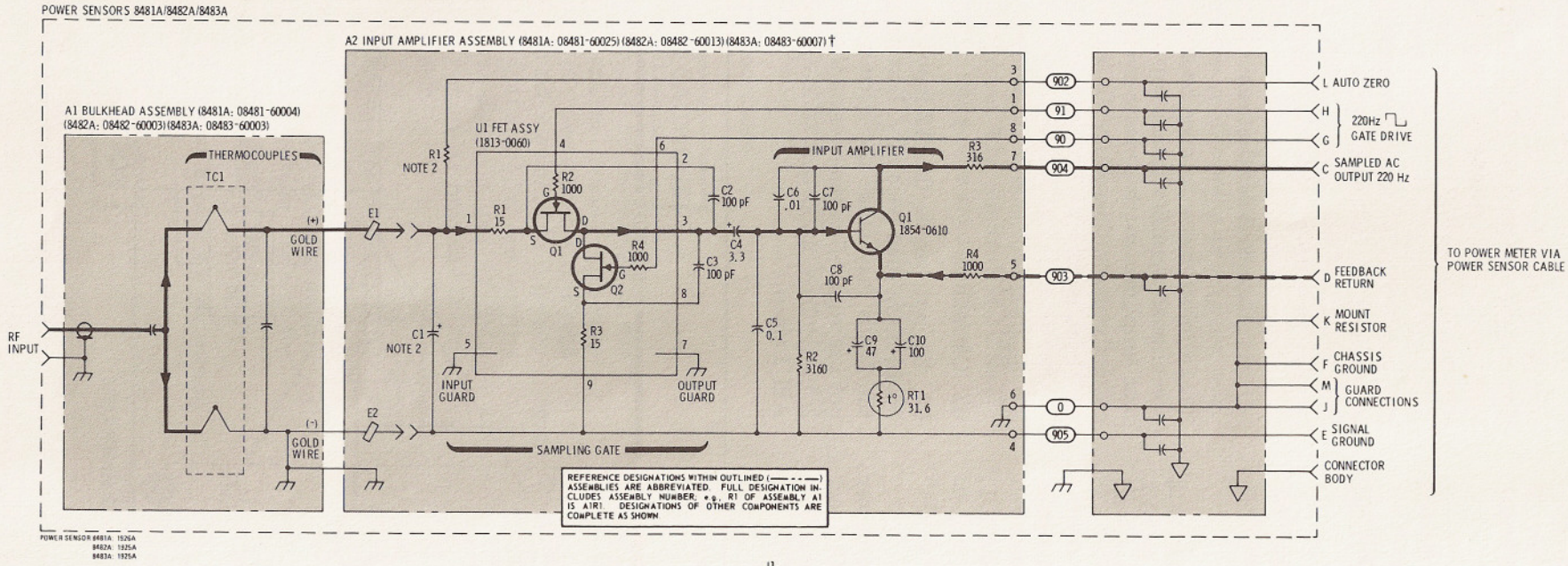
56. Troubleshooting

57. 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 across the gold wires. They are delicate and can be damaged easily.

58. The A1 bulkhead assembly normally supplies +12 ± 3 mV when the RF input is 100 mW. 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 (8481A), 245 ± 12.5 ohms (8482A) or 375 ± 17.5 ohms (8483A).



NOTES

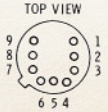
1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN MICROFARADS.
2. THE VALUES OF COMPONENTS A2R1 AND A2C1 ARE AS FOLLOWS:
   - 8481A: A2R1 IS 464 KΩ, A2C1 IS 47 µF
   - 8482A: A2R1 IS 562 KΩ, A2C1 IS 39 µF
   - 8483A: A2R1 IS 787 KΩ, A2C1 IS 27 µF
3. A1 BULKHEAD ASSEMBLY IS NOT FIELD REPAIRABLE.
4. COMPONENTS OF THE J1 ASSEMBLY ARE NOT SEPARATELY REPLACEABLE.

† REFER TO BACKDATING INFORMATION IN THE APPENDIX.

REFERENCE DESIGNATIONS

NO PREFIX	A2 ASSY
J1	C1-10 CR1 E1,2 Q1 R1-4 RT1 U1

U1 TOP VIEW



J1 MATING SIDE

CAUTION: DO NOT FORCE LARGE-DIAMETER TEST PRODS INTO THE PIN RECEPTACLES OF J1. THIS MAY PERMANENTLY DEFORM THE RECEPTACLES.

Figure 4. Schematic Diagram

Note that excessive power will damage the thermocouples and cause their resistance to increase. If the A1 Bulkhead Assembly is defective, the entire Bulkhead Assembly must be replaced.

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

a. Disconnect the cables from the Power Sensor.

b. Remove the upper chassis from the Power Sensor. (Refer to disassembly procedures, paragraph 68).

c. 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.

d. 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.

e. Set a power supply to 10 Vdc.

f. 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.

g. Measure the resistance between pins 2 and 3 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 d.

60. 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).

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

62. REPAIR

63. Cleanliness

64. Do not handle the A2 input amplifier circuit board more than necessary. Dirt or moisture from the hands may make the circuits inoperative. Do not use solder-flux remover on the circuit board. It is particularly important to keep the area around A2U1 clean.

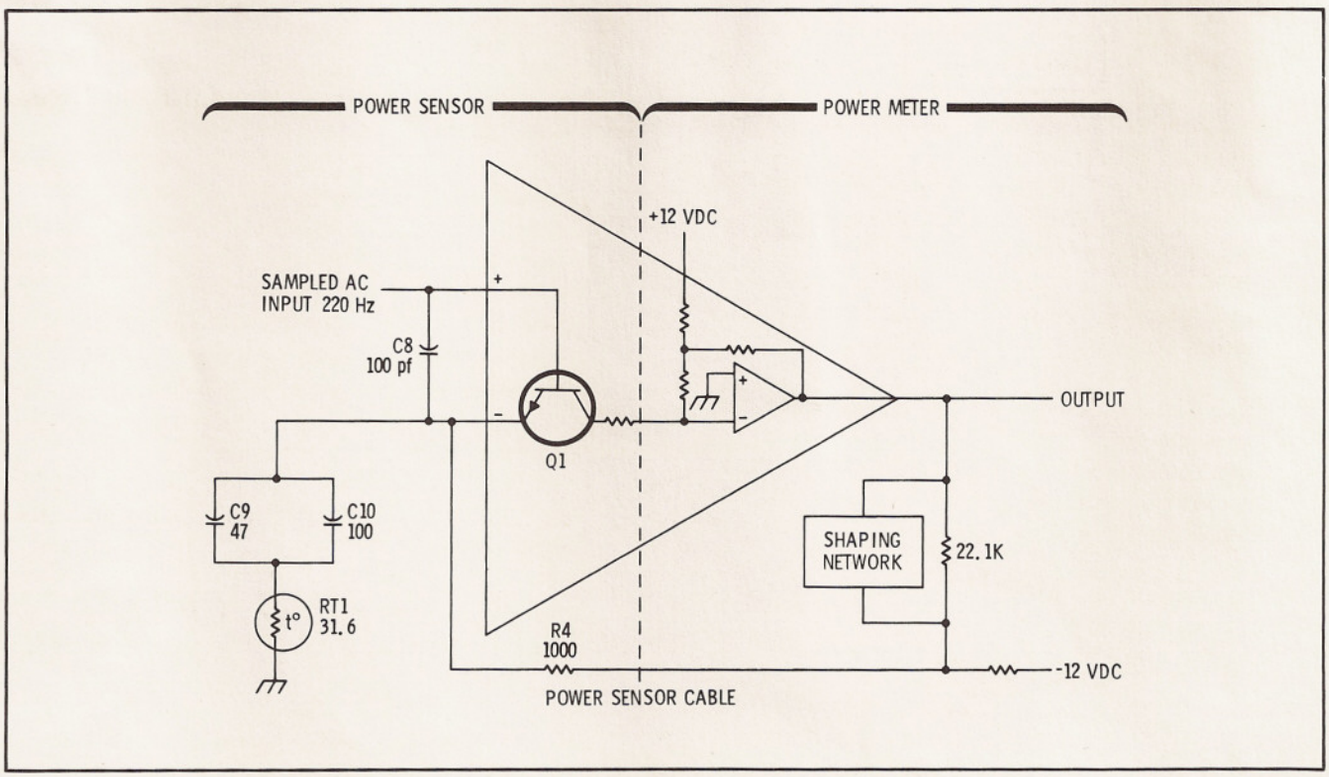


Figure 5. Operational Amplifier

65. Soldering Techniques

66. 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, several hours must be allowed for the unit to reach thermal equilibrium before it is used or tested.

67. Capacitors A2C2, A2C3, A2C7, and A2C8 (Figure 3) 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. The required low-temperature soldering iron and solder are as follows:

a. Hexacon Thermo-O-Trac soldering iron with J206X tip, temperature 600° F (311°C).

b. Low-temperature solder SN 62, HP part number 5090-0410.

68. 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.

69. 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 extremely delicate and

(Caution cont'd)
may be easily broken. Be careful when working around them.

a. Insert the blade of a small screwdriver between the two-piece plastic shell at the rear of the Power Sensor. Gently pry the sections apart. (See Figure 6).

b. Proceed to the other side of the connector and again pry the cover sections apart. Remove the shells and magnetic shields.

c. Position the Power Sensor as shown in Figure 7 (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.

d. Remove the spring clamp cap screw (7) to free the gold leads which come from the Bulkhead Assembly.

e. Remove cap screws (3), (4), and (6).

f. Slide the Bulkhead Assembly straight out from the chassis.

g. Remove cap screws (8), (9), (11), (12), (14), and (15).

e. Lift the A2 Input Amplifier and J1 connector out of the chassis.

70. 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.

a. Place the printed circuit board and connector into place.

b. Cap screws (8), (9), (11), (12), (14), and (15) must be inserted but not tightened. Refer to Figure 7.

c. Center the circuit board so there is equal air gap between each side and the chassis. Tighten (8), (9), (14), and (15).

d. 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.

e. Insert screws (3), (4), and (6). Tighten only screw (6).

f. Position the ends of the gold wires over the 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.

g. Place the upper chassis in position and insert cap screws (1), (2), (10), and (13).

h. Tighten (1), (2), (3), and (4).

i. Tighten (10), (11), (12), and (13).

j. Place the plastic shells, magnetic shields, and the chassis together as shown in Figure 2. Snap the plastic shells together.

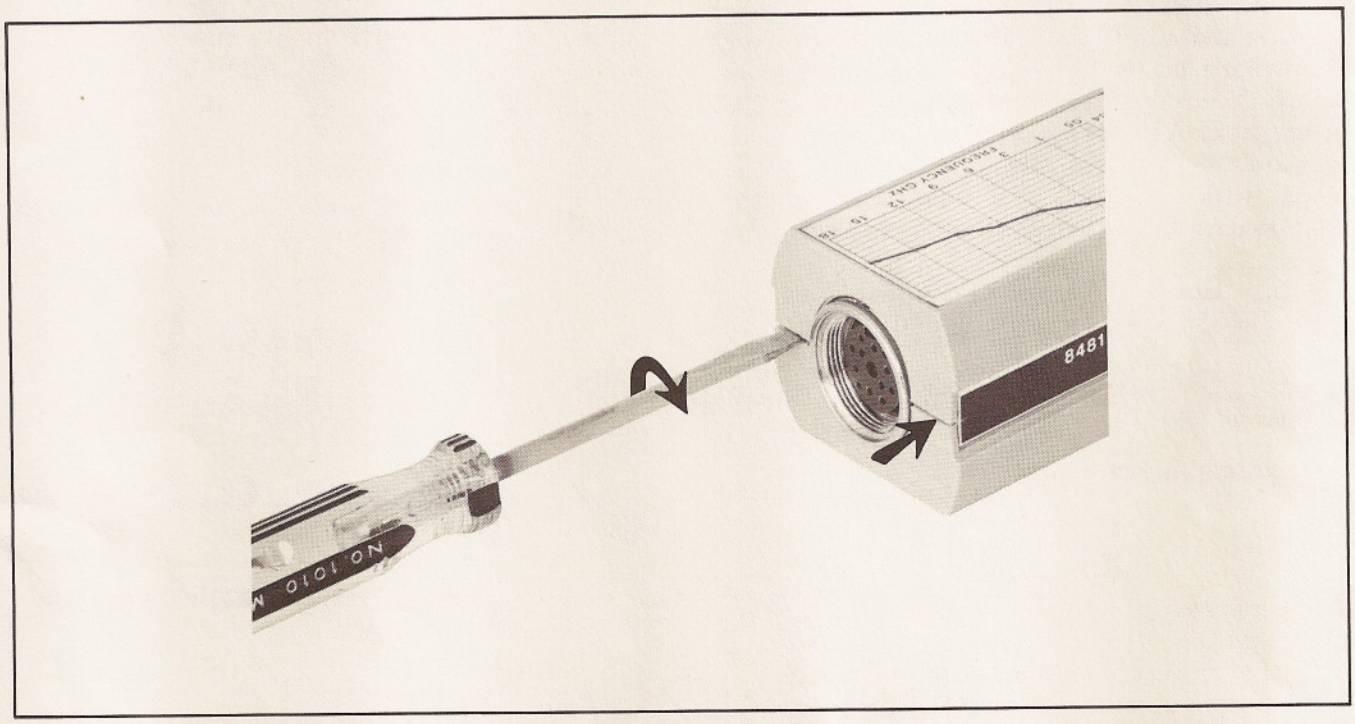


Figure 6. Removing the Power Sensor's Cover

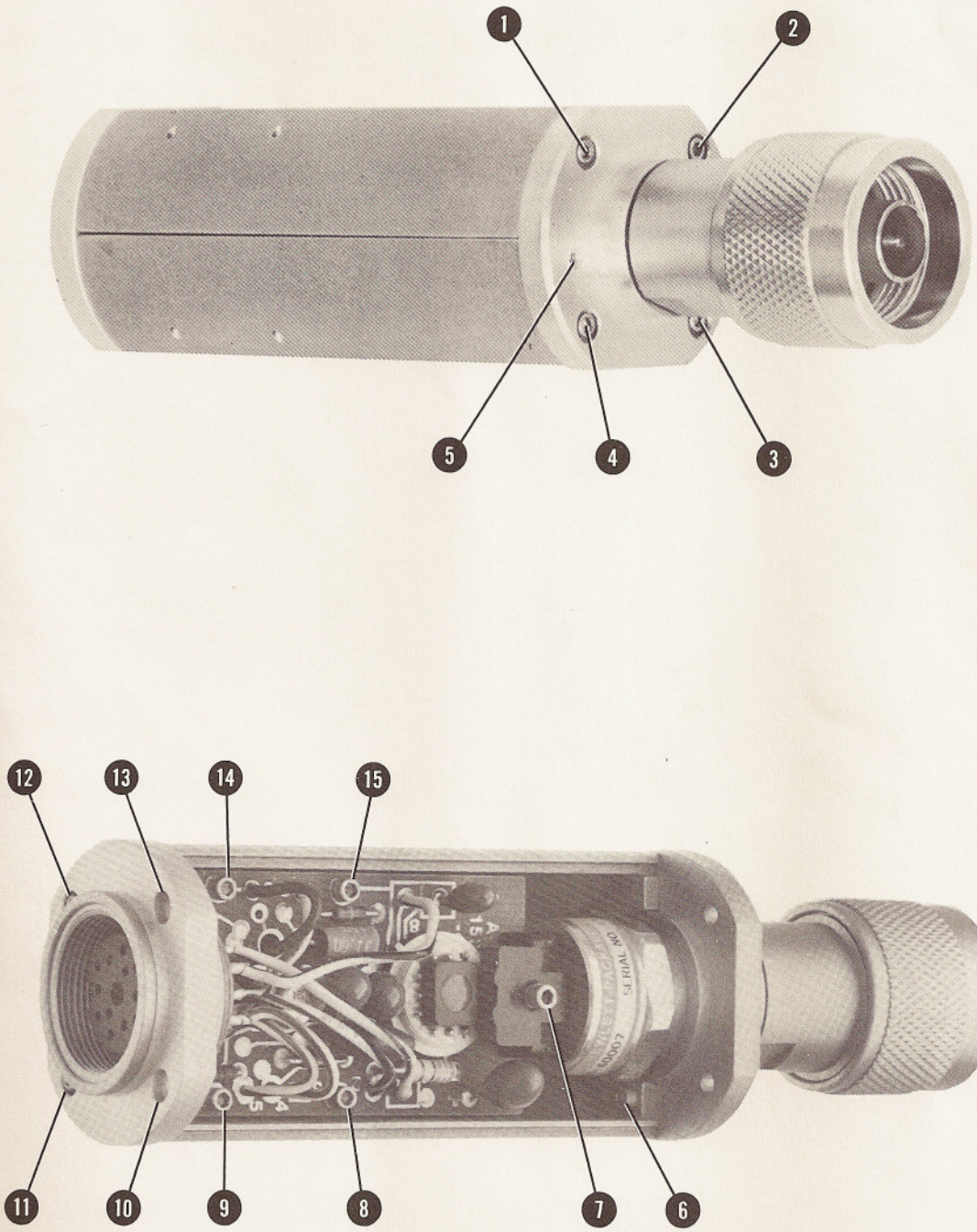


Figure 7. Power Sensor Hardware Locations

APPENDIX I

MANUAL CHANGES

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

To adapt this manual to your instrument, refer to Table I-1 and make the changes listed opposite your instrument serial number.

Table I-1. Manual Changes by Serial Number.

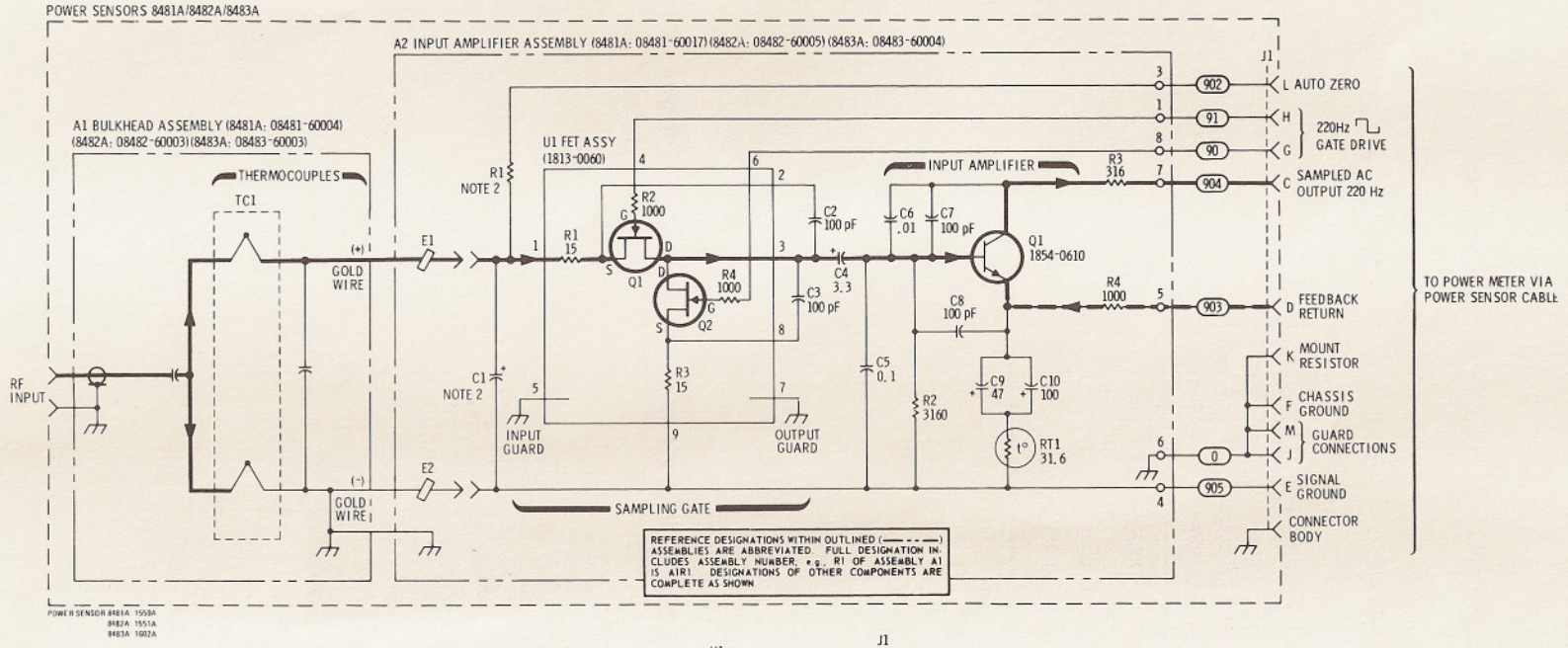
Serial Prefix or Number	Make Manual Changes
8481A:1550A	A
8482A:1551A	A
8483A:1602A	A

CHANGE INSTRUCTIONS

CHANGE A

Page 8, Table 5:
Change A2 part numbers as follows:
08481-60025 to 08481-60017
08482-60013 to 08482-60005
08483-60007 to 08483-60004
Change J1 to 1251-3228 CONNECTOR, 12 PIN FEMALE MULTICONTACT 90949 91T-3638.

Page 10, Figure 4:
Replace Figure 4 with Figure I-1.

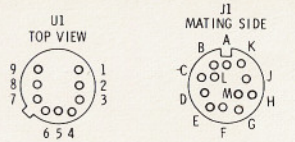


NOTES

1. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN MICROFARADS.
2. THE VALUES OF COMPONENTS A2R1 AND A2C1 ARE AS FOLLOWS:
   - 8481A: A2R1 IS 464 KΩ, A2C1 IS 47 µf
   - 8482A: A2R1 IS 562 KΩ, A2C1 IS 39 µf
   - 8483A: A2R1 IS 787 KΩ, A2C1 IS 27 µf
3. A1 BULKHEAD ASSEMBLY IS NOT REPAIRABLE.

REFERENCE DESIGNATIONS

NO PREFIX	A2 ASSY
J1	C1-10
	CR1
	E1,2
	Q1
	R1-4
	RT1
	U1



CAUTION: DO NOT FORCE LARGE-DIAMETER TEST PRODS INTO THE PIN RECEPTACLES OF J1. THIS MAY PERMANENTLY DEFORM THE RECEPTACLES.

Figure I-1. Schematic Diagram (P/O Change A)

HP Part No. 08481-90063

Printed in U.S.A.