Errata

Title & Document Type: **4436A Attenuator Operating and Service Manual**

Manual Part Number: **04436-90002**

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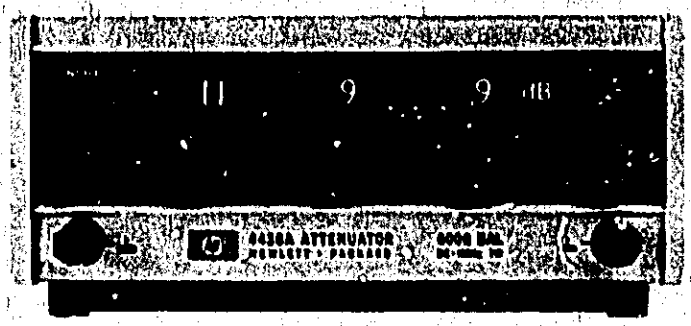
OPERATING AND SERVICE MANUAL

ATTENUATOR

4436A



HEWLETT PACKARD

4436A

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The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards to the extent allowed by the Bureau's calibration facility.

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OPERATING AND SERVICE MANUAL

MODEL 4436A
ATTENUATOR

SERIALS PREFIXED: 1217/1218

See Section VII for Other Serial Prefixes.

Manual Part No. 04436-90002
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HEWLETT PACKARD

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Table 1-1. Specifications

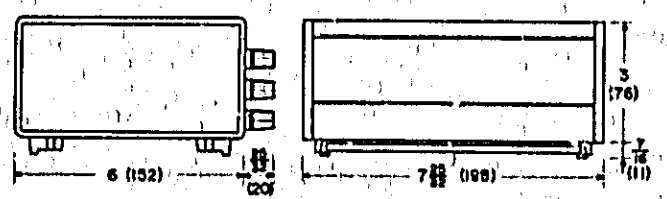
Frequency Range: dc to 1 MHz
Maximum Attenuation: 119.9 dB
Attenuation Increments: 0.1 dB
Accuracy:

Attenuation	100kHz	1MHz	1.5MHz*
0 to 60dB	±0.1dB	±0.2dB	±0.2dB
60 to 90dB	±0.1dB	±0.3dB	±0.3dB
90 to 110dB	±0.2dB	±0.5dB	±0.5dB
110 to 119.9dB	±0.3dB	±1.0dB	

* typical value

Input/Output Impedance: 600Ω, balanced.
Input/Output Impedance Accuracy (at 100kHz):
600Ω ±10Ω.
Unbalanced Capacitance: less than 10pF.
Maximum Input Power: 1W (24.5V max.).
Operating Temperature: 0°C to 65°C.
Weight: Net 3 lb 13 oz (1.7 kg).
Shipping 6 lb (2.7 kg).

Dimensions:



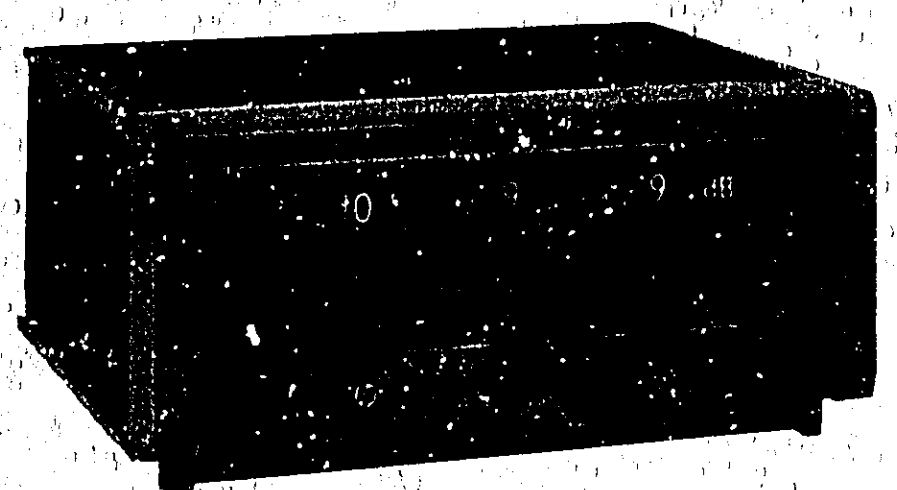


Figure 1-1. Model 4436A Attenuator

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. The HP 4436A(Figure 1-1)is an in-line reading variable attenuator usable from dc to 1.5MHz. The 4436A uses balanced-type pads and its input and output impedances are 600 ohms. This attenuator provides accurate steps of attenuation up to 119.9dB with excellent resolution of 0.1dB for power-level measurements, transmission efficiency tests, and gain or loss measurements on filters and amplifiers, and similar equipment.

1-3. Utilizing printed-circuit switches and unique drive mechanism, the unit is compact, light weight and rugged. The drive mechanisms, controlled from the front panel, are three rotary shafts which mount four pairs of cams. Each rotary shaft drives eight printed-circuit switches. The cam actuated switches set up connections in the proper sequence to obtain the desired degree of attenuation. The 4436A has pads of 0.1, 0.2, 0.3, 0.3, 1, 2, 3, 3, 10, 20, 40, and 40 decibels which allow a range of 0 to 119.9dB in 0.1dB steps.

1-4. IDENTIFICATION

1-5. Hewlett-Packard uses a two-section ten-character (0000J00000) serial number. The first four digits (serial prefix) identify series of instruments; the last five digits identify a particular instrument in that series. A letter placed between the two sections identifies the country where the instrument was manufactured, i.e. A=U.S.A., E=England, G=West Germany, J=Japan, and U=United Kingdom. If the first four digits of the instrument serial number are not the same as those on the title page, change sheets included with this manual will define any differences between other instruments and the Model 4436A described herein. If the change sheets are missing, your HP Sales and Service Office can supply the information (addresses are listed at the back of this manual).

1-6. SPECIFICATIONS

1-7. A complete list of specifications is found in Table 1-1.

1-8. INSTALLATION AND OPERATION

1-9. Installation, Storage and Shipping procedures are described in Section II. An explanation of controls, connectors, and operational procedures is contained in Section III.

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section contains information for unpacking, inspection, repackaging, storage, and installation of the Model 4436A.

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for damage (scratches, dents, broken knobs, etc.). If the instrument is damaged or fails to meet specifications, notify the carrier and the nearest Hewlett-Packard Field Office (see list at back of this manual). Retain the shipping carton and the padding material for the carrier's inspection. The field office will arrange for the repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. STORAGE AND SHIPMENT

2-6. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here are a few recommended packaging methods:

a. RUBBERIZED HAIR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument securely in strong corrugated container (350 lb/sq in. bursting test) with 2-inch rubberized hair pads placed along all surfaces of the instrument. Insert fillers between pads and container to ensure a snug fit.

b. EXCELSIOR. Cover painted surfaces of instrument with protective wrapping paper. Pack instrument in strong corrugated container (350 lb/sq in. bursting test) with a layer of excelsior about 6 inches thick packed firmly against all surfaces of the instrument.

2-7. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

a. Maximum altitude, 20,000 feet.

b. Minimum temperature, -40° F (-40° C)

c. Maximum temperature, 167° F (75° C)

2-8. INSTALLATION

2-9. The Model 4436A is a submodular unit, equipped with plastic feet for bench operation as shipped from the factory. However, when used in combination with other submodular units it can be rack mounted. The HP adapter frame is designed for this purpose and is available through your Hewlett-Packard Sales and Service office.

2-10. ADAPTER FRAME (HP Part No. 5060-0808)

2-11. The adapter frame is a rack frame that accepts any combination of submodular units. It can be rack mounted only.

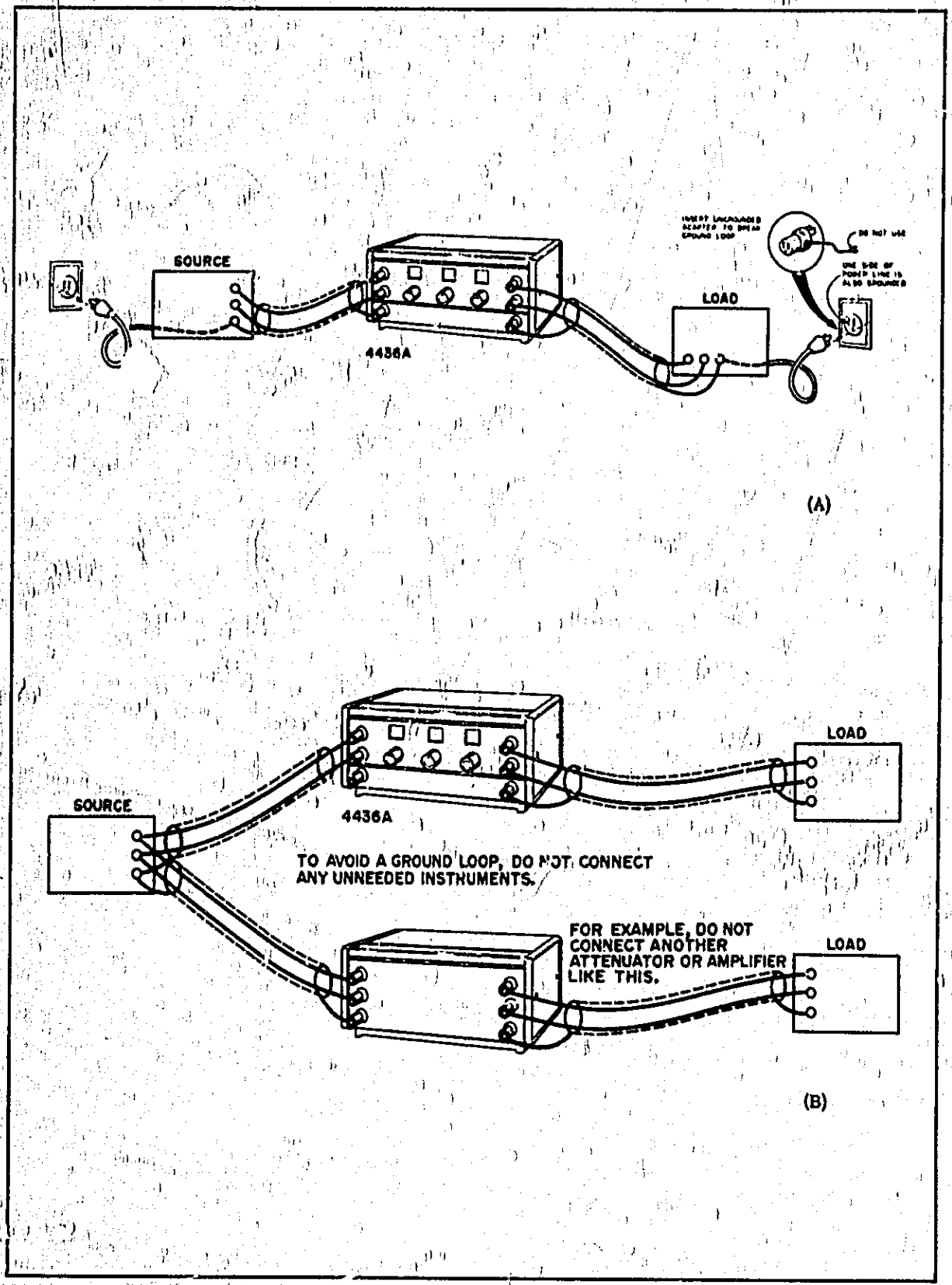


Figure 3-1. Measurement and/or Test Setup Connections

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. The Model 4436A is designed to provide attenuation up to 119.9dB with 0.1dB resolution and dissipate a maximum average power of 1W. The attenuator will be damaged if overloaded.

3-3. CONTROLS AND CONNECTORS

3-4. The front panel controls and connectors are explained in Figure 3-2. The descriptions are keyed to the corresponding items which are indicated on the figure.

3-5. OPERATING CONSIDERATIONS

3-6. IMPEDANCE

3-7. For full accuracy and ease of application, the source and load impedances should match the impedance at the INPUT and OUTPUT terminals of the Model 4436A. When source and load impedances are the same as the impedance of the Model 4436A, the amount of attenuation in the circuit is the attenuator-knob settings. If an impedance-matching network is used (see Paragraph 3-12), the amount of insertion loss must be added to the Model 4436A setting to obtain the amount of attenuation between source and load.

3-8. LEADS AND CONNECTIONS

3-9. The following describes the procedure for making connections to the Model 4436A and the other instruments for test or measurement setups. It is of especial use at high attenuator settings (above 60dB) and at high frequencies (above 100kHz).

a. Use a shielded two-conductor cable as short in length as possible.

b. All terminals of test setup and matching 600Ω or 300Ω resistor must be enclosed in the shield.

c. Do not create a complete electrical circuit loop in the lower signal line or ground line. The different current which flows through the lower signal line of Model 4436A may result in an attenuation of a different value from that set on the Model 4436A controls. Do not create ground loops by making two or more ground connections! For example, do not ground load instrument at power source (See Figure 3-1A). In addition, disconnect any instruments which are not needed for the measurement to avoid looping (See Figure 3-1B).

3-10. INPUT POWER LIMITATION

3-11. Do not apply more than 1 watt maximum to the Model 4436A INPUT terminals. For the attenuator, 1 watt corresponds to 24.5 volts (dc or rms).

CAUTION

Always connect input to the INPUT terminals. If the OUTPUT terminals are used as input terminals, listed specifications may not be obtained.

3-12. OPERATING PROCEDURE

3-13. MATCHED IMPEDANCE

3-14. When the Model 4436A INPUT and OUTPUT terminals are terminated properly, the attenuation reading corresponds to the control settings. The voltage at the output of the Model 4436A may be determined if the input voltage (or input dB level) and the amount of attenuation inserted by the Model 4436A are known. Table 3-1 shows the attenuation factor (A_f) over the attenuation range of the Model 4436A in 1dB steps. The method for finding the input level in dBm, is explained in Section IV. To find the voltage at the output terminals proceed as follows:

a. Determine the input voltage to the Model 4436A and the amount of attenuation set on the Model 4436A.

b. Locate the amount of attenuation in the dB column of Table 3-1 and read the corresponding attenuation factor.

c. To calculate the output voltage, multiply the input voltage by the attenuation factor. See Paragraph 3-15 for an example.

3-15. In Figure 3-3A and B the Model 4436A is shown connected to a matching source and load. In both cases the Model 4436A is set to attenuate the signal by 24dB. The attenuation factor for 24dB from Table 3-1 is 0.0631 and the output voltage, for the condition shown in Figure 3-3A, is then:

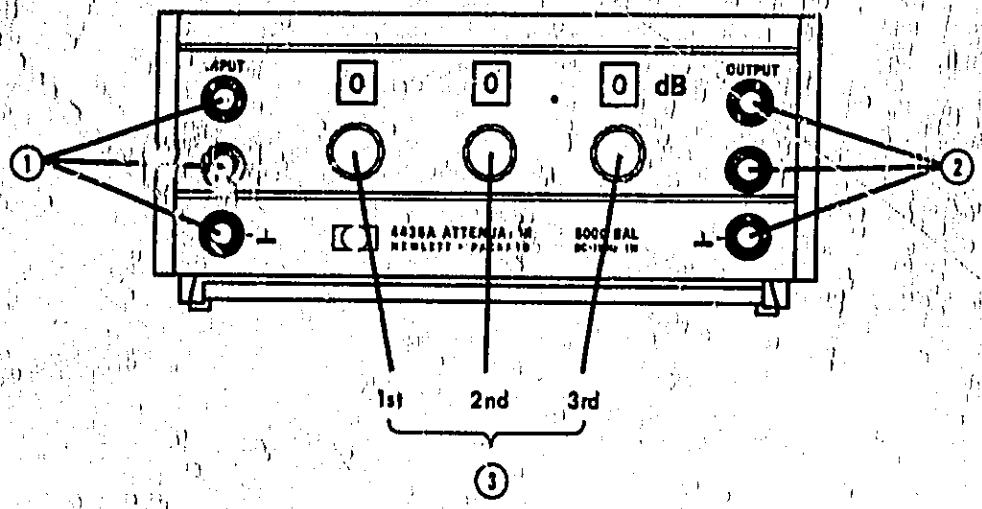
$$V_{out} = (24.5V)(0.0631) = 1.546 \text{ volts}$$

For Figure 3-3B the attenuation factor is the same as for Figure 3-3A and the output voltage is:

$$V_{out} = (20V)(0.0631) = 1.262 \text{ volts}$$

3-16. USE OF IMPEDANCE-MATCHING CIRCUIT

3-17. When the Model 4436A OUTPUT terminals are terminated improperly, attenuation and input impedance may be affected with losses caused by mismatch. Figure 3-4 and 3-5 show input impedance change due to terminated resistance error and attenuation change due to terminated resistance error, respectively. Figure 3-4 graphically shows characteristics that terminated resistance error does not affect the input impedance when the attenuator is set to a value greater than 20dB attenuation. Impedance matching between load and Model 4436A is, therefore, very important.



1. INPUT terminals: Provide input connections to source. Ground terminal(⊥) is connected to the cabinet internally.

CAUTION

Do not apply more than 1W (24.5V) maximum to the INPUT terminals, and always connect input to the INPUT terminals.

2. Decade Switches: Provide attenuation up to 119.9dB between INPUT and OUTPUT terminals in steps of 0.1dB. The amount of attenuation is displayed in the windows just above the control knobs ganged with the switches in in-line form.

1st. decade switch: provides attenuation of 0 to 110dB in 10dB steps.

2nd. decade switch: provides attenuation of 0 to 9dB in 1dB steps.

3rd. decade switch: provides attenuation of 0 to 0.9dB in 0.1dB steps.

3. OUTPUT terminals: Provide output connections to load. Lower-most ground terminal is connected to the cabinet internally.

Figure 3-2. Front Panel Controls and Connectors

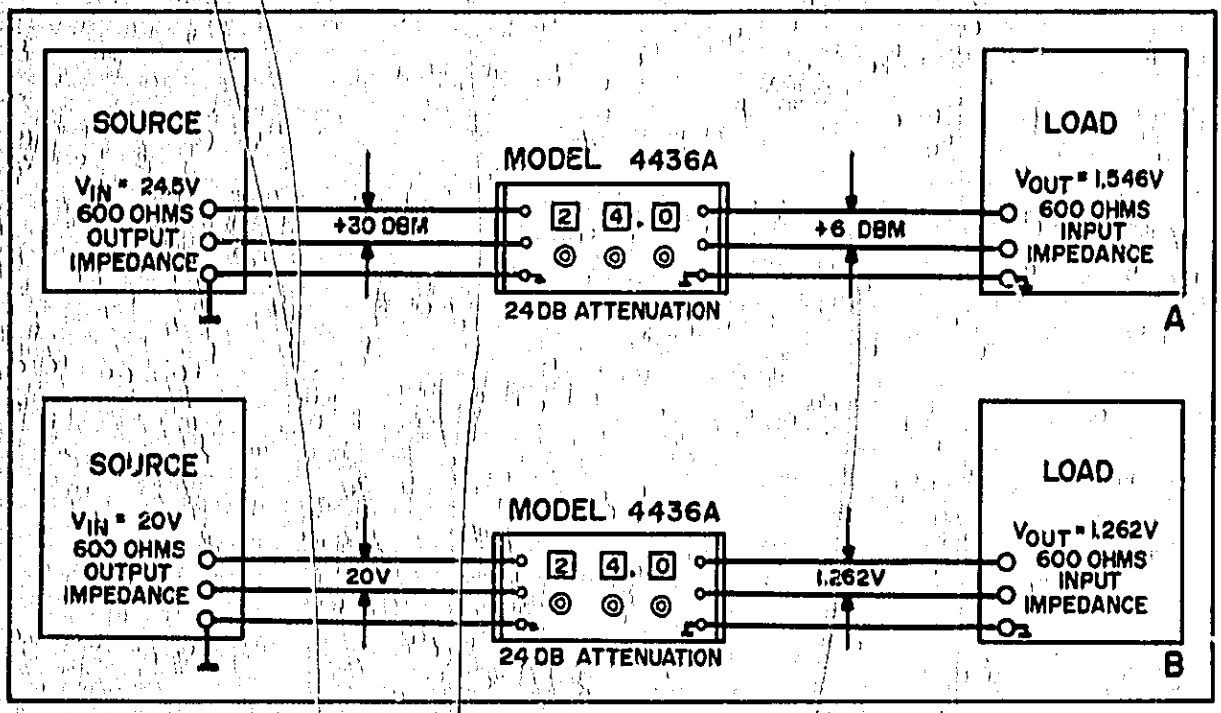


Figure 3-3. Impedance Matched Connection

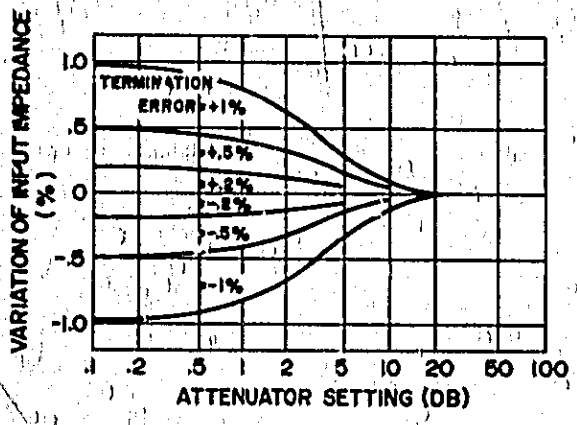


Figure 3-4. Input Impedance Change Due to Terminated Resistance Error

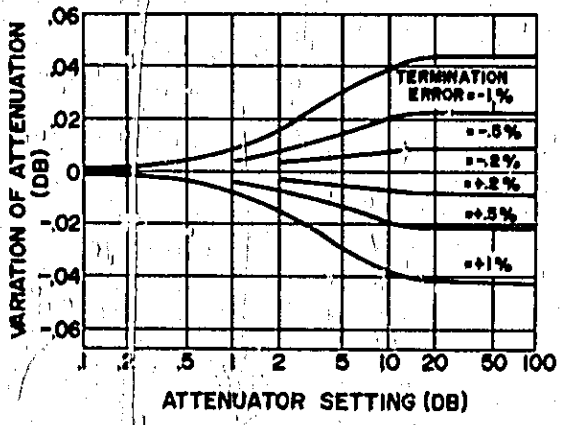


Figure 3-5. Attenuation Change Due to Terminated Resistance Error

3-18. Similarly, impedance matching technique at INPUT terminals is necessary, especially in high frequency measurements or using at low attenuation settings. Refer to Paragraphs below for actual impedance matching technique.

3-19. NEED FOR INPUT MATCH. An impedance matching circuit is necessary between source and Model 4436A Attenuator under the following conditions:

a. Source frequency is 100kHz or above.

b. Model 4436A is set for less than 20dB attenuation.

c. Source output frequency response is affected by mismatched impedance.

d. Source output is monitored by meter which is accurate only when the source operates into a matched load.

3-20. MATCHING AT THE INPUT

a. When the source is not affected by mismatch

and source impedance is lower than that of Model 4436A, two series resistors may be used between source and attenuator as shown in Figure 3-6. The resistor value should be half of the difference between Model 4436A impedance and source impedance. For example, to match the Model 4436A to a 200 ohms source requires two series resistances of 200 ohms each.

b. Except for the condition stated in a., a resistive impedance - matching network or a matching transformer should be used. Impedance matching with matching transformer is shown in Figure 3-7. The transformer should possess good balance and frequency characteristics at the range of frequency to be used and proper input and output impedances equal to the source impedance and the impedance of the Model 4436A. Also, insertion loss of the transformer should be small. Impedance matching with matching network is shown in Figure 3-8. Resistors used in the network should be deposited film or carbon type. Also, better accuracy is obtained if the network is enclosed in a shielded container and connecting leads are kept short.

3-21. NEED FOR OUTPUT MATCH. To maintain the rated attenuation accuracy of the Model 4436A, the impedance of the load must match the output impedance of the Model 4436A. When the load also must be terminated in its matching impedance, a matching transformer or a resistive matching network must be used. When mismatch does not affect the load, the required impedance match for the Model 4436A can under some conditions be obtained by used of two resistors. Conditions under which resistors can be used and use of matching transformers and matching networks are discussed in the following paragraphs.

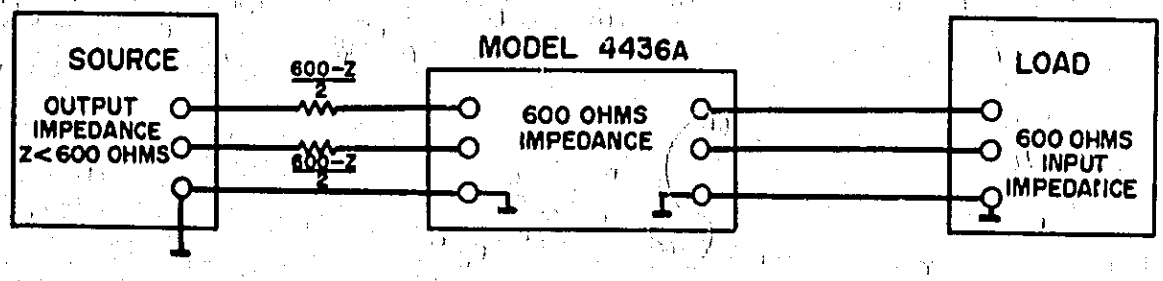


Figure 3-6. Simple Input Matching with Series Resistors.

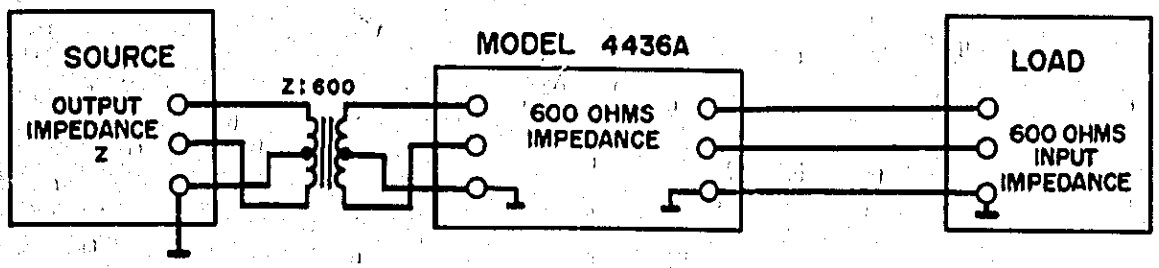


Figure 3-7. Input Matching with Transformer.

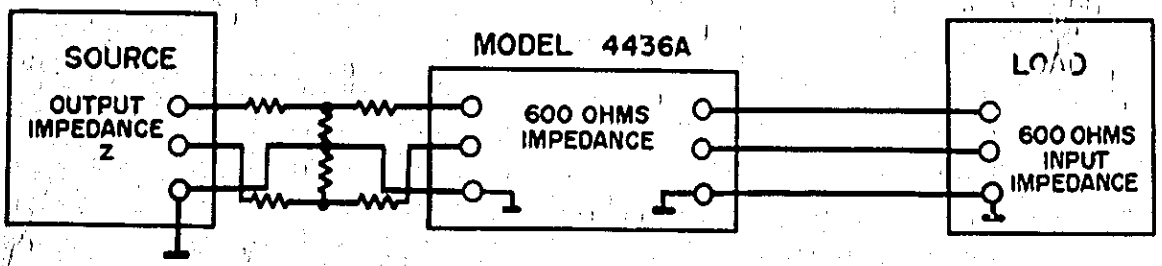


Figure 3-8. Input Matching with Resistive Network.

3-22. MATCHING AT THE OUTPUT

a. When the impedance of the load is lower than that of the Model 4436A and the load is not affected by a mismatch, impedance match for the Model 4436A output can be obtained by inserting series resistors between 4436A output and load as shown in Figure 3-9. Resistor value should be half of the difference between the Model 4436A output impedance and the load impedance.

b. When the impedance of the load is much higher than that of the Model 4436A, on the order of 100,000 ohms or more, impedance match for the Model 4436A can be obtained by using two shunting resistors across the Model 4436A output as shown in Figure 3-10. For the Model 4436A, the shunting resistors should be 300 ohms.

c. Resistive matching networks or matching transformers may be used to provide the Model 4436A and its load with an impedance match. Figure 3-11 shows impedance matching with matching network and Figure 3-12 shows impedance matching with transformer. Similarly in matching at the INPUT, the insertion loss of the resistive network or the transformer should be taken into account.

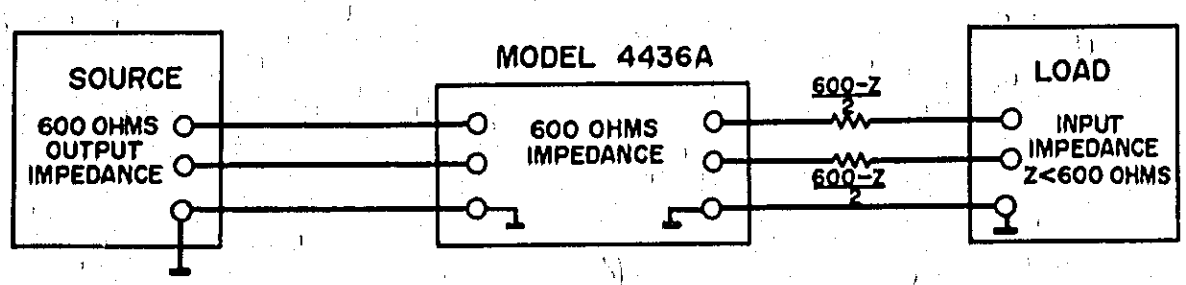


Figure 3-9. Simple Output Matching with Series Resistors

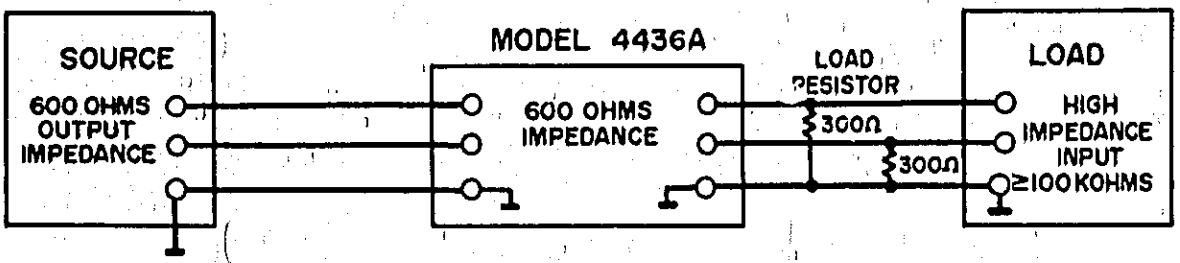


Figure 3-10. Output Matching with Shunt Resistors

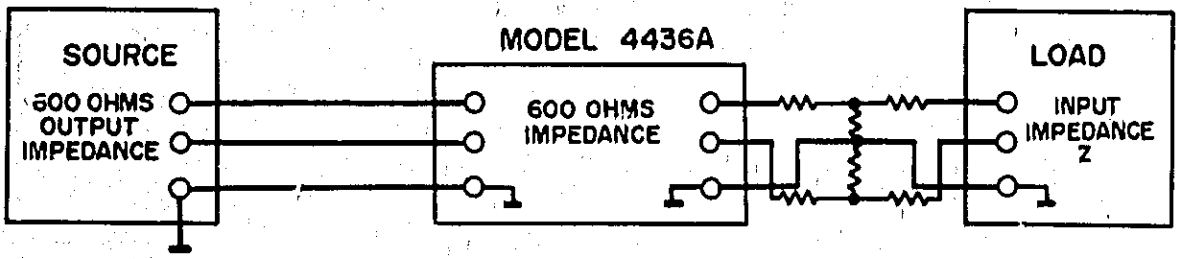


Figure 3-11. Output Matching with Resistive Network

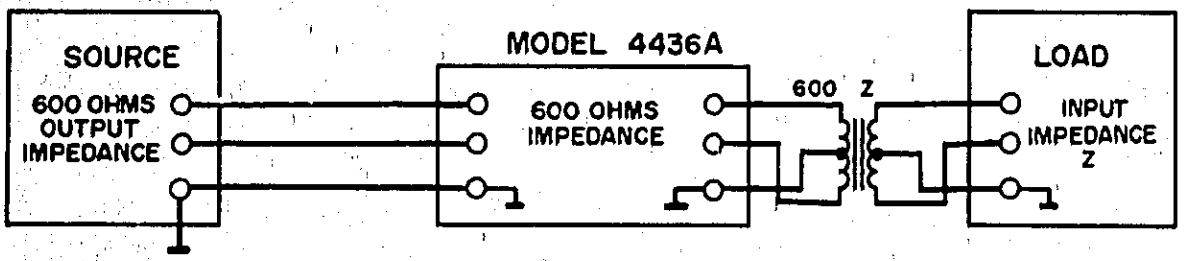


Figure 3-12. Output Matching with Transformer

Table 3-1. Attenuation Factors

db	Attenuation Factor A_f	db	Attenuation Factor A_f	db	Attenuation Factor A_f
0	1.0000	40	.010000	80	.00010000
1	.8913	41	.008913	81	.00008913
2	.7943	42	.007943	82	.00007943
3	.7079	43	.007079	83	.00007079
4	.6310	44	.006310	84	.00006310
5	.5623	45	.005623	85	.00005623
6	.5012	46	.005012	86	.00005012
7	.4467	47	.004467	87	.00004467
8	.3981	48	.003981	88	.00003981
9	.3548	49	.003548	89	.00003548
10	.3162	50	.003162	90	.00003162
11	.2818	51	.002818	91	.00002818
12	.2512	52	.002512	92	.00002512
13	.2239	53	.002239	93	.00002239
14	.1995	54	.001995	94	.00001995
15	.1778	55	.001778	95	.00001778
16	.1585	56	.001585	96	.00001585
17	.1413	57	.001413	97	.00001413
18	.1259	58	.001259	98	.00001259
19	.1122	59	.001122	99	.00001122
20	.1000	60	.001000	100	.00001000
21	.0891	61	.0008913	101	.000008913
22	.07943	62	.0007943	102	.000007943
23	.07079	63	.0007079	103	.000007079
24	.06310	64	.0006310	104	.000006310
25	.05623	65	.0005623	105	.000005623
26	.05012	66	.0005012	106	.000005012
27	.04467	67	.0004467	107	.000004467
28	.03981	68	.0003981	108	.000003981
29	.03548	69	.0003548	109	.000003548
30	.03162	70	.0003162	110	.000003162
31	.02818	71	.0002818	111	.000002818
32	.02512	72	.0002512	112	.000002512
33	.02239	73	.0002239	113	.000002239
34	.01995	74	.0001995	114	.000001995
35	.01778	75	.0001778	115	.000001778
36	.01585	76	.00015850	116	.000001585
37	.01413	77	.00014130	117	.000001413
38	.012590	78	.00012590	118	.000001259
39	.011220	79	.00011220	119	.000001122
				120	.000001000

SECTION IV
THEORY OF OPERATION

4-1. GENERAL

4-2. The Model 4436A is shown in simplified schematic form in Figure 4-1. In the complete schematic (Figure 6-2) note that each attenuator section, 0, 9dB, 9dB, and 110dB, is composed of four-segments. Each basically has the same configuration as shown in Figure 4-1. H-type attenuation pads are used in 110dB and 9dB sections, and O-type pads are used in 0, 9dB section. The 4436A consists of two 300 ohm unbalanced type attenuators. A balanced input signal should be applied to INPUT upper and middle terminals with 600Ω input impedance. An unbalanced signal should be applied to INPUT upper or middle and bottom terminals with 300Ω input impedance.

4-3. ATTENUATION EXPRESSED IN DECIBELS

4-4. POWER AND VOLTAGE RATIOS

4-5. The basic equation for computing attenuation in decibels is based on a power ratio where P = power, V = voltage, and R = resistance:

$$\text{Decibels} = 10 \log_{10}\left(\frac{P_1}{P_2}\right) \qquad (1)$$

since power is expressed as: $P = \frac{V^2}{R}$ (2)

Equation (1) may be written as:

$$\text{Then dB} = 10 \log_{10}\left(\frac{\frac{V_1^2}{R_1}}{\frac{V_2^2}{R_2}}\right) \qquad (3)$$

and if R1 = R2 -

$$\text{Then dB} = 10 \log_{10}\left(\frac{V_1}{V_2}\right)^2 \qquad (4)$$

The basic rules for exponents of logarithms then allow equation (4) to be written as:

$$\text{dB} = 20 \log_{10}\left(\frac{V_1}{V_2}\right) \qquad (5)$$

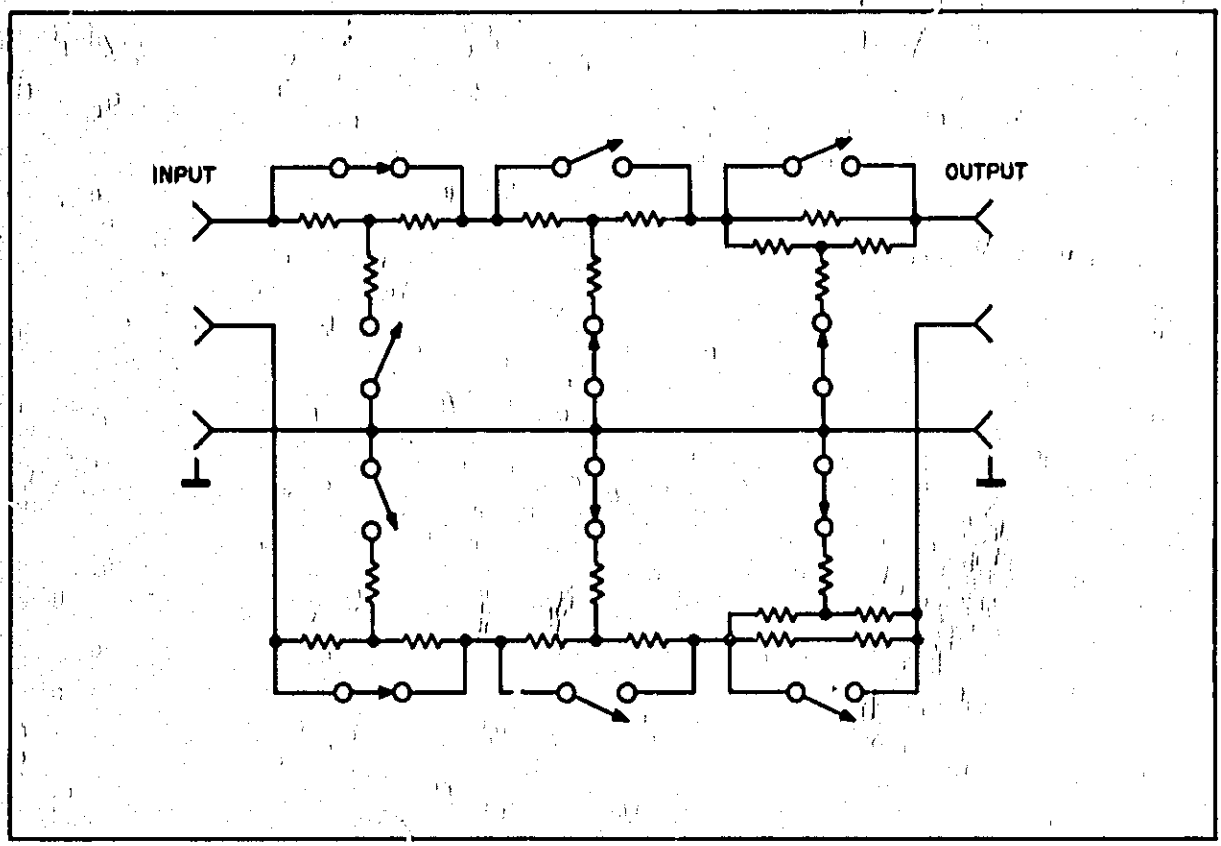


Figure 4-1. Model 4436A Simplified Diagram

4-6. The values for A_f (attenuation factor) given in Table 3-1 are based on a voltage ratio which assumes that the resistances at the input and the output are the same. Values for A are computed using equation (5) where $V_1 = V_{in}$ and $V_2 = V_{out}$.

$$V_{out} = V_{in}A_f \text{ or } \frac{V_{in}}{V_{out}} = \frac{1}{A_f} \qquad (6)$$

Then substituting equation (6) in equation (5) gives-

$$dB = 20 \log_{10}\left(\frac{1}{A_f}\right) \qquad (7)$$

Solving for A_f gives

$$A_f = \frac{1}{\text{antilog}_{10}\frac{\text{number of dB}}{20}} \qquad (8)$$

An example will check the value for A_f given in Table 3-1 for 24dB.

$$A_f = \frac{1}{\text{antilog}_{10}\left(\frac{24}{20}\right)} = \frac{1}{\text{antilog}_{10}(1,2)} \qquad (9)$$

From a log table, the antilog_{10} of 1,2 is 15,85 and

$$A_f = \frac{1}{15,85} = 0,0631 \qquad (10)$$

4-7. REFERENCE FOR dB

4-8. The dB levels given in Figure 3-3 are referenced to a milliwatt of power, hence the term dBm. This indicates that the logarithm is taken of a power ratio where 1 milliwatt is the reference. For the 30dBm shown in Figure 3-3A, equation (1) and (2) show that:

$$dBm = 10 \log_{10}\frac{\left(\frac{24,5}{600}\right)^2}{1 \text{ milliwatt}} = 10 \log_{10}(1000)$$

$$= 10(3) = 30$$

SECTION V
MAINTENANCE

5-1. INTRODUCTION

5-2. Maintenance requirements for the Model 4436A are minimal unless an overload voltage or physical damage requires replacement of a part. This section outlines maintenance and service information. Included is a table of recommended test equipment, repair procedures and an in-cabinet performance check.

5-3. TEST EQUIPMENT

5-4. Table 5-1 lists recommended equipment for maintaining and checking performance of instrument. Test equipment having equivalent characteristics may be substituted.

5-5. RESISTANCE MEASUREMENTS

5-6. If overload power has been applied and damage to the instrument is suspected, make dc resistance measurements as follows:

a. Terminate the OUTPUT terminals with 600Ω ±0.5%.

b. Connect a high performance multimeter with resistance measurement capabilities, such as the HP 3480A/B with 3484A option 042, to upper and middle terminals at INPUT. Measure the dc resistance at each step of each decade. Resistance measured should be 600Ω ±0.5%.

c. If the reading on any step is not within specified limit, the instrument has been damaged.

5-7. IN-CABINET PERFORMANCE CHECK

5-8. GENERAL

5-9. The performance check can be used at any time to verify proper operation of the instrument and also may be used:

a. As part of an incoming inspection check of instrument specifications.

b. Periodically, for instruments used in systems where maximum reliability is important.

c. As part of procedure to locate a defective component.

d. After any repair or adjustment before returning instrument to regular service.

e. As a permanent record of instrument maintenance performed.

5-10. AC PERFORMANCE TEST

5-11. The ac performance test setup is illustrated in Figure 5-1. An Oscillator (HP 654A) and a battery operated ac voltmeter (HP 400EL or 400FL with external battery) are required for this test. In addition, two 300Ω 1 watt resistors (HP Part No. 0761-0053) are required. These resistors must be enclosed in a shield as shown in Figure 5-1. The range-to-range accuracy of the battery operated ac voltmeter (HP Model 400FL) from +20dB to -60dB must be known to within 0.1dB at 100kHz and 1MHz. Any errors

Table 5-1. Test Equipment Required

Instrument Type	Required Characteristics	Use	Recommended Model
Digital Ohmmeter	Range: 1000Ω 1 range Accuracy: better than ±0.05%	Resistance Measurement	-hp- Model 3480A/P with 3484A Opt 042 Ohmmeter Plug-in
Battery Operated ac Voltmeter	Frequency range: 100kHz and 1MHz Range: +20dB to -60dB 9 range Accuracy: ±1% of reading	ac Performance Test	-hp- Model 400FL ac Voltmeter with external battery
Oscillator	Output frequency: 100kHz to 1MHz Output Level: +11dB to -90dB into 600Ω	ac Performance Test	-hp- Model 654A Oscillator
Milliohmmeter	Range: 10mΩ to 100Ω Accuracy: better than ±2%	Troubleshooting	HP Model 4328A with 16005A Probe

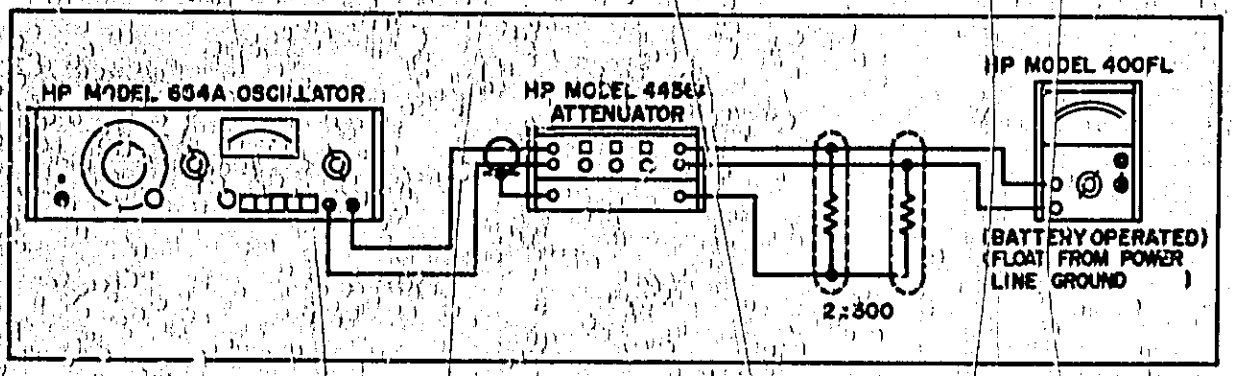


Figure 5-1. AC Performance Test Setup

should be algebraically subtracted from the error found during the performance test.

5-12. To perform the ac performance test, proceed as follows:

a. Assemble test setup as illustrated in Figure 5-1 (See Paragraph 3-9).

b. Set controls as indicated in step 1 of Table 5-2.

c. Adjust the Oscillator AMPLITUDE control for a convenient reference on the ac voltmeter connected to 4436A OUTPUT terminals.

CAUTION

Do not apply more than 1 watt maximum (24.5 Vrms) to Model 4436A INPUT terminals to prevent damage the attenuator.

d. Monitor input signal amplitude with ac voltmeter connected to 4436A OUTPUT terminals and note its indication.

e. Set controls as indicated in step 2 of Table 5-2. Maintain same input signal amplitude as in step d. using the Oscillator AMPLITUDE control. Check that the ac voltmeter indicates same as reference ±tolerances listed in Table 5-2.

f. Repeat Step e, for steps 3 thru 6 of Table 5-2.

g. Set controls as indicated in step 7 of Table 5-2.

h. Adjust the Oscillator AMPLITUDE control for a convenient reference as indicated on the ac voltmeter.

i. Monitor the input signal amplitude using the ac voltmeter and note its indication.

j. Set controls as indicated in step 8 of Table 5-2. Maintain the same input signal amplitude as in step i. using the Oscillator AMPLITUDE control. Check that ac voltmeter indicates same as reference ±tolerances listed in Table 5-2.

Table 5-2. AC Performance Test A

Step	Oscillator Frequency	4436A dB Setting	AC Voltmeter dB Range	Tolerance in dB
1	100kHz	0	+20	±0.1
2	100kHz	10	+10	±0.1
3	100kHz	20	0	±0.1
4	100kHz	30	-10	±0.1
5	100kHz	40	-20	±0.1
6	100kHz	50	-30	±0.1
7	1MHz	0	+20	±0.2
8	1MHz	10	+10	±0.2
9	1MHz	20	0	±0.2
10	1MHz	30	-10	±0.2
11	1MHz	40	-20	±0.2
12	1MHz	50	-30	±0.2

k. Repeat step j. for steps 9 thru 12 of Table 5-2.

l. Set controls as indicated in step 1 of Table 5-3.

m. Adjust Oscillator AMPLITUDE control so that ac voltmeter indicates 0dB.

n. Monitor input signal amplitude using ac voltmeter and note its indication.

o. Set controls as indicated in step 2 of Table 5-3. Maintain the same input signal amplitude as in Step n. using the oscillator AMPLITUDE control. Check that the ac voltmeter indicates same as reference (0dB) ±tolerance listed in Table 5-3.

p. Change 4436A Attenuation to 59dB in 1dB steps (steps 3 thru 11) maintaining the same input signal amplitude as in step n. using the oscillator AMPLITUDE control (if necessary). Check that the ac voltmeter indicates 1dB change for each step. The ac voltmeter indications should be within the tolerances listed in Table 5-3.

Table 5-3. AC Performance Test B

Step	Oscillator Frequency	4436A dB Setting	AC Voltmeter dB Range	Tolerance in dB
1	100kHz	00.0	+20	±0.1
2	100kHz	50.0	-30	±0.1
3	100kHz	51.0	-30	±0.1
4	100kHz	52.0	-30	±0.1
5	100kHz	53.0	-30	±0.1
6	100kHz	54.0	-30	±0.1
7	100kHz	55.0	-30	±0.1
8	100kHz	56.0	-30	±0.1
9	100kHz	57.0	-30	±0.1
10	100kHz	58.0	-30	±0.1
11	100kHz	59.0	-30	±0.1
12	100kHz	59.1	-30	±0.1
13	100kHz	59.2	-30	±0.1
14	100kHz	59.3	-30	±0.1
15	100kHz	59.4	-30	±0.1
16	100kHz	59.5	-30	±0.1
17	100kHz	59.6	-30	±0.1
18	100kHz	59.7	-30	±0.1
19	100kHz	59.8	-30	±0.1
20	100kHz	59.9	-30	±0.1

Table 5-4. AC Performance Test C

Step	Oscillator Frequency	4436A dB Setting	AC Voltmeter dB Range	Tolerance in dB
1	1MHz	00.0	+20	±0.2
2	1MHz	50.0	-30	±0.2
3	1MHz	51.0	-30	±0.2
4	1MHz	52.0	-30	±0.2
5	1MHz	53.0	-30	±0.2
6	1MHz	54.0	-30	±0.2
7	1MHz	55.0	-30	±0.2
8	1MHz	56.0	-30	±0.2
9	1MHz	57.0	-30	±0.2
10	1MHz	58.0	-30	±0.2
11	1MHz	59.0	-30	±0.2
12	1MHz	59.1	-30	±0.2
13	1MHz	59.2	-30	±0.2
14	1MHz	59.3	-30	±0.2
15	1MHz	59.4	-30	±0.2
16	1MHz	59.5	-30	±0.2
17	1MHz	59.6	-30	±0.2
18	1MHz	59.7	-30	±0.2
19	1MHz	59.8	-30	±0.2
20	1MHz	59.9	-30	±0.2

q. Change 4436A Attenuation to 59.9dB in 0.1dB steps (steps 12 thru 20) maintaining the same input signal amplitude as in Step n, using the oscillator AMPLITUDE control (if necessary). Check that the ac voltmeter indicates 0.1dB change for each step. The ac voltmeter indications should be within the tolerances listed in Table 5-3.

r. Repeat Steps i. thru q. at a frequency of 1MHz. Applicable tolerances at 1MHz are listed in Table 5-4.

5-13. COVER REMOVAL

5-14. When it is necessary to perform preventive maintenance or to do repairs, the covers must be removed. Refer to following steps for cover removal:

a. TOP and BOTTOM COVER - Remove the two screws at rear of top cover and slide covers to rear.

b. SHIELD COVERS - Remove the screw at rear of cover and slide cover to rear.

5-15. COMPONENT REPLACEMENT

5-16. REPLACEMENT OF SPRING CONTACTS

5-17. Figure 8-1 and Figure 8-2 identify spring contact component. To replace spring contacts, proceed as follows:

a. Remove all instrument covers.

b. Remove the screw in molded rail.

c. Carefully pull molded rail up while holding molded slide down.

d. Push molded slide horizontally to remove.

e. Unsolder the spring contact and remove.

f. Clean gold plated contact using a Contact Burnishing Tool (HP Part No. 8660-0083, see Figure 5-2 ABRASIVE-STICK).

g. Solder a new spring contact in place and reinstall molded slide and rail.

5-18. REPLACEMENT OF MOLDED SLIDES

5-19. Figure 8-1 and Figure 8-2 identify the part numbers of molded slides. When a molded slide is ordered with part number 04437-5023, you will receive the slide component shown in Figure 5-3 (a). This molded slide must be cut as illustrated in Figure 5-3 (b) or Figure 5-3 (c), respectively, for the segment to be used.

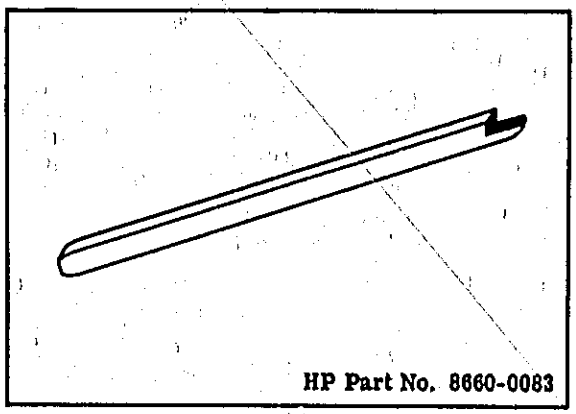


Figure 5-2. Abrasive Stick

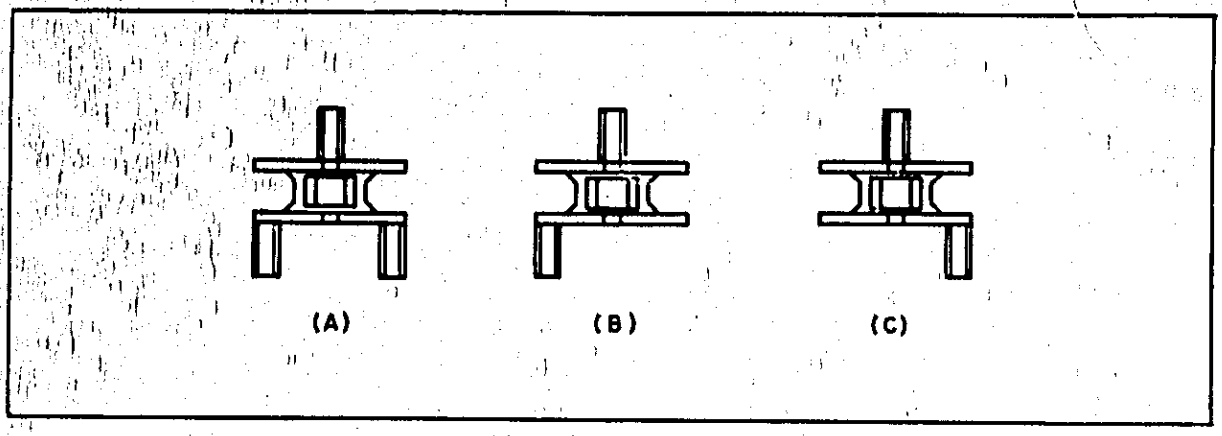


Figure 5-3. Molded Slide

5-20. REPLACEMENT OF RESISTORS

5-21. Figure 8-1 and Figure 8-2 identify the resistors on A1 and A2 board assemblies. Replacement resistors may be ordered from parts information in Section VI. When a resistor is replaced, no adjustment is required.

5-22. PREVENTIVE MAINTENANCE

5-23. Recommended preventive maintenance operations for the attenuator include cleaning, lubrication and electrical checks. These procedures insure proper attenuator operation. Generally, under normal use and conditions, preventive maintenance should be performed every nine to twelve months.

5-24. CLEANING

5-25. Cleaning routine should include the following:

a. Remove all instrument covers.

b. Remove screw in the molded rail.

NOTE

Do not remove the four screws in molded rails for more than one a attenuator decade digit at a time.

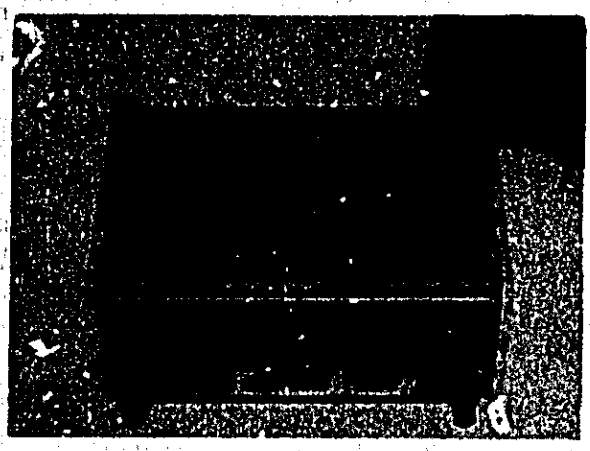


Figure 5-4. Contact Cleaning

c. Carefully pull molded rail up while holding molded slide down.

d. Push molded slide horizontally and lift to remove.

e. Clean contacts as shown in Figure 5-4, using Abrasive Stick (HP Part No. 8660-0083, see Figure 5-2).

f. Replace the molded rail and slide. Repeat above steps for all contacts.

NOTE

S1 is shielded. Remove the screw to remove shield cover.

5-26. LUBRICATION

5-27. The cam assembly in the Attenuator has been lubricated at factory before shipment. Relubrication is required every twelve months. For lubrication, use HP Part No. 6040-0018 or equivalent. Lubricate as follows:

a. Remove top and bottom covers by taking the two screws out.

b. Remove top shield cover by taking the single screw out.

c. Remove the shield cover for A1S1 by taking single screw out.

d. Remove all molded rails and molded slides from A1.

e. Take out the eleven screws fastening board A1.

f. Lift up A1 at the rear and lubricate all cam assemblies using HP Part No. 6040-0018 lubricant.

g. Replace all components.

5-28. ELECTRICAL CHECKS

5-29. The electrical checks required for the preventive maintenance program are the same as those listed for the performance checks (paragraphs 5-7 through 5-12). Perform these checks for every twelve months of attenuator operation. A record of the results of the checks will provide data history which could prove valuable if troubleshooting is ever necessary.

5-30. TROUBLESHOOTING

5-31. Use the simplified diagram Figure 4-1 and the schematic diagram Figure 8-5 to determine the section of instrument in which trouble is located. Figure 8-1 and Figure 8-2 show physical location of components (cover removed). Give instrument a through visual check. Look for loose connections or any other condition which suggests a probable trouble location. The following paragraphs list procedures for specific troubles.

5-32. CONTACT RESISTANCE CHECK FOR SWITCHES

5-33. The purpose of this check is to verify proper operation of attenuator switches by using the HP Model 4328A Milliohmmeter. Proceed as follows:

a. Remove all instrument covers.

b. Set the 4436A controls to 00.0dB.

c. Connect the Model 4328A to upper terminals at INPUT and OUTPUT as shown in Figure 5-5 using 16005A Clip-Type probes.

d. The 4328A reading should be less than 300mΩ. If not, gently press down spring contacts (which meet the gold plated contacts) with a plastic stick to isolate the contact which has the higher contact resistance. Then clean contact as described in paragraph 5-25.

e. Connect the Model 4328A to middle terminal at INPUT and at OUTPUT.

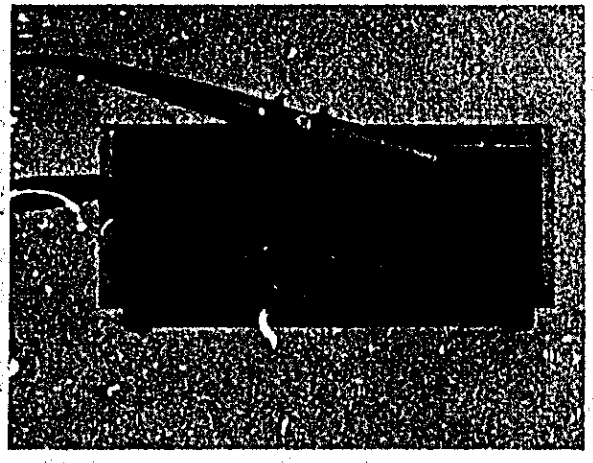


Figure 5-5. Contact Resistance Check (1)

f. The 4328A reading should be less than 300mΩ. If not, gently press down spring contacts (which meet the gold plated contacts) with a plastic stick to isolate the contact which has the higher contact resistance. Then clean contact as described in paragraph 5-25.

g. Set the 4436A controls to 119.9dB and connect Model 4328A between bottom terminal at OUTPUT and switch side of resistors (R3, R6, R9, R12, R16, R19, R23, R26, R31, R36, R40 and R44). See Figure 5-6.

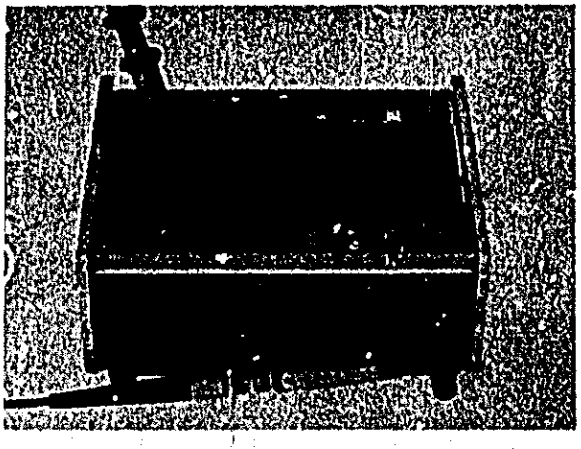


Figure 5-6. Contact Resistance Check (2)

h. The reading of the 4328A for each contact is shown in Table 5-5. The values shown in Table 5-5 are typical and tolerance should be ±30% of the value. If the 4328A reading is more than +30% of the value, press the spring contact down gently using a plastic stick. If reading goes down, clean the contact or replace the spring contact.

Table 5-5. Resistance between OUTPUT and Switch Resistors

Resistor	Readings
R3	30mΩ
R6	30mΩ
R9	30mΩ
R12	30mΩ
R16	40mΩ
R19	40mΩ
R23	40mΩ
R26	40mΩ
R31	20mΩ
R36	20mΩ
R40	20mΩ
R44	20mΩ

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. Table 6-2 lists parts in alphanumerical order of their reference designators and indicates the description (see Table 6-1 for abbreviations used) and HP Part number of each part, together with any applicable notes.

6-3. Miscellaneous parts associated with each assembly are listed at the end of each assembly listing. Others are listed at the end of Table 6-2.

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers.

6-6. To obtain a part that is not listed, include:

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

REFERENCE DESIGNATORS

A = assembly	E = misc electronic part	P = plug	V = vacuum tube, neon bulb, photocell, etc.
B = motor	F = fuse	Q = transistor	
BT = battery	FL = filter	R = resistor	VR = voltage regulator
C = capacitor	J = jack	RT = thermistor	W = cable
CP = coupler	K = relay	S = switch	X = socket
CR = diode	L = inductor	T = transformer	Y = crystal
DL = delay line	M = meter	TB = terminal board	
DS = device signaling (lamp)	MP = mechanical part	TP = test point	

ABBREVIATIONS

A = amperes	H = henries	NPN = negative-positive-negative	RMS = root-mean square
A.F.C. = automatic frequency control	HEX = hexagonal	NRFR = not recommended for field replacement	RWV = reverse working voltage
AMPL = amplifier	HG = mercury	NSR = not separately replaceable	S-B = slow-blow
B.F.O. = beat frequency oscillator	HR = hour(s)		SCR = screw
BE CU = beryllium copper	IF = intermediate freq		SE = selenium
BH = binder head	IMPG = impregnated		SECT = section(s)
BP = bandpass	INCD = incandescent		SEMICONDR = semiconductor
BRS = brass	INCL = include(s)	OBD = order by description	SI = silicon
BWO = backward wave oscillator	INS = insulation(ed)	OH = oval head	SIL = silver
	INT = internal	OX = oxide	SL = slide
CCW = counter-clockwise	K = kilo = 1000		SPG = spring
CER = ceramic	LH = left hand	P = peak	SPL = special
CMO = cabinet mount only	LIN = linear taper	PC = printed circuit	SST = stainless steel
COEF = coefficient	LK WASH = lock washer	PF = picofarads = 10 farads	STR = split ring
COM = common	LOG = logarithmic taper	PH BRZ = phosphor bronze	STL = steel
COMP = composition	LPF = low pass filter	PHL = Phillips	TA = tantalum
COMPL = complete	M = milli = 10^{-3}	PIV = peak inverse voltage	TD = time delay
CONN = connector	MEG = meg = 10^6	PNP = positive-negative-positive	TGL = toggle
CP = cadmium plate	MET FLM = metal film	P/O = part of	THD = thread
CRT = cathode-ray tube	MET OX = metallic oxide	POLY = polystyrene	TI = titanium
CW = clockwise	MFR = manufacturer	PORC = porcelain	TOL = tolerance
DEPC = deposited carbon	MINAT = miniature	POS = position(s)	TRIM = trimmer
DR = drive	MOM = momentary	POT = potentiometer	TWT = traveling wave tube
ELECT = electrolytic	MTG = mounting	PP = peak-to-peak	U = micro = 10^{-6}
ENCAP = encapsulated	MY = "mylar"	PT = point	VAR = variable
EXT = external	N = nano (10^{-9})	PWV = peak working voltage	VDCW = dc working volts
F = farads	N/C = normally closed	RECT = rectifier	W/ = with
FH = flat head	NE = neon	RF = radio frequency	W = watts
FIL H = fillister head	NI PL = nickel plate	RH = round head or right hand	WIV = working inverse voltage
FXD = fixed	N/O = normally open	RMO = rack mount only	WW = wirewound
GE = germanium	NPO = negative positive zero (zero temperature coefficient)		W/O = without
GL = glass			
GRD = ground(ed)			

Table 6-1. List of Reference Designators and Abbreviations

Table 6-2, Replaceable Parts

Reference Designation	HP Part No.	Description	Note
A1	04436-7721	BOARD ASS'Y	
	04436-8721	BOARD:BLANK P.C.	
A1J1	1250-0257	CONNECTOR:RF FEMALE	
A1J2	1250-0257	CONNECTOR:RF FEMALE	
A1R1	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A1R2	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A1R3	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A1R4	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A1R5	0698-2062	R:FXD MET FLM 155.84Ω 0.1% 1/2W	
A1R6	0698-2057	R:FXD MET FLM 210.8Ω 0.25% 1/4W	
A1R7	0698-2062	R:FXD MET FLM 155.84Ω 0.1% 1/2W	
A1R8	0698-2065	R:FXD MET FLM 245.45Ω 0.1% 1/2W	
A1R9	0698-2056	R:FXD MET FLM 60.6Ω 0.25% 1/8W	
A1R10	0698-2063	R:FXD MET FLM 245.45Ω 0.1% 1/2W	
A1R11	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A1R12	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A1R13	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A1R14	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A1R15	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A1R16	0698-2058	R:FXD MET FLM 851.6Ω 0.25% 1/4W	
A1R17	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A1R18	0698-2060	R:FXD MET FLM 34.38Ω 0.25% 1/2W	
A1R19	0698-2059	R:FXD MET FLM 1291.4Ω 0.25% 1/4W	
A1R20	0698-2060	R:FXD MET FLM 34.38Ω 0.25% 1/2W	
A1R21	0698-3389	R:FXD MET FLM 17.8Ω 1% 1/2W	
A1R22	0698-4467	R:FXD MET FLM 1150Ω 1% 1/8W	
A1R23	0698-2055	R:FXD MET FLM 2600.0Ω 0.5% 1/8W	
A1R24	0698-3389	R:FXD MET FLM 17.8Ω 1% 1/2W	
A1R25	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A1R26	0698-2058	R:FXD MET FLM 851.6Ω 0.25% 1/4W	
A1R27	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A1R28	0698-4482	R:FXD MET FLM 17.4kΩ 1% 1/8W	
A1R29	0698-3391	R:FXD MET FLM 21.5Ω 1% 1/2W	
A1R30	0698-3390	R:FXD MET FLM 19.6Ω 1% 1/2W	
A1R31	0698-4482	R:FXD MET FLM 17.4kΩ 1% 1/8W	
A1R32	0757-0272	R:FXD MET FLM 52.3kΩ 1% 1/8W	
A1R33	0757-0376	R:FXD MET FLM 11.0Ω 1% 1/8W	
A1R34	0757-0346	R:FXD MET FLM 10.0Ω 1% 1/8W	
A1R35	0757-0346	R:FXD MET FLM 10.0Ω 1% 1/8W	

See list of abbreviations in introduction to this section

Table 6-2, Replaceable Parts (Cont'd)

Reference Designation	HP Part No.	Description	Note
A1R36	0757-0272	R:FXD MET FLM 52.3kΩ 1% 1/8W	
A1R37	0698-3159	R:FXD MET FLM 26.1kΩ 1% 1/8W	
A1R38	0698-3388	R:FXD MET FLM 14.7Ω 1% 1/2W	
A1R39	0757-0001	R:FXD MET FLM 13.3Ω 1% 1/2W	
A1R40	0698-3159	R:FXD MET FLM 26.1kΩ 1% 1/8W	
A1R41	0698-4482	R:FXD EMT FLM 17.4kΩ 1% 1/8W	
A1R42	0698-3391	R:FXD MET FLM 21.5Ω 1% 1/2W	
A1R43	0698-3390	R:FXD MET FLM 19.6Ω 1% 1/2W	
A1R44	0698-4482	R:FXD MET FLM 17.4kΩ 1% 1/8W	
A1S1		SWITCH:P.C. BOARD NSR PART OF A1 BOARD	
	04437-5022	RAIL:MOLDED 4 REQ'D	
	04437-5023	SLIDE:MOLDED 4 REQ'D	
	04437-5025	ARM:MOLDED	
	1460-0313	CONTACT:SPRING 8 REQ'D	
A1S2		SWITCH:P.C. BOARD NSR PART OF A1 BOARD	
	04437-5022	RAIL:MOLDED 4 REQ'D	
	04437-5023	SLIDE:MOLDED 4 REQ'D	
	04437-5025	ARM:MOLDED	
	1460-0313	CONTACT:SPRING 8 REQ'D	
A1S3		SWITCH:P.C. BOARD NSR PART OF A1 BOARD	
	04437-5022	RAIL:MOLDED 4 REQ'D	
	04437-5023	SLIDE:MOLDED 4 REQ'D	
	04437-5025	ARM:MOLDED	
	1460-0313	CONTACT:SPRING 8 REQ'D	

See list of abbreviations in introduction to this section

Table 6-2, Replaceable Parts (Cont'd)

Reference Designation	HP Part No.	Description	Note
A2	04436-7722	BOARD ASS'Y	
	04436-8722	BOARD:BLANK P.C.	
A2J1	1250-0257	CONNECTOR:RF FEMALE	
A2J2	1250-0257	CONNECTOR:RF FEMALE	
A2R1	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A2R2	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A2R3	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A2R4	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A2R5	0698-2062	R:FXD MET FLM 155.84Ω 0.1% 1/2W	
A2R6	0698-2057	R:FXD MET FLM 210.8Ω 0.25% 1/4W	
A2R7	0698-2062	R:FXD MET FLM 155.84Ω 0.1% 1/2W	
A2R8	0698-2063	R:FXD MET FLM 245.45Ω 0.1% 1/2W	
A2R9	0698-2056	R:FXD MET FLM 60.6Ω 0.25% 1/8W	
A2R10	0698-2063	R:FXD MET FLM 245.45Ω 0.1% 1/2W	
A2R11	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A2R12	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A2R13	0698-7383	R:FXD MET FLM 12.0Ω 0.5% 1/8W	
A2R14	0698-2064	R:FXD MET FLM 294.05Ω 0.1% 1/2W	
A2R15	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A2R16	0698-2058	R:FXD MET FLM 851.6Ω 0.25% 1/4W	
A2R17	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A2R18	0698-2060	R:FXD MET FLM 34.38Ω 0.25% 1/2W	
A2R19	0698-2059	R:FXD MET FLM 1291.4Ω 0.25% 1/4W	
A2R20	0698-2060	R:FXD MET FLM 34.38Ω 0.25% 1/2W	
A2R21	0698-3389	R:FXD MET FLM 17.8Ω 1% 1/2W	
A2R22	0698-4469	R:FXD MET FLM 1150Ω 1% 1/8W	
A2R23	0698-2055	R:FXD MET FLM 2600.0Ω 0.5% 1/8W	
A2R24	0698-3389	R:FXD MET FLM 17.8Ω 1% 1/2W	
A2R25	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A2R26	0698-2058	R:FXD MET FLM 851.6Ω 0.25% 1/4W	
A2R27	0698-2061	R:FXD MET FLM 51.30Ω 0.25% 1/2W	
A2R28	0698-4482	R:FXD MET FLM 17.4kΩ 1% 1/8W	
A2R29	0698-3391	R:FXD MET FLM 21.5Ω 1% 1/2W	
A2R30	0698-3390	R:FXD MET FLM 19.6Ω 1% 1/2W	
A2R31	0698-4482	R:FXD MET FLM 17.4kΩ 1% 1/8W	
A2R32	0757-0272	R:FXD MET FLM 52.3kΩ 1% 1/8W	
A2R33	0757-0378	R:FXD MET FLM 11.0Ω 1% 1/8W	
A2R34	0757-0346	R:FXD MET FLM 10.0Ω 1% 1/8W	
A2R35	0757-0346	R:FXD MET FLM 10.0Ω 1% 1/8W	

See list of abbreviations in introduction to this section

Table 6-2, Replaceable Parts (Cont'd)

Reference Designation	HP Part No.	Description	Note
A2R36	0757-0272	R:FXD MET FLM 52.3kΩ 1% 1/8W	
A2R37	0698-3159	R:FXD MET FLM 26.1kΩ 1% 1/8W	
A2R38	0698-3388	R:FXD MET FLM 14.7Ω 1% 1/2W	
A2R39	0757-0001	R:FXD MET FLM 13.3Ω 1% 1/2W	
A2R40	0698-3159	R:FXD MET FLM 26.1kΩ 1% 1/8W	
A2R41	0698-4482	R:FXD MET FLM 17.4kΩ 1% 1/8W	
A2R42	0698-3391	R:FXD MET FLM 21.5Ω 1% 1/2W	
A2R43	0698-3390	R:FXD MET FLM 19.6Ω 1% 1/2W	
A2R44	0698-4482	R:FXD MET FLM 17.4kΩ 1% 1/8W	
A2S1		SWITCH:P.C. BOARD NSR PART OF A1 BOARD	
	04437-5022	RAIL:MOLDED 4 REQ'D	
	04437-5023	SLIDE:MOLDED 4 REQ'D	
	04437-5025	ARM:MOLDED	
	1460-0313	CONTACT:SPRING 8 REQ'D	
A2S2		SWITCH:P.C. BOARD NSR PART OF A1 BOARD	
	04437-5022	RAIL:MOLDED 4 REQ'D	
	04437-5023	SLIDE:MOLDED 4 REQ'D	
	04437-5025	ARM:MOLDED	
	1460-0313	CONTACT:SPRING 8 REQ'D	
A2S3		SWITCH:P.C. BOARD NSR PART OF A1 BOARD	
	04437-5022	RAIL:MOLDED 4 REQ'D	
	04437-5023	SLIDE:MOLDED 4 REQ'D	
	04437-5025	ARM:MOLDED	
	1460-0313	CONTACT:SPRING 8 REQ'D	
J1	1510-0528	BINDING POST RED	
	04437-40001	INSULATOR:BINDING POST FRONT	
	04437-5030	INSULATOR:BINDING POST SHAFT	
	04437-3029	SCREW:BINDING POST	
J2	1510-0529	BINDING POST BLACK	
	04437-40001	INSULATOR:BINDING POST FRONT	
	04437-5030	INSULATOR:BINDING POST SHAFT	
	04437-3029	SCREW:BINDING POST	
J3	1510-0529	BINDING POST BLACK	
	04437-40001	INSULATOR:BINDING POST FRONT	

Table 6-2, Replaceable Parts (Cont'd)

Reference Designation	HP Part No.	Description	Note
J4	1510-0528	BINDING POST RED	
	04437-40001	INSULATOR:BINDING POST FRONT	
	04437-5030	INSULATOR:BINDING POST SHAFT	
	04437-3029	SCREW:BINDING POST	
J5	1510-0529	BINDING POST BLACK	
	04437-40001	INSULATOR:BINDING POST FRONT	
	04437-5030	INSULATOR:BINDING POST SHAFT	
	04437-3029	SCREW:BINDING POST	
J6	1510-0529	BINDING POST BLACK	
	04437-40001	INSULATOR:BINDING POST FRONT	
	04437-5030	INSULATOR:BINDING POST SHAFT	
	04437-3029	SCREW:BINDING POST	
P1	1250-0872	CONNECTOR:RF MALE PART OF W1	
P2	1250-0872	CONNECTOR:RF MALE PART OF W2	
P3	1250-0872	CONNECTOR:RF MALE PART OF W3	
P4	1250-0872	CONNECTOR:RF MALE PART OF W4	
W1	04436-7202	CABLE ASS'Y:INCLUDING P1	
W2	04436-7202	CABLE ASS'Y:INCLUDING P2	
W3	04436-7201	CABLE ASS'Y:INCLUDING P3	
W4	04436-7201	CABLE ASS'Y:INCLUDING P4	

See list of abbreviations in introduction to this section

Table 6-2, Replaceable Parts (Cont'd)

Reference Designation	HP Part No.	Description	Note
		MISCELLANEOUS	
	04436-1120	PANEL:FRONT HP	
	04436-1121	PANEL:FRONT YHP	
	5040-3316	FRAME:SIDE 2 REQ'D	
	04437-1127	COVER ASS'Y:TOP	
	04436-1126	COVER BOTTOM	
	5000-4197	COVER:SIDE 2 REQ'D	
	04437-3130	TRIM:FRONT PANEL 2 REQ'D	
	5060-0728	FOOT ASS'Y:HALF MOD 2 REQ'D	
	0370-0025	KNOB:ROUND 3 REQ'D	
	04437-5124	DIAL:MARKED "0 to 11"	
	04440-5124	DIAL:MARKED "0 to 9" 2 REQ'D	
	04437-1022	CHASSIS:FRONT	
	04437-1023	CHASSIS:MAIN	
	04436-1025	COVER:SHIELD BOTTOM	
	04437-1025	COVER:SHIELD TOP	
	04436-7023	COVER:ASS'Y:SHIELD A2 BOARD	
	04436-7024	COVER:ASS'Y:SHIELD A1 BOARD	
	04437-1030	ANGLE:L	
	04437-1031	ANGLE:L	
	04440-1033	ANGLE:L SIDE FRAME 2 REQ'D	
	1460-0314	SPRING:WIRE 3 REQ'D	
	04437-7023	CLICK ARM ASS'Y:DIAL 3 REQ'D	
	04440-1038	SPRING:ANGLE 2 REQ'D	
	04437-3021	SHAFT:CAM 3 REQ'D	
	04437-3022	STUD:ARM 3 REQ'D	
	04437-3024	STUD:SPRING 3 REQ'D	
	04437-5021	ARM:MOLDED 12 REQ'D	
	04437-5026	CAM:10 POSITION 2 REQ'D	
	04437-5027	CAM:12 POSITION	
	04437-5031	BUSH:CAM SHAFT:6 REQ'D	
	04436-3021	SPACER CONNECTION BETWEEN A1 AND A2	
	04436-1022	BRACKET:CAM SHAFT	

See list of abbreviations in introduction to this section

SECTION VII
MANUAL CHANGES AND OPTIONS

7-1. OPTIONS

7-2. Options are standard modifications performed on HP instruments at the factory. No options for the Model 4436A are offered at the present time.

7-3. SPECIAL INSTRUMENTS

7-4. "Specials" are standard HP instrument that are modified according to customer specifications. A separate insert sheet is included with the manual for special instruments having electrical changes. Make the changes specified in addition to any other changes that are necessary.

7-5. MANUAL CHANGES

7-6. This manual applies directly to the Model 4436A with serials prefixed 1217/1218. The following paragraph explains how to adapt this manual to apply to later instruments with higher serial prefix. Technical corrections to this manual (if any) are called errata and are listed on a separate "Manual Changes" sheet supplied with this manual.

7-7. LATER INSTRUMENTS: If the serial prefix of your Model 4436A is above 1217/1218J, refer to a separate "Manual Changes" sheet supplied with this manual. Locate the serial prefix of your instrument and make the indicated changes.

7-8. EARLIER INSTRUMENTS (Backdating Changes): If the serial prefix of your Model 4436A is below 1217/1218, refer to Table 7-1 for the changes necessary to adapt this manual to your particular instrument. Locate the serial prefix of number of your instrument in the table and make the indicated changes. Note that instrument component values that differ from those in this manual, yet are not listed in part number given in this manual.

Table 7-1. Backdating Changes

Instrument Serial Prefix or Number	Make Changes
1115J/1116J	1, 2
1218J-00225 and below	2

CHANGE 1

Page 6-4, Table 6-2. Replaceable Parts, Miscellaneous:

Change HP Part No. of PANEL:FRONT HP to 04436-1020
Change HP Part No. of PANEL:FRONT YHP to 04436-1021
Change HP Part No. of FRAME:SIDE to 5040-3310
Change HP Part No. of COVER ASS'Y:TOP to 04437-1127
Change HP Part No. of COVER:BOTTOM to 04436-1028
Change HP Part No. of COVER:SIDE to 04440-1031
Change HP Part No. of TRIM:FRONT PANEL to 04437-3030
Change HP Part No. of DIAL:MARKED "0 to 11" to 04437-5011
Change HP Part No. of DIAL:MARKED "0 to 9" to 04440-5024

CHANGE 2

Page 6-8, Table 6-2. Replaceable Parts, Miscellaneous:

Change HP Part No, of KNOB:ROUND 3 REQ'D to 0370-0310

SECTION VIII
CIRCUIT DIAGRAMS

8-1. INTRODUCTION

8-2. This section includes the following:

a. General Notes for schematic diagram.

b. Schematic Diagram and Parts Location illustration.

8-3. GENERAL NOTES

a. Unless otherwise indicated, resistance is in ohms, capacitance is in microfarads, and inductance is in microhenries.

b. Components assigned an asterisk(*) are factory selected, average values shown.

c. The components mounted on chassis or mainframe parts are not assigned an assembly designation (i.e. R1, Q1, etc.).

d. Reference designations (R1, Q1, etc.) within assembly (A1, A2, ... etc.) use assembly designation as prefix to form complete designation (i.e. R1 in A1 assembly A1R1).

e. The numbers (9.4.7) indicate the wire color code. Wire color code (MIL-STD-681) is the same as resistor color code. First number identifies ground color, second number identifies wide stripe, and third number identifies narrow stripe, i.e. (9.4.7) denotes white ground, yellow wide stripe, violet narrow stripe.

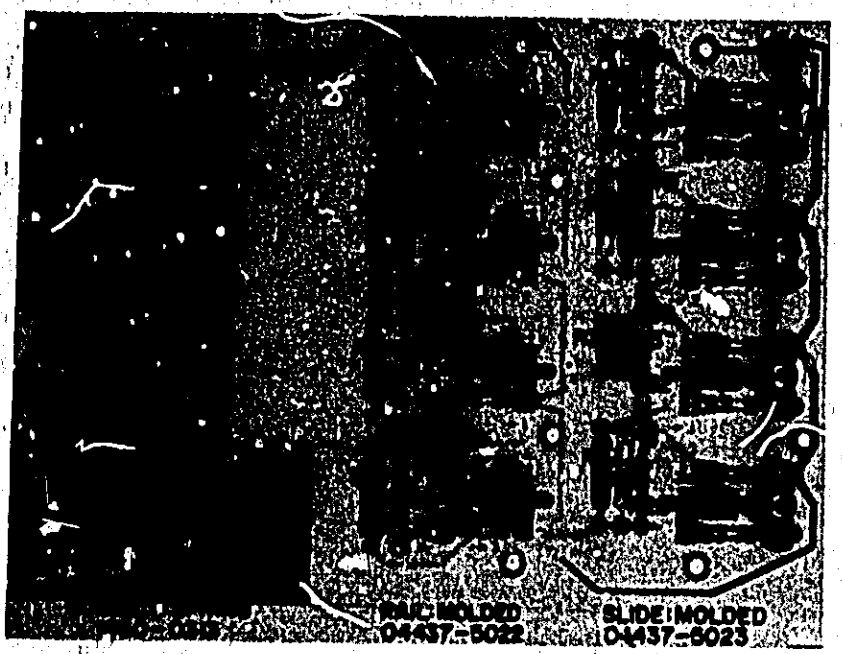


Figure 8-1. A1 Board Assembly

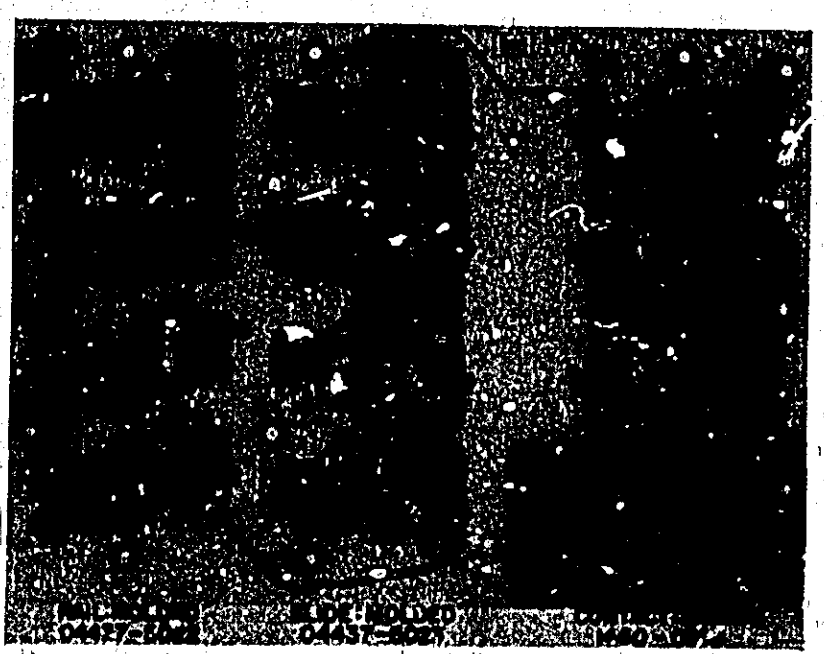


Figure 8-2. A2 Board Assembly

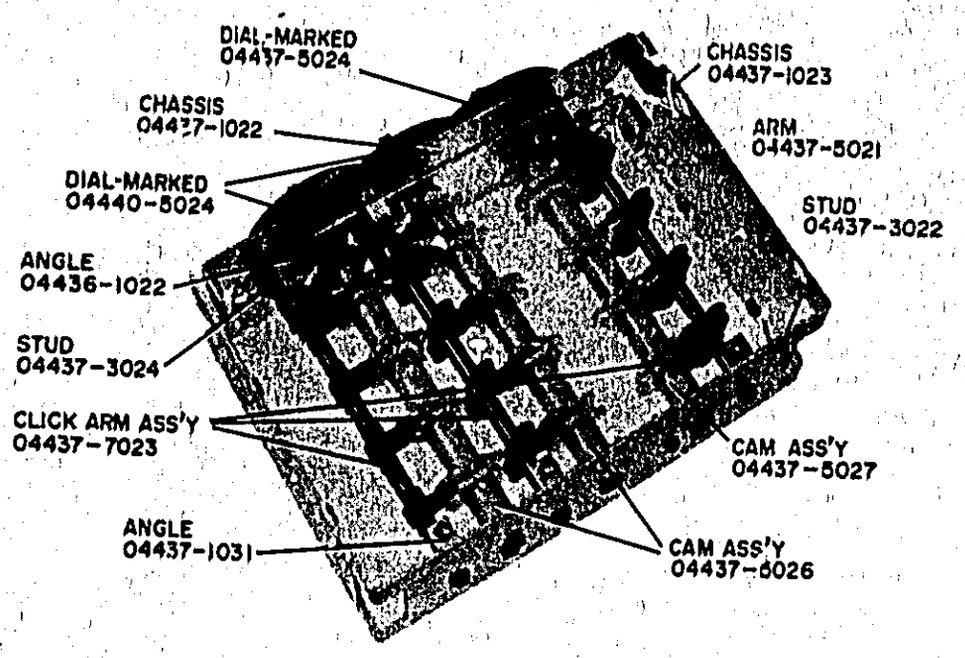


Figure 8-3. Cam Assembly

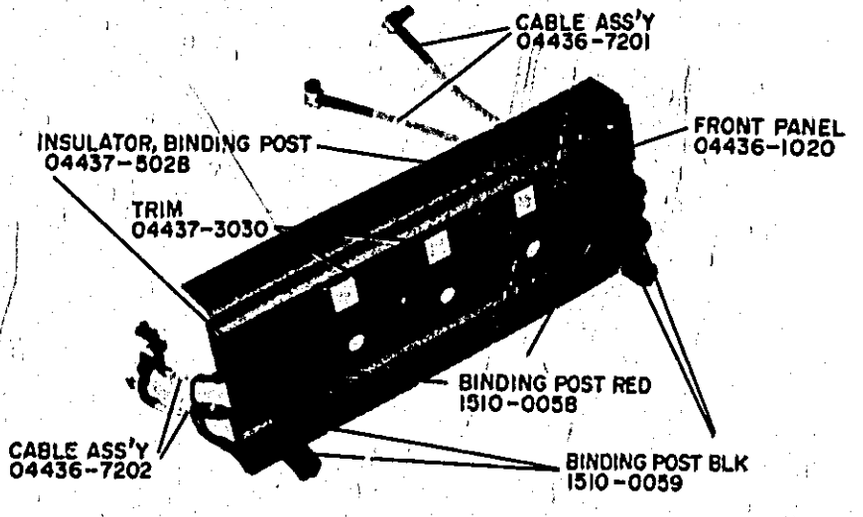
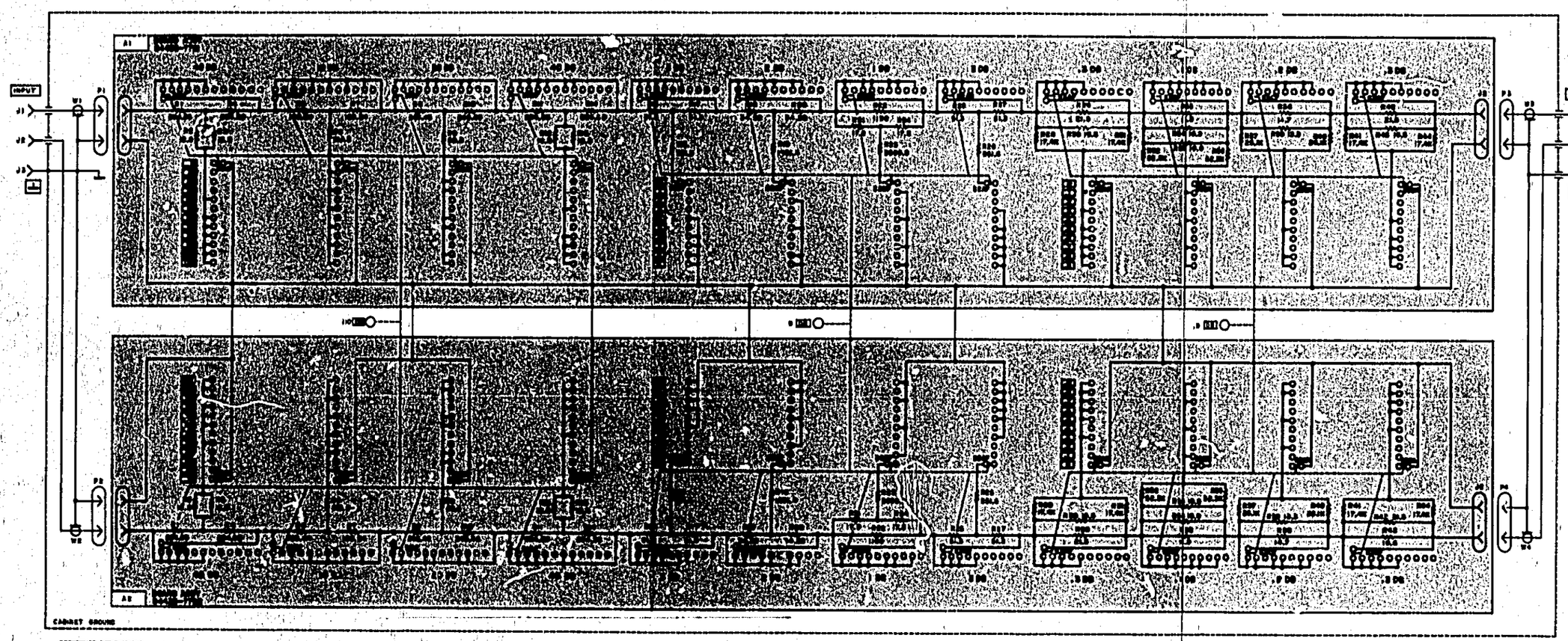


Figure 8-4. Front Panel



REFERENCE DESIGNATIONS

NO PREFIX	A1 ASSY	A2 ASSY
J1-J3 P1-P4 W1-W4	J1,J2 R1-R44 S1-S5	J1,J2 R1-R44 S1-S5

DELETED;

NOTES

1. SWITCHES SHOWN IN ZERO ATTENUATION POSITION
2. RESISTANCE VALUES ARE IN OHMS
3. ⏚ = CABINET GROUND

Figure 8-5. Model 4436A Schematic Diagram

MANUAL CHANGES

4436A

ATTENUATOR

MANUAL IDENTIFICATION

Model Number: 4436A
Date Printed: NOV. 1981
Part Number: 04436-90002

This supplement contains important information for correcting manual errors and for adapting the manual to instruments containing improvements made after the printing of the manual.

To use this supplement:
Make all ERRATA corrections.
Make all appropriate serial number related changes indicated in the tables below.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES	SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
ALL	ERRATA		

► NEW ITEM

ERRATA

Page 5-2, Table 5-2, AC Performance Test A:
Change the 'AC Voltmeter dB Range' as listed in Table 1.

Page 5-3, Table 5-3, AC Performance Test B:
Change the 'AC Voltmeter dB Range' as listed in Table 2.

Page 5-3, Table 5-4, AC Performance Test C:
Change the 'AC Voltmeter dB Range' as listed in Table 3.

NOTE

Manual change supplements are revised as often as necessary to keep manuals as current and accurate as possible. Hewlett-Packard recommends that you periodically request the latest edition of this supplement. Free copies are available from all HP offices. When requesting copies quote the manual identification information from your supplement, or the model number and print date from the title page of the manual.

HEWLETT PACKARD

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Table 1

Step	AC Voltmeter dB Range
1	+10
2	0
3	-10
4	-20
5	-30
6	-40
7	+10
8	0
9	-10
10	-20
11	-30
12	-40

Table 2

Step	AC Voltmeter dB Range
1	+10
2	-40
3	-40
4	-40
5	-40
6	-40
7	-40
8	-40
9	-40
10	-40
11	-40
12	-40
13	-40
14	-40
15	-40
16	-40
17	-40
18	-40
19	-40
20	-40

Table 3

Step	AC Voltmeter dB Range
1	+10
2	-40
3	-40
4	-40
5	-40
6	-40
7	-40
8	-40
9	-40
10	-40
11	-40
12	-40
13	-40
14	-40
15	-40
16	-40
17	-40
18	-40
19	-40
20	-40

▶ ERRATA

Page 8-3, Figure 8-4. Front Panel:
Change the figure as shown in Figure 1.

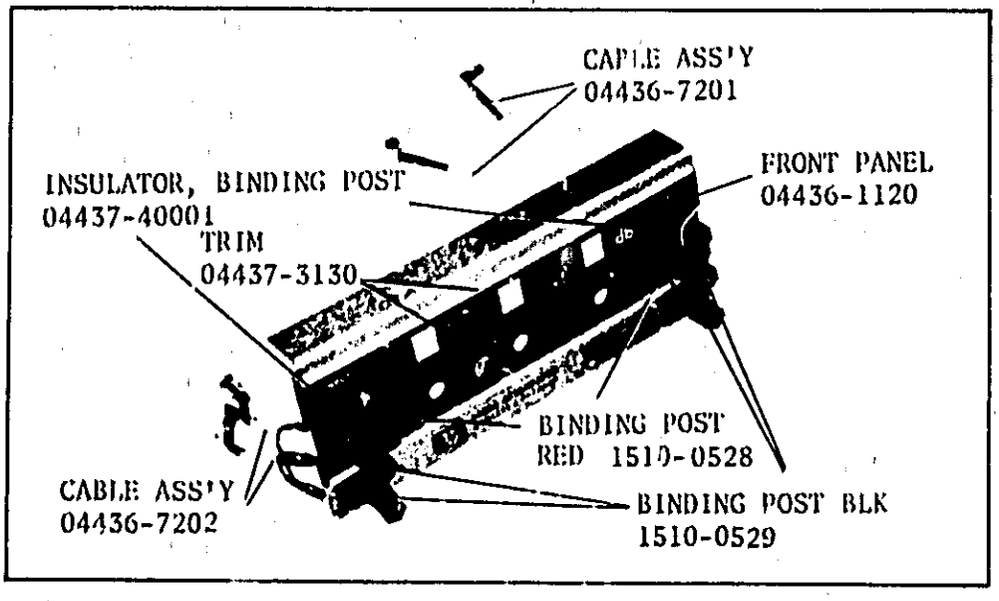

Figure 1