Errata

Title & Document Type: **1430A/B, 1431A, 1432A Samplers Operating and Service Manual**

Manual Part Number: **01430-90904**

Revision Date: **August 1970**

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HP References in this Manual

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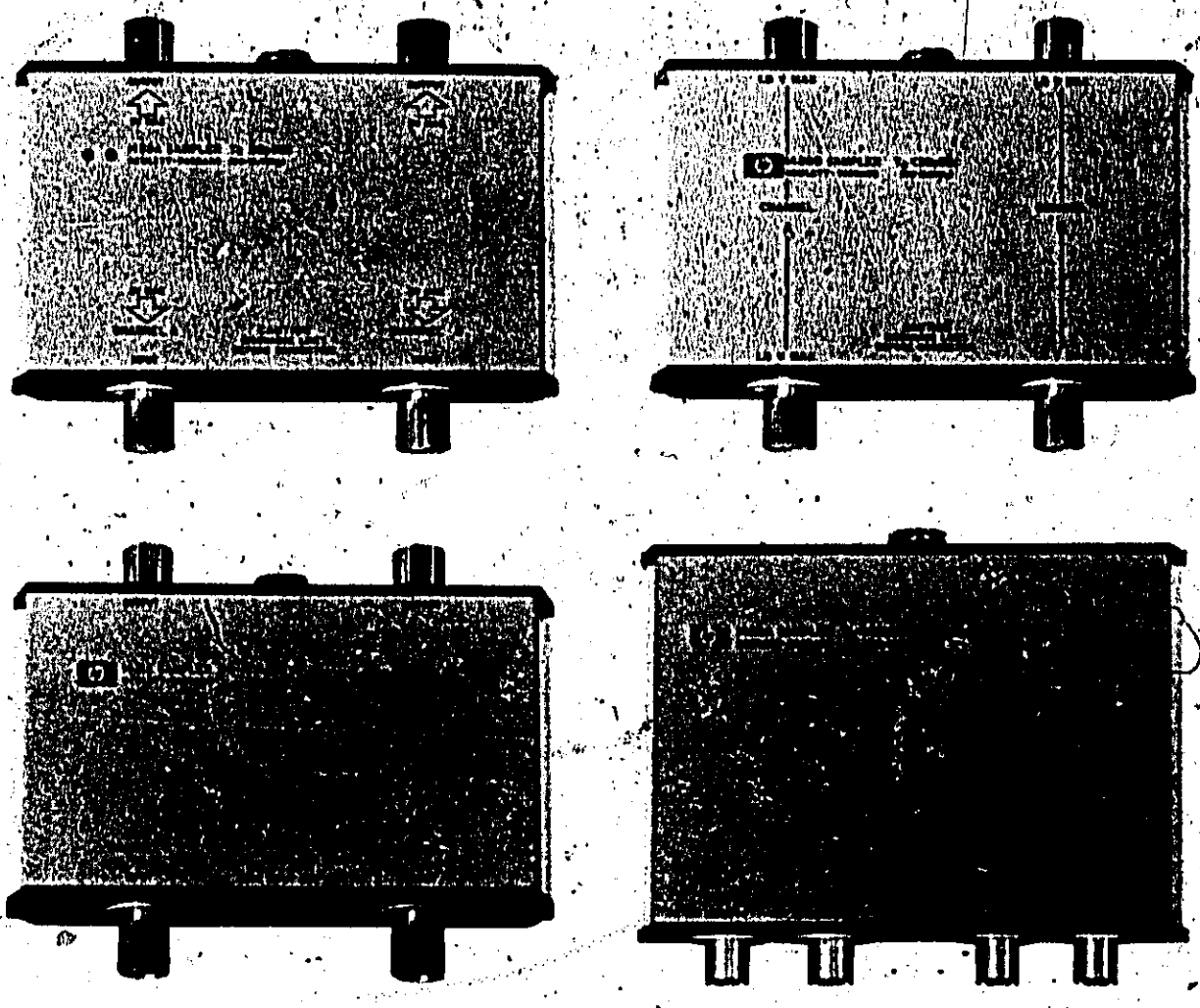
Agilent Technologies

OPERATING AND SERVICE MANUAL

SAMPLERS

1430A/B
1431A
1432A



HEWLETT hp PACKARD

HP 1430A/B, 31A, 32A

CERTIFICATION

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.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard. No other warranty is expressed or implied. We are not liable for consequential damages.

Service contracts or customer assistance agreements are available for Hewlett-Packard products that require maintenance and repair on-site.

For any assistance, contact your nearest Hewlett-Packard Sales and Service Office. Addresses are provided at the back of this manual.

OPERATING AND SERVICE MANUAL

MODELS
1430A/B, 1431A, 1432A
SAMPLERS

1430A	SERIALS PREFIXED:	810-
1430B	SERIALS PREFIXED:	959-
1431A	SERIALS PREFIXED:	819-
1432A	SERIALS PREFIXED:	801-

Refer to Section VII for instruments with other Serial Prefixes.

CAUTION

Both diodes in a sampler will burn out only due to excessively large input voltage. If both diodes are destroyed, the equipment warranty will be void. Refer to the specifications table in Section I for maximum safe input voltages.

HEWLETT-PACKARD COMPANY/COLORADO SPRINGS DIVISION
1900 GARDEN OF THE GODS ROAD, COLORADO SPRINGS, COLORADO, U.S.A.

Manual Part Number 01430-90904
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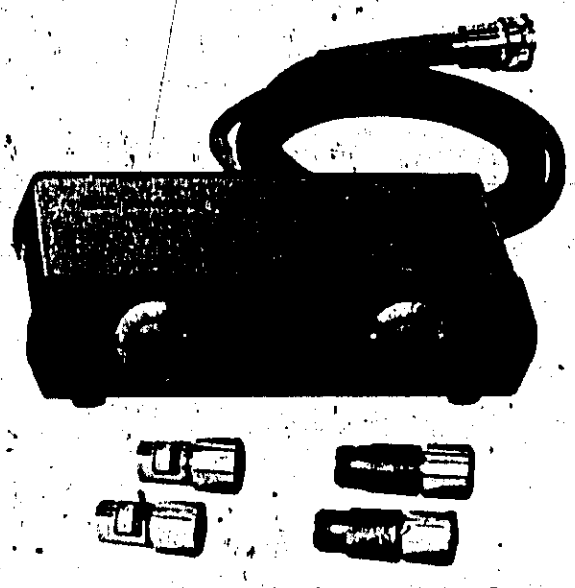
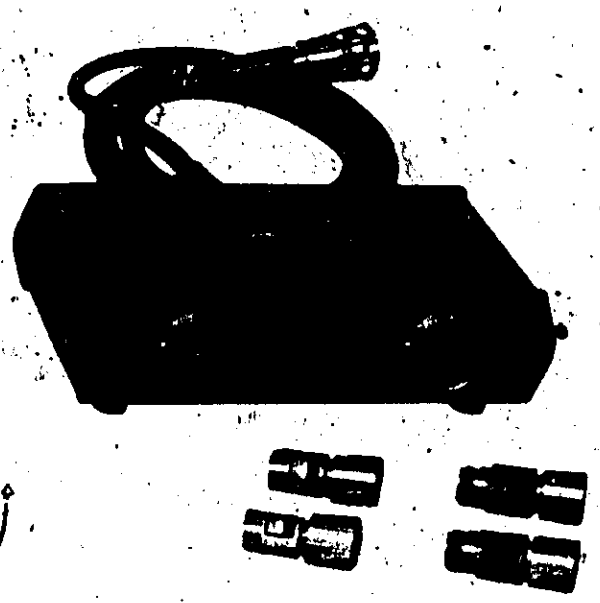
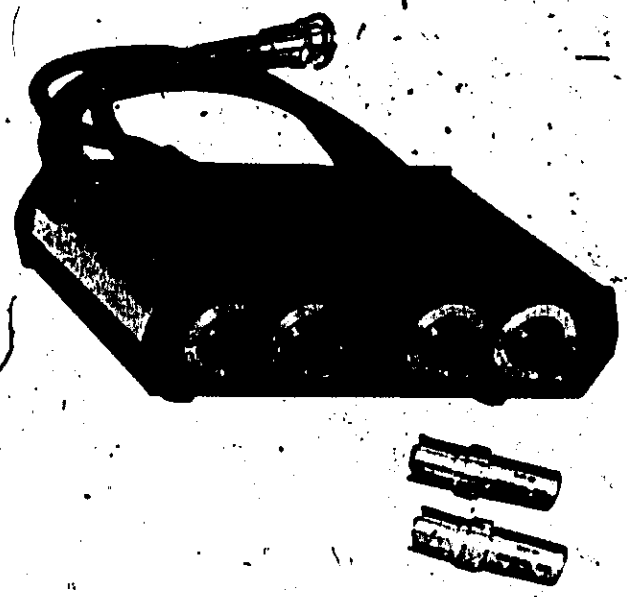


Model 1430A/B



Model 1431A



Model 1432A

1430A/B—R-3

Figure 1-1. Model 1430A/B, Model 1431A, Model 1432A Samplers

SECTION I.

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This section contains complete instrument specifications. A description of features and data for instrument and manual identification.

1-3. SCOPE OF MANUAL.

1-4. This manual provides operating and service information for HP Model 1430A, 1430B, 1431A and 1432A Samplers. All aspects of the instruments are covered in eight sections, each of which can be referred to for specific details by use of the table of contents. Schematics are located at the rear of the manual on fold out pages that permit reference to the text and a block diagram is in Section IV. The information in this manual is supplemented by that presented in the Hewlett-Packard Model 1411A Sampling Vertical Amplifier and 140-series oscilloscope Operating and Service Manuals. For information about these instruments refer to the manual for that particular instrument.

1-5. INSTRUMENT DESCRIPTION.

1-6. The Models 1430A, 1430B, 1431A, and 1432A Samplers (Figure 1-1) are two-channel remote samplers designed for use with the Model 1411A Sampling Vertical Amplifier.

1-7. The Models 1430A and 1430B provide a pulse response with minimal overshoot for accurate measurement of fast-rise pulses. Response and feedthrough inputs make them ideal for TDR measurements. The Model 1430B has a bandwidth from dc to approximately 18 GHz.

1-8. The Model 1431A differs slightly from the Model 1430A, having a very flat bandwidth and low VSWR at the expense of increased overshoot. Phase shift measurements can be made to within a few degrees. Both the Model 1430A and Model 1431A have a bandwidth from dc to approximately 12.4 GHz.

1-9. The Model 1432A is a lower priced version of the Models 1430A and 1431A. Risetime is 90 picoseconds (corresponding to a bandwidth from dc to 4 GHz). A deflection factor of 1 mv/div and feedthrough inputs permit accurate measurement of cw signals and fast pulses. This permits the instrument to be used for time domain reflectometry (TDR).

1-10. The standard five foot, or optional 10 foot interconnecting cable allows the sampler to be placed right at the test point, thus eliminating losses caused by long test probe leads.

1-11. ACCESSORIES.

1-12. Accessories provided with the Models 1430A, 1430B and 1431A include two Amphenol APC-7 to female Type N adapters (HP 11524A) and two 50-ohm terminations (HP 909A). Accessories provided with the Model 1432A are two 50-ohm terminations, (GR Model 874W-50).

1-13. MANUAL IDENTIFICATION.

1-14. Hewlett-Packard uses a two section serial number to identify instruments. The first section (000-00000) is the serial prefix and identifies a group of instruments; the second section identifies a particular instrument in that group. The serial number appears on a plate located on the bottom of the instrument housing. When corresponding with a Hewlett-Packard Sales/Service Office regarding any instrument, refer to the complete serial number of that instrument.

1-15. Information in this manual applies directly to instruments with serial prefixes as shown on the title page of the manual. If the serial prefix on the instrument is not the same as the serial prefix on the title page, a Manual Changes sheet supplied with the manual or the information in Section VII will define the differences between that instrument and the one described in this manual. The change sheet may also contain corrections to this manual due to errors that existed when the manual was printed. These corrections are called Errata. For information pertaining to the instrument, manual or change sheets, contact the nearest Hewlett-Packard Sales/Service Office.

Table 1-1. Specifications (When used with Model 1411A)

Model 1430A

RISETIME: Approx 28 ps. (< 35 ps observed with 1105A/1106A pulse generator and 909A 50-ohm load.)

BANDWIDTH: DC to approx 12.4 GHz.

OVERSHOOT: < 5%.

NOISE: < 10 mV unsmoothed; < 2.5 mV smoothed. Both measured tangentially.

DYNAMIC RANGE: ±1 volt.

LOW FREQUENCY DISTORTION: < ±3%.

MAXIMUM SAFE INPUT: ±3 volts.

INPUT CHARACTERISTICS:

Mechanical: Amphenol APC-7 precision 7mm connectors on input and output.

Electrical: 50-ohm feedthrough, dc coupled. Reflection from sampler is approx 10%, using a 40 ps TDR system. Pulses emitted from sampler input are approx 10 mV in amplitude and 5 ns in duration. VSWR < 3:1 at 12.4 GHz.

TIME DIFFERENCE BETWEEN CHANNELS: < 5 ps.

CONNECTING CABLE LENGTHS: 5 ft (for longer cable, see options below).

WEIGHT: Net, 4 lb (1,8 kg). Shipping, 9 lb (4,1 kg).

ACCESSORIES PROVIDED: Two Amphenol APC-7 to female Type N adapters (HP Model 11524A). Two 50-ohm loads (HP Model 909A).

OPTIONS: C01; 10 ft. connecting cable.

Model 1430B

RISETIME: Approx 20 ps. (< 28 ps observed with 1105/1106A pulse generator and 909A 50-ohm load).

BANDWIDTH: DC to approx 18 GHz.

OVERSHOOT: < 7.5%

NOISE: < 10 mV unsmoothed; < 2.5 mV smoothed. Both measured tangentially.

DYNAMIC RANGE: ±1 volt.

LOW FREQUENCY DISTORTION: < ±5%.

MAXIMUM SAFE INPUT: ±3 volts.

INPUT CHARACTERISTICS:

Mechanical: Amphenol APC-7 precision 7 mm connectors on input and output.

Electrical: 50-ohm feedthrough, dc coupled. Reflection from sampler is approx 10%, using a 40 ps TDR system. Pulses emitted from sampler input are approx 10 mV in amplitude and 5 ns in duration.

TIME DIFFERENCE BETWEEN CHANNELS: < 5 ps.

CONNECTING CABLE LENGTHS: 5 ft (for longer cable see options).

WEIGHT: Net, 4 lb (1,8 kg). Shipping, 9 lb (4,1 kg).

ACCESSORIES PROVIDED: Two Amphenol APC-7 to female Type N adapters (HP Model 11524A). Two 50-ohm loads (HP Model 909A).

OPTIONS: C01; 10 ft connecting cable.

Table 1-1. Specifications (When used with Model 1411A) (Cont'd)

Model 1431A

BANDWIDTH: Dc to > 12.4 GHz (< 3 db down from a 10 cm dc reference).

RISETIME: Approx 28 ps.

VSWR:

DC to 8 GHz	1.4:1
8 to 10 GHz	1.6:1
10 to 12.4 GHz	2.0:1

NOISE: < 10 mV unsmoothed; < 2.5 mV smoothed. Both measured tangentially.

DYNAMIC RANGE: ±1 volt.

LOW FREQUENCY DISTORTION: < ±3%.

MAXIMUM SAFE INPUT: ±3 volts.

INPUT CHARACTERISTICS:

Mechanical: Amphenol APC-7 precision 7 mm connector used on input and output.

Electrical: 50-ohm feedthrough, dc coupled. Reflection from sampler is approx 5%, using a 40 ps TDR system. Pulses emitted from sampler input are approx 10 mV in amplitude and 5 ns in duration.

PHASE SHIFT BETWEEN CHANNELS: < 10° at 5 GHz, typically less than 2° at 1 GHz.

CONNECTING CABLE LENGTHS: 5 ft (for longer cable, see options).

WEIGHT: Net, 5 lb. (1,8 kg). Shipping, 9 lb. (4,1 kg).

ACCESSORIES PROVIDED: Two Amphenol APC-7 to female Type N adapters (HP 11524A). Two 50-ohm loads (HP Model 909A).

OPTIONS: C01; 10 ft. connecting cable.

Model 1432A

RISETIME: < 90 ps.

BANDWIDTH: DC to 4 GHz.

OVERSHOOT: < ±5%.

NOISE: < 4 mV unsmoothed; < 2 mV smoothed. Both measured tangentially.

DYNAMIC RANGE: ±1 volt.

LOW FREQUENCY DISTORTION: < ±3%.

MAXIMUM SAFE INPUT: ±5 volts.

INPUT CHARACTERISTICS:

Mechanical: GR type 874 connectors used on input and output.

Electrical: 50-ohm feedthrough, dc coupled. Reflection from sampler is approx 15%, using a 90 ps TDR system. Pulses emitted from sampler input are approx 50 mV in amplitude and 10 ns wide.

TIME DIFFERENCE BETWEEN CHANNELS: < 25 ps.

CONNECTING CABLE LENGTH: 5 ft (for longer cable, see options).

WEIGHT: Net, 4 lb. (1,8 kg). Shipping, 9 lb. (4,1 kg).

ACCESSORIES PROVIDED: Two GR Model 874-W50 50-ohm loads.

OPTIONS: C01; 10 ft connecting cable.

SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains information for making a visual and electrical inspection of the instrument, processing a claim, repackaging for shipment and preparation for use.

2-3. INITIAL INSPECTION.

2-4. Inspect the instrument upon receipt for external damage such as bent or broken connectors, and dents or scratches on the panel surface that may have occured in transit. If damage is found, refer to Paragraph 2-8 for recommended claim procedure.

2-5. Check the electrical performance as soon as possible after receipt; refer to Section V for recommended performance check. These checks, when performed, verify that the instrument is operating within the specifications listed in Table 1-1. Initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the instrument does not operate as specified, refer to Paragraph 2-8 for claim procedure.

2-6. PREPARATION FOR USE.

2-7. Connect the interconnecting cable (supplied with each sampler) between the interconnecting jack on the sampler and the front panel interconnecting jack on the Model 1411A. The sampler is now ready for use. All necessary operating voltages are provided by the Model 1411A.

2-8. CLAIMS.

2-9. The warranty statement applicable to this instrument is provided inside the front cover of this manual. If physical damage is found or if the operation is not as specified when the instrument is first received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office immediately (see list in back of manual for addresses). The Sales/Service Office will arrange for repair or replacement without waiting for settlement of the claim with the carrier.

2-10. REPACKAGING FOR SHIPMENT.

2-11. When shipping an instrument to a Hewlett-Packard Sales/Service Office for service or repair, attach a tag showing owner (with address), instrument model number, full serial number of the instrument and description of the service or repair required.

2-12. Use the original carton and packaging material for shipping. If the original material is not available or reusable, use the following.

a. A double-walled carton, refer to Table 2-1 for test strength required.

b. Heavy paper or sheets of cardboard to protect all instrument surfaces; use a nonabrasive material such as polyurethane or cushioned paper such as Kimpak around all projecting parts.

c. At least 4 inches of tightly-packed, industry approved shock-absorbing material such as extra firm polyurethane foam.

d. Heavy-duty shipping tape for securing outside of carton.

Table 2-1. Shipping Carton Test Strength

Gross Weight (lb)	Carton Test Strength (lb)
up to 10	200
10 to 30	275
30 to 120	350
120 to 140	500
140 to 160	600

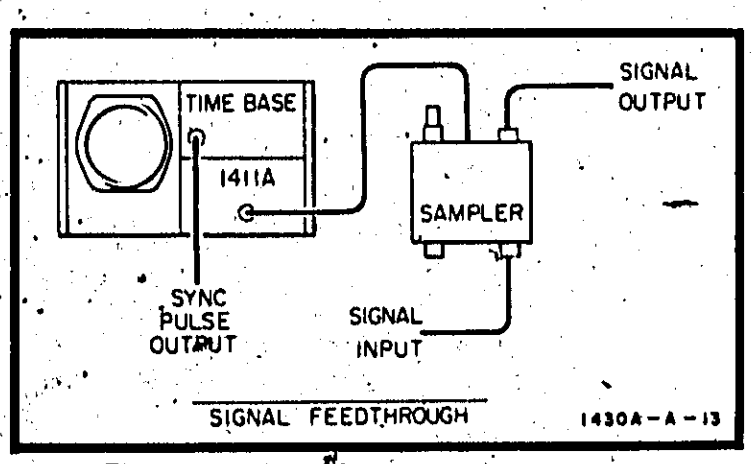


Figure 3-1. Signal Feed-through Test Setup

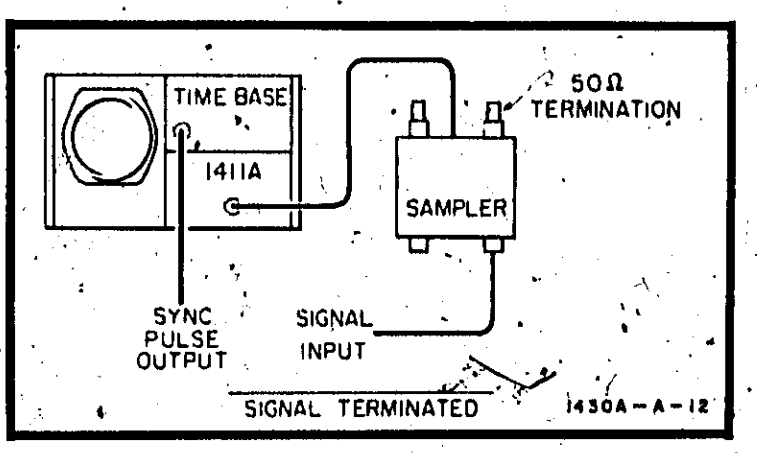


Figure 3-2. Test Setup with Signal Terminated

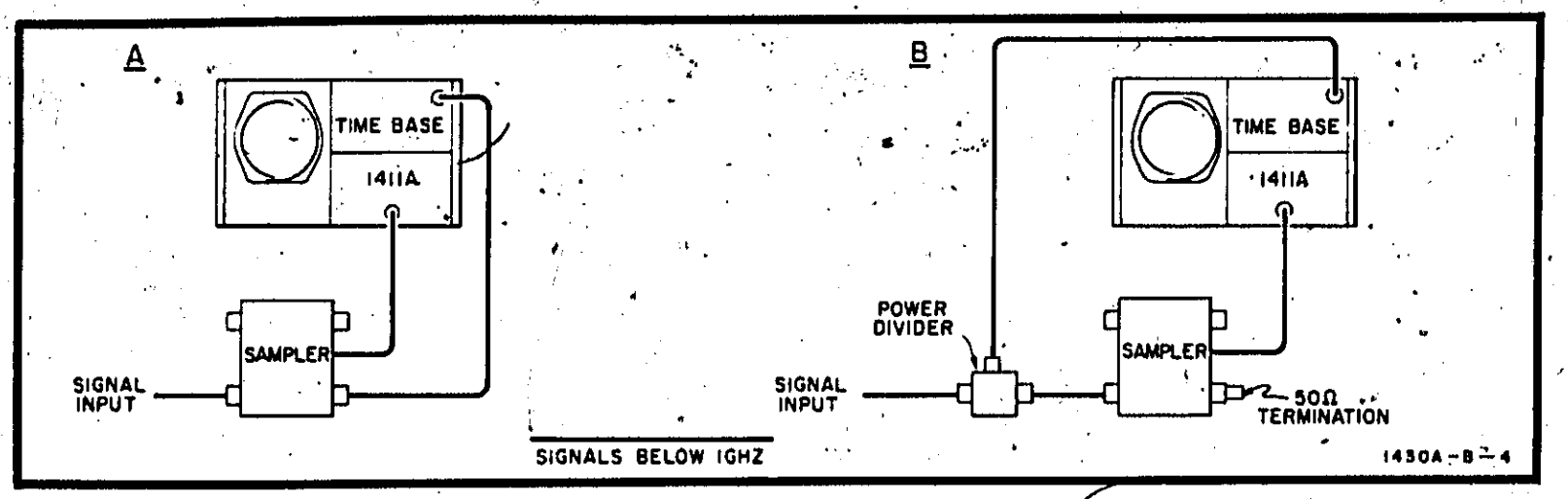


Figure 3-3. Triggering Time Base from Sampler

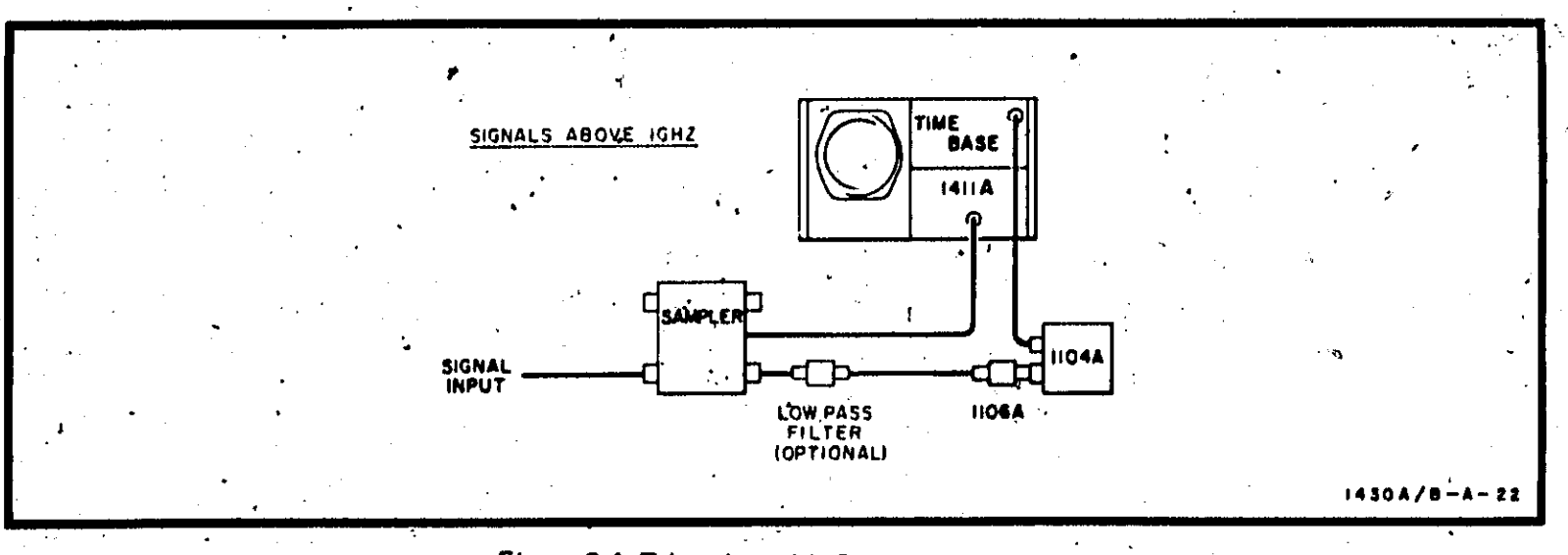


Figure 3-4. Triggering with Countdown Device

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section includes operating considerations and general operating instructions, supplementing the information provided in the Model 1411A Sampling Vertical Amplifier Operating and Service Manual.

3-3. The Models 1430A, 1430B, 1431A and 1432A Samplers permit sampling of high-frequency, low-level signals with a minimum of disturbance. Two independent signal channels are provided, enabling accurate time comparisons to be made between signals.

3-4. INPUT/OUTPUT CONNECTORS.

3-5. TYPE.

3-6. The INPUT/OUTPUT connectors of the Models 1430A, 1430B, and 1431A are Amphenol APC-7 coaxial type. Connectors for the Model 1432A are GR type 874. Mating connectors are available with many types of adapters. Refer to an appropriate catalog to determine the availability of connector adapters for your specific requirements.

3-7. DESCRIPTION.

3-8. Each INPUT/OUTPUT is a feed-through type connector with a characteristic impedance of 50 ohms. A signal applied to the INPUT passes unattenuated thrbugh the 50-ohm line to the OUTPUT. This permits signals in 50-ohm systems to be observed without terminating or loading the system under test (Figure 3-1).

3-9. OPERATING PROCEDURES.

3-10. The set up of the Models 1430A, 1431A and 1432A for optimum response is covered in the Operating and Service Manual for the Model 1411A Sampling Vertical Amplifier. To set up the Model 1430B, follow the instructions for the Model 1430A with the exception that the observed risetime of the Model 1430B, when used with the Model 1105A/1106A Pulse Generator, is 28 ps.

3-11. OPERATING CONSIDERATIONS.

3-12. CABLES.

3-13. To minimize loss of risetime caused by high-frequency losses in cables, use large diameter cable, such as RG214/U. Cable length must be kept to a minimum. Cable length becomes increasingly more important as the risetime of the signal approaches the risetime limits of the sampler; even one foot of cable will noticeably degrade risetime. All cable connections must be made securely. Loose fitting connectors can cause undesirable reflections and degrade the sighal. If critical time comparisons are being made between two signals, use connecting cables of equal length.

3-14. SIGNAL TERMINATION.

3-15. If the feed-through feature of the sampler is not being used, the signal must be terminated with a 50-ohm impedance (Figure 3-2). Failure to terminate the signal will result in reflections that make the display invalid.

3-16. If the sampler output is used to trigger the time base, it is not necessary to terminate the system since the external trigger input of the time base has an input impedance of 50 ohms (Figure 3-3A). This setup can be used with any signal under 1 GHz.

3-17. When the signal is split before being applied to the sampler INPUT, a power divider must be used (Figure 3-3B). Using this test setup, the sampler OUTPUT must be terminated. If a 50-ohm Tee connector is used, the resulting source impedance of the two inputs will be 25 ohms each, resulting in an impedance mismatch to both the time base trigger input and the sampler INPUT.

3-18. If the signal is above 1 GHz, a countdown device such as the HP Model 1104A/1106A Trigger Countdown must be used to reduce the frequency of the signal being applied to the time base (Figure 3-4). A low-pass filter such as the HP Model 1109A may be used to prevent signals generated by the tunnel diode mount from feeding into the signal channel.

3-19. USING MODEL 1430B WITH CW SIGNALS.

3-20. When using the Model 1430B to observe CW signals above 12.4 GHz the signal must be fed into the feed-through samplers through the connector nearest the power cable. If the signal is fed into the other connector, the standing waves which are reflected from the discontinuity created by the low frequency pick-off resistor, R105, will create ripples in the frequency response characteristics of the Model 1430B. See Figure 3-5. If the signal is fed into connector #1 the signal seen by the sampling gate consists of only the incident signal, plus any signal reflected from the device connected to connector #2 (Figure 3-5 B and C). If signal is fed into connector #2 the signal seen by the sampling gate

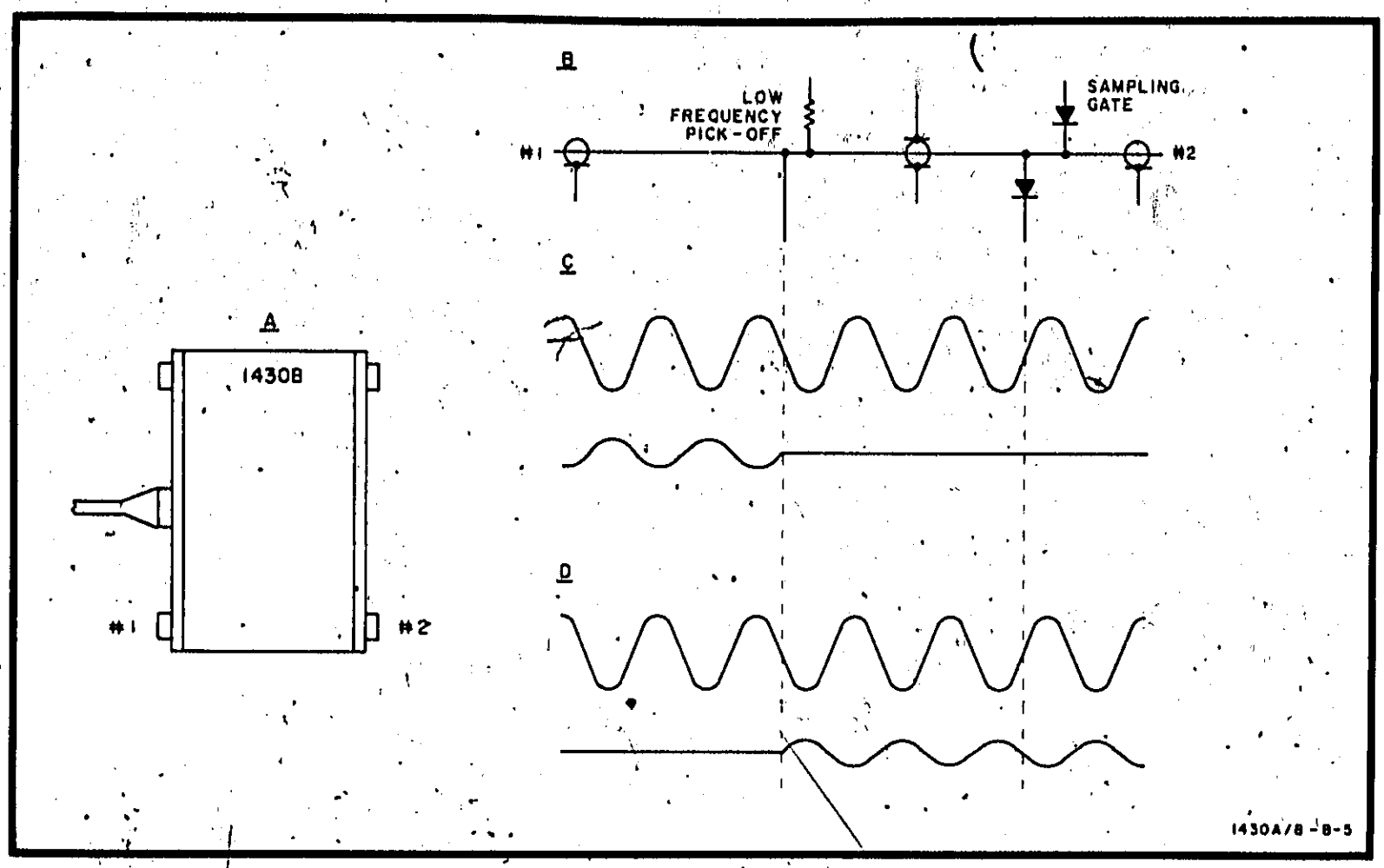


Figure 3-5. Using 1430B with High-Frequency CW Signal

consists of the incident signal plus the signal reflected from the low frequency pick-off resistor (Figure 3-5 B and D).

3-21. CHANGING SAMPLERS.

3-22. When the sampler is originally connected to the Model 1411A, or when the sampler is used with a different Model 1411A, the MILLIVOLTS/CM CAL and VERT CAL adjustments on the Model 1411A front panel must be performed to recalibrate vertical sensitivity. Refer to the Model 1411A Operating and Service Manual for calibration procedures.

3-23. OPERATING PRECAUTIONS.

3-24. MAXIMUM SAFE INPUT.

3-25. Dynamic range of the samplers is ±1 volt. Signal inputs exceeding this value will cause distortion of the signal being observed.

CAUTION

Signal Inputs to the Model 1430A, 1430B or 1431A must not exceed ±3 volts. Inputs to the Model 1432A must not exceed ±5 volts. Costly damage to the sampler will occur if higher voltages are applied.

3-26. Signal levels can be reduced to safe levels by using attenuators. HP offers a wide variety of precision 50-ohm coaxial attenuators in both fixed and variable models. For information about attenuators for specific needs, refer to an HP catalog or consult an HP Sales/Service Office.

3-27. ROUGH HANDLING.

3-28. The extremely high frequency operation of the instrument is made possible by the diodes located within each sampling block. The sampling block and diodes are factory assembled using the most advanced packaging methods possible. However, the instrument should be handled gently, avoiding all mechanical shocks as much as possible. If a malfunction is suspected, MAKE NO ATTEMPT TO DISASSEMBLE THE SAMPLING BLOCKS EXCEPT AS OUTLINED IN SECTION VIII OF THIS MANUAL.

3-29. WIDE-BAND TDR.

3-30. GENERAL.

3-31. In the transmission of electrical information, fidelity is very important. The received information must resemble the transmitted information. The propagating vehicle may distort or delete some of the information. Once a distortion condition is found, the nature and location of the distortion must be determined before the problem

can be corrected. There are many methods for determining that a problem exists, but few which determine the location and characteristics of the problem.

3-32. Time domain reflectometry (TDR) is a test method for determining the location and nature of distortion causes. An incident pulse is transmitted into a system. When the incident pulse encounters a change of impedance in the line (discontinuity), a certain portion of the pulse amplitude is reflected back to the source (echo). Energy reflected becomes an indication of transmission loss. The reflected energy is displayed on an oscilloscope CRT plotted as a series of voltages with respect to time or distance.

3-33. The wide-band sampling system may be used for TDR tests when connected as shown in Figure 3-6. The TDR system will detect discontinuities separated by less than 1 centimeter over the entire frequency range of the sampling system.

CAUTION

Before making any connections to the system or line to be tested, discharge any static charge that may be present in the cable.

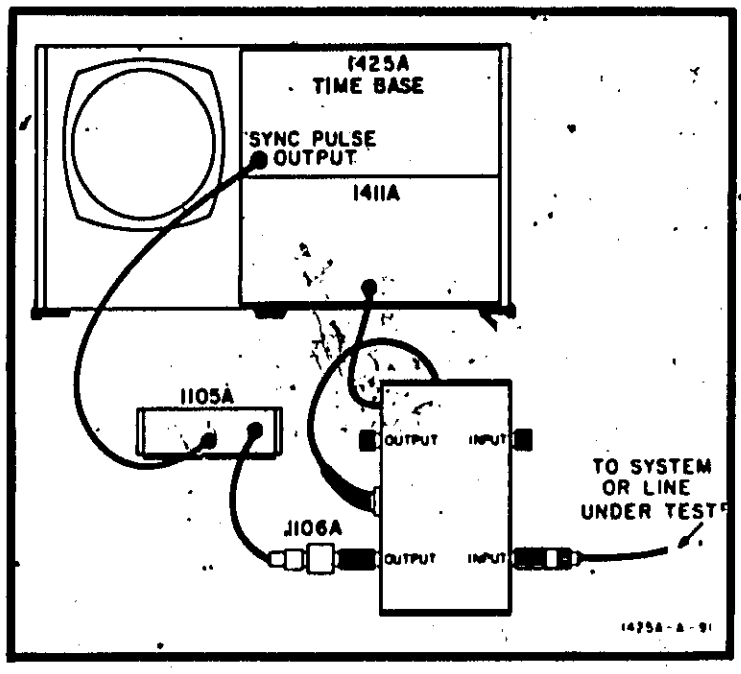


Figure 3-6. TDR Connections

3-34. This charge occurs most often in cables over 10 feet in length. Failure to discharge the cable may result in costly damage to the sampling diodes and/or the Model 1106A Tunnel Diode Mount.

3-35. DISPLAY INTERPRETATION.

3-36. When the incident pulse reaches the end of an unterminated line (infinite impedance), the full amplitude of the incident pulse is reflected back, increasing the standing voltage at the source by the amplitude of the original pulse. Conversely, a short at the end of the line reflects back a drop to 0 volt at the source.

3-37. The initial reaction of an incident pulse to a capacitance in a line is as to a short. The capacity charges toward the level of the applied incident pulse with an RC time constant.

3-38. The initial reaction of an incident pulse to an inductance is as to an open circuit. The reactance decays to a short circuit with an LR time constant.

3-39. A single cable fault often shows up as a small positive or negative deflection on the trace. A positive deflection may be caused by either a short section of higher impedance line or a series inductance. A negative deflection may be caused by a short section of line with lowered impedance or a shunt capacitance. A pinched cable displays a shunt capacitance since the outer conductor is closer to the center conductor. The value of an inductance or capacitance may be approximated by measuring the peak amplitude of the deflection and width at the 50% points and using this information in the applicable formulas described in the HP Application Notes for TDR testing.

3-40. Hewlett-Packard Application Notes 62 and 67 provide complete formulas and operating data for performing TDR tests. Application Notes may be obtained by contacting the nearest HP Sales/Service Office.

3-41. REMOTE SAMPLER SELECTION.

3-42. Any one of four remote samplers can be used in the test setup (Model 1430A, 1430B, 1431A, or 1432A). Before using the Model 1431A in TDR operations, consult the local HP Sales/Service Office. The Model 1431A is optimized for sine wave response. The Models 1430A, 1430B and 1432A may be used with the Model 1108A Pulse Generator instead of the Model 1106A. The Model 1108A is less expensive than the Model 1106A. When the Model 1430A or 1430B is used with the Model 1108A, some system risetime is sacrificed.

3-43. RISETIME.

3-44. The risetime of the system is very important in detecting and resolving discontinuities. With greater system risetime, the frequency spectrum is increased and smaller discontinuities can be detected and resolved. Frequency (risetime) is lost each time an incident pulse encounters a discontinuity and reflects. When the Model 1430A, or 1430B is used, system RESPONSE must be adjusted for optimum risetime. In any system, the RESPONSE adjustment will reduce noise, but will tend to reduce system sensitivity.

3-45. REFLECTION COEFFICIENT (ρ).

3-46. Reflection coefficient (ρ) is a term used to describe the quality of a system tested using TDR. The ρ of a system is described by the formula:

$$\rho = E_r/E_i$$

where: E_i = the input voltage of the incident pulse.
E_r = the reflected voltage.

3-47. For a system with an incident pulse of 1 volt and a single discontinuity producing a reflection of 0.1 volt, the ρ would be 0.1. Transmission lines normally do not have single large discontinuities, but have a series of small discontinuities. While a single small discontinuity causes very little distortion, a series of small discontinuities reflecting back and forth during a transmission period will seriously degrade transmitted information.

3-48. Overlays are available from Hewlett-Packard to directly indicate values of ρ for several sensitivities on a CRT display. A slide-rule calculator (HP Time Domain Reflectometer) may be used to quickly calculate values of ρ for any displayed reflection. Contact the nearest Hewlett-Packard Sales/Service Office to obtain either overlays or the calculator.

NOTE

A pair of overlays in the rear of the Model 1411A manual allow direct selection of ρ-per-centimeter sensitivities.

3-49. OPERATING PROCEDURE.

3-50. To use the sampling system in TDR operations, set it for free-run operation. The sync pulse is used to trigger the incident pulse generator. Display the pulse generator output as a step waveform. Magnification of the display may be obtained by adjusting the MAGNIFIED POSITION control on the time base plug-in to place the intensified dot in the area desired. Display resolution may be increased by selecting greater sensitivity on the Model 1411A.

3-51. To obtain maximum accuracy for any display, use maximum dot density and photograph a trace at a slow scan speed.

3-52. Calculate the reflection coefficient ρ of the system under test by using the following formula: (Refer to Paragraph 3-46).

$$\rho = E_r/E_i$$

where: E_i = the input voltage of the incident pulse.

E_r = the reflected voltage.

3-53. To determine horizontal sensitivity in feet per centimeter on the display, use the setting of the TIME/CM switch in the following formula:

$$\text{ft/cm} = (\text{TIME/CM}) \frac{1}{2\sqrt{K}}$$

where: K = dielectric constant for the transmission line under test.

3-54. For a polyethylene line, $K = 2.3$ or TIME/CM multiplied by 0.33 ft/ns. For an air line, $K = 1.0$ or TIME/CM multiplied by 0.5 ft/ns. Example: if TIME/CM were set to 50 nSEC and a polyethylene line tested, each centimeter on the CRT would represent 16.5 feet along the line. If the X100 MAIN SWEEP MAGNIFIER were used, each centimeter would represent 0.165 foot.

3-55. The HP Time Domain Reflectometer may be used to calculate ρ and distance along a line under observation to determine the characteristics and location of a discontinuity.

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section includes circuit theory analysis of the Models 1430A, 1430B, 1431A, and 1432A Samplers. All four samplers are designed to operate in conjunction with a Model 1411A Sampling Vertical Amplifier. Basic sampling theory as well as detailed theory of the vertical amplifier is described in the Model 1411A Operating and Service Manual and it is recommended that these explanations be studied first.

4-3. Circuit analysis will first be explained on a block diagram basis, applicable to all four samplers. Specific theory for the samplers follows the general explanation.

4-4. OVER-ALL DESCRIPTION.

4-5. Figure 4-1 shows an over-all block diagram of the sampler. It consists of two sampling heads, four stages of emitter-followers, two differential amplifiers, and a pulse generator that is common to both A and B channels.

4-6. The purpose of the sampling head is to pick-off or "sample" the amplitude of the signal under test at a given time and apply this voltage to a capacitor (not shown). The actual sampling period is so brief that the capacitor only has time to charge to about 5% of the actual signal amplitude. This voltage is sent to a differential emitter follower stage, amplified, and coupled to an output emitter follower. Routed to the Model 1411A it is further amplified to drive the vertical deflection plates of the CRT. Signal feedback from the Model 1411A is used by the sampler to charge the sampling capacitor to 100% of the sampled signal amplitude prior to the next sample. Because of this feedback, the sampler extracts energy from the signal under test only when the signal level changes from one sample to the next.

4-7. The pulse generator and bias circuit provides a reverse-bias voltage to keep the sampling heads biased off. Upon receipt of the sampling command trigger, the pulse generator produces a pulse to forward-bias the sampling heads, permitting the incoming signal amplitude to be sampled.

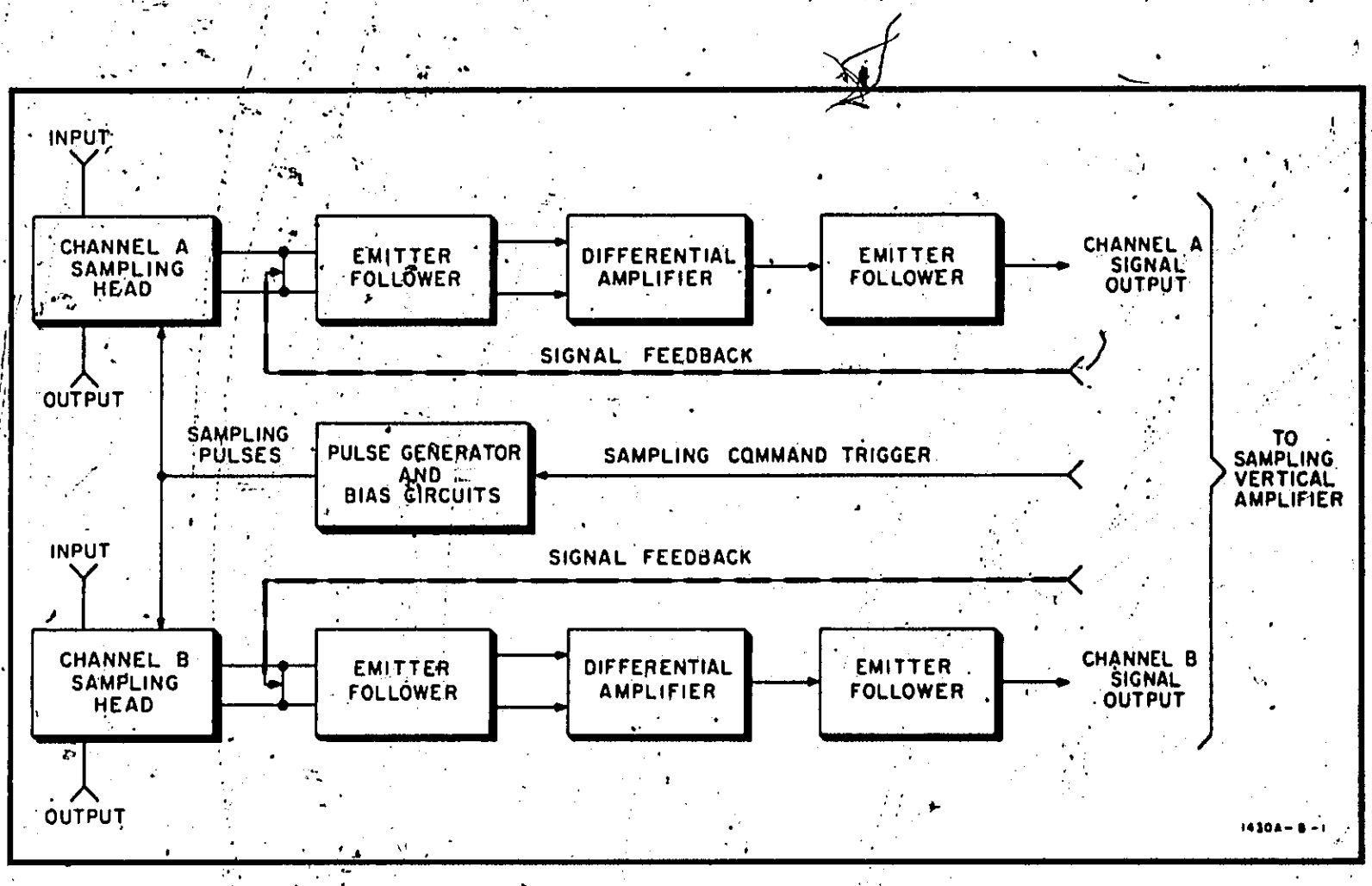


Figure 4-1. Sampler Block Diagram

4-8. CIRCUIT DETAILS.

4-9. The following explanation pertains to all four samplers since all are quite similar electrically. Since circuit theory for channels A and B is identical, only channel A theory will be covered. Section VIII of this manual contains a circuit diagram for the Model 1430A, 1430B and 1431A and another for the Model 1432A.

NOTE

Whenever a specific component is referred to by its reference designation, the reference disignation given in parenthesis applies to the Model 1432A all others are for the Model 1430A, 1430B and 1431A.

4-10. PULSE GENERATOR.

4-11. Signal input to the pulse generator is the sampling trigger. This pulse originates in the time base plug-in. Sent to the Model 1411A, it is amplified and shaped before being applied to the sampler.

4-12. The sampling trigger, a positive pulse, is ac coupled to the base of saturating switch Q103 (Q201). Q103 (Q201) is normally off. When the pulse is applied, the transistor saturates. The negative-going collector signal is transformer coupled through T101 (T201) to the step-recovery diodes.

4-13. Step-recovery diodes CR112, CR113 and CR114 (CR201 and CR203) are normally forward biased and conducting. When the negative pulse from T101 (T201) is applied to the anode of CR114 (CR203) reverse current flows in the diode. The reverse current is supplied by the carriers stored during forward bias conditions. The diode does not stop conducting immediately and the voltage across it remains low as reverse current flows. When the carriers at the junction are depleted, the diode suddenly stops conducting.

4-14. When CR114 (CR203) stops conducting, the negative voltage generated at its anode, coupled through isolation diodes CR110 and CR111 (CR202), reverse biases CR113 (CR201). When the carriers at the junction of CR113 (CR201) are depleted, it turns off even faster than CR114 (CR203). The same action then occurs with CR112 (Models 1430A, 1430B and 1431A only) and it turns off even faster than CR113. This results in a very fast-rising negative pulse being applied to the 50-ohm transmission line.

4-15. One side of the pulse generator output is grounded while the other side contains the negative-going pulse. The negative-going pulse is coupled differentally through C105 (C103) to sampling diode CR105 (CR101), and through C106 (C104) to sampling diode CR106 (CR102). This causes both CR105 and CR106 (CR101 and CR102) to become forward biased, and permits sampling to occur.

4-16. SAMPLING ASSEMBLY.

4-17. The bias network applies approximately 1.5 volts to sampling diodes CR105 and CR106 (CR101 and CR102) keeping them non-conducting. The bias centering adjustment, R122 (R121), allows this bias to be set equally for both diodes. Pulses from the pulse generator overcome this reverse-bias and open the gate. The input signal then starts to charge sampling capacitors C105 and C106 (C103 and C104) toward the input signal level. After the sampling pulses cease, the diodes are again reverse-biased and the gate closes. The charge stored on C105 and C106 (C103 and C104) leaks off through R107, R108, R118 and R119 (R117 and R118) to the base of emitter follower Q101B (Q101B).

4-18. If the signal level changes, feedback from the Model 1411A will cause the sampling diode bias level to shift correspondingly (Figure 4-2). Since the bias voltages shift to keep the sampler output voltage centered between them, an input signal will turn on one of the diodes if the signal varies more than ±1 volt from the voltage level of the sampling capacitor. This factor limits the dynamic range of the sampler to ±1 volt.

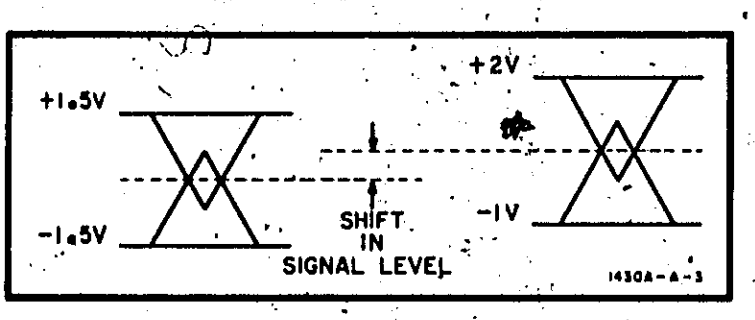


Figure 4-2. Shift in Signal Level

4-19. The over-all sampling efficiency of the Model 1411A/sampler combination depends upon three factors: the RC time constant of the sampling capacitors, signal source and diode impedance; the length of time the sampling gate is opened; and the loop gain of the Model 1411A/sampler combination. The signal source impedance and RC time constant are fixed. Sampling efficiency can be adjusted however, with the RESPONSE and SMOOTHING controls (on front panel of the Model 1411A). SMOOTHING controls the loop gain of the sampler/vertical amplifier combination. This adjustment is set for an over-all sampling efficiency of 100% (optimum response). Refer to the Model 1411A Operating and Service Manual for adjustment procedure. Under normal circumstances, once the SMOOTHING adjustments have been made for a particular Model 1411A/sampler combination these controls should not require readjustment.

4-20. Adjusting the RESPONSE control changes the amount of bias applied to the sampling diodes. This (Figure 4-3) changes the sampling time. Decreasing sampling time increases bandwidth (improving risetime). However the response will be smoothed since sampling efficiency has been reduced. Increasing sampling efficiency slows risetime but decreases noise. Complete instructions for optimizing RESPONSE and SMOOTHING are given in the Model 1411A Operating and Service Manual.

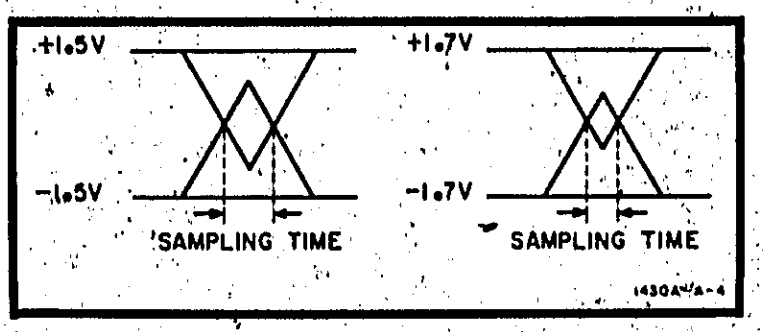


Figure 4-3. Response vs Sampling Time

4-21. PREAMPLIFIER.

4-22. The emitter output of Q101B (Q101B) is coupled to microcircuit MC101 (MC101). Low frequency signals are also coupled from the sampling head, through R105 (R102) to the base of Q101A (Q101A). The output of Q101A (Q101A) is also coupled to microcircuit MC101 (MC101). MC101 (MC101) is an amplifier with a differential input and single-ended output. The differential input provides high common mode rejection to signal leakage through the sampling diodes thereby minimizing low frequency distortion. The single-ended output of MC101 (MC101) is directly coupled to output emitter follower Q102 (Q102). The emitter output of Q102 (Q102) is then routed through the interconnecting cable to the Model 1411A. Gain of the sampling preamplifier is approximately 30.

4-23. VSWR AND RESPONSE.

4-24. The Model 1430A and 1430B sampling heads have been designed for optimum pulse response, and have a relatively high VSWR. The Model 1431A, better suited for CW monitoring, has a much improved VSWR. The Model 1431A differs from the Model 1430A/1430B in that filter sections L102/L103 and L302/L303 have been added to the sampling heads. Figure 4-4 compares response and VSWR of the compensated Model 1431A and uncompensated Model 1430A/1430B samplers.

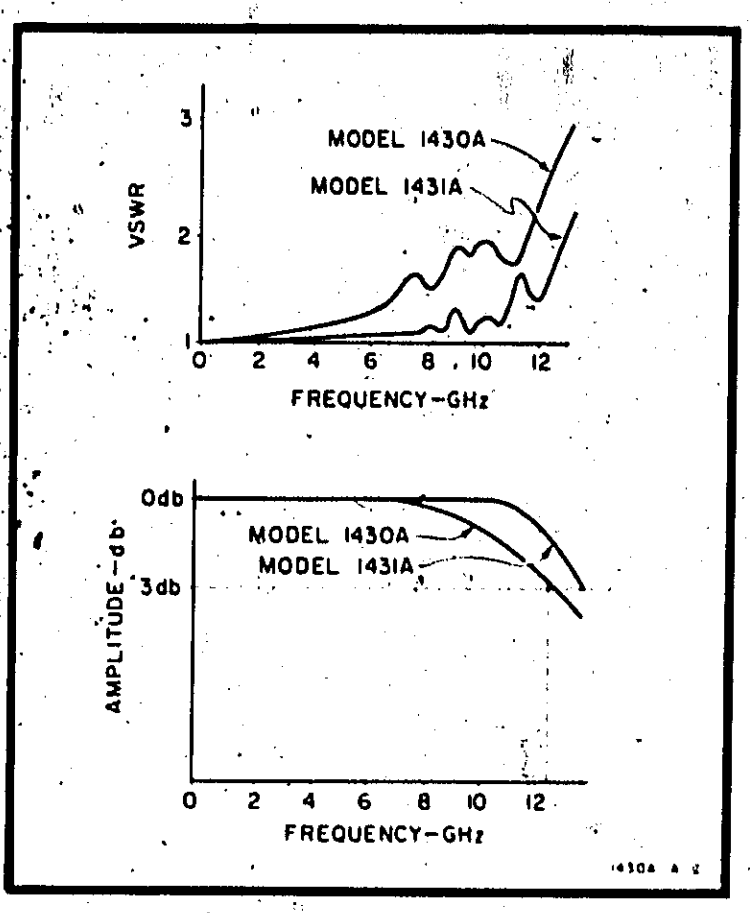


Figure 4-4. Frequency vs VSWR

Table 5-1. Recommended Test Equipment

Instrument		Required Characteristics	Required For
Type	Model		
DC Voltmeter	HP 412A	100 Vdc ±1%	Power Supply Checks
Fast Risetime Pulse Generator	HP 1105/1106	≈20 ps risetime	Risetime and Overshoot
Fast Risetime Pulse Generator	HP 1105/1108	<90 ps risetime	Optional for Model 1432A
VHF Attenuator	HP 355D	up to 60 dB in 10 dB steps ±.3 dB accuracy	Tangential Noise Measurement
Variable Pulse Generator	HP 222A	1 volt output 100 kHz	Dynamic Range Sampling Efficiency Adj Tangential Noise Measurement Channel Crosstalk Low Frequency Distortion Check Low Frequency Distortion Adj
VHF Signal Generator	HP 608D	450 MHz 0.5V output	Bias Centering and Diode Bias Adj
Air Line	General Radio	20 cm	Risetime and Overshoot
High Frequency Oscilloscope	HP 180A 1801A 1820A	20 MHz	Bias Centering and Diode Bias Adj
Oscilloscope Mainframe with Sampling Vertical Amplifier	HP 140A HP 141A HP 1411A		Required for operation of samplers
Time Base plug-in	HP 1424A HP 1425A		

7000-A-19

SECTION V

PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section includes a performance check and the adjustment procedure for the instrument. The performance check may be used to verify that the instrument meets the specifications listed in Table 1-1, as incoming inspection or after repairs or adjustments have been made. A Performance Check Record, which may be removed from the manual, is also included. When the initial performance check is made, record the indication on the Performance Check Record. These indications may be used for comparison with equipment performance at a later date.

5-3. The performance check and adjustment procedure is applicable to all four instruments. Differences in adjustments and performance checks are noted wherever they occur. Reference designators applicable to the Model 1432A are given in parenthesis, all others apply to the Models 1430A, 1430B and 1431A.

5-4. Test equipment recommended for the checks and adjustments is listed in Table 5-1. Similar equipment may be substituted if it has the required characteristics as listed in the table.

5-5. PERFORMANCE CHECK.

5-6. PRELIMINARY SETUP.

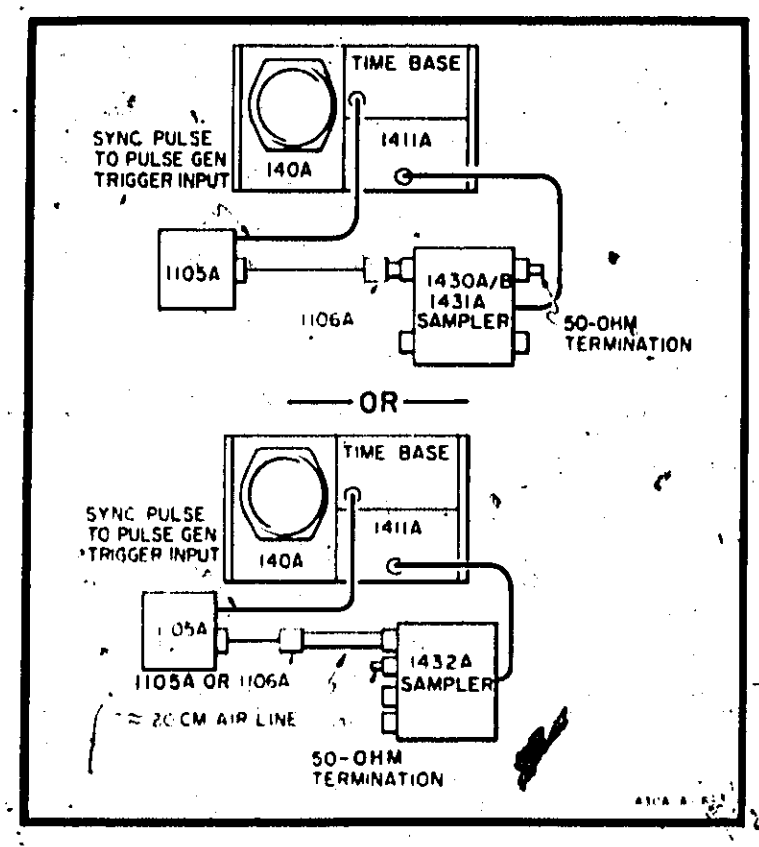


Figure 5-1. Risetime Test Setup

5-7. Assemble the Model 1411A/time base/oscilloscope combination (Figure 5-1) according to instructions in the Model 1411A Operating and Service Manual and allow at least 10 minutes for warm-up. The time base, oscilloscope and all test equipment must be calibrated and operating properly before proceeding with performance checks and adjustments for the sampler.

CAUTION

Do not connect the sampler before checking the Model 1411A power supplies. Refer to the Model 1411A Operating and Service Manual for the procedure and tolerances.

5-8. RISETIME AND OVERSHOOT.

a. Set time base controls as follows: (if Model 1425A is used settings apply to MAIN SWEEP).

SYCN PULSE	ON
TIME/CM	1 nSEC
VERNIER	CAL
MAGNIFIER (Model 1425A)	X1
NORMAL-EXPANDED (Model 1424A)	NORMAL
SCANNING	NORMAL
Trigger MODE	FREE RUN
Trigger SLOPE	+
Trigger Source	INT
Trigger Sensitivity	SENS

b. Using a fast risetime pulse generator such as HP Model 1105A/1106A (HP Model 1105A/1108A may be used with Model 1432A Sampler if desired) and connect equipment as shown in Figure 5-1. Connect pulse generator to channel A INPUT. Use cable furnished with Model 1105A between Model 1105A and Model 1106A (1108A). If sampler is a Model 1432A, isolate pulse generator from sampler with approximately 20 cm of air line.

c. Set Model 1411A NORM-SMOOTHED switch to SMOOTHED and mode selector to A.

d. Adjust Model 1411A MILLIVOLTS/CM and VERNIER to obtain a display of 10 vertical divisions.

e. Adjust time base sweep expansion controls to display pulse risetime.

f. Model 1430A pulse risetime must be less than 35 ps with less than 5% overshoot. Model 1430B pulse risetime must be less than 28 ps with less than 10% overshoot. Model 1431A pulse risetime must be less than 35 ps (no specification on overshoot). Model 1432A pulse risetime must be less than 90 ps with less than 5% overshoot.

g. Change Model 1411A mode selector to B.

h. Disconnect pulse generator from channel A INPUT and connect to channel B INPUT.

i. Repeat steps d, e, and f for channel B.

5-9. DYNAMIC RANGE.

a. Use a variable pulse generator such as HP Model 222A, and connect equipment as shown in Figure 5-2. Connect pulse generator output to channel A INPUT.

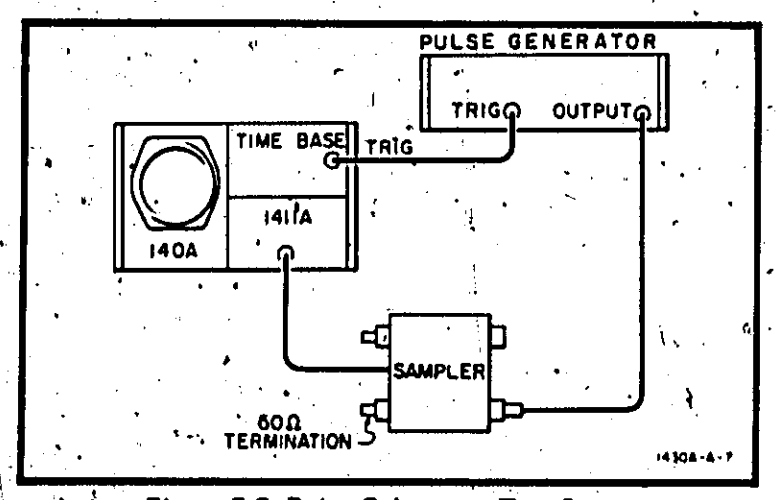


Figure 5-2. Pulse Generator Test Setup

b. Set pulse generator controls to obtain a pulse 2 to 5 usec wide and 0.5 volt in amplitude at a repetition rate of approximately 50 kHz.

c. Change Model 1411A controls to:

MILLIVOLTS/CM (A and B) 200
mode selector . . . . . A

d. Set time base TIME/CM to 2 usec.

e. Adjust time base for stable display.

f. Slowly increase amplitude of pulse generator output until pulse begins to break up (extreme distortion). Amplitude must be greater than 1 volt before break up occurs.

g. Change Model 1411A mode selector to B.

h. Disconnect pulse generator output from channel A INPUT and connect to channel B INPUT.

i. Repeat steps e and f for channel B.

5-10. CHANNEL CROSSTALK.

a. Disconnect pulse generator output from channel B INPUT and connect pulse generator to channel A INPUT.

b. Adjust pulse generator output to obtain a pulse approximately 5 usec wide and 1 volt in amplitude at a repetition rate of 100 kHz.

c. Change Model 1411A controls to:

MILLIVOLTS/CM (channel B) 1
mode selector . . . . . B

d. Slowly rotate Model 1411A channel A MILLIVOLTS/CM through all positions. Check Models 1430A, 1430B, and 1431A to see that signal present in channel B produces less than 5 div vertical deflection. Check Model 1432A to see that signal present in channel B produces less than 1.5 div vertical deflection.

e. Change Model 1411A controls to:

MILLIVOLTS/CM (channel A) 1
mode selector . . . . . A

f. Disconnect pulse generator output from channel A INPUT and connect to channel B INPUT.

g. Using Model 1411A channel B MILLIVOLTS/CM switch, repeat step d for channel A.

5-11. LOW FREQUENCY DISTORTION.

a. Disconnect pulse generator output from channel B INPUT and connect to channel A INPUT.

b. Set pulse generator controls to obtain a pulse approximately 5 usec wide and 0.25 volt in amplitude at a repetition rate of approximately 50 kHz.

c. Adjust Model 1411A channel A MILLIVOLTS/CM and VERNIER to obtain at least 5 vertical divisions display. The observed waveform must have a flat top with not more than 3% rounding or overshoot. (1430B rounding ±5%, overshoot < 7 1/2%).

d. Change Model 1411A mode selector to B.

e. Disconnect pulse generator output from channel A and connect to channel B.

f. Repeat step c for channel B.

5-12. TANGENTIAL NOISE MEASUREMENT.

a. Check both vertical channels to insure that Model 1411A RESPONSE is properly set and that sampling efficiency is exactly 100%. Refer to Model 1411A Operating and Service Manual for procedures.

b. Connect pulse generator output through VHF attenuator to channel A INPUT of sampler as shown in Figure 5-3.

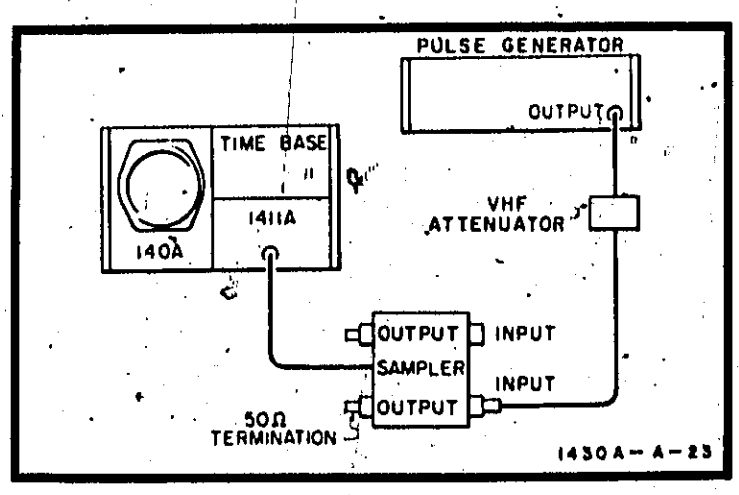


Figure 5-3. Noise Test Setup

c. Set Model 1411A controls as follows:

NORM-SMOOTHED ..... NORM
MILLIVOLTS/CM 10
mode selector ..... A

d. Set VHF attenuator to 50 dB.

e. Set pulse generator controls to produce a pulse output approximately 5 volts in amplitude at 10 kHz repetition rate.

f. Set time base to free run at a sweep speed of 10 ns/div.

g. Adjust SCAN DENSITY to observe free-running pulse and set pulse generator pulse width for a 50% duty cycle.

h. Readjust SCAN DENSITY for an incoherent display with minimum flicker. The display should consist of two lines, approximately 1 div apart. If the display consists of a square wave moving across the CRT as at B of Figure 5-4, readjust SCAN DENSITY to obtain a display as shown at A of Figure 5-4.

i. Decrease pulse generator output until a dark band is just visible between the two lines (see Figure 5-4 C, D and E).

j. Switch VHF attenuator to 30 dB.

k. Measure voltage difference between the two lines on display. Unsmoothed tangential noise is 1/10 of this value and must be less than 10 mV for Models 1430A, 1430B and 1431A; less than 4 mV for Model 1432A.

l. Set Model 1411A NORM-SMOOTHED TO SMOOTHED and repeat steps d through j.

m. Measure voltage difference between the two lines on display. Smoothed tangential noise is 1/10 of this value and must be less than 2.5 mV for Models 1430A, 1430B and 1431A; less than 2 mV for Models 1432A.

n. Connect pulse generator output through VHF attenuator to channel B INPUT of the sampler.

o. Set Model 1411A mode selector to B.

p. Repeat steps d through m for channel B.

q. Disconnect equipment.

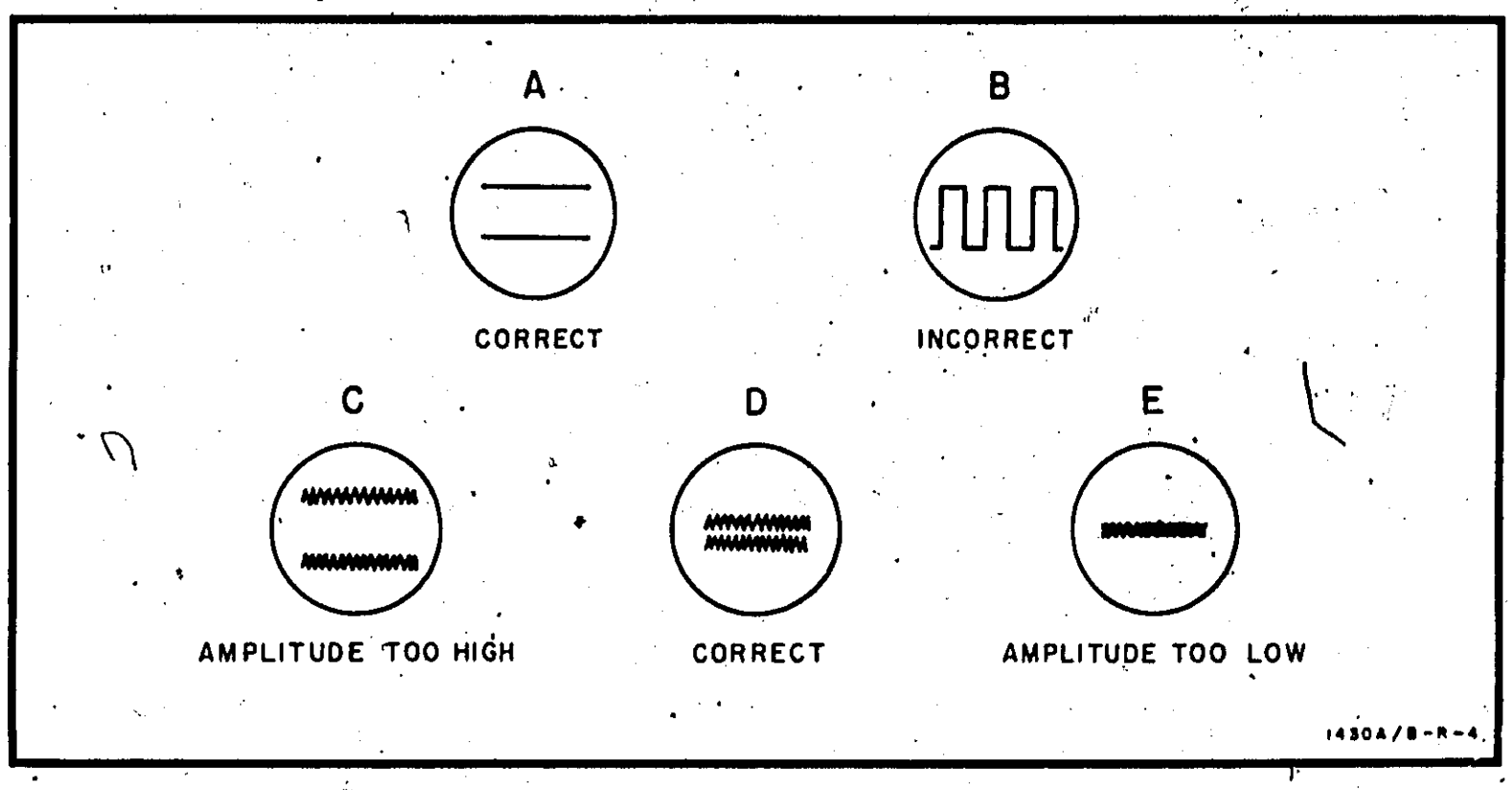


Figure 5-4. Noise Measurement Display

5-13. This completes the performance check. If the instrument fails to meet the specification in Table 1-1, the adjustment procedure which follows should be undertaken. If this does not result in satisfactory performance refer to Section VIII of this manual for troubleshooting information.

5-14. ADJUSTMENTS.

5-15. The following paragraphs give procedures for adjusting the samplers. Adjustment locations are shown on photographs in Section VIII of this manual. Reference designators given in parenthesis in adjustment procedure apply to Model 1432A, all others are for Models 1430A, 1430B and 1431A.

5-16. PRELIMINARY ADJUSTMENTS.

5-17. Before making sampler adjustments, proceed as follows:

a. Set time base for free-run mode.

b. Using a monitor oscilloscope observe the waveform on collector of Q125 in Model 1411A.

c. Adjust stretcher gate width potentiometer R183 for a pulse width of 350 nanoseconds.

d. Observe waveform on collector of Q325 in Model 1411A.

e. Adjust stretcher gate width potentiometer R383 for a pulse width of 350 nanpseconds.

5-18. BIAS CENTERING AND DIODE BIAS ADJ.

a. Set Model 1411A controls as follows:

RESPONSE (A and B)	fully cw then back 1/3 turn
SMOOTHING (A and B)	fully cw then back 1/3 turn
MILLIVOLTS/CM (Channel A)	100
VERNIER	CAL
Polarity	+UP
Mode selector	A

b. Set time base controls as follows: (if Model 1425A is used, settings apply to MAIN sweep).

TIME/CM	500 ns
MAIN SWEEP MAGNIFIER (Model 1425A)	X1
NORMAL-EXPANDED (Model 1424A)	NORMAL
Trigger MODE	FREE RUN
SCANNING	NORMAL
INT-EXT	EXT
NORM-SENS	SENS
TRIGGER HOLD OFF	NORM
SLOPE	+

c. Connect equipment as shown in Figure 5-2. Connect signal generator output to channel A INPUT.

d. Set signal generator controls to obtain an approximately 450 MHz, 140 mV/rms, CW signal.

e. Short junction of R128 and R129 (R126 and R129) to ground.

f. Trigger monitor oscilloscope with stretcher gate pulse from collector of Q125 or Q325 in Model 1411A.

g. Using monitor oscilloscope, observe waveform at emitter of Q102 (Q102). The observed waveform should look like one of the three waveforms shown in Figure 5-5.

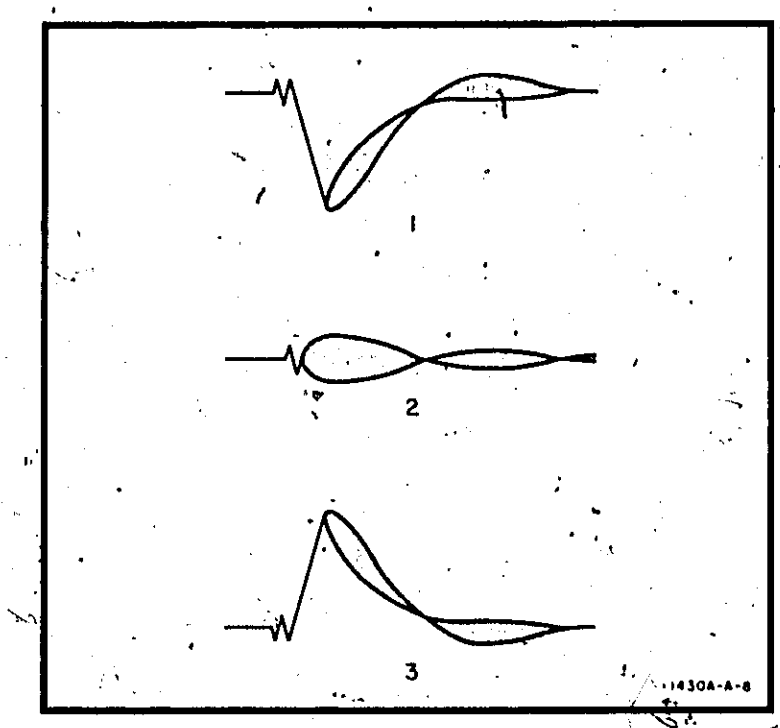


Figure 5-5. Bias Centering Waveforms

h. Adjust Bias Centering Adj R122 (R121) fully ccw to fully cw to be sure that all three waveforms can be obtained, then adjust R122 (R121) for display most similar to waveform 2.

i. Adjust 1st Bias Adj R153 (R208) for maximum p-p voltage on waveform.

j. Adjust 2nd Bias Adj R148 (R210) for maximum p-p voltage on waveform. Readjust bias centering R122 (R121) as necessary to maintain display similar to waveform 2.

k. Adjust 3rd Bias Adj R147 for maximum p-p voltage on waveform (Models 1430A, 1430B, and 1431A only).

NOTE

If proper waveforms cannot be obtained, refer to procedure for checking sampler diodes in Section VIII of this manual.

l. Remove input and ground connections.

m. Set time base to free-run to obtain a baseline display.

n. Set Model 1411A channel A MILLIVOLTS/CM switch to 200 and VERNIER to CAL.

o. Rotate Model 1411A channel A VERT POS control fully cw to fully ccw. Baseline must adjust approximately 9 divisions. If baseline does not travel up and down equally from CRT center, readjust bias centering potentiometer R122 (R121).

p. Change Model 1411A mode selector to B.

q. Set Model 1411A channel B MILLIVOLTS/CM switch to 200.

r. Rotate Model 1411A channel B VERT POS control fully cw to fully ccw. Baseline must adjust approximately 9 divisions. If baseline does not travel up and down equally from CRT center, adjust bias centering potentiometer R322 (R321).

5-19. SAMPLING EFFICIENCY ADJUSTMENT. (Model 1430B only).

a. Set Model 1411A mode selector to A.

b. Connect equipment as shown in Figure 5-2. Connect pulse generator output to channel A INPUT.

c. Set pulse generator to obtain a pulse 2-5 usec wide and 0.5 volt in amplitude at a repetition rate of approximately 100 kHz.

d. Set time base TIME/CM to 100 ns.

e. Adjust pulse generator Pulse Delay so that display first consists of a baseline, then a change in signal level as display disappears on right side of CRT (refer to instructions for optimizing sampling efficiency, contained in Model 1411A Operating and Service Manual).

f. Set time base SCAN DENSITY to minimum.

g. Adjust Model 1411A channel A SMOOTHING to fully cw position.

h. Rotate Model 1411A channel A RESPONSE slowly ccw and observe that sampling efficiency decreases to less than 100%.

i. If less than 100% sampling efficiency cannot be obtained (even with RESPONSE set fully ccw) re-adjust 2nd Bias Adj R148, and 3rd Bias Adj R147 until less than 100% sampling efficiency can be obtained. Adjust for approximately 60-70% sampling efficiency with RESPONSE set fully ccw.

j. Reset channel A SMOOTHING and RESPONSE to original positions.

k. Set Model 1411A mode selector to B.

l. Disconnect pulse generator output from channel A INPUT and connect to channel B INPUT.

m. Using Model 1411A channel B SMOOTHING and RESPONSE controls, repeat steps g, h and i for channel B.

n. R147 and R148 must be adjusted for less than 100% sampling efficiency on both channel A and channel B.

5-20. LOW FREQUENCY DISTORTION.

a. Connect equipment as shown in Figure 5-2. Connect the pulse generator output to channel A INPUT.

b. Set pulse generator controls to obtain a pulse approximately 2.5 usec wide and 0.25 volt in amplitude at a 50 kHz repetition rate.

c. Set Model 1411A mode selector to A.

d. Adjust Model 1411A MILLIVOLTS/CM and VERNIER to obtain at least 5 div of display. Set time base TIME/CM to 1 uSEC. The observed square wave should look like one of the three waveforms in Figure 5-6.

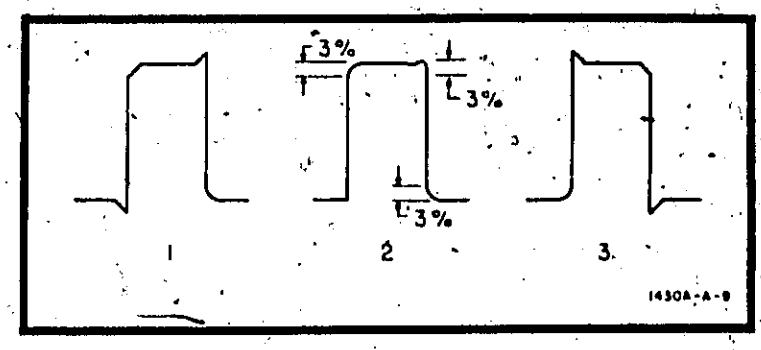


Figure 5-6. Low Frequency Distortion

e. Adjust C107 and C108 alternately (C102, C106 and R132) to obtain square wave as shown in Figure 5-6 waveform 2 (minimum peaking or rounding). Rounding of up to 3% can be expected on leading edge. (1430B rounding ±5%, overshoot < 7 1/2%).

CAUTION

WHEN ADJUSTING C107 and C307 (SCREWS LOCATED ON CIRCUIT BOARDS OF MODELS 1430A, 1430B, and 1431A). BE CAREFUL NOT TO TIGHTEN ENOUGH TO BREAK THE PICK-OFF RESISTORS.

f. Disconnect pulse generator output from channel A INPUT and connect to channel B INPUT.

g. Set Model 1411A mode selector to B.

h. Repeat steps d and e for channel B, using C307 and C308 (C302, C306 and R332).

i. C129 in Models 1430A, 1430B and 1431A is factory selected for optimum dynamic range and minimum low frequency distortion. Typical value is 56 pF. If replacement is necessary, select value for optimum dynamic range and minimum distortion. (Decreasing value improves low frequency distortion).

j. C107 and C307 in Model 1432A are factory selected for minimum low frequency distortion. Nominal value is .22 pF but may be .47 pF or may be omitted from either or both channels. If replacement is necessary, select value for minumum low frequency distortion.

5-21. This completes the sampler adjustments. If the instrument cannot be adjusted to meet the requirements in the adjustment procedure, refer to Section VIII of this manual for troubleshooting information.

PERFORMANCE CHECK RECORD

_____

Instrument Serial Number _____

Paragraph Reference	Check		Specification	Measured
5 - 8.	RISETIME & OVERSHOOT			
	Channel A	1430A	< 35 ps	_____
			< 5%	_____
		1430B	< 28 ps	_____
			< 7.5%	_____
		1431A	< 35 ps	_____
		1432A	< 90 ps	_____
			< 5%	_____
	Channel B	1430A	< 35 ps	_____
			< 5%	_____
		1430B	< 28 ps	_____
			< 7.5%	_____
		1431A	< 35 ps	_____
		1432A	< 90 ps	_____
			< 5%	_____
5 - 9.	DYNAMIC RANGE			
	Channel A		±1V	_____
	Channel B		±1V	_____
5 - 10.	CROSS TALK			
	Channel A	1430A	< 5 div	_____
		1430B		
		1431A		
	Channel B		< 5 div	_____
	Channel A	1432A	< 1.5 div	_____
	Channel B		< 1.5 div	_____

PERFORMANCE CHECK RECORD (CONT'D)

_____

Instrument Serial Number _____

Paragraph Reference	Check		Specification	Measured
5 - 11.	LOW FREQUENCY DISTORTION			
	Channel A	1430A	< ±3%	_____
		1430B	< ±5%	_____
		1431A	< ±3%	_____
		1432A	< ±3%	_____
	Channel B	1430A	< ±3%	_____
		1430B	< ±5%	_____
		1431A	< ±3%	_____
		1432A	< ±3%	_____
5 - 12.c	TANGENTIAL NOISE MEASUREMENT		UNSMOOTHED	
	Channel A	1430A	< 10 mV	_____
		1430B	< 10 mV	_____
		1431A	< 10 mV	_____
		1432A	< 4 mV	_____
	Channel B	1430A	< 10 mV	_____
		1430B	< 10 mV	_____
		1431A	< 10 mV	_____
		1432A	< 4 mV	_____
5 - 12.l	TANGENTIAL NOISE MEASUREMENT		SMOOTHED	
	Channel A	1430A	< 2.5 mV	_____
		1430B	< 2.5 mV	_____
		1431A	< 2.5 mV	_____
		1432A	< 2 mV	_____
	Channel B	1430A	< 2.5 mV	_____
		1430B	< 2.5 mV	_____
		1431A	< 2.5 mV	_____
		1432A	< 2 mV	_____

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replaceable parts. Table 6-2 lists parts for Models 1430A, 1430B and 1431A. Table 6-3 lists parts for Model 1432A. Both tables list the parts in alpha-numeric order by reference designation and provide the following information on each item:

a. HP Part Number.

b. Description of part; refer to Table 6-1 for list of reference designators and abbreviations.

c. Typical manufacturer of part in a five-digit code, except for Hewlett-Packard Company; refer to Table 6-4 for code list of manufacturers.

d: Manufacturer's part number.

6-3. ORDERING INFORMATION.

6-4. To order replacement parts from Hewlett-Packard, address the order or inquiry to the nearest Hewlett-Packard Sales/Service Office (list in rear of manual) and supply the following information:

a. Instrument model and serial number.

b. HP Part Number of item (s).

c. Quantity of part (s) desired.

6-5. To order a part not listed in the table, provide the following information:

a. Instrument model and serial number.

b. Description of part, including function and location.

c. Quantity of part (s) desired.

6-6. To order a part from a manufacturer other than Hewlett-Packard, provide complete part description and manufacturer's part number from the table.

Table 6-1. Abbreviations for Replaceable Parts List

A	= ampere(s)	GRD	= ground(ed)	NPO	= negative positive zero (zero temperature coefficient)	RWV	= reverse working voltage
ASSY	= assembly	H	= henry(ies)	NPN	= negative-positive-negative	S-B	= slow-blow
BD	= board(s)	HG	= mercury	NSR	= not separately replaceable	SCR	= silicon controlled rectifier
BH	= binder head	HP	= Hewlett-Packard			SE	= selenium
BP	= bandpass	HZ	= hertz	OBD	= order by description	SEC	= second(s)
C	= centi (10^{-2})	IF	= intermediate freq.	OH	= oval head	SECT	= section(s)
CAR	= carbon	IMPG	= impregnated	OX	= oxide	SI	= silicon
CCW	= counterclockwise	INCD	= incandescent	P	= peak	SIL	= silver
CER	= ceramic	INCL	= include(s)	PC	= printed (etched) circuit(s)	SL	= slide
CMO	= cabinet mount only	INS	= insulation(ed)	PF	= picofarads	SP	= single pole
COAX	= coaxial	INT	= internal	PHL	= Phillips	SPL	= special
COEF	= coefficient	K	= kilo (10^{3})	PIV	= peak inverse voltage(s)	ST	= single throw
COMP	= composition	KG	= kilogram	PNP	= positive-negative-positive	STD	= standard
CONN	= connector(s)	LB	= pound(s)	P/O	= part of	TA	= tantalum
CRT	= cathode-ray tube	LH	= left hand	PORC	= porcelain	TD	= time delay
CW	= clockwise	LIN	= linear taper	POS	= position(s)	TFL	= teflon
D	= deci (10^{-1})	LOG	= logarithmic taper	POT	= potentiometer(s)	TGL	= toggle
DEPC	= deposited carbon	LPF	= low-pass filter(s)	P-P	= peak-to-peak	THYR	= thyristor
DP	= double pole	LVR	= lever	PRGM	= program	TI	= titanium
DT	= double throw	M	= milli (10^{-3})	PS	= polystyrene	TNLDIO	= tunnel diode(s)
ELECT	= electrolytic	MEG	= mega (10^{6})	PWV	= peak working voltage	TOL	= tolerance
ENCAP	= encapsulated	MET FILM	= metal film			TRIM	= trimmer
EXT	= external	MET OX	= metal oxide	RECT	= rectifier(s)	U	= micro (10^{-6})
F	= farad(s)	MFR	= manufacturer	RF	= radio frequency	V	= volts
FET	= field-effect transistor(s)	MINAT	= miniature	RFI	= radio frequency interference	VAR	= variable
FH	= flat head	MOM	= momentary	RH	= round head or right hand	VDCW	= dc working volt(s)
FIL H	= fillister head	MTG	= mounting	RMO	= rack mount only	W	= watt(s)
FXD	= fixed	MY	= mylar	RMS	= root mean square	W/	= with
G	= giga (10^{9})	N	= nano (10^{-9})			WIV	= working inverse voltage
GE	= germanium	N/C	= normally closed			W/O	= without
GL	= glass	NE	= neon			WW	= wirewound
		N/O	= normally open				

Table 6-2. Replaceable Parts 1430A, 1430B, 1431A

Reference Designation	HP Part Number	TQ	Description (Refer to Table 6-1.)	Mfr Code	Manufacturer's Part Number
A1	1901-0302		A: sampler (1430A), channel A, includes diodes	HP	
A1	0950-1282		A: sampler (1430B), channel A, includes diodes	HP	
A1	1901-0353		A: sampler (1431A), channel A, includes diodes	HP	
A2	1901-0303		A: sampler (1430A), channel B, includes diodes	HP	
A2	0950-1281		A: sampler (1430B), channel B, includes diodes	HP	
A2	1901-0354		A: sampler (1431A), channel B, includes diodes	HP	
A3	01430-66503		A: preamplifier, channel A	HP	
A4	01430-66504		A: preamplifier, channel B		
A5	01430-66502		A: 50-ohm strip line, assy: (includes C120, C121, CR110 and CR114)	HP	
	01430-69501		A: 50-ohm strip line (includes C120 and C121)	HP	
A6	01430-66501		A: pulse gen board	HP	
A7	01430-26505		A: diode mount	HP	
AT1-AT2	909A		AT: 50-ohm load	HP	
C105			NSR: p/o CR105		
C106			NSR: p/o CR106		
C107			NSR: p/o A3		
C108	0121-0060		C: var cer 2–8 pF NPO	HP	
C112	0140-0222		C: fxd mica 240 pF 1% 300 wVdc	HP	
C113	0140-0222		C: fxd mica 240 pF 1% 300 wVdc	HP	
C114	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 WVdc	56289	150D225X0020A2
C115	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 WVdc	56289	150D225X0020A2
C116	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 WVdc	56289	150D225X0020A2
C118	0160-0174		C: fxd cer 0.47 uF 80% 25 wVdc	56289	5C11A
C119	0160-0174		C: fxd cer 0.47 uF 80% 25 wVdc	56289	5C11A
C120			NSR: p/o A5		
C121			NSR: p/o A5		
C122	0160-0157		C: fxd my 0.0047 uF ±10% 200 wVdc	HP	
C123	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 wVdc	56289	150D225X0020A2
C124	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 wVdc	56289	150D225X0020A2
C127	0160-0174		C: fxd cer 0.47 uF 80% 25 wVdc	56289	5C11A
C128	0150-0121		C: fxd cer 0.1 uF –20 +80% 50 wVdc	56289	5C50B1
C129	0140-0191		C: fxd mica 56 pF 5% 300 wVdc	04062	RDM15E560J3C
C130	0140-0178		C: fxd mica 560 pF 20% 300 wVdc	HP	
C131	0170-0040		C: fxd my 0.047 uF 10% 200 wVdc	HP	
C132	0170-0040		C: fxd my 0.047 uF 10% 200 wVdc	HP	
C305			NSR: p/o CR305		
C306			NSR: p/o CR306		
C307			NSR: p/o A4		
C308	0121-0060		C: var cer 2–8 pF NPO	HP	
C312	0140-0222		C: fxd mica 240 pF 1% 300 wVdc	HP	
C313	0140-0222		C: fxd mica 240 pF 1% 300 wVdc	HP	
C314	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 wVdc	56289	150D225X0020A2
C315	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 wVdc	56289	150D225X0020A2
C316	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 wVdc	56289	150D225X0020A2
CP1-CP2	11524A		CP: adapter, type N-APC–7	HP	
CR105	1901-0558		CR: (includes C105 and R107)	HP	
CR106	1901-0559		CR: (includes C106 and R108)	HP	
CR110	1901-0050		CR: Si	HP	
CR111	1901-0050		CR: Si	HP	
CR112	1901-0556		CR: Si step recovery	HP	
CR113	1901-0555		CR: Si step recovery	HP	
CR114	1901-0165		CR: Si step recovery	HP	
CR115	1901-0041		CR: Si	HP	
CR305	1901-0558		CR: (includes C305 and R307)	HP	
CR306	1901-0559		CR: (includes C306 and R308)	HP	
J101			includes:		
	0363-0009		Contact: socket	HP	
	1250-0819		Nut: coupling	HP	
	1250-0820		Retainer: assy	HP	

Table 6-2. Replaceable Parts 1430A, 1430B, 1431A (Cont'd)

Reference Designation	HP Part Number	TQ	Description (Refer to Table 6-1.)	Mfr Code	Manufacturer's Part Number
J102			Includes:		
	0363-0009		Contact: socket	HP	
	1250-0819		Nut: coupling	HP	
	1250-0820		Retainer: assy	HP	
J301			Includes:		
	0363-0009		Contact: socket	HP	
	1250-0819		Nut: coupling	HP	
	1250-0820		Retainer: assy	HP	
J302			Includes:		
	0363-0009		Contact: socket	HP	
	1250-0819		Nut: coupling	HP	
	1250-0820		Retainer: assy	HP	
L101	9140-0094		L: fxd 0.68 uH 20%	86684	CA30051.C.
L102			NSR: p/o A1 (1431A only)		
L103			NSR: p/o A1 (1431A only)		
L302			NSR: p/o A2 (1431A only)		
L303			NSR: p/o A2 (1431A only)		
MC101	1820-0046		MC: integrated amplifier	HP	
MC301	1820-0046		MC: integrated amplifier	HP	
MP1	01430-25204		MP: chassis, main (includes P4)	HP	
MP2	01430-21202		MP: clamp, strip line wire	HP	
MP3	01430-21202		MP: clamp, strip line wire	HP	
MP4	01430-04104		MP: cover, bottom	HP	
MP5	01430-20501		MP: clamp, cover	HP	
MP6	01430-20501		MP: clamp, cover	HP	
MP7	01430-04101		MP: cover, top (1430A only)	HP	
MP8	01430-64101		MP: cover, top (1430B only)	HP	
MP9	01431-04101		MP: cover, top (1431A only)	HP	
MP10-MP13	1401-0047		MP: cap, plastic (for J101, J102, J301, J302)	HP	
P4	1251-1444		P: connector, 18 contact	HP	
			Consists of:		
	1251-1445		P: 18 contact	HP	
	01430-23202		Connector: adapter	HP	
	01430-41202		Clamps	HP	
	01430-42301		Boot assy	HP	
Q101	1854-0221		Q: dual Si npn	HP	
Q102	1854-0019		Q: Si npn	HP	
Q103	1854-0035		Q: Si npn	HP	
Q301	1854-0221		Q: dual Si npn	HP	
Q302	1854-0019		Q: Si npn	HP	
R105	0675-2221		R: fxd comp 2200 ohms 10% 1/8W (1430A only)	HP	
R105	0811-1716		R: fxd cer 2000 ohms 10% (1430B and 1431A only)	HP	
R106	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R107			NSR: p/o CR105		
R108			NSR: p/o CR106		
R112	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R113	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R114	0757-0442		R: fxd metflm 10 kilohms 1% 1/8W	HP	
R115	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R116	0757-0451		R: fxd metflm 24.3 kilohms 1% 1/8W	HP	
R117	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R118	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R119	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R120	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R121	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R122	2100-0364		R: var ww 20 kilohms 5% 1W	HP	
R128	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R129	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R130	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R131	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	

Table 6-2. Replaceable Parts 1430A, 1430B, 1431A (Cont'd)

Reference Designation	HP Part Number	TQ	Description (Refer to Table 6-1.)	Mfr Code	Manufacturer's Part Number
R132	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R133	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R138	0757-0420		R: fxd metflm 750 ohms 1% 1/8W	HP	
R139	0757-0411		R: fxd metflm 332 ohms 1% 1/8W	HP	
R140	0757-0434		R: fxd metflm 3650 ohms 1% 1/8W	HP	
R141	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R142	0757-0401		R: fxd metflm 100 ohms 1% 1/8W	HP	
R146	0757-0726		R: fxd metflm 511 ohms 1% 1/4W	HP	
R147	2100-0755		R: var ww 100 ohms 5% 1W	HP	
R148	2100-0755		R: var ww 1000 ohms 5% 1W	HP	
R149	0757-0726		R: fxd metflm 511 ohms 1% 1/4W		
R152	0698-3620		R: fxd metox 100 ohms 5% 2W	HP	
R153	2100-0755		R: var ww 1000 ohms 20% 1W	HP	
R154	0757-0415		R: fxd metflm 475 ohms 1% 1/8W	HP	
R155	0757-0393		R: fxd metflm 47.5 ohms 1% 1/8W	HP	
R156	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R157	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R305	0675-2221				
R306	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R307			NSR: p/o CR305		
R308			NSR: p/o CR306		
R312	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R313	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R314	0757-0442		R: fxd metflm 10 kilohms 1% 1/8W	HP	
R315	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R316	0757-0451		R: fxd metflm 24.3 kilohms 1% 1/8W	HP	
R317	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R318	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R319	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R320	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R321	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R322	2100-0364		R: var ww 20 kilohms 20% 1W	HP	
R328	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R329	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R330	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R331	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R332	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R333	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R338	0757-0420		R: fxd metflm 750 ohms 1% 1/8W	HP	
R339	0757-0411		R: fxd metflm 332 ohms 1% 1/8W	HP	
R340	0757-0434		R: fxd metflm 3650 ohms 1% 1/8W	HP	
R341	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R342	0757-0401		R: fxd metflm 100 ohms 1% 1/8W	HP	
T101	9100-1112		T: current	HP	
VR105	1902-0022		VR: breakdown 2.67V	HP	
VR106	1902-0049		VR: breakdown 6.19V	HP	
VR305	1902-0022		VR: breakdown 2.67V	HP	
VR306	1902-0049		VR: breakdown 6.19V	HP	
W1	5060-0440		W: cable, main (5 foot interconnecting)	HP	
W2	01430-61603		W: cable, channel A	HP	
W3	01430-61604		W: cable, channel B	HP	
W4	01430-61605		W: cable, pulse generator	HP	

Table 6-3. Replaceable Parts 1432A

Reference Designation	HP Part Number	TQ	Description (Refer to Table 6-1.)	Mfr Code	Manufacturer's Part Number
A1	01432-66501		A: pulse gen. and pre-amp	HP	
A2	01432-66502		A: compensator board "A"	HP	
A3	01432-66502		A: compensator board "B"	HP	
A4	00188-66503		A: pulse gen strip line	HP	
AT1-AT2	0950-0090		AT: 50-ohm load	HP	
C101	0160-2236		C: fxd cer 1 pF ±.25% 500 wVdc	72982	obd
C102	0121-0173.		C: var glass .8–4.5 pF 750 wVdc	18736	TF5A
C103	00188-68201		C: 3.5 pF	HP	
C104	00188-68201		C: 3.5 pF	HP	
C106	0121-0403		C: var glass dielec. .8–8.5 pF 750 wVdc	18736	TF9AR
C107	0150-0021		C: fxd Ta .47 pF 5% 500 wVdc	78488	Type GA (obd)
	or				
	0150-0048		C: fxd Ta .22 pF 5% 500 wVdc (factory selected parts, may be either value or omitted)	78488	Type GA (obd)
C110	0180-0155		C: fxd elect Ta 2.2 uF 20 wVdc	56289	150D225X0020A2
C111	0140-0225		C: fxd mica 300 pF 1% 300 wVdc	HP	
C112	0140-0225		C: fxd mica 300 pF 1% 300 wVdc	HP	
C113	0180-0155		C: fxd elect Ta 2.2 uF 20 wVdc	56289	150D225X0020A2
C114	0180-0155		C: fxd elect Ta 2.2 uF 20 wVdc	56289	150D225X0020A2
C115	0150-0121		C: fxd cer 0.1 uF −20 +80% 50 wVdc	56289	5CM0A
C116	0160-0153		C: fxd my 1000 pF 10% 200 wVdc	HP	
C117	0160-0153		C: fxd my 1000 pF 10% 200 wVdc	HP	
C201			NSR: p/o A4		
C202	0150-0014		C: fxd cer 0.005 uF 500 wVdc	00656	D1–4
C203	0150-0121		C: fxd cer 0.1 uF −20 +80% 50 wVdc	56289	5C50B1
C206	0150-0121		C: fxd cer 0.1 uF −20 +80% 50 wVdc	56289	5C50B1
C207	0140-0192		C: fxd mica 68 pF 5% 300 wVdc	HP	
C208	0140-0178		C: fxd mica 560 pF 2% 300 wVdc	HP	
C301	0160-2236		C: fxd cer 1 pF ±.25% 500 wVdc	72982	obd
C302	0121-0173		C: var glass .8–4.5 pF 750 wVdc	18736	TF5A
C303	00188-68201		C: 3.5 pF	HP	
C304	00188-68201		C: 3.5 pF	HP	
C306	0121-0403		C: var glass dielec .8–8.5 pF 750 wVdc	18736	TF9AR
C307	0150-0021		C: fxd Ta .47 pF 5% 500 wVdc	78488	Type GA (obd)
	or				
	0150-0048		C: fxd Ta .22 pF 5% 500 wVdc (factory selected parts, may be either value or omitted)	78488	Type GA (obd)
C310	0180-0155		C: fxd elect Ta 2.2 uF 20 wVdc	56289	150D225X0020A2
C311	0140-0225		C: fxd mica 300 pF 1% 300 wVdc	HP	
C312	0140-0225		C: fxd mica 300 pF 1% 300 wVdc	HP	
C313	0180-0155		C: fxd elect Ta 2.2 uF 20 wVdc	56289	150D225X0020A2
C314	0180-0155		C: fxd elect Ta 2.2 uF 20 wVdc	56289	150D225X0020A2
C315	0150-0121		C: fxd cer 0.1 uF −20 +80% 50 wVdc	56289	5CMOA
C316	0160-0153		C: fxd my 1000 pF 10% 200 wVdc	HP	
C317	0160-0153		C: fxd my 1000 pF 10% 200 wVdc	HP	
CR101	1901-0350		CR: Si	HP	
CR102	1901-0350		CR: Si	HP	
CR201	1901-0155		CR: Si step recovery	HP	
CR202	1901-0050		CR: Si	HP	
CR203	1901-0165		CR: Si step recovery	HP	
CR204	1901-0050		CR: Si	HP	
CR301	1901-0350		CR: Si	HP	
CR302	1901-0350		CR: Si	HP	
E101	00188-26101		E: terminal, diode	HP	
E301	00188-26101		E: terminal, diode	HP	
J101-J102			Consists of:		
	1250-0195		Conductor: outer	24655	0874-0603
	1250-0196		Conductor: inner	24655	0874-0612
	1250-0197		Bead: insulating	24655	0874-0700
	1250-0198		Ring: retaining	24655	0874-0810

Table 6-3. Replaceable Parts 1432A (Cont'd)

Reference Designation	HP Part Number	TQ	Description (Refer to Table 6-1.)	Mfr Code	Manufacturer's Part Number
J101-J102	1250-0199		Adapter: panel	24655	0874-6500
	1250-0200		Clamp: ring	24655	0874-6224
	1250-0203		Nut: coupling	24655	0874-0623
	00188-27602		Transition: outer	HP	
	00188-27603		Transition: inner	HP	
J301-J302			Consists of:		
	1250-0195		Conductor: outer	24655	0874-0603
	1250-0196		Conductor: inner	24655	0874-0612
	1250-0197		Bead: insulating	24655	0874-0700
	1250-0198		Ring: retaining	24655	0874-0810
	1250-0199		Adapter: panel	24655	0874-6500
	1250-0200		Clamp, ring	24655	0874-6224
	1250-0203		Nut: coupling	24655	0874-0623
	00188-27602		Transition: outer	HP	
	00188-27603		Transition: inner	HP	
L201	9140-0098		L: fxd 2.2 uH 10%	HP	
MC101	1820-0046		MC: integrated circuit	HP	
MC301	1820-0046		MC: integrated circuit	HP	
MP1	01432-25204		MP: chassis, main (includes P4)	HP	
MP2	00188-21201		MP: clamp terminal	HP	
MP3	01432-25203		MP: housing, sampler	HP	
MP4	00188-04101		MP: plate, ground	HP	
MP5	01432-25203		MP: housing, sampler	HP	
MP6	00188-21201		MP: clamp, terminal	HP	
MP7	01432-04101		MP: cover, top	HP	
MP8	01432-04102		MP: cover, bottom	HP	
MP9-MP10	01432-20501		MP: clamp, cover	HP	
MP11	5060-0485		MP: wiper spade assy	HP	
MP12	3030-0060		MP: setscrew		
MP13	01415-23802		MP: rod connector.		
MP14	00188-27603		MP: transition, inner	24655	
MP15	1250-0197		MP: bead, insulating	24655	
MP16	1250-0196		MP: conductor, inner	24655	
P4	1251-1444		P: connector, 18 contact	HP	
			Consists of:		
	1251-1445		P: 18 contact	HP	
	01430-23202		Connector: adapter	HP	
	01430-41202		Clamps	HP	
	01430-42301		Boot assy	HP	
Q101	1854-0221		Q: dual Si npn	HP	
Q102	1854-0019		Q: Si npn	HP	
Q201	1854-0035		Q: Si npn	HP	
Q301	1854-0221		Q: dual Si npn	HP	
Q302	1854-0019		Q: Si npn	HP	
R101	0698-0065		R: fxd car flm 18 ohms 5% 1/10W	03888	100R62
R102	0683-1525		R: fxd comp 1500 ohms 5% 1/4W	HP	
R103	0757-0453		R: fxd metflm 30.1 kilohms 1% 1/8W	HP	
R104	0757-0283		R: fxd metflm 2000 ohms 1% 1/8W	HP	
R105	0757-0283		R: fxd metflm 2000 ohms 1% 1/8W	HP	
R106	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R108	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R109	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R110	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R111	0757-0442		R: fxd metflm 10 kilohms 1% 1/8W	HP	
R115	0757-0451		R: fxd metflm 24.3 kilohms 1% 1/8W	HP	
R116	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R117	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R118	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R119	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	

Table 6-3. Replaceable Parts 1432A (Cont'd)

Reference Designation	HP Part Number	TQ	Description (Refer to Table 6-1.)	Mfr Code	Manufacturer's Part Number
R120	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R121	2100-1776		R: var ww 10 kilohms 10% 1/2W	HP	
R125	0757-0410		R: fxd metflm 301 ohms 1% 1/8W	HP	
R126	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R127	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R128	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R129	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R130	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R131	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R132	2100-2030		R: var precision flm 20 kilohms 30% 1/2W	HP	
R135	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R136	0757-0435		R: fxd metflm 3920 ohms 1% 1/8W	HP	
R137	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R138	0757-0401		R: fxd metflm 100 ohms 1% 1/8W	HP	
R201			NSR: p/o A4		
R202			NSR: p/o A4		
R203			NSR: p/o A4		
R204			NSR: p/o A4		
R205	0687-2711		R: fxd comp 270 ohms 10% 1/2W	HP	
R208	2100-1773		R: var ww 1000 ohms 10% 1/2W	HP	
R209	0757-0801		R: fxd metflm 150 ohms 1% 1/2W	HP	
R210	2100-1774		R: var ww 2000 ohms 10% 1/2W	HP	
R211	0757-0415		R: fxd metflm 475 ohms 1% 1/8W	HP	
R212	0757-0393		R: fxd metflm 47.5 ohms 1% 1/8W	HP	
R301	0698-0065		R: fxd car flm 18 ohms 5% 1/10W	03888	100R62
R302	0683-1525		R: fxd comp 1500 ohms 5% 1/4W	HP	
R303	0757-0453		R: fxd metflm 30.1 kilohms 1% 1/8W	HP	
R304	0757-0283		R: fxd metflm 2000 ohms 1% 1/8W	HP	
R305	0757-0283		R: fxd metflm 2000 ohms 1% 1/8W	HP	
R306	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R308	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R309	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R310	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R311	0757-0442		R: fxd metflm 10 kilohms 1% 1/8W	HP	
R315	0757-0451		R: fxd metflm 24.3 kilohms 1% 1/8W	HP	
R316	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R317	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R318	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R319	0757-0474		R: fxd metflm 243 kilohms 1% 1/8W	HP	
R320	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R321	2100-1776		R: var ww 10 kilohms 10% 1/2W	HP	
R325	0757-0410		R: fxd metflm 301 ohms 1% 1/8W	HP	
R326	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R327	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R328	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R329	0757-0465		R: fxd metflm 100 kilohms 1% 1/8W	HP	
R330	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R331	0757-0449		R: fxd metflm 20 kilohms 1% 1/8W	HP	
R332	2100-2030		R: var precision flm 20 kilohms 30% 1/2W	HP	
R335	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R336	0757-0435		R: fxd metflm 3920 ohms 1% 1/8W	HP	
R337	0757-0280		R: fxd metflm 1000 ohms 1% 1/8W	HP	
R338	0757-0401		R: fxd metflm 100 ohms 1% 1/8W	HP	
T201	9100-1112		T: current	HP	
VR101	1902-0036		VR: breakdown 6.19V 10%	HP	
VR102	1902-0022		VR: breakdown 2.67V 10%	HP	
VR301	1902-0036		VR: breakdown 6.19V 10%	HP	
VR302	1902-0022		VR: breakdown 2.67V 10%	HP	
W1	5060-0440		W: cable, main (5 foot interconnecting)	HP	
W2	01432-61603		W: cable assy, channel B	HP	
W3	01432-61604		W: cable assy, channel A	HP	

Table 6-4. List of Manufacturers' Codes

The following code numbers are from the Federal Supply Code for Manufacturers Cataloging Handbooks H4-1 (Name to Code) and H4-2 (Code to Name) and their latest supplements. The date of revision and the date of the supplements used appear at the bottom of each page. Alphabetical codes have been arbitrarily assigned to suppliers not appearing in the H4 Handbooks.

Code No.	Manufacturer	Address
00000	U. S. A. Common	Any supplier of U. S.
00136	McCoy Electronics	Mount Holly Springs, Pa.
00213	Sage Electronics Corp.	Rochester, N. Y.
00287	Cenco Inc.	Danielson, Conn.
00334	Humidial	Colton, Calif.
00348	Microtron Co., Inc.	Valley Stream, N.Y.
00373	Garlock Inc.	Cherry Hill, N. J.
00656	Aerovox Corp.	New Bedford, Mass.
00779	Amp. Inc.	Harrisburg, Pa.
00781	Aircraft Radio Corp.	Boonton, N. J.
00809	Croven Ltd.	Whitby, Ontario Canada
00815	Northern Engineering Laboratories, Inc.	Burlington, Wis.
00853	Sangamo Electric Co.	Pickens Div. Pickens, S. C.
00866	Goe Engineering Co.	City of Industry, Cal.
00891	Carl E. Holmes Corp.	Los Angeles, Calif.
00929	Microlab Inc.	Livingston, N. J.
01002	General Electric Co., Capacitor Dept.	Hudson Falls, N.Y.
01009	Alden Products Co.	Brockton, Mass.
01121	Allen Bradley Co.	Milwaukee, Wis.
01255	Litton Industries, Inc.	Beverly Hills, Calif.
01281	TRW Semiconductors, Inc.	Lawndale, Calif.
01295	Texas Instruments, Inc., Transistor Products Div.	Dallas, Texas
01349	The Alliance Mfg. Co.	Alliance, Ohio
01538	Small Parts Inc.	Los Angeles, Calif.
01589	Pacific Relays, Inc.	Van Nuys, Calif.
01670	Gudebrod Bros. Silk Co.	New York, N.Y.
01930	Ametock Corp.	Rockford, Ill.
01961	Pulse Engineering Co.	Santa Clara, Calif.
02114	Ferroxcube Corp. of America	Saugerties, N.Y.
02116	Wheelock Signals, Inc.	Long Branch, N. J.
02286	Cole Rubber and Plastics Inc.	Sunnyvale, Calif.
02660	Amphenol-Borg Electronics Corp.	Broadview, Ill.
02735	Radio Corp. of America, Semiconductor and Materials Div.	Somerville, N. J.
02771	Vocaline Co. of America, Inc.	Old Saybrook, Conn.
02777	Hopkins Engineering Co.	San Fernando, Calif.
02875	Hudson Tool & Die Co.	Newark, N. J.
03508	G. E. Semiconductor Prod. Dept.	Syracuse, N.Y.
03705	Apex Machine & Tool Co.	Dayton, Ohio
03797	Eldema Corp.	Compton, Calif.
03818	Parker Seal Co.	Los Angeles, Calif.
03877	Transitron Electric Corp.	Wakefield, Mass.
03888	Pyrofilm Resistor Co., Inc.	Cedar Knolls, N. J.
03954	Singer Co., Diehl Div. Finderne Plant	Sumerville, N. J.
04009	Arrow, Hart and Hegeman Elect. Co.	Hartford, Conn.
04013	Taurus Corp.	Lumbertville, N. J.
04062	Arco Electronic Inc.	Great Neck, N.Y.
04217	Essex Wire	Los Angeles, Calif.
04222	Hi-Q Division of Aerovox	Myrtle Beach, S.C.
04354	Precision Paper Tube Co.	Wheeling, Ill.
04404	Dymec Division of Hewlett-Packard Co.	Palo Alto, Calif.
04651	Sylvania Electric Products, Microwave Device Div.	Mountain View, Calif.
04673	Dakota Engr. Inc.	Culver City, Calif.
04713	Motorola, Inc., Semiconductor Prod. Div.	Phoenix, Arizona
04732	Filtron Co., Inc. Western Div.	Culver City, Calif.
04773	Automatic Electric Co.	Northlake, Ill.
04796	Sequoia Wire Co.	Redwood City, Calif.
04811	Precision Coil Spring Co.	El Monte, Calif.
04870	P. M. Motor Company	Westchester, Ill.
04919	Component Mfg. Service Co.	W. Bridgewater, Mass.
05006	Twentieth Century Plastics, Inc.	Los Angeles, Calif.
05245	Components Corp.	Chicago, Ill.
05277	Westinghouse Electric Corp. Semi-Conductor Dept.	Youngwood, Pa.
05347	Ultronix, Inc.	San Mateo, Calif.
05397	Union Carbide Corp., Elect. Div.	New York, N.Y.
05574	Viking Ind. Inc.	Canoga Park, Calif.
05593	Icore Electro-Plastics Inc.	Sunnyvale, Calif.
05616	Cosmo Plastic (c/o Electrical Spec. Co.)	Cleveland, Ohio
05624	Barber Colman Co.	Rockford, Ill.
05728	Tiffen Optical Co.	Roslyn Heights, Long Island, N.Y.
05729	Metro-Tel Corp.	Westbury, N.Y.
05783	Stewart Engineering Co.	Santa Cruz, Calif.
05820	Wakefield Engineering Inc.	Wakefield, Mass.
06004	Bassick Co., Div. of Stewart Warner Corp.	Bridgeport, Conn.
06090	Raychem Corp.	Redwood City, Calif.
06175	Bausch and Lomb Optical Co.	Rochester, N.Y.
06402	E.T.A. Products Co. of America	Chicago, Ill.
06540	Amatom Electronic Hardware Co., Inc.	New Rochelle, N.Y.
06555	Beede Electrical Instrument Co., Inc.	Penacook, N.H.
06666	General Devices Co., Inc.	Indianapolis, Ind.
06751	Components Inc., Ariz. Div.	Phoenix, Ariz.
06812	Torrington Mfg. Co., West Div.	Van Nuys, Calif.
06980	Varian Assoc. Eimac Div.	San Carlos, Calif.
07088	Kelvin Electric Co.	Van Nuys, Calif.
07126	Digitran Co.	Pasadena, Calif.
07137	Transistor Electronics Corp.	Minneapolis, Minn.
07138	Westinghouse Electric Corp. Electronic Tube Div.	Elmira, N.Y.
07149	Filmohm Corp.	New York, N.Y.
07233	Cinch-Graphik Co.	City of Industry, Calif.
07256	Silicon Transistor Corp.	Carle Place, N.Y.
07261	Avnet Corp.	Culver City, Calif.
07263	Fairchild Camera & Inst. Corp. Semiconductor Div.	Mountain View, Calif.
07322	Minnesota Rubber Co.	Minneapolis, Minn.
07387	Bircher Corp., The	Monterey Park, Calif.
07397	Sylvania Elect. Prod. Inc., Mt. View Operations	Mountain View, Calif.
07700	Technical Wire Products Inc.	Cranford, N.J.
07829	Bodine Elect. Co.	Chicago, Ill.
07910	Continental Device Corp.	Hawthorne, Calif.
07933	Raytheon Mfg. Co., Semiconductor Div.	Mountain View, Calif.
07980	Hewlett-Packard Co., Boonton Radio Div.	Rockaway, N.J.
08145	U.S. Engineering Co.	Los Angeles, Calif.
08289	Bunn, Delbert Co.	Pomona, Calif.
08358	Burgess Battery Co.	Niagara Falls, Ontario, Canada
08524	Deutsch Fastener Corp.	Los Angeles, Calif.
08664	Bristol Co., The	Waterbury, Conn.
08717	Sloan Company	Sun Valley, Calif.
08718	ITT Cannon Electric Inc., Phoenix Div.	Phoenix, Arizona
08727	National Radio Lab. Inc.	Paramus, N.J.
08792	CBS Electronics Semiconductor Operations, Div of C.B.S. Inc.	Lowell, Mass.
08806	General Electric Co. Miniat. Lamp Dept.	Cleveland, Ohio
08984	Mel-Rain	Indianapolis, Ind.
09026	Babcock Relays Div.	Costa Mesa, Calif.
09134	Texas Capacitor Co.	Houston, Texas
09145	Tech. Ind. Inc. Atohm Elect.	Burbank, Calif.
09250	Electro Assemblies, Inc.	Chicago, Ill.
09353	C & K Components Inc.	Newton, Mass.
09569	Mallory Battery Co. of Canada, Ltd.	Toronto, Ontario, Canada
09922	Burndy Corp.	Norwalk, Conn.
10214	General Transistor Western Corp.	Los Angeles, Calif.
10411	Ti-Tal, Inc.	Berkeley, Calif.
10646	Carborundum Co.	Niagara Falls, N.Y.
11236	CTS of Berne, Inc.	Berne, Ind.
11237	Chicago Telephone of California, Inc.	So. Pasadena, Calif.
11242	Bay State Electronics Corp.	Waltham, Mass.
11312	Teledyne Inc., Microwave Div.	Palo Alto, Calif.
11314	National Seal	Downey, Calif.
11453	Precision Connector Corp.	Jamaica, N.Y.
11534	Duncan Electronics Inc.	Costa Mesa, Calif.
11711	General Instrument Corp., Semiconductor Div., Products Group	Newark, N.J.
11717	Imperial Electronic, Inc.	Buena Park, Calif.
11870	Melabs, Inc.	Palo Alto, Calif.
12040	National Semiconductor	Danbury, Conn.
12136	Philadelphia Handle Co.	Camden, N.J.
12361	Grove Mfg. Co., Inc.	Shady Grove, Pa.
12574	Gulton Ind. Inc. Data System Div.	Albuquerque, N.M.
12697	Clarostat Mfg. Co.	Dover, N.H.
12728	Elmar Filter Corp.	W. Haven, Conn.
12859	Nippon Electric Co., Ltd.	Tokyo, Japan
12881	Melex Electronics Corp.	Clark, N.J.
12930	Delta Semiconductor Inc.	Newport Beach, Calif.
12954	Dickson Electronics Corp.	Scottsdale, Arizona
13019	Airco Supply Co., Inc.	Wichita, Kansas
13103	Thermalloy	Dallas, Texas
13396	Telefunken (GmbH)	Hanover, Germany
13835	Midland-Wright Div. of Pacific Industries, Inc.	Kansas City, Kansas
14099	Sem-Tech	Newbury Park, Calif.
14193	Calif. Resistor Corp.	Santa Monica, Calif.
14298	American Components, Inc.	Conshohocken, Pa.
14433	ITT Semiconductor, A Div. of Int. Telephone & Telegraph Corp.	West Palm Beach, Fla.
14493	Hewlett-Packard Company	Loveland, Colo.
14655	Cornell Dublier Electric Corp.	Newark, N.J.
14674	Corning Glass Works	Corning, N.Y.
14752	Electro Cube Inc.	San Gabriel, Calif.
14960	Williams Mfg. Co.	San Jose, Calif.
15106	The Sphere Co., Inc.	Little Falls, N.J.
15203	Webster Electronics Co.	New York, N.Y.
15287	Scionics Corp.	Northridge, Calif.
15291	Adjustable Bushing Co.	N. Hollywood, Calif.
15558	Micron Electronics	Garden City, Long Island, N.Y.
15566	Amprobe Inst. Corp.	Lynbrook, N.Y.
15631	Cableitronics	Costa Mesa, Calif.
15772	Twentieth Century Coil Spring Co.	Santa Clara, Calif.
15801	Fenwal Elect. Inc.	Framingham, Mass.
15818	Ametco Inc.	Mt. View, Calif.
16037	Spruce Pine Mica Co.	Spruce Pine, N.C.
16179	Omni-Spectra Inc.	Farmington, Mich.
16352	Computer Diode Corp.	Lodi, N.J.
16585	Boots Aircraft Nut Corp.	Pasadena, Calif.
16688	Ideal Prec. Meter Co., Inc. De Jur Meter Div.	Brooklyn, N.Y.
16758	Delco Radio Div. of G.M. Corp.	Kokomo, Ind.
17109	Thermonetics Inc.	Canoga Park, Calif.
17474	Trapex Company	Mountain View, Calif.
17554	Components Inc.	Biddeford, Me.
17675	Hamlin Metal Products Corp.	Akron, Ohio
17745	Angstrohm Prec. Inc.	No. Hollywood, Calif.
17856	Siliconix Inc.	Sunnyvale, Calif.

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Table 6-4. List of Manufacturers' Codes (Cont')

Code No.	Manufacturer	Address
17870	McGraw-Edison Co.	Manchester, N.H.
18042	Power Design Pacific Inc.	Palo Alto, Calif.
18083	Clevite Corp., Semiconductor Div.	Palo Alto, Calif.
18324	Signetics Corp.	Sunnyvale, Calif.
18476	Ty-Car Mfg. Co., Inc.	Holliston, Mass.
18486	TRW Elect. Comp. Div.	Des Plaines, Ill.
18583	Curtis Instrument, Inc.	Mt. Kisco, N.Y.
18612	Vishay Instruments Inc.	Malvern, Pa.
18873	E.I. DuPont and Co., Inc.	Wilmington, Del.
18911	Durant Mfg. Co.	Milwaukee, Wis.
19315	The Bendix Corp., Navigation & Control Div.	Teterboro, N.J.
19500	Thomas A. Edison Industries, Div. of McGraw-Edison Co.	West Orange, N.J.
19589	Concoa	Baldwin Park, Calif.
19644	LRC Electronics	Horseheads, N.Y.
19701	Electra Mfg. Co.	Independence, Kansas
20183	General Atronics Corp.	Philadelphia, Pa.
21226	Executone, Inc.	Long Island City, N.Y.
21335	Fafnir Bearing Co., The	New Britain, Conn.
21520	Fansteel Metallurgical Corp.	N. Chicago, Ill.
23042	Texscan Corp.	Indianapolis, Ind.
23783	British Radio Electronics Ltd.	Washington, D.C.
24455	G.E. Lamp Division	Nela Park, Cleveland, Ohio
24655	General Radio Co.	West Concord, Mass.
24681	Memcor Inc., Comp. Div.	Huntington, Ind.
24756	Pacelco Inc.	San Juan Capistrano, Calif.
26365	Gries Reproducer Corp.	New Rochelle, N.Y.
26462	Globe Fite Co. of America Inc.	Carlstadt, N.J.
26851	Compac/Hollister Co.	Hollister, Calif.
26992	Hamilton Watch Co.	Lancaster, Pa.
27251	Specialties Mfg. Co., Inc.	Stratford, Conn.
28480	Hewlett-Packard Co.	Palo Alto, Calif.
28520	Heyman Mfg. Co.	Kenilworth, N.J.
30817	Instrument Specialties Co., Inc.	Little Falls, N.J.
33173	G.E. Receiving Tube Dept.	Owensboro, Ky.
35434	Lectrohm Inc.	Chicago, Ill.
36196	Stanwyck Coil Products Ltd.	Hawkesbury, Ontario, Canada
36287	Cunningham, W.H. & Hill, Ltd.	Toronto Ontario, Canada
37942	P.R. Mallory & Co. Inc.	Indianapolis, Ind.
39543	Mechanical Industries Prod. Co.	Akion, Ohio
40920	Miniature Precision Bearings, Inc.	Keene, N.H.
42190	Muter Co.	Chicago, Ill.
43990	C.A. Norgren Co.	Englewood, Colo.
44655	Ohmite Mfg. Co.	Skokie, Ill.
46384	Penn Eng. & Mfg. Corp.	Doylestown, Pa.
47904	Polaroid Corp.	Cambridge, Mass.
48620	Precision Thermometer & Inst. Co.	Southampton, Pa.
49956	Microwave & Power Tube Div.	Waltham, Mass.
52090	Rowan Controller Co.	Westminster, Md.
52983	Sanborn Company	Waltham, Mass.
54294	Shallcross Mfg. Co.	Selma, N.C.
55026	Simpson Electric Co.	Chicago, Ill.
55933	Sonotone Corp.	Elmsford, N.Y.
55938	Raytheon Co. Commercial Apparatus & Systems Div.	So. Norwalk, Conn.
56137	Spaulding Fibre Co., Inc.	Tonawanda, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
59446	Telex Corp.	Tulsa, Okla.
59730	Thomas & Betts Co.	Elizabeth, N.J.
60761	Triplett Electrical Inst. Co.	Bluffton, Ohio
61775	Union Switch and Signal, Div. of Westinghouse Air Brake Co.	Pittsburgh, Pa.
62119	Universal Electric Co.	Owosso, Mich.
63743	Ward-Leonard Electric Co.	Mt. Vernon, N.Y.
64959	Western Electric Co., Inc.	New York, N.Y.
65092	Weston Instl. Inc. Weston-Newark	Newark, N.J.
66295	Willek Mfg. Co.	Chicago, Ill.
66346	Minnesota Mining & Mfg. Co. Revere Mincom Div.	St. Paul, Minn.
70276	Allen Mfg. Co.	Hartford, Conn.
70309	Allied Control	New York, N.Y.
70318	Allmetal Screw Product Co., Inc.	Garden City, N.Y.
70417	Amplex, Div. of Chrysler Corp.	Detroit, Mich.
70485	Atlantic India Rubber Works, Inc.	Chicago, Ill.
70563	Amperite Co., Inc.	Union City, N.J.
70674	ADC Products Inc.	Minneapolis, Minn.
70903	Belden Mfg. Co.	Chicago, Ill.
70998	Bird Electronic Corp.	Cleveland, Ohio
71002	Birnbach Radio Co.	New York, N.Y.
71034	Blitley Electric Co., Inc.	Erie, Pa.
71041	Boston Gear Works Div. of Murray Co. of Texas	Quincy, Mass.
71218	Bud Radio, Inc.	Willoughby, Ohio
71279	Cambridge Thermionics Corp.	Cambridge, Mass.
71286	Camloc Fastener Corp.	Paramus, N.J.
71313	Cardwell Condenser Corp.	Lindenhurst L.I., N.Y.
71400	Bussmann Mfg. Div. of McGraw-Edison Co.	St. Louis, Mo.
71436	Chicago Condenser Corp.	Chicago, Ill.
71447	Calif. Spring Co., Inc.	Pico-Rivera, Calif.
71450	CTS Corp.	Elkhart, Ind.
71468	ITT Cannon Electric Inc.	Los Angeles, Calif.
71471	Cinema, Div. Aerovox Corp.	Burbank, Calif.
71482	G.P. Clare & Co.	Chicago, Ill.
71590	Centralab Div. of Globe Union Inc.	Milwaukee, Wis.
71616	Commercial Plastics Co.	Chicago, Ill.
71700	Cornish Wire Co., The	New York, N.Y.
71707	Coto Coil Co., Inc.	Providence, R.I.
71744	Chicago Miniature Lamp Works	Chicago, Ill.
71785	Cinch Mfg. Co., Howard B. Jones Div.	Chicago, Ill.
71984	Dow Corning Corp.	Midland, Mich.
72136	Electro Motive Mfg. Co., Inc.	Willimantic, Conn.
72619	Dialight Corp.	Brooklyn, N.Y.
72656	Indiana General Corp., Electronics Div.	Keasby, N.J.
72699	General Instrument Corp., Cap. Div.	Newark, N.J.
72765	Drake Mfg. Co.	Harwood Heights, Ill.
72825	Hugh H. Eby Inc.	Philadelphia, Pa.
72928	Gudeman Co.	Chicago, Ill.
72962	Elastic Stop Nut Corp.	Union, N.J.
72964	Robert M. Hadley Co.	Los Angeles, Calif.
72982	Erie Technological Products, Inc.	Erie, Pa.
73061	Hansen Mfg. Co., Inc.	Princeton, Ind.
73076	H.M. Harper Co.	Chicago, Ill.
73138	Helipot Div. of Beckman Inst., Inc.	Fullerton, Calif.
73293	Hughes Products Division of Hughes Aircraft Co.	Newport Beach, Calif.
73445	Amperex Elect Co.	Hicksville, L.I., N.Y.
73506	Bradley Semiconductor Corp.	New Haven, Conn.
73559	Carling Electric, Inc.	Hartford, Conn.
73586	Circle F Mfg. Co.	Trenton, N.J.
73682	George K. Garrett Co., Div. MSL Industries Inc.	Philadelphia, Pa.
73734	Federal Screw Products Inc.	Chicago, Ill.
73743	Fischer Special Mfg. Co.	Cincinnati, Ohio
73793	General Industries Co., The	Elyria, Ohio
73846	Goshen Stamping & Tool Co.	Goshen, Ind.
73899	JFD Electronics Corp.	Brooklyn, N.Y.
73905	Jennings Radio Mfg. Corp.	San Jose, Calif.
73957	Groov-Pin Corp.	Ridgefield N.J.
74276	Sealite Inc.	Neptune, N.J.
74455	J.H. Winns, and Sons	Winchester, Mass.
74861	Industrial Condenser Corp.	Chicago, Ill.
74868	R.F. Products Division of Amphenol-Berg Electronics Corp.	Danbury, Conn.
74970	E.F. Johnson Co.	Waseca, Minn.
75042	International Resistance Co.	Philadelphia, Pa.
75263	Keystone Carbon Co., Inc.	St. Marys, Pa.
75378	CTS Knights Inc.	Sandwich, Ill.
75382	Kulka Electric Corporation	Mt. Vernon, N.Y.
75818	Lenz Electric Mfg. Co.	Chicago, Ill.
75915	Littlefuse, Inc.	Des Plaines, Ill.
76005	Lord Mfg. Co.	Erie, Pa.
76210	C.W. Marwedel	San Francisco, Calif.
76433	General Instrument Corp., Micamold Division	Newark, N.J.
76487	James Millen Mfg. Co., Inc.	Malden, Mass.
76493	J.W. Miller Co.	Los Angeles, Calif.
76530	Cinch-Monadnock, Div. of United Carr Fastener Corp.	San Leandro, Calif.
76545	Mueller Electric Co.	Cleveland, Ohio
76703	National Union	Newark, N.J.
76854	Oak Manufacturing Co.	Crystal Lake, Ill.
77068	The Bendix Corp., Electrodynamics Div.	N. Hollywood, Calif.
77075	Pacific Metals Co.	San Francisco, Calif.
77221	Phanostran Instrument and Electronic Co.	South Pasadena, Calif.
77252	Philadelphia Steel and Wire Corp.	Philadelphia, Pa.
77342	American Machine & Foundry Co. Potter & Brumfield Div.	Princeton, Ind.
77630	TRW Electronic Components Div.	Camden, N.J.
77638	General Instrument Corp., Rectifier Div.	Brooklyn, N.Y.
77764	Resistance Products Co.	Harrisburg, Pa.
77969	Rubbercraft Corp. of Calif.	Torrance, Calif.
78189	Shakeproof Division of Illinois Tool Works	Elgin, Ill.
78277	Sigma	So. Braintree, Mass.
78283	Signal Indicator Corp.	New York, N.Y.
78290	Struthers-Dunn Inc.	Pitman, N.J.
78424	Specialty Leather Prod. Co.	Newark, N.J.
78452	Thompson-Bremer & Co.	Chicago, Ill.
78471	Tilley Mfg. Co.	San Francisco, Calif.
78488	Stackpole Carbon Co.	St. Marys, Pa.
78493	Standard Thomson Corp.	Waltham, Mass.
78553	Tinnerman Products, Inc.	Cleveland, Ohio
78790	Transformer-Engineers	San Gabriel, Calif.
78947	Ucinite Co.	Newtonville, Mass.
79136	Waldes Kohinoor Inc.	Long Island City, N.Y.
79142	Veeder Root, Inc	Hartford, Conn.
79251	Wenco Mfg. Co.	Chicago, Ill.
79727	Continental Wirl Electronics Corp.	Philadelphia, Pa.
79963	Zierick Mfg. Corp	New Rochelle, N.Y.
80031	Mepco Division of Sessions Clock Co.	Morristown, N.J.
80033	Prestole Corp.	Toledo, Ohio
80120	Schnitzer Alloy Products Co.	Elizabeth, N.J.
80131	Electronic Industries Association. Any brand Tube meeting EIA Standards-Washington, DC.	
80707	Unimax Switch, Div. Maxon Electronics Corp.	Wallingford, Conn.
80723	United Transformer Corp.	New York, N.Y.
80748	Oxford Electric Corp.	Chicago, Ill.
80794	Bourns Inc.	Riverside, Calif.
80411	Acro Div. of Robertshaw Controls Co.	Columbus, Ohio

Table 6-4. List of Manufacturers' Codes (Cont')

Code No.	Manufacturer	Address
80486	All Star Products Inc.	Defiance, Ohio
80509	Avery Label Co.	Monrovia, Calif.
80583	Hammarlund Co., Inc.	Mars Hill, N.C.
80640	Stevens, Arnold, Co., Inc.	Boston, Mass.
80813	Dimco Gray Co.	Dayton, Ohio
81030	International Instruments Inc.	Orange, Conn.
81073	Grayhill Co.	LaGrange, Ill.
81095	Triad Transformer Corp.	Venice, Calif.
81312	Winchester Elec. Div. Litton Ind., Inc.	Oakville, Conn.
81349	Military Specification	
81483	International Rectifier Corp.	El Segundo, Calif.
81541	Airpax Electronics, Inc.	Cambridge, Maryland
81860	Barry Controls, Div. Barry Wright Corp.	Watertown, Mass.
82042	Carter Precision Electric Co.	Skokie, Ill.
82047	Sperti Faraday Inc., Copper Hewitt Electric Div.	Hoboken, N.J.
82116	Electric Regulator Corp.	Norwalk, Conn.
82142	Jeffers Electronics Division of Speer Carbon Co.	Du Bois, Pa.
82170	Fairchild Camera & Inst. Corp. Space & Defense System Div.	Paramus, N.J.
82209	Maguire Industries, Inc.	Greenwich, Conn.
82219	Sylvania Electric Prod. Inc. Electronic Tube Division	Emporium, Pa.
82376	Astron Corp.	East Newark, Harrison, N.J.
82389	Switchcraft, Inc.	Chicago, Ill.
82647	Metals & Controls Inc. Spencer Products	Attleboro, Mass.
82768	Phillips-Advance Control Co.	Joliet, Ill.
82866	Research Products Corp.	Madison, Wis.
82877	Rotron Mfg. Co., Inc.	Woodstock, N.Y.
82893	Vector Electronic Co.	Glendale, Calif.
83014	Hartwell Corp.	Los Angeles, Calif.
83058	Carr Fastener Co.	Cambridge, Mass.
83086	New Hampshire Ball Bearing, Inc.	Peterborough, N.H.
83125	General Instrument Corp., Capacitor Div.	Darlington, S.C.
83148	ITT Wire and Cable Div.	Los Angeles, Calif.
83186	Victory Eng. Corp.	Springfield, N.J.
83298	Bendix Corp., Red Bank Div.	Red Bank, N.J.
83315	Hubbell Corp.	Mundelein, Ill.
83324	Rotan Inc.	Newport Beach, Calif.
83330	Smith, Herman H., Inc.	Brooklyn, N.Y.
83332	Tech Labs	Palisade's Park, N.J.
83385	Central Screw Co.	Chicago, Ill.
83501	Gavitt Wire and Cable Co. Div. of Amerace Corp.	Brookfield, Mass.
83594	Burroughs Corp. Electronic Tube Div.	Plainfield, N.J.
83740	Union Carbide Corp. Consumer Prod. Div.	New York, N.Y.
83777	Model Eng. and Mfg., Inc.	Huntington, Ind.
83821	Loyd Scruggs Co.	Festus, Mo.
83942	Aeronautical Inst. & Radio Co.	Lodi, N.J.
84171	Arco Electronics Inc.	Great Neck, N.Y.
84396	A. J. Glesener Co., Inc.	San Francisco, Calif.
84411	TRW Capacitor Div.	Ogallala, Neb.
84970	Sarkes Tarzian, Inc.	Bloomington, Ind.
85454	Boonton Molding Company	Boonton, N.J.
85471	A.B. Boyd Co.	San Francisco, Calif.
85474	R.M. Bracamonte & Co.	San Francisco, Calif.
85660	Koiled Kords, Inc.	Hamden, Conn.
85911	Seamless Rubber Co.	Chicago, Ill.
86174	Fafnir Bearing Co.	Los Angeles, Calif.
86197	Clifton Precision Products Co., Inc.	Clifton Heights, Pa.
86579	Precision Rubber Products Corp.	Dayton, Ohio
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.
86928	Seastrom Mfg. Co.	Glendale, Calif.
87034	Marco Industries	Anaheim, Calif.
87216	Philco Corporation (Lansdale Division)	Lansdale, Pa.
87473	Western Fibrous Glass Products Co.	San Francisco, Calif.
87664	Van Waters & Rogers Inc.	San Francisco, Calif.
87930	Tower Mfg. Corp.	Providence, R.I.
88140	Cutler-Hammer, Inc.	Lincoln, Ill.
88220	Gould-National Batteries, Inc.	St. Paul, Minn.
88698	General Mills, Inc.	Buffalo, N.Y.
89231	Graybar Electric Co.	Oakland, Calif.
89473	G.E. Distributing Corp.	Schenectady, N.Y.
89665	United Transformer Co.	Chicago, Ill.
90030	United Shoe Machinery Corp.	Beverly, Mass.
90179	US Rubber Co., Consumer Ind. & Plastics Prod. Div.	Passaic, N.J.
90763	United Carr Fastener Corp.	Chicago, Ill.
90970	Bearing Engineering Co.	San Francisco, Calif.
91146	ITT Cannon Elect, Inc., Salem Div.	Salem, Mass.
91260	Connor Spring Mfg. Co.	San Francisco, Calif.
91345	Miller Dial & Nameplate Co.	El Monte, Calif.
91418	Radio Materials Co.	Chicago, Ill.
91506	Augat Inc.	Attleboro, Mass.
91637	Dale Electronics, Inc.	Columbus, Nebr.
91662	Elco Corp.	Willow Grove, Pa.
91737	Gremar Mfg. Co., Inc.	Wakefield, Mass.
91827	K F Development Co.	Redwood City, Calif.
91886	Malco Mfg. Co., Inc.	Chicago, Ill.
91929	Honeywell Inc., Micro Switch Div.	Freeport, Ill.
91961	Nahm-Bros. Spring Co.	Oakland, Calif.
92180	Tru-Connector Corp.	Peabody, Mass.
92367	Elgeet Optical Co. Inc.	Rochester, N.Y.
92607	Tensolite Insulated Wire Co., Inc.	Tarrytown, N.Y.
92702	IMC Magnetics Corp.	Westbury Long Island, N.Y.
92966	Hudson Lamp Co.	Kearney, N.J.
93332	Sylvania Electric Prod. Inc. Semiconductor Div.	Woburn, Mass.
93369	Robbins & Myers Inc.	Palisades Park, N.J.
93410	Stemco Controls Div. of Essex Wire Corp.	Mansfield, Ohio
93632	Waters Mfg. Co.	Culver City, Calif.
93929	G.V. Controls	Livingston, N.J.
94137	General Cable Corp.	Bayonne, N.J.
94142	Phelps Dodge	Yonkers, N.Y.
94144	Raytheon Co., Comp. Div., Ind. Comp. Operations	Quincy, Mass.
94148	Scientific Electronics Products, Inc.	Loveland, Colo.
94154	Wagner Elect. Corp., Tung-Sol Div.	Newark, N.J.
94197	Curtiss-Wright Corp. Electronics Div.	East Paterson, N.J.
94222	South Chester Corp.	Chester, Pa.
94330	Wire Cloth Products, Inc.	Bellwood, Ill.
94375	Automatic Metal Products Co.	Brooklyn, N.Y.
94682	Worcester Pressed Aluminum Corp.	Worcester Mass.
94696	Magnecraft Electric Co.	Chicago, Ill.
95023	George A. Philbrick Researchers, Inc.	Boston, Mass.
95236	Allies Products Corp.	Dania, Fla.
95238	Continental Connector Corp.	Woodside, N.Y.
95263	Leecraft Mfg. Co., Inc.	Long Island, N.Y.
95265	National Coil Co.	Sheridan, Wyo.
95275	Vitramon, Inc.	Bridgeport, Conn.
95348	Gordos Corp.	Bloomfield, N.J.
95354	Methode Mfg. Co.	Rolling Meadows, Ill.
95566	Arnold Engineering Co.	Marengo, Ill.
95712	Dage Electric Co., Inc.	Franklin, Ind.
95984	Simon Mfg. Co.	Wayne, Ill.
95987	Weckesser Co.	Chicago, Ill.
96067	Microwave Assoc., West Inc.	Sunnyvale, Calif.
96095	Hi-Q Div. of Aerovox Corp.	Olean, N.Y.
96256	Thordarson-Meissner Inc.	Mt. Carmel, Ill.
96296	Solar Manufacturing Co.	Los Angeles, Calif.
96306	Microswitch, Div. of Minn.-Honeywell	Freeport, Ill.
96330	Carlton Screw Co.	Chicago, Ill.
96341	Microwave Associates, Inc.	Burlington, Mass.
96501	Excel Transformer Co.	Oakland, Calif.
96508	Xcelite Inc.	Orchard Park, N.Y.
96733	San Fernando Elect. Mfg. Co.	San Fernando, Calif.
96881	Thomson Ind. Inc.	Long Is., N.Y.
97464	Industrial Retaining Ring Co.	Irvington, N.J.
97539	Automatic & Precision Mfg.	Englewood, N.J.
97979	Reon Resistor Corp.	Yonkers, N.Y.
97983	Litton System Inc., Adler-Westrex Commun. Div.	New Rochelle, N.Y.
98141	R-Troncis, Inc.	Jamaica, N.Y.
98159	Rubber Teck, Inc.	Gardena, Calif.
98220	Hewlett-Packard Co., Moseley Div.	Pasadena, Calif.
98278	Microdot, Inc.	So. Pasadena, Calif.
98291	Sealectro Corp.	Mamaroneck, N.Y.
98376	Zero Mfg. Co.	Burbank, Calif.
98410	Etc Inc.	Cleveland, Ohio
98731	General Mills Inc., Electronics Div.	Minneapolis, Minn.
98734	Paeco Div. of Hewlett-Packard Co.	Palo Alto, Calif.
98871	North Hills Electronics, Inc.	Glen Cove, N.Y.
98978	International Electronic Research Corp.	Burbank, Calif.
99109	Columbia Technical Corp.	New York, N.Y.
99313	Varian Associates	Palo Alto, Calif.
99378	Allee Corp.	Winchester, Mass.
99515	Marshall Ind., Capacitor Div.	Monrovia, Calif.
99707	Control Switch Division, Controls Co. of America	El Segundo, Calif.
99800	Delevan Electronics Corp.	East Aurora, N.Y.
99848	Wilco Corporation	Indianapolis, Ind.
99928	Branson Corp.	Whippany, N.J.
99934	Renbrandt, Inc.	Boston, Mass.
99942	Hoffman Electronics Corp. Semiconductor Div.	El Monte, Calif.
99957	Technology Instrument Corp. of Calif.	Newbury Park, Calif.

THE FOLLOWING HP VENDORS HAVE NO NUMBER ASSIGNED IN THE LATEST SUPPLEMENT TO THE FEDERAL SUPPLY CODE FOR MANUFACTURERS HANDBOOK.

0000F	Malco Tool and Die	Los Angeles, Calif.
0000Z	Willow Leather Products Corp.	Newark, N.J.
000AB	ETA	England
000BB	Precision Instrument Components Co.	Van Nuys, Calif.
000CS	Hewlett-Packard Co., Colorado Springs	Colorado Springs, Colorado
000MM	Rubber Eng. & Development	Hayward, Calif.
000NN	"A" "N" O Mfg. Co.	San Jose, Calif.
000QQ	Cooltron	Oakland, Calif.
000WW	California Eastern Lab.	Burlington, Calif.
000YY	S.K. Smith Co.	Los Angeles, Calif.

From: FSC. Handbook Supplements

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION.

7-2. This section contains information required to backdate or update this manual for a specific instrument. Descriptions of special options and standard options are also in this section.

7-3. MANUAL CHANGES.

7-4. This manual applies directly to the instrument having a serial prefix as shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, refer to Tables 7-1 through 7-4 for changes necessary to backdate the manual to the instrument. If the serial prefix of the instrument is not listed either in the title page or in Tables 7-1 through 7-4, refer to an enclosed MANUAL CHANGES sheet for updating information. Also, if a MANUAL CHANGES sheet is supplied, make all indicated ERRATA corrections.

Table 7-1. Model 1430A Manual Changes

Serials Prefixed	Make Changes
616	1, 3, 4
648	2, 3, 4
715	4

Table 7-2. Model 1430B Manual Changes

No backdating are required at this time.

Table 7-3. Model 1431A Manual Changes

Serials Prefixed	Make Changes
628	1, 3, 4
707	4

Table 7-4. Model 1432A Manual Changes

Serials Prefixed	Make Changes
633	5, 6
725	6

CHANGE 1

Table 6-2,
MP1: chassis, main: change HP Part No. to 01430-25201.
MP4: cover, bottom: change HP Part No. to 01430-04102.

CHANGE 2

Table 6-2,
MP1: chassis, main: change HP Part No. to 01430-25203.

CHANGE 3

Table 6-2,
P4: change HP Part No. to 1251-1445.
W1: cable, main: change HP Part No. to 01430-61601.
Delete: W2, cable, channel A.
Delete: W3, cable, channel B.
Delete: W4, cable, pulse generator.

CHANGE 4

Table 6-2,
CR110, CR111: change HP Part No. to 1901-0118.

NOTE

When 1901-0188 diodes are replaced with 1901-0050, replace both CR110 and CR111 to maintain circuit balance.

CHANGE 5

Table 6-3,
C102, C302: change HP Part No. to 0132-0004
C: var .7–3 pF
C106, C306: change HP Part No. to 0121-0060
C: var cer 2–8 pF 300 wVdc
C111, C112, C311, C312: change HP Part No. to 0140-0222, C: fxd mica 240 pF 1% 300 wVdc.
CR202: change HP Part No. to 1901-0118.
MP1, housing: change HP Part No. to 01432-25202.
P4: change HP Part No. to 1251-1445.
R103, R303: change HP Part No. to 0757-0465
R: fxd metflm 100 kilohms 1% 1/8W.
R121, R321: change HP Part No. to 2100-0363
R: var 10 kilohms 5%.
R136, R336: change HP Part No. to 0757-0434
R: fxd metflm 3650 ohms 1% 1/8W.

Table 6-3,

R208: change HP Part No. to 2100-0755. R: var 1000 ohms 5%.

R210: change HP Part No. to 2100-1429, R: var 2000 ohms 5%.

W1: cable, main: change HP Part No. to 01432-61602.

Delete: C107, C116, C117, C307, C316, C317, R106, R132, R306, R332.

Delete: W2, cable assy, channel A.

Delete: W3, cable assy, channel B.

Add: C211, C212, HP Part No. 0170-0040, C: fxd mv .047 uF 10% 200 wVdc.

Add: L202, HP Part No. 9140-0094, L: fxd .68 uH 10%.

Add: R214, R215, HP Part No. 0757-0280, R: fxd metflm 1000 ohms 1% 1/8W.

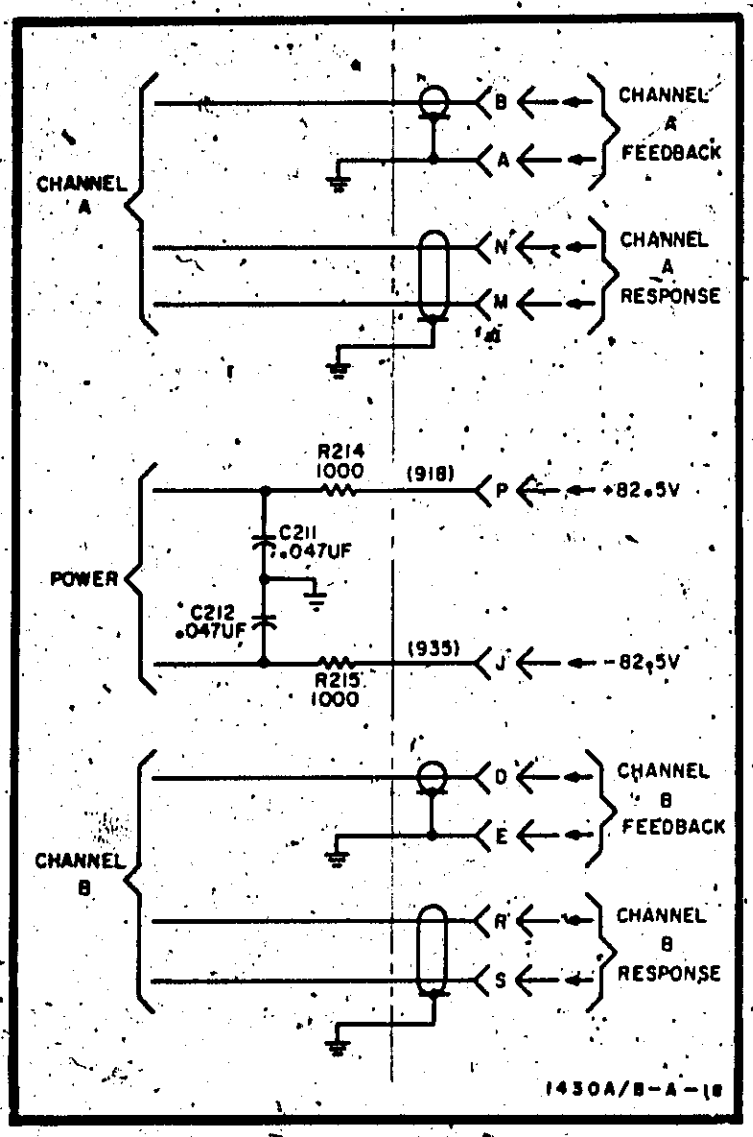


Figure 7-1. Cable Connections

Figure 8-16,

C102, C302: change value to .7–3 pF.

C111, C112, C311, C312: change value to 240 pF.

R103, R303: change value to 100K.

R136, R336: change value to 3650 ohms.

Add: L202, .68 uH. Connect in parallel with R212.

Delete: C107, C116, C117, C307, C316, C317, R106, R132, R306 and R332.

Add: C211, C212, R214 and R215. Connect as shown in Figure 7-1.

CHANGE 6

Table 6-3,

C207: change HP Part No. to 0150-0051 C: fxd cer 100 pF 600 wVdc.

Figure 8-16,

C207: change value to 100 pF.

7-5. SPECIAL OPTIONS.

7-6. Most customer special application requirements and/or specifications can be met by factory modification of a standard instrument. A standard instrument modified in this way will carry a special option number (Model 0000A/Option C01).

7-7. An Operating and Service Manual and a manual insert are provided with each special option instrument. The Operating and Service Manual contains information about the standard instrument. The manual insert for the special option describes the factory modifications required to produce the special option instrument. Amend the Operating and Service Manual by changing it to include all manual insert information (and MANUAL CHANGES sheet information, if applicable). When these changes are made, the Operating and Service Manual will apply to the special option instrument.

7-8. If you have ordered a special option instrument and the manual insert is missing, notify the nearest Hewlett-Packard Sales/Service Office. Be sure to give a full description of the instrument, including the complete serial number and special option number.

7-9. STANDARD OPTIONS.

7-10. Standard options are modifications installed on HP instruments at the factory and are available on request. Contact the nearest Hewlett-Packard Sales/Service Office for information concerning standard options.

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains schematic diagrams, information regarding repair and replacement, component identification, and troubleshooting tips. Refer to Table 8-2 for symbols used on the schematics.

8-3. COMPONENT IDENTIFICATION.

8-4. Components on the etched circuit boards and on the chassis are identified in photos adjacent to the applicable schematic. Model 1430A, 1430B and 1431A adjustments are identified in Figure 8-7. Model 1432A adjustments are identified in Figure 8-13 and 8-14.

8-5. REPAIR AND REPLACEMENT.

8-6. Most of the electrical components are accessible for replacement from the component side of the etched circuit board. Section VI provides a detailed parts list for ordering parts. If satisfactory repair or operation cannot be accomplished, contact the nearest Hewlett-Packard Sales/Service Office (addresses at rear of this manual). If shipment for repair is recommended, see Section II for recommended repackaging information.

8-7. SERVICING ETCHED CIRCUIT BOARDS.

8-8. The Samplers have plated-through type etched circuit boards. When servicing this type of board, components may be removed or replaced by unsoldering from either side of the board. When replacing large components, such as potentiometers, rotate the soldering iron tip from lead to lead while applying pressure to the part to lift it from the board. HP Service Note M-20E contains additional information on the repair of etched circuit boards, however, the important considerations are as follows:

a. Do not apply excessive heat.

b. Apply heat to component lead and remove lead with a straight pull from the board.

c. Use a toothpick or wooden splinter to clean holes.

d. Do not force leads of replacement component into holes.

8-9. If the plated metal surface (conductor) lifts from the board, it may be cemented back with a quick-drying acetate base cement (use sparingly) having good insulating properties. An alternate method of repair is to solder a good conducting wire along the damaged area.

8-10. REMOVING SAMPLING DIODES.

8-11. MODELS 1430A, 1430B, and 1431A. The sampling diode(s) should be removed only after definitely establishing that it is faulty (see Paragraph 8-29 for procedure). The diodes are EXTREMELY FRAGILE and must be handled with the utmost caution. The following steps provide instructions for diode removal and replacement.

CAUTION

Physically, the upper and lower diodes look alike, however, they are electrically different. Figure 8-2 identifies the diodes by reference designation and HP Part No. (viewed from front and top of instrument). Always replace diodes exactly as shown. MAKE NO ATTEMPT TO FURTHER DISASSEMBLE THE SAMPLER BLOCK.

a. Loosen the screw and slide the diode retainer away from the insulator as shown in Figure 8-1.

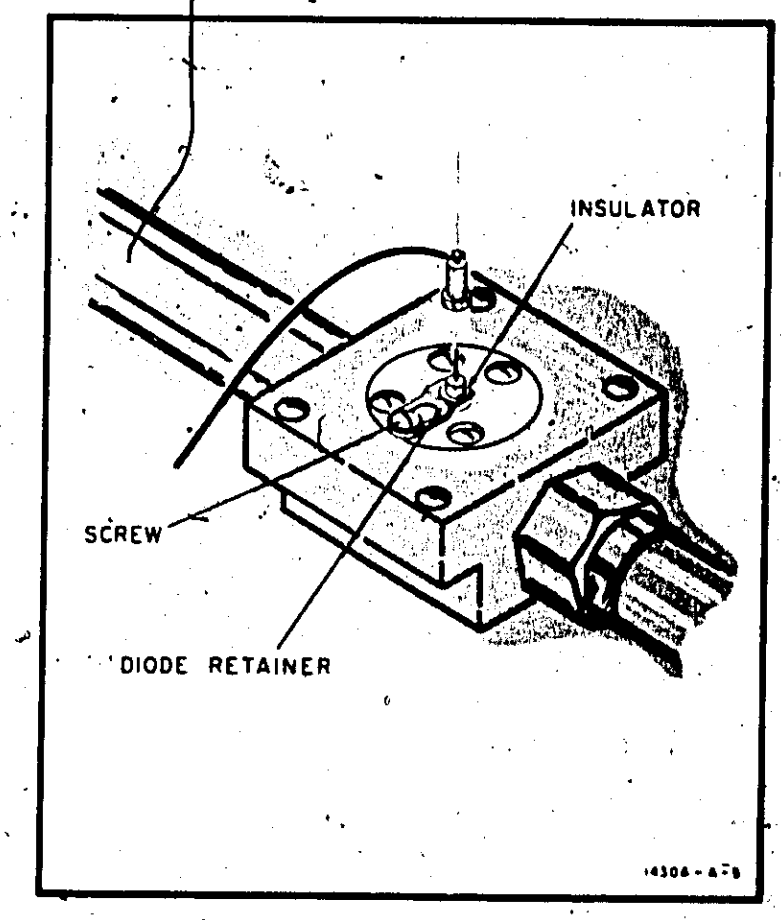


Figure 8-1. Diode Removal, Model 1430A and 1431A

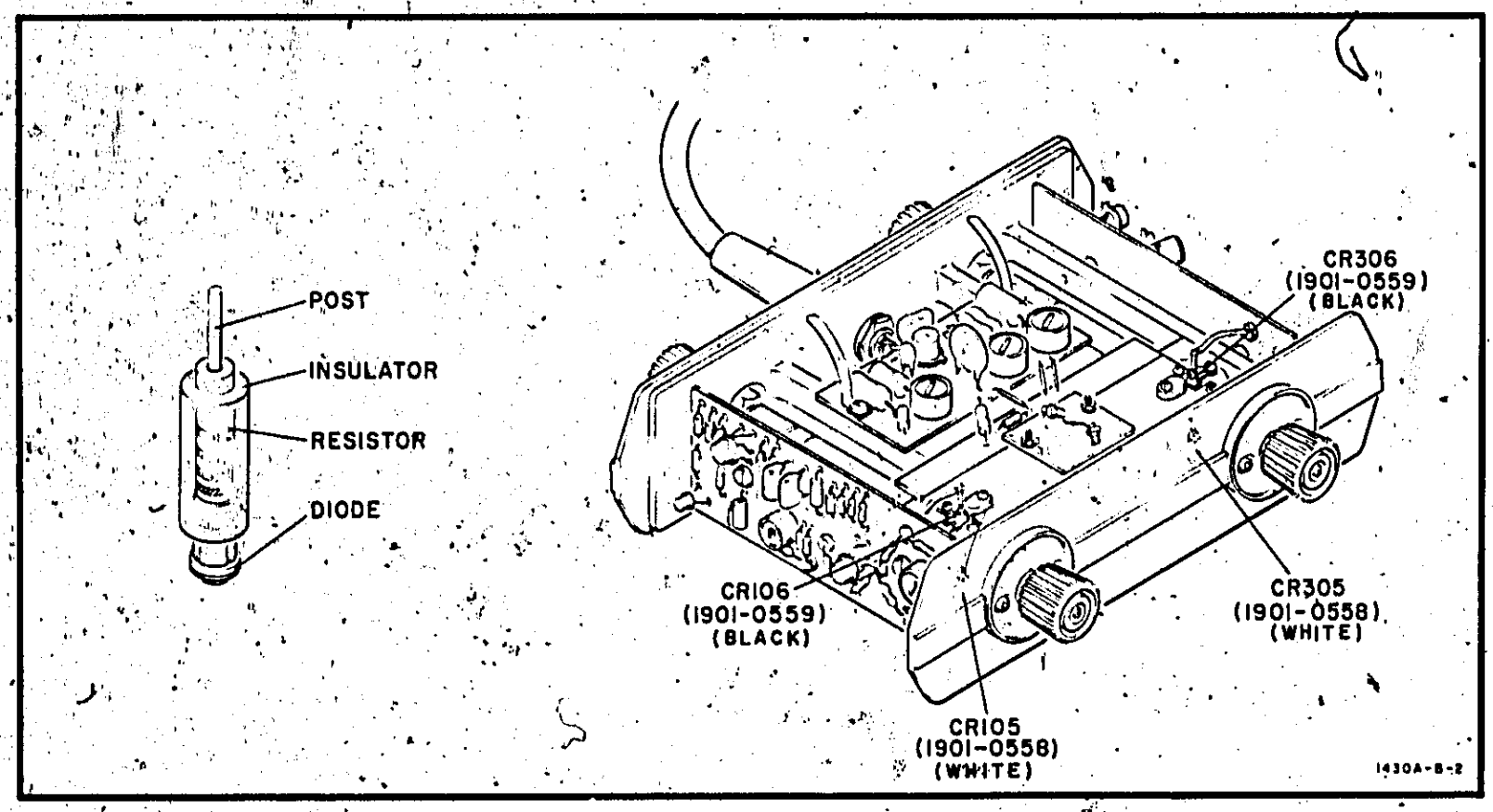


Figure 8-2A. Diode and Resistor Assembly, Model 1430A and 1431A

b. Gently withdraw the diode insulator assembly from the sampler. It should appear exactly as in Figure 8-2A. If the glass bead is broken off, it may remain inside the sampler. It must be removed before the new diode assembly is inserted. To remove the broken bead, turn the sampler upside-down and gently tap the side of the block. Do not bang the connectors.

c. Grasp the new diode by the post. Do not handle the glass bead. The bead is quite fragile and continued handling at that area tends to weaken the device mechanically.

d. Refer to Figure 8-2A to make sure the correct diode assembly is being used as a replacement. Insert the assembly straight into the sampler. (A lateral blow is in the plane most likely to break the glass bead.) The glass bead should center itself in the bottom of the hole.

e. Replace the diode retainer and carefully tighten the screw until it is snug.

f. Recalibrate the instrument as outlined in Section V.

g. The diodes may be damaged by the following:

1. Rough handling.

2. Static discharge, approximately 0.2 ergs.

3. Soldering irons that induce 60 cycle pickup and leakage currents. Do NOT solder anything in the diode circuits without taking precautions.

8-12. MODEL 1432A. To remove the sampling diodes from the Model 1432A, remove diode holders from sampler block using a 1/4 inch wrench (Figure 8-3). Make a note of the cathode markings (green and orange stripes), when removing diodes, so that the diode will not be reinstalled backwards. Figure 8-4 is an exploded view of the Model 1432A sampler assembly.

8-13. TROUBLESHOOTING.

8-14. DC voltages are indicated on the schematics for most of the active components. Typical waveform test points (▽ with a number enclosed) are also shown on the schematics. The numbers inside the test point symbols

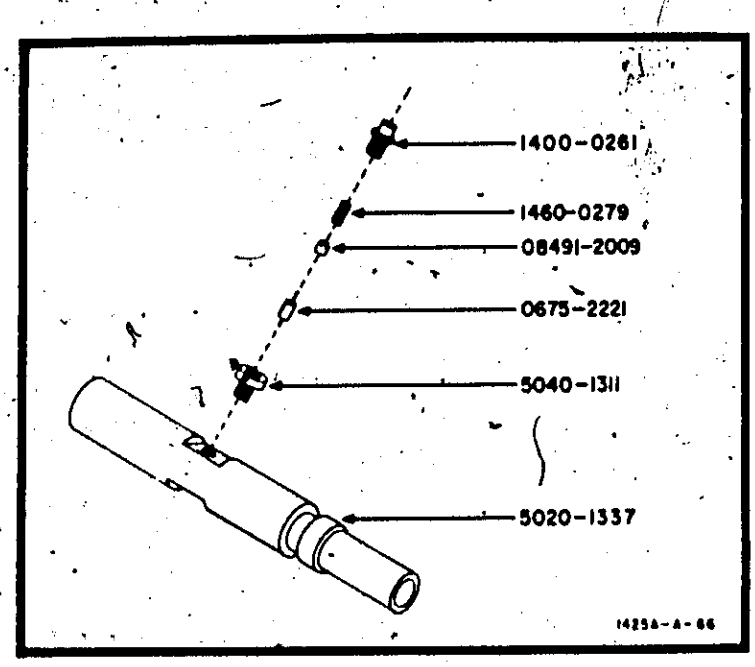


Figure 8-2B. Model 1430A and 1431A Pick-off Resistor

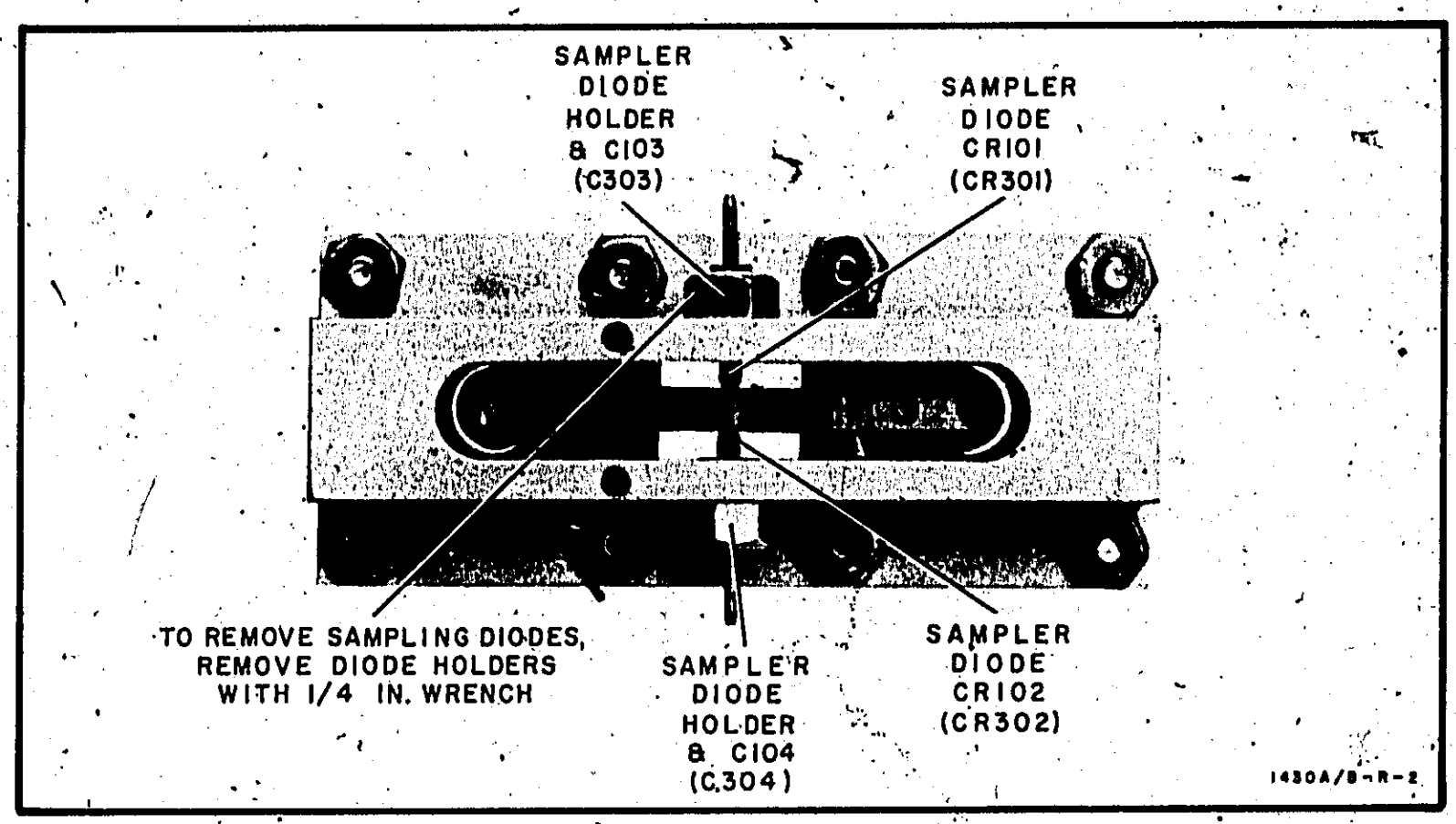


Figure 8-3. Diode Removal Model 1432A

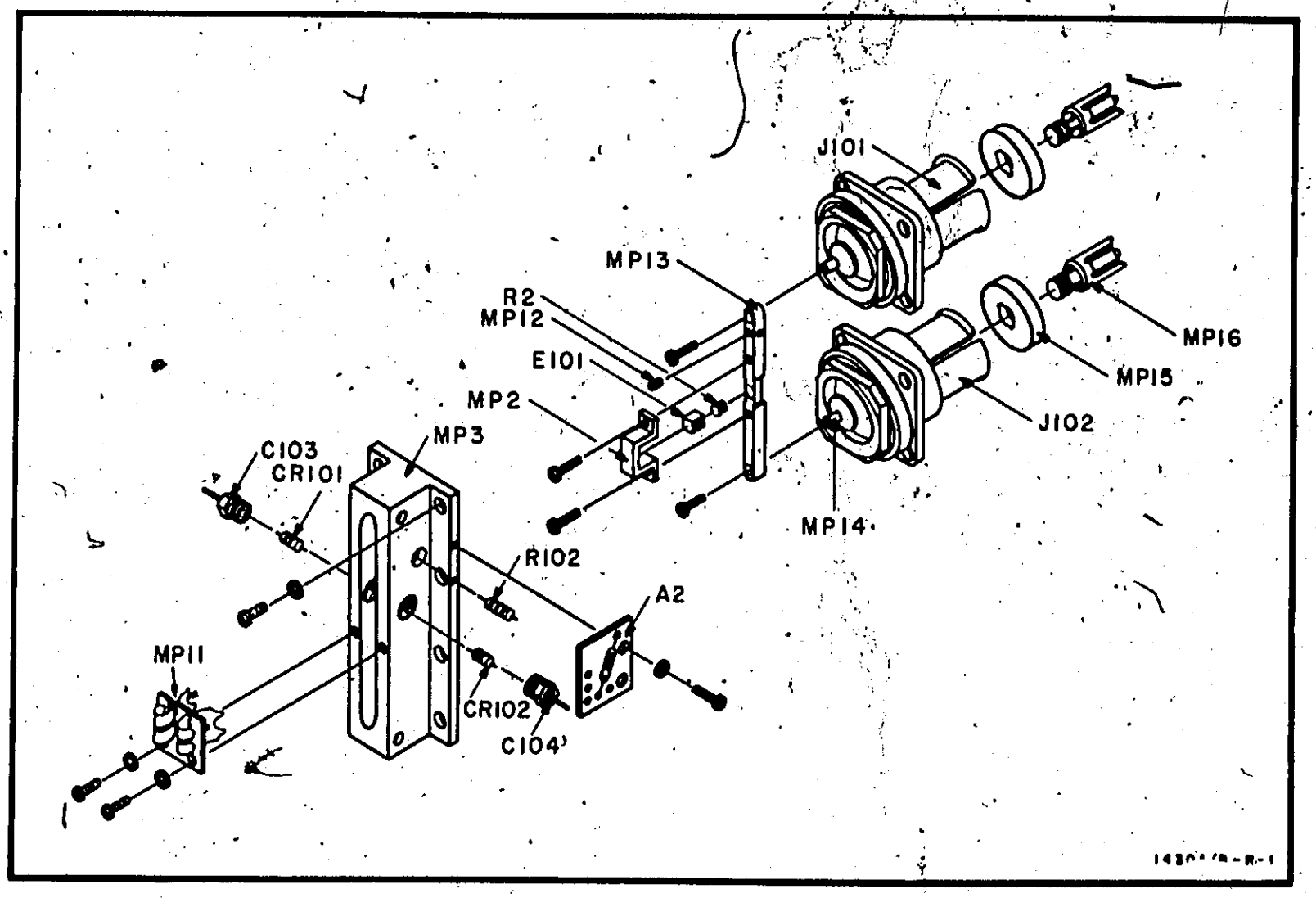


Figure 8-4. Model 1432A Sampling Assembly

are keyed to corresponding waveforms adjacent to the schematics. The dc voltages and typical waveforms provide an excellent troubleshooting aid for checking dc bias levels, amplifier stage gain, etc. When using these aids, always refer to the specific conditions for the measurement as listed adjacent to the schematic.

8-15. If trouble is suspected, first perform a visual inspection of the instrument. Look for loose or burned components or wires, bent pins in the interconnecting cable or any other condition that might suggest a source of trouble. If a visual inspection reveals no obvious trouble, proceed with an electrical check-out.

8-16. Troubleshooting tips are given in the following paragraphs and in Table 8-1. These are not intended as a foolproof method for pinpointing every possible trouble, but as an aid in troubleshooting and a practical guide for isolating the trouble to the faulty component. Except in Table 8-1, reference designators in parentheses pertain to the Model 1432A, reference designators not enclosed in parentheses are for Models 1430A, 1430B and 1431A.

8-17. DISTORTION.

8-18. Distortion is usually the result of improper control settings or adjustments. Calibrate the sampler and the Model 1411A stretcher loop circuitry following the procedure in Section V. If distortion is still present, check dc voltages and waveforms for both the sampler and the Model 1411A until the faulty component is located. Signals exceeding the dynamic range of the sampler will also cause distortion.

CAUTION

Do not measure dc voltages or waveforms in the sampler without first discharging the probe to ground.

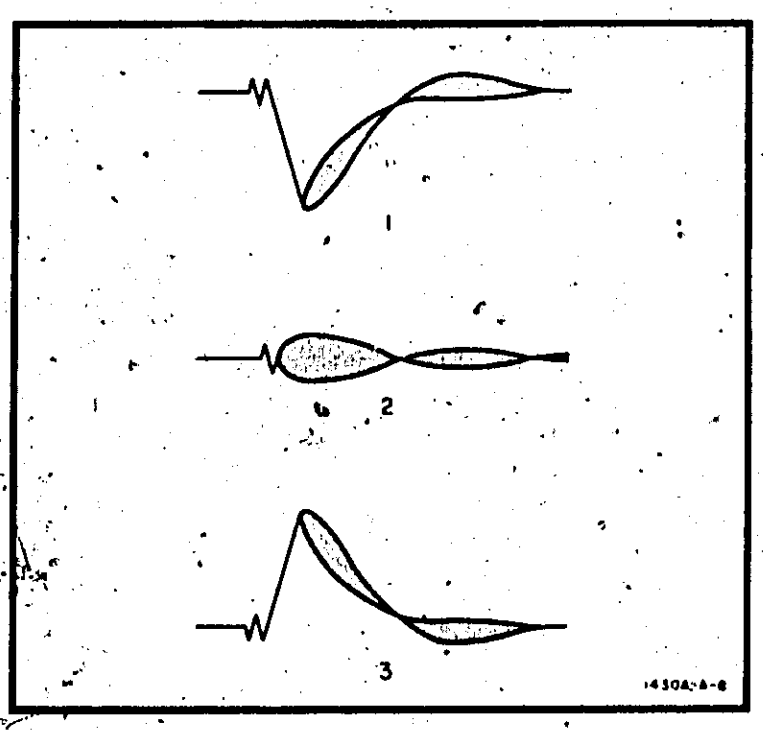


Figure 8-5. Bias Centering Waveforms

8-19. EXCESSIVE NOISE.

8-20. If noise is present on both channels, the trouble is probably in the pulse generator (step recovery diodes). If noise is present on only one channel, check alignment of stretcher loop circuitry in Model 1411A (refer to Section V of Model 1411A Manual for procedures). If stretcher loop circuits are properly aligned and noise is still present, the trouble is probably faulty (noisy) sampling diodes, differential emitter follower or microcircuit for the noisy channel.

8-21. SMALL STEP IN THE 35 PS RISETIME (1430A, 1430B and 1431A).

8-22. If a small step appears during pulse risetime, readjust 3rd Bias Adj. R147, or gently reposition CR110 and CR111.

8-23. RISETIME GREATER THAN SPECIFICATIONS.

8-24. If risetime is 40-50 ps and unit is otherwise normal proceed as follows:

a. Check time base calibration (paragraph 5-8).

b. Ensure that screws holding stripline board are snug (do not overtighten).

c. Ensure that black plastic caps at end of stripline are snug (do not overtighten).

d. Readjust 3rd Bias Adj, R147. Step-recovery diode bias controls amplitude of the pulse going from the pulse generator circuitry to the sampling diodes. Longer risetime may be the result of too wide a sampling pulse.

e. Move CR110 and CR111 closer to the circuit board.

8-25. TWO CHANNEL TROUBLES.

8-26. A trouble that affects both sampler channels will probably be in the pulse generator assembly. Presence or absence of the sampler pulse can be determined by checking stripline with a 50 MHz monitor oscilloscope (always discharge scope probe to ground before making this check). Presence of the pulse can be traced from switch transistor Q103 (Q102) through the transformer and step-recovery diodes to check for opens or shorts in the circuit. However, the mere presence of the pulse does not necessarily indicate that the circuit is working properly and meaningful data cannot be obtained by observing the pulse shape, because insertion of any type of test equipment will disrupt prpper circuit operation.

8-27. ONE CHANNEL TROUBLES.

8-28. If the trouble affects only one sampler channel it is unlikely the pulse generator circuitry is defective with the possible exception of an open between the stripline and the sampler of the inoperative channel. Perform the checks in Table 8-1 to isolate the problem. Reference designators in parentheses pertain to Channel B.

8-29. CHECKING SAMPLER DIODES.

8-30. The following procedure is written for channel A. To check channel B sampler diodes, perform same procedure substituting corresponding channel B reference designator.

8-31. Connect a 450 MHz, 140 mV/rms signal (refer to paragraph 5-18) to the suspected channel. Short the junction of R128 (R126) and R129 (R129) to ground and observe the signal at the emitter of Q102). Adjust bias centering adjust R122 (R121) from fully ccw to fully cw to be sure that all three waveforms (Figure 8-5) can be obtained. If only waveform 1 can be obtained, CR105 or C305 (CR101 or CR301) is probably faulty. If only waveform 2 can be obtained, CR106 or CR306 (CR102 or CR302) is probably bad. If all these waveforms can be obtained, perform the diode bias and bias centering adjustments before proceeding with troubleshooting.

CAUTION

Do not check sampling diodes with an ohmmeter. Voltage and current output of ohmmeter may exceed maximum safe input of the diodes.

8-32. STRIPLINE AND STEP RECOVERY DIODE REPLACEMENT (Models 1430A, 1430B and 1431A).

8-33. The sampler stripline can be replaced easily and it must be replaced if damaged or if capacitors C120 or C121 become defective. These capacitors are part of the stripline assembly and individual replacement is not recommended.

8-34. If the stripline is ordered as an assembly, HP Part No. 01430-66502, it will come as a complete assembly including CR110 through CR114. If only the stripline board or capacitor C120 or C121 are defective, it is less expensive to order stripline board, HP Part No. 01430-69501. There is a piece of conductive rubber, made of RFI gasket material, HP Part No. 8160-0070, under step-recovery diodes CR112 and CR113. Stripline board HP Part No. 01430-69501, will not have this material installed and it will have to be inserted by the repair facility.

8-35. To remove stripline proceed as follows:

a. Remove sampling diodes from sampler block and mark them so that they can be replaced exactly in the position from which removed. (Soldering iron can damage the diode).

b. Unsolder the small green wire connecting stripline to diode board.

c. Remove board containing CR110 and CR111. Step-recovery diodes CR112 and CR113 are sandwiched between the two boards. THESE DIODES ARE ELECTRICALLY DIFFERENT AND EXTREMELY SMALL. BE CAREFUL NOT TO SWITCH OR LOSE THEM.

d. Remove bottom board and unsolder the wire connected to stripline.

e. Remove the black nylon screws and washers at each end of stripline.

f. Carefully bend the small coax wire from the sampler at each end of stripline, bend these wires no more than absolutely necessary.

g. Remove four small and two large screws that hold stripline down and remove stripline.

NOTE

If instrument does not have a piece of dielectric material extending up through the slot in the stripline be very careful not to catch the center conductor between stripline board and sampler.

8-36. To replace stripline proceed as follows:

a. Replace stripline using original screws.

b. Gently bend coax. center conductor up through slot in stripline board. BE CAREFUL NOT TO PULL THE CENTER CONDUCTOR OUT OF THE JACKET.

c. Make sure bottom of transition makes good contact with ground ridge provided around the coax.

d. Lay center conductor on top of stripline transition and replace nylon screws and clamps being sure that clamp provides good contact between stripline and coax.

e. Replace step-recovery diodes and diode board and resolder all connections.

f. Replace sampling diodes in sampler.

Table 8-1. One Channel Troubleshooting Tips

Check	Result	Procedure
a. Check bias centering waveforms (para. 8-29).	All waveforms present	Troubleshoot the Model 1411A using Model 1411A Operating and Service Manual.
	No waveforms present	Go to step b.
b. Monitor base of Q102 (Q302)	Waveforms present	Q102 (Q302) or associated output Circuitry is defective.
	No waveforms present	Go to step c.
c. Disconnect the 450 MHz signal and apply a 50 mV, 5 usec pulse to the base of Q101B (Q301B). Using a monitor oscilloscope check for a pulse at pin 11, MC101 (MC301)	No pulse	Trace signal to isolate trouble to Q101 (Q301) or MC101 (MC301) and associated circuitry.
	Pulse present	Go to step d.
d. Replace the sampling diodes in the good channel with those from the bad channel. Note. Placing known good diodes in the defective channel could cause damage to the diodes.	Formerly good channel is now defective.	Sampling diodes are faulty.
	Good channel still o.k.	Go to step e.

Table 8-1. One Channel Troubleshooting Tips (Cont'd)

Check	Result	Procedure
e. Remove and mark the sampling diodes so that they can be replaced exactly in original positions. Removal of the diodes eliminates the possibility of damaging them with voltage from the ohmmeter.	Note: Do NOT mix the upper and lower diodes. They differ electrically. Using an ohmmeter check resistance from inner conductor of INPUT jack to inner conductor of OUTPUT jack.	
	More than 0 ohms	Replace sampler block
	0 ohms	1430A, 1430B, 1431A, go to step f. 1432A go to step g.
f. Check for 102K ohms between center conductor and ground.	Improper resistance	Check R105 and R106 (R305 and R306). Note. Pick-off resistor R105 and R305 can be replaced in any Model 1430B (see Figure 8-2B). These resistors are replaceable in Model 1430A serial numbers 648-00165 and above, Model 1431 serial numbers 707-00131 and above. For all other samplers the entire sampler block must be replaced.
	O.K.	Go to step g.
g. Check for 22K ohms between pin of removed diode and base of Q101B (Q301B).	Improper resistance	Check each resistor between these two points.
	Resistance o.k.	go to step h.
h. Visually inspect inner conductor for breaks or other damage.	Damaged	Repair as necessary.
	O.K.	If all checks are good the trouble is probably in the sampling block. Contact nearest HP Sales and Service Office for repair service.

Table 8-2. Schematic Notes

Refer to MIL-STD -15-1A for schematic symbols not listed in this table.

= Etched circuit board

= Front-panel marking

= Rear-panel marking

= Front-panel control

= Screwdriver adjustment

P/O = Part of

CW = Clockwise end of variable resistor

NC = No connection

3 = Waveform test point (with number)

A = Common electrical point (with letter) not necessarily ground

= Single-pin connector on board

A = Pin of a plug-in board (with letter or number)

= Coaxial cable connected to snap-on jack

= Coaxial cable connected directly to board

= Wire connected to pressure-fit socket on board

= Main signal path

= Primary feedback path

= Secondary feedback path

G D S = Field-effect transistor (P-type base)

G D S = Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

= Step-recovery diode

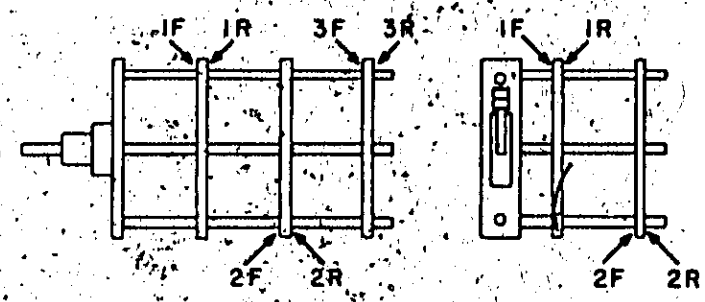
= Circuits or components drawn with dashed lines (phantom) show function only and are not intended to be complete. The circuit or component is shown in detail on another schematic.

(925) = Wire colors are given by numbers in parentheses using the resistor color code

[(925) is wht-red-grn]

0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

Switch wafers are identified as follows:



* = Optimum value selected at factory, typical value shown, part may have been omitted.

Unless otherwise indicated:
resistance in ohms
capacitance in picofarads,
inductance in microhenries

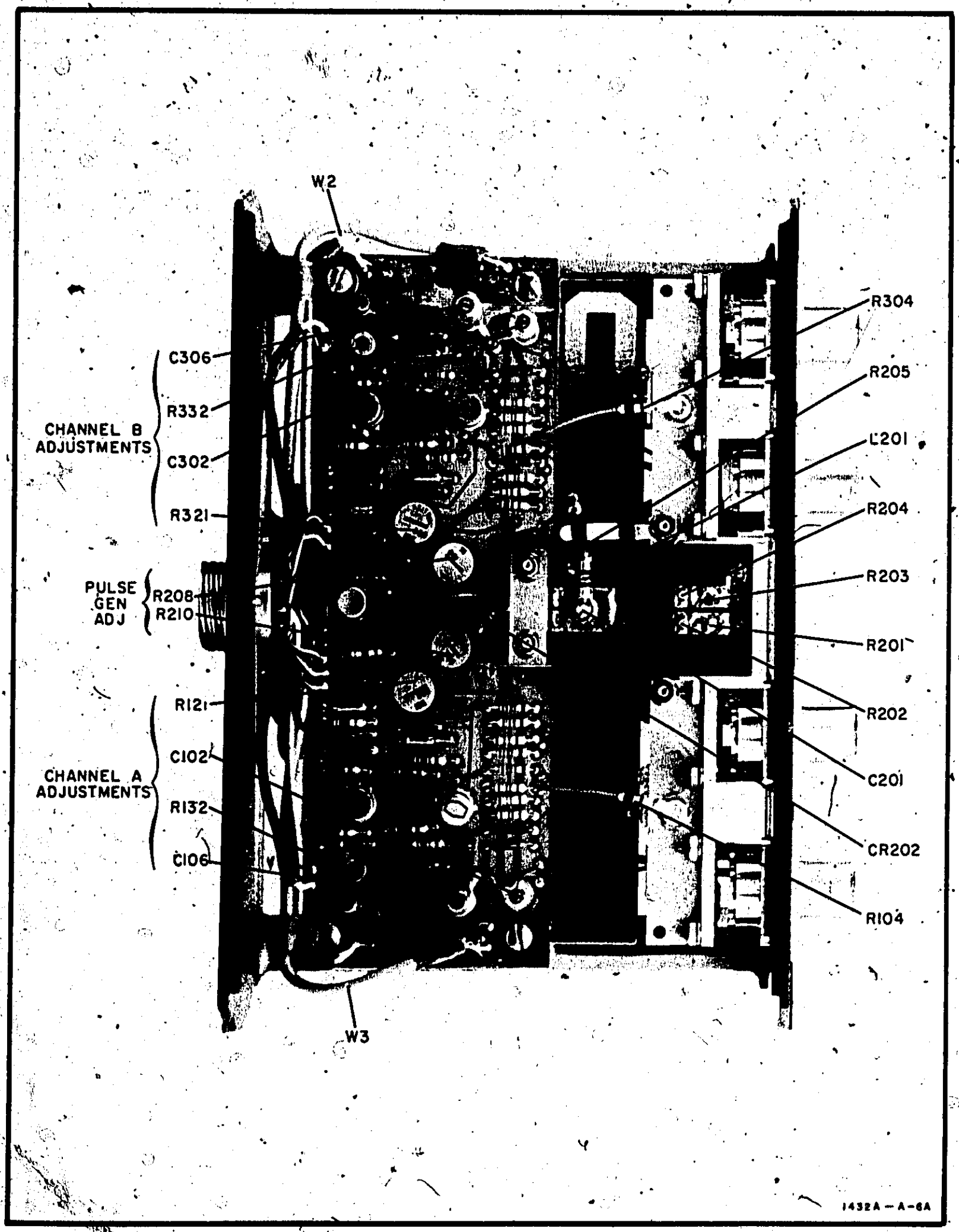


Figure 8-6. Model 1432A Adjustments and Component Identification, Top View

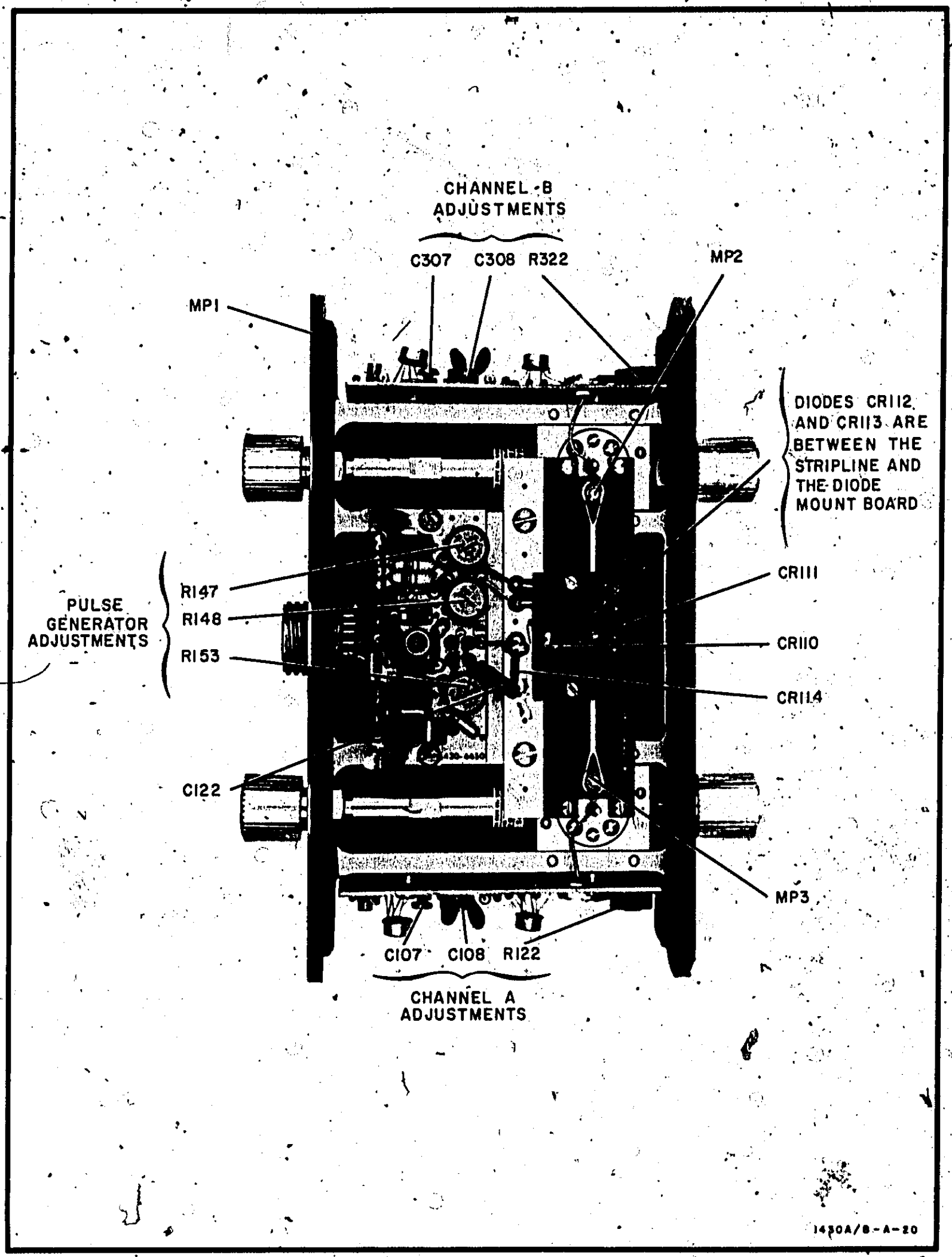


Figure 8-7. Model 1430A and 1431A Adjustment and Component Identification, Top View

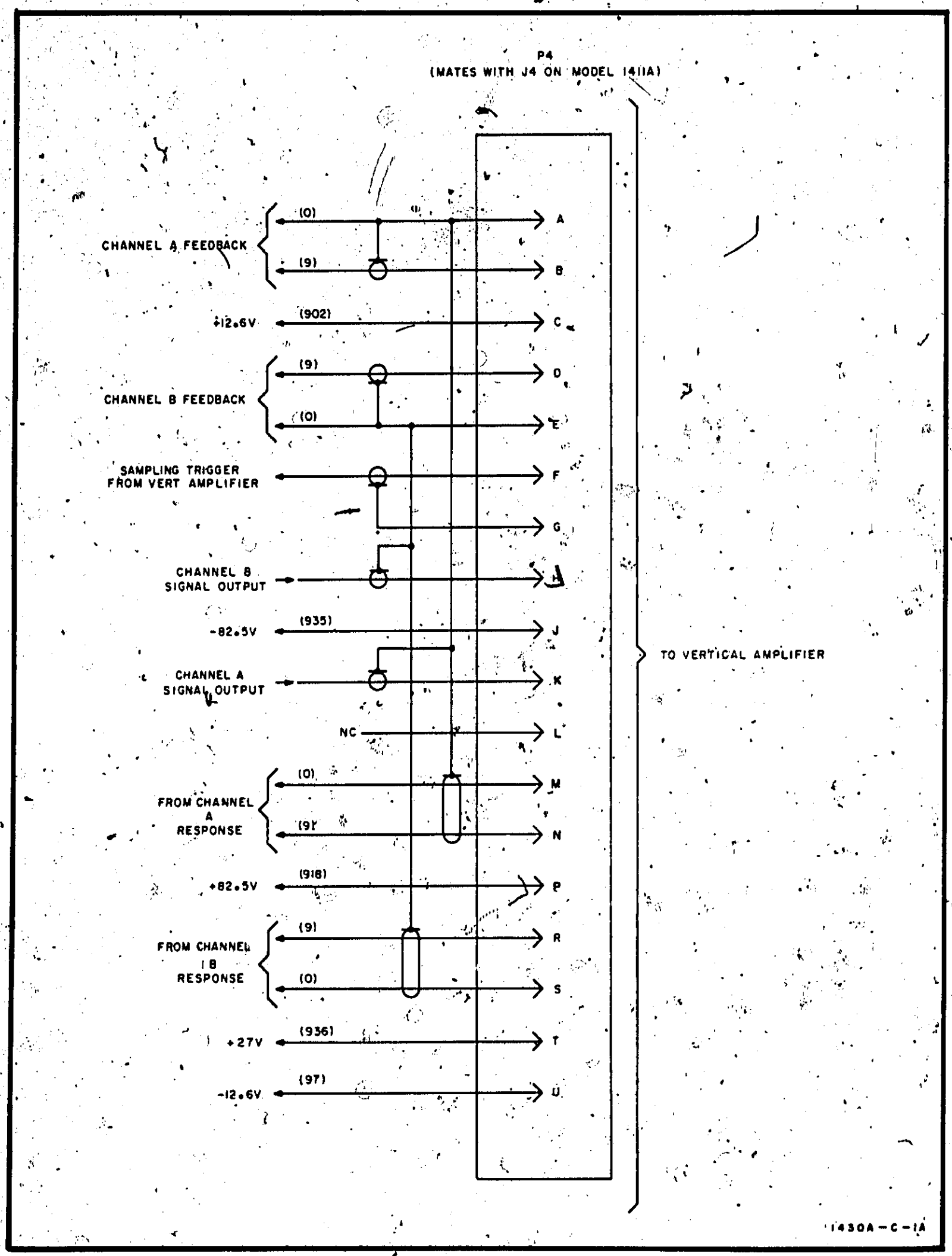


Figure 8-8. P4 Cable Connections

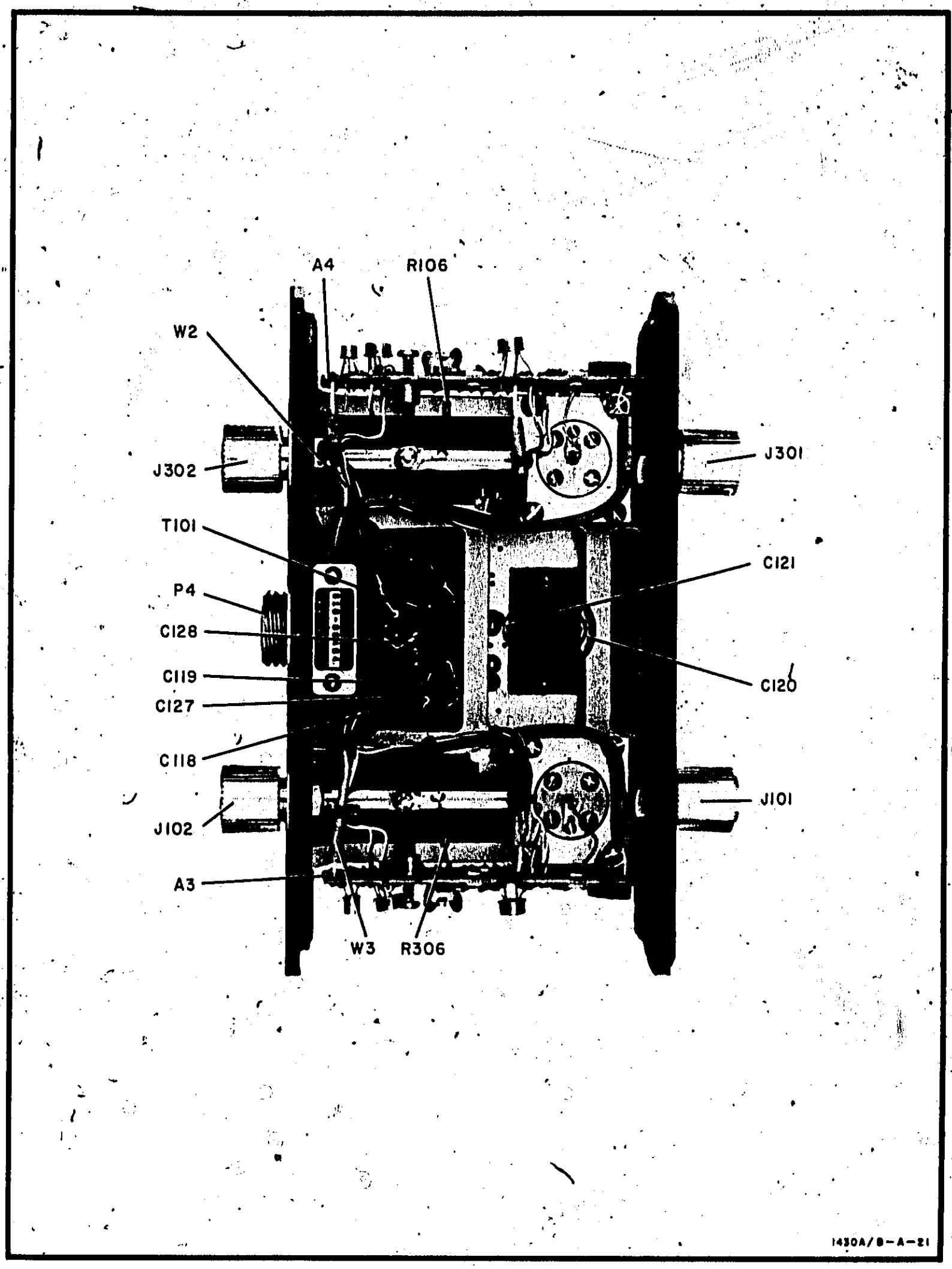


Figure 8-9. Model 1430A and 1431A Component Identification, Bottom View

DC VOLTAGE MEASUREMENT CONDITIONS

a. Connect sampler to Model 1411A. Set both the MODE and LEVEL control on the time base to 12 o'clock. Disconnect any incoming signals from the sampler and the time base.

b. Set Model 1411A controls as follows:

Mode Selector	A
both MILLIVOLTS/CM	100
both VERNIER	CAL
both Polarity	+UP
both NORM-SMOOTHED	NORM
both RESPONSE	optimized
both SMOOTHING	optimized
both VERT POS	traces centered

c. Set time base controls as follows:

TIME/CM	10 μSEC/CM
VERNIER	CAL
SCAN DENSITY	fully ccw
SCANNING	NORMAL

d. Locate R180 (R380 for Channel B) on Model 1411A Circuit board and ground the end common to S101 (end nearest to rear of instrument). Connect the gate of Q120 (Q320 if checking Channel B) to ground.

e. Voltages may vary somewhat from the values shown, depending upon the setting of SMOOTHING and RESPONSE controls. All voltages are referenced to ground.

WAVEFORM MEASUREMENT CONDITIONS

a. Connect a 10 kHz square wave at 0.5V p-p to channel A INPUT of sampler, terminated with a 50-ohm load. Use the pulse generator trigger output to externally trigger the time base.

b. Set time base controls as follows:

LEVEL	12 o'clock
MODE	12 o'clock
MAGNIFIER	X1
SCAN DENSITY	fully ccw
TRIGGER HOLD-OFF	NORMAL
TIME/CM	10 μSEC/CM
Trigger SLOPE	–
Trigger Source	EXT
SCANNING	NORMAL
NORM-SENS	SENS
SWEEP	MAIN

c. Set Model 1411A controls as follows:

Mode Selector	A
both MILLIVOLTS/CM	100
both VERNIER	CAL
both VERT POS	pulse or trace centered
both NORM-SMOOTHED	NORM
both RESPONSE	optimized
both SMOOTHING	optimized

d. Locate R180 (R380 for channel B) on circuit board of Model 1411A and ground the end common to S101 (end closest to rear of instrument).

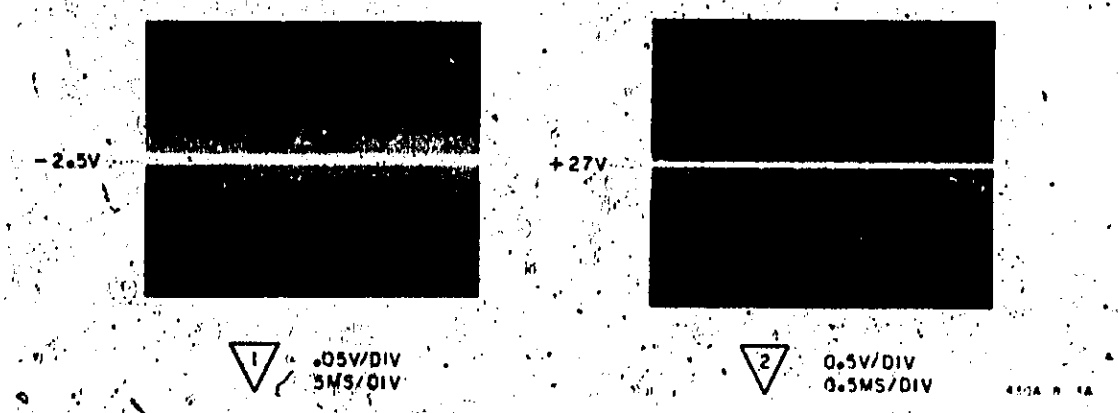
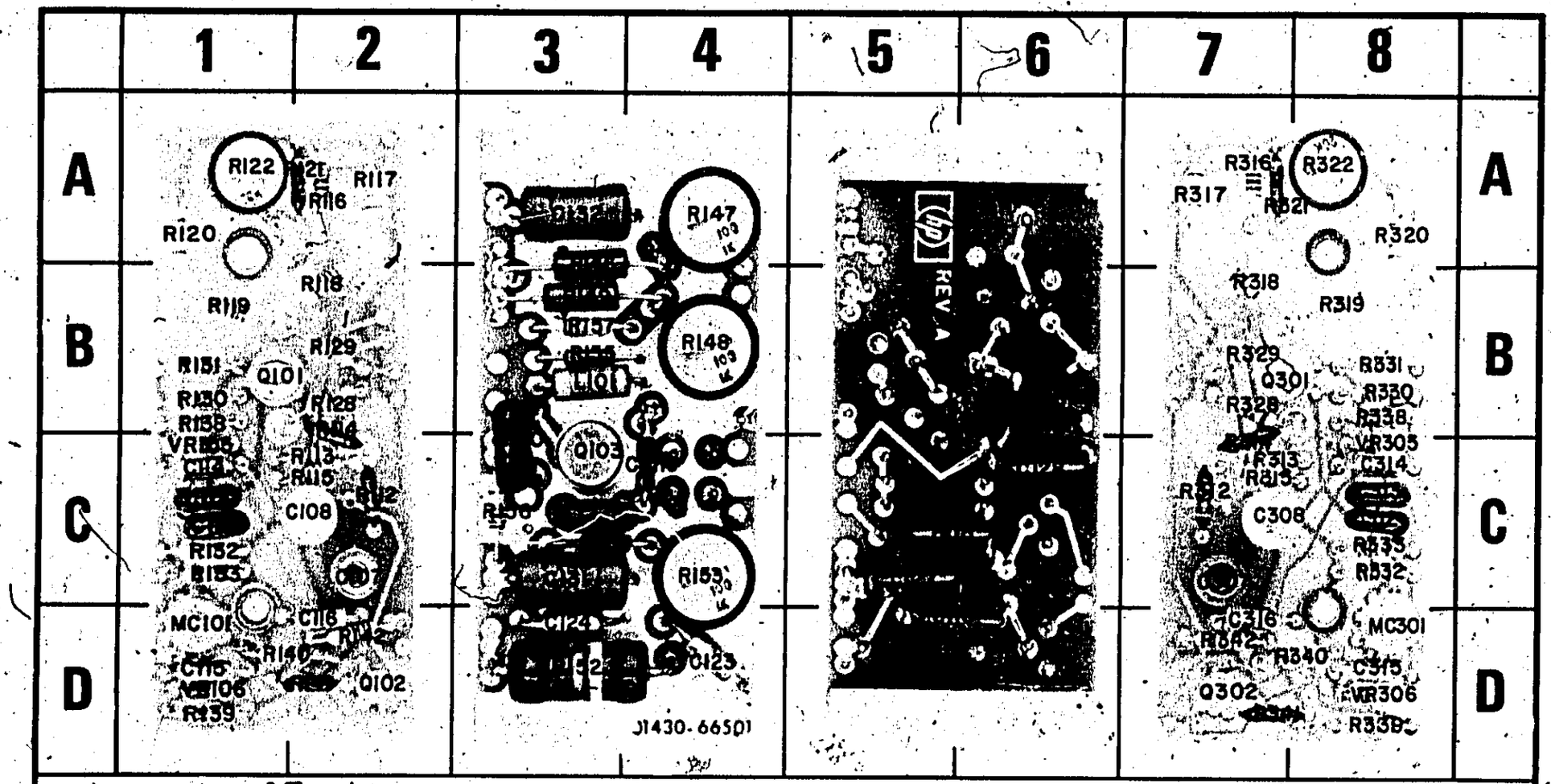


Figure 8-10. Measurement Conditions



A3

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C107	C-2	R119	B-1
C108	C-2	R120	A-1
C112	C-1	R121	A-1
C113	C-1	R122	A-1
C114	C-1	R128	B-2
C115	D-1	R129	B-2
C116	D-2	R130	B-1
MC101	D-1	R131	B-1
Q101	B-1	R132	C-1
Q102	D-2	R133	C-1
R112	C-2	R138	B-1
R113	C-2	R139	D-1
R114	B-2	R140	D-2
R115	C-2	R141	D-2
R116	A-2	R142	D-2
R117	A-2	VR105	C-1
R118	B-2	VR106	D-1

A6

REF DESIG	GRID LOC	REF DESIG	GRID LOC	REF DESIG	GRID LOC
C123	D-4	L101	B-3	R152	D-3
C124	D-3	Q103	C-3	R153	C-4
C129	C-3	R146	B-3	R154	C-3
C130	C-3	R147	A-4	R155	B-3
C131	C-3	R148	B-4	R156	C-3
C132	A-3	R149	B-3	R157	B-3
CR115	C-4				

A6

REF DESIG	GRID LOC
C118	D-5
C119	C-5
C127	C-5
C128	C-6
T101	B-6

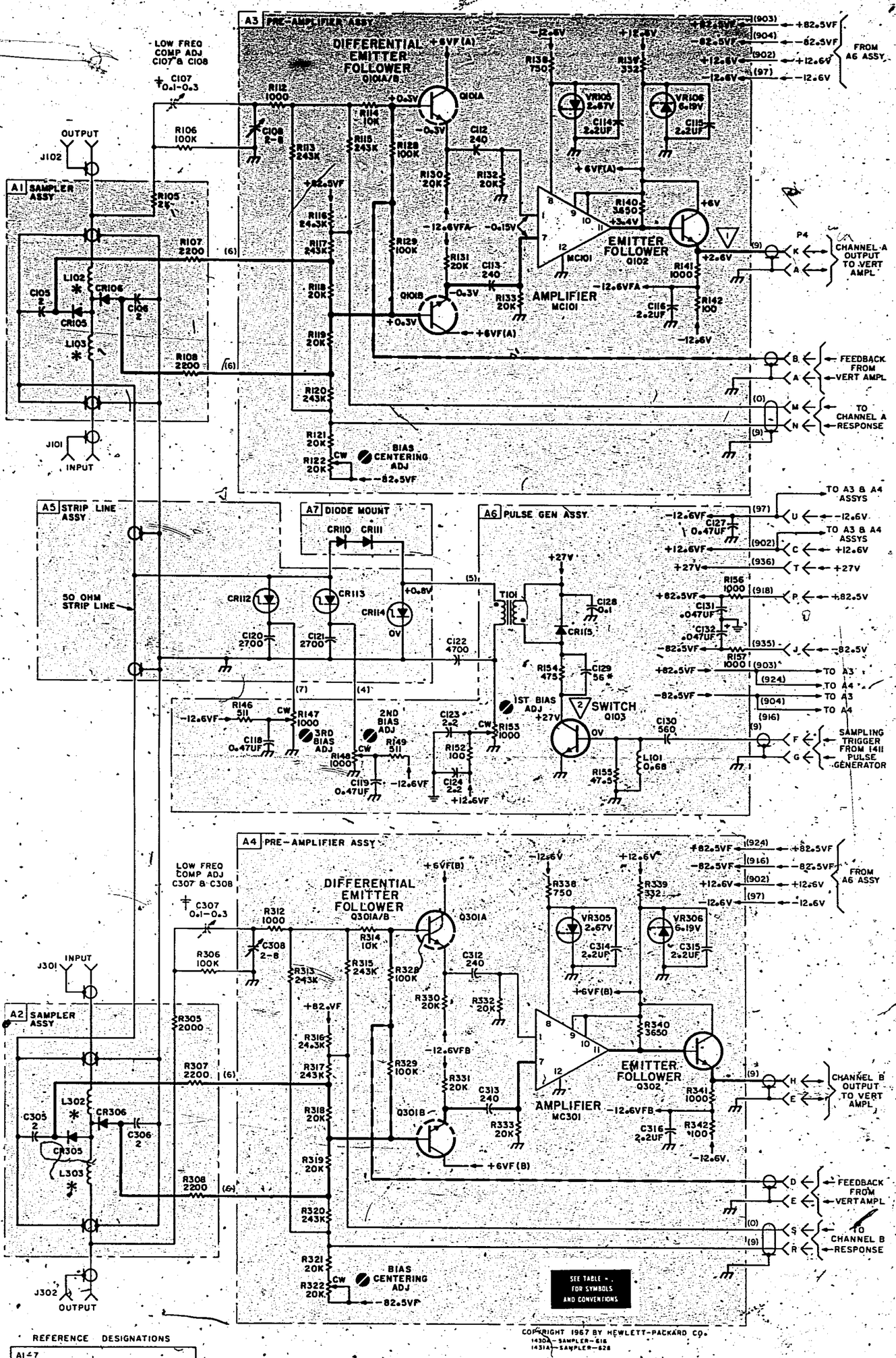
A4

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C307	C-7	R319	B-8
C308	C-7	R320	A-8
C312	C-8	R321	A-7
C313	C-8	R322	A-8
C314	C-8	R328	B-7
C315	D-8	R329	B-7
C316	D-7	R330	B-8
MC301	D-8	R331	B-8
Q301	B-7	R332	C-8
Q302	D-7	R333	C-8
R312	C-7	R338	B-8
R313	C-7	R339	D-8
R314	C-7	R340	D-7
R315	C-7	R341	D-7
R316	A-7	R342	D-7
R317	A-7	VR305	C-8
R318	B-7	VR306	D-8

1430A/B-A-19

Figure 8-11. Model 1430A and 1431A Component Identification, A3, A4 and A6 Assembly

Figure 8-11. Model 1430A and 1431A Component Identification, A3, A4 and A6 Assembly



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1430A-SAMPLER-616
1431A-SAMPLER-628

REFERENCE DESIGNATIONS

A1-7
C105-108, 112-115, 118-124, 127-132, 305-308, 312-316
CR105, 106, 110-115, 305, 306
J101, 102, 301, 302
L101-103, 302, 303
MC101, 301
P4
Q101-103, 301, 302.
R105-108, 112-122, 128-133, 138-142, 146-149, 152-157, 305-308, 312-322, 328-333, 338-342
T101
VR105, 106, 305, 306

DELETED:

NOTE:
* L102, 103, 302, 303 ON MODEL 1431A ONLY
† SCREW ON CHASSIS - C107 & C307

Figure 8-12. Model 1430A and 1431A Schematic

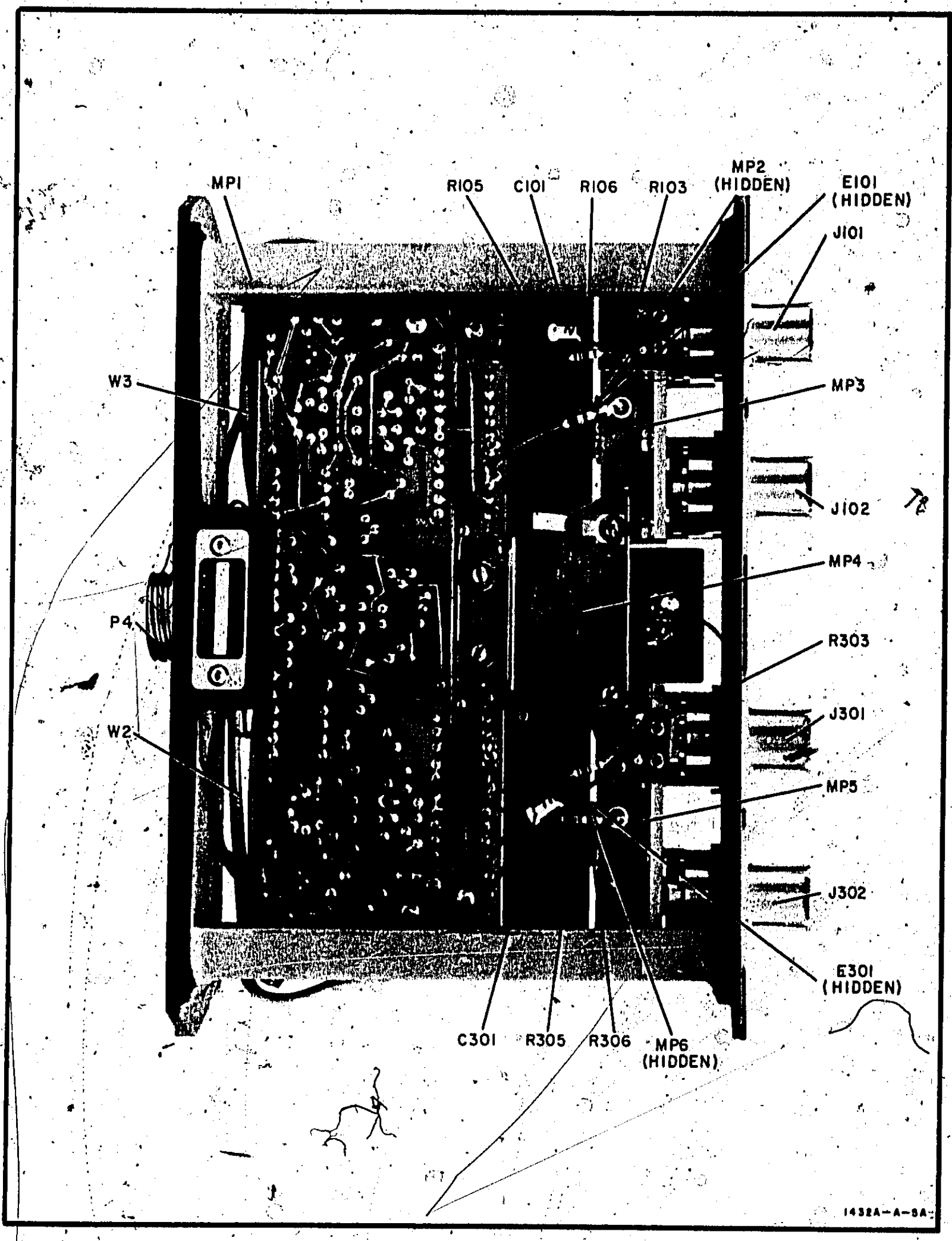
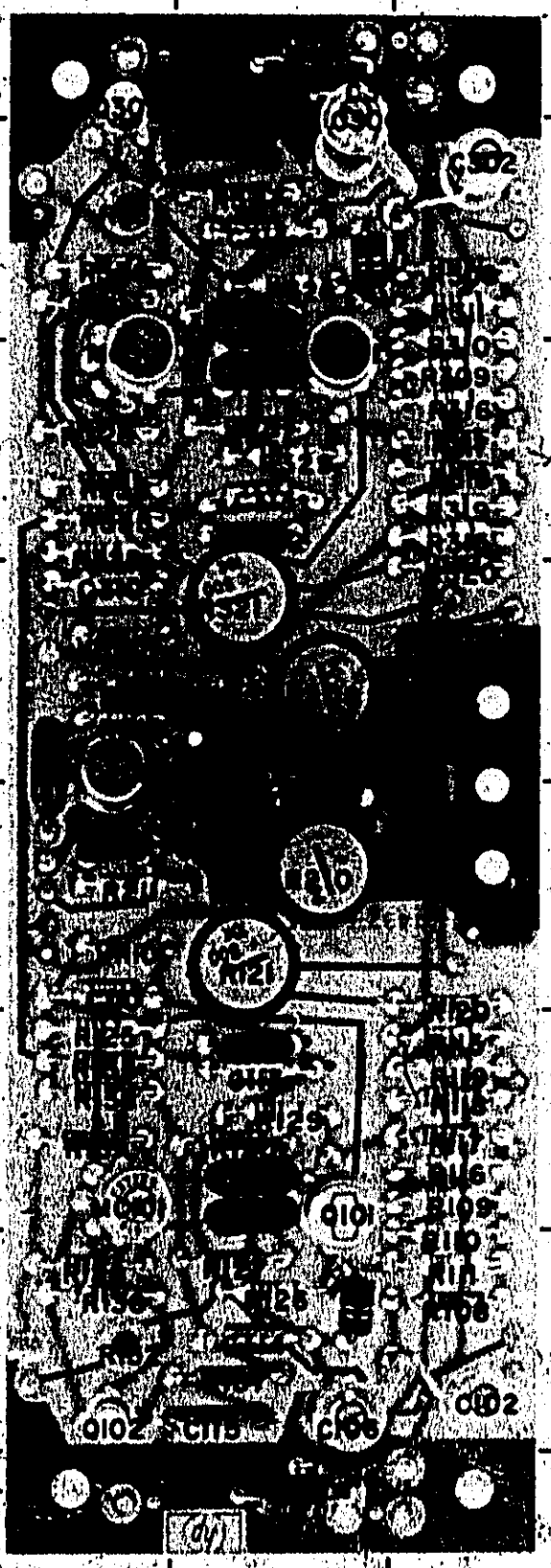


Figure 8-13. Model 1432A Component Identification, Bottom View



REF DESIG	GRID LOC	REF DESIG	GRID LOC
C102	C-7	R121	B-5
C106	B-7	R125	A-6
C107	B-7	R126	B-7
C110	A-5	R127	B-7
C111	B-6	R128	A-7
C112	B-6	R129	B-6
C113	B-6	R130	B-6
C114	B-7	R131	A-6
C115	B-7	R132	A-7
C116	B-8	R135	A-6
C117	B-8	R136	A-7
C202	B-4	R137	B-7
C203	C-4	R138	A-6
C206	B-5	R208	B-4
C207	A-5	R209	A-4
C208	A-4	R210	B-5
C302	C-2	R211	A-5
C306	B-1	R212	A-4
C307	B-2	R308	C-2
C310	A-4	R309	C-3
C311	B-3	R310	C-3
C312	B-2	R311	C-2
C313	B-3	R315	C-3
C314	B-2	R316	C-3
C315	B-2	R317	C-3
C316	B-1	R318	C-3
C317	B-1	R319	C-3
CR203	B-5	R320	C-4
CR204	A-5	R321	B-4
MC101	A-6	R325	A-3
MC301	A-3	R326	B-2
Q101	B-6	R327	B-3
Q102	A-7	R328	A-2
Q201	A-4	R329	B-3
Q301	B-3	R330	B-2
Q302	A-1	R331	A-2
R108	C-7	R332	A-2
R109	C-6	R335	A-3
R110	C-7	R336	A-2
R111	C-7	R337	B-2
R115	C-6	R338	A-3
R116	C-6	T201	B-4
R117	C-6	VR101	A-5
R118	C-6	VR102	B-6
R119	C-6	VR301	A-4
R120	C-6	VR302	B-3

1432A-A-28

Figure 8-14. Model 1432A Component Identification, A1 Amplifier Assembly

DC VOLTAGE MEASUREMENT CONDITIONS

a. Connect sampler to Model 1411A. Set both the MODE and LEVEL control on the time base to 12 o'clock. Disconnect any incoming signals from the sampler and the time base.

b. Set Model 1411A controls as follows:

Mode Selector	A
both MILLIVOLTS/CM	100
both VERNIER	CAL
both Polarity	+UP
both NORM-SMOOTHED	NORM
both RESPONSE	optimized
both SMOOTHING	optimized
both VERT POS	traces centered

c. Set time base controls as follows:

TIME/CM	10 μSEC/CM
VERNIER	CAL
SCAN DENSITY	fully ccw
SCANNING	NORMAL

d. Locate R180 (R380 for Channel B on Model 1411A Circuit board and ground the end common to S101 (end nearest to rear of instrument). Connect the gate of Q120 (Q320 if checking Channel B) to ground.

e. Voltages may vary somewhat from the values shown, depending upon the setting of SMOOTHING and RESPONSE controls. All voltages are referenced to ground.

WAVEFORM MEASUREMENT CONDITIONS.

a. Connect a 10 kHz square wave at 0.5V p-p to channel A INPUT of sampler, terminated with a 50-ohm load. Use the pulse generator trigger output to externally trigger the time base.

b. Set time base controls as follows:

LEVEL	12 o'clock
MODE	12 o'clock
MAGNIFIER	X1
SCAN DENSITY	fully ccw
TRIGGER HOLD-OFF	NORMAL
TIME/CM	10 μSEC/CM
Trigger SLOPE	–
Trigger Source	EXT
SCANNING	NORMAL
NORM-SENS	SENS
SWEEP	MAIN

c. Set Model 1411A controls as follows:

Mode Selector	A
both MILLIVOLTS/CM	100
both VERNIER	CAL
both VERT POS	pulse or trace centered
both NORM-SMOOTHED	NORM
both RESPONSE	optimized
both SMOOTHING	optimized

d. Locate R180 (R380 for channel B) on circuit board of Model 1411A and ground the end common to S101 (end closest to rear of instrument).

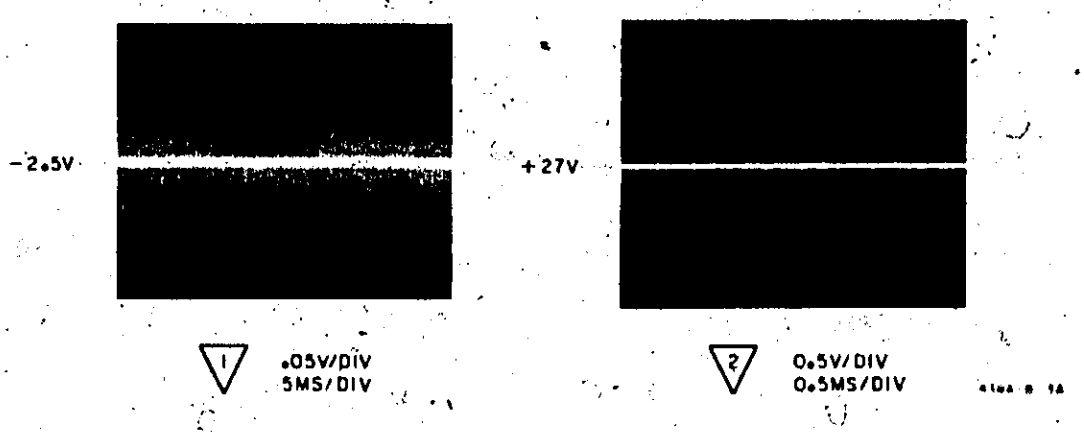
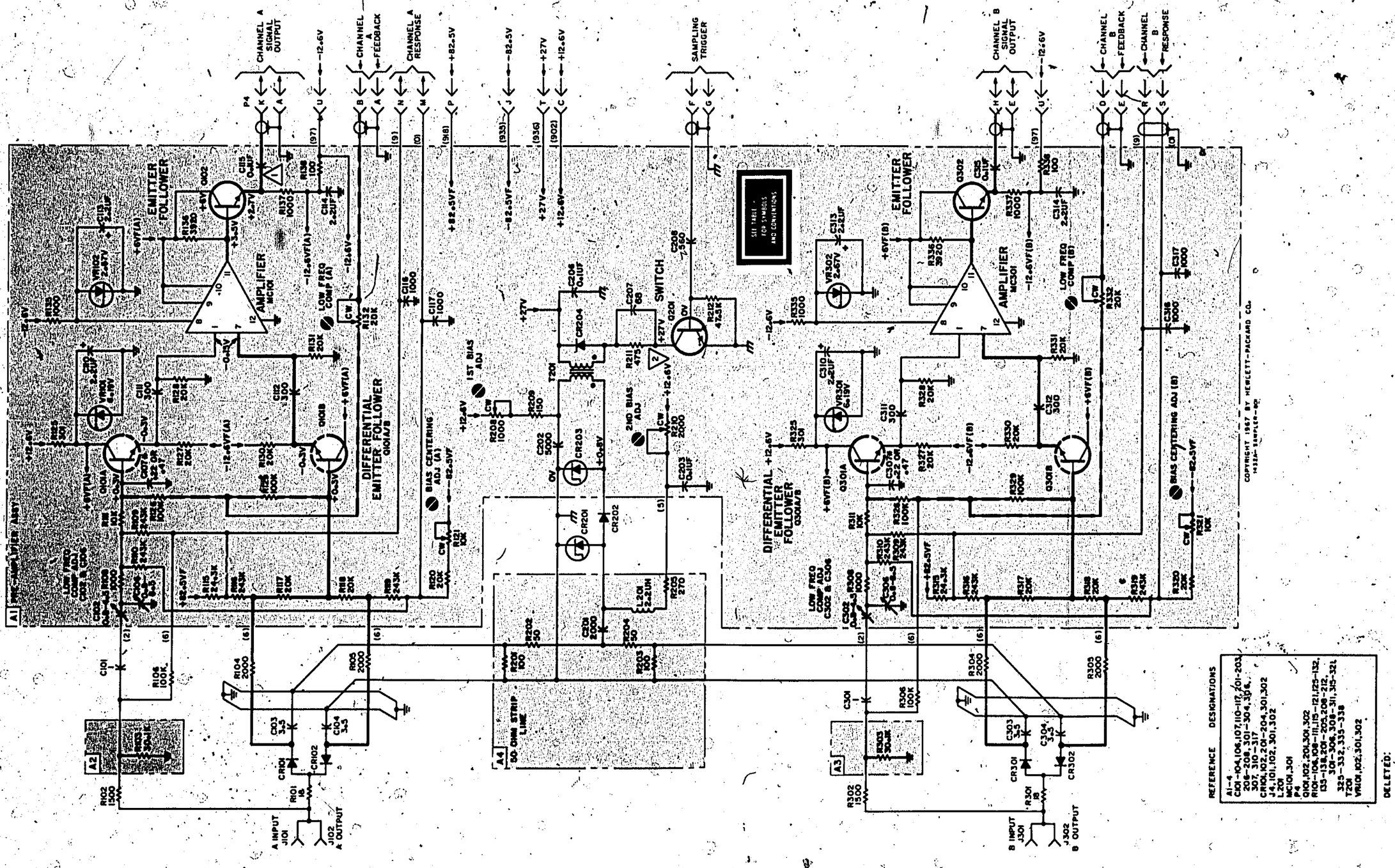


Figure 8-15. Measurement Conditions



REFERENCE DESIGNATIONS	DELETED:
A1-4	
C101-104,106,107,110-117,201-203, 206-208,301-304,306, 307, 310-317	
CR101,102,201-204,301,302	
J4,101,102,301,302	
L201	
MC101,301	
P4	
Q101,102,201,301,302	
R101-106,108-111,115-121,125-132, 133-138,201-205,208-212, 301-306,308-311,315-321, 325-332,335-338	
T201	
VR101,102,301,302	

Figure 8-16. Model 1432A Schematic

HEWLETT hp PACKARD

SERVICE NOTE

1430A-1

-hp- Model 1430A

SERIALS PREFIXED 715-00325 AND BELOW

If replacement of CR 110 or CR 111 becomes necessary, use -hp- part number 1901-0050. Note, when replacing with new diode BOTH CR 110 AND CR 111 must be changed. This will still result in a cost savings and instrument performance is not affected.

February 1968 - 8

1900 Garden of the Gods Road, Colorado Springs, Colorado, U.S.A. Tel. (303) 636-1111

Europe: 54 Route Des Acacias, Geneva, Switzerland, Cable: "HEWPACKSA" Tel. (022) 42.81.50

HEWLETT hp PACKARD

SERVICE NOTE

1431A-1

-hp- MODEL 1431A

SERIAL PREFIXED 707-00205 AND BELOW

If replacement of CR 110 or CR 111 becomes necessary, use -hp- part number 1901-0050. Note - when replacing with new diode, BOTH CR 110 AND CR 111 must be changed. This will result in a cost savings and instrument performance is not affected.

February 1968 8

1900 Garden of the Gods Road, Colorado Springs, Colorado, U.S.A. Tel. (303) 636-5111

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