Errata

Title & Document Type: 1430C Sampler Operating and Service Manual

Manual Part Number: 01430-90905

Revision Date: March 1980

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HP References in this Manual

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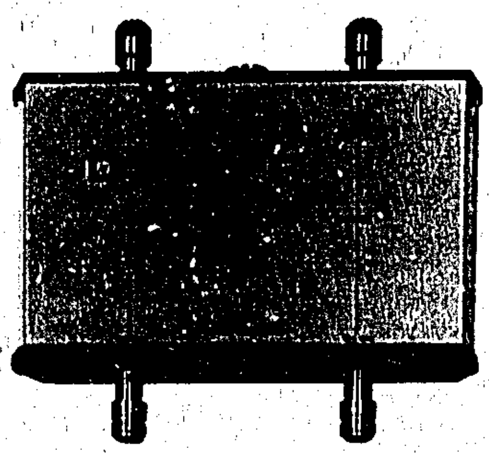
HP 1430

OPERATING AND SERVICE MANUAL

SAMPLER
1430C



HEWLETT hp PACKARD

HP 1430C

OPERATING AND SERVICE MANUAL

MODEL 1430C SAMPLER

SERIALS PREFIXED: 1217A

Refer to Section VII for instruments with other Serial Prefixes.

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

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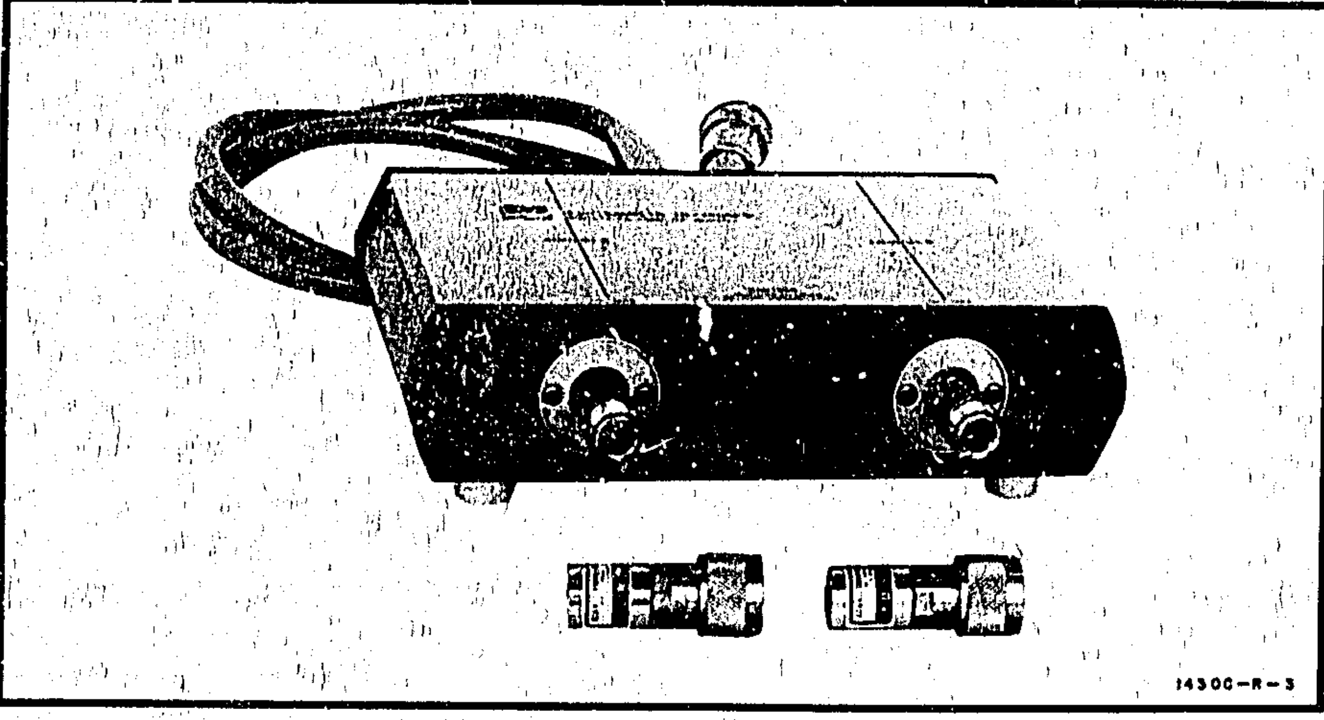

Figure 1-1. Model 1430C Sampler

Table 1-1. Model 1430C Specifications

RISETIME: approx 20 ps (<28 ps observed with 1105A/1106B pulse generator and 909A Option 012, 50-ohm load).

BANDWIDTH: dc to >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: type N connectors on input and output parts.

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

TIME DIFFERENCE BETWEEN CHANNELS: <5 ps.

CONNECTING CABLE LENGTH: 5 ft.

WEIGHT: net, 4 lb (1,8 kg); shipping, 9 lb (4,1 kg).

ACCESSORIES PROVIDED: two 50-ohm loads (HP Model 909A Option 012).

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual provides operating and service information for the Hewlett-Packard Model 1430C Sampler. The manual is divided into eight sections, each covering a specific topic or aspect of the instrument. The schematic is located at the rear of the manual and can be unfolded and used for reference while reading any part of the manual.

1-3. This section of the manual contains a description of the Model 1430C. The instrument specifications are listed in table 1-1. Table 1-2 lists and describes the abbreviations used in this manual. Accessories available for this instrument are listed in the specifications table and described in this section.

1-4. Since the Model 1430C Sampler is designed for use with either the Hewlett-Packard Model 1411A Sampling Vertical Amplifier or the Model 1811A Sampling Time Base and Vertical Amplifier, the information in this manual supplements that presented in the Model 1411A or Model 1811A manual. It is recommended that the operating instructions (Section III) of both this manual and the appropriate sampling vertical amplifier manual be read prior to operating the sampling system.

1-5. DESCRIPTION.

1-6. The Model 1430C Sampler, mated with either the Model 1411A or Model 1811A Sampling Vertical Amplifier, together comprises a two-channel vertical sampling system with a bandwidth of 18 GHz and a risetime of <20 ps. The Model 1430C and sampling vertical amplifier combination offers numerous advantages over conventional sampling devices. By placing the Model 1430C right at the test point, losses caused by long probe leads are eliminated. The sampler is of feedthrough design, allowing measurement to be made using the system under test as a load rather than using an artifical internal termination. Time difference between channels is <5 ps, making the system ideal for phase shift measurements.

1-7. The feedthrough feature also permits the system to be used for TDR applications. TDR (Time Domain Reflectometry) is a technique used to analyze components and identify discontinuties that may be present in connectors, adapters, striplines, cables and other devices. When the system is used in conjunction with a 20-ps pulse generator, it becomes a high-resolution TDR with an incident step risetime of <30 ps. Refer to Section III for more information about TDR and its applications.

1-8. WARRANTY.

1-9. The instrument is certified and warranted as stated on the inside front cover of this manual. A special warranty clause exists regarding the sampling diodes. Refer to Section III, Operating Precautions, for this information.

CAUTION

The warranty may be void for instruments having a mutilated serial tag.

1-10. ACCESSORIES FURNISHED.

1-11. Accessories provided with the Model 1430C are two 50-ohm loads (HP Model 909A Option 012).

1-12. AVAILABLE ACCESSORIES.

1-13. Signals in excess of the dynamic range of the Model 1430C (± 1volt) may be observed if the signal is first attenuated to the correct level by use of 50-ohm coaxial attenuators. The HP Model 8491A/B fixed coaxial attenuator may be obtained in several ranges (3, 6, 10, 20 dB or higher). Variable attenuators are also available. Refer to an HP catalog or consult an HP Sales/Service Office for information on attenuators or cable adaptors, etc, to meet any requirements.

1-14. INSTRUMENT AND MANUAL IDENTIFICATION.

1-15. This manual applies directly to Model 1430C instruments with a serial prefix number as listed on the manual title page. The serial prefix number is the first group of digits in the instrument serial number (figure 1-2). The instrument serial number is on a tag located on the bottom of the instrument.

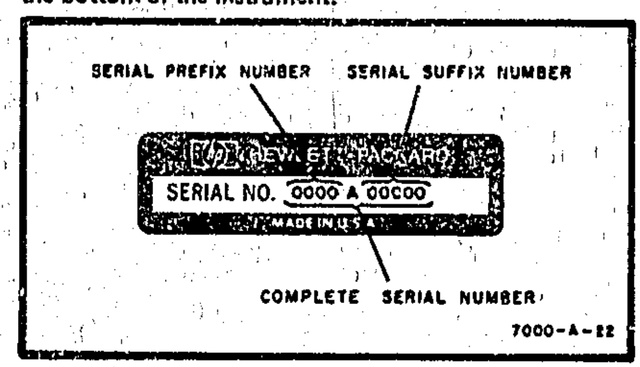

Figure 1-2. Instrument Serial Number

1-16. Check the serial prefix number of the instrument. If the serial prefix number is different from that listed on the title page of this manual, refer to Section VII for instructions to adapt this manual for proper instrument coverage.

1-17. Errors in the manual are listed under errata on an enclosed MANUAL CHANGES sheet (if any).

1-18. INQUIRIES.

1-19. Refer any questions regarding the manual, the change sheet, or the instrument to the nearest HP Sales/Service Office. Always identify the instrument by model number, complete name, and complete serial number in all correspondence. Refer to the inside rear cover of this manual for a world-wide listing of HP Sales/Service Offices.

Table 1-2. Reference Designators and Abbreviations

REFERENCE DESIGNATORS

A	= assembly	E	= misc. electrical part	P	= plug	U	= integrated circuit (unrepairable)
AT	= attenuator, resistive termination	F	= fuse	PS	= power supply	V	= vacuum tube, neon bulb, photocell, etc.
B	= motor, fan	FL	= filter	Q	= transistor	VR	= voltage regulator (diode)
BT	= battery	H	= hardware	R	= resistor	W	= cable
C	= capacitor	J	= jack	RT	= thermistor	X	= socket
CP	= coupling	K	= relay	S	= switch	Y	= crystal
CR	= diode	L	= inductor	T	= transformer	Z	= network
DL	= delay line	LS	= speaker	TB	= terminal board		
DS	= device signaling (lamp)	M	= meter	TP	= test point		
		MP	= mechanical part				

ABBREVIATIONS

A	= ampere(s)	FET	= field-effect transistor(s)	n	= nano (10^{-9})	rfi	= radio frequency interference
ampl	= amplifier(s)	G	= giga (10^{9})	nc	= normally closed	rms	= root mean square
assy	= assembly	gnd	= ground(ed)	no.	= normally open	rwv	= reverse working voltage
ampltd	= amplitude	H	= henry(ies)	npn	= negative-positive-negative	SCR	= silicon controlled rectifier
bd	= board(s)	hr	= hour(s)	ns	= nanosecond	sec	= second(s)
bp	= bandpass	HP	= Hewlett-Packard	p	= pico (10^{-12})	std	= standard
c	= centi (10^{-2})	Hz	= hertz	pc	= printed (etched) circuit(s)	trmr	= trimmer
C	= carbon	if.	= intermediate freq.	pk	= peak	u	= micro (10^{-6})
ccw	= counterclockwise	intl	= internal	pnp	= positive-negative-positive	usec	= microsecond
coax.	= coaxial	k	= kilo (10^{3})	p/o	= part of	V	= volts
coef	= coefficient	lb	= pound(s)	p-p	= peak-to-peak	var	= variable
com	= common	lpf	= low-pass filter(s)	prgm	= program	w/	= with
CRT	= cathode-ray tube	m	= milli (10^{-3})	prv	= peak inverse voltage(s)	w/o	= without
cw	= clockwise	M	= mega (10^{6})	ps	= picosecond	wiv	= working inverse voltage
d	= deci (10^{-1})	ms	= millisecond	pwv	= peak working voltage		
dB	= decibel			rf	= radio frequency		
ext	= external						
F	= farad(s)						

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SECTION II

INSTALLATION

2-1. INTRODUCTION.

2-2. This section contains instructions for performing an initial inspection of the Model 1430C. Procedures for making a claim for warranty repairs and for repacking the instrument for shipment are also described in this section.

2-3. INITIAL INSPECTION.

2-4. The instrument was inspected mechanically and electrically before shipment. Upon receipt, inspect it for damage that may have occurred in transit. Check for bent or broken connectors, and dents or scratches. If damage is found, refer to the claims paragraph in this section. Retain the packing material for possible future use.

2-5. Check the electrical performance of the instrument immediately after receipt. Refer to Section V for the performance check procedure. The performance check will determine whether or not 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 the claims paragraph in this section.

2-6. PREPARATION FOR USE.

2-7. Connect the interconnecting cable (suppled with the sampler) between the interconnecting jack on the sampler and the front panel interconnecting jack on the Model 1411A or 1811A. The sampler is now ready for use. All necessary operating voltages are provided by the sampling vertical amplifier.

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 reuseable, 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-frim 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

OPERATION

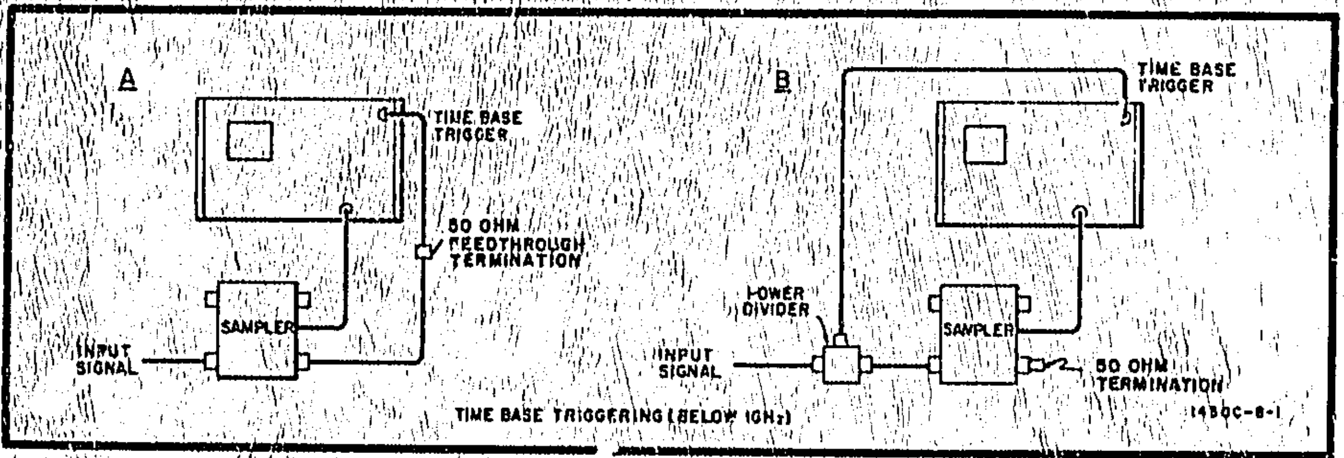


Figure 3-1. Time Base Triggering

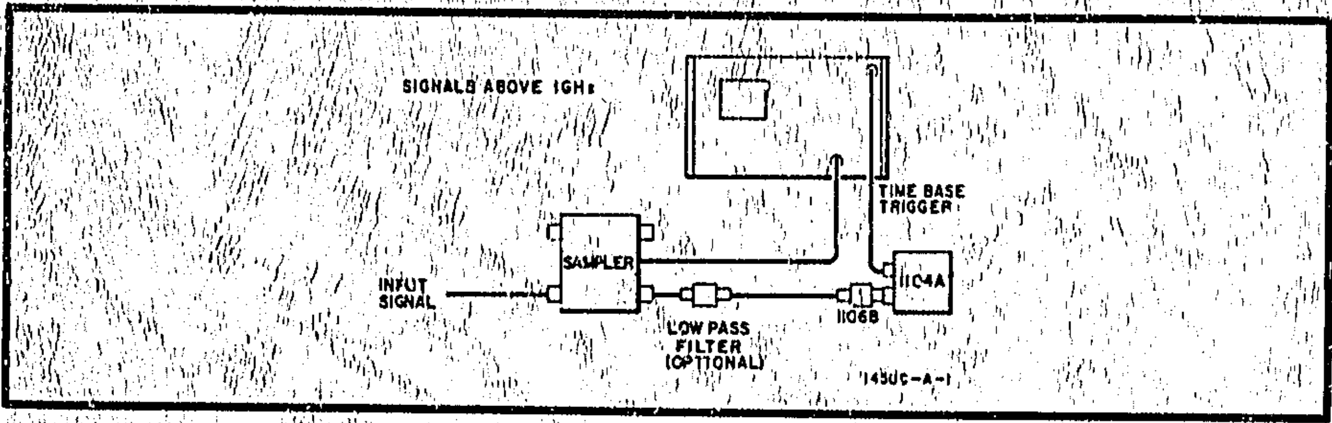


Figure 3-2. Triggering With Countdown Device

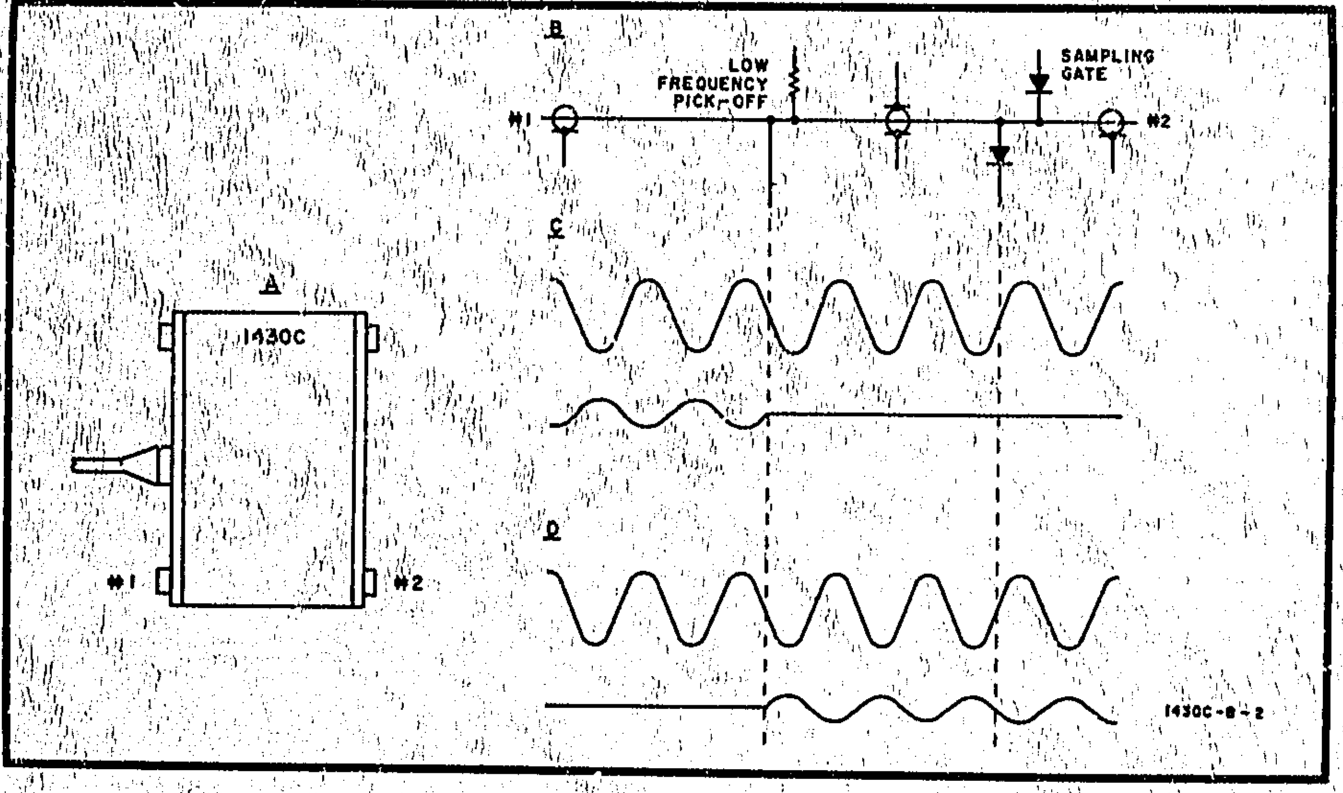


Figure 3-3. Using 1430C With HF CW Signal

SECTION III

OPERATION

3-1. INTRODUCTION.

3-2. This section includes operating considerations and some general operating instructions, supplementing the information provided in either the Model 1411A or Model 1811A Sampling Vertical Amplifier manuals. Refer to the appropriate sampling vertical amplifier manual for more specific operating instructions.

3-3. INPUT/OUTPUT CONNECTORS.

3-4. TYPE.

3-5. The input/output connectors on the Model 1430C are precision Type N. Mating connectors are available with many types of adapters. Refer to an appropriate catalog to determine availability of connector adapters for your specific requirements.

3-6. DESCRIPTION.

3-7. Each input/output is a feedthrough-type connector with a characteristic impedance of 50 ohms. A signal applied to the input passes unattenuated and practically undisturbed through the 50-ohm sampler block to the output. This permits the sampler to be connected in series into a line under observation with a minimum of disturbance to the signal.

CAUTION

The connectors are an integral part of the sampling block. Make no attempt to disassemble the connectors as costly damage to the sampling block may result.

3-8. OPERATING CONSIDERATIONS.

3-9. CABLES.

3-10. 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 1 foot of cable will noticeably degrade risetime. All cable connections must be made securely. Loose fitting connectors can cause undesirable reflections and degrade the signal. If critical time comparisons are being made between two signals, use connecting cables of equal length.

3-11. SIGNAL TERMINATION.

3-12. If the feedthrough feature of the sampler is not being used, the signal must be terminated with a 50-ohm impedance. Failure to terminate the signal will result in reflections that make the display invalid.

3-13. When the sampler output is used to trigger the time base, a 50-ohm feedthrough is recommended (figure 3-1A).This will assure that the sampler output is terminated into 50 ohms. This setup can be used with any signal under 1 GHz.

3-14. When the signal is split before being applied to the sampler input, a power divider must be used (figure 3-1B). 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.

3-15. If the signal is above 1 GHz, a countdown device such as the HP Model 1104A/1106B Trigger Countdown must be used to reduce the frequency of the signal being applied to the time base (figure 3-2). A low-pass filter such as the HP Model 1109B may be used to prevent signals generated by the tunnel diode mount from feeding into the signal channel.

3-16. USING MODEL 1430C WITH CW SIGNALS.

3-17. When using the Model 1430C to observe cw signals above 12.4 GHz, the signal must be applied to the feedthrough samplers through the connector nearest the power cable. If the signal is applied to the other connector, the standing waves which are reflected from the discontinuity created by the low frequency pickoff resistor will create ripples in the frequency response characteristics of the Model 1430C. See figure 3-3. If the signal is applied to 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 3-3B and C). If signal is applied to connector #2, the signal seen by the sampling gate consists of the incident signal plus the signal reflected from the low frequency pickoff resistor (figure 3-3B and D).

3-18. CHANGING SAMPLERS.

3-19. When the sampler is originally connected to the sampling vertical amplifier or if the sampler/sampling vertical amplifier combination is changed, the front panel controls for risetime, sampling efficiency and vertical sensitivity should be checked and readjusted if necessary. Refer to the appropriate sampling vertical amplifier operating and service manual for procedures.

3-20. OPERATING PRECAUTIONS.

3-21. MAXIMUM SAFE INPUT.

3-22. Dynamic range of the sampler is ±1 volt. Signal inputs exceeding this value will cause distortion of the displayed signal.

3-23. If the system is to be used for TDR operation, discharge all lines and associated equipment prior to making connections. This will prevent damage to the sampling diodes from static charges.

CAUTION

A voltage well above the maximum safe input is required to damage both sampling diodes. When both sampling diodes in one channel are damaged, repair charges will be assessed to the customer, regardless of the equipment warranty period.

3-24. 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.

3-25. ROUGH HANDLING.

3-26. 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.

3-27. WIDE-BAND TDR.

3-28. GENERAL.

3-29. 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.

3-30. 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.

3-31. The wide-band sampling system may be used for TDR tests when connected as shown in figure 3-4. 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.

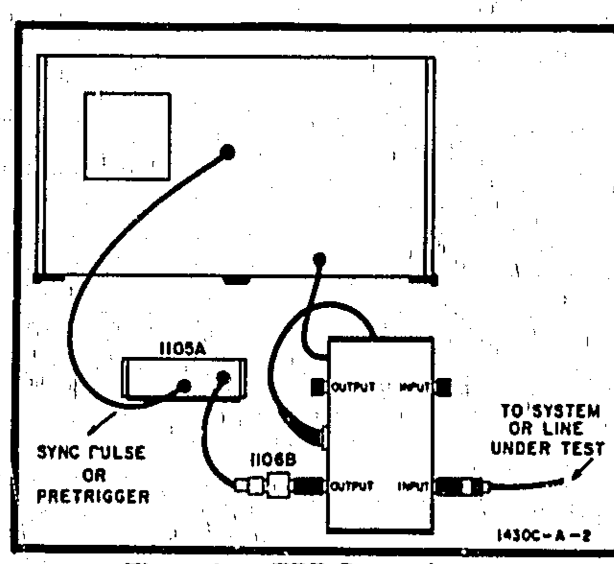


Figure 3-4. TDR Connections

3-32. 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 1106B Tunnel Diode Mount.

3-33. DISPLAY INTERPRETATION.

3-34. 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.

3-35. 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.

3-36. 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.

3-37. 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.

3-38. Hewlett-Packard Application Notes 62, 67, 75 and 153 provide complete formulas and operating data for performing TDR tests. Application Notes may be obtained by contacting the nearest HP Sales/Service Office.

3-39. RISETIME.

3-40. The risetime of the system is very important in detecting and resolving discontinuties. With a faster 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. Prior to use, system risetime should be checked and optimized.

3-41. REFLECTION COEFFICIENT (p).

3-42. Reflection coefficient (p) is a term used to describe the quality of a system tested using TDR. The p of a system is described by the formula:

$$p = E_r / E_i$$

Where: E_i = The input voltage of the incident pulse.

E_r = the reflected voltage.

3-43. For a system with an incident pulse of 1 volt and a single discontinuity producing a reflection of 0.1 volt, the p 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.

3-44. Overlays are available from Hewlett-Packard to directly indicate values of p for several sensitivies on a CRT display. A slide-rule calculator (HP Time Domain Reflectometer) may be used to quickly calculate values of p for any displayed reflection. Contact the nearest Hewlett-Packard Sales/Service Office to obtain either overlays or the calculator.

3-45. OPERATING PROCEDURE.

3-46. To use the sampling system in TDR operations, set the sampling time base to a free-running condition. The sync pulse (or pretrigger output) is used to trigger the incident pulse generator. See figure 3-4. Display the pulse generator output as a step waveform.

3-47. To obtain maximum accuracy for any display, use maximum dot density and photograph a trace at a slow scan speed.

3-48. Calculate the reflection coefficient p of the system under test by using the following formula:

$$p = E_r / E_i$$

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

E_r = the reflected voltage.

3-49. To determine horizontal sensitivity in feet per division on the display, use the setting of the TIME/DIV switch in the following formula:

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

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

3-50. For a polyethylene line, K = 2.3 or TIME/DIV multiplied by 0.33 ft/ns. For an air line, K = 1.0 or TIME/DIV multiplied by 0.5 ft/ns. Example: if TIME/DIV were set to 50 nSEC and a polyethylene line tested, each division on the CRT would represent 16.5 feet along the line. If the sweep were expanded by a factor of X100, each division would represent 0.165 feet.

THEORY

SECTION IV

PRINCIPLES OF OPERATION

4-1. INTRODUCTION.

4-2. This section includes circuit theory for the Model 1430C. Circuit analysis will first be explained on a block diagram basis, followed by circuit details. Basic sampling theory as well as detailed theory of the vertical amplifier is described in both the Model 1411A and Model 1811A sampling vertical amplifier operating and service manuals. It is recommended that these explanations be studied first.

4-3. OVERALL DESCRIPTION.

4-4. Figure 4-1 shows an overall 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.

4-5. 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 an emitter follower stage, amplified, and then coupled to another emitter follower. Routed to the sampling vertical amplifier, it is further amplified to drive the vertical deflection plates of the CRT. Signal feedback from the sampling vertical amplifier is used by the sampler to charge the sampler capacitance to 100% of the sampled signal amplitude prior to taking 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.

4-6. 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.

4-7. CIRCUIT DETAILS.

4-8. The following detailed theory is referenced to the schematic located in Section VIII. The schematic

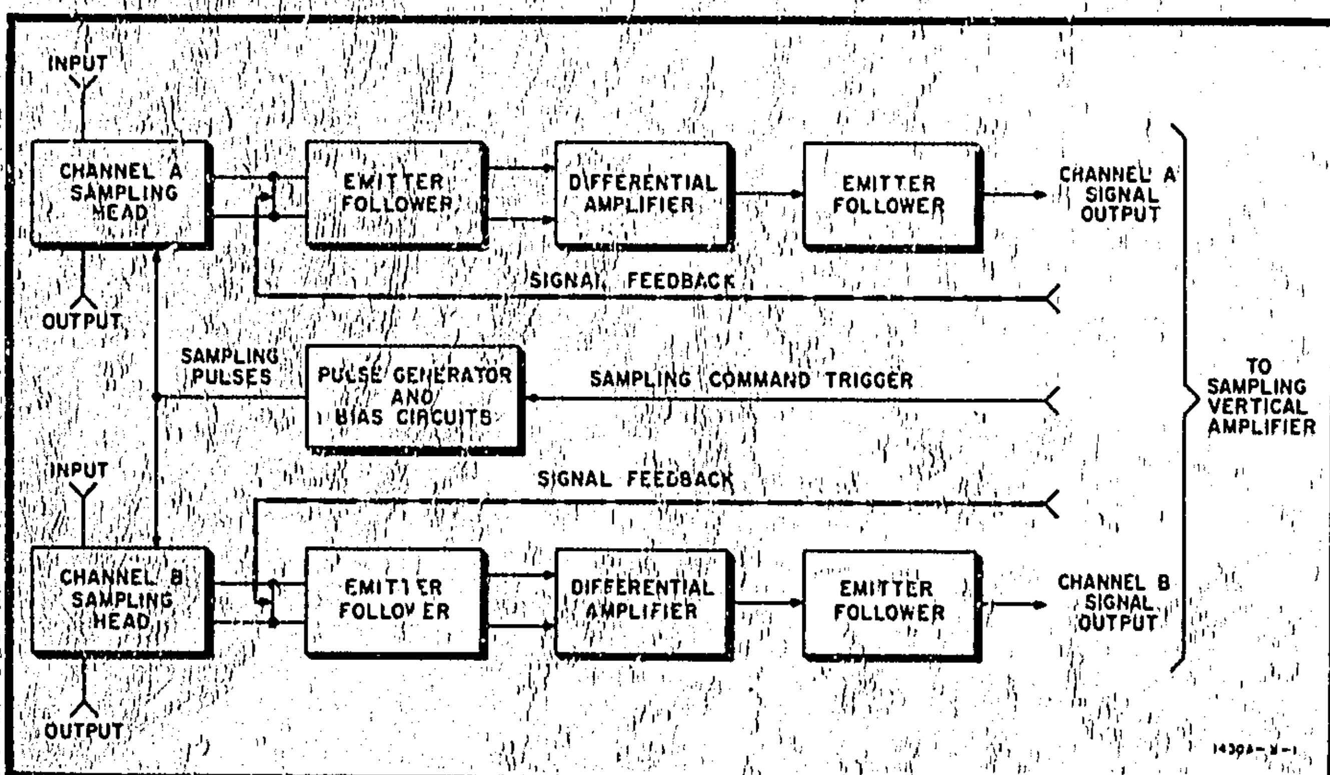


Figure 4-1. Sampler Block Diagram

can be unfolded and referred to, while reading the text.

4-9. PULSE GENERATOR.

4-10. Signal input to the pulse generator circuitry is the sampling command trigger. This pulse originates in the sampling time base circuitry. Sent to the sampling vertical amplifier, it is amplified and shaped before being applied to the sampler.

4-11. The sampling trigger, a positive pulse, is ac coupled to the base of saturating switch Q103. Q103 is normally off. When the pulse is applied, the transistor saturates. The negative-going collector signal is transformer coupled through T101 to the step-recovery diodes.

4-12. Step-recovery diodes CR112, CR113 and CR114 are normally forward biased and conducting. When the negative pulse from T101 is applied to the anode of CR114, 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.

4-13. When CR114 stops conducting, the negative voltage generated at its anode, coupled through isolation diodes CR110 and CR111, reverse biases CR113. When the carriers at the junction of CR113 are depleted, it turn off even faster than CR114. The same action then occurs with CR112 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.

4-14. One side of the pulse generator output is grounded while the other side contains the negative-going pulse. The negative-going pulse is coupled differentially through C105 to sampling diode CR105, and through C106 to sampling diode CR106. This causes both CR105 and CR106 to become forward biased, and permits sampling to occur.

4-15. SAMPLING ASSEMBLY.

4-16. The bias network applies approximately 1.5 volts of reverse bias to sampling diodes CR105 and CR106, keeping them nonconducting. The bias centering adjustment, R122, 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 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, is felt on the base of emitter follower Q101B.

4-17. If the signal level changes, feedback from the sampling vertical amplifier 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.

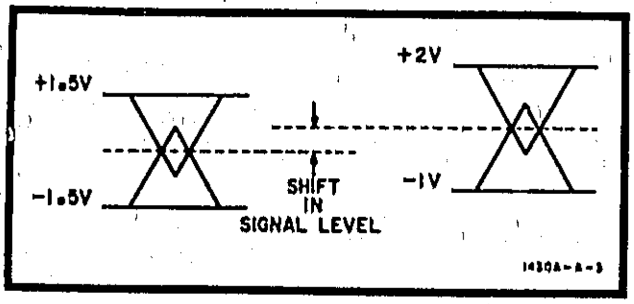


Figure 4-2. Shift in Signal Level

4-18. The overall sampling efficiency of the sampling vertical amplifier/sampler combination depends upon three factors: the RC time constant of the sampling capacitance, signal source, and sampling diode impedance; the length of time the sampling gate is opened; and the loop gain of the sampler/vertical amplifier combination. The signal source impedance and RC time constant are fixed. Sampling efficiency can be adjusted, however, with Model 1411A RESPONSE and SMOOTHING controls or Model 1811A RESPONSE and TR ADJUST controls.

4-19. Adjusting the Model 1411A SMOOTHING control or Model 1811A RESPONSE control changes the loop gain of the sampler/vertical amplifier combination. This adjustment is set for an overall sampling efficiency of 100% (optimum response). Refer to the appropriate operating and service manual for adjustment procedure (Section III). Under normal circumstances, once this adjustment is made for a particular sampler/vertical amplifier combination, it should not require readjustment.

4-20. Adjusting the Model 1411A RESPONSE control or Model 1811A TR ADJUST changes the amount of bias applied to the sampling diodes (figure 4-3). This changes the sampling time. Decreasing sampling time increases bandwidth (improving risetime). Increasing sampling time slows risetime but decreases noise. Complete instructions for making these adjustments are also provided in Section III of the appropriate sampling vertical amplifier manual.

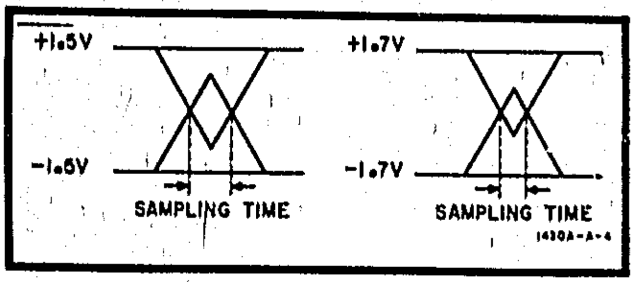


Figure 4-3. TR vs Sampling Time

4-21. PREAMPLIFIER.

4-22. The emitter output of Q101B is coupled to U101. Low frequency signals are also coupled from the sampling head, through R105, to the base of Q101A. The output of Q101A is also coupled to U101. U101 is an amplifier with a differential input and a 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 U101 is directly coupled to emitter follower Q102. The emitter output of Q102 is then routed through the interconnecting cable to the sampling vertical amplifier. Gain of the sampling preamplifier is approximately 30.

PERFORMANCE CHECK

Table 5-1. Recommended Test Equipment

Instrument		Required Characteristics	Required For
Type	Model		
Fast-rise Pulse Generator	HP Models 1105A + 1106B	Risetime < 20 ps NO SUBSTITUTE	Performance Checks
Pulse Generator	HP Model 222A	100 kHz 5 volts into 50 ohms Trigger output Variable pulse delay Positive and negative polarity	Performance Checks and Adjustments
Variable Attenuator	HP Model 355D	Up to 50 dB in 10 dB steps	Performance Checks
50-ohm Power Divider	General Radio	Maintains 50-ohms at each output	Performance Checks
Monitor Oscilloscope	HP Models 180C 1801A 1820C	50-MHz Bandwidth	Adjustments
Signal Generator	HP Model 608E	450 MHz 140 mV RMS	Adjustments
Four 24 in. to 36 in. BNC cables			Performance Checks and Adjustments
Two BNC to male type N adapters			Performance Checks and Adjustments

7C00-A-19

SECTION V
PERFORMANCE CHECK AND ADJUSTMENTS

5-1. INTRODUCTION.

5-2. This section contains step-by-step procedures for checking the instrument specifications as given in table 1-1 of this manual. The performance check procedure gives trouble-shooting suggestions in case the instrument fails to meet any specification tested. A table (performance check record) is provided at the end of the performance check for recording the measurements obtained in the first running of the procedure. This record may be used to compare measurements taken at later dates with the original. The procedures for making all internal adjustments are covered in paragraphs 5-34 through 5-49. A photograph showing the locations of all internal adjustment controls is presented in figure 8-5.

5-3. TEST EQUIPMENT.

5-4. Test equipment required for procedures in this section is listed in table 5-1. Test equipment equivalent to that recommended may be substituted, provided it meets the required characteristics listed in the table. For best results, use recently calibrated test equipment.

5-5. PERFORMANCE CHECK.

5-6. The following subparagraphs describe procedures to determine whether or not the instrument is operating within the specifications of table 1-1. This check can be used as part of an incoming inspection, as a periodic operational test, or to check calibration after repairs or adjustments have been made. Any one of the following checks can be made separately, if desired.

5-7. The first time the performance check is made, enter the results on the performance check record at the end of the procedure. Remove the record from the manual and file it for future reference. Be sure to include the instrument serial number on the record for identification.

5-8. Install the sampling vertical amplifier and time base into the oscilloscope, connect the Model 1430C to the sampling vertical amplifier, turn power on, and allow at least 10 minutes for warm-up. The time base, oscilloscope, and all test equipment should be calibrated and operating properly before proceeding with the performance checks and adjustments.

5-9. RISETIME AND OVERSHOOT.

5-10. SPECIFICATION. Risetime: approximately 20 ps (less than 28 ps observed with Model 1105A and 1106B Fast-rise Pulse Generator and Model 909A Option 012 50-ohm load). Overshoot: less than 7.5% using Model 1105A and 1106B.

5-11. DESCRIPTION. Both risetime and overshoot are checked, using Model 1105A/1106B Fast-rise Pulse Generator with a risetime of less than 20 ps. The Model 1105A is slaved to the free-running rate of the time base sync pulse or pretrigger.

5-12. EQUIPMENT. The following equipment is required:

a. Model 1105A and 1106B Fast-rise Pulse Generator.

b. BNC cable, 24 in. to 36 in.

c. adapter, BNC to male type N.

5-13. PROCEDURE. To check risetime and overshoot, proceed as follows:

a. Connect Model 1105A/1106B Fast-rise Pulse Generator to channel A input as shown in figure 5-1.

b. Set time base controls for free-running trace.

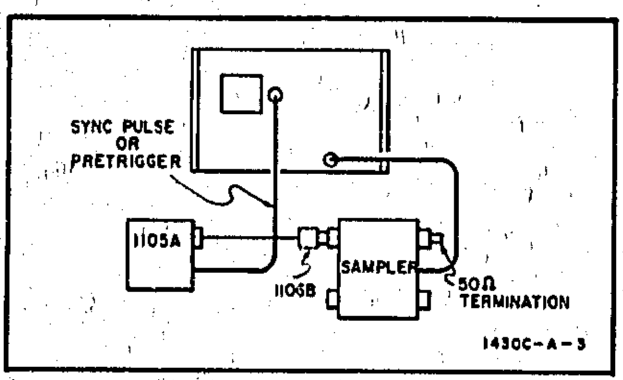


Figure 5-1. Risetime Test Setup

c. Set sampling vertical amplifier controls as follows:

NORMAL/FILTERED or NORM/SMOOTHED switch .... FILTERED or SMOOTHED
display selector .... A

d. Adjust Model 1105A SENSITIVITY to obtain pulse output from Model 1106B.

e. Adjust channel A vertical sensitivity and vernier to obtain full screen vertical deflection.

f. Set sweep time and sweep time magnifier to measure risetime. Risetime is measured between 10% and 90% points on waveform. Observed risetime should be less than 28 ps.

g. Observe overshoot. It should be less than 7.5%.

h. Set display selector to B.

i. Repeat steps a through g for channel B.

j. If risetime and/or overshoot specifications cannot be met, refer to (1) adjustment procedure for Bias Centering and Diode Bias Adj., and (2) risetime adjustment procedure of sampling vertical amplifier manual.

5-14. DYNAMIC RANGE.

5-15. SPECIFICATION. Dynamic range should be greater than ± 1 volt.

5-16. DESCRIPTION. A pulse generator with a variable output amplitude and polarity is connected to the sampler. Amplitude is increased to +1 volt. Signal must not break up (extreme distortion).

5-17. EQUIPMENT. The following equipment is required:

a. pulse generator.

b. two BNC cables, 24 in. to 36 in.

c. adapter, BNC to male type N.

5-18. PROCEDURE. To check dynamic range, proceed as follows:

a. Connect equipment as shown in figure 5-2.

b. Set pulse generator controls to obtain positive 2 to 5-usec wide pulse, approximately 0.5 volt amplitude at approximately 50 kHz.

c. Set time base for stable external triggering, displaying one or two pulses.

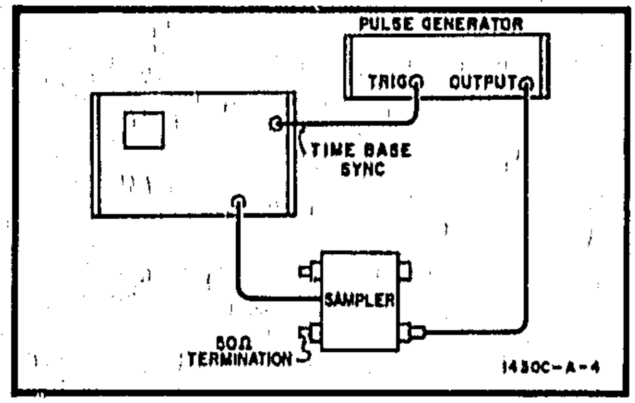


Figure 5-2. Dynamic Range Test Setup

d. Set sampling vertical amplifier controls as follows:

display selector .... A
vertical sensitivity .... 200 mV/div
NORMAL/FILTERED or NORM/SMOOTHED .... NORMAL or NORM

e. Slowly increase pulse generator amplitude. Amplitude should reach + 1 volt without any signal distortion or break up.

CAUTION

DO NOT EXCEED 1 VOLT.

f. Change polarity of pulse generator from + to — and repeat steps b through e.

g. Change display selector to channel B.

h. Repeat steps a through f for channel B.

i. If dynamic range specification is not met, check Diode Bias adjustments. Check C120 and C121 and sampling diodes. If these all check good, then trouble is most likely to be in sampling vertical amplifier.

5-19. LOW FREQUENCY DISTORTION.

5-20. SPECIFICATION. Low frequency distortion shall be less than ±5%.

5-21. DESCRIPTION. A pulse generator signal is observed for corner rounding and pulse top flatness.

5-22. EQUIPMENT. The following equipment is required:

a. pulse generator.

b. two BNC cables, 24 in. to 36 in.

c. adapter, BNC to male type N.

5-23. PROCEDURE. To check low frequency distortion, proceed as follows:

a. Connect equipment as shown in figure 5-2.

b. Set pulse generator controls to obtain pulse approximately 5-usec wide, 0.25-volt amplitude at approximately 50 kHz.

c. Set time base controls for stable external triggering.

d. Set time base sweep time to display one or two pulses.

e. Set sampling vertical amplifier controls as follows:

display selector .... A
vertical sensitivity ....
..........to display 5 or 6 divisions of deflection

f. Observed waveform should have flat top with not more than ±5% rounding at pulse corners. Disregard leading edge overshoot which may as be much as 7.5%.

g. Set display selector to B.

h. Repeat steps a through f for channel B.

i. If low frequency distortion is not within specification, check Low Frequency Distortion Adj. C107 and C108 or C307 and C308.

5-24. TANGENTIAL NOISE.

5-25. SPECIFICATION. Noise shall be less than 10 mV unfiltered or unsmoothed and less than 2.5 mV FILTERED or SMOOTHED.

5-26. DESCRIPTION. A pulse generator output is connected to the sampler through 50 dB of attenuation. Time base is free-running, so that display is incoherent. Output amplitude is adjusted so that the two lines (representing top and bottom of pulse) just begin to converge into one line. Attenuation is decreased to 30 dB. Signal amplitude is measured and tangential noise is 10% of this value.

5-27. EQUIPMENT. The following equipment is required:

a. pulse generator.

b. two BNC cables, 24 in. to 36 in.

c. adapter, BNC to male type N.

d. variable attenuator.

5-28. PROCEDURE. To check noise, proceed as follows:

a. Check both vertical channels to ensure that sampling efficiency and risetime are set properly. Refer to sampling vertical amplifier manual for procedures.

b. Connect equipment as shown in figure 5-3.

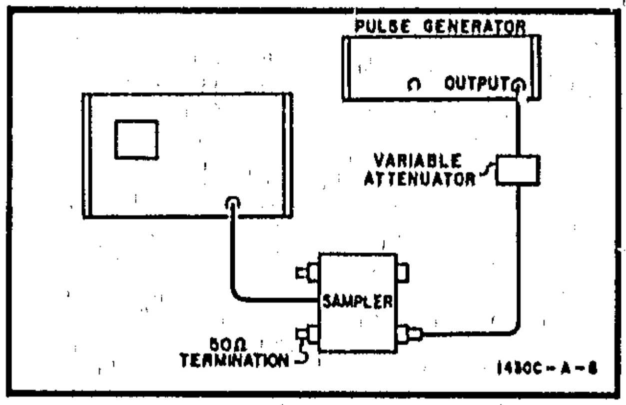


Figure 5-3. Noise Test Setup

c. Set variable attenuator to 50 dB.

d. Set pulse generator controls to obtain 5-volt square wave (50% duty cycle) at approximately 10 kHz.

e. Set time base for free-running trace at 10 ns/div.

f. Set sampling vertical amplifier controls as follows:

display selector .... A
NORMAL/FILTERED or NORM/SMOOTHED
.... NORMAL or NORM
vertical sensitivity .... 10 mV

g. Adjust SCAN DENSITY for incoherent display with minimum flicker. Display should consists of two lines, approximately 1 div apart. If display consists of square wave moving across CRT as shown in figure 5-4 part b, readjust SCAN DENSITY to obtain display as shown in figure 5-4, part a.

h. Decrease pulse generator amplitude until dark band is just visible between two lines (two lines just converge into one). See figure 5-4 parts c, d, and e.

i. Change variable attenuator to 30 dB.

j. Measure voltage difference between two lines on display. Unsmoothed (unfiltered) noise is

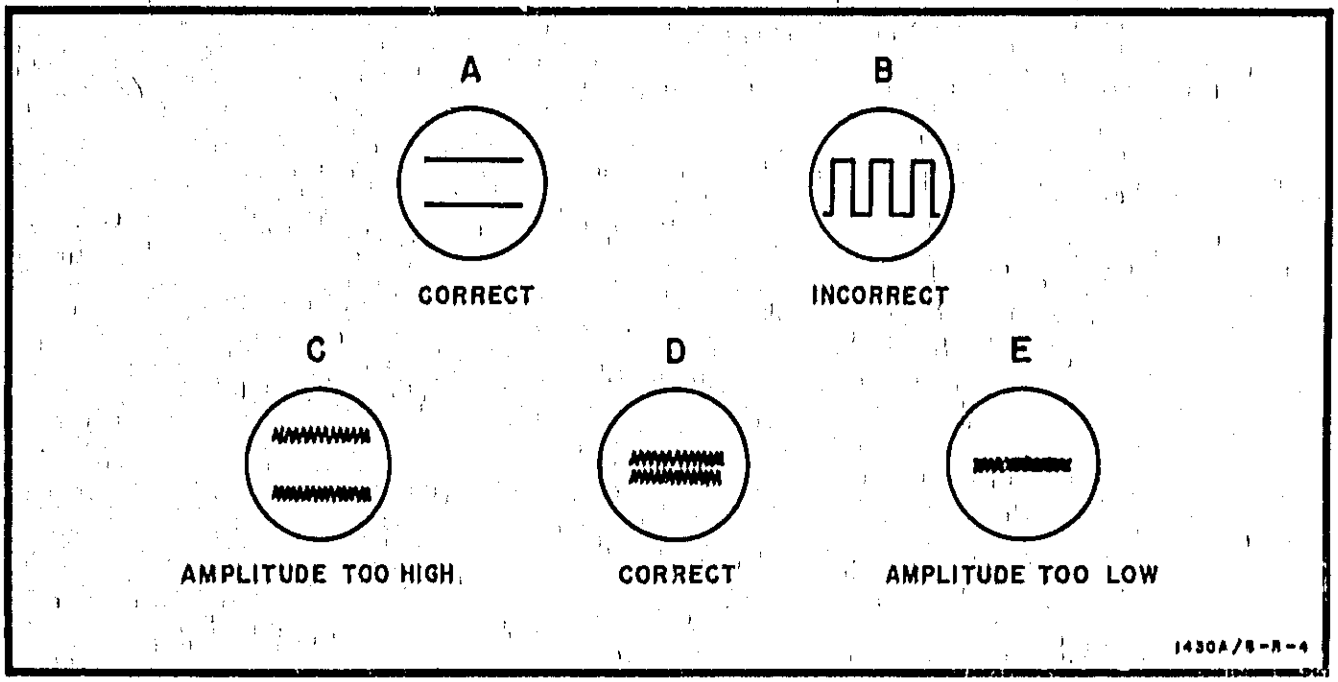


Figure 5-4. Noise Measurement Display

10% of this value and should be less than 10 mV.

k. Change NORMAL/FILTERED or NORM/SMOOTHED control to FILTERED or SMOOTHED.

l. Repeat steps a thru j. Tangential noise should now be less than 2.5 mV.

m. Set display selector to B.

n. Repeat steps a through l for channel B.

o. If noise is not within specification, first check sampling efficiency and risetime adjustment on sampling vertical amplifier. If these adj are set properly, then check sampling diodes for faulty channel.

5-29. TIME DIFFERENCE BETWEEN CHANNELS.

5-30. SPECIFICATION. Time difference between channels shall be less than 5 ps.

5-31. DESCRIPTION. A pulse is applied to both channels, through a power divider and equal length cables. Time difference between leading edges is measured.

5-32. EQUIPMENT. The following equipment is required:

a. pulse generator.

b. four BNC cables (two must be equal length).

c. two adapters, BNC to male type N.

5-33. PROCEDURES. To check time difference between channels, proceed as follows:

a. Connect equipment as shown on figure 5-5.

b. Adjust pulse generator to obtain 0.5-volt pulse at approximately 100 kHz.

c. Set sampling vertical amplifier controls as follows:

display selector .... ALT or A & B
vertical sensitivity .... 5 to 6 div of deflection

d. Adjust time base controls for stable external triggering.

e. Adjust vertical amplifier POSITION controls so that two traces are exactly centered on CRT.

f. Expand time/div and measure time difference between pulses. Time difference should be less than 5 ps.

g. If time difference between channels is not within specification, first make certain that two signal input cables to sampler are exactly same length. If so, then trouble is most likely in sampling vertical amplifier channel switching area.

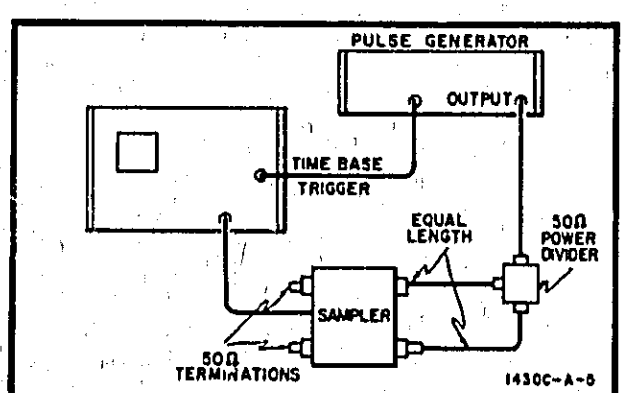


Figure 5-5. Time Difference Test Setup

PERFORMANCE CHECK RECORD
Model 1430C

Instrument Serial Number ____________ Date ____________

Check	Specification	Measured
RISETIME AND OVERSHOOT		
Channel A		
Risetime	< 28 ps	____________
Overshoot	< 7.5%	____________
Channel B		
Risetime	< 28 ps	____________
Overshoot	< 7.5%	____________
DYNAMIC RANGE		
Channel A	<+ 1V	____________
	<– 1V	____________
Channel B	<+ 1V	____________
	<– 1V	____________
LOW FREQUENCY DISTORTION		
Channel A	±5%	____________
Channel B	±5%	____________
TANGENTIAL NOISE		
Channel A		
Unsmoothed (Unfiltered)	< 10 mV	____________
Smoothed (Filtered)	< 2.5 mV	____________
Channel B		
Unsmoothed (Unfiltered)	< 10 mV	____________
Smoothed (Filtered)	< 2.5 mV	____________
TIME DIFFERENCE BETWEEN CHANNELS	< 5 ps	____________

5-34. ADJUSTMENTS.

5-35. The following paragraphs describe procedures to calibrate the instrument so that it will perform as specified in table 1-1. Use a nonmetalic screwdriver and recently calibrated test equipment with characteristics as specified in table 5-1. Refer to figure 8-5 for adjustment locations. After adjustments are complete for the sampler/vertical amplifier, check instrument performance by doing the performance checks at the beginning of this section.

5-36. Note that there are two adjustment procedures for the Bias Centering and Diode Bias Adj. One applies to the Models 1811A/1430C combination and the other applies to the Models 1411A/1430C combination. The Low Frequency Distortion Adjustments apply to either combination of instruments.

5-37. BIAS CENTERING AND DIODE BIAS ADJ (MODELS 1811A/1430C).

5-38. DESCRIPTION. The sampled envelope is monitored with an oscilloscope and the step-recovery diode biases are optimized for maximum envelope amplitude. The Bias Centering Adj. is made at the same time to keep the back-bias applied equally to both sampling diodes.

5-39. EQUIPMENT. The following equipment is required:

a. monitor oscilloscope.

b. pulse generator.

c. signal generator.

d. two BNC cables, 24 in. to 36 in.

e. adapter, BNC to male type N.

5-40. PROCEDURE. To make the adjustments, proceed as follows:

a. Set Model 1811A controls as follows:

RESPONSE .... 1/3 from full cw
TR ADJUST.................... 1/3 from full cw
both MV/DIV 200
LEVEL..................... 12 o'clock (free-run)
SCAN .... SWEEP
NORMAL/FILTERED.............. NORMAL
TIME/DIV .... 5 nSEC

b. Connect signal generator output to channel A input.

c. Terminate output into 50 ohms.

d. Set signal generator controls for cw output of approximately 140 mV RMS at approximately 450 MHz.

e. Locate junction of R128 and R129 and short junction to ground. Refer to figure 8-7 for location.

f. Connect PRETRIG OUTPUT to monitor oscilloscope external trigger input.

g. Using monitor oscilloscope, observe waveform at emitter of Q120. Waveform should look like one of three waveforms shown in figure 5-6.

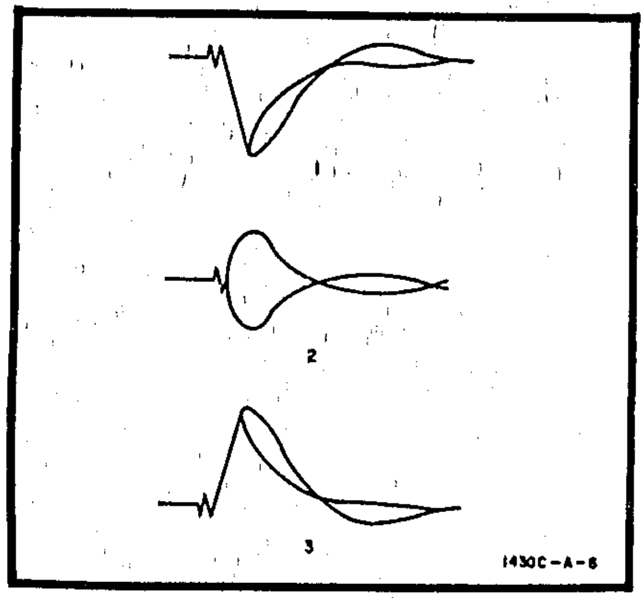


Figure 5-6. Bias Centering Waveforms

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

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

j. Adjust 2nd Bias Adj R148 for maximum p-p voltage on waveform. Readjust Bias Centering R122 as necessary to maintain display similar to waveform 2.

k. Adjust 3rd Bias Adj R147 for maximum p-p voltage on waveform.

Note

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

l. Disconnect all equipment.

m. Rotate Model 1811A channel A vertical POSITION from one extreme to other and adjust R122 so that baseline travels equally up and down from center screen.

n. Change Model 1811A MODE selector to B.

o. Adjust Channel B vertical POSITION and adjust R322 so that free-running trace (terminated into 50 ohms) travels equally up and down from center screen.

p. Connect pulse generator to channel B input (figure 5-2).

q. Adjust pulse generator for pulse 2 to 5-usec wide, 0.5V amplitude at approximately 100 kHz.

r. Adjust pulse generator Pulse Delay so that display consists of baseline and change in signal level as display disappears on right side of CRT.

s. Set Model 1811A SCAN DENSITY for minimum dot-density.

t. Set Model 1811A channel B RESPONSE adj to full cw position.

u. Rotate Model 1811A channel B TR ADJUST slowly ccw and observe that sampling efficiency decreases to less than 100% (refer to Section III of sampling vertical amplifier manual).

v. If less than 100% sampling efficiency cannot be obtained (even with TR ADJUST set fully ccw), readjust 2nd Bias Adj R148 and 3rd Bias Adj R147 until less than 100% sampling efficiency can be obtained. Adjust for approximately 60% to 70% sampling efficiency with TR ADJUST set fully ccw.

w. Reset channel B RESPONSE and TR ADJUST to original positions.

x. Change MODE selector to A.

y. Disconnect pulse generator from channel B and connect to channel A.

z. Using Model 1811A channel A TR ADJUST and RESPONSE adjustments, repeat steps a through w for channel A. R147 and R148 must be adjusted for less than 100% sampling efficiency on both channels A and B.

5-41. BIAS CENTERING AND DIODE BIAS ADJ (MODELS 1411A/1430C).

5-42. DESCRIPTION. The sampled RF envelope is monitored with an oscilloscope and the step-recovery diode biases are optimized for maximum envelope amplitude. The Bias Centering Adj. is made at the same time to keep the back-bias applied equally to both sampling diodes.

5-43. EQUIPMENT. The following equipment is required:

a. monitor oscilloscope.

b. pulse generator.

c. signal generator.

d. two BNC cables, 24 in. to 36 in.

e. adapter, BNC to male type N.

5-44. PROCEDURE. To make the adjustments, proceed as follows:

a. Set Model 1411A controls as follows:

RESPONSE (both) .... 1/3 from full cw
SMOOTHING (both) .... 1/3 from full cw
MILLIVOLTS/DIV (both) 200
VERNIER (both) .... CAL
display .... A

b. Set time base controls as follows:

TIME/DIV .... 5 nSEC
MAGNIFIER XI
MODE .... FREE RUN
SCANNING .... NORMAL
INT/EXT .... EXT
SYNC PULSE .... ON

c. Using monitor oscilloscope, observe waveform on collector of Q125 in Model 1411A.

d. Adjust Stretcher Gate Width Adj R183 for pulse width of 350 ns.

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

f. Adjust channel B Stretcher Gate Width Adj R383 for pulse width of 350 ns.

g. Connect signal generator output to channel A input.

h. Terminate channel A into 50 ohms.

i. Set signal generator for cw output of approximately 140 mV RMS at about 450 MHz.

j. Locate junction of R128 and R129 and short junction to ground. See figure 8-7 for location.

k. Connect time base SYNC PULSE output to externally trigger monitor oscilloscope.

l. Using monitor oscilloscope, observe waveform at emitter of Q102. Waveform should look like one of three waveforms shown in figure 5-6.

m. Adjust Bias Centering Adj R122 fully ccw to fully cw to be sure all three waveforms can be obtained. Then adjust R122 for display most similar to waveform 2.

n. Adjust 1st Bias Adj R153 for maximum p-p amplitude.

o. Adjust 2nd Bias Adj R148 for maximum p-p amplitude. Readjust Bias Centering Adj R122 as necessary to make display most similiar to waveform 2.

p. Adjust 3rd Bias Adj. R147 for maximum p-p amplitude.

Note

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

q. Disconnect equipment.

r. Rotate Model 1411A channel A VERT POS control fully cw to fully ccw. If baseline does not travel up and down equally from CRT center, readjust Bias Centering Adj R122.

s. Change Model 1411A display selector to B.

t. Rotate Model 1411A channel B VERT POS control from one extreme to other. Adjust R322 until baseline traverses equally up and down from center screen.

u. Connect pulse generator to channel B input (figure 5-2).

v. Terminate channel B into 50 ohms.

w. Set pulse generator to obtain 2 to 5-usec wide pulse 0.5V amplitude at approximately 100 kHz.

x. Set time base sweep time to 100 nSEC.

y. Adjust pulse generator Pulse Delay so that display first consists of baseline and 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).

z. Set time base SCAN DENSITY to minimum.

aa. Adjust Model 1411A channel B SMOOTHING to fully cw position.

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

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

ad. Reset channel B SMOOTHING and RESPONSE to original positions.

ae. Set Model 1411A display selector to A.

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

ag. Using Model 1411A channel A SMOOTHING and RESPONSE controls, repeat steps u through ad for channel A. R147 and R148 must be adjusted for less than 100% sampling efficiency on both channel A and channel B.

5-45. LOW FREQUENCY DISTORTION ADJ. (BOTH 1811A/1430C and 1411A/1430C).

5-46. DESCRIPTION. A pulse is observed and the low frequency distortion adjustments are made to make the observed pulse most similiar to its known shape.

5-47. EQUIPMENT. The following equipment is required:

a. pulse generator.

b. two BNC cables, 24 in. to 36 in.

c. adapter, BNC to male type N.

5-48. PROCEDURE. To make the adjustments, proceed as follows:

a. Connect equipment as shown in figure 5-2.

b. Set pulse generator controls for 2-usec wide pulse, 0.25V in amplitude at 50 kHz.

c. Set time base sweep time to 1 uSEC/DIV.

d. Adjust pulse generator Pulse Delay to observe pulse.

e. Adjust vertical sensitivity and vernier to obtain at least 5 div of deflection. Observed pulse should look like one of three waveforms in figure 5-7.

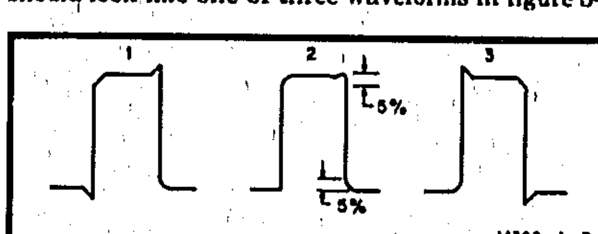


Figure 5-7. Low Frequency Distortion

f. Adjust Low Freq Comp Adj C107 and C108 alternately to obtain pulse most similiar to figure 5-7 waveform 2 (minimum peaking and rounding). Overshoot specification is 7.5%.

CAUTION

When adjusting C107 and C307 (screws located on circuit boards), be careful not to tighten enough to break the pick-off resistors.

g. Disconnect pulse generator from channel A and connect to channel B.

h. Terminate channel B into 50 ohms.

i. Set Model 1411A display selector to B.

j. Repeat steps e and f for channel B, adjusting C307 and C308.

k. C129 is factory selected for optimum dynamic range and minimum low frequency distortion. Typical value is 56 pF. If replacement is necessary, select value for these two parameters. Decreasing value improves low frequency distortion.

5-49. 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.

PARTS LIST

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. The abbreviations used in the parts list are described in Table 6-1. Table 6-2 lists the parts in alphanumeric order by reference designator and includes the manufacturer and manufacturer's part number. Table 6-3 contains the list of manufacturers' codes.

6-3. ORDERING INFORMATION.

6-4. To obtain replacement parts from Hewlett-Packard, address order or inquiry to the nearest Hewlett-Packard Sales/Service Office and supply the following information:

a. Instrument model and serial number.

b. HP Part Number of item(s).

c. Quantity of part(s) desired.

d. Reference designator of part(s).

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

a. Instrument model and serial number.

b. Description of the part, including function and location in the instrument.

c. Quantity desired.

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	OBD	= order by description	SE	= selenium
BP	= bandpass	HZ	= hertz	OH	= oval head	SEC	= second(s)
C	= centi (10^{-2})	IF	= intermediate freq.	OX	= oxide	SECT	= section(s)
CAR	= carbon	IMPG	= impregnated	P	= peak	SI	= silicon
CCW	= counterclockwise	INCD	= incandescent	PC	= printed (etched) circuit(s)	SIL	= silver
CER	= ceramic	INCL	= include(s)	PF	= picofarads	SL	= slide
CMO	= cabinet mount only	INS	= insulation(ed)	PHL	= Phillips	SP	= single pole
COAX	= coaxial	INT	= internal	PIV	= peak inverse voltage(s)	SPL	= special
COEF	= coefficient	K	= kilo (10^{3})	PNP	= positive-negative-positive	ST	= single throw
COMP	= composition	KG	= kilogram	P/O	= part of	STD	= standard
CONN	= connector(s)	LB	= pound(s)	PORC	= porcelain	TA	= tantalum
CRT	= cathode-ray tube	LH	= left hand	POS	= position(s)	TD	= time delay
CW	= clockwise	LIN	= linear taper	POT	= potentiometer(s)	TFL	= teflon
D	= deci (10^{-1})	LOG	= logarithmic taper	P-P	= peak-to-peak	TGL	= toggle
DEPC	= deposited carbon	LPF	= low-pass filter(s)	PRGM	= program	THYR	= thyristor
DP	= double pole	LVR	= lever	PS	= polystyrene	TI	= titanium
DT	= double throw	M	= milli (10^{-3})	PWV	= peak working voltage	TNLDIO	= tunnel diode(s)
ELECT	= electrolytic	MEG	= mega (10^{6})	RECT	= rectifier(s)	TOL	= tolerance
ENCAP	= encapsulated	MET FILM	= metal film	RF	= radio frequency	TRIM	= trimmer
EXT	= external	MET OX	= metal oxide	RFI	= radio frequency interference	U	= micro (10^{-6})
F	= farad(s)	MFR	= manufacturer	RH	= round head or right hand	V	= volts
FET	= field-effect transistor(s)	MINAT	= miniature	RMO	= rack mount only	VAR	= variable
FH	= flat head	MOM	= momentary	RMS	= root mean square	VDCW	= dc working volt(s)
FIL H	= fillister head	MTG	= mounting			W	= watt(s)
FXD	= fixed	MY	= mylar			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

Ref Desig	HP Part No.	TQ	Description	Mfr Code	Mfr Part Number
A1	0950-1445		A: sampler, channel A, includes diodes CR105 & CR106	HP	
A2	0950-1446		A: sampler, channel B, includes diodes CR305 & CR306	HP	
A3	01430-66503		A: preamplifier, channel A	HP	
A4	01430-66504		A: preamplifier, channel B	HP	
A5	01430-66502		A: 50-ohm strip line, assy: (includes C120, C121, CR110 thru 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 (Opt. 012)		AT: 50-ohm load	HP	
C105			NSR: p/o CR105		
C106			NSR: p/o CR106		
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		
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% wVdc	56289	150D225X0020A2
C316	0180-0155		C: fxd elect Ta 2.2 uF 20% 20 wVdc	56289	150D225X0020A2
CR105/ CR106	1901-0617		CR: A1 sampler diode assy consists of matched pair CR105-CR106. Also includes C105-C106, R107-R108.	HP	

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

Ref Desig	HP Part No.	TQ	Description	Mfr Code	Mfr Part Number
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/ CR306	1901-0617		CR: A2 sampler diode assy consists of matched pair CR305-CR306. Also includes C305-C306, R307-R308.	HP	
J101			NSR: p/o A1		
J102			NSR: p/o A1		
J301			NSR: p/o A2		
J302			NSR: p/o A2		
L101	9140-0094		L: fxd 0.68 uH 20%	86684	CA30051.C.
MP1	01430-25205		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	01430-04107		MP: cover, bottom	HP	
MP5	01430-20501		MP: clamp, cover	HP	
MP6	01430-20501		MP: clamp, cover	HP	
MP7	01430-64102		MP: cover, top	HP	
P4	1251-1444		P: connector, 18 contact Consists of:	HP	
	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	0811-1716		R: fxd cer 2000 ohms 10% 1/8W	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	

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

Ref Desig	HP Part No.	TQ	Description	Mfr Code	Mfr Part Number
R122	2100-1777		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	
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	2100-1773		R: var ww 1000 ohms 5% 1W	HP	
R148	2100-1773		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	2100-1773		R: var ww 1000 ohms 5% 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	0811-1716		R: fxd cer 2000 10% 1/8W	HP	
P306	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	2100-1777		R: var ww 20 kilohms 5% 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	

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

Ref Desig	HP Part No.	TQ	Description	Mfr Code	Mfr Part Number
U101	1820-0046		U: integrated amplifier	86684	CA3005
U301	1820-0046		U: integrated amplifier	86684	CA3005
VR105	1902-0126		VR: breakdown 2.61V	04713	SZ10939-14
VR106	1902-0049		VR: breakdown 6.19V	HP	
VR305	1902-0126		VR: breakdown 2.61V	04713	SZ10939-14
VR306	1902-0049		VR: breakdown 6.19V	HP	
W1	5060-0540		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. List of Manufacturers' Codes

MFR NO.	MANUFACTURER NAME	ADDRESS
04062	Arco Electronic Inc.	Great Nech, N.Y.
56289	Sprague Electric Co.	North Adams, Mass.
86684	Radio Corp. of America, Electronic Comp. & Devices Div.	Harrison, N.J.

BACK DATING
MANUAL CHANGES

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. Description 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 the same serial prefix shown on the manual title page. If the serial prefix of the instrument is not the same as the one on the title page, find your serial prefix in table 7-1 and make the changes to the manual that are listed for that serial prefix. When making changes listed in table 7-1, make the change with the highest number first. Example: if backdating changes 1, 2, and 3 are required for your serial prefix, do change 3 first, then change 2, and finally change 1. If the serial prefix of the instrument is not listed either in the title page or in table 7-1, 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. Manual Changes

Serial Prefix	Make Changes
No backdating changes are required at this time.	

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, such as 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.

SCHEMATIC DIAGRAMS

SECTION VIII

SCHEMATICS AND TROUBLESHOOTING

8-1. INTRODUCTION.

8-2. This section contains the schematic, repair and replacement information, component identification figures, waveforms and troubleshooting information. Table 8-1 defines symbols and conventions used on the schematics.

8-3. COMPONENT IDENTIFICATION.

8-4. Components on etched circuit boards are identified in figure 8-7. Mechanical and chassis mounted components are identified in figures 8-4 and 8-5.

8-5. SCHEMATICS.

8-6. The schematic is printed on a fold-out page for reference to the text and figures in other sections. A table on the schematic lists all components shown on the schematic by reference designation. All components within the shaded areas on a schematic are physically located on circuit boards. Components not physically located on a circuit board are shown in the unshaded areas of the schematic.

8-7. REPAIR AND REPLACEMENT.

8-8. 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, refer to Section II for recommended repackaging information.

8-9. SERVICING ETCHED CIRCUIT BOARDS.

8-10. 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 with straight pull from board.

c. Use toothpick or wooden splinter to clean holes.

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

8-11. 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.

8-12. REMOVING SAMPLING DIODES.

8-13. The sampling diode (s) should be removed only after definitely establishing that it is faulty (refer to paragraph 8-31 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.

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

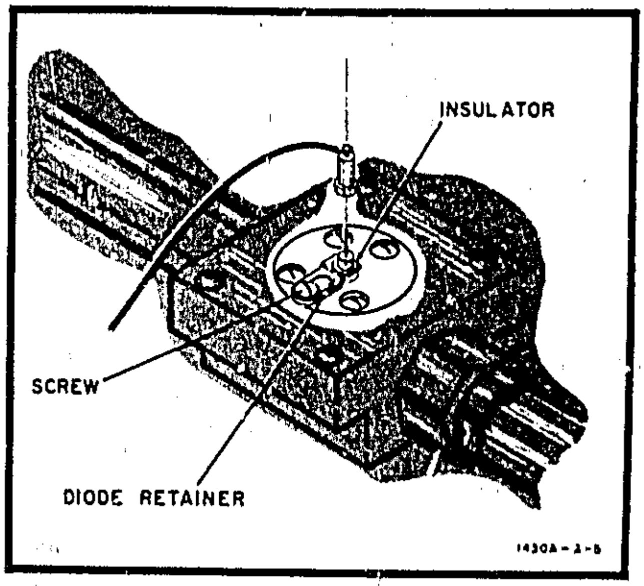


Figure 8-1. Diode Removal

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.

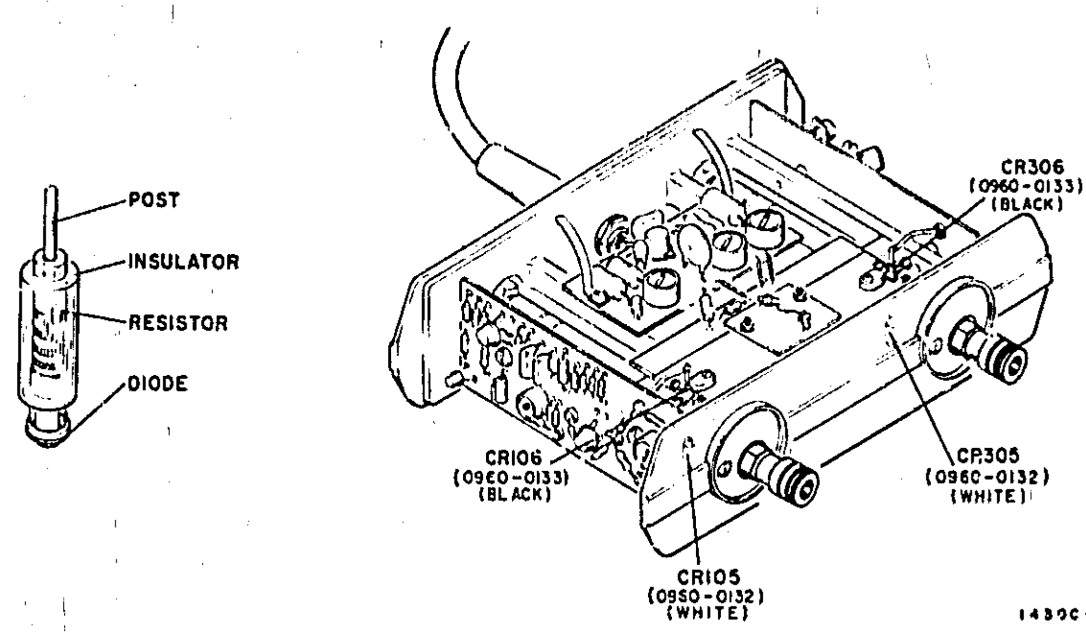


Figure 8-2. Diode and Resistor Assy

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

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

d. See figure 8-2 to make sure correct diode assembly is being used as replacement. Insert assembly straight into sampler. (A lateral blow is in plane most likely to break glass bead.) Glass bead will center itself in bottom of hole.

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

f. Recalibrate instrument as outlined in Section V.

g. Diodes may be damaged by:

(1). Rough handling.

(2). Static discharge, approximately 0.2 ergs.

(3). Soldering irons that induce 60-hertz pickup leakage currents.

8-14. STRIPLINE AND STEP-RECOVERY DIODE REPLACEMENT.

8-15. 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.

8-16. If the stripline is ordered as an assembly, it will come complete with the diodes CR110 through CR114. If only the stripline board, capacitor C120 or C121, is defective, it is less expensive to order the assembly listed in the parts list that does not include the diodes.

8-17. To remove stripline, proceed as follows:

a. Remove sampling diodes from sampler block. Mark them so that they can be replaced exactly as removed. (Soldering iron can damage diode).

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

c. Remove board containing CR110 and CR111. Step-recovery diodes CR112 and CR113 are sandwiched between two boards. These diodes are electrically different and extremely small. Be careful not to switch or lose them.

d. Remove bottom board.

e. Unsolder wires connected to stripline.

f. Remove screws and washers at each end of stripline.

g. Carefully bend small wires from sampler at each end of stripline. Bend these wires no more than absolutely necessary.

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

CAUTION

Be very careful not to catch the center conductor between stripline board and sampler, or to pull center conductor out of jacket.

8-18. To replace stripline, proceed as follows:

a. Replace stripline using original screws.

b. Gently bend wire up through slot in stripline board.

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

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

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

f. Replace sampling diodes in sampler.

8-19. TROUBLESHOOTING.

8-20. 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 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 (table 8-2).

8-21. 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 checkout.

8-22. Troubleshooting tips are given in the following paragraphs. 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.

8-23. DISTORTION.

8-24. Distortion is usually the result of improper control settings or adjustments. Calibrate the sampler/vertical amplifier following the procedures in Section V. If distortion is still present, check dc voltages and waveforms for both the sampler and vertical amplifier. Also, check for a possible faulty interconnecting cable, check C120 and C121, and check sampling diodes. Signals exceeding the dynamic range of the sampler will also cause distortion.

8-25. EXCESSIVE NOISE.

8-26. If noise is present on both channels, the trouble is most likely in the pulse generator (step-recovery diodes). If noise is present on one channel, check sampling diodes (substitution of known good diodes is the surest way).

8-27. STEP IN RISETIME.

8-28. If a small step appears during pulse risetime, check the risetime adj (TR ADJUST in Model 1811A, RESPONSE in Model 1411A). If this adjustment is set properly, check 3rd Bias Adj R147; then gently reposition CR110 and CR111 either closer or further away from the board.

8-29. SLOW RISETIME.

8-30. If risetime is too slow but unit is otherwise normal, first confirm that the Model 1106B is good and that the time base is in calibration. Second, check all connections and screws around the 50-ohm stripline to see that they are all tight. Third, readjust 3rd Bias Adj R147. The step-recovery diode bias controls the amplitude and width of the pulse that turns on the sampling diodes. Longer (slower) risetime may be the result of too wide a sampling pulse. Last, try moving CR110 and CR111 closer to the circuit board.

8-31. CHECKING SAMPLER DIODES AND SAMPLER BLOCK.

8-32. To check the sampling diodes, connect a signal generator to the suspected channel and adjust for a 140-mV rms signal at approximately 450 MHz. Next, short the junction of R128 and R129 to ground and observe the waveform at the emitter of Q102. Adjust Bias Centering Adj R122 through its range to be sure that all three waveforms can be obtained as shown in figure 8-3. If all three waveforms cannot be obtained, then one or more of the sampling diodes is faulty. If only waveform 1 of figure 8-3 can be obtained, then CR105 or CR305 is probably bad. If only waveform 3 can be obtained, then CR106 or CR306 is probably bad. If it is

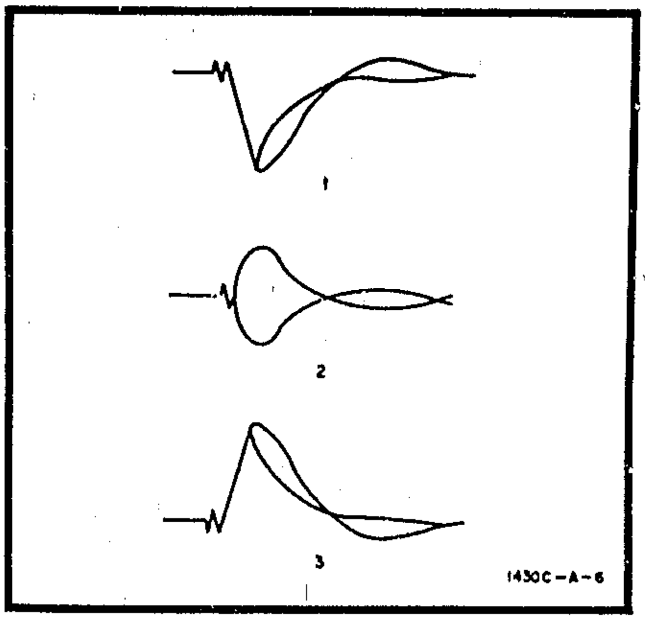


Figure 8-3. Bias Centering Waveforms

ascertained that the diodes are good, recalibrate the Bias Centering and Diode Bias Adjustments as described in Section V prior to further troubleshooting.

CAUTION

Checking the sampling diodes with an ohmmeter is not recommended. The voltage or current output of the ohmmeter may exceed the maximum safe input limits of the diodes.

8-33. If the diodes check OK in the functional channel, then make the following checks. First remove and mark the diodes so they can be replaced exactly from where they came. Removal of the diodes will eliminate the possibility of damaging them with too much voltage from the ohmmeter.

Note

Do not mix the upper and lower diodes, they differ electrically.

8-34. Check for continuity from the input center conductor to the output center conductor. It should be a short. If not, the sampler block must be replaced. This is a factory repair.

8-35. Check for 100k ohms from center conductor to ground. If open or shorted, check across R106 to ground and between R106 and R105.

8-36. Visually inspect the collect (inner conductor of connectors) for breakage or other damage. If all of these checks are good, then the malfunction is probably within the sampling block itself. Contact the nearest HP Sales/Service Office for repair service.

8-37 BOTH CHANNELS AFFECTED.

8-38. If the trouble affects both sampler channels, it is probably in the pulse generator assembly. The presence or absence of the sampler pulse can be seen with a 50-MHz monitor oscilloscope by checking the stripline (always discharge oscilloscope probe to ground before making this check). More meaningful data cannot be obtained from the pulse shape, however, because any type of test instrument will disrupt proper circuit operation. The presence of the pulse may be traced from the switch transistor Q103 across the transformer and step-recovery diodes to indicate opens or shorts somewhere in the circuit.

8-39. ONE CHANNEL AFFECTED.

8-40. If the sampler trouble affects only one channel, then probably nothing is wrong with the pulse generator assembly, except a possible open between the stripline and the sampler of the bad channel. The following checks in the following order should be made to isolate the problem:

a. Check diode bias centering waveforms as outlined in paragraph 8-32.

b. If all waveforms of figure 8-3 are present, place 50-mV 5-usec pulse on base of Q101B input differential emitter follower. With monitor oscilloscope, check for presence of pulse at output of integrated differential amplifier. If signal is present, go to step c. If not, trace signal to see if differential amplifier or differential emitter follower is bad. (Pulse may appear differentiated at output of differential amplifier.)

c. Since other channel is functional, try suspected bad diode in good channel. Do not try a known good diode in bad channel as damage to the diode may result.

Table 8-1. 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

= Waveform test point (with number)

= Common electrical point (with letter) not necessarily ground

= Single-pin connector on board

= 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

= Field-effect transistor (P-type base)

= Field-effect transistor (N-type base)

= Breakdown diode (voltage regulator)

= Tunnel diode

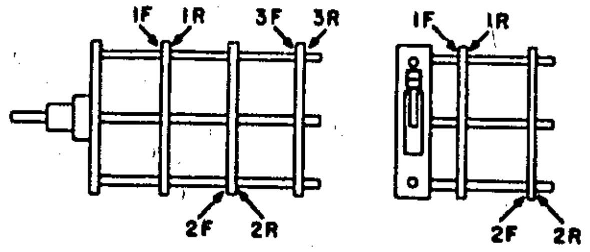
= Step-recovery diode

= 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

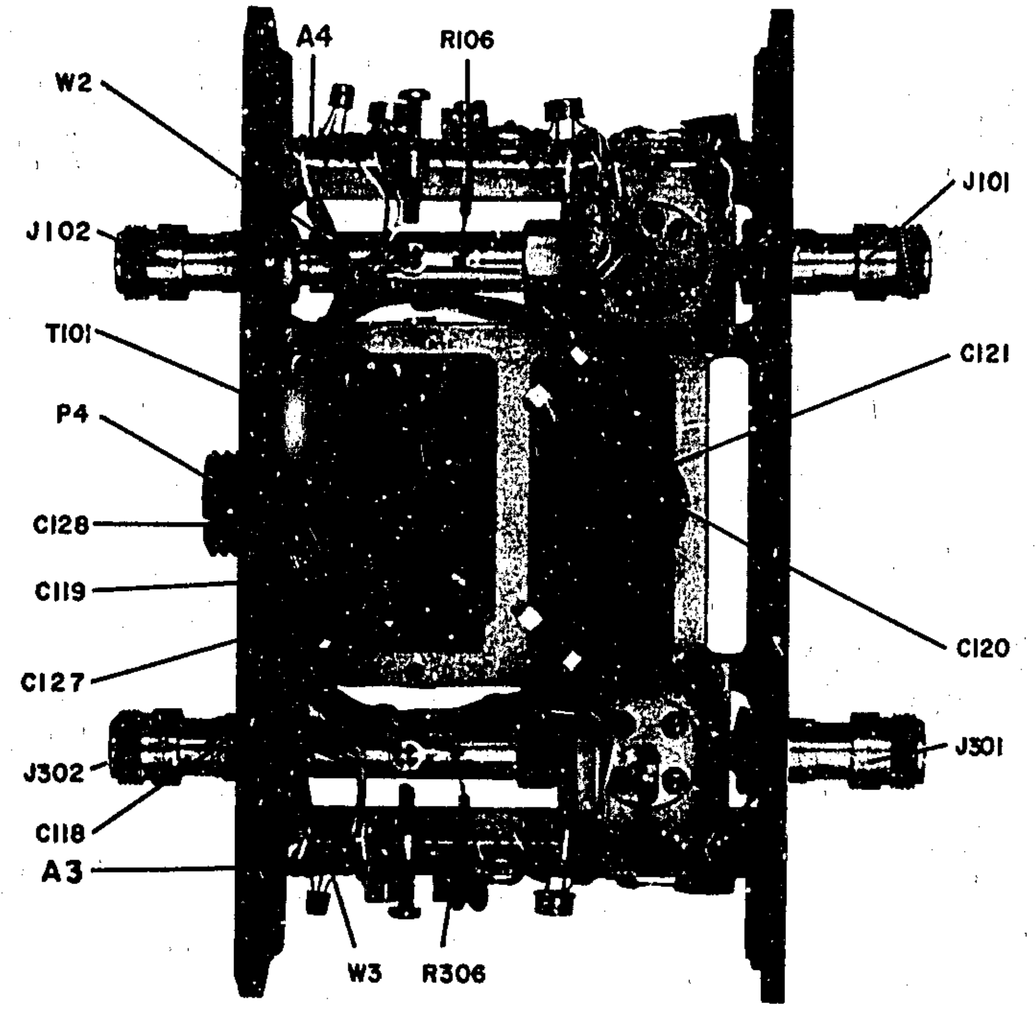


Figure 8-4. Component Identification, Bottom View

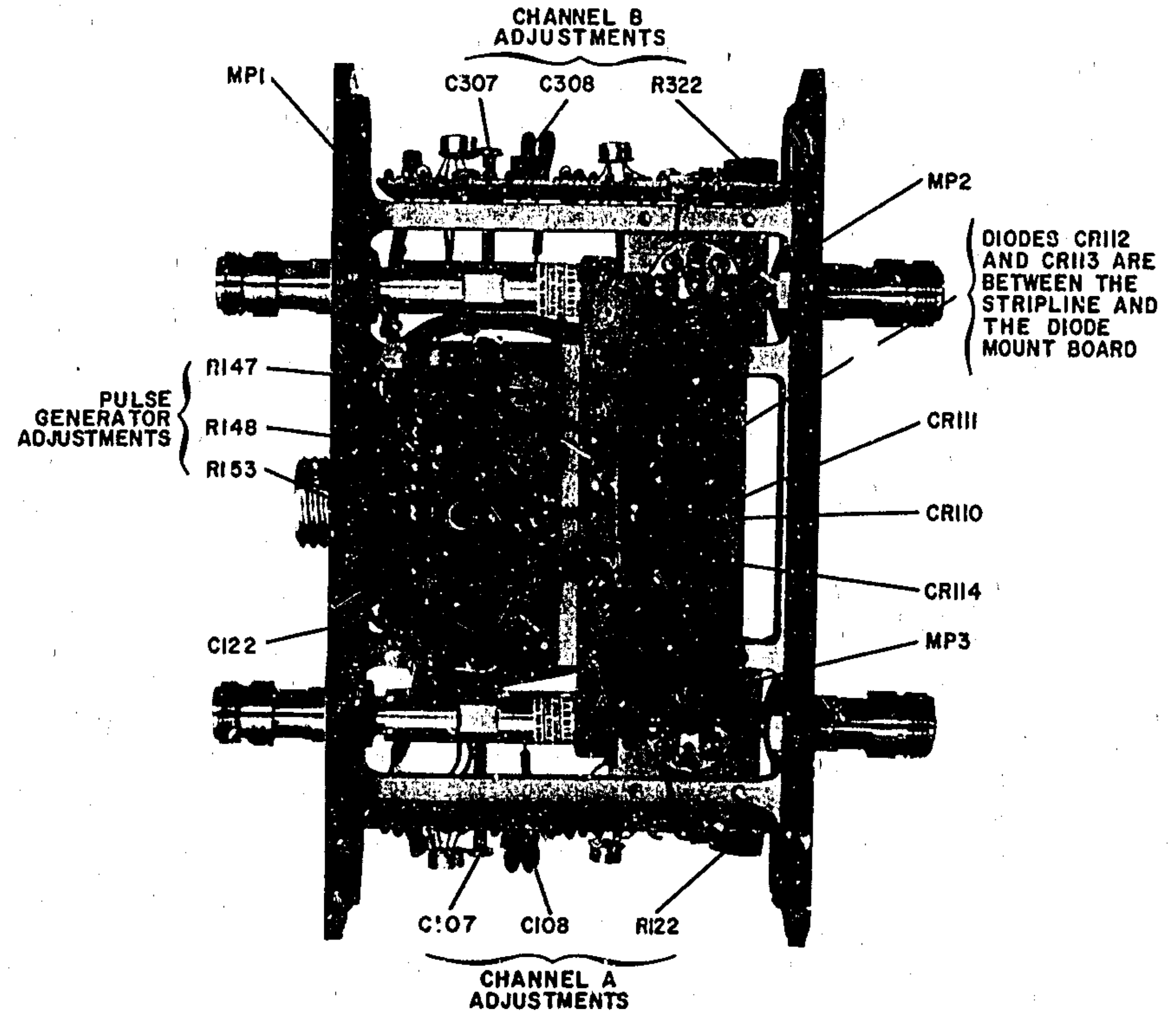


Figure 8-5. Adj and Component Identification, Top View

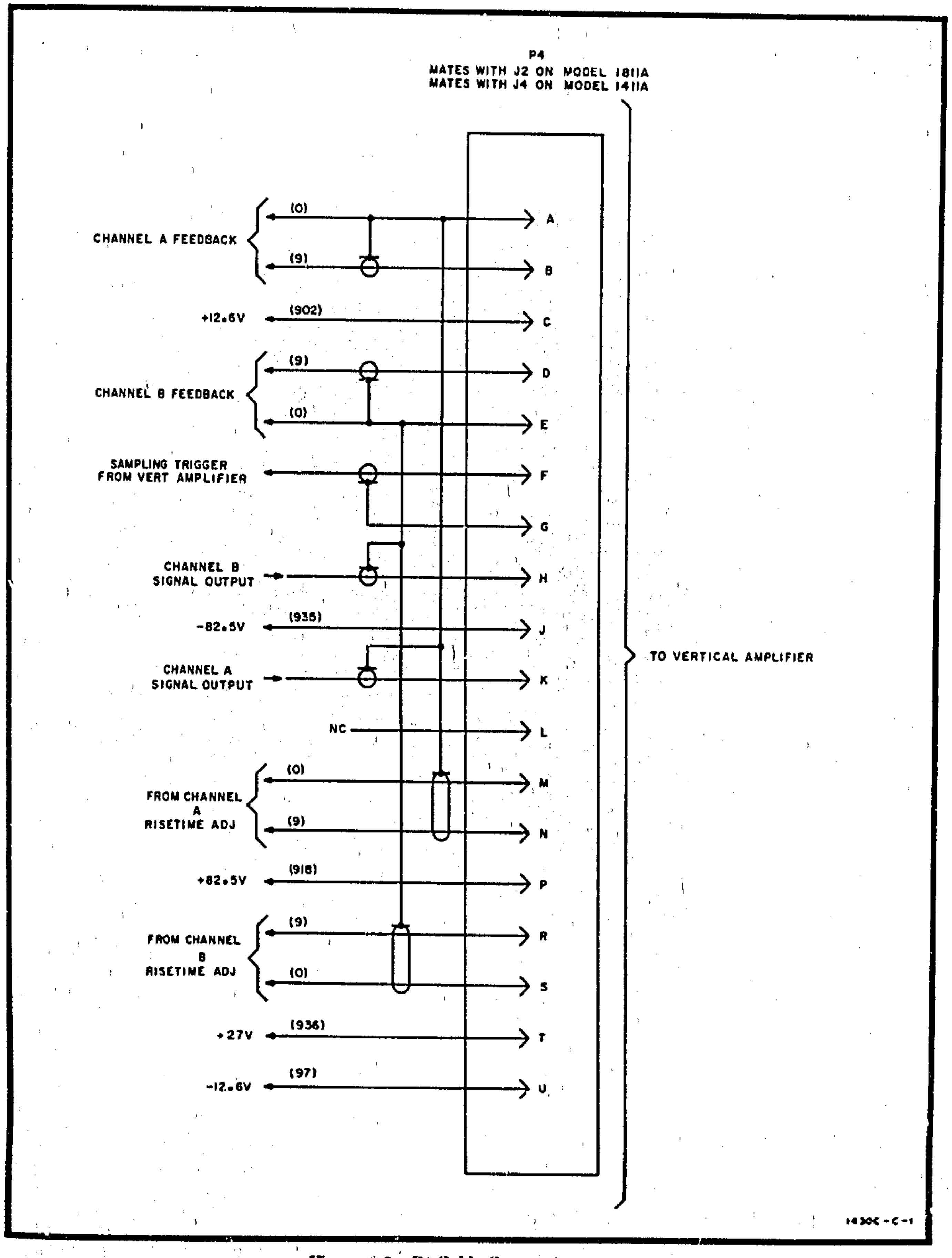


Figure 8-6. P4 Cable Connections

DC VOLTAGE MEASUREMENT CONDITIONS

a. Connect sampler to sampling vertical amplifier.

b. Set sampling vertical amplifier controls as follows:

vertical sensitivity .... 200 mV
vernier .... CAL
polarity .... up
NORMAL/FILTERED or NORM/SMOOTHED .... NORMAL or NORM
risetime .... optimized
sampling efficiency .... optimized
vertical positions .... midrange

c. Set time base controls as follows:

sweep time .... 10 uSEC
vernier .... CAL
SCAN DENSITY .... minimum
scan mode .... SWEEP (NORMAL)

d. If using Model 1811A, ground following points: A9TP4 (A10TP4 for channel B) and gate of A9Q8 (A10Q8 for channel B).

e. If using Model 1411A, ground following points: end of R180 that is common to S101 (end nearest to rear of instrument), and gate of Q120 (R380 and Q320 for channel B).

f. Voltages may vary somewhat, depending upon risetime and sampling efficiency settings. All voltages are referenced to ground.

WAVEFORM MEASUREMENT CONDITIONS

a. Connect 10-kH square wave at 0.5V p-p to appropriate channel input.

b. Use pulse generator trigger output to externally trigger time base.

c. Terminate channel into 50 ohms.

d. Set sampling vertical amplifier controls as follows:

vertical sensitivity 100
vernier .... CAL
vertical position .... midrange
NORMAL/FILTERED or NORM/SMOOTHED .... NORMAL or NORM
risetime .... optimized
sampling efficiency .... optimized

e. Set time base controls as follows:

LEVEL .... as required for stable display
SCAN DENSITY .... minimum
sweep time .... 10 uSEC
scan mode .... SWEEP/NORMAL

f. If using Model 1811A, locate A9TP4 (A10TP4 for channel B) and connect to ground.

g. If using Model 1411A, locate R180 (R380 for channel B) and ground end common to S101 (end closest to rear of instrument).

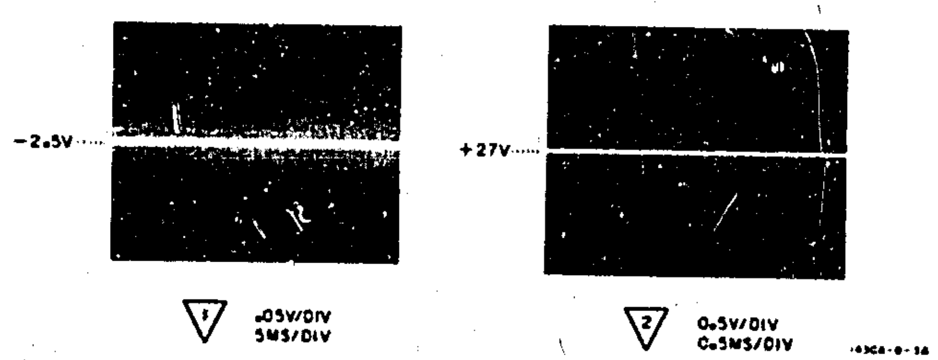
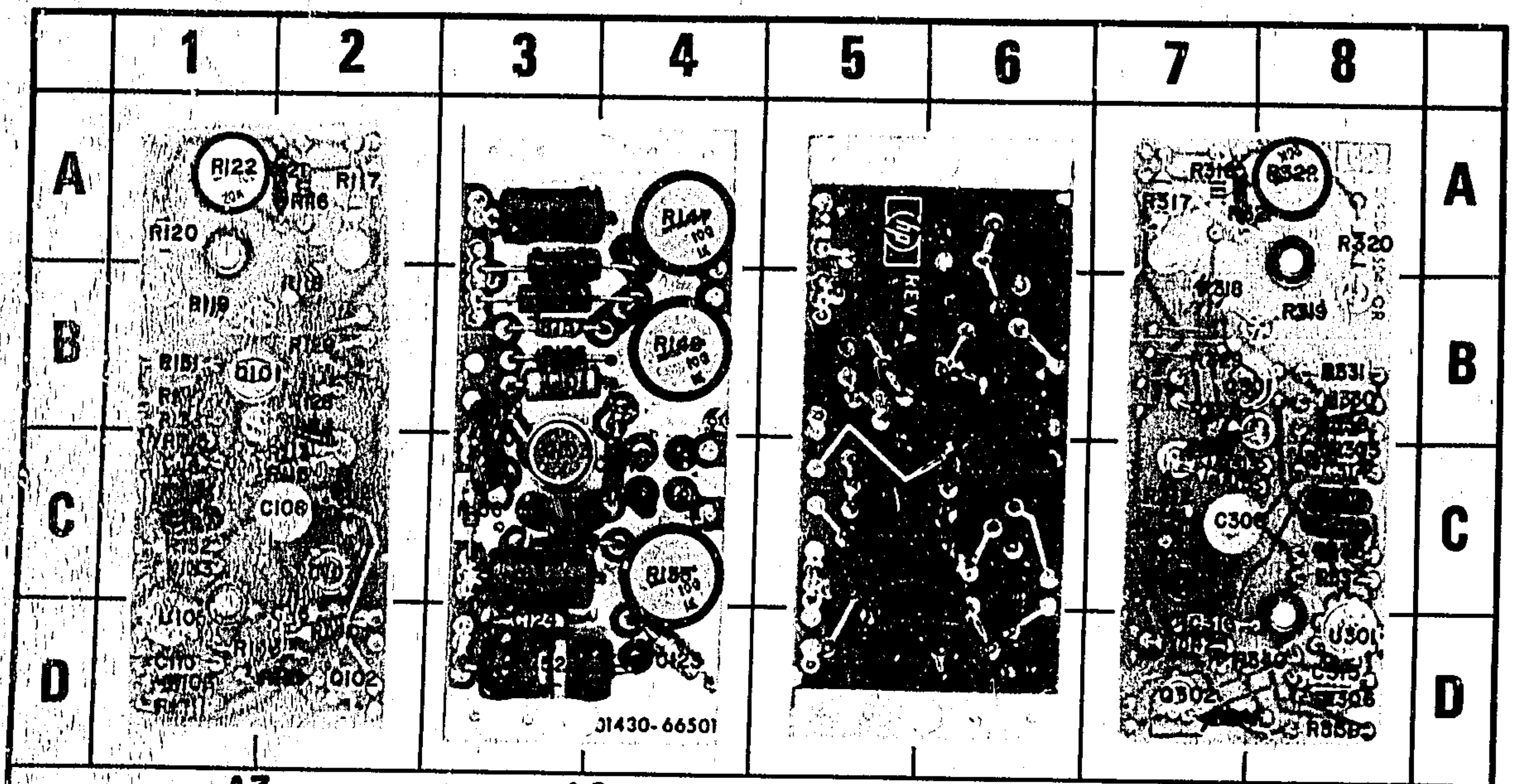


Table 8-2. DC Voltage and Waveform Measurement Conditions



A3

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C107	C-2	R120	A-1
C108	C-2	R121	A-1
C112	C-1	R122	A-1
C113	C-1	R128	B-2
C114	C-1	R129	B-2
C115	D-1	R130	B-1
C116	D-2	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	U101	D-1
R118	B-2	VR105	C-1
R119	B-1	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-6
C123	C-6
T101	B-6

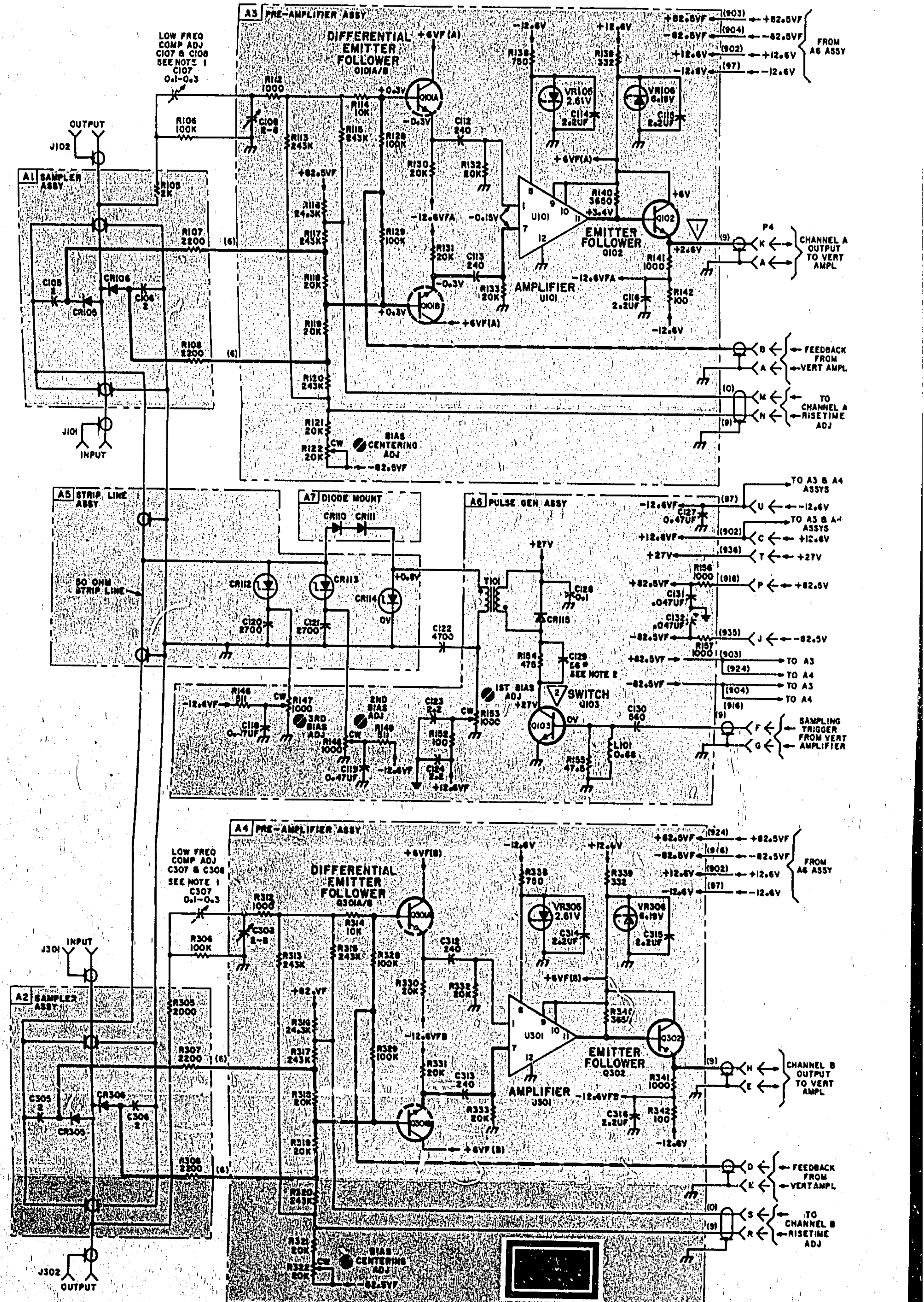
A4

REF DESIG	GRID LOC	REF DESIG	GRID LOC
C307	C-7	R320	A-8
C308	C-7	R321	A-7
C312	C-8	R322	A-8
C313	C-8	R328	B-7
C314	C-8	R329	B-7
C315	D-8	R330	B-8
C316	D-7	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	U301	D-8
R318	B-7	VR305	D-8
R319	B-8	VR303	D-8

Circuit boards have plated through component holes. This permits soldering from either side of the board.

1430C–R–4

Figure 8-7. Component Identification A3, A4, and A6



REFERENCE DESIGNATIONS

A1	A2	A3
C105,106 CR105,106 R105-108	C305,306 CR305,306 R305,307,308	C108,112,113, 115,116 Q101-102 R112-122,128-133,136-142 U101 VR105,106
A4	**A5**	
C312-316 Q301-302 R312-322 328-333 336-342 U301 VR305,306	C120-122 CR112-114	
	A6	**A7**
	C118,119,123,124, 127-132 CR115, L101, Q103 R146-149, 152-157, T101	CR110, 111
		CHASSIS
		C107,307 J101,102,301, 302 R106,306

DELETED:

NOTE: 1. MACHINE SCREW, C107 & C307
2. FACTORY SELECTED VALUE (SEE SECTION V. FOR PROCEDURE)

Reference designations within assemblies are abbreviated. Add assembly designation as prefix to form complete designation (e.g., R1 on assembly A2 is A2R1).

Model 1430C Sampler Schematic Figure 8-8.