SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section contains maintenance and service information on the Model 241A Oscillator. A performance check is included in this section which can be used to verify instrument operation. This check can be made with the covers attached to the instrument as a part of routine maintenance or incoming quality control inspection.

5-3. TEST EQUIPMENT REQUIRED.

5-4. The critical specifications and suggested test equipment needed in the performance and calibration procedures are given in Table 5-1.

5-5. PERFORMANCE CHECKS.

5-6. The performance checks are in-cabinet procedures verifying that the Model 241A is operating within specifications. These checks can be used for an incoming inspection test, for periodic maintenance, or to check instrument performance after repairs.

5-7. The performance checks are performed with the AC power cord connected to nominal line voltage (115 V/230 V) 50 to 1000 cps unless otherwise specified.

Table 5-1.

Required Test Equipment

Instrument Type	Required Characteristics	Use	Recommended Model
Oscilloscope	Passband: DC to 1 Mc Sensitivity: 0.05 volts/cm Input Impedance: 1 megohm	Waveform Measurement	℗ Model 175A with plug-in Model 1751A
Distortion Analyzer	Measure distortion to -40 db at 20 kc	Distortion Measurement	℗ Model 330B/C/D
AC Voltmeter	Frequency Range: 10 cps to 1 Mc Voltage Range: 1 mv to 5 V Accuracy: ±1.0% 50 cps to 500 kc ±2.0% 20 cps to 1 Mc ±5.0% 10 cps to 4 Mc	AC Voltage Measurements	℗ Model 400H
DC Voltmeter	Voltage Range: Positive and Negative voltages from 100 mv to 15 volts Input Impedance: at least 10 megohms	DC Voltage Check	℗ Model 412A
Frequency Counter	Counting Range: 10 cps to 1 Mc. 10 period average for time interval of 1 ms Accuracy: 0.1%	Frequency Measurements	℗ Model 5232A / 5532A
Resistor	600 ohms, 1/2 watt ±1%	Maintenance Test	℗ Stock No. 0727-0081
Variable Auto Transformer	Voltage Range: 102-128 vac Meter Accuracy: ±2% Power Capability: 1 W	Power Supply Tests	General Radio W10MT3A
Printed Circuit Board extender	18 pin connector	Troubleshooting	℗ Stock No. 5060-2041

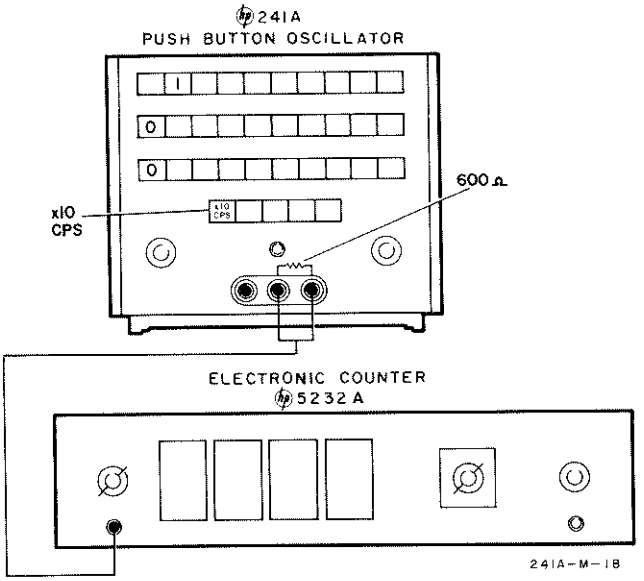


Figure 5-1. Frequency Check Setup

5-8. FREQUENCY CHECK.

a. Connect Model 241A as shown in Figure 5-1.

b. Set Model 241A controls as follows: (10 cps)
MULTIPLIER. . . . . .x10 cps
FREQUENCY Pushbuttons . . .1.00
AMPLITUDE . . . . . .MAX.
VERNIER. . . . . .CAL.

c. Set Electronic Counter FUNCTION Switch to measure 10 PERIOD AVERAGE in milliseconds.

d. The Electronic Counter should read between 99.000 and 101.000 milliseconds (1%).

e. Set Model 241A FREQUENCY pushbuttons to 5.00 (50 cps); Electronic Counter should read between 19.900 and 20.200 milliseconds.

f. Set Model 241A FREQUENCY pushbuttons to 9.00 (90 cps); Electronic Counter should read between 11.000 and 11.222 milliseconds.

g. Depress Model 241A MULTIPLIER pushbuttons to x100 CPS and the FREQUENCY pushbuttons to 1.00 (100 cps).

h. The Electronic Counter should read between 9.999 and 10.10000 milliseconds.

j. Set Electronic Counter FUNCTION switch to FREQUENCY.

k. Depress Model 241A FREQUENCY pushbuttons to 5.00; the Electronic Counter should read 500 cps ±5 cps.

m. Depress Model 241A MULTIPLIER and FREQUENCY pushbuttons as called out in Table 5-2. The Frequency Counter should indicate value given.

Table 5-2. Frequency Check

MULTIPLIER PUSHBUTTON	FREQUENCY PUSHBUTTON	FREQUENCY COUNTER READING
x100	5.00	500 cps ±5 cps
x100	9.00	900 cps ± 9 cps
x1 KC	1.00	1000 cps ±10 cps
x1 KC	5.00	5000 cps ±50 cps
x1 KC	9.00	9000 cps ±90 cps
x10 KC	1.00	10 kc ±100 cps
x10 KC	5.00	50 kc ±500 cps
x10 KC	9.00	90 kc ±900 cps
x100 KC	1.00	100 kc ±1 kc
x100 KC	5.00	500 kc ±5 kc
x100 KC	9.00	900 kc ±9 kc

5-9. FREQUENCY RESPONSE AND OUTPUT VOLTAGE CHECK.

a. Connect an AC Voltmeter (Model 400H) and a 600-ohm load across Model 241A OUTPUT.

NOTE
Use a split pair one foot long, with banana plugs on each end to connect the 400H to the Model 241A.

b. Depress Model 241A x1 KC MULTIPLIER and 1.00 DIGITS pushbuttons (1000 cps).

c. Adjust the 241A AMPLITUDE control for a 2.5 volt rms reading on the AC Voltmeter. For all frequencies in Table 5-3, the AC Voltmeter should read 2.5 ±0.05 volts.

NOTE
The ±0.05 volt tolerance applies to the Model 241A only; therefore, a calibration curve for the AC Voltmeter should be used when making this measurement.

d. Rotate Model 241A AMPLITUDE control fully counter-clockwise. The AC Voltmeter should indicate less than 25 millivolts for all frequencies listed in Table 5-3.

Table 5-3. Frequency Response

MULTIPLIER PUSHBUTTON	FREQUENCY PUSHBUTTON
x1 KC	1.00
x1 KC	5.00
x1 KC	9.00
x100 CPS	1.00
x100 CPS	5.00
x100 CPS	9.00
x10 CPS	1.00
x10 CPS	5.00
x10 CPS	9.00
x10 KC	1.00
x10 KC	5.00
x10 KC	9.00
x100 KC	1.00
x100 KC	5.00
x100 KC	9.00

5-10. RESIDUAL NOISE TEST.

a. Disable the oscillator by depressing a MULTIPLIER button half way and then releasing; all range buttons should then be in the released position.

b. Connect an AC Voltmeter (hp Model 400H) and a 600-ohm load across the Model 241A OUTPUT terminals. The residual Noise should not exceed 1.25 mv (0.05% of output).

5-11. OUTPUT IMPEDANCE CHECK.

a. Connect an AC Voltmeter (hp Model 400H) across Model 241A terminals.

b. Set Model 241A controls as follows:
MULTIPLIER. . . . . .x1 KC
FREQUENCY Pushbutton. . . .1.00
VERNIER. . . . . .CAL.

c. Adjust the AMPLITUDE control to obtain an indication of 5.0 volts on the AC Voltmeter.

d. Connect a 600 ohm ±1% load across Model 241A OUTPUT terminals.

e. The AC Voltmeter should indicate 2.5 volts (±5%)

5-12. DISTORTION CHECK.

a. Connect the Model 241A as shown in Figure 5-2.

b. Set Model 241A controls as follows:
MULTIPLIER. . . . . .x1 KC
FREQUENCY Pushbuttons . . .1.00
AMPLITUDE . . . . . .MAX.
VERNIER. . . . . .CAL.

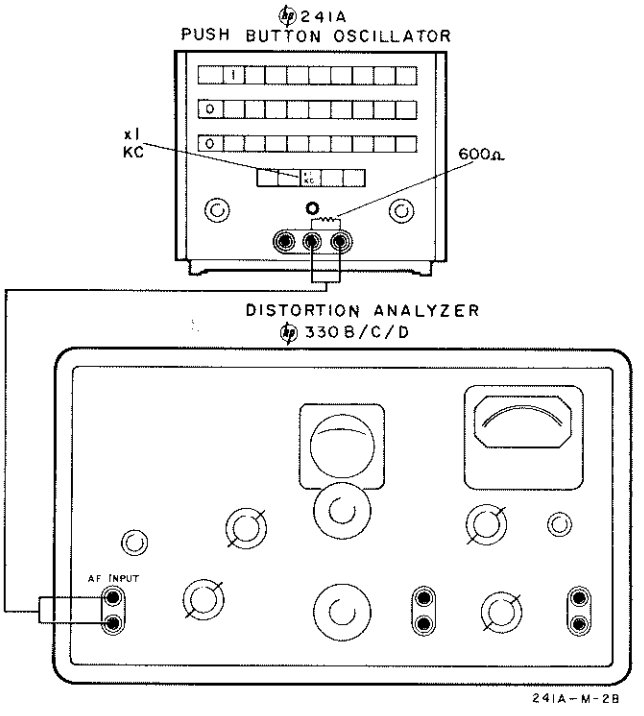


Figure 5-2. Distortion Check Setup

c. Set Distortion Analyzer controls as follows:
FREQUENCY RANGE. x100
INPUT. . . . . .AF
FUNCTION . . . . . .Set Level
METER RANGE. 100%

d. Adjust Distortion Analyzer INPUT SENSITIVITY for full-scale reading (1.0).

e. Set FUNCTION switch to DISTORTION.

f. Adjust Distortion Analyzer FINE and COARSE frequency controls and BALANCE control for a dip or null (on Distortion Analyzer meter) at fundamental frequency (1 KC), switch METER RANGE as necessary to obtain upscale meter reading.

g. Readjust controls until maximum meter dip or null is obtained.

h. Meter reading should be less than 1.0 on 1% range of Distortion Analyzer.

j. Repeat Steps d through h at frequencies of 20 cps and 20 kc.

5-13. TOP AND BOTTOM COVER REMOVAL.

5-14. For access to circuit components, remove the top and bottom covers. When repairing the frequency-selector switch assemblies (S101 through S103); or, when replacing multiplier switch S104, remove the side covers as well. To remove covers, refer to Figure 5-3, and proceed as follows:

a. Remove screws from top and bottom covers as shown in Figure 5-3.

b. Slide covers to rear, lift to remove.

c. Side covers: remove four screws on each side which hold cover.

5-15. CALIBRATION PROCEDURE.

5-16. The calibration procedure should be made only after the Model 241A is determined to be out of adjustment using the Performance Check, Paragraph 5-5. If your instrument fails to satisfy any one of the requirements given in the following steps, carefully recheck the cable connections and procedure. If the Oscillator still fails the step, refer to Paragraph 5-32, Troubleshooting, for possible cause and corrective action.

5-17. Perform specific tests associated with the particular sections of the instrument shown to be faulty by the Performance Check (Paragraphs 5-5 to 5-13). Indiscriminate adjustment of the internal controls to "refine" the settings should be avoided.

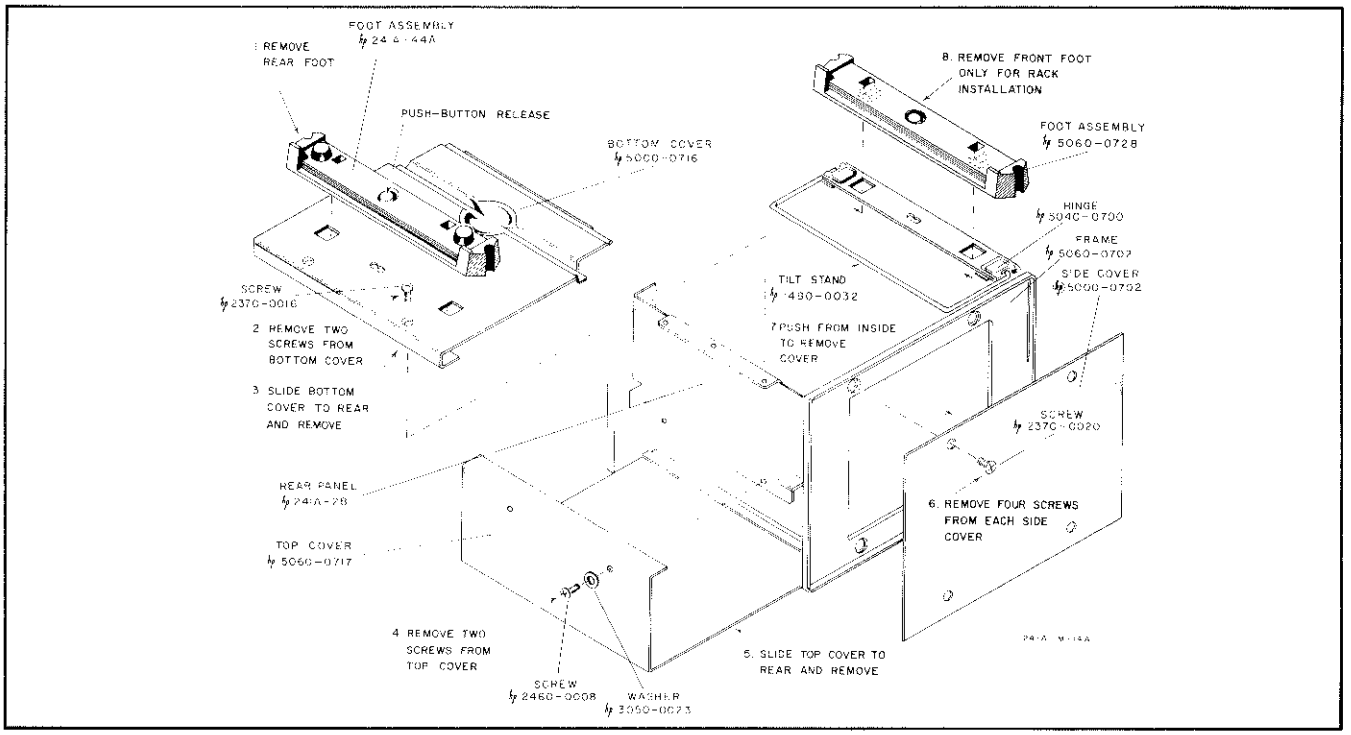


Figure 5-3. Cover Removal

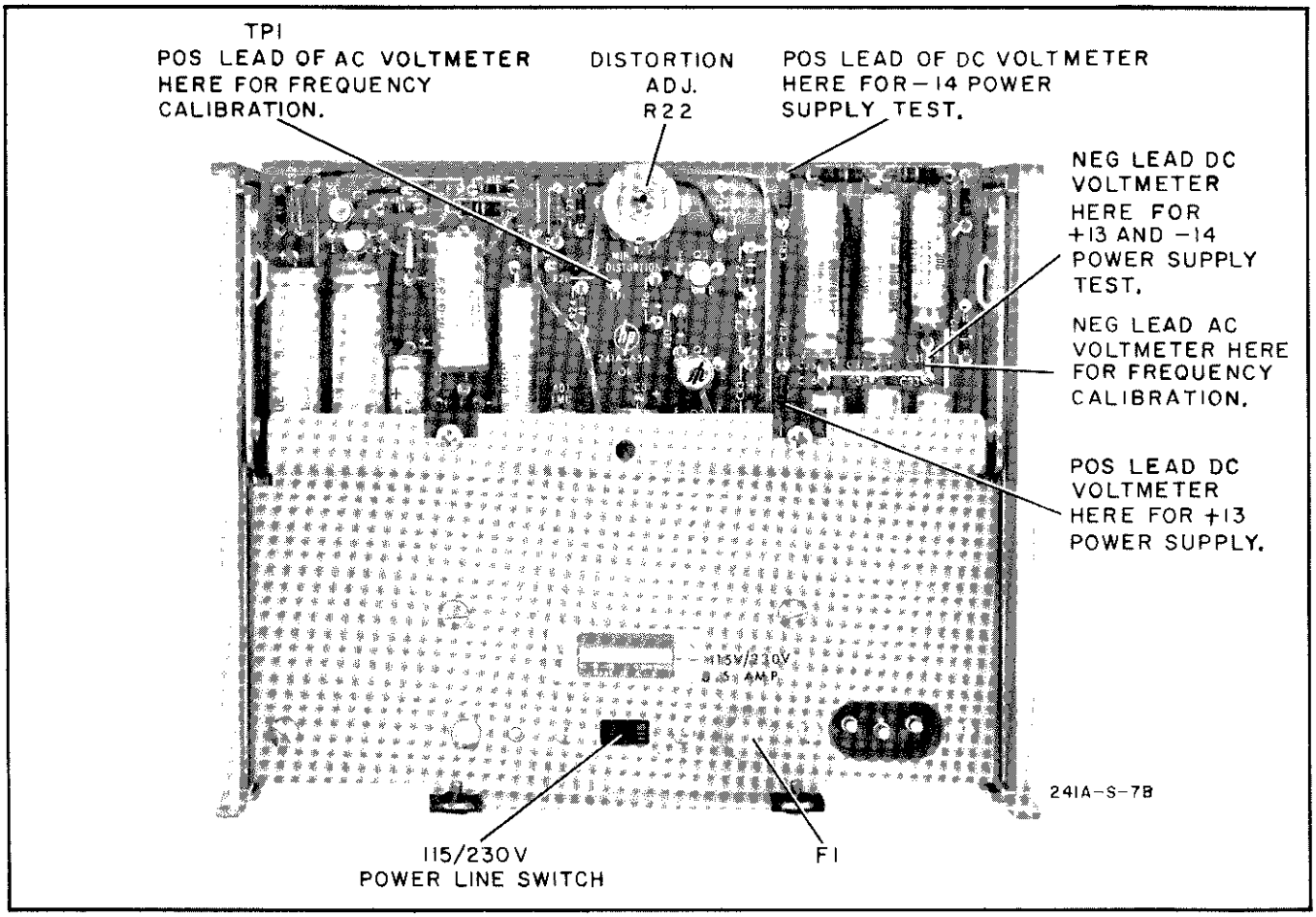


Figure 5-4. Rear View

5-18. POWER SUPPLY.

a. Remove top cover from Model 241A cabinet. (Refer to Figure 5-3.)

b. Measure +13 volt supply using a DC Voltmeter (hp Model 412A); connect the common lead to the junction of C31, C32, and C33 and the volts probe to the cathode of CR16. (Refer to Figure 5-4.)

c. Connect hp Model 241A to a variable auto transformer and adjust the line voltage to 115 volts.

d. The DC Voltmeter should indicate between +12.0 to +13.5 volts.

e. Vary input line voltage with the variable auto transformer from 103.5 to 126.5 volts; DC Voltmeter indication should not change more than ±0.75 volts from the reading, observed in Step d.

f. Connect common lead of DC Voltmeter to the junction of C33 and C34, Volts probe to the anode of CR15 (see Figure 5-4).

g. Adjust variable auto transformer to 115 volts; DC Voltmeter should read between -13.0 to -15.0 volts.

h. Vary input line voltage with the variable auto transformer from 103.5 to 126.5 volts; DC Voltmeter indication should not change more than ±0.75 volts from the reading observed in Step g.

j. Disable the oscillator by depressing a MULTIPLIER button half way and then releasing all range buttons. All range buttons should then be in released position.

k. Measure the AC ripple across the +13 and -14 volt supply using an AC Voltmeter (hp Model 400H). Connect AC Voltmeter using a shielded cable with short clip leads to the test points described in Steps b and f.

m. The AC ripple across each supply should be less than 2 millivolts rms.

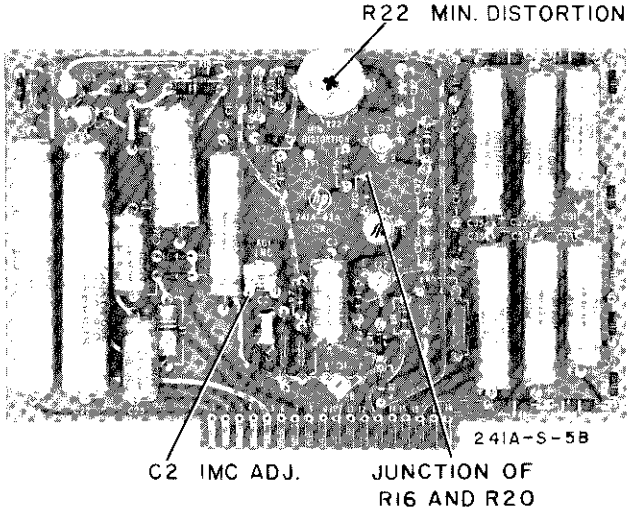


Figure 5-5. Amplifier Board Assembly

n. Measure DC Voltage between ground and junction of R16 and R20 (see Figure 5-5). Adjust the value of R7 to obtain a reading of -1.0 ±0.5 volts.

5-19. FREQUENCY CALIBRATION.

5-20. Frequency calibration of the x10 CPS, x100 CPS, x1 KC and x10 KC range consists of padding the capacitive element in the series and parallel arms of the wein bridge circuit. Typical values are given in Table 5-4.

Table 5-4. Frequency Calibration

Range	Nominal Series C	Series Pad	Nominal Parallel C	Parallel Pad
x10 CPS	3.1 μfd	C102	3.1 μfd	C121
x100 CPS	0.31 μfd	C104	0.31 μfd	C123
x1 KC	0.031 μfd	C105	0.031 μfd	C124
x10 KC	3100 pf	C106	3100 pf	C125

NOTE

The AC error voltage test point (TP1) on the rear circuit board is used to monitor bridge balance. A 1% increase in the series capacitance will decrease the frequency by 0.5% and increase the error voltage by 12 mv. A 1% increase in the parallel capacitance will decrease the frequency by 0.5% and decrease the error voltage by 12 millivolts.

5-21. x1 KC RANGE.

a. Connect Model 241A as shown in Figure 5-1.

b. Set Model 241A controls as follows:
MULTIPLIER. . . . . x1 KC
FREQUENCY Pushbuttons 5.00
VERNIER. . . . . CAL.
AMPLITUDE . . . . . MAX.

c. Connect common lead of an AC Voltmeter (hp Model 400H) to the junction of C33 and C32, positive lead to Test Point TP1. (See Figure 5-4.)

d. Adjust R22 for a minimum reading on AC Voltmeter.

e. Select the value of C105 and C124 (see Table 5-4) for an indication of 5000 cps ±50 cps on the Electronic Counter and an error voltage indication of 105 mv ±5 millivolts on AC Voltmeter.

NOTE

Frequency should be measured with the AC Voltmeter lead removed from Test Point TP1.

f. Check frequency and error voltage at buttons 1.00, 2.00, 7.00, and 9.00. Frequency should be within 1% of selected value and error voltage between 95 and 115 millivolts. If necessary, repeat Step e selecting the value of C105 and C124 for optimum performance.

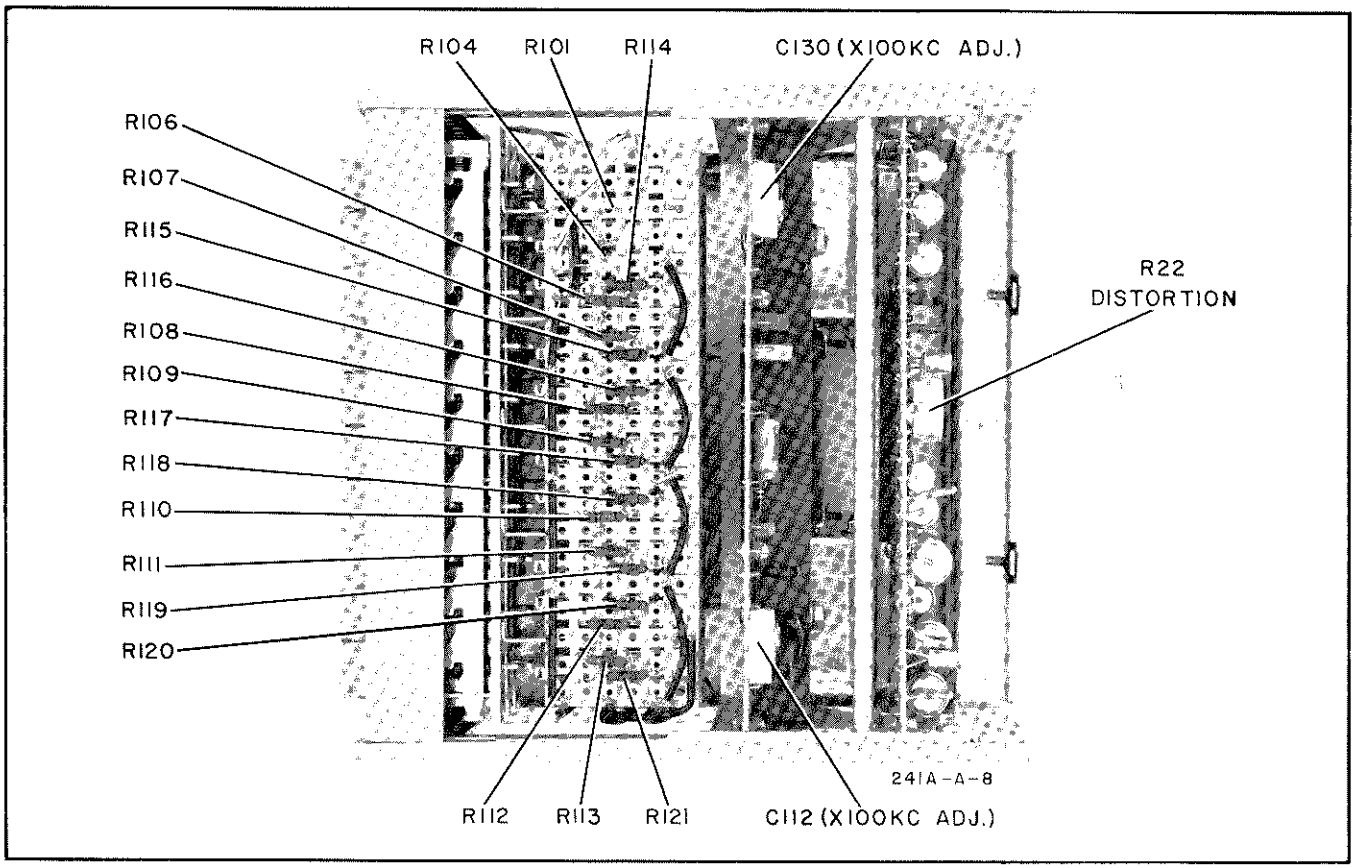


Figure 5-6. Top View

5-22. x100 CPS RANGE.

a. Set Electronic Counter FUNCTION switch to 10 PERIOD AVERAGE; set Model 241A FREQUENCY controls to 5.00 x 100 CPS.

b. Select value of C104 and C123 for an indication of 2 ms ±0.02 milliseconds on Electronic Counter and an error voltage indication of 105 mv ±5.0 millivolts on AC Voltmeter.

c. Check frequency and error voltage at 100, 200, 700, and 900 cps. Frequency should be within 1% of selected value and error voltage between 95 and 115 millivolts. If necessary, repeat Step b selecting the value of C104 and C123 for optimum adjustment.

5-23. x10 CPS RANGE.

a. Set Model 241A FREQUENCY controls to 5.00 x 10 CPS.

b. Select value of C102 and C121 (see Table 5-4) for an indication of 20 milliseconds ±2 ms on the Electronic Counter (10 PERIOD AVERAGE) and an error voltage indication on AC Voltmeter of 105 mv ±5.0 millivolts.

c. Check frequency and error voltage at 10, 20, 70, and 90 cps. Frequency should be within 1% of selected value and error voltage between 95 and 115 millivolts. If necessary, select value of C102 and C121 for optimum performance.

5-24. x100 KC RANGE.

a. Set the 241A frequency controls to 1.00 x 100 KC.

b. Set Electronic Counter FUNCTION switch to measure FREQUENCY.

c. Adjust trimmer capacitors C112 and C130 (see Figure 5-7) for a frequency indication of 100.2 kc with an error voltage indication of 115 millivolts.

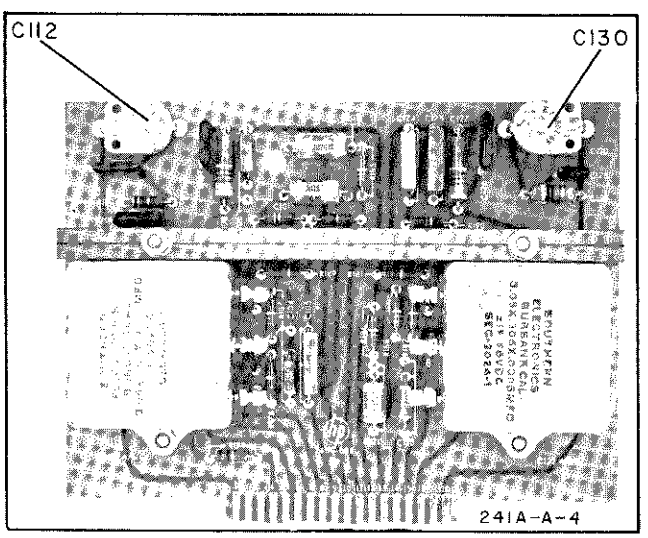


Figure 5-7. Range Capacitor Board Assembly

NOTE

Frequency should be set high as the frequency will decrease by 0.2% when the covers are installed.

d. Set 241A frequency controls to 9.00 x 100 KC.

e. Adjust C2 (see Figure 5-5) for an indication of 903 KC.

f. Check frequency and error voltage at 100, 200, 700, and 900 KC. Frequency should be within 1% of selected value and error voltage should be between 90 and 125 millivolts. If necessary, adjust C2, C112, and C130 for optimum performance.

5-25. x10 KC RANGE.

a. Set the 241A frequency controls to 5.00 x 10 KC.

b. Set Electronic Counter FUNCTION switch to measure FREQUENCY.

c. Select value of C106 and C125 for a frequency indication of 50 kc ±500 cps and an error voltage indication of 105 mv ±5 mv.

d. Check frequency and error voltage at 10, 20, 70, and 90 KC. Frequency should be within 1% of selected value and error voltage between 95 and 115 mv. If necessary, adjust C106 and C125 for optimum performance.

5-26. DISTORTION ADJUSTMENT.

a. Connect Model 241A as shown in Figure 5-2.

b. Set the Model 241A as follows:
MULTIPLIER. . . . . .x1 KC
FREQUENCY Pushbuttons 1.00
AMPLITUDE . . . . . .MAX.
VERNIER. . . . . .CAL.

c. Set the Distortion Analyzer controls as follows:
FREQUENCY RANGE x100
INPUT . . . . . .AF
FUNCTION . . . . . .SET LEVEL
METER RANGE 100%

d. Adjust INPUT SENSITIVITY for full-scale reading (1.0).

e. Set FUNCTION switch to DISTORTION.

f. Adjust FINE and COARSE frequency controls and BALANCE control for a null on Distortion Analyzer Meter at fundamental frequency (1 kc); switch METER RANGE as necessary to obtain upscale meter reading.

g. Adjust R22 (see Figure 5-4) for a minimum reading on the Distortion Analyzer.

5-27. FREQUENCY SELECTOR SWITCH ASSEMBLY REPLACEMENT.

5-28. Multiplier switch S104 and the three frequency selector switch assemblies (S101 through S103) are a single switch unit in the oscillator; however, each switch assembly is individually replaceable. To replace an assembly, it is necessary to remove the switch unit first.

a. Remove top, bottom, and side covers from oscillator.

b. Remove front side screws (two on each side) which hold plastic mounting plate of the switch unit to chassis.

c. Swing front panel and switch unit away from oscillator.

d. Note and sketch wire connections to defective frequency selector switch assembly, and then unsolder those connections.

e. Slide switch unit away from front panel, and remove all frequency pushbuttons from it.

NOTE

When prying pushbuttons off, use equal pressure on both sides of button.

f. Remove three screws which are holding defective switch unit to plastic mounting plate. These screws are on front panel side of mounting plate.

g. Slip defective switch out of the unit and install replacement switch.

CAUTION

AVOID TOUCHING THE SWITCH WAFERS AS OIL FROM YOUR HAND WILL DEGRADE INSTRUMENT PERFORMANCE.

h. Attach replacement assembly to plastic mounting plate with three screws removed in Step f.

j. Replace pushbuttons removed in Step e. Be sure pushbuttons are installed in correct numerical sequence.

k. Slide switch unit into front panel and, using sketch made in Step d, resolder wire connections.

m. Swing front panel and combined unit back into place in oscillator and replace front side screws removed in Step b.

n. Perform the calibration procedure outlined in Paragraphs 5-15 through 5-26.

5-29. SERVICING ETCHED CIRCUIT BOARDS.

5-30. Model 241A has two plug-in type etched circuit boards. Plug-in type printed circuit boards are easily removed by pulling board firmly away from plug. Use care to avoid damaging components on the board.

5-31. The etched circuit boards in the Model 241A are plated through the eyelet holes. When servicing this type of board, components may be removed or replaced from either side of the board. For large components such as potentiometers, rotate heating of all leads while lifting the part from the board. You may also use a soldering tip such as Ungar #855 3/4 inch Cup Tip. In addition to the above, observe the following:

a. Do not apply excessive heat.

b. Apply heat to component lead, and remove lead with a straight outward pull.

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

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

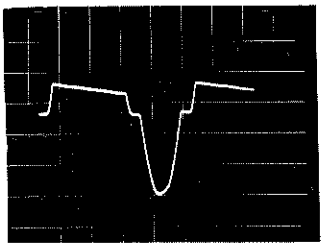
5-32. TROUBLESHOOTING.

5-33. To locate trouble in the Model 241A Oscillator, start with a thorough visual inspection; look for burned-out or loose components, loose connections, or any other similar condition which suggests a source of trouble. If visual inspection does not reveal the trouble, use the block diagram, Figure 4-1, and Troubleshooting Summary, Table 5-6, as guides in isolating the trouble. Figure 5-8 (used with Table 5-5) illustrates typical wave shapes that may be used as an aid in troubleshooting. Figures 5-3, 5-4, 5-5, 5-6, 5-7, and 5-9 can be used for identifying components in the Model 241A.

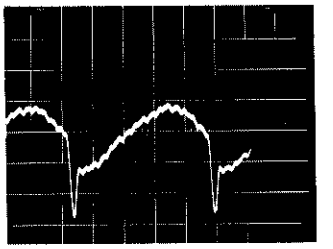
Table 5-5. Using Oscilloscope to Troubleshoot Oscillator

Set the hp Model 241A Oscillator to the frequency indicated below and connect the hp Model 175A Oscilloscope to test points a, b, or c (refer to Figure 5-10). The table below recommends what oscilloscope settings should be used, and Figure 5-8 illustrates the typical waveforms.

Frequency Setting of hp Model 241A Oscillator	Test Point A	Test Point B	Test Point C (TP1)
10 CPS	Photograph #1 Vertical 1 v/cm Horizontal 20 ms/cm	Photograph #2 Vertical 10 mv/cm Horizontal 20 ms/cm	Photograph #3 Vertical 0.1 v/cm Horizontal 20 ms/cm
100 CPS	Photograph #4 Vertical 1 v/cm Horizontal 2 ms/cm	Photograph #5 Vertical 10 mv/cm Horizontal 2 ms/cm	Photograph #6 Vertical 0.1 v/cm Horizontal 2 ms/cm
1 KC	Photograph #7 Vertical 1 v/cm Horizontal 0.2 ms/cm	Photograph #8 Vertical 10 mv/cm Horizontal 0.2 ms/cm	Photograph #9 Vertical 0.1 v/cm Horizontal 0.2 ms/cm
10 KC	Photograph #10 Vertical 1 v/cm Horizontal 20 ms/cm	Photograph #11 Vertical 10 mv/cm Horizontal 20 ms/cm	Photograph #12 Vertical 0.1 v/cm Horizontal 20 ms/cm
100 KC	Photograph #13 Vertical 1 v/cm Horizontal 2 ms/cm	Photograph #14 Vertical 10 mv/cm Horizontal 2 ms/cm	Photograph #15 Vertical 0.1 v/cm Horizontal 2 ms/cm



Photograph#1



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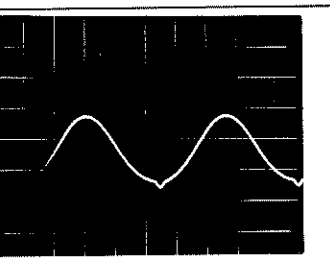

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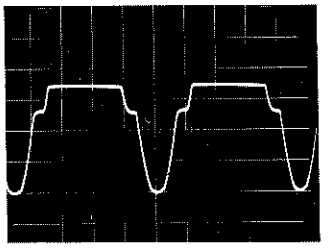

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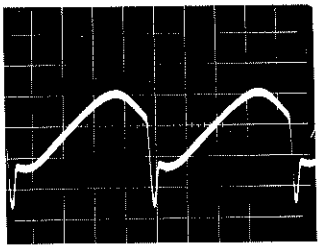

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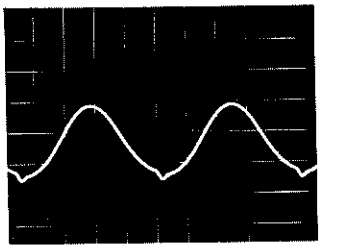

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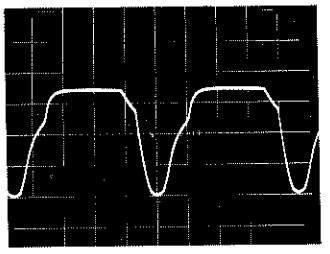

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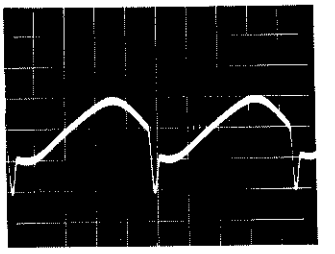

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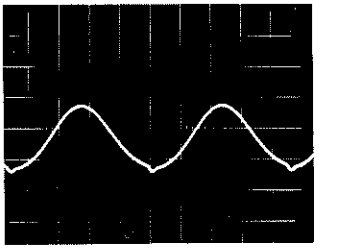

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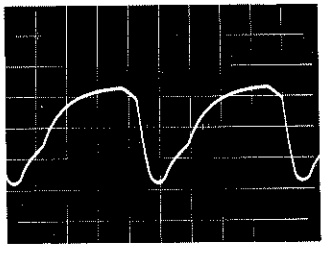

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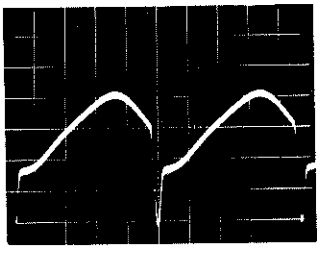
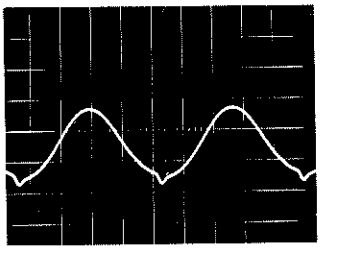
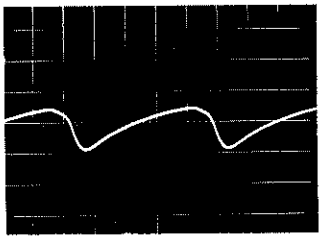


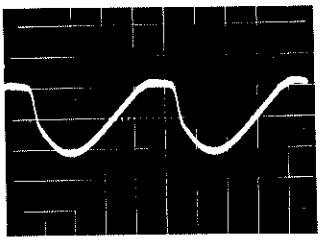
Photograph#11



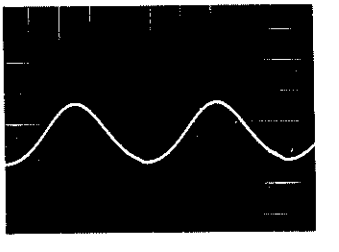
Photograph#12



Photograph#13



Photograph#14



Photograph#15

Figure 5-8 Typical Waveforms (see Table 5-5)

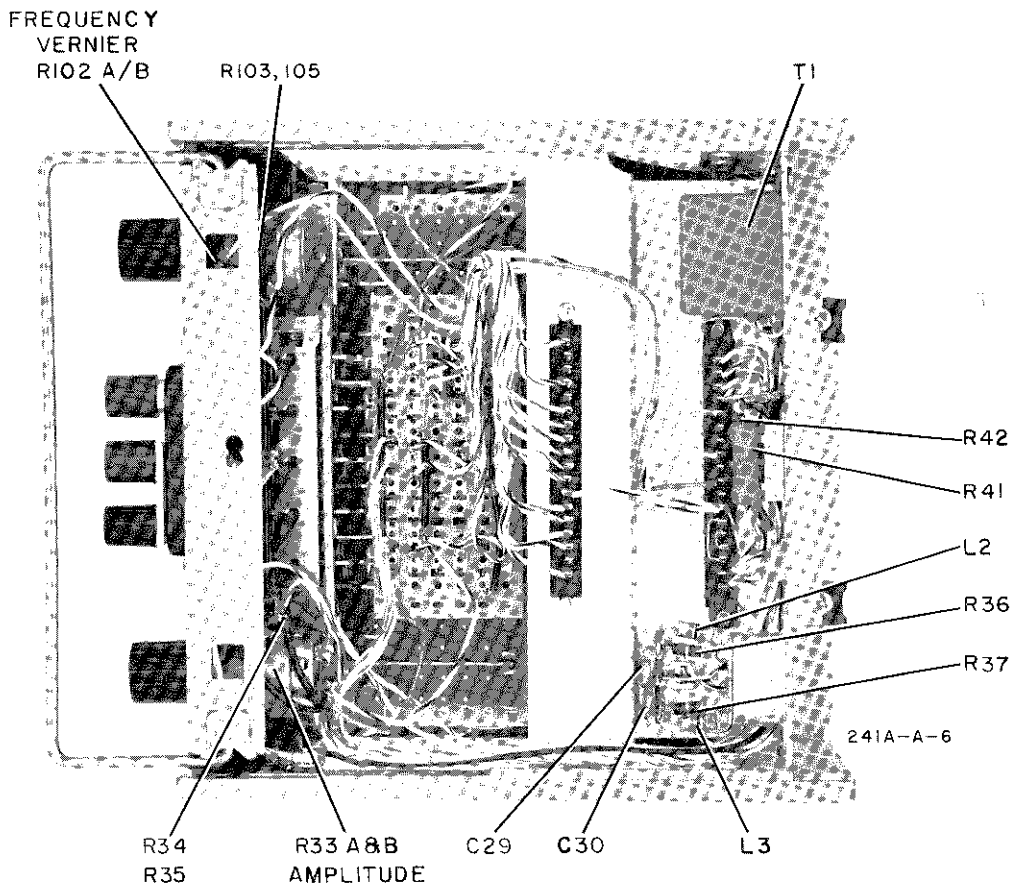


Figure 5-9. Bottom View

Table 5-6. Troubleshooting Summary

Indication	Action
No AC signal at junction of R16 and R20 for all range and frequency settings	Check power-supply voltages (+13 and -14 volts) Check peak detector circuit (Q5, CR4, CR5, CR6 and CR7) Check Q3, Q4, CR2 and CR3 for correct DC voltages (refer to Figure 5-10)
No output signal in one range	Check contacts of S104 Check components connected to Wien bridge in inoperative range (see Figure 5-11)
No output signal or distorted output signal at one setting of FREQUENCY pushbuttons	Check resistors connected to frequency switches at incorrect setting for proper value ± percent of tolerance (refer to Table 6-1 for tolerances)
Incorrect frequency at one setting of FREQUENCY pushbuttons	Check all FREQUENCY switch contacts and resistors connected to Wien bridge at inoperative setting (see Figure 5-12)

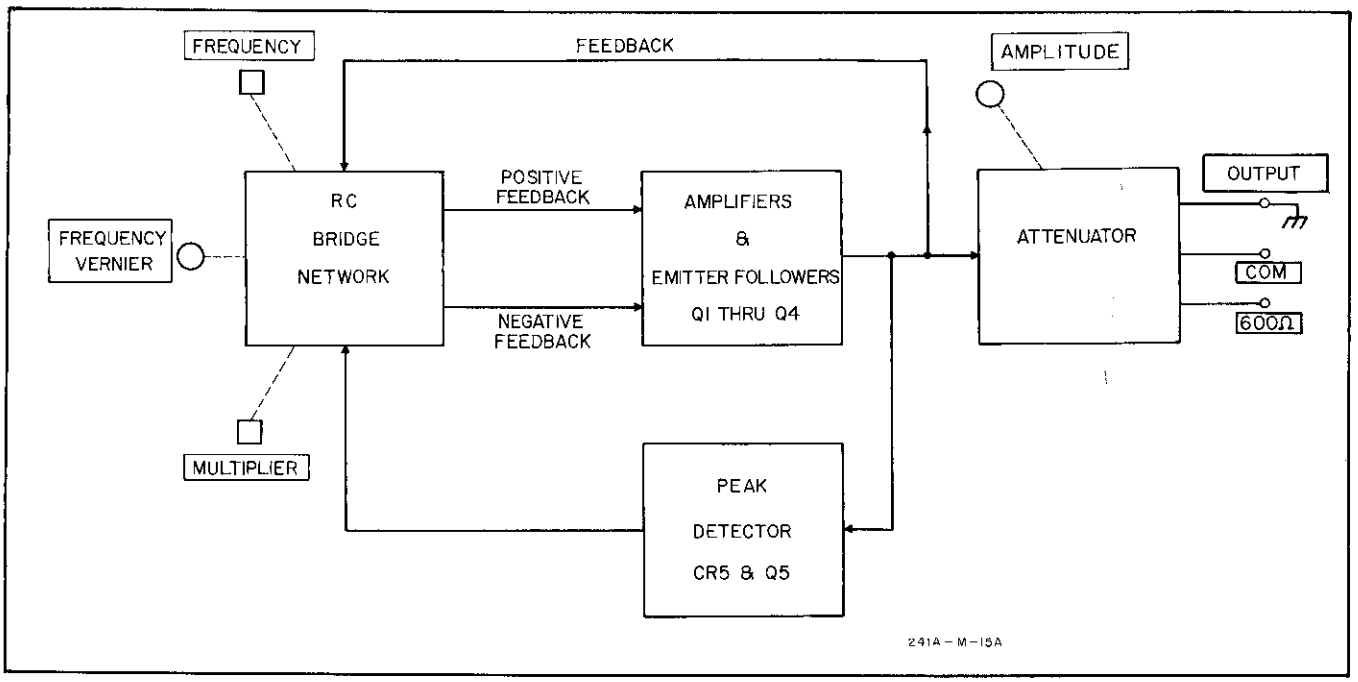


Figure 4-1. Block Diagram

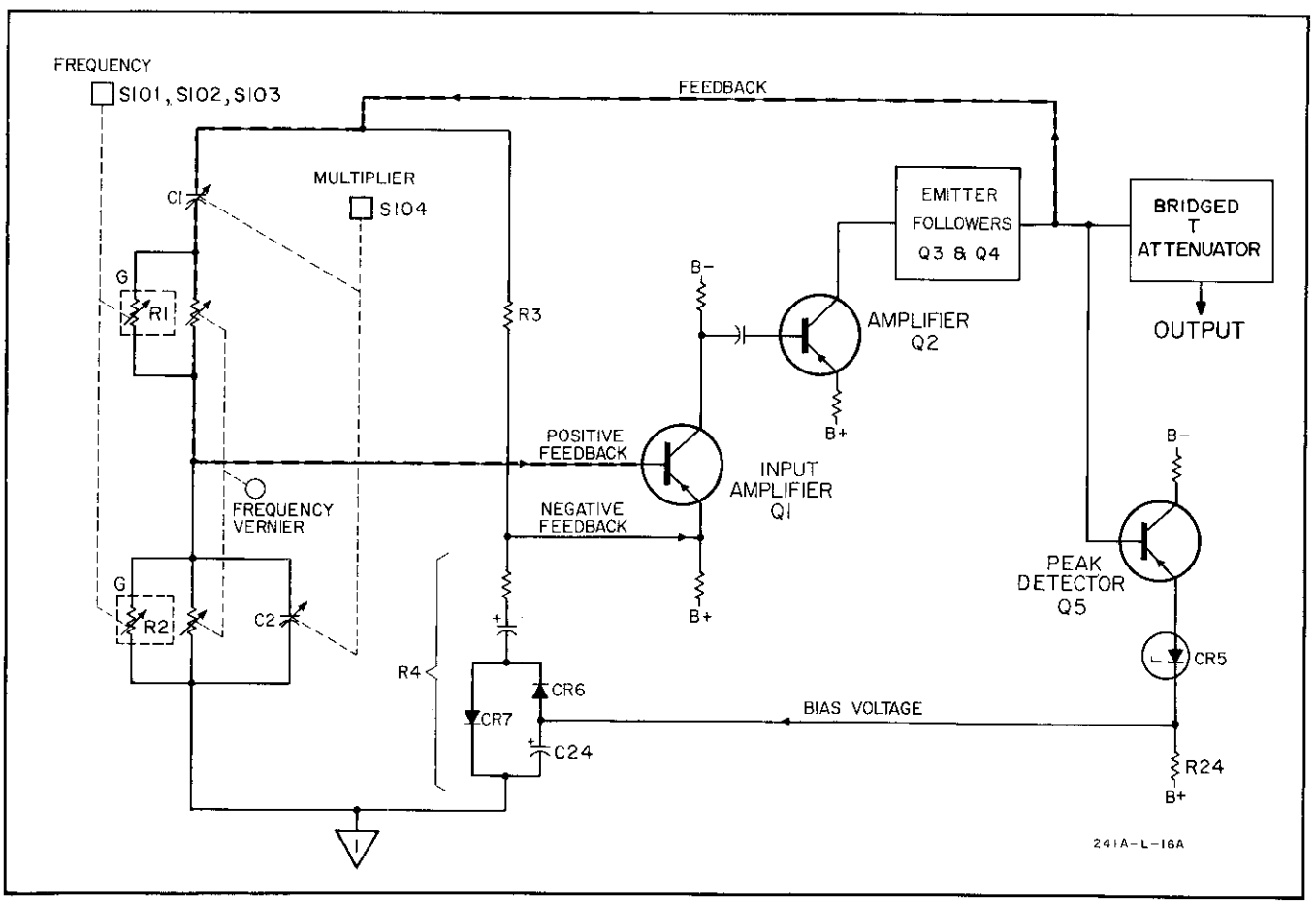
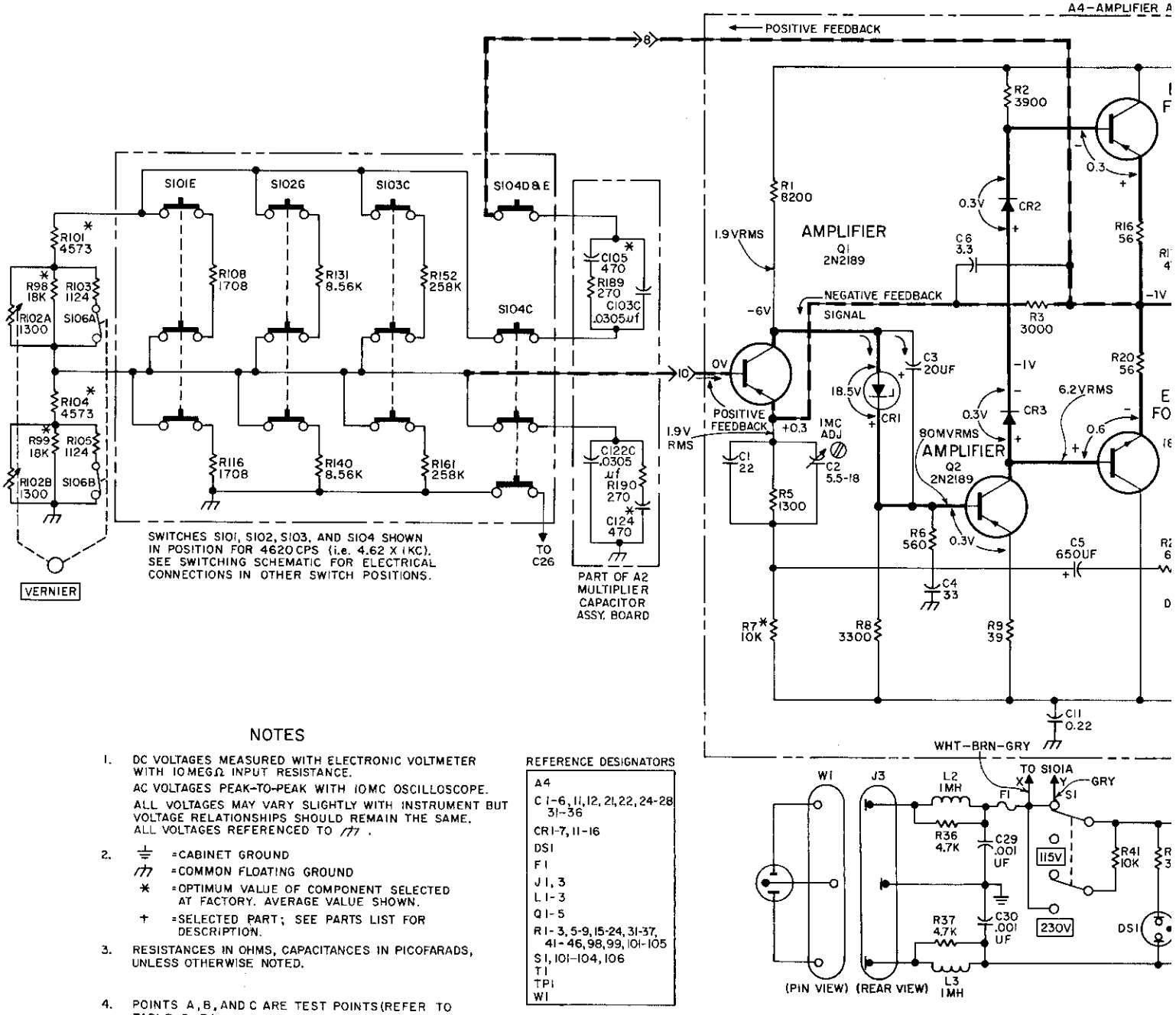


Figure 4-2. Simplified Partial Schematic Diagram



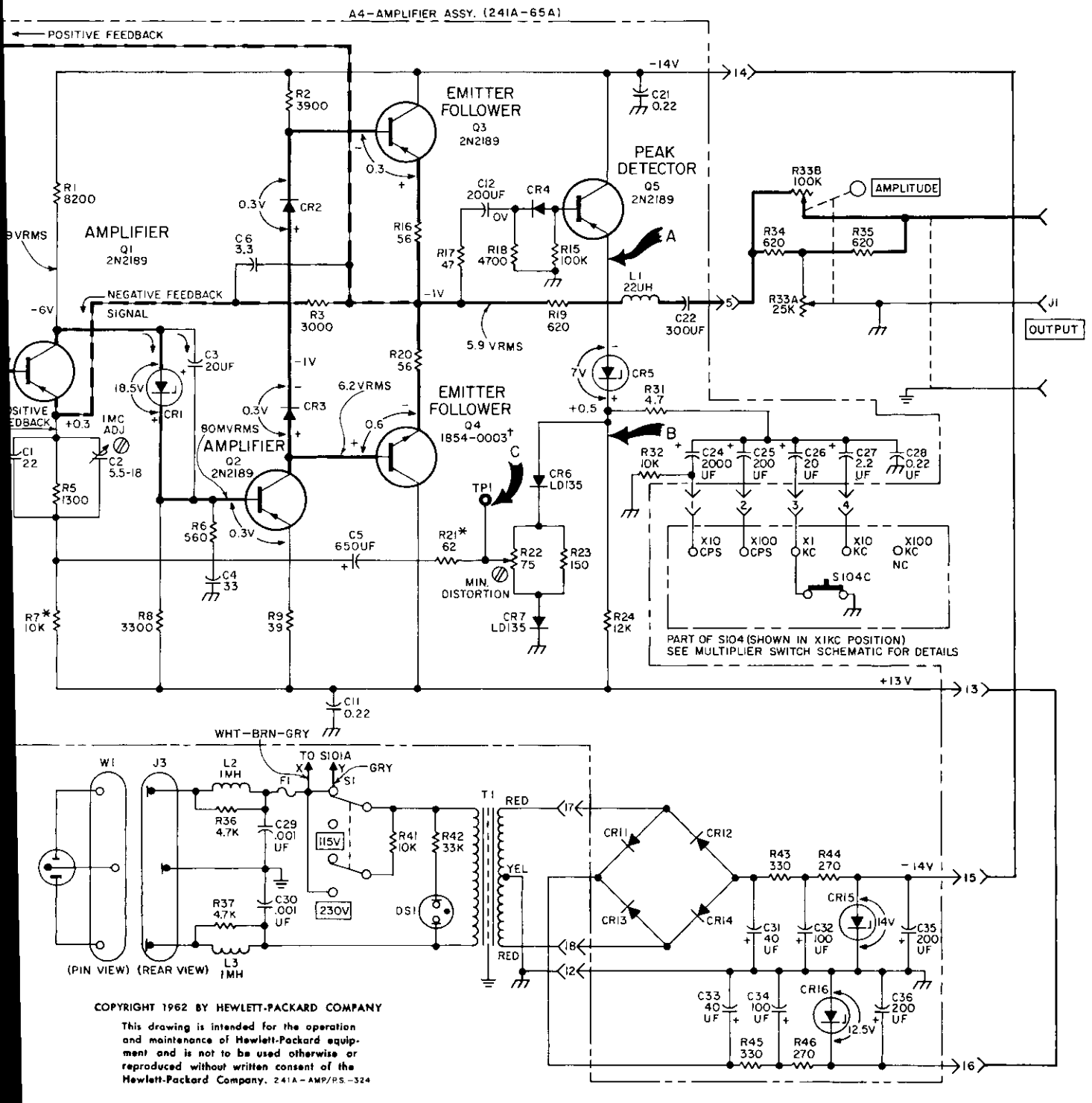
NOTES

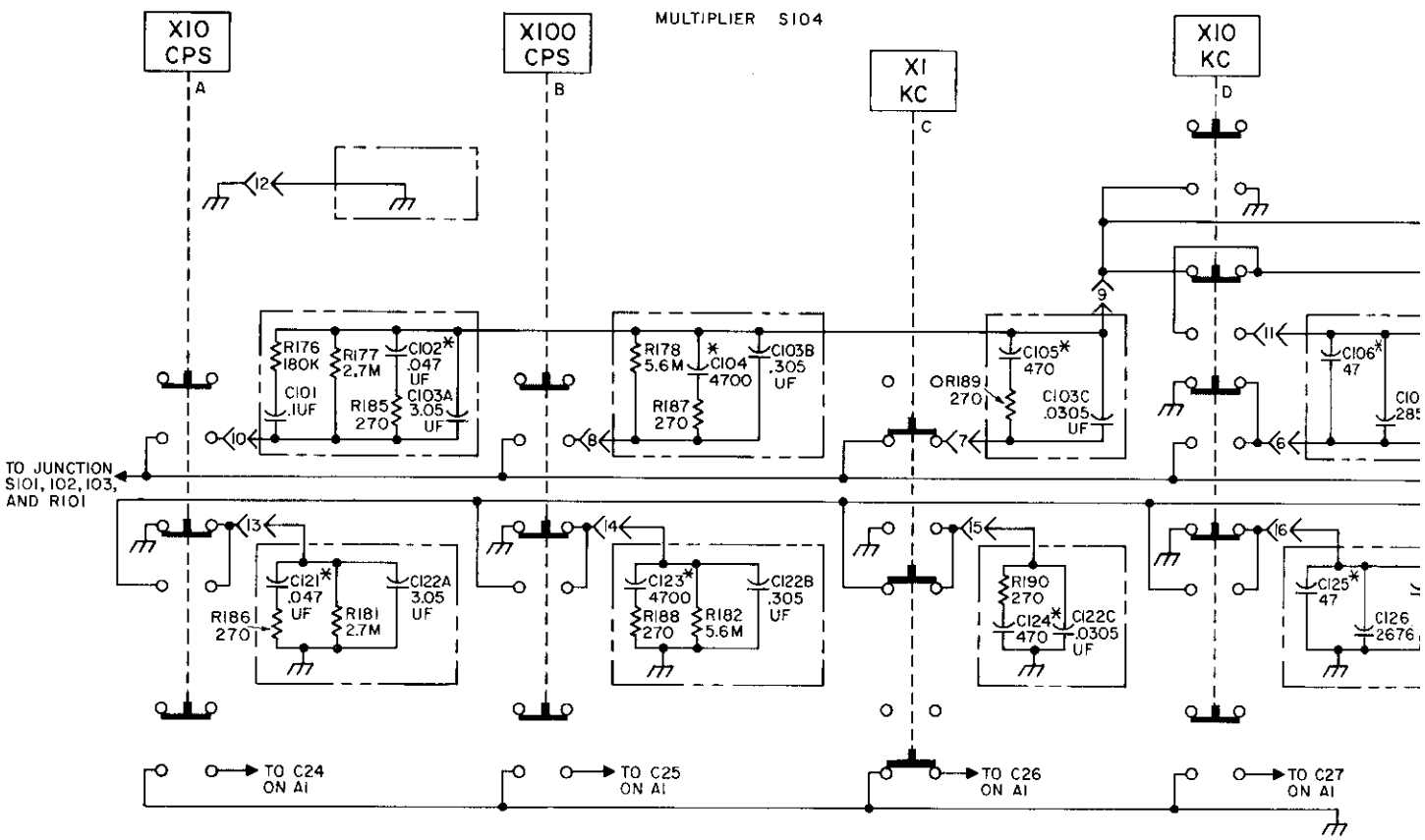
1. DC VOLTAGES MEASURED WITH ELECTRONIC VOLTMETER WITH 10 MEGΩ INPUT RESISTANCE.
   AC VOLTAGES PEAK-TO-PEAK WITH 10MC OSCILLOSCOPE.
   ALL VOLTAGES MAY VARY SLIGHTLY WITH INSTRUMENT BUT VOLTAGE RELATIONSHIPS SHOULD REMAIN THE SAME.
   ALL VOLTAGES REFERENCED TO ⫽ .
2. ⏚ =CABINET GROUND
   ⫽ =COMMON FLOATING GROUND
   * =OPTIMUM VALUE OF COMPONENT SELECTED AT FACTORY. AVERAGE VALUE SHOWN.
   + =SELECTED PART; SEE PARTS LIST FOR DESCRIPTION.
3. RESISTANCES IN OHMS, CAPACITANCES IN PICOFARADS, UNLESS OTHERWISE NOTED.
4. POINTS A, B, AND C ARE TEST POINTS (REFER TO TABLE 5-7).

REFERENCE DESIGNATORS

A4
C 1-6, 11, 12, 21, 22, 24-28, 31-36
CR1-7, 11-16
DS1
F1
J 1, 3
L 1-3
Q 1-5
R 1-3, 5-9, 15-24, 31-37, 41-46, 98, 99, 101-105
S1, 101-104, 106
T1
TP1
W1

241A-E-103B





NOTES

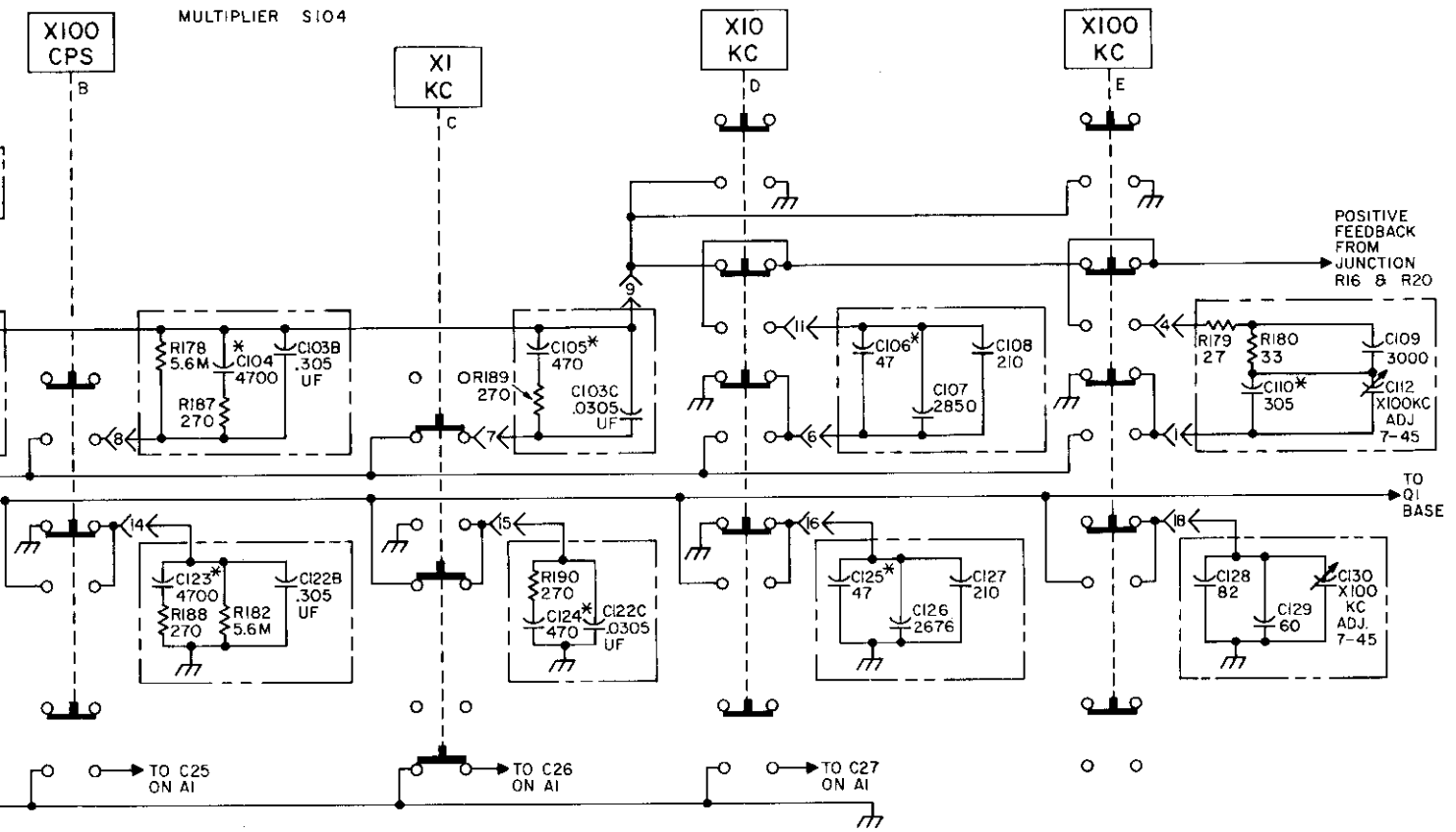
REFERENCE DESIGNATORS

A5
C101-110, 112, 121-130
R176-182, 185-190
S104

1. SWITCH SHOWN FOR X1KC.
2. ONLY ONE PUSH BUTTON MAY BE DEPRESSED AT A TIME. A BUTTON DEPRESSED PREVIOUSLY IS RELEASED AUTOMATICALLY BY A NEW SELECTION.
3. RESISTANCE IN OHMS, CAPACITANCE IN PICO FARADS, UNLESS OTHERWISE NOTED.
4. ⏚ = COMMON FLOATING, CIRCUIT GROUND.
   * = FACTORY-SELECTED PART, AVERAGE VALUE SHOWN.
5. COMPONENTS ENCIRCLED BY DASHED (— — —) LINES ARE LOCATED ON A5 (241-65B)

241A-E-303A

Figure 5-11. Multiplier Switch



NOTES

1. SWITCH SHOWN FOR X1KC.
2. ONLY ONE PUSH BUTTON MAY BE DEPRESSED AT A TIME. A BUTTON DEPRESSED PREVIOUSLY IS RELEASED AUTOMATICALLY BY A NEW SELECTION.
3. RESISTANCE IN OHMS, CAPACITANCE IN PICO FARADS, UNLESS OTHERWISE NOTED.
4. ⏚ = COMMON FLOATING, CIRCUIT GROUND.
   * = FACTORY-SELECTED PART, AVERAGE VALUE SHOWN.
5. COMPONENTS ENCIRCLED BY DASHED (– – –) LINES ARE LOCATED ON A5 (241-65B)

Figure 5-11. Multiplier Switch

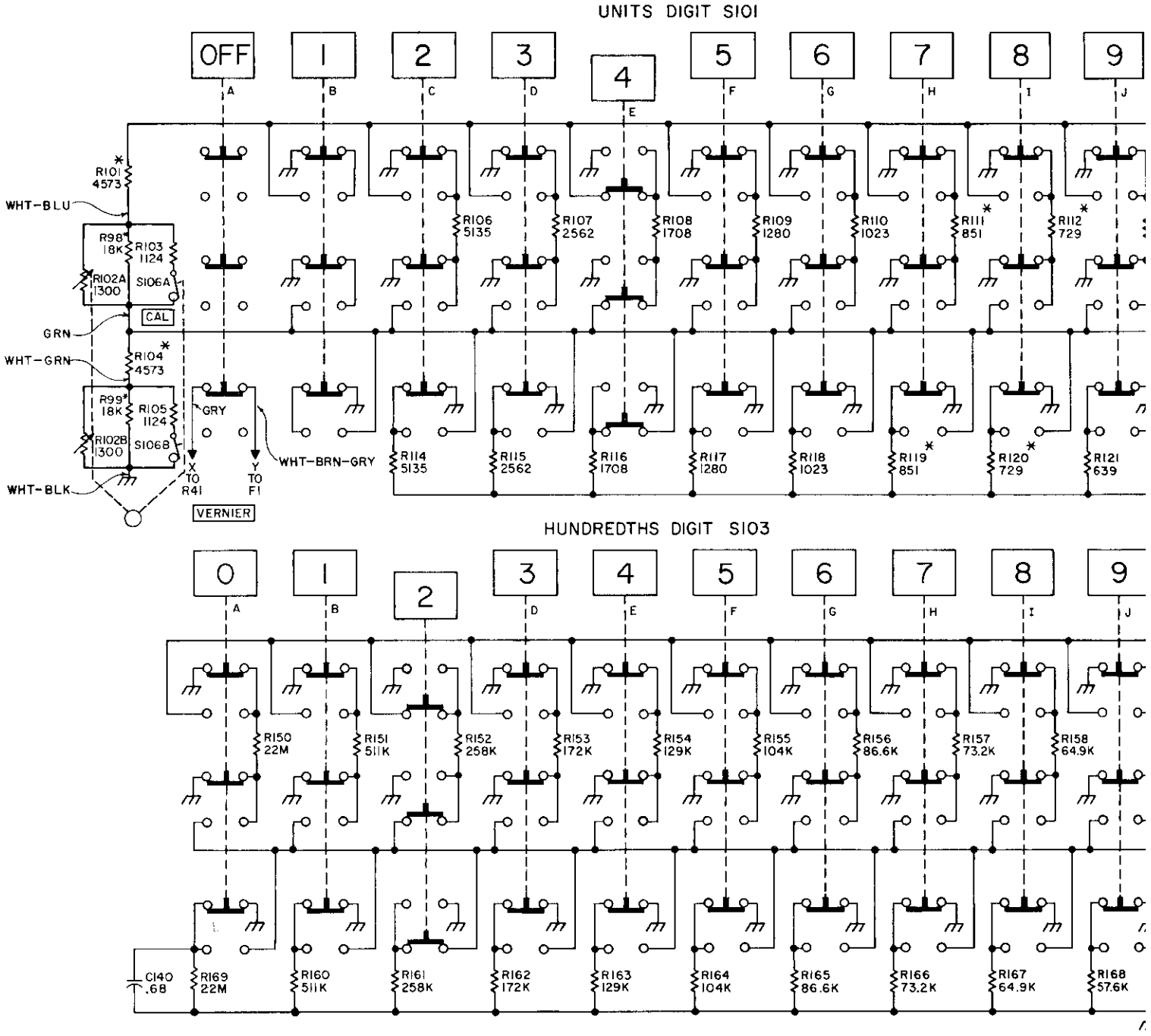
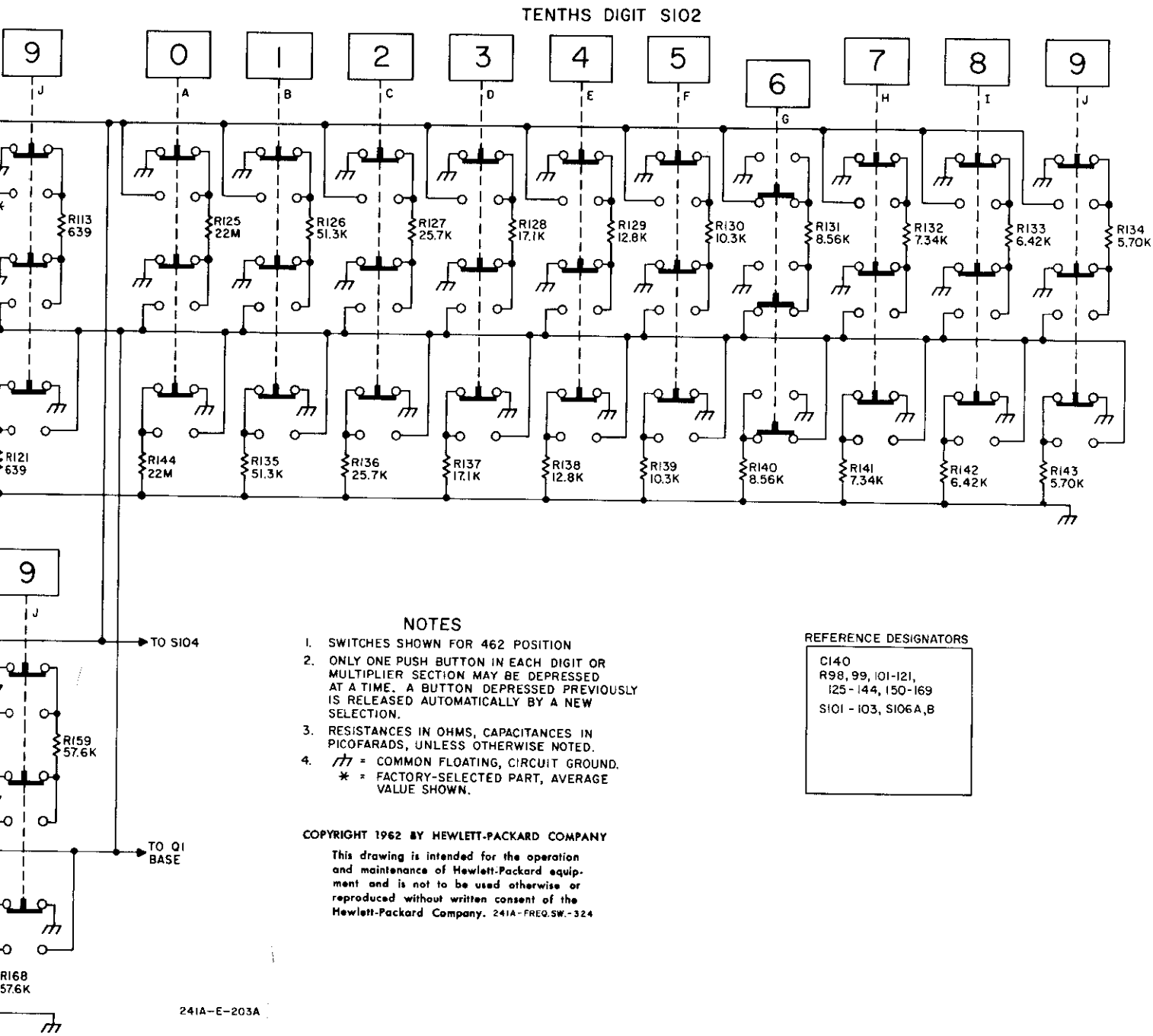


Figure 5-12. Frequenc



NOTES

1. SWITCHES SHOWN FOR 462 POSITION
2. ONLY ONE PUSH BUTTON IN EACH DIGIT OR MULTIPLIER SECTION MAY BE DEPRESSED AT A TIME. A BUTTON DEPRESSED PREVIOUSLY IS RELEASED AUTOMATICALLY BY A NEW SELECTION.
3. RESISTANCES IN OHMS, CAPACITANCES IN PICOFARADS, UNLESS OTHERWISE NOTED.
4. ⏚ = COMMON FLOATING, CIRCUIT GROUND.
   * = FACTORY-SELECTED PART, AVERAGE VALUE SHOWN.

REFERENCE DESIGNATORS

C140
R98, 99, 101-121, 125-144, 150-169
S101 - 103, S106A,B

quency Selector Switch