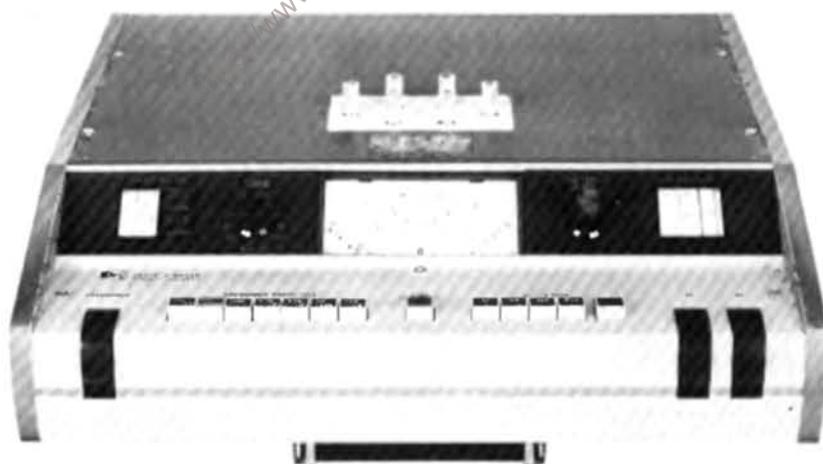


## OPERATING AND SERVICE MANUAL

# Q METER

## 4342A



HEWLETT  PACKARD

## CERTIFICATION

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

## WARRANTY AND ASSISTANCE

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

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

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

## MODEL 4342A Q METER

### SERIAL NUMBERS COVERED

This manual applies directly to Model 4342A Q Meter with serial prefixed 1212J. Backdating changes in Section VII cover instruments with serials 1212J-00590 and below. Instruments with higher serial prefix will be covered in an Updating Manual Supplement at the first of the manual.

### OPTIONS COVERED

This manual covers Option 001 instruments as well as the standard instrument.

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## SECTION I

### GENERAL INFORMATION

#### 1-1. DESCRIPTION

1-2. The HP Model 4342A Q Meter (Figure 1-1) is designed to meet the requirements of the laboratory, manufacturing and incoming inspection. The direct reading expanded scale of the 4342A permits measurement of Q from 5 to 1000 and readings of very small changes in Q ( $\Delta Q$ ) resulting from variation of test parameters. The 4342A is an all solid state instrument of good stability and reliability of operation. Specially matched, fragile thermocouple component has been eliminated.

1-3. The Q Meter consists of a stable, continuously variable oscillator, whose controlled output level is fed into a resonance circuit by a transformer (sometimes called injection transformer). A stable solid state voltmeter with a high input impedance is connected across the internal variable capacitor, (portion of the tuned circuit) to measure the reactive voltage in terms of circuit Q. The coil portion of the tuned circuit is connected externally and represents the unknown to be measured. By inserting low impedance in series with the coil and high impedance in parallel with the capacitor, the parameters of the unknown circuits or components can be measured in terms of their effect on circuit Q and resonant frequency.

1-4. The internal oscillator source is a seven band variable frequency oscillator covering a frequency range from 22kHz to 70MHz (10kHz to 32MHz in Option 001). This source is automatically leveled by an ALC loop to provide the injection voltages required by the Q range used. This eliminates the need for a Q-Multiplier control (OSC Level). This feature shortens measurement time and adds greatly to the ease of Q measurement in high-volume testing.

1-5. The 4342A utilizes a Constant Voltage Injection System eliminating the fragile thermocouple system used in traditional Q measurement circuits. The low source impedance of the injection transformer contributes to increased Q accuracy.

1-6. High stability of the Q Voltmeter virtually eliminates Q-zero adjustment for routine measurements. Troublesome zero settings prior to each measurement are eliminated, ensuring simple and rapid operation. Accurate information on changes in Q is obtainable on all Q-ranges through the greater resolution ( $\times 10$ ) of delta-Q measurement.

1-7. The unique Q-Limit selector will be especially useful on the production line for Go/No-Go checking.

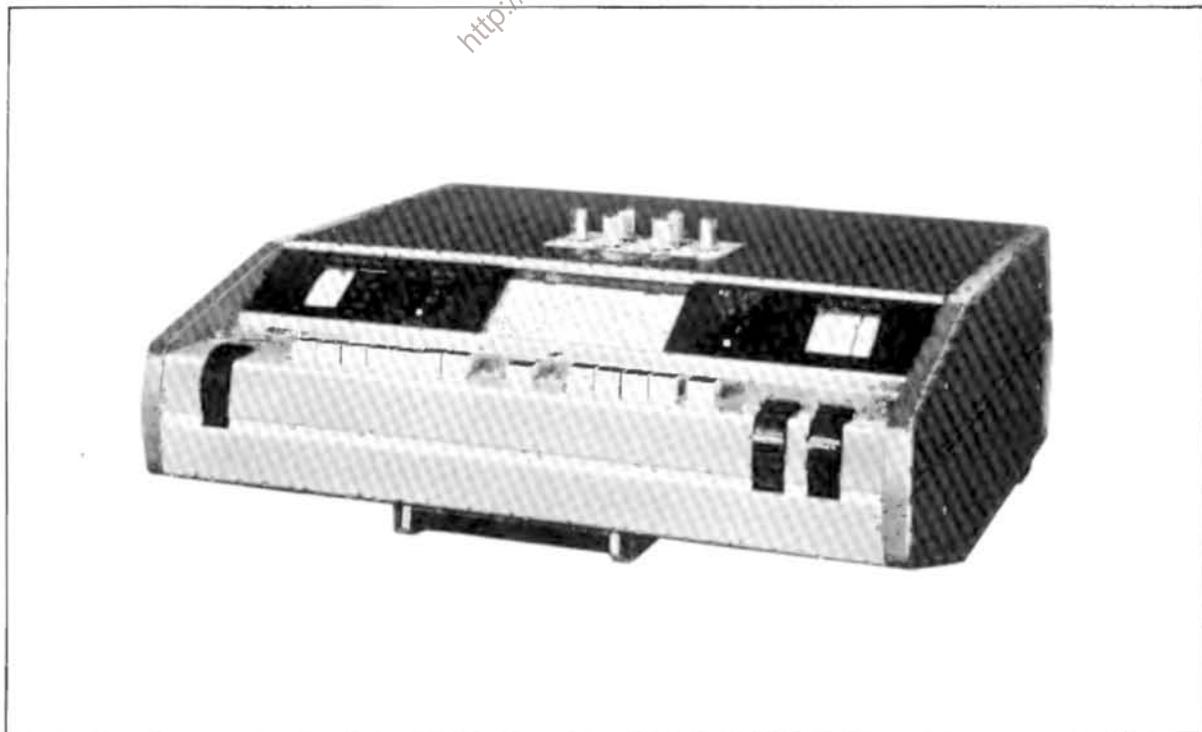


Figure 1-1. Model 4342A Q Meter

Simplified operation due to the high response speed of the Go/No-Go indicator compared to the meter movement is an added benefit. External indicating devices may be remotely controlled by the Go/No-Go Over Limit signal.

1-8. Complete specifications of the Model 4342A are given in Table 1-1.

#### 1-9. ACCESSORIES AVAILABLE

1-10. Three kinds of accessories are available for use with the 4342A Q Meter: Models 16471A to 16490A and 16465A Reference Inductors for measuring the RF characteristics of capacitors, resistors and insulating materials; Model 16462A Auxiliary Capacitor for extending the measurement capability of the Q Meter; Model 16014A Series Loss Test Adaptor for measuring low impedance components. Measurement is made by connecting components in series with the test circuit. See Table 1-2 for detailed information.

#### 1-11. INSTRUMENT IDENTIFICATION

1-12. Hewlett-Packard uses a two-section ten-character (0000J00000) serial number. The first four digits (serial prefix) identify a series of instruments;

the last five digits identify a particular instrument in that series. A letter placed between the two sections identifies the country where the instrument was manufactured (J-Japan, A-U.S.A., G-West Germany, U-United Kingdom). The serial number appears on a plate located on the rear panel. All correspondence with Hewlett-Packard Sales/Service Offices with regard to an instrument should refer to the complete serial number.

#### 1-13. MANUAL CHANGES

1-14. This manual provides operating and service information for the HP Model 4342A an all solid state instrument for measurement of Q from 5 to 1000. Information in this manual applies directly to instruments (as manufactured) with serial numbers prefixed by the four digits indicated on the title page. If the serial prefix of the instrument is above that on the title page, a "Manual Change" sheet supplied will describe changes which will adapt this manual to provide correct coverage. Technical correction (if any) due to known errors in print are called Errata and are shown on the change sheet. And if the serial prefix or number of the instrument is below that on the title page, see SECTION VII MANUAL CHANGES AND OPTIONS. For information on manual coverage of any HP instrument, contact the nearest HP Sales/Service Office (addresses are listed at the rear of this manual).

Table 1-1. Specifications

RF CHARACTERISTICS		
RF Range: 22kHz to 70MHz in 7 bands; 22 to 70kHz, 70 to 220kHz, 220 to 700kHz, 700 to 2200kHz, 2.2 to 7MHz, 7 to 22MHz, 22 to 70MHz.		
RF Accuracy: $\pm 1.5\%$ at 22kHz to 22MHz. $\pm 2\%$ at 22MHz to 70MHz. $\pm 1\%$ at "L" point on Frequency Dial.		
RF Increments: Approximately 1% resolution.		
Q MEASUREMENT CHARACTERISTICS		
Q Range: 5 to 1000 in 4 ranges: 5 to 30, 20 to 100, 50 to 300, 200 to 1000.		
Q Accuracy: % of indicated value. (at 25°C)		
Q	Freq.	
		22kHz - 30MHz      30MHz - 70MHz
5 - 300		$\pm 7$ $\pm 10$
300 - 600		$\pm 10$ $\pm 15$
600 - 1000		$\pm 15$ $\pm 20$
Q Increments: upper scale: 1 from 20 to 100, lower scale: 0.5 from 5 to 30.		
$\Delta Q$ Range: 0 to 100 in 4 ranges: 0 to 3, 0 to 10, 0 to 30, 0 to 100.		
$\Delta Q$ Accuracy: $\pm 10\%$ of full scale.		
$\Delta Q$ Increments: upper scale: 0.1 from 0 to 10, lower scale: 0.05 from 0 to 3.		
INDUCTANCE MEASUREMENT CHARACTERISTICS		
L Range: 0.09 $\mu$ H to 1.2H, direct reading at 7 specific frequencies.		
L Accuracy: $\pm 3\%$ after substitution of residuals (approx. 10nH).		
RESONATING CAPACITOR CHARACTERISTICS		
Capacitor Range: main dial: 25 to 470pF; vernier dial: -5 to +5pF.		
Capacitor Accuracy: main dial: $\pm 1\%$ of 1pF, whichever is greater; vernier dial: $\pm 0.1$ pF.		
Capacitor Increments: main dial: 1pF from 25 to 30pF, 2pF from 30 to 200pF, 5pF from 200 to 470pF; vernier dial: 0.1pF.		

Table 1-1. Specifications (Cont'd)

## REAR PANEL OUTPUTS

Frequency Monitor: 170mVrms min. into 50Ω.

Q Analog Output: 0 to 1V ±50mV dc after 15 minutes warm-up, proportional to meter deflection. Output impedance approx. 1kΩ.

Over Limit Signal Output: a contact closure at the rear panel is provided. Relay contact capacity 0.5A/15VA.

Over Limit Display Time: selectable, 1 sec. or continuously on after limit exceeded.

## GENERAL

Temperature Range: 0°C to 50°C

Power: 115 or 230V ±10%, 50 - 400Hz, approx. 25 Watts.

Weight: approx. 31 lbs. (14 kg)

## Accessories Furnished:

- Extender 15 pin (5060-4940)
- Extender 6 pin (5060-0651)
- Detachable Power Cord

## Accessories Available:

- 16471A through 16490A, 16465A Inductors
- 16462A Auxiliary Capacitor
- 16014A Series Loss Test Adaptor

OPTION 001: This option covers a frequency range from 10kHz to 32MHz. Specifications are identical to standard model except as noted below.

RF Range: 10kHz to 32MHz in 7 bands: 10 to 32kHz, 32 to 100kHz, 100 to 320kHz, 320 to 1000kHz, 1 to 3.2MHz, 3.2 to 10MHz, 10 to 32MHz.

RF Accuracy: ±1.5% at 10kHz to 10MHz  
±2% at 10MHz to 32MHz  
±1% at "L" point on Frequency Dial.

Q Accuracy: % of indicated value. (at 25°C)

Q		
5 - 300	300 - 600	600 - 1000
±7	±10	±15

## DIMENSIONS:

NOTE:  
DIMENSION IN INCHES AND (MILLIMETERS).

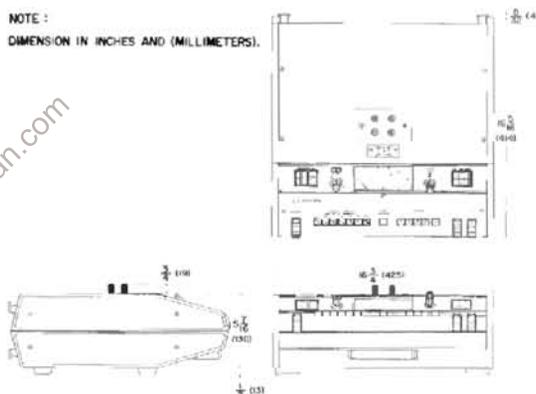


Table 1-2. Accessories - Typical Values.

16471A - 16490A, 16465A Inductors						
Model	Inductance	Approx. resonant frequency for tuning capacitance of			Hi - Lo Q Limits at ( ) Frequency	Capaci- tance pF
		400pF	100pF	50pF		
16471A	130 mH	22	40	62 kHz	250~280( 30 kHz)*	8
16472A	52 mH	35	70	100 kHz	250~280( 50 kHz)*	8
16473A	25 mH	50	100	140 kHz	250~280( 70 kHz)*	8
16474A	10 mH	80	160	220 kHz	250~280(100 kHz)*	8
16475A	5.2 mH	110	220	300 kHz	250~280(150 kHz)*	8
16476A	2.8 mH	150	300	420 kHz	250~280(200 kHz)*	8
16477A	1 mH	250	500	700 kHz	250~280(300 kHz)*	8
16478A	520 $\mu$ H	350	700	1000 kHz	250~280(500 kHz)*	8
16479A	250 $\mu$ H	500	1000	1400 kHz	250~280( 1MHz)	7
16480A	100 $\mu$ H	800	1600	2200 kHz	250~280( 1MHz)	7
16481A	56 $\mu$ H	** 1	2.2	3.1MHz	250~280( 1MHz)	7
16482A	28 $\mu$ H	1.5	3	4.2MHz	250~280(1.5MHz)	7
16483A	10 $\mu$ H	2.5	5	7 MHz	250~280(2.5MHz)	6
16484A	5.2 $\mu$ H	3.5	7	10 MHz	250~280( 10MHz)	6
16485A	2.5 $\mu$ H	5	10	14 MHz	250~280( 15MHz)	6
16486A	1 $\mu$ H	8	16	22 MHz	250~280( 20MHz)	6
		100pF		35pF		
16487A	0.52 $\mu$ H	22MHz		35MHz	250 280( 35MHz)	6
16488A	0.28 $\mu$ H	30MHz		50MHz	250 280( 50MHz)	4
16489A	0.1 $\mu$ H	50MHz		70MHz	250 280( 70MHz)	3
16490A	0.07 $\mu$ H	60MHz		100MHz	250 280( 70MHz)	2
		400pF	100pF	50pF		
***16465A	630 mH	10	20	28 kHz	250 280( 12 kHz)	9

- \* Q limits can be adjusted to within this range (with internal potentiometer).  
 \*\* Approx. resonant frequency for tuning capacitance of 450pF.  
 \*\*\* For 4342A Option 001 use only.

16462A Auxiliary Capacitor

Capacitance Range: 300pF to 2700pF in steps of 300pF. 10 ranges including OFF position.

Capacitance Accuracy:  $\pm 1\%$  on all ranges.

Q: 10,000 at 20kHz on all ranges.

Residual Inductance: approx. 0.1  $\mu$ H.

Residual Capacitance at OFF Position: approx. 23pF.

16014A Series Loss Test Adaptor

Usable Frequency Range: 10kHz to 10MHz.

Measurable Capacitance Range: 450pF to 0.225  $\mu$ F

Measurable Resistance Range: 10m $\Omega$  to 80 $\Omega$  at 10MHz, 4 $\Omega$  to 8k $\Omega$  at 10kHz.

Equivalent Parallel Capacitance Between Unknown Terminals: approx. 3pF

Equivalent Parallel Resistance Between Unknown Terminals: approx. 10M $\Omega$  at 1MHz.

Residual Inductance: approx. 30nH.

## SECTION II

### INSTALLATION

#### 2-1. INTRODUCTION

2-2. This section contains information for unpacking, inspection, repacking, storage, and installation of the Model 4342A.

#### 2-3. INITIAL INSPECTION

#### 2-4. MECHANICAL CHECK

2-5. If damage to the shipping carton is evident, ask that the carrier's agent be present when the instrument is unpacked. Inspect the instrument for mechanical damage. Also check the cushioning material for signs of severe stress.

#### 2-6. PERFORMANCE CHECKS

2-7. The electrical performance of the Model 4342A should be verified upon receipt. Performance checks suitable for incoming inspection are given in Section V, Maintenance.

#### 2-8. DAMAGE CLAIMS

2-9. If the instrument is mechanically damaged in transit, notify the carrier and the nearest Hewlett-Packard field office immediately. A list of field offices is at the back of this manual. Retain the shipping carton and padding material for the carrier's inspection. The field office will arrange for replacement or repair of your instrument without waiting for claim settlements against the carrier.

2-10. Before shipment this instrument was inspected and found free of mechanical and electrical defects. If there is any deficiency, or if electrical performance is not within specifications, notify your nearest Hewlett-Packard Sales and Service Office.

#### 2-11. STORAGE AND SHIPMENT

2-12. PACKAGING. To protect valuable electronic equipment during storage or shipment always use the best packaging methods available. Your Hewlett-Packard field office can provide packing material such as that used for original factory packaging. Contract packaging companies in many cities can provide dependable custom packaging on short notice. Here are a few recommended packaging methods:

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

sq in. bursting test) with a layer of excelsior about 6 inches thick packed firmly against all surfaces of the instrument.

2-13. ENVIRONMENT. Conditions during storage and shipment should normally be limited as follows:

- a. Maximum altitude, 20,000 feet
- b. Minimum temperature, -40° F (-40° C)
- c. Maximum temperature, 167° F (75° C)

#### 2-14. POWER CONNECTION

2-15. LINE VOLTAGE. The Model 4342A operates from either 115 or 230 volt ( $\pm 10\%$ ) ac line voltage. Line frequency may vary from 50 to 400Hz. A slide switch on the rear panel permits quick conversion for operating from either voltage. Insert a narrow-blade screwdriver in the switch slot and slide the switch to the right for 115-volt operation ("115" marking exposed) or to the left for 230-volt operation ("230" marking exposed). The Model 4342A is supplied with 115-volt fuse; be sure to replace this fuse for 230-volt operation; see Table 2-1.

Table 2-1. AC Line Fuse

Conversion	115-volt	230-volt
Slide Switch	Right ("115")	Left ("230")
AC Line Fuse	0.6 amperes Slow-Blow 2110-0339	0.3 amperes Slow-Blow 2110-0044

#### CAUTION

To avoid damage to the instrument, before connecting the power cable, set the 115/230-volt switch for the line voltage to be used.

2-16. POWER CABLE. To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that instrument panels and cabinets be grounded. Accordingly, the Model 4342A is equipped with a detachable three-conductor power cable which, when plugged into an appropriate receptacle, grounds panel and cabinet. The offset pin of the three-prong connector is the ground pin. Proceed as follows for power cable installation.

- a. Connect flat plug (3-terminal connector) to LINE jack at rear of instrument.
- b. Connect plug (2-blade with round grounding pin) to 3-wire (grounded) power outlet. Exposed

portions of instrument are grounded through the round pin on the plug for safety; when only 2-blade outlet is available, use connector adapter (HP Part No. 1251-0048). Then connect short wire from slide of adapter to ground to preserve the protection feature.

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## SECTION III OPERATION

### 3-1. INTRODUCTION

3-2. The Model 4342A Q Meter measures the Quality factor of inductors with Q values from 5 to 1000, over a frequency range of 22kHz to 70MHz (10kHz to 32MHz in Option 001). Values of inductance from 0.09 $\mu$ H to 1.2H can also be measured directly with the Model 4342A.

3-3. This section provides detailed instructions and general information necessary for operation of the HP 4342A Q Meter.

### 3-4. CONTROLS, CONNECTORS, AND INDICATORS

3-5. The front, top, and rear panel controls, connectors, and indicators are explained in Figure 3-1 and 3-2. The descriptions are keyed to corresponding items which are indicated on the figure.

3-6. LINE PUSH ON/OFF switch is the instrument power ON/OFF switch. The Model 4342A Q Meter operates on 115 or 230V ac  $\pm 10\%$  line power. Power line frequencies from 50 to 400Hz may be used.

3-7. FREQUENCY control dial is located on the left side of the front panel. Seven bands controlled by the FREQUENCY RANGE switch completely cover the frequency range from 22kHz to 70MHz (10kHz to 32MHz in Option 001). Oscillator output level is maintained constant by automatic level control loop.

3-8. Tuning capacitor C and  $\Delta C$  dials are on the right side of the front panel, covering capacitance ranges of 25pF to 470pF, and  $0 \pm 5$ pF, respectively.

3-9. L scale, next to the capacitance scale, reads the effective inductance of coils at the specified frequency indicated on the frequency dial by the letter "L".

3-10. Q RANGE switch on the front panel provides four ranges, 30, 100, 300, and 1000 full scale Q values respectively. The  $\Delta Q$  scale indicates the change in Q between two circuit conditions ( $\Delta Q = Q_1 - Q_2$ ). The  $\Delta Q$  switch expands Q voltmeter sensitivity ten times on each Q RANGE, viz. 3, 10, 30, and 100 full scale, respectively.

3-11.  $\Delta Q$  ZERO, COARSE, and FINE controls zero the meter on the  $\Delta Q$  mode. The meter is zeroed for  $\Delta Q$  at the right-hand side of the scale.

3-12. Q LIMIT control provides Go/No-Go function. If Q LIMIT is set to 50%, the OVER LIMIT lamp located above the Q LIMIT control turns on when Q is over 50% of full scale on each Q range.

3-13. The rear-panel BNC connector labelled FRE-

QUENCY MONITOR provides capability for more accurate indication of oscillator frequency by direct connection to a frequency counter. The Q ANALOG OUTPUT provides an output voltage proportional to meter deflection (Q); 1V max. is available at Q full scale. Output impedance is approximately 1k $\Omega$ .

3-14. OVER-LIMIT SIG. OUTPUT connector on rear panel provides simultaneous relay contact when measured Q exceeds set limit. If measured Q exceeds the Q LIMIT control setting, the relay is closed. This output may be used for external monitoring of Go/No-Go testing (it may be used to control indicators such as lamps or buzzers). The OVER LIMIT DISPLAY TIME switch is provided on rear panel to permit selecting the display time (1 sec or continuous ON). When 1 sec is selected, Go/No-Go function remains on for the 1 sec. If  $\infty$  is selected, Go/No-Go function remains on until measured Q drops below set limit.

### 3-15. MEASURING TECHNIQUE

#### 3-16. GENERAL

3-17. Model 4342A is used to measure Q factor, inductance, capacitance and resistance of the component. The use of the model 4342A in these modes of operation is described below. The Model 4342A requires the connection of an inductor to the COIL terminals to complete the measuring circuit. This circuit may then be tuned to resonance, either by setting the oscillator to a given frequency and varying the internal tuning capacitor, or by presetting the tuning capacitor to a desired value and adjusting the frequency controls. Resonance is indicated by a maximum deflection of the Q meter.

3-18. The "indicated Q" (which is the resonant reading on the Q meter) is called the "circuit Q" because the losses of the internal tuning capacitor, Q voltmeter, and injection transformer resistance are all included in the measuring circuit. To avoid ambiguity, the "circuit Q", as read on the Q Meter, will be called "indicated Q" throughout the remainder of this manual. The "effective Q" of the measured inductor will be somewhat greater than the "indicated Q". The 4342A utilizes a Constant Voltage Injection System eliminating the fragile thermocouple system and the coupling resistor used in traditional Q measurement circuit. The low source impedance of the injection transformer, the improved performance of the Q voltmeter and capacitor minimize the difference between "indicated Q" and "effective Q". The difference can generally be neglected.

#### 3-19. GO/NO-GO FUNCTION

3-20. The 4342A Go/No-Go function and Q-LIMIT lamp are provided to indicate if the Q of the component is over a designated Q-values. The Q-LIMIT control

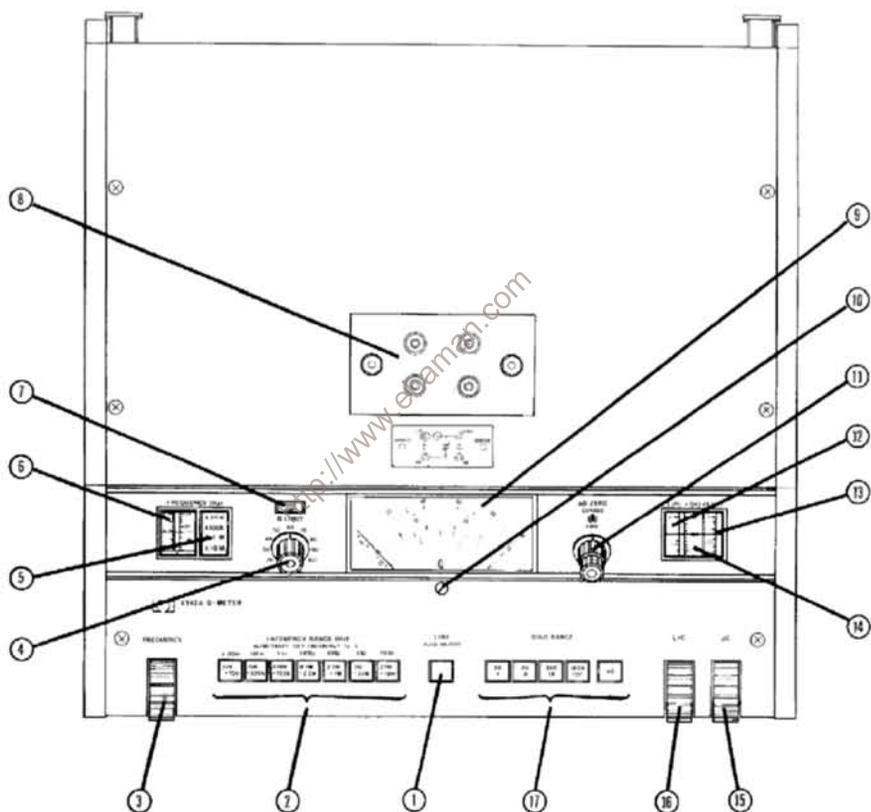
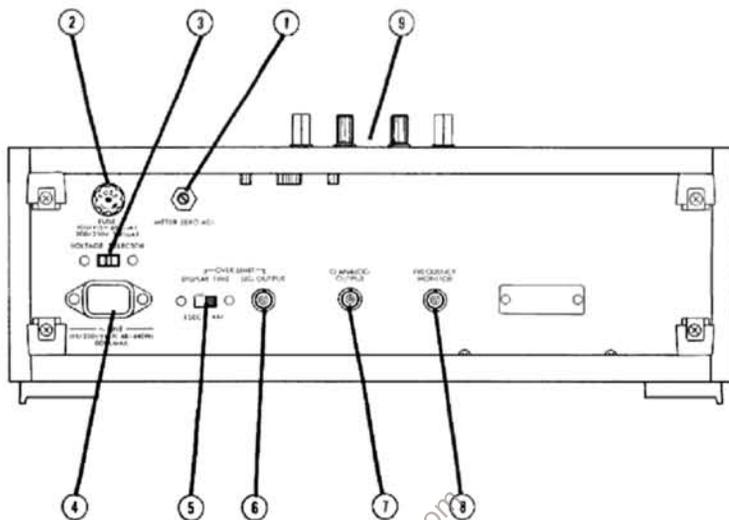


Figure 3-1. Front and Top Panel Controls, Connectors and Indicators (sheet 1 of 2)

1. **LINE PUSH ON/OFF:** Instrument power ON/OFF switch.
2. **FREQUENCY RANGE:** Covers from 22kHz to 70MHz (10kHz to 32MHz in Option 001) over seven ranges. Multiplying factors for direct inductance measurement are given adjacent to the push button switches.
3. **FREQUENCY dial:** Adjusts variable capacitor to control the test oscillator frequency.
4. **Q LIMIT:** Sets the value of lower limit for "Go" in "Go/No-Go" checks.
5. **Frequency Multiplier Indicator:** Indicates factor to multiply frequency dial reading by. Controlled by push button selectors.
6. **FREQUENCY scale:** Two scales provided, 2.2 to 7.0 and 7 to 22 (1.0 to 3.2 and 3.2 to 10 in Option 001). Frequency scale to be read is automatically illuminated.
7. **OVER LIMIT lamp:** Indicates the unknown Q exceeds the value of Q LIMIT setting.
8. **Measuring-Circuit Terminals:** Makes contact with unknowns, and Reference Inductors, dielectric samples under test, etc.
9. **Meter:** Indicates Q and  $\Delta Q$  values.  $\Delta Q$  scale expands Q scale by factor of ten. Meter Scale Indicator is provided to indicate meter scale to be read.
10. **Mechanical Meter Zero:** Sets meter suspension to indicate zero. To adjust zero:
  - a. Remove power from instrument.
  - b. Turn the adjustment screw clockwise until the indicator falls below zero and returns to zero again.
  - c. Turn the adjustment very slightly counter-clockwise to free the mechanism from the adjustment peg.
11.  **$\Delta Q$  ZERO COARSE/FINE:** Sets  $\Delta Q$  zero on meter in  $\Delta Q$  measurement.
12. **L Scale:** Gives the effective inductance value of coil at specified frequencies shown on the frequency scale by the letter "L".
13.  **$\Delta C$  Scale:** Vernier capacitor scale, -5pF to +5pF.
14. **C Scale:** Main capacitor scale, 25pF to 470pF.
15.  **$\Delta C$  Dial:** Adjusts vernier capacitor ( $\Delta C$  Scale).
16. **L/C Dial:** Adjusts main capacitor (L and C Scale).
17. **Q/ $\Delta Q$  RANGE Switch:** Selects the indicated Q maximum 30, 100, 300, or 1000;  $\Delta Q$  switch increases Q resolution by ten times, to 3, 10, 30, or 100 full scale.

Figure 3-1. Front and Top Panel Controls, Connectors and Indicators (sheet 2 of 2)



1. METER ZERO ADJUST: Sets electrical Q zero of meter.
2. FUSES: 115V 0.6A Slow-blow.  
230V 0.3A Slow-blow.
3. 115/230 V ac selector: Selects appropriate line voltage. Must be operated with power off.
4. AC LINE input jack: Male receptacle for 115/230V ac power. Center pin is ground. Use power cord provided, HP 8120-1348. Line power limits are 115/230V ac, 50-400Hz. Check FUSE ratings and position of line voltage slide-switch before connecting power.
5. OVER LIMIT DISPLAY TIME Switch: Sets the "ON" time of Go/No-Go function to 1 sec or continuous ( $\infty$ ).
6. OVER LIMIT SIG. OUTPUT: Provides simultaneous relay contact closure when measured Q exceeds set limit.
7. Q ANALOG OUTPUT: 0 to 1V analog output proportional to meter deflection. Output impedance is approximately 1k $\Omega$ .
8. FREQUENCY MONITOR Output: Provides test oscillator output for monitoring oscillator frequency more accurately. Output level is 170mV rms min. and its impedance is 50 $\Omega$ .
9. Measuring-Circuit Terminals: For connecting of unknowns, Reference Inductors, and other devices to be tested.

Figure 3-2. Rear Panel Controls, Connectors and Indicators

on the front panel may be used to set from 20% to 100% of full scale for each Q range. If Q of a component is "Go", the lamp above the Q-LIMIT control turns on, and a relay contact at the rear panel (OVER LIMIT SIG. OUTPUT) is closed. On-time of Go/No-Go function. (1 sec or continuous) is selected by OVER LIMIT DISPLAY TIME switch on rear panel. If Q value decreases below Q LIMIT value and then again exceeds it, the Go/No-Go function repeats for another 1 sec. cycle.

### 3-21. MEASURING CIRCUIT CONNECTION TERMINALS

3-22. Four binding post terminals and two ground lugs (SHIELD terminals) on top of the instrument allow connection of unknown components to the measuring circuit, as shown in Figure 3-3.

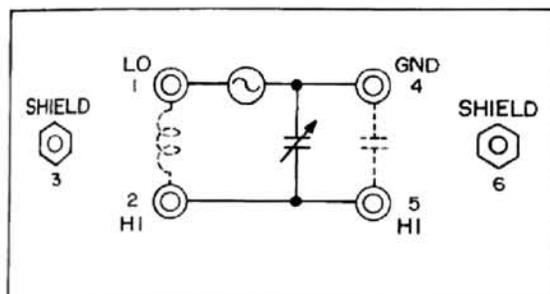


Figure 3-3. Measuring Circuit Connection Terminals

Ground lugs 3 and 6, and binding post 4 are grounded. Binding posts 1 and 2 are LO and HI COIL terminals, respectively. Inductors which resonate with the tuning capacitor may be measured by connecting them to the COIL terminals. LO COIL terminal 1 is not at ground potential. Signal voltage from the internal oscillator is injected into the measuring circuit between this LO COIL terminal 1 and GND 4. Posts 4 and 5 are CAPACITOR terminals. CAPACITOR terminals are used for parallel connection measurement described in paragraph 3-26. Ground lugs 3 and 6 are needed to shield the coil or component paralleled with tuning capacitor.

### 3-23. METHODS OF CONNECTING COMPONENTS

3-24. There are three basic methods of connecting components to the measuring circuit of the Q Meter. The type of impedance and its magnitude will usually dictate the method of connection.

3-25. Direct Connection. Most coils can be measured by connecting them directly to the COIL terminals, as shown in Figure 3-4. The measuring circuit is resonated by adjusting either capacitance or frequency.

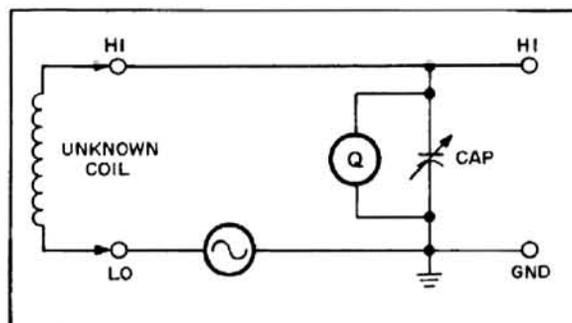


Figure 3-4. Direct Connection to Measuring Circuit

The "indicated Q" is read on the Q meter. If the frequency control is set to "L" on the frequency scale, the effective inductance of the coil may be read on the L scale of the tuning-capacitor L/C dial. For frequencies other than those given on the scale, the inductance of the coil can be calculated using indicated values of frequency and capacitance.

3-26. Parallel Connection. High impedance components, such as high-valued resistors, certain inductors, and small capacitors, are measured by connecting them in parallel with the CAPACITOR terminals. This connection is shown in Figure 3-5. Before the unknown component is connected, however, the measuring circuit must be resonated, using a stable coil (such as Reference Inductors 16471A through 16490A and 16465A) to establish reference values of Q and C.

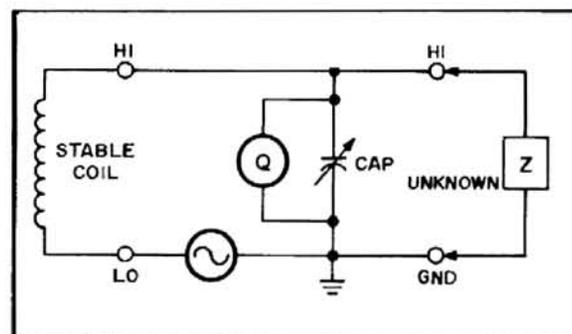


Figure 3-5. Parallel Connection to Measuring Circuit

Then, when the component under test is connected to the measuring circuit and the capacitor is readjusted for resonance, the altered values of Q and C can be combined with the reference values in equations which yield the parameters of the unknown sample (refer to paragraph 3-50).

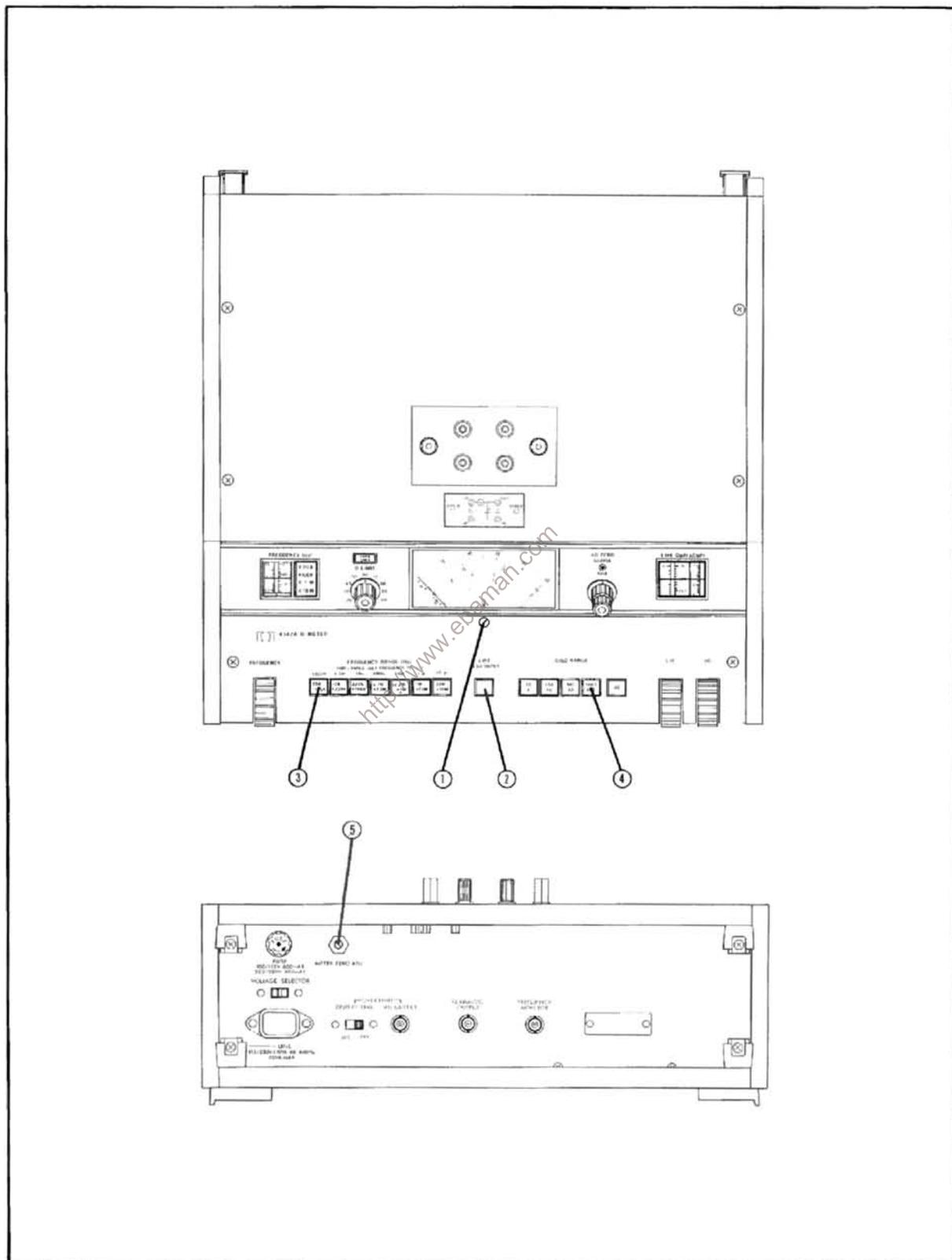


Figure 3-6. Turn-On and Zeroing Procedure (sheet 1 of 2)

1. Check and adjust the mechanical zero of meter. To adjust the zero:
  - a. With the instrument turned off, rotate the meter adjustment screw clockwise until the pointer approaches the zero mark from the left.
  - b. Continue the clockwise rotation until the pointer coincides with the zero mark. If the pointer overshoots, continue rotating the adjustment screw clockwise until the pointer once again approaches the zero mark from the left.
  - c. Rotate the adjustment screw about three degrees counter clockwise to disengage screw adjustment from the meter suspension.
2. Turn the 4342A LINE switch ON. Allow 15 minutes for the instrument to warm up.
3. Set FREQUENCY RANGE to 22k - 70k (10k - 32k in Option 001).
4. Set Q RANGE to 1000.
5. Check, and if necessary, adjust the zero of the Q voltmeter using the METER ZERO ADJUST.

The instrument is now ready for use.

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Figure 3-6. Turn-On and Zeroing Procedure (sheet 2 of 2)

Section III  
Paragraphs 3-27 to 3-33

3-27. **Series Connection.** Low impedance components, which include low valued resistors, small coils, and large capacitors, are measured in series with the measuring circuit. Figure 3-7 shows this connection.

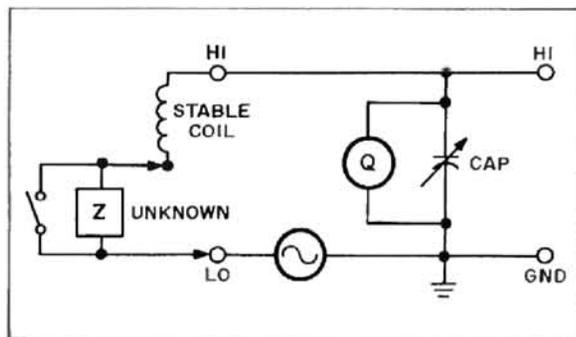


Figure 3-7. Series Connection to Measuring Circuit

The component to be measured is placed in series with a work coil between the LO terminal and the low-potential end of the work coil. A heavy shorting strap should be used to short-circuit the unknown component while a reference condition is established. The strap is then opened, or removed, and the measuring circuit is re-resonated. This procedure permits the component under test to be physically connected even though it is electrically out of the circuit, and eliminates possible errors by maintaining the relative positions of the work coil and unknown component. The reference and altered values of Q and C may be combined in suitable equations (refer to paragraph 3-61) to calculate the parameters of the unknown component.

3-28. Q MEASUREMENT (DIRECT CONNECTION)

3-29. The following procedure can be used to measure directly the Q of coils connected to the COIL terminals.

- Connect the coil to be measured to the COIL terminals.
- Set the FREQUENCY RANGE switch to proper band and adjust the FREQUENCY control to the desired frequency.
- Resonate the coil by adjusting the tuning capacitor L/C control for maximum deflection of the Q meter. Alternatively, the tuning capacitor L/C control may be set to a desired value and the measuring circuit resonated by adjusting the oscillator frequency.
- Select the Q RANGE switch to get maximum resolution and readjust for resonance.
- Read the "indicated Q" on the scale to be read (indicated by lamp).

Note

The final adjustment for resonance can be made with greater ease, for high-Q coils, by using the vernier ( $\Delta C$ ) capacitor. The total circuit capacitance is then obtained by adding or subtracting the vernier ( $\Delta C$ ) dial reading to or from the reading on main (C) capacitor dial as indicated by the sign on the vernier ( $\Delta C$ ) dial.

- To calculate the effective series resistance of the coil being measured, substitute the values of Q, C, and  $\omega$  in the equation,

$$R_s = 1/\omega CQ \quad (\Omega)$$

where  $\omega = 2\pi$  times the frequency in Hz.  
C = measuring circuit capacitance in farads.  
Q = indicated Q.

3-30.  $\Delta Q$  MEASUREMENT

3-31. When the two values of Q are nearly identical, the difference is difficult to read accurately on the normal Q scale.

3-32. The  $\Delta Q$  feature of the 4342A provides accurate information on changes in Q on all Q ranges (through ten times resolution, namely, 0 to 3, 0 to 10, 0 to 30, and 0 to 100 (from right to left). Delta ( $\Delta$ ) Q is measured as follows:

- Resonate the measuring circuit with only the work coil in the circuit. Note the value of  $Q_1$ .
- Push the  $\Delta Q$  switch, and set the  $\Delta Q$  zero of the meter by using the COARSE and FINE  $\Delta Q$  ZERO adjustment controls.
- Recheck the tuning for resonance and  $\Delta Q$  zero again.
- Make the desired circuit change, and again resonate the circuit.
- Carefully recheck the tuning for resonance (maximum meter deflection to the right) by adjusting the C dial, and read the change in Q on the  $\Delta Q$  scale. (Scale to be read is indicated by illuminated arrow at the left side of the scales.)
- Q of changed circuit is given by
 
$$Q_2 = Q_1 - \Delta Q$$
- If the change in Q exceeds full-scale the difference should be calculated from the two Q values, namely,  $\Delta Q = Q_1 - Q_2$

3-33. INDUCTANCE MEASUREMENT (DIRECT CONNECTION)

3-34. The following procedure can be used to measure directly the inductance of coils connected to the COIL terminals.

- If the approximate value of inductance is known, select the appropriate measuring frequency from the inductance value written on the **FREQUENCY RANGE** switches.
- Set the **FREQUENCY** control to the specified frequency designated by the symbol "L" (shown in blue) on the **FREQUENCY** scale.
- Resonate the coil by adjusting the tuning capacitor L/C control. Vernier capacitor  $\Delta C$  must be zero. If the inductance cannot be estimated, resonate the coil at any frequency, then select the next higher **FREQUENCY RANGE**, and resonate the coil by adjusting the tuning capacitor L/C accordingly.
- Read the effective inductance of the coil on the L scale of the tuning capacitor L/C dial. The value shown on this scale must be multiplied by the factor written above the **FREQUENCY RANGE** switch.
- Occasionally it may be necessary to measure inductance at frequencies other than those specified on the **FREQUENCY** dial. In such instances, after resonating the measuring circuit, the effective inductance can be calculated with the equation,

$$L = 1/\omega^2 C \quad (\text{H})$$

where  $\omega = 2\pi$  times the frequency in Hz.

C = capacitance in farads, as read on the dials of the internal tuning capacitor.

### 3-35. MEASUREMENTS WITH CORRECTIONS

#### 3-36. NOMENCLATURE

3-37. In the following nomenclature for parallel and series measurements, the subscript 1 (as in  $C_1, Q_1$ ) will denote values measured with only the work coil connected to the measuring circuit. The subscript 2 (as in  $C_2, Q_2$ ) will refer to values measured after the unknown is added to the circuit. For other measurements the subscript 1 will refer to the first reading while the second reading will be identified by the subscript 2. Subscripts "p" and "s" will denote parallel and series parameters, respectively. The units are defined as follows:

C = capacitance of the tuning capacitor as indicated on the main and vernier dials. (F)

Q = indicated Q observed on the meter

$\Delta Q$  = change in Q;  $\Delta Q = Q_1 - Q_2$

f = oscillator frequency (Hz)

$\omega = 2\pi f$

L = inductance (H)

R = resistance ( $\Omega$ )

$L_{in}$  = residual inductance referred to the COIL terminals. (H)

$C_d$  = distributed capacitance of an inductor (F)

$f_0$  = self-resonant frequency of an inductor (Hz)

### 3-38. DISTRIBUTED CAPACITANCE

#### 3-39. General

3-40. The presence of distributed capacitance in a coil modifies the effective Q and inductance of the coil.

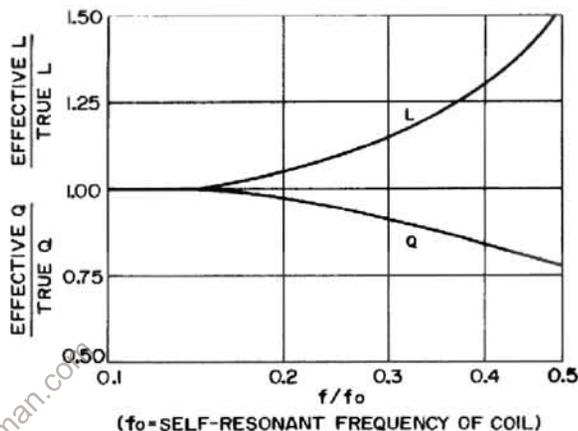


Figure 3-8. Typical Variation of Effective Q and Inductance with Frequency

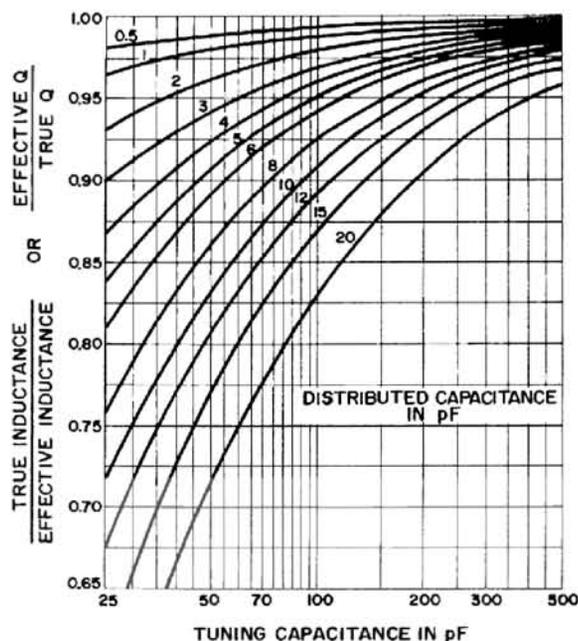


Figure 3-9. Correction Chart for Distributed Capacitance

At the frequency at which the distributed capacitance and the inductance of the coil are resonant, the circuit exhibits a purely resistive impedance. Typical variations of the effective Q and L under these conditions with frequency are shown in Figure 3-8. The true Q and inductance may be determined, however, if the value of distributed capacitance is known. Figure 3-9 is a chart which gives ratios of effective inductance to true inductance and true Q to effective Q for various values of distributed capacitance and tuning capacitance. The chart also illustrates that the effective inductance and Q will closely approximate true values if the distributed capacitance is not excessive and the Q capacitance which tunes the coil is large.

3-41. Measuring  $C_d$  (Preferred Method)

3-42. The impedance of a coil at its self-resonant frequency is resistive and usually high. This characteristic may be utilized for the measurement of distributed capacitance. Proceed as follows:

- Set the tuning capacitor to about 400pF. Call this value  $C_1$ .
- Connect the coil to be measured to the COIL terminals and resonate the measuring circuit by adjusting the oscillator frequency. When resonance is established, note frequency  $f_1$ . Now find the self-resonant frequency of the coil, as follows:
- Reset the oscillator frequency to approximately ten times  $f_1$  and replace the test coil with a work coil capable of resonating in the measuring circuit at this higher frequency.
- Adjust the tuning capacitor for circuit resonance.
- Connect the test coil to the CAPACITOR terminals and restore resonance by readjusting the tuning capacitor.
- If the capacitance has to be increased, increase the oscillator frequency until alternately connecting and disconnecting the test coil to the CAPACITOR terminals changes the indicated Q but does not affect the tuning. Call this frequency the self-resonant frequency,  $f_0$ . Likewise, if the capacitance must be decreased, the frequency should be decreased until the self-resonant frequency of the coil obtains. Unless the required change of capacitance is very small, the frequency should be changed at first in reasonably large steps, for example, 20 to 30 percent.

The distributed capacitance may be found from,

$$C_d = \frac{C_1}{\left(\frac{f_0}{f_1}\right)^2 - 1} \quad (F)$$

If  $f_0 \gg f_1$ , this expression reduces to

$$C_d = \left(\frac{f_1}{f_0}\right)^2 C_1 \quad (F)$$

3-43. Measuring  $C_d$  (Approximate Method  
 $C_d \geq 10 \text{ pF}$ )

3-44. The distributed capacitance of coils with large values of  $C_d$  may be approximated with a simple measuring procedure.

- Set the tuning capacitor to about 50pF. Call this value  $C_1$ .
- Connect the test coil to the COIL terminals and resonate the measuring circuit by adjusting the oscillator frequency. Note this frequency as  $f_1$ .
- Reset the oscillator to a lower frequency,  $f_2$ , equal to  $f_1/n$ . Restore resonance by increasing the tuning capacitance. Let this new value of capacitance be  $C_2$ . The distributed capacitance is then,

$$C_d = \frac{(C_2 - n^2 C_1)}{n^2 - 1} \quad (F)$$

If  $f_2$  is made exactly one half of  $f_1$ , then

$$C_d = \frac{C_2 - 4C_1}{3} \quad (F)$$

An average of several measurements using different values of  $C_1$  will improve the results of this measurement. The best accuracy to be expected with this method, however, is in the order of  $\pm 2\text{pF}$ .

3-45. CORRECTION FOR Q

3-46. The effective Q of a coil with distributed capacitance is less than the true Q by a factor that depends on the value of the distributed capacitance and the measuring circuit tuning capacitance. It can be shown that,

$$\text{true } Q = Q_e \frac{C + C_d}{C}$$

where  $Q_e$  = effective Q of the coil  
and C = measuring-circuit tuning capacitance

The effective Q can usually be considered the indicated Q. A graphical solution for the above equation is given in Figure 3-9.

3-47. CORRECTION FOR INDUCTANCE  
(MEASURED AT COIL TERMINALS)

3-48. The Q Meter Model 4342A measures the effective inductance of coils, except where the measured inductance is in the vicinity of 0.5μH or less. In these cases, the internal inductance of the measuring circuit,  $L_m$ , must be subtracted from the measured value. The correction is simply,

$$\text{effective } L, L_e = L_{\text{meas}} - L_m$$

Where the residual inductance,  $L_m$  is approximately 0.01μH.

3-49. The effective inductance of a coil with distributed capacitance is somewhat greater than its true

inductance. Ratios of true inductance to effective inductance can be found from Figure 3-9 for various values of distributed and tuning capacitance. The true inductance can also be calculated from,

$$\text{true inductance} = L_e \frac{C}{C + C_d} \quad (\text{H})$$

where  $L_e$  = effective inductance of the coil

and  $C$  = measuring-circuit tuning capacitance

### 3-50. PARALLEL MEASUREMENTS

#### 3-51. GENERAL

3-52. High impedance components, such as high value resistors, certain inductors, and small capacitors, are measured by connecting them across the CAPACITOR terminals. This connection is shown in Figure 3-5. Before the unknown is connected, however, the measuring circuit must be resonated, using a stable coil (such as Inductors Model 16471A through 16490A and 16465A), to establish reference values of  $Q$  and  $C$ . Then, when the component under test is connected to the circuit and the capacitor is readjusted for resonance the altered values of  $Q$  and  $C$  can be combined with the reference values in equations which yield the parameters of the unknown sample.

#### 3-53. LARGE RESISTORS

3-54. When the measuring circuit is at resonance (using a work coil), a resistor placed in parallel with the tuning capacitor will lower the indicated  $Q$ . The smaller this resistance, the greater the reduction of  $Q$ . A reasonable range of resistance may be measured with the parallel method, providing that  $\Delta Q$  is not less than 0.1 at  $\Delta Q = 3$  range, 0.3 at 10 range, 1 at 30 range and 3 at 100 range, respectively, nor the indicated  $Q$  reduced below 10.

3-55. The limits of measurable resistance are dependent on frequency and both maximum and minimum limits decrease as the frequency increases. Figure 3-10 shows approximate limits for both parallel and series measurements. These limits are based on an average working coil's  $Q_1$  of 280. The lower limits for parallel measurements may be extended by using external standard capacitors connected to the CAPACITOR terminals.

3-56. The following procedure may be used for the measurement of large resistors:

- Set the FREQUENCY controls to the desired measuring frequency.
- Connect a suitable work coil to the COIL terminals and adjust the tuning capacitor for resonance noting these values of  $Q_1$ ,  $C_1$ . The work coil should be selected so that larger resistors are measured with small values of tuning capacitance and smaller resistors are measured with large value of tuning capacitance.
- Turn on  $\Delta Q$  switch and set  $\Delta Q$  zero of the  $Q$  meter by COARSE and FINE  $\Delta Q$  ZERO adjustment controls.

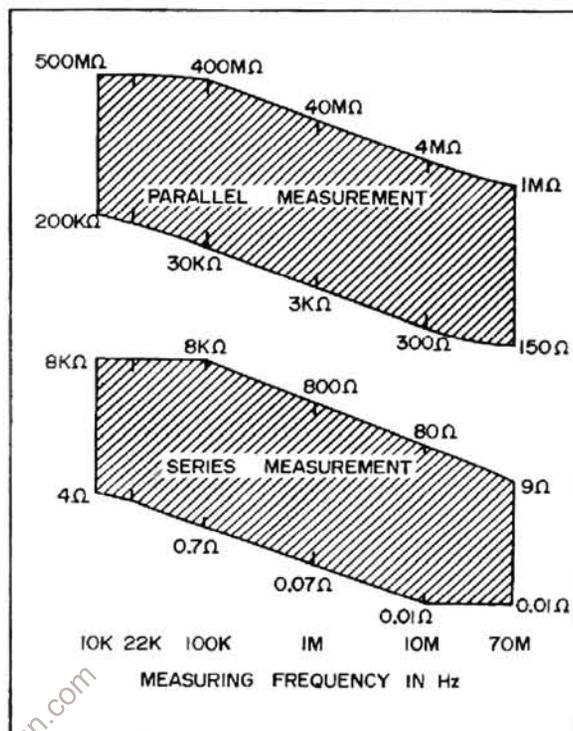


Figure 3-10. Ranges of Measurable Resistance

- Turn off  $\Delta Q$  switch and recheck the tuning for resonance. Again turn on  $\Delta Q$  switch and recheck  $\Delta Q$  zero.
- Make the desired circuit change. Restore resonance to the circuit by adjusting tuning capacitor, note  $C_2$ . And read the change in  $Q$  on the  $\Delta Q$  scale. If the change in  $Q$  exceeds the limit of the scale, the difference should be calculated arithmetically from the two  $Q$  values, viz,  $\Delta Q = Q_1 - Q_2$ .
- The parameters of the resistor are:

$$R_p = \frac{Q_1 Q_2}{\omega C_1 \Delta Q} \quad (\Omega)$$

If the resistor is also reactive,

$$X_p = \frac{1}{\omega(C_2 - C_1)} \quad (\Omega) \text{ (usually capacitive)}$$

$$\text{and } C_p = C_1 - C_2 \quad (\text{F})$$

If the resistor is inductive,  $C_2 > C_1$ .

#### 3-57. SMALL CAPACITORS

3-58. Capacitors of less than about 450pF can be measured by a simple substitution method on the  $Q$  Meter.

- Connect a work coil to the COIL terminals and set the tuning capacitor to a convenient value.

Call this value  $C_1$ . If the capacitance of the test capacitor is known approximately, select a value of  $C_1$  such that the difference between  $C_1$  and the test capacitance falls between 30 and 100pF.

- b. Adjust the FREQUENCY controls for circuit resonance. Call this value  $f_1$ . Read the Q value,  $Q_1$ .
- c. Connect the unknown capacitor to the CAPACITOR terminals and adjust the tuning capacitor to restore resonance. Note  $C_2$ ,  $Q_2$ . The parameters of the capacitor are:

effective capacitance,  $C_p = C_1 - C_2$  (F)

$$\text{effective } Q = \frac{Q_1 Q_2 (C_1 - C_2)}{\Delta Q C_1}$$

and effective parallel resistance,

$$R_p = \frac{Q_1 Q_2}{\omega C_1 \Delta Q} \quad (\Omega)$$

### 3-59. LARGE INDUCTORS

3-60. As the measuring frequency approaches the self-resonant frequency of the coil, the parallel method must be used to measure the effective inductance just below resonance, the impedance at resonance, and the apparent capacitance above  $f_0$ . The parallel measurement can be made with coils of only normal inductance, but which are designed to tune with values of capacitance less than the minimum 20pF of the tuning capacitor. A great number of coils known as "peaking" coils fall in this category. While the inductance of such coils can be found with the equation given for effective inductance, it should be emphasized that an advantage of measuring coils by the "direct method", is that the capacitance required to tune the coil at the measuring frequency is given directly on the tuning capacitor dial. The distributed capacitance of the coil is taken into account with the "direct measurement". If the capacitance required to tune a coil which normally resonates with less than 20pF is desired, a direct measurement is impossible, due to the minimum tuning capacitance in the Q Meter measuring circuit. A parallel measurement, however, will yield the desired information, including the effects of distributed capacitance.

- a. Set the FREQUENCY controls to the required measuring frequency.
- b. If possible, select a work coil which will allow the measuring circuit to resonate at this frequency with a tuning capacitance of 30pF to 70pF. For convenience only, adjust the main capacitor dial to the nearest round value and call this  $C_1$ . Make the final adjustment for resonance with the vernier capacitor.

Note

If the vernier is not changed during the measurement, its value will not affect the calculated effective inductance. When calculating the effective Q, however, the

value of  $C_1$  in the denominator must be the sum (or difference) of the readings on the main and vernier capacitor dials.

- c. Connect the test coil to the CAPACITOR terminals and restore resonance by increasing the tuning capacitance. Note the value of  $C_2$ . The inductance of the unknown coil is:

$$\text{effective inductance} = \frac{1}{\omega^2 (C_2 - C_1)} \quad (H)$$

and the effective Q equals,

$$\text{effective } Q = \frac{Q_1 Q_2 (C_2 - C_1)}{\Delta Q C_1}$$

- d. The capacitance required to tune the coil at the measuring frequency is simply,

$$C = C_2 - C_1 \quad (F)$$

If the measuring frequency, however, is greater than the self-resonant frequency of the coil, the coil under test will not appear inductive but is capacitive, and  $C_2$  will be less than  $C_1$ . A convenient expression for coils in the neighborhood of self-resonance and at frequencies greater than  $f_0$ , is,

$$\text{apparent capacitance, } C_a = C_1 - C_2 \quad (F)$$

Another useful expression for coils operating under these conditions is,

$$\text{apparent conductance, } G_a = \frac{\omega C_1 \Delta Q}{Q_1 Q_2} \quad (S)$$

### 3-61. SERIES MEASUREMENTS

#### 3-62. GENERAL

3-63. Low impedance components, which include low value resistors, small coils, and large capacitors, are measured in series with the measuring circuit. Figure 3-7 shows this connection. The sample to be measured is placed in series with a work coil between the LO terminal and the low potential end of the work coil. A heavy shorting strap should be employed to short-circuit the unknown component while a reference condition is established. The strap can then be opened, or removed, and the measuring circuit re-resonated. This procedure permits the sample to be physically connected even though it is electrically out of the circuit and eliminates possible errors by maintaining the relative positions of the work coil and unknown component.

#### 3-64. SMALL RESISTORS

3-65. A small resistor connected in series with a work coil will lower the indicated Q and thus produce information for the calculation of the resistance. The higher this resistance, the greater the reduction of Q. The following procedure is recommended.

- a. Set the FREQUENCY controls to the desired measuring frequency,  $f_1$ .

- b. Connect a suitable work coil and the unknown resistor in series and place a shorting strap across the resistor. Connect the series combination to the COIL terminals with the strapped resistor next to the LO terminal. The work coil should be selected so that larger resistors are measured with small values of tuning capacitance and smaller resistors are measured with large values of tuning capacitance.
- c. Resonate the measuring circuit with the resistor shorted. Note the values of  $Q_1$ ,  $C_1$ .
- d. Turn on  $\Delta Q$  switch and set  $\Delta Q$  zero of the Q meter using the COARSE and FINE  $\Delta Q$  ZERO adjustment controls.
- e. Turn off  $\Delta Q$  switch and recheck the tuning for resonance. Again turn on  $\Delta Q$  switch and recheck  $\Delta Q$  zero.
- f. Remove the short from across the resistor, and restore resonance by adjusting tuning capacitor; read the  $\Delta Q$  value and  $C_2$ .
- g. The parameters of the resistor are:

$$R_s = \frac{\left(\frac{C_1}{C_2}\right) Q_1 - Q_2}{\omega C_1 Q_1 Q_2} \quad (\Omega)$$

If  $R_s$  is very small and  $Q_2$  approximates  $Q_1$ , it is recommended that the value of  $Q_2$  be obtained by subtracting  $\Delta Q$  from the measured value  $Q_1$ . The reactance of the resistor may be found from,

$$X_s = \frac{(C_1 - C_2)}{\omega C_1 C_2} \quad (\Omega)$$

If the resistor is purely resistive,  $C_2 = C_1$ , the equation for resistance reduces to,

$$R_s = \frac{\Delta Q}{\omega C_1 Q_1 Q_2} \quad (\Omega)$$

### 3-66. SMALL INDUCTORS

3-67. Measurement of small coils at relatively low frequencies cannot be made directly at the COIL terminals. By using an external high Q capacitor connected in parallel with the tuning capacitor, resonance can be obtained at the desired frequency. In this paragraph, the series method is recommended to measure small inductors, without using an external capacitor.

- a. Set the FREQUENCY controls to the desired measuring frequency.
- b. Connect the unknown coil in series with the work coil, between the LO terminal and the low-potential end of the work coil. Provide a heavy shorting strap, which may be placed across the unknown coil.
- c. With the shorting strap connected across the coil, adjust the tuning capacitor for resonance

and note  $C_1$ . The work coil selected should allow  $C_1$  to be about 400pF.

- d. Remove the short from across the unknown coil and restore resonance by decreasing the tuning capacitor. Note  $C_2$ . The inductance may be found from,

$$L_s = \frac{(C_1 - C_2)}{\omega^2 C_1 C_2} \quad (H)$$

If the Q of the coil is required, it may be calculated from,

$$Q = \frac{Q_1 Q_2 (C_1 - C_2)}{C_1 Q_1 - C_2 Q_2}$$

### 3-68. LARGE CAPACITORS

3-69. The series measuring method is also suitable for the measurement of large capacitors. Capacitors larger than about 450pF are normally measured by this technique.

- a. Set the FREQUENCY controls to the desired measuring frequency.
- b. Connect the unknown capacitor in series with the work coil, between the LO terminal and the low-potential end of the work coil. Provide a heavy shorting strap, which may be placed across the unknown capacitor.
- c. Resonate the measuring circuit with the capacitor shorted. Note  $Q_1$ ,  $C_1$ . The initial setting of the tuning capacitance should be just low enough so that the addition of the unknown capacitor in series with the work coil will not require a value of  $C_2$  greater than 470pF in order to restore resonance to the measuring circuit. In general,  $C_1$  need not be less than about 200pF.
- d. Turn on  $\Delta Q$  switch and set  $\Delta Q$  zero of the Q meter by COARSE and FINE  $\Delta Q$  ZERO adjustment controls.
- e. Turn off  $\Delta Q$  switch and recheck the tuning for resonance. Again turn on  $\Delta Q$  switch and recheck  $\Delta Q$  zero.
- f. Remove the short from across the capacitor, and restore resonance by adjusting tuning capacitor, and read the  $\Delta Q$  value,  $C_2$ . If the change in Q exceeds the limit of the scale, the difference should be calculated from the two Q values,

$$\Delta Q = Q_1 - Q_2$$

- g. The effective capacitance of the series capacitor may be calculated using the equation,

$$C_s = \frac{C_1 C_2}{(C_2 - C_1)} \quad (F)$$

The Q of the capacitor may be found with the equation,

$$Q = \frac{Q_1 Q_2 (C_1 - C_2)}{C_1 Q_1 - C_2 Q_2}$$

3-70. MEASUREMENT OF SELF-RESONANT  
FREQUENCY OF LARGE CAPACITORS

3-71. The measurement technique described in paragraph 3-68, 69 is also convenient for finding the self resonant frequency of large capacitors, such as bypass capacitors. At that frequency the impedance of the capacitor is a minimum owing to series resonance between the capacitance and the lead inductance.

3-72. The self-resonant frequency of the capacitor can be found by alternately connecting and disconnecting the shorting strap while the frequency is increased in relatively large increments until a frequency is reached where  $C_2$  (strap removed) is less than  $C_1$  (capacitance shorted). Now decrease the frequency in smaller increments until  $C_2$  equals  $C_1$ . The impedance of the capacitor is resistive at this frequency ( $f_0$ ) and equals,

$$R_s = \frac{\Delta Q}{\omega C_1 Q_1 Q_2} \quad (\Omega)$$

For example, a 0.01  $\mu$ F paper tubular capacitor with 2-inch leads (total length) was found to be resonant at 5.2 MHz. The impedance at this frequency was only 0.19  $\Omega$  (resistive).

<http://www.ebaman.com>

Table 3-1. Formulas for Calculating Q and Impedance Parameters from Parallel and Series Measurements

Parallel Measurements

Effective Q of Unknown

$$Q = \frac{Q_1 Q_2 (C_2 - C_1)}{\Delta Q C_1}$$

Effective Parallel Resistance of Unknown

$$R_p = \frac{Q_1 Q_2}{\omega C_1 \Delta Q}$$

Effective Parallel Reactance of Unknown

$$X_p = \frac{1}{\omega (C_2 - C_1)}$$

Effective Parallel Inductance of Unknown

$$L_p = \frac{1}{\omega^2 (C_2 - C_1)}$$

Effective Parallel Capacitance of Unknown

$$C_p = C_1 - C_2$$

## Note 1

In Eq. of  $X_p$  the sign of the quantity  $(C_2 - C_1)$  indicates the type of effective reactance. A positive quantity results from an inductive reactance and a negative sign from a capacitive reactance.

## Note 2

Disregard the sign of the quantity  $(C_2 - C_1)$  in Eq. of Q above.

Series Measurements

Effective Q of Unknown

$$Q = \frac{Q_1 Q_2 (C_1 - C_2)}{C_1 Q_1 - C_2 Q_2}$$

Effective Series Resistance of Unknown

$$R_s = \frac{\left(\frac{C_1}{C_2}\right) Q_1 - Q_2}{\omega C_1 Q_1 Q_2}$$

Effective Series Reactance of Unknown

$$X_s = \frac{C_1 - C_2}{\omega C_1 C_2}$$

Effective Series Inductance of Unknown

$$L_s = \frac{C_1 - C_2}{\omega^2 C_1 C_2}$$

Effective Series Capacitance of Unknown

$$C_s = \frac{C_1 C_2}{C_2 - C_1}$$

## Note 1

In Eq. of  $X_s$  the sign of the quantity  $(C_1 - C_2)$  indicates the type of effective reactance. A positive quantity results from an inductive reactance and a negative sign from a capacitive reactance.

## Note 2

Disregard the sign of the quantity  $(C_1 - C_2)$  in Eq. of Q above.

Table 3-2. Formulas Relating Series and Parallel Components

$$Q = \frac{X_s}{R_s} = \frac{\omega L_s}{R_s} = \frac{1}{\omega C_s R_s} = \frac{R_p}{X_p} = \frac{R_p}{\omega L_p} = R_p \omega C_p = \sqrt{\frac{L}{C}} = \frac{R_p}{\sqrt{L/C}}$$

	Formulas for Q greater than 10	Formulas for Q less than 0.1		Formulas for Q greater than 10	Formulas for Q less than 0.1
$R_s = \frac{R_p}{1 + Q^2}$	$R_s = \frac{R_p}{Q^2}$	$R_s = R_p$	$R_p = R_s (1 + Q^2)$	$R_p = R_s Q^2$	$R_p = R_s$
$X_s = X_p \frac{Q^2}{1 + Q^2}$	$X_s = X_p$	$X_s = X_p Q^2$	$X_p = X_s \frac{1 + Q^2}{Q^2}$	$X_p = X_s$	$X_p = \frac{X_s}{Q^2}$
$L_s = L_p \frac{Q^2}{1 + Q^2}$	$L_s = L_p$	$L_s = L_p Q^2$	$L_p = L_s \frac{1 + Q^2}{Q^2}$	$L_p = L_s$	$L_p = \frac{L_s}{Q^2}$
$C_s = C_p \frac{1 + Q^2}{Q^2}$	$C_s = C_p$	$C_s = \frac{C_p}{Q^2}$	$C_p = C_s \frac{Q^2}{1 + Q^2}$	$C_p = C_s$	$C_p = C_s Q^2$

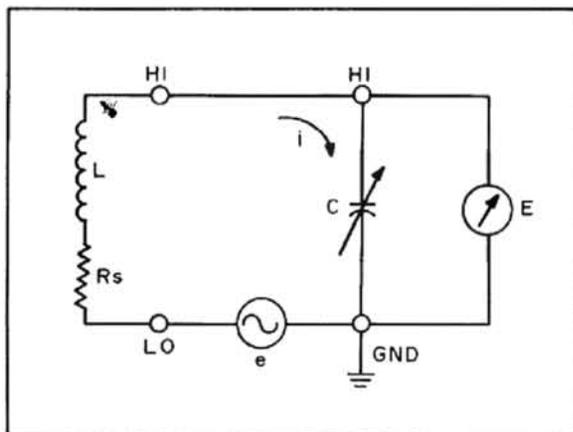


Figure 4-1. Series Resonant Circuit

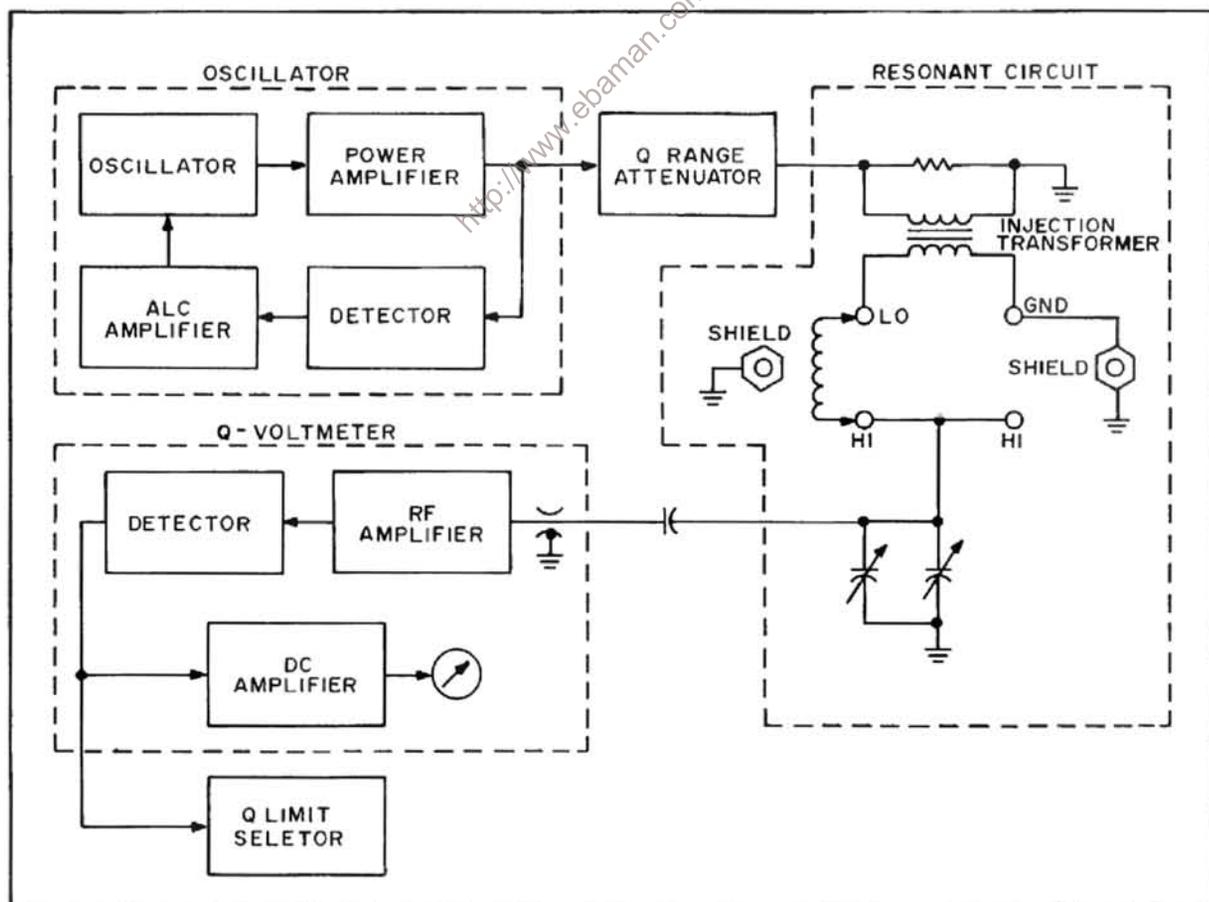


Figure 4-2. Model 4342A Simplified Block Diagram

## SECTION IV

### THEORY OF OPERATION

#### 4-1. INTRODUCTION

4-2. This discussion of the HP Model 4342A Q Meter internal operation is divided into two parts: Block diagram description and circuit description. The block diagram section discusses the functions of the major circuits within the instrument, using the overall block diagram. The circuit description provides a detailed description of all the major circuits within the instrument. It is suggested that the block diagram and schematics which have been included in this manual be referred to while reading the circuit description. A Functional Overall Block Diagram of the instrument, showing all the major circuits and associated relevant information is provided in Section VIII at the back of the manual. Also in Section VIII, there are complete schematics of all the circuitry within the Model 4342A which include components, reference designators, and values.

#### 4-3. Q DETERMINATION AND MEASUREMENT.

4-4. The ratio of a component's reactance to its resistance is measured by the Q meter. The magnitude of Q is usually considered a figure of merit expressing the ability of component to store energy compared to the energy it dissipates. A measure of Q is important to determine the RF resistance of components, the loss angle of capacitors, dielectric constants, transmission line parameters and antenna characteristics, etc. Q is a dimensionless number. In a circuit at resonance, Q can be defined as the ratio of total energy stored to the average power dissipated per cycle. For a single reactance component:

$$Q = X_s/R_s = R_p/X_p$$

Where  $X_s$  and  $X_p$  are series and parallel reactance and  $R_s$  and  $R_p$  are series and parallel resistance. The most common form of Q meter uses a series resonant circuit to measure Q, as shown in Figure 4-1.

4-5. When the variable air capacitor C is adjusted so that  $X_c = X_L$ , the only remaining impedance in the loop is  $R_s$ . The current that flows then is;

$$i = \frac{e}{R_s}$$

and the voltage E across capacitor C is;

$$E = \frac{e}{R_s} \cdot X_c \text{ and } \frac{E}{e} = \frac{X_c}{R_s} = \frac{X_L}{R_s} = Q$$

This equation is correct for values of  $Q \geq 10$ , for it can be shown that the true Q value being measured by the Q meter is equal to  $\sqrt{1 + Q^2}$ . Therefore, if e is held at a constant and known level, a voltmeter with high input impedance can be connected across the capacitor and calibrated directly in terms of Q. The e values in the above equations are functions of selected Q ranges.  $R_s$  is a function of the unknown inductor or Q reference coils. A detailed explanation

for the measurement of unknowns is provided in SECTION III.

#### 4-6. SIMPLIFIED BLOCK DIAGRAM

4-7. The measurement principle used in the Model 4342A is the series resonant circuit. A simplified block diagram of the Q Meter is shown in Figure 4-2. The oscillator which covers 22kHz to 70MHz (10kHz to 32MHz in Option 001), is automatically leveled by a loop consisting of the detector and the ALC amplifier. The oscillator output is controlled automatically by comparing it to a fixed dc level. Thus, constant voltage is supplied to the Q-range attenuator. The attenuator adjusts the signal level according to the Q range settings. This signal is fed into the resonant circuit by a transformer (sometimes called an injection transformer). Resonance is achieved by adjusting the variable capacitor, and this level is read by the high-impedance voltmeter. Thus the Q value of the resonant circuit is indicated on the meter.

#### 4-8. BLOCK DIAGRAM DESCRIPTION

4-9. The Model 4342A Q Meter performs Q measurement in the range of 5 to 1000 on coils in seven bands covering a frequency range from 22kHz to 70 MHz (10kHz to 32MHz in Option 001). The following paragraphs contain a brief outline of function of the major circuit groups in the Q Meter. Reference is made to the Functional Overall Block Diagram in SECTION VIII.

#### 4-10. OSCILLATOR AND IMPEDANCE CONVERTER (A1A1)

4-11. The Oscillator circuit Q1-Q2 is a seven-band variable frequency oscillator covering a frequency range from 22kHz to 70MHz (10kHz to 32MHz in Option 001). The instrument utilizes a Hartley type circuit which operates from 22kHz to 22MHz (10kHz to 10MHz in Option 001) and a Colpitts type circuit from 22MHz to 70MHz (10MHz to 32MHz in Option 001). The FREQUENCY RANGE switch provides for the selection of the desired band of operation. The output amplitude of the oscillator is automatically controlled by an ALC loop Q9-Q13 (P/O A8) to provide the injection voltages required by the Q ranges used. The oscillator output is further coupled to a high impedance circuit Q3-Q6 which provides a buffer stage between the oscillator and the RF power amplifier assembly.

#### 4-12. RF POWER AMPLIFIER (A1A2)

4-13. The RF Power Amplifier assembly consists of a cascode amplifier circuit Q1-Q2 with a gain of about 18dB and an impedance converter Q3-Q4. Commonly called a cascode, the circuit uses an emitter grounded amplifier followed by a grounded base stage. The circuit has excellent noise figure, broadband characteristics, and is very stable. The impedance con-

verter Q3-Q4 consists of a pair of emitter followers connected in series which provides a higher input impedance and lower output impedance.

#### 4-14. ALC AMPLIFIER(P/O A8)

4-15. The ALC Amplifier circuit Q9-Q13 provides the appropriate correction signal to the Oscillator assembly(A1A1) in order to control the oscillator output in accordance with the fixed reference dc level set by the OSC LEVEL control.

#### 4-16. Q/ΔQ RANGE ATTENUATOR(A3)

4-17. The Q RANGE Attenuator consists of four switches which provide a total attenuation of 30.4dB. An additional switch is used for the ΔQ measurement. The Meter Scale Indicator(A11) ganged with Q RANGE switches, utilizes four lamps, two of these lamps are used for the Q scale display and the other two for the ΔQ scale. The attenuator output is fed to an Impedance Converter(A4) which consists of transistors Q1 and Q2 and which is similar in operation to the one described in paragraph 4-13.

#### 4-18. TUNING CAPACITOR AND INJECTION TRANSFORMER(A2)

4-19. The Tuning Capacitor sometimes referred to as the Q Capacitor is an important part of the Q Meter. It is the reactance standard in the Q measurement. Because the Q Capacitor can be calibrated precisely, the Q Meter provides direct reading of inductance in addition to Q. To achieve this high accuracy, the capacitor is designed with low loss and low residual inductance. Minimum capacitance is low to maintain accuracy at high frequencies. The Q Capacitor covers a range of 20pF to 475pF. Residual inductance is less than 10nH.

4-20. The Model 4342A uses a new method of injecting a constant voltage through a transformer as shown in Figure 4-3, which has very low output impedance. The transformer has a toroidal core and nearly flat frequency response from 10kHz to 70MHz. The LO terminal consists of a one-turn secondary winding which has an output impedance of approximately 1 milliohm. High measurement accuracy is thus achieved.

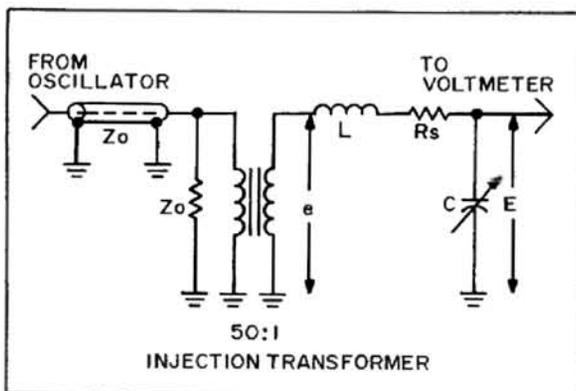


Figure 4-3. Constant Voltage Injection System

#### 4-21. RF AMPLIFIER AND DETECTOR(A5)

4-22. The RF Amplifier and Detector assembly includes the Impedance Converter, the RF Amplifier and the Detector circuits. The impedance converter Q1-Q4 is a "unity" gain buffer stage amplifier between the Tuning Capacitor assembly A2 and the RF Amplifier Q5-Q9. It provides a high input impedance and low output impedance similar to what has been described in paragraph 4-13.

4-23. The RF Amplifier circuit Q5-Q9 is a high gain and broad band amplifier. The frequency response of the amplifier is flat and covers the entire spectrum range given in the specifications, while broad band RF transistors supply power gain. The approximate gain is about 34dB. The amplified signal is detected by diodes CR2-CR5 and coupled to the DC Amplifier assembly A6.

#### 4-24. DC AMPLIFIER(A6)

4-25. The DC Amplifier Q1-Q5 provides a gain from 0 to 20dB. It is used to drive linearly the meter. Various gain adjustment, balance control, ΔQ COARSE AND FINE adjustments, METER ZERO ADJUST, and ΔQ function are provided for in this assembly. A Q ANALOG OUTPUT is also supplied which can be interfaced with other instruments. Frequency signals down to and including dc can be handled by the amplifier. By combining direct coupling with a resistive feedback circuit, good stability is obtained.

#### 4-26. Q LIMIT SELECTOR(A7)

4-27. The Q Limit Selector assembly includes a comparator circuit Q1-Q3, a Schmitt trigger Q4-Q5, a monostable multivibrator Q6-Q7 and a driver Q8-Q9. The comparator compares the output of the detected RF signal with the Q LIMIT setting. The comparator output is then coupled via an emitter follower to the Schmitt trigger which generates a fast rise pulse output. This signal is coupled to the monostable multivibrator which has a fixed time constant of 1 second, and also supplies the necessary drive signal to the driver stage. An OVER LIMIT SIGNAL OUTPUT and DISPLAY TIME(1 sec or ∞) are provided.

#### 4-28. CIRCUIT DETAILS

#### 4-29. LC OSCILLATOR(P/O A1A1)

4-30. FREQUENCY RANGE switches select the appropriate LC circuit, setting the operating frequencies of the oscillator Q1-Q2. In the Hartley configuration, when an RF current flows in the tuned circuit, there is a voltage drop across L. The tap on the L coil will be at an intermediate potential with respect to the two ends of the coil. The amplified current in the Q2 collector circuit, which flows through the bottom section of L, is in phase with the current already flowing in the circuit and thus in the proper relationship for positive feedback. The Colpitts arrangement uses the voltage drops across the two capacitors C18 and C19 in series in the tuned circuit to supply the feedback. Other than this, the Colpitts operation is the same as just described for the Hartley configuration.

**4-31. IMPEDANCE CONVERTER(P/O A1A1) AND RF POWER AMPLIFIER(A1A2)**

4-32. FET Q3 provides a high input impedance for the impedance Converter circuit. Transistor Q5 is used as a current source and Q4 provides positive feedback to make Q3 gain equal to unity. Emitter follower Q6 provides low impedance output signals to the RF Amplifier stage. Inductor L8 acts as a parasitic oscillation suppressor and C30 is a dc blocking capacitor. The signal from the Impedance Converter is ac coupled to RF Power Amplifier Q2 via C2. Transistors Q1 and Q2 form a cascode stage as previously described in paragraph 4-12. Resistor R11 and C6 form a frequency compensation network and C5 is a bypass capacitor. Transistors Q3 and Q4 form an Impedance Converter as described in paragraph 4-12. Inductor L1 and L4 are parasitic oscillation suppressors.

**4-33. ALC AMPLIFIER(P, O A8)**

4-34. Transistor Q9 thru Q13 form the ALC Amplifier assembly. FET Q9A and Q9B form a differential amplifier with Q11 as its current source. A portion of the rectified RF Amplifier signal is taken across diode A3CR1 and coupled to FET Q9B. Transistors Q10 and Q12 form another differential amplifier with Q13 as its current source. The drain output signal of FET Q9B turns on transistor Q12. The current flowing through the collectors of transistors A1A1Q1 and A1A1Q2 is caused to vary by the setting of the OSC LEVEL control R26. This variation in A1A1Q1 collector current causes a change in the tuned circuit current and the gain of the Oscillator is thereby controlled. C10 provides ac feedback and circuit stabilization.

**4-35. Q RANGE ATTENUATOR(A3)**

4-36. The Q Range Attenuator with a total attenuation of 30.4dB covers the entire frequency range. The following steps of 10.4dB, 9.6dB, and 10.4dB are provided to correlate the meter reading with the Q Ranges used in the proper ratio (ie. 30/3, 100/10, etc.). The maximum insertion loss is 0.1dB and the impedance is 50Ω nominal. The Q Attenuator output is coupled to Impedance Converter A4 which is arranged in a Darlington pair configuration.

**4-37. IMPEDANCE CONVERTER, RF AMPLIFIER AND DETECTOR(A5)**

4-38. The Impedance Converter Q1-Q4 is identical in operation to the description given in paragraph 4-32. Diode CR1 protects Q4 from initial current surge. Transistors Q5-Q9 provide RF amplification for the broad band RF frequencies with a total gain of approximate 34dB. Variable resistor R32 and variable capacitor C16 provide for the adjustment of medium and high frequency response of the amplifier respectively. A flat response is obtained through out the entire frequency band. The signal is ac coupled to detector diode CR2 via C19. Capacitor C20 provides filtering action. Diodes CR3 thru CR5 in conjunction with R42 and R43 cancel the non-linearities of diode CR2. A linear reading is provided to the meter circuit.

**4-39. DC AMPLIFIER(A6)**

4-40. FET Q1 supplies Q ANALOG OUTPUT proportional to the meter deflection to J1 connector. Variable resistors R4 and R6 are used for the settings of the Q ANALOG OUTPUT-BALANCE and GAIN respectively. FET Q2A and Q2B form a differential amplifier with transistor Q4 as a current source. Diode CR1 compensates for temperature changes. Q3 and Q5 supply current drive to the meter. Resistors R2 and R21 provide for X1 GAIN and X10 GAIN adjustments respectively. Zener diode CR2 and CR3 are used to regulate for the +25V and -25V supplies, inductors L1, L2 and capacitors C2, C3 are used to obtain additional filtering of meter circuit supply voltages. Resistor R2(mounted on chassis) provides for METER ZERO adjustment. Resistors R3 and R4(mounted on chassis) are used for the ΔQ ZERO FINE and COARSE adjustments respectively.

**4-41. Q LIMIT SELECTOR(A7)**

4-42. High impedance FETs Q1 and Q2 form a comparator circuit. Emitter follower Q3 dc couples the comparator output to the Schmitt trigger Q4 and Q5. Capacitor C2 is used as a negative feedback path to reduce the ripple voltage at Q3 emitter. Transistors Q4 and Q5 provide Schmitt trigger action. When Q4 base voltage reaches 9V, the transistor will turn on and Q5 which is normally on will turn off. A positive going pulse will be generated and coupled via capacitor C3 and diode CR3 to the one-shot multivibrator Q6 and Q7. Normally, transistor Q7 is on and Q6 is cut off by the voltage drop across the common bias resistor R19. The pulse from Q5 turns on Q6 which in turn switches off Q7 for one second. Capacitor C6, resistors R20, R21, and R22 determine the constant of the circuit. Transistor Q8 turned on by the rise in Q7 collector voltage operates K1 the OVER LIMIT DISPLAY relay. Transistor Q9(normally on) is used for ∞ OVER LIMIT DISPLAY TIME. Diodes CR5 and CR6 protect Q8 and Q9 against initial line transient when the instrument is turned on.

**4-43. POWER SUPPLY(P, O A8)**

4-44. Description of the Power Supply operation will pertain to the +25 volt supply. For the negative supply, operation will be identical but with reversed polarities. Rectifiers CR1 thru CR4 form a fullwave bridge rectifier for the +25 volt supply. In this arrangement two rectifiers operate in series on each half of the cycle, one rectifier being in the lead to the load; the other being in the return lead.

4-45. Pulsating(rectified) dc at the output of the four-diode rectifier bridge is applied to the collector of the series regulator Q1. Closely matched transistors Q2, Q5 and Q3, Q4 form differential amplifier with high common mode signal rejection. The output voltage is applied across R11, R12, and R13 a voltage divider, such that some fraction of this voltage will be applied to the base of Q5. Should the voltage at the base of Q5 increase, its collector will go more negative. This negative going signal will be applied through emitter follower Q4 and cause Q3 collector to go negative. The negative going signal from Q3 is coupled through emitter follower Q1 and series regulator Q1(mounted on chassis). Subsequently the signal

Section IV  
Paragraph 4-46

at the base of Q1 will increase the effective resistance of series regulator.

4-46. The rectifier output is continually changing, as it is a pulsating current. Thus the amplifier chain feeding the series regulator is continually compensating for this pulsation, effectively smoothing the rectifier's output. Capacitor C2 (mounted on chassis) sets ac output impedance. Zener diode CR5 provides constant base voltage to Q2. Diode CR6 protects transistor Q3 against transients. Diodes CR7, CR8, and CR9 provide current limiting in the event of a grounded output. As stated earlier the operation for the negative supply is identical to the positive supply, except that only one differential amplifier is used in the circuit.

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Table 5-1. Required Test Equipment.

Instrument Type	Required Specifications	Recommended Model
AC Voltmeter	Frequency Range 10Hz to 1MHz Voltage Range 1mV to 1V Accuracy $\pm 0.5\%$ at 200kHz	HP Model 400E AC Voltmeter
HF AC Voltmeter	Frequency Range 500kHz to 100MHz Voltage Range 10mV to 1V Frequency Flatness $\pm 1\%$	HP Model 411A RF Millivoltmeter (with known frequency flatness)
DC Voltmeter	Voltage Range 0.1V to 100V Accuracy 0.1% of Reading	HP Model 3440A with 3444A
Electronic Counter	Range 10kHz to 70MHz	HP Model 5246L with 5253B
Test Oscillator	Frequency Range 10kHz to 1MHz Output 1.0 volt max. Distortion less than 1%	HP Model 651B Test Oscillator
RF Oscillator	Frequency Range 100kHz to 70MHz Output 1.0 Volt max.	HP Model 8601A Generator/Sweeper
Reference Inductor	Frequency Range 100kHz to 300kHz Q: greater than 100	HP Model 16475A
Oscilloscope	Pass Band 10Hz to 50MHz Sensitivity 5mV/cm Input Impedance 1M $\Omega$	HP Model 180A with 1801A and 1820A Plug-ins
Capacitance Bridge	Frequency 100kHz Full Scale Range 500pF Accuracy: less than $\pm 0.3\%$	HP Model 4270A Automatic Capacitance Bridge
50 $\Omega$ Resistor	Metal Film 0.5% 1/4W	HP Part No. 0698-5965
50 $\Omega$ Termination	Feed Through	HP Model 10100C
Isolator		HP Model 10216A
BNC Adaptor		HP Model 10218A
Coaxial Adaptor	FBNC FBNC	HP Part No. 1250-0080

## SECTION V MAINTENANCE

### 5-1. INTRODUCTION

5-2. This section contains the necessary service information required to maintain the HP Model 4342A Q Meter. Included are In-Cabinet Performance Checks, Adjustment and Calibration Procedures, Servicing and Troubleshooting.

### 5-3. TEST EQUIPMENT REQUIRED

5-4. The equipment required to maintain the Model 4342A is listed in Table 5-1. The table lists the type of equipment to be used, the specification requirements and recommended model. If the model recommended is not available, equipment which meets or exceeds the critical specifications listed may be substituted.

### 5-5. Q ACCURACY.

5-6. Theoretically, a Q Meter measures the Q of a complete circuit. In practical cases residual circuit parameters, which do not exist in the ideal circuits can contribute to Q readings. Insertion resistance, residual inductance in series with the COIL Terminals, Q Voltmeter conductance, and tuning capacitor loss are typical examples of sources of error in a practical Q measuring circuit. These errors can be minimized through use of a low output impedance injection transformer system, a low loss tuning capacitor and a low input conductance Q Voltmeter, as in the Model 4342A. Consequently, the 4342A will indicate higher Q values than other currently available Q Meters. When assuring that no internal loss exists

in the Q Meter, the Q accuracy described in Table 1-1 can be guaranteed by performing the adjustment and calibration procedures in this section. If a Q calibration which takes the actual internal loss of the instrument into account is required, a Q value reading check with actual Q standards should be done in addition to adjustment and calibration procedures described in this manual. At the present time, no Q standards are available, thus the Q accuracy check with Q standards cannot be performed at the facility where the instrument is used. Since HP, however, maintains the Q standards traceable to NBS (National Bureau of Standard) in major repair offices, the calibration service with authorized Q standards for the 4342A is always available. If a Q accuracy check is needed, contact your nearest Hewlett-Packard office. If HP Models 513A/518A Q standards are owned and maintained, a Q accuracy check for the 4342A can be done at the user's location. Refer to Table 5-2 for Q Correlation Factors.

### 5-7. OPTION

5-8. Any calibration procedures for Option 001 that differ from the standard Model 4342A are included in the back of this section.

### 5-9. IN-CABINET PERFORMANCE CHECKS

5-10. The following In-Cabinet Performance Checks compare the Model 4342A with its accuracy specifications. These checks should be used for incoming inspection, periodic maintenance and for specification checks after a repair.

### 5-11. METER ZERO CHECK.

5-12. Before beginning the Performance Checks, adjust the meter zero according to the procedure in Figure 3-6.

### 5-13. FREQUENCY ACCURACY CHECK

- a. Connect the counter to the FREQUENCY MONITOR on the rear panel.
- b. Set 4342A controls as follows:  
 FREQUENCY RANGE . . . . . 22k - 70k  
 FREQUENCY dial . . . . . 2.2  
 Other controls . . . . . any settings
- c. Counter should read between 21,670 kHz and 22,320kHz.
- d. Check all frequency settings given in Table 5-3. Use the frequency converter for higher frequencies. Table 5-3 lists the check frequencies and tolerances required.

### 5-14. Q RANGE CHECK

- a. An AC Voltmeter and a Digital Voltmeter listed in Table 5-1 should be used.
- b. Connect the AC Voltmeter and the Digital Voltmeter to LO and GND terminals as shown in Figure 5-1.

Table 5-2. Q Correlation Factors.

Q Standard	Frequency	Correlation Factor*
518-A5	50 kHz	1.04
	100 kHz	1.07
	150 kHz	1.13
518-A4	150 kHz	1.05
	300 kHz	1.08
	450 kHz	1.12
513-A	500 kHz	1.01
	1 MHz	1.04
	1.5MHz	1.12
518-A3	1.5MHz	1.05
	3 MHz	1.03
	4.5MHz	1.05
518-A2	5 MHz	1.07
	10 MHz	1.09
	15 MHz	1.23
518-A1	15 MHz	1.27
	30 MHz	1.17
	45 MHz	1.37

\* Correlation Factor x Indicated Q - Value on 513/518 = 4342A Indicated Q-Value.

Table 5-3. Frequency Accuracy Check

Frequency Range	Frequency Dial	Specified Accuracy	Counter Reading
22k - 70k	2.2	$\pm 1.5\%$	21.670 - 22.330 kHz
	L	$\pm 1.0\%$	24.922 - 25.424 kHz
	5.0	$\pm 1.5\%$	49.250 - 50.750 kHz
	7.0	$\pm 1.5\%$	68.950 - 71.050 kHz
70k - 220k	7.0	$\pm 1.5\%$	68.950 - 71.050 kHz
	L	$\pm 1.0\%$	78.822 - 80.413 kHz
	15	$\pm 1.5\%$	147.75 - 152.25 kHz
	22	$\pm 1.5\%$	216.70 - 223.30 kHz
220k - 700k	2.2	$\pm 1.5\%$	216.70 - 223.30 kHz
	L	$\pm 1.0\%$	249.22 - 254.24 kHz
	5.0	$\pm 1.5\%$	492.50 - 507.50 kHz
	7.0	$\pm 1.5\%$	689.50 - 710.50 kHz
700k - 2.2M	7.0	$\pm 1.5\%$	689.50 - 710.50 kHz
	L	$\pm 1.0\%$	788.22 - 804.13 kHz
	15	$\pm 1.5\%$	1477.5 - 1522.5 kHz
	22	$\pm 1.5\%$	2167.0 - 2233.0 kHz
2.2M - 7M	2.2	$\pm 1.5\%$	2167.0 - 2233.0 kHz
	L	$\pm 1.0\%$	2492.2 - 2542.4 kHz
	5.0	$\pm 1.5\%$	4925.0 - 5075.0 kHz
	7.0	$\pm 1.5\%$	6895.0 - 7105.0 kHz
7M - 22M	7.0	$\pm 1.5\%$	6895.0 - 7105.0 kHz
	L	$\pm 1.0\%$	7882.2 - 8041.3 kHz
	15	$\pm 1.5\%$	14.775 - 15.225 MHz
	22	$\pm 1.5\%$	21.670 - 22.330 MHz
22M - 70M	2.2	$\pm 2.0\%$	21.560 - 22.440 MHz
	L	$\pm 1.0\%$	24.922 - 25.424 MHz
	5.0	$\pm 2.0\%$	49.000 - 51.000 MHz
	7.0	$\pm 2.0\%$	68.600 - 71.400 MHz

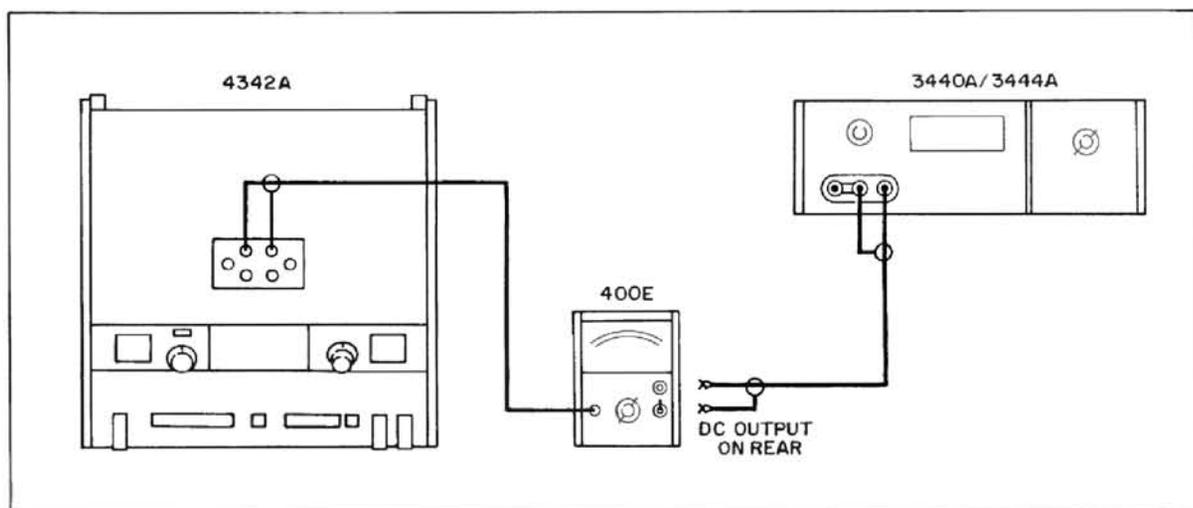


Figure 5-1. Q Range Check

- c. Set 4342A controls as follows:

FREQUENCY RANGE . . . . . 70k - 220k  
 FREQUENCY dial . . . . . 20  
 Q RANGE . . . . . 30  
 Q LIMIT . . . . . CW  
 C dial . . . . . 25  
 $\Delta$  C dial . . . . . 0

- d. Set the AC Voltmeter range to 30mV and the Digital Voltmeter to 1000mV. The Digital Voltmeter should read between 920.6 and 977.4mV.
- e. Set Q RANGE and AC Voltmeter range as shown in Table 5-4. The Digital Voltmeter should read within the limits given in Table 5-4.

Table 5-4. Q Range Check

Q Range	AC Voltmeter Range	Digital Voltmeter Reading
30	30 mV	920.6 - 977.4 mV
100	10 mV	873.0 - 927.0 mV
300	3 mV	920.6 - 977.4 mV
1000	1 mV	873.0 - 927.0 mV

5-15.  $\Delta$ Q RANGE CHECK

- a. The AC Voltmeter, the Digital Voltmeter, and a Reference Inductor listed in Table 5-1 should be used.
- b. Connect the AC Voltmeter and the Digital Voltmeter to HI and GND terminals, and connect the Reference Inductor to HI and LO terminals as shown in Figure 5-2. Set the AC Voltmeter range to 1V.

- c. Set 4342A controls as follows:

FREQUENCY RANGE . . . . . 70k - 220k  
 FREQUENCY dial . . . . . 20  
 Q RANGE . . . . . 100  
 Q LIMIT . . . . . CW  
 C dial . . . . . 25  
 $\Delta$  C dial . . . . . 0

- d. Adjust C and  $\Delta$ C dials so that Q meter indicates just 100, it needs not indicate the peak value.
- e. The Digital Voltmeter should read between 873 mV and 927V.
- f. Adjust C dial and  $\Delta$ C dial so that the Digital Voltmeter indicates 999.9mV.
- g. Set Q/ $\Delta$ Q RANGE to  $\Delta$ Q10 and adjust  $\Delta$ Q ZERO so that the Q Meter indicates 0(full scale).
- h. Adjust  $\Delta$ C dial so that the Q-Meter indicates 10 and note the Digital Voltmeter reading. It should be within 890.0 and 910.0mV.

5-16. CAPACITANCE ACCURACY CHECK

- a. A Capacitance Bridge should be used.
- b. Connect the Capacitance Bridge to HI and GND terminals, as shown in Figure 5-3.
- c. Set 4270A controls as follows:

FREQUENCY . . . . . 100k  
 RANGE MODE . . . . . AUTO  
 TEST VOLT . . . . . NORM  
 MEAS RATE . . . . . SHORT  
 LOSS MEAS . . . . . G  
 MEAS CKT . . . . . L-GND  
 DC BIAS RANGE . . . . . OFF

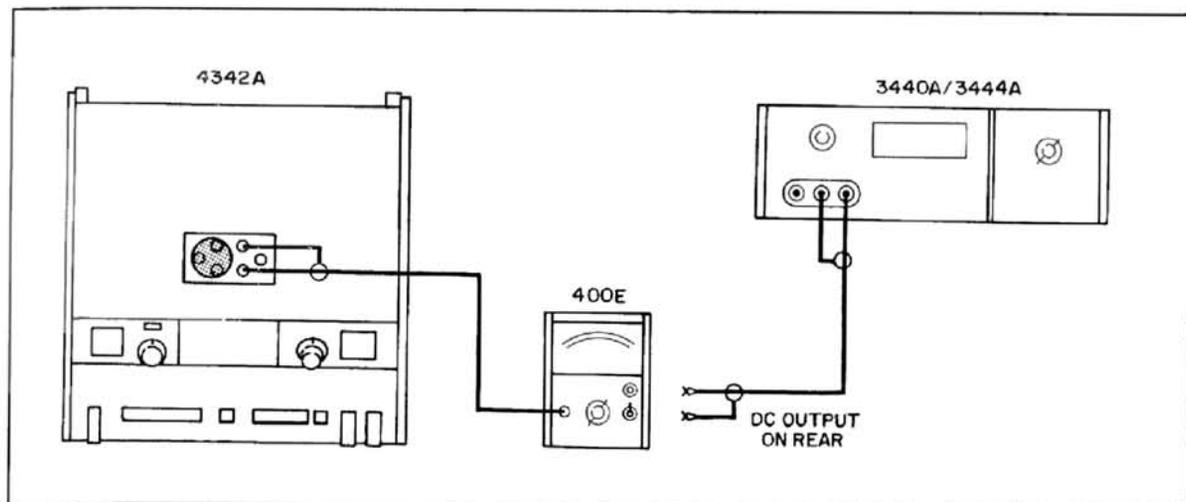


Figure 5-2.  $\Delta$ Q Range Check

Section V  
Paragraphs 5-17 to 5-20

d. Set 4342A controls as follows:

C dial . . . . . 25  
 $\Delta$ C dial . . . . . 0  
 Other controls . . . . . any settings

e. The C-Bridge should read between 23.9 and 26.1pF.

f. Check all C dial and  $\Delta$ C dial settings given in Table 5-5. The C-Bridge readings should be within specified in Table 5-5.

g. Adjust C dial to 100 and  $\Delta$ C dial to 0. Note the C-Bridge reading.

h. Adjust  $\Delta$ C dial to +5, note the C-Bridge reading. The difference between the readings in step g and step h should be not less than +4.9 and not more than +5.1pF.

i. Adjust C dial to -5, note the C-Bridge reading. The difference between the readings in step g and step i. should be not less than -4.9 and not more than -5.1pF.

Table 5-5. Capacitance Accuracy Check

C Dial	$\Delta$ C Dial	C-Bridge Reading
25	-5	18.9 - 21.1
25	0	23.9 - 25.9
25	+5	28.9 - 31.1
100	0	98.9 - 101.1
200	0	197.9 - 202.1
300	0	296.9 - 303.1
400	0	395.9 - 404.1
470	0	465.2 - 474.8
470	+5	470.2 - 479.8

5-17. Q OVER LIMIT OPERATION CHECK

a. A reference inductor should be used.

b. Insert the reference inductor into the HI and LO terminals.

c. Set 4342A controls as follows:

FREQUENCY RANGE . . . . . 70k - 220k  
 FREQUENCY dial . . . . . 20  
 Q RANGE . . . . . 100  
 Q LIMIT . . . . . CW  
 C dial . . . . . 25  
 $\Delta$ C dial . . . . . 0  
 OVER LIMIT DISPLAY  
 TIME on rear panel . . . . .  $\infty$

d. Adjust C dial until the meter indicates greater than full scale.

e. Set Q-LIMIT to 60; the OVER LIMIT lamp should come on.

f. Adjust C dial so that the Q Meter indicates approximately 50. The OVER LIMIT lamp should go off.

g. Slowly adjust C dial so that Q increases when the meter exceeds 60. The OVER LIMIT lamp should come on.

5-18. ADJUSTMENT AND CALIBRATION PROCEDURES

5-19. The following is a complete adjustment and calibration procedure for the Model 4342A. This operation should be conducted only when it is determined that any performance check does not meet these specifications. Assembly location and adjustment location are shown in Figures 5-4 and 5-5 respectively.

5-20. POWER SUPPLY ADJUSTMENT

a. Remove top cover.

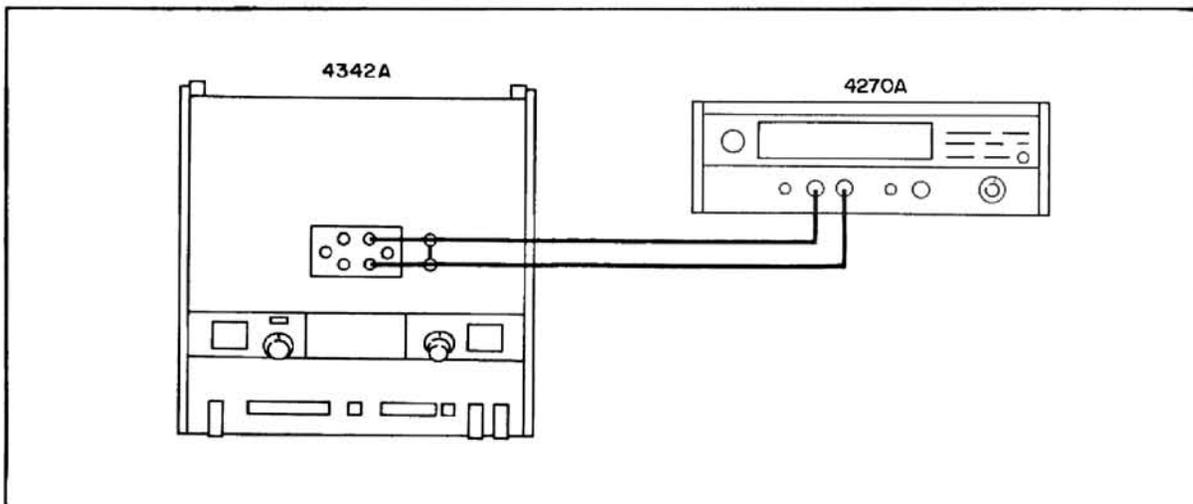
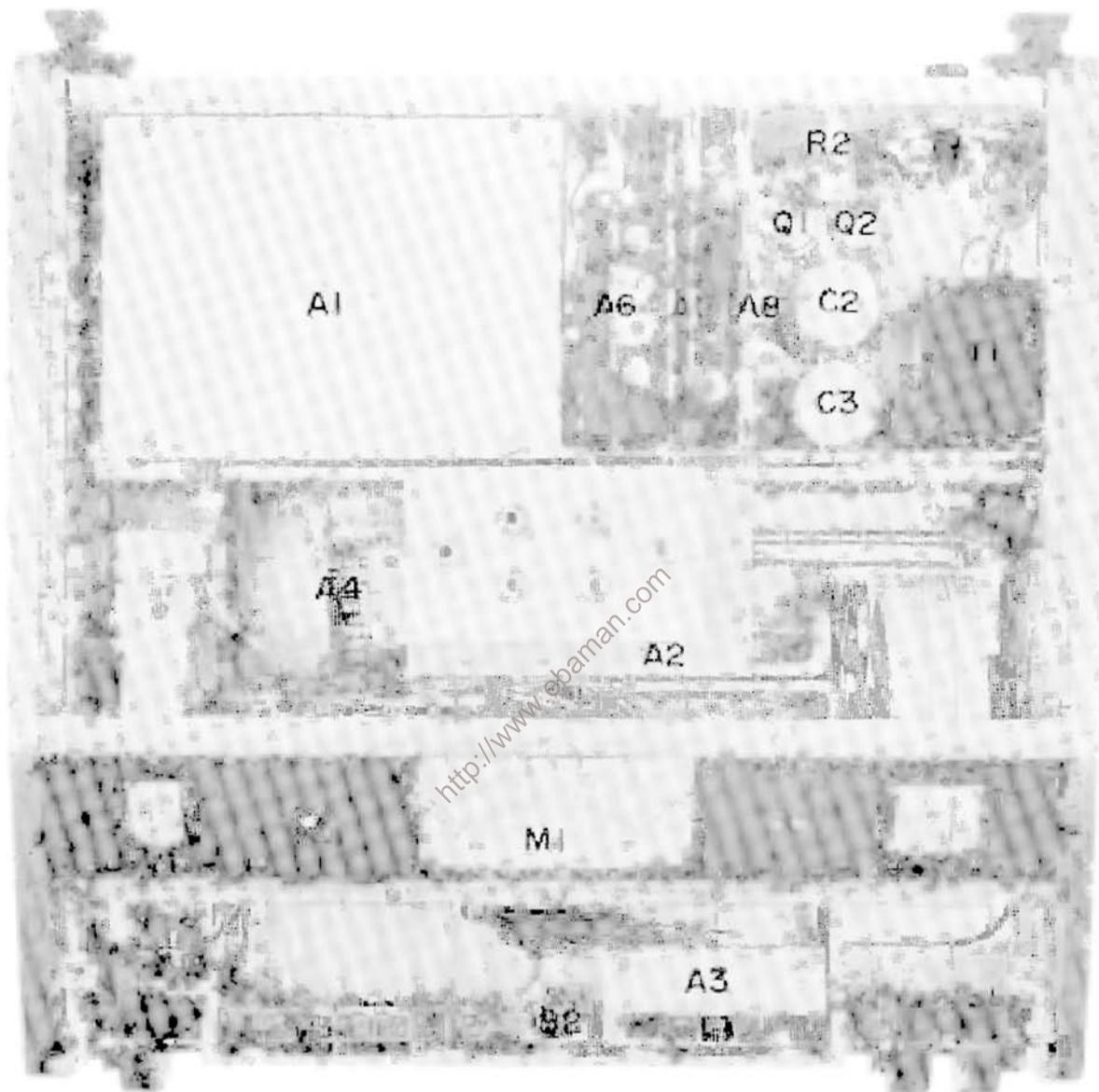
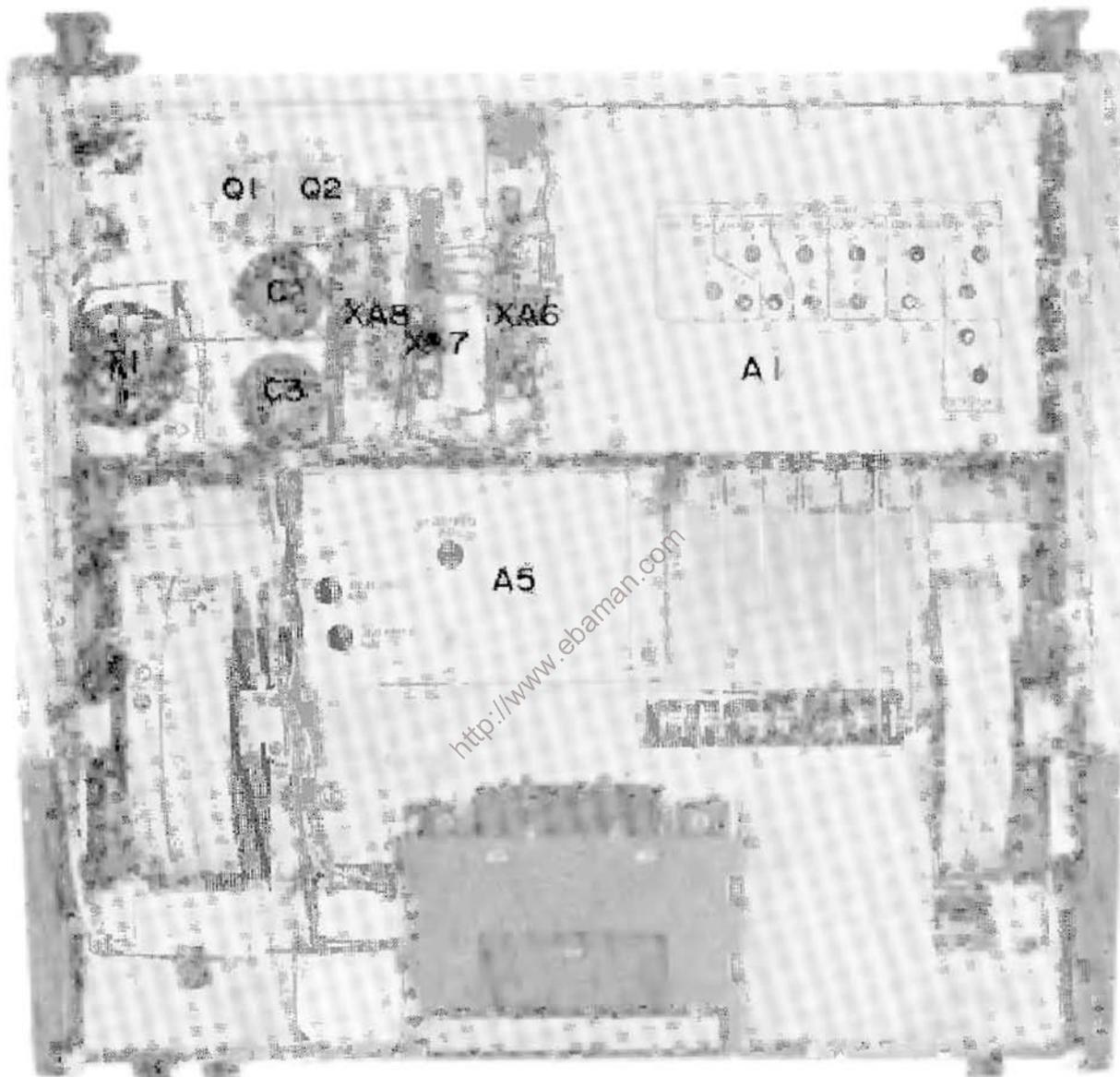


Figure 5-3. Capacitance Accuracy Check



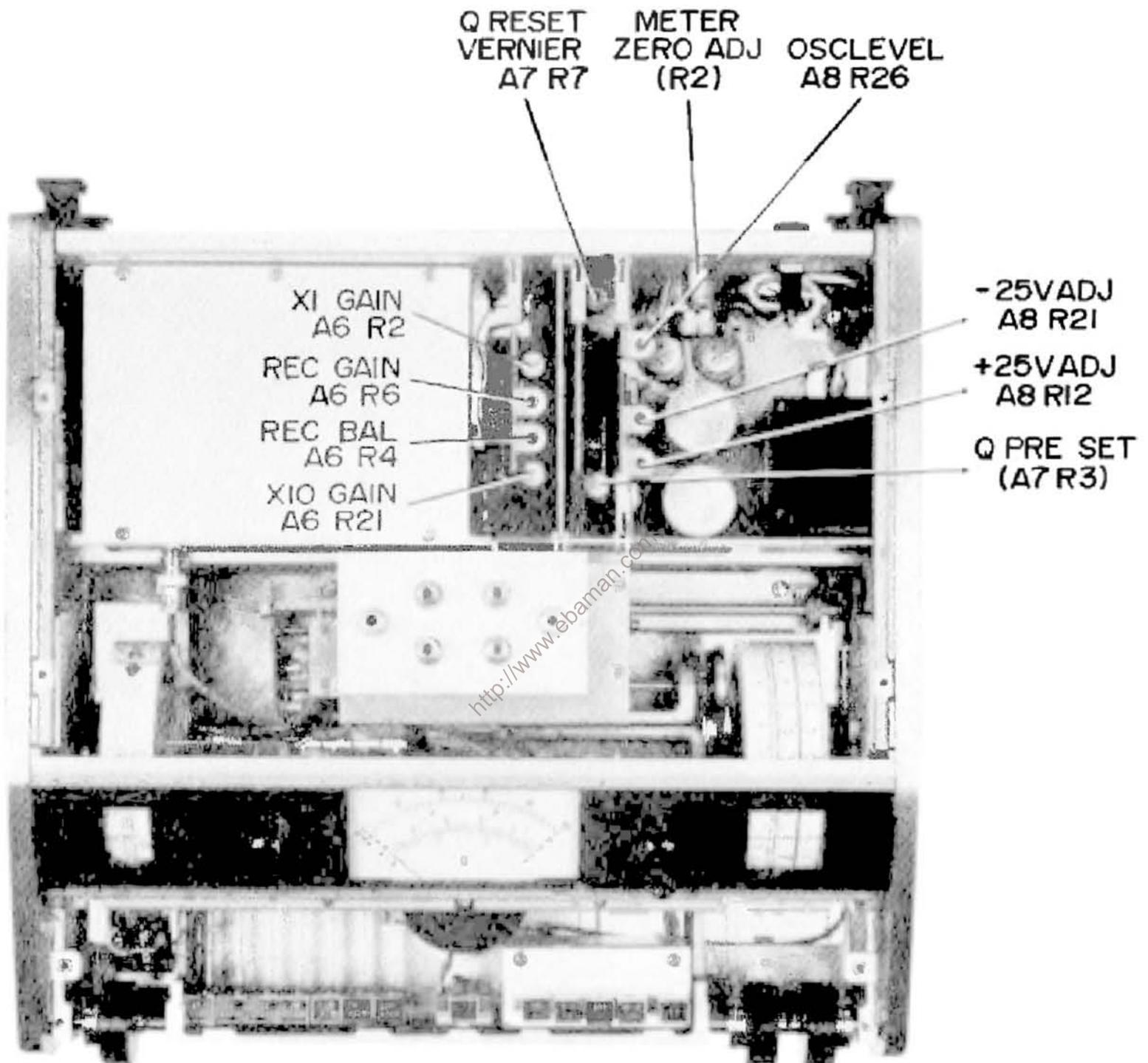
Top View

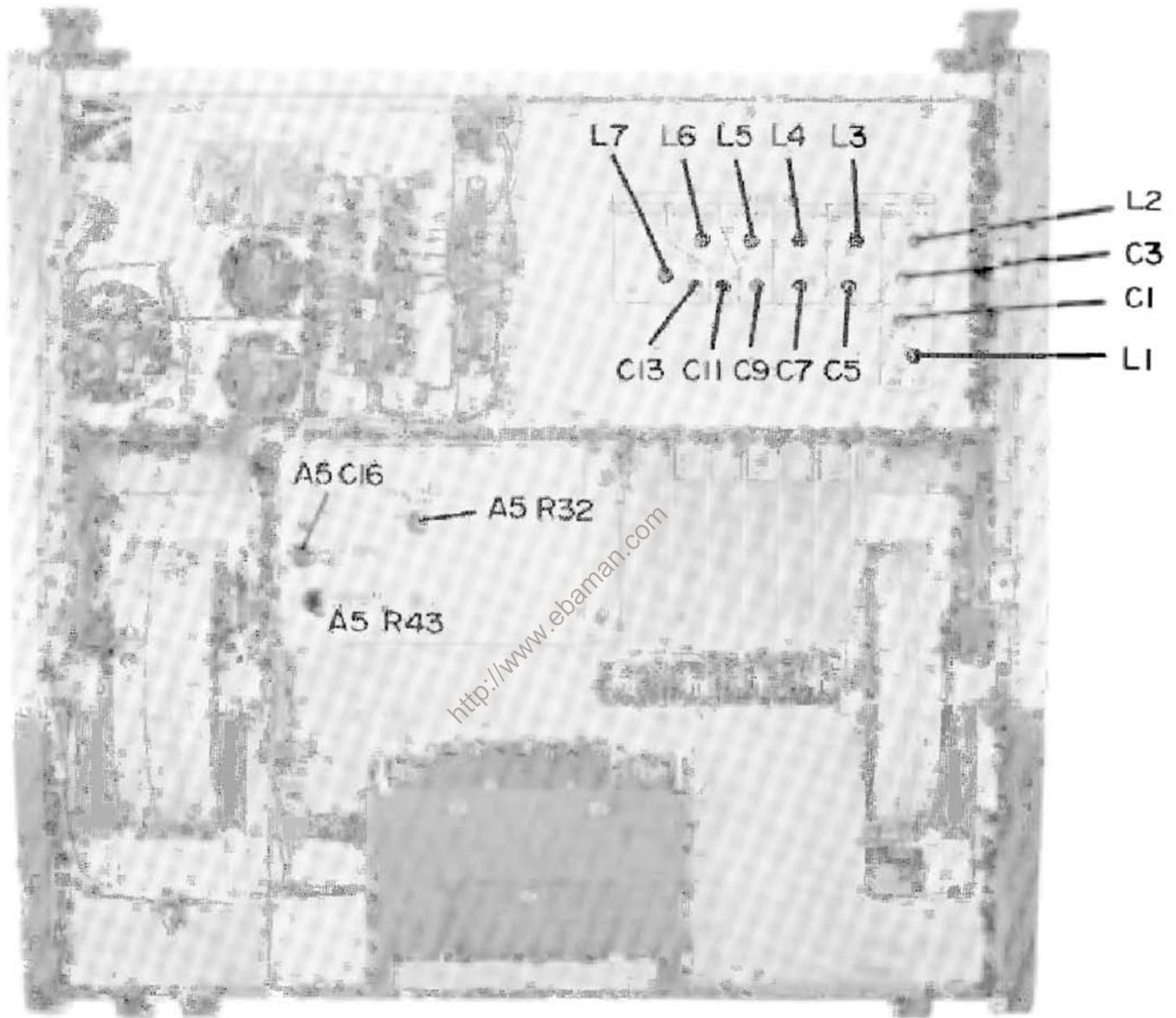
Figure 5-4. Model 4342A Assembly Location



Bottom View

Figure 5-4. Model 4342A Assembly Location





Bottom View

Figure 5-5. Model 4342A Adjustment Location

- b. Turn the 4342A off and put power supply assembly A8 on Extender Board.
- c. Turn the 4342A on. With a DVM and an AC Voltmeter, make the following adjustments:

Table 5-6. Power Supply Adjustments

Test Point	A8C3 (+) to chassis ground	A8C6 (-) to chassis ground
Voltage	+25 $\pm$ 0.025Vdc	-25 $\pm$ 0.025Vdc
Ripple	0.35mV rms	0.35mV rms
Adjustment	A8R12	A8R21

- d. Turn the 4342A off and replace the A8 board.

5-21. OSCILLATOR ADJUSTMENT

## 5-22. Oscillator Level Adjustment(A8R26)

- a. Connect the AC Voltmeter and the Digital Voltmeter to LO and GND terminals as shown in Figure 5-6 and turn the 4342A on.
- b. Set the 4342A controls as follows:
- FREQUENCY RANGE . . . . . 22k - 70k  
 FREQUENCY dial . . . . . 5.0  
 Q RANGE . . . . . 30  
 Q LIMIT . . . . . CW  
 C dial . . . . . 25  
 $\Delta$ C dial . . . . . 0
- c. Set the AC Voltmeter range to 30mV and the Digital Voltmeter to 1000mV.
- d. Adjust A8R26 for 949.0mV display on the Digital Voltmeter.

## 5-23. Oscillator Frequency Adjustment.

- a. Connect the Electronic Counter to the FREQUENCY MONITOR on the rear panel of the 4342A.
- b. Set the 4342A controls as follows:
- FREQUENCY RANGE . . . . . 22k - 70k  
 FREQUENCY dial . . . . . 2.2  
 Other control . . . . . any settings
- c. Remove bottom cover and bottom cover of oscillator. Loosen coil lock nuts. Replace oscillator cover.
- d. Adjust A1A1L1 for an indication of 22.000kHz  $\pm$  0.330kHz. See bottom view on page 8-4.
- e. Set FREQUENCY dial to 7.0.
- f. Adjust A1A1C1 for an indication of 70.000kHz  $\pm$  1.050kHz.
- g. Set FREQUENCY dial to "L".
- h. The indication on the counter should be between 24.922kHz and 25.42kHz. If not, repeat steps b through f.
- i. Check dial tracking across 22 - 70kHz. A compromise adjustment may improve tracking. Compare with Table 5-3, Page 5-2.
- j. Set FREQUENCY RANGE and dial as shown in Table 5-7 and adjust control for correct frequency with same procedure described in steps b through i.
- k. Remove oscillator cover. Lock coil lock nuts.
- l. Recheck against Table 5-7.

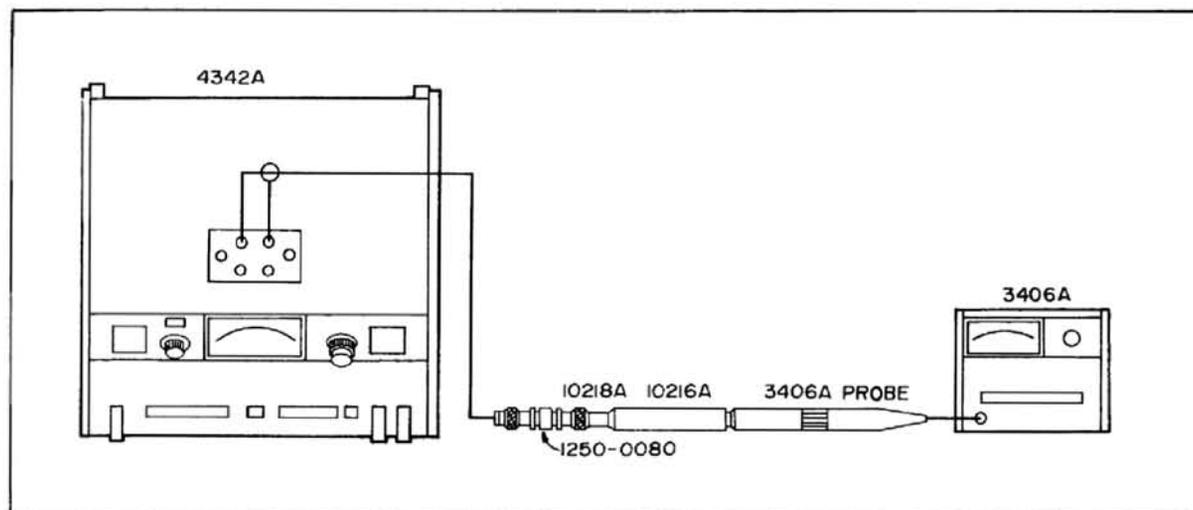


Figure 5-6. Oscillator Level Adjustment

Section V

Paragraphs 5-24 to 5-27

5-24. VOLTMETER ADJUSTMENT.

- Check mechanical zero (page 3-7, Figure 3-6).
- $\Delta Q$  ..... release  
other controls ..... any setting

5-25. Adjust METER ZERO ADJ. on the rear panel for the electrical meter zero.

5-26. X1 Gain, X10 Gain, and linearity adjustment, (A6R2, A6R21, A5R43). See page 5-6, Figure 5-5.

- Connect the Oscillator as shown in Figure 5-7.
- Set the 4342A controls as follows:  
  
FREQUENCY RANGE ..... 22k - 70k  
FREQUENCY dial ..... 2.2  
C dial ..... 25  
 $\Delta C$  dial ..... -5
- Set the Oscillator frequency to 100kHz with the output of 900.0mV.
- Adjust A6R2 for a full scale reading on the 4342A meter.
- Set the Oscillator output to 450.0mV.
- The 4342A meter should indicate 1/2 full scale. If meter reading is low, turn A5R43 a little CCW. If meter reading is high, turn A5R43 a little CW.

- Repeat steps c through f until meter indicates 1/2 full scale  $\pm 0.5/100$  full scale in step f.
- Set the Oscillator output to 300.0mV.
- The 4342A meter should indicate 1/3 full scale  $\pm 1/100$  full scale. If not, repeat steps through f.
- Set the Oscillator output to 810mV.
- Depress:  
  
 $\Delta Q$  Range ..... 10  
 $\Delta Q$  .....  $\Delta Q$   
  
Set  $\Delta Q$  zero for 10 reading on the  $\Delta Q$  scale (zero scale deflection).
- Set the Oscillator output to 900mV.
- The 4342A should indicate zero on the  $\Delta Q$  scale. If reading is other than zero, adj A6R21 for a zero reading.
- Repeat steps j through m.

5-27. Q ANALOG OUTPUT ADJUSTMENT

Note

Allow three hour warm up before conducting this adjustment.

Table 5-7. Frequency Adjustment

Frequency Range	Frequency Dial	Current Frequency	Adjustment
22k - 70k	2.2	22.000 $\pm 0.330$ kHz	A1A1L1
	7.0	70.000 $\pm 1.050$ kHz	A1A1C1
	"L"	25.173 $\pm 0.251$ kHz	NO
220k - 700k	2.2	220.00 $\pm 3.30$ kHz	A1A1L3
	7.0	700.00 $\pm 10.50$ kHz	A1A1C5
	"L"	251.73 $\pm 2.51$ kHz	NO
2.2M - 7.0M	2.2	2200.0 $\pm 33.0$ kHz	A1A1L5
	7.0	7000.0 $\pm 105.0$ kHz	A1A1C9
	"L"	2517.3 $\pm 25.1$ kHz	NO
22M - 70M	2.2	22.000 $\pm 0.440$ MHz	A1A1L7
	7.0	70.000 $\pm 1.400$ MHz	A1A1C13
	"L"	25.173 $\pm 0.251$ MHz	NO
70k - 220k	7.0	70.000 $\pm 1.050$ kHz	A1A1L2
	22	220.00 $\pm 3.30$ kHz	A1A1C3
	"L"	79.618 $\pm 0.796$ kHz	NO
0.7M - 2.2M	7.0	700.00 $\pm 10.50$ kHz	A1A1L4
	22	2200.0 $\pm 33.0$ kHz	A1A1C7
	"L"	796.18 $\pm 7.96$ kHz	NO
7.0M - 22M	7.0	7000.0 $\pm 105.0$ kHz	A1A1L6
	22	22,000 $\pm 0.330$ MHz	A1A1C11
	"L"	7961.8 $\pm 79.6$ kHz	NO

- Depress 30 Q RANGE button.
- Connect the Digital Voltmeter to Q ANALOG OUTPUT on the rear panel.
- Disconnect the Oscillator from HI and GND terminals.
- Adjust A6R4 for  $0V \pm 0.01V$  on the Digital Voltmeter.
- Reconnect oscillator per Figure 5-7. Set oscillator output for a full scale reading on the 4342A meter.
- Adjust A6R6 for  $1V \pm 0.01V$  on the Digital Voltmeter.
- Repeat steps c through f. The two adjustments interact.

#### 5-28. FREQUENCY RESPONSE ADJUSTMENT

- Connect the RF Oscillator and the RF Voltmeter (with known frequency flatness), as shown in Figure 5-8.
- Set C and  $\Delta C$  to minimum.
- Set the RF Oscillator frequency to 10MHz and set the output for a full scale reading on the 4342A meter.
- Note the RF Voltmeter reading.
- Set the RF Oscillator frequency to 20MHz and set the output for the same RF Voltmeter reading as noted in step d.
- Adjust MF ADJ(A5R32) for a full scale reading on the 4342A meter.
- Set the RF Oscillator frequency to 70MHz and set the output for the same reading on the RF Voltmeter as noted in step d.
- Adjust HP ADJ(A5C16) for a full scale reading on the 4342A meter.
- Repeat steps c. through h. until the frequency flatness is less than  $\pm 2\%$ .

#### 5-29. Q LIMIT SELECTOR ADJUSTMENT

- Set OVER LIMIT DISPLAY TIME on the rear panel to  $\infty$ .
- Connect the Oscillator between HI and GND terminals.
- Set Q LIMIT to 100.
- Set the Oscillator output for a full scale reading on the 4342A meter.
- Turn Q PRESET ADJ(A7R3) CCW until front panel OVER LIMIT indicator comes on.
- Turn Q PRESET ADJ very slowly CW until OVER LIMIT indicator goes off.
- Set Q LIMIT to 50. OVER LIMIT indicator should come on.
- Decrease the Oscillator output level and note the 4342A meter reading at which OVER LIMIT indicator just goes off. The reading should be about  $1/2$  full scale ( $50 \pm 5$  div on the top scale).
- If the reading is low, turn Q PRESET VERNIER(A7R7) a little CW and repeat steps c. through h.
- If the reading is high, turn Q PRESET VERNIER a little CCW and repeat steps c. through h.

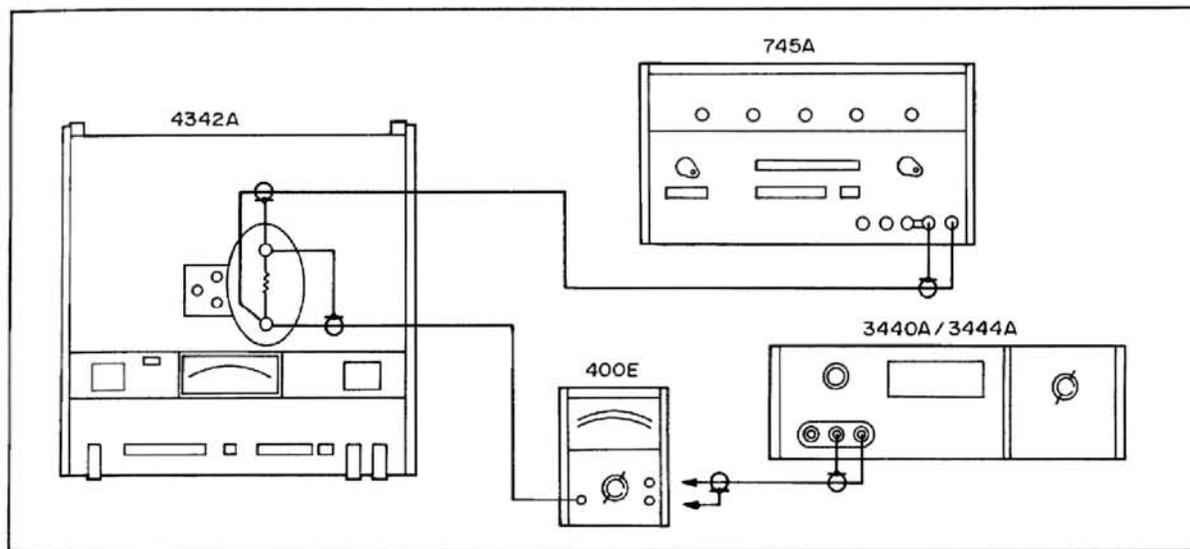


Figure 5-7. Voltmeter Adjustment

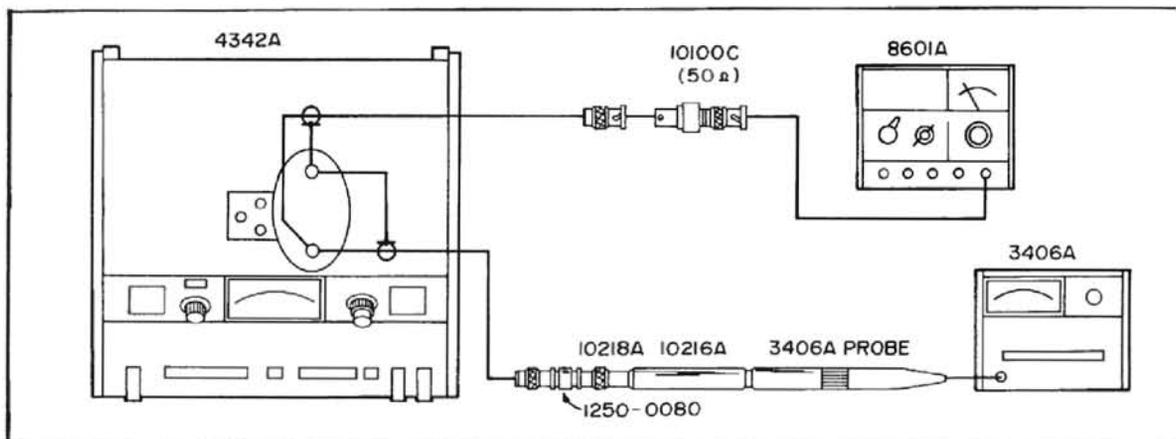


Figure 5-8. Frequency Response Adjustment

5-30. ADJUSTMENT AND CALIBRATION PROCEDURES(OPTION 001)

5-31. The following paragraphs describe the changes that must be made in the Performance Checks and Adjustment and Calibration Procedures in this section in order to make this manual applicable to Option 001.

5-32. PERFORMANCE CHECKS, OPTION 001

5-33. The following changes are required to adapt the the Performance Checks in this manual to the Model 4342A Option 001.

- a. Paragraph 5-13b. Change the settings of the FREQUENCY RANGE and FREQUENCY dial to 10k-32k and 1.0, respectively.  
Paragraph 5-13c. Change the upper and lower frequency limits to 9.8500kHz and 10.150kHz respectively.  
Paragraph 5-13d. Use Table 5-8 for Option 001, instead of Table 5-3.
- b. Paragraphs 5-14c, 5-15c, and 5-17c. Change the settings of the FREQUENCY RANGE and FREQUENCY dial to 100k-320k and 2.0, respectively.

5-34. MODEL 4342A OPTION 001 PROCEDURES

5-35. The following changes should be made in Adjustment and Calibration Procedures in this section to make them applicable to the 4342A Option 001.

- a. Paragraph 5-22b. Change the settings of the FREQUENCY RANGE and FREQUENCY dial to 10k-32k and 2.0, respectively.
- b. Paragraph 5-23b. Change the settings of the FREQUENCY RANGE and FREQUENCY dial to 10k-32k and 1.0, respectively.  
Paragraph 5-23d. Change the adjustment limit to 10.000kHz  $\pm$ 0.150kHz.  
Paragraph 5-23c. Change the setting of the FREQUENCY dial to 3.2.  
Paragraph 5-23f. Change the adjustment limit to 32.000kHz,  $\pm$ 0.480kHz.

Paragraph 5-23i. Change the frequency range from 22-70kHz to 10-32kHz.

Paragraph 5-23j. Use Table 5-9 instead Table 5-7.

- c. Paragraph 5-26b. Change the settings of the FREQUENCY RANGE and FREQUENCY dial 10k-32k and 1.0, respectively.
- d. Paragraph 5-28g. Change the setting of the RF Oscillator frequency to 32MHz.

5-36. RESTRINGING INSTRUCTIONS

5-37. Disassembly, to restring FREQUENCY dial Main Tuning and  $\Delta$ C Tuning Capacitor dials, it is recommended that the top and bottom covers, front panel, black panel and scale panel, relevant side covers, and casting frames be removed.

- a. Front panel is fastened by 4 screws at the extreme ends of the instrument front deck(2of them are located at the bottom).
- b. Top and bottom covers are fastened by 8 screws (4 screws on each side).
- c. Black panel and scale panel are part of the same assembly. They can be taken out by the removal of any of the side casting frame.
- d. Side covers consist of a pair on each side fastened by 4 screws each.
- e. Casting frame are fastened by 8 screws on each side.

5-38. FREQUENCY DIAL

5-39. Materials Required. Before attempting to restring the FREQUENCY dial, the following material should be available.

- a. String I : HP Part No. 04342-8541
- b. String II : HP Part No. 04342-8542
- c. Bell : HP Part No. 04342-1051
- d. Two screws: HP Part No. 0520-0127

Table 5-8. Frequency Accuracy Check (Option 001)

Frequency Range	Frequency Dial	Specified Accuracy	Counter Reading
10k - 32k	1.0	$\pm 1.5\%$	9.8500 - 10.150 kHz
	1.5	$\pm 1.5\%$	14.775 - 15.225 kHz
	L	$\pm 1.0\%$	24.922 - 25.424 kHz
	3.2	$\pm 1.5\%$	31.520 - 32.480 kHz
32k - 100k	3.2	$\pm 1.5\%$	31.520 - 32.480 kHz
	5.0	$\pm 1.5\%$	49.250 - 50.750 kHz
	L	$\pm 1.0\%$	78.822 - 80.413 kHz
	10	$\pm 1.5\%$	98.500 - 101.50 kHz
100k - 320k	1.0	$\pm 1.5\%$	98.500 - 101.50 kHz
	1.5	$\pm 1.5\%$	147.75 - 152.25 kHz
	L	$\pm 1.0\%$	249.22 - 254.24 kHz
	3.2	$\pm 1.5\%$	315.20 - 324.80 kHz
320k - 1M	3.2	$\pm 1.5\%$	315.20 - 324.80 kHz
	5.0	$\pm 1.5\%$	492.50 - 507.50 kHz
	L	$\pm 1.0\%$	788.22 - 804.13 kHz
	10	$\pm 1.5\%$	985.00 - 1015.0 kHz
1M - 3.2M	1.0	$\pm 1.5\%$	985.00 - 1015.0 kHz
	1.5	$\pm 1.5\%$	1477.5 - 1522.5 kHz
	L	$\pm 1.0\%$	2492.2 - 2542.4 kHz
	3.2	$\pm 1.5\%$	3152.0 - 3248.0 kHz
3.2M - 10M	3.2	$\pm 1.5\%$	3152.0 - 3248.0 kHz
	5.0	$\pm 1.5\%$	4925.0 - 5075.0 kHz
	L	$\pm 1.0\%$	7882.2 - 8041.3 kHz
	10	$\pm 1.5\%$	9.8500 - 10.150 MHz
10M - 32M	1.0	$\pm 2.0\%$	9.8000 - 10.200 MHz
	1.5	$\pm 2.0\%$	14.700 - 15.300 MHz
	L	$\pm 1.0\%$	24.922 - 25.424 MHz
	3.2	$\pm 2.0\%$	31.360 - 32.640 MHz

Table 5-9. Frequency Adjustment (Option 001)

Frequency Range	Frequency Dial	Current Frequency	Adjustment
10k - 32k	1.0	10.000 $\pm 0.150$ kHz	A1A1L1
	3.2	32.000 $\pm 0.480$ kHz	A1A1C1
	L	25.173 $\pm 0.251$ kHz	NO
100k - 320k	1.0	100.00 $\pm 1.50$ kHz	A1A1L3
	3.2	320.00 $\pm 4.80$ kHz	A1A1C5
	L	251.73 $\pm 2.51$ kHz	NO
1M - 3.2M	1.0	1000.0 $\pm 15.0$ kHz	A1A1L5
	3.2	3200.0 $\pm 48.0$ kHz	A1A1C9
	L	2517.3 $\pm 25.1$ kHz	NO
10M - 32M	1.0	10.000 $\pm 0.200$ MHz	A1A1L7
	3.2	32.000 $\pm 0.640$ MHz	A1A1C13
	L	25.173 $\pm 0.251$ MHz	NO
32k - 100k	3.2	32.000 $\pm 0.480$ kHz	A1A1L2
	10	100.00 $\pm 1.50$ kHz	A1A1C3
	L1	79.618 $\pm 0.796$ kHz	NO

(Continued)

Table 5-9. Frequency Accuracy Check (Option 001)

Frequency Range	Frequency Dial	Current Frequency	Adjustment
320k - 1M	3.2	320.00 ± 4.80 kHz	A1A1L4
	10	1000.0 ± 15.0 kHz	A1A1C7
	L	796.18 ± 7.96 kHz	NO
3.2M - 10M	3.2	3200.0 ± 48.0 kHz	A1A1L6
	10	10.000 ± 0.150 MHz	A1A1C11
	L	7961.8 ± 79.6 kHz	NO

5-40. The restringing procedure of FREQUENCY dial is shown in Figure 5-9:

5-41. C DIAL

5-42. Material Required. Before attempting to restring the Tuning Capacitor dial, the following materials should be available.

- String I : HP Part No. 04342-8541
- String II : HP Part No. 04342-8544
- Belt : HP Part No. 04342-1052
- Two screws: HP Part No. 0520-0127

5-43. The restringing procedure of C dial is shown in Figure 5-10.

5-44. Δ C DIAL

5-45. Material Required. Before attempting to restring the Δ C dial, the following materials should be available.

- String I : HP Part No. 04342-8541
- String II : HP Part No. 04342-8543
- Belt : HP Part No. 04342-1053
- Two screws: HP Part No. 0520-0127

5-46. The restringing procedure of Δ C dial is shown in Figure 5-11:

5-47. TROUBLESHOOTING PROCEDURES

5-48. The following paragraphs contain procedures designed to assist in isolating a malfunction(s). These operations should be undertaken only after it has been established that the difficulty cannot be eliminated by the Adjustment and Calibration Procedure(s). An investigation should also be made to insure that the trouble is not a result of conditions external to the 4342A.

5-49. MALFUNCTION AT TURN ON

5-50. If LINE ON/OFF Switch cannot be locked, replace the switch(HP Part No. 3101-0263). If LINE ON/OFF Switch can be locked but any indicator lamps (FREQUENCY Dial Indicator, Frequency Multiplier Indicator and Meter Scale Indicator) do not light, make the following check:

- Is each one of FREQUENCY RANGE Switches and Q RANGE Switches depressed and locked?

- Is Line Voltage Selector Switch on the rear panel set for power source correctly?
- Is the power cord plugged into the 4342A and power source?
- Is the line FUSE good?
- Is AC power available at source?
- Are all power supplies of the 4342A good?

5-51. MALFUNCTION DURING METER ZEROING

5-52. If the 4342A will turn on, but malfunctions when the meter zeroing is attempted according to the procedure in Figure 3-6, check DC Amplifier (A6) the meter (M1) and the Power Supply (P/O A8).

5-53. MALFUNCTION DURING Q MEASUREMENT

5-54. If the meter indication of the 4342A is not correct during Q measurement, the trouble can be isolated to one of two major blocks (oscillator or voltmeter) in the following manner:

- Connect an AC Voltmeter to Lo and GND terminals (See Page 5-7, Figure 5-6). Set Q range to 30.

Note

Check 3406A accuracy in the 10 - 100kHz range.

- Turn the 4342A FREQUENCY RANGE switch and FREQUENCY dial through the entire frequency range. The external AC Voltmeter should indicate 30mVrms ±3% between 22kHz and 30MHz (between 10kHz and 32MHz in Option 001) and 30mVrms ±5% between 30MHz and 70MHz. If not, check the oscillator section according to Troubleshooting Tree, Table 5-10. If the meter indication is normal, check the voltmeter section according to Troubleshooting Tree, Table 5-11.

5-55. MALFUNCTION DURING Q LIMIT OPERATION

5-56. If the 4342A will function on Q measurement, but malfunctions during Q LIMIT operation, check Q LIMIT SELECTOR Assembly A7.

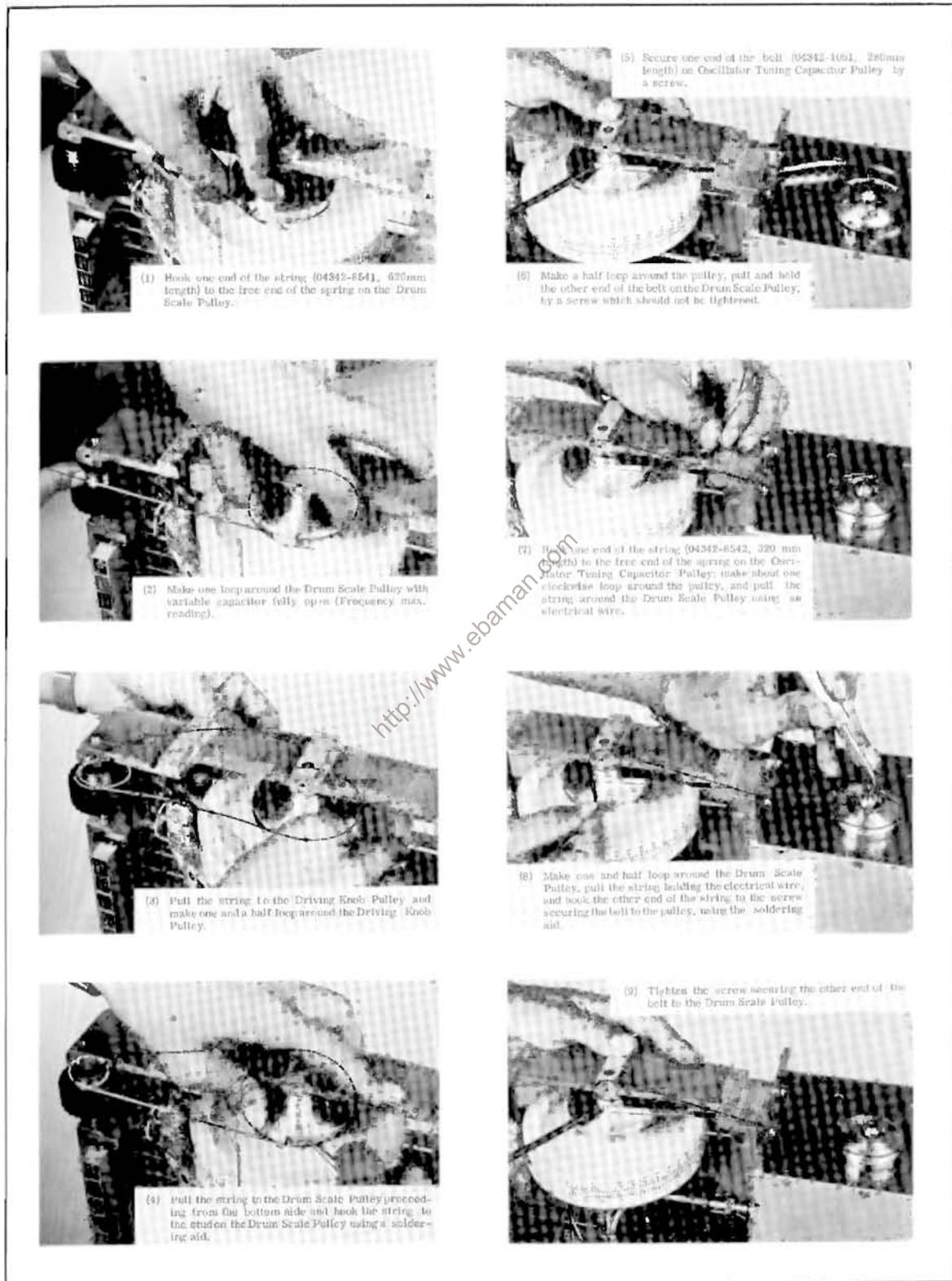


Figure 5-9. Frequency Dial Restring

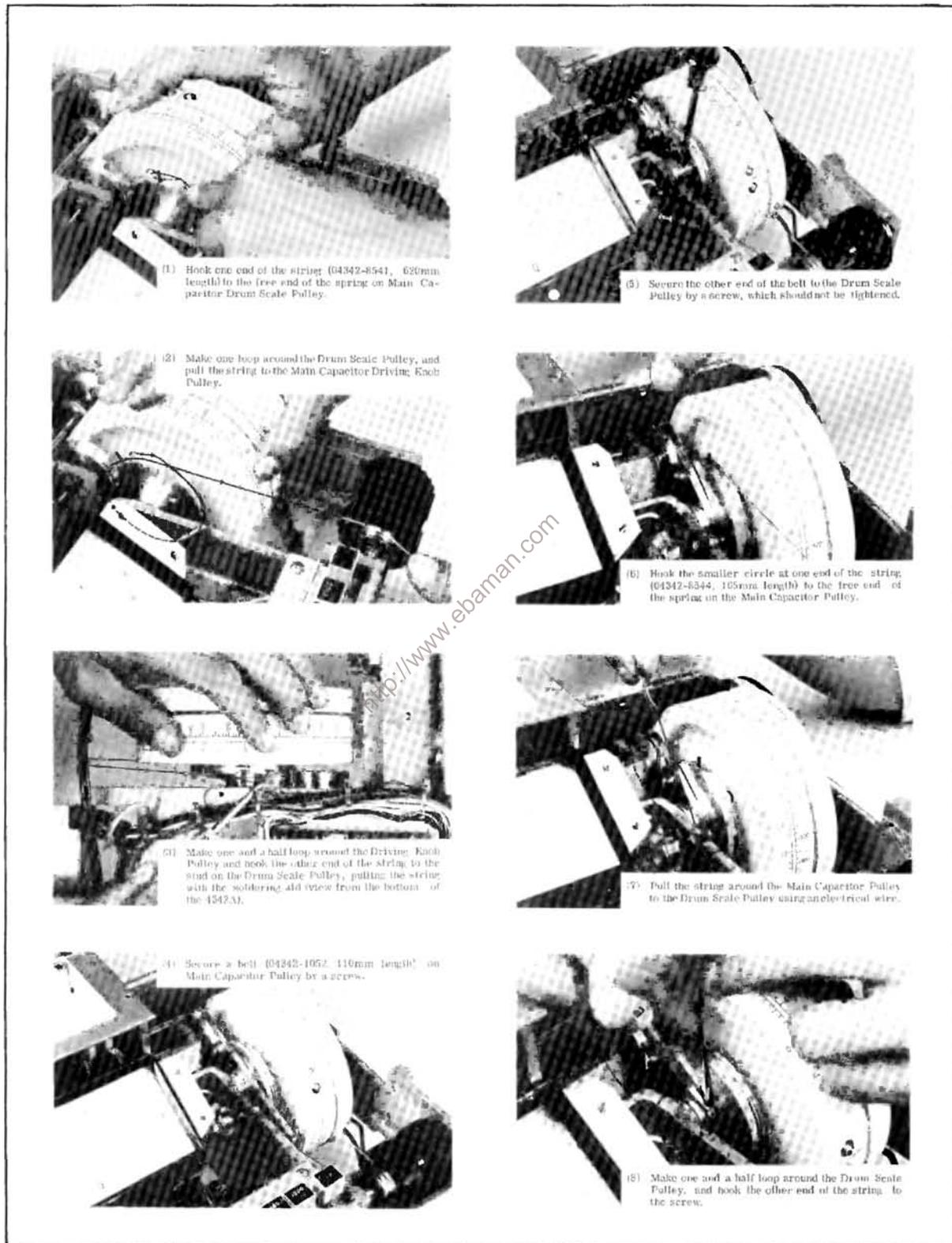


Figure 5-10. Main C Dial Restring

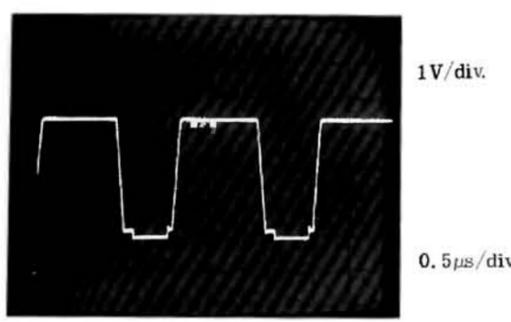


Figure A

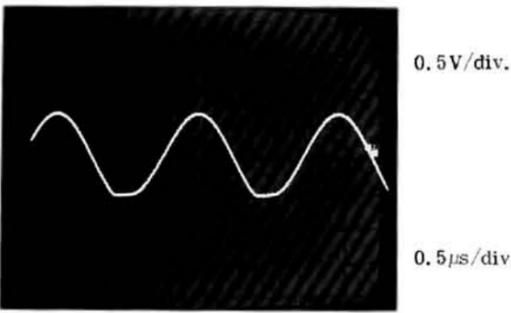


Figure B

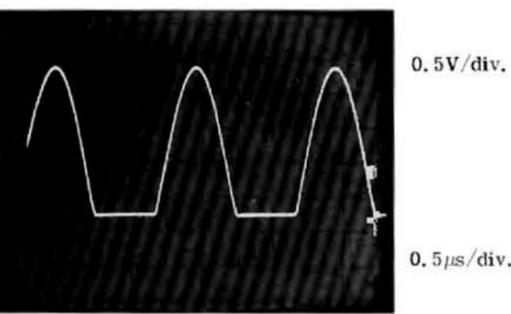
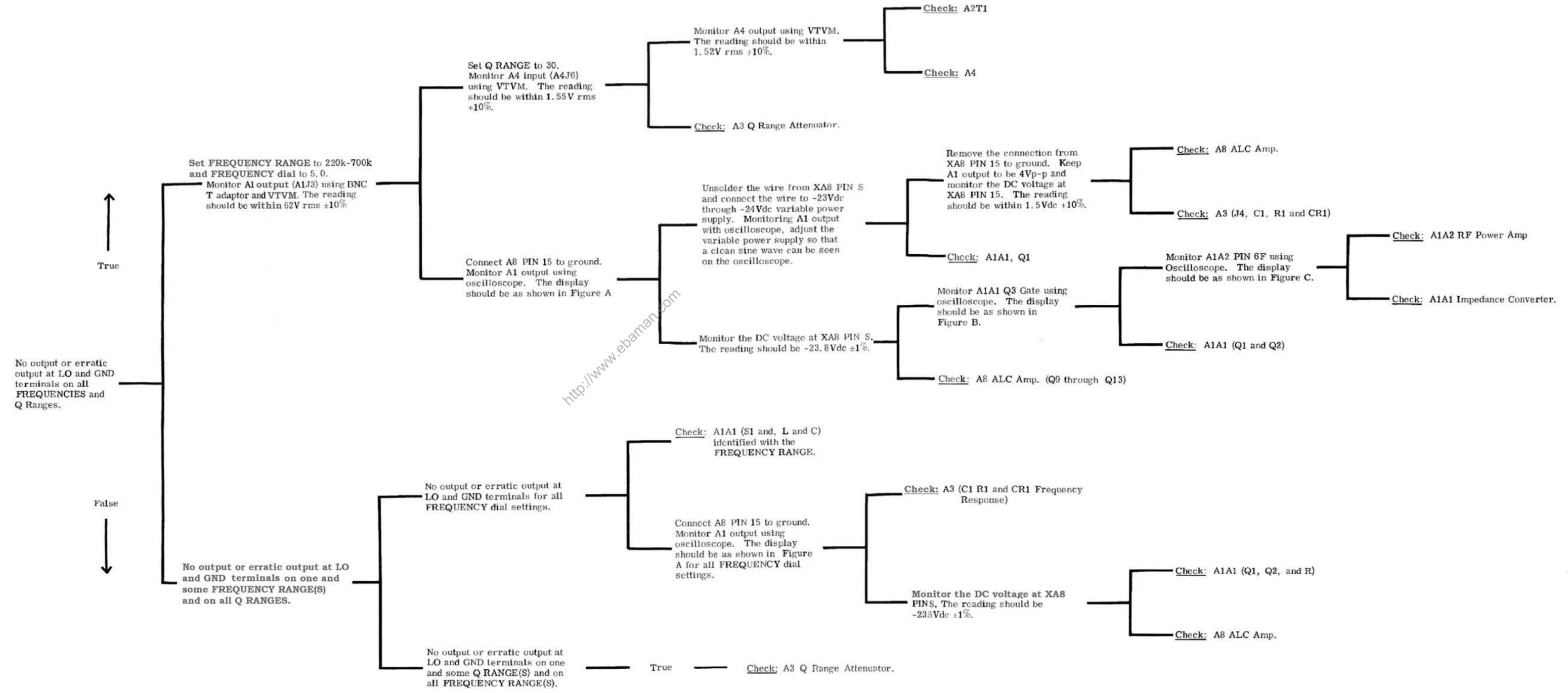
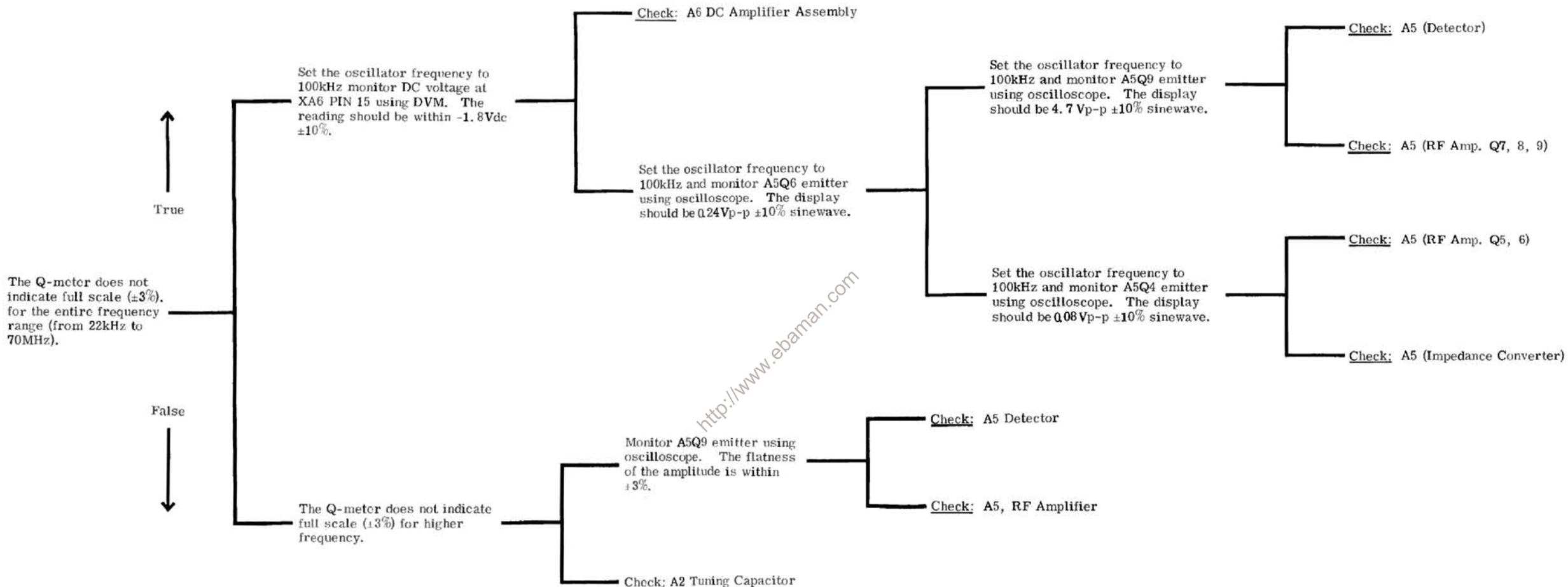


Figure C





**SET-UP**

Connect the oscillator or a signal generator to HI and GROUND terminals terminated with 50Ω resistor and set the output to 0.9V rms monitoring with a HF AC Voltmeter. Set C and ΔC dial to minimum.

Table 5-11 Troubleshooting, Voltmeter Section

### PERFORMANCE CHECK TEST CARD

Hewlett-Packard Model 4342A  
Q Meter  
Serial No. \_\_\_\_\_

Test Performed by \_\_\_\_\_  
Date \_\_\_\_\_

DESCRIPTION	CHECK	
<b>1. FREQUENCY ACCURACY: STANDARD</b>		
	Counter Reading	
22 kHz - 70 kHz Range	22 kHz	21.670 kHz < _____ < 22.330 kHz
	L	24.922 kHz < _____ < 25.424 kHz
	50 kHz	49.250 kHz < _____ < 50.750 kHz
	70 kHz	68.950 kHz < _____ < 71.050 kHz
70 kHz - 220 kHz Range	70 kHz	68.950 kHz < _____ < 71.050 kHz
	L	78.822 kHz < _____ < 80.413 kHz
	150 kHz	147.75 kHz < _____ < 152.25 kHz
	220 kHz	216.70 kHz < _____ < 223.30 kHz
220 kHz - 700 kHz Range	220 kHz	216.70 kHz < _____ < 223.30 kHz
	L	249.22 kHz < _____ < 254.24 kHz
	500 kHz	492.50 kHz < _____ < 507.50 kHz
	700 kHz	689.50 kHz < _____ < 710.50 kHz
700 kHz - 2.2 MHz Range	700 kHz	689.50 kHz < _____ < 710.50 kHz
	L	788.22 kHz < _____ < 804.13 kHz
	1.5 MHz	1477.5 kHz < _____ < 1522.5 kHz
	2.2 MHz	2167.0 kHz < _____ < 2233.0 kHz
2.2 MHz - 7.0 MHz Range	2.2 MHz	2167.0 kHz < _____ < 2233.0 kHz
	L	2492.2 kHz < _____ < 2542.4 kHz
	5.0 MHz	4925.0 kHz < _____ < 5075.0 kHz
	7.0 MHz	6895.0 kHz < _____ < 7105.0 kHz
7.0 MHz - 22 MHz Range	7.0 MHz	6895.0 kHz < _____ < 7105.0 kHz
	L	7882.2 kHz < _____ < 8041.3 kHz
	15 MHz	14.775 MHz < _____ < 15.225 MHz
	22 MHz	21.670 MHz < _____ < 22.330 MHz
22 MHz - 70 MHz Range	22 MHz	21.560 MHz < _____ < 22.440 MHz
	L	24.922 MHz < _____ < 25.424 MHz
	50 MHz	49.000 MHz < _____ < 51.000 MHz
	70 MHz	68.600 MHz < _____ < 71.400 MHz
<b>1'. FREQUENCY ACCURACY: OPTION 001</b>		
	Counter Reading	
10 kHz - 32 kHz Range	10 kHz	9.8500 kHz < _____ < 10.150 kHz
	15 kHz	14.775 kHz < _____ < 15.225 kHz
	L	24.922 kHz < _____ < 25.424 kHz
	32 kHz	31.520 kHz < _____ < 32.480 kHz
32 kHz - 100 kHz Range	32 kHz	31.520 kHz < _____ < 32.480 kHz
	50 kHz	49.250 kHz < _____ < 50.750 kHz
	L	78.822 kHz < _____ < 80.413 kHz
	100 kHz	98.500 kHz < _____ < 101.50 kHz
100 kHz - 320 kHz Range	100 kHz	98.500 kHz < _____ < 101.50 kHz
	150 kHz	147.75 kHz < _____ < 152.25 kHz
	L	249.22 kHz < _____ < 254.24 kHz
	320 kHz	315.20 kHz < _____ < 324.80 kHz

**PERFORMANCE CHECK TEST CARD**

<p><b>1'. FREQUENCY ACCURACY: OPTION 001</b> (Cont'd)</p> <table border="0"> <tr> <td>320 kHz - 1.0 MHz Range</td> <td>320 kHz 500 kHz L 1.0 MHz</td> </tr> <tr> <td>1.0 MHz - 3.2 MHz Range</td> <td>1.0 MHz 1.5 MHz L 3.2 MHz</td> </tr> <tr> <td>3.2 MHz - 10 MHz Range</td> <td>3.2 MHz 5.0 MHz L 10 MHz</td> </tr> <tr> <td>10 MHz - 32 MHz Range</td> <td>10 MHz 15 MHz L 32 MHz</td> </tr> </table>	320 kHz - 1.0 MHz Range	320 kHz 500 kHz L 1.0 MHz	1.0 MHz - 3.2 MHz Range	1.0 MHz 1.5 MHz L 3.2 MHz	3.2 MHz - 10 MHz Range	3.2 MHz 5.0 MHz L 10 MHz	10 MHz - 32 MHz Range	10 MHz 15 MHz L 32 MHz	<p align="center">Counter Reading</p> <table border="0"> <tr> <td>315.20 kHz</td> <td>&lt; _____ &lt;</td> <td>324.80 kHz</td> </tr> <tr> <td>492.50 kHz</td> <td>&lt; _____ &lt;</td> <td>507.50 kHz</td> </tr> <tr> <td>788.22 kHz</td> <td>&lt; _____ &lt;</td> <td>804.13 kHz</td> </tr> <tr> <td>985.00 kHz</td> <td>&lt; _____ &lt;</td> <td>1015.0 kHz</td> </tr> <tr> <td>985.00 kHz</td> <td>&lt; _____ &lt;</td> <td>1015.0 kHz</td> </tr> <tr> <td>1477.5 kHz</td> <td>&lt; _____ &lt;</td> <td>1522.5 kHz</td> </tr> <tr> <td>2492.2 kHz</td> <td>&lt; _____ &lt;</td> <td>2542.4 kHz</td> </tr> <tr> <td>3152.0 kHz</td> <td>&lt; _____ &lt;</td> <td>3248.0 kHz</td> </tr> <tr> <td>3152.0 kHz</td> <td>&lt; _____ &lt;</td> <td>3248.0 kHz</td> </tr> <tr> <td>4925.0 kHz</td> <td>&lt; _____ &lt;</td> <td>5075.0 kHz</td> </tr> <tr> <td>7882.2 kHz</td> <td>&lt; _____ &lt;</td> <td>8041.3 kHz</td> </tr> <tr> <td>9.8500 MHz</td> <td>&lt; _____ &lt;</td> <td>10.150 MHz</td> </tr> <tr> <td>9.8000 MHz</td> <td>&lt; _____ &lt;</td> <td>10.200 MHz</td> </tr> <tr> <td>14.700 MHz</td> <td>&lt; _____ &lt;</td> <td>15.300 MHz</td> </tr> <tr> <td>24.922 MHz</td> <td>&lt; _____ &lt;</td> <td>25.424 MHz</td> </tr> <tr> <td>31.360 MHz</td> <td>&lt; _____ &lt;</td> <td>32.640 MHz</td> </tr> </table>	315.20 kHz	< _____ <	324.80 kHz	492.50 kHz	< _____ <	507.50 kHz	788.22 kHz	< _____ <	804.13 kHz	985.00 kHz	< _____ <	1015.0 kHz	985.00 kHz	< _____ <	1015.0 kHz	1477.5 kHz	< _____ <	1522.5 kHz	2492.2 kHz	< _____ <	2542.4 kHz	3152.0 kHz	< _____ <	3248.0 kHz	3152.0 kHz	< _____ <	3248.0 kHz	4925.0 kHz	< _____ <	5075.0 kHz	7882.2 kHz	< _____ <	8041.3 kHz	9.8500 MHz	< _____ <	10.150 MHz	9.8000 MHz	< _____ <	10.200 MHz	14.700 MHz	< _____ <	15.300 MHz	24.922 MHz	< _____ <	25.424 MHz	31.360 MHz	< _____ <	32.640 MHz
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<p><b>2. Q RANGE</b></p> <table border="0"> <tr> <td>Q Range</td> <td>30 100 300 1000</td> </tr> </table>	Q Range	30 100 300 1000	<p align="center">Digital Voltmeter Reading</p> <table border="0"> <tr> <td>920.6 mV</td> <td>&lt; _____ &lt;</td> <td>977.4 mV</td> </tr> <tr> <td>873.0 mV</td> <td>&lt; _____ &lt;</td> <td>927.0 mV</td> </tr> <tr> <td>920.6 mV</td> <td>&lt; _____ &lt;</td> <td>977.4 mV</td> </tr> <tr> <td>873.0 mV</td> <td>&lt; _____ &lt;</td> <td>927.0 mV</td> </tr> </table>	920.6 mV	< _____ <	977.4 mV	873.0 mV	< _____ <	927.0 mV	920.6 mV	< _____ <	977.4 mV	873.0 mV	< _____ <	927.0 mV																																										
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<p><b>3. ΔQ RANGE</b></p> <table border="0"> <tr> <td>Q Range</td> <td>100</td> </tr> <tr> <td>ΔQ Range</td> <td>10</td> </tr> </table>	Q Range	100	ΔQ Range	10	<p align="center">Digital Voltmeter Reading</p> <table border="0"> <tr> <td>873.0 mV</td> <td>&lt; _____ &lt;</td> <td>927.0 mV</td> </tr> <tr> <td>890.0 mV</td> <td>&lt; _____ &lt;</td> <td>910.0 mV</td> </tr> </table>	873.0 mV	< _____ <	927.0 mV	890.0 mV	< _____ <	910.0 mV																																														
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<p><b>4. CAPACITANCE ACCURACY</b></p> <table border="0"> <tr> <td>C Dial</td> <td>ΔC Dial</td> </tr> <tr> <td>25 pF</td> <td>-5 pF</td> </tr> <tr> <td>25 pF</td> <td>0</td> </tr> <tr> <td>25 pF</td> <td>+5 pF</td> </tr> <tr> <td>100 pF</td> <td>0</td> </tr> <tr> <td>200 pF</td> <td>0</td> </tr> <tr> <td>300 pF</td> <td>0</td> </tr> <tr> <td>400 pF</td> <td>0</td> </tr> <tr> <td>470 pF</td> <td>0</td> </tr> <tr> <td>470 pF</td> <td>+5 pF</td> </tr> </table>	C Dial	ΔC Dial	25 pF	-5 pF	25 pF	0	25 pF	+5 pF	100 pF	0	200 pF	0	300 pF	0	400 pF	0	470 pF	0	470 pF	+5 pF	<p align="center">Capacitance Bridge Reading</p> <table border="0"> <tr> <td>18.9 pF</td> <td>&lt; _____ &lt;</td> <td>21.1 pF</td> </tr> <tr> <td>23.9 pF</td> <td>&lt; _____ &lt;</td> <td>26.1 pF</td> </tr> <tr> <td>28.9 pF</td> <td>&lt; _____ &lt;</td> <td>31.1 pF</td> </tr> <tr> <td>98.9 pF</td> <td>&lt; _____ &lt;</td> <td>101.1 pF</td> </tr> <tr> <td>197.9 pF</td> <td>&lt; _____ &lt;</td> <td>202.1 pF</td> </tr> <tr> <td>296.9 pF</td> <td>&lt; _____ &lt;</td> <td>303.1 pF</td> </tr> <tr> <td>395.9 pF</td> <td>&lt; _____ &lt;</td> <td>404.1 pF</td> </tr> <tr> <td>465.2 pF</td> <td>&lt; _____ &lt;</td> <td>474.8 pF</td> </tr> <tr> <td>470.2 pF</td> <td>&lt; _____ &lt;</td> <td>479.8 pF</td> </tr> </table>	18.9 pF	< _____ <	21.1 pF	23.9 pF	< _____ <	26.1 pF	28.9 pF	< _____ <	31.1 pF	98.9 pF	< _____ <	101.1 pF	197.9 pF	< _____ <	202.1 pF	296.9 pF	< _____ <	303.1 pF	395.9 pF	< _____ <	404.1 pF	465.2 pF	< _____ <	474.8 pF	470.2 pF	< _____ <	479.8 pF									
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<p><b>5. Q OVER LIMIT OPERATION</b></p> <table border="0"> <tr> <td>Q Limit Setting</td> <td>60</td> </tr> <tr> <td>Meter Indication</td> <td>50</td> </tr> <tr> <td>Meter Indication</td> <td>≥ 60</td> </tr> </table>	Q Limit Setting	60	Meter Indication	50	Meter Indication	≥ 60	<p align="center">Over Limit Lamp</p> <table border="0"> <tr> <td>On</td> <td><input type="checkbox"/></td> </tr> <tr> <td>Off</td> <td><input type="checkbox"/></td> </tr> <tr> <td>On</td> <td><input type="checkbox"/></td> </tr> </table>	On	<input type="checkbox"/>	Off	<input type="checkbox"/>	On	<input type="checkbox"/>																																												
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## SECTION VI

### REPLACEABLE PARTS

#### 6-1. INTRODUCTION

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

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

6-4. Exploded views of major parts of the instrument are given in Figure 6-1 through 6-8 to aid in identifying mechanical parts. The parts in these figures are keyed to the mechanical parts index which are also included in each figure.

6-5. Replaceable Part Lists for Option 001 are given in Appendix. Changes were made in Assembly A1A1 and Assembly A5 only.

#### 6-6. ORDERING INFORMATION

6-7. To obtain replacement parts, address order or inquiry to your local Hewlett-Packard Field Office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers.

6-8. To obtain a part that is not listed, include:

- a. Instrument model number.
- b. Instrument serial number
- c. Description of the part.
- d. Function and location of the part.

Table 6-1. List of Reference Designators and Abbreviations

REFERENCE DESIGNATORS			
<b>A</b> = assembly <b>B</b> = motor <b>BT</b> = battery <b>C</b> = capacitor <b>CP</b> = coupler <b>CR</b> = diode <b>DL</b> = delay line <b>DS</b> = device signaling (lamp)	<b>E</b> = misc electronic part <b>F</b> = fuse <b>FL</b> = filter <b>J</b> = jack <b>K</b> = relay <b>L</b> = inductor <b>M</b> = meter <b>MP</b> = mechanical part	<b>P</b> = plug <b>Q</b> = transistor <b>R</b> = resistor <b>RT</b> = thermistor <b>S</b> = switch <b>T</b> = transformer <b>TB</b> = terminal board <b>TP</b> = test point	<b>V</b> = vacuum, tube, neon bulb, photocell, etc. <b>VR</b> = voltage regulator <b>W</b> = cable <b>X</b> = socket <b>Y</b> = crystal
ABBREVIATIONS			
<b>A</b> = ampere <b>A. F. C.</b> = automatic frequency control <b>AMPL</b> = amplifier <b>B. F. O.</b> = beat frequency oscillator <b>BE CU</b> = beryllium copper <b>BH</b> = binder head <b>BP</b> = bandpass <b>BR</b> = brass <b>BWO</b> = backward wave oscillator  <b>CCW</b> = counter-clockwise <b>CER</b> = ceramic <b>CMO</b> = cabinet mount only <b>COEF</b> = coefficient <b>COM</b> = common <b>COMP</b> = composition <b>COMPL</b> = complete <b>CONN</b> = connector <b>CP</b> = cadmium plate <b>CRT</b> = cathode-ray tube <b>CW</b> = clockwise  <b>DEPC</b> = deposited carbon <b>DR</b> = drive  <b>ELECT</b> = electrolytic <b>ENCAP</b> = encapsulated <b>EXT</b> = external  <b>F</b> = farads <b>FH</b> = flat head <b>FIL H</b> = fillister head <b>FXD</b> = fixed  <b>GE</b> = germanium <b>GL</b> = glass <b>GRD</b> = ground(ed)	<b>H</b> = henries <b>HEX</b> = hexagonal <b>HG</b> = mercury <b>HR</b> = hour(s)  <b>IF</b> = intermediate freq <b>IMPG</b> = impregnated <b>INCD</b> = incandescent <b>INCL</b> = include(s) <b>INS</b> = insulation(ed) <b>INT</b> = internal  <b>K</b> = kilo = 1000  <b>LH</b> = left hand <b>LIN</b> = linear taper <b>LK WASH</b> = lock washer <b>LOG</b> = logarithmic taper <b>LPF</b> = low pass filter  <b>M</b> = milli = 10 <sup>-3</sup> <b>MEG</b> = meg = 10 <sup>6</sup> <b>MET FLM</b> = metal film <b>MET OX</b> = metallic oxide <b>MFR</b> = manufacturer <b>MINAT</b> = miniature <b>MOM</b> = momentary <b>MTG</b> = mounting <b>MY</b> = "mylar"  <b>N</b> = nano = 10 <sup>-9</sup> <b>N/C</b> = normally closed <b>NE</b> = neon <b>NI PL</b> = nickel plate <b>N/O</b> = normally open <b>NPO</b> = negative positive zero (zero temperature coefficient)	<b>NPN</b> = negative-positive-negative <b>NRFR</b> = not recommended for field replacement <b>NSR</b> = not separately replaceable  <b>OBD</b> = order by description <b>OH</b> = oval head <b>OX</b> = oxide  <b>P</b> = peak <b>PC</b> = printed circuit <b>PF</b> = picofarads = 10 farads  <b>PH BRZ</b> = phosphor bronze <b>PHL</b> = Phillips <b>PIV</b> = peak inverse voltage <b>PNP</b> = positive-negative-positive  <b>P/O</b> = part of <b>POLY</b> = polystyrene <b>PORC</b> = porcelain <b>POS</b> = position(s) <b>POT</b> = potentiometer <b>PP</b> = peak-to-peak <b>PT</b> = point <b>PWV</b> = peak working voltage  <b>RECT</b> = rectifier <b>RF</b> = radio frequency <b>RH</b> = round head or right hand <b>RMO</b> = rack mount only	<b>RMS</b> = root-mean square <b>RWV</b> = reverse working voltage  <b>S-B</b> = slow blow <b>SCR</b> = screw <b>SE</b> = selenium <b>SECT</b> = section(s) <b>SEMICON</b> = semiconductor <b>SI</b> = silicon <b>SIL</b> = silver <b>SL</b> = slide <b>SPG</b> = spring <b>SPL</b> = special <b>SST</b> = stainless steel <b>SR</b> = split ring <b>STL</b> = steel  <b>TA</b> = tantalum <b>TD</b> = time delay <b>TGL</b> = toggle <b>THD</b> = thread <b>TI</b> = titanium <b>TOL</b> = tolerance <b>TRIM</b> = trimmer <b>TWT</b> = traveling wave tube  <b>U</b> = micro = 10 <sup>-6</sup> <b>VAR</b> = variable <b>VDCW</b> = dc working volts  <b>W/</b> = with <b>W</b> = watts <b>WIV</b> = working inverse voltage <b>WW</b> = wirewound <b>W/O</b> = without

Table 6-2. Reference Designation Index

Reference Designation	Part No.	Description	Note
A1	04342-7020	OSCILLATOR ASS'Y	
A1A1	04342-7751 04342-8751	OSCILLATOR BOARD ASS'Y BOARD:BLANK PC	
A1A1C1	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C2*	0160-2248	C:FXD CER 4.3pF $\pm 0.25$ pF 500VDCW	
A1A1C3	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C4*	0150-2243	C:FXD CER 2.7pF $\pm 0.25$ pF 500VDCW	
A1A1C5	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C6*	0160-2240	C:FXD CER 2.0pF $\pm 0.25$ pF 500VDCW	
A1A1C7	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C8*	0160-2247	C:FXD CER 3.9pF $\pm 0.25$ pF 500VDCW	
A1A1C9	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C10*	0160-2253	C:FXD CER 6.8pF $\pm 0.25$ pF 500VDCW	
A1A1C11	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C12*	0160-2256	C:FXD CER 9.1pF $\pm 0.25$ pF 500VDCW	
A1A1C13	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C14*	0160-2241	C:FXD CER 2.2pF $\pm 0.25$ pF 500VDCW	
A1A1C15		NOT ASSIGNED	
A1A1C16		NOT ASSIGNED	
A1A1C17	0180-1743	C:FXD TA 0.1 $\mu$ F 10% 35VDCW	
A1A1C18	0160-2264	C:FXD CER 20pF 5% 500VDCW	
A1A1C19	0160-0417	C:FXD CER 150pF 10% 500VDCW	
A1A1C20	0121-0232	C:VAR AIR 12 - 460pF	
A1A1C21	0160-2238	C:FXD CER 1.5pF 500VDCW	
A1A1C22	0180-0291	C:FXD TA 1 $\mu$ F 10% 35VDCW	
A1A1C23*	0160-2251	C:FXD CER 5.6pF 500VDCW	
A1A1C24	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A1C25		NOT ASSIGNED	
A1A1C26	0180-0291	C:FXD TA 1 $\mu$ F 10% 35VDCW	
A1A1C27	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A1C28	0160-2266	C:FXD CER 24pF 5% 500VDCW	
A1A1C29	0160-2266	C:FXD CER 24pF 5% 500VDCW	
A1A1C30	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A1C31	0150-0093	C:FXD CER 0.01 $\mu$ F -20% +80% 100VDCW	
A1A1L1	04342-8603	COIL:VAR 39 - 58mH	
A1A1L2	04342-8604	COIL:VAR 9 - 14mH	
A1A1L3	04342-8605	COIL:VAR 1 - 1.6mH	
A1A1L4	04342-8606	COIL:VAR 102 - 150 $\mu$ H	
A1A1L5	04342-8607	COIL:VAR 11 - 15 $\mu$ H	

See list of abbreviations in introduction to this section

Section VI  
Table 6-2

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Notes
A1A1L6	04342-8608	COIL:VAR 1 - 1.3 $\mu$ H	
A1A1L7	04342-8609	COIL:VAR 0.09 - 0.1 $\mu$ H	
A1A1L8	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A1L9	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A1L10	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A1Q1	1854-0071	TRANSISTOR:NPN SILICON	
A1A1Q2	1854-0296	TRANSISTOR:NPN SILICON	
A1A1Q3	1855-0022	TRANSISTOR:FIELD EFFECT N-CHANNEL	
A1A1Q4	1853-0034	TRANSISTOR:PNP SILICON	
A1A1Q5	1854-0019	TRANSISTOR:NPN SILICON	
A1A1Q6	1854-0019	TRANSISTOR:NPN SILICON	
A1A1R1*	0698-4469	R:FXD MET FLM 1.15k $\Omega$ 1% 1/8W	
A1A1R2*	0757-0417	R:FXD MET FLM 562 $\Omega$ 1% 1/8W	
A1A1R3*	0757-0411	R:FXD MET FLM 332 $\Omega$ 1% 1/8W	
A1A1R4*	0698-3488	R:FXD MET FLM 442 $\Omega$ 1% 1/8W	
A1A1R5*	0698-3446	R:FXD MET FLM 383 $\Omega$ 1% 1/8W	
A1A1R6*	0698-6324	R:FXD MET FLM 187 $\Omega$ 1% 1/8W	
A1A1R7*	0698-3243	R:FXD MET FLM 178k $\Omega$ 1% 1/8W	
A1A1R8	0698-0085	R:FXD MET FLM 2.61k $\Omega$ 1% 1/8W	
A1A1R9	0698-3359	R:FXD MET FLM 12.7k $\Omega$ 1% 1/8W	
A1A1R10	0757-0279	R:FXD MET FLM 3.16k $\Omega$ 1% 1/8W	
A1A1R11	0698-3156	R:FXD MET FLM 14.7k $\Omega$ 1% 1/8W	
A1A1R12	0683-2265	R:FXD COMP 22M $\Omega$ 5% 1/4W	
A1A1R13	0757-0123	R:FXD MET FLM 34.8k $\Omega$ 1% 1/8W	
A1A1R14	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A1A1R15	0698-3156	R:FXD MET FLM 14.7k $\Omega$ 1% 1/8W	
A1A1R16	0698-3153	R:FXD MET FLM 3.83k $\Omega$ 1% 1/8W	
A1A1R17	0698-3151	R:FXD MET FLM 2.87k $\Omega$ 1% 1/8W	
A1A1R18	0698-4453	R:FXD MET FLM 402 $\Omega$ 1% 1/8W	
A1A1R19	0698-4125	R:FXD MET FLM 953 $\Omega$ 1% 1/8W	
A1A1R20*	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A1A1R21	0757-0821	R:FXD MET FLM 1.21k $\Omega$ 1% 1/2W	
A1A1R22	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A1A1R23	0757-0453	R:FXD MET FLM 30.1k $\Omega$ 1% 1/8W	
A1A1S1	3101-0260	SWITCH:PUSH BUTTON 7-RANGE	
A1A1XA1A2	1251-0478	CONNECTOR:PRINTED CIRCUIT 12-CONTACT	
		MISCELLANEOUS	
	04342-1026	PLATE:ANGLE	
	04342-3022	NUT:HEX FOR FERRITE CORE 7 REQ'D	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A1A2	04342-7702 04342-8702	RF POWER AMPLIFIER ASS'Y BOARD:BLANK PC	
A1A2C1	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A2C2	0180-0376	C:FXD TA 0.47 $\mu$ F 10% 35VDCW	
A1A2C3	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A2C4	0180-0197	C:FXD TA 2.2 $\mu$ F 10% 20VDCW	
A1A2C5	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A2C6	0160-2203	C:FXD MICA 91pF 5% 300VDCW	
A1A2C7	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A2J1	1250-0257	CONNECTOR:RF FEMALE	
A1A2L1	9140-0158	COIL:FXD RF 1 $\mu$ H 10%	
A1A2L2	9140-0098	COIL:FXD RF 2.2 $\mu$ H 10%	
A1A2L3	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A2L4	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A2Q1	1854-0091	TRANSISTOR:NPN SILICON	
A1A2Q2	1854-0091	TRANSISTOR:NPN SILICON	
A1A2Q3	1854-0091	TRANSISTOR:NPN SILICON	
A1A2Q4	1854-0332	TRANSISTOR:NPN SILICON	
A1A2R1	0757-0395	R:FXD MET FLM 56.2 $\Omega$ 1% 1/8W	
A1A2R2	0698-0085	R:FXD MET FLM 2.61k $\Omega$ 1% 1/8W	
A1A2R3	0698-4422	R:FXD MET FLM 1.27k $\Omega$ 1% 1/8W	
A1A2R4	0757-0424	R:FXD MET FLM 1.1k $\Omega$ 1% 1/8W	
A1A2R5	0757-0394	R:FXD MET FLM 51.1 $\Omega$ 1% 1/8W	
A1A2R6	0698-4418	R:FXD MET FLM 205 $\Omega$ 1% 1/8W	
A1A2R7	0757-0294	R:FXD MET FLM 17.8 $\Omega$ 1% 1/8W	
A1A2R8	0757-0294	R:FXD MET FLM 17.8 $\Omega$ 1% 1/8W	
A1A2R9	0698-3439	R:FXD MET FLM 178 $\Omega$ 1% 1/8W	
A1A2R10	0698-3438	R:FXD MET FLM 147 $\Omega$ 1% 1/8W	
A1A2R11	0698-3430	R:FXD MET FLM 21.5 $\Omega$ 1% 1/8W	
A1A2R12	0757-0159	R:FXD MET FLM 1000 $\Omega$ 1% 1/2W	
A1A2R13	0698-3628	R:FXD MET OX 220 $\Omega$ 5% 2W	
		MISCELLANEOUS	
	1205-0007	HEAT DISSIPATOR NUT	
	1205-0008	HEAT DISSIPATOR BODY	
A1A3	04342-8709	BOARD:WIRING	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A1C1	0160-2357	C:FXD CER 1000pF -20% +80%	
A1C2	0160-2357	C:FXD CER 1000pF -20% +80%	
A1C3	0160-2357	C:FXD CER 1000pF -20% +80%	
A1J1		NOT ASSIGNED	
A1J2	1250-0314	CONNECTOR:BNC FEMALE	
A1J3	1250-0252	CONNECTOR:BNC FEMALE PART OF A1W1	
	1250-0050	NUT:RF CONNECTOR PART OF A1J3	
	1250-0051	CONTACT:RF CONNECTOR PART OF A1J3	
A1P1	1250-0872	CONNECTOR:RF MALE PART OF A1W1	
A1W1	04342-7601	CABLE ASS'Y:INTER CONNECTING INCLUDING A1J3 AND A1P1	
		MISCELLANEOUS	
		See Figure 6-1.	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A2	04342-7201	TUNING CAPACITOR ASS'Y	
A2C1		C:VAR AIR MAIN 25 - 475pF NOT SEPARATELY REPLACEABLE PART OF A2	
A2C2		C:VAR AIR VERNIER -5 - +5pF NOT SEPARATELY REPLACEABLE PART OF A2	
A2C3	04342-7205	C:FXD AIR 2pF INCLUDING C4	
A2C4	0140-0074	C:FXD MICA 56pF 10% 500VDCW NOT SEPARATELY REPLACEABLE PART OF C3	
A2J1	04342-3231	CONNECTOR:BINDING POST BODY	
A2J2	04342-3259	CAP:BINDING POST	
A2J2	04342-3230	CONNECTOR:BINDING POST BODY	
	04342-3259	CAP:BINDING POST	
A2J3	04342-3239	CONNECTOR:HEXAGONAL GROUND LUG	
	04342-3232	BODY:GROUND LUG	
A2J4	04342-3231	CONNECTOR:BINDING POST BODY	
	04342-3259	CAP:BINDING POST	
A2J5	04342-3230	CONNECTOR:BINDING POST BODY	
	04342-3259	CAP:BINDING POST	
A2J6	04342-3239	CONNECTOR:HEXAGONAL GROUND LUG	
	04342-3232	BODY:GROUND LUG	
A2R1	0757-0398	R:FXD MET FLM 75 $\Omega$ 1% 1/8W	
A2T1	04342-8601	TRANSFORMER:INJECTION	
		MISCELLANEOUS	
		See Figure 6-2.	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A3	04342-7703 04342-8703	Q RANGE ATTENUATOR ASS'Y BOARD:BLANK PC	
A3C1	0160-2145	C:FXD CER 0.005 $\mu$ F -20% +80%	
A3CR1	1901-0347	SEMICON DEVICE:DIODE HOT CARRIER	
A3J1		NOT ASSIGNED	
A3J2		NOT ASSIGNED	
A3J3		NOT ASSIGNED	
A3J4	1250-0257	CONNECTOR:RF FEMALE	
A3J5	1250-0257	CONNECTOR:RF FEMALE	
A3R1	0757-0482	R:FXD MET FLM 511k $\Omega$ 1% 1/8W	
A3R2	0698-2041	R:FXD MET FLM 10.4dB $\pm$ 0.1dB	
A3R3	0698-2040	R:FXD MET FLM 9.6dB $\pm$ 0.1dB	
A3R4	0698-2041	R:FXD MET FLM 10.4dB $\pm$ 0.1dB	
A3S1	3101-0262	SWITCH:PUSH BUTTON 4-RANGE	
A3S2	3101-0261	SWITCH:PUSH BUTTON 1-RANGE	
		MISCELLANEOUS	
	04342-1047 04342-1055	PLATE:SHIELD MOUNTED ON PC BOARD BRACKET:SHIELD MOUNTED ON PC BOARD See Figure 6-3.	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A4	04342-7704 04342-8704	IMPEDANCE CONVERTER ASS'Y BOARD:BLANK PC	
A4C1	0180-0291	C:FXD TA 1 $\mu$ F +10% 35VDCW	
A4C2	0150-0121	C:FXD CER 0.1 $\mu$ F -20% +80% 50VDCW	
A4C3	0180-0228	C:FXD TA 22 $\mu$ F 10% 15VDCW	
A4J1		NOT ASSIGNED	
A4J2		NOT ASSIGNED	
A4J3		NOT ASSIGNED	
A4J4		NOT ASSIGNED	
A4J5		NOT ASSIGNED	
A4J6	1250-0257	CONNECTOR:RF FEMALE	
A4L1	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A4L2	9140-0098	COIL:FXD RF 2.2 $\mu$ H 10%	
A4Q1	1854-0091	TRANSISTOR:NPN SILICON	
A4Q2	1854-0332	TRANSISTOR:NPN SILICON	
A4R1	0757-0395	R:FXD MET FLM 56.2 $\Omega$ 1% 1/8W	
A4R2	0757-0417	R:FXD MET FLM 562 $\Omega$ 1% 1/8W	
A4R3	0698-4431	R:FXD MET FLM 2.05k $\Omega$ 1% 1/8W	
A4R4	0757-0159	R:FXD MET FLM 1k $\Omega$ 1% 1/8W	
A4R5	0698-3628	R:FXD MET OX 220 $\Omega$ 5% 2W	
		MISCELLANEOUS	
	1205-0007	HEAT DISSIPATOR NUT 1 REQ'D	
	1205-0008	HEAT DISSIPATOR BODY 1 REQ'D	
	04342-1223	PLATE	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description
A5	04342-7705 04342-8705	IMPEDANCE CONVERTER & RF AMPLIFIER ASS'Y BOARD:BLANK PC
A5C1	0160-2244	C:FXD CER 3pF $\pm 0.25\mu\text{F}$
A5C2	0180-0197	C:FXD TA 2.2 $\mu\text{F}$ 10% 20VDCW
A5C3	0180-0376	C:FXD TA 0.47 $\mu\text{F}$ 10% 35VDCW
A5C4	0160-2259	C:FXD CER 12pF 5%
A5C5	0180-1745	C:FXD TA 1.5 $\mu\text{F}$ 10% 20VDCW
A5C6	0160-0128	C:FXD CER 2.2 $\mu\text{F}$ 20% 25VDCW
A5C7	0160-0128	C:FXD CER 2.2 $\mu\text{F}$ 20% 25VDCW
A5C8	0160-0128	C:FXD CER 2.2 $\mu\text{F}$ 20% 25VDCW
A5C9	0160-0155	C:FXD MY 0.0033 $\mu\text{F}$ 10% 200VDCW
A5C10	0180-0376	C:FXD TA 0.47 $\mu\text{F}$ 10% 35VDCW
A5C11	0160-0174	C:FXD CER 0.47 $\mu\text{F}$ -20% +80% 25VDCW
A5C12	0160-0128	C:FXD CER 2.2 $\mu\text{F}$ 20% 25VDCW
A5C13	0140-0192	C:FXD MICA 68pF 5% 300VDCW
A5C14	0160-0128	C:FXD CER 2.2 $\mu\text{F}$ 20% 25VDCW
A5C15	0160-2150	C:FXD MICA 33pF 5% 300VDCW
A5C16	0121-0147	C:VAR AIR 2.0 - 19.3pF
A5C17	0160-0128	C:FXD CER 2.2 $\mu\text{F}$ 20% 25VDCW
A5C18	0180-0376	C:FXD TA 0.47 $\mu\text{F}$ 10% 35VDCW
A5C19	0160-0174	C:FXD CER 0.47 $\mu\text{F}$ -20% +80% 25VDCW
A5C20	0150-0121	C:FXD CER 0.1 $\mu\text{F}$ -20% +80% 50VDCW
A5C21	0180-0376	C:FXD TA 0.47 $\mu\text{F}$ 10% 35VDCW
A5C22	0180-0376	C:FXD TA 0.47 $\mu\text{F}$ 10% 35VDCW
A5C23	0180-0291	C:FXD TA 1 $\mu\text{F}$ 10% 35VDCW
A5CR1	1901-0025	SEMICON DEVICE:DIODE SILICON
A5CR2	1910-0016	SEMICON DEVICE:DIODE GERMANIUM
A5CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM
A5CR4	1910-0016	SEMICON DEVICE:DIODE GERMANIUM
A5CR5	1910-0016	SEMICON DEVICE:DIODE GERMANIUM
A5CR6	1910-0016	SEMICON DEVICE:DIODE GERMANIUM
A5L1		NOT ASSIGNED
A5L2	9140-0179	COIL:FXD RF 22 $\mu\text{H}$ 10%
A5Q1	1855-0022	TRANSISTOR:FIELD EFFECT N-CHANNEL
A5Q2	1853-0015	TRANSISTOR:PNP SILICON 2N3640
A5Q3	1854-0023	TRANSISTOR:NPN SILICON
A5Q4	1854-0092	TRANSISTOR:NPN SILICON 2N3563
A5Q5	1854-0296	TRANSISTOR:NPN SILICON MPS6543
A5Q6	1854-0092	TRANSISTOR:NPN SILICON 2N3563
A5Q7	1853-0015	TRANSISTOR:PNP SILICON 2N3640
A5Q8	1854-0233	TRANSISTOR:NPN SILICON 2N3866
A5Q9	1854-0091	TRANSISTOR:NPN SILICON

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A5R1	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A5R2	0698-3151	R:FXD MET FLM 2.87k $\Omega$ 1% 1/8W	
A5R3	0757-0465	R:FXD MET FLM 100k $\Omega$ 1% 1/8W	
A5R4	0757-0465	R:FXD MET FLM 100k $\Omega$ 1% 1/8W	
A5R5	0730-0149	R:FXD C FLM 28.1M $\Omega$ 0.5% 1W	
A5R6	0698-0085	R:FXD MET FLM 2.61k $\Omega$ 1% 1/8W	
A5R7	0698-3155	R:FXD MET FLM 4.64k $\Omega$ 1% 1/8W	
A5R8	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A5R9	0757-0441	R:FXD MET FLM 8.25k $\Omega$ 1% 1/8W	
A5R10	0698-3150	R:FXD MET FLM 2.37k $\Omega$ 1% 1/8W	
A5R11	0698-3439	R:FXD MET FLM 178 $\Omega$ 1% 1/8W	
A5R12	0698-0089	R:FXD MET FLM 1.78k $\Omega$ 1% 1/2W	
A5R13	0698-3430	R:FXD MET FLM 21.5 $\Omega$ 1% 1/8W	
A5R14	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A5R15	0698-3152	R:FXD MET FLM 3.48k $\Omega$ 1% 1/8W	
A5R16	0757-0438	R:FXD MET FLM 5.11k $\Omega$ 1% 1/8W	
A5R17	0757-0440	R:FXD MET FLM 7.5k $\Omega$ 1% 1/8W	
A5R18	0757-0438	R:FXD MET FLM 5.11k $\Omega$ 1% 1/8W	
A5R19	0757-0422	R:FXD MET FLM 909 $\Omega$ 1% 1/8W	
A5R20	0757-0398	R:FXD MET FLM 75 $\Omega$ 1% 1/8W	
A5R21	0757-0294	R:FXD MET FLM 17.8 $\Omega$ 1% 1/8W	
A5R22	0698-4422	R:FXD MET FLM 1.27k $\Omega$ 1% 1/8W	
A5R23	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A5R24	0757-0405	R:FXD MET FLM 162 $\Omega$ 1% 1/8W	
A5R25	0698-3409	R:FXD MET FLM 2.37k $\Omega$ 1% 1/2W	
A5R26	0757-0439	R:FXD MET FLM 6.81k $\Omega$ 1% 1/8W	
A5R27	0757-0290	R:FXD MET FLM 6.19k $\Omega$ 1% 1/8W	
A5R28	0757-0274	R:FXD MET FLM 1.21k $\Omega$ 1% 1/8W	
A5R29	0698-3434	R:FXD MET FLM 34.8 $\Omega$ 1% 1/8W	
A5R30	0757-0419	R:FXD MET FLM 681 $\Omega$ 1% 1/8W	
A5R31	0757-0394	R:FXD MET FLM 51.1 $\Omega$ 1% 1/8W	
A5R32	2100-1986	R:VAR MET FLM 1k $\Omega$ 10% 1/2W	
A5R33	0698-3430	R:FXD MET FLM 21.5 $\Omega$ 1% 1/8W	
A5R34	0698-3700	R:FXD MET FLM 715 $\Omega$ 1% 1/8W	
A5R35	0757-0814	R:FXD MET FLM 511 $\Omega$ 1% 1/2W	
A5R36	0757-0379	R:FXD MET FLM 12.1 $\Omega$ 1% 1/8W	
A5R37	0757-1092	R:FXD MET FLM 287 $\Omega$ 1% 1/2W	
A5R38	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A5R39	0757-0159	R:FXD MET FLM 1k $\Omega$ 1% 1/2W	
A5R40	0698-3152	R:FXD MET FLM 3.48k $\Omega$ 1% 1/8W	
A5R41	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A5R43	2100-1777	R:VAR WW 20k $\Omega$ 5% 1W	
A5R44	0698-3429	R:FXD MET FLM 19.6 $\Omega$ 1% 1/8W	
A5R45	0698-3429	R:FXD MET FLM 19.6 $\Omega$ 1% 1/8W	
	0340-0008	MISCELLANEOUS INSULATOR-STAND OFF 2 REQ'D	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A6	04342-7706 04342-8706	DC AMPLIFIER ASS'Y BOARD:BLANK PC	
A6C1	0160-0127	C:FXD CER 1 $\mu$ F 20% 25VDCW	
A6C2	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A6C3	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A6C4	0180-0197	C:FXD TA 2.2 $\mu$ F 10% 20VDCW	
A6C5	0180-0197	C:FXD TA 2.2 $\mu$ F 10% 20VDCW	
A6CR1	1901-0025	SEMICON DEVICE:DIODE SILICON	
A6CR2	1902-3097	SEMICON DEVICE:DIODE BREAKDOWN 5.23V 2% 400mW	
A6CR3	1902-3097	SEMICON DEVICE:DIODE BREAKDOWN 5.23V 2% 400mW	
A6L1	9140-0179	COIL:FXD RF 22 $\mu$ H 10%	
A6L2	9140-0179	COIL:FXD RF 22 $\mu$ H 10%	
A6Q1	1855-0081	TRANSISTOR:FIELD EFFECT N-CHANNEL	
A6Q2	1855-0049	TRANSISTOR:FIELD EFFECT N-CHANNEL DUAL	
A6Q3	1853-0010	TRANSISTOR:PNP SILICON	
A6Q4	1854-0023	TRANSISTOR:PNP SILICON	
A6Q5	1853-0010	TRANSISTOR:PNP SILICON	
A6R1	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A6R2	2100-1967	R:VAR MET FLM 200k $\Omega$ 20% 3/4W	
A6R3	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A6R4	2100-1757	R:VAR WW 500 $\Omega$ 5% 1W	
A6R5	0757-0439	R:FXD MET FLM 6.81k $\Omega$ 1% 1/8W	
A6R6	2100-1758	R:VAR WW 1k $\Omega$ 5% 1W	
A6R7	0698-3151	R:FXD MET FLM 2.87k $\Omega$ 1% 1/8W	
A6R8	0757-0416	R:FXD MET FLM 511 $\Omega$ 1% 1/8W	
A6R9	0757-0482	R:FXD MET FLM 511k $\Omega$ 1% 1/8W	
A6R10	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A6R11	0757-0462	R:FXD MET FLM 75k $\Omega$ 1% 1/8W	
A6R12	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A6R13	0757-0280	R:FXD MET FLM 1k $\Omega$ 1% 1/8W	
A6R14	0757-0439	R:FXD MET FLM 6.81k $\Omega$ 1% 1/8W	
A6R15	0757-0419	R:FXD MET FLM 681 $\Omega$ 1% 1/8W	
A6R16	0698-3136	R:FXD MET FLM 17.8k $\Omega$ 1% 1/8W	
A6R17	0757-0438	R:FXD MET FLM 5.11k $\Omega$ 1% 1/8W	
A6R18	0757-0419	R:FXD MET FLM 681 $\Omega$ 1% 1/8W	
A6R19	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A6R20	0698-4037	R:FXD MET FLM 46.4 $\Omega$ 1% 1/8W	

See list of abbreviations in introduction to this section

Table 6-2, Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A6R21	2100-1755	R:VAR WW 100 $\Omega$ 5% 1W	
A6R22	0757-0462	R:FXD MET FLM 75k $\Omega$ 1% 1/8W	
A6R23	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A6R24	0698-0083	R:FXD MET FLM 1.96k $\Omega$ 1% 1/8W	
A6R25	0698-0083	R:FXD MET FLM 1.96k $\Omega$ 1% 1/8W	
A6R26	0698-4431	R:FXD MET FLM 2.05k $\Omega$ 1% 1/8W	
A6R27	0757-0200	R:FXD MET FLM 5.62k $\Omega$ 1% 1/8W	
A6R28	0757-0200	R:FXD MET FLM 5.62k $\Omega$ 1% 1/8W	
A6R29	0757-0273	R:FXD MET FLM 3.01k $\Omega$ 1% 1/8W	
		MISCELLANEOUS	
	5040-5117	EXTRACTOR:BLUE 2 REQ'D	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description
A7	04342-7707 04342-8707	Q-LIMIT SELECTOR ASS'Y BOARD:BLANK PC
A7C1	0160-2964	C:FXD CER 0.01 $\mu$ F -20% +80%
A7C2	0150-0121	C:FXD CER 0.1 $\mu$ F -20% +80%
A7C3	0160-0155	C:FXD MY 0.0033 $\mu$ F 10% 200VDCW
A7C4	0180-0373	C:FXD TA 0.68 $\mu$ F 10% 35VDCW
A7C5	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW
A7C6	0160-0128	C:FXD CER 2.2 $\mu$ F 20% 25VDCW
A7C7	0160-0155	C:FXD MY 0.0033 $\mu$ F 10% 200VDCW
A7C8	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW
A7CR1	1902-3059	SEMICON DEVICE:DIODE BREAKDOWN 3.83V 5% 400mW
A7CR2	1902-3234	SEMICON DEVICE:DIODE BREAKDOWN 19.6V 5% 400mW
A7CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM
A7CR4	1902-3149	SEMICON DEVICE:DIODE BREAKDOWN 9.09V 5% 400mW
A7CR5	1901-0025	SEMICON DEVICE:DIODE SILICON
A7CR6	1901-0025	SEMICON DEVICE:DIODE SILICON
A7K1	0490-0214	RELAY REED:DPST 8.7 - 22VDCW 0.5A, 15VA SRG-13A
A7L1	9140-0210	COIL:FXD RF 100 $\mu$ H 5%
A7L2	9140-0210	COIL:FXD RF 100 $\mu$ H 5%
A7Q1	1855-0081	TRANSISTOR:FIELD EFFECT N-CHANNEL
A7Q2	1855-0081	TRANSISTOR:FIELD EFFECT N-CHANNEL
A7Q3	1854-0071	TRANSISTOR:NPN SILICON 2N3391
A7Q4	1854-0071	TRANSISTOR:NPN SILICON 2N3391
A7Q5	1854-0071	TRANSISTOR:NPN SILICON 2N3391
A7Q6	1854-0071	TRANSISTOR:NPN SILICON 2N3391
A7Q7	1854-0298	TRANSISTOR:NPN SILICON
A7Q8	1854-0071	TRANSISTOR:NPN SILICON 2N3391
A7Q9	1854-0071	TRANSISTOR:NPN SILICON 2N3391
A7R1	0757-1094	R:FXD MET FLM 1.47k $\Omega$ 1% 1/8W
A7R2	0757-0280	R:FXD MET FLM 1k $\Omega$ 1% 1/8W
A7R3	2100-1762	R:VAR WW 20k $\Omega$ 5% 1W
A7R4	0698-3157	R:FXD MET FLM 19.6k $\Omega$ 1% 1/8W
A7R5	0757-0199	R:FXD MET FLM 21.5k $\Omega$ 1% 1/8W
A7R6	0698-3245	R:FXD MET FLM 20.5k $\Omega$ 1% 1/8W
A7R7	2100-1967	R:VAR MET FLM 200k $\Omega$ 20% 3/4W
A7R8	0698-3445	R:FXD MET FLM 348 $\Omega$ 1% 1/8W
A7R9	0698-3429	R:FXD MET FLM 19.6 $\Omega$ 1% 1/8W
A7R10	0757-0458	R:FXD MET FLM 51.1k $\Omega$ 1% 1/8W

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A7R11	0698-4207	R:FXD MET FLM 44.2k $\Omega$ 1% 1/8W	
A7R12	0757-0443	R:FXD MET FLM 11k $\Omega$ 1% 1/8W	
A7R13	0757-1094	R:FXD MET FLM 1.47k $\Omega$ 1% 1/8W	
A7R14	0757-0409	R:FXD MET FLM 274 $\Omega$ 1% 1/8W	
A7R15	0757-0440	R:FXD MET FLM 7.5k $\Omega$ 1% 1/8W	
A7R16	0698-3136	R:FXD MET FLM 17.8k $\Omega$ 1% 1/8W	
A7R17	0757-0433	R:FXD MET FLM 5.11k $\Omega$ 1% 1/8W	
A7R18	0757-0441	R:FXD MET FLM 8.25k $\Omega$ 1% 1/8W	
A7R19	0757-0289	R:FXD MET FLM 13.3k $\Omega$ 1% 1/8W	
A7R20	0698-3460	R:FXD MET FLM 422k $\Omega$ 1% 1/8W	
A7R21	0698-3158	R:FXD MET FLM 23.7k $\Omega$ 1% 1/8W	
A7R22	0757-0433	R:FXD MET FLM 3.32k $\Omega$ 1% 1/8W	
A7R23	0757-0279	R:FXD MET FLM 3.16k $\Omega$ 1% 1/8W	
A7R24	0690-6811	R:FXD COMP 680 $\Omega$ 10% 1W	
A7R25	0698-3158	R:FXD MET FLM 23.7k $\Omega$ 1% 1/8W	
A7R26	0698-3160	R:FXD MET FLM 31.6k $\Omega$ 1% 1/8W	
A7R27	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A7R28	0698-3160	R:FXD MET FLM 31.6k $\Omega$ 1% 1/8W	
A7R29	0757-0416	R:FXD MET FLM 511 $\Omega$ 1% 1/8W	
A7R30	0698-3136	R:FXD MET FLM 17.8k $\Omega$ 1% 1/8W	
A7R31	0698-3400	R:FXD MET OX 147 $\Omega$ 1% 1/2W	
	5040-5118	MISCELLANEOUS EXTRACTOR:VIOLET 2 REQ'D	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A8	04342-7708 04342-8708	POWER SUPPLY & ALC AMPLIFIER ASS'Y BOARD:BLANK PC	
A8C1	0150-0121	C:FXD CER 0.1 $\mu$ F -20% +80% 50VDCW	
A8C2	0180-0291	C:FXD TA 1 $\mu$ F 10% 35VDCW	
A8C3	0180-0097	C:FXD TA 47 $\mu$ F 10% 35VDCW	
A8C4	0150-0121	C:FXD CER 0.1 $\mu$ F -20% +80% 50VDCW	
A8C5	0180-0291	C:FXD TA 1 $\mu$ F 10% 35VDCW	
A8C6	0180-0097	C:FXD TA 47 $\mu$ F 10% 35VDCW	
A8C7	0180-0982	C:FXD ELECT 1 $\mu$ F -10% +100% 250VDCW	
A8C8	0180-0982	C:FXD ELECT 1 $\mu$ F -10% +100% 250VDCW	
A8C9	0180-1735	C:FXD TA 0.22 $\mu$ F 10% 35VDCW	
A8C10	0180-1735	C:FXD TA 0.22 $\mu$ F 10% 35VDCW	
A8CR1	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR2	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR3	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR4	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR5	1902-0041	SEMICON DEVICE:DIODE BREAKDOWN 5.11V 5% 400mW	
A8CR6	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR7	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR8	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR9	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR10	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR11	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR12	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR13	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR14	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR15	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR16	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR17	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A8CR18	1902-0041	SEMICON DEVICE:DIODE BREAKDOWN 5.11V 5% 400mW	
A8CR19	1901-0025	SEMICON DEVICE:DIODE SILICON	
A8CR20	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR21	1901-0026	SEMICON DEVICE:DIODE SILICON	
A8CR22	1902-3182	SEMICON DEVICE:DIODE BREAKDOWN 12.1V 5% 400mW	
A8Q1	1854-0039	TRANSISTOR:SILICON NPN 2N3053	
A8Q2	1854-0071	TRANSISTOR:SILICON NPN 2N3391	
A8Q3	1854-0215	TRANSISTOR:SILICON NPN 2N3904	
A8Q4	1854-0215	TRANSISTOR:SILICON NPN 2N3904	
A8Q5	1854-0071	TRANSISTOR:SILICON NPN 2N3391	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A8Q6	1854-0039	TRANSISTOR:SILICON NPN 2N3053	
A8Q7	1854-0071	TRANSISTOR:SILICON NPN 2N3391	
A8Q8	1854-0071	TRANSISTOR:SILICON NPN 2N3391	
A8Q9	1855-0049	TRANSISTOR:FIELD EFFECT N-CHANNEL DUAL	
A8Q10	1853-0036	TRANSISTOR:SILICON PNP 2N3906	
A8Q11	1854-0071	TRANSISTOR:SILICON NPN 2N3391	
A8Q12	1853-0036	TRANSISTOR:SILICON PNP 2N3906	
A8Q13	1853-0036	TRANSISTOR:SILICON PNP 2N3906	
A8R1	0813-0029	R:FXD WW 1 $\Omega$ 10% 3W	
A8R2	0757-0288	R:FXD MET FLM 9.09k $\Omega$ 1% 1/8W	
A8R3	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A8R4	0813-0029	R:FXD WW 1 $\Omega$ 10% 3W	
A8R5	0698-0084	R:FXD MET FLM 2.15k $\Omega$ 1% 1/8W	
A8R6	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A8R7	0757-0439	R:FXD MET FLM 6.81k $\Omega$ 1% 1/8W	
A8R8	0698-4433	R:FXD MET FLM 2.26k $\Omega$ 1% 1/8W	
A8R9	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A8R10	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A8R11	0757-0441	R:FXD MET FLM 8.25k $\Omega$ 1% 1/8W	
A8R12	2100-1758	R:VAR WW 1k $\Omega$ 5% 1W	
A8R13	0698-4431	R:FXD MET FLM 2.05k $\Omega$ 1% 1/8W	
A8R14	0813-0029	R:FXD WW 1 $\Omega$ 10% 3W	
A8R15	0698-3447	R:FXD MET FLM 422 $\Omega$ 1% 1/8W	
A8R16	0698-0084	R:FXD MET FLM 2.15k $\Omega$ 1% 1/8W	
A8R17	0698-4020	R:FXD MET FLM 9.53k $\Omega$ 1% 1/8W	
A8R18	0698-3158	R:FXD MET FLM 23.7k $\Omega$ 1% 1/8W	
A8R19	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A8R20	0698-3156	R:FXD MET FLM 14.7k $\Omega$ 1% 1/8W	
A8R21	2100-1758	R:VAR WW 1k $\Omega$ 5% 1W	
A8R22	0698-4020	R:FXD MET FLM 9.53k $\Omega$ 1% 1/8W	
A8R23	0813-0029	R:FXD WW 1 $\Omega$ 10% 3W	
A8R24	0698-3412	R:FXD MET FLM 3.83k $\Omega$ 1% 1/2W	
A8R25	0698-4477	R:FXD MET FLM 10.5k $\Omega$ 1% 1/8W	
A8R26	2100-1758	R:VAR WW 1k $\Omega$ 5% 1W	
A8R27	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A8R28	0683-1055	R:FXD COMP 1M $\Omega$ 5% 1/4W	
A8R29	0698-4511	R:FXD MET FLM 86.6k $\Omega$ 1% 1/8W	
A8R30	0757-0453	R:FXD MET FLM 30.1k $\Omega$ 1% 1/8W	
A8R31	0757-0470	R:FXD MET FLM 162k $\Omega$ 1% 1/8W	
A8R32	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A8R33	0757-0280	R:FXD MET FLM 1k $\Omega$ 1% 1/8W	
A8R34	0757-0444	R:FXD MET FLM 12.1k $\Omega$ 1% 1/8W	
A8R35	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	

See list of abbreviations in introduction to this section

Table 6-2, Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A8R36	0757-0280	R:FXD MET FLM 1k $\Omega$ 1% 1/8W	
A8R37	0757-0200	R:FXD MET FLM 5.62k $\Omega$ 1% 1/8W	
A8R38	0757-0453	R:FXD MET FLM 30.1k $\Omega$ 1% 1/8W	
A8R39	0757-0438	R:FXD MET FLM 5.11k $\Omega$ 1% 1/8W	
A8R40	0698-3157	R:FXD MET FLM 19.6k $\Omega$ 1% 1/8W	
A8R41	0683-1055	R:FXD COMP 1M $\Omega$ 5% 1/4W	
A8R42	0757-0482	R:FXD MET FLM 511k $\Omega$ 1% 1/8W	
A8R43	0757-0461	R:FXD MET FLM 68.1k $\Omega$ 1% 1/8W	
	5040-4592	MISCELLANEOUS EXTRACTOR:GRAY 2 REQ'D	
A9		NOT ASSIGNED	
A10	04342-7710 04342-8710	FREQUENCY MULTIPLIER AND OVER LIMIT INDICATOR ASS'Y BOARD:BLANK PC	
A10DS1	2140-0037	LAMP:INCD 28V 0.04A	
A10DS2	2140-0037	LAMP:INCD 28V 0.04A	
A10DS3	2140-0037	LAMP:INCD 28V 0.04A	
A10DS4	2140-0037	LAMP:INCD 28V 0.04A	
A10DS5	2140-0037	LAMP:INCD 28V 0.04A	
A10R1	0698-3402	R:FXD MET FLM 316 $\Omega$ 1% 1/2W	
	04342-5022	MISCELLANEOUS SEPARATOR:LAMP	
A11	04342-7711 04342-8711	METER SCALE INDICATOR ASS'Y BOARD:BLANK PC	
A11DS1	2140-0123	LAMP:NEON	
A11DS2	2140-0123	LAMP:NEON	
A11DS3	2140-0123	LAMP:NEON	
A11DS4	2140-0123	LAMP:NEON	
	5040-3313	MISCELLANEOUS HOLDER:LAMP	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
C1a	0160-3202	C:FXD CER 1800pF $\pm 20\%$ 3000VDCW	
C1b	0160-3202	C:FXD CER 1800pF $\pm 20\%$ 3000VDCW	
C2	0180-0056	C:FXD ELECT 1000 $\mu$ F -10% +100% 50VDCW	
C3	0180-0056	C:FXD ELECT 1000 $\mu$ F -10% +100% 50VDCW	
DS1	2140-0037	LAMP:INCD 28V 0.04A	
DS2	2140-0037	LAMP:INCD 28V 0.04A	
F1	2110-0339	FUSE:0.6A 250V SLOW BLOW	
	2110-0044	FUSE:0.3A 250V SLOW BLOW	
J1	1250-0083	CONNECTOR:BNC FEMALE	
J2	1250-0083	CONNECTOR:BNC FEMALE	
J3	1251-2357	CONNECTOR:POWER 3-PIN MALE	
L1	9140-0136	COIL:FXD 22 $\mu$ H $\pm 10\%$ 1.33A	
L2	9140-0136	COIL:FXD 22 $\mu$ H $\pm 10\%$ 1.33A	
M1	1120-0762	METER:1mA SPEC	
P1		NOT ASSIGNED	
P2		NOT ASSIGNED	
P3	1250-0052	CONNECTOR:BNC MALE PART OF W1	
	1250-0050	NUT:RF CONNECTOR PART OF P3	
	1250-0089	CONTACT:RF CONNECTOR PART OF P3	
P4	1250-0872	CONNECTOR:RF PART OF W1	
P5	1250-0872	CONNECTOR:RF PART OF W2	
P6	1250-0872	CONNECTOR:RF PART OF W2	
Q1	1854-0063	TRANSISTOR:NPN SILICON	
Q2	1854-0063	TRANSISTOR:NPN SILICON	
R1	0698-3400	R:FXD MET FLM 147 $\Omega$ 1% 1/2W	
R2	2100-0732	R:VAR COMP 500 $\Omega$ 10% 2.25W	
R3	2100-2500	R:VAR COMP 200 $\Omega$ 10% WITH R4	
R4		R:VAR COMP 1k $\Omega$ 10%	
		NOT SEPARATELY REPLACEABLE PART OF R3	
R5	2100-0006	R:VAR WW 5k $\Omega$ 10% 2W	
S1	3101-0011	SWITCH:SLIDE DPDT	
S2	3101-0263	SWITCH:PUSH BUTTON	
S3	3101-1234	SWITCH:SLIDE DPDT	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
T1	9100-0779	TRANSFORMER:POWER	
W1	04342-7602	CABLE ASS'Y:COAXIAL INCLUDING P3 AND P4	
W2	04342-7603	CABLE ASS'Y:COAXIAL INCLUDING P5 AND P6	
W3	8120-1348	CABLE ASS'Y:POWER CORD	
XA1		NOT ASSIGNED	
XA2		NOT ASSIGNED	
XA3		NOT ASSIGNED	
XA4		NOT ASSIGNED	
XA5		NOT ASSIGNED	
XA6	1251-0135	CONNECTOR:PRINTED CIRCUIT 15-CONTACT	
XA7	1251-0135	CONNECTOR:PRINTED CIRCUIT 15-CONTACT	
XA8	1251-0159	CONNECTOR:PRINTED CIRCUIT 30-CONTACT	
XF1	1400-0084	FUSE HOLDER:EXTRACTOR POST TYPE	
XQ1	1200-0041	SOCKET:TRANSISTOR	
XQ2	1200-0041	SOCKET:TRANSISTOR	
		MISCELLANEOUS	
	5060-4940	EXTENDER:PC BOARD 30-CONTACT	
	5060-0651	EXTENDER:PC BOARD 12-CONTACT	
	5060-4004	FRAME:SIDE 2 REQ'D	
	04342-1149	PANEL ASS'Y:FRONT	
	04342-1310	PANEL:BLACK FREQUENCY DIAL	
	04342-1311	PANEL:BLACK CAPACITOR DIAL	
	04342-1024	PANEL:REAR	
	04342-1128	COVER ASS'Y:TOP	
	04342-1127	COVER:BOTTOM	
	5000-4167	COVER:SIDE A 2 REQ'D	
	5000-4168	COVER:SIDE B 2 REQ'D	
	0370-0100	KNOB:ROUND RED 1 ARROW	
	0370-0133	KNOB:SKIRTED BLACK 1 ARROW	
	04342-3095	KNOB:SKIRTED BLACK 1 ARROW CONCENTRIC	
	0370-0440	KNOB:PUSH BUTTON GRAY 13 REQ'D	
	04342-5020	KNOB:THUMB WHEEL BLACK 3 REQ'D	
	04342-3037	HANDLE ASS'Y	
	5040-0447	FOOT:REAR 4 REQ'D	
	5060-0767	FOOT ASS'Y:FULL MODULE 4 REQ'D	
	7120-0480	PLATE:SERIAL NUMBER	
	04342-3261	KNOB:ROUND BLACK 1 ARROW 7 REQ'D	

See list of abbreviations in introduction to this section

Table 6-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
	04342-1025	BRACKET:FRONT PANEL 2 REQ'D	
	04342-1030	STOPPER:F. C. 2 REQ'D	
	04342-1131	BRACKET:HANDLE H1	
	04342-1132	BRACKET:HANDLE H2	
	04342-1033	BRACKET:HANDLE H3	
	04342-1034	PLATE:HANDLE	
	04342-1035	BRACKET:A5 ASS'Y	
	04342-1036	SHIELD:A5 ASS'Y	
	04342-1042	BRACKET:METER RIGHT	
	04342-1043	BRACKET:METER LEFT	
	04342-1044	BRACKET:FREQUENCY SCALE INDICATOR	
	04342-1051	BELT:FREQUENCY DIAL	
	04342-1052	BELT:MAIN CAPACITOR DIAL	
	04342-1053	BELT:VERNIER CAPACITOR DIAL	
	04342-1054	STOPPER:D	
	04342-1064	SCALE:FREQUENCY DIAL	
	04342-1058	SCALE:MAIN CAPACITOR DIAL	
	04342-1059	SCALE:VERNIER CAPACITOR DIAL	
	04342-1061	DECK:POWER SUPPLY	
	04342-1062	SHIELD:POWER SUPPLY	
	04342-3269	GLASS:CAPACITOR DIAL	
	04342-3033	BOARD:FREQUENCY SCALE INDICATOR	
	04342-3045	GUIDE:OSCILLATOR LEVER	
	04342-3052	SHAFT:FREQUENCY DIAL AND KNOB 2 REQ'D	
	04342-3054	SHAFT:CAPACITOR DIAL AND KNOB 2 REQ'D	
	04342-5023	HOUSE:LAMP FREQUENCY SCALE INDICATOR 2 REQ'D	
	04342-5024	BRACKET:LAMP HOUSE	
	04342-3270	PLATE:TERMINAL INDICATION	
	04342-3271	GUIDE:A5 ASS'Y ADJUSTMENT	
	04342-5027	BRACKET:POWER SWITCH	
	04342-5200	DECK:MAIN	
	04342-7021	LEVER ASS'Y:OSCILLATOR	
	04342-7030	DIAL ASS'Y:FREQUENCY	
	04342-7031	DIAL ASS'Y:MAIN CAPACITOR	
	04342-7032	DIAL ASS'Y:VERNIER CAPACITOR	
	04342-3020	GLASS:FREQUENCY DIAL	
	04342-8541	STRING:KNOB TO DIAL 3 REQ'D	
	04342-8542	STRING:FREQUENCY DIAL TO PULLEY	
	04342-8543	STRING:VERNIER CAPACITOR DIAL TO PULLEY	
	04342-8544	STRING:MAIN CAPACITOR DIAL TO PULLEY	
	1520-0001	PLATE:CAPACITOR MOUNTING 2 REQ'D	
	5040-4528	GUIDE:PC BOARD GRAY 6 REQ'D	
	5040-5125	GUIDE:PC BOARD BLUE	
	5040-5126	GUIDE:PC BOARD VIOLET	
	04342-8551	FILM:FREQUENCY RANGE SWITCH	
	04342-8552	FILM:FREQUENCY MULTIPLIER INDICATOR	
	04342-8553	FILM:Q RANGE SWITCH	

See list of abbreviations in introduction to this section

Section VI  
Figure 6-1

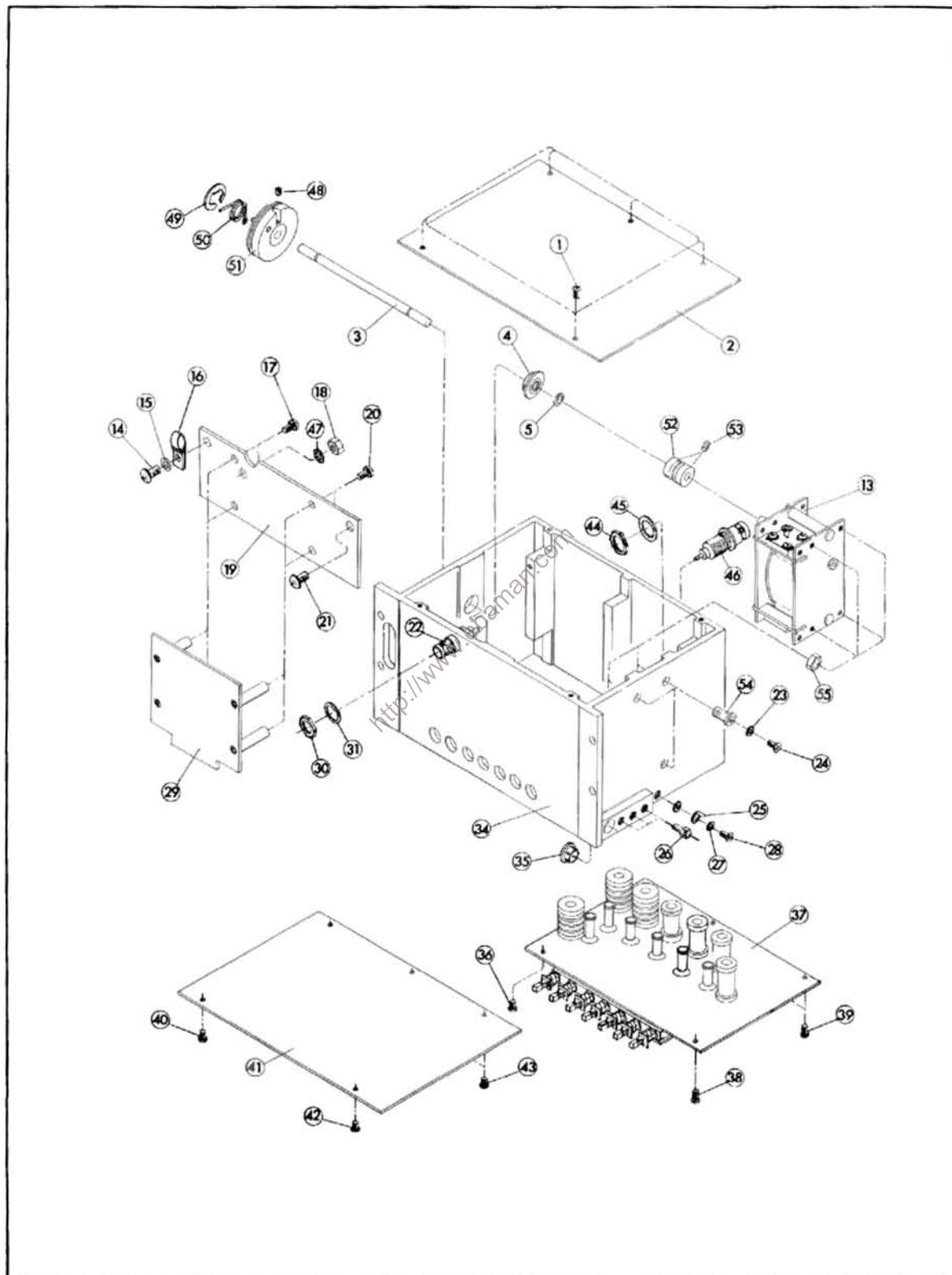


Figure 6-1. Exploded View of Oscillator Ass'y (sheet 1 of 2)

Item No.	Part No.	Q'ty	Description	Note
1	2360-0115	5	SCREW:MACH SST 6-32 X .312	
2	04342-1070	1	COVER:TOP	
3	04342-3092	1	SHAFT:OSCILLATOR	
4	1410-0307	1	BEARING	
5	0510-0045	2	RING:RET EXT .188 DIA	
6			NOT ASSIGNED	
7			NOT ASSIGNED	
8			NOT ASSIGNED	
9			NOT ASSIGNED	
10			NOT ASSIGNED	
11			NOT ASSIGNED	
12			NOT ASSIGNED	
13	0121-0232	1	CAPACITOR:AIR	
14	2360-0199	1	SCREW:MACH SST 6-32 X .438 PH	
15	3050-0066	1	WASHER:BRASS .147 ID	
16	1400-0325	1	CLAMP:CABLE (NYLON)	
17	2360-0115	2	SCREW:MACH SST 6-32 X .312	
18	2740-0003	1	NUT:HEX 10-32 X .375	
19	04342-1073	1	PLATE	
20	2360-0115	2	SCREW:MACH SST 6-32 X .312	
21	2360-0119	2	SCREW:MACH SST 6-32 X .438 PH	
22	04342-7601	1	CABLE ASS'Y	
23	2190-0047	4	WASHER:LOCK CNTRSK NO. 6	
24	0570-0237	4	SCREW:MACH BRASS 3mm	
25	0360-0032	1	TERMINAL:LUG	
26	0160-2357	3	C:FXD CER 1000pF	
27	2190-0008	1	WASHER:LOCK EXT PHS .BRZ .141 ID	
28	2360-0115	1	SCREW:MACH SST 6-32 X .312	
29	04342-7702	1	PC BOARD:A1A2 ASS'Y	
30	2190-0102	1	WASHER:LOCK BRZ .475 ID	
31	2950-0035	1	NUT HEX BRASS 15/32-32	
32			NOT ASSIGNED	
33			NOT ASSIGNED	
34	04342-5001	1	CASE:OSCILLATOR (CASTING)	
35	0400-0111	1	GROMMET:SNAP IN	
36	2360-0115	1	SCREW:MACH SST 6-32 X .312	
37	04342-7731/41	1	PC BOARD:A1A1 ASSEMBLY	
38	2360-0115	1	SCREW:MACH SST 6-32 X .312	
39	2360-0115	3	SCREW:MACH SST 6-32 X .312	
40	2360-0115	1	SCREW:MACH SST 6-32 X .312	
41	04342-1071	1	COVER BOTTOM	
42	2360-0115	1	SCREW:MACH SST 6-32 X .312	
43	2360-0115	3	SCREW:MACH SST 6-32 X .312	
44	2950-0035	1	NUT:HEX BRASS 15/32-32	
45	2190-0102	1	WASHER:LOCK BRZ .475 ID	
46	1250-0314	1	CONNECTOR:BNC FEMALE	
47	2190-0012	1	WASHER:LOCK EXT BRZ	
48	3030-0033	1	SCREW:SET 6-32 X .188LG HEX SKT .DR	
49	0510-0080	1	RING:RET EXT .500 DIA E TYPE	
50	04342-8524	1	SPRING:COIL	
51	04342-5035	1	PULLEY:MOLDED	
52	04342-5039	1	COUPLER:FLEXIBLE	
53	3030-0007	4	SCREW:SET #4-40 x .188LG	
54	04342-3097	3	SPACER	
55	2950-0036	3	NUT:BRASS .25-28 x .4375	

Figure 6-1. Exploded View of Oscillator Ass'y (sheet 2 of 2)

Section VI  
Figure 6-2

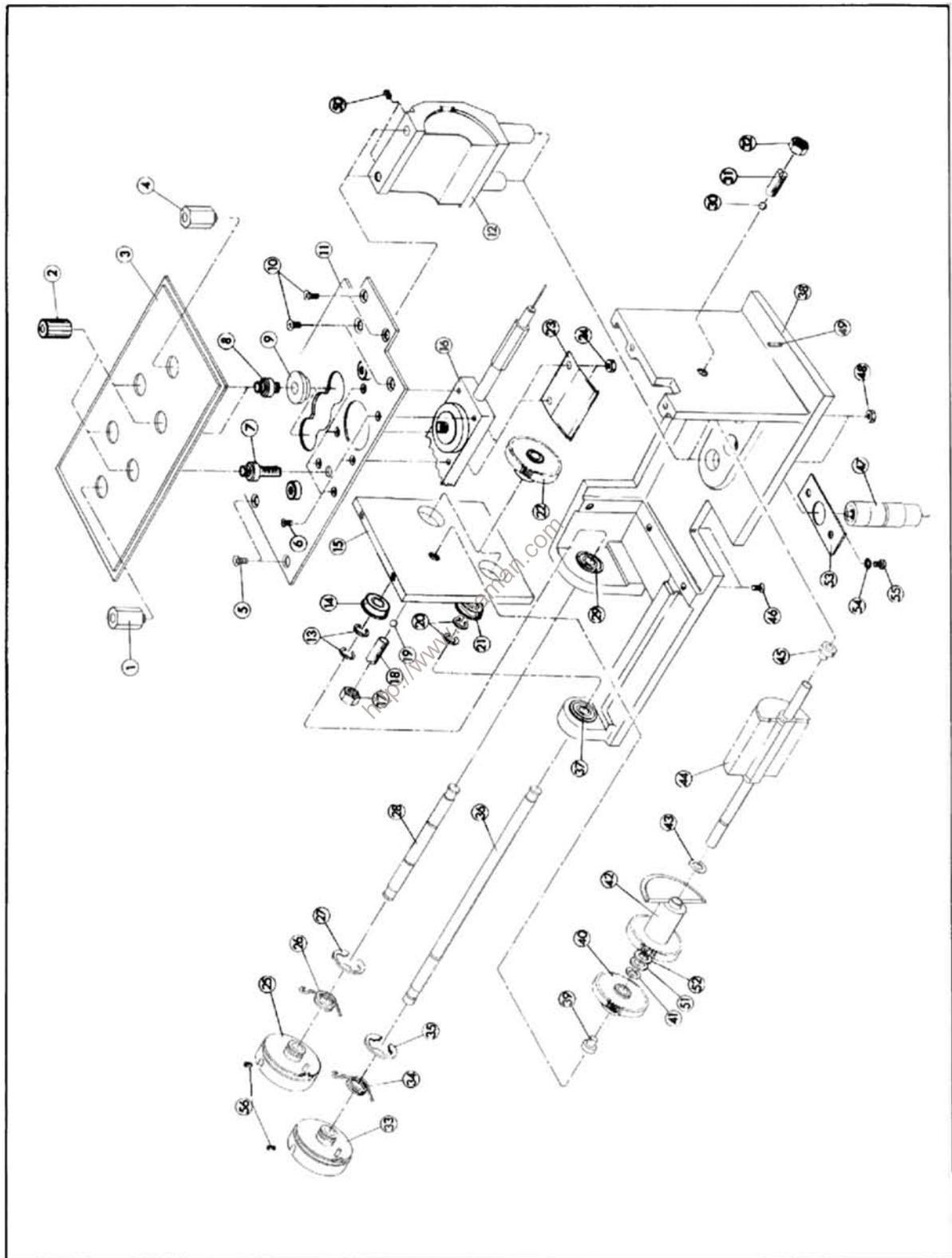


Figure 6-2. Exploded View of Tuning Capacitor Ass'y (sheet 1 of 2)

Item No.	Part No.	Q'ty	Description	Note
1	04342-3239	1	CONNECTOR:HEXAGONAL GROUND LUG	
2	04342-3259	4	CAP:BINDING POST	
3	04342-3256	1	BOARD:TERMINAL TEFLON	
4	04342-3239	1	CONNECTOR:HEXAGONAL GROUND LUG	
5	2360-0185	2	SCREW:MACH SST 6-32 X . 375	
6	0520-0164	6	SCREW:MACH SST 2-56	
7	04342-3231	1	CONNECTOR:BINDING POST BODY	
8	04342-3230	2	CONNECTOR:BINDING POST BODY	
9	04342-3265	2	INSULATOR:BOSS	
10	2360-0185	4	SCREW:MACH SST 6-32 X. 375	
11	04342-7512	1	PLATE:TERMINAL	
12	04342-7510	1	STATOR ASSEMBLY	
13	0510-0045	1	RING:RET EXT . 188 DIA	
14	1410-0307	1	BEARING	
15	04342-3220	1	PLATE	
16	04342-7200	1	TRANSFORMER ASS'Y:INJECTION	
17	04342-3140	1	NUT:HEX P=0. 75mm	
18	04342-3141	1	SCREW:BRASS P=0. 75mm	
19	1490-0127	1	BALL:SST	
20	0510-0045	2	RING:RET EXT . 188 DIA	
21	1410-0307	1	BEARING	
22	04342-7503	2	GEAR ASS'Y	
23	04342-1222	1	BRASH:PH BRZ CHEMICAL Au PLATED	
24	2420-0003	2	NUT:HEX SST 6-32 THRD	
25	04342-5035	1	PULLEY:MOLDED	
26	04342-8524	1	SPRING:COIL	
27	0510-0080	1	RING:RET EXT . 500 DIA E TYPE	
28	04342-3222	1	SHAFT:MAIN CAPACITOR	
29	1410-0307	1	BEARING	
30	1490-0127	1	BALL:SST	
31	04342-3141	1	SCREW:BRASS P=0. 75mm	
32	04342-3140	1	NUT:HEX P=0. 75mm	
33	04342-5035	1	PULLEY:MOLDED	
34	04342-8524	1	SPRING:COIL	
35	0510-0080	1	RING:RET EXT . 500 DIA E TYPE	
36	04342-3223	1	SHAFT:VERNIER CAPACITOR	
37	1410-0307	1	BEARING	
38	04342-5200	1	DECK:CASTING	
39	04342-3245	1	INSULATOR:DELTRIN	
40	04342-7502	1	GEAR ASS'Y	
41	0510-0045	1	RING:RET EXT . 188 DIA E TYPE	
42	04342-7511	1	VERNIER CAPACITOR ASS'Y	
43	5000-4192 . . 4	2	WASHER:FLAT PHS. BR5 (SELECTED)	
44	04342-7202	1	ROTOR ASS'Y	
45	04342-3245	1	INSULATOR:DELTRIN	
46	2360-0185	2	SCREW:MACH SST 6-32 X . 500	
47	04342-7205	1	C DIVIDER ASS'Y	
48	2740-0003	2	NUT:HEX 10-32 X . 375	
49	1480-0007	1	PIN	
50	3030-0022	2	SCREW:SET	
51	3050-0201	1	WASHER:FLAT BRASS	
52	3050-0161	1	WASHER:WAVY	
53	04342-1085	1	PLATE	
54	2190-0008	2	WASHER:LOCK EXT	
55	2460-0002	2	SCREW:MACH 6-32 X 3/8	
56	3030-0033	1	SCREW:SET 6-32 X . 188 LG HEX SKT . DR	

Figure 6-2. Exploded View of Tuning Capacitor Ass'y (sheet 2 of 2)

Section VI  
Figure 6-3

Item No.	Part No.	Q'ty	Description	Note
1	0400-0011	2	GROMMET: VINYL . 375 ID	
2	04342-1046	1	COVER: SHIELD	
3	2360-0115	2	SCREW: MACH SST 6-32 X . 312	
4	04342-7513	1	SWITCH ASS'Y: Q RANGE	
5	04342-1045	1	CASE: SHIELD	
6	0624-0077	2	SCREW: TAPPING 4-40 THD	
7	2190-0008	1	WASHER: LOCK EXT PHS. BRZ	
8	2360-0193	1	SCREW: MACH SST 6-32 X . 250	

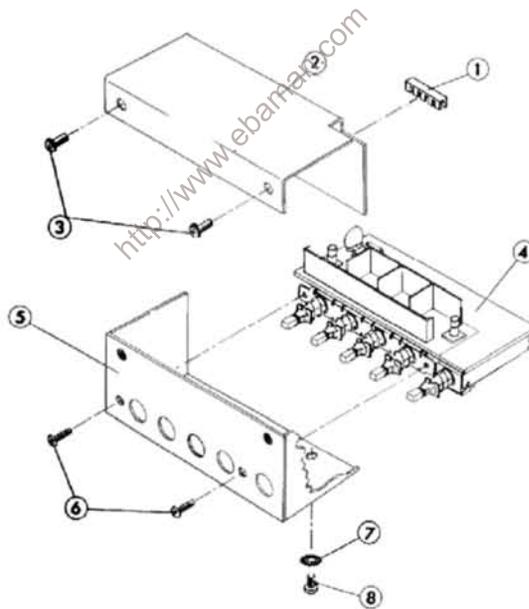


Figure 6-3. Exploded View of Q Range Attenuator Ass'y

Item No.	Part No.	Q'ty	Description	Note
1	04342-3020	1	GLASS:FREQUENCY DIAL	
2	0361-0078	2	RIVET:SEMITUB ALUM . 123 DIA	
3	2200-0166	1	SCREW:MACH SST 4-40 X . 312	
4	0460-0126	2	TAPE:POLYESTER METALIZED	
5	0510-0741	2	BRACKET 90 DEG ANGLE	
6	3050-0067	1	WASHER:FLAT . 375 ID	
7	2360-0113	2	SCREW:MACH SST 6-32 X 125	
8	2190-0018	2	WASHER:LOCK HELICAL	
9	3050-0016	2	WASHER:BRASS . 147 ID	
10	04342-7710	1	PC BOARD ASS'Y	
11	04342-5022	1	SEPARATOR:LAMP P/O ITEM 10	
12	3050-0079	3	WASHER:NYLON . 0937 ID	
13	2190-0223	3	WASHER:SPRING . 0937	
14	0520-0129	3	SCREW:MACH SST 2-56 X . 321	
15	0460-0126	1	TAPE:POLYESTER METALIZED	
16	0610-0001	1	NUT:HEX 2-56 . 188 WD, . 063 THK	
17	2190-0223	1	WASHER:SPRING	
18	3050-0098	1	WASHER:SST . 25 OD, 0313 THK	
19	04342-5023	2	HOUSE:LAMP FREQUENCY SCALE INDICATOR	
20	04342-5024	1	BRACKET:LAMP HOUSE	
21	0520-0183	1	SCREW:MACH SST 2-56 X 1. 25	

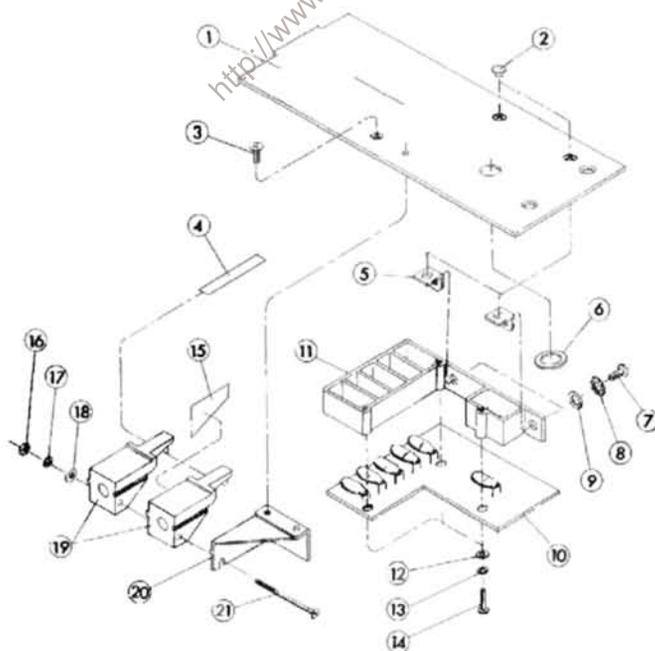


Figure 6-4. Exploded View of Frequency Multiplier, Over Limit Indicator, and Frequency Scale Indicator

Section VI  
Figure 6-5

Item No.	Part No.	Q'ty	Description	Note
1	04342-5032	1	PULLEY:MOLDED	
2	04342-8522	1	SPRING:COIL	
3	04342-3081	1	DRUM:MOLDED	
4	3050-0016	1	WASHER:FLAT BRASS .147 ID	
5	2360-0121	1	SCREW:MACH SST 6-32 X .500	
6	2360-0121	1	SCREW:MACH SST 6-32 X .500	
7	3050-0016	1	WASHER:FLAT BRASS .147 ID	
8	04342-3082	1	DRUM:MOLDED	
9	04342-8523	1	SPRING:COIL	
10	04342-5033	1	PULLEY:MOLDED	

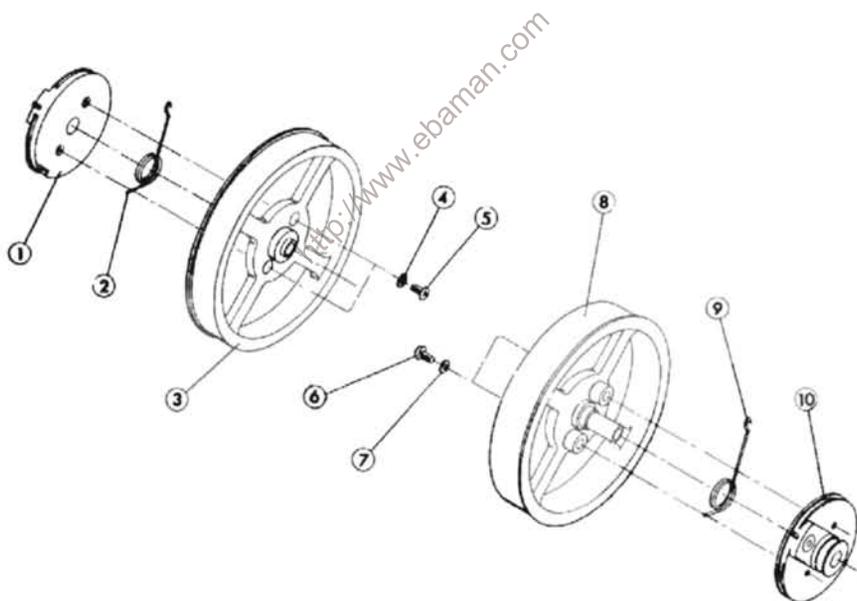


Figure 6-5. Exploded View of Main and Vernier Capacitor Dial Ass'y

Item No.	Part No.	Q'ty	Description	Note
1	0510-0045	1	RING:RET EXT .500 DIA E TYPE	
2	04342-1037	1	ANGLE:L	
3	04342-3044	1	SHAFT:LEVER	
4	0510-0045	7	RING:RET EXT .500 DIA E TYPE	
5	3050-0253	7	WASHER:SPRING STL .250 ID	
6	04342-3043	1	BOSS	
7	04342-3042	6	BOSS	
8	04342-1038	7	LEVER:J	
9	04342-3041	7	BOSS (ACTUATOR)	
10	04342-1039	7	LEVER:L	
11	04342-1037	1	ANGLE:L	
12	0510-0045	1	RING:RET EXT .500 DIA E TYPE	

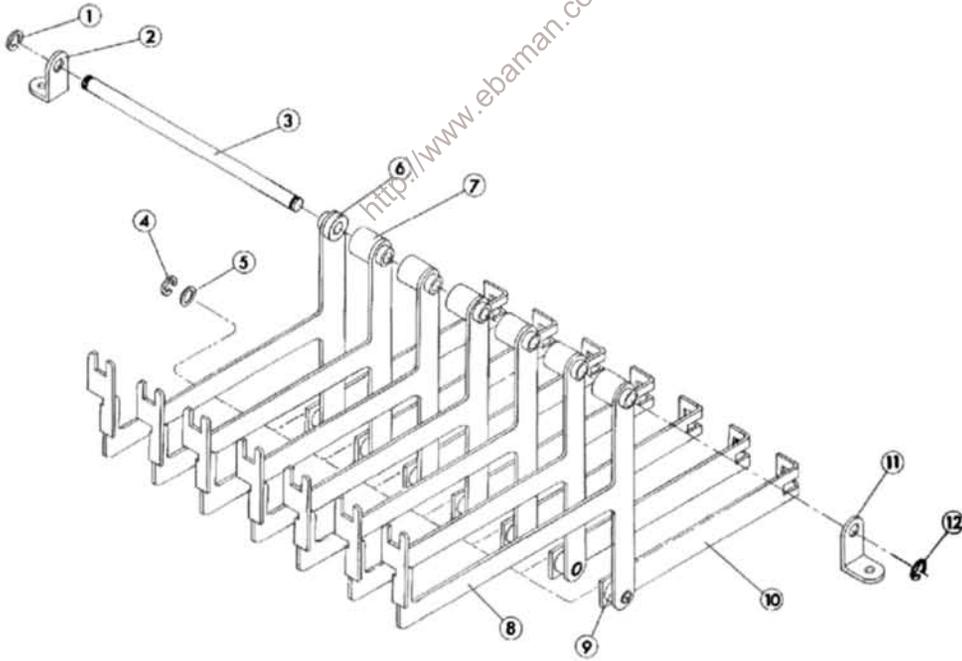


Figure 6-6. Exploded View of Oscillator Lever Ass'y

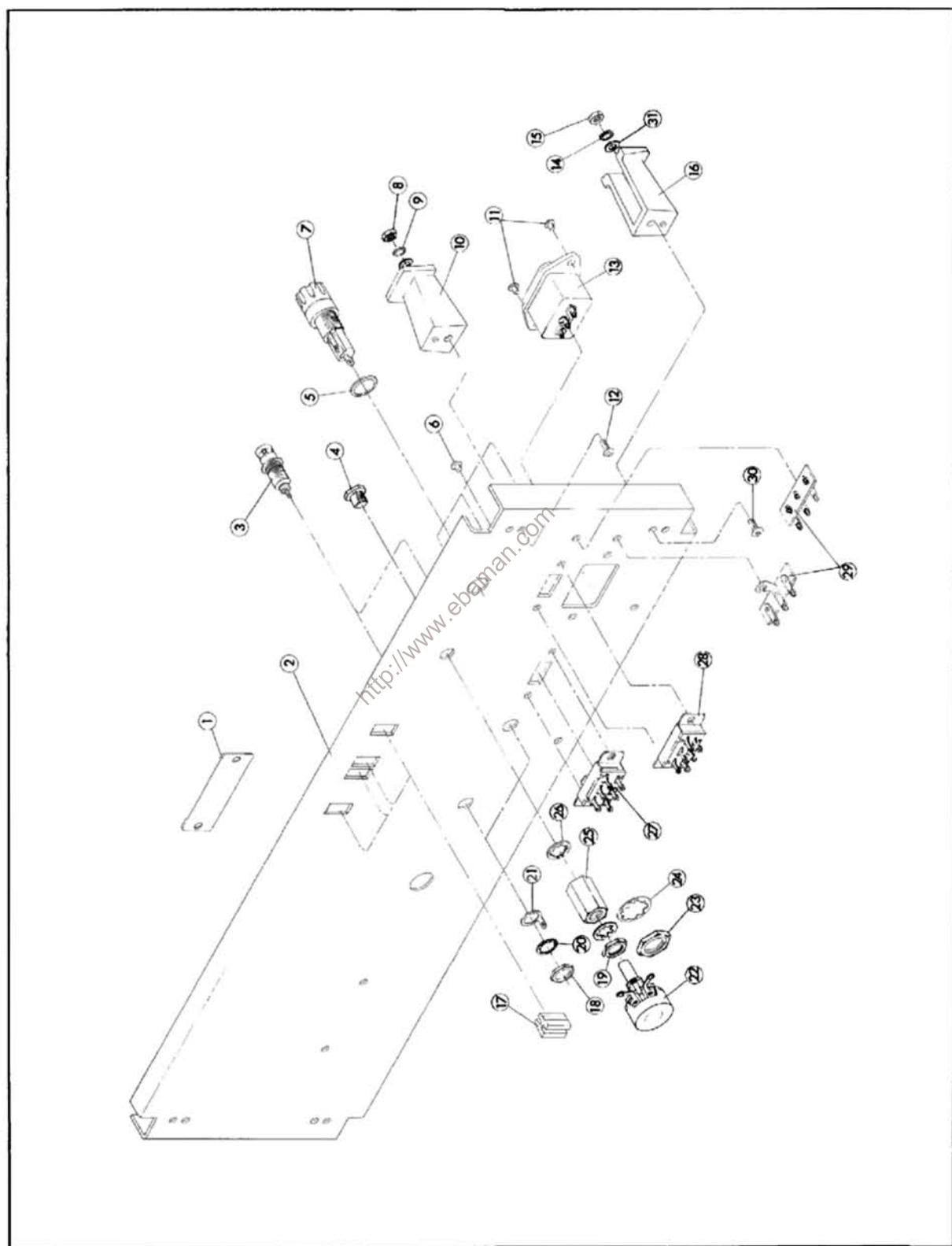


Figure 6-7. Exploded View of Rear Panel (sheet 1 of 2)

Item No.	Part No.	Q'ty	Description	Note
1	7120-0480	1	PLATE:SERIAL NUMBER	
2	04342-1024	1	PANEL:REAR	
3	1251-0083	2	CONNECTOR:BNC FEMALE	
4	1410-0052	1	SCREW:BUSHING	
5	1400-0090	1	WASHER:FUSE HOLDER .500 ID	
6	0361-0008	4	RIVET SEMTUB ALUM	
7	1400-0084	1	FUSE HOLDER:EXTRACTOR POST TYPE	
8	2420-0001	4	NUT:HEX SNP 6-32 X .312 WD	
9	2190-0008	4	WASHER:LOCK EXT PH BRZ	
10	5040-0447	2	FOOT:REAR	
11	0361-0011	2	RIVET SEMTUB ALUM 1/8 DIA	
12	2450-0002	2	SCREW:MACH 6-32 X .25	
13	1251-2357	1	CONNECTOR:POWER 3-PIN MALE	
14	2190-0008	4	WASHER:LOCK EXT PH BNZ	
15	2420-0001	4	NUT:HEX SNP 6-32 .312 WD	
16	5040-0447	2	FOOT REAR	
17	5040-4528	4	GUIDE:PC BOARD GRAY	
18	2950-0001	2	NUT:HEX BRS 3/8 X .50 AF NI-P	
19	2950-0001	1	NUT:HEX BRS 3/8 X .50 AF NI-P	
20	2190-0016	2	WASHER:LOCK INT 3/8 PH BRZ	
21	0360-1190	2	TERMINAL:SOLDER LUG .500 WD	
22	2100-0732	1	R:VARIABLE COMP LIN 500Ω 10% 2W	
23	2950-0038	1	NUT:HEX 5-24 X .6875	
24	2190-0037	1	WASHER:LOCK INT NO .1/2. 789 OD STL CAD	
25	2950-0039	1	WASHER:LOCK INT NO .1/2. 789 PH BRZ	
26	2190-0016	1	WASHER:LOCK INT 3/8 PH BRZ	
27	3101-1234	1	SWITCH:SLIDE DPDT 115/230V	
28	3101-0011	1	SWITCH:SLIDE DPDT 0.5 AMP 125 VDC	
29	0360-0015	2	BOARD:TERMINAL	
30	2450-0002	2	SCREW:MACH 6-32 X .25	
31	3050-0066	4	WASHER:FLAT BRASS .147 ID	

Figure 6-7. Exploded View of Rear Panel (sheet 2 of 2)

Section VI  
Figure 6-8

Item No.	Part No.	Q'ty	Description
1	04342-1031	1	BRACKET:HANDLE H1
2	2510-0043	2	SCREW:MACH SST 8-32 X . 312
3	04342-1033	1	BRACKET:HANDLE H3
4	04342-1034	1	PLATE:HANDLE
5	2510-0120	2	SCREW:MACH SST 8-32 X . 312
6	04342-3037	1	HANDLE ASS'Y
7	04342-1034	1	PLATE:HANDLE
8	2510-0120	2	SCREW:MACH SST 8-32 X . 312
9	04342-1032	1	BRACKET:HANDLE H2
10	2510-0043	2	SCREW:MACH SST 8-32 X . 312

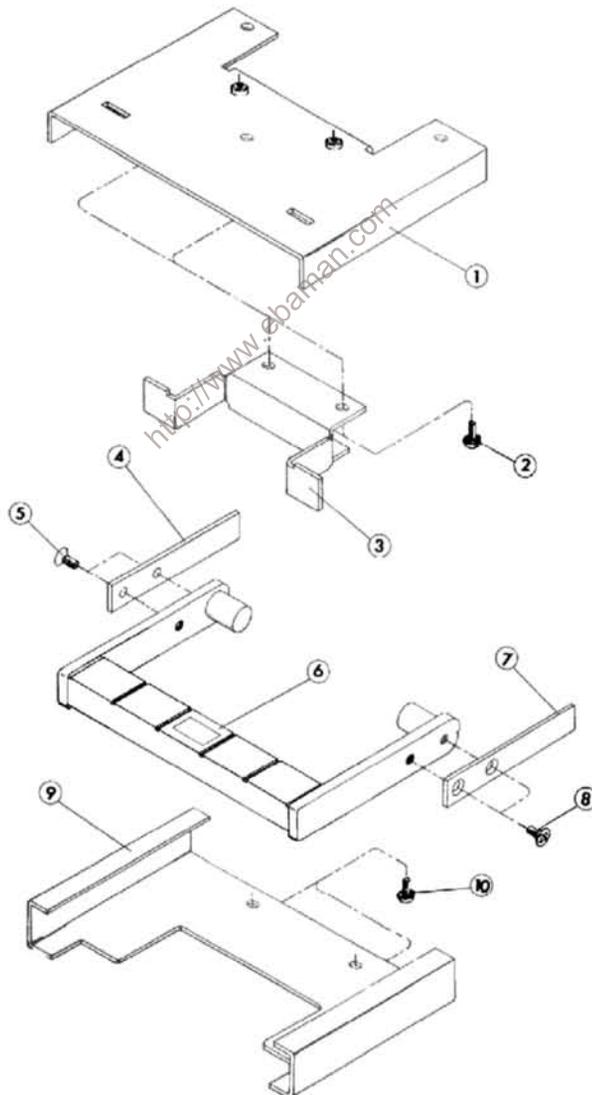


Figure 6-8. Exploded View of Handle Section

## SECTION VII MANUAL CHANGES AND OPTIONS

### 7-1. OPTIONS

7-2. Options are standard modifications performed on HP instruments at the factory. Model 4342A Option 001 low frequency version covering a frequency range from 10kHz to 32MHz is available.

### 7-3. SPECIAL INSTRUMENTS

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

### 7-5. MANUAL CHANGES

7-6. This manual applies directly to the Model 4342A with serial prefixed 1212J-00591 and above. The following paragraphs explain how to adapt this manual to apply to later instruments with higher serial prefix, or earlier instruments with lower serial prefix. Technical corrections to this manual (if any) are called errata and are listed on a separate "Manual Changes" sheet supplied with this manual.

7-7. **LATER INSTRUMENTS:** If the serial prefix of your Model 4342A is above 1212J, refer to a separate "Manual Changes" sheet supplied with this manual. Locate the serial prefix of your instrument and make the indicated changes.

7-8. **EARLIER INSTRUMENTS(Backdating Changes):** If the serial prefix of your Model 4342A is 1212J-00590 and below, refer to Table 7-1 for the changes necessary to adapt this manual to your particular instrument. Locate the serial prefix of your instrument in the table and make the indicated changes.

Note that instrument-component values that differ from those in this manual, yet are not listed in this backdating changes, should be replaced using the part number given in this manual.

7-9. **OPTION001 INSTRUMENTS:** Information about Option 001 is given in Appendix.

Table 7-1. Backdating Changes.

Instrument Serial Prefix or Number	Make Changes
941/942	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
1005/1006J00115 and below	2, 3, 4, 5, 6, 7, 8, 9, 10, 11
1005/1006J00135 and below	3, 4, 5, 6, 7, 8, 9, 10, 11
1018/1019	4, 5, 6, 7, 8, 9, 10, 11
1027/1028	5, 6, 7, 8, 9, 10, 11
1035/1036J00240 and below	6, 7, 8, 9, 10, 11
1035/1036J00290 and below	7, 8, 9, 10, 11
1035/1036J00315 and below	8, 9, 10, 11
1035/1036J00340 and below	9, 10, 11
1211/1212J00570 and below	10, 11
1212J00590 and below	11

### CHANGE 1

Page 6-3 and 6-4, Table 6-2, Reference Designation Index  
Delete A1A1C31 and A1A1R22.

Page 8-5, Figure 8-3, Oscillator Ass'y A1  
Delete A1A1C31 and A1A1R22 from circuit.

Page 6-10, Table 6-2, Reference Designation Index  
Delete A5CR1.

Page 8-9, Figure 8-5, Impedance Converter, RF Amplifier & Detector Ass'y A5.  
Delete A5CR1 from circuit.

Page 6-14, Table 6-2, Reference Designation Index  
Change A7C2 to HP Part No. 0160-0128, C:FXD CER 2, 2 $\mu$ F 20% 25VDCW.

Page 8-11, Figure 8-6, Q-Limit Selector Ass'y A7  
Change value of A7C2 to 2, 2 $\mu$ .  
Change circuit as shown in partial schematic Figure 7-1.

Section VII  
Change I

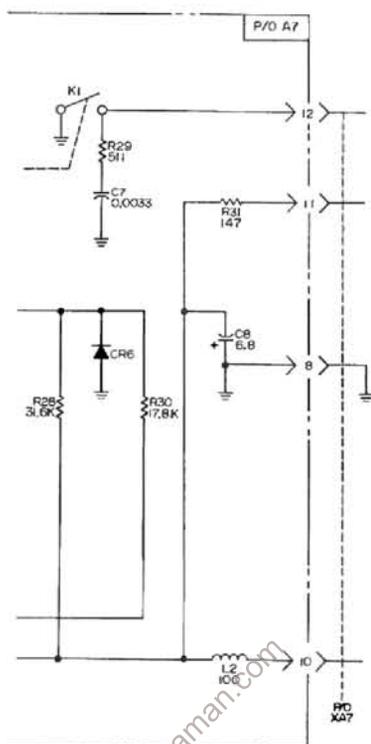


Figure 7-1. A7 04342-7707

Page 6-16, Table 6-2, Reference Designation Index  
Change A8CR17 to HP Part No. 1910-0102, SEMICON DEVICE:DIODE GERMANIUM.

Page 6-18, Table 6-2, Reference Designation Index  
Delete A8R43.

Page 8-13, Figure 8-7, Power Supply & ALC Amplifier Ass'y A8  
Delete A8R43 from circuit.

Page 6-18, Table 6-2, Reference Designation Index  
Add A11R1, R2, HP Part No. 0757-0461, R:FXD MET FLM 68.1k $\Omega$  1% 1/8W.

Page 8-7, and 8-9, Figure 8-4 and 8-5, Meter Scale Indicator Ass'y A11  
Change circuit as shown in schematic Figure 7-2.

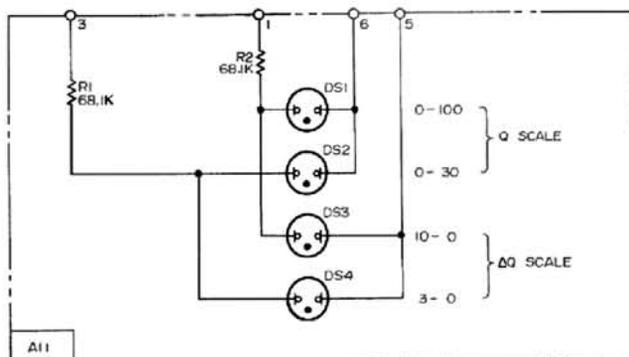


Figure 7-2. A11 04342-7711

## CHANGE 2

- Page 6-4, Table 6-2, Reference Designation Index  
Change A1A1R8 to HP Part No. 0757-0438, R:FXD MET FLM 5.11k $\Omega$  1% 1/8W.  
Change A1A1R20 to HP Part No. 0757-0346, R:FXD MET FLM 10 $\Omega$  1% 1/8W, and  
remove asterisk (\*) from A1A1R20.  
Delete A1A1R23.
- Page 8-5, Figure 8-3, Oscillator Ass'y A1  
Change value of A1A1R8 to 5110 $\Omega$ .  
Change value of A1A1R20 to 10 $\Omega$ , and remove asterisk (\*) from A1A1R20.  
Delete A1A1R23 from circuit.

## CHANGE 3

- Page 6-4, Table 6-2, Reference Designation Index  
Delete A1A1L9.
- Page 8-5, Figure 8-3, Oscillator Ass'y A1  
Delete A1A1L9 from circuit.
- Page 6-7, Table 6-2, Reference Designation Index, Miscellaneous  
Change HP Part No. of PLATE: TERMINAL to 04342-3221.
- Page 6-11, Table 6-2, Reference Designation Index  
Change A5C23 to HP Part No. 0180-0376, C:FXD TA 0.47 $\mu$ F 10% 35VDCW.  
Delete A5R44 and R45.  
Add A5L1 and L3 HP Part No. 9140-0179, COIL:FXD RF 22 $\mu$ H 10%.
- Page 8-9, Figure 8-5, Impedance Converter, RF Amplifier & Detector Ass'y A5  
Change value of A5C23 to 0.47 $\mu$ F.  
Replace A5R44 and R45 with A5L1 and L3, 22 $\mu$ H respectively.

## CHANGE 4

- Page 6-3, Table 6-2, Reference Designation Index  
Change HP Part No. of A1A1 to 04342-7701.  
Change HP Part No. of A1A1 BLANK PC BOARD to 04342-8701.
- Page 8-3, Figure 8-2, Functional Overall Block Diagram  
Change HP Part No. of A1A1 Oscillator Board to 04342-7701.
- Page 8-5, Figure 8-3, Oscillator Ass'y A1  
Change HP Part No. of A1A1 Oscillator Board Ass'y to 04342-7701
- Page 6-4, Table 6-2, Reference Designation Index, Miscellaneous  
Change HP Part No. of PLATE:ANGLE to 04342-1074
- Page 6-8, Table 6-2, Reference Designation Index, Miscellaneous  
Delete ANGLE: SHIELD HP Part No. 04342-1048.  
Add SHIELD HP Part No. 04342-1055 and ANGLE (2 REQ'D) HP Part No. 04342-1056.
- Page 6-12, Table 6-2, Reference Designation Index  
Change A6CR2 and CR3 to HP Part No. 1902-0041, SEMICON DEVICE:DIODE  
BREAKDOWN 5.11V 5% 400mW.
- Page 8-9, Figure 8-5, DC Amplifier Ass'y A6  
Change values of A5CR2 and CR3 to 5.11V

- Page 6-13, Table 6-2, Reference Designation Index  
Change A6R26 to HP Part No. 0698-4433, R:FXD MET FLM 2, 26k $\Omega$  1% 1/8W.  
Change A6R29 to HP Part No. 0757-0433, R:FXD MET FLM 3, 32k $\Omega$  1% 1/8W.
- Page 8-9, Figure 8-5, DC Amplifier Ass'y A6  
Change value of A6R26 to 2260 $\Omega$ .  
Change value of A6R29 to 3320 $\Omega$ .
- Page 6-20, Table 6-2, Reference Designation Index  
Change HP Part No. of XA6 and XA7 to 1251-0160.  
Change HP Part No. of FRONT PANEL ASS'Y to 04342-1021.  
Change HP Part No. of BOTTOM COVER to 04342-1029.

CHANGE 5

- Page 6-14, Table 6-2, Reference Designation Index  
Change A7CR1 to HP Part No. 1902-0041, SEMICON DEVICE DIODE BREAKDOWN  
5.11V 5% 400mW.  
Change A7R7 to HP Part No. 2100-1759, R:VAR WW 2k $\Omega$  5% 1W.
- Page 8-11, Figure 8-6, Q-Limit Selector Ass'y A7  
Change value of A7CR1 to 5.11V.  
Change value of A7R7 to 2000 $\Omega$ .

CHANGE 6

- Page 6-4, Table 6-2, Reference Designation Index  
Delete A1A1L10.
- Page 8-5, Figure 8-3, Oscillator Ass'y A1  
Delete A1A1L10 from circuit.

CHANGE 7

- Page 6-9, Table 6-2, Reference Designation Index  
Change A4C3 to HP Part No. 0180-0374, C:FXD TA 10 $\mu$ F 10% 20VDCW.
- Page 8-7, Figure 8-4, Impedance Converter Ass'y A4  
Change value of A4C3 to 10 $\mu$ F.
- Page 6-19, Table 6-2, Reference Designation Index  
Change C1a and C1b to HP Part No. 0150-0119, C:FXD CER 2 x 0.01 $\mu$ F 20% 250WVAC.
- Page 8-13, Figure 8-7, Power Supply & ALC Amplifier Ass'y A8  
Change circuit as shown in partial schematic Figure 7-3.

CHANGE 8

- Page 6-14, Table 6-2, Reference Designation Index  
Change A7R7 to HP Part No. 2100-1910, R:VAR MET FLM 100k $\Omega$  2% 3/4W.
- Page 8-11, Figure 8-6, Q Limit Selector Ass'y A7  
Change value of A7R7 to 100k $\Omega$ .

CHANGE 9

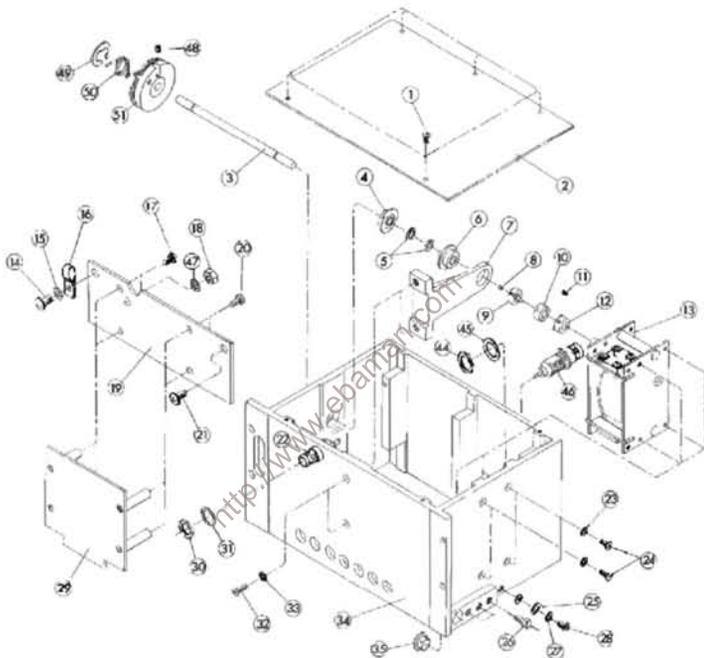
- Page 6-10, Table 6-2, Reference Designation Index  
Change A5C7 to HP Part No. 0180-1745, C:FXD TA 1.5 $\mu$ F 10% 20VDCW.  
Change A5C13 to HP Part No. 0160-2201, C:FXD MICA 51pF 5% 300VDCW.  
Change A5C15\* to HP Part No. 0160-2266, C:FXD CER 24pF 5% 500VDCW.



CHANGE 11

Page 6-20, 6-21, Table 6-2, Reference Designation Index  
Change HP Part No. of PANEL ASS'Y FRONT to 04342-1049.  
Change HP Part No. of COVER ASS'Y TOP to 04342-1028.  
Change HP Part No. of COVER BOTTOM to 04342-1027.  
Change HP Part No. of BRACKET HANDLE H1 to 04342-1031.  
Change HP Part No. of BRACKET HANDLE H2 to 04342-1032.

Page 6-22, Figure 6-1, Exploded View of OSC Ass'y (sheet 1 of 2).  
Change partial illustrated parts identification of Figure 6-1 as shown below:



Page 6-23, Figure 6-1, Exploded View of OSC Ass'y (sheet 2 of 2)  
Change Parts List of Figure 6-1 as follows:

Item No.	Part No.	Q'ty	Description	Note
1	2360-0115	5	SCREW:MACH SST 6-32 X .312	
2	04342-1070	1	COVER:TOP	
3	04342-3092	1	SHAFT:OSCILLATOR	
4	1410-0307	1	BEARING	
5	0510-0046	2	RING:RET EXT , 188 DIA	
6	1410-0307	1	BEARING	
7	04342-3093	1	BRACKET:SHAFT	
8	3030-0033	2	SCREW:SET 6-32 X , 188 LG HEX SKT , DR	
9	1500-0005	1	HUB:COUPLER (BRASS)	
10	1500-0004	1	HUB:COUPLER (NYLON)	
11	3030-0033	2	SCREW:SET 6-32 X , 188 LG HEX SKT , DR	
12	04342-3096	1	HUB:COUPLER (BRASS)	
13	0121-0232	1	CAPACITOR:AIR	
14	2360-0199	1	SCREW:MACH SST 6-32 X .438 PH	
15	3050-0066	1	WASHER:BRASS , 147 ID	
16	1400-0325	1	CLAMP:CABLE (NYLON)	
17	2360-0115	2	SCREW:MACH SST 6-32 X .312	
18	2740-0003	1	NUT:HEX 10-32 X , 375	
19	04342-1073	1	PLATE	
20	2360-0115	2	SCREW:MACH SST 6-32 X .312	
21	2360-0110	2	SCREW:MACH SST 6-32 X .438 PH	
22	04342-7601	1	CABLE ASS'Y	
23	2190-0047	4	WASHER:LOCK CNTRSK NO. 6	
24	0570-0237	4	SCREW:MACH BRASS 3mm	
25	0360-0032	1	TERMINAL:LUG	
26	0160-2357	3	C:FXD CER 1000pF	
27	2190-0008	1	WASHER:LOCK EXT PHS , BRZ , 141 ID	
28	2360-0115	1	SCREW:MACH SST 6-32 X .312	
29	04342-7702	1	PC BOARD:A1A2 ASS'Y	
30	2190-0102	1	WASHER:LOCK BRZ , 475 ID	
31	2950-0035	1	NUT:HEX BRASS 15 , 32-32	
32	2360-0200	2	SCREW:MACH SST 6-32 X .500	
33	2190-0047	2	WASHER:LOCK CNTRSK NO. 6	
34	04342-5001	1	CASE:OSCILLATOR (CASTING)	
35	0400-0111	1	GROMMET:SNAP IN	
36	2360-0115	1	SCREW:MACH SST 6-32 X .312	
37	04342-7731/41	1	PC BOARD:A1A1 ASSEMBLY	
38	2360-0115	1	SCREW:MACH SST 6-32 X .312	
39	2360-0115	1	SCREW:MACH SST 6-32 X .312	
40	2360-0115	1	SCREW:MACH SST 6-32 X .312	
41	04342-1071	1	COVER BOTTOM	
42	2360-0115	1	SCREW:MACH SST 6-32 X .312	
43	2360-0115	3	SCREW:MACH SST 6-32 X .312	
44	2950-0035	1	NUT:HEX BRASS 15 , 32-32	
45	2190-0102	1	WASHER:LOCK BRZ , 475 ID	
46	1250-0314	1	CONNECTOR:BNC FEMALE	
47	2190-0012	1	WASHER:LOCK EXT BRZ	
48	3030-0033	1	SCREW:SET 6-32 X , 188 LG HEX SKT , DR	
49	0510-0080	1	RING:RET EXT , 500 DIA E TYPE	
50	04342-8524	1	SPRING:COLL	
51	04342-5035	1	PULLEY:MOULDED	

Figure 6-1. Exploded View of Oscillator Ass'y (sheet 2 of 2)

## SECTION VIII

### CIRCUIT DIAGRAMS

#### 8-1. INTRODUCTION

8-2. This section includes the following:

- a. General Notes for schematic diagrams.
- b. Functional Overall Block Diagram (Figure 8-2).
- c. Schematic Diagrams and Parts Location Illustrations. Waveforms and voltages at indicated test points are also included.

8-3. Circuit diagrams of Option 001 are given in APPENDIX. A1 and A5 Ass'y circuit diagrams are different from the Standard Model 4342A. For other assemblies, refer to this section.

#### 8-4. GENERAL NOTES

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

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

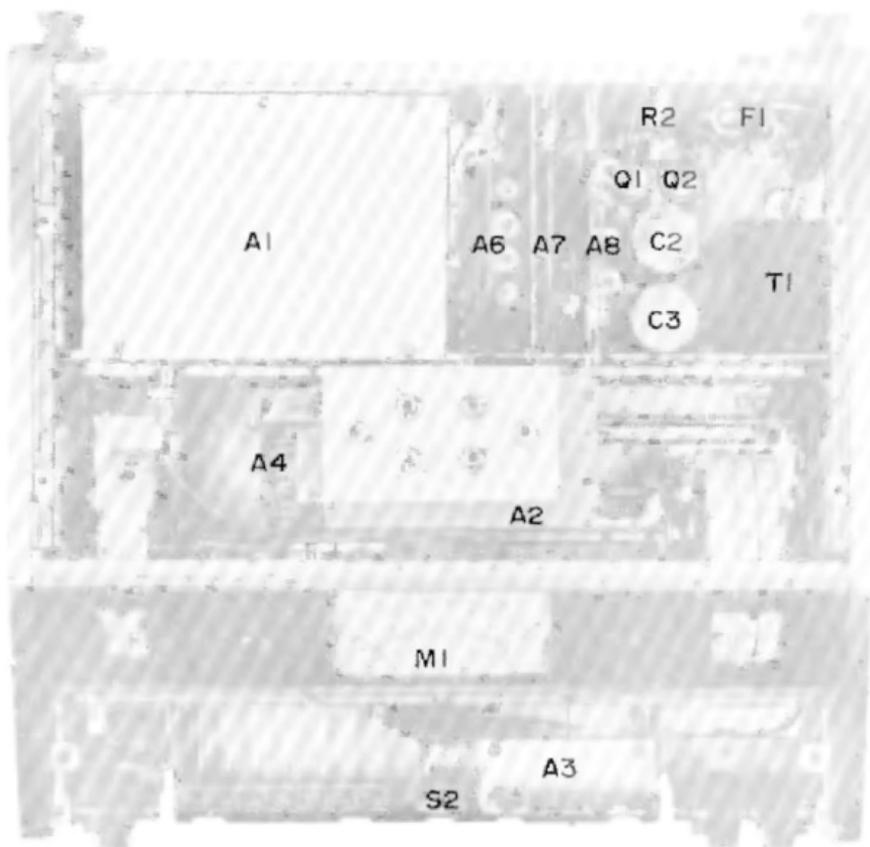
c. (9.4.7) indicates wire color code. Wire color code (MIL-STD-681) same as resistor color code. First number identifies ground color, second number identifies wide stripe, third number identifies narrow stripe, i. e. (9.4.7) denotes white ground, yellow wide stripe, violet narrow stripe.

d. The components mounted on chassis or main-frame parts are not assigned an assembly designation (i. e. R1, Q1, etc.).

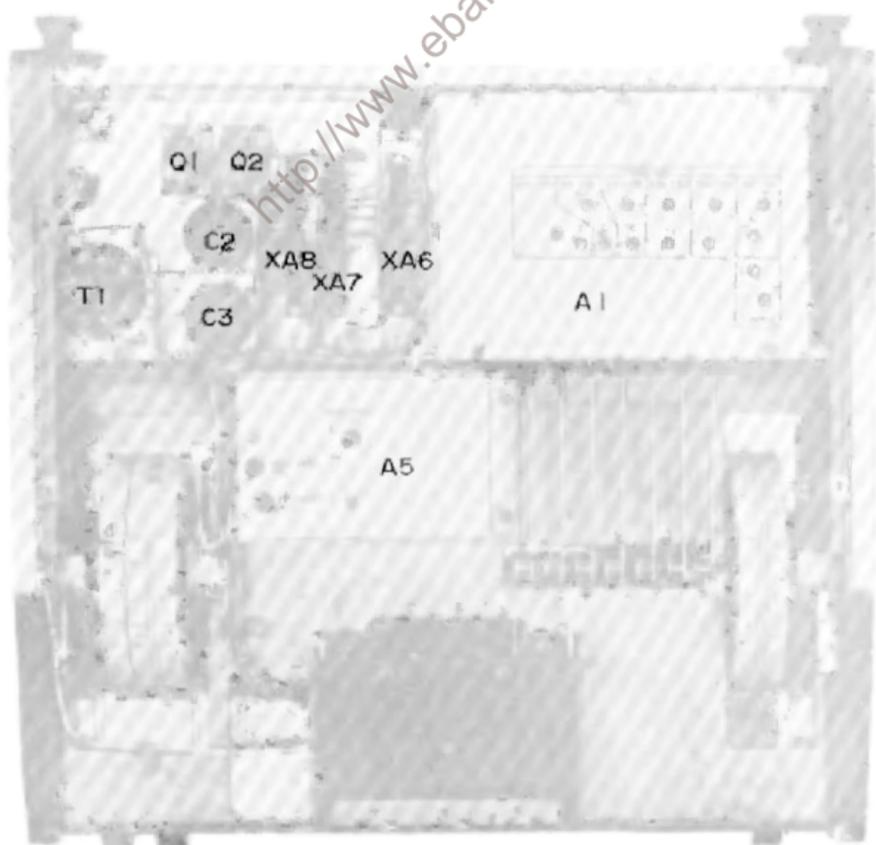
e. Reference designations (R1, Q1, etc.) within assembly (A1, A2, . . . etc.) use assembly designation as prefix to form complete designation. (i. e. R1 in A1 assembly is A1R1)

8-5. Additional notes are shown in Figure 8-1.



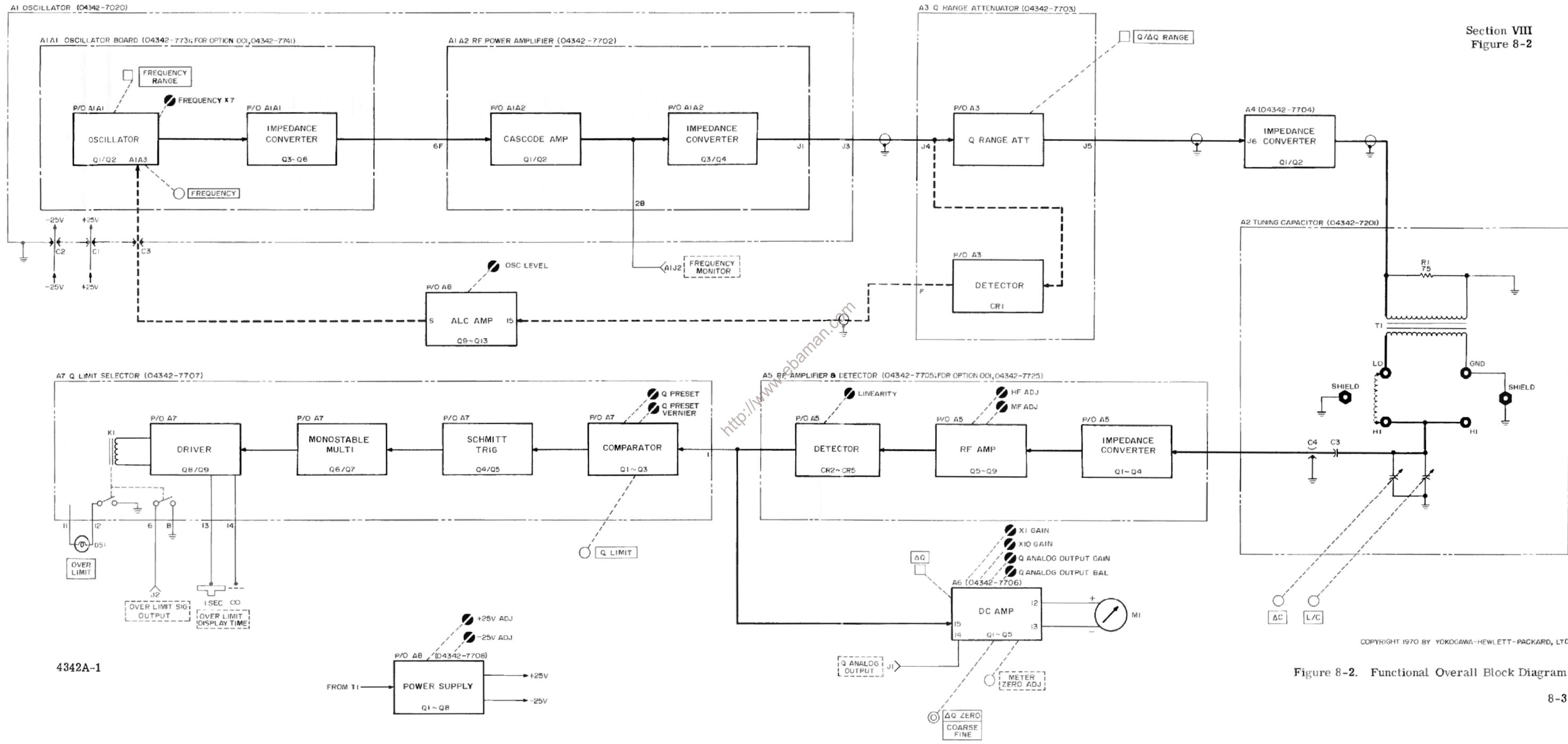


TOP VIEW



BOTTOM VIEW

ASSEMBLY LOCATION



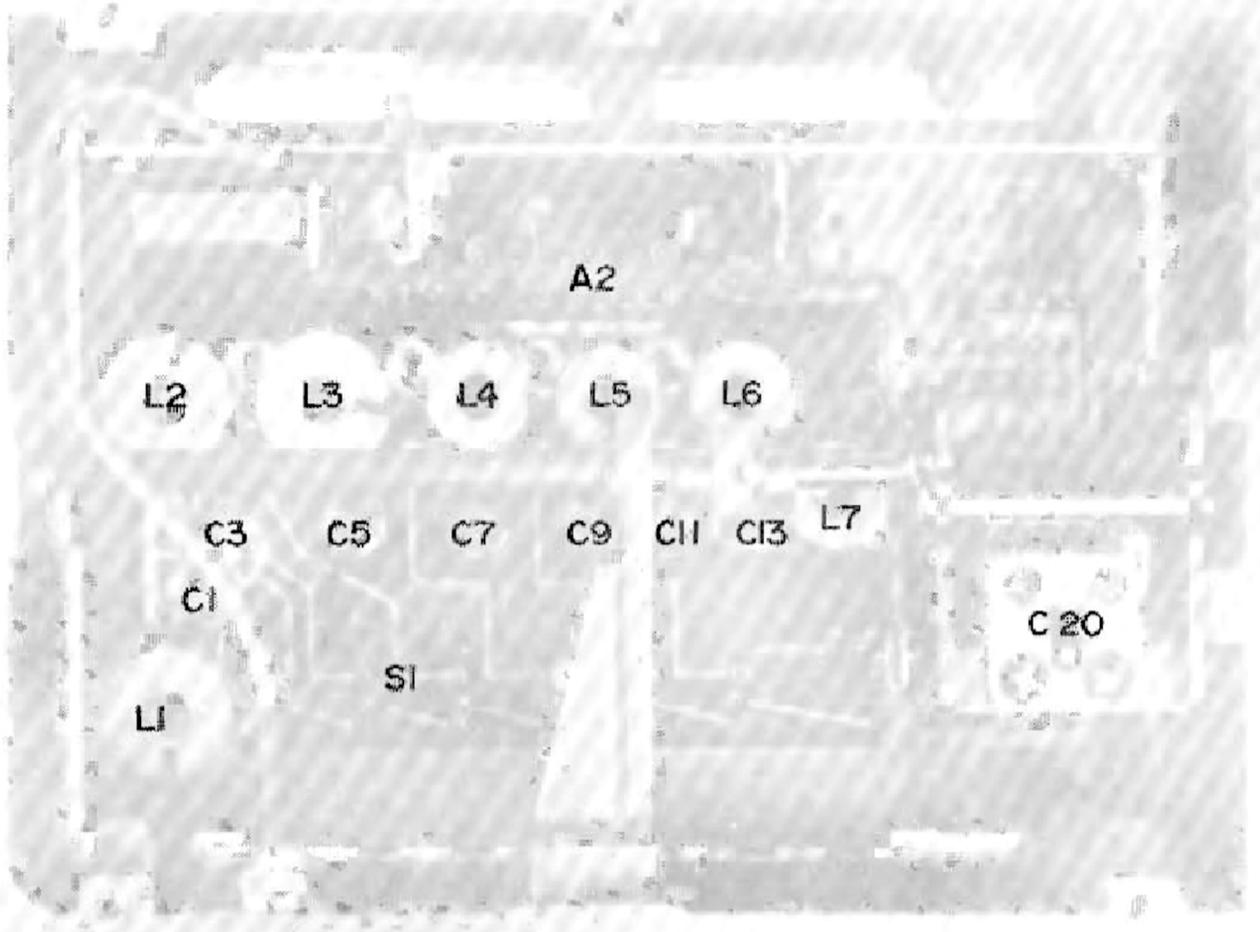
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Figure 8-2. Functional Overall Block Diagram

4342A-1

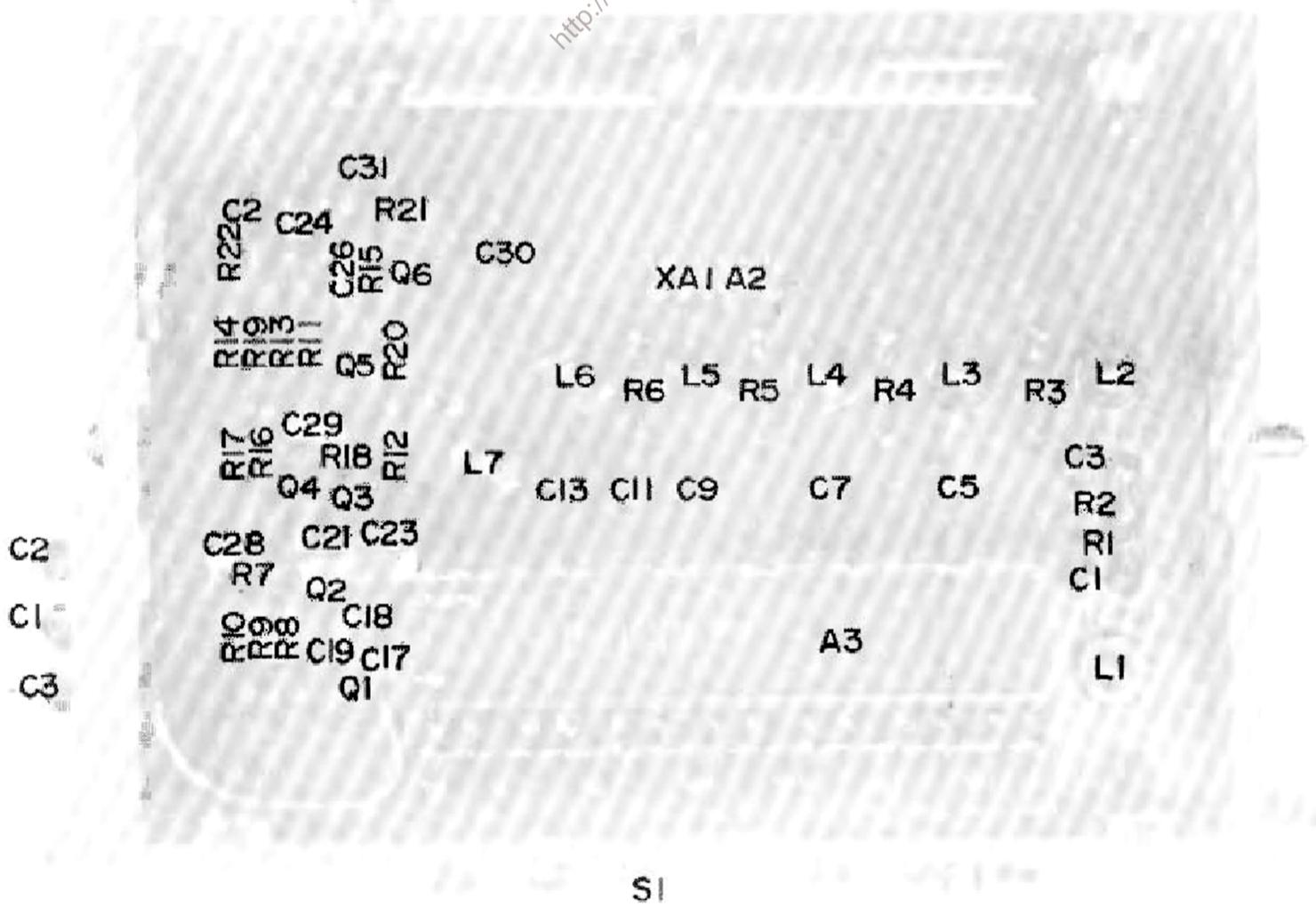


J2

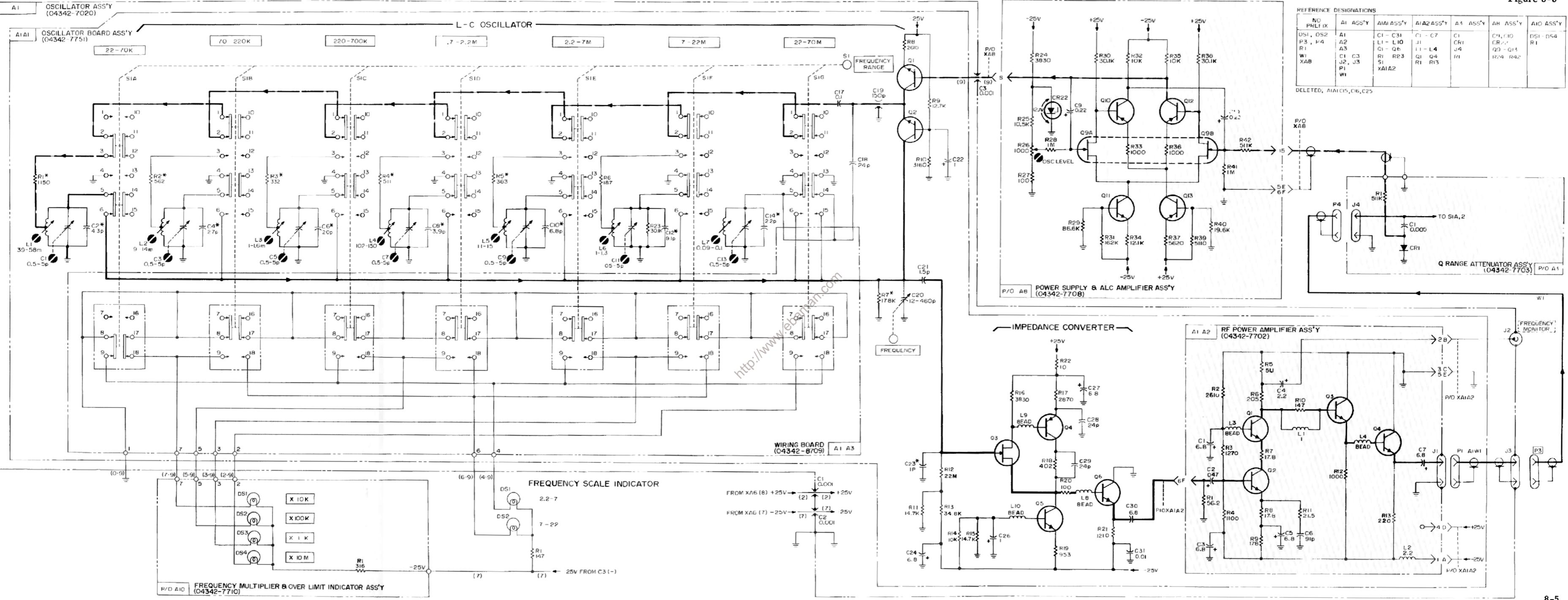


OSCILLATOR ASS'Y A1 (TOP VIEW)  
COMPONENT LOCATION

J2



OSCILLATOR ASS'Y A1 (BOTTON VIEW)  
COMPONENT LOCATION



REFERENCE DESIGNATIONS							
NO	PHLT IX	A1 ASS'Y	A1A1 ASS'Y	A1A2 ASS'Y	A4 ASS'Y	AH ASS'Y	A10 ASS'Y
DS1, DS2	A1	C1 - C31	C1 - C7	C1	C1	C1, C10	DS1 - DS4
P3, P4	A2	L1 - L10	J1	CR1	CR1	CR1	R1
R1	A3	C1 - Q6	L1 - L4	J4	J4	Q0 - Q1	
W1	C1, C3	R1 - R23	Q1 - Q4	R1	R1	R24 - R42	
XAB	J2, J3	S1	R1 - R13				
	P1	XA1A2					
	W1						

DELETED, A1A1 C15, C16, C25

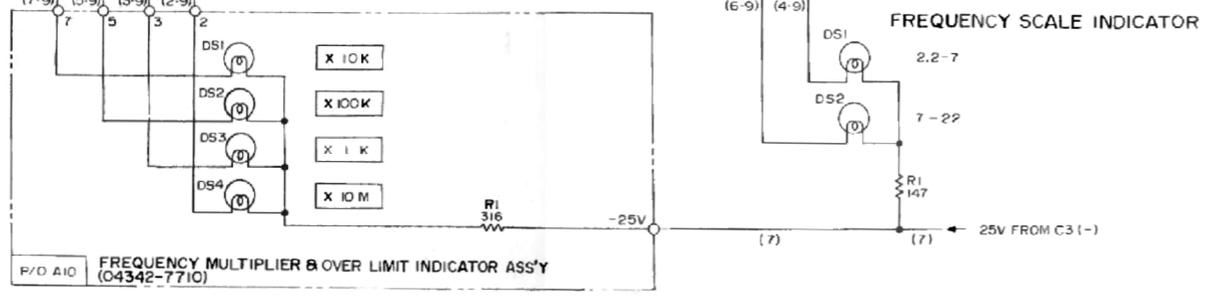
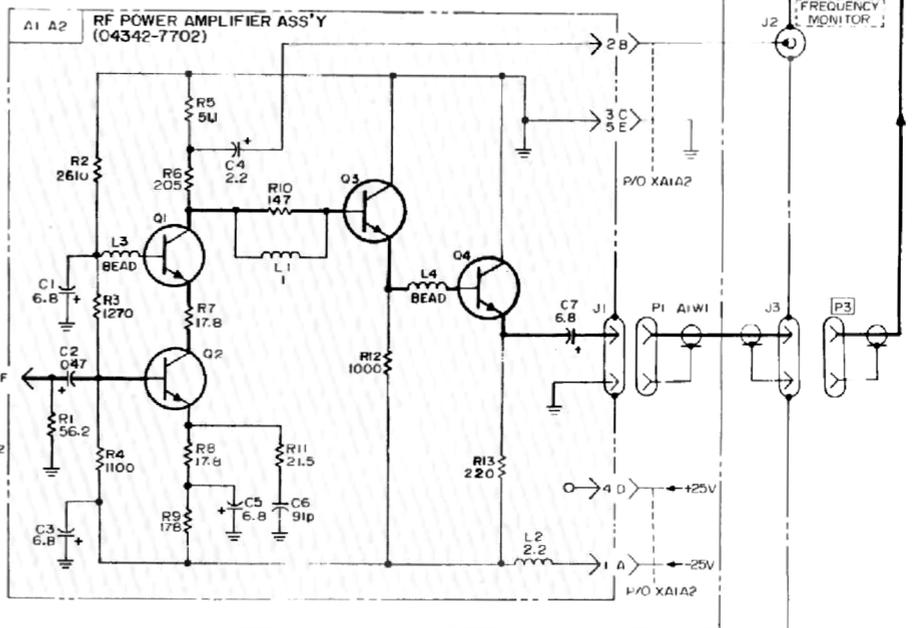
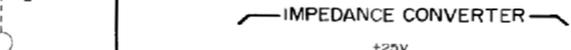
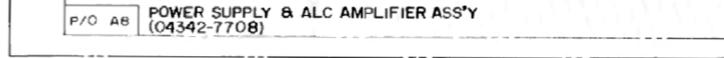
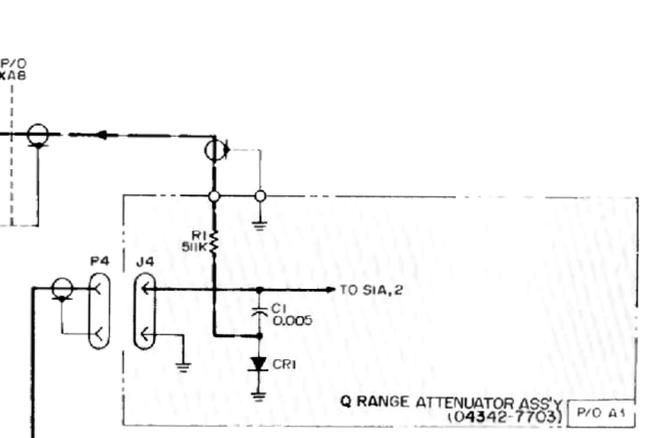
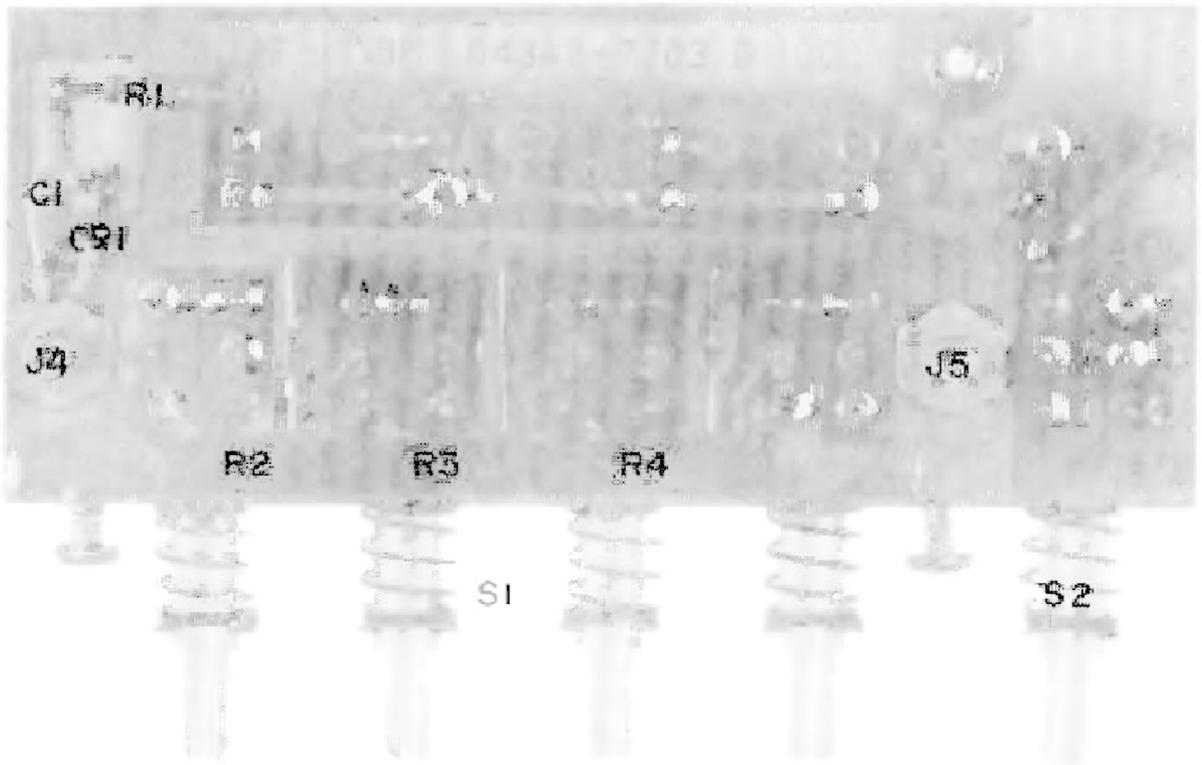
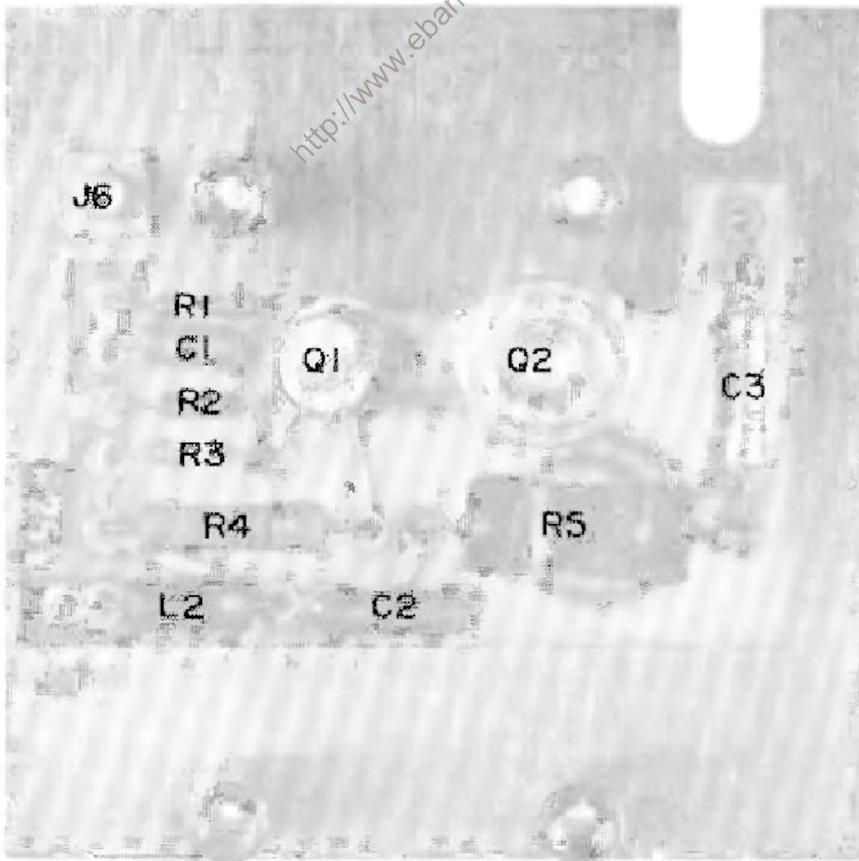


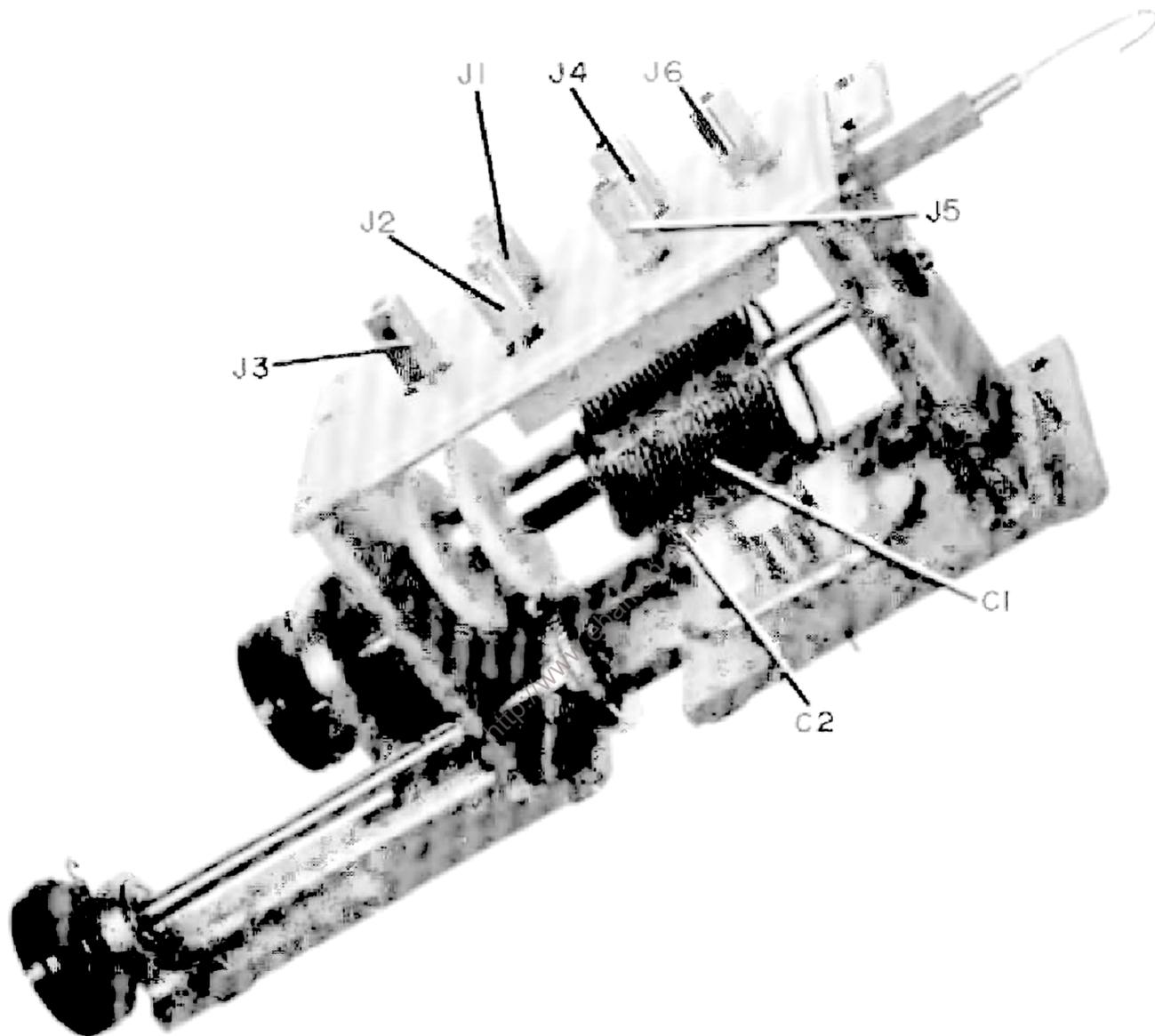
Figure 8-3. Oscillator Ass'y A1  
Q Range Attenuator Ass'y A3  
Power Supply & ALC Amplifier Ass'y A8  
Frequency Multiplier & Over Limit Indicator Ass'y A10



**Q RANGE ATTENUATOR ASS'Y A3  
COMPONENT LOCATION**



**IMPEDANCE CONVERTER ASS'Y A4  
COMPONENT LOCATION**



**TUNING CAPACITOR ASS'Y A2  
COMPONENT LOCATION**

Section VIII  
Figure 8-4

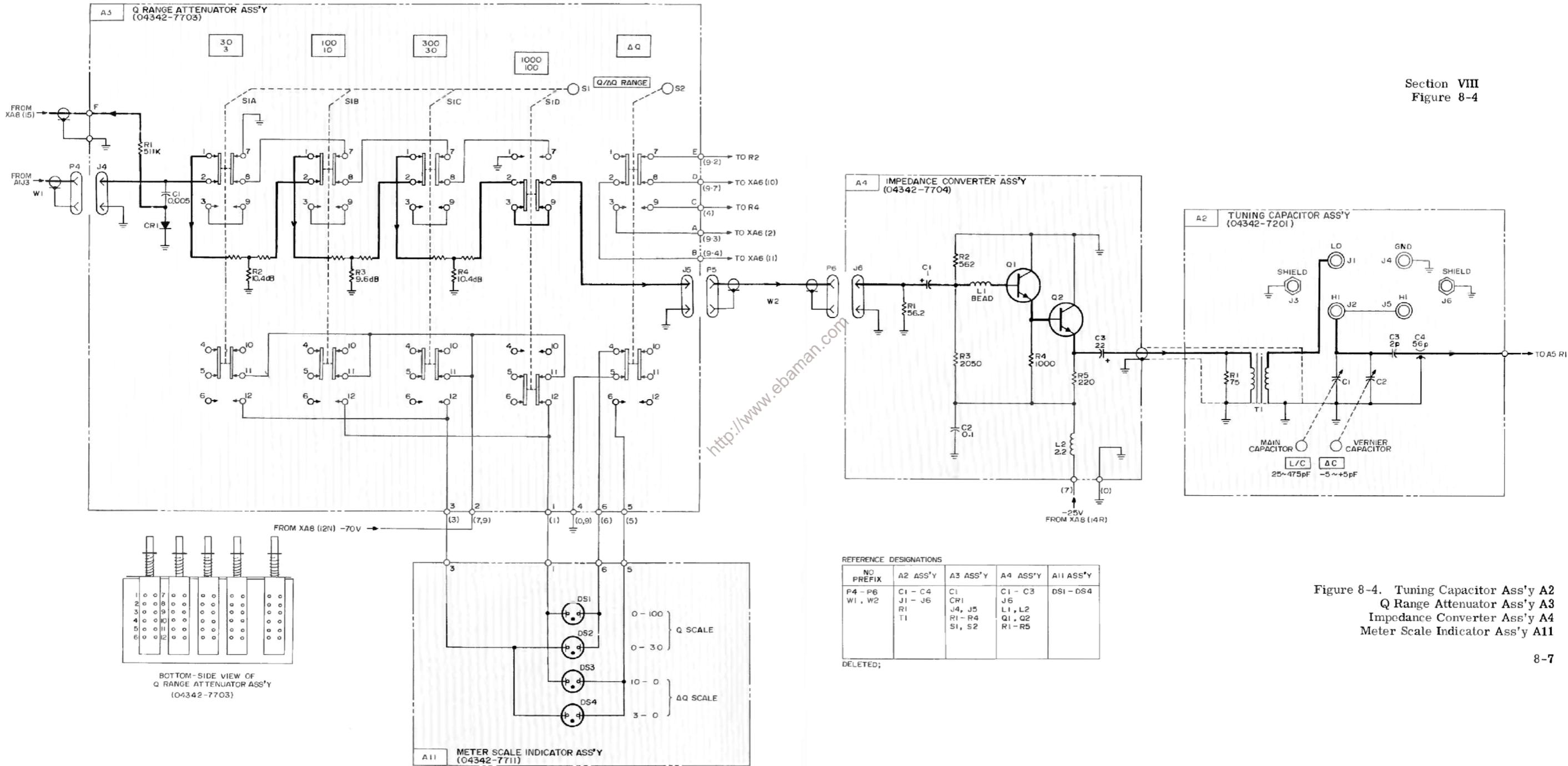
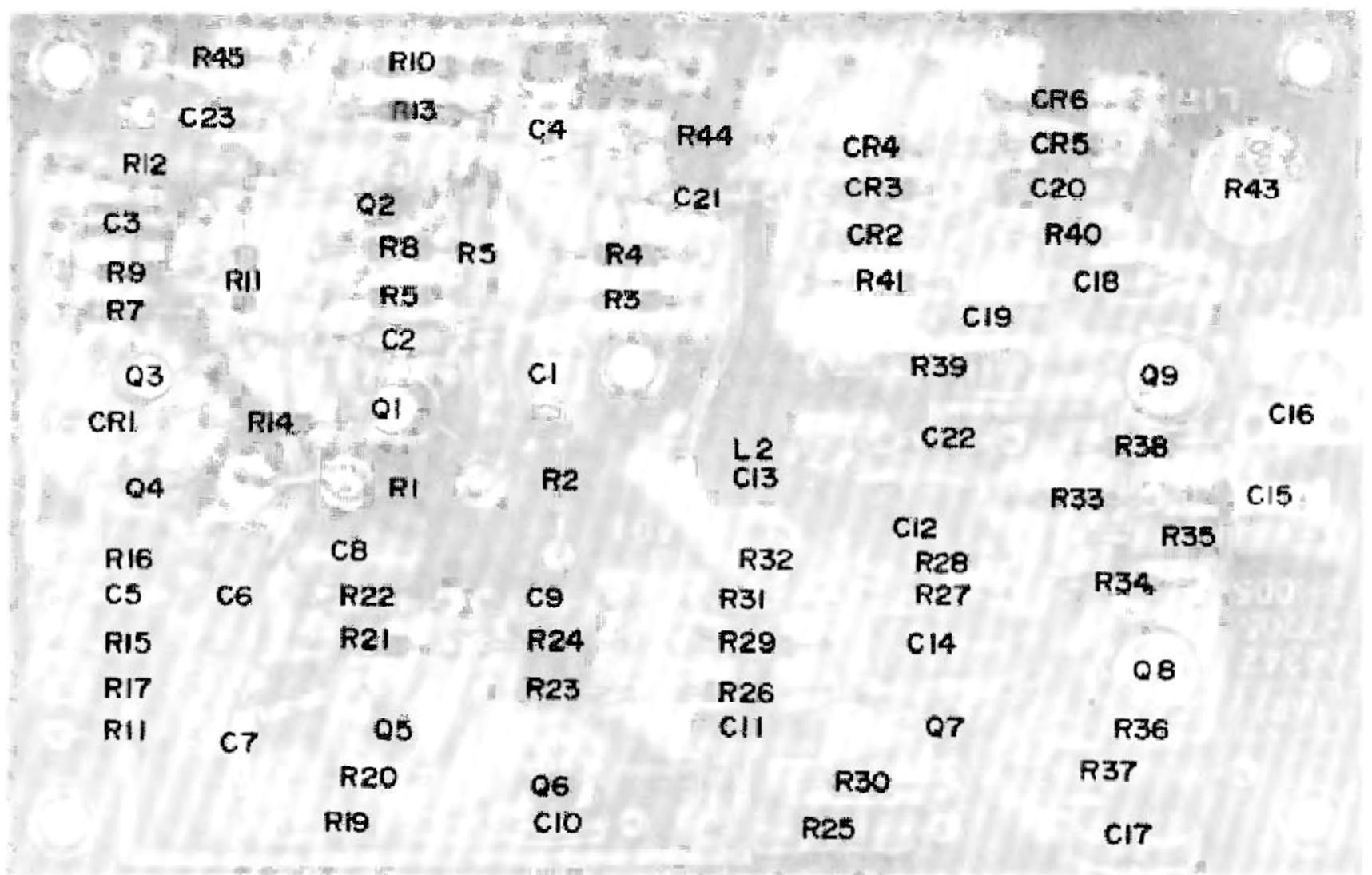
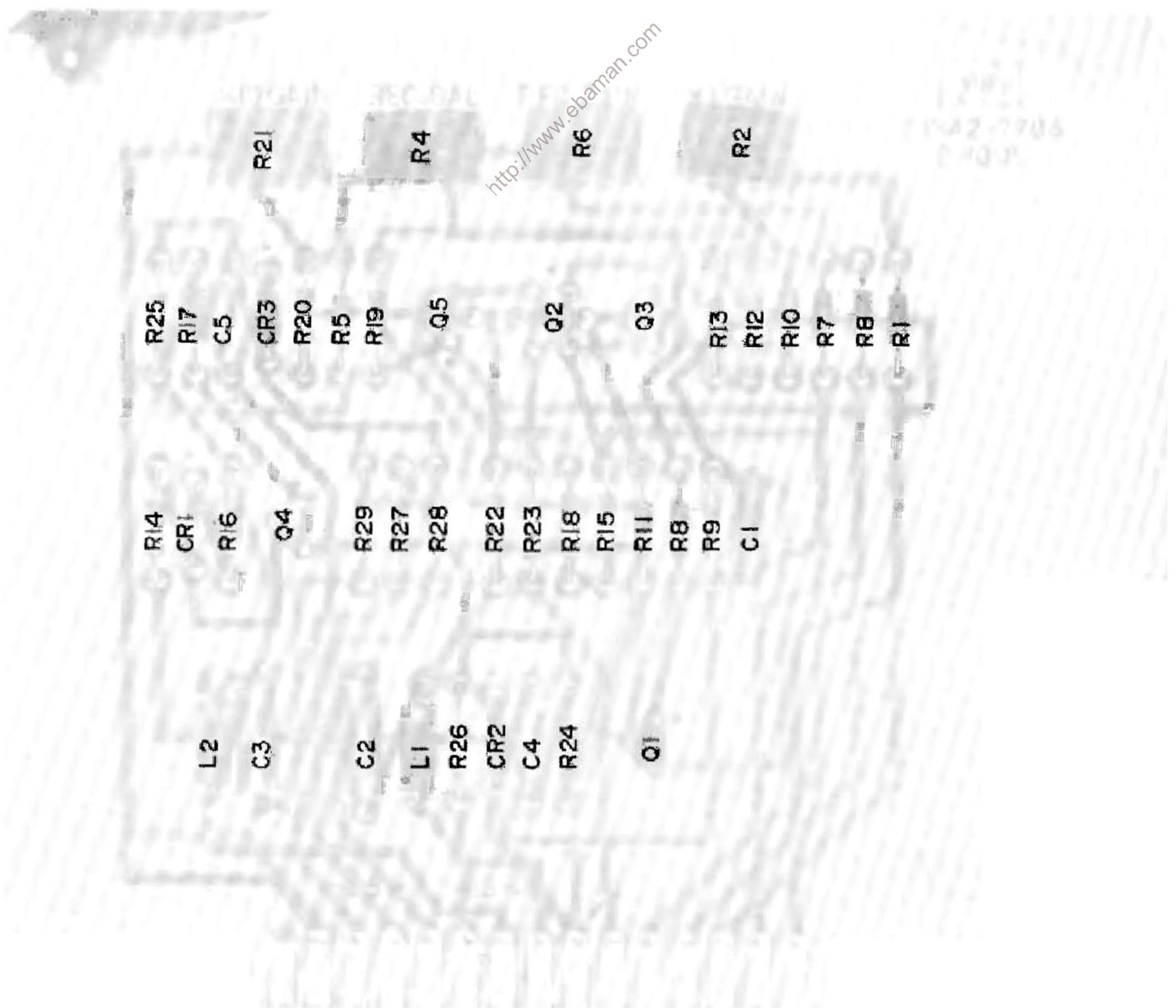


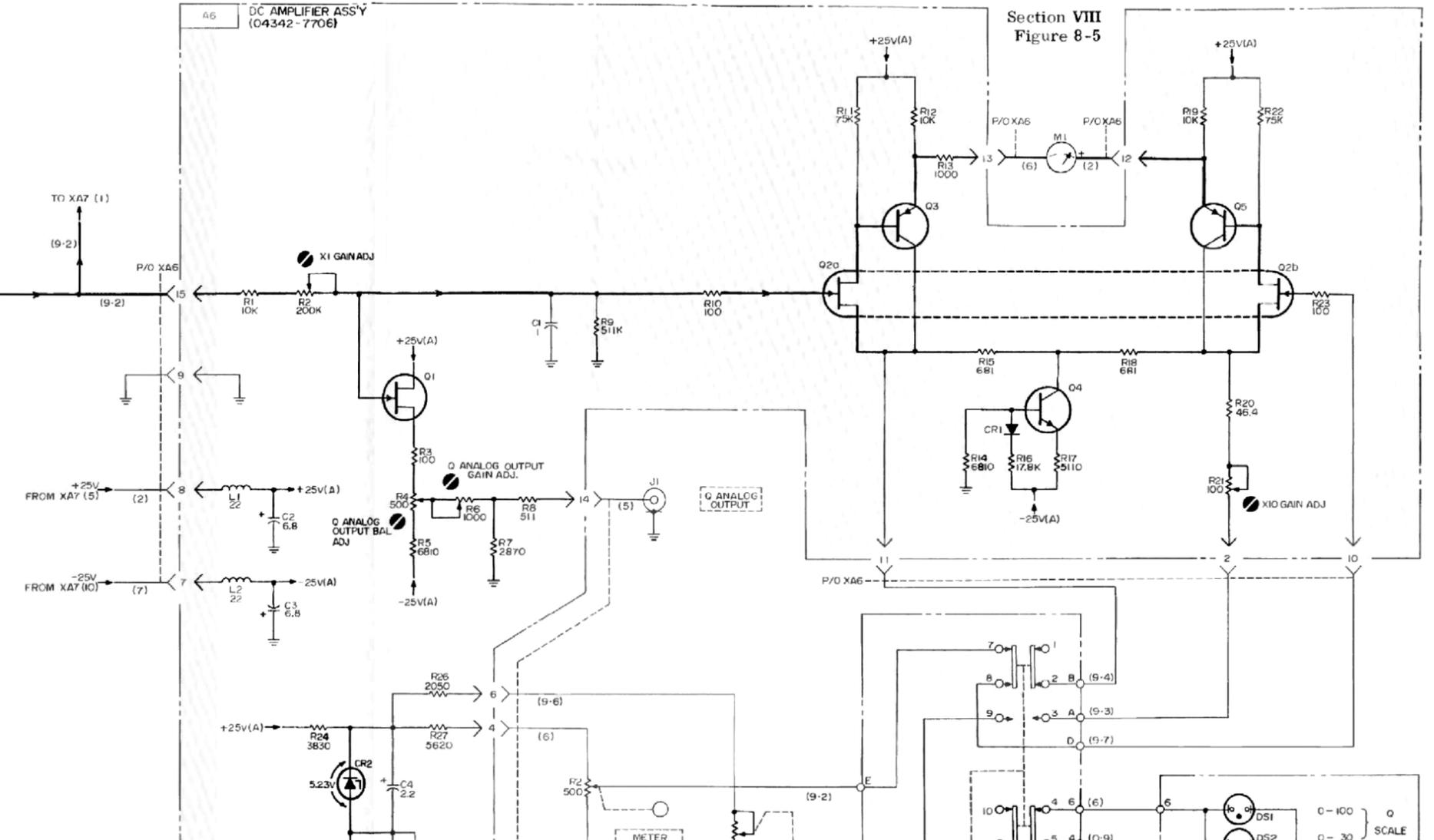
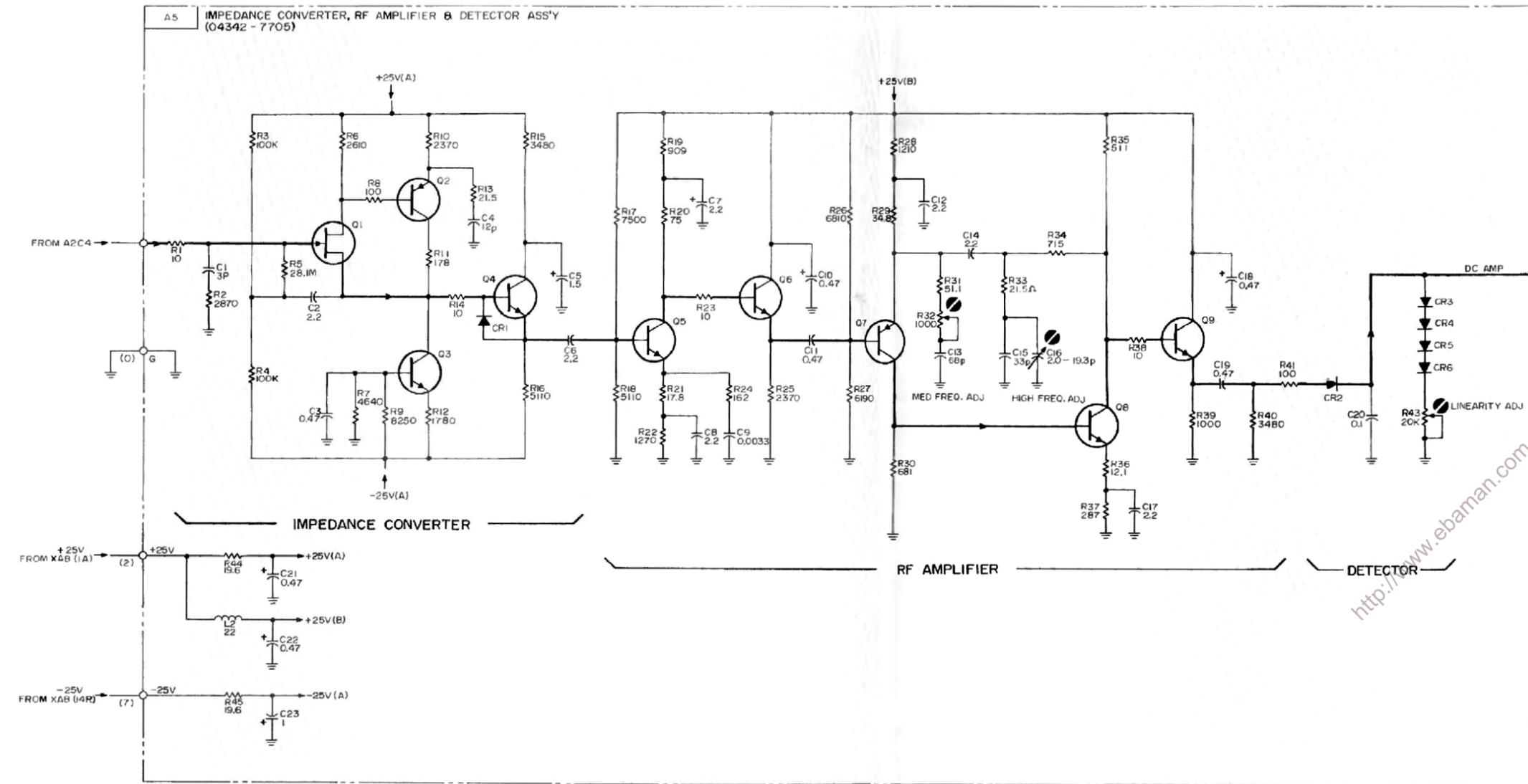
Figure 8-4. Tuning Capacitor Ass'y A2  
Q Range Attenuator Ass'y A3  
Impedance Converter Ass'y A4  
Meter Scale Indicator Ass'y A11



**IMPEDANCE CONVERTER , RF AMPLIFIER & DETECTOR ASS'Y A5  
COMPONENT LOCATION**



**DC AMPLIFIER ASS'Y A6  
COMPONENT LOCATION**



REFERENCE DESIGNATIONS

NO PREFIX	A3 ASS'Y	A5 ASS'Y	A6 ASS'Y	A11 ASS'Y
J1	S2	C1-C23	C1-C5	DS1-DS4
M1		CR1-CR6	CR1-CR3	
R2-R4		L2	L1, L2	
XA6		Q1-Q9	Q1-Q5	
		R1-R45	R1-R29	

DELETED; A5 L1, L3

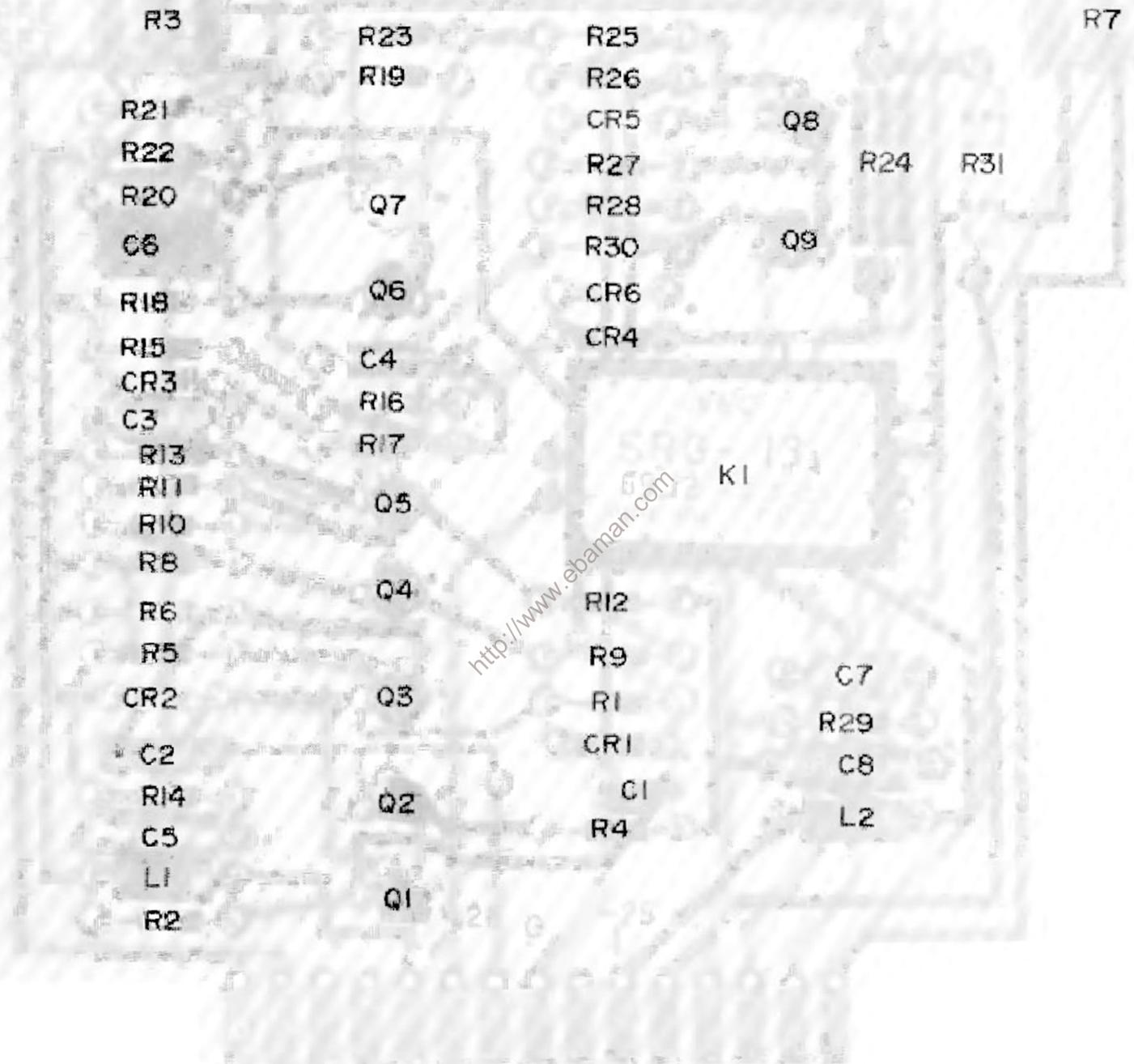
Figure 8-5. Q Range Attenuator Ass'y A3  
 Impedance Converter, RF Amplifier & Detector Ass'y A5  
 DC Amplifier Ass'y A6  
 Meter Scale Indicator Ass'y A11

04342-7707

9-1005

Q-LIMIT SELECTOR ASS'Y A7

VIEW



**Q-LIMIT SELECTOR ASS'Y A7  
COMPONENT LOCATION**

Section VIII  
Figure 8-6

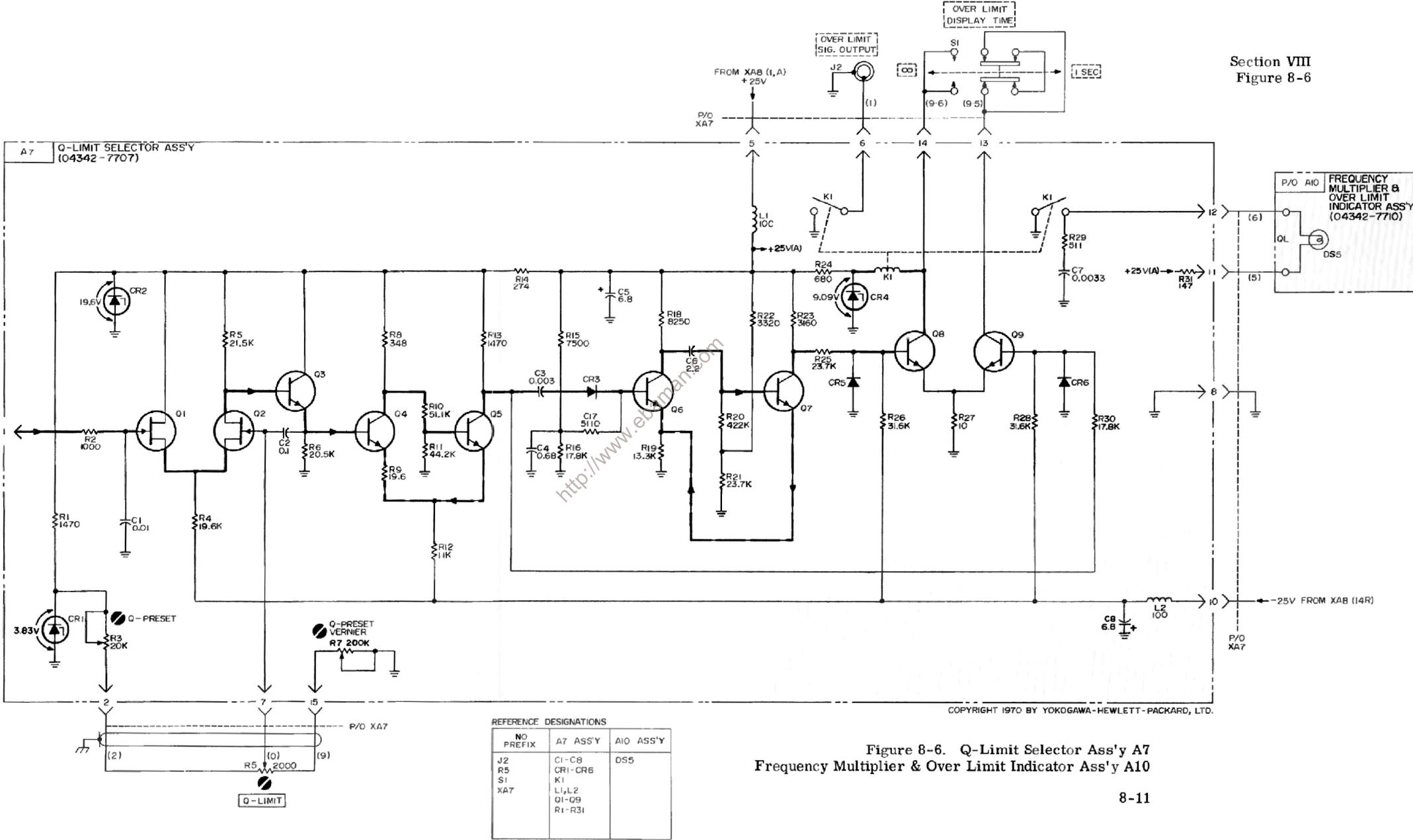
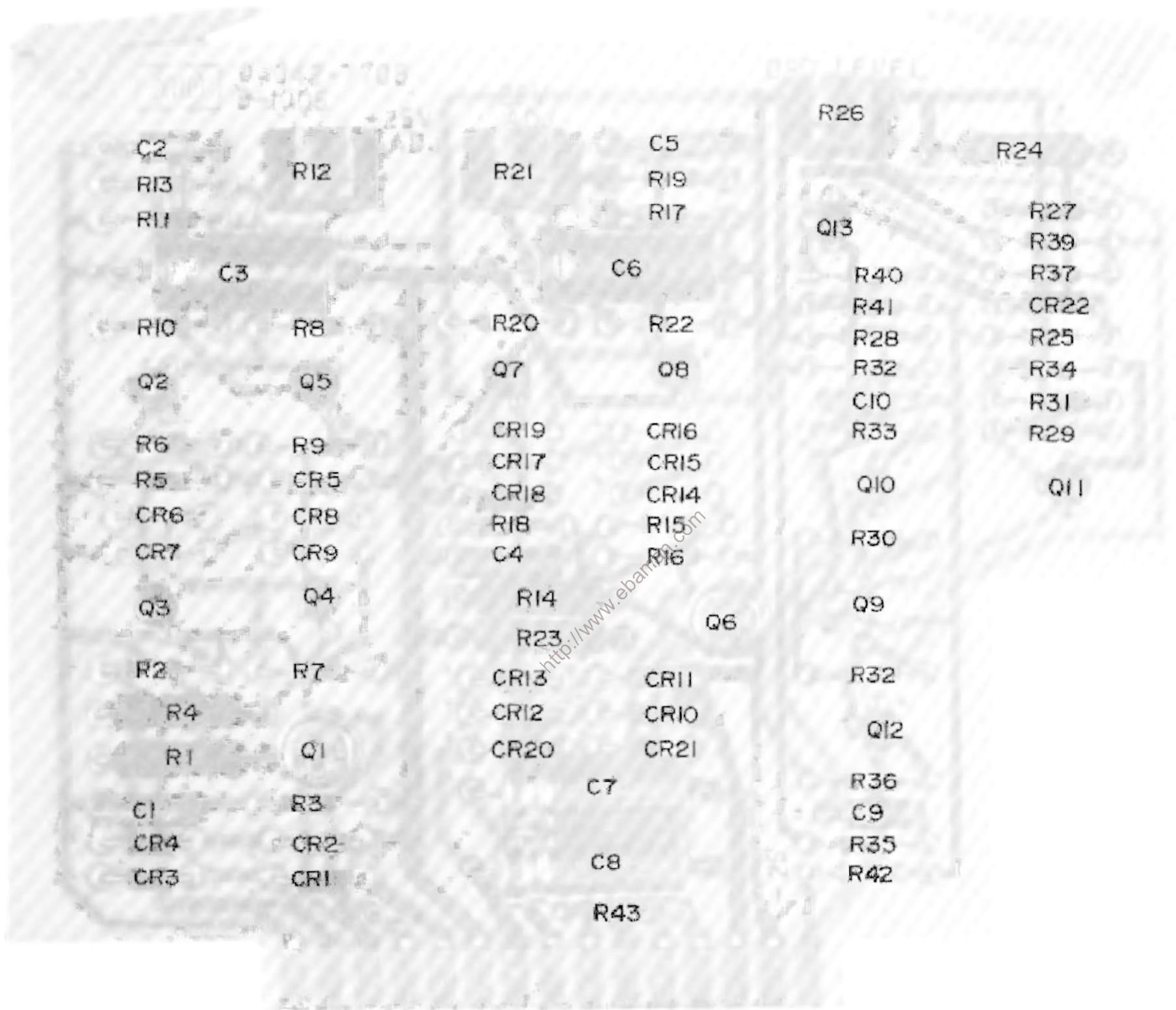


Figure 8-6. Q-Limit Selector Ass'y A7  
Frequency Multiplier & Over Limit Indicator Ass'y A10



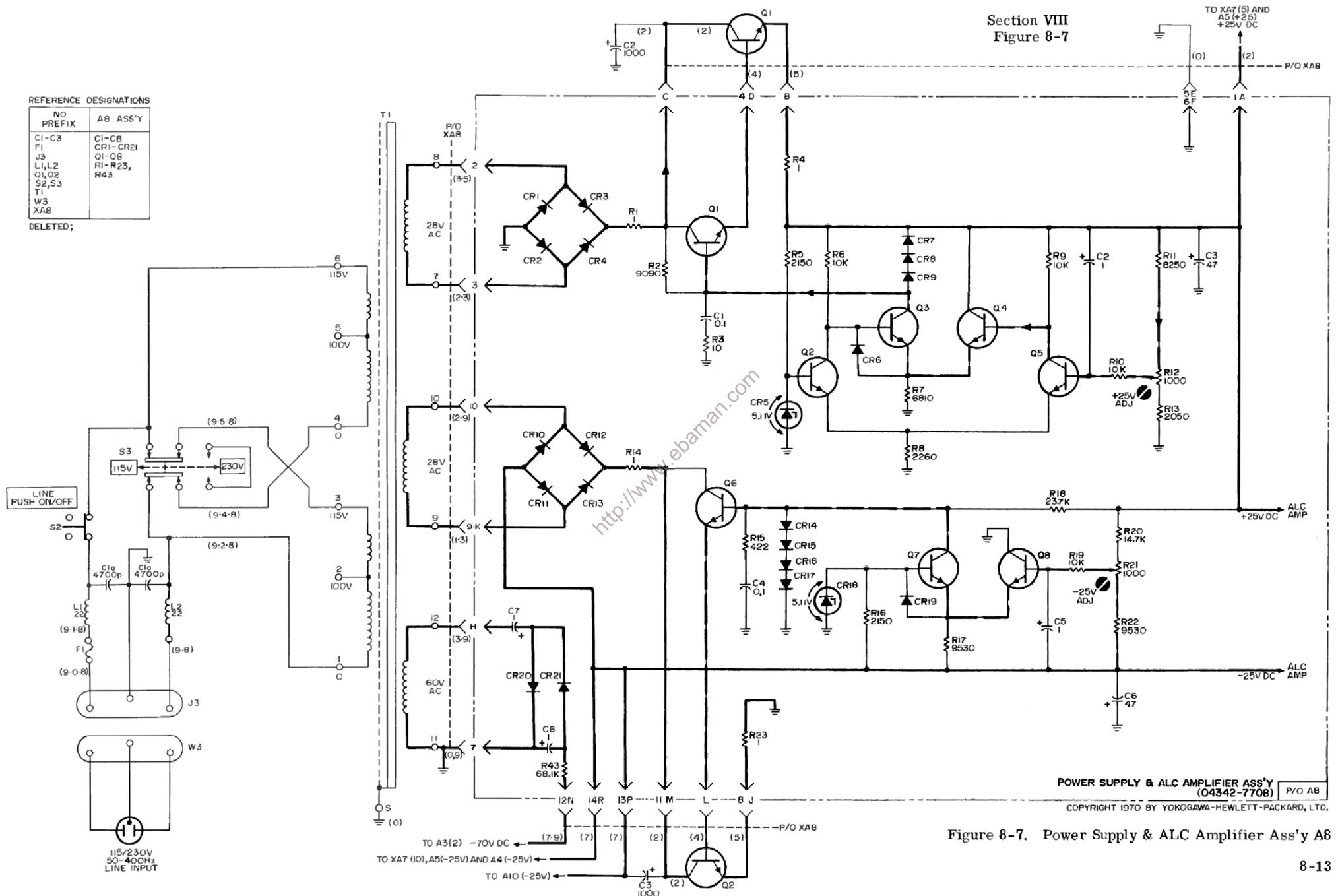
**POWER SUPPLY & ALC AMPLIFIER ASS'Y A8  
COMPONENT LOCATION**

Section VIII  
Figure 8-7

REFERENCE DESIGNATIONS

NO PREFIX	AB ASS'Y
C1-C3	C1-CB
F1	CR1-CR21
J3	Q1-Q5
L1,L2	R1-R23, R43
Q1,Q2	
S2,S3	
T1	
W3	
XAB	

DELETED;



POWER SUPPLY & ALC AMPLIFIER ASS'Y  
(04342-7708) P/O AB  
COPYRIGHT 1970 BY YOKOGAWA-HEWLETT-PACKARD, LTD.

Figure 8-7. Power Supply & ALC Amplifier Ass'y AB

## APPENDIX OPTION 001

This manual applies directly to the 4342A Standard Models. To adapt this manual to Option 001 instruments, refer to the followings.

### I. REPLACEABLE PARTS

Replace page 6-3 and 6-4, Table 6-2, Reference Designation Index for A1A1 Ass'y with Table A-1.

Replace page 6-11 and 6-12, Table 6-2, Reference Designation Index for A5 Ass'y with Table A-2.

Page 6-21, Table 6-2, Reference Designation Index Miscellaneous  
Change HP Part No. of SCALE:FREQUENCY DIAL to 04342-1060.  
Change HP Part No. of FILM:FREQUENCY RANGE SWITCH to 04342-8554.

### II. MANUAL CHANGES

Information in this Appendix applies directly to the 4342A Option 001 instruments with serials 1035/1036J00341 and above. This information with the following changes also applies to the 4342A Option 001 having serials 1035/1036J00340 and below. For other changes except A1A1 and A5 Ass'y, see SECTION VII MANUAL CHANGES AND OPTIONS.

Instrument Serial Prefix or Number	Change No.
1005/1006	1, 2, 3, 4,
1018/1019	2, 3, 4,
1035/1036J00240 and below	3, 4,
1035/1036J00340 and below	4

#### CHANGE 1

Page A-4, Table A-1, Reference Designation Index

Delete A1A1L9.

Change A1A1R1\* to HP Part No. 0757-0422; R:FXD MET FLM 909 $\Omega$  1% 1/8W.

Change A1A1R2\* and R3\* to HP Part No. 0698-3443; R:FXD MET FLM 287 $\Omega$  1% 1/8W.

Page A-7, Figure A-1, Oscillator Ass'y (Option 001) A1

Delete A1A1L9 from circuit.

Change value of A1A1R1\* to 909 $\Omega$ .

Change values of A1A1R2\* and R3\* to 287 $\Omega$ .

#### CHANGE 2

Page A-3, Table A-1, Reference Designation Index,

Change HP Part No. of A1A1 to 04342-7721.

Change HP Part No. of A1A1 BLANK PC BOARD to 04342-8721.

Page A-7, Figure A-1, Oscillator Ass'y (Option 001) A1

Change HP Part No. of A1A1 OSCILLATOR BOARD ASS'Y to 04342-7721.

CHANGE 3

Page A-3, Table A-1, Reference Designation Index

Change A1A1C23\* to HP Part No. 0160-2236; C:FXD CER 1pF 500VDCW.

Page A-4, Table A-1, Reference Designation Index

Delete A1A1L10.

Change A1A1R1\* to HP Part No. 0698-4398; R:FXD MET FLM 8.66k $\Omega$  1% 1/8W.

Change A1A1R3\* to HP Part No. 0698-0083; R:FXD MET FLM 1.96k $\Omega$  1% 1/8W.

Change A1A1R4\* to HP Part No. 0698-4460; R:FXD MET FLM 649 $\Omega$  1% 1/8W.

Page A-7, Figure A-1, Oscillator Ass'y (Option 001) A1

Change value of A1A1C23\* to 1pF.

Delete A1A1L10 from circuit.

Change value of A1A1R1\* to 8.66k $\Omega$ .

Change value of A1A1R3\* to 1.96k $\Omega$ .

Change value of A1A1R4\* to 649 $\Omega$ .

Page A-5, Table A-2, Reference Designation Index

Change A5C13 to HP Part No. 0140-0205; C:FXD MICA 62pF 5%, and remove asterisk (\*) from A5C13.

Change A5C15 to HP Part No. 0160-2262; C:FXD CER 16pF 5%, and remove asterisk (\*) from A5C15.

Change A5C16 to HP Part No. 0121-0146; C:VAR AIR 1.8-16.7pF.

Page A-9, Figure A-2, Impedance Converter, RF Amplifier and Detector Ass'y (Option 001) A5

Change value of A5C13 to 62pF, and remove asterisk (\*) from A5C13.

Change value of A5C15 to 16pF, and remove asterisk (\*) from A5C15.

Change value of A5C16 to 1.8-16.7pF.

CHANGE 4

Page A-5, Table A-2, Reference Designation Index

Change A5C13\* to HP Part No. 0160-2202; C:FXD MICA 75pF 5% 300VDCW.

Change A5C15\* to HP Part No. 0140-0190; C:FXD MICA 39pF 5% 300VDCW.

Change A5R33 to HP Part No. 0698-3433; R:FXD MET FLM 28.7 $\Omega$  1% 1/8W.

Change A5R42 to HP Part No. 0757-0442; R:FXD MET FLM 10k $\Omega$  1% 1/8W.

Page A-9, Figure A-2, Impedance Converter & RF Amplifier and Detector Ass'y (Option 001) A5

Change value of A5C13\* to 75pF.

Change value of A5C15\* to 39pF.

Change value of A5R33 to 28.7 $\Omega$ .

Change value of A5R42 to 10k $\Omega$ .

III. CIRCUIT DIAGRAMS

Circuit diagrams of Oscillator Ass'y (Option 001) A1 and Impedance Converter, RF Amplifier and Detector Ass'y (Option 001) A5 are given in Figure A-1 and A-2. For other assemblies, see SECTION VIII CIRCUIT DIAGRAMS.

Table A-1. Reference Designation Index

Reference Designation	Part No.	Description	Note
A1	04342-7120 04342-5001 04342-1070 04342-1171	OSCILLATOR ASS'Y (OPTION 001) CASE:OSCILLATOR COVER:TOP COVER:BOTTOM	
A1A1	04342-7761 04342-8761	OSCILLATOR BOARD ASS'Y (OPTION 001) BOARD:BLANK PC	
A1A1C1	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C2*	0160-2244	C:FXD CER 3.0pF $\pm 0.25$ pF 500VDCW	
A1A1C3	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C4*	0160-2250	C:FXD CER 5.1pF $\pm 0.25$ pF 500VDCW	
A1A1C5	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C6*	0160-2252	C:FXD CER 6.2pF $\pm 0.25$ pF 500VDCW	
A1A1C7	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C8*	0160-2253	C:FXD CER 6.8pF $\pm 0.25$ pF 500VDCW	
A1A1C9	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C10*	0160-2248	C:FXD CER 4.3pF $\pm 0.25$ pF 500VDCW	
A1A1C11	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C12*	0160-2256	C:FXD CER 9.1pF $\pm 0.25$ pF 500VDCW	
A1A1C13	0121-0205	C:VAR CER CYLINDER 0.5 - 5pF	
A1A1C14*		NORMALLY OPEN	
A1A1C15		NOT ASSIGNED	
A1A1C16		NOT ASSIGNED	
A1A1C17	0180-1743	C:FXD TA 0.1 $\mu$ F 10% 35VDCW	
A1A1C18	0160-2262	C:FXD CER 16pF 5%	
A1A1C19	0160-0417	C:FXD CER 150pF 10% 500VDCW	
A1A1C20	0121-0232	C:VAR AIR 12 - 460pF	
A1A1C21	0160-2238	C:FXD CER 1.5pF 500VDCW	
A1A1C22	0180-0291	C:FXD TA 1 $\mu$ F 10% 35VDCW	
A1A1C23*	0150-0059	C:FXD CER 3.3pF 500VDCW	
A1A1C24	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A1C25		NOT ASSIGNED	
A1A1C26	0180-0291	C:FXD TA 1 $\mu$ F 10% 35VDCW	
A1A1C27	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A1C28		NOT ASSIGNED	
A1A1C29		NOT ASSIGNED	
A1A1C30	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A1A1C31	0150-0093	C:FXD CER 0.01 $\mu$ F -20% +80% 100VDCW	
A1A1L1	04342-8610	COIL:VAR 500 - 700mH	
A1A1L2	04342-8611	COIL:VAR 51 - 78mH	
A1A1L3	04342-8612	COIL:VAR 4.7 - 7.2mH	
A1A1L4	04342-8613	COIL:VAR 486 - 740 $\mu$ H	
A1A1L5	04342-8614	COIL:VAR 49 - 71.3 $\mu$ H	

Table A-1. Reference Designation Index (Cont'd)

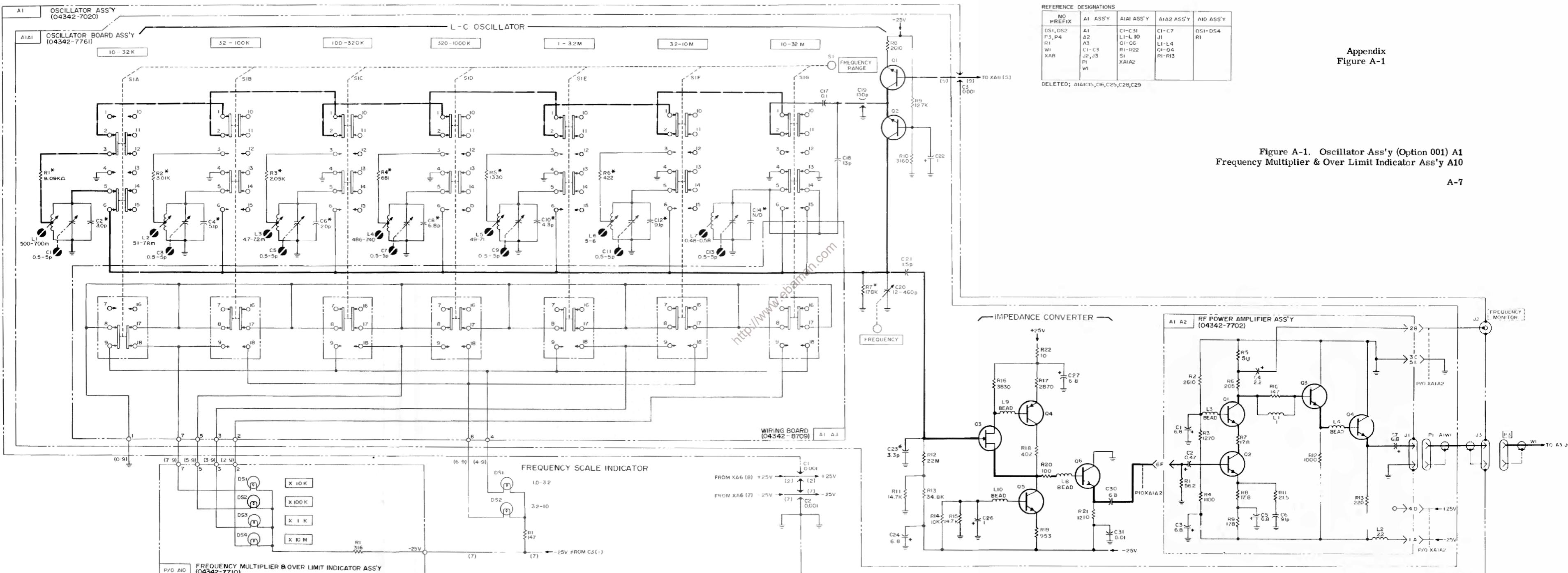
Reference Designation	Part No.	Description	Note
A1A1L6	04342-8615	COIL:VAR 5 - 6 $\mu$ H	
A1A1L7	04342-8616	COIL:VAR 0.48 - 0.58 $\mu$ H	
A1A1L9	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A1L9	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A1L10	9170-0029	MAGNETIC CORE:BEAD FERRITE	
A1A1Q1	1854-0071	TRANSISTOR:NPN SILICON	
A1A1Q2	1854-0296	TRANSISTOR:NPN SILICON	
A1A1Q3	1855-0022	TRANSISTOR:FIELD EFFECT N-CHANNEL	
A1A1Q4	1853-0034	TRANSISTOR:PNP SILICON	
A1A1Q5	1854-0019	TRANSISTOR:NPN SILICON	
A1A1Q6	1854-0019	TRANSISTOR:NPN SILICON	
A1A1R1*	0757-0288	R:FXD MET FLM 9.09k $\Omega$ 1% 1/8W	
A1A1R2*	0757-0273	R:FXD MET FLM 3.01k $\Omega$ 1% 1/8W	
A1A1R3*	0698-4431	R:FXD MET FLM 2.05k $\Omega$ 1% 1/8W	
A1A1R4*	0757-0419	R:FXD MET FLM 681 $\Omega$ 1% 1/8W	
A1A1R5*	0757-0317	R:FXD MET FLM 1.33k $\Omega$ 1% 1/8W	
A1A1R6*	0698-3447	R:FXD MET FLM 422 $\Omega$ 1% 1/8W	
A1A1R7*	0698-3243	R:FXD MET FLM 178k $\Omega$ 1% 1/8W	
A1A1R8*	0757-0290	R:FXD MET FLM 6.19k $\Omega$ 1%	
A1A1R9	0698-3359	R:FXD MET FLM 12.7k $\Omega$ 1% 1/8W	
A1A1R10	0757-0279	R:FXD MET FLM 3.16k $\Omega$ 1% 1/8W	
A1A1R11	0698-3156	R:FXD MET FLM 14.7k $\Omega$ 1% 1/8W	
A1A1R12	0683-2265	R:FXD COMP 22M $\Omega$ 5% 1/4W	
A1A1R13	0757-0123	R:FXD MET FLM 34.8k $\Omega$ 1% 1/8W	
A1A1R14	0757-0442	R:FXD MET FLM 10k $\Omega$ 1% 1/8W	
A1A1R15	0698-3156	R:FXD MET FLM 14.7k $\Omega$ 1% 1/8W	
A1A1R16	0698-3153	R:FXD MET FLM 3.83k $\Omega$ 1% 1/8W	
A1A1R17	0698-3151	R:FXD MET FLM 2.87k $\Omega$ 1% 1/8W	
A1A1R18	0698-4453	R:FXD MET FLM 402 $\Omega$ 1% 1/8W	
A1A1R19	0698-4125	R:FXD MET FLM 953 $\Omega$ 1% 1/8W	
A1A1R20*	0757-0401	R:FXD MET FLM 100 $\Omega$ 1% 1/8W	
A1A1R21	0757-0821	R:FXD MET FLM 1.21k $\Omega$ 1% 1/2W	
A1A1R22	0757-0346	R:FXD MET FLM 10 $\Omega$ 1% 1/8W	
A1A1S1	3101-0260	SWITCH:PUSH BUTTON 7-RANGE	
A1A1XA1A2	1251-0478	CONNECTOR:PRINTED CIRCUIT 12-CONTACT	
	04342-1074	MISCELLANEOUS PLATE:ANGLE	
	04342-3022	NUT:HEX FOR FERRITE CORE	

Table A-2. Reference Designation Index

Reference Designation	Part No.	Description	Note
A5	04342-7725 04342-8725	IMPEDANCE CONVERTER & RF AMPLIFIER ASS'Y (OPTION 001) BOARD:BLANK PC	
A5C1	0160-2244	C:FXD CER 3pF $\pm 0.25$ pF	
A5C2	0180-0197	C:FXD TA 2.2 $\mu$ F 10% 20VDCW	
A5C3	0180-0376	C:FXD TA 0.47 $\mu$ F 10% 35VDCW	
A5C4	0160-2259	C:FXD CER 12pF 5%	
A5C5	0180-1745	C:FXD TA 1.5 $\mu$ F 10% 20VDCW	
A5C6	0160-0128	C:FXD CER 2.2 $\mu$ F 20% 25VDCW	
A5C7	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A5C8	0180-1746	C:FXD TA 15 $\mu$ F 10% 20VDCW	
A5C9	0160-0155	C:FXD MY 0.0033 $\mu$ F 10% 200VDCW	
A5C10	0180-0376	C:FXD TA 0.47 $\mu$ F 10% 35VDCW	
A5C11	0160-0174	C:FXD CER 0.47 $\mu$ F -20% +80% 25VDCW	
A5C12	0180-0116	C:FXD TA 6.8 $\mu$ F 10% 35VDCW	
A5C13*	0140-0192	C:FXD MICA 68pF 5% 300VDCW	
A5C14	0160-0128	C:FXD CER 2.2 $\mu$ F 20% 25VDCW	
A5C15*	0160-2150	C:FXD MICA 33pF 5% 300VDCW	
A5C16*	0121-0147	C:VAR AIR 2.0 $\mu$ F 19.3pF	
A5C17	0160-0128	C:FXD CER 2.2 $\mu$ F 20% 25VDCW	
A5C18	0180-0376	C:FXD TA 0.47 $\mu$ F 10% 35VDCW	
A5C19	0160-0174	C:FXD CER 0.47 $\mu$ F -20% +80% 25VDCW	
A5C20	0150-0121	C:FXD CER 0.1 $\mu$ F -20% +80% 50VDCW	
A5C21	0180-0376	C:FXD TA 0.47 $\mu$ F 10% 35VDCW	
A5C22	0180-0376	C:FXD TA 0.47 $\mu$ F 10% 35VDCW	
A5C23	0180-0291	C:FXD TA 1 $\mu$ F 10% 35VDCW	
A5CR1	1901-0025	SEMICON DEVICE:DIODE SILICON	
A5CR2	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A5CR3	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A5CR4	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A5CR5	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A5CR6	1910-0016	SEMICON DEVICE:DIODE GERMANIUM	
A5L1	9140-0179	COIL:FXD RF 22 $\mu$ H 10%	
A5L2	9140-0179	COIL:FXD RF 22 $\mu$ H 10%	
A5L3	9140-0137	COIL:FXD RF 1000 $\mu$ H 10%	
A5Q1	1855-0022	TRANSISTOR:FIELD EFFECT N-CHANNEL	
A5Q2	1853-0015	TRANSISTOR:PNP SILICON 2N3640	
A5Q3	1854-0023	TRANSISTOR:NPN SILICON	
A5Q4	1854-0092	TRANSISTOR:NPN SILICON 2N3563	
A5Q5	1854-0296	TRANSISTOR:NPN SILICON MPS6543	
A5Q6	1854-0092	TRANSISTOR:NPN SILICON 2N3563	
A5Q7	1853-0015	TRANSISTOR:PNP SILICON 2N3640	
A5Q8	1854-0233	TRANSISTOR:NPN SILICON 2N3866	
A5Q9	1854-0091	TRANSISTOR:NPN SILICON	

Table A-2. Reference Designation Index (Cont'd)

Reference Designation	Part No.	Description	Note
A5R1	0757-0346	R:FXD MET FLM 10Ω 1% 1/8W	
A5R2	0698-3151	R:FXD MET FLM 2.87kΩ 1% 1/8W	
A5R3	0757-0465	R:FXD MET FLM 100kΩ 1% 1/8W	
A5R4	0757-0465	R:FXD MET FLM 100kΩ 1% 1/8W	
A5R5	0730-0149	R:FXD C FLM 28.1MΩ 0.5% 1W	
A5R6	0698-0085	R:FXD MET FLM 2.61kΩ 1% 1/8W	
A5R7	0698-3155	R:FXD MET FLM 4.64kΩ 1% 1/8W	
A5R8	0757-0401	R:FXD MET FLM 100Ω 1% 1/8W	
A5R9	0757-0441	R:FXD MET FLM 8.25kΩ 1% 1/8W	
A5R10	0698-3150	R:FXD MET FLM 2.37kΩ 1% 1/8W	
A5R11	0698-3439	R:FXD MET FLM 178Ω 1% 1/8W	
A5R12	0698-0089	R:FXD MET FLM 1.78kΩ 1% 1/2W	
A5R13	0698-3430	R:FXD MET FLM 21.5Ω 1% 1/8W	
A5R14	0757-0346	R:FXD MET FLM 10Ω 1% 1/8W	
A5R15	0698-3152	R:FXD MET FLM 3.48kΩ 1% 1/8W	
A5R16	0757-0438	R:FXD MET FLM 5.11kΩ 1% 1/8W	
A5R17	0757-0440	R:FXD MET FLM 7.5kΩ 1% 1/8W	
A5R18	0757-0438	R:FXD MET FLM 5.11kΩ 1% 1/8W	
A5R19	0757-0422	R:FXD MET FLM 909Ω 1% 1/8W	
A5R20	0757-0398	R:FXD MET FLM 75Ω 1% 1/8W	
A5R21	0757-0294	R:FXD MET FLM 17.8Ω 1% 1/8W	
A5R22	0698-4422	R:FXD MET FLM 1.27kΩ 1% 1/8W	
A5R23	0757-0346	R:FXD MET FLM 10Ω 1% 1/8W	
A5R24	0757-0405	R:FXD MET FLM 162Ω 1% 1/8W	
A5R25	0698-3409	R:FXD MET FLM 2.37kΩ 1% 1/2W	
A5R26	0757-0439	R:FXD MET FLM 6.81kΩ 1% 1/8W	
A5R27	0757-0290	R:FXD MET FLM 6.19kΩ 1% 1/8W	
A5R28	0757-0274	R:FXD MET FLM 1.21kΩ 1% 1/8W	
A5R29	0698-3434	R:FXD MET FLM 34.8Ω 1% 1/8W	
A5R30	0757-0419	R:FXD MET FLM 681Ω 1% 1/8W	
A5R31	0757-0394	R:FXD MET FLM 51.1Ω 1% 1/8W	
A5R32	2100-1986	R:VAR MET FLM 1kΩ 10% 1/2W	
A5R33	0698-3430	R:FXD MET FLM 21.5Ω 1% 1/8W	
A5R34	0698-3700	R:FXD MET FLM 715Ω 1% 1/8W	
A5R35	0757-0814	R:FXD MET FLM 511Ω 1% 1/2W	
A5R36	0757-0379	R:FXD MET FLM 12.1Ω 1% 1/8W	
A5R37	0757-1092	R:FXD MET FLM 287Ω 1% 1/2W	
A5R38	0757-0346	R:FXD MET FLM 10Ω 1% 1/8W	
A5R39	0757-0159	R:FXD MET FLM 1kΩ 1% 1/2W	
A5R40	0698-3152	R:FXD MET FLM 3.48kΩ 1% 1/8W	
A5R41	0757-0401	R:FXD MET FLM 100Ω 1% 1/8W	
A5R43	2100-1777	R:VAR WW 20kΩ 5%	
	0340-0008	MISCELLANEOUS INSULATOR-STAND OFF 2 REQ'D	



Appendix  
Figure A-1

Figure A-1. Oscillator Ass'y (Option 001) A1  
Frequency Multiplier & Over Limit Indicator Ass'y A10

A-7

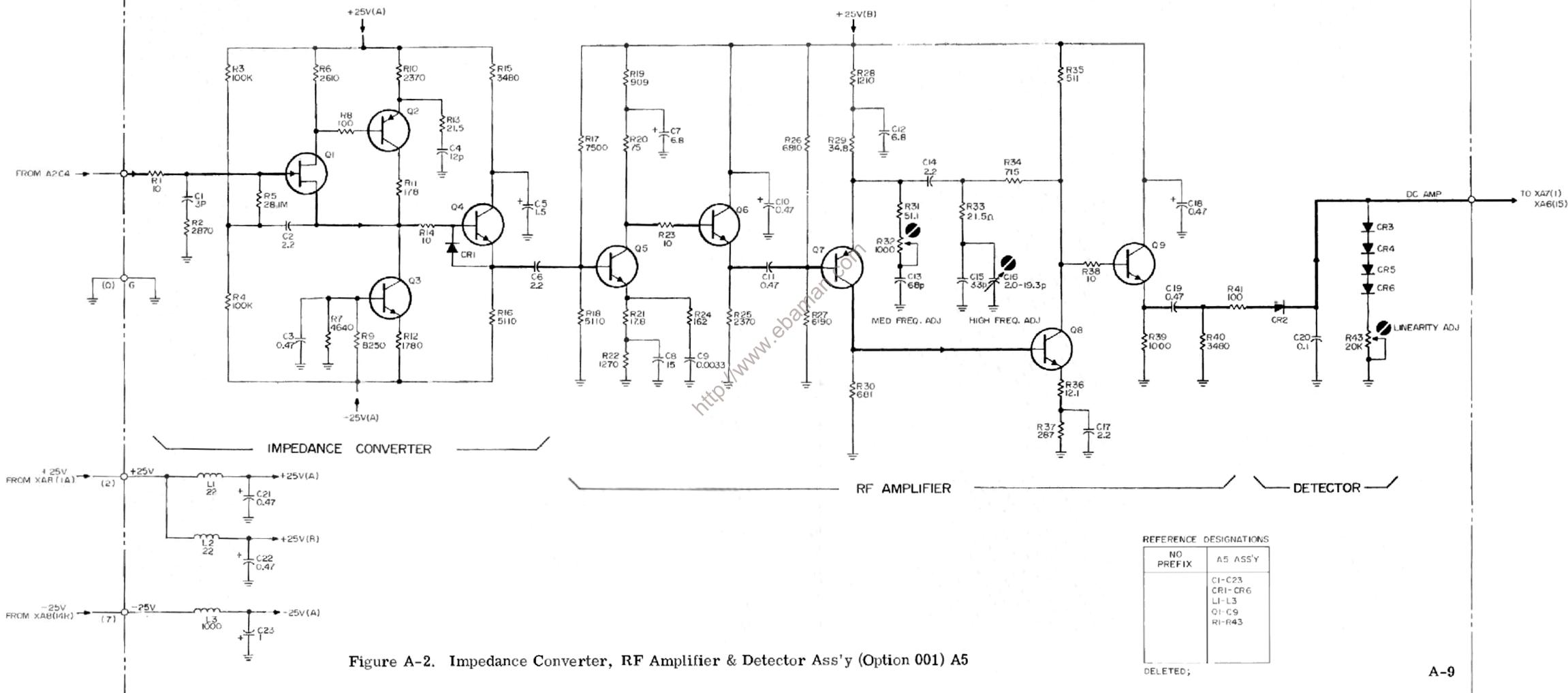


Figure A-2. Impedance Converter, RF Amplifier & Detector Ass'y (Option 001) A5



# MANUAL CHANGES

MODEL 4342A Q METER

Manual Serial Prefixed: 1212J

Manual Printed: Nov. 1975

MAKE ALL CORRECTIONS IN THIS MANUAL ACCORDING TO ERRATA BELOW. THEN CHECK THE FOLLOWING TABLE FOR YOUR INSTRUMENT SERIAL PREFIX (4 DIGITS) OR SERIAL NUMBER (9 DIGITS) AND MAKE ANY LISTED CHANGE(S) IN THE MANUAL.

► NEW ITEM.

SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES	SERIAL PREFIX OR NUMBER	MAKE MANUAL CHANGES
ALL	1		

## CHANGE 1

Page 6-7, Table 6-2, Reference Designation Index  
Change Part No. of A2: TUNING CAPACITOR ASSY to 04342-65001.  
Add: 04342-1063: SCALE  $\Delta$  C  
5000-4169: SCALE C

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