TECHNICAL MANUAL

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LISTS FOR GENERATOR, SIGNAL SG-1122/U (HEWLETT-PACKARD MODEL 8443A and 8443B) (NSN 6625-00-155-5990)

This copy is a reprint which includes current pages from Changes 1 through 3.

HEADQUARTERS, DEPARTMENT OF THE ARMY
16 OCTOBER 1981

WARNING

Remove the power cord from the Model 8443A/B before removing the board. Voltages are still present when the instrument is placed in standby. Voltages are present in this instrument, when energized, which can cause death on contact.

NOTE

Users of this manual are advised to consult Section VII and Appendix B which contains errors and changes in text and illustrations. The user should correct the errors and perform the changes as indicated and needed.

CHANGE
No. 3

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, DC. *1 January 1989*

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL
SIGNAL GENERATOR SG-1 122/U
(NSN 6625-00-155-5990)

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CHANGE

No. 2

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OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL
SIGNAL GENERATOE SG-1122/U
(NSN 6625-00-155-5990)

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SIGNAL GENERATOR SG-1 122/U
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a and b	a and b
i and ii	i and ii
0-1 and 1-0	0-1 and 1-0
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B-I through B-4	B-l through B-43/(B-44 blank)

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5 SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

1. DO NOT TRY TO PULL OR GRAB THE INDIVIDUAL
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER
3. IF YOU CANNOT TURN OFF THE ELECTRICAL POWER, PULL, PUSH OR LIFT THE PERSON TO SAFETY USING A DRY WOODEN POLE OR A DRY ROPE OR SOME OTHER INSULATING MATERIAL
4. SEND FOR HELP AS SOON AS POSSIBLE
5. AFTER THE INJURED PERSON IS FREE OF CONTACT WITH THE SOURCE OF ELECTRICAL SHOCK, MOVE THE PERSON A SHORT DISTANCE AWAY AND IMMEDIATELY START ARTIFICIAL RESUSCITATION

TRACKING GENERATOR/COUNTER
8443A
Serial Numbers Prefixed: 955-, 964-, 1049A, 1145A, 1217A

This manual applies directly to HP Model 8443A Tracking Generator/Counters having the serial number prefixes listed above.

NOTE

For Tracking Generator/Counters having serial number prefix 1145A and below, see Section VII, Manual Changes.

NOTE

For Tracking Generator/Counters having serial number prefix 1217A00786 and above, see Appendix B, Difference Data Sheets.

TRACKING GENERATOR
8443B
Serial Numbers Prefixed: 0973A, 1142A, 1228A

This manual applies directly to HP Model 8443B Tracking Generators having the serial number prefixes listed above.

NOTE

For Tracking Generators having serial number prefix 1142A and below, see Section VII, Manual Changes.

NOTE

For Tracking Generators having serial number prefix 1228A00151 and above, see Appendix B, Difference Data Sheets.

Manual Part Number: 08443-90028
Supplement Part Number: 08443-90030
Microfiche Part Number: 08443-90029

Printed: APRIL 1972

CERTIFICATION

The Hewlett-Packars 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 facilities, or to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery. Hewlett-Packard 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.

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Technical Manual

No. 11-6625-2858-14&P

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 16 October 1981

OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL FOR SIGNAL GENERATOR SG-1122/U (NSN 6625-00-155-5990)

REPORTING OF ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-ME-MP, Fort Monmouth, NJ 07703-5000. A reply will be furnished to you.

TABLE OF CONTENTS

This manual is an authentication of the manufacturer's commercial literature which, through usage, has been found to cover the data required to operate and maintain this equipment. Since the manual was not prepared in accordance with military specifications and AR 310-3, the format has not been structured to consider levels of maintenance.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

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Section 0

INTRODUCTION

0-1. Scope.

This manual contains instructions for the operator, organizational, direct support and general support maintenance manuals for the SG-1122/U Generator, Signal. Throughout this manual the SG-1122/U is referred to as the 8443A and 8443B.

0-2. Consolidated Index of Army Publications and Blank Forms.

Refer to the latest issue of DA Pam 310-1 to determine whether there are new editions, changes, or additional publications pertaining to the equipment.

0-3. Maintenance Forms, Records, and Reports.

a. Report of Maintenance and Unsatisfactory Equipment. Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750 as contained in Maintenance Management Update.

b. Report of Packaging and Handling Deficiencies. Fill out and forward SF 364 (Report of Discrepancy (ROD)) as prescribed in AR 735-11-2/DLAR 4140.55/NAVMATINST 4355.73B/AFR 400-54/MCO 4430.3H.

c. Discrepancy in Shipment Report (DISREP) (SF 361). Fill out and forward Discrepancy in Shipment Report (SF 361) as prescribed in AR 55-38/ NAVSUPINST 4610.33C/ AFR 75-18/ MCO P4610.19D/ DLAR 4500.15.

0-4. Reporting Equipment Improvement Recommendations (EIR).

If your Signal Generator needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to Commander, US Army Communications-Electronics Command and Fort Monmouth, ATTN: AMSEL-PA-MA-D, Fort Monmouth, New Jersey 07703-5000. We'll send you a reply.

0-5. Administrative Storage.

The Generator SG-1122/U can be stored in stockrooms, warehouses or other protected facilities. The equipment should be protected from excessive humidity, sand, dust, and chemical contaminants. Before putting the SG1122/U into administrative storage, make the following preparations:

a. Perform all Operator's Checks given in Figure 3-3 and assure that the unit is completely operable before storing.

b. If the original packing material is not available, follow the instructions in paragraph 2-23.

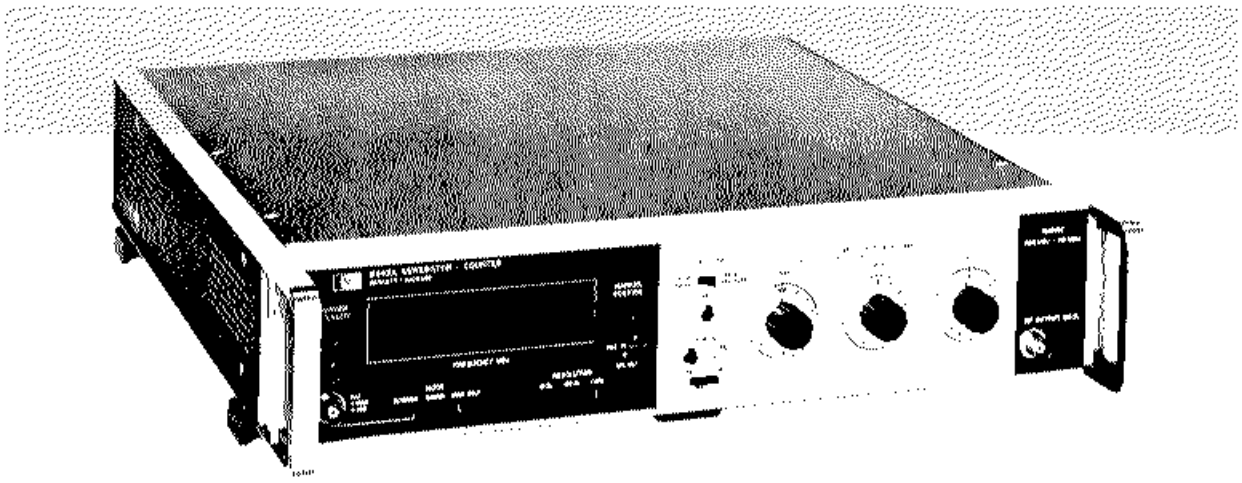
c. Store the equipment indoors, protected from elements. Maintain the equipment at moderate temperatures and humidity.

0-6. Destruction of Army Electronics Material.

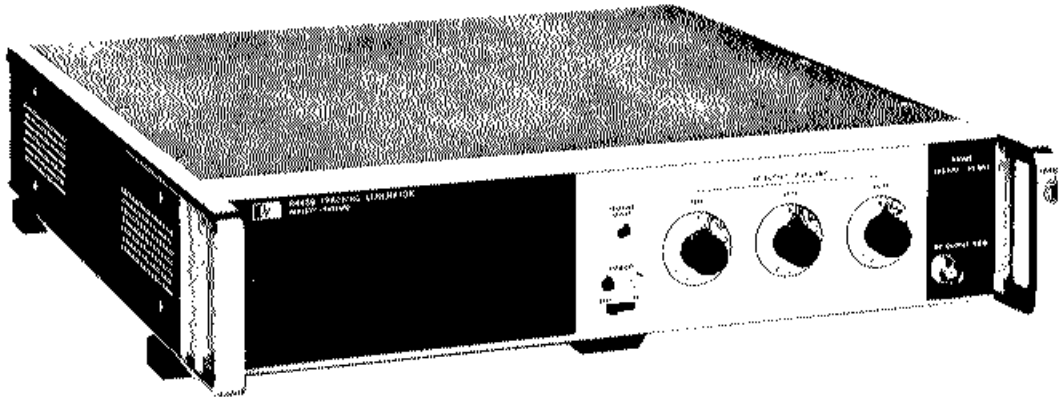
Destruction of Army electronics materiel to prevent enemy use shall be in accordance with TM 750-244-2.

0-7. Warranty Information.

(See MIL-M-63038B, para 3.2.3.1.8).



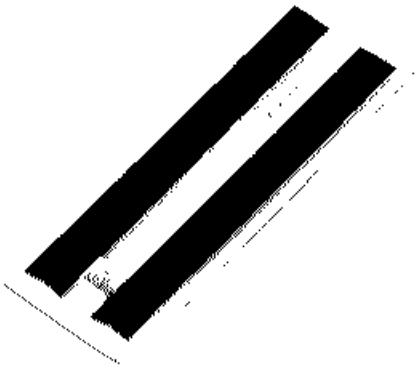
8443A TRACKING GENERATOR/COUNTER



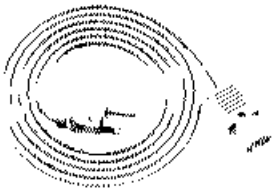
8443B TRACKING GENERATOR

JOINING KIT

RACK MOUNTING KIT



POWER CABLE



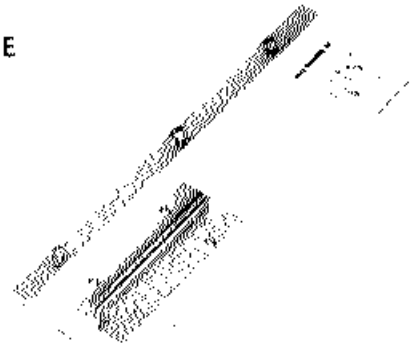


Figure 1-1. Models 8443A Tracking Generator/ Counter, 8443B Tracking Generator, and Accessories.

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual contains all information required to install, operate, test adjust and service the Hewlett-packard Model 8443A Tracking Generator/ Counter and the Model 8443B Tracking Generator. This section covers instrument identification, description, options, accessories, specifications and other basic information.

1-3. Figure 1-1 shows the 8443A and 8443B with the supplied accessories.

1-4. The various sections in this manual provide information as follows:

a. SECTION II, INSTALLATION, provides information relative to incoming inspection, power requirements, mounting, packing and shipping, etc.

b. SECTION III, OPERATION, provides information relative to operating the instrument.

c. SECTION IV, PERFORMANCE TESTS, provides information required to ascertain that the instrument is performing in accordance with published specificaitons.

d. SECTION V, ADJUSTMENTS, provides information required to properly adjust and align the instrument after repairs are made.

e. SECTION VI, PARTS LISTS, provides ordering information for all replaceable parts and assemblies.

f. SECTION VII, MANUAL CHANGES, provides manual back-dating information.

g. SECTION VIII, SERVICE, includes all information required to service the instrument.

1-5. INSTRUMENTS COVERED BY MANUAL

1-6. Hewlett-Packard instruments carry a ten digit serial number (see Figure 1-2) on the back panel. When the prefix on the serial number plate of your instrument is the same as one of the prefix numbers on the inside title page of this manual, the manual applies directly to the instrument. When the instrument serial number prefix is not listed on the inside title page of initial issue, manual change sheets and manual up-dating information are provided. Later editions or revisions to the manual will contain the required change information in Section VII.

1-7. DESCRIPTION

1-8. The Model 8443A/B was designed to be used in conjunction with the Hewlett-Packard 8553/8552 Spectrum Analyzer. The Tracking Generator provides a CW signal which tracks the frequency tuning of the spectrum analyzer or restores the Spectrum Analyzer input signal.

1-9. As implied by the instrument name, the Model 8443A also includes a counter section. The counter section may be used to count the output frequency of the tracking generator or the frequency of signals generated by external sources (up to better than 120 MHz). A rear panel connector provides BCD data output from the counter section for use in external equipment such as a recorder.

1-10. The time base for the Model 8443A counter section is a stable oven-contained, crystal-controlled 1 MHz oscillator. Provisions are made to use an external 1 MHz source for the time base if a frequency standard is available. An output from the internal 1 MHz source is also available for use in external equipment if desired.

1-11. The Model 8443A Counter Section may be operated in one of three modes. They are:

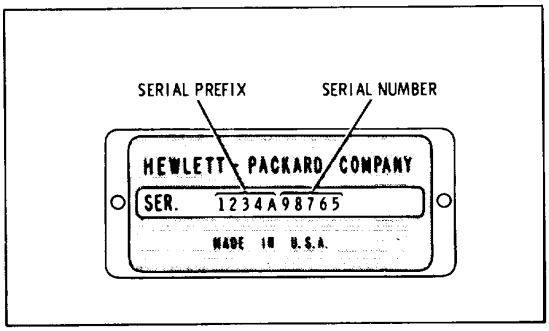


Figure 1-2. Instrument Identification

Table 1-1. Model 8443A/B Specification

SPECIFICATIONS

NOTE

Numbered specifications coincide with numbered performance tests in `Section IV.

TRACKING GENERATOR

1. Frequency Range: 100 kHz to 110 MHz. (Output frequency tracks the 8553/8552 Spectrum Analyzer tuning.)

2. Amplitude Range: <-120 dBm to +10 dBm in 10 and 1 dB steps with a continuous 1.2 dB vernier.

3. Amplitude Accuracy (flatness): ±0.5 dB. Output attenuators 10 dB steps ±0.2 dB, 1 dB steps ±0.1 dB. Absolute: 0 dBm at 30 MHz ±0.3 dB.

4. Output Impedance: 50 ohms, AC coupled, reflection coefficient <0.09 (1.2 SWR); output <0 dBm.

*COUNTER

Modes:

Marker: Counter reads frequency at marker position on the Spectrum Analyzer Display. **Scan Hold:** Scan starts at left edge of display and stops at marker. Counter measures frequency continually. **External:** Counter measures frequency of signal at counter input.

5. Measurement Range: 100 kHz to 110 MHz. Display; 7 digits with 1 digit overrange.

6. **Resolution** (gate time): 1 kHz (1 mS), 100 Hz (10 mS) and 10 Hz (100 mS).

7. **Accuracy:** ±1 count ± time base accuracy.

8. **Time Base Aging Rate:** $<3 \times 10^{-9}$ per day. (0.3 Hz/day) after warmup.

9. **Time Base Temperature Drift:** $<3 \times 10^{-8}$ (3 Hz) variation, 0 to 55 C.

Function:

Restore Signal: Counter reads frequency of an unknown signal to counter accuracy when marker is placed anywhere on signal response. Typically 15 dB signal-to-noise ratio required for restored operation.

Track Analyzer: RF OUTPUT tracks spectrum analyzer tunging for swept frequency at marker on spectrum analyzer CRT.

External Inputs:

10. Counter: 10 kHz to 120 MHz, 50 ohms, -10 dBm minimum, +25 dBm maximum.

11. Time Base: 1 MHz, 40 ohms, 1 Vrms minimum.

Auxiliary Outputs:

12. Time Base: 1 MHz, 1 V rms nominal.

13. Digital Frequency Output: 8,4,2,1, code: positive logic.

GENERAL

Temperature Range: Operation 0 to 550C, storage, -40 to +750C. Power: 115 V or 230 V, 48440 Hz, 75 watts. (When the instrument is in standby power consumption is 30 watts.) **RFI:** Meets or exceeds MIL-I-6181D.

DIMENSIONS: 18-3/4 L x 16-3/4 W x 3-7'/8 H.

WEIGHT: 24 lbs, 5 oz. (11,02 kg)

* 8443A only

a. EXTERNAL. For use in measuring frequency of external signals not related to the Model 8443A or the Spectrum Analyzer.

b. MARKER. In this mode the scan ramp of the Spectrum Analyzer is stopped momentarily at a point determined by the Model 8443A MARKER POSITION control. At the point where the scan is stopped a bright marker appears on the analyzer display CRT. Simultaneously, the RF OUTPUT frequency from the Tracking Generator is counted by the Model 8443A Counter. If the FUNCTION switch is set to TRACK ANALYZER, the counter frequency indicates marker frequency, independent of Spectrum Analyzer input signal frequency. If the FUNCTION switch is set to RESTORE SIGNAL, the counter indicates the Spectrum Analyzer input signal frequency (as long as the marker is placed on the signal response).

c. SCAN HOLD. in this mode operational sequence is similar to the MARKER mode except that when the scan is stopped it will not restart until the operator changes the mode of operation. The counter will count continually in the SCAN HOLD mode. The marker position may be controlled manually by the MARKER POSITION control to measure the frequency at any point on the CRT.

1-12. A three-position RESOLUTION control on the Model 8443A provides counter readouts (in MHz) to accuracies of 10 Hz, 100 Hz and 1 kHz.

1-13. The output of the Model 8443A/B is level (±0.5 dB) from 100 kHz to 110 MHz. The output level may be adjusted, by means of three front panel controls, to any level between +10 dBm and -123.2 dBm.

1-14. Complete specifications for the Model 8443A/B are provided in Table 1-1.

1-15. COMPATIBILITY

1-16. Spectrum Analyzer RF Section

1-17. 8553L. The HP Model 8553L that does not have the TG-1 modification installed requires a modification to provide compatibility with the Model 8443B and the Model 8443A. Modification kit part number is 08553-6065; after modification, the unit is designated 8553L-TG-2.

NOTE

The TG labels should be on the rear panel next to the serial number.

1-18. The HP Model 8553L that has the TG-1 modification installed requires an additional modification to provide compatibility with the Model 8443A with serial numbers prefix 1217A and above. The modification kit part number is 08553-60142; after modification, the unit is designated 8553L-TG-2.

1-19. 8553B. The HP Model 8553B with serial number prefix 1215A and above is fully compatible with the Model 8443A/B. The Model 8553B with serial number prefix 1144A and below requires a modification to provide compatibility with the Model 8443A with serial number prefix 1217A and above. The modification kit part number is 08553-60142; after modification, the unit is designated 8553B-TG-2.

1-20. Spectrum Analyzer IF Section

1-21. 8552A. The HP Model 8552A with serial number prefix 1213A and above is fully compatible with the Model 8443A/B. The Model 8552A with serial number prefix 945and below that does not have the TG-1 modification installed requires a modification to provide compatibility with the Model 8443B and the Model 8443A. The modification kit part number is 08552-6060; after modification, the unit is designated 8552A-TG-2.

1-22. The HP Model 8552A with serial number prefix 1144A and below that has the TG-1 modification installed requires an additional modification to provide compatibility with the Model 8443A with serial number prefix 1217A and above. The modification kit part number is 08552-60159; after modification, the unit is designated 8552A-TG-2.

1-23. 8552B. The HP Model 8552B with serial number prefix 1210A and above is fully compatible with the Model 8443A/B. The Model 8552B with serial number prefix 1209A and below requires a modification to provide compatibility with the Model 8443A with serial number prefix 1217A and above. The modification kit part number is 08552-60159; after modification, the unit is designated 8552B-TG-2.

1-24. Spectrum Analyzer Display Section

1-25. Display section models 140A, 140S, 141A and 141S all require HP modification kit number 00140-69504 to provide compatibility with the Model 8443A/B

1-26. Display section models 140T and 141T are compatible with the Model 8443A/B.

1-27. ACCESSORIES SUPPLIED

1-28. The following accessories are provided with the Model 8443A/B:

a. An interconnecting cable for use between the Spectrum Analyzer and the 8443A/B (HP 08443-60009). (See Figure 3-2.)

b. A power cable (HP 8120-1348).

c. A rack mounting kit (HP 5060-8739).

d. A joining bracket kit (HP 5060-8543).

1-29. ACCESSORIES NOT SUPPLIED

1-30. A Service Kit, HP part number 08443-60011 is recommended for maintenance purposes. An HP 562A-16C Interface Cable can be used to connect the 8443A/B BCD output to an HP 5050 Digital Recorder.

1-31. WARRANTY

1-32. Certification and Warranty information for the Model 8443A/B appears on the inside front cover of this manual.

1-33. TEST EQUIPMENT AND ACCESSORIES REQUIRED

1-34. Table 1-2 lists test equipment and accessories recommended to service the Model 8443A/B.

Table 1-2. Test Equipment and Accessories

Item	Minimum Specifications	Suggested Model
Digital Voltmeter	Voltage Accuracy: ±0.2% Range Selection: Manual or Automatic Voltage Range: 1 - 1000 Vdc full scale Input Impedance: 10 megohms Polarity: Automatic Indication	HP 3480A Digital Voltmeter with HP 3482A Plug-in
Oscilloscope	Frequency Range: dc to 50 MHz Time Base: 1 us/div to 10 ms/div Time Base Accuracy: ± 3% Dual Channel, Alternate Operation Ac or dc Coupling External Sweep Mode Voltage Accuracy: ±3% Sensitivity: 0.020 V/div	HP 180A with HP 1804A Vertical Amplifier and HP 1821A Horizontal Amplifier HP 10004 10:1 Divider HP 10004 10:1 Divider
Spectrum Analyzer	Frequency Range: 0 - 100 MHz Scan Width: 10 MHz	HP 8443/8552/141S Spectrum Analyzer
VHF Signal Generator	Frequency Range: 40 -455 MHz Frequency Accuracy: ±1% Output Amplitude: >-20 dBm Output Impedance: 50 ohms	HP 608E/F VHF Signal Generator
Frequency Counter	Frequency Range: 100 kHz - 300 MHz Accuracy: ±0.001% Sensitivity: 100 mVrms Readout Digits: 7 digits	HP 5245L Frequency Counter
Tunable RF Voltmeter	Bandwidth: 1 kHz Frequency Range: 1 - 1000 MHz Sensitivity: 10 mV - 1 Vrms Input Impedance: ≥,0.1 megohms	HP 8405A Vector Voltmeter

Table 1-2. Test Equipment and Accessories (cont'd)

Item	Minimum Specifications	Suggested Model
Three-Port Mixer	Frequency Range: 0.2 - 500 MHz Impedance: 50 ohms Connectors: Female BNC on all ports Input Power: 5 mW nominal	HP 10514A Mixer (2)
Power Supply	Output Voltage: Variable, 0 - 30 Vdc Output Current: 0 --400 mA Meter Resolution: <5 mV	HP 6217A Power Supply
Spectrum Analyzer	0 - 310 MHz	HP 8554/8552/140 Spectrum Analyzer
Digital to Analog Converter/Recorder	Accuracy: 5% of full scale Command Pulse: ±20 μsec or greater, 6 to 20 volts Recorder: Response time < 1/2 second or less	HP 581A Option 01 with HP 680A
Recorder Paper	Accuracy: Better than 0.2% full scale Std. 5" roll chart: 50 minor divisions	HP 9270-1012
Amplifier	Frequency Range: dc to 1 MHz Accuracy: ±0.3% from dc to 10 kHz Distortion: <0.01% below 1 kHz	HP 467A
Quartz Oscillator	Output Frequencies: 5 MHz, 1 MHz, 100 kHz Stability: <5 X 10^{-10} per day	HP 105B
Frequency Synthesizer	Output Frequency: 100 kHz to 500 MHz Digital Frequency Selection: 0.1 Hz through 100 MHz per step, 20 μsec selection time	HP 5101A/5110B
Attenuator Standard	Range: 120 dB in 10 dB steps Accuracy: ±0.01 dB	HP H38-355D
RF Amplifier	20 dB or 40 dB gain - 1 kHz to 150 MHz	HP 461A
RF Crystal Detector	0.1 MHz to 110 MHz, 50 ohms	HP 8471A
Temperature Controlled Oven	Adjustable from 0° to +55°C	
Test Oscillator	10 Hz to 10 MHz, 3.16V max into 50Ω	HP 651B
Digital Recorder	8-4-2-1 input positive logic Eight column printout	HP 5050B
AC Voltmeter	0.5V to 300 full scale Frequency Range: 20 Hz to 4 MHz	HP 400D/E/F/H

Table 1-2. Test Equipment and Accessories (cont'd)

Item	Minimum Specifications	Suggested Model
Service Kit	Contents: 12 Pin extender board (HP 5060-5915) 6 Pin extender board (HP 5060-5914) 22 Pin extender board (HP 5060-0630) Coax Adapter, Selectro plug to BNC jack (HP 1250-1236) Coax Adapter, Selectro jack to BNC jack (HP 1250-1237 Oscilloscope probe Adapters (4 each) (HP 10035-53202) Alignment Screwdriver (HP 8710-1010)	HP 08443-60011 Service Kit
Variable Voltage Transformer	Range: 102 - 127 Vac Voltmeter Range: 103 - 127 Vac +1 volt	General Radio W5NMT3A or Superior Electric UC1M
Cable Assembly (4)	Male BNC Connectors, 48 inches long	HP 10503A
Soldering Iron	47-1/2 watt	Ungar #776 with p4037 Heating Unit
X-Y Recorder	1,10,100 mV/in; 1 and 10 V/in continuous vernier between range	HP 7035B
Attenuator Standard	Range: 1.2 dB in 0.1 dB steps Accuracy: 0.01 dB	HP H38-355C

SERVICE KIT

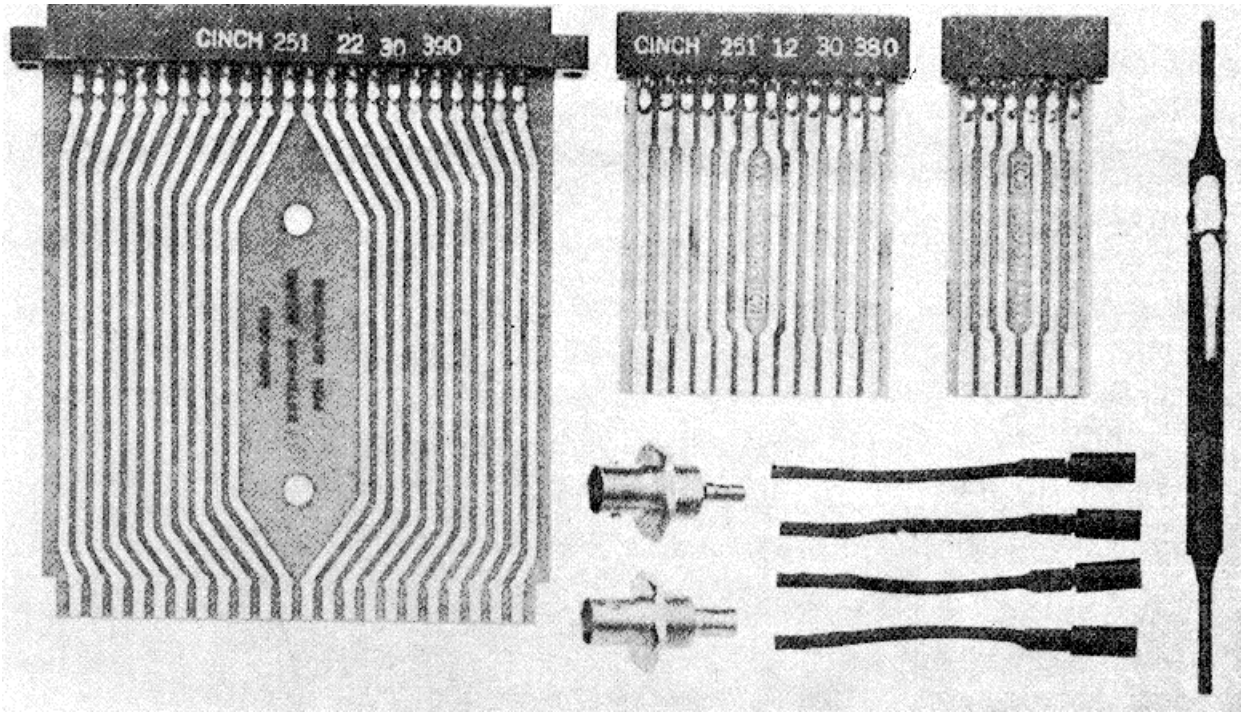


Figure 1-3. Service Kit Required for Maintenance

SECTION II
INSTALLATION

2-1. INITIAL INSPECTION

2-2. Mechanical Check

2-3. Check the shipping carton for evidence of damage immediately after receipt. If there is any visible damage to the carton, request the carrier's agent to be present when the instrument is unpacked. Inspect the Model 8443A/B for physical damage such as bent or broken parts and dents or scratches. If damage is found refer to paragraph 2-6 for recommended claim procedures. If the Model 8443A/B appears undamaged, perform the electrical check (see paragraph 2-4). The packaging material should be retained for possible future use.

2-4. Electrical Check

2-5. The electrical performance check consists of following the procedures listed in paragraphs 4-10 to 4-22. These procedures allow the operator to determine that the instrument is, or is not, operating within the specifications listed in Table 1-1. The initial performance and accuracy of the instrument are certified as stated on the inside front cover of this manual. If the Model 8443A/B does not operate as specified, refer to paragraph 2-6 for the recommended claim procedure.

2-6. DELETED.

2-7. DELETED.

2-8. DELETED.

2-9. PREPARATION FOR USE

CAUTION

Before applying power check the rear panel slide switch for proper position (115 or 230 volts).

2-10. Power Requirements

2-11. The model 8443A/B may be operated on 115 or 230 volts ac +10% at 48 to 440 cycles, single phase. Power required is 75 watts. The 115/230 volt slide switch on the rear of the instrument must be in the correct position to avoid damage to the instrument. When shipped, the instrument is set for 115 volt ac operation.

2-12. Power Cable

2-13. To protect operating personnel, the National Electrical Manufacturers Association (NEMA) recommends that the instrument panel and cabinet be grounded. This instrument is equipped with a detachable three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cable three-prong connector is the ground connection. When using a three-prong to two-prong adapter the ground lead on the adapter should be grounded to retain the safety feature.

2-14. Operating Environment

2-15. The Model 8443B does not require forced air cooling when operating at temperatures form 0 to 550C (32 to 131° F). Normal air circulation will maintain a reasonable temperature within the instrument. The 8443A is equipped with a fan which is capable of keeping the instrument ambient temperature within reasonable limits when the instrument is operated at temperatures between 0° to 550C (32° to 1310F).

2-16. Bench Operation

2-17. The Model 8443A/B cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The tilt stand permits inclining the instrument for ease in viewing the frequency readout. The plastic feet are shaped to provide clearance for air circulation and to make modular cabinet width instruments self-aligning when stacked. The instrument may also be rack mounted. A joining bracket kit is provided to assure a common ground between the Model 8443A/B and the Spectrum Analyzer.

2-18. DELETED.

2-19. DELETED.

2-20. DELETED.

2-21. DELETED.

2-22. In any correspondence refer to the instrument by model number and full serial number.

2-23. Other Packaging Materials

2-24. The following general instructions should be used for repackaging with commercially available materials.

a. Wrap the instrument in heavy paper or plastic. (If shipping to a Hewlett-Packard Service Office or center, attach a tag indicating the type of service required, return address, model number and full serial number.)

b. Use a strong shipping container. A double-wall carton made of 350 pound test material is adequate.

c. Use enough shock-absorbing material (three to four inch layer) around all sides of the instrument to provide firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

d. Seal the shipping container securely.

e. Mark the shipping container FRAGILE to assure careful handling.

SECTION III
OPERATION

3-1. INTRODUCTION

3-2. This section provides operating instructions for the HP Model 8443A Tracking Generator/ Counter and the Model 8443B Tracking Generator.

3-3. Operating instructions for the HP Model 8553/8552 Spectrum Analyzer, which must be interconnected with the Model 8443A/B, are not included in this manual except as required in initial setup and operation. The operator should be thoroughly familiar with operation of the Spectrum Analyzer or have the appropriate manual on hand.

3-4. PANEL FEATURES

3-5. Front and rear panel controls, indicators and connectors are identified and described in Figures 3-1 and 3-2. For the 8443B, disregard references to the Counter controls; the Tracking Generator controls are the same in both instruments.

3-6. OPERATING INSTRUCTIONS

3-7. In view of the simplicity of operation of the Model 8443A/B, the Operator's Checks provide adequate information to assure proper operation of the instrument. However, the operator should experiment with the instrument in order to become more familiar with its operation. It should be noted that the output of any device (within the frequency and amplitude range of the analyzer) may be connected to the RF Section RF INPUT and the frequency at any point of the response counted by the Model 8443A. The input to the device under test may be provided by an external signal generator, or by the output of the Tracking Generator itself.

3-8. OPERATOR'S CHECKS

3-9. Use the operator's checks in Figure 3-3 to verify proper operation of the instrument's main functions.

3-10. SPECIAL FEATURES

3-11. The output of the internal 1 MHz time base reference oscillator is available for use in external equipment at J4 on the rear of the 8443A.

3-12. An external time base reference signal may be applied to J3 on the rear panel of the Model 8443A. When an external reference signal is used, the switch located on the top of the A4 Time Base Assembly must be placed in the EXT position.

3-13. OPERATOR'S MAINTENANCE

3-14. Operator's maintenance on the Model 8443A/B is limited to fuse replacement and adjustment of the controls indicated in the checkout procedure.

NOTE

If maintaining an 8443B, disregard references to the Counter section.

3-15. Adjustment of A7Rll on the marker control board should be made only if the condition described in step j of Figure 3-3 exists. To properly adjust A7Rll first turn the MARKER POSITION control fully clockwise. Adjust the CTR ADJ control so that the marker appears approximately one minor division from the far right CRT graticule line. Turn the MARKER POSITION control fully counterclockwise. The marker should be two minor division or less from the far left graticule line. Now pull the MARKER POSITION control away from the panel and adjust A7Rll to center the marker on the center CRT graticule line.

3-16. Fuse replacement information is provided in Table 3-1.

Table 3-1. Fuse Information

Designation	Purpose	Rating
F1	Line Fuse	2 amperes
A15F1	+175 Volt Supply	0.25 ampere
A15F2	+24 Volt Supply	1 ampere
A15F3	+5.8 Volt Supply	2 amperes
A15F4	+20 Volt Supply	1 ampere
A15F5	-12 Volt Supply	1 ampere

3-17. TRACKING GENERATOR OPERATION

3-18. The Tracking Generator section of the 8443A and the 8443B is a leveled signal source whose output frequency precisely tracks the Spectrum Analyzer tuning frequency. This output can be used as a source to measure the frequency response of passive and active devices operating within its frequency range.

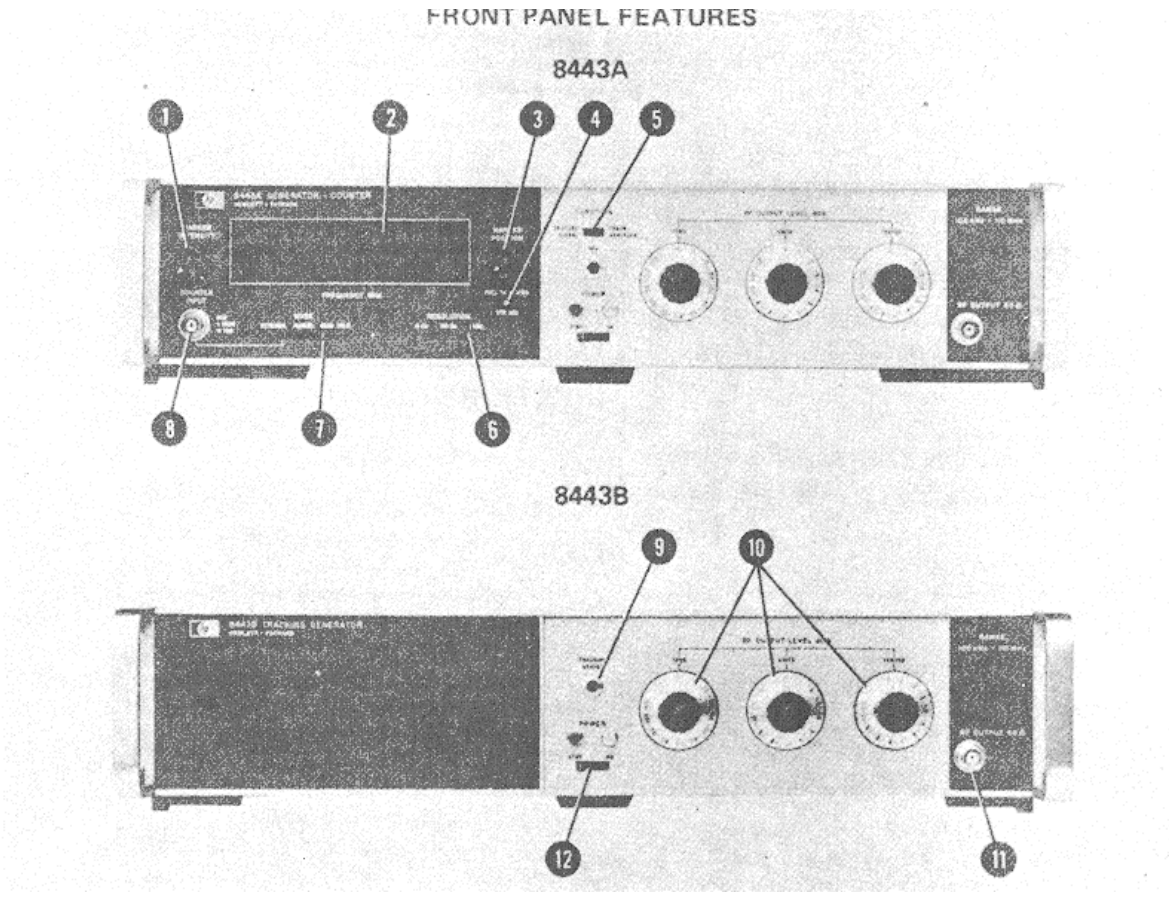


Figure 3-1. Front Panel Controls, Indicators, and Connectors (1 of 2)

(1) MARKER INTENSITY: adjusts the intensity of the marker that appears on the Spectrum Analyzer's CRT display.

(2) FREQUENCY MHz: display indicates reading of Counter.

(3) MARKER POSITION: when in, sets position of marker on CRT. When out, marker automatically goes to center of CRT display.

(4) CTR ADJ: adjusts position of marker when MARKER POSITION knob is out.

(5) FUNCTION*: controls function of Tracking Generator and Counter.

TRACK ANALYZER: the signal at RF OUTPUT tracks the Spectrum Analyzer's tuning frequency. The Counter reads the frequency at the marker (if MODE is set to MARKER or SCAN HOLD). (This mode is used for frequency response measurements.)

RESTORE SIGNAL: if the marker is placed anywhere on a signal response that appears on the CRT, a restored version of that signal appears at RF OUTPUT (i.e., frequency characteristics are the same, and the amplitude depends upon RF OUTPUT LEVEL controls); also, the COUNTER reads that signal's frequency (if MODE is set to MARKER or SCAN HOLD). If the marker is not placed on a signal response, little or no output appears at RF OUTPUT and any COUNTER reading should be disregarded. (This mode is used to precisely measure the frequency of unknown signals.)

* Function control not installed on units with serial number prefix 1049A and below. See backdating information in Section VII.

FRONT PANEL FEATURES

(6) RESOLUTION: sets frequency resolution of Counter

(7) MODE: controls mode of Counter.

EXTERNAL: Counter reads frequency of signal at COUNTER INPUT jack (up to 110 MHz).

MARKER: Counter reads frequency at marker.

SCAN HOLD: analyzer stops scanning: tuning frequency follows marker, controlled by MARKER POSITION. Counter reads frequency at marker.

(8) COUNTER INPUT: external input to frequency counter. Signal level should be >-10 dBm and <+15 dBm. BNC 50 ohm jack.

(9) TRACKING ADJUST: centers tracking signal in IF pass-band of Spectrum Analyzer (when FUNCTION is set to TRACK ANALYZER).

(**10) RF OUTPUT LEVEL dBm:** controls set the signal level at the RF OUTPUT jack.

TENS: 10 dB steps from +10 to -110 dB.

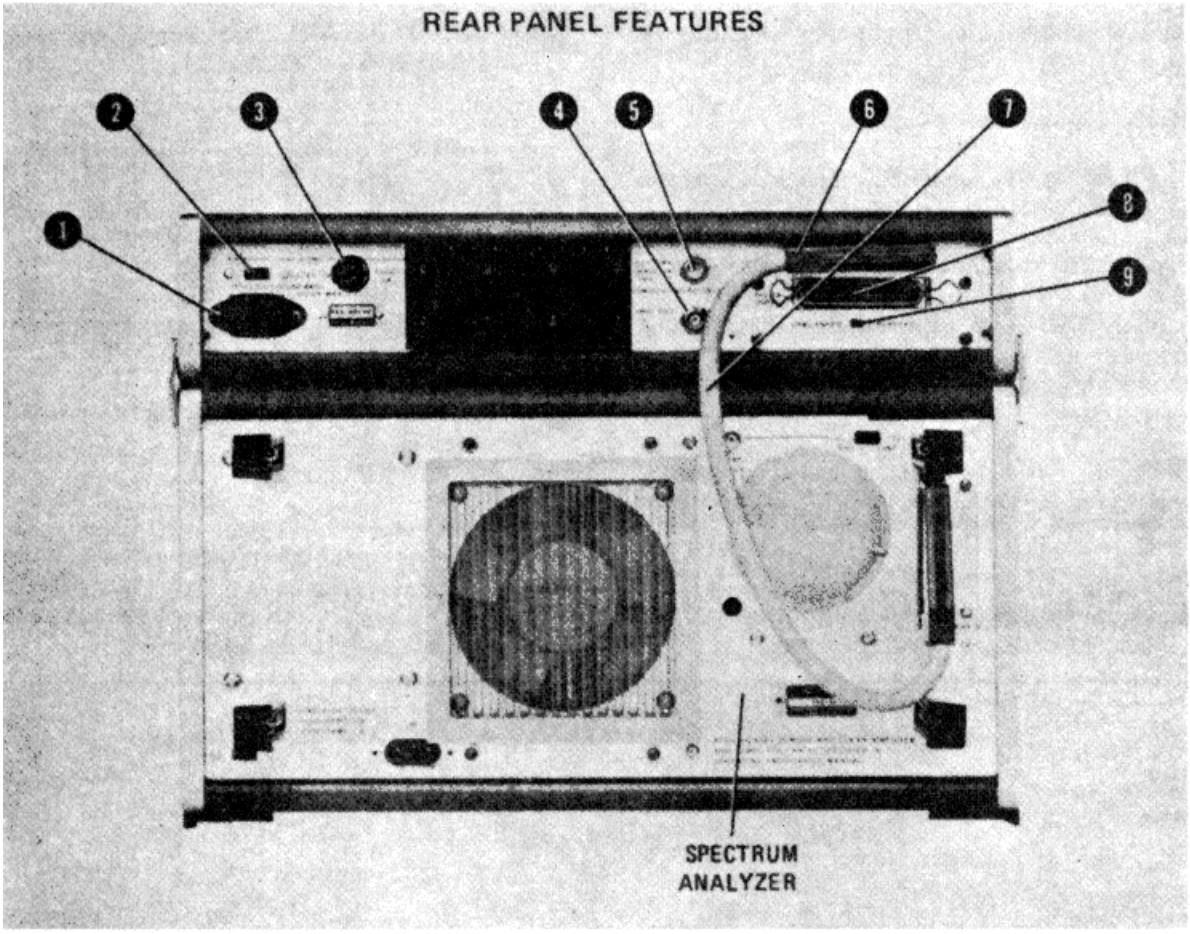
UNITS: 1 dB steps from 0 to -12 dB.

TENTHS: 0 to -1.2 dB vernier, calibrated at tenth-dB points.

(11) RF OUTPUT 50 Ω: output for tracking signal. BNC 50 ohm jack.

(12) POWER: when in ON position, it applies power to the circuitry (while lamp lights). When in STBY, it removes power from the circuitry (blue lamp lights), however, power is still applied to Counter reference oscillator heater (8443A only).

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



(1) LINE Power Jack: connection for line power cable.

(2) LINE SELECTOR: used to select 115 of 230 VAC operation.

(3) LINE FUSE: houses line power fuse (fuse value is the same for both voltages).

(4) 1 MHz OUT: output for internal time base signal, 1 Vrms (8443A).

(5) EXT TIME BASE IN: input for external time base signal, 1 MHz, >1 Vrms (8443A).

(6) Interconnection Jack: connects to Spectrum Analyzer Display Section AUX A jack through interconnection cable.

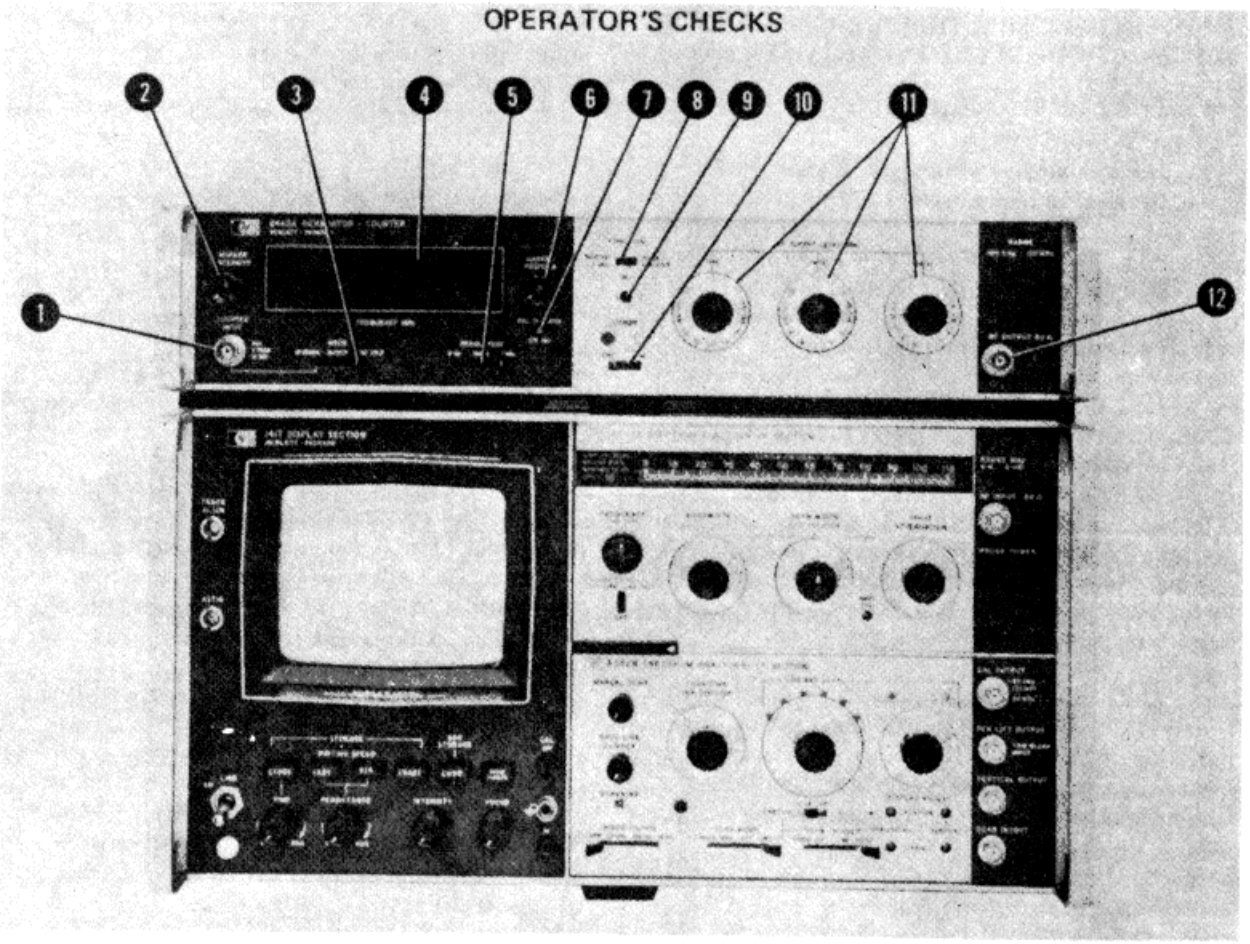
(7) Interconnection Cable: connects to Tracking \Generator/Counter interconnection jack and to Display Section AUX A jack.

(8) DIGITAL OUTPUT: BCD output of Counter indication (8443A).

(9) UNBLANKED/BLANKED: in UN-BLANKED position, all seven digits are always lit. In BLANKED position, insignificant zeros to the left of the decimal point are blanked (8443A).

Figure 3-2. Rear Panel Controls and Connectors

OPERATOR'S CHECKS



a. Set the LINE SELECTOR on the rear panel (see Figure 3-2) to be compatible with the available line voltage.

b. Connect line power cable to LINE power jack on rear panel (see Figure 3-2); plug power cable into line power outlet. The blue STBY lamp (10) should light.

NOTE

The Model 8443A should remain connected to line power when not in use. This will maintain a constant temperature in the time base reference oscillator oven.

c. Connect the interconnection cable to the interconnection jack and to the analyzer's AUX A jack (see Figure 3-2).

d. Set POWER switch (10) to ON. The white ON lamp should light.

e. Apply power to the Spectrum Analyzer and adjust the Display Section controls. Set the analyzer as follows:

FREQUENCY.....50 MHz
BANDWIDTH .....300 kHz
SCAN WIDTH .....PER DIVISION
SCAN WIDTH PER DIVISION
.....10 MHz
INPUT ATTENUATION.....10 dB
BASE LINE CLIPPER .....ccw
SCAN TIMER PER DIVISION
.....1 MILLISECOND
LOG REF LEVEL .....0 dBm
LOG/LINEAR..... l0 dB LOG
VIDEO FILTER .....OFF
SCAN MODE ..... INT
SCAN TRIGGER.....AUTO

f. Set the FUNCTION switch (8) to TRACK ANALYZER. Set MODE switch (3) to

Figure 3-3. Operator's Checks (1 of 2)

OPERATOR'S CHECKS

MARKER, the RESOLUTION switch (5) to 100 Hz, and RF OUTPUT LEVEL controls (11) to 0 dBm.

NOTE
If checking an 8443B, disregard references to the Counter controls.

g. Connect RF OUTPUT (12) to the analyzer RF INPUT with a BNC to BNC cable assembly. The trace on the analyzer's CRT display should rise from the baseline to the top graticule line.

h. Set RF OUTPUT LEVEL (11) to -30 dBm. Set the Spectrum Analyzer SCAN WIDTH to ZERO, BANDWIDTH to the narrowest bandwidth, LOG/LINEAR to LINEAR and LINEAR SENSITIVITY to 1 mV/Div. Adjust TRACKING ADJUST (9) for maximum vertical deflection on the CRT. (This assures that the Tracking Generator is accurately tracking the Spectrum Analyzer's tuning frequency.) Re-set the analyzer as set in step e.

i. Change the RF OUTPUT LEVEL controls (11); the trace on the CRT should change as indicated by the controls. (At low output levels it will be necessary to change the analyzer LOG REF LEVEL control to keep the signal above the baseline.)

NOTE
This concludes the checks that apply to. the 8443B

j. Adjust MARKER INTENSITY (2) for the desired marker intensity. The marker is a bright spot on the trace on the CRT. If it is not visible, check that the MARKER POSITION knob (6) is in (push toward the panel) and turn the knob to position the marker on-screen. (If the marker cannot be positioned on-screen, follow the procedures specified in Paragraph 3-15.)

k. Rotate MARKER POSITION (6) to position the marker to various points on the CRT. The Counter should display whatever frequency is represented by the position of the marker.

l. Pull the MARKER POSITION knob (6) away from the panel; the marker should be near the center vertical graticule line on the CRT. Adjust CRT ADJ (7) to position the marker on the line.

m. Tune the analyzer FREQUENCY control through its range. The Counter should again display whatever frequency is represented by the position of the marker.

n. Set the analyzer to a narrow scan width (20 kHz PER DIVISION or less), and set TUNING STABILIZER to on. Set RESOLUTION (5) to 10 Hz and then to 1 kHz. The Counter's readout (4) should have 10 Hz and then 1 kHz resolution.

o. Push the MARKER POSITION knob (6) in, and set MODE (3) to EXTERNAL. Set RF OUTPUT LEVEL (11) to 0 dBm and connect RF OUTPUT (12) to COUNTER INPUT (1). Set analyzer SCAN WIDTH to ZERO. The Counter should display the frequency the analyzer is tuned to; the marker should not be visible.

p. Set MODE (3) to SCAN HOLD. The analzyer's scan should stop at the marker, and the Counter should display the frequency represented by the position of the marker. The marker (the point at which the scan is stopped) can be positioned at any point on the CRT by the MARKER POSITION control (6).

q. Set MODE (3) to MARKER, RESOLUTION (5) to 1 kHz, and tune the analyzer to a frequency below 10 MHz. Set MARKER POSITION (6) ccw and set the rear panel UNBLANKED/BLANKED switch (see Figure 3-2) to UNBLANKED. The digits to the left of any significant digits that are left of the decimal point should display zeros. Set UNBLANKED/BLANKED to blanked; the zeros should blank (i.e., disappear).

r. Set the analyzer as set in step e. Connect analyzer CAL OUTPUT to RF INPUT. Set FUNCTION (8) to RESTORE SIGNAL. Using MARKER POSITION (6) set marker on skirt of 30 MHz signal; the Counter should indicate approximately 30 MHz. Set marker off signal into baseline noise; the Counter should indicate 0 MHz or random frequencies.

Figure 3-3. Operator's Checks (2 of 2)

3-19. The signal output of the 8443A/B has absolute amplitude calibration. It can be set, in one dB steps, from +10 dBm to -122 dBm. There is also a vernier, calibrated in tenth dB steps, that allows continuously adjustable attenuation over a 1.2 dB range.

3-20. Measuring Passive Devices

3-21. To quickly measure the frequency response of a passive device, set the Spectrum Analyzer to display the desired frequency range. Set the RF OUTPUT LEVEL control settings so that:

a. The signal level at the analyzer's input mixer does not exceed -10 dBm (Signal level at input mixer = Signal level at RF INPUT INPUT ATTENUATION).

b. The signal level out of the 8443A/B will not damage or over-drive the device to be measured.

3-22. Set the analyzer LOG REF LEVEL controls to the same settings as RF OUTPUT LEVEL. Connect the device between the 8443A/B RF OUTPUT and the analyzer RF INPUT. The frequency response of the device will be displayed directly on the CRT. Insertion loss can be read directly from the graticule lines.

3-23. Measuring Active Devices

3-24. When measuring active devices, some provision should be made for the gain of the device to prevent damage to the Spectrum Analyzer or to the device. This is readily accomplished using the 8443A/B RF OUTPUT LEVEL controls.

3-25. Set the Tracking Generator and the Spectrum Analyzer using the procedure described for measuring passive devices. However, before connecting the active device between the 8443A/B and the analyzer, *decrease* the signal level out of the 8443A/B by an amount greater than the gain of the device. The gain of the device will be the sum of the decrease and the dB reading from the CRT graticule. (Remember, this is a negative number on the graticule).

3-26. For example, the Spectrum Analyzer is calibrated for a reference at the top graticule line of the CRT. Then the setting of the RF OUTPUT LEVEL TENS control is decreased 40 dB, and the device is connected between the 8443A/B RF OUTPUT and the analyzer RF INPUT. If the response curve is at the -7 dB graticule line, the gain of the device is 33 dB (40 Db - 7 dB).

3-27. Important Considerations

3-28. When using the Tracking Generator for swept response measurements, the Spectrum Analyzer BANDWIDTH control and DISPLAY UNCAL light take on a somewhat different significance. The BANDWIDTH setting mainly affects the average noise level of the analyzer and has only a secondary effect on resolution. Narrowing BANDWIDTH improves dynamic range, but requires slower scan rates.

3-29. In most cases the DISPLAY UNCAL light will not apply. The best procedure in swept response measurements is to slow the scan rate (i.e. increase SCAN TIME PER DIVISION) until the display amplitude remains constant. At this point, the scan is at the proper rate to satisfy the requirements of both the Spectrum Analyzer and the device being measured.

3-30. Spurious responses are not displayed on the CRT due to the tracking signal source and receiver. Therefore measurements can be made over a dynamic range limited only by gain compression as an upper limit and system noise as a lower limit.

3-31. Devices, such as filters, which have attenuation greater than 100 dB can be measured. Trace the response on the CRT in two 70 dB segments; photograph each segment to get a composite picture.

SECTION IV
PERFORMANCE TESTS

4-1. INTRODUCTION

4-2. This section provides instructions for performance testing the Model 8443A Tracking Generator/Counter and the Model 8443B Tracking Generator. When testing an 8443B, disregard tests and references that deal with the Counter section of the 8443A.

4-3. TEST PROCEDURES

4-4. Purpose. The performance test procedures are used to check instrument performance for incoming inspection and periodic evaluation. The tests are designed to verify published specifications. Tests are numbered in the same sequence as the specifications in Table 1-1.

4-5. Each test applies directly to a listed specification. Next a description of the test and any special instructions are listed. Each test that requires test equipment has a test setup drawing and a list of required equipment. Step 1 of each test lists control settings for that test. Each test procedure provides spaces for test data which are duplicated in the Performance Test Card, Table 4-1, at the end of this section.

4-6. All tests are made with the Model 8443A/B interconnected with a HP 8553/8552/140 Spectrum Analyzer which is known to be functioning properly.

4-7. Test Equipment Required. The test instruments required for performance testing are listed in Table 1-2 and in the individual tests. Test instruments other than those listed may be used providing their performance equals or exceeds the critical specifications listed in Table 1-2.

4-8. Front Panel Checks and Adjustments. Refer to paragraph 3-8 Operator's Checks.

4-9. PERFORMANCE TESTS

4-10. Specification 1, Frequency Range

SPECIFICATION: 100 kHz to 110 MHz. (Output frequency tracks the 8553/8552 Spectrum Analyzer tuning).

DESCRIPTION: The frequency range is checked by applying signals to the Spectrum Analyzer, centering these signals on the CRT and counting the signal frequency.

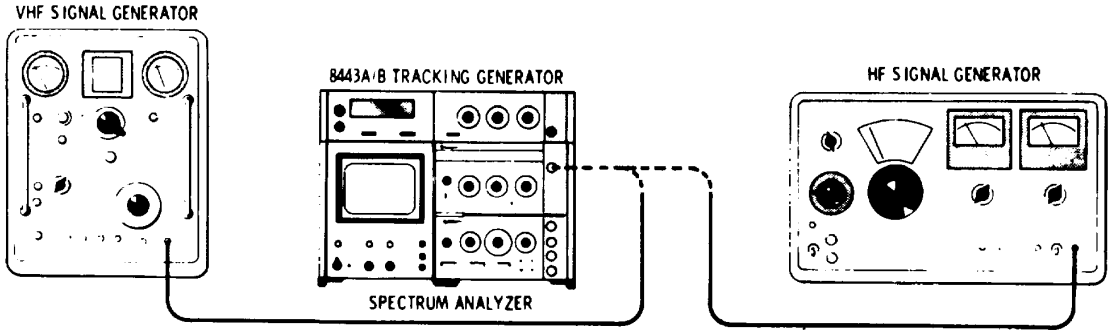


Figure 4-1. Frequency Range Test

EQUIPMENT:

HF Signal Generator
VHF Signal Generator

4-10. Specification 1, Frequency Range (cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-1 and set the control as follows:

Tracking Generator/Counter:

MODE ..... MARKER
RESOLUTION ..... 10 Hz
MARKER POSITION ..... Knob pulled out
MARKER INTENSITY ..... Mid- range

Spectrum Analyzer:

DISPLAY SECTION ..... Clearly defined trace
INPUT ATTENUATION ..... 10 dB
SCAN WIDTH ..... PER DIVISION
SCAN WIDTH PER DIVISION ..... 5 kHz
BANDWIDTH ..... 1 kHz
SCAN TIME PER DIVISION ..... 20 mSec
LOG REF LEVEL ..... 0 dBm

HF Signal Generator:

FREQUENCY ..... 100 kHz
ATTENUATOR . ..... -50 dBm
MODULATION SELECTOR . ..... CW

VHF Signal Generator:

FREQUENCY . ..... 110 MHz
OUTPUT ..... -50 dBm
MODULATION ..... CW

2. With the HF Signal Generator output connected to the analyzer RF INPUT, tune the analyzer FREQUENCY to 100 kHz. The Model 8443A counter, which is reading the output of the tracking generator, should provide a readout of 100 kHz ± 1 kHz.

100 kHz _____

NOTE

When testing an 8443B, connect a frequency counter to RF OUTPUT. Measure frequency range with the counter.

3. With the VHF Signal Generator output connected to the analyzer RF INPUT, tune the analyzer FREQUENCY to 110 MHz. The Model 8443 counter should provide a readout of 110 MHz.

110 MHz _____

4. Any other frequency or frequencies of special interest within the range of 110 kHz to 110 MHz may be displayed in the same manner.

4-11. Specification 2, Amplitude Range

SPECIFICATION: <-120 dBm to +10 dBm in 10 and 1 dB steps with a continuous 1.2 dB vernier.

DESCRIPTION: The output of the video amplifier in the Model 8443A/B is a constant +10 dBm signal. Two step attenuators are provided to enable the operator to control the output amplitude in 10 dB and 1 dB steps. In addition, a 1.2 dB vernier provides continuous attenuation of its range. This test demonstrates the accuracy of the attenuators.

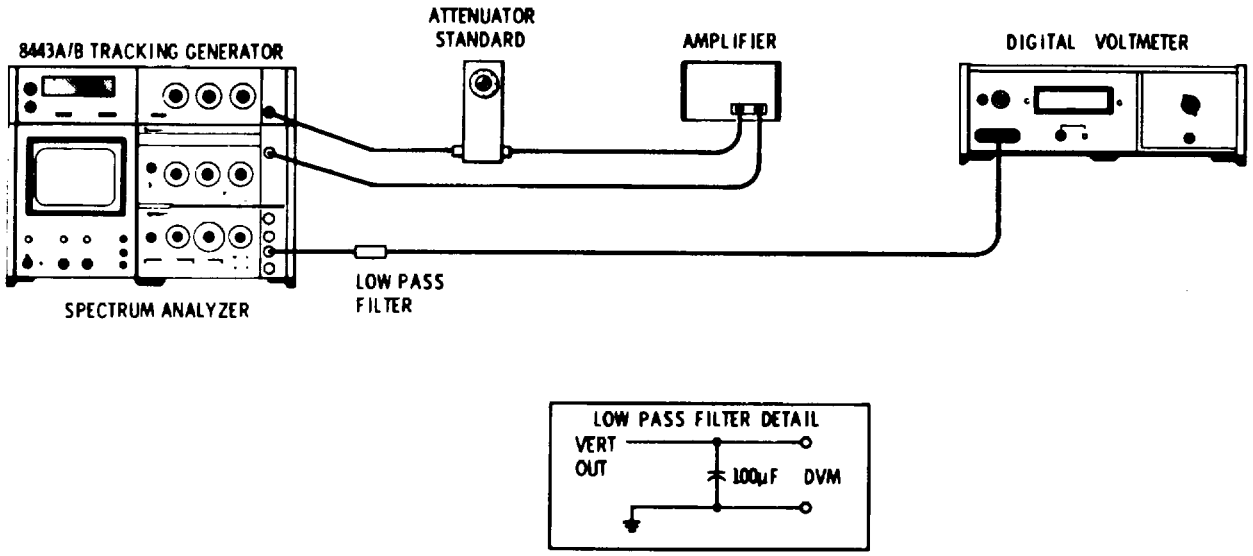


Figure 4-2. Amplitude Range Test Setup

EQUIPMENT:

120 dB Attenuator Standard (10 dB Steps)
12 dB Attenuator Standard (1 dB Steps)
RF Amplifier (20dB gain, 30 MHz)
Digital Voltmeter

PROCEDURE:

1. Connect the 120 dB attenuator to the Model 8443A/B RF OUTPUT using a BNC to BNC adapter (do not use a cable). Set the controls as follows:

Tracking Generator/Counter:

MODE ..... MARKER
RESOLUTION ..... 1 kHz
MARKER POSITION ..... Any
FUNCTION ..... TRACK ANALYZER

Attenuators:

TENS ..... +10
UNITS 0
TENTHS 0

4-11. Specification 2, Amplitude Range (cont'd)

Spectrum Analyzer:

FREQUENCY ..... 30 MHz
BANDWIDTH ..... 50 Hz
SCAN WIDTH ..... ZERO
SCAN WIDTH PER DIVISION ..... Any
INPUT ATTENUATION 0
SCAN TIME PER DIVISION ..... 1 MILLISECOND
LOG REF LEVEL 40dBm
LOG REF LEVEL VERNIER 0
LOG/LINEAR ..... LOG

RF Amplifier: Power ON 40 dB gain

120 dB Calibrated Attenuator: Set for 120 dB attenuation

Digital Voltmeter: AUTORANGE or 1000 Millivolts

2. Use very short double shielded cables to connect the equipment as shown in Figure 4-2. A low-pass filter (100 microfarad) is required between the vertical output of the 8552 and the digital voltmeter.

3. Adjust the analyzer FREQUENCY to 30 MHz.

4. Use the Model 8443A/B TENTHS control to set the digital voltmeter reading to 300 mV. (Allow time for the low-pass filter to stabilize).

5. Set the Model 8443A/B TENS control to 0 and the calibrated attenuator to 110 dB.

   0 dBm DVM reading: 298 mV _____ 302 mV

6. If necessary, reset the Model 8443A/B TENTHS control to obtain a reading of 300 mV on the digital voltmeter. Change the Model 8443A/B TENS control to -10 and the calibrated attenuator to 100 dB.

   -10 dBm DVM reading: 298 mV _____ 302 mV

7. Check the remaining Model 8443A/B attenuator steps by adding 10 dB steps with the TENS attenuator, while decreasing the calibrated attenuator in 10 dB steps (the sum of the two attenuators should always total 110 dB). The digital voltmeter should be reset to 300 mV prior to each step if necessary.

   -20 dBm DVM reading: 298 mV _____ 302 mV
   -30 dBm DVM reading: 298 mV _____ 302 mV
   -40 dBm DVM reading: 298 mV _____ 302 mV
   -50 dBm DVM reading: 298 mV _____ 302 mV
   -60 dBm DVM reading: 298 mV _____ 302 mV
   -70 dBm DVM reading: 298 mV _____ 302 mV
   -80 dBm DVM reading: 298 mV _____ 302 mV
   -90 dBm DVM reading: 298 mV _____ 302 mV
   -100 dBm dBM reading: 298 mV _____ 302 mV
   -110 dBm DVM reading: 298 mV _____ 302 mV

4-11. Specification 2, Amplitude Range (cont'd)

8. Remove the RF Amplifier and the 120 dB calibrated attenuator from the test setup. Connect the 12 dB calibrated attenuator between the Model 8443A/B RF OUTPUT and the analyzer RF INPUT. Set the Model 8443A/B TENS attenuator to -50 dBm and the analyzer LOG REF LEVEL to -10 dBm. Set the calibrated 12 dB attenuator to 12 dB. Adjust the Model 8552 LOG REF LEVEL vernier control to obtain a reading of 300 mV on the digital voltmeter.

9. Set the Model 8443A/B UNITS attenuator to -1 and the 12 dB calibrated attenuator to 11. The digital voltmeter should indicate 300 mV ± 1 mV.

-1 dBm DVM reading:	299 mV	301 mV

10. Check the remaining UNITS steps by increasing the UNITS attenuation in 1 dB steps while decreasing the 12 dB calibrated attenuator by 1 dB steps. (The sum of the two attenuators should always total 12 dB.) The digital voltmeter should be reset to 300 mV prior to each step if necessary.

-3 dBm DVM reading:	299 mV	301 mV
-4 dBm DVM reading:	299 mV	301 mV
-5 dBm DVM reading:	299 mV	301 mV
-6 dBm DVM reading:	299 mV	301 mV
-7 dBm DVM reading:	299 mV	301 mV
-8 dBm DVM reading:	299 mV	301 mV
-9 dBm DVM reading:	299 mV	301 mV
-10 dBm DVM reading:	299 mV	301 mV
-11 dBm DVM reading:	299 mV	301 mV
-12 dBm DVM reading:	299 mV	301 mV

4-12. Specification 3, Amplitude Accuracy (Flatness)

SPECIFICATION: ± 0.5 dB across entire range.

DESCRIPTION: The Spectrum Analyzer is swept through its entire range and the output of the Mode. 443A/B is recorded on an X-Y Recorder.

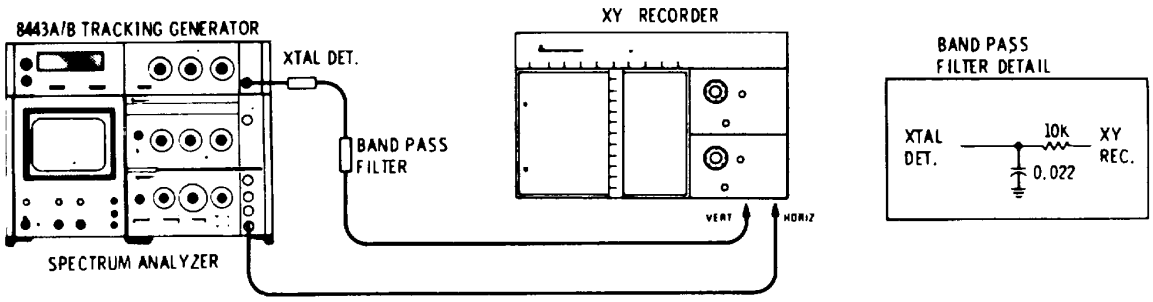


Figure 4-3. Amplitude Accuracy Test

EQUIPMENT:

X-Y Recorder
Crystal Detector

PROCEDURE:

1. Connect the equipment as shown in Figure 4-3 and set the controls as follows:

Tracking Generator/Counter:

MODE ..... MARKER
RF LEVEL ATTENUATORS ..... 0 dB
MARKER POSITION ..... CCW

Spectrum Analyzer:

SCAN WIDTH ..... ZERO
SCAN MODE ..... SINGLE
SCAN TIME ..... 2 sec/Div
SCAN TRIGGER . ..... AUTO

X-Y Recorder:

Horizontal trace begins at left margin of recorder chart paper and ends at right margin synchronized to the beginning and end of the analyzer scan ramp.

Vertical position of the stylus may be anywhere on the recorder chart paper which permits a 1 dB step without reaching top or bottom limits.

2. With all controls set as shown above, place the PEN switch on the recorder to the DOWN position. ,ii and push the SINGLE scan button on the analyzer. Be sure to place the recorder PEN switch in the UP position as soon as the scan stops.

3. Turn the Model 8443A/B UNITS attenuator to 1 dB and repeat step 2. Return the UNITS attenuate to 0 dB.

4-12. Specification 3. Amplitude Accuracy (Flatness) (cont'd)

4. Set the analyzer to SCAN WIDTH PER DIVISION at 10 MHz, and tune the analyzer to approximately 50 MHz. Carefully tune the analyzer to indicate a 100 kHz readout on the Model 8443A. (On the 8443B, use a frequency counter, connected to RF OUTPUT, to tune the analyzer to 100 kHz). Position the recorder stylus slightly below the top line drawn in steps 2 and 3. Place the PEN switch on the recorder in the down position and depress the SINGLE scan button on the analyzer. When the scan stops, set the PEN switch to UP.

5. Set the analyzer SCAN WIDTH PER DIVISION to 2 MHz and tune the analyzer FREQUENCY to a point where the Model 8443A counter reads 90 MHz. (Connect an external counter to the 8443B to tune the analyzer to 90 MHz). The recorder stylus should be positioned at the same level as measured at 90 MHz in test 4. Place the recorder PEN switch in the DOWN position and push the SINGLE button on the analyzer. When the recorder stylus reaches the right hand margin of the recorder chart place the PEN switch in the UP position. The entire trace (steps 4 and 5) should be between the two lines drawn in steps 2 and 3.

± 0.5 dB _____

4-13. Specification 4, Output Impedance

SPECIFICATION: 50 ohms, ac coupled, reflection coefficient < or = 0.09 (1.2 SWR); output 0 dBm.

DESCRIPTION: The RF output from the Tracking Generator is measured with an RF Voltmeter, first with no load, then terminated in 50 ohms. The source resistance (R_S) of the Tracking Generator is then calculated and finally the SWR is determined by dividing Z_O by R_S (R_S by Z_O if Z_O is greater than R_S).

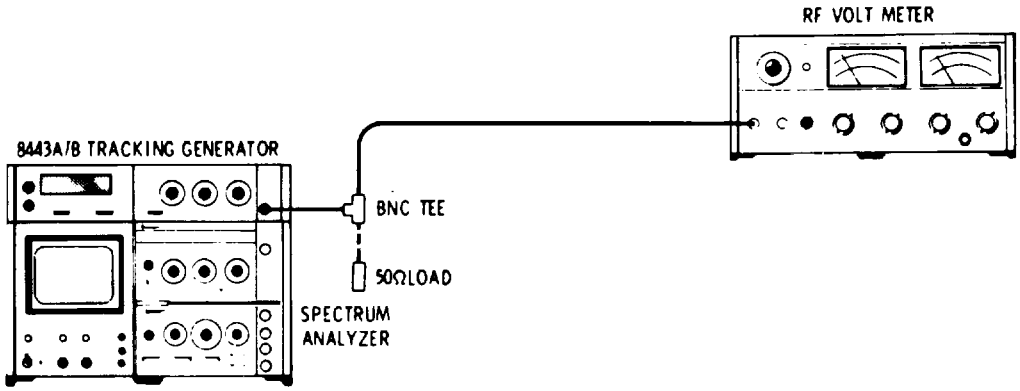


Figure 4-4. Output Impedance Test Setup

EQUIPMENT:

RF Vector Voltmeter
50 ohm dummy load
BNC Tee

4-13. Specification 4, Output Impedance (cont'd)

PROCEDURE:

1. Connect the equipment as shown in Figure 4-4 and set the controls as follows:

Tracking Generator/Counter:

RF OUTPUT
LEVEL dBm ..... All controls set to 0
POWER ..... ON

Spectrum Analyzer:

FREQUENCY ..... 30 MHz
SCAN WIDTH PER DIVISION ..... 1 kHz
SCAN WIDTH ..... ZERO
ALL OTHER CONTROLS ..... Any setting

RF Vector Voltmeter:

CHANNEL ..... A
FREQ RANGE - MHz ..... 30 MHz (APC locked)
RANGE ..... 1000 mV
PHASE CONTROLS ..... Not used

2. Measure the RF output of the Tracking Generator with the RF Vector Voltmeter. Record the reading:

V_{oc} = _____ mVrms

3. Use the BNC Tee and terminate the Tracking Generator RF OUTPUT in 50 ohms. Measure the RF output with the RF Vector Voltmeter. Record the reading:

V_L = _____ mVrms

4. Find the source resistance of the Tracking Generator by the following formula:

$$Rs = \frac{R_L V_{oc}}{V_L} - RL$$

V_{oc} = Tracking Generator RF output open circuit voltage
V_L = Tracking Generator RF output terminated in 50 ohms
$R_L = Z_o$ = Characteristic Impedance = 50 ohms

5. Find SWR by the formula:

$$SWR = \frac{Z_o}{R_S}$$

$$\left(\frac{R_S}{R_o} \text{ if } Z_o \text{ is greater than } R_S.\right)$$

6. Record this value; maximum allowable is 1.2

1.2 _____ SWR

4-14. Specification 5, Measurement Range (8443A Only)

SPECIFICATION: 100 kHz to 110 MHz. Display: seven digits with one digit over-range (for frequencies of 100 MHz and higher).

DESCRIPTION: This test is identical to 4-10.

4-15. Specification 6, Resolution (Gate time, 8443A Only)

SPECIFICATION: 1 kHz (1 mSec), 100 Hz (10 mSec) and 10 Hz (100 mSec).

DESCRIPTION: This test consists of placing the RESOLUTION switch on the 8443A in each of its three positions and observing the numerical readout.

PROCEDURE: Operate the Model 8443A in the MARKER mode with the MARKER POSITION knob pulled out. Tune the analyzer to any frequency over 100 MHz, and place the Model 8443A RESOLUTION control in each of its three positions. In the 10 Hz position all of the numerical readouts are illuminated and the decimal point is between the third and fourth readouts. In the 100 Hz position the first numerical readout is blanked and the decimal point is between the fourth and fifth readouts. In the 1 kHz position the first and second readouts are blanked and the decimal point is between the fifth and sixth readouts.

4-16. Specification 7, Accuracy (8443A Only)

SPECIFICATION: ± count ± time base accuracy.

DESCRIPTION: Connect the 1 MHz OUT (J4 on rear panel of the Model 8443A) to the COUNTER INPUT. Place the MODE control in the EXTERNAL position. In any position of the RESOLUTION control the last digit of the numerical readout will be 0, 1 or 9.

4-17. Specification 8, Time Base Aging Rate (8443A Only)

SPECIFICATION: < 3 x 10^{-9} per day. (0.003 Hz/day at 1 MHz after warmup).

DESCRIPTION: This test checks long term frequency stability. This is accomplished by mixing the reference oscillator frequency of the Model 8443A with a stable 1.000001 MHz signal and recording the drift on a strip recorder.

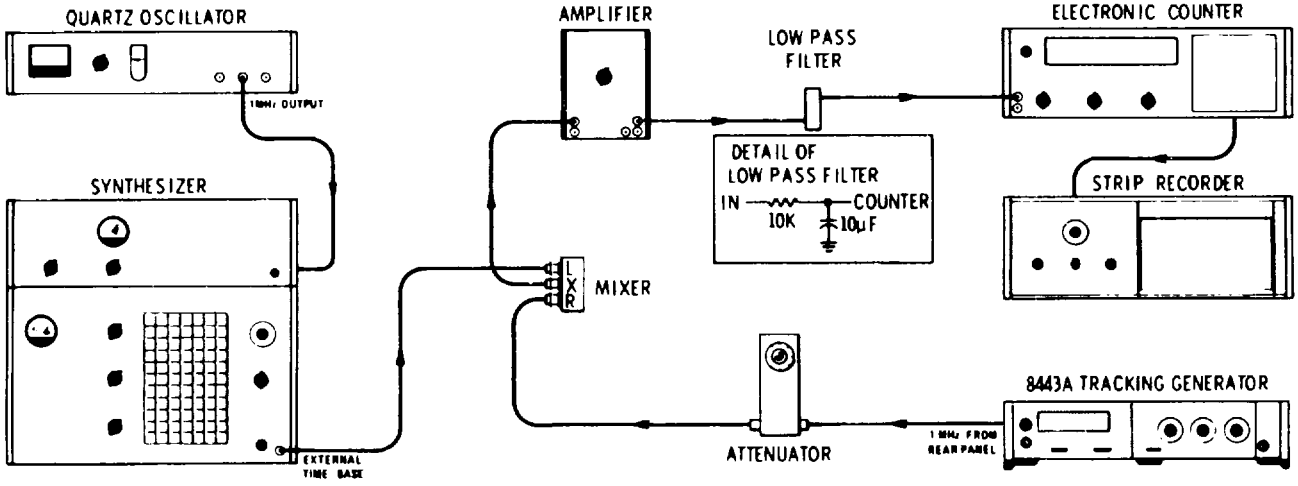


Figure 4-5. Time Base Again Rate Test

EQUIPMENT:

Digital-to-Analog Converter/Recorder	Quartz Oscillator
Frequency Counter	Frequency Synthesizer
Double Balanced Mixer	Oscilloscope
Amplifier, dc to 1 MHz	Attenuator

PROCEDURE:

1. Set controls as follows:

Digital-to-Analog Converter/Recorder:

POWER ..... ON
COLUMN SELECTOR ..... 2, 3 and 4
OPERATE ..... (after ZERO-CALIBRATE procedure)
MIN-N-HR ..... HR
div 8
PEN ..... down
RANGE ..... 100 mV

Amplifier, dc:

Remove ground strap from low output terminal

GAIN X10

Quartz Oscillator:

OUTPUT ..... From 1 MHz jack

4-17. Specification 8, Time Base Aging Rate (8443A Only) (cont'd)

Frequency Counter:

SIGNAL INPUT	DC
TIME BASE	10 µ S
SAMPLE RATE	Just out of POWER OFF detent
SENSITIVITY (preset)	0.1V
FUNCTION to PERIOD AVERAGE	1
STORAGE/OFF (on back panel)	STORAGE

Frequency Synthesizer:

FREQUENCY SELECTION	Local keyboard and OPERATE
OUTPUT LEVEL	full CW
FREQUENCY	1,000,001 Hz
SEARCH OSCILLATOR	Function not used
FREQUENCY STANDARD	EXT
ATTENUATOR	20 dB

2. After connecting the equipment as shown in Figure 4-5 and setting controls, use the oscilloscope to check for the presence of 50 cycle ac on the 1 cycle input to the frequency counter. If 60 cycles is present it is probably due to a ground loop. Check all equipment grounds.

3. After warmup (seven days of continuous operation of 72 hours of continuous operation after an off time of less than 72 hours) test the time base aging rate.

4. After the digital to analog converter/recorder has been calibrated, position the recorder stylus to a convenient point on the recording paper. Check the time base for a 24 hour period. The recorder excursions must not exceed 1.4 minor divisions.

_____ divisions

4-18. Specification 9, Time Base Temperature Drift (8443A Only)

SPECIFICATION: $<3 \times 10^{-8}$ (0.03 Hz) variation referenced to 100 MHz 0 to 55°C.

DESCRIPTION: This test verifies frequency stability over the specified operating temperature range.

EQUIPMENT: Same as 4-17 plus a temperature controllable oven.

PROCEDURE:

1. With the equipment connected and adjusted as in 4-16, place the Model 8443A in a temperature controllable oven. Adjust the temperature to +24°C and allow the temperature to stabilize.

2. Make a reference plot on the recorder at +24°C.

3. Lower the oven temperature to 0°C and allow three hours for the temperature to stabilize. Record the deviation from the +24°C trace.

4. Increase the oven temperature to +55°C and allow three hours for the temperature to stabilize. Record the deviation from the previous traces.

5. Total deviation must be not more than 3×10^{-8}.

_____ Deviation

4-19. Specification 10, External Counter Input (8443A Only)

SPECIFICATION: 10 kHz to 120 MHz, 50 ohms, -10 dBm minimum, +25 dBm maximum.

DESCRIPTION: This test verifies the ability of the counter to count frequencies between 10 kHz and 120 MHz at signal levels as low as -10 dBm.

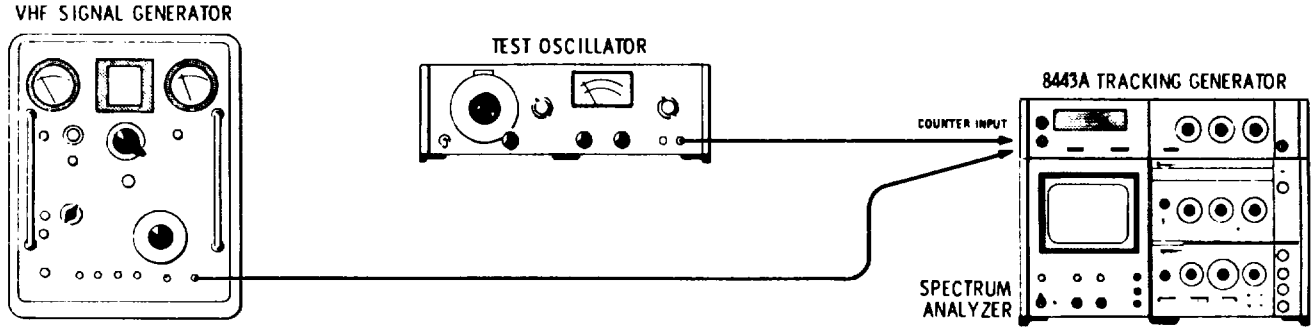


Figure 4-6. Counter Input Test Setup

EQUIPMENT:

Test Oscillator
VHF Signal Generator

PROCEDURE:

1. Place the Model 8443A MODE switch in the EXTERNAL position and connect the test oscillator output to the COUNTER INPUT. Set the test oscillator output to 10 kHz at -10 dBm. The counter readout should indicate 10 kHz. Increase the test oscillator output to +25 dBm. Counter readout remains the same.

2. Connect the VHF Signal Generator RF OUTPUT to the Model 8443A COUNTER INPUT. Set generator output to 120 MHz at -10 dBm. The counter readout should indicate 120 MHz.

3. Repeat the test at various frequencies between 10 kHz and 120 MHz.

4-20. Specification 11, External Time Base (8443A Only)

SPECIFICATION: 1 MHz, 50 ohm, 1 Vrms minimum.

DESCRIPTION: This test verifies proper operation of the counter when an external time base is used.

EQUIPMENT:

Frequency Standard
VHF Signal Generator

PROCEDURE:

1. Connect the signal generator RF OUTPUT to the Model 8443A COUNTER INPUT (100 MHz, -10 dBm). Counter readout indicates 100 MHz.

2. Connect the frequency standard output (1 MHz) to the Model 8443A EXT TIME BASE IN (rear panel J3). Place A4S2 in the EXT position. The counter readout should again indicate 100 MHz.

4-21. Specification 12, Time Base Output (8443A Only)

SPECIFICATION: 1 MHz, 1 Vrms nominal.

DESCRIPTION: This test verifies the presence of the internal time base signal at J4 on the rear panel of the Model 8443A.

EQUIPMENT: Oscilloscope

PROCEDURE: Connect the 1 MHz OUT (rear panel J4) to the oscilloscope input. Oscilloscope displays a 1 MHz signal at least 1 Vrms in amplitude.

4-22. Specification 14, Digital Frequency Readout (8443A Only)

SPECIFICATION: 8, 4, 2, 1 code: positive logic.

DESCRIPTION: This test verifies the availability of the digital output from the Model 8443A.

EQUIPMENT: Digital Recorder

PROCEDURE: Connect the DIGITAL OUTPUT on the rear panel of the Model 8443A to the digital recorder input. Place the UNBLANKED/BLANKED switch on the Model 8443A to the BLANKED position (to prevent zero's before the first significant digit). In the EXTERNAL Mode set the analyzer to 10 MHz/Div and 10 second/Div. Connect the RF OUTPUT to the COUNTER INPUT. Note that the digital recorder readout tracks (one count behind) the Model 8443A counter readout.

Table 4-1. Performance Test Record

4-10. Frequency Range		100 kHz_____	
		110 MHz_____	
4-11. Amplitude Range			
	0 dBm reading:	298 mV_____	302 mV
	-10 dBm reading:	298 mV_____	302 mV
	-20 dBm reading:	298 mV_____	302 mV
	-30 dBm reading:	298 mV_____	302 mV
	-40 dBm reading:	298 mV_____	302 mV
	-50 dBm reading:	298 mV_____	302 mV
	-60 dBm reading:	298 mV_____	302 mV
	-70 dBm reading:	298 mV_____	302 mV
	-80 dBm reading:	298 mV_____	302 mV
	-90 dBm reading:	298 mV_____	302 mV
	-100 dBm reading:	298 mV_____	302 mV
	-110 dBm reading:	298 mV_____	302 mV
	-1 dBm reading:	299 mV_____	301 mV
	-2 dBm reading:	299 mV_____	301 mV
	-3 dBm reading:	299 mV_____	301 mV
	-4 dBm reading:	299 mV_____	301 mV
	-5 dBm reading:	299 mV_____	301 mV
	-6 dBm reading:	299 mV_____	301 mV
	-7 dBm reading:	299 mV_____	301 mV
	-8 dBm reading:	299 mV_____	301 mV
	-9 dBm reading:	299 mV_____	301 mV
	-10 dBm reading:	299 mV_____	301 mV
	-11 dBm reading:	299 mV_____	301 mV
	-12 dBm reading:	299 mV_____	301 mV
4-12. Amplitude Accuracy (Flatness)			
		± 0.5 dB _____	
4-13. Output Impedance			
		1.2 _____	SWR
4-17. Time Base Aging Rate			
			divisions
		_____	
4-18. Time Base Temperature Drift			
			deviation
		_____	

SECTION V
ADJUSTMENTS

5-1. INTRODUCTION

5-2. This section describes adjustments and checks required to return the Model 8443A/B to peak operation capability when repairs are required. Included in this section are test setups and procedures and a test card for recording data taken during adjustment procedures. Adjustment location illustrations are provided on the first foldout in this manual. If adjusting an 8443B, disregard references to the Counter circuits.

5-3. Checks and Adjustments Arrangement

5-4. The check and adjustment procedures are arranged in numerical order.

5-5. Test Equipment Required

5-6. Each test procedure in this section contains a list of test equipment to be used. Required specifications for test equipment are detailed in Table 1-2. Also, each test setup identifies all test equipment and accessories by callouts. Any equipment substituted for the instruments or accessories listed in Table 1-2 must meet the minimum specifications in order to adjust the Model 8443A/B effectively.

5-7. HP 08443-60011 Service Kit

5-8. The HP 08443-60011 Service Kit is an accessory item available from Hewlett-Packard for use in maintaining the Model 8443A/B.

5-9. Table 1-2 contains a detailed description of the contents of the service kit. Any item in the kit may be ordered separately if desired.

5-10. Factory Selected Components

5-11. Some component values in the Model 8443A/B are selected at the time of final assembly and test. These components are listed in Table 8-1. They are also listed in the adjustment procedure for the circuit in which they appear.

5-12. ADJUSTMENT PROCEDURES

5-13. Power Supplies

REFERENCE: Service Sheet 4.

DESCRIPTION: The power supplies in the Model 8443A provide regulated outputs of +175 volts, +24 volts, +20 volts, +5.8 volts and -12 volts. These checks verify proper operation of the power supplies. (The power supplies in the 8443B provide only +24 volts, +20 volts, and -12 volts).

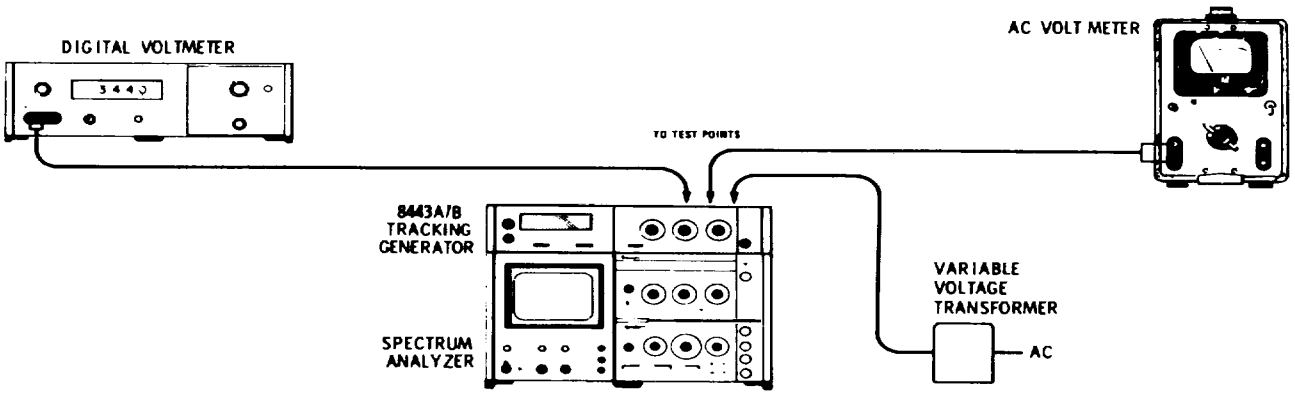


Figure 5-1. Power Supply Test Setup

EQUIPMENT:

Digital Voltmeter
AC Voltmeter
Service Kit
Variable Voltage
Transformer

PROCEDURE:

1. With power applied to the model 8443A/B through the variable voltage transformer, connect the digital voltmeter to the +24 volt test point on the A14 assembly. Vary the ac line voltage from 100 volts to 130 volts. The +24 volts should not vary more than +10 mV.

Input AC	+24V
100 Vac	_____
115 Vac	_____
130 Vac	_____

2. Measure the dc levels and the ac ripple at the test points on the A14 Sense Amplifier.

Level	Tolerance	Ripple
+24V	±10.00 mV	<0.2 mV
+20V	±0.40 V	<1.0 mV
+5.8V	±0.12 V	<1.0 mV
-12V	±0.24V	<1.0 mV

3. Measure the dc level and ac ripple at the 175 V test point.

5-13. Power Supplies (cont'd)

Level	Tolerance	Ripple
+175V	± 3.5V	<1.0 V

4. If the voltages are not within tolerance connect the digital voltmeter to the +24 volt test point on the A14 assembly and adjust reference level potentiometer R50. If the voltage cannot be adjusted to +24 volts, or if other dc outputs are not within tolerance, refer to Service Sheet 4 in Section VIII and repair the power supply. Repeat these tests after completing repairs.

NOTE

R11, R33, R38 and R43 are all factory selected at time of final assembly to provide the proper reference level for the sense amplifier in which they appear. The value of these resistors determines the dc level of the supply output.

5-14. First Converter (A13)

REFERENCE: Service Sheet 2.

DESCRIPTION: The first converter contains a 3 MHz crystal controlled oscillator, 3 MHz and 47 MHz amplifiers and a diode quad mixer. These tests verify proper operation of the assembly.

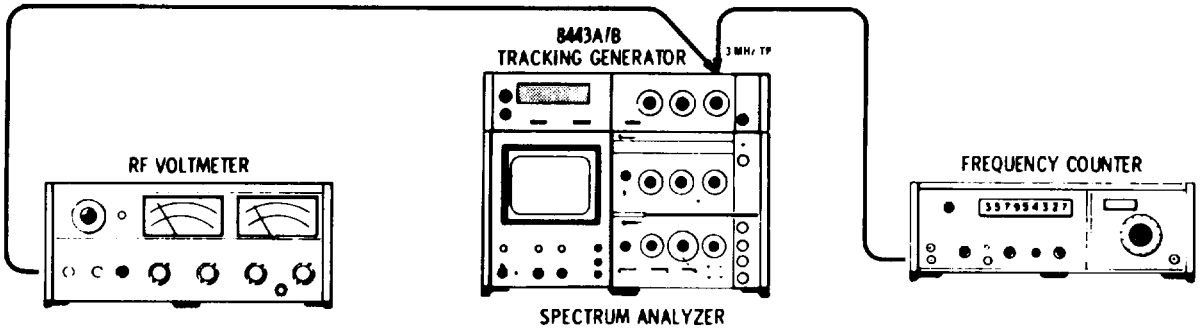


Figure 5-2. First Converter Test Setup

EQUIPMENT:

RF Voltmeter
Service Kit
Frequency Counter

PROCEDURE:

1. Set the TRACKING ADJUST control full ccw and monitor the 3 MHz test point on the A13 assembly with the RF Voltmeter. Adjust L1 PEAK ADJ for maximum indication on the RF Voltmeter.

2. Monitor the 3 MHz test point with the frequency Counter and set L2, RANGE ADJ, for a frequency of 2 MHz.

3. Turn the TRACKING ADJUST control full cw. The frequency at the 3 MHz test point should be 3 MHz. If the frequency is greater than 3.00025 MHz, replace R20 with a higher value.

4. Connect the RF Voltmeter to the 3 MHz test point. The minimum output level over the range of the TRACKING ADJUST control should be 275 mVrms.

275 mVrms _____

5-14. First Converter (A13) (cont'd)

5. Measure the output of the 3 MHz oscillator (Test Point 1) with the RF Voltmeter. Signal level should be 480 mVrms minimum.

480 mVrms

6. Reinstall the A13 assembly and connect the 50 MHz output to the Spectrum Analyzer RF INPUT. The 40 MHz signal should be -26 dBm minimum.

26 dBm

5-15. 50 MHz IF Amplifier (A12)

REFERENCE: Service Sheet 2.

DESCRIPTION: The 50 MHz amplifier provides about 12 dB of gain. These tests verify proper operation of the bandpass filter and the 44 and 47 MHz traps.

EQUIPMENT: Service Kit

PROCEDURE:

1. Connect the output of the A12 assembly to the Spectrum Analyzer RF INPUT. Adjust the BPF ADJ capacitors for maximum 50 MHz signal on the analyzer CRT. Minimum signal level is -15 dBm.

-15 dBm

2. Adjust C8 and C17 for minimum signal at 44 MHz and C10 for minimum signal at 47 MHz. Check for minimum separation of 60 dB between the 50 MHz signal and the 44 and 47 MHz signals over the entire range of the analyzer's third local oscillator signal.

Separation 60 dB

5-16. Second Converter (All)

REFERENCE: Service Sheet 2.

DESCRIPTION: The second converter contains a three-stage amplifier (about 20 dB gain) and a diode quad mixer. These tests verify proper operation of the assembly.

EQUIPMENT:

Service Kit
RF Voltmeter

PROCEDURE:

1. Remove the All assembly and reinstall it using an extender board. Check the output from the amplifier to the mixer (Test Point 1) with the RF Voltmeter. Level should be 800 mVrms minimum.

800 mVrms

2. Check the 200 MHz output with the RF Voltmeter (terminated in 50 ohms). Minimum level should be -22 dBm.

-22 dBm

5-17. 200 MHz IF Amplifier (A10)

REFERENCE: Service Sheet 3.

DESCRIPTION: The A10 assembly contains a two-stage variable gain (about 20 dB) amplifier and a bandpass filter. These tests verify proper operation of the assembly.

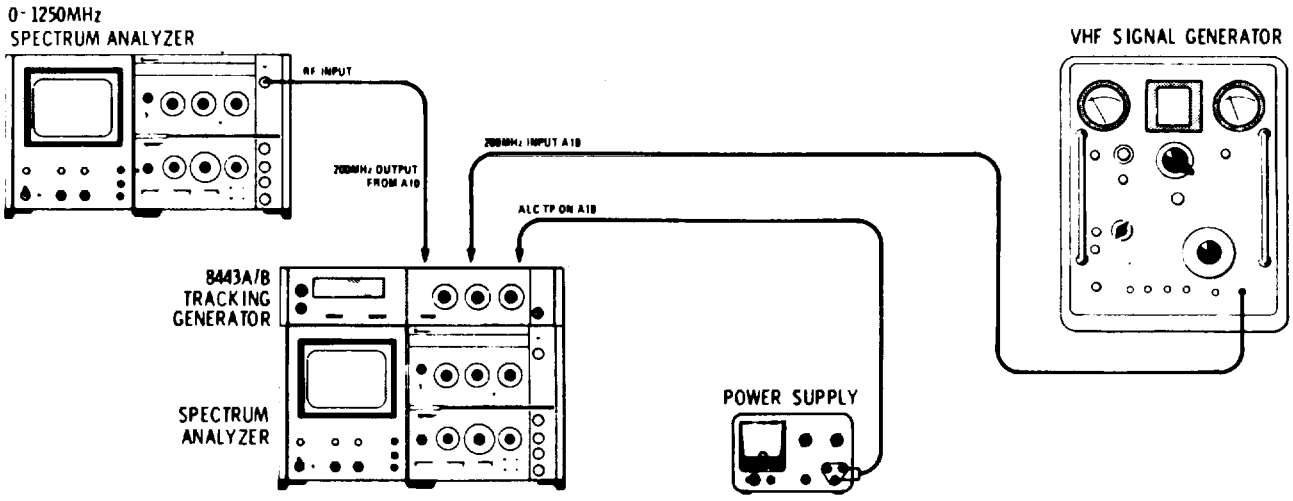


Figure 5-3. 200 MHz IF Test Setup

EQUIPMENT:

VHF Signal Generator
Service Kit
0 - 1250 MHz Spectrum Analyzer
DC Power Supply

PROCEDURE:

1. Apply a -10 dBm, 100 MHz, CW signal to the 200 MHz input (green cable) on the A10 assembly. Connect the 200 MHz output of the A10 assembly to the RF INPUT of the 0 - 1250 MHz Spectrum Analyzer and tune the analyzer to 100 MHz. Adjust A10C5 for minimum response on the analyzer CRT.

2. Change the input signal to 150 MHz and adjust A10C4 for minimum 150 MHz response.

3. Change the input signal to 200 MHz, center the signal on the 0 - 1250 Spectrum Analyzer CRT and adjust the bandpass filter (C3, C5 and C6) for maximum response. Reduce the output of the signal generator to -35 dBm. The signal level displayed on the 0 1250 Spectrum Analyzer should be -18 dBm (17 dB gain).

4. Remove the A8 assembly and apply a 23 volt dc level to the ALC Test Point (A10TP3) on the A10 assembly. Tune the ALC RANGE ADJ for minimum signal level out as observed on the 0 - 1250 Spectrum Analyzer CRT.

5-18. Third Converter (A9)

REFERENCE: Service Sheet 3.

DESCRIPTION: Third converter assembly contains a three-stage (about 20 dB gain) amplifier, a diode quad mixer and a 120 MHz low pass filter. These tests verify proper operation of the assembly.

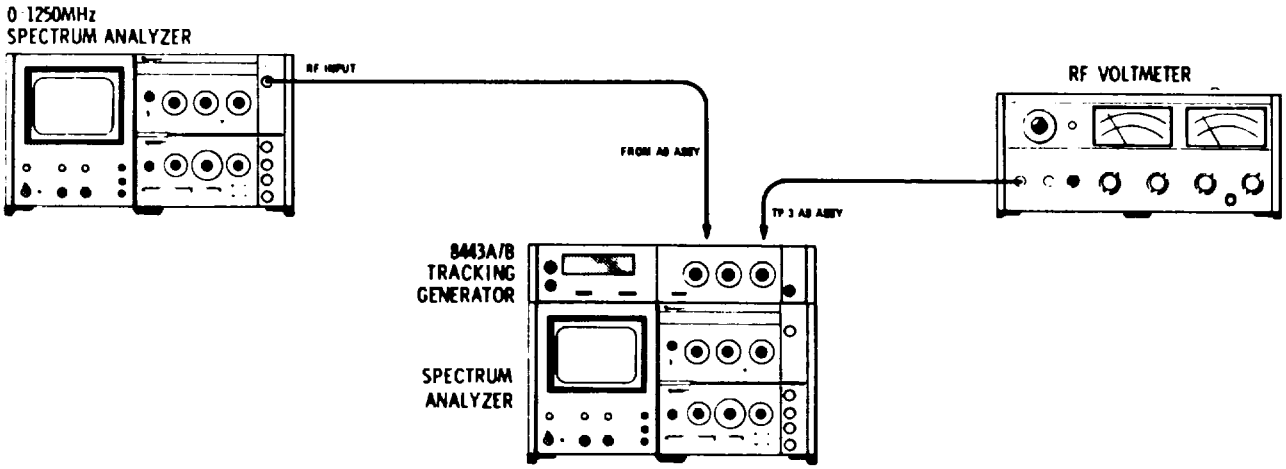


Figure 5-4. Third Converter Test Setup

EQUIPMENT:

RF Voltmeter
0 - 1250 MHz Spectrum Analyzer
Service Kit

PROCEDURE:

1. Remove the A9 assembly and reinstall it using an extender board from the service kit. Check the amplifier output at Test Point 3 (Q1-c). Signal level should be 800 mVrms minimum.

   800 mVrms _____

2. Connect the output of the A9 assembly to the analyzer RF INPUT. Signal level should be --32 dBm minimum.

   -32 dBm _____

3. Connect the output of the A9 assembly to the RF INPUT of the 0 - 1250 MHz Spectrum Analyzer and verify that frequencies above 120 MHz are sharply attenuated.

5-19. ALC/Video Amplifier

REFERENCE: Service Sheet 3.

DESCRIPTION: The A8 assembly contains two integrated circuit RF amplifiers and a leveling circuit which controls the gain of the 200 MHz IF amplifier. These tests verify proper operation of the assembly.

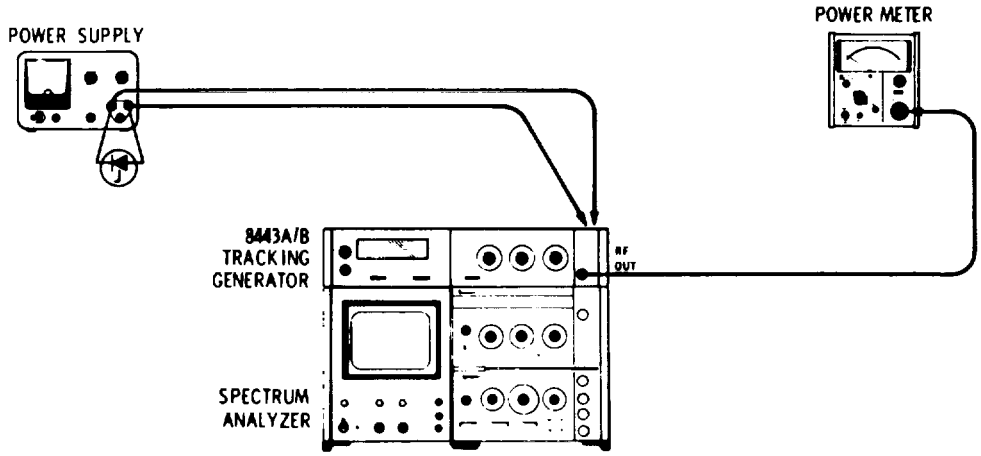


Figure 5-5. ALC/Video Amplifer Test Setup

EQUIPMENT:

Power Supply
Service KIT
Power Meter
3.7 Volt Zener Diode

PROCEDURE:

1. Connect the 3.7 volt zener diode across the external power supply output terminals. Connect the negative power supply lead to the CCW lead of the output vernier control and the positive lead to ground.

2. Set the OUTPUT LEVEL dBm TENS to +10 (UNITS and TENTHS to 0) and connect the power meter to the RF OUTPUT. Set the analyzer to ZERO scan at 100 MHz.

3. Set OUTPUT LEVEL UNITS to -9 and TENTHS to -1. Adjust the power supply for a 0 dBm output from the Model 8443A/B as read on the power meter.

4. Set OUTPUT LEVEL dBm UNITS to -10 and TENTHS to 0. Adjust R16, 0 dB ADJ, on the A8 assembly for a 0 dBm output from the Model 8443A/B as read on the power meter.

5. Repeat steps 3 and 4 until further adjustment is unnecessary.

6. Disconnect the external power supply and set OUTPUT LEVEL dBm UNITS to -9 and TENTHS to -1.

7. Adjust -1 dB ADJ (R14) on the A8 assembly for a 0 dBm output from the Model 8443A/B as read on the power meter.

8. Set OUTPUT LEVEL dBm UNITS to -10 and TENTHS to 0. Verify 0 dBm output with the power meter.

5-20. Reference Oscillator (A4) (8443A Only)

REFERENCE: Service Sheet 7.

DESCRIPTION: This procedure allows adjustment of the reference oscillator (A4) in comparison with an external frequency standard.

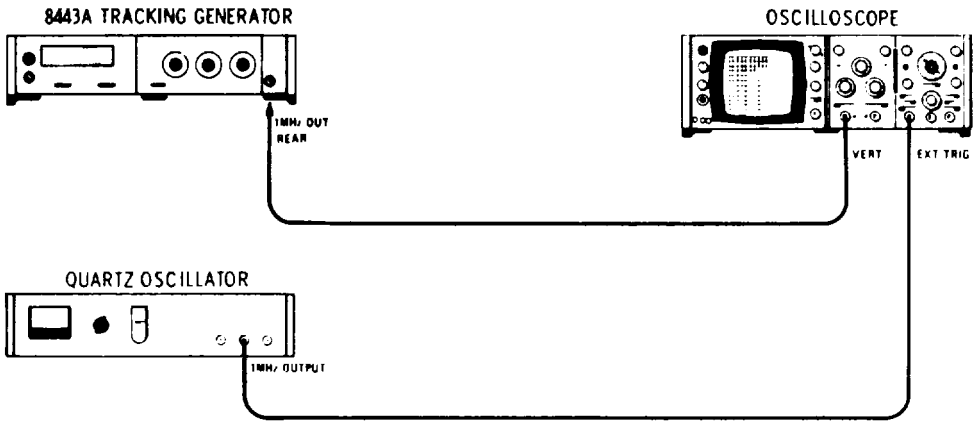


Figure 5-6. Reference Oscillator Test Setup

EQUIPMENT:

1 MHz Frequency Standard
Oscilloscope

PROCEDURE: After warmup (seven continuous days of operation or 72 hours of operation after an off time of 72 hours or less), connect the oscilloscope and frequency standard as shown in Figure 5-6; set the oscilloscope to .05 µ Sec/Div and adjust the vertical sensitivity for full scale sinusoid. Adjust the reference oscillator COARSE and FINE controls until the display moves in either direction no faster than one division in five seconds.

Table 5-1. Adjustment Test Record

Hewlett-Packard Model 8443A/B Tracking Generator/Counter **Tests Performed by** _____

Serial No. _____ **Date** _____

5-13. Power Supplies Checks and Adjustments.

+24 volt supply at 100 Vac _____ at 115 Vac _____ at 130 Vac _____

Power Supply:	Measured Level	Measured ripple
+24V	_____	_____
+20V	_____	_____
+5.8V	_____	_____
-12V	_____	_____
+175V	_____	_____

5-14. First Converter (A13) Checks and Adjustments.

Test	
4	275 mVrms _____
5	480 mVrms _____
6	-26 dBm _____

5-15. 50 MHz IF Amplifier (A12) Checks and Adjustments.

Test	
1	-15 dBm _____
2	Separation 60 dB _____

5-16. Second Converter (All) Checks and Adjustments.

Test	
1	800 mVrms _____
2	-22 dBm _____

5-18. Third Converter (A9) Checks and Adjustments.

Test	
1	800 mVrms _____
2	-32 dBm _____

SECTION VI
REPLACEABLE PARTS

6-1. This section contains information relative to ordering replacement parts and assemblies.

6-2. Table 6-1 provides correct stock numbers for use when ordering printed circuit board assemblies on an exchange basis.

6-3. Table 6-2 provides an index of reference designations and abbreviations used in the preparation of manuals by Hewlett-Packard.

6-4. Table 6-3 identifies parts by reference designations.

6-5. Table 6-4 provides code number identification of manufacturers.

Table 6-1. Part Numbers for Assembly Exchange Orders

Assembly	New Pat No.	Exchange No.
A1 Low Frequency Counter	08443-60071	08443-60075
A2 0-120 dB Attenuator	08443-60001	08443-60102
A3 0-12 dB Attenuator	08443-60002	08443-60103
A5 Time Base	08443-60048	08443-60104
A6 High Frequency Decade	084.43-60047	08443-60105
A7 Marker Control	08443-60046	08443-60106
A8 ALC Video Amplifier	08443-60045	08443-60107
A9 Third Converter	08443-60044	08443-60108
A10 200 MHz IF Amplifier	08443-60043	08443-60109
A11 Second Converter	08443-60042	08443-60110
A12 50 MHz IF Amplifier	08443-60041	08443-60111
A13 First Converter	08443-60077	08443-60115
A14 Sense Amplifier	08443-60015	08443-60113
A15 Rectifier	08443-60014	08443-60114

Table 6-2. Reference Designators and Abbreviations used in Parts List

REFERENCE DESIGNATORS

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

ABBREVIATIONS

A	= amperes	H	= henries	N/O	= normally open	RMO	= rack mount only
AFC	= automatic frequency control	HDW	= hardware	NOM	= nominal	RMS	= root-mean square
		HEX	= hexagonal	NPO	= negative positive zero (zero temperature coefficient)	RWV	= reverse working voltage
AMPL	= amplifier	HG	= mercury			S-B	= slow-blow
		HR	= hour(s)			SCR	= screw
BFO	= beat frequency osclla-tor	Hz	= Hertz			SE	= selenium
				NPN	= negative-positive-negative	SECT	= section(s)
BE CU	= beryllium copper	IF	= intermediate freq			SEMICON	= semiconductor
BH	= binder head	IMPG	= impregnated	NRFR	= not recommended for field replacement	SI	= silicon
BP	= bandpass	INCD	= Incandescent			SIL	= silver
BRS	= brass	INCL	= Include(s)			SL	= slide
BWO	= backward wave oscilla-tor	INS	= insulation(ed)	NSR	= not separately replaceable	SPG	= spring
		INT	= internal			SPL	= special
						SST	= Stainless steel
CCRW	= counterclockwise	K	= kilo =1000	OBD	= order by description	SR	= split ring
CER	= ceramic					STL	= steel
CMO	= cabinet mount only			OH	= oval head		
COEF	= coefficient	LH	= left hand	OX	= oxide		
COM	= common	LIN	= linear taper	P	= peak	TA	= tantalum
COMP	= composition	LK WASH	= lock washer	PC	= printed circuit	TD	= time delay
COMPL	= complete	LOG	= logarithmic taper	PF	= picofarads = 10^{-12} farads	TGL	= toggle
CONN	= connector	LPF	= low pass filter			THD	= thread
CP	= cadmium plate			PH BRZ	= phosphor bronze	TI	= titanium
CRT	= cathode-ray tube	M	= milli = 10^{-3}	PHL	= Phillips	TOL	= tolerance
CW	= clockwise	MEG	= meg = 10^{6}	PIV	= peak inverse voltage	TRIM	= trimmer
DEPC	= deposited carbon	MET FLM	= metal film			TWT	= traveling wave tube
DR	= drive	MET OX	= metallic oxide	PNP	= positive-negative-positive		
		MFR	= manufacturer				
ELECT	= electrolytic	MHz	= mega Hertz	P/O	= part of	µ	= micro = 10^{-6}
ENCAP	= encapsulated	MINAT	= miniature	POLY	= polystrene		
EXT	= external	MOM	= momentary	PORC	= porcelain		
		MOS	= metalized substrate	POS	= position(s)	VAR	= variable
F	= farads			POT	= potentiometer	VDCW	= dc working volts
FH	= flat head	MTO	= mounting	PP	= peak-to-peak		
FIL H	= Fillister head	MY	= “mylar"	PT	= point		
FXD	= fixed			PWV	= peak working voltage	W/	= with
						W	= watts
G	= giga (10^{9})	N	= nano (10^{-9})			WIV	= working Inverse voltage
		N/C	= normally closed	RECT	= rectifier		
GE	= germanium	NE	= neon	RF	= radio frequency	WW	= wire wound
GL	= glas	NI PL	= nickel plate	RH	= round head or right hand	W/O	= without
GRD	= ground(ed)						

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	08443-60071	1	BOARD ASSY:LOW-FREOUENCY COUNTER (8443A ONLY)	28480	
A10P1	08443-00009	1	COVER:TOP COUNTER BOX	28480	08443-00009
A1MP2	08443-00016	1	BRACKET:RETAINING	28480	08443-00016
A1MP3	08443-00042	1	COVER BOX	29480	08443-00042
A1MP3	08443-00007	1	COVER:BOTTOM C-BOX	28483	08443-00007
A1MP3	08443-00008	1	PANEL:REAR C-BOX	28480	08443-00008
A1MP3	08443-00010	1	BRACKET MOUNTING, LEFT C-BOX	28480	08443-00010
A1MP3	08443-00011	1	BRACKET MOUNTING, RIGHT C-BOX	28480	08443-00011
A1MP3	08443-00015	1	SCREEN:NIXIE SHIELD	28480	08443-00015
A1MP3	08443-4D004	2	BRACKET:SCREEN	28480	08443-40004
A1MP4	08443-03044	1	GUIDE:CONNECTOR BOARD	28480	08443-00044
A1MP5	08443-60039	1	BOARD ASSY:CONNECTOR	28480	08443-60039
A1MP5	0380-0885	2	STANDOFF:CAPTIVE 0.156" LG 4-43 THREAD	00000	DBD
A1MP5	1251-1887	2	CONNECTOR:PC 44 CONTACTS (2 X 22)	71785	252-22-30-340
A1MP6	1400-0818	1	CLAMP:MOTOR 0.750" TO #6 MTG HOLES	91506	2601-20
A1MP6	0400-0009	8	GROMMET:VINYL FITS 1/4" DIA HOLE	01538	G250
A1MP7	3160-0231	1	FAN BLADE:2.500" DIA	04870	2-1/2 LMF .0795
A1MP7	0400-0009		GROMMET:VINYL FITS 1/4" DIA HOLE	01536	G250
A1MP8	0400-0009	5	GROMMET:VINYL FITS 1/4" DIA HOLE	01538	G250
A1MP9	0400-0009		GROMMET:VINYL FITS 1/4" DIA HOLE	01538	G250
A1MP10	0400-0009		GROMMET:VINYL FITS 1/4“ DIA HOLE	01538	G250
A1MP11	0400-0009		GROMMET:VINYL FITS 1/4" DIA HOLE	01538	G250
A1MP12	0400-0009		GROMMET:VINYL FITS 1/4" DIA HOLE	01538	G250
A1MP13	0400-0009		GROMMET:VINYL FITS 1/4” DIA HOLE	01538	G250
A1W1	08443-60064	1	CABLE ASSY	28480	08443-60064
A1W1	08443-60037	1	BOARD ASSY:LOW FREQ COUNTER	28480	08443-60037
A1A1C1	0160-2143	3	C:FXD CER 2000 PF +80-20% 1000VDCW	91418	TYPE B
A1A1C2	0160-2143		C:FXD CER 2000 PF +80-20% 1000VDCW	91418	TYPE B
A1A1C3	0160-2930	6	C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A1A1C4	0180-0197	12	C:FXD CER 2.2 UF +80-10% 20VDCW	56289	1500225X9020A2-DVS
A1A1CR1	0180-0137	1	C:FXD CER 100 UF +80-20% 10VDCW	56289	1500107X0010R2-DVS
A1A1CR1	1901-0025	30	DIODE:SILICON 100MA/IV	07263	FD 2387
A1A1CR2	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A1A1CR3	1901-0025		DIODE:SILICON 100MA/IV	07263	FD 2387
A1A1CR4	1901-0025		DIODE:SILICON 100MA/IV	07263	FD 2387
A1A1CR5	1901-0025		DIODE:SILICON 100MA/IV	07263	FD 2387
A1A1DS1	1970-0042	8	TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1A1DS2	1200-0405	8	SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1A1DS2	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1A1DS2	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1A1DS3	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1A1DS3	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1A1DS4	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1A1SD4	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1A1SD5	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1A1SD5	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1A1SD6	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1A1SD6	1200-0405		SOCKET:TUBE FOR 5730 SERIES	83594	SK 207
A1A1DS7	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-5
A1A1DS7	1200-0435		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1A1DS8	1970-0042		TUBE:NUMERICAL INDICATOR	83594	B-5750-S
A1A1DS8	1200-0405		SOCKET:TUBE FOR 5700 SERIES	83594	SK 207
A1A1L1	9100-1643	2	COIL/CHOKE 300 UH 5%	28480	9100-1643
A1A1L2	9100-1616	6	COIL/CHOKE 1.50 UH 10%	99800	1537-16
A1A1L3	9140-0051	1	COIL:FXD 400 UHY	28480	9140-0051
A1A1Q1	1854-0022	4	TSTRI:SI NPN	07263	S17843
A1A1Q2	1854-0071	43	TSTR:SI NPN SELECTED FROM 2N3704)	28480	1854-0071
A1A1Q3	1854-0022		TSTR:SI NPN	07263	S17843
A1A1Q4	1854-0022		TSTR:SI NPN	07263	S17843
A1A1Q5	1854-0022		TSTR:SI NPN	07263	S17843
A1A1R1	0683-6825	8	R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1A1R2	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1A1R3	0683-3025	7	R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A1A1R4	0683-6825		R:FXD COMP 6500 OHM 5% 1/4W	01121	CB 6825
A1A1R5	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A1A1R6	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1A1R7	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A1A1R8	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1A1R9	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CB 3025
A1A1R10	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1A1R11	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1A1R12	0683-6825		R:FXD COMP 6800 OHM 5% 1/4W	01121	CB 6825
A1A1R13	0683-1025	13	R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 3025

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A1R14	0683-3025		R:FXD COMP 3000 OHM 51 114w	01121	CB 3025
A1A1R15	0683-3025		R:FXD COMP 3330 OHM 5S 1(/4	01121	CB 3025
A1A1U1	1820-0092	7	INTEGRATED CIRCUIT:DECODER-DIVIDER	28400	1820-0092
A1A1U2	1820-0092		INTEGRATED CIRCUIT:DECOOER-DIVIDER	28480	1820-0092
A1A1U3	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A1A1U4	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A1A1U5	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1820-0092
A1A1U6	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1920-0092
A1A1U7	1820-0092		INTEGRATED CIRCUIT:DECODER-DIVIDER	28480	1920-0092
A1A1U8	1820-0116	7	IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0016
A1A1U9	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1A1U10	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1A1U11	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	284B0	1820-0016
A1A1U12	1120-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0116
A1A1U13	1120-0116		IC:4-BIT BUFF STORE GATED OUTS	28400	1820-0116
A1A1U14	1820-0116		IC:4-BIT BUFF STORE GATED OUTS	28480	1820-0016
A1A1U15	1820-0077	1	IC:TTL DUAL D F/F	01295	S97474N
A1A1U16	1820-0117	1	IC:TTL DEC. COUNTER W/ZERO SUP.	28480	1820-0117
A1A1U17	1820-0119	5	IC:TTL BLANKING DECADE COUNTER	28480	1920-0119
A1A1U18	1820-0119		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A1A1U19	1820-0119		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A1A1U20	1820-0119		IC:TTL BLANKING DECADE COUNTER	20480	1920-0119
A1A1U21	1820-0119		IC:TTL BLANKING DECADE COUNTER	28480	1820-0119
A1A1U22	1B20-0174	1	IC:TTL HEX INVERTER	01295	SN7404N
A1A2	08443-60070	1	COOLING FAN ASSY	28480	08443-60070
A1A2C1	0180-0155	1	C:FXD ELECT 2.2 UF 20% 20VDCw	56289	1500225X0020A2-DYS
A1A2C2	0160-3451	1	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023B101F103ZS25-CDH
A1A2CR1	1901-0040	6	DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR2	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR3	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR4	1901-0049	1	DIODE:SILICON 50 PIV	28480	1901-0049
A1A2CR4	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR7	1901-0040		DIODE:SILICON 30MA 30WV	07263	FDG1088
A1A2CR8	1902-3094	1	DIODE BREAKDOWN:5.11V 2%	28480	1902-3094
A1A2M1	3140-0487	1	MOTOR:DC 10-15 VDC	95984	1AD20
A1A2Q1	1853-0027	4	TSTR:SI PNP	37263	S1554S
A1A2Q2	1853-0027		TSTR:SI PNP	07263	51554S
A1A2Q3	1953-0027		TSTR:SI PNP	07263	5 1554S
A1A2Q4	1853-0027		TSTR:SI PNP	07263	51554S
A1A2Q5	1854-0045	1	TSTR:SI NPN	04713	2N956
A1A2Q6	1853-0020	10	TSTR:SI PNP (SELECTED FROM 2N3702)	28480	1853-0020
A1A2Q7	1854-0071		TSTR:SI NPN (SELECTED FROM 2N3704)	28480	1854-0071
A1A2R	0683-0335	1	R:FXD COMP 3.3 OHM 5% 1/4W	01121	CB 0335
A1A2R2	0684-3311	2	R:FXD COMP 300 OHM 10% 1/4W	01121	CB 3311
A1A2R3	0684-3311		R:FXD COMP 300 OHM 10% 1/4W	01121	CB 3311
A1A2R4	0698-7255	2	R:FXD FLM 6.19 OHM 2% 1/8W	28480	0690-7255
A1A2R5	0698-7255		R:FXD FLM 6.19 OHM 2% 1/8W	28480	0698-7255
A1A2R6	0698-7239	1	R:FXD FLM 1.33K OHM 2% 1/8W	28480	0698-7239
A1A2R7	0698-7253	1	R:FXD MET FLM 5.11K OHM 2% 1/8W	28480	0698-7253
A2	08443-60001	1	ATTENUATOR ASSY:10 DB	28480	08443-60001
A2			NOT FIELD REPAIRABLE		
A2W1	08443-60102		REBUILT 08443-60001,REQUIRES EXCHANGE	28480	08443-60102
A3	08443-60002	1	ATTENUATOR ASSY:1 DB	28480	08443-60002
A3			NOT FIELD REPAIRABLE		
A3W1	05443-60049	1	CABLE ASSY:INTERCONNECT, BROWN	28480	08443-60049
A3W2	08443-60050	1	CABLE ASSY:OUTPUT. RED	28480	08443-60050
A4	0960-0079	1	OSCILLATOR-CRYSTAL ASSY: 1.0 MHZ	28480	0960-0079
A4			(8443A ONLY)		
A5	06443-60048	1	BOARD ASSY:TIME BASE	28480	08443-60048
A5			(8443A ONLY)		
A5C1	0163-2055	23	C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A5C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
ASC3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A5C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH
A5C5	0160-2218	1	C:FXD CER MICA 1000 PF 5%	28480	0160-2218
A5C6	0180-0229	1	C:FXD ELECT 33 UF 10% 10VDCW	28480	0180-0229
A5C7	0180-0116	5	C:FXD ELECT 6.8 UF 10% 33VDCW	56289	150D68X903582-DYS
A5C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F301ZS22-CDH
A5C9	0180-1735	3	C:FXD ELECT 0.22 UF 10% 35VDCW	28480	0180-1735
A5C10	0160-2139	10	C:FXD CER 220 PF +80-20% 1000VDCW	91418	TYPE B
A5C11	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CDH

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5C12	0180-1735		C:FXD ELECT 0.22 UF 10% 35VDCW	28480	0180-1735
A5C13	0160-3453	9	C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A5C14	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A5CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A5CR2	1910-0016	5	DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A5CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A5CR4	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A5J1	1250-1195	9	CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A5J2	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A5L1	9100-1629	6	COIL/CHOKE 47.0 UH 5%	28480	9100-1629
A5L2	9100-1643		COIL/CHOKE 300 UH 5%	28480	9100-1643
A5L3	9100-1629		COIL/CHOKE 47.0 UH 5%	28480	9100-1629
A514	9100-1629		COIL/CHOKE 47.0 UH 5%	28480	9100-1629
A5L5	9100-1622	1	COIL/CHOKE 24.0 UH 5%	28480	9100-1622
A5Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q2	1854-0071		TSTR:SI NPN[SELECTED FROM 2N3704)	28480	1854-0071
A5Q3	1854-0071	1	TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A5R1	0757-0438	16	R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5R2	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5R3	0683-5135	1	R:FXD COMP 51K OHM 5% 1/4W	01121	CB 5135
A5R4	0683-1005	4	R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A5R5	0683-7525	1	R:FXD COMP 7590 OHM 52 1/4W	01121	CB 7525
A5R6	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5R7	0757-0416	10	R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5R8	0698-0084	8	R:FXD MET FLM 2.15K OHM 1% 1/8	28480	0698-0084
A5R9	0757-0394	7	R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A5R10	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A5R11	0698-3441	7	R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A5R12	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5R13	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A5R14	0757-0420	5	R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A5R15	0683-1025		R:FXD COMP 1333 OHM 51 1/4W	01121	CB 1025
A5R16	0698-3441		R:FXD MET FLM 215 OHM L8 1/8W	28480	0698-3441
A5R17	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A5R18	0757-0159	2	R:FXD MET FLM 1000 OHM 1% 1/2W	28480	0757-0159
A5R19	0683-1025		R:FXD COMP 1330 OHM 5% 1/4W	01121	CB 1025
A5R20	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R21	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R22	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R23	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R24	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R25	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A5R26	0683-6225	1	R:FXD COMP 6200 OHM 5% 1/4W	01121	CB 6225
A5R27	0698-3441		R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A5R28	0757-1094	1	R:FXD MET FLM 1.47K OHM 1% 1/8W	28480	0757-1094
A5R29	0698-3441		R:FXD MET FLM 215 OHM 1% 18W	28480	0698-3441
A5S1	3101-1213	1	SWITCH:TOGGLE DPST-DB SUB-MINIATURE	81640	T8001
A5TP1	08443-00041	14	TEST POINT	28480	08443-00041
A5TP2	08443-00041		TEST POINT	28480	08443-00041
A5TP3	08443-00041		TEST POINT	28480	08443-00041
A5TP4	08443-00041		TEST POINT	28480	08443-00041
A5TP5	08443-00041		TEST POINT	28480	08443-00041
A5TP6	08443-00041		TEST POINT	28480	08443-00041
A5U1	1820-0054	2	IC:TTL OUAD 2-INPT NAND GATE	01295	SN7400N
A5U2	1820-0304	2	IC:TTL J-K M/S F/F W/CLOCKED & INPTS	01295	SN7472N
A5U3 A	1820-0412	5	INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U3 B	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U4	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U5A	1820-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5U5B	182D-0412		INTEGRATED CIRCUIT:DECADE DIVIDER	28480	1820-0412
A5W1	08443-60051	1	CABLE ASSY:TIME BA5E INPUT	28480	08443-60051
A6	08443-60047	1	BOARD ASSY:RF DECADE	28480	08443-60047
A6			(8443A ONLY)		
A6C1	0160-2327	11	C:FXD CER 1033 PF 20 100IVDCW	96733	B104BX102M
A6C2	0160-2327		C:FXD CER 1000 PF 202 100VDC1	96733	B104BX102M
A6C3	0180-0376	6	C:FXD ELECT 0.47 UF 1% 35DVCW	56289	150D474X9035A2-DYS
A6C4	0180-0197		C:FXD ELECT 2.2 UF 102 20VDCW	56289	150D225X9020A2-DYS
A6C5	0160-2930		C:FXD CER 0.01 UF +80-20% 1000VUCW	91418	TA
A6C6	0160-2930		C:FXD CER 0.31 UF +80-20% 1000VDCW	91418	TA
A6C7	0160-2327		C:FXD CER 1000 PF 20% 100VLCW	96733	B104BX102M

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6C8	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B104BX102M
A6C9	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C10	0180-0376		C:FXD ELECT 0.47 UF 1% 35VDCW	56289	150D474X9035A2-DYS
A6C11	0180-0197		C:FXD ELECT Z.2 UF 10% 20VDCW	56289	150225X902R2-3YST
A6C12	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D6b85X903532-3S
A6C13	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A6C14	0160-2930		C:FXD CER 0.01 UF +80-20% 100VDCW	91418	TA
A6C15			NOT ASSIGNED		
A6C16	0160-2327		C:FXD CER 1000 UF 20% 100VDCW	96733	B104BX102M
A6C17	0180-0376		C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X9035A2-DYS
A6C18	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225x9020A2-DYS
A6C19	0180-0376		C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X903542-DYS
A6C20	0160-2930		C:FXD CER 0.31 UF +80-20% 100VDCW	91418	TA
A6C21	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C22	0180-0376		C:FXD ELECT 0.47 UP 10% 35VDCW	56289	150D474X9035A2-DYS
A6C23	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X9020A2-DYS
A6C24	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B1046X102M
A6C25	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	150D225X902042-DYS
A6C26	0160-2327		C:FXD CER 1033 PP 20% 100VDCW	96733	B104BX102M
A6C27	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B104BX102M
A6C28	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B104BX102M
A6C29	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B104BX102M
A6C30	0180-0197		C:FXD ELECT 2.2 UF 10%: 20VDCW	56289	150D225X9020A2-DYS
A6C31	0160-2204	3	C:FXD MICA 100PF 5%	72136	RDM15F101J3C
A6CR1	1901-0047	6	DIODE JUNCTION:SILICON 20PlV	28480	1901-0047
A6CR2	1901-0047	3	JUNCTION:SILICON 20PIV	28480	1901-0047
A6CR3	1901-0518		DIDOE:HOT CARRIER	28480	1901-0518
A6CR4	1901-0518		DIODE:HOT CARRIER	28480	1901-0518
A6CR5	1902-0518	1	DIODE BREAKDOWN:5.11V	28480	1902-0518
A6CR6	1901-0047		JUNCTION:SILICON 20PIV	28480	1901-0047
A6CR7	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A6CR8	1901-0047		DIODE JUNCTION:SILICON 20PIV	28480	1901-0047
A6CR9	1902-3024	1	DIODE:BREAKDOWN 2.87V 5%	04713	SZ10939-26
A6CR10	1901-0047		DI0DE JUNCTION:SILICON 20PIV	28480	1901-0047
A6CR11	1901-0518		DIODE:HOT CARRIER	28480	1901-0518
A6CR12	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A6CR13	1902-0048	3	DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A6CR14	1902-0048		DIODE BREAKDOWN 6.81V 5%	04713	S210939-134
A6CR15	1901-0179	2	DIODE:SILICON 15WV	28480	1901-0179
A6CR16	1901-0179		DIODE:SILICON 1SWV	28480	1901-0179
A6CR17	1901-0039	2	DIODE:SILICON 200MA 50WV	28480	1901-0039
A6CR18	1901-0039		DIODE:SILICON 200MA 50WV	28480	1901-0039
A6J1	1250-1194	9	CO4NECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A6J1	08443-20011	4	CONNECTOR:RECESS	28480	08443-20011
A6J2	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A6J2	08443-20011		CONNECTOR:RECESS	28480	08443-20011
A6L1	9100-1616		COIL/CHOKE 1.50 UH 10%	99800	1537-16
A6L2	9100-1616		COIL/CHOKE 1.50 UH 10%	99800	1537-16
A6L3	9100-1630	2	C3IL/CHOKE 51.0 UH 5%	28480	9100-1630
A6L4	9100-1623	1	COIL/CHOKE 21.0 UH 5%	99800	1537-48
A6L5	9100-1616		COIL/CHOKE 1.50 UH 10%	99800	1537-16
A6L6	9100-1616		COIL/CHOKE 1.50 UH 10%	99800	1537-16
A6L7			NOT ASSIGNED		
A6L8	9100-1616		COIL/CHOKE 1.50 UH 10%	99800	1537-16
A6L9	9100-1611	4	COIL:FXD 0.22 UH 20%	28480	9100-1611
A6L10	9100-1611		COIL:FXD 0.22 UH 20%	28480	9100-1611
A6L11	9100-1611		COIL:FXD 0.22 UH 20%	28480	9100-1611
A6Q1	1854-0345	7	TSTR:SI NPN	80131	2N5179
A6Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A6Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A6Q4	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A6Q5	1854-0019	6	TSTR:SI NPN	28480	1854-0019
A6Q6	1854-0019		TSTR:SI NPN	28480	1854-0019
A6Q7	1854-0019		TSTR:SI NPN	28480	1854-0019
A6R1	0698-7229	2	R:FXD FLM 511 OHM 2% 1/8W	28480	0698-7229
A6R2	0757-0395	2	R:FXD MET FLM 56.2 OHM 1% 1/8W	28480	0757-0395
A6R3	0757-0442	21	R:FXD MET FLM 10.OK OHM 1% 1/8W	28480	0757-0442
A6R4	0698-7229		R:FXD MET 511 OHM 2%1/8W	28480	0698-7229
A6R5	0757-0395		R:FXD MET FLM 56.2 OHM 1% 1/8W	28480	0757-0395
A6R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A6R7	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	2B840	0757-0438
A6R8	0757-0438		R:FXD MET FLM 5.11K OHM 1%1/8W	28480	0757-0438
A6R9	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	20480	0757-0438
A6R10	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6R11	0757-0280	8	R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A6R12	0757-0438		R:FXD MET FLM 5.11K OHM 13 1/8W	28480	0757-0438
A6R13	0698-3151	3	R:FXD MET FLM 2.87K OHM 1% /8W	28480	0698-3151
A6R14	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A6R15	0698-0083	5	R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R16	0757-0405	2	R:FXD MET FLM 162 OHM 1%1 1/8W	28480	0757-0405
A6R17	0698-3434	2	R:FXD MET FLM 34.8 OHM 1% 1/8W	28480	0698-3434
A6R18	0698-3444	3	R:FXD MET FLM 316 OHM 1%/ 1/8W	28480	0698-3444
A6R19	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R20	0757-0279	9	R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A6R21	0757-0405		R:FXD MET FLM 162 OHM 1% 1/8W	28480	0757-0405
A6R22	0698-3434		R:FXD MET FLM 34.8 OHM 1% 1/8W	28480	0698-3434
A6R22			FACTORY SELECTED PART		
A6R23	0757-0416		R:FXD MET FLM 511 OHM 1% 18W	28480	0757-0416
A6R24	0698-3435	2	R:FXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A6R24			FACTORY SELECTED PART		
A6R25	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A6R26	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R27	0757-1001	1	R:FXD MET FLM 56.2 OHM 1% 1/2W	28480	0757-1001
A6R28	0698-7236	3	R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236
A6R29	0698-7236		R:FXD FLM I1K OHM 2% 1/8W	28480	0698-7236
A6R30	0698-7236		R:FXD FLM 1K OHM 2% 1/8W	28480	0698-7236
A6R31	0757-0442		R:FXD MET FLM 10.0K OHM 1% I1/8W	28480	0757-0442
A6R32	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A6R33	0757-0274	2	R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A6TP1	08443-00041		TEST POINT	28480	08443-00041
A6TP2	08443-00041		TEST POINT	28480	08443-00041
A6TP3	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A6TP3	08443-20011		CONNECTOR:RECESS	28480	08443-20011
A6TP4	0360-1514	8	TERMINAL PIN:SQUARE	28480	0360-1514
A6TP5	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A6TP6	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A6TP7	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A6U1	1820-0275	1	IC:ECL TO TTL QUAD 2-INPT OR TRANS	04713	MC1019P
A6U2	1820-0102	4	INTEGRATED CIRCUIT:J-K FLIP FLOP	04713	MC1013P
A6U3	1820-0101	1	INTEGRATED CIRCUIT:DIFFERENTIAL AMPL	04713	MC1034P
A6U4	1820-0102		INTEGRATED CIRCUIT:J-K FLIP FLOP	04713	MC1013P
A6U5	1820-0102		INTEGRATED CIRCUIT:J-K FLIP FLOP	04713	MC1013P
A6U6	1820-0102		INTEGRATED CIRCUIT:J-K FLIP FLOP	04713	MC1013P
A6W1	08443-60056	1	CABLE ASSY:TRIGGER GENERATOR COUNTER	28480	08443-60056
A7	08443-60046	1	MARKER CONTROL ASSY	28480	08443-60046
A7			(8443A ONLY)		
A7C1	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C2	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C3	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C4	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C5	0160-2257	2	C:FXD CER 10 PF 5% 500VDCW	72982	301-000-00H0-100J
A7C6	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C7	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C8	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C9	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C03F101F103ZS22-CD-1
A7C10	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A7C11	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A7C12	0180-0197		C:FXD ELECT 2.2 UF 10% 20VDCW	56289	1500225X9020A2-DYS
A7C13	0180-0098	1	C:FXD ELECT L100 UF 20% 20VDCW	56289	150D107X0020S2-DYS
A7C14	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A7C15	0160-2139		C:FXD CER 220 PF +80-20% 1000VDCW	91418	TYPE B
A7C16	0160-2143		C:FXD CER 2000 PF +80-20% 1000VDCW	91418	TYPE B
A7C17	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D685X9035B2-DYS
A7C18	0180-0376		C:FXD ELECT 0.47 UF 10% 35VDCW	56289	150D474X90356A2-DYS
A7C19	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A7CR1	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR2	1902-3268	2	DIODE BREAKDOWN:26.1V 5%	28480	1902-3268
A7CR3	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR4	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR5	1901-0025		DIODE:SILICON	07263	FD 2387
A7CR6	1901-0159	7	DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A7CR7	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR8	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR9	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A7CR10	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A7CR11	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR12	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR13	1901-0025		DIODE:SILICON 100MA/1V	07263	PD 2387

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7CR14	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR15	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR16	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR17	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR18	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A7CR19	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR20	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR21	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A7CR22	1910-0016		DIODE:GERMANIUM 100MA/0.85V 60PIV	93332	D2361
A7J1	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A7J2	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A7L1	9140-0129	4	COIL:FXD RF 220 UH	28480	9140-0129
A7L2	9100-1629		COIL/CHOKE 47.3 UH 5%	28480	9100-1629
A7L3	9100-1629		COIL/CHOKE 47.0 UH 5%	28480	9100-1629
A7L4	9100-1629		COIL/CHOKE 47.3 UH 5%	28480	9100-1629
A7L5	9140-0129		COIL:FXD RF 220 UN	28480	9140-0129
A7L6	9140-0129		COIL:FXD RF 220 UH	28480	9140-0129
A7L7	9140-0129		COIL:FXD RF 220 UN	28480	9142-0129
A7Q1	1853-0020		TSTR:SI NPN(SELECTED FROM 2N3702)	28480	1853-0020
A7Q2	1853-0020		TSTR:SI NPN(SELECTED FROM 2N3732)	28480	1853-0020
A7Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q4	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q5	1854-0221	4	TSTR:SI NPN(REPL.BY 2N4044)	28480	1854-0221
A7Q6	1854-0221		TSTR:SI NPN(REPL.BY 2N4044)	28480	1854-0221
A7Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q10	1853-0020		TSTR:SI NPN(SELECTED FROM 2N3702)	28480	1853-0020
A7Q11	1853-0020		TSTR:SI NPN(SELECTED FROM 2N3702)	28480	1853-0020
A7Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q13	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q14	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q15	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q16	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q17	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q18	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q19	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A7Q20	1853-0020		TSTR:SI NPN(SELECTED FROM 2N3702)	28480	1853-0020
A7R1	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R2	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R3	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R4	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A7R5	0698-3155	5	R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A7R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R7	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A7R8	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A7R9	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A7R10	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R11	2100-1758	1	R:FXD WW 1K OHM 5% TYPE V 1W	28480	2100-1758
A7R12	0698-0085	3	R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A7R13	0698-0085		R:FXD MET FLM 2.61K OHM 1%1/8W	28480	0698-0085
A7R14	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R15	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R16	0757-0442		R:FXD MET FLM 100.0K OHM 1% 1/8W	28480	0757-0442
A7R17	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	3757-0442
A7R18	0757-0458	3	R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A7R19	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A7R20	0757-0401	7	R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R21	0757-0199	7	R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A7R22	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R23	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A7R24	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R25	0757-0440	4	R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A7R26	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A7R27	0757-0416		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0416
A7R28	0757-0458		R:FXD MET FLM 51.1K OHM 1% 1/8W	28480	0757-0458
A7R29	0698-3452	1	R:FXD MET FLM 147K OHM 1% 1/8W	28480	0698-3452
A7R30	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A7R31	0698-3153	4	R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A7R32	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A7R33	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A7R34	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A7R35	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A7R36	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A7R37	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7R38	0757-0289	1	R:FXD MET FLM 13.3K OHM 1% 1/8W	28480	0751-0289
A7R39	0757-0401		R:FLED MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A7R40	0698-3260	1	R:FXD MET FLM 464K OHM 1% 1/8W	28480	0698-3260
A7R41	0757-0442		R:FXD MET FLM 10.0K OHM1 % 1/8W	28480	0757-0442
A7R42	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A7R43	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0157-0279
A7T1	08443-00041		TEST POINT	28480	08443-00041
A7T2	08443-00041		TEST POINT	28480	08443-00041
A7T3	08443-00041		TEST POINT	28480	08443-00041
A7T4	08443-00041		TEST POINT	28480	08443-00041
A7T5	08443-00041		TEST POINT	28480	08443-00041
A7U1	1820-0054		IC:TTL QUAO 2-INPT NAND GATE	01295	SN7400N
A7U2	1820-0304		IC:TTL J-K M/S F/F W/CLOCKED & INPTS	01295	SN7472N
A8	08443-60045	1	VIDEO ASSY:AMPLIFIER ALC	28480	08443-60045
A8C1	0160-2145	12	C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A8C2	0160-2204		C:FXD MICA 100PF 5%	72136	R0M15F101J3C
A8C3	0180-1743	3	C:FXD ELECT 0.1 UF k 10% 35VDCW	56289	150D104X9035A2-DYS
A8C4	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A8C5	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A8C6	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A8C7	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A8J1	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A8J2	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A8J3	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A8L1	9100-1618	1	COIL:MOLDED CHOKE 5.60 DH	28480	9100-1618
A8MP1	08443-20002	1	HOUSING:VIDEO AMPLIFIER	28480	08443-20002
A8MP2	08443-00029	1	SHIELD:COVER VIDEO AMPLIFIER	28480	08443-00029
A8Q1	1854-0221		TSTR:SI NPN(REPL.BY 2N4044)	28480	1854-0221
A8Q2	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A8Q3	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8Q4	1854-0071		TSPR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A8R1	0683-1135	5	R:FXD COMP 11K OHM 5% 1/4W	01121	CB 1135
A8R2	0683-1565	1	R:FXD COMP 15 MEGOHM 5% 1/4W	01121	CB 1565
A8R3	0683-1135		R:FXD COMP 11K OHM 5% 1/4W	01121	CB 1135
A8R4	0683-1045	3	R:FXD COMP 100K OHM 5% 1/4W	01121	CB 1045
A8R5	0683-1315	3	R:FXD COMP 130 OHM 5% 1/4W	01121	CB 1315
A8R6	0683-1315		R:FXD COMP 130 OHM 5% 1/4W	01121	CB 1315
A8R7	0683-3035	1	R:FXD COMP 30K OHM 5% 1/4W	01121	CB 3035
A8R8	0683-1135		R:FXD COMP 11K OHM 5% 1/4W	01121	CB 1135
A8R9	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A8R10	0683-1135		R:FXD COMP 11K OHM 5% 1/4W	01121	CB 1135
A8R11	0683-1135		R:FXD COMP 11K OHM 5% 1/4W	01121	CB 1135
A8R12	0757-0459	1	R:FXD MET FLM 56.2K OHM 1% 1/8W	28480	0757-0459
A8R13	0757-0440		R:FXD MET FLM 7.50K OHM 1% 1/8W	28480	0757-0440
A8R14	2100-2489	1	R:VAR FLM 5K OHM 10% LIN 1/2W	28480	2100-2489
A8R15	0683-1025		R:FX0 COMP 1000 OHM 5% 1/4W	01121	CB 1025
A8R16	2100-2517	1	R:VAR FLM 50K OHM 10% LIN 1/2W	28480	2100-2517
A8R17	0683-1315	1	R:FXD COMP 130 OHM 5% 1/4W	01121	CB 1315
A8A1	0443-60022	1	BOARD ASSY:VIDEO AMPLIFIER	28480	08443-60022
A8A1C1	0160-3060	3	C:FXD CER 0.1 UF 23% 25VDCW	56289	3C42A-CML
A8A1C2	0160-3060		C:FXD CER 0.1 UF 20% 25VDCW	56289	3C42A-CML
A8A1C3	0180-0160	1	C:FXD ELECT 22 UF 20% 35VDCW	28480	0180-0160
A8A1C4	0160-3060		C:FXD CER 0.1 UF 23% 25VDCW	56289	3042A-CML
A8A1C5	0160-3036	3	C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A8A1C6	0160-3036		C:FXD CER 5000 PF +80-20% 200VDCW	28480	0160-3036
A8A1J1	1251-1556	1	CONNECTOR:SINGLE CONTACT	00779	2-330808-8
A8A1R1	0683-1005		R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A8A1R2	0683-1005		R:FXD COMP 10 OHM 5%1/4W	01121	CB 1105
A8A1R3	0699-0001	1	R:FXD COMP 2.71 OHM 10% 1/2W	01121	EB 27G1
A8A1R4	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A8A1R5	0757-0421	2	R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A8A1R6	0698-7222	1	R:FXD FLM 261 OHM 2% 1/8W	28480	0698-7222
A8A1R6			FACTORY SELECTED PART		
A8A1U1	5086-7010	1	MC:POWER AMP 130 MHZ	28480	1820-0267
A8A1U2	5086-7099	1	MC:PRE-AMP 2.1-100 MHZ	28480	1820-0403
A9	08443-60044	1	CONVERTER ASSY:THIRD	28480	08443-60044
A9C1	0160-2327		C:FXD CER 1000 PF 20% 100VDCW	96733	B104BX102M
A9C2	0160-2140	7	C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A9C3	0160-2139		C:FXD CER 220 PF +80-20% 1000VDCW	91418	TYPE B
A9C4	0160-2139		C:FXD CER 220 PF ++80-20% 1000VDCW	91418	TYPE B
A9C5	0160-3425	1	C FXD CER 33 PF St 500VDCW	72982	301-000- 2G-330J
A9C6	0160-2139		C:FXD CER 220 PF +80-20% 1000VDCW	91418	TYPE B
A9C7	0160-2139		C:FXD CER 220 PF +80-20% 1000VDCW	91418	TYPE B

See: Introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9C8	0160-2139		C:FXD CER 220 PF +80-20% 100VDCW	91418	TYPE B
A9C9	0160-2260	1	C:FXD CER 13 PF 5% 503VDCW	72982	301-000-C0G0 130J
A9C10	0163-2139		C:FXD CER 220 PF +80-20% 100VDCW	91418	TYPE B
A9C11	0160-2139		C:FXD CER 220 PF +80-20% 100VDCW	91418	TYPE B
A9C12	0160-2139		C:FXD CER 220 PF +80-20% 100VDCW	91418	TYPE B
A9J1	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A9J1	08443-20011		CONNECTOR:RECESS	28480	08443-20011
A9L1	9140-0158	6	COIL:FXD RF 1 UH 10%	99800	1025-20
A9L2	9100-2248	1	COIL/CHOKE 0.12 UH 10%	82142	09-4416-2K
A9L3	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A9L4	9100-2247	5	COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A9L5	9140-0158		COIL:FXD RF 10H 10%	99800	1025-20
A9Q1	1854-0247	3	TSTR:SI NPN	28480	1854-0247
A9Q2	1854-0345		TSTR:SI NPN	80131	2N5179
A9Q3	1854-0345		TSTR:SI NPN	80131	2N5179
A9R1	0757-0398	2	R:FXD MET FLM 75 OHM 1% 1/8W	28480	0757-0398
A9R2	0757-0403	3	R:FXD MET FLM 121 OHM 1% 1/8W	28480	0757-0403
A9R3	0757-0398		R:FXD 4FT- FLM 75 OHM 1% 1/8W	28480	0757-0398
A9R4	0757-0428	3	R:FXD MET FLM1.62K OHM 1% 1/8W	28480	0757-0428
A9R5	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A9R6	0757-0346	3	R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A9R7	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A9R8	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A9R9	0698-3431	2	R:FXD MET FLM 23.7 OHM 1% 1/8W	28480	0698-3431
A9R10	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A9R11	0698-3444		R:FXD MET FLM 316 OHM 1% 1/8W	28480	0698-3444
A9R12	0757-0419	1	R:FXD MET FLM 681 OHM 1%t 1/8W	28480	0757-0419
A9R13	0757-0422	1	R:FXD MET FLM 909 OHM 1% 1/8W	28480	0757-0422
A9R14	0698-3429	4	R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A9R15	0757-1060	1	R:FXD MET FLM 196 OHM 1% 1/2W	28480	0757-1060
A9R16	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A9T1	08552-6018	4	TRANSFORMER:RF(CODE-RED)	28480	08552-6018
A9T2	08552-6018		TRANSFORMER:RF(CODE-RED)	28480	08552-6018
A9W1	08443-60058	2	CABLE ASSY:RF. GREEN	28480	08443-60058
A9W2	08443-60057	3	CABLE ASSY:RF. VIOLET	28480	08443-60057
A9A1	08443-60005	1	MIXER ASSY:THIRD	28480	08443-60005
A9A1CR1	5080-0271	2	DIODE:SILICON MATCHED QUAD	28480	5080-0271
A9A1CR2			PART OF A9A1CR1		
A9A1CR3			PART OF A9A1CR1		
A9A1CR4			PART OF A9A1CR1		
A9A1J1	1250-0828	1	CONNECTOR:RF 50-OHM SCREW ON TYPE	98291	50-043-4610
A9A1R1	0698-3435		R:FXD MET FLM 38.3 OHM 1% 1/8W	28480	0698-3435
A9A1R2	0698-3438	2	R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A9A1R3	0698-3438		R:FXD MET FLM 147 OHM 1% 1/8W	28480	0698-3438
A9A1T1	08552-6024	4	TRANSFORMER:RF(CODE-YELLOW)	28480	08552-6024
A9A1T2	08553-6012	4	TRANSFORMER:RF(CODE-BLUE)	28480	08553-6012
A9A1T3	08553-6012		TRANSFORMER:RF(CODE-BLUE)	28480	08553-6012
A9A1T4	08552-6024		TRANSFORMER:RF(CODE-YELLOW)	28480	08552-6024
A9A1	0340-0038	1	FEEDTHRU:TERMINAL	28480	0340-0038
A9A1	0340-0039	1	INSULATOR:BUSHING	28480	0340-0039
A9A1	08443-00031	1	SHIELD:COVER THIRD MIXER	28480	08443-00031
A9A1	08443-00037	1	SHIELD:CAN THIRD MIXER	28480	08443-00037
A9A1	08443-30038	1	INSULATOR:THIRD MIXER	28480	08443-00038
A9A2	08443-60006	1	FILTER ASSY:120 MHZ	28480	08443-60006
A9A2P1	1250-0880	1	CONNECTOR:RF SUB-MINIATURE	98291	50-046-0000
A9A2	08443-00034	1	SHIELD:COVER 120 MHZ	28480	08443-00034
A9A2	08443-00035	1	SHIELD:CAN 120 MHZ	28480	08443-00035
A9A2	08553-0024	1	INSULATOR:SECOND MIXER	28480	08553-0024

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9A2C1	0160-2013	2	C:FXD MICA 39 PF 5% 300VDCW	04062	RMI5E39OJ3S
A9A2C2	0160-2016	2	C:FXD MICA 62 PF 5% 500VDCW	14655	RDM15E620J5S
A9A2C3	0160-0949	1	C:FXD MICA 68 PF 5%	28480	0160-0949
A9A2C4	0160-2016		C:FXD MICA 62 PF 5% 500VDCW	14655	RDM15E620J5S
A9A2C5	0160-2013		C:FXD MICA 39 PF 5% 300VDCW	04062	RDM15F390J3S
A9A2L1	08553-6018	4	INDUCTOR ASSY:AIR CORE	28490	08553-6018
A9A2L2	9100-22417		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A9A2L3	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A9A2L4	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A9A2L5	9100-2247		COIL:FXD RF 0.10 UH 10%	28480	9100-2247
A9A2L6	08553-6018		INDUCTOR ASSY:AIR CORE	28480	08553-6018
A10	08443-60043	1	IF ASSY:200 MHZ	28480	08443-60043
A10C1	0160-2204		C:FXD MICA 100 PF 5%	72136	RM15P101J3C
A10C2	0160-2140		C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A10C3	0160-2140		C:FXD CER 470 PF 480-20% 1000VDCW	91418	TYPE B
A10C4	0121-0446	1	C:VAR CER 4.5-20 PF 160VDCW N750	28480	0121-0446
A10C5	0121-0105	1	C:VAR CER 9-35 PF NP0	28480	0121-0105
A10C6	0160-2140		C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A10C7	0150-0050	29	C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A10C8	0160-2140		C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A10C9	0160-2140		C:FXD CER 470 PF +80-20% 1000VDCW	91418	TYPE B
A10C10	0122-0285	1	C: VOLTAGE VAR 6.8 PF 5%	04713	SMV 389-285
A10C11	0160-2140		C:FXD CER 470 PF .80-20% 1000VDCW	91418	TYPE B
A10C12	0150-0050		C:FXD CER 1000 PF *+80O-20% 1000VDCW	56289	C067B102E102ES26-CD-1
A10C13	0150-0050		C:FXD CER 1003 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A10C14	0150-0050		C:FXD CER 1003 PF +80-20% 1000VDCW	56289	C367D102E102ZS26-CD-11
A10C15			NOT ASSIGNED		
A10C16	0160-2145		C:FXD CER 000 PF +80-20% 1000VDCW	91418	TA
A10C17	0160-2244	1	C:FXD CER 3.0+/-0.25 PF 500VDCW	28480	0160-2244
A10CR1	1902-3104	2	DIODE:BREAKDOWN 5.62V 5%	04713	SZ10939-110
A10CR2	1902-3104		DIODE:BREAKDOWN 5.62V 5%	04713	SZ10939-110
A10L1	9100-1611		COIL:FXD 0.22 UH 20%	28480	9100-1611
A10L2	9100-1610	2	COIL:MOLDED CHOKE 0.15 UH 20%	28480	9100-1610
A10L3	9100-1610		COIL:MOLDED CHOKE 0.15 UH 20%	28480	9100-1610
A10L4	9140-0141	2	COIL:FXD OF 0.58 UH	28480	9140-0141
A10L5	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A10L6	9100-3101	1	COIL:VAR 0.142 TO 0.158 UH	71279	CDD4003-2
A10L7	9100-1612	3	COIL:FXD RF 0.33 UH 20%	28480	9100-1612
A10L8	9140-0141		COIL:FXD RF O.68 UH	28480	9140-0141
A10L9	9140-0158		COIL:FXD RF 1 UH 10%	99800	1025-20
A10L10	9140-0120	1	COIL:FXD 0.10 UH 20%	82142	10175-B
A10Q1	1854-0345		TSTR:SI NPN	80131	2N5179
A10Q2	1854-0345		TSTR:SI NPN	80131	245179
A10R1	0698-3441		R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A10R2	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A10R3	0757-0417	4	R:FXD MET FLM 562 OHM 1% 1/8W	28480	0757-0417
A1OR4	0683-3025		R:FXD COMP 3000 OHM 5% 1/4W	01121	CR 3025
AI10RS	0698-3441		R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A10R6	0757-0346		R:FXD MET FLM 10 OHM 1% 1/8W	28480	0757-0346
A10R7	0757-0417		R:FXD MET FL4 562 OHM 1% 1/8W	28480	0757-0417
A10TP1	08443-00041		TEST POINT	28480	08443-00041
A10W1	08443-60058		CABLE ASSY:RF, GREEN	28480	08443-60058
A10A1	08443-60007	1	FILTER ASSY:200 MHWZ	28480	08443-60007
A10A1C1	0160-3121	2	C:FXD CER 15 PF 1%1 5OOVDCW	01121	FB2B 1501
A10A1C2	0160-2266	2	C:FXD CER 24 PF 5% 500VDCW	72982	301-000-C0G0-240J
A10A1C3	0121-0457	3	C:VAR GLASS 0.8-8.5 PF 750VDCW	28480	0121-0457
A10A1C4	0160-2257		C:FXD CER 10 PF 5% 500VDCW	72982	301-000-C0H0-100J
A10A1C5	0121-0457		C:VAR GLASS 0.8-8.5 PF 750VDCW	28480	0121-0457
A10A1IC6	0121-0457		C:VAR GLASS 0.8-8.5 PF 750VDCW	28480	0121-0457
A10A1C7			NOT ASSIGNED		
A10A1C8	0160-2266		C: FXD CER 24 PF 5% 500VDCW	72982	301-000-C0G0-240J
A10A1C9	0160-3121		C:FXD CER 15 PF 10% 500VDCW	01121	FB2B 1501
A10A1J1	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A10A1J1	2190-0057	3	WASHER:LOCK FOR #12 HDW	00000	08D
A10A1J1	0590-0060	3	NUT:HEX 12-32 UNEF-2B	01121	M-6377
A10A1L1	08553-6018		INDUCTOR ASSY:AIR CORE	28480	08553-6018
A10A1L2	08553-6017	1	INDUCTOR ASSY:200MHZ	28480	08553-6017
A10A1L3	08553-6018		INDUCTOR ASSY:AIR CORE	28480	08553-6018
A10A1	08443-00039	1	SHIELD:CAN 200 MLHZ	28480	08443-00039
A10A1	08553-0026	1	SHIELD COVER:FIRST MIXER	28480	08553-0026
A10A1	08553-0027	1	INSULATOR:FIRST MIXER	28480	08553-0027
A10A1	0380-0810	2	STANDOFF:0 .437" LG	01255	1530B7/16-11
A11	08443-60042	1	CONVERTER ASSY:SECOND	28480	08443-60042

See introduction to this section for ordering Information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11C1	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A11C2	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C3	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C4	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C5	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C6	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C7	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C8	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C9	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C10	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11C11	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A11CR1	1902-3139	2	DIODE:BREAKDOWN 8.25V 5%	04713	SZ10939-158
A11CR2	5080-0271		DIODE:SILICON MATCHED QUAD	28480	5080-0271
A11CR3			PART OF CR2		
A11CR4			PART OF CR2		
A11CR5			PART OF CR2		
A11J1	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A11J2	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A11L1	9140-0144	3	COIL:FXD RF 4.7 UH	28480	9140-0144
A11L2	9100-1612		COIL:FXD RF 0.33 UH 20%	28480	9100-1612
A11Q1	1854-0345		TSTR:SI NPN	80131	2N5179
A11Q2	1853-0018	1	TSTR:SI PNP(SELECTED FROM 2N4263)	28480	1853-0018
A11Q3	1854-0247		TSTR:51 NPN	28480	1854-0247
A11R1	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A11R2	0757-0397	2	R:FXD MET FLM 68.1 OHM 1% 1 1/8W	28480	0757-0397
A11R3	0757-0417		R:FXD MET FLM 562 2l'S 1% 1/8W	28480	0757-0417
A11R4	0757-0276	3	R:FXD MET FLM 61.9 OHM 1% 1/8W	28480	0757-0276
A11R5	0698-3428	1	R:FXD MET FLM 14.7 OHM 1% 1/8W	28480	0698-0420
A11R6	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A11R7	0757-02o9	1	R:FXD MET FLM 270 OHM 1% 1/8W	28480	0757-0269
A11R8	0698-7200	1	R:FXD FLM 31.6 OHM 2% 1/8W	28480	0697-7200
A11R9	0757-0276		R:FXD MET FLM 51.9 OHM 1% 1/8W	28480	0757-0276
A11R10	0757-0815	2	R:FXD MET FLM 562 OHM 1% 1/2W	28480	0757-0815
A11R11	0698-3334	1	R:FXD MET FLM 178 OHM 1% 1/2W	28480	0698-3334
A11R12	0698-3429		R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A11R13	0698-3401	1	R:FXD MET FLM 215 OHM 1% 1/2W	28480	0698-3401
A11R14			NOT ASSIGNED		
A11R15	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A11R16	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A11R17	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A11R18	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A11R19	0757-0403		R:FXD MET FLM 121 OHM 1% 1/8W	28480	0757-0403
A11R20	0757-0394		R:FXD MET FLM 51.1 OHM 1% 1/8W	28480	0757-0394
A11T1	08552-6024		TRANSFORMER:RF(CODE=YELLOW)	28480	08552-6024
A11T2	08553-6012		TRANSFORMER:RF{CODE=BLUE)	28480	08553-6012
A11T3	08553-6012		TRANSFORMER:RF(CODE=BLUE)	28480	08553-6012
A11T4	08552-6024		TRANSFORMER:RIF(CODE=YELLOW)	28480	08552-6024
A11W1	08443-63057		CABLE ASSY:RF, VIOLET	28480	08443-60057
A12	08443-60041	1	IF ASSY:50 MHZ	28480	08443-60041
A12C1	0160-2145		C:FXD CER 1000 PF +80-20% 100VDCW	91418	TA
A12C2	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A12C3	0150-0050	1	C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A12C4	0160-2142	1	C:FXD CER 1000 PF +100-0% 500VDCW	91418	TYPE SM
A12C5	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A12C6	0160-2254	3	C:FXD CER 7.5 PF 500VDCM	72982	C067B102E102ZS26-CD-1
A12C7	0160-2307	1	C:FXD MICA 47 PF 5%	28480	0160-2307
A12C8	0121-0059	3	C:VAR CER 2-8 PF 300VDCW	28480	0121-0059
A12C9	0160-2254		C:FXD CER 7.5 PF 500 VDCW	72982	301-000-C0H0-759C
A12C10	0121-0059		C:VAR CER 2-8 PF 300VDCW	28480	0121-0059
A12C11	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A12C12	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A12C13	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A12C14	0160-2201	1	C:FXD MICA 51 PF 5%	72136	RDM15B510J1C
A12C15	0160-2254		C:FXD CER 7.5 FF 500VDCW	72982	301-000-C0H0-759C
A12C16			NOT ASSIGNED		
A12C17	0121-0059		C:VAR CER 2-8 PF 300VDCW	28480	0121-0059
A12L1	9140-0158		COIL:FXD RF I UH 10%	99800	1025-20
A12L2	9100-0346	1	COIL:FXD 0.05 UNH 2%	36196	H-10886
A12L3	9140-0096	3	COIL/CHOKE 1.00 UH 10%	99800	1537-12
A12L4	9140-0114	1	COIL:FXD RF 10 UH	28480	9140-0114
A12L5	9140-0096		COIL/CHOKE 1.00 UH 10%	99800	1537-12
A12L6	9140-0096		COIL/CHOKE 1.00 UH 10%	99800	1537-12
A12Q1	1853-0089	1	TSTR:SI PNP	80131	2N4917

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1202	1854-0247		TSTR:SE NPN	28480	1854-0247
A12R2	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	0698-3155
A12R2	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A22R3	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A12R4	0757-0159		R:FXD MET FLM 1000 OHM 1% 1/2W	28460	0757-0159
A12R5	0698-3429		R:FXD MET FLM 19.6 OHM 1% 11/8W	28480	0698-3429
A12R6	0698-3441		R:FXD MET FLM 215 OHM 1% 1/8W	28480	0698-3441
A12R7	0757-1092	1	R:FXD MET FLM 2187 OHM 1% 1/2W	28480	0757-1092
A12R8	0698-3437	1	R:FXD MET FLM 133 OHM 1% 1/8W	28480	0698-3437
A12R9	0698-3433	1	R:FXD MET FLM 28.7 OHM 1% 1/8W	28480	0698-3433
A12R10	0757-0180	1	R:FXD MET FLM 31.6 OHM 1% 1/8W	28480	0757-0180
A12T1	08552-6018		TRANSFORMER:RF(CODE-RED)	28480	08552-6018
A12T2	08552-6018		TRANSFORMER:RF(CODE-RED)	28480	08552-6018
A12W1	08443-60057		CABLE ASSY:RF. VIOLET	28480	08443-60057
A12A1	08443-60004	1	FILTER ASSY:50 MHZ	25480	08443-60004
A12A1C1	0160-0778	1	C:FXD CER 56 PF 10% 500VDCW	01121	FB2B
A12A1C2	0160-0145	1	C:FXD MICA 82 PF 2% 100VDCW	84171	RDM15E820G1S
A12A1C3			NOT ASSIGNED		
AZ2A1C4	0160-2258	4	C:FXD CER 11 PF 5% 500VOCw	72982	301-300-C0G0-110J
A12A1C5	0121-0036	5	C:VAR CER 5.5-18 PF	28480	0121-0036
A12A1C6	0121-0036		C:VAR CER 5.5-18 PF	28480	0121-0036
A12A1C7	0160-2258		C:FXD CER 11 PF 5% 500VDCW	72982	301-300-C0G0-110J
A12A1C8	0160-2258		C:FXD CER 11 PF 5% 500VDCW	72982	301-300-C0G0-110J
A12A1C9	0121-0036		C:VAR CER 5.5-18 PF	28480	0121-0036
A12A2C10	0121-0036		C:VAR CER 5.5-18 PF	28480	0121-0036
A12A1C11	0160-2258		C:FXD CER 11 PF 5% 500VDCW	72982	301-300-C0G0-110J
A12A1C12	0160-2362	1	C:FX) MICA 140 PF 2% 300VDCW	04062	RDM15F141G3S
A12A1J1	1250-1194		CONNECTOR:RF BULKHEAD RECEPTACLE	98291	52-045-4610
A12A1J1	0590-0060		NUT:HEX 12-32 UNEF-2B	01121	M-6377
A12A1J1	2190-0057		WASHER:LOCK FOR #12 HDW	00000	0BD
A12A1L1	08552-6023	1	INDUCTOR ASSY:AIR CORE	28480	08552-6023
A12A1L2	08552-6017	1	INDUCTOR ASSY:50 MHZ	28480	08552-6017
A12A1	08443-00032	1	SHIELD:CAN 50 MHZ FL	28480	08443-00032
A12A1	08443-00033	1	SHIELD:COVER 50 MHZ	28480	08443-00033
A12A1	08552-0023	1	INSULATOR:47 MHZ OSC	28480	08552-0023
A13	08443-60077	1	CONVERTER ASSY:FIRST	28480	08443-60077
A13	08443-20046	1	COVER:FIRST CONVERTER	28480	08443-20046
A13	0624-0097	3	SCREW:TAPPING 4-43 THREAD	00000	OBD
A13C1	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A13C2	0150-0050		C:FXD CER 1003 PF +80-20%100VCDW	56289	C067B102E102ZS26-CD-1
A13C3	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A13C4	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A13CS	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A13C6	0160-3453		C:FXD CER 0.05 UF +50-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A13C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A13C8	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A13C9	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A13C10	0160-2229	1	C:FXD MICA 3000 PF 5%	28480	0160-2229
A13C11	0160-0157	1	C:FXD MY 0.0047 UF 10% 200VDCW	56289	192P47292-PTS
A13C12	0150-0050		C:FXD CER 1000PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A13C13	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A13C14	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCWd	56289	C067B102E102ZS26-CD-1
A13C15	0122-0049	1	DIODE TUNING:90 PF 10%	28480	0122-0049
A13C17	0150-0050		C:FXD CER 1000 PF +80-20% 1000VDCW	56289	C067B102E102ZS26-CD-1
A13C18	0160-3453		C:FXD CER 0.05 UF +50-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A13C19	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A13C20	0160-2145		C:FXD CER 5000 PF +80-20% 100VDCW	91418	TA
A13C21	0160-3036		C:FXD CER 5000 PF +50-20% 200VDCW	28480	0160-3036
A13C22	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A13C23	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A13C24	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A13C25	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A13C26	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A13C27	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A13C28	0160-2055		C:FXD CER 0.01 UF +80-20% 100VDCW	56289	C023F101F103ZS22-CD-1
A13CR1	1902-3139		DIODE:BREAKDOWN 8.25V 5%	04713	SZ10939-158
A13CR2	1901-0050	6	DIODE:SI 200 MA AT IV	07263	FDA 6308
A13CR3	1901-0050		DIODE:SI 200 MA AT IV	07263	FDA 6308
A13CR4	1901-0050		DIODE:SI 200 MA AT IV	07263	FDA 6308
A13CR5	1901-0050		DIODE:SI 200 MA AT IV	07263	FDA 6308
A13CR6	1901-0050		DIODE:SI 200 MA AT IV	07263	FDA 6338
A13CR7	1901-0050		DIODE:SI 200 MA AT IV	07263	FDA 6308
A13J1	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A13J2	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13J3	1250-1195		CONNECTOR:RF SUB-MINIATURE SERIES	98291	52-053-0000
A13L1	9100-3102	1	COIL:VAN 1.42 TO 1.58 UH	71279	CDD4003-8
A13L2	9100-3103	1	COIL:VAR 42.0 TO 51.5 UH	71279	CDD4003-18
A13L3	9100-1612		COIL:FXD RF 0.33 UH 2%	28480	9103-1612
A13L4	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A13L5	9140-0144		COIL:FXD RF 4.7 UH	28480	9140-0144
A13Q1	1854-0019		TSTR:SI NPN	28480	1854-0019
A13Q2	1853-0034	1	TSTR:SI PNP(SELECTED FROM 2N3251)	28480	1853-0034
A13Q3	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A13Q4	1854-0023	1	TSTR:SI NPN(SELECTED FROM 2N2484)	28480	1854-0023
A13Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
AL3Q8	1854-0019		TSTR:SI NPN	28480	1854-0019
A13Q9	1854-0019		TSTR:SI NPN	28480	1854-0019
A13R10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A13R1	0757-0279		R:FXD MET PLM 3.15K OHM 1% 1/8W	28480	0757-0279
A13R2	0757-0397		R:FXD MET FLM 68.1 OHM 1% 1/8W	28480	0757-0397
A13R3	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A13R4	0757-0416		R:FXD MET FLM 511 OHM 1% 1/8W	28480	0757-0416
A13R5	0757-0417		R:FXD MET FLM 562 OHM 1%1/8W	28480	0757-0417
A13R6	0757-0276		R:FXD MET FLM 61.9 OHM 1% 1/8W	28480	0757-0276
A13R7	0698-3429		R:FXD MET FLM 19.6 OHM 1% 1/8W	28480	0698-3429
A13R8	0757-0420		R:FXD MET FLM 750 OHM 1% 1/8W	28480	0757-0420
A13R9	0757-0288	5	R: FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A13R10	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A13R11	0698-3443	1	R:FXD MET FLM 287 OHM 1% 1/8W	28480	0698-3443
A13R12	0698-3431		R:FXD MET FLM 23.7 OHM 1% 1/8W	28480	0698-3431
A13R13	0757-0815		R:FXD MET FLM 562 OHM I1% 1/2W	28480	0757-0815
A13R14	0698-0082	1	R:FXD MET FLM 464 OHM 1% 1/8W	28480	0698-0082
A13R15	0757-0401		R:FXD MET FLM 100K OHM 1% 1/8W	28480	0757-0401
A13R16	0757-0438		R:FXD MET FLM 5.11K OHM 1% 1/8W	28480	0757-0438
A13R17	0683-1005		R:FXD COMP 10 OHM 5% 1/4W	01121	CB 1005
A13R18	0698-0085		R:FXD MET FLM 2.61K OHM 1% 1/8W	28480	0698-0085
A13R19	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A13R20	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A13R20			FACTORY SELECTED PART		
A13R21	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A13R22	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A13RZ3	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A13R24	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A13R25	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A13R26	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A13R27	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0757-0401
A13R28	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A13R29	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A13R30	0757-0279		R:FXD MET FLM 3.16K OHM 1% 1/8W	28480	0757-0279
A13R31	0757-0440		R:FXD MET FLM 7.50K OHM 1% 11/8W	28480	0757-0440
A13R32	0757-0401		R:FXD MET FLM 100 OHM 1% 1/8W	28480	0157-0401
A13R33	0757-0288		R:FXD MET FLM 9.09K OHM 1% 1/8W	28480	0757-0288
A13R34	0757-0280		R:FXD MET FLM 1K OHM 1% 1/8W	28480	0757-0280
A13T1	08443-80001	2	TRANSFORMER:RF	28480	08443-80001
A13T2	08443-80001		TRANSFORMER:RF	28480	08443-80001
A13XY1	1200-0770	1	SOCKET:CRYSTAL	91506	R000-AG-26
A13Y1	0410-0474	1	CRYSTAL:OUARTZ	28480	0410-0474
A14	08443-60015	1	BOARD ASSY:SENSE AMPLIFIER	28480	15443-60015
A14C1	0160-0163	1	C:FXD MY 0.033 UF 10% 200VDCW	56289	192P33392-PTS
A14C2	0180-0116		C:FXD ELECT 6.8 UF 10% 35VDCW	56289	150D68X59035B2-DYS
A14C3	0180-1743		C:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A14C4	0180-1743		C:FXD ELECT 0.1 UF 10% 35VDCW	56289	150D104X9035A2-DYS
A14C5	0180-1735		C:FXD ELECT 0.22 UF 10% 35VDCW	28480	0183-1735
A14C6	0180-0291	3	C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X9035A2-DYS
A14C7	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	150D105X903542-DYS
A14C8	0160-2208	1	C:FXD MICA 330 PF 5% 300VDCW	28480	0160-2208
A14C9	0180-1747	1	C:FXD ELECT 150 UF 20% 15VDCW	28480	0180-1747
A14C10	0180-0291		C:FXD ELECT 1.0 UF 10% 35VDCW	56289	1150D105X9035A2-DYS
A14CR1	1901-0200	11	DIODE:SILICON 100 PIV 3A	02735	1N4998
A14CR2	1902-0048		DIODE:BREAKDOWN 6.81V 5%	04713	SZ10939-134
A14CR3	1902-3193	1	DIODE BREAKDOWN 13.3V 5%	28480	1902-3193
A14CR4	1884-0012	2	RECTIFIER:SILICON CONTROLLED 2N3528	02735	2N352B
A14CR5	1902-0033	1	DIODE:BREAKDOWN 6.2V	04713	1N823
A14CR6	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A14CR7	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A14CR8	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14CR9	1901-0025		DIDOE:SILICON 1001MA/1V	07263	FD 2387
A14CR10	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A14CR11	1884-0012		RECTIFIER:SILICON CONTROLLED 2N3528	02735	2N3528
A14CR12	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A14CR13	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A14CA14	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A14CR15	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A14CR16	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A14CR17	1902-3268		DIODE:BREAKDOWN:26.1V 5%	28480	1902-3268
A14CR18	1902-3256	1	DIODE:BREAKDOWN SILICON 23.7V 5%	28480	1902-3256
A14CR19	1902-0049	1	DIODE:BREAKDOWN 6.19V 5%	04713	SZ10939-122
A14Q1	1854-0039	4	TSTR:SI NPN	80131	2N3053
A14Q2	1854-0039		TSTR:SI NPN	80131	2N3053
A14Q3	1854-0039		TSTR:SI NPN	80131	2N3053
A14Q4	1853-0020		TSTR:SI PNP(SELECTED FROM 2N3702)	28480	1853-0020
A14Q5	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q6	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q7	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q8	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q9	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q10	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q11	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q12	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q13	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q14	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q15	1854-0039		TSTR:SI NPN	80131	2N3053
A14Q16	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q17	1854-0221		TSTR:SI NPN(REPL.BY 2N4044)	28480	1854-0221
A14Q18	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
A14Q19	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3734)	28480	1854-0071
A14R1	0683-5115	5	R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A14R2	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A14R3	0683-0275	4	R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A14R4	0683-1015	4	R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A14R5	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A14R6	0683-1635	2	R:FXD COMP 16K OHM 5% 1/4W	01121	CB 1635
A14R7	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A14R8	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A14R9	0683-5125	3	R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A14R10	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A14R12	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A14R13	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A14R14	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8w	28480	0698-0084
A14R15	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A14R16	0683-6205	2	R:FXD COMP 62 OHM 5% 1/4W	01121	CB 6205
A14R17	0683-1015		R:FXD COMP 100 OHM 5% 1/4W	01121	CB 1015
A14R18	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28450	0757-0428
A14R19	0698-3409	2	R:FXD MET FLM 2.37K OHM 1% 1/2W	28480	0698-3409
A14R20	0683-1125	1	R:FXD COMP 1100 OHM 5% 1/4k	01121	CB 1125
A14R21	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084
A14R22	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A14R23	0698-3159	1	R:FXD MET FLM 26.1K OHM 1% 1/8W	28480	0698-3159
A14R24	0698-3151		R:FXD MET FLM 2.87K OHM 1% 1/8W	28480	0698-3151
A14R25	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A14R26	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A14R27	0698-3153		R:FXD MET FLM 3.83K OHM 1% 1/8W	28480	0698-3153
A14R28	0757-0199		R:FXD MET FLM 21.5K OHM 1% 1/8W	28480	0757-0199
A14R29	0683-6235	2	R:FXD COMP 62K OHM 5% 1/4W	01121	CB 6235
A14R30	0683-5125		R:FXD COMP 5100 OHM 5% 1/4W	01121	CB 5125
A14R31	0683-1635		R:FXD COMP 16K OHM 5% 1/4W	01121	CB 1635
A14R32	0757-0821	1	R:FXD NET FLM 1.21K OHM 1% 1/2W	28480	0757-0821
A14R33	0757-0418	1	R:FXD MET FLM 519 OHM 1% 1/8W	28480	0757-0418
A14R33			FACTORY SELECTED PART		
A14R34	0698-3150	2	R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A14R35	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/SW	28480	0698-3155
A14R36	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A14R37	0683-5125		R:FXD COMP 5100 OHM 5% 14W	01121	CB 5125
A14R38	0757-0428		R:FXD MET FLM 1.62K OHM 1% 1/8W	28480	0757-0428
A14R38			FACTORY SELECTED PART		
A14R39	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A14R40	0683-4315	1	R:FXD COMP 430 OHM 5% 1/4W	01121	CB 4315
A14R41	0698-0083		R:FXD MET FLM 1.96K OHM 1% 1/8W	28480	0698-0083
A14R42	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A14R43	0698-0084		R:FXD MET FLM 2.15K OHM 1% 1/8W	28480	0698-0084

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14R43			FACTORY SELECTED PART		
A14R44	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	3757-0442
A14R45	0698-3150		R:FXD MET FLM 2.37K OHM 1% 1/8W	28480	0698-3150
A14R46	0698-3155		R:FXD MET FLM 4.64K OHM 1% 1/8W	28480	3698-3155
A14R47	0683-0275		R:FXD COMP 2.7 OHM 5% 1/4W	01121	CB 27G5
A14R48	0683-6235		R:FXD COMP 62K OHM 5% 1/4W	01121	CB 6235
A14R49	0698-3409		R:FXD MET FLM 2.37K OHM 1% 1/2W	28480	0698-3409
A14R50	2100-2632	1	R:VAR FLM 100 OHM 10% LIN 1/2W	28480	2100-2632
A14R51	0757-0421		R:FXD MET FLM 825 OHM 1% 1/8W	28480	0757-0421
A14R52	0683-6205		R:FXD COMP 62 OHM 5% 1/4W	01121	CB 6205
A14R53	0683-5115		R:FXD COMP 510 OHM 5% 1/4W	01121	CB 5115
A14S1	3101-1277	1	SWITCH:TOGGLE SPDT MOM.-ON-NONE-ON	81640	T8003
A14TP1			NOT ASSIGNED		
A14TP2	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A14TP3	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A14TP4	0360-1514		TERMINAL PIN:SOUARE	28480	0360-1514
A14TPS	0360-1514		TERMINAL PIN:SQUARE	28480	0360-1514
A15	08443-60014	1	BOARD ASSY:RECTIFIER	28480	08443-60014
A15C1	0160-3043	2	C:FXD CER 2 X 0.005 UF 20% 250VAC	56289	29C147A-CDH
A15C2	0160-3043		C:FXD C-R 2 X 0.005 UF 20% 250VAC	56289	29C147A-CDH
A15C3	0180-2212	1	C:FXD ELECT 10 UF +50-0% 450VDCW	56289	39D106F450FL4-SB
A15C4	0170-0040	2	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A15C5	0170-0040		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A15C6	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A15C7	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A15C8	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A15C9	0160-3453		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD-1
A15C10	0160-0168	1	C:FXD MY 0.1 UF 10% 200VDCW	56289	192P10492-PTS
A15CR1	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A15CR2	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A15CR3	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A15CR4	1901-0159		DIODE:SILICON 0.75 400PIV	04713	SR1358-4
A15CR5	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR6	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR7	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR8	1901-0200		DIODE:SILICON 100 PIV 3A	02735	1N4998
A15CR9	1901-0159		DIODE:SILICON 0.75A 400PIV	04713	SR1358-4
A15CR10	1901-0159		DIODE:SILICON O.75A 400PIV	04713	SR1358-4
A15CR11	1901-0025		DIODE:SILICON 100MA/1V	07263	FD 2387
A15CR2	1902-0041	1	DIODE:BREAKDOWN 5.11V 5%	04713	SZ10939-98
A15F1	2110-0004	1	FUSE:CARTRIDGE 1/4 AMP 250V	75915	3AG/CAT. 312.250
A15F2	2110-0001	3	FUSE:1 AMP 250V	75915	312001.
A15F3	2110-0001		FUSE:1 AMP 250V	75915	312001.
A15F4	2110-0002	1	FUSE:CARTRIDGE 2 AMP 3 AG	75915	312.002
A15F5	2110-0001		FUSE:LAMP 250V	75915	312001.
A15Q1	1854-0071		TSTR:SI NPN(SELECTED FROM 2N3704)	28480	1854-0071
415Q2	1854-0232	2	TSTR:SI NPN(SELECTED FROM 2N3440)	28480	1854-0232
A15Q3	1854-0232		TSTR:SI NPN(SELECTED FROM 2N3440)	28480	1I54-0232
A15R1	0812-0012	1	R:FXD WW 18 OHM 5% 3W	28480	0812-0012
A15R2	0757-0063	3	R:FXD MET FLM 196K OHM 1% 1/2W	28480	0757-0063
A15R3	0757-0063		R:FXD MET FLM 196K OHM 1% 1/2W	28480	0737-0063
A15R4	0757-0063		R:FXD MET FLM 196K OHM 1% 1/2W	28480	0757-0063
A15R5	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A15R6	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A15R7	0683-1025		R:FXD COMP 1000 OHM 5% 1/4W	01121	CB 1025
A15R8	0757-0855	1	R:FXD MET FLM 68.1K OHM 1% 1/2W	28480	0157-0855
A15R9	0683-1045		R:FXD COMP 100K OHMS 5% 1/4W	01121	CB 1045
A15R10	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A15R11	0757-0274		R:FXD MET FLM 1.21K OHM 1% 1/8W	28480	0757-0274
A15R11			FACTORY SELECTED PART		
A15R12	0757-0442		R:FXD MET FLM 10.0K OHM 1% 1/8W	28480	0757-0442
A15R13	0653-1855	1	R:FXD COMP 1.8 MEGOHM 5% 1/4W	01121	CB 1855
A15XF1	2110-0269	10	CLIP:FUSE 0.250" DIA	91506	6008-32CN
A15XF2	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A15XF3	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A15XF4	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A15XF5	2110-0269		CLIP:FUSE 0.250" DIA	91506	6008-32CN
A16	08443-60038	1	BOARD ASSY:SWITCH	28480	08443-60039
A16			(8443A ONLY)		
A16S1	08443-60073	1	SWITCH ASSY:SLIDE	28480	08443-60073
£16S2	08443-60072	3	SWITCH ASSY:SLIDE	28480	08443-60072
£16S3	08443-60072		SWITCH ASSY:SLIDE	28480	08443-60072
A16	08443-60138	1	BOARD ASSY:SWITCH	28480	08443-60138
A16			(8443B ONLY)		

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A16S1			NOT ASSIGNED		
A16S2	08443-60072		SWITCH ASSY:SLIDE	28480	08443-60072
A16S3			NOT ASSIGNED		
A17			JACK ASSY INTERCONNECTION(8443A ONLY)		
A17	08443-00123	1	COVER:BCD HOLE	28480	08443-00123
A17			(8443B ONLY)		
A17J1	1251-2366	1	CONNECTOR:R AND P 8 POSITIONS	71468	DCM 8W8S
A17W1	08443-60052	1	CABLE ASSY:BLANK CONTROL	28480	08443-60052
A17W2	08443-63055	1	CABLE ASSYS:THIRD LOCAL OSCILLATOR	28480	08443-60055
A17W3	08443-60054	1	CABLE ASSY:SECOND LOCAL OSCILLATOR	28480	08443-60054
A17W4	08443-60053	1	CABLE ASSY:SCAN CONTROL	28480	08443-60053
A17W5	08443-60063	1	CABLE ASSY:FIRST LOCAL OSCILLATOR	28480	08443-60063
418	08443-60016	1	BOARD ASSY:MOTHER	28480	08443-60016
A18C1			NOT ASSIGNED		
A18C3			NOT ASSIGNED		
A18C4	0150-0050		C:FXD CER 1000 PF .80-20% 1000VDCW	56289	C067B102E102ZS26-CDH
A18R1	0683-2005	1	R:FXD COMP 20 OHM 5% 1/4W	01121	CB 2005
A18R2	0811-1666	3	R:FXD NW 1.0 OHM 5% 2W	28480	0811-1666
A18R3	0811-1666		R:FXD WW 1.0 OHM 5% 2W	28480	0811-1666
A18R4	0811-1661	1	R:FXD WW 0.39 OHM 5% 2W	28480	0811-1661
A18R5	0811-1666		R:FXD WW 1.0 OHM 5% 2W	28480	0811-1666
A18R6	0683-3615	1	R:FXD COMP 360 OHM 5% 1/4W	01121	CB 3615
A18R7	0683-2015	1	R:FXD COMP 200 OHM 5% 1/4W	01121	CB 2015
A18A1	1251-1887		C0NNECTOR:PC 44 CONTACT(12 X 22)	71785	252-22-30-340
A18A2					
A18XA4			NOT ASSIGNED		
A18XA5	1251-1626	5	CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A18XA6	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A18XA7	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A18XA8	1251-0472	6	CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A18XA9	1251-0472		CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A18XA10	1251-0472		CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A18XA11	1251-0472		CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A18XA12	1251-0472		CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A18XA13	1251-0472		CONNECTOR:PC 12 CONTACTS	71785	252-06-30-300
A18XA14	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A18XA15	1251-1626		CONNECTOR:PC (2 X 12) 24 CONTACT	71785	252-12-30-300
A18XA16	1251-2091	1	CONNECTOR:PC (1 X 15) 15 CONTACT	95354	178-118-181
A18	0360-0124	1	TERMINAL:SOLDER LUG	28480	0360-0124
A18	0380-0756	20	STANDOFF:0.125" LG	00000	0BD
A18	0380-0884	2	STANDOFF:CAPTIVE 4-40 X 0.156" LG	00000	0BD
A18	0380-0895	2	STANDOFF:CAPTIVE 4-40 X 0.312" LG	00000	0BD
A18	1251-2229	2	CONNECTOR:SINGLE CONTACT	00779	1-331677-3
A18	1251-2313	8	CONNECTOR:SINGLE CONTACT	00779	3-332070-5
A19	08443-60068	1	BCD ASSY:DIGITAL OUTPUT	28480	08443-60068
A19			(8443A ONLY)		
A19	09443-00023	1	SHIELD:RCD	28480	08443-00023
A19J1	1251-0087	1	CONNECTOR:FEMALE 5O-PIN MINAT	28480	1251-0087
A19S1	3101-0070	3	SWITCH:SLIDE	79727	G-126
A20	08443-60003	1	MARKER POSITION ASSY	28480	08443-60063
A20			(8443A ONLY)		
A20	08443-00014	1	BRACKET:MARKER POSITION POT	28480	08443-00014
A20	08443-20009	1	COUPLER:MARKER POSITION POT	28480	08443-20009
A20R1			NOT ASSIGNED		
A20R10			NOT ASSIGNED		
A20R11	2100-2066	1	R:VAR COMP 2K OHM 20% LIN 1/2W	28480	2100-2066
A20R12	0698-3154	1	R:FXD MET FLM 4.22K OHM 1% 1/8W	28480	0698-3154
A20R12			FACTORY SELECTED PART		
A20R13	2100-2898	1	R:VAR CERMET 5K/50K OHM 20% LIN	28480	2100-2898
A20S1	3101-0070		SWITCH:SLIDE	79727	G-126
A20S1			(PART OF BRACKET)		
			CHASSIS PARTS		
C1	0180-2181	2	C:FXD ELECT 1300 UF +75-10% 50VDCW	56289	36D132G050AA2A-DQB
C2	0180-2290	1	C:FXD ELECT 2700 UF +75-10% 25VDCW	56289	36D272G025AA2A-DQB
C2			(8443A ONLY)		
C3	0180-2181		C:FXD ELECT 1300 UF +75-10% 5OVDCW	56289	36D132G050AA2A-DQB
DS1	2140-0253	2	LAMP:INCANDESCENT 28V 0.030A	08717	FB38
DS2	2140-0253		LAMP:INCANDESCENT 28V 0.030A	08717	FB38
FL1	9100-3121	1	FILTER:LINE 50-400 CYCLE 2A	28480	9100-3121
J1			PART OF W1		
J2	08553-6063	1	CAPACITOR ASSY	28480	08553-6036
J3			PART OF W3 (8443B ONLY)		
J3	6960-0002	2	PLUS:HOLE FOR 1/2 DIA	76530	SS-48152
J4			PART OF W4 (8443B ONLY)		
J4	6960-0002		PLUS:HOLE FOR 1/2" DIA	76530	SS-48152

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
J5			PART OF FL1		
MP1	5040-0331	2	ABSORBER:RF	28480	5040-0331
MP2	5040-0331		ABSORBER:RF	28480	5040-0331
MP3	0370-0084	2	KNOB:ROUND BLK 5/8 DIA	28480	0370-0084
MP4	0370-0084		KNOB:ROUND BLK 5/8 DIA	28480	0370-0084
MP5	1251-0218	2	CONNECTOR:LOCK POST SUBMINAT TYPE D	71468	D53018
MP6	1251-0218		CONNECTOR:LOCK POST SUBMINAT TYPE D	71468	D53018
MP7	1410-0112	1	BBUSHIN:5/16-32 THD	28480	1410-0112
MP7			(TRACK ADJ)		
MP8	3150-0214	1	FILTER:AIR, GRAY POLYURETHANE	00000	0BD
MP8			(8443A ONLY)		
MP9	08443-00048	1	RETAINER:FILTER	28480	08443-00048
MP9			(8443A ONLY)		
MP10	5060-0254	2	COUPLER:SHAFT	28480	5060-0254
MP11	5060-0254		COUPLER:SHAFT	28480	5060-0254
MP12	08443-00004	1	SUPPORT:MOTHER BOARD ,FRONT	28480	08443-00004
MP13	08443-00005	1	SUPPORT:MOTHER BOARD, REAR	28480	08443-00005
MP14	08443-00006	1	DECK:ATTENUATOR MOUNTING	28480	08443-00006
MP15	08443-00012	1	BRACKET MOUNTING:SIDE FRAME	28480	08443-00012
MP15			(8443A ONLY)		
MP16	08443-00018	1	BRACKET:REGULATOR MOUNTING	28480	08443-00018
MP17	08443-00019	1	BRACKET:CAPACITOR MOUNTING	28480	08443-00019
MP18	08443-00020	1	BRACKET:TRANSFORMER MOUNTING	28480	08443-00020
MP19	08443-00021	4	BRACKET:FRONT PANEL	28480	08443-00021
MP20	08443-00021		BRACKET:FRONT PANEL	28480	08443-00021
MP21	08443-00021		BRACKET:FRONT PANEL	28480	08443-00021
MP22	08443-00021		BRACKET:FRONT PANEL	28480	08443-00021
MP23	08443-00022	1	SHIELD:MOTHER BOARD	28480	08443-00022
MP24	08443-00024	1	DIAL KNOB ASSY:"TENS"	28480	08443-00024
MP25	08443-00025	1	DIAL KNOB ASSY:"UNITS"	28480	08443-00025
MP26	08443-00026	1	DIAL KNOB ASSY:"TENTHS"	28480	08443-00326
MP27	08443-00043	1	COVER, POWER SUPPLY	28480	08443-00043
MP28	08443-00046	1	COVER, SERIES REGULATOR	28480	08443-00046
MP29	08443-20001	11	SHIELD:PC BOARD	28480	08443-20001
MP30	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP31	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP32	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP33	08443-20001		SHIELD:PC BOARD	28460	08443-20001
MP34	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP35	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP36	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP37	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP37			NOT ASSIGNED (8443B ONLY)		
MP38	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP38			NOT ASSIGNED (8443B ONLY)		
MP39	08443-20001		SHIELD:PC BOARD	28480	08443-20001
MP39			NOT ASSIGNED (8443B ONLY)		
MP40	08443-20004	2	SHAFT:ATTENUATOR KNOB	28480	08443-20004
MP41	08443-20004		SHAFT:ATTENUATOR KNOB	28480	08443-20004
MP42	08443-20005	3	BUSHING:KNOB SHAFT(ATTENUATORS)	28480	08443-20005
MP43	08443-20005		BJSAINGSKNO8 SHAFT(ATTENUATORS)	28480	08443-20005
MP44	08443-20005		BUSHING:KNOB SHAFT(ATTENUATORS)	28480	08443-20005
MP45	08443-20006	1	HEAT SINK	28480	08443-20006
MP45			(Q1 THROUGH Q5)		
MP46	08443-40001	1	WINDOW:COUNTER	28480	08443-40001
MP46			(8443A ONLY)		
MP47	08443-40003	1	INSULATOR:REGULATOR	28480	08443-40003
MP47			(Q1 THROUGH Q5)		
MP48	5000-0206	2	SPRING:WASHER	28480	5000-0206
MP49	08443-40006	1	HANDLE:FUNCTION SWITCH	28480	08443-40006
MP49			(8443A ONLY)		
MP50	NOT ASSIGNED	1	SPRING:COMPRESSION-FUNCTION SWITCH	28480	1460-0297
MP50			(8443A ONLY)		
MP51	0380-0793	2	SPACER:POST 0.156" LG-FUNCTION SWITCH	76854	15525-610
MP51			(8443A ONLY)		
MP52	0380-0793		SPACER:POST 0.156" LG-FUNCTION SWITCH	76854	15525-610
MP52			(8443A ONLY)		
Q1	1854-0063	4	TSTR:SI NPN	80131	2N3055
Q2	1854-0063		TSTR:SI NPN (844A ONLY)	80131	2N3055
Q3	1854-0063		TSTR:SI NPN	80131	2N3055
Q4	1854-0063		TSTR:SI NPN	80131	2N3055
Q5	1854-0324	1	TSTR:SI NPN	80131	2N3739
Q5			(8443A ONLY)		
R1			NOT ASSIGNED		

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
R7			NOT ASSIGNED		
R8	2100-2886	1	R:VAR WW 5K ORM 5% LIN 2W	28480	2100-2886
R8	08443-20008	1	MOUNT:TRACK ADJ POT	2848o	O8443-20008
R8	08443-20010	1	TRACK ADJ. POT:5K OHM	28480	08443-20010
R9	2100-2501	1	R:VAR WW 2K OHM 20% LIN 1.5W	28480	2100-2501
R10	2100-2729	1	R:VAR CERMET 2.5K OHM 20% LIN 2W	28480	2100-2729
R10			(8443A ONLY)		
S1	3101-1234	1	SWITCH:SLIDE DPDT	82389	11A-1242
S1			(PART OF REAR PANEL)		
S2	3101-0070		SWITCH:SLIDE- FUNCTION	79727	G-126
S2			(8443A ONLY)		
T1	9100-2886	1	TRANSFORMER:POWER	28480	9100-2886
W1	08443-60061	1	CABLE ASSY:EXT INPUT	28480	08443-60061
W1			(8443A ONLY)		
W2			NOT ASSIGNED		
W3	08443-60059	1	CABLE ASSY:1 MHZ INPUT	28480	08443-60059
W3			(84434 ONLY)		
W4	08443-60060	1	CABLE ASSY:1 MHZ OUTPUT	28480	08443-60060
W4			(8443A ONLY)		
W5	08443-60009	1	CABLE ASSY:INTERCONNECT	28480	08443-60009
W6	8120-1348	1	CABLE ASSY:POWER. DETACHABLE	70903	KHS-7041
W7	08443-60079	1	CABLE ASSY:3 MHZ IF	28480	08443-60079
W7			(8443A ONLY)		
W8	08443-60080	1	CABLE ASSY:FUNCTION SWITCH	28480	08443-60080
W8			(8443A ONLY)		
XA1			NOT ASSIGNED		
XA14			NOT ASSIGNED		
XA15	1251-0198	1	CONNECTOR:PC EDGE (2 X 6) 12 CONTACT	71785	251-06-30-261
XA15	5040-0327	2	HOOD:CONNECTOR	28480	5040-0327
XA16			NOT ASSIGNED		
XA17			NOT ASSIGNED		
XA18	1251-2400	1	CONNECTOR:PC (2 X 15) 30 CONTACT	11453	610-093-15
XDS1	1450-0153	2	LAMP:HOLDER:FOR T-1 SERIES	08717	102SR
XDS1	1450-0493	1	LENS:PLASTIC	28480	1450-0493
XDSZ2	1450-0153		LAMP4OLDERsFOR T-1 SERIES	08717	102SR
XDS2	1450-0157	1	LENS: LAMPHOLDER	08717	102XX-W
XF1	1400-0084	1	FUSEHOLDER:EXTRACTOR POST TYPE	75915	342014
			MISCELLANEOUS		
	0624-0268	512	SCREW:PAN HD POZI DR 4-24 X 0.375" LG	00000	0BD

See introduction to this section for ordering information

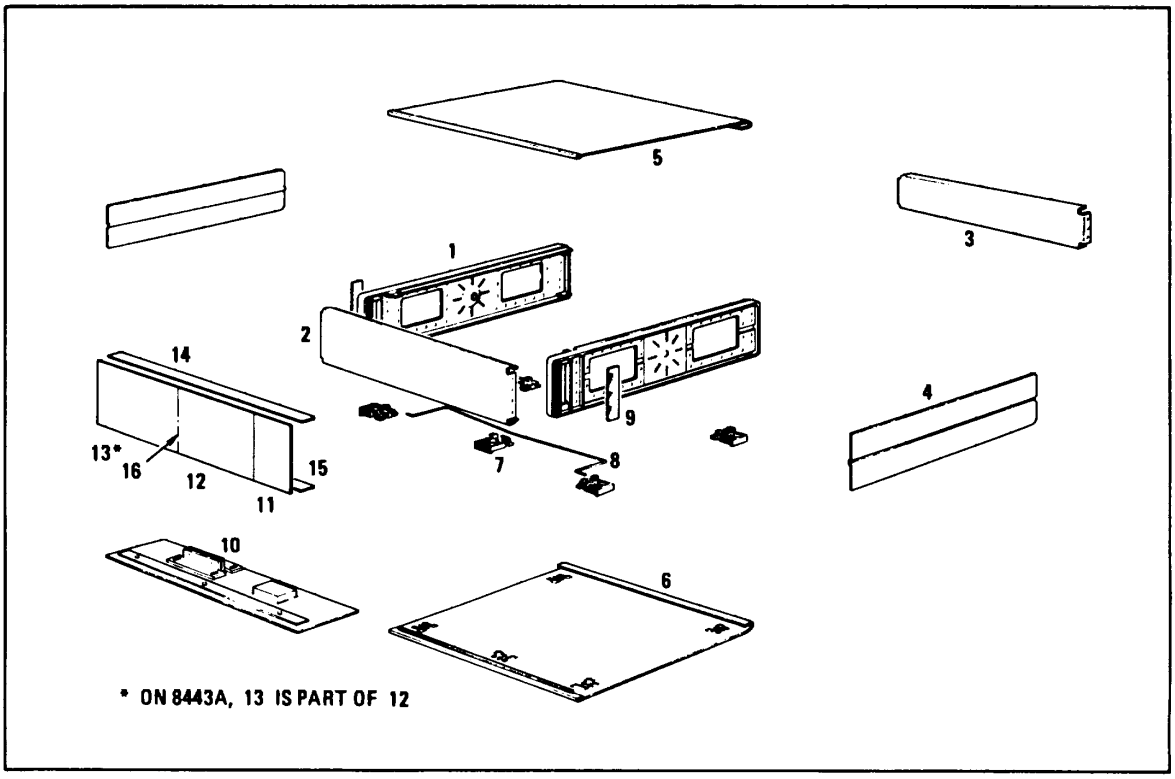


Figure 6-1. Cabinet Parts

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
1	5060-0730	2	FRAME ASSY:3 X 16	28480	5060-0730
2	08443-00055	1	SUB-PANEL	28480	08443-00055
3	08443-00003	1	PANEL:REAR	28480	08443-00003
4	5000-0731	2	COVER:SIDE, BLUE GRAY	28480	5000-0731
4	5000-8595	2	COVER:SIDE. OLIVE GRAY	28480	5000-8595
5	08443-00045		COVER:TOP, BLUE GRAY	28480	08443-00045
5	08443-00052	1	COVER:TOP, OLIVE GRAY	Z8480	08443-00052
6	5060-0752	1	COVER ASSY:BOTTOM 16L (BLUE GRAY)	28480	5060-3752
6	5060-8713	1	COVER:BOTTOM	28480	5060-8713
7	5060-0767	5	FOOT ASSY:FM	28480	5060-0767
8	1490-0030	1	STAND:TILT	28480	1490-0030
9	5000-0050	2	TRIM:SIDES	28480	5003-0050
10	5060-0774	1	RACK MOUNTING KIT:3H (LIGHT GRAY)	28480	5060-0774
10	5060-8739	1	KIT:RACK MOUNT 3H	28480	5060-8739
11	08443-00027		CONNECTOR PLATE. BLACK(OPTIONS)	28480	083443-00027
11	08443-00051		CONNECTOR PLATE:OLIVE BLACK	28480	08443-00051
12	08443-00054	1	PANEL:FRONT,LITE GRAYI8443AI	28480	08443-00054
12	08443-00101	1	PANEL:RIGHT FRONT, LITE GRAY(8443B)	28480	08443-00101
12	08443-00124		PANEL:RIGHT FRONT, MINT GRAY(8443B)	28480	08443-00124
12	08443-00053		PANEL:FRONT, MINT GRAY(8443A)	28480	08443-00053
13	08443-00102		PANEL:LEFT FRONT,BLACKI44381)	28480	08443-00102
13	08443-00125		PANEL:LEFT FRONT, OLIVE BLACK(84431B)	28480	08443-00125
14	5020-0900	1	TRIM:PANEL, LITE GRAY	28480	5020-0900
14	5020-6850	1	TRIM:PANEL, MINT GRAY	28480	5020-6850
15	5020-0901	1	TRIM:PANEL, LITE GRAY	28480	5020-0901
15	5020-6851	1	TRIM:PANEL, MINT GRAY	28480	5020-6RSI
16	08443-40002	1	WINDOW TRIM STRIP	28480	08443-43D02
17	5060-0216	1	BRACKET:JOINING KIT, BLUE GRAY	28480	5060-0216
17	5060-8543	1	BRACKET:JOINING KIT, OLIVE GRAY	28480	5n60-8S43

See introduction to this section for ordering information

TABLE 6-4.

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
B104BX102M	96733	5910-00-244-7171	0160-2139	28480	5910-00-180-7816
D2361	93332	5961-00-954-9182	0160-2140	28480	5910-00-430-5625
D53018	71468	5935-00-570-6119	0160-2142	28480	5910-00-430-5626
FB2B	01121	5910-00-920-3478	0160-2143	28480	5910-00-430-5628
FDG1088	07263	5961-00-928-7939	0160-2145	28480	5910-00-430-5637
G250	01538	5325-00-079-7237	0160-2204	28480	5910-00-463-5949
KHS-7041	70903	6150-01-004-8773	0160-2208	28480	5910-00-430-5685
MC1013P	04713	5962-00-450-8830	0160-2218	28480	5910-00-261-3413
MC1034P	04713	5962-00-405-1385	0160-2229	28480	5910-00-719-9881
MC1039P	04713	5962-00-519-0787	0160-2244	28480	5910-00-008-4451
RDM15E820G1S	84171	5910-00-138-1318	0160-2254	28480	5910-00-043-1371
RDM15F101J3C	72136	5910-00-463-5949	0160-2260	28480	5910-00-789-6956
SN7400N	01295	5962-00-865-4625	0160-2266	28480	5910-00-430-5754
SN7400N	01295	5962-00-922-3138	0160-2307	28480	5910-00-406-9675
SN7404N	01295	5962-00-404-2559	0160-2327	28480	5910-00-244-7171
SN7472N	01295	5962-00-865-4631	0160-2930	28480	5910-00-465-9754
SN7474N	01295	5962-00-106-4287	0160-3036	28480	5910-00-138-1326
SR1358-4	04713	5961-00-496-7363	0160-3043	28480	5910-00-472-5006
SZ10939-110	04713	5960-00-995-2310	0160-3060	28480	5910-00-006-5732
SZ10939-134	04713	5960-00-912-3099	0160-3121	28480	5910-00-138-7268
SZ10939-158	04713	5960-00-845-6458	0160-3451	28480	5910-01-036-1474
S17843	07263	5961-00-917-0660	0170-0040	28480	5910-00-829-0245
T8001	81640	5930-00-237-1160	0180-0098	28480	5910-00-430-5947
0121-0036	28480	5910-00-463-5960	0180-0116	28480	5910-00-809-4701
0121-0059	28480	5910-00-776-4185	0180-0137	28480	5910-00-915-1393
01210105	28480	5910-00-761-1216	0180-0160	28480	5910-00-752-4249
0122-0049	28480	5961-00-329-7671	0180-0197	28480	5910-00-850-5355
0150-0050	28480	5910-00-784-0927	0180-0229	28480	5910-00-403-2449
0160-0145	28480	5910-00-138-1318	0180-0291	28480	5910-00-931-7055
0160-0157	28480	5910-00-961-9591	0180-0376	28480	5910-00-444-6726
0160-0163	28480	5910-00-893-1261	0180-1735	28480	5910-00-430-6016
0160-0168	28480	5910-00-917-0668	0180-1743	28480	5910-00-430-6017
0160-2055	28480	5910-00-211-1611	0340-0038	28480	5940-00-904-0300

TABLE 6-4 (cont'd.)

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
0340-0039	28480	5970-00-072-1625	0698-3435	28480	5905-00-489-2046
0360-0124	28480	5940-00-993-9338	0698-3437	28480	5905-00-402-7080
0360-1514	28480	5940-00-150-4513	0698-3438	28480	5905-00-974-6080
0370-0084	28480	5355-00-809-9329	0698-3441	28480	5905-00-974-6076
0400-0009	28480	5325-00-079-7237	0698-3443	28480	5905-00-194-0341
0683-1005	28480	5905-00-960-0099	0698-3444	28480	5905-00-974-6079
0683-1015	28480	5905-00-102-5294	0698-3452	28480	5905-00-826-3239
0683-2015	28480	5905-00-111-4845	0698-7200	28480	5905-00-161-8936
0683-5115	28480	5905-00-801-8272	0698-7229	28480	5905-01-009-7560
0683-5125	28480	5905-00-139-1642	0699-0001	28480	5905-00-998-1953
0683-6225	28480	5905-00-056-0505	0757-0063	28480	5905-00-244-7182
0683-6235	28480	5905-00-542-7776	0757-0159	28480	5905-00-830-6677
0683-7525	28480	5905-00-056-0520	0757-0180	28480	5905-00-972-4907
0698-0082	28480	5905-00-974-6075	0757-0199	28480	5905-00-981-7513
0698-0083	28480	5905-00-407-0052	0757-0269	28480	5905-00-858-6985
0698-0084	28480	5905-00-974-6073	0757-0274	28480	5905-00-858-9105
0698-0085	28480	5905-00-998-1814	0757-0276	28480	5905-00-493-0777
0698-3150	28480	5905-00-481-1357	0757-0279	28480	5905-00-221-8310
0698-3151	28480	5905-00-246-8634	0757-0280	28480	5905-00-853-8190
0698-3153	28480	5905-00-974-6081	0757-0288	28480	5905-00-193-4318
0698-3154	28480	5905-00-891-4215	0757-0289	28480	5905-00-998-1908
0698-3155	28480	5905-00-976-3418	0757-0346	28480	5905-00-998-1906
0698-3159	28480	5905-00-407-0053	0757-0394	28480	5905-00-412-4036
0698-3260	28480	5905-00-998-1809	0757-0395	28480	5905-00-891-4210
0698-3334	28480	5905-00-407-2350	0757-0397	28480	5905-00-232-3125
0698-3401	28480	5905-00-252-4219	0757-0398	28480	5905-00-788-0291
0698-3409	28480	5905-00-473-3276	0757-0401	28480	5905-00-981-7529
0698-3428	28480	5905-00-891-4238	0757-0403	28480	5905-00-412-4023
0698-3429	28480	5905-00-407-0075	0757-0405	28480	5905-00-096-4167
0698-3431	28480	5905-00-402-7079	0757-0416	28480	5905-00-998-1795
0698-3433	28480	5905-00-407-0076	0757-0417	28480	5905-00-858-9417
0698-3434	28480	5905-00-997-4071	0757-0418	28480	5905-00-412-4037

TABLE 6-4 (cont'd.)

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
0757-0419	28480	5905-00-891-4213	1400-0084	28480	5920-00-881-4636
0757-0420	28480	5905-00-493-5404	1410-0112	28480	5365-00-417-5217
0757-0421	28480	5905-00-891-4219	1490-0030	28480	6625-00-760-9521
0757-0422	28480	5905-00-728-9980	1537-12	99800	5950-00-925-5249
0757-0428	28480	5905-00-998-1794	1537-16	99800	5950-00-835-1513
0757-0438	28480	5905-00-929-2529	1537-48	99800	5950-00-905-1839
0757-0440	28480	5905-00-858-6795	1820-0054	28480	5962-00-138-5248
0757-0442	28480	5905-00-998-1792	1820-0077	28480	5962-00-138-5250
0757-0458	28480	5905-00-494-4628	1820-0092	28480	6350-00-401-9149
0757-0459	28480	5905-00-997-9579	1820-0010	28480	5962-00-405-1385
0757-0821	28480	5905-00-828-6705	1820-0102	28480	5962-00-450-8830
0757-0855	28480	5905-00-930-7957	1820-0116	28480	5962-00-175-3051
0757-1060	28480	5905-00-405-8094	1820-0116	28480	6350-00-401-9151
0757-1092	28480	5905-00-412-0754	1820-0119	28480	5962-00-409-3521
0757-1094	28480	5905-00-917-0580	1820-0174	28480	5962-00-404-2559
0811-1661	28480	5905-00-222-3549	1820-0304	28480	5962-00-270-1961
0811-1666	28480	5905-00-402-7082	1820-0413	28480	5962-00-009-6621
08552-6017	28480	5950-00-787-7470	1853-0018	28480	5961-00-989-2747
08552-6018	28480	5950-00-430-6816	1853-0020	28480	5961-00-904-2540
08552-6023	28480	5950-00-787-7471	1853-0027	28480	5961-00-193-4463
08552-6024	28480	5950-00-138-1334	1853-0034	28480	5961-00-987-4700
08553-6012	28480	5950-00-138-1335	1854-0022	28480	5961-00-917-0660
08553-6063	28480	5910-00-430-6120	1854-0023	28480	5961-00-998-1923
1N4998	02735	5961-00-994-0520	1854-0045	28480	5961-00-059-3063
1N823	04713	5961-00-103-7417	1854-0063	28480	5961-00-985-9074
1025-20	99800	5950-00-059-5920	1854-0071	28480	5961-00-137-4608
1250-1194	28480	5935-00-446-4102	1854-0221	28480	5961-00-836-1887
1251-0087	28480	5935-00-043-4067	1854-0232	28480	5961-00-229-1963
1251-0198	28480	5935-00-974-6874	1854-0247	28480	5961-00-464-4049
1251-1556	28480	5999-00-165-0403	1854-0324	28480	5961-00-938-5100
1251-1887	28480	5935-00-147-7384	1854-0345	28480	5961-00-401-0507
1251-2313	28480	5935-00-104-1184	1901-0025	28480	5961-00-978-7468

TABLE 6-4 (cont'd.)

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
1901-0039	28480	5961-00-833-6626	2110-0004	28480	5920-00-798-5710
1901-0040	28480	5961-00-965-5917	2110-0269	28480	5920-00-280-8344
1901-0047	28480	5961-00-929-7778	2140-0253	28480	6240-00-078-9094
1901-0049	28480	5961-00-911-9275	251-06-30-261	71785	5935-00-974-6874
1901-0050	28480	5961-00-914-7496	252-06-30-300	71785	5935-00-188-0135
1901-0159	28480	5961-00-496-7363	252-12-30-300	71785	5935-00-448-2236
1901-0179	28480	5961-00-853-7934	252-22-30-340	71785	5935-00-147-7384
1901-0200	28480	5961-00-994-0520	3-332070-5	00779	5935-00-104-1184
1901-0518	28480	5961-00-430-6819	3101-0070	28480	5930-00-919-1755
1902-0041	28480	5961-00-858-7372	3101-1213	28480	5930-00-237-1160
1902-0048	28480	5961-00-912-3099	3101-1234	28480	5930-00-406-8746
1902-0049	28480	5961-00-752-6121	342014	75915	5920-00-881-4636
1902-0518	28480	5961-00-138-7317	50-046-0000	98291	5935-00-917-9089
1902-3094	28480	5961-00-493-5428	5000-0050	28480	6625-01-014-8071
1902-3193	28480	5961-00-247-8437	5060-0767	28480	6625-00-903-0348
1902-3256	28480	5961-00-412-0957	5080-0271	28480	5961-00-513-2726
1902-3268	28480	5961-00-412-0958	5086-7010	28480	5962-00-483-1953
1910-0016	28480	5961-00-954-9182	52-0530-0000	98291	5935-00-107-2601
1970-0042	28480	5960-00-477-1203	8120-1348	28480	6150-01-004-8773
2-330808-8	00779	5935-00-965-9612	9100-0346	28480	5950-00-780-7332
2N3053	80131	5961-00-985-9073	9100-1610	28480	5950-00-431-3185
2N3055	80131	5961-00-985-9074	9100-1611	28480	5950-00-438-4375
2N3528	02735	5961-00-945-3380	9100-1612	28480	5950-00-438-4376
2N3739	80131	5961-00-938-5100	9100-1616	28480	5950-00-835-1513
2N4917	80131	5961-00-179-8478	9100-1618	28480	5950-00-431-3196
2N5179	80131	5961-00-401-0507	9100-1622	28480	5950-00-431-3197
2100-1758	28480	5905-00-228-5989	9100-1623	28480	5950-00-476-5686
2100-2066	28480	5905-00-236-7416	9100-1629	28480	5950-00-430-6864
2100-2489	28480	5905-00-105-1774	9100-1630	28480	5950-00-431-3198
2100-2501	28480	5905-00-431-3183	9100-1643	28480	5950-00-443-9517
2100-2517	28480	5905-00-161-9090	9100-2247	28480	5950-00-405-3735
2100-2632	28480	5905-00-476-5718	9140-0051	28480	5950-00-069-7747

TABLE 6-4 (cont'd.)

PART NUMBER - NATIONAL STOCK NUMBER CROSS REFERENCE INDEX

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
9140-0096	28480	5950-00-138-1381			
9140-0114	28480	5950-00-657-8167			
9140-0129	28480	5950-00-845-6927			
9140-0141	28480	5950-00-059-5919			
9140-0144	28480	5950-00-837-6029			
9140-0158	28480	5950-00-059-5920			

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-2. As changes are made to the 8443A/B, newer instruments may have serial number prefixes not listed in this manual. The manuals for those instruments will be supplied with an additional "Manual Changes" insert containing the required information; contact your local Hewlett-Packard Sales and Service Office if this sheet is missing.

7-3. The information in this section covers the manual changes necessary to backdate this manual so that it directly applies to 8443A Tracking Generator/Counters with serial numbers 1049A00440 and below, and 8443B Tracking Generators with serial numbers 0973A00120 and below.

7-4. MANUAL BACK-DATING

7-5. Table 7-1 lists the serial number history of the 8443A, and Table 7-2 lists the serial number history of the 8443B. The back-dating changes needed to document any instrument are listed opposite the serial numbers. Table 7-4 lists the back-dating changes. Use Table 7-1 or 7-2 to find the changes needed to document your instrument. Then follow the instructions listed under the changes, perform the changes in the sequence listed in Table 7-1 or 7-2.

7-6. Table 7-3 is a summary of 8443A/B changes. It cross references the changes to the assemblies they affect; it also shows whether the factory recommends that instruments be up-dated or not.

Table 7-1. 8443A Back-Dating Serial Numbers

Serial Number or Prefix	Perform Manual Changes (In Sequence)
955-	I,H,G,F,E,D,C,B,A
964-00161 to 00200	I,H,G,F,E,D,C,B
964-00201 to 00220	I,H,G,F,E,D,C
964-00221 to 00245	I,H,G,F,E,D
1049A00246 to 00270	I,H,G,F,E
1049A00271 to 00296	I,H,G,F
1049A00296 to 00440	I,H,G
1049A00440 to 1145A00560	I,H
1145A00561 and above	I

Table 7-2. 8443B Back-Dating Serial Numbers

Serial Number or Prefix	Perform Manual Changes (In Sequence)
973-00110 and below	I,H,G,F,E,D,C,B
973-00111 to 0973A00120	I,H,G
0973A00121 to 1142A00130	I,H

Table 7-3. Changes Summary

Changes	Components Affected																			
	A1 Assy	A2 Assy	A3 Assy	A4 Assy	A5 Assy	A6 Assy	A7 Assy	A8 Assy	A9 Assy	A10 Assy	A11 Assy	A12 Assy	A13 Assy	A14 Assy	A15 Assy	A16 Assy	A17 Assy	A18 Assy	A19 Assy	A20 Assy	Chassis (no prefox)
A										L10 C17											J5* FL1* Covers for Q1-4*
B											R19* R20* R21*										
C						J1,2** TR3-7**															
D	A2***																				
E																					MP1,2*** (RF absorbers) MP8,9*** (fan filter)
F																					MP10,11** (A2,3 shaft couplers)
G														C5**							
H					R4 **						R7,8*										
I																					A13***

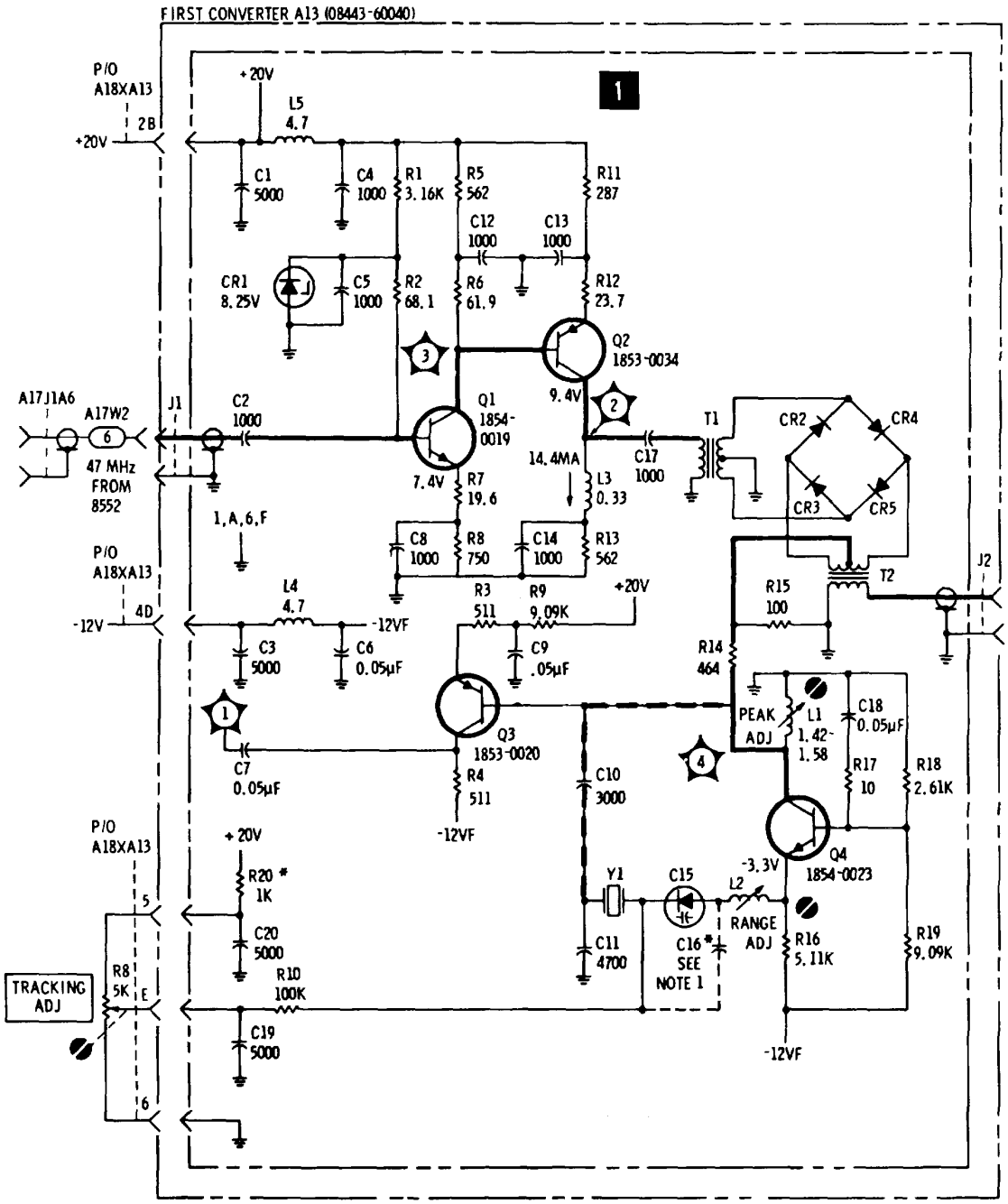
*No instrument up-date recommended.
**New part is preferred replacement part.
***This change is recommended for all prior seals.
****Modification to new configuration described in Service Note 8443a-4 (requires modification kit 08843-60078 for light gray front panel or 08443-60081 for mint gray front panel.

Table 7-4. Manual Back-Dating

CHANGE A	Table 6-3, Replaceable Parts: Delete: Capacitor A10C17 and inductor A10L10. Add: 4 transistor insulating covers (Q1-4) 0349-0486. Change: Line filter FL1 to 9100-2878. Change: Power input connector J5 to 1251-2357. Service Sheet 3 (schematic): Delete: A10C17 and A10L10.
CHANGE B	Table 6-3, Replaceable Parts: Change: Resistors A11R19 and R21 to 0757-0401 R:FXD MET FLM 100 OHM 1% 1/8W Change: Resistor A11R20 to 0757-0398 R:FXD MET FLM 75 OHM 1% 1/8 W Service Sheet 2 (schematic): Change: A11R19 and R21 to 100 ohms. Change: A11R20 to 75 ohms.
CHANGE C	Table 6-3, Replaceable Parts: Change: Connectors A6J1, J2 and TP3 to 1250-1195 CONNECTOR: RF SUB-MINIATURE SERIES Change: Test point pins A6TP4-7 to 08443-00041
CHANGE D	Table 6-3, Replaceable Parts: Delete: Cooling Fan Assembly A1A2. Change: Low Frequency Counter Assembly A1 to 08443-60066. Delete: Inductor A6L12. Service Sheet 8 (schematic): Delete: A6L12.
CHANGE E	Table 6-3, Replaceable Parts: Delete: RF absorbers MP1 and 2. Delete: Fan filter MP8 and filter retainer MP9.
CHANGE F	Table 6-3, Replaceable Parts: Delete: Shaft couplers (for A2 and A3) MP10 and 11. Add: Coupler yokes (4) 1500-0002 and insulated flexible couplings (2) 5040-0212.
CHANGE G	Table 6-3, Replaceable Parts: Change capacitor A14C5 to 0180-1743 C:FXD ELECT 0.1 UF 10% 35 VDCW Service Sheet 4 (schematic): Change: A14C5 to 0.1 pF.
CHANGE H	Table 6-3, Replaceable Parts: Change: A5R4 to 0698-3435 R:FXD 38.3 OHMS. Change: A11R7 to 0698-3443 R:FXD 287 OHMS. Change: A11R8to 0698-3428 R:FXD 14.7 OHMS. Service Sheet 2 (schematic): Change value of A11R7 to 270 ohms, and A11R8 to 31.6 ohms. Service Sheet 7 (schematic): Change value of A5R4 to 10 ohms.

Table 7-4. Manual Back-Dating (cont'd)

CHANGE I	Table 6-3, Replaceable Parts: Change: A13 to 08443-60040 **NOTE** **08443-60112 is exchange assy for 08443-60040.** Delete: A13C21-28, A13CR6,7, A13Q5-10, and A13R21-34. Delete: S2, W7, and W8. Service Sheet 4: Replace appropriate portions of Figure 8-23 with Figure 7-1. Replace Figure 8-21 with Figure 7-2.



REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED FULL DESIGNATION INCLUDES ASSEMBLY NUMBER, e.g. R1 OF ASSEMBLY A1 IS A1R1 DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN

REFERENCE DESIGNATORS

A13	A12	A12A1	A11	CHASSIS
Q1-Q4 Y1 L1-L5 R1-R20 T1-T2 C1-C18 CR1-CR5	C1-C17 Q1-Q2 R1-R10 L1-L6 T1-T2	L1-L2 C1,3-12	Q1-Q3 L1-L2 R1-R21 CR1-CR5 C1-C11 T1-T4	R8

Figure 7-1. Changes for Figure 8-23 (Part of Change I)

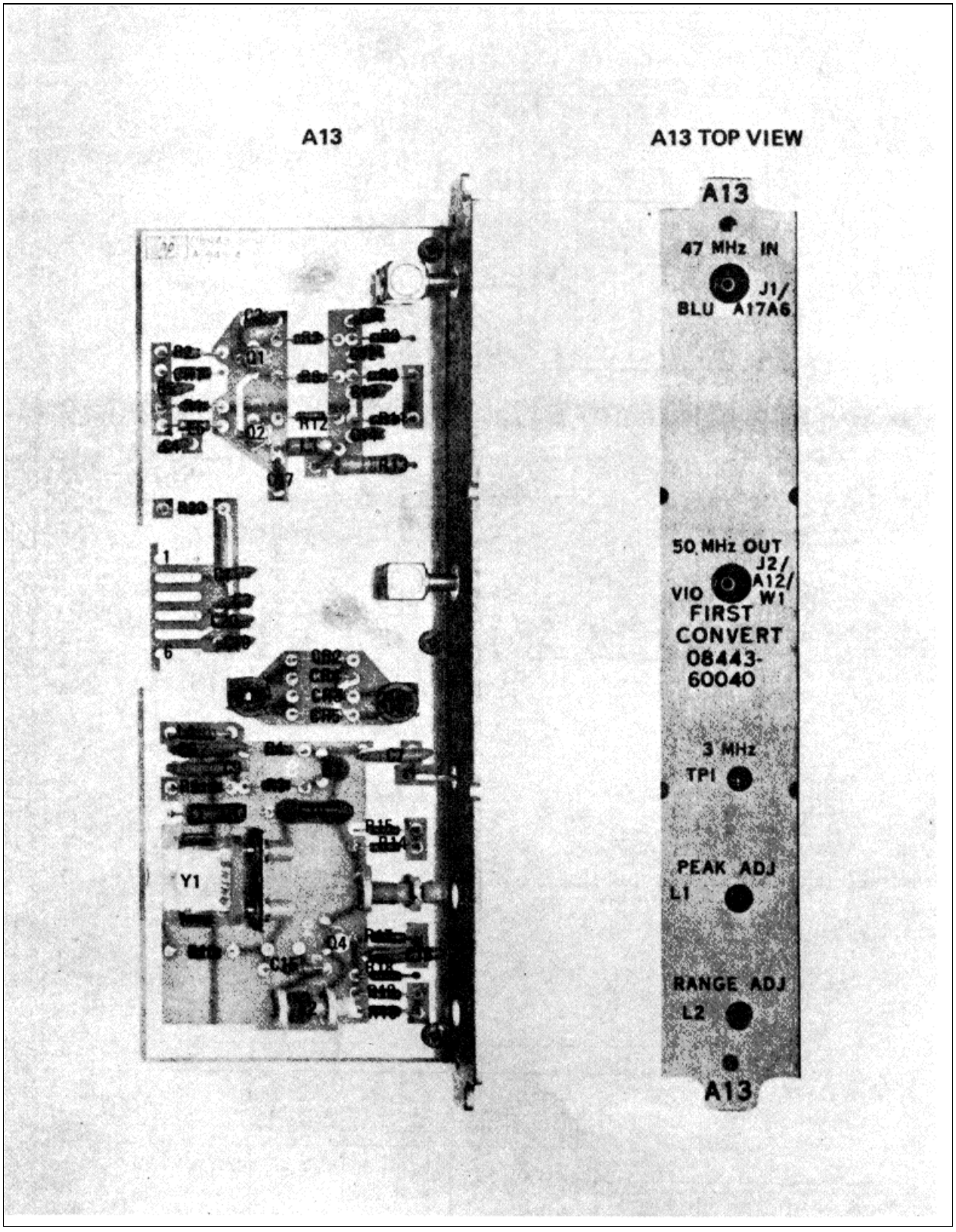


Figure 7-2. Changes for Figure 8-21 (Part of Change I)

SECTION VIII
SERVICE

8-1. INTRODUCTION

8-2. This section provides instructions for testing, troubleshooting and repairing the HP Model 8443A Tracking Generator/Counter and the Model 8443B Tracking Generator.

8- 3. PRINCIPLES OF OPERATION

8-4. Information relative to the principles of operation appears on the foldout pages opposing the Block Diagrams, Service Sheet 1 for the Tracking Generator and Service Sheet 5 for the Counter Section (8443A). This correlation of data will enable the reader to quickly relate functions to specific circuits without having to look in different parts of the manual.

8-5. RECOMMENDED TEST EQUIPMENT

8-6. Test equipment and accessories required to maintain the Model 8443A/B are listed in Table 1-2. If the equipment listed is not available, equipment that meets the minimum specifications shown may be substituted.

8-7. TROUBLESHOOTING

8-8. Troubleshooting procedures are divided into two maintenance levels in this manual. The first, a troubleshooting tree, is designed to isolate the cause of a malfunction to a circuit or assembly.

8-9. The second maintenance level provides circiut analysis and test procedures to aid in isolating faults to a defective component. Circuit descriptions and test procedures for the second maintenance level are located on the page facing the schematic diagram of the circuit to be repaired.

8-10. After the cause of a malfunction has been found and remedied in any circuit containing adjustable components, the applicable procedure specified in Section V of this manual should be performed.

8-11. REPAIR

8-12. Module Exchange. For the benefit of those who do not wish to repair at the component level, a module exchange program has been initiated for the Model 8443A/B. These factory-repaired modules are available at a considerable savings in cost over the cost of a new module.

8-13. These exchange modules should be ordered from the nearest Hewlett-Packard Sales/Service
Office using the special part numbers in Table 6-1 of this manual.

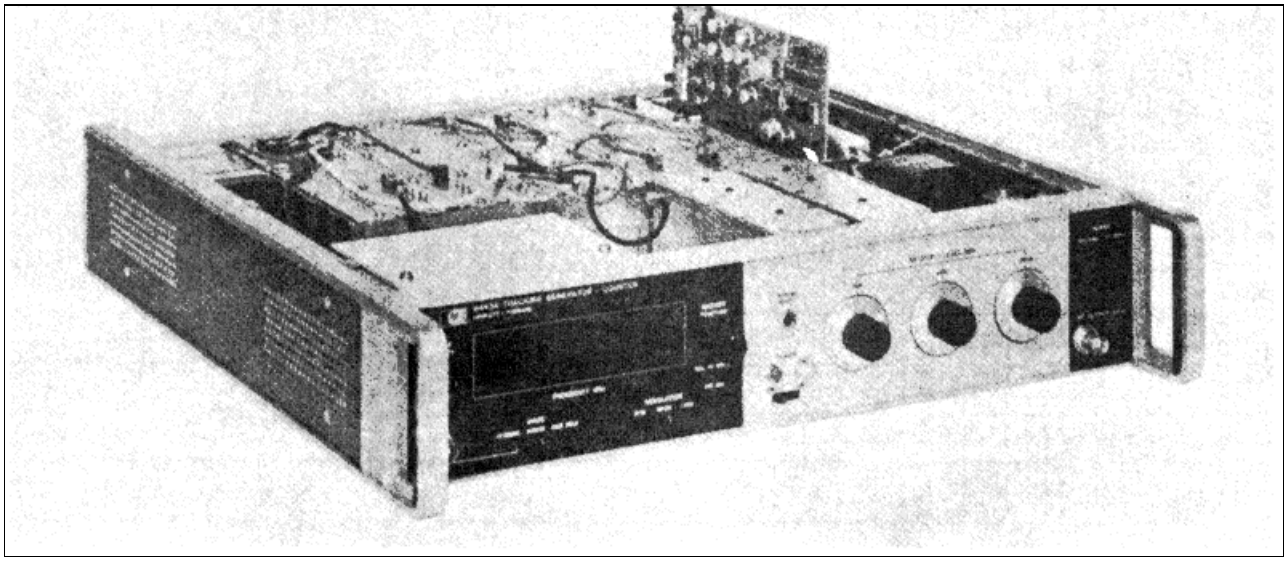


Figure 8-1. Model 8443A with Circuit Board Extended for Maintenance

Virtually all orders for replacements received by HP offices are shipped the same day received either from the local office or from a Service Center.

8-14. Line Voltage Requirements. During adjustment and testing the Model 8443A/B must be connected to a source of power capable of delivering 74 watts of power at 115 or 230 volts ac ±10%, single phase. If adjustment of the dc voltage regulators is required, the Model 8443A/B should be connected to the ac source through an adjustable auto-transformer. The line voltage to the Model 8443A/B may then be adjusted to check regulator action when the line voltage is changed ±10%.

8-15. Servicing Aids on Printed Circuit Boards. Servicing aids on printed circuit boards include test points, transistor designations, adjustment callouts and assembly stock numbers with alpha-numerical revision information.

8-16. Circuit Board Extenders. Circuit board extenders are provided with the Service Kit. These extenders enable the technician to extend the boards clear of the assembly to provide easy access to components and test points. See Figure 8-1 for a typical example of extender board use.

8-17. Part Location Aids. The locations of chassis mounted parts and major assemblies are shown in `Figure 8-18. The location of individual components mounted on printed circuit boards or other assemblies are shown on the appropriate schematic page or on the page opposite it. The part reference designator is the assembly designation plus the part designation. (Example: A10R1 is R1 on the A10 assembly.) For specific component description and ordering information refer to the parts list in Section VI.

8-18. Factory Selected Components. Some component values are selected at the time of final checkout at the factory. Usually these values are not extremely critical; they are selected to provide optimum compatibility with associated component. These components, which are identified on the schematics with an asterisk, are listed in Table 8-1. The recommended procedure for replacing a factory selected component is as follows:

a. Try the original value, then perform the test specified in Section V of this manual for the circuit being repaired.

b. If the specified test cannot be satisfactorily performed, try the typical value shown in the parts list and repeat the test.

Table 8-1. Factory Selected Components

Designation	Location	Purpose	Range of Values
R12	Front Panel	To center range of CTR ADJ	3.16 to 4.75K
A5R4	Time Base	Adjusts 1 MHz ref. output. Select for 2.8 Vp-p at J3 (terminated in 50 I)	5 to 20Q1
A6R22	HF Decade	Adjust gain	24.6 to 38.3
A6R24	HF Decade	Adjust dc level at input to	34.4 to 42.2 decade counter
A8R6	Video Amp	Unleveled output adjust	10,23.7, 38.3, 56.2, 75, 100, 121,167,196, 215,261, 287, 348, 383,422,511 (Resistor values given re-solve gain in 1 dB steps.)
A13R20	First Conv.	Center range of TRACKING ADJUST potentiometer	348 to 1.47K
A14R33	Sense Amp	20 volt adjust	110 to 1.2 K
A14R38	Sense Amp	6 volt adjust	1.47K to 2.61K
A14R43	Sense Amp	-12 volt adjust	1.33K to 1.96K
A15R11	Rectifier	+175 volt adjust	619 to 1.78K

Table 8-2. Schematic Diagram Notes

SCHEMATIC DIAGRAM NOTES

Resistance is in ohms, capacitance is in picofarads, and inductance is in mH unless otherwise noted.

P/O = part of.

*Asterisk denotes a factory-selected value. Value shown is typical. Capacitors may be omitted or resistors jumpered.

Screwdriver adjustment.

O Panel control.

Encloses front panel designations.

Encloses rear panel designation.

Circuit assembly borderline.

Other assembly border line.

Heavy line with arrows indicates path and direction of main signal.

Heavy dashed line with arrows indicates path and direction of main feedback.

Wiper moves toward CW with clockwise rotation of control as viewed from shaft or knob.

Numbers in stars on circuit assemblies show locations of test points.

Encloses wire color code. Code used (MIL-STD-681) is the same as the resistor color code. First number identifies the base color, second number the wider stripe, and the third number identifies the narrower stripe. E.G., (947) denotes white base, yellow wide stripe, violet narrow stripe.

Indicates an output from a schematic that goes to an input identified as  on Service Sheet 4.

Indicates an input to a schematic that comes from an output identified as  on Service Sheet 2.

c. If the test results are still not satisfactory, substitute various values within the tolerances specified in Table 8-1 until the desired result is obtained.

8-19. Diagram Notes. Table 8-2, Schematic Diagram Notes, provides information relative to symbols and values shown on schematic diagrams.

8-20. GENERAL SERVICE HINTS

8-21. The etched circuit boards used in Hewlett-Packard equipment are the plated-through type consisting of metallic conductors bonded to both sides of an insulating material. The metallic conductors are extended through the component holes by a plating process. Soldering can be performed on either side of the board with equally good results. Table 8-3 lists recommended tools and materials for use in repairing etched circuit boards. Following are recommendations and precautions pertinent to etched circuit repair work.

a. Avoid unnecessary component substitution; it can result in damage to the circuit board and/or adjacent components.

b. Do not use a high power soldering iron on etched circuit boards. Excessive heat may lift a conductor or damage the board.

c. Use a suction device (Table 8-3) or wooden toothpick to remove solder from component mounting holes.

CAUTION

Do not use a sharp metal object such as an awl or twist drill for this purpose. Sharp objects may damage the plated-through conductor.

d. After soldering, remove excess flux from the soldered areas and apply a protective coating to prevent contamination and corrosion.

8-22. Component Replacement. The following procedures are recommended when component replacement is necessary:

a. Remove defective component from board.

Table 8-3. Etched Circuit Soldering Equipment

Item	Use	Specification	Item Recommended
Soldering tool	Soldering Unsoldering	Wattage rating: 47-1/2 56-1/2 Tip Temp: 850 - 9000	-Ungar #776 handle with *Ungar #4037 Heating Unit
Soldering* Tip	Soldering Unsoldering	*Shape: pointed	*Ungar #PL111
De-soldering aid	To remove molten solder from connection	Suction device	Soldapullt by Edsyn Co., Arleta, California
Resin (flux) solvent	Remove excess flux from soldered area before application of protective coating	Must not dissolve etched circuit base board material or conductor bonding agent	Freon Acetone Lacquer Thinner Isopropyl Alcohol (100% dry)
Solder	Component replacement Circuit board repair Wiring	Resin (flux) core, high tin content (60/40 tin/lead), 18 gauge (SWG) preferred	
Protective Coating	Contamination, corrosion protection	Good electrical insulation, corrosion-prevention properties	Krylon R ** #1302 Humiseal Protective Coating, Type 1B12 by Columbia Technical Corp., Woodside 77, New York

*For working on etched Poards: for general purpose work, use Ungar #1237 Heating Unit (37.5W, tip temp of 750 B00) and Ungar ;;PL113 1/8 inch chisel tip
'*Krylon. Inc., Norristown, Pennsylvanla

b. If component was unsoldered, remove solder from mounting holes with a suction device (Table 8-3) or a wooden toothpick.

c. Shape leads of replacement component to match mounting hole spacing.

d. Insert component leads into mounting holes and position component as original was positioned. Do not force leads into mounting holes; sharp lead ends may damage the plated-through conductor.

Note

Although not recommended when both sides of the circuit board are accessible, axial lead components such as resistors and tubular capacitors, can be replaced without unsoldering. Clip leads near body of defective component, remove component and straighten leads left in board. Wrap leads of replacement component one turn around original leads. Solder wrapped connection and clip off excess lead.

8-23. BASIC SERVICE INFORMATION

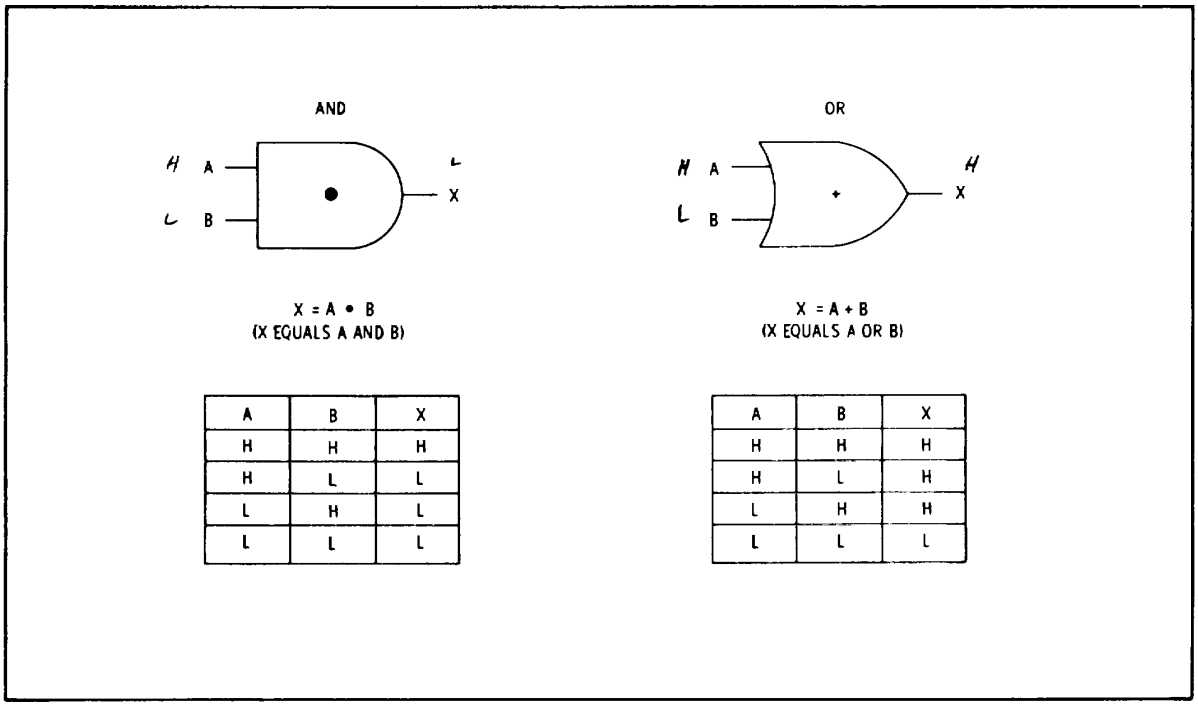
8-24. Since basic service information appears in the Spectrum Analyzer Service Manual, it will not be repeated here.

8-25. LOGIC CIRCUITS AND SYMBOLS

8-26. The following paragraphs and illustrations provide basic information about logic circuits and symbols. While a complete treatment of the subject is not within the scope of this manual, it is believed that this material will help the technician experienced with analog devices, who has had little or no experience with digital circuits.

8-27. The circuits discussed are digital in nature; their outputs are always in one of two possible states, a "1" or "0". These two states are also referred to as being either high (H) or low (L). The high and low states are relative; low must be less positive (more negative) than high, both states may be positive or negative, or high may be positive and low negative. In positive logic the more positive (H) state is a logical "1" and the more negative (L) state is a logical "0". In negative logic the more negative (L) state is a logical "1" and the more positive (H) state is a logical “0".

8-28. Two of the basic "building blocks" of logic circuits are the AND and OR gates. The symbols and truth tables for basic AND and OR gates are shown in Figure 8-2.



A	B	X
H	H	H
H	L	L
L	H	L
L	L	L

A	B	X
H	H	H
H	L	H
L	H	H
L	L	L

Figure 8-2. Basic AND and OR Gates.

Table 8-4. Logic Symbology

1 indicates true signal

0 indicates false signal.

o on symbol indicates logical inversion (not necessarily electrical) of the input or output signal(s). The logic indicated within the symbol remains the same.

→ indicates direction of signal flow.

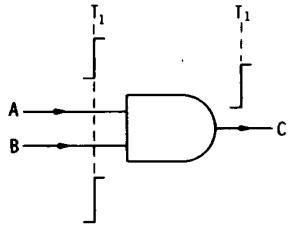
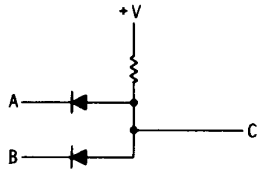
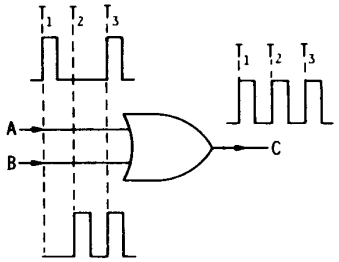
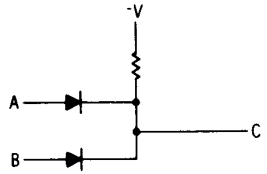
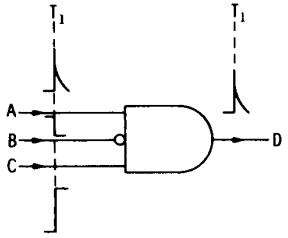
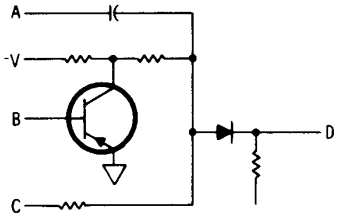
Designation	Logic Symbol	Description	Truth Table	Typical Circuit
AND Gate (Positive True)		Both input signals (A and B) must be true simultaneously to produce a true output at C.	A B C 0 0 0 0 1 0 1 0 0 1 1 1	
OR Gate (Positive True)		If either input signal (A or B) or both is true, the output at C is true.	A B C 0 0 0 0 1 1 1 0 1 1 1 1	
Multiple Input Gate (Positive True)		Any combinations of inputs may be used with an AND or OR Gate to obtain a desired output. In the AND gate shown, input B is inverted and inputs A and C are without inversion. Inputs A and C must both be true and input B must be false simultaneously to produce a true output at D.	A B C D 0 0 0 0 0 0 1 0 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 1 1 1 0 0 1 1 1 0	
Time Delay		Input signal delayed by the time indicated. True input at A produces a true output at B after a 15 ms delay.		RC and RL Coupling

Table 8-4. Logic Symbology (Cont.)

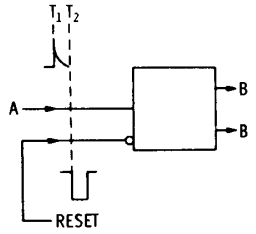
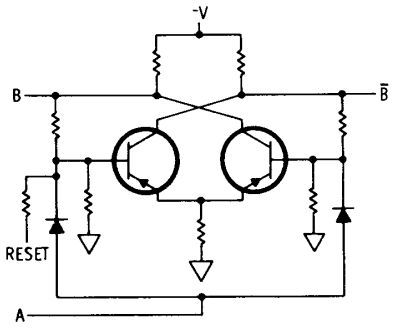
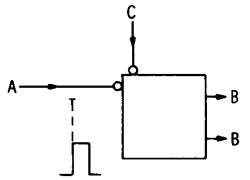
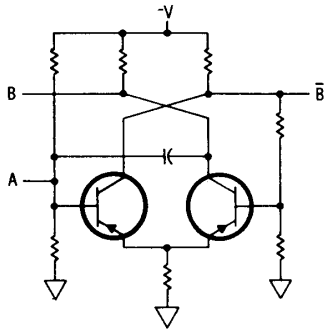
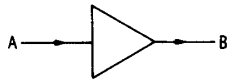
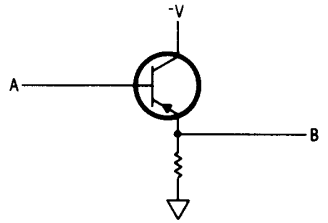
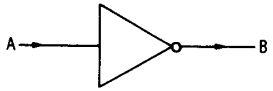
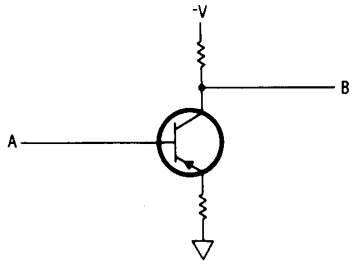
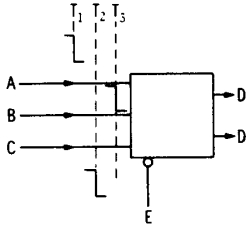
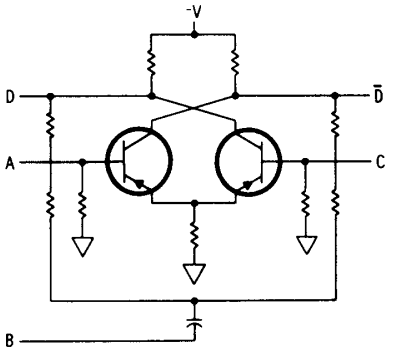
Designation	Logic Symbol	Description	Truth Table	Typical Circuit
Trigger		The binary is a flip-flop which changes state with every true input pulse at A. Since A is applied to the bases of both transistors, it is shown centered in the symbol. The negative pulse produces the same effect as a positive pulse applied to the opposite base. To preserve the positive logic, the reset pulse is shown inverted and applied to the opposite side. A reset pulse sets $\bar{B}$ true.		
One-Shot		True input at A sets the one-shot to unstable state (active) and produces a true output at B. In the symbol shown, the A input must be false (positive) with respect to negative true logic of the one-shot. During the stable state, the $\bar{B}$ output is true. A true input at C (direct set) holds the one-shot in the unstable state.		

Table 8-4. Logic Symbology (Cont.)

Designation	Logic Symbol	Description	Truth Table	Typical Circuit
Amplifier		True input at A produces amplified true output at B. An amplifier will function with either positive true or negative true signals.		
Inverter Amplifier		True input at A produces false output at B and fase input at A produces a true output at B (inverts the input logic level).		
Flip-Flop		Outputs $\overline{D}$ and D are always in opposite states — if D is true, $\overline{D}$ is false. A true input will cause the output directly across to go true — true input at A sets output D true. With no input, the flip-flop remains in the state set by the last input signal. A true input at B will cause the flip-flop to reverse state. A true input at the direct reset input E holds the flip-flop in the $\overline{D}$ true state.		

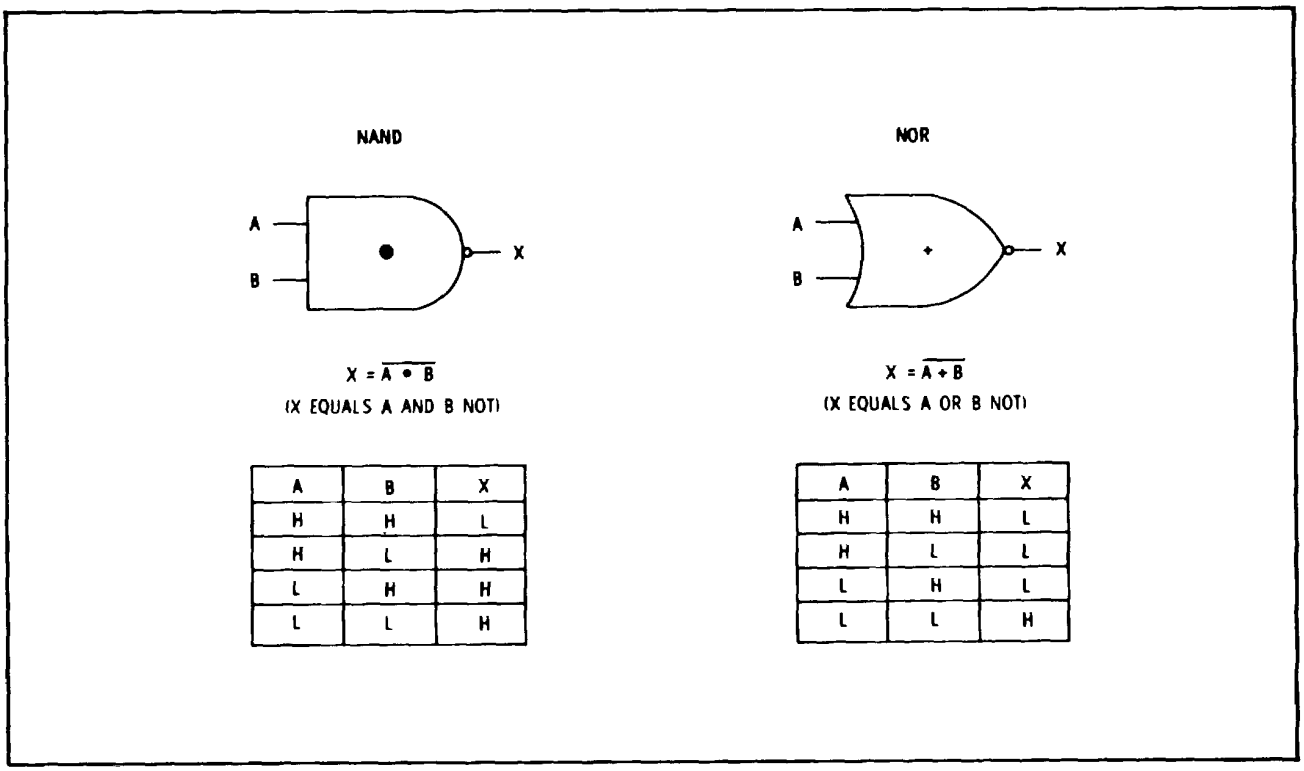
8-29. Basic AND Gate (Positive logic). The basic AND gate is a circuit which produces an output "1" when, and only when, a "1" is applied to all inputs. As shown in Figure 8-2, terminal X will be high only when terminals A and B are both high. The dot (•) shown in the AND gate is the logic term for AND. The term for a simple two input AND gate is X = A • B (X equals A and B). AND gates may be designed to have as many inputs as required to fill a specific requirement.

8-30. Basic OR Gate (Positive logic). The basic OR gate is a circuit which procedures a "1" output when any one, or all of the inputs are in a "1" state. As shown in Figure 8-2, terminal X will be high when either terminal A or terminal B, or both are high. The + shown in the OR gate symbol is the logic term for OR. The term for a simple two input OR gate is X = A + B (X equals A or B). OR gates may be designed to have as many inputs as required for specific needs.

8-31. The symbols for AND and OR gates differ in that AND gate symbols have a flat input side and a rounded output side while OR gate symbols have a concave input side and a pointed output side.

8-32. Truth Tables. Truth tables provide a means of presenting the output state of logic devices for any set of inputs in tabular form. Truth tables contain one column for each of the inputs and a column for the output. In basic truth tables the column notations are usually H or L (for high and low) or, for binary notation, "1" or "0". More complex truth tables use other terms which will be explained where these tables appear in the text.

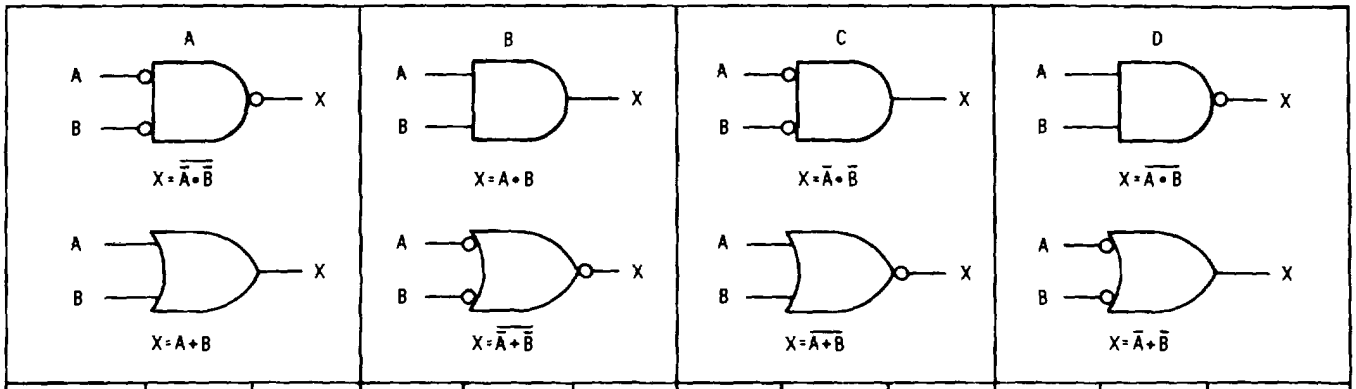
8-33. Logic Inversion. Adding inversion to AND and OR gates changes their characteristics. Inversion is usually accomplished by adding an inverter stage (common emitter) in front of an input or after an output. A circle added to the input or output leads indicates the portion of the circuit in which the inversion takes place. The simplest of these devices are AND and OR gates in which the output is inverted. These gates are called NAND (for Not AND) and NOR (for Not OR). Basic NAND and NOR gates are shown in Figure 8-3. When all inputs and outputs of an AND gate are inverted, it functions as an OR gate. When all inputs and outputs of an OR gate are inverted, it functions as an AND gate. Figure 8-4 provides information relative to various gate inversion functions.



A	B	X
H	H	L
H	L	H
L	H	H
L	L	H

A	B	X
H	H	L
H	L	L
L	H	L
L	L	H

Figure 8-3. Basic NAND and NOR Gates



A	B	X	A	B	X	A	B	X	A	B	X
H	H	H	H	H	H	H	H	L	H	H	L
H	L	H	H	L	L	H	L	L	H	L	H
L	H	H	L	H	L	L	H	L	L	H	H
L	L	L	L	L	L	L	L	H	L	L	H

Figure 8-4. Logic Comparison Diagrams

8-34. When inversion is used the designation at the inverted terminal is frequently termed A (not A), B (not B), X (not X), etc. Table 8-4 shows basic logic, circuits and associated symbology.

8-35. Binary Circuits. Many types of flip-flops are used in binary circuits. Each half of a flip-flop is in one of two states at any given time. The outputs are complementary; when one stage is on, the other is off. The outputs are termed 1 and 0, high and low, or true and false, by the same rules that apply to AND and OR gates. The outputs may be identified in many different ways. This text identifies these outputs as Q and $\overline{Q}$ for the sake of uniformity. Basic flip-flops which are particularly adaptable to binary circuits and combinations of flip-flops are discussed in the following paragraphs.

8-36. Basic NOR Gate Flip-Flop. Figure 8-5 illustrates a flip-flop constructed with two NOR gates. Operation of the circuit is described below. Assume that initially Q is high and Q is low, and A and B are both low. When a high is applied to input A, Q goes low and since there are now two lows applied to NOR gate 2, Q will go high. The Q high is applied back to NOR gate 1, but since Q is already low, no change in state results. When a high is applied to input B the flip-flop again reverses State. Since the flip-flop will remain in the last state to which it is set, it "remembers" which signal was last received, and can be used as a memory circuit.

8-37. Triggered Flip-Flop. Figure 8-6 illustrates a triggered flip-flop which changes state each time a pulse of a given polarity is applied to the input. The output of a triggered flip-flop is a square wave at one half the frequency of the input triggers. In the circuit shown in Figure 8-6 the input may be negative going triggers or a square wave. If the input is a square wave it will be differentiated by C2 to produce both negative going and positive going pulses. Assume that initially Q is low (Q2 on) and Q is high Q1 off).

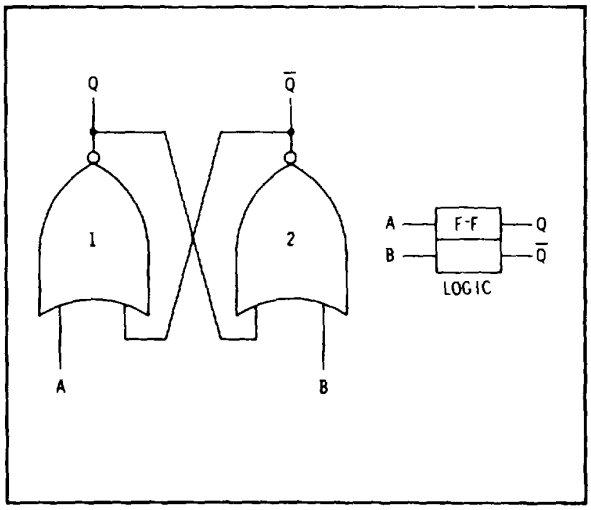


Figure 8-5. Basic NOR Gate Flip-Flop

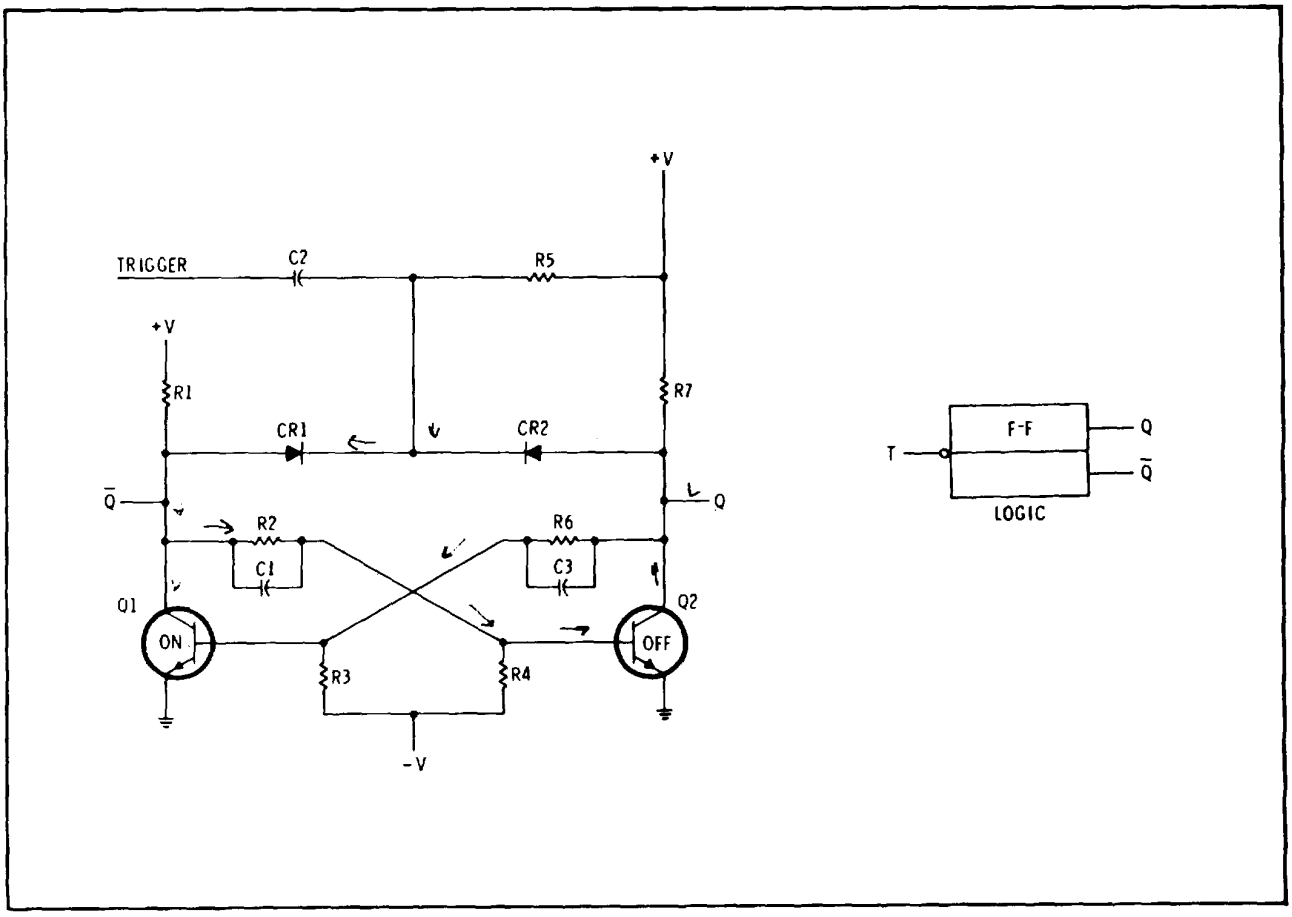


Figure 8-6. Triggered Flip-Flop

When a negative going trigger appears at the junction of CR1 and CR2 it has no effect on Q2 through CR2 because output Q is low. However, CR1 is forward biased by the high at Q and the trigger is coupled to the collector of Q1. As the collector of Q1 is driven in a negative direction the trigger is also coupled through C1 to the base of Q2. As Q2 begins to cut off, the positive going collector voltage is coupled to the base of Q1 through C3 to drive Q1 into conduction. The process is regenerative; Q2 cuts off quickly and Q1 goes into saturation. The next negative going trigger reverses the procedure just described.

8-38. Reset-Set (RS) Flip-Flop. Figure 8-7 shows an RS flip-flop. The RS flip-flop has two inputs, S for Set and R for Reset (sometimes labeled S for set and C for clear). Assume that initially Q is high (Q2 off) and $\overline{Q}$ is low (Q1 on). In this state the flip-flop is set and a positive pulse at the set input will not affect the circuit. When a positive pulse is applied to the reset input it is coupled through C4 and CR2 to the base of Q2. Q2 begins to conduct and the negative going collector voltage is coupled through C3 to the base of Q1 to cut off Q1. The process is regenerative; Q1 is quickly cut off and Q2 saturates. The flip-flop will remain in the reset state until a positive set pulse is applied through C2 and CR1 to the base of Q1. Note that operation of the RS flip-flop is the same as operation of the basic NOR gate flip-flop described in paragraph 8-36.

8-39. RST Flip-Flop. Figure 8-8 illustrates a RST flip-flop which is a combination of reset-set and triggered flip-flops. In the circuit shown, negative trigger pulses will make the flip-flop change states. Positive pulses are required for the set and reset inputs. A positive set input will cause Q. to go high and a positive reset pulse will cause Q to go high.

840. Clocked JK Flip-Flop. A clocked JK flip-flop is triggered by an input clock pulse when certain conditions prevail at the J and K inputs. Figure 8-9 illustrates the logic symbol for a JK flip-flop derived from a RS flip-flop and two three-input AND gates. Figure 8-10 shows a typical JK flip-flop integrated circuit schematic diagram. JK flip-flops have three inputs (J, K and Clock) and complementary outputs.

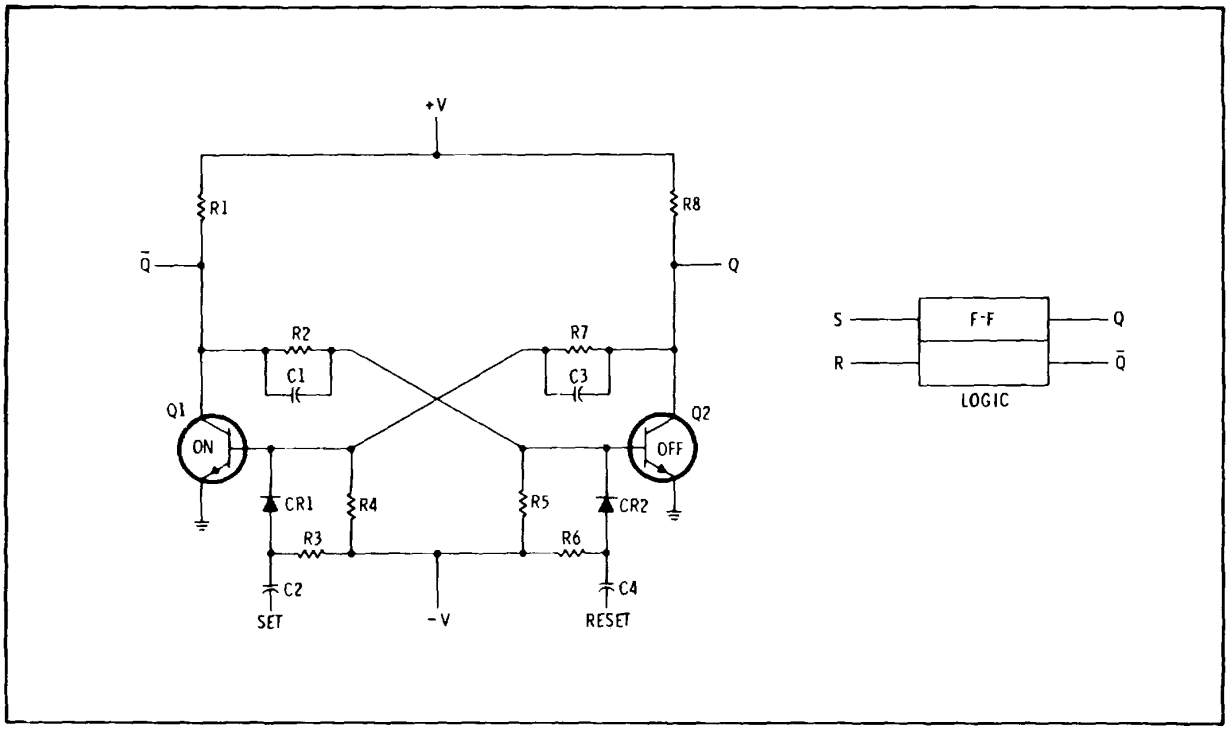


Figure 8-7. RS Flip-Flop

JK flip-flops used as decade counters also have clear or reset inputs, preset and in some cases, a blanking input. When the J and K inputs are both high the flip-flop changes state every time a clock pulse appears; operation is the same as a triggered flip-flop. When the J input is high and the K input is low $\overline{Q}$ will go high; operation is the same as the reset in RS flip-flops. When the J input is low and the K input is high Q will go high; operation is the same as the reset in RS flip-flops. When the J and K inputs are both low clock pulses do not affect the circuit. Frequently JK flip-flops are shown schematically with no connection shown to the J and K inputs; when this occurs, both J and K are actually held high and the circuit functions as a triggered flip-flop.

8-41. Binary Logic. The following paragraphs will explain the basic binary logic required to understand the operation of the dividers and decade counters used in a frequency counter.

8-42. In frequency counters the decimal numbers 0 through 9 are displayed on each readout device. For this reason, only binary numbers 0000 through 1001, which correspond to decimal numbers 0 through 9 will be discussed in this text. The only exception to this is the discussion of Figure 8-11 which follows.

8-43. Figure 8-11 illustrates four triggered flip-flops in series, with the Q outputs of the first three driving the trigger inputs of the next flip-flop. Since each flip-flop is triggered only by negative going excursions of the input signal, each provides one cycle of output signal for two cycles of input signal The flip-flops, then are weighted in ascending powers of two. The first flip-flop has a weighted value of 2^0 (1), the second has a weighted value of 2^1 (2), the third has a weighted value of 2^2 (2 x 2 = 4) and the fourth has a weighted value of 2^3 (2 x 2 x 2 = 8).

8-44. Assume that initially the flip-flops in Figure 8-11 were all set to 0 (Q low). When seven input cycles have been received the flip-flops have operated as follows; the first has been turned on (Q high) by inputs 1, 3, 5 and 7, and turned off (Q low) by inputs 2, 4 and 6. The second flip-flop has been turned on by the first and third outputs of the first flip-flop (coincident with initial inputs 2 and 6) and turned off by the second output of the first flip-flop (coincident with initial input 4). The third flip-flop has been turned on by the first negative going output of the second flip-flop (coincident with initial input 4). The fourth flip-flop has not been triggered because there has been no negative going output from flip-flop three. The first three flip-flops are now in the 1 state (Q high) and the binary state is 1110.

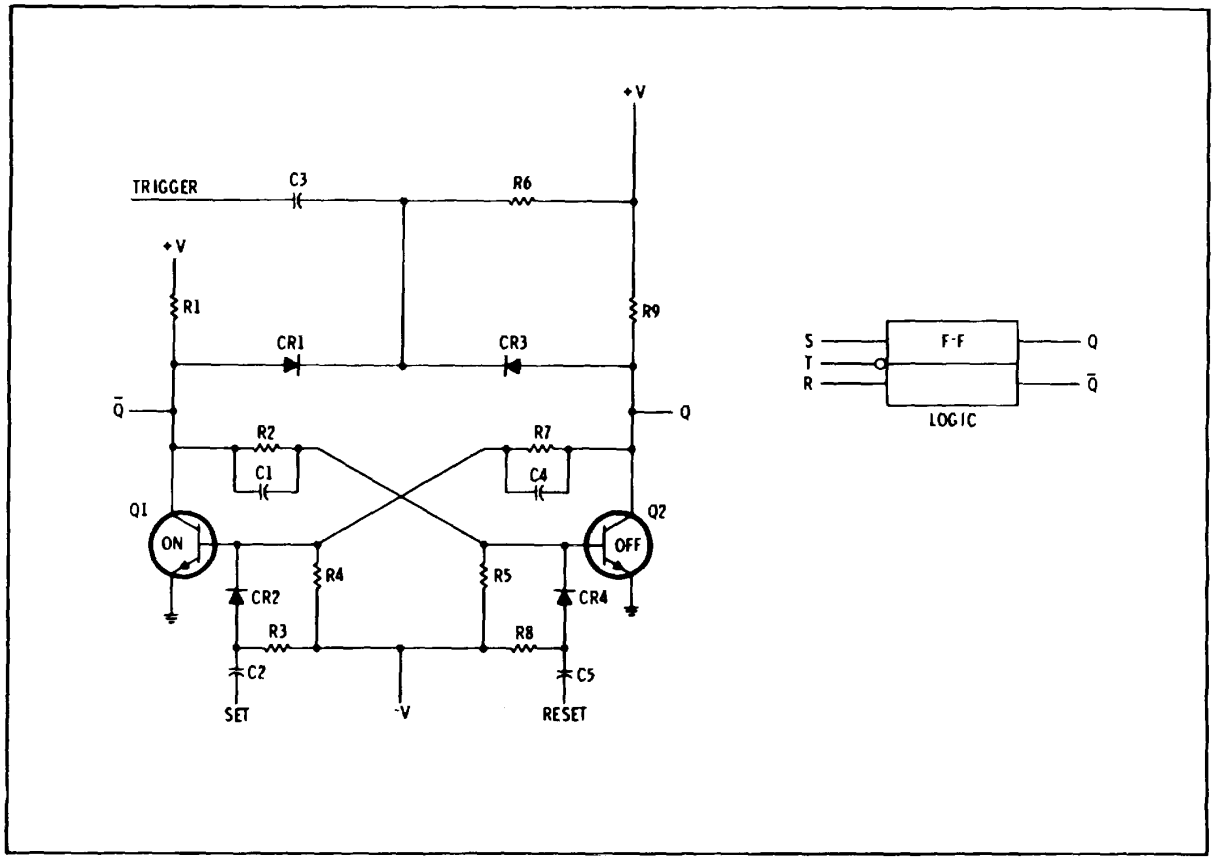


Figure 8-8. RST Flip-Flop

Their decimal weighted value then is $2^0 + 2^1 + 2^2 = 1 + 2 + 4 = 7$. The next negative input to the chain will cause the first three flip-flops to go off and the fourth to go on. The binary state then is 0001; the decimal weighted value is $0 + 0 + 0 + 2^3 = 0 + 0 + 0 + 8 = 8$.

8-45. As the timing diagram in Figure 8-11 indicates, four flip-flops in this configuration are capable of counting up to 16. Since only the decimal digits 0 through 9 are used in counter circuits, a means must be provided to limit the count to ten. A means must also be provided to reset the flip-flops to zero before beginning a new count. The means by which these facilities are provided are discussed in later paragraphs.

8-46. Since binary numbers, like decimal numbers, are written in ascending order from right to left, the weighted values of the flip-flops are easier to understand in 8, 4, 2, 1 order. Table 8-6 lists the true binary numbers for 8, 4, 2, 1 binary weights and their decimal equivalents.

8-47. A Simple 8421 BCD Code Decade Counter. Figure 8-12 illustrates a simplified decade counter using triggered RS flip-flops. This circuit operates like the circuit shown in Figure 8-11 up through decimal count 9 (binary 1001).

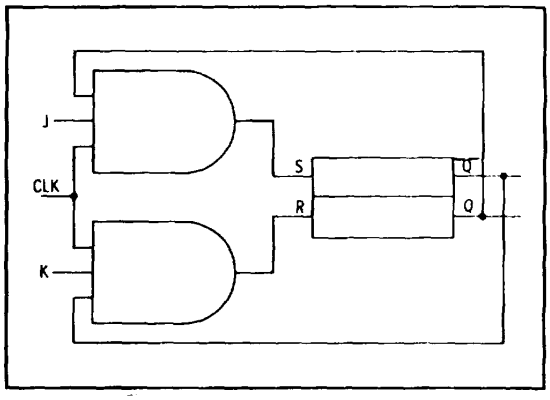


Figure 8-9. Clocked JK Flip-Flop

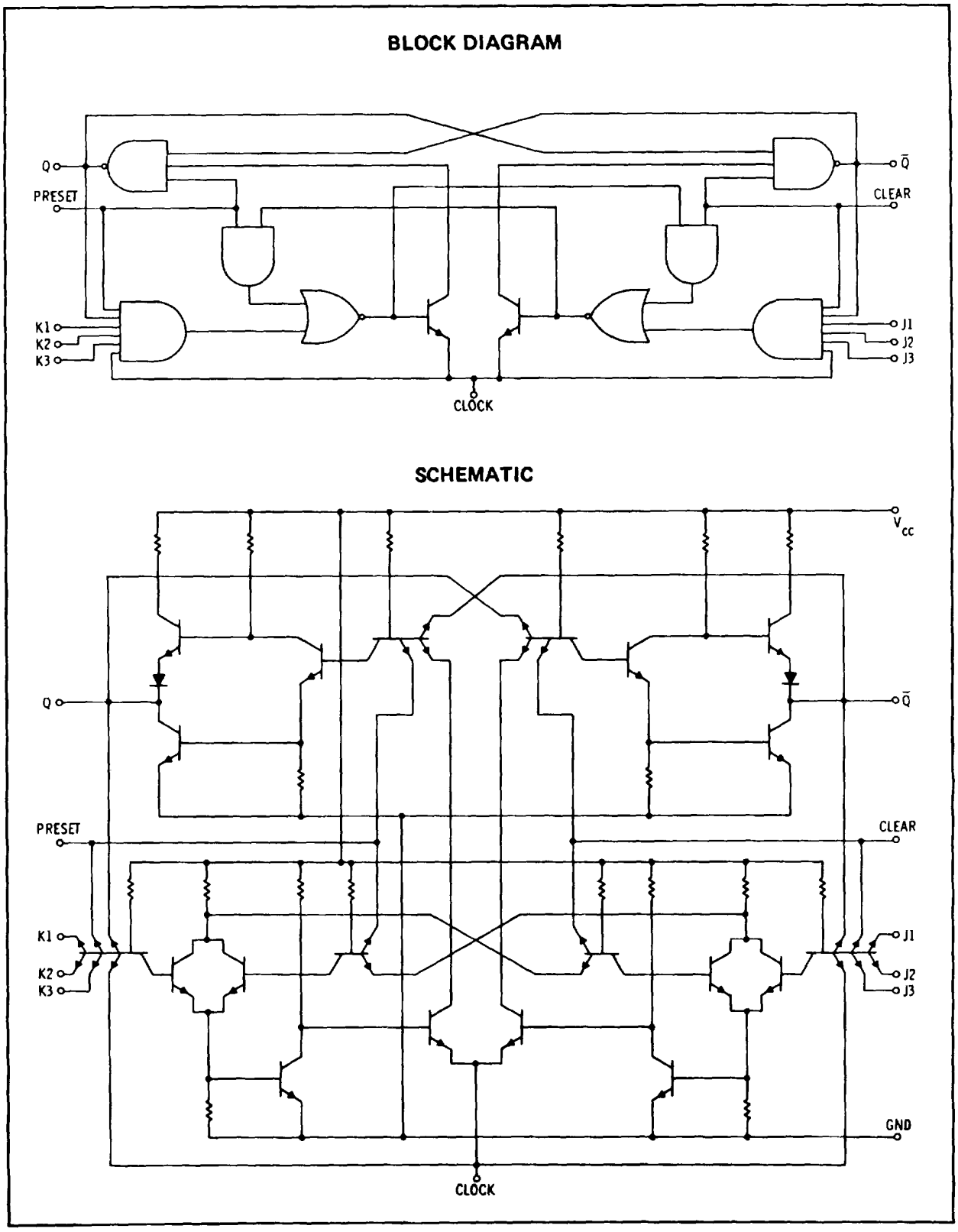


Figure 8-10. JK Master-Slave flip-flop (Typical)

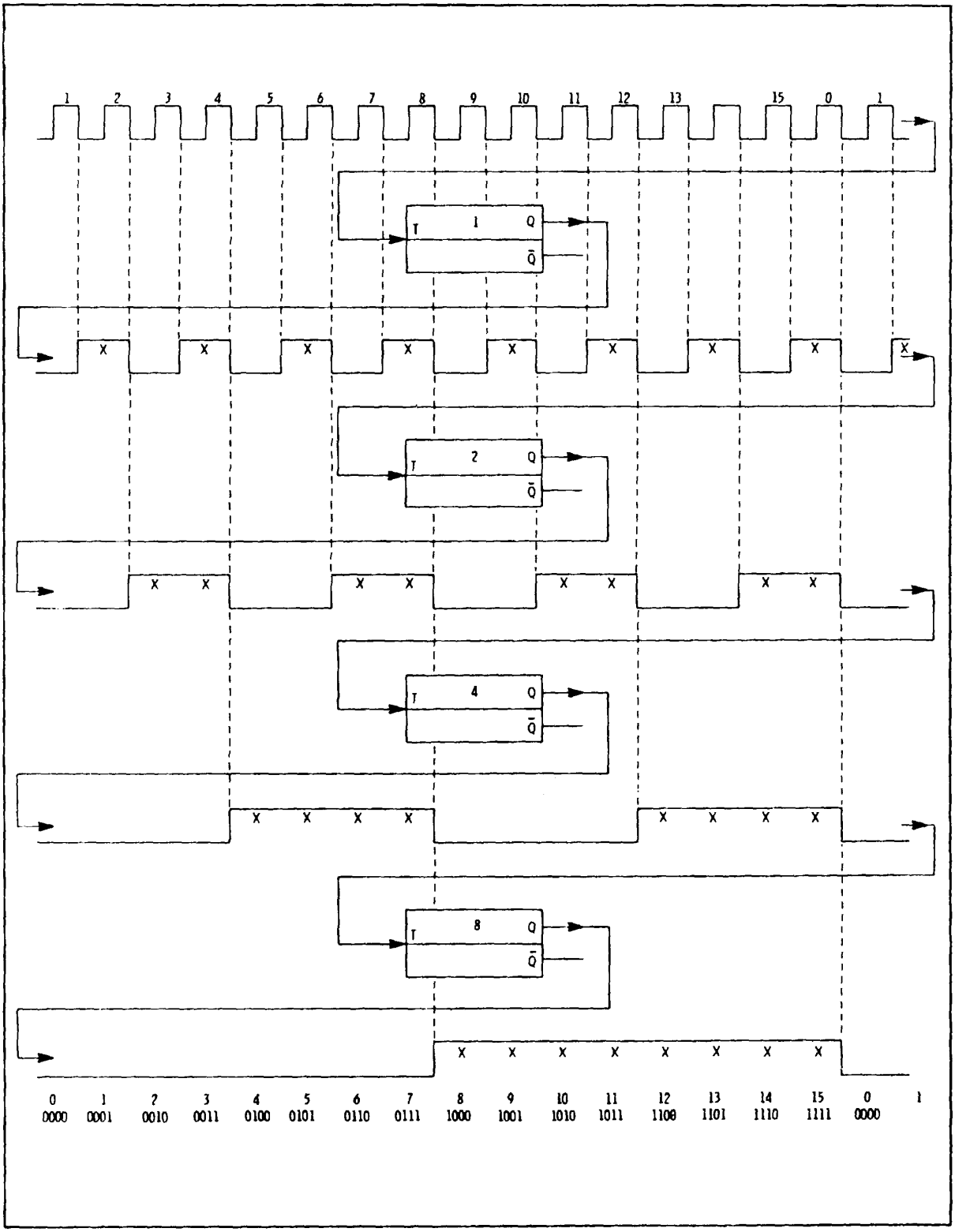


Figure 8-11. 16 Counter Binary Counter Chain

Table 8-5. JK Flip-Flop Truth Table

		Before Trigger		After Trigger	
J	K	Q	$\overline{Q}$	Q	$\overline{Q}$
0	0	1	0	1	0
0	1	1	0	0	1
1	0	0	1	1	0
1	1	0	1	1	0

Table 8-6. 16 Count Binary Truth Table

Binary				Decimal
$8 - 2^3$	$4 = 2^2$	$2 = 2^1$	$1 = 2^0$	
0	O	0	1	1
0	0	1	0	2
0	0	1	1	3
0	1	0	0	4
0	1	0	1	5
0	1	1	0	6
0	1	1	1	7
1	0	0	0	8
1	0	0	1	9
1	0	1	0	10
1	0	1	1	11
1	1	0	0	12
1	1	0	1	13
1	1	1	0	14
1	1	1	1	15
0	0	0	0	0

When the tenth pulse is received at the input flip-flop point A goes low, flip-flop point B goes high and the flip-flops are temporarily in the 1010 state. Almost immediately the output from B causes D to reset and the output from D then causes B to reset. The end result is that all flip-flops are reset to 0 by the tenth pulse and are ready to begin the next count. This circuit is useful as a divide by ten decade. To be used as a frequency counter a reset must be provided to reset all flip-flops to zero when the count ends at a number other than ten.

8-48. Blanking Decade Counter. Figure 8-13 illustrates a blanking decade counter. The circuit will divide by ten and provide BCD (binary coded decimal) outputs for decimal numbers 0 through 9. In addition, the A, B, C and D outputs may be set to 1111 (15) to cause the numerical readout device to be blanked.

8-49. The output of the blanking control NAND gate is normally high. When the JK flip-flops are reset their $\overline{Q}$ outputs go high. After reset and before the frequency count begins the outputs of the A, D, B and C NAND gates are normally low because both inputs are high. Now if the blanking control input goes high and $\overline{Q}$ of the first flip-flop is high, the blanking control NAND gate output goes low and the outputs of the A, D, B and C NAND gates go high. In actual use, inverter: follow the A, D, B and C NAND gates to provide a negative logic BCD output of 1111 (decimal 15) to the decoders which have no gate to accept 1111, so none of the elements in the numerical readout devices are energized.

8-50. Buffer-Store. In frequency counters it is necessary to transfer the information stored in the decade counters to display decoders prior to starting the next count. Isolation must also be provide to prevent

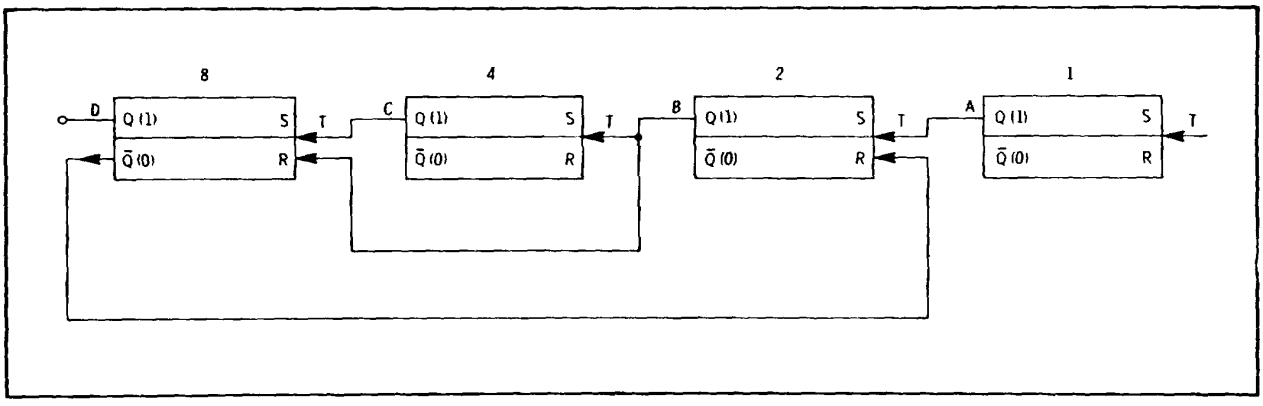


Figure 8-12. 8421 BCD Decade Counter

the display from being affected by a count while it is in progress. Figure 8-14 shows a typical buffer-store circuit.

8-51. The terminals labeled A, B, C and D at the bottom of Figure 8-14 are connected to the outputs of the decade counters. Operation of the buffer-store is described below. Normally the input labeled TRANSFER is high, the inverter output is low and all of the AND gates between the BCD inputs and the RS flip-flops are disabled. When the transfer pulse appears one of the two AND gates between the inputs and the RS flip-flops goes high. Assume that when the transfer pulse appears the A input is low. The output of the reset AND gate of the first RS flip-flop goes high, the input to the A inverter goes high and the inverter output goes low. If the A, B, C and D outputs are to be used, the GATE input must be high in order for the output NAND gates to function. With the A input low the input to the A NAND gate from the RS flip-flop will be low and the NAND gate output will be high. When the A input is high the set AND gate output is high, both inputs to the A NAND gate are high and the A output is low. At the same time the input to the A inverter is low, so A is high. Operation of the B, C and D circuits is identical to the A circuit. Typically the A, B, C and D outputs are used to drive decoders and the A, B, C and D outputs are used to drive recorders, Digital to Analog converters, etc.

8-52. Decoder-Driver. Decoder-drivers provide a means to "translate" the BCD binary code to a decimal equivalent to drive numerical readout devices. Figure 8-15 shows ten four-input AND gates connected as a decoder. Each AND gate will respond to one, and only one, of the binary equivalents of decimal numbers 0 through 9. Example: the number 1 gate will provide a high output only when A is low and B, C and D are high.

8-53. Integrated Circuits. Many circuits used in counters and other equipment are available as integrated circuits. The last three circuits discussed are all available as integrated circuits. Figure 8-16 shows some of the packages used for integrated circuits.

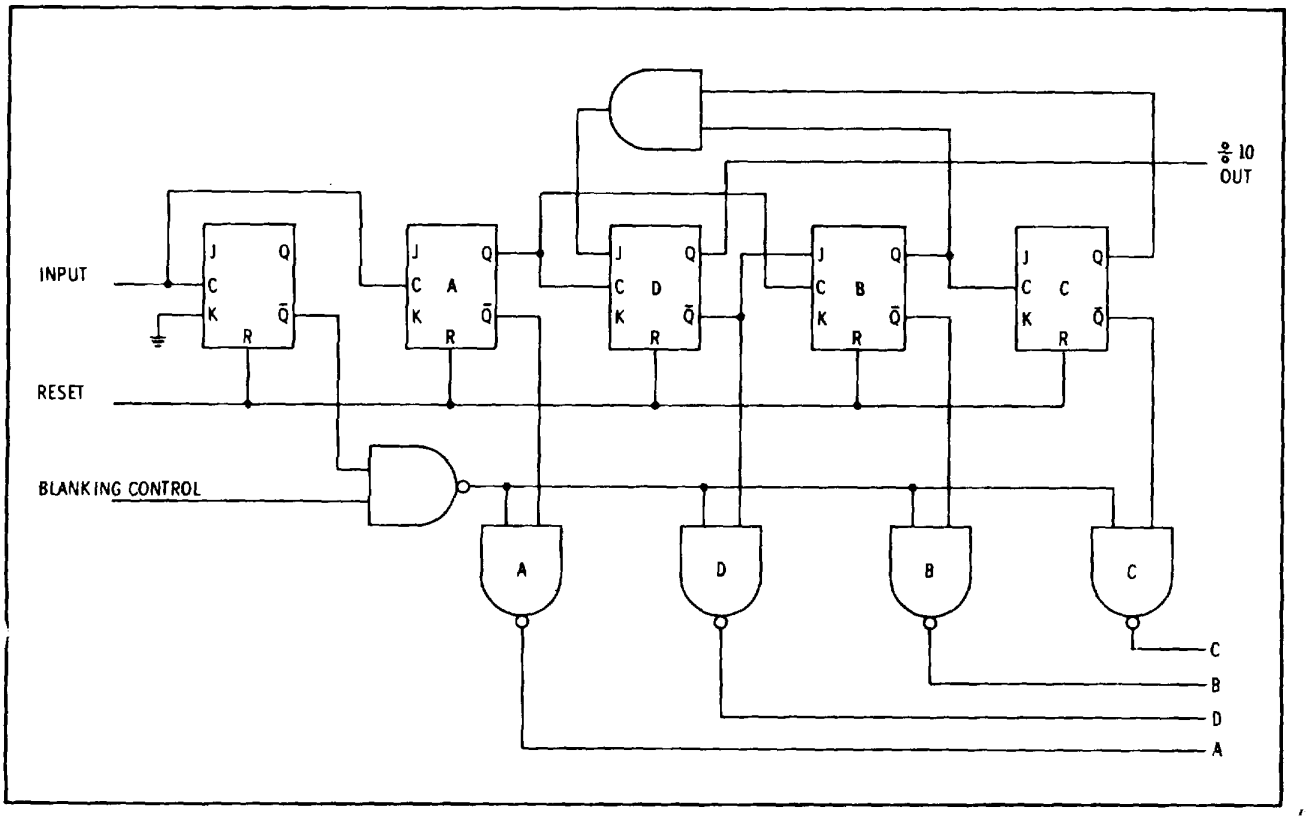


Figure 8-13. Blanking Decade Counter

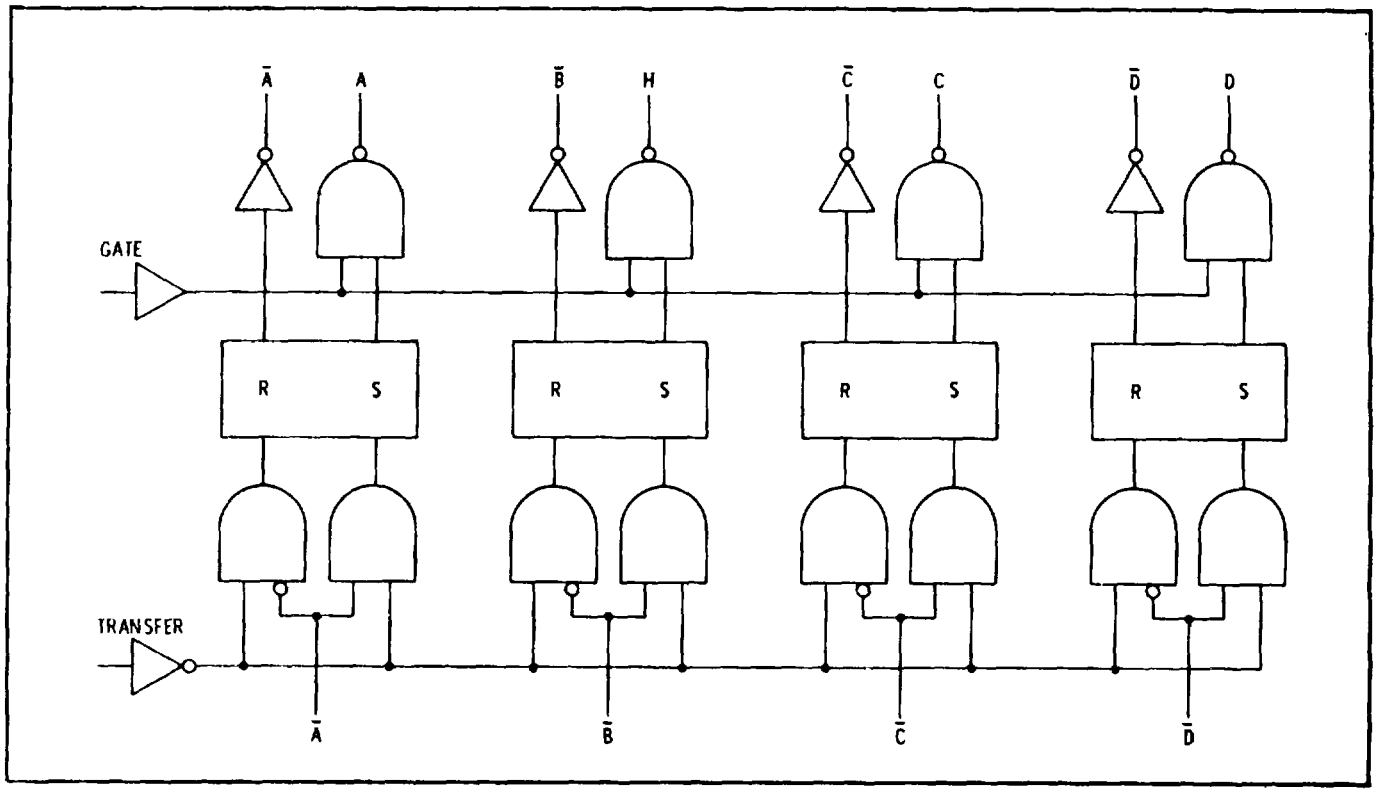


Figure 8-14. Buffer/Store

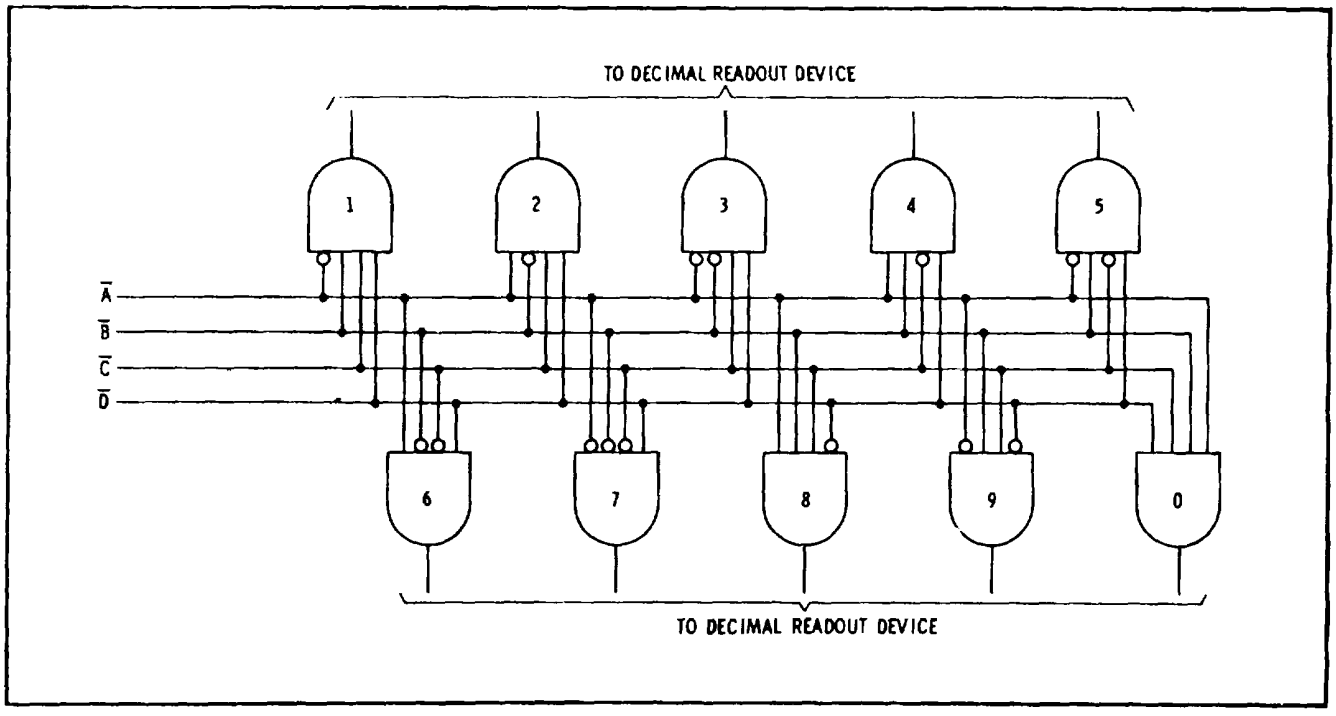
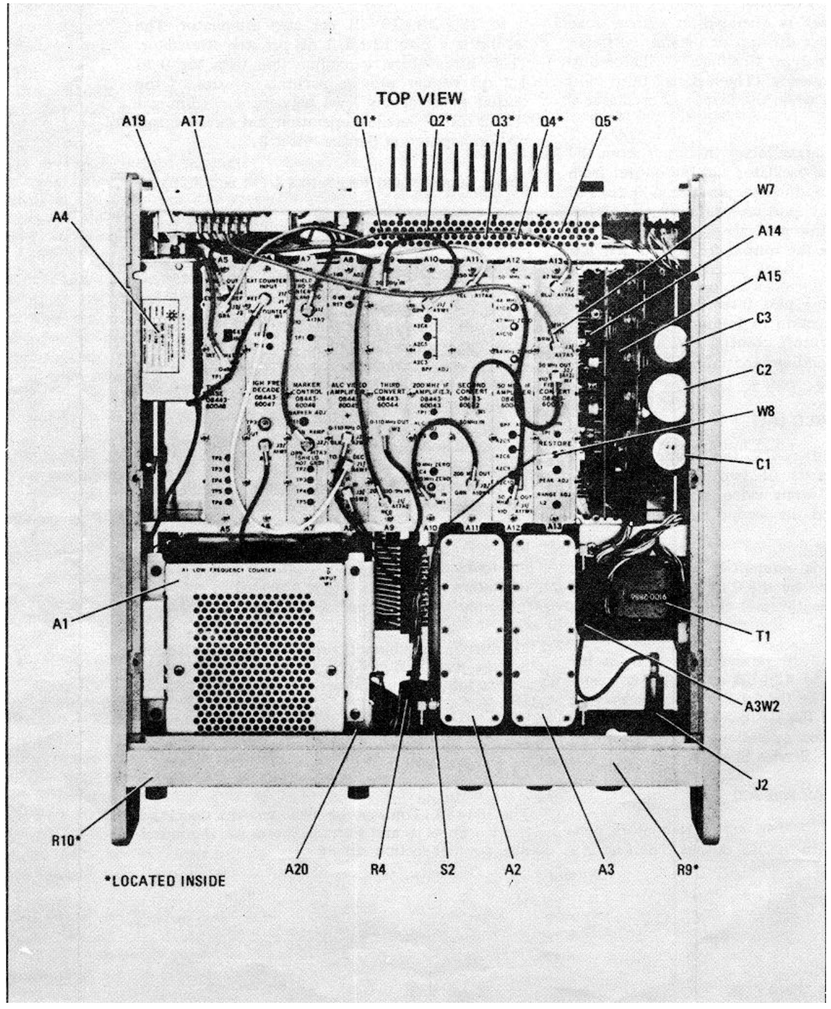


Figure 8-15. Decoder



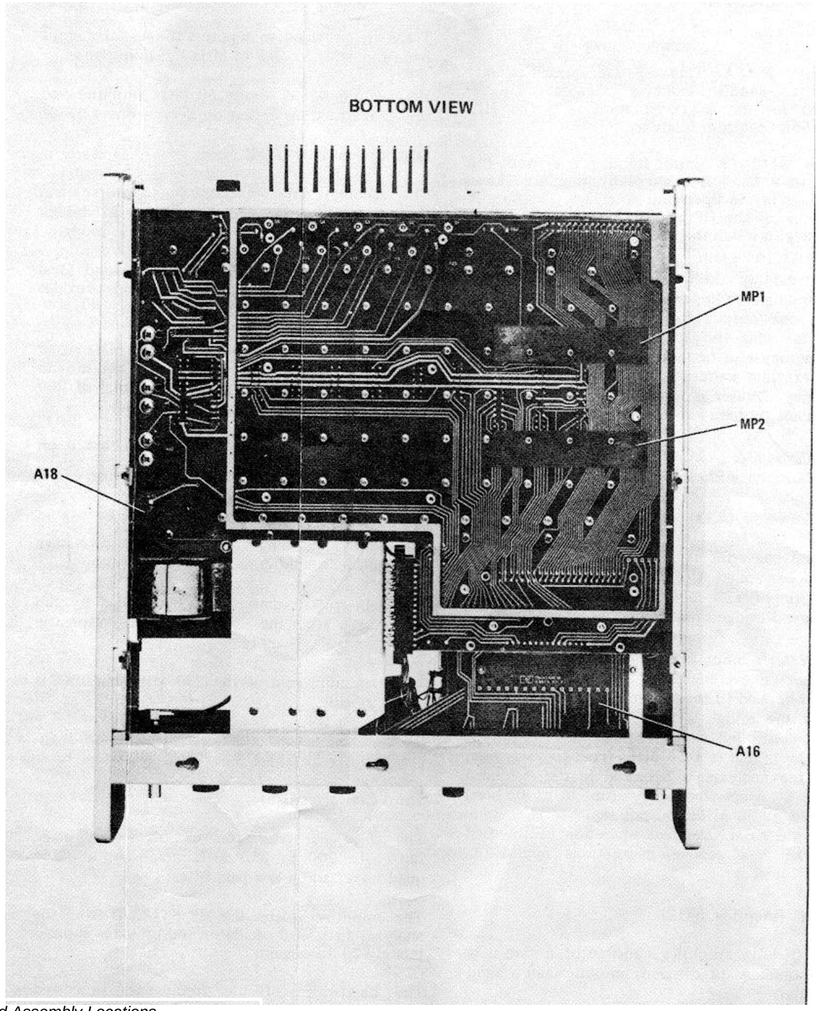


Figure 8-18. Chassis Mounted Parts and Assembly Locations

SERVICE SHEET 1

General

The HP 8443A Tracking Generator/Counter and the 8443B Tracking Generator were designed for use in conjunction with the HP 8553/8552 Spectrum Analyzer.

The HP 8443A/B output frequency is swept (or tuned to a fixed frequency) by the three local oscillators in the Spectrum Analyzer. The output frequency of the HP 8443A/B always tracks the frequency to which the analyzer is tuned.

The HP 8443A counter section provides a means of stopping the Spectrum Analyzer scan and counts the output frequency of the Tracking Generator while the analyzer scan is stopped. The counter may also be used to count the frequency of an external source. BCD information from the frequency counter is available at the rear of the instrument to drive external equipment.

The HP 8443A Counter Section is described in detail on Service Sheet 5.

First Converter (A13)

The first converter assembly consists of a 3 MHz crystal controlled Colpitts oscillator, a 3 MHz buffer amplifier, a 47 MHz buffer amplifier and a diode quad bridge mixer.

The 47 MHz input from the analyzer third local oscillator (approximately -7 dBm) is amplified 14 dB and applied to the bridge mixer. The other input to the bridge is the 3 MHz output of the crystal controlled Colpitts oscillator. The output from the bridge is a 50 MHz fixed frequency or, when the analyzer is operated in the stabilized mode, a swept frequency (up to 200 kHz) centered at 50 MHz. Output signal level is nominally -26 dBm. Detailed operation of the first converter and service instructions appear on Service Sheet 2.

50 MHz Amplifier (A12)

The 50 MHz amplifier consists of a two-stage (approximately 11 dB gain) amplifier and a bandpass filter.

The bandwidth of the bandpass filter at the 3 dB points is approximately 4 MHz. Traps are provided to suppress the 47 MHz input from the analyzer and 44 MHz image response.

Detailed operation of the 50 MHz amplifier and service instructions appear on Service Sheet 2.

Second Converter (A11)

The second converter assembly consists of a three-stage amplifier and a diode quad bridge mixer.

The amplifier isolates the analyzer second local oscillator from the HP 8443A/B and provides approximately 20 dB of gain.

The diode quad bridge mixes the 150 MHz signal from the analyzer with the signal from the 50 MHz IF to produce an output IF signal of 200 MHz. The output level is about -38 dBm.

Detailed operation and service information is on Service Sheet 2.

200 MHz Amplifier (A10)

The 200 MHz amplifier contains a two-stage variable-gain amplifier and a bandpass filter.

The gain of the amplifier is controlled by the ALC signal from the Video Amplifier/Automatic Level Control Assembly.

The maximum gain of the 200 MHz amplifier is about 20 dB.

Detailed operation and service information appears on Service Sheet 3.

Third Converter (A9)

The third converter consists of a three-stage fixed-gain 200 to 310 MHz amplifier, a diode quad mixer and a low pass filter.

The amplifier isolates the HP 8443A/B from the analyzer first local oscillator and provides approximately 20 dB of gain.

The bandwidth of the frequencies processed through the amplifier is determined by the position of the SCAN WIDTH switch on the Spectrum Analyzer RF section.

SERVICE SHEET 1 (cont'd)

When the analyzer is operated in narrow scan widths (20 kHz per division or less) in the stabilized mode, the analyzer first local oscillator output is a fixed frequency. (The analyzer third local oscillator is swept when the first local oscillator is not.)

The diode quad mixer mixes the input from the analyzer first local oscillator and the output from the 200 MHz amplifier to produce a 0 to 110 MHz signal or any portion of this range of frequencies. When the analyzer is operated in the ZERO) scan mode the output from the mixer is a fixed frequency.

The 120 MHz low pass filter provides approximately 75 dB rejection to frequencies above 200 MHz. The 3 dB cutoff point is at 120 MHz. Detailed operation and service information appears on Service Sheet 3.

Video Amplifier/ALC (A8)

The Video Amplifier/ALC (automatic level control) circuit consists of two amplifiers and a comparator. The input video amplifier provides 32 dB of gain and the second amplifier provides 20 dB of gain.

The comparator is referenced to a fixed level which is controlled by the 0 to 1.2 dB vernier to provide the automatic level control signal to the 200 MHz amplifier.

When the 0 to 1.2 dB vernier is set to 0 the RF output to the 0 to 120 dB attenuator is a constant +10 dBm. The 0 to 1.2 dB vernier may be used to attenuate the RF output linearly from 0 to 1.2 dB. Detailed operation and service information appears on Service Sheet 3.

RF Attenuators (A2 and A3)

There are two precision step attenuators connected in series with the RF output. The first is a 0 to 120 dB, 10 dB per step attenuator. The second is a 0 to 12 dB, 1 dB per step attenuator. These attenuators, in conjunction with the 0 to 1.2 dB vernier provide accurate control of the output signal at any level between +10 dBm and -123.2 dBm. Detailed operation and service information appears on Service Sheet 3.

Power Supplies and Regulators (A14 and A15)

All dc power supplies use a common power transformer and all are referenced to the +24 volt supply.

When the instrument is in the standby mode the +24 volt supply functions to maintain crystal oven temperature and avoid long warmup periods when the instrument is placed in service. In the standby mode all other power supplies are disabled.

The regulated power supplies provide +170, +24, +20, +6 and -12 volts. A zener circuit in the high frequency decade (A5) reduces the -12 volt level to -6 volts for use in counter circuits.

Silicon controlled rectifier "crowbar" protection is provided for the +24, +20, +6 and -12 volt regulators. A reset feature is provided to reset the "crowbar" should it be tripped by a transient.

Current limiting circuits provide further protection for the 8443A/B circuits. Detailed operation and service information appears on Service Sheet 4.

Counter Circuits

The 8443A counter circuits are discussed on Service Sheet 5 and Service Sheets for the individual counter section circuits.

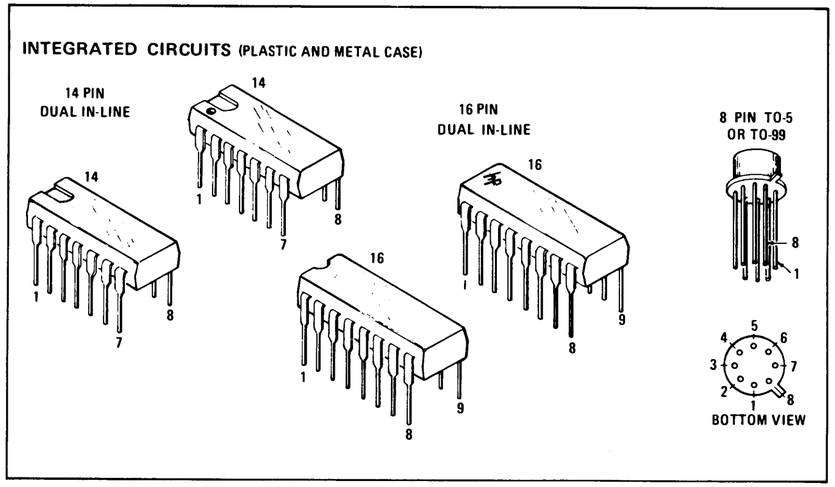
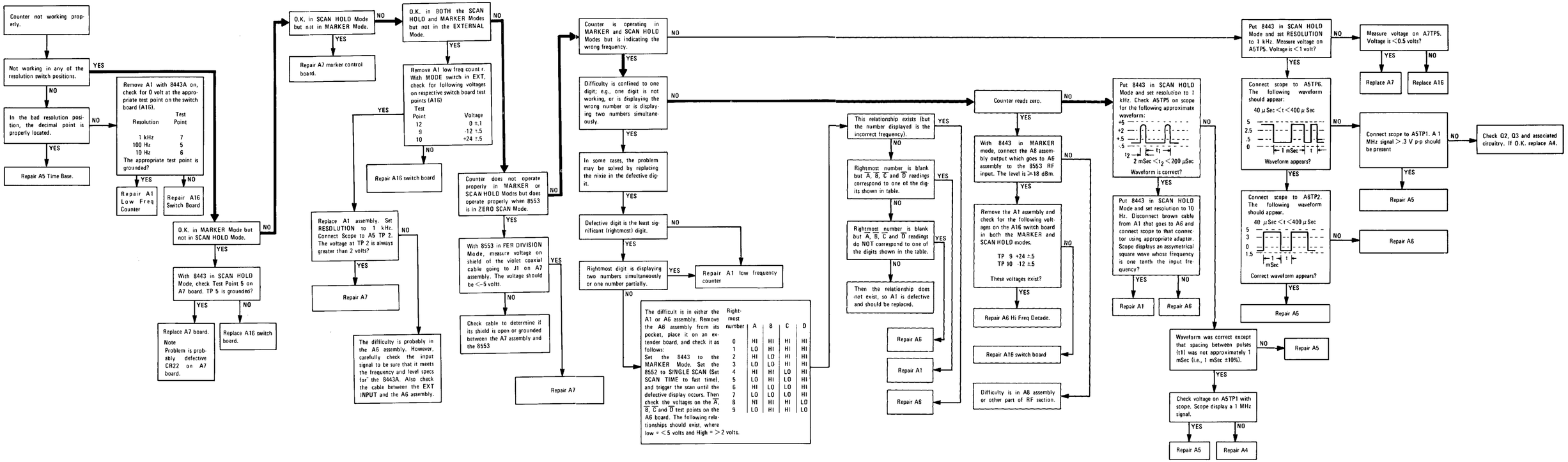


Figure 8-16. Integrated Circuit Packing



8443A COUNTER TROUBLESHOOTING TREE

Figure 8-17. Troubleshooting Tree (Sheet 1 of 2)

START

1. Controls not mentioned in the following tests need not be adjusted. They are properly set from the previous test, or do not affect the test being made.
2. All tests are based on the model 8443A/B being interconnected with an analyzer which is known to be operating properly.
3. It is assumed in RF section tests that the RF output is missing or that the level and/or flatness is not as specified.
4. Since the model 8443A/B RF output level is largely determined by the ALC assembly, a deviation of ±2 dB or so from that illustrated is permissible in individual tests. However, the minimum signal levels specified in each test must be met.
5. In several of the analyzer CRT displays a signal other than that shown may be observed. Usually these signals may be ignored; they are mixing products which are filtered out in later stages.
6. If the RF output is as specified and the counter section is not operating properly, or if the scan hold function is not operating properly, proceed to the "COUNTER SECTION TROUBLESHOOTING TREE."

Connect the model 8443A/B to the ac line with the POWER switch in the STBY position. The blue STBY light illuminates.

NO

Place the POWER switch in the ON position. White ON light illuminates.

NO

STBY lamp or wiring or POWER switch is defective.

YES

Activate RESET switch on A14 lights illuminate.

NO

Repair as required.

NO

Check POWER switch and wiring. OK

YES

Check the line fuse. Fuse is OK.

YES

NO

Replace line fuse. New fuse burns out.

NO

YES

Remove the connector from the top of the A15 rectifier assembly and install a new line fuse. Line fuse again burns out.

NO

Check C1, C2, and C3 on the mother board for shorts. If they are good trouble is in the A15 assembly. Order a replacement assembly or refer to Service Sheet 4 and make necessary repairs.

YES

The power transformer or line voltage switch or wiring are probably defective.

YES

Place the POWER switch in the ON position. White ON light illuminates.

NO

Refer to Service Sheet 10 and check the ON lamp, the POWER switch and interconnecting wiring. Repair as required.

YES

Check the +6, +24, +20 and -12 volt test points on the A14 assembly and the +175 volt test point on the mother board. Refer to paragraph 5-13 for tolerances. A11 voltages are present.

YES

NO

Refer to Service Sheet 4 and check for shorts between the A14 test points and ground. Next check the series regulators by removing both A14 and A15 and checking the base to emitter resistance from the pins shown on Service Sheet 4. The +175 volt series regulator should have a b-e resistance (forward biased) of approximately 600 ohms. The other series regulators should have a b-e resistance of about 550 ohms. If there are no shorts and the series regulators check good, repair or replace the A14 assembly.

YES

Refer to Service Sheet 4 and check the voltages at the A15 fuse test points. Voltages are present at the fuse test points.

NO

First check the fuses on the A15 assembly. Then check the transformer secondaries; replace T1 if necessary. If correct ac voltages are present at the transformer secondaries replace the A15 assembly or refer to Service Sheet 4 and make the necessary repairs.

Set the analyzer controls as follows:
POWER . . . . . ON
SCAN WIDTH
P/D . . . . . 10 MHz
BANDWIDTH . 300 kHz
SCAN TIME
P/D . . . . . 2 mSec
SCAN WIDTH
. . . . . PER DIVISION
INPUT
ATTENUATION 10 dB
LOG REF
LEVEL . . . . . 0 dBm
LOG/LINEAR . . LOG
FREQUENCY 50 MHz

Adjust the analyzer display for a clear baseline trace.

With the model 8443A/B operating in the MARKER mode, connect the output of the A9 assembly to the analyzer RF INPUT using the HP 1250-1237 adapter.

The baseline trace of the analyzer CRT rises to -36 dBm minimum.

YES

Connect the output from the A8 assembly (the output which goes to the attenuators) to the analyzer RF INPUT using the HP 1250-1237 adapter. Set the analyzer controls as follows:
SCAN WIDTH
P/D . . . . . 10 MHz
BANDWIDTH . 300 kHz
INPUT
ATTENUATION 20 dB
LOG REF
LEVEL . . . +10 dBm
The analyzer CRT display is a straight line on the top graticule line.

NO

Replace the A8 assembly or refer to Service Sheet 3 and make necessary repairs.

NOTE
The "TENTHS" attenuator should be set at 0 for all tests.

YES

Connect the model 8443A RF OUTPUT to the analyzer RF INPUT with the TENS attenuator set to +10 and the UNITS and TENTHS attenuators set to 0.

The analyzer CRT display should again be a straight line on the CRT graticule line.

NO

Connect the TENS attenuator output to the analyzer RF INPUT. If the analyzer CRT display is now as specified, replace the UNITS attenuator or refer to Service Sheet 3 and make the necessary repairs.

NOTE
Due to critical selection of values and placement of parts, factory service is recommended.

If the analyzer CRT display is not as specified with the TENS attenuator output connected to the analyzer RF INPUT, the TENS attenuator is defective and should be replaced.

NO

Connect the model 8443A/B A13 assembly 50 MHz output to the analyzer RF INPUT using the HP 1250-1236 adapter.

Set the analyzer SCAN WIDTH PER DIVISION to 2 MHz.

50 MHz signal is -28 dBm minimum.

YES

Connect the 50 MHz output from the A12 assembly to the analyzer RF INPUT using the HP 1250-1237 adapter. Set the analyzer controls as follows:
FREQUENCY 50 MHz
SCAN WIDTH P/D 2 MHz
BANDWIDTH . 100 kHz

The 50 MHz signal is -16 dBm minimum.

NO

Replace the A12 assembly or refer to Service Sheet 2 and make necessary repairs.

NO

Connect the A13 3 MHz test point to an oscilloscope; 3 MHz level should be 680 mV peak-to-peak.

NO

Replace the A13 assembly or refer to Service Sheet 2 and make necessary repairs.

YES

Connect the 47 MHz input from the analyzer to the analyzer RF INPUT using the HP 1250-1237 adapter. Set the analyzer FREQUENCY to 47 MHz. Signal is -9 dBm minimum.

NO

Repair cabling between the analyzer and the model 8443A.

YES

Replace the A13 assembly or refer to Service Sheet 2 and make necessary repairs.

YES

Connect the 200 MHz output from the A10 assembly to a power meter. Signal level should be -22 dBm minimum.

NO

YES

Connect the 150 MHz from the analyzer second LO to a power meter. Signal level should be -4 dBm minimum.

NO

Repair cabling between the analyzer and the model 8443A/B.

YES

Connect a 30 dB attenuator (A2 may be used, set to -20 dBm) between the 200 to 310 MHz LO input from the analyzer and the input to the A10 assembly and ground the ALC test point. Set analyzer controls as follows:
FREQUENCY . 0 MHz
SCAN WIDTH . ZERO
Connect a power meter to the A10 assembly. Signal level should be -19 dBm minimum.

NO

Replace the A10 assembly or refer to Service Sheet 3 and make necessary repairs.

YES

Replace the A11 assembly or refer to Service Sheet 2 and make necessary repairs.

Connect the input to the model 8443A/B A9 assembly from the analyzer first local oscillator to a power meter. Set the analyzer SCAN WIDTH to ZERO. Tune the analyzer FREQUENCY from 0 to 110 MHz. Signal level should be −9 dBm minimum.

NO

Repair cabling between the analyzer and the model 8443A/B.

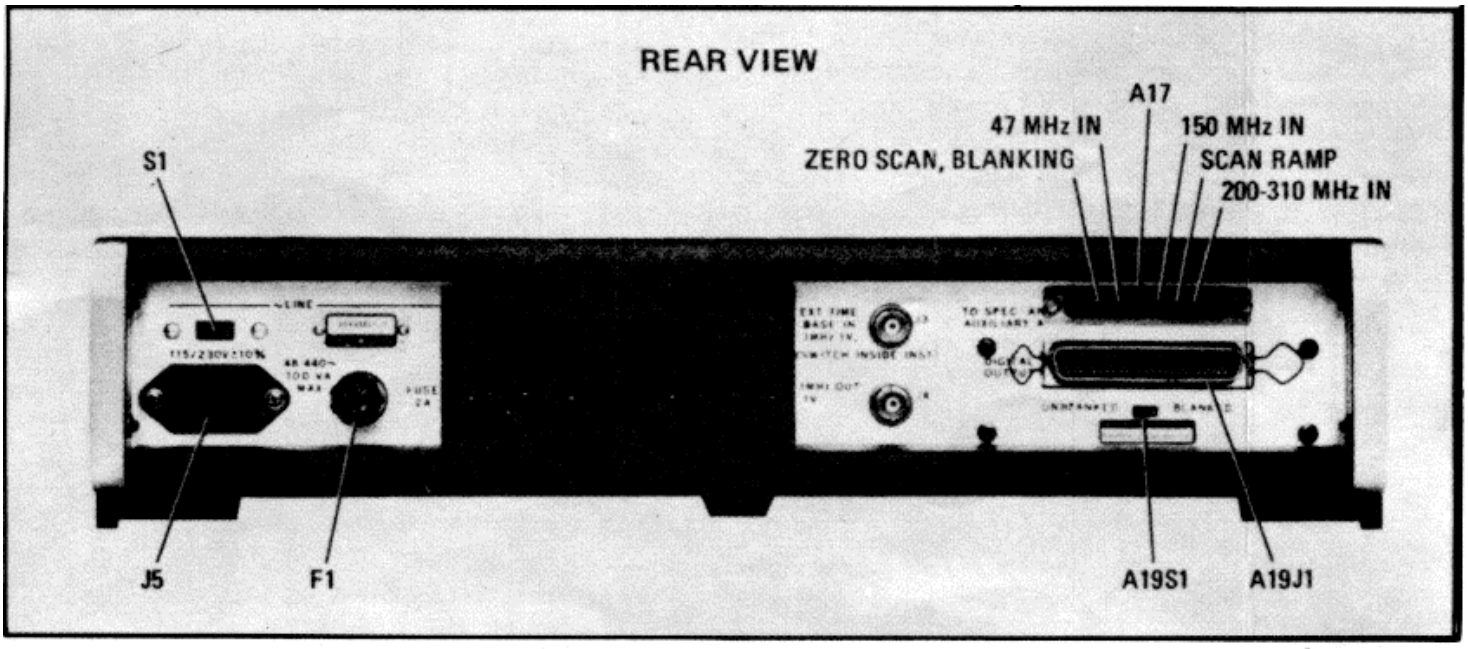
YES

Replace the A9 assembly or refer to Service Sheet 2 and make the necessary repairs.

Figure 8-17. Troubleshooting Tree (Sheet 2 of 2)

Table 8-7. Assembly and Component Locations

Assembly	Schematic	Photo
A1 Low Frequency Counter	Service Sheet 9, 10	Service Sheet 9, 10
A2 0-120 dB Attenuator	Service Sheet 3	Figure 8-18
A3 0-12 dB Attenuator	Service Sheet 3	Figure 8-18
A4 Reference Oscillator	None	Figure 8-18
A5 Time Base Assembly	Service Sheet 7	Service Sheet 7
A6 High Frequency Decade	Service Sheet 8	Service Sheet 8
A7 Marker Control	Service Sheet 6	Service Sheet 6
A8 ALC/Video Amplifier	Service Sheet 3	Service Sheet 3
A9 Third Converter	Service Sheet 3	Service Sheet 3
A10 200 MHz IF Amplifier	Service Sheet 3	Service Sheet 3
A11 Second Converter	Service Sheet 2	Service Sheet 2
A12 50 MHz IF Amplifier	Service Sheet 2	Service Sheet 2
A13 First Converter	Service Sheet 2	Service Sheet 2
A14 Sense Amplifiers	Service Sheet 4	Service Sheet 4
A15 Rectifier Assembly	Service Sheet 4	Service Sheet 4
A16 Switch Assembly	Service Sheet 11	Service Sheet 11
A17 Interconnection Jack Assembly	Service Sheet 2, 3, 6	Figure 8-18
A18 Mother Board Assembly	Service Sheet 11	Figure 8-18
A19 Digital Output Assembly	Service Sheet 2, 10	Figure 8-18
A20 Marker Position Assembly	Service Sheet 11	Figure 8-18



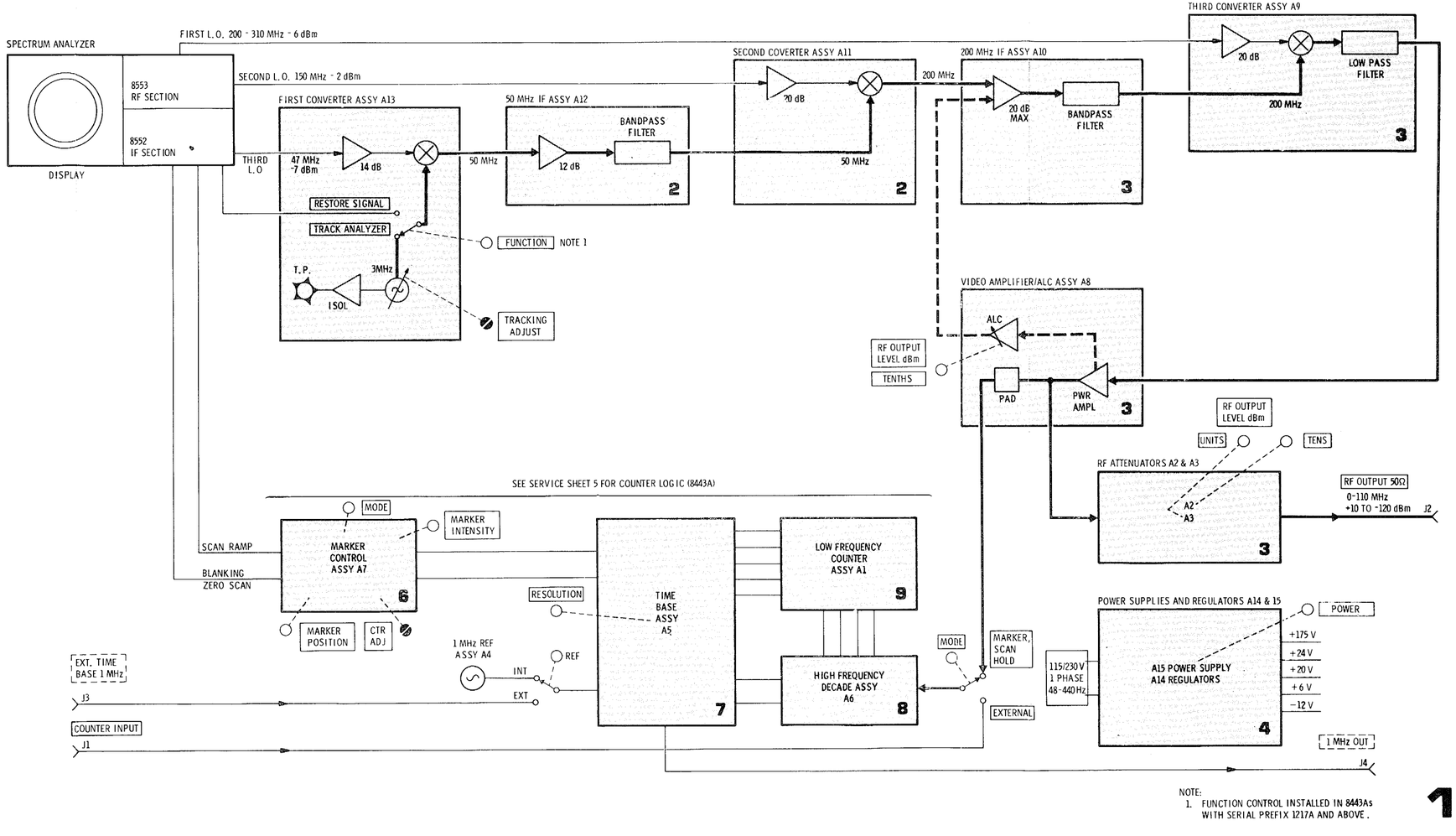


Figure 8-19. Overall Block Diagram

Normally, the cause of a malfunction in the model 8443A/B will be isolated to a circuit board or assembly as a result of performing the tests specified in the Troubleshooting Tree.

When trouble has been isolated to a specific circuit, the circuit board should be removed and reinstalled using an extender board, to provide easy access to test points and components.

All tests are based on the assumption that the model 8443A/B is interconnected with an 8443/8552/140 Spectrum Analyzer which is known to be operating properly.

Equipment Required:

Digital Voltmeter	Service Kit
Shielded Probe	BNC Tee
Dummy Load	BNC to BNC Cable
0 to 1250 MHz Spectrum Analyzer	

Spectrum Analyzer Control Settings:

Power ..... ON
DISPLAY CONTROLS ..... Set for clear display
SCAN WIDTH
  PER DIVISION ..... 2 MHz
SCAN WIDTH ..... PER DIVISION
BANDWIDTH ..... 300 kHz
INPUT ATTENUATION ..... 10 dB
LOG REF LEVEL ..... 0 dBm
LOG/LINEAR ..... LOG
SCAN TIME
  PER DIVISION ..... 20 MILLISECONDS
VIDEO FILTER ..... OFF

Tracking Generator/Counter Control Settings:

POWER ..... ON
RF OUTPUT
  LEVEL dBm ..... All controls set to 0

Note

In individual tests only those controls mentioned need to be changed. Other control settings are compatible with previous tests.

First Converter Assembly A13

The first converter assembly consists of a 3 MHz crystal controlled oscillator, a 47 MHz buffer amplifier, a diode quad bridge, a 3 MHz buffer amplifier, and a restore-signal amplifier.

The 3 MHz oscillator is a Colpitts crystal controlled oscillator with a varactor as a fine frequency control element. Since a decrease in the capacity of the varactor results in an increase in oscillator frequency, inductor L2 is tuned as required to lower the frequency and center the range of the varactor control. The frequency is variable by the varactor approximately 400 Hz. The 3 MHz oscillator supplies approximately 12 mVolts to one side of the diode quad mixer. A buffer stage is provided which isolates the 3 MHz test point to prevent loading the circuit when measurements are taken during maintenance.

The 47 MHz buffer isolates the spectrum analyzer third local oscillator from the model 8443A/B and provides about 14 dB of gain. When the analyzer is operated in wide scan modes (unstabilized) the 47 MHz signal from the analyzer is a fixed frequency. When the analyzer is operated in narrow scan width modes (stabilized) the 47 MHz signal is swept in frequency.

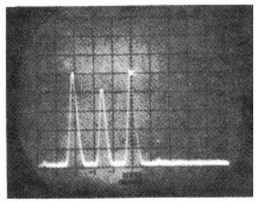
The restore-signal amplifier circuitry disables the 3 MHz oscillator and applies the 3 MHz IF signal from the IF Section to the mixer whenever the FUNCTION switch is set to RESTORE SIGNAL. The signal at the base of Q5 is approximately 0.4 to 4 mVrms; gain from Q5-b to Q7-3 is 100. Q8 and Q9 usually function as a limiter; however, small signal gain is about 10, and the signal at Q9-c is approximately 40 m Vp-p.

The diode quad mixer is a conventional mixer which accepts the 3 MHz and 47 MHz signals and produces a 50 MHz output. (When the analyzer is operated in narrow scan stabilized modes the bridge output is swept, in frequency, by an amount determined by the setting of the SCAN WIDTH control on the analyzer.)

Test Procedure 1

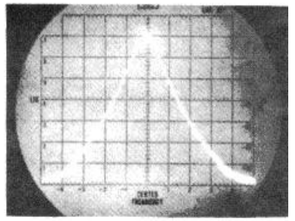
Test 1-a. Use the digital voltmeter to verify the presence of -12 volts and +20 volts at terminals shown on the schematic diagram.

Test 1-b. Connect the 50 MHz output from the A13 assembly to the analyzer RF INPUT. Tune the analyzer to a center frequency of 50 MHz and center the 50 MHz signal on the CRT. A CRT presentation similar to waveform SS2-1 should be ovserved. If the correct wave-form is observed the assembly is operating properly. If the CRT presentation is not correct, proceed to test 1-c.



Waveform SS2-1

When a malfunction is found and corrected in any of the following steps, repeat test 1-b.

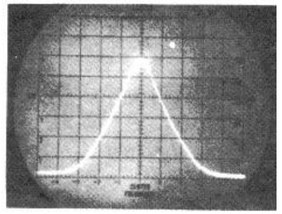


Waveform SS2-2

Test 1-c. Connect the 47 MHz input to the A13 assembly from the analyzer to the analyzer RF INPUT. Tune the analyzer to 47 MHz. Set analyzer SCAN WIDTH to .2 MHz. A presentation similar to SS2-2 should be observed on the analyzer CRT. If the CRT presentation is correct, proceed to test 1-d. If not, check the wiring to the analyzer.

Test 1-d. Connect Test Point 2 (Q2-c) to the analyzer RF INPUT and monitor the analyzer CRT for a display similar to that shown in waveform SS2-3. If the CRT display is correct, proceed to test 1-f. If not, proceed to test 1-e.

Test 1-e. Connect Test Point 3 (Q1-c) to the analyzer RF INPUT and monitor the analyzer CRT for a display similar to, but about 10 dB less than, waveform SS2-3. If the display is correct check Q2 and associated components. If the display is not correct check Q1 and associated components.



Waveform SS2-3

Test 1-f. Connect Test Point 1 to the analyzer RF INPUT and tune the analyzer to display the 3 MHz signal. The CRT display should be similar to waveform SS2-3. Proceed to test 1-g.

Test 1-g. Connect Test Point 4 to the analyzer RF INPUT. The analyzer CRT display should be similar to waveform SS2-3. If the display is not present check Q4 and associated components. If the display is present, but was not present in test 1-f, check Q3 and associated components.

If the cause of the malfunction has not been found in any of the preceding tests, trouble is probably T1, T2 or the diode quad. Repair as required and repeat test 1-b.

Note

After repairing the first converter assembly it should be adjusted in accordance with instructions in paragraph 5-14 of this manual to assure reliable operation of the instrument.

2 50 MHz IF Amplifier Assembly A12

The 50 MHz amplifier assembly consists of a two-stage amplifier and a bandpass filter. Gain of the amplifier is approximately 12 dB. The bandwidth of the 50 MHz bandpass filter at the 3 dB points is about 4 MHz. L3/C6/C8 and L6/C15/C17 are 44 MHz traps. L5/C9/C10 is a 47 MHz trap.

Test Procedure 2

Test 2-a. Use the digital voltmeter to verify the presence of +20 volts at terminals shown on the schematic diagram. Proceed to test 2-b.

Test 2-b. Connect the 50 MHz output from the A12 assembly to the analyzer RF INPUT and tune the analyzer to 50 MHz. Set the analyzer SCAN WIDTH to .2 MHz/DIV. The analyzer CRT display should be similar to that of waveform SS2-2. If the display is correct the assembly is functioning properly. If not, proceed to test 2-c.

Test 2-c. Connect Test Point 1 to the analyzer RF INPUT (be sure to ground the coax shield at the A12 assembly). The analyzer CRT display should be similar to that of waveform SS2-2 (about -14 dB). If the analyzer display is correct, proceed to test 2-d. If not, the bandpass filter is probably defective.

Test 2-d. Connect Test Point 2 (Q1-c) to the analyzer RF INPUT. A waveform similar to that shown in waveform SS2-3 should appear on the analyzer CRT (about -27 dB). If the waveform is not present check Q1 and associated components

If the waveform is present but was not in test 2-c, check Q2 and associated components. Repeat test 2-b.

Note

After repairing the 50 MHz amplifier assembly it should be adjusted in accordance with instructions in paragraph 5-15 of this manual to assure reliable operation of the instrument.

Second Converter Assembly A11

The second converter assembly contains a three-stage amplifier and a diode quad bridge mixer. The amplifier isolates the analyzer second local oscillator

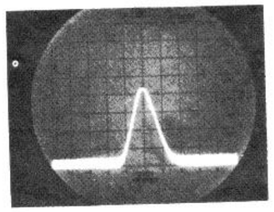
from the model 8443A/B and provides about 20 dB of gain. The diode quad bridge mixes the 150 MHz signal from the analyzer with the 50 MHz signal from the 50 MHz amplifier to produce an output rf signal of 200 MHz.

Test Procedure 3

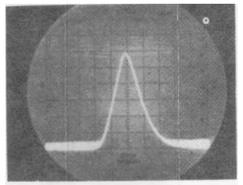
Test 3-a. Use the digital voltmeter to verify the presence of +20 volts at terminals shown on the schematic diagram.

Test 3-b. Connect the 200 MHz output from the All assembly to the 0 to 1250 MHz analyzer RF INPUT. Be sure that coax shield is grounded at the All assembly. Set the 0 to 1250 MHz analyzer controls to the same positions as the controls on the 8553/8552/140 except set SCAN WIDTH to .5 MHz/DIV. The 0 to 1250 MHz analyzer CRT should be similar to SS2-4. If the correct display is observed, the All assembly is functioning properly. If not, proceed to test 3-c.

Test 3-c. Connect Test Point 1 (Q3-c) to the 0 to 1250 MHz analyzer RF INPUT and tune the analyzer to 150 MHz. The analyzer display should be similar to waveform SS2-5. If the correct display is observed trouble is probably in the



Waveform SS2-4

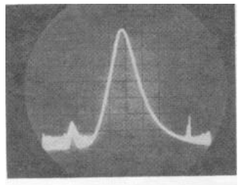


Waveform SS2-5

diode quad bridge mixer or associated components. Repair and repeat test 3-b. If the correct display is not observed, proceed to test 3-d.

Test 3-d. Connect Test Point 2 (Q2-c) to the 0 to 1250 MHz analyzer RF INPUT. The analyzer display should be similar to waveform SS2-6. If the display is correct, check Q3 and associated components and repair as required. After repairs perform test 3-b. If the correct waveform is not observed, proceed to test 3-e.

Test 3-e. Connect Test Point 3 (Q1-c) to the 0 to 1250 MHz analyzer RF INPUT. The analyzer display should be similar to waveform SS2-5 (about 3 dB lower). If the display is correct, check Q2 and associated components. After repairs repeat test 3-b. If the display is not correct proceed to test 3-f.



Waveform SS2-6

Test 3-f. Connect the 150 MHz input from the analyzer to the RF INPUT of the 0 to 1250 MHz analyzer. The CRT display should be similar to that shown in waveform SS2-6. If the waveform is correct check Q1 and associated components. If the waveform is not correct check the wiring to the analyzer. After repairs repeat test 1-b.

Note

After repairing the second converter it should be checked in accordance with paragraph 5-16 of this manual to assure reliable operation of the instrument.

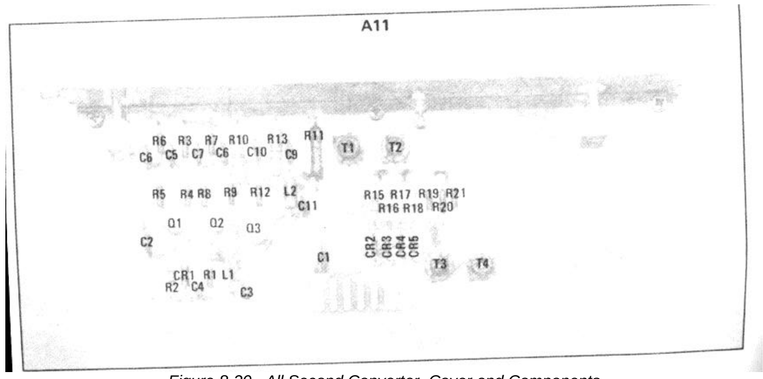
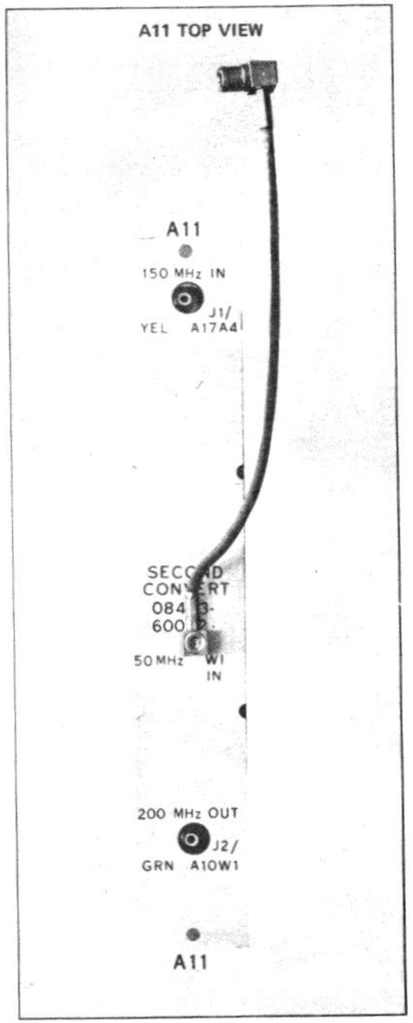


Figure 8-20. All Second Converter, Cover and Components



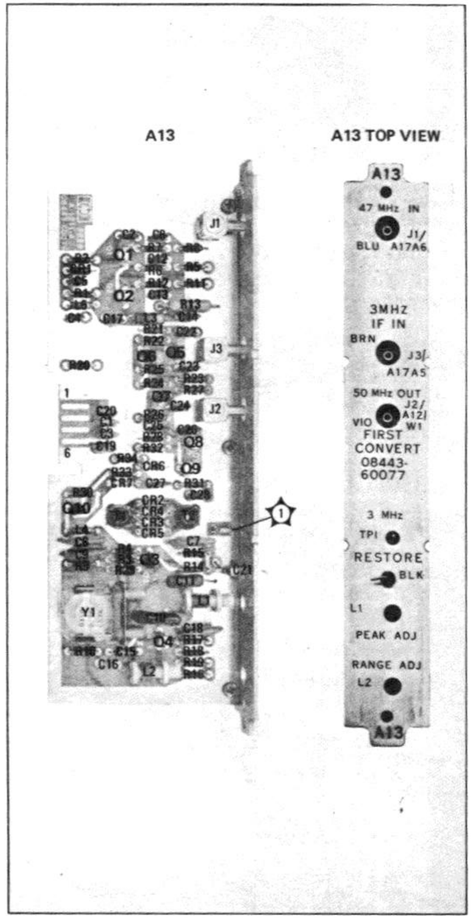


Figure 8-21. A13, First Converter, Cover and Components

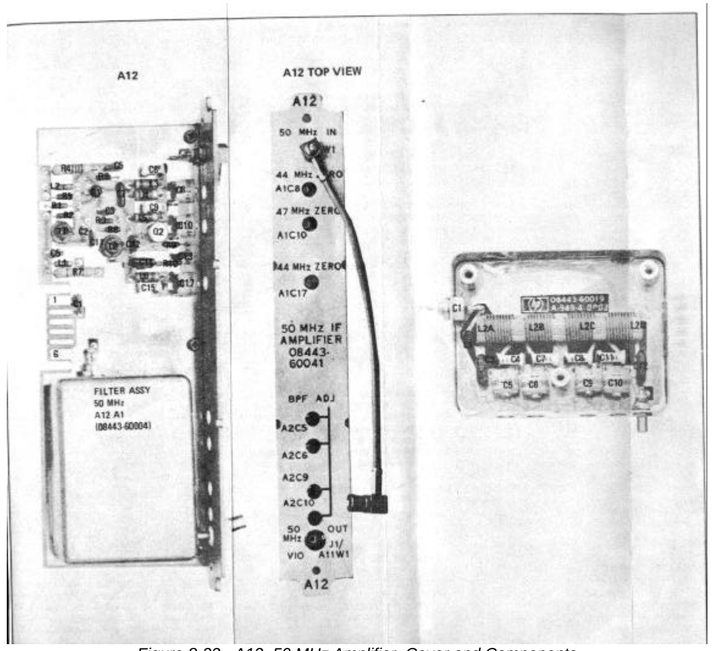


Figure 8-22. A12, 50 MHz Amplifier, Cover and Components

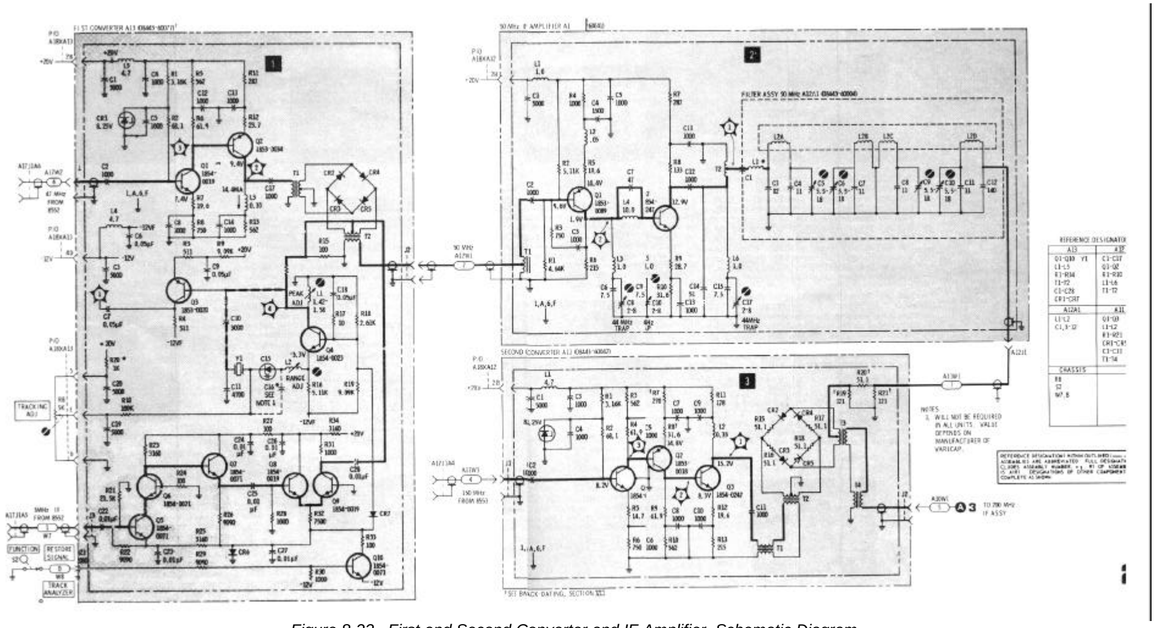


Figure 8-23. First and Second Converter and IF Amplifier, Schematic Diagram

Normally, the cause of a malfunction in the model 8443A/B will be isolated to a circuit board or assembly as a result of performing the tests specified in the Troubleshooting Tree.

When the trouble has been isolated to a specific circuit, the circuit board should be removed and reinstalled using an extender board to provide easy access to test points and components.

All tests are based on the assumption that the model 8443A/B is interconnected with a HP 8553/8552/140 Spectrum Analyzer which is known to be operating properly.

Equipment Required:

Digital Voltmeter	Service Kit
Shielded Probe	0 - 1250 MHz
Variable Voltage	Spectrum Analyzer
Power Supply	BNC to BNC coaxial Cable

Spectrum Analyzer Control Settings:

POWER ..... ON
DISPLAY CONTROLS ..... Set for clear display
SCAN WIDTH PER DIVISION ..... 10 MHz
SCAN WIDTH ..... PER DIVISION
BANDWIDTH ..... 300 kHz
INPUT ATTENUATION ..... 10 dB
LOG REF LEVEL ..... 0 dBm
SCAN TIME
PER DIVISION ..... 20 MILLISECONDS
VIDEO FILTER ..... OFF

Tracking Generator/Counter Control Settings:

POWER ..... ON
RF OUTPUT LEVEL dBm ..... All controls set to 0

Note

In individual tests only those controls mentioned need to be changed. Other control settings are compatible with previous tests.

1 200 MHz IF Amplifier A10

The 200 MHz IF amplifier assembly contains a two-stage variable-gain amplifier and a bandpass filter. The gain of the amplifier is controlled by the ALC signal from the Video Amplifier/ Automatic Level Control Assembly, A8. L10/C17 is a 250 MHz trap. L2/C3 is a 150 MHz trap. L3/C5 is a 100 MHz trap. The gain of the 200 MHz amplifier is about 20 dB.

The bandwidth of the 200 MHz IF Bandpass Filter is +2 MHz. Insertion loss is about 2 dB.

Test Procedure 1

Note

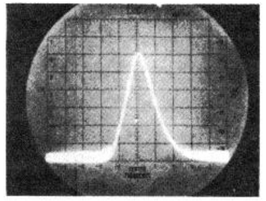
Before proceeding with tests disable the ALC signal by lifting the A8 assembly out of its socket.

Test 1-a. Use the Digital Voltmeter to verify the presence of -12 volts at terminals shown on the schematic diagram.

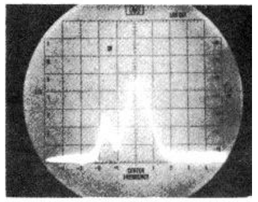
Test 1-b. Connect the 200 MHz output from the A10 assembly to the RF INPUT of the 0 1250 MHz Spectrum Analyzer and tune the CENTER FREQUENCY MHz to 200 MHz. 0 1250 Spectrum Analyzer controls are set the same as the 8553/8552 except SCAN WIDTH is set to .5 MHz/Div. Center the signal on the analyzer CRT. The CRT display should be similar to that shown in waveform SS3-1. If the correct display is present, the A10 assembly is functioning properly. If it is not, proceed to test 1-c.

Test 1-c. Connect the input of the bandpass filter (Test Point 2) to the RF INPUT of the 0 1250 Spectrum Analyzer. The waveform should be similar to that shown in SS3-1. If the correct waveform is present, but was not present in test 1-b, trouble is probably in the bandpass filter. Repair as required and repeat test 1-b. If the correct display is not present, proceed to test 1-d.

Test 1-d. Connect Test Point 3 (junction of C8/C9) to the RF INPUT of the 0 1250 Spectrum Analyzer. The CRT display should be similar to that shown in waveform SS3-2. If the correct display is present, but was not present in test 1-c, check Q2 and associated components. If the display is not present proceed to test 1-e.

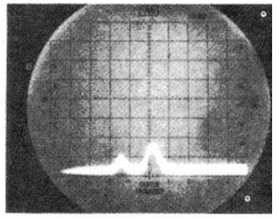


Waveform SS3-1



Waveform SS3-2

Test 1-e. Connect Test Point 4 (Q1-b) to the RF INPUT of the 0 - 1250 MHz Spectrum Analyzer. The CRT display should be similar to that shown in waveform SS3-3. If the correct display is present, but was not in test l-d, check Q1 and associated components. If the display is not present, check the traps for a short and the cabling to the All assembly. Proceed to test 1-f.

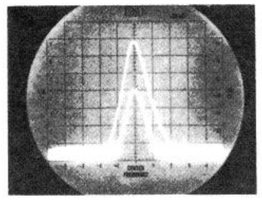


Waveform SS3-3

Test 1-f. Connect the 200 MHz output from the A10 assembly to the RF INPUT of the 0 1250 MHz Spectrum Analyzer and tune the CENTER FREQUENCY MHz to 200 MHz. Center the signal on the CRT display. Connect the variable voltage power supply to TP 1 and vary the voltage from 0 to +20 volts. Waveform SS3-4 shows the upper and lower levels of output. The lower level is with +20 volts applied; the higher level is with 0 volts applied. If the signal level does not vary; or if the levels are not approximately as shown, check C1, R4, C8, C9, C10, L6 and adjustment of L6 as specified in paragraph 5-17.

NOTE

After repairing the 200 MHz amplifier assembly' it should be adjusted in accordance with paragraph 5-17 of this manual to assure reliable operation of the instrument.



Waveform SS3-4

2 Third Converter Assembly A9

The third converter assembly consists of a three-stage, fixed-gain 200 to 310 MHz amplifier, a diode quad balanced mixer and a low pass filter.

The amplifier isolates the model 8443A/B from the first local oscillator in the analyzer and provides about 20 dB of gain. The bandwidth of the frequencies processed through the amplifier is determined by the position of the SCAN WIDTH switch on the analyzer. When the analyzer is operated at narrow scan width (20 kHz per division or less) in the stabilized mode, the analyzer first local oscillator output is a fixed frequency. (The frequency is still swept, but now by the third local oscillator).

The diode quad balanced mixer accepts the outputs from the 200 to 310 MHz amplifier and from the 200 MHz amplifier (A10), and mixes them to provide a 0 to 110 MHz signal, or any portion of this range of frequencies. When the analyzer is operated in the ZERO scan mode the output from the mixer is a fixed frequency.

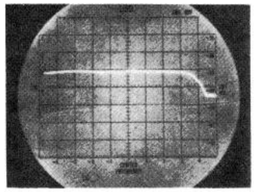
The 120 MHz low-pass filter provides about 75 dB rejection to frequencies above 200 MHz.

Test Procedure 2

Test 2-a. Use the Digital Voltmeter to verify the presence of -12 volts at terminals shown on the schematic diagram.

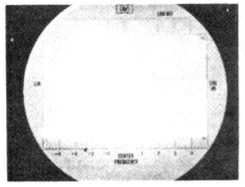
Test 2-b. Connect the output from the A9 assembly to the RF INPUT of the 8553 analyzer, and set the analyzer frequency to 80 MHz. The analyzer CRT display should be similar to that shown in waveform SS3-5. If the display is as shown, the assembly is functioning properly. If not, proceed to test 2-c.

Test 2-c. Connect Test Point 3 (LO IN to the mixer) to the RF INPUT of the 0 - 1250 MHz Spectrum Analyzer and tune to 250 MHz. Controls of both analyzers



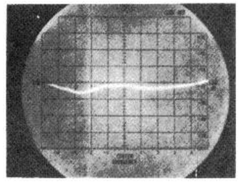
Waveform SS3-5

are set as they were initially except that the 8553/8552 SCAN TIME PER DIVISION is set to .5 MILLISECOND per division and the 0 1250 MHz Spectrum Analyzer INPUT ATTEN to -20 dB, LOG REF LEVEL set to 1 on linear scale. The 0 1250 MHz CRT should show a display similar to waveform SS3-6. If the display is correct, proceed to test 2-d. If not, proceed to test 2-e.



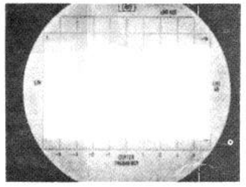
Waveform SS3-6

Test 2-d. Remove the cover from the third mixer and connect the output to the low pass filter to the 8553 RF INPUT. (Be sure to ground the coax shield close to the pickup point.) Set the 8553/8552 SCAN TIME PER DIVISION to 20 MILLISECONDS. The CRT display should be similar to that shown in waveform SS3-7. (It should be noted that with the mixer cover removed, the mixer circuit may be affected by radiation from nearby devices. This may cause the CRT display to differ considerably from that shown. If the CRT display shows that the output frequency goes from 0 to 100 MHz, the test is successfully completed.) If the CRT shows that the output is being swept from 0 to 100 MHz, the low pass filter is probably defective. If the mixer output is not present, repair or replace the mixer and repeat test 2-b.



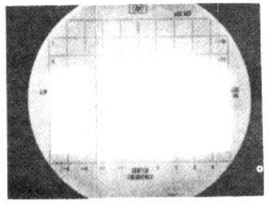
Waveform SS3-7

Test 2-e. Connect Test Point 2 (Q2-c) to the RF INPUT of the 0 1250 MHz Spectrum Analyzer, with all controls set as in test 2-c. The CRT display should be similar to that shown in waveform SS3-8. If the display is correct, but was not in Lest 2-c, check Q1 and associated components. If The display is not present, proceed to test 2-f.



Waveform SS3-8

Test 2-f. Connect Test Point 1 (Q3-c) to the RF INPUT of the 0 1250 MHz Spectrum Analyzer, with all controls set as in test 2-c. The CRT display should be similar to that shown in waveform SS3-9. If the display is correct, but was not in Lest 2-e, check Q2 and associated components. If the display is not



Waveform SS3-9

present, check Q3, associated components and cabling to the analyzer. After repairs repeat test 2-b.

NOTE

After repairing the third converter assembly it should be adjusted in accordance with paragraph 5-18 of this manual to assure reliable operation of the instrument.

3 Video Amplifier/ALC Assembly (A8) and Attenuators

The Video Amplifier/ALC (automatic level control) contains two amplifiers and a comparator. The input video amplifier provides 32 dB of gain and the second amplifier provides 20 dB of gain.

The comparator is referenced to a fixed level which is controlled by the 0 to 1.2 dB vernier to provide the automatic level control signal to the200 MHz amplifier.

When the 0 to 1.2 dB vernier is set to 0 the RF output to the 0 to 120 dB attenuator is a constant +10 dBm. The 0 to 1.2 dB vernier may be used to attenuate the RF output linearly from 0 to 1.2 dB.

There are two precision step attenuators connected in series with the RF output. The first is a 0 to 120 dB step attenuator. The second is a 0. to 12 dB, 1 dB per step, attenuator. These attenuators, in conjunction with the 0 to 1.2 dB vernier provide accurate control of the output signal at any level between +10 dBm and -123.6 dBm.

Test Procedure 3

Test 3-a. Use the Digital Voltmeter to check dc input voltages shown on the schematic diagram.

Test 3-b. Connect the Model 8443A/B RF OUTPUT to the analyzer RF INPUT. A straight line should appear along the LOG REF (top graticule) line on the analyzer CRT. If the correct display is observed, the Tracking Generator portion of the model 8443 is functioning properly. If the CRT display is not correct proceed to test 3-c.

Test 3-c. Connect the 0 110 MHz OUT from the A8 assembly to the analyzer RF INPUT and increase the analyzer INPUT ATTENUATION to 20 dB. The analyzer CRT display should be as in test 3-b. If the CRT display is correct, but was not in test 3-b, check the attenuators.

SERVICE SHEET 3 (cont'd)

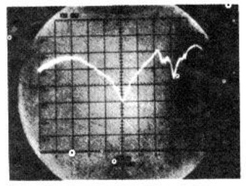
NOTE

Component selection and placement in the attenuators is extremely critical, factory service is recommended.

If the CRT display is incorrect proceed to test 3-d.

Test 3-d. Connect the A8 output to the HF Decade (A5W1) to the analyzer RF INPUT and reset the analyzer INPUT ATTENUATION to 0 dB. The analyzer CRT display should show a straight line across the CRT about -14 dB from the top graticule line. If the display is correct, but was not in test 3-c, U2 is probably defective. After repairs, repeat test 3-b. If the CRT display is not correct, proceed to test 3-e.

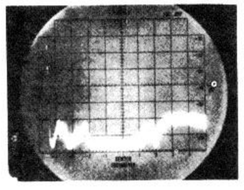
Test 3-e. Connect Test Point 1 (A8A1R6) to the analyzer RF INPUT. The analyzer CRT display should be similar to waveform SS3-10. If the correct display is observed, but was not in test 3-d, U2 is probably defective. If the display. is not correct, U1 is probably defective. Replace and repeat test 3-b. If the assembly is still not functioning properly, proceed to test 3-f



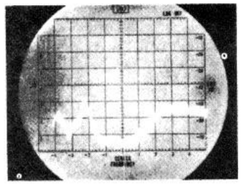
Waveform SS3-10*

Test 3-f. Connect the analyzer RF INPUT to Test Point 2 (Q1A-b). The analyzer CRT display should be similar to waveform SS3-11. If the waveform is not correct, U2 is probably defective. Repair as required and repeat test 3-b. If the waveform is correct and the assembly still does not function properly, proceed to test 3-g.

Test 3-g. Connect the analyzer RF INPUT to TP 3. The analyzer CRT display should be similar to that shown in waveform SS3-12. If the display is incorrect, check Q1, Q2, Q3, Q4 and associated components. After repairs, repeat test 3-b.



Waveform SS3-11*



Waveform SS3-12*

NOTE

After repairs the Video Amplifier/ALC assembly should be adjusted in accordance with paragraph 5-19 to assure reliable operation of the instrument.

*These waveforms are typical and may vary greatly between instruments.

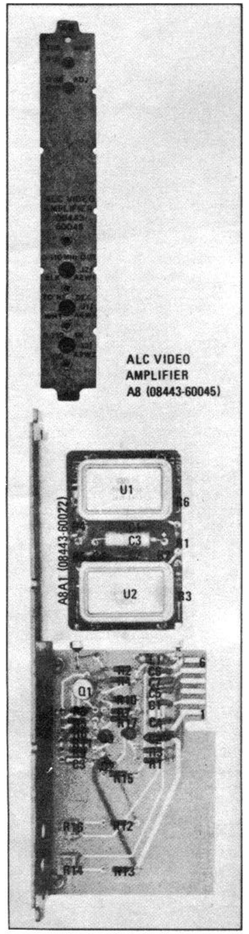


Figure 8-24. A8, ALC Video Amplifier

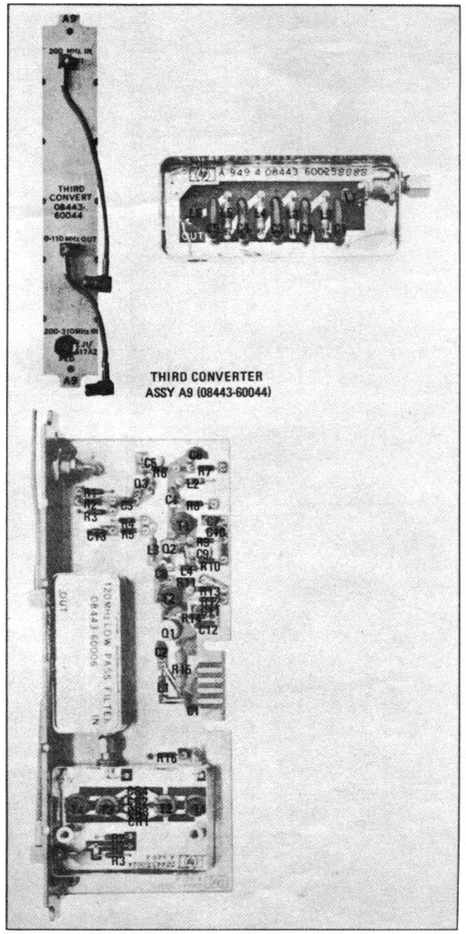


Figure 8-25. A9, Third Converter Assembly

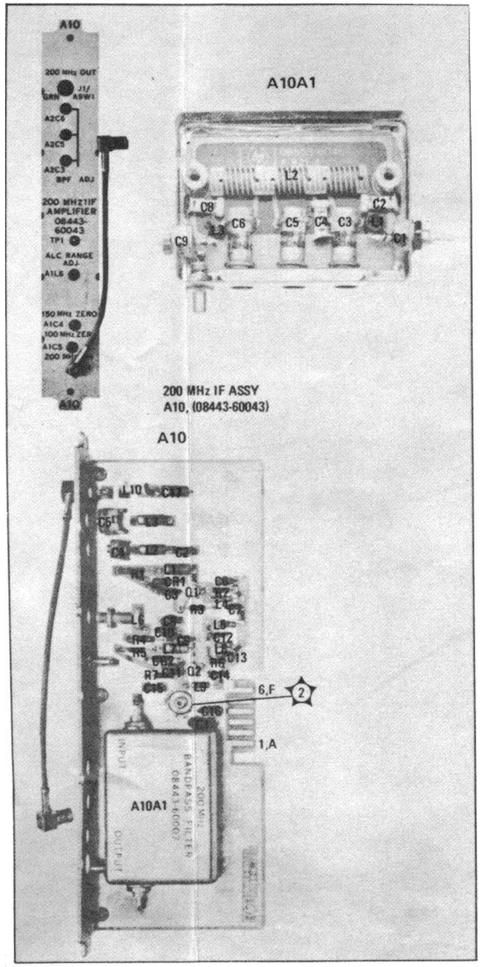


Figure 8-26. A10, Bandpass Filter Assembly

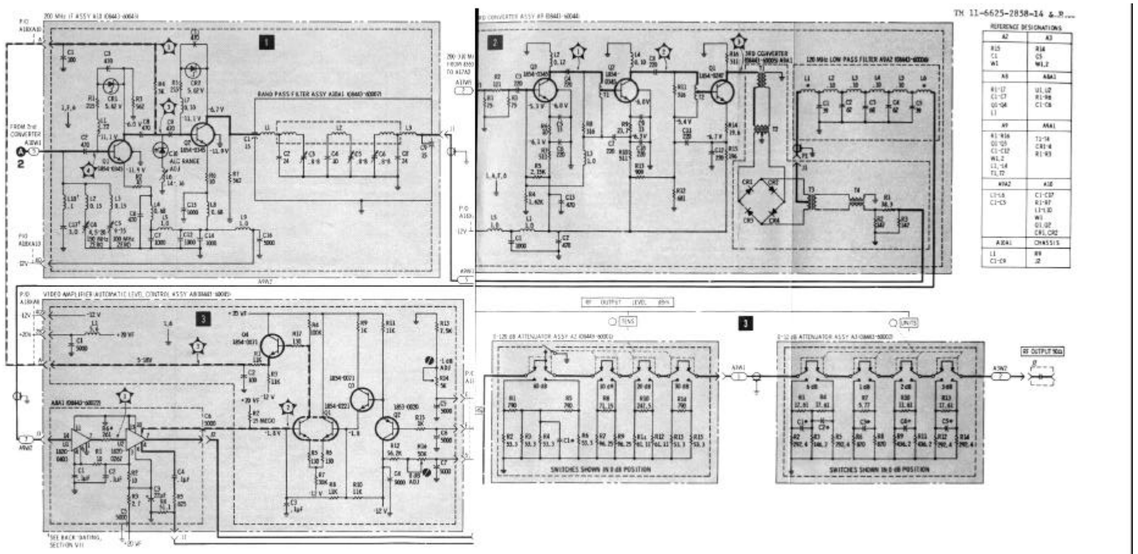


Figure 8-27. 200 MHz IF Amplifier, Third Converter, ALC/Video Amplifier and Attenuator, Schematic Diagram

Normally, the cause of a malfunction in the model 8443A/B will be isolated to a circuit board or assembly as a result of performing the tests specified in the Troubleshooting Tree.

Equipment Required

Digital Voltmeter — Spectrum Analyzer
Volt-ohm-ammeter — AC Voltmeter
Service Kit

1 Rectifier Assembly A15

AC power for the four rectifier circuits in the model 8443A/B is supplied by a single transformer with four secondary windings.

When the model 8443A/B is in the standby mode all of the power supplies except the 24 volt (switched) are disabled. The +175 volt, +20 volt, +5.8 volt and -12 volt supplies are all referenced to the 24 volt supply. Placing the model 8443A/B in standby removes the +24 volt reference from the sense amplifiers and disables all of the series regulators except the +24 volt regulator. The +24 volts is used in standby to maintain temperature control in the crystal oscillator assembly A4 (8443A).

A full wave bridge type rectifier is used to provide the +175 volts required to drive the numerical readout devices in the counter section (8443A).

The +24 volt and +20 volt outputs are derived from a single full wave rectifier and two regulator circuits.

The +6 volt and -12 volt outputs are provided by separate full wave rectifiers and regulators (the +6 V regulator is used in the 8443A only).

Test Procedure 1

Test 1-a. Turn the model 8443A/B on and before removing the circuit board, check the voltage levels at the upper end of the fuses mounted on the rectifier board. Check fuse(s) where voltage is not present. If new fuses placed in the +24 volt, +20 volt, +5.8 volt or -12 volt supplies burn out, trouble is probably not in the power supply circuit; proceed to test procedure **2** . If correct voltages are not present at the +24 volt, +20 volt, +5.8 volt or -12 volt fuses and the fuses are good, proceed to test 1-b. If the +175 volts is not present at Test Point 6 on the mother board proceed to test 1-d.

Test 1-b. Remove the rectifier board and reconnect it using an extender board.

WARNING

Remove the power cord from the model 8443A/B before removing the board. Voltages are still present when the instrument is placed in standby.

Use the AC voltmeter to measure the ac voltages across the primary and secondary windings of the transformer. If any of the secondary windings do not have voltage present and the primary voltage is present, the transformer is defective. If the transformer primary voltage is not present check the line fuse, the line switch, the line filter and the line cord. If ac voltage is present at all windings proceed to test 1-c.

Test 1-c. If the ac voltages are present, use the digital voltmeter to check for dc voltages shown on the schematic. Check components associated with the power supply that is not functioning and repair as required. (Do not overlook C1, C2 and C3 on the mother board). After making repairs if the model 8443A/B is still not functioning properly, proceed to Test Procedure **2**.

Test 1-d. If the +175 volt supply is not working in the 8443A, remove the rectifier board and reinstall it using the extender board. If the 1/4 amp fuse, F1, is not burned out check CR1 through CR4 and associated components. If the fuse is burned out check Q1, Q2, Q3 and associated components. If the cause of the trouble is not found, or if trouble is found and the instrument still does not function properly, proceed to test Procedure **2** .

2 Series Regulators

The series regulators are all located on a flange mounted on the inside of the rear panel adjacent to a heat sink located on the outer side of the rear panel.

Series regulators function as a variable resistance in series with the power supply and the load. If the regulated output rises, the series regulators conduct less and cause the output to be lowered. If the regulated output drops, the series regulators conduct more and cause the output voltage to rise. The control circuits for these regulators are discussed in **3** Sense Amplifiers.

SERVICE SHEET 4 (cont'd)

Test Procedure 2

Since the series regulator connections are difficult to reach when installed, it is recommended that when one is suspected of being defective, it be removed and checked with an ohmmeter. An alternate method is to remove both the rectifier and sense amplifier circuit boards and make measurements from the connectors.

3 Sense Amplifiers A15

The sense amplifier assembly contains circuits to control the operation of the +24 volt, +20 volt, +5.8 volt and -12 volt series regulators. The +175 volt, +20 volt, +5.8 volt and -12 volt sense amplifiers are all referenced to the +24 volt power supply. Only one adjustable component, R50, is required to set the level of all power supplies.

Each of the sense amplifiers contains a comparator circuit. In the comparator the voltage to be controlled is compared to a fixed reference level derived from the +24 volt supply, The output from the comparator controls the conduction of the series regulators. Two crowbar circuits protect the power' supplies from damage in the event of an overvoltage. Current limiting provides additional protection.

Test Procedure 3.

When a malfunction has been traced to the sense amplifier circuit board, the board should be removed from the frame and reinstalled using an extender board. Checking for the voltages shown on the schematic diagram should enable the technician to quickly isolate the defective component or components.

NOTE

The +175 volt supply and the +5.8 volt supply are used in the 8443A only.

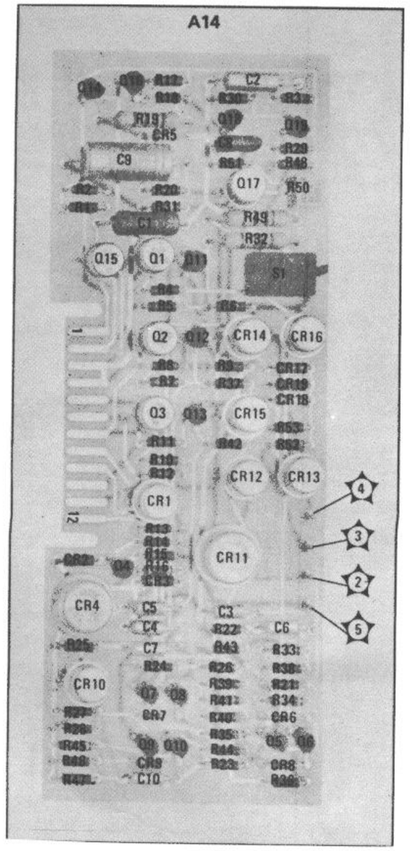


Figure 8-28. A14, Sense amplifier Assembly, Components

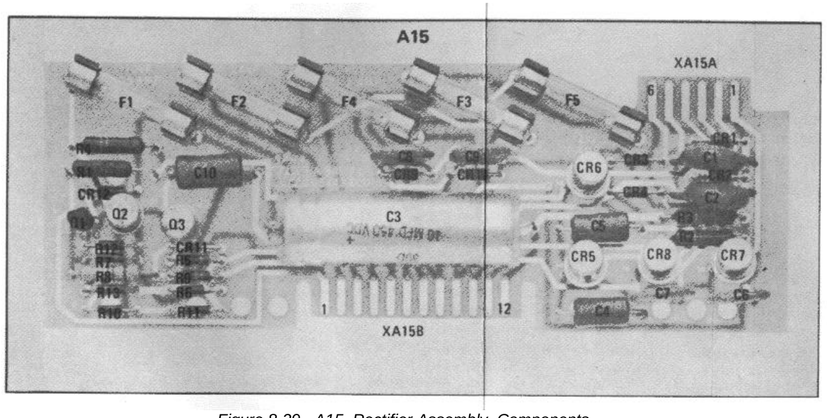


Figure 8-29. A15, Rectifier Assembly, Components

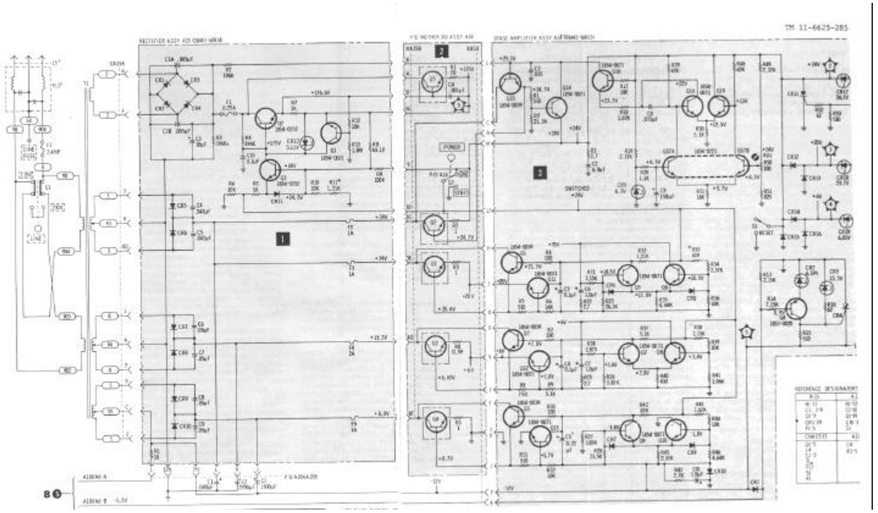


Figure 8-30. Power Supplies and Regulators, Schematic Diagram

SERVICE SHEET 5

The counter section of the HP Model 8443A consists of five major assemblies. These are the Marker Control assembly A7, the Time Base assembly A5, the High Frequency Decade assembly A6, the Low Frequency Counter assembly A1 and the Reference Oscillator assembly A4.

General

The marker control circuit stops the scan ramp in the model 8552 IF section when the model 8443A is operated in the MARKER and SCAN HOLD modes. The marker control circuit also provides blanking to the analyzer and, when operated in the MARKER or SCAN HOLD modes, a signal to the time base circuit which is used to initiate the count cycle.

When the model 8443A is operated in the MARKER mode the active clamp in the marker control assembly causes the scan ramp of the analyzer to stop at a point determined by the MARKER POSITION control. Usually, the scan is stopped for a period of time determined by the position of the RESOLUTION control. The scan stop period may be extended, for short count periods, by the MARKER INTENSITY control.

When the model 8443A is operated in the SCAN HOLD mode the active clamp in the marker control assembly again causes the scan ramp of the analyzer to stop at a point determined by the MARKER POSITION control. In this mode the scan remains stopped until the mode of operation is changed. The operator can manually position the marker to any point on the scan with the MARKER POSITION control. In the SCAN HOLD mode the counter counts continually.

When the model 8443A is operated in the EXTERNAL mode, the counter section is used to count signals applied to the COUNTER INPUT, J1. The marker control function is not used and the counter counts continually.

When the analyzer is operated in ZERO scan the marker is not used; the counter counts continually.

The time base may be referenced to an internal crystal-controlled oscillator or to an external 1 MHz source. The time base controls the main gate flip-flop, in the high frequency decade, which enables the counter. The time base also generates the transfer and reset pulses. These pulses transfer the information from the decade counters to the numerical readout device drivers and reset the decade counters in both the high frequency decade and the low frequency counter.
The signal is gated to the high frequency decade by the main gate flip-flop which is toggled by the decade divider circuits in the time base assembly. In addition to dividing the input frequency by ten, the high frequency decade provides BCD information to the buffer store in the low frequency counter for the least significant digit and provides the drive for following decade counter stages.
The low frequency counter receives the A, B, C and D outputs from the high frequency decade. The A, B, C and D outputs are all used to drive the buffer store for the least significant digit. The D signal (0 to 11 MHz) also drives the blanking decade counter for the 10' readout. The following decade counters are all triggered by the divide-by-ten output of the preceding decade counter. The blanking decade counters drive the numerical readout devices (through buffer store and decoder stages) to provide a visual readout of the input frequency. The buffer store stages also provide BCD information to 'a rear panel connector for use in equipment external to the model 8443A.

Marker Control Assembly A7 (Service Sheet 6)

The marker control circuit has three inputs from the analyzer IF section. These are the scan ramp input, the blanking input and the ZERO scan input. The analyzer provides a ground reference.

The following paragraphs describe the marker control circuit operation when the model 8443A is operated in the MARKER mode. Differences in circuit operation for other modes of operation are described later in this marker control text.

The scan ramp (a 0 to approximately 8 volt signal) is developed across a capacitor in the spectrum analyzer by current from a constant current source. A comparator in the marker control circuit compares the voltage of the scan ramp to a dc level determined by the position of the MARKER POSITION control. When the charge on the scan ramp capacitor reaches the predetermined level, the comparator acts as an active clamp to sink the current from the analyzer constant current source at a rate that effectively clamps the scan ramp voltage. The analyzer scan is stopped and the output frequency of the model 8443A RF section is counted once.

In addition to the scan ramp and the dc level from the MARKER POSITION control, the active clamp has a control input and a control output. The input is from the Q output (TP 4) of the stop-enable flip-flop which allows the active clamp to
operate when the Q output is low. The output provides signal information to other circuits that the scan ramp has been stopped.

The stop-enable flip-flop is reset at the beginning of each scan by the end of the blanking pulse (TP 1) from the analyzer. When the analyzer scan ramp ends, TP 1 goes positive until the next scan ramp begins. At the end of the blanking pulse (1), TP6 is low (more about TP 6 later), AND gate (U1A/B/D) output TP 7 goes low and clocks the stop-enable flip-flop. This makes the stop-enable Q (TP 4) low and enables the active clamp. However, the active clamp will have no effect on the scan ramp voltage until it reaches the level set by the MARKER POSITION control. When this occurs the spectrum analyzer scan is stopped for a period of time determined by the RESOLUTION control and, in some instances, by the MARKER INTENSITY control.

When the scan ramp is stopped the active clamp stop signal TP8 goes low and causes the output of one-shot C16/R21, TP 10, the count trigger signal, to go low. It also closes a switch on a current sink which is part of the marker intensity circuit.

The marker intensity control circuit controls the intensity of the marker on the analyzer CRT. This is accomplished by providing blanking for long count periods or by extending the scan stop time for short count periods.

The output from Q18 is applied to NAND gate U1C which provides the CLEAR input to the stop-enable flip-flop and to AND gate U1A/B/D which controls the CLOCK input to the stop-enable flip-flop. The signal at TP6 also causes the analyzer CRT to be blanked as determined by the marker intensity circuit. Blanking is required to protect the analyzer CRT from excessive intensity (blooming) during long count periods. During short count periods, when it is desired to keep the marker on the analyzer CRT longer than the count period, TP 6 is held low for a period of time determined by the MARKER INTENSITY control and NAND gate U1C is held high. This prevents the stop-enable flip-flop from being cleared.

The period of time the scan is stopped ends when the CLEAR input to the stop-enable flip-flop goes low, the Q output goes high and the active clamp is disabled. This occurs only when signals at TP 6 and TP 10 are both high. The signal at TP 6 is high only when the model 8443A is
causing the analyzer CRT to be blanked. The signal at TP 10 is the count acknowledge signal from the time base circuit
signaling that the frequency count has been completed.

In the EXTERNAL mode the CLEAR input to the stop-enable flip-flop is held low. This causes the Q output (TP 4) to remain high and disable the active clamp. The inverted input to NAND gate Q16/Q17 is also held low and since the input to NAND gate Q16/Q17 is normally high the count trigger, TP 9 is held low. When the count acknowledge, TP 10, is received, one-shot C18/R40 provides a 200 millisecond low to disable NAND gate Q16/17 and inhibit the count trigger (TP 9) for 200 milliseconds.

In the SCAN HOLD mode signals TP 5 and TP 6 will be held low; CLEAR gate U1C cannot reset the stop-enable flip-flop, the active clamp remains active and the counter counts continually. The major difference between the SCAN HOLD mode and the MARKER mode is that in the SCAN HOLD mode the scan remains stopped until the operator changes the mode of operation.

In the ZERO scan mode (initiated when the analyzer is placed in ZERO scan), operation is the same as in the external mode, except that the counter counts the output of the model 8443A instead of an external frequency source. Time Base Assembly A5 (Service Sheet 7) The time base circuit controls all timing and control functions of the counter section. The internal reference generator for the timing function is a stable 1 MHz crystal oscillator. The oscillator is enclosed in a temperature controlled assembly to improve stability. The internal reference signal may be used as a reference for other equipment. An external reference signal may be used in lieu of the internal reference if desired.

Operation of the time base circuit with the model 8443A operating in the MARKER mode is described in the following paragraphs. During the first 200 microseconds after the marker control circuits stop the analyzer scan, the count trigger signal (TP 2) goes low. When the count trigger goes low the signal at TP 7 will go high provided that the input to the inhibit inverter Q4 is low. This initiates the count cycle.

At the beginning of the timing sequence the time base flip-flop Q output (TP 4) is high and the Q output is low. The signal at TP 8 will also be high and when the signal at TP 7 goes high, the signal at TP 9 will go low. The signal at TP 5 will go high and all decades will be reset. The signal at TP 5 will remain high about 50 microseconds.

The time base flip-flop is cleared about 50 microseconds after TP 9 goes low. This causes the time base flip-flop Q output
to go high and the Q output (TP 4) to go low. About 1 microsecond after TP 4 goes low TP 8 goes low, TP 9 goes high and TP 5 goes low to end the reset pulse. The first decade divider in the time base circuit was set to 0 by the reset pulse and the rest of the decade dividers were set to 9. When the time base flip-flop Q output goes high NAND gate U1D couples the 1 MHz reference signal to the first of the five decade dividers. After ten cycles the second decade divider will receive an input. Since the last four decade dividers were set to 9, each will reset to 0 with the first input they receive. The reset output of each divider will reset the following decade divider.

Resolution, which in this case is a function of the time the input signal is counted, is controlled by the three-position RESOLUTION switch.

When the RESOLUTION switch is set to 1 kHz, a ground is provided to a control gate in the third decade divider which provides an output to toggle the main gate flip-flop in the high frequency decade. The output signal (TP 6) is, in this case, a square wave with a 1 millisecond period.

When the RESOLUTION switch is set to 100 Hz, a ground is provided to a control gate in the fourth decade divider which provides an output to toggle the main gate flip-flop in the high frequency decade. The output signal TP 6 is, in this case, a square wave with a 10 millisecond period.

When the RESOLUTION switch is set to 10 Hz, a ground is provided to a control gate in the fifth decade divider which provides an output to toggle the main gate flip-flop in the high frequency decade. The output signal TP 6 is, in this case, a square wave with a 100 millisecond period.

The third, fourth and fifth decade divider outputs are wired to perform an OR function. Only one output will be present at any given time; only one control gate is grounded at any given time.

At the end of the count period the main gate flip-flop in the high frequency decade changes state and provides a low to clock the time base flip-flop. When clocked, the time base flip-flop Q output goes low and the Q output (TP 4) goes high. NAND gate U1D is inhibited and the reference signal can no longer reach the decade dividers. In addition, the signal at TP 4 triggers a 150 microsecond one-shot which drives TP 10 high and TP 3 low to transfer information stored in the decade counters in the low frequency counter to buffer store stages and then to the decoders which drive the numerical readout devices.

The 1 microsecond delay between the time TP 4 goes high and TP 8 goes high prevents generation of a reset before the transfer (TP 3) begins, in the case where TP 7 is still high. Once initiated, the transfer signal at TP 3 prevents generation of a reset signal by forward biasing a diode to keep TP 7 low for the duration of the transfer pulse.

When the Q output (TP 4) of the time base flip-flop goes high it is also used as a signal to the marker control circuit to permit the spectrum analyzer scan to continue. The time base circuit then becomes dormant until the next count trigger (TP 2) arrives from the marker control circuit.

When the model 8443A is operated in the SCAN HOLD mode the count trigger (TP 2) is held low. Counting periods are separated by the time required for transfer and reset functions.

In the EXTERNAL mode the count trigger (TP 2) is inhibited by a 200 millisecond one-shot in the marker control circuit, which is triggered by the count acknowledge signal at TP 4.

High Frequency Decade A6 (Service Sheet 8) The main gate flip-flop, which is controlled by the gate toggle from the time base, controls the start and stop of the count period. The count duration is controlled by the RESOLUTION switch.

The input to the high frequency decade may be either the model 8443A Tracking Generator output or any signal within the counter frequency and amplitude range from an external source.

The high frequency decade is a divide-by-ten decade. The input frequency of 100 kHz to 110 MHz is converted to a 0 to 11 MHz signal and applied to the low frequency counter.

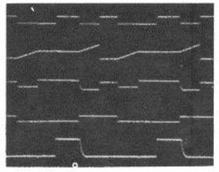
The A, B, C and D outputs of the high frequency decade directly drive the buffer store in the least significant digit circuit. In addition, the D output drives the following blanking decade counter.

Low Frequency Counter A1 (Service Sheet 9)

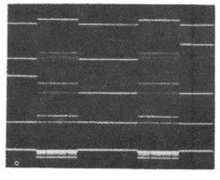
The least significant digit (100) circuit consists of a buffer store, a decoder driver and a numerical readout device. When the transfer pulse occurs the numerical readout device displays the count that remained in the high frequency decade when the count period ended.

The circuits for the next six digits are identical in function and configuration. Each circuit has a blanking decade counter which provides a BCD output to the buffer store and a divide-by-ten output to drive the next blanking decade counter. The buffer store circuits store the count remaining in the decade counters when the count period ended until the next transfer pulse appears. When the transfer pulse appears the buffer stores provide BCD information to the decoder drivers (A, B, C and D) and to a rear panel connector (A, B, C and D) for use in external equipment. The decoder driver stages convert the BCD information to an output which drives one of the ten elements in the numerical readout devices. The third, fourth and fifth numerical readout devices (from the right side) have decimal point inputs. The decimal point to be displayed is selected by the RESOLUTION switch.

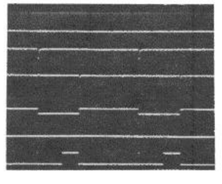
All leading zeros to the left of the decimal point, which are also to the left of the first significant digit, are blanked.
The eighth display circuit consists of two flip-flops and two amplifiers. It detects and displays an overflow from the previous decades. One of the amplifiers drives the 1 element in the numerical readout device when an overflow is present. The other amplifier provides an overflow BCD output for external use.



Marker Control



HF Decade



Time Base

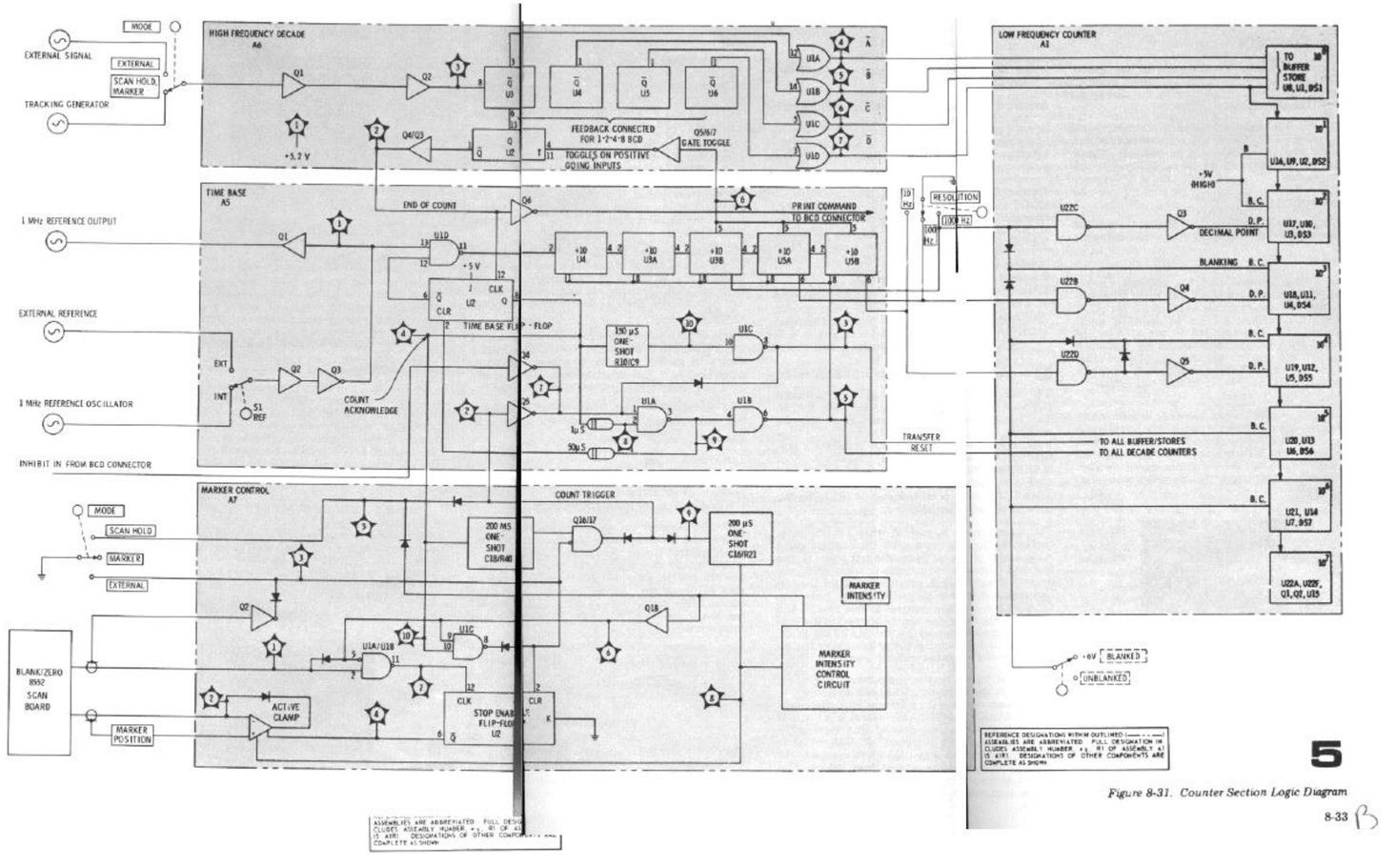


Figure 8-31. Counter Section Logic Diagram.

SERVICE SHEET 6

Normally, causes of malfunction in the model 8443A circuits will be isolated to a circuit board or assembly as a result of performing the tests specified in the Troubleshooting Tree.

When trouble has been isolated to the marker control assembly (A7), it should be removed from the chassis and reinstalled using an extender board. This will provide easy access to test points and components.

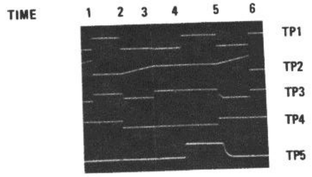
Equipment Required

4 Channel Oscilloscope — Digital Voltmeter
10:1 Oscilloscope Probes (4) — Service Kit

General

The marker control assembly contains circuits which will stop the analyzer scan ramp temporarily, stop the scan ramp for an indefinite period, or enable the counter section to count a signal identical to a signal applied to the analyzer RF INPUT, from an external source. It also contains a circuit which controls the intensity of the marker on the analyzer CRT and a circuit which provides a trigger to start the cycle of the time base circuit.

When the marker control assembly is functioning properly, the waveforms shown in composite waveform SS6-1 will appear at the five test points which are available at the top cover of the assembly. The timing functions of the waveforms shown are identified in the table below the composite waveform.



Composite Waveform SS6-1

Time 1. Analyzer CRT is being blanked by the analyzer scan generator.
Time 2. Analyzer blanking ends TP 1; Scan ramp starts TP 2; Active clamp is enabled TP 4.
Time 3. Analyzer scan ramp is stopped TP 2.
Time 4. Analyzer CRT is blanked by model 8443A TP 1.
Time 5. Analyzer scan ramp is released TP 2.
Time 6. Analyzer scan ramp ends TP 2; Analyzer blanking begins TP 1.

Initial Control Settings (for above timing waveforms)

Spectrum Analyzer: (control settings not listed are not important)

SCAN TIME PER DIVISION ..... 1 MILLISECOND
SCAN MODE ..... INT
SCAN TRIGGER ..... AUTO

Tracking Generator/Counter

MODE ..... MARKER
RESOLUTION ..... 100 Hz
MARKER INTENSITY ..... Full CW
MARKER POSITION KNOB ..... Pulled out

Oscilloscope

Triggered by Analyzer Scan IN/OUT
TIME/DIV ..... 2 Milliseconds
VOLTS/DIV 1
10:1 probes — DC input
TIME/DIV
VERNIER set to show one analyzer scan

1 Active Clamp (Instrument in MARKER mode)

The active clamp consists of a comparator (Q5/Q6/Q7) and a current source (Q4/Q8/Q9). The purpose of the active clamp is to stop the analyzer scan ramp at a predetermined voltage level. The reference level for the comparator portion of the active clamp is established by a MARKER POSITION dual potentiometer (R13), a CTR ADJ (center adjust) potentiometer (R11) and a MARKER ADJ potentiometer (A7Rll) on the cover of the A7 assembly.

The active clamp is enabled when U2, the stop-enable flip-flop, is clocked by the negative going trailing edge of the analyzer blanking pulse; Q goes low and causes Q20 to conduct, when Q20 conducts, it enables Q9 to provide a path for the current sink and enable the active clamp. Note that Q9 does not actually conduct at this time, it will conduct only when the scan ramp reaches the voltage level predetermined by the MARKER POSITION control. Enabling the active clamp has no immediate effect on the analyzer scan ramp.

The signal input to the comparator is the scan ramp from the analyzer. When the analyzer scan ramp voltage reaches the reference level established by the MARKER POSITION control it is clamped at that level. When the base of Q5A reaches the reference level, Q5B is turned off, Q5B collector goes high and CR2 biases Q4 on to complete the current sink path. The current from the constant current source in the analyzer scan generator circuit is then sunk to the model 8443A -12 volt supply.

Q8, in addition to being in the current sink path, acts as a detector. Since the current from the analyzer scan generator must pass through the emitter-base junction of Q8, Q8 conducts while the scan ramp is stopped and turns on Q1. Q1 will be discussed later in this text.

The analyzer scan ramp is stopped until NAND gate U1C, pins 9 and 10, are high. The input to U1C pin 10 is the count acknowledge signal from the time base circuit which signifies that the count has been completed. The input to U1C pin 9 is generated in the marker intensity circuit. Generation of the signal applied to U1C pin 9 is discussed later in this text.

When both inputs to NAND gate U1C are high the output (pin 8) will go low and clear the stop-enable flip-flop. The Q output of U2 then goes high and turns off Q20; Q9 turns off to open the current sink path and the analyzer scan ramp is permitted to continue.

The shield of the scan ramp coax from the analyzer is not grounded in the model 8443A. The shield is used as a ground reference to ensure a common ground between the analyzer scan generator and the active clamp and to prevent ground loops. CR1 provides protection to Q5 when the connecting cable between the analyzer and the model 8443A is not connected.

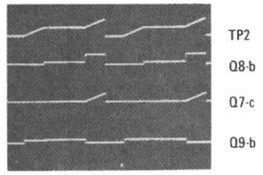
Test Procedure 1

Test 1-a. Use the digital voltmeter to verify the presence of dc voltages at terminals 3/C, 4/D and 5/E as shown on the schematic diagram.

Test 1-b. Connect the digital voltmeter between Q5B-b and ground; rotate the MARKER POSITION control through its range. The dc level at Q5B-b should vary from about ground level (control full ccw) to about +8 volts (control full cw). If observed levels are correct, proceed to test 1-c. If correct levels are not present check Q5B, Q6B, Q7, the MARKER POSITION control and associated components.

Test 1-c. Connect the oscilloscope as follows: Channel A - TP 2, Channel B - Q8-b, Channel C - Q7-c and Channel D - Q9-b. Set all controls as shown for waveform SS6-1 except that the oscilloscope TIME/DIV is 5 Milliseconds and the TIME/DIV VERNIER is in the CAL position (off). The oscilloscope CRT display should be as shown in waveform SS6-2. If the display is as shown, the marker control circuit is functioning properly. If the display is not as shown, proceed to test 1-d.

Test 1-d. With the equipment connected as in test 1-c, ground TP 4. The analyzer scan should stop

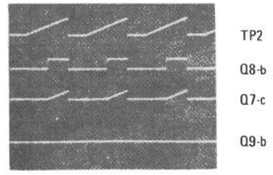


Waveform SS6-2
(See Test 1-c)

and the oscilloscope CRT display should consists of four straight horizontal lines. If the scan does not stop when TP 4 is grounded, place the model 8443A MODE switch in the EXTERNAL position (remove ground from TP4). The oscilloscope CRT display should be as shown in waveform SS6-3. If the correct waveform is now present, check Q8, Q9, Q20 and U2. If the channel A and channel C displays are correct, but channel B is not, check CR2, CR3 and Q4. If the channel A display is as shown, but B and C are not, check Q5, Q6, Q7 and associated components.

Test 1-e. With the equipment connected as in test 1-c, return the model 8443A MODE switch to MARKER. Place the REF switch on the A5 assembly in the EXT position. The oscilloscope CRT display should appear as four horizontal lines and the analyzer CRT should be blanked. If these conditions exist, proceed to test 1-f. If not, check U1A, U1D, U2, Q3 and associated components.

Test 1-f. With test conditions as described in test 1-e, short pin 2 of U2 to ground. The oscilloscope CRT display should be as shown in waveform SS6-3, and the analyzer CRT baseline should reappear (no marker). If these conditions are met, check U1B, U1C, Q18 and associated components. If trouble persists, the intensity circuit should be checked next. If above conditions are not met, U2 is probably defective.



Waveform SS6-3
(See Test 1-d)

2 Trigger and Marker Intensity.

The following discussion assumes that the model 8443A is operating in the MARKER mode.

When Q1 is turned on as the scan stops, the positive-going signal at Q1-c is coupled through C16 to the base of Q15. Q15 is normally off and the collector is at +5 volts (the +5 volts is provided by the time base circuit). Due to the time constant of C16 and R21, the signal from Q1-c causes Q15 to conduct for about 200 microseconds; this provides a negative-going pulse at Q15-c to trigger the time base flip-flop in the time base circuit.

During the period of time that the analyzer scan ramp is stopped the positive dc level at the collector of Q1 turns on Q12 through the MARKER INTENSITY control. The junction of Q12-c, Q11-c, Q13-b, R29 and C17 will be designated as a "current node" for purposes of discussion in the rest of this text. Q12 acts as a current sink for the current node. The rate at which C17 is discharged is determined by the setting of the MARKER INTENSITY control; the more heavily Q12 conducts, the shorter the discharge time of C17. When the MARKER INTENSITY control is turned cw, conduction of Q12 decreases, and more time is required to discharge C17 to the ground reference level; this results in extending the period of time that the scan is stopped to provide a brighter marker. Q13 and Q14 act as a differential amplifier to sense when C17 has been discharged to ground reference.

Initially (before Q12 is turned on), C17 is charged, Q13 is conducting and Q14 is turned off. Since Q14 is off, so are Q11 and Q10. When Q12 is turned on C17 begins to discharge. When the current node reaches the ground reference established by Q14, both Q13 and Q14 are conducting. When Q14 conducts, the voltage at the base of Q11 is reduced and Q11 conducts; current is now being sourced to the current node by Q11 and R29 at the same rate that current is being sunk from the current node by Q12. When Q11 conducts the voltage on the base of Q10 decreases, Q10 conducts and Q18 is turned on.

When Q18 conducts U1C pin 9 goes high (about +4 volts). If the count acknowledge signal is a high at U1C pin 10, U1C pin 8 goes low and the stop-enable flip-flop, U2, is cleared. This disables the active clamp current sink and permits the analyzer scan to continue. If Q18 conducts before the count acknowledge signal at U1C pin 10 goes high, the high dc level at Q18-e blanks the analyzer CRT through R33 and CR16 until the count acknowledge signal goes positive. The count acknowledge signal also turns on Q19 which for all practical purposes provides a ground at the junction of R33

and CR16, this prevents the CRT display in the spectrum analyzer from being blanked when the scan ramp is released and the scan ramp continues to the limits set by the analyzer.

Test Procedure 2

General

When the instrument is functioning properly, the waveforms shown in SS6-4 will appear at the following points: A - Q1-b, B - A5TP2, C - junction of Q11-c/Q12-c/Q13-b and D - Q18-b.

Initial Control Settings (for waveform SS6-4)

Spectrum Analyzer: (control settings not listed are not important)

SCAN TIME
PER DIVISION.....1 MILLISECOND
SCAN MODE .....INT
SCAN TRIGGER .....AUTO

Tracking Generator/Counter

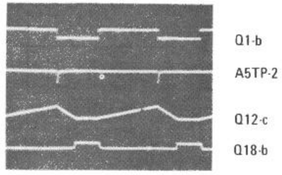
Mode.....MARKER
RESOLUTION .....100 Hz
MARKER INTENSITY.....Full CW
MARKER POSITION KNOB.....Pulled out

Oscilloscope

Triggered by Analyzer SCAN IN/OUT
Time/DIV.....5 Milliseconds
VOLTS/DIV.....A-.2
B-.5 C- .05
D-5
DC inputs 10:1 probes

Test 2-a. Connect the digital voltmeter form Q13-b to ground. The average dc level measured should vary considerably with rotation of the MARKER INTENSITY control (the level should be higher when the control is full cw). In the SCAN HOLD and MARKER modes the average voltage read should be below 1 volt. In the EXTERNAL mode the dc level should rise to approximately 18.5 volts. Proceed to test 2-b.

Test 2-b. If the dc level remains at about +18.5 volts in test 2-a in all positions of the MODE control switch, connect a 10K ohm resistor between Q1-b and the -12 volt supply (XA7-5) with the MODE switch in the EXTERNAL position. The digital voltmeter should indicate the same dc levels specified for the SCAN HOLD mode shown above. If the voltage level still remains at about +18.5 volts, check Q1, Q12, the MARKER INTENSITY control and associated components. If the voltage drops to the level specified for the SCAN HOLD mode in test 2-a, and the scan can be stopped in the SCAN HOLD mode, Q8 may be defective. If the dc levels differ greatly from those listed in tests 2-a and 2-b, check Q13, Q14 and associated components.



Waveform SS6-4
(See Test 2)

Test 2-c. If the dc levels for the SCAN HOLD and EXTERNAL modes were as specified in test 3-a and the instrument functions properly in these modes, but will not function in the MARKER mode, check Q10 and Q18. (Q18 may have been checked in test procedure -f.)

3 Blanking, Scan Hold, External and Zero Scan

Whenever the blanking signal is high (from the analyzer or originating in the model 8443A), Q3 conducts. When the blanking is originating in the model 8443A the high input at pin 2 of U1A has no effect because U1B is holding pin 1 of U1A low. When the model 8443A blanking pulse ends, pin 9 of U1C and pin 5 of U1B go low and pin 6 of U1B and pin 1 of U1A go high. However, Q3 has stopped conducting and the output of U1A at pin 3 remains unchanged. When the analyzer scan ramp ends and the analyzer blanking begins, Q3 again conducts. Now both inputs to U1A are high and the output, pin 3, goes low. The output of U1D pin 11 goes high, but this has no effect on U2 since U2 is clocked only on negative-going signals. When the analyzer blanking pulse ends, Q3 is turned off, U1A output (pin 3) goes high and pin 11 of U1D goes low. This clocks the stop-enable flip-flop (U2) and enables the active clamp.

In the SCAN HOLD mode CR11 and CR22 cathodes are grounded. CR22 provides a continuous ground (enable) to the count trigger output. CR11 prevents Q18 from conducting. This disables the model 8443A. blanking to the analyzer and also holds pin 9 of U1C low to prevent U2 from being cleared. The count periods are separated only by the time it takes the time base circuit to provide transfer and reset pulses and provide a toggle to the main gate flip-flop in the high frequency decade. The count acknowledge has no effect on the counter in the scan hold mode.

In the EXTERNAL mode the cathode of CR10 is grounded and U2 cannot be clocked. The counter trigger is held low by Q17, which is initially conducting. When the count acknowledge signal is received Q16 is turned on. C18 couples the signal to the base of Q17 through CR17 to turn off Q17. This causes the count trigger signal to go high. Q17 stays off for a period of time determined by C18 and R40. When C18 has charged up to approximately 1.4 volts as determined by CR17 and the emitter-base junction of Q17, Q17 again conducts and causes the count trigger to go low. The count periods are separated by the time Q17 is off, the transfer and reset pulse periods and the time required for the time base circuit to toggle the main gate flip-flop in the high frequency decade.

SERVICE SHEET 6 (cont'd)

When the analyzer is operated in the ZERO scan mode, and the model 8443A is in the MARKER mode, the marker control circuit works as it did in the EXTERNAL mode except that the low at test point 3 is provided by CR21 instead of a ground being provided by the MODE switch. When the analyzer is not in the ZERO scan mode, there is about -10 volts on the blanking coax shield. This causes Q2 to conduct and reverse bias CR21. When the analyzer is operating in the ZERO scan mode the -10 volts is no longer on the blanking coax shield, and Q2 is turned off. Q2-c is held slightly below ground by CR20, CR21 is forward biased and test point 3 is essentially at ground potential. Q16 and Q17 operate as they did in the EXTERNAL mode.

Test Procedure 3

General

When this portion of the marker control assembly is functioning properly in the MARKER mode, the critical points in the circuit will be working as indicated in waveform SS6-5. These waveforms represent the following: A - Q3-e blanking, B - U1C pin 9 internal blanking, C - the count acknowledge signal and D - U1C pin 8.

Initial Control Settings (for waveform SS6-5) Control settings are the same as those specified for waveform SS6-4 except for oscilloscope VOLTS/ DIV. A - 1, B - 5, C - .5 and D - 1.

Test 3-a. Connect the oscilloscope as follows: Channel A - U1 pin 9, Channel B - U1 pin 10, Channel C - U1 pin 8 and Channel D - Q3-e. Set oscilloscope VOLTS/DIV to .5 for all channels. The oscilloscope CRT display should be as shown in waveform SS6-6. (Model 8443A in MARKER mode.) Note that the Channel C waveform goes negative only during the short period of time that the Channels A and B waveform are both high. If the waveforms are not correct, proceed to test 3-b.

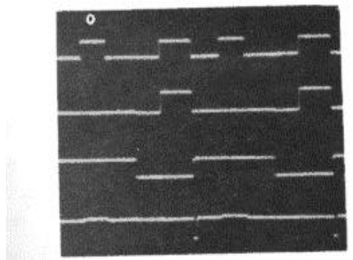
Test 3-b. Connect the digital voltmeter between pin 9 of U1 and ground, and set the RESOLUTION control to 10 Hz. In the EXTERNAL mode the digital voltmeter should indicate about -590 mVolts. In the MARKER mode the digital voltmeter should indicate about +3 volts. In the SCAN HOLD mode the digital voltmeter should indicate about -580 mVolts. If the dc level is high (+4 volts or more) the model 8443A is in the MARKER mode and the scan remains stopped, apply a ground to U1 pin 8; the scan should continue. If the scan does not continue, check U2. If it does, check U1.

Test 3-c. If waveform D is SS6-6 is incorrect, check for the same waveform (slightly higher in amplitude) at Test Point 1. If the waveform is present at TP 1, but not at Q3-e, Q3 is probably defective. If the waveform is not present at either point, check the cabling to the analyzer.

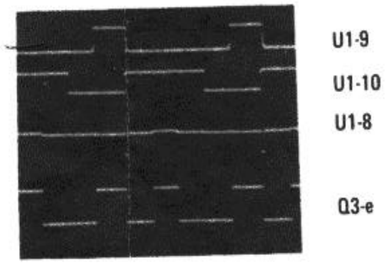
Test 3-d. If the model 8443A functions properly in the MARKER mode but does not function in the EXTERNAL mode, check Q16, Q17, the MODE switch and associated components.

Test 3-e. If the model 8443A will not function properly in the SCAN HOLD mode, but does in other modes, check CR11, CR22 and the MODE switch.

Test 3-f. If the counter will not work when the analyzer is placed in the ZERO scan mode, check Q2 and associated components.



(See Test 3)



Waveform SS6-6
(See Test 3-a)

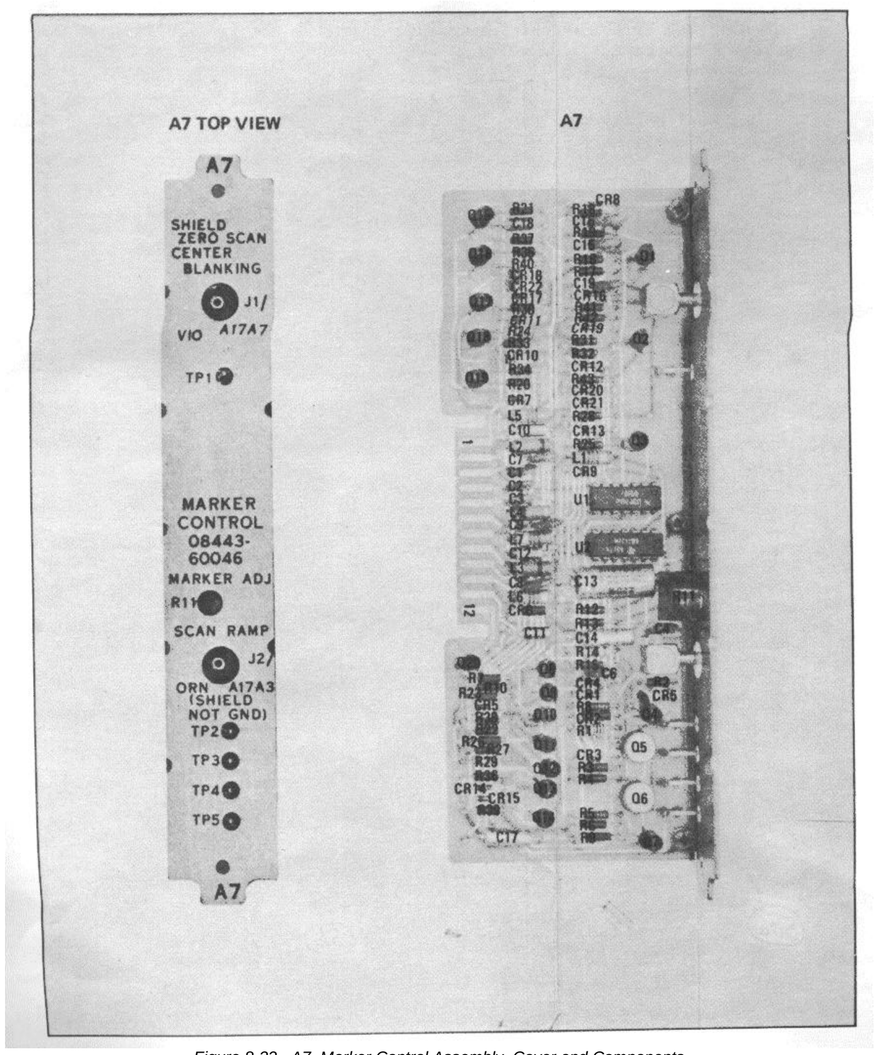


Figure 8-32. A7, Marker Control Assembly, Cover and Components

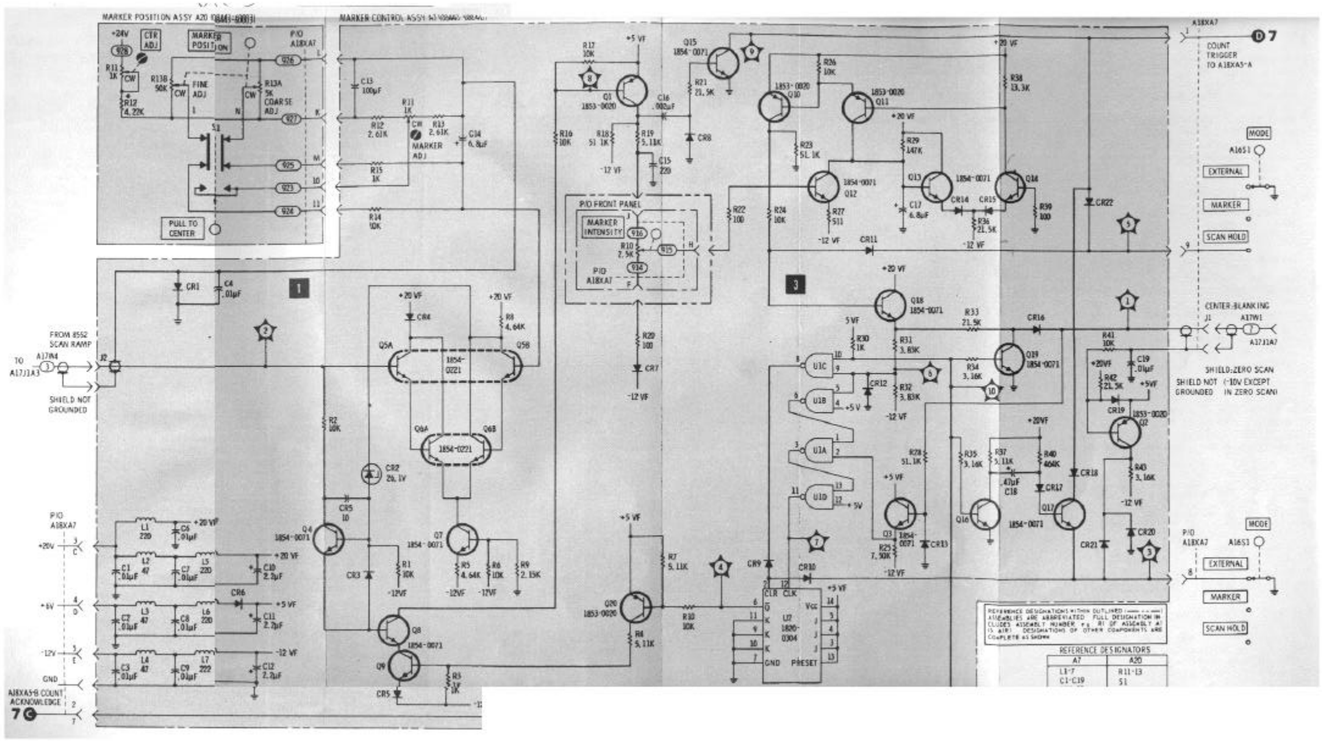


Figure 8-33. Marker Counter Circuit, Schematic Diagram

Section 8

SERVICE SHEET 7

Normally causes of malfunction in the model 8443A circuits will be isolated to a circuit board or assembly as a result of performing the tests specified in the Troubleshooting Tree.

When trouble has been isolated to the time base assembly (A5), it should be removed from the chassis and reinstalled using an extender board. This will provide easy access to test points and components.

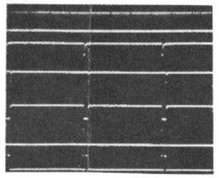
Equipment Required

4 Channel Oscilloscope — Service Kit
10:1 Oscilloscope — Digital Voltmeter
Probes (4)

General

The time base assembly contains circuits which provide transfer and reset pulses for all decade counters, a count acknowledge signal to the marker control circuit, a gate toggle signal for the high frequency decade, a print command for use in external equipment and a buffer amplifier to provide a 1 MHz output for use in external equipment.

When the time base assembly is functioning properly, the waveforms shown on composite waveform SS7-1 will appear at the six test points which are available at the top cover of the assembly. The functions of the waveforms are listed directly below the composite waveform.



Composite Waveform SS7-1

Trace 1. 1 MHz Reference Signal.
Trace 2. Input Trigger Signal.
Trace 3. Transfer Pulse.
Trace 4. Count Acknowledge Signal.
Trace 5. Reset Pulse.
Trace 6. Gate Toggle.

Initial Control Settings (for above waveforms)

Spectrum Analyzer (controls not listed may be set anywhere)

SCAN TIME
PER DIVISION ..... 1 MILLISECOND
SCAN MODE ..... INT
SCAN TRIGGER ..... AUTO

Tracking Generator/Counter

MODE ..... MARKER
RESOLUTION ..... 1 kHz
MARKER INTENSITY ..... Full CW
MARKER POSITION knob ..... Pulled Out

Note

For all tests using the oscilloscope synchronize the oscilloscope to the analyzer SCAN IN/OUT unless otherwise noted.

1 Trigger, Transfer and Reset

Q5 is normally conducting; pin A of XA5 is connected to the open collector of a transistor, Q15, in the marker control circuit. When the trigger goes low, Q5 is turned off. Q4 is normally off; it conducts only when the inhibit signal is high. (The inhibit signal is provided by external equipment connected to the rear panel BCD output connector when such equipment needs more time to process the previous count.)

When Q5-c and NAND gate pin 1 U1A go high, U1A pin 3 goes low because U1A pin 2 is high when the count trigger is received. C10, between pins 1 and 3 of U1A, prevents loop oscillations from occurring. When pin 3 of U1A goes low, pin 6 of NAND gate U1B goes high and turns on Q7 to begin the reset pulse. The reset pulse for U4, U3A, U3B, U5A and U5B is provided directly from the output of NAND gate U1B because these dividers require that current be sunk from them. Because the decade dividers in the high frequency decade require current to be sourced to their reset inputs, Q7 is required. NAND gate U1B cannot provide enough current for these decades.

The reset signal is a pulse of about 50 microseconds duration, as determined by the time constant of R16 and C12. R16 and C12 delay the application of the trigger pulse to the clear input of the time base flip-flop, U2, for 50 microseconds. When U2 is cleared the Q output goes low, U1A pin 2 goes low, U1A pin 3 goes high and pin 6 of U1B goes high to end the reset pulse.

When the count has been completed the main gate flip-flop in the high frequency decade provides a signal to clock the time base flip-flop, U2. C14 delays application of the end-of-count signal to the U2 clock input to assure that the transfer pulse will be applied to U15B in the low frequency counter after the overflow information has been stored. The delay is required because the D input of a type D flip-flop should not be changed while the clock input is low. When U2 is clocked, the Q output goes low and the Q output goes high. NAND gate U1C pin 10 goes high and pin 8 goes low for about 150 microseconds due to the time constant of R10 and C9. This 150 microsecond pulse from U1C transfers the information in the low frequency counter blanking decade counters to the buffer stores. The high Q output of U2 also provides the count acknowledge signal to the marker control circuit.

CR2, CR3 and CR4 prevent the start of the reset pulse while the transfer pulse is present. When the transfer pulse is present, CR3 and CR4 are reverse biased and the -12 volt source forward biases CR2 to prevent a high from appearing on U1A pin 1. When the transfer pulse is not present, CR3 and CR4 are forward biased and CR2 is reverse biased.

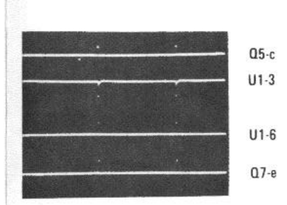
Test Procedure 1

Note

These tests assume that trouble has been isolated to the time base assembly as a result of performing the troubleshooting procedures.

Test 1-a. Use the digital voltmeter to verify the presence of dc voltages at terminals 4/D and 5/C as shown on the schematic diagram.

Test 1-b. Connect the oscilloscope as follows: Channel A to Q5-c, Channel B to U1-3, Channel C to U1-6 and Channel D to Q7-e. All channels set to .5 V/Div, TIME/DIV to 5 mSec. The oscilloscope display should be as shown in Waveform SS7-2. If the display is correct, use one of the oscilloscope channels to check the transfer signal



Waveform SS7-2
(See Test 1-b)

SERVICE SHEET 7 (cont'd)

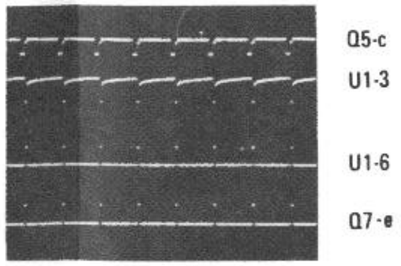
at TP-3. The waveform should be as shown in trace 3 of composite waveform SS7-1. If the waveforms are correct proceed to test procedure **2** if not, proceed to test 1-c.

Test 1-c. With the oscilloscope connected as it was for waveform SS7-2, set the oscilloscope TIME/DIV to 1 mSec and sync to internal. Place the model 8443A MODE switch to SCAN HOLD. The oscilloscope display should be as shown in waveform SS7-3, If the display is correct, but was not correct in test 1-b, trouble is in the marker control circuit. If waveform A is correct, and none of the others are correct, check U1A. If waveforms A and B are correct and C and D are not, check U1B. If only waveform D is incorrect, Q7 is probably defective. Use one of the oscilloscope probes to check the transfer pulse at TP 3. The transfer pulse should occur 1 ms after the input trigger pulse and almost identical to it in appearance. If the waveforms shown in SS7-3 are correct and the transfer pulse is not, check U1C, CR2, CR3, CR4 and associated components.

2 Reference Signal Amplifiers and Gate

The reference signal (internal or external) is selected by a switch, A5S1, located on the cover of the A5 assembly. L5 and C5 form a 1 MHz series resonant tank. R4 and the intrinsic resistance of Q2 provides a 50 ohm load for the reference source. Q2 is a common base amplifier with a voltage gain of ten. Q3 is a common emitter amplifier which saturates on positive half cycles of the reference signal. Q1 is a buffer amplifier which serves to isolate the time base circuits from external loads when the 1 MHz reference output is used in external equipment.

NAND gate U1D couples the 1 MHz reference signal to the first divide-by-ten circuit, U4, when the Q signal from U2 is high.



Waveform SS7-3
(See Test 1-c)

Test Procedure 2

Test 2-a. Connect the oscilloscope Channel A to R17/R29 junction, (channel B to U1-13, Channel C to U1-11 and Channel D to U1-12. The oscilloscope display should be as shown in waveform SS7-4. If the oscilloscope Channel B signal is not present, the other signals cannot be present either, because they are derived from the divide-by-ten circuits. If the Channel B signal is not present check for it first, at the base of Q3, then at the emitter of Q2. After making repairs, if the oscilloscope display .s as shown in SS7-4, and the counter still does not function properly, proceed to test procedure **3**.

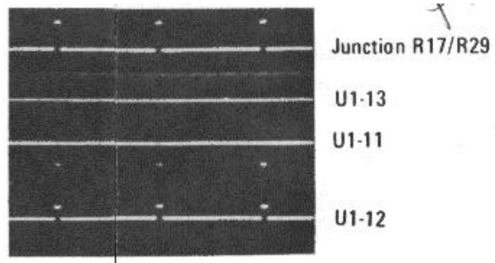
3 Divide-by-Ten Circuits

The divide-by-ten circuits (U4, U3A, U3B, U5A and U5B) are reset when pin 6 of U1B goes high. U4 is set to zero and the other four dividers are set to nine. When NAND gate U1D couples the reference signal to U4, U4 provides an output to reset the last four dividers to zero on the tenth input pulse. At the lime the last four dividers are set to zero, a pulse from one of the last three dividers (the divider output selected is determined by the position of the RESOLUTION switch) is provided to toggle the main gate flip-flop in the high frequency decade.

The outputs from tile last three dividers, which are used to toggle t e main gate flip-flop in the high frequency decade, are wired together in an OR configuration. Only one of the three outputs is available at any given time; the output from the divider selected is enabled by a ground return from the resolution switch. U3B provides the 1 kHz resolution, U5A provides the 100 Hz resolution and U5B provides the 10 Hz resolution. The resolution switch also provides a ground to one of three inputs in the low frequency counter to cause the decimal point in one of three numerical readouts to illuminate.

The 1K resistors in the outputs of the divide-by-ten circuits are the pullup resistors. The outputs in these dividers are open collectors and the resistors are required to provide wired OR capabilities.

When the end-of-count signal from the high frequency decade goes low, Q6 is turned off and a high is provided as an external print command to devices connected to the model 8443A rear panel BCD output connector.



Waveform SS7-4
(See Test 2-a)

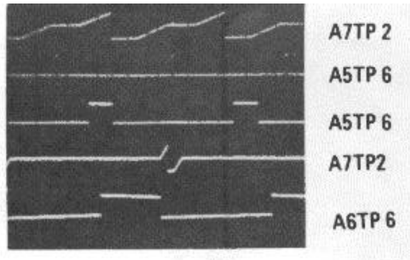
Test Procedure 3

Test 3-a. Composite waveform SS7-5 illustrates the correct gate toggle outputs from the time base circuit for various settings of the RESOLUTION switch referenced to the analyzer scan ramp.

Waveform 1 represents an analyzer scan time of 1 mSec per division, displayed on the oscilloscope at 5 mSec per division. Waveform 2 is the gate toggle pulse with the model 8443A in the 1 kHz resolution mode. Waveform 3 is the gate toggle pulse with the model 8443A in the 100 Hz resolution mode. Waveform 4 is the analyzer scan (1 mSec/Div) displayed on the oscilloscope at 20 mSec/Div and waveform 5 is the gate toggle with the model 8443A in the 10 Hz resolution mode.

Service Note

If the model 8443A works properly in the MARKER mode at 100 Hz and 1 kHz, but not at 10 Hz, U5B is defective. If it works at 1 kHz, but not at 100 Hz or 10 Hz, U5A is defective.



Composite Waveform SS7-5
(See Test 3-a)

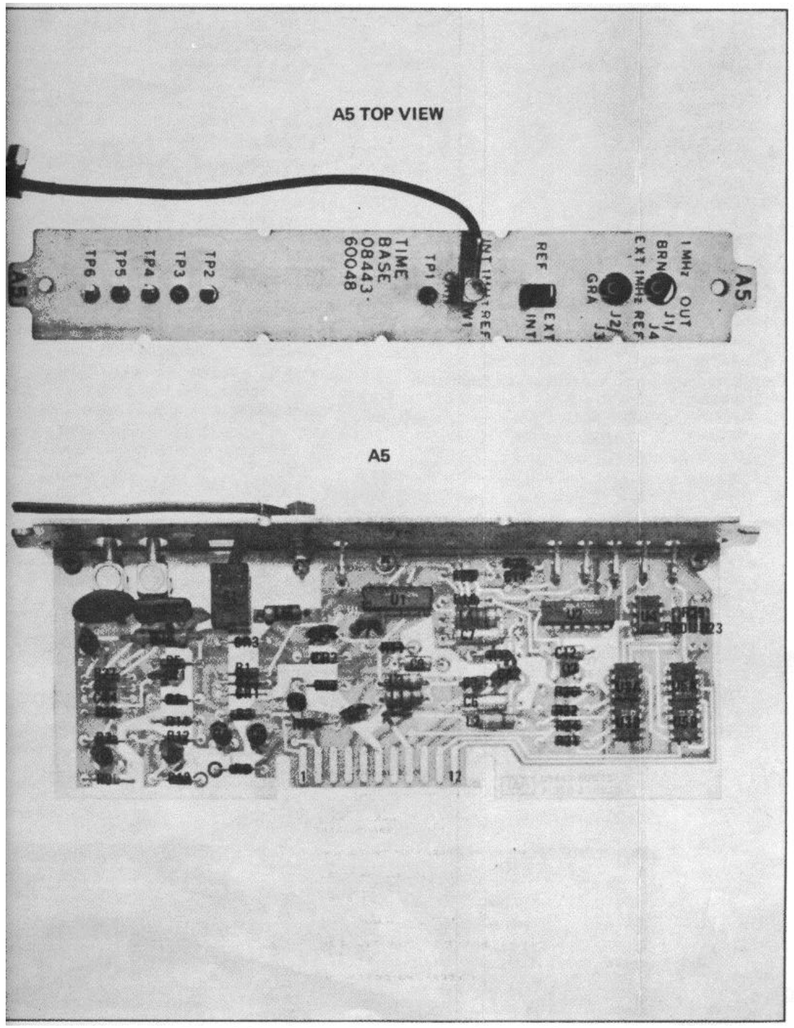


Figure 8-34. A5, Time Base Assembly, Cover and Components

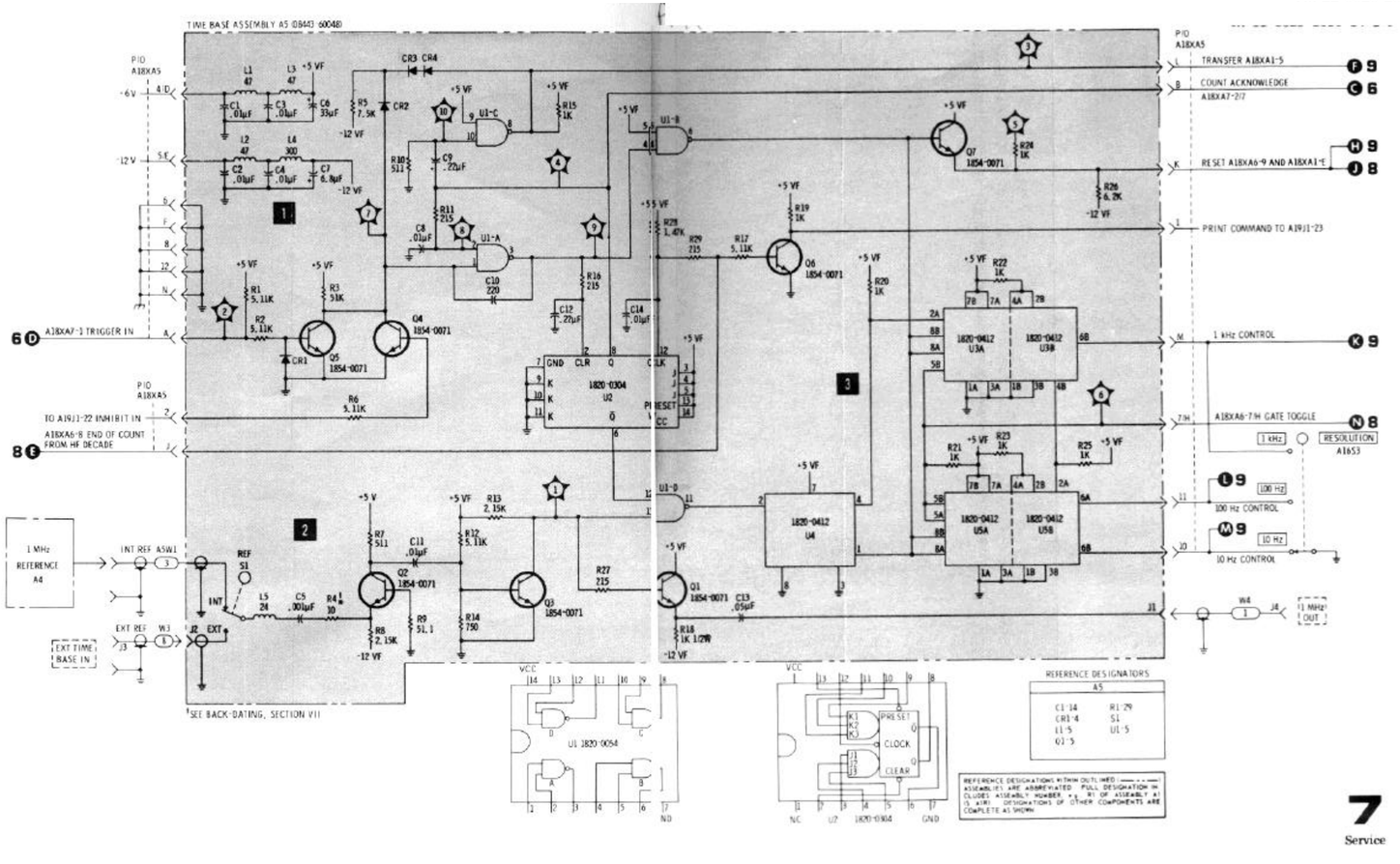


Figure 8-35. Time Base Circuit, Schematic Diagram

SERVICE SHEET 8

Normally, causes of malfunction in the model 8443A circuits will be isolated to a circuit board or assembly as a result of performing the tests specified in the Troubleshooting Tree.

When trouble has been isolated to the high frequency decade assembly (A6), it should be removed from the chassis and reinstalled using an extender board. This will provide easy access to test points and components.

Equipment Required

4 Channel Oscilloscope	Service Kit
10:1 Oscilloscope	HF Signal Generator
Probes (4)	Digital Voltmeter

General

The major purpose of the high frequency decade is to divide the input frequency by ten and supply suitable signals to drive the circuits in the low frequency counter assembly.

When the high frequency decade is functioning properly, the outputs to the low frequency counter will appear as shown in waveform SS8-1.

Initial Control Settings (for waveform SS8-1)

Spectrum Analyzer (setting of controls not listed is unimportant)
SCAN WIDTH
PER DIVISION ..... 10 MHz
SCAN WIDTH ..... PER DIVISION
FREQUENCY ..... 10 MHz
SCAN TIME
PER DIVISION ..... 1 MILLISECOND
SCAN MODE ..... INT
SCAN TRIGGER ..... AUTO

Tracking Generator/Counter
MODE ..... SCAN HOLD
RESOLUTION ..... 100 Hz
MARKER CONTROL knob ..... Pulled out

Oscilloscope
SYNC ..... INTERNAL
TIME/DIV ..... 2 mSec
VOLTS/DIV 2
SLOPE ..... --
TRIGGER ..... ACF

1 Input Amplifier and Switching Matrix

Q1 and Q2 provide flat amplification for signals with frequencies up to 120 MHz. L10 and L11 are peaking inductors to peak the gain at the high frequency end of the bandpass. R22 in the Q2 emitter circuit is selected so that a nominal -18 dBm signal will toggle U3. The value of R24 is selected to provide a dc level at pin 8 of U3 that is -900 mV +30 mV with no signal input. CR1, CR2, CR3, CR4, CR6, CR7, CR8, CR10 and CR11 comprise a switching matrix. When the tracking generator output is used, CR1, CR4, CR6 and CR11 are all forward biased and CR2, CR3, CR7, CR8 and CR10 are all reverse biased. The signal is coupled through C3, CR1, CR6, C17 and L9 to the base of Q1. When the EXTERNAL input is used, the diodes mentioned above are biased directly opposite from the way they are when the tracking generator output is counted. The signal is coupled through C4, C9, C10, CR2, CR7, CR8, CR10, C17 and L9 to the base of Q1.

Test Procedure

Test 1-a. Connect a 1 MHz source at +10 dBm to the model 8443A COUNTER INPUT and set the model 8443A MODE switch to EXTERNAL. Connect the oscilloscope Channel A input to Q1-b, the Channel B input to Q2-b and the Channel C input to U3 pin 8. Set the oscilloscope VOLTS/DIV to .2 for each channel and the TIME/DIV to 1 μSec, Trigger INT, ACF and SLOPE +. The waveform should be as shown in waveform SS8-2. If none of the waveforms are present, check the switching matrix. If waveform A is present and B and C are not, check Q1 and associated components. If waveform A and B are present and C is not, check Q2 and associated components. If all of the waveforms are present, proceed to test procedure .

2 Main Gate Flip-Flop

The main gate flip-flop (U2) is toggled by the output of one of the last three dividers in the time base circuit. When U2 is toggled to start the count, Q goes low to enable U3 and Q goes high. When U2 is again toggled Q goes high and Q goes low, U3 is no longer enabled and the negative-going trailing edge of the Q output of U2 produces an end-of-count signal to the time base.

Gate toggle translator Q5/Q6/Q7 translates the TTL output from the decade dividers in the time base circuit into the ECL input required by U2. Rise time is critical in U2 so a zener circuit such as that used in the reset translator cannot be used.

End of count translator Q3/Q4 translates the ECL output from U2 Q to the TTL logic required to clock the flip-flop in the time base circuit.

Test Procedure 2

Test 2-a. Set the model 8443A to operate in the MARKER mode with the RESOLUTION control

1. Q6-b Gate toggle from A5 ..... .2 VOLTS/DIV
2. Translated Gate toggle Q5-e ..... .2 VOLTS/DIV
3. U2 pin 13 Q output ..... .2 VOLTS/DIV
4. U2 pin 1 Q output ..... .1 VOLTS/DIV
5. Translated Q output, TP2 ..... .5 VOLTS/DIV

set to 100 Hz. Set the analyzer SCAN TIME PER DIVISION to 1 MILLISECOND. Synchronize the oscilloscope to the analyzer scan, triggered on + slope, ACF. Waveform SS8-3 is a composite waveform for the five critical circuit points; these points are identified directly below the composite waveform. Oscilloscope VOLTS/DIV information follows identification of test points.

If waveforms 1 and 2 are correct and 3, 4, and 5 are not, U2 is probably defective. If waveform 1 is present and 2 is not, check Q5/Q6/Q7 and associated components. If waveforms 1, 2, 3 and 4 are correct and waveform 5 is not, check Q3/Q4 and associated components.

Note

This test assumes that the time base circuit is functioning properly. If waveforms 1 and 3 do not appear, ground TP2 on the A5 assembly. Waveform 1 and 2 should appear (at a much faster rate). If they do, U2 is defective.

3 Reset Translator and Divide-By-Ten Decade.

CR9, a 2.87 volt zener diode is used to translate the TTL input from the reset line to an ECL input compatible with the input requirements of the high frequency decade.

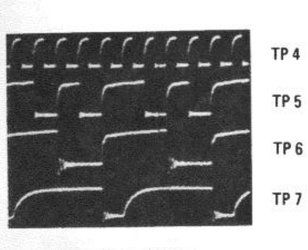
U3, U4, U5 and U6 are feedback connected to provide 1-2-4-8 BCD output to the low frequency counter circuit. U1A, U1B, U1C and U1D comprise a quad ECL to saturated logic translator which makes the ECL output of the decade compatible with TTL used in the low frequency counter circuits. R28/C24, R29/C26 and R30/C27 serve as RFI filters.

The decade dividers convert the 100 kHz to 110 MHz input frequency to an output frequency of 10 kHz to 11 MHz. The A, B, C and D outputs directly drive the buffer/store for the least significant digit in the low frequency counter. In addition the D output drives the following blanking decade counter.

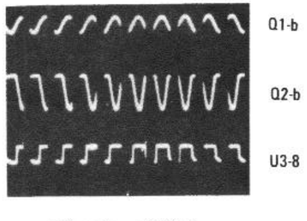
Test Procedure 3

Test 3-a. Use the oscilloscope to check for the reset pulse at XA6 pin 9 and at the junction of R11/CR12. The reset pulses should be positive-going, three to four volts in amplitude.

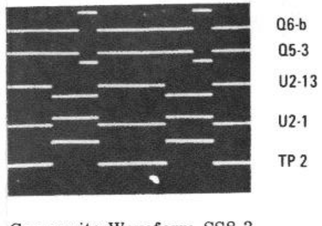
Test 3-b. Set the model 8443A to operate in the MARKER mode 100 Hz resolution. Set the analyzer SCAN TIME PER DIVISION to 1 MILLISECOND. Connect the oscilloscope Channel A, B, C and D inputs to test points 4, 5, 6 and 7 respectively. Set oscilloscope TIME/DIV to 5 mSec and VOLTS/DIV to .5 for all channels. The oscilloscope display should appear as shown in waveform SS8-4. Since the gate toggle U2 and the input amplifiers have been checked, an output which is not as shown must be due to a defective flip-flop or an associated OR gate. Note that if an output is missing (TP 5 for instance) and following outputs are present (in this instance, TP 6 and TP 7), the only possible cause of trouble is a defective OR gate (U1B).



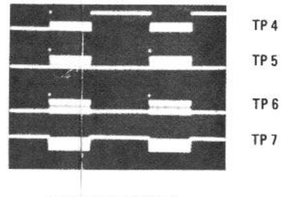
Waveform SS8-1
(See General)



Waveform SS8-2
(See Test 1-a)



Composite Waveform SS8-3
(See Test 2-a)



Waveform SS8-4
(See Test 3-b)

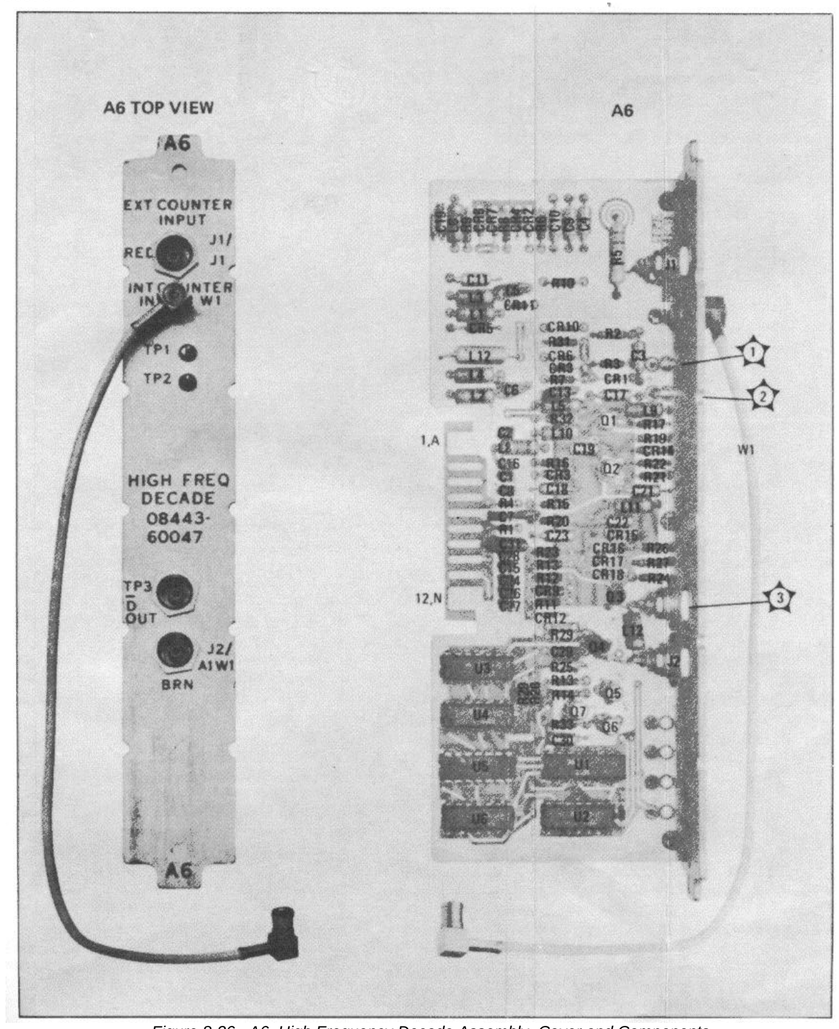


Figure 8-36. A6, High Frequency Decade Assembly, Cover and Components

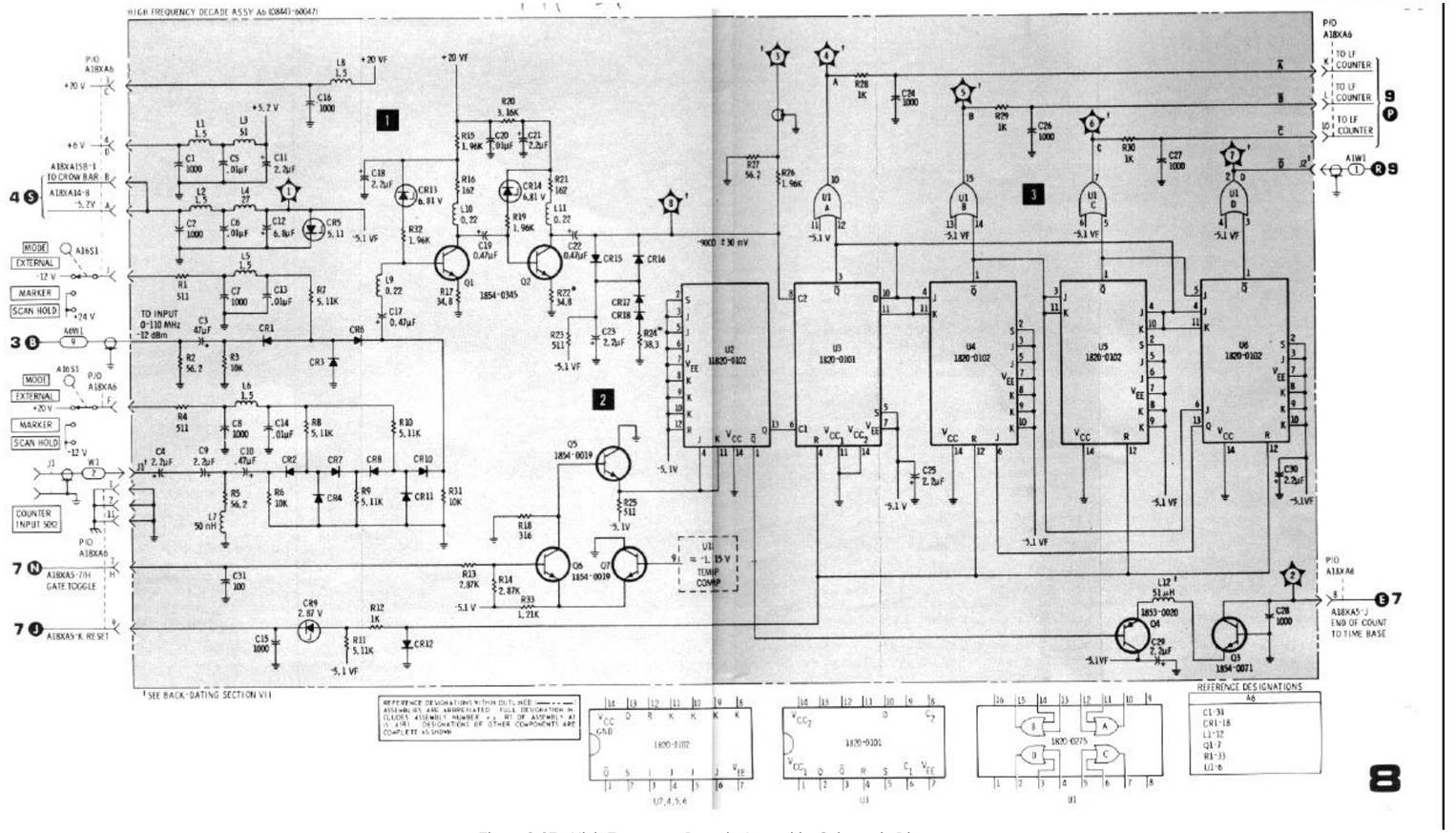


Figure 8-37. High Frequency Decade Assembly, Schematic Diagram

SERVICE SHEET 9

Normally causes of malfunctions in the model 8443A circuits will be isolated to a circuit board or assembly as a result of performing the tests specified in the Troubleshooting Tree.

When trouble has been isolated to the low frequency counter assembly (Al), it should be removed from the chassis and reinstalled using an extender board. This will provide easy access to test points and components.

Equipment Required

4 Channel Oscilloscope Service Kit
10:1 Oscilloscope Digital Voltmeter
Probes (4)

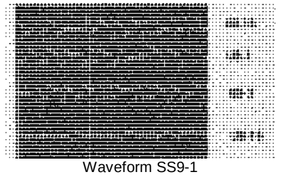
1 DS1 Drive Circuit

The least significant digit is displayed on DS1. When the transfer pulse from the time base is applied to buffer/store U8, the information in the high frequency decade is transferred to decoder/driver U1. U1 decodes the 1-2-4-8 information to cause the appropriate number in the numerical readout to be illuminated. U8 also provides a BCD output to a rear panel connector for use in external equipment.

Test Procedure 1

Test 1-a. Use the digital voltmeter to verify the presence of dc levels at pins A and B/2 shown on the schematic diagram.

Test 1-b. If the A, B, C and D inputs are as shown in Waveform SS9-1, and none of the numerical readouts illuminate, trouble is probably in the +175 volt or +5 volt circuits. Check for an open circuit in L1, L2 or L3.



Waveform SS9-1
(See Test 1-c)

Test 1-c. If some, or all of the other numerical readouts illuminate, trouble is probably in DS1, U1 or U8. Isolate the cause of trouble as follows:

Ground (one at a time) pins 1, 2, 3, 4, 11, 12, 13, 14, 15 and 16 of U1. Refer to the schematic and verify that the proper number illuminates for each pin as they are grounded. If none of the numbers illuminate, check R1. If R1 is providing power to DS1, DS1 is defective.

If DS1 numbers illuminate as they should in the previous test, connect the oscilloscope to U8 as follows: Channel A - pin 14, Channel B - pin 1, Channel C - pin 3 and Channel D - pin 16. Set the oscilloscope TIME/DIV to .5 second and the Volts/Div to .5. Operate the model 8443A in the MARKER mode at 10 Hz resolution. Place the analyzer SCAN WIDTH PER DIVISION to 10 MHz, SCAN WIDTH to PER DIVISION and SCAN TIME PER DIVISION to 1 MILLISECOND. At these analyzer settings, the least significant digit of the counter will change numbers quite rapidly; as a result, the output from the buffer store will also change rapidly. The oscilloscope display should appear (to the/eye) as four dots moving from left to right and changing in amplitude erratically. A time exposure of the oscilloscope CRT should be similar to that shown in waveform SS9-1. If the oscilloscope display is correct, U1 is defective. If the display is not correct, U8 is defective.

2 DS2 through DS7 Drive Circuits

The six counter circuits following that of the least significant digit each consist of a blanking decade counter, a buffer/store, a decoder/driver and a numerical readout device. DS3, DS4 and DS5 have inputs that will cause a decimal point to illuminate in one of them; the position of the RESOLUTION switch determines which decimal point is illuminated. Blanking inputs are provided to the circuits driving DS4, DS5, DS6 and DS7.

Each of the last five blanking decade counters is driven by the divide-by-ten output of the blanking decade counter which precedes it. The first blanking decade counter (U16) is driven by the D output of the high frequency decade. When the transfer pulse is received, each buffer/store transfers the count information from the blanking decade counter to the decoder/driver and to a BCD output connector on the rear panel. The decoder/drivers operate on negative logic; the rear panel BCD outputs are positive logic. When the reset pulse appears all of the blanking decade counters and the high frequency decade are set to zero.

Test Procedure 2

General

The numerical readout indicators, in many instances, will help to localize a problem to a specific area within the low frequency counter circuits.

If any one of the numerical readouts does not function, but numerical readouts to the left of it do, the trouble is likely to be the readout itself, the decoder/driver, or the buffer/store associated with that readout. It is not likely that the associated blanking decade counter is defective.

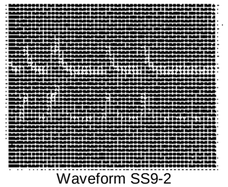
If any numerical readout is blank or reads only one number and the readouts to the left consistently read 0, the blanking decade counter for the first readout affected (from the right) is probably defective.

Test 2-a. If a single numerical readout is not functioning, ground (one at a time) pins 1, 2, 3, 4, 11, 12, 13, 14; 15 and 16 of the decoder/driver which drives it. Refer to the schematic diagram to verify that the right number is illuminating.

If none of the numbers illuminate, check the 6800 ohm resistor associated with that readout. If the 6800 ohm resistor is supplying power, the readout device is defective.

If the readout device illuminates correctly when the specified pins are grounded, proceed to test 2-b.

Test 2-b. Connect the oscilloscope to the buffer/store associated with the malfunctioning readout as follows: Channel A - pin 14, Channel B - pin 1, Channel C - pin 3 and Channel D - pin 16. Set the oscilloscope TIME/DIV to 1 second and the VOLTS/DIV to .5. Operate the model 8443A in the EXTERNAL mode at 10 Hz resolution with the RF OUTPUT connected to the COUNTER INPUT. Set the analyzer SCAN WIDTH PER DIVISION to 10 MHz, the SCAN WIDTH to PER



Waveform SS9-2
(See Test 2-c)

DIVISION and the SCAN TIME PER DIVISION to 1 second. The oscilloscope CRT display should appear (to the eye) as four dots moving from left to right and changing erratically in amplitude. A time exposure of the oscilloscope CRT should be similar to waveform SS9-1. If the oscilloscope CRT display is as shown, the decoder/driver is defective. If the display is not correct, proceed to test 2-c.

Test 2-c. Connect the oscilloscope to the blanking decade counter associated with the malfunctioning readout as follows: Channel A - pin 15, Channel B - pin 1, Channel C - pin 2 and Channel D -- pin 16. With all equipment operating as it was in test 2-b, the oscilloscope CRT should again show four dots moving from left to right and varying erratically in amplitude. If the signal is present, but was not in test 2-b, the buffer/store is defective. If the signal is not present, connect one channel of the oscilloscope to pin 9 of the blanking decade counter. All controls remain the same except that the oscilloscope CRT trace is centered and VOLTS/DIV is set to .2. The oscilloscope CRT presentation should be similar to that shown in Waveform SS9-2. If this waveform is present and the previous one was not, the blanking decade counter is probably defective. If the signal is not present, the preceeding blanking decade counter is defective.

3 DS8 Drive Circuit

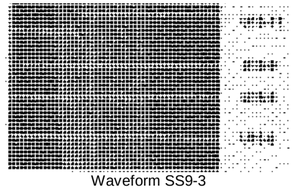
The most significant digit, displayed by DS8 in the 10 Hz resolution mode, is used only when the input frequency to the high frequency decade is 100 MHz or higher. Below 100 MHz, DS8 is blanked because there is no positive-going output from U21. The output of U21 changes state on a count of 8 (representative of 80 MHz), but since this transition is negative-going, it has no effect on U15A. When U2 receives a tenth input pulse (representative of [D MHz), it again changes state and the positive-going transition clocks U15A. The Q output of U15A goes high and is applied to the D input of U15B, which acts as a buffer/store. When the transfer pulse appears and the D input to U15B is high, U15B is clocked and the Q output is used to turn on Q1. When Q1 conducts it completes the circuit for the numeral 1 in DS8. The Q output of U15B is inverted by Q2 and applied as a BCD bit to the rear panel BCD connector.

Test Procedure 3

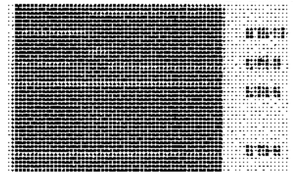
Test 3-a. Connect the oscilloscope to U15 as follows: Channel A - pin 11, Channel B - pin 9, Channel C - pin 5 and Channel D - pin 6. Set the oscilloscope SWEEP MODE to NORM, INTernal Sync, 5 mSec/Div, .5 VOLTS/DIV and DC inputs. Set the mode 8443A to operate in the SCAN HOLD mode, MARKER POSITION knob pulled out, 10 Hz resolution. Operate the analyzer in the ZERO scan mode at 95 MHz. The oscilloscope CRT display should be as shown in waveform SS9-3.

Change the analyzer FREQUENCY to 105 MHz. Note that U15A Channel B Q output (pin 9) goes high when the frequency reaches 100 MHz. The Q output of U15B (Channel C), goes high and the Q output of U15B (Channel D) goes low. The oscilloscope CRT display should now be as shown in Waveform SS9-4.

In the above tests, if the Channel A and B waveforms were correct and the Channel C and/or D were not, proceed to test 3-b. If all waveforms were correct and the numeral 1 did not light in DS8 when the frequency was over 100 MHz, proceed to test 3-c. If the Channel A waveform was correct, but channel B was not, U15 is defective.



Waveform SS9-3
(See Test 3-a)



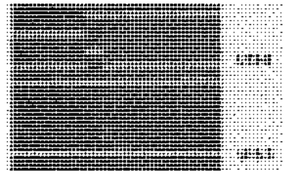
Waveform SS9-4
(See Test 3-a)

Test 3-b. Leave Channel A and B of the oscilloscope connected as they were in the above tests. Connect the Channel C input to U15 pin 13 and the Channel D input to U15 pin 3. The oscilloscope CRT display should be as shown in waveform SS9-5. If either the transfer or reset pulses are missing and the other counter digits function properly, U22 is defective.

Test 3-c. Apply a ground to Q1-c. If DS8 numeral 1 illuminates, Q1 is defective. If it does not, DS8 is defective.

4 Blanking

When the UNBLANKED-BLANKED switch on the rear panel is in the BLANKED position, all zeros which are to the left of the decimal point and also to the left of the first significant digit are blanked.



Waveform SS9-5
(See Test 3-b)

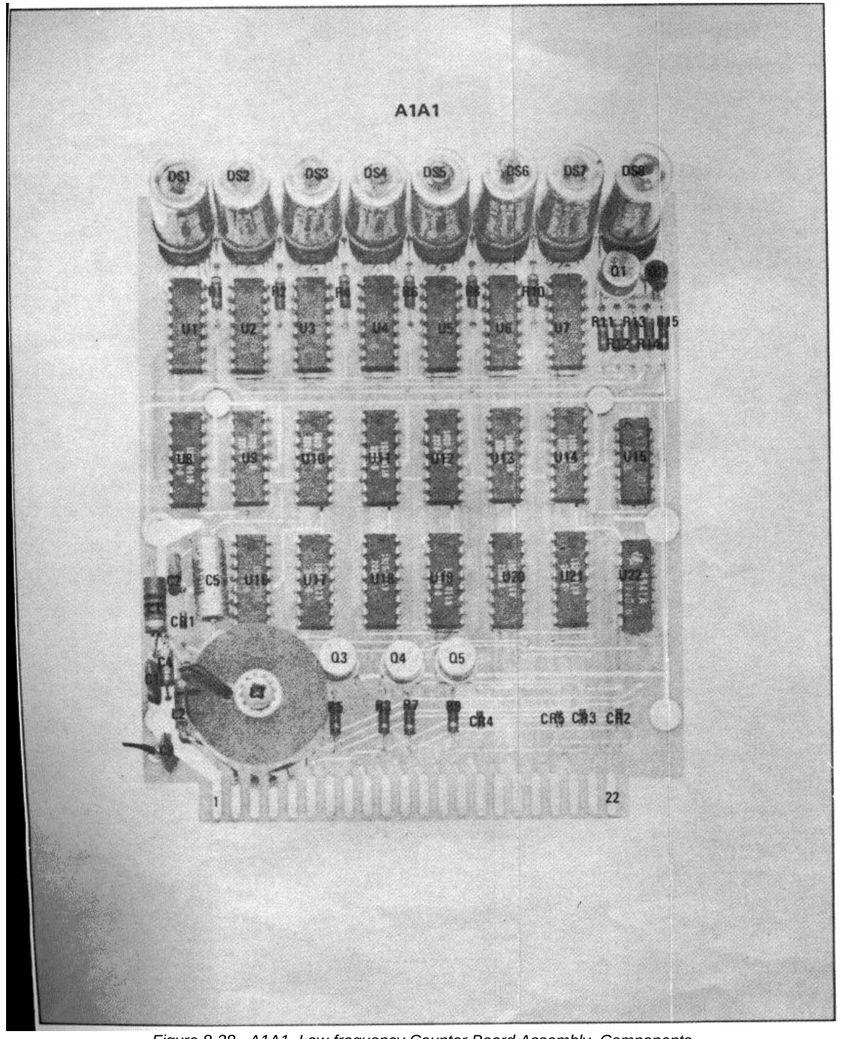


Figure 8-38. A1A1, Low frequency Counter Board Assembly, Components

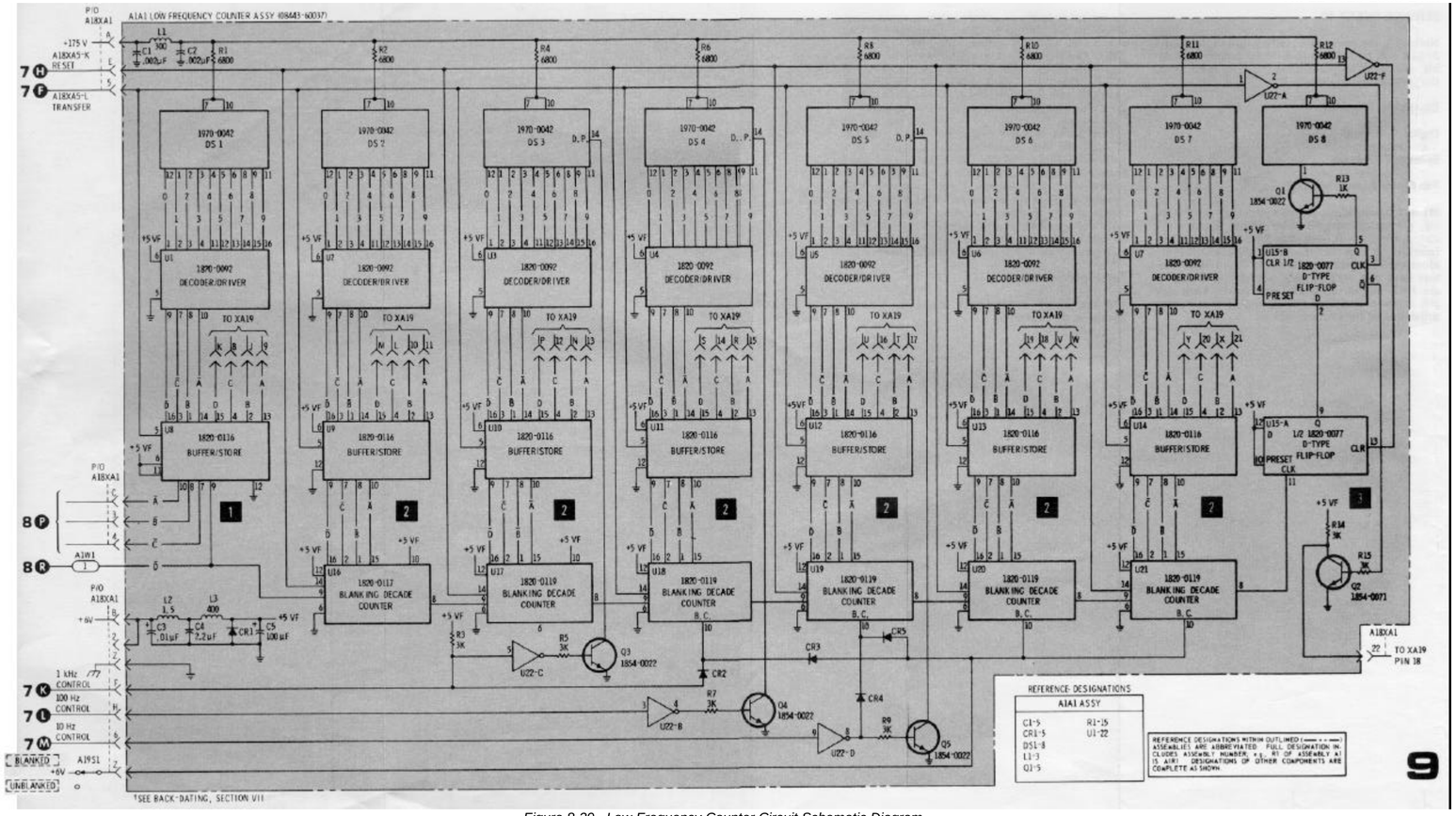


Figure 8-39. Low Frequency Counter Circuit Schematic Diagram

SERVICE SHEET 10

Normally, the cause of a malfunction in the model 8443A will be isolated to a circuit board or assembly as a result of performing the tests specified in the troubleshooting tree.

Equipment Required

Digital Voltmeter
Volt-ohm-ammeter
Spectrum Analyzer
Fan Motor Assembly A1A2

M1 is a brushless, dc motor comprising a cylindrical, permanent magnet rotor and a four section stator winding. It also has two Hall generators (marked "X" on the schematic); the generators are mounted 900 apart on the stator. The Hall generators have two outputs each, and the two outputs are 1800 out of phase with each other. Each output drives a transistor (Q1-4) and each transistor drives one of the stator windings.

As the rotor turns, an evenly rotating signal is produced by the Hall generators. This signal is four sine waves relatively spaced at 0°, 90°, 180°, and 270°. The sine waves are amplified by the transistors (Q1-4) and applied to the stator windings (W1-4). The relationship between the Hall generators and the stator windings causes the rotor to turn whenever power is applied to the circuit.

Motor speed is dependent upon the dc current through the Hall generators. This current is controlled by Q5. Q6, Q7 and CR8 provide a reference voltage for Q5. Q5 is also referenced to the voltage produced by CR1-4; this voltage is the rectified counter EMF of the motor and is proportional to motor speed. If motor speed varies, the counter EMF voltage changes; this changes the conduction of Q5, which changes the dc current through the Hall generators, which stabilizes motor speed.

Test Procedure

Use the digital voltmeter to check the voltages shown on the schematic.

SERVICE SHEET 10 (cont'd)

Table 8-8. Signal Path for BCD Information from Low Frequency Counter to Rear Panel

Signal	Low Frequency Counter AA1 08443-60037 XA1A1 Connector Pin No	Connector Board AIMP5 08443-60039 AIMP5 Connector Pin No	Mother Board A18 08443-60016 XA19 Connector Pin No	BCD Board A19 08443-60068 Digital Output Connector Pin No.		
A0	9	R	5	1	Note	
B0	J	15	D	2		
C0	8	S	4	26	Signals A0, B0, C0 and	
D0	K	14	E	27	D0 are right-most digit.	
A1	11	N	7	3		
B1	10	P	6	4		
C1	L	13	F	28		
D1	M	12	H	29		
A2	13	L	9	5		
B2	N	11	J	6		
C2	12	M	8	30		
D2	P	10	K	31		
A3	15	J	11	7		
B3	R	9	L	8		
C3	14	K	10	32		
D3	S	8	M	33		
A4	17	F	13	9		
B4	T	7	N	10		
C4	16	H	12	34		
D4	U	6	P	35		
A5	W	4	S	11		
B5	V	5	R	12		
C5	18	E	14	36		
D5	19	D	15	37		
A6	21	B	17	13		
B6	X	3	T	14		
C6'	20	C	16	38		
D6	Y	2	U	39		
A7	22	A	18	15		
Blanking	Z	1	V	Blanking Switch	Blanked Unblanked	Gnd +5
Print Inhibit	XA5, 1 XA5, 2		A B	48 22		
+5 Switch		1	25, Blanking			
Gnd		2	24, 50, 16, 40,	41, Blanking Switch		

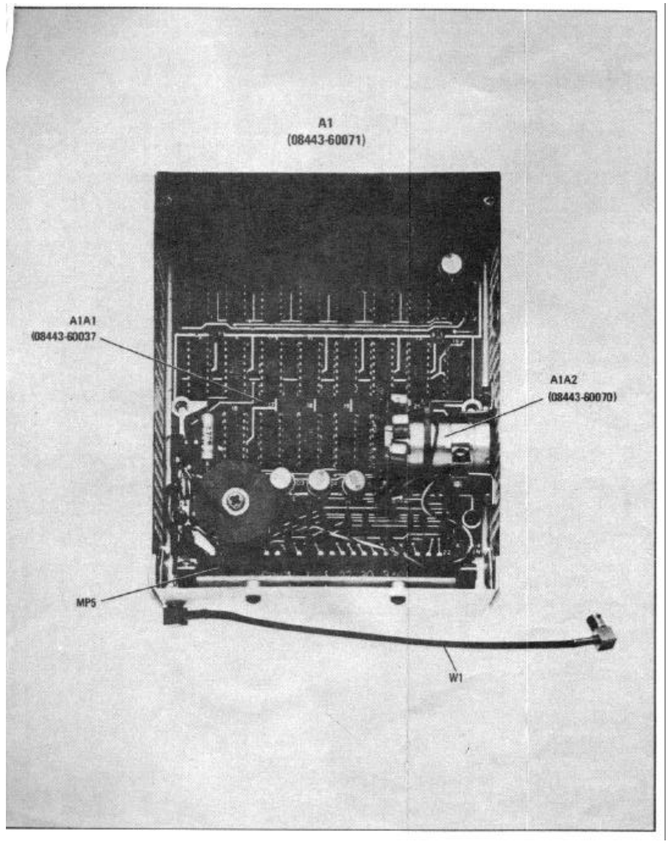


Figure 8-40. A1, Low Frequency Counter Assembly, Components

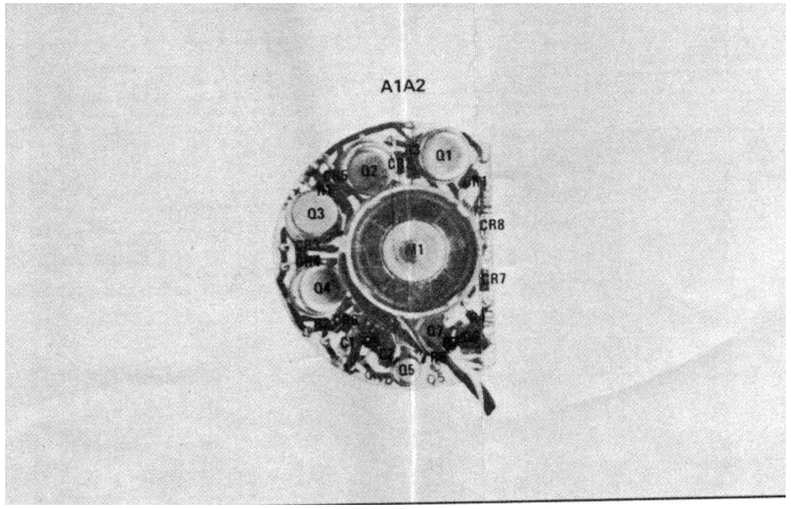


Figure 8-41. A1A2, Fan Motor Assembly, Components

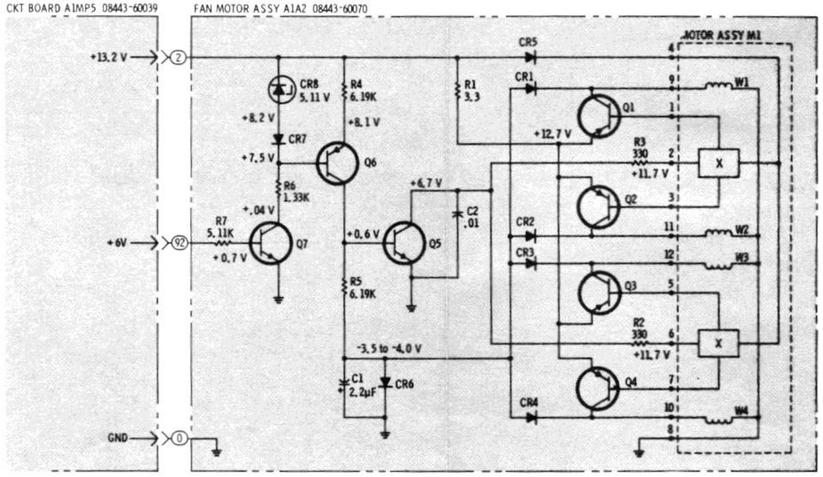


Figure 8-42. Fan Motor Credits, Schematic Diagram

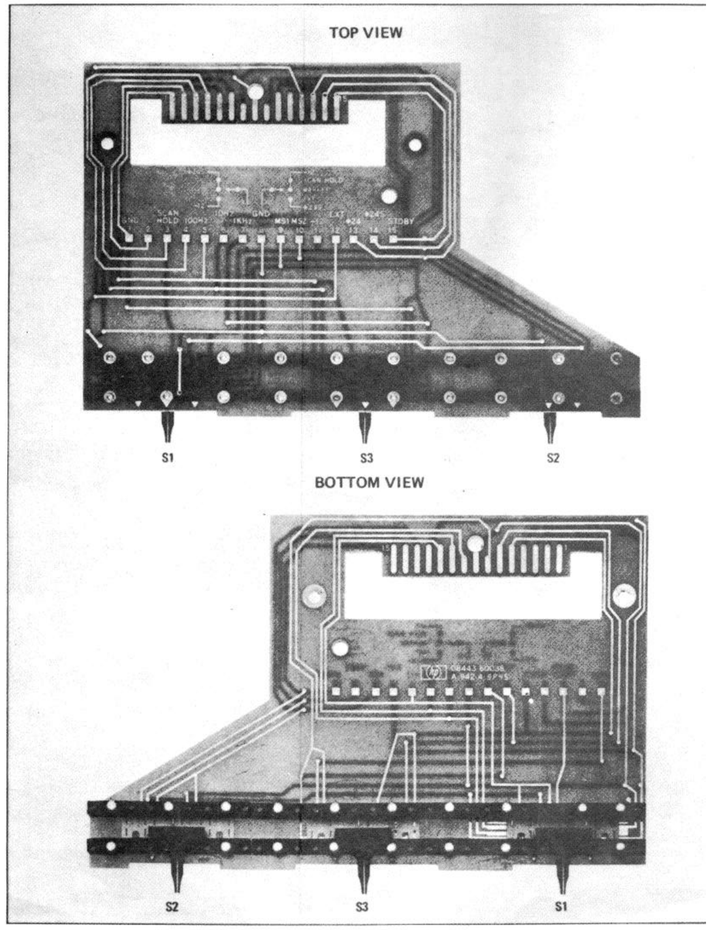


Figure 8-44. A16, Switch Assembly (8443A)

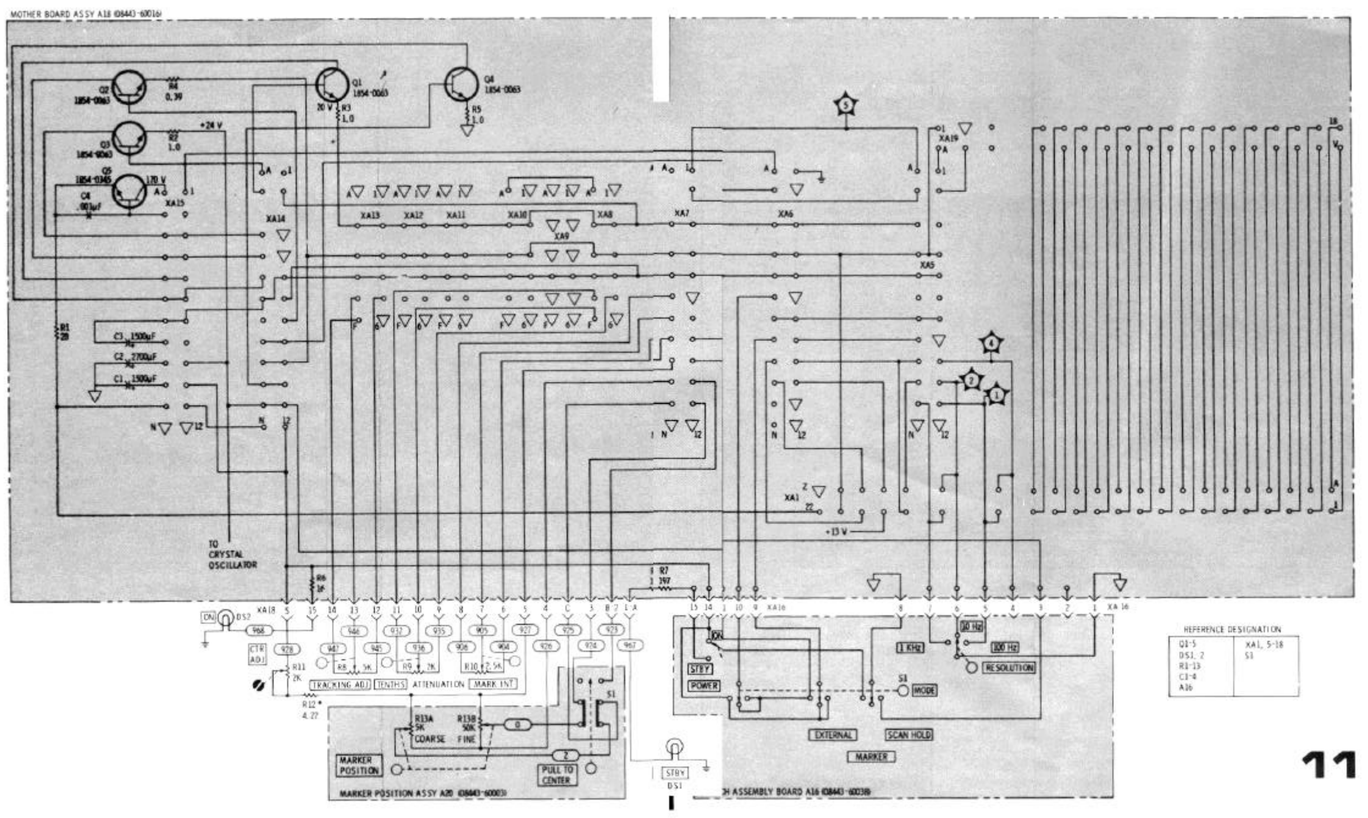


Figure 8-43. Overall Wiring Diagram, Including Chassis Mounted Parts

SERVICE SHEET 4 (CHANGE 12)

1. Rectifier Assembly A15

The Rectifier Assembly contains three two-diode, fullwave rectifiers; a regulator circuit; and four fuses. The rectifiers on this board assembly supply the dc voltages that are regulated by the sense amplifier (regulator control) circuits on Sense Amplifier Assembly A14 and the series regulator transistors mounted inside the HP 8443A rear panel. All together, these components make up four dc power supplies to furnish regulated dc power levels of +24 volts, +6 volts, +20 volts, and -12 volts.

Full-wave rectifier CR1-CR2 supplies +39 volts to the +24 volts and +20 volts series regulators, Q3 and Q1 respectively, both of which are controlled by sense amplifiers on Sense Amplifier Assembly A14. Full-wave rectifiers CR3-CR4 and CR5-CR6 furnish +13.2 volts and +8.8 volts to transistors Q2 and Q4 respectively, the +6 volts and -12 volts regulators. Q2 and Q4 are also each controlled by a separate sense amplifier circuit on the Sense Amplifier Assembly. The regulator circuit comprising CR7, Q1, R2 and R3 taps off the +39 volts output of rectifier CR1-CR2 to provide a +25.3 volts reference for the +24 volts sense amplifier. The output of the +24 volts sense amplifier, switched through the POWER STBY-ON switch, serves as the reference for the other three sense amplifier circuits.

Test Procedure 1

Test 1-a. Check the voltage levels at the upper ends of the fuses mounted on the Rectifier Board Assembly. (See Service Sheet 4 for fuse locations and voltage levels.)

Test 1-b. If there is no voltage present at the upper end of a fuse, check the fuse. If you replace a blown fuse with a new one, and it too burns out, the problem is most likely in the associated sense amplifier circuit on Sense Amplifier Assembly A14.

Test 1-c. If the problem is not a blown fuse, set the front-panel POWER switch to STBY, disconnect the ac power cable, and place the Rectifier Assembly on an extender circuit board. Then reconnect the ac power cable and set the POWER switch to ON.

Test 1-d. With an ac voltmeter, measure the voltages across the primary and secondary windings of the ac input power transformer. If there is voltage across the transformer primary, but none across one or more of the secondary windings in use, replace the transformer. If there is no voltage across the transformer primary, check the ac line fuse and the LINE SELECTOR switch on the rear panel, the front-panel POWER switch, the line filter (FL1), and the ac power cable.

Test 1-e. If the voltage across the transformer secondary windings is normal, use the digital voltmeter to check for the dc voltages shown on the schematic diagram.

3 Sense Amplifier Assembly A14

The Sense Amplifier Assembly contains four sense amplifier (series regulator control) circuits. Each sense amplifier controls the series regulator transistor for a particular one of the dc outputs: +24V, +20V, +6V, and 12V. In each sense amplifier, a comparator circuit compares the output voltage of its associated regulator transistor with a fixed dc reference derived from the +24 volts supply. Any variation in the output is translated by the comparator and an amplifier circuit into a signal which causes the series regulator to counteract the change in output level.

The sense amplifier circuits and their associated series regulators are made up as follows:

+24V sense amplifier A14Q14 through A14Q19 controls series regulator Q3.

+20V sense amplifier A14Q1, A14Q5, A14Q6, and A14Q11 controls series regulator Q1.

+6V sense amplifier A14Q2, A14Q7, A14Q8, and A14Q12 controls series regulator Q2.

-12V sense amplifier A14Q3, A14Q9, A14Q10, and A14Q13 controls series regulator Q4.

The Sense Amplifier Assembly also contains two crowbar circuits, one (CR11 through CR19) for the +dc supplies, and one (CR2 through CR4, and Q4) for the -12V supply. Reset switch S1 on the Sense Amplifier Assembly is a momentary push button used to reset the +dc crowbar. The -12V crowbar rests automatically.

Test Procedure 3

To test the Sense Amplifier Assembly, place it on an extender circuit board and use a digital voltmeter to check for the voltage levels shown in the assembly schematic diagram on Service Sheet 4.

NOTE

The voltages shown on the Sense Amplifier assembly schematic diagram are nominal values and may vary slightly from instrument to instrument.

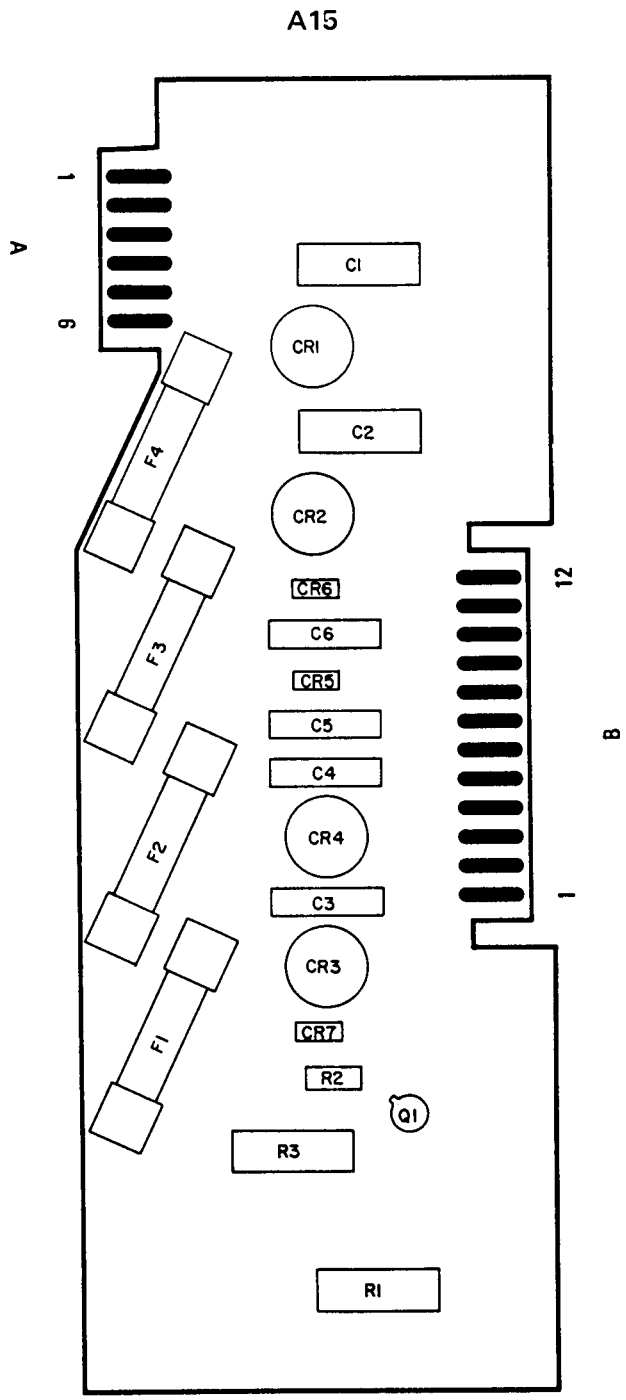


Figure 8-29. A15, Rectifier Assembly, Components (CHANGE 12)

Table 6-3. Replaceable Parts (CHANGE 13)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A5	08443-60094	5	1	BOARD ASSEMBLY-TIME BASE	26480	08443-60094
A5C1	0160-2055	9	25	CAPACITOR-FXD .01UF +80 -20% 100VDC CER	28480	0160-2055
A5C2	0160-2055	9		CAPACITOR-FXD .01UF +80 -20% 100VDC CER	28480	0160-2055
A5C3	0160-2055	9		CAPACITOR-FXD .01UF +80 -20% 100VDC CER	28480	0160-2055
A5C4	0160-2055	9		CAPACITOR-FXD .01UF +80 -20% 100VDC CER	23480	0160-2055
A5C5	0160-0174	9	1	CAPACITOR-FXD .47UF +80 -20% 25VDC CER	28480	0160-0174
A5C6	0160-0229	7	1	CAPACITOR-FXD 33UF + -10% 10VDC TA	56289	150D336X9010B2
A5C7	0180-0116	1	6	CAPACITOR-FXD 6.8UF + -10% 35VDC TA	56289	150D685X9035B2
A5C8	0160-2055	9		CAPACITOR-FXD .01UF +80 -20% 100VDC CER	24804	0160-2055
A5C9	0180-1735	2		CAPACITOR-FXD .22UF + -10% 35VDC CER	56289	150D224X9035A2
A5C10*	0160-3456	6	9	CAPACITOR-FXD 1000PF + -10% 1KVDC CER	28460	0160-3456
A5C11	0160-2055	9		CAPACITOR-FXD .01UF +80 -20% 100VDC CER	28480	0160-2055
A5C12	0180-1735	2		CAPACITOR-FXD .22UF -10% 35VDC CER	56289	150D224X9035A2
A5C13	0160-3453	3	9	CAPACITOR-FXD .05UF +80 -20% 100VDC CER	28480	0160-3453
A5C14-C17	0160-2055	9		CAPACITOR-FXD .01UF +80 -20% 100VDC CER	28480	0160-2055
A5CR1	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR2	1910-0016	0	5	DIODE-GE 60V 60MA 1US DO-7	28480	1910-0016
A5CR3	1901-0025	2		DIODE-GEN PRP 100V 200MA DO-7	28480	1901-0025
A5CR4	1901-0025	2		DIODE-GEN PRP 100V 200HA DO-7	28480	1901-0025
A5CR5	1901-0535	9		DIODE-SM SIG SCHOTTKY	26480	1901-0535
A5E1	8159-0005	0	2	WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A5E2	8159-0005			WIRE 22AWG W PVC 1X22 80C	28480	8159-0005
A5J1	1250-1195	8	9	CONNECTOR-RF SM-SLD M PC 50-OHM	28480	1250-1195
A5J2	1250-1195	8		CONNECTOR-RF SM-SLD M PC 50-OHM	28480	1250-1195
A5L1	9100-1629	4	6	INDUCTOR RF-CH-MLD 47UH 5% .166DX .385LG	28480	9100-1629
A5L2	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX .385LG	28480	9100-1629
A5L3	9100-1629	4		INDUCTOR RF-CH-MLD 47UH 5% .166DX .385LG	26480	9100-1629
A5L4	9100-1643	2		INDUCTOR RF-CH-MLD 300UH 5%.166DX .385LG	28480	9100-1643
A5Q1	1854-0404	0	3	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q2	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q3	1854-0404	0		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0404
A5Q4	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q5	1854-0071	7		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q6	1854-0071	7		TRANSISTOR NPN SI PD:300MW FT=200MHZ	28480	1654-0071
A5Q7	1854-0071	7		TRANSISTOR NPN SI PD 300MW FT=200MHZ	28480	1854-0071
A5R1	0757-0438	3	8	RESISTOR 5.11K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-5111-F
A5R2	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-5111-F
A5R3	0757-0458	7	1	RESISTOR 51.1K 1% .125W FC TC = 400/+800	28480	0757-0458
A5R4*	0757-0316	6	1	RESISTOR 42.2 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-42R2-F
A5R5	0757-0440	7	1	RESISTOR 7.5K 1%.125W FC TC = 400/+700	28480	0757-0440
A5R6	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-5111-F
A5R7	0757-0416	7	11	RESISTOR 511 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-511R-F
A5R8	0698-0084	9		RESISTOR 2.15K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-2151-F
A5R9	0757-0394	0	6	RESISTOR 5.1K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-51R1-F
A5R10	0757-0416	7		RESISTOR 511 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-511R-F
A5R11	0698-3441	8	7	RESISTOR 215 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-215R-F
A5R12	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-5111-F
A5R13	0698-0084	9		RESISTOR 2.15K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-2151-F
A5R14*	0757-0420	3	7	RESISTOR 750 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-751-F
A5R15	0757-0280	4		RESISTOR 1K 1% .125W FC TC = 400/+ 600	28480	0757-0280
A5R16	0698-3441	8		RESISTOR 215 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-215R-F
A5R17	0757-0438	3		RESISTOR 5.11K 1% .125W F TC = 0 + -100	24546	C4-1/8-TO-5111-F
A5R18	0757-0159	5	2	RESISTOR 1K 1% .5W F TC = 0 + -100	28480	0757-0159
A5R19	0757-0280	3		RESISTOR 1K 1%.125W FC TC= -400/+600	28480	0757-0280
A5R20	0757-1094	9		RESISTOR 1.47K 1%.125W FC TC= -400/+600	28480	0757-1094
A5R21	0698-3441	8		RESISTOR 1K 1%.125W FC TC= -400/+600	28480	0693-3441
A5R22	0757-0280	3		RESISTOR 1K 1% .125W FC TC= -400/+600	28480	0757-0280
A5R23	0757-0290	5		RESISTOR 6.19K 1% .125W FC TC= -400/+600	28480	0757-0290
A5R24	0698-3441	8		RESISTOR 1K 1%.125W FC TC= -400/+600	28480	0698-3441
A5R25	0757-0438	3		RESISTOR 5.11K 1%.25W FC TC= -400/+600	28480	0757-0438
A5R26	0757-0438	3	1	RESISTOR 5.11K 1% .25W FC TC= -400/+700	28480	0757-0438
A5R27	0757-0438	3		RESISTOR 5.11K 1%.125W F TC= 0 +-100	28480	0757-0438
A5R28	0757-0280	3		RESISTOR 1K 1% .125W FC TC= -400/+600	28480	0757-0280
A5R29	0698-8821	8	1	RESISTOR 5.62 OHM 1% .125W F TC= 0 + -100	24546	C4-1/8-TO-5R62-F
A5S1	3101-1213	8	1	SWITCH-TGL SUBMIN DPST .5A 120VAC PC	28480	3101-1213
A5TP1	08443-00041	6	16	TEST POINT	28480	08443-00041
A5TP2	08443-00041	6		TEST POINT	28480	08443-00041
A5TP3	08443-00041	6		TEST POINT	28400	08443-00041
A5TP4	08443-00041	6		TEST POINT	28460	08443-00041
A5TP5	06443-00041	6		TEST POINT	28480	08443-00041
A5TP6	08443-00041	6		TEST POINT	28480	08443-00041
A5U1	1820-0054	5	2	IC GATE TTL NAND QUAD 2-INP	01295	SN7400N
A5U2	1820-0304	8	2	IC FF TTL J-K M/S PULSE PRESET/CLEAR	01295	SN7472N
A5U3	1820-2078	7	5	IC 74LS 490 P2 CNTR	28480	1820-2078
A5U4	1820-2078	7		IC 74LS 490 P2 CNTR	28480	1820-2078
A5U6	1820-2078	7		IC 74LS 490 P2 CNTR	28480	1820-2078
A5U6	1820-1217	0		IC 74LS 151P MUXR	28480	1820-1217

PART NUMBER	FSCM	NATIONAL STOCK NUMBER	PART NUMBER	FSCM	NATIONAL STOCK NUMBER
CB1555	01121	5905-00-841-8307	0698-3454	28480	5905-00-974-6077
C023A101L503ZS25	56289	5910-00-544-6063	0698-7229	28480	5905-01-009-7560
C3-1/8-TO-1001-G	24546	5905-01-109-5428	0698-7236	28480	5905-01-015-8085
C4-1/8-TO-511R-F	24546	5905-01-033-3492	0698-7240	28480	5905-00-163-0847
MC10102P	04713	5962-00-496-2209	0698-8821	28480	5905-01-158-9776
MC10125L	04713	5962-00-626-3626	0757-0159	28480	5905-00-830-6677
MC10135L	04713	5962-01-014-9638	0757-0279	28480	5905-00-221-8310
MC10138L	04713	5962-00-059-2590	0757-0280	28480	5905-00-853-8190
MLM324P	04713	5962-01-029-4500	0757-0288	28480	5905-00-193-4318
P8155	34649	5962-01-083-2249	0757-0316	28480	5905-00-981-7475
P8243	34649	5962-01-102-1633	0757-0317	28480	5905-00-244-7189
SN74LS00N	01295	5962-00-056-4888	0757-0394	28480	5905-00-412-4036
SN74LS138N	01295	5962-01-004-1270	0757-0395	28480	5905-00-891-4210
SN74LS248N	01295	5962-01-150-8841	0757-0405	28480	5905-00-493-0738
SN74LS290N	01295	5962-01-064-8075	0757-0416	28480	5905-00-998-1795
SN74LS373N	01295	5962-01-107-6934	0757-0420	28480	5905-00-493-5404
SN7400N	01295	5962-01-096-2153	0757-0438	28480	5905-00-929-2529
SN7472N	01295	5962-00-865-4631	0757-0440	28480	5905-00-858-6795
0160-0127	28480	5910-00-809-5484	0757-0442	28480	5905-00-998-1792
0160-0174	28480	5910-00-234-9817	0757-0458	28480	5905-00-494-4628
0160-0575	28480	5910-01-091-0106	0757-0465	28480	5905-00-904-4412
0160-2055	28480	5910-00-211-1611	0757-1000	28480	5905-00-057-8480
0160-2204	28480	5910-00-463-5949	0757-1094	28480	5905-00-917-0580
0160-2327	28480	5910-00-244-7171	0812-0012	28480	5905-00-581-6437
0160-2930	28480	5910-00-465-9754	08443-00041	28480	6625-00-581-8806
0160-3453	28480	5910-00-544-6063	08443-60047	28480	6625-00-355-4855
0160-3456	28480	5910-01-014-2874	08443-60056	28480	6625-01-109-3488
0160-3875	28480	5910-01-056-2163	08443-60064	28480	6625-01-109-3482
0160-3877	28480	5910-01-035-6720	08443-60067	28480	5995-01-137-3129
0160-3879	28480	5910-00-477-8011	1N4004	01295	5961-00-106-6991
0160-4084	28480	5910-00-057-8158	1N4998	02735	5961-00-994-0520
0170-0040	28480	5910-00-829-0245	1N5338B	04713	5961-00-409-3632
0180-0116	28480	5910-00-809-4701	1200-0565	28480	5935-01-082-4293
0180-0197	28480	5910-00-850-5355	1200-0694	28480	5935-01-082-1765
0180-0229	28480	5910-00-403-2449	1250-1194	28480	5935-00-446-4102
0180-0376	28480	5910-00-444-6726	1250-1195	28480	6625-01-110-4142
0180-1735	28480	5910-00-430-6016	1251-0600	28480	5905-01-082-1966
0180-2215	28480	5910-00-187-2609	1251-1887	28480	5935-00-147-7384
0340-0140	28480	5970-00-088-5074	1251-2035	28480	5935-01-087-8437
0360-0124	28480	5940-00-993-9338	1400-0084	28480	5920-00-881-4636
0683-1555	28480	5905-00-111-1684	1480-0059	28480	5315-01-082-1814
0698-0082	28480	5905-00-974-6075	150-110-X5R-102M	51642	5910-00-244-7171
0698-0083	28480	5905-00-407-0052	150D224X9035A2	56289	5910-00-141-5862
0698-0084	28480	5905-00-974-6073	150D225X9020A2	56289	5910-00-850-5355
0698-0085	28480	5905-00-998-1814	150D336X9010B2	56289	5910-00-722-4117
0698-3132	28480	5905-00-828-0388	150D474X9035A2	56289	5910-00-069-5340
0698-3151	28480	5905-00-246-8634	150D685X9035B2	56289	5910-00-809-4701
0698-3429	28480	5905-00-407-0075	1810-0037	28480	5905-00-931-5084
0698-3434	28480	5905-00-997-4071	1810-0204	28480	5905-01-133-3422
0698-3438	28480	5905-00-974-6080	1820-0054	28480	5962-00-138-5248
0698-3439	28480	5905-00-407-0059	1820-0304	28480	5962-00-270-1961
0698-3441	28480	5905-00-974-6076	1820-0802	28480	5962-00-496-2209
0698-3442	28480	5905-00-489-6773	1820-1052	28480	5962-00-626-3626
0698-3444	28480	5905-00-339-7209	1820-1197	28480	5962-01-004-1272
0698-3447	28480	5905-00-828-0404	1820-1216	28480	5962-01-004-1270

PART NUMBER	FSCM	NATIONAL STOCK NUMBER
1820-1383	28480	5962-01-154-1072
1820-1442	28480	5962-01-093-6941
1820-1644	28480	5962-01-150-8841
1826-0161	28480	5961-01-008-4826
1853-0007	28480	5961-00-765-6071
1853-0020	28480	5961-00-904-2540
1853-0213	28480	5961-00-937-1409
1853-0281	28480	5961-00-904-4262
1854-0019	28480	5961-00-108-4783
1854-0071	28480	5961-00-137-4608
1854-0345	28480	5961-00-401-0507
1854-0404	28480	5961-00-408-9807
1854-0477	28480	5961-00-951-8757
1901-0039	28480	5961-00-833-6626
1901-0047	28480	5961-00-929-7778
1901-0050	28480	5961-00-914-7496
1901-0200	28480	5961-00-994-0520
1901-0518	28480	5961-00-430-6819
1901-0535	28480	5961-00-451-8685
1901-0539	28480	5961-00-577-0558
1901-0743	28480	5961-00-496-7364
1902-0048	28480	5961-00-912-3099
1902-0126	28480	5961-00-780-8330
1902-1291	28480	5961-00-138-7317
1902-3002	28480	5961-00-252-1307
1910-0016	28480	5961-00-954-9182
192P47392PTS	56289	5910-00-889-4462
2N2222A	04713	5961-00-136-8280
2N2907A	04713	5961-00-477-7364
2N4236	04713	5961-00-937-1409
2N5179	04713	5961-01-082-1003
208A102	01121	5905-01-133-3422
2110-0001	28480	5920-01-076-5560
2110-0002	28480	5920-00-280-4960
2110-0269	28480	5999-00-333-9620
2110-0564	28480	5920-01-087-1951
2110-0565	28480	5920-01-087-0836
2110-0569	28480	5310-01-097-7987
2200-0103	28480	5305-00-492-8796
2360-0121	28480	5305-01-083-3907
30D177G015DD2	56289	5910-00-187-2609
3050-0010	28480	5310-01-096-5618
3101-1213	28480	5930-00-237-1160
312-002	75915	5920-01-082-3333
312-001	75915	5920-00-280-8342
4040-0750	28480	5999-00-415-1213
5086-7010	28480	5962-00-483-1953
5086-7099	28480	5962-00-504-0511
5086-7357	28480	5985-00-357-3713
5086-7358	28480	5985-00-357-3712
761-3-R1K	11236	5905-00-931-5084
8159-0005	28480	6625-01-014-3446

APPENDIX C
MAINTENANCE ALLOCATION

Section I. INTRODUCTION

C-1. General.

This appendix provides a summary of the maintenance operations for Generator, Signal SG-1122/U. It authorizes categories of maintenance for specific maintenance functions on repairable items and components and the tools and equipment required to perform each function. This appendix may be used as an aid in planning maintenance operations.

C-2. Maintenance Function.

Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipments used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Install. The act of emplacing, seating, or fixing into position an item, part, module (component or assembly) in a manner to allow the proper functioning of the equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly, or module (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining, or resurfacing) to restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by maintenance standards (i.e., DMWR) in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipments/components.

C-3. Column Entries.

a. Column 1, Group Number. Column 1 lists group numbers, the purpose of which is to identify components, assemblies, subassemblies, and modules with the next higher assembly.

b. Column 2, Component/Assembly. Column 2 contains the noun names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column 3, Maintenance Functions. Column 3 lists the functions to be performed on the item listed in column 2. When items are listed without maintenance functions, it is solely for the purpose of having the group numbers in the MAC and RPSTL coincide.

d. Column 4, Maintenance Category. Column 4 specifies, by the listing of a "work time" figure in the appropriate subcolumn(s), the lowest level of maintenance authorized to perform the function listed in column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function vary at different maintenance categories, appropriate "work time" figures will be shown for each category. The number of task-hours specified by the "work time" figure represents the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time, troubleshooting time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart. Subcolumns of column 4 are as follows:

C - Operator/Crew
O - Organizational
F - Direct Support
H - General Support
D - Depot

e. Column 5, Tools and Equipment. Column 5 specifies by code, those common tool sets (not individual tools) and special tools, test, and support equipment required to perform the designated function.

f. Column 6, Remarks. Column 6 contains an alphabetic code which leads to the remark in section IV, Remarks, which is pertinent to the item opposite the particular code.

C-4. Tool and Test Equipment Requirements (Sect. III).

a. Tool or Test Equipment Reference Code. The numbers in this column coincide with the numbers used in the tools and equipment column of the MAC. The numbers indicate the applicable tool or test equipment for the maintenance functions.

b. Maintenance Category. The codes in this column indicate the maintenance category allocated the tool or test equipment.

c. Nomenclature. This column lists the noun name and nomenclature of the tools and test equipment required to perform the maintenance functions.

d. National/NATO Stock Number. This column lists the National/NATO stock number of the specific tool or test equipment.

e. Tool Number. This column lists the manufacturer's part number of the tool followed by the Federal Supply Code for manufacturers (5-digit) in parentheses.

C-5. Remarks (Sect. IV).

a. Reference Code. This code refers to the appropriate item in section II, column 6.

b. Remarks. This column provides the required explanatory information necessary to clarify items appearing in section II.

SECTION II MAINTENANCE ALLOCATION CHART
FOR
GENERATOR, SIGNAL SG-1122/U

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINT. FUNCTION	(4) MAINTENANCE LEVEL C	O	F	H	D	(5) TOOLS AND EQUIPMENT	(6) REMARKS
00	SIGNAL GENERATOR SG-1122/U	Inspect	0.2						A
		Test	0.3						B
		Test				0.6			
		Repair	0.3					1	C
		Adjust				2.0		2 thru 16	
		Repair				9.0			D
		Calibrate				4.0		2 thru 16	
01	LOW FREQUENCY COUNTER ASSEMBLY A1	Inspect				0.2			
		Test				1.0		2 thru 16	
		Repair				1.0			E
02	VIDEO ASSEMBLY: AMPLIFIER ALC A8	Inspect				0.2			
		Test				2.0			
		Repair				3.0		2 thru 16	F
03	BOARD ASSY: RECTIFIER A15	Inspect				0.2			
		Test				0.5			
		Repair				0.5		16	G
04	MOTHERBOARD ASSEMBLY A18	Inspect				0.5			
		Test				0.5			
		Repair				3.0			

SECTION III TOOL AND TEST EQUIPMENT REQUIREMENTS FOR GENERATOR, SIGNAL SG-1122/U

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	O	TOOL KIT, ELECTRONIC EQUIPMENT TK-101/G	5180-00-064-5178	
2	H	TOOL KIT, JTK-17	4931-01-073-3845	
3	H	MULTIMETER, DIGITAL	6625-01-010-9255	HP3490A
4	H	OSCILLOSCOPE AND	6625-01-034-3269	TEK 5440
		PLUG-IN UNIT	4931-01-008-1479	TEK 5S14N
5	H	GENERATOR, SIGNAL	6625-00-318-6304	HP8640B
6	H	COUNTER, FREQUENCY, SYSTEM	6625-00-531-4752	HP5345A
7	H	POWER SUPPLY PLUG-IN	6130-01-004-6705	TEK PS 805A
8	H	SPECTRUM ANALYZER CONSISTING OF:		
		DISPLAY SECTION	6625-00-424-4370	HP141T
		IF	6625-00-431-9339	HP8552B
		RF SECTION PLUG IN	6625-00-140-0156	HP8554B
9	H	FREQUENCY MEASURING SYSTEM CONSISTING OF:		
		RECEIVER, STANDARD	6625-00-528-6773	TRACOR 599K
		OSCILLATOR	4931-00-113-2942	HP105A
		METER, FREQUENCY DIFFERENCE	6625-01-085-7707	TRACOR 527E
10	H	AMPLIFIER, POWER	4931-00-128-1444	RF 815
11	H	DETECTOR, CRYSTAL	6625-00-880-4978	HP 423A
12	H	OSCILLATOR, TEST	6625-00-054-3483	HP652A
13	H	VOLTMETER, AC	6625-00-229-0457	HP4D0EL
14	H	RECORDER, X-Y	6625-00-463-6042	HP7O35B
16	H	ATTENUATOR	5985-00-993-1377	HP355C
16	H	MULTIMETER	6625-00-238-1274	SIMPSON 260-6

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SECTION IV. REMARKS

REFERENCE CODE	REMARKS
A	VISUAL INSPECTION OF EXTERNAL SURFACE ONLY.
B	NORMAL OPERATIONAL TEST.
C	REPLACEMENT OF FUSES, KNOBS, AND ANY OTHER MAINTENANCE ON THE EXTERNAL SURFACE OF THE SG-1122/U.
D	REPAIR BY REPLACEMENT OF ASSEMBLIES: A2, A3, A4, AS, A6, A7, A9, A10, A11, A12, A13, A14, A16, A17, A19, A20, T-1, W-1, W3 thru W8.
E	A1 REPAIRED BY REPLACEMENT OF A1A1, A1A2, A1A3.
F	A8 REPAIRED TO COMPONENT LEVEL AND REPLACEMENT OF A8A1, A8A1U1, ABA1U2.
G	LIMITED TO REPLACEMENT OF A15F1 thru A15F4.

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APPENDIX D

OPERATOR, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE REPAIR PARTS AND SPECIAL TOOLS LISTS

Refer to Section, Replaceable Parts, for all parts required for the operation and repair of the Generator, Signal SG-1122/U.

HEWLETT PACKARD

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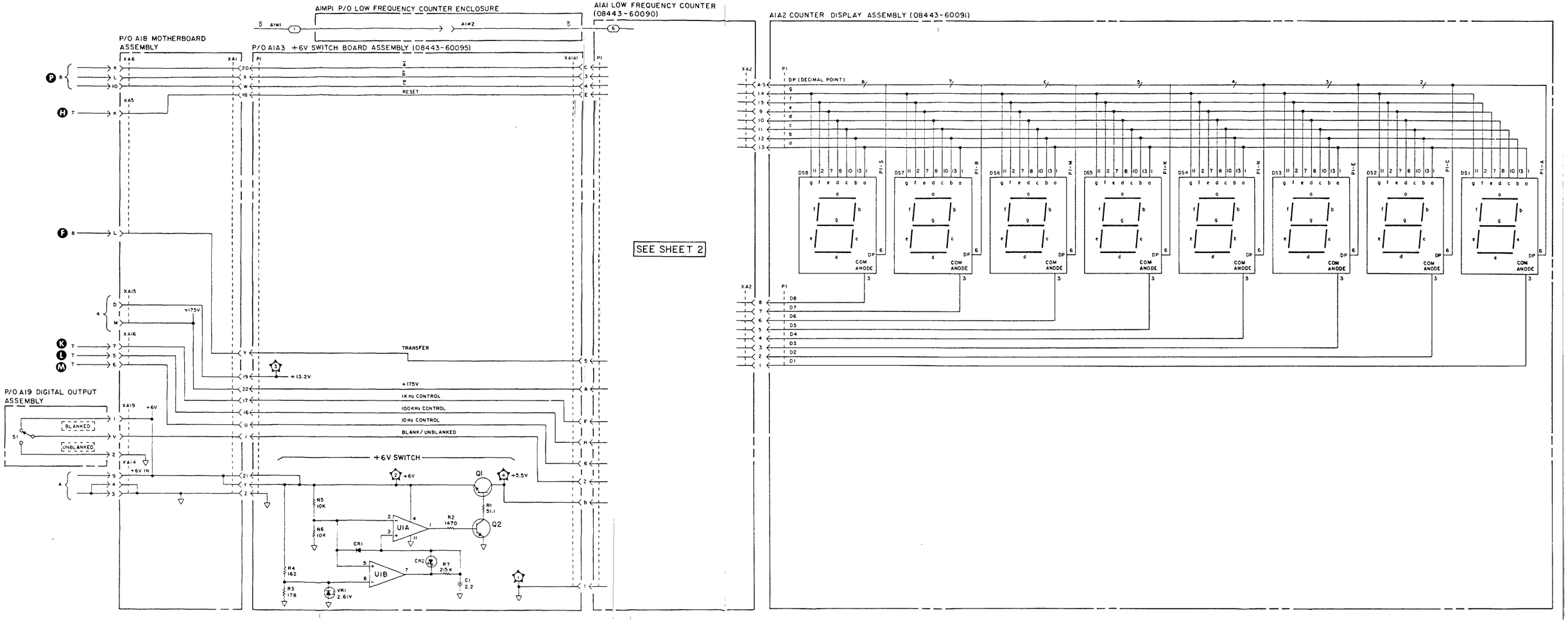
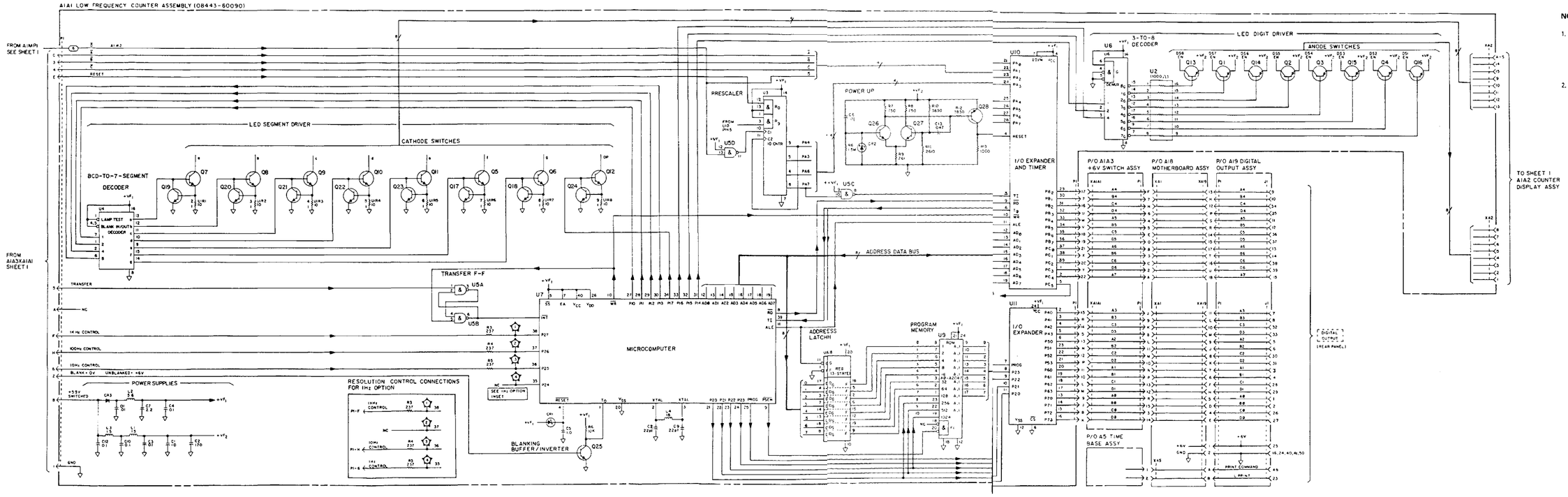


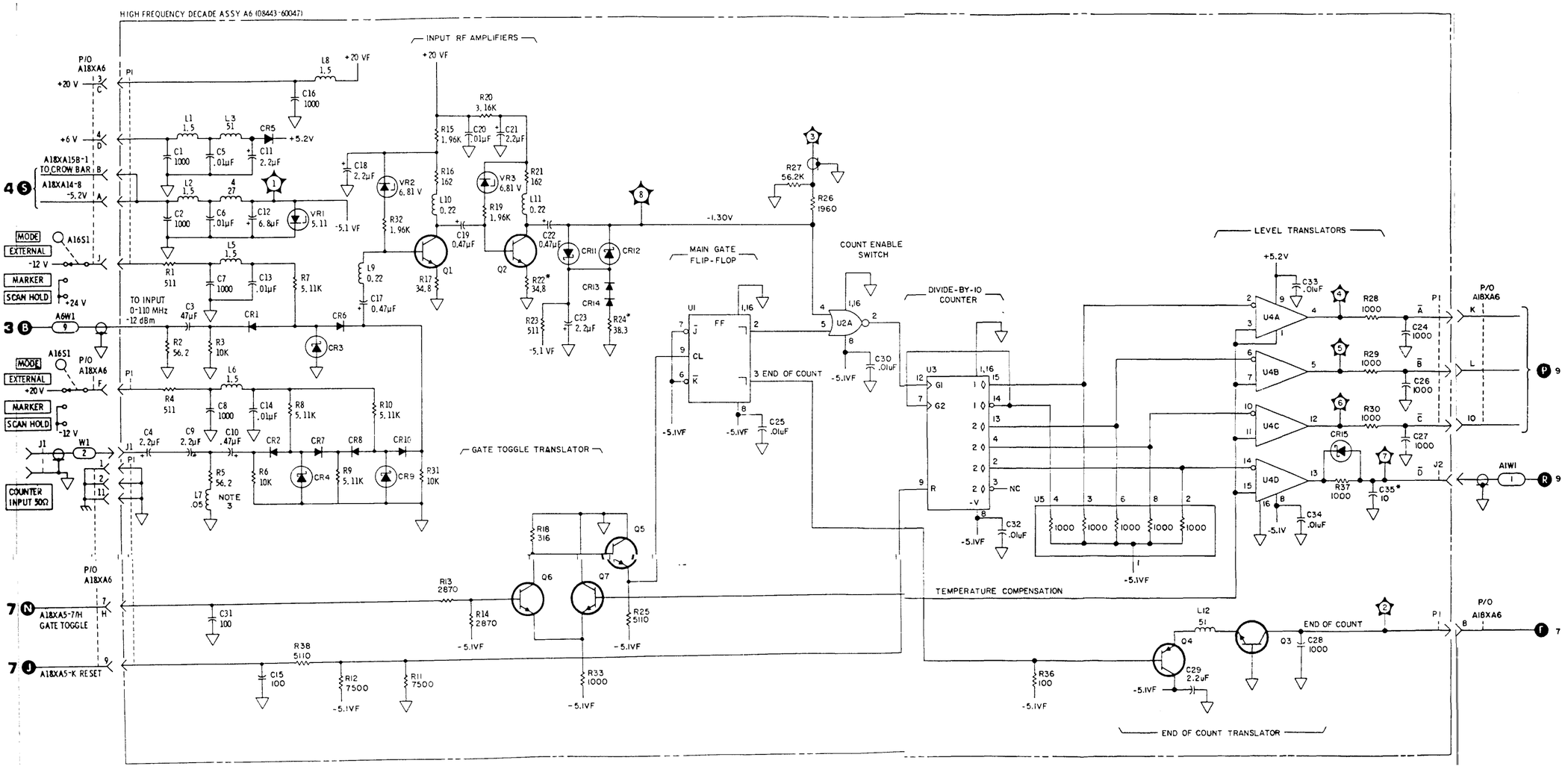
Figure 8-39. Low Frequency Counter Assembly A1 and Digital Output Assembly A19 Schematic Diagram, Sheet 1 of 2 (CHANGE 9)



NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN PICOFARADS (PF) INDUCTANCE IS IN MICROHENRIES (μH)

Figure 8-39. Low Frequency Counter Assembly A1 and Digital Output Assembly A19 Schematic Diagram, Sheet 2 of 2 (CHANGE 9)



NOTES

1. REFERENCE DESIGNATORS WITHIN THIS ASSEMBLY ARE ABBREVIATED. FOR COMPLETE REFERENCE DESIGNATION, PREFIX ABBREVIATION WITH ASSEMBLY DESIGNATION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IS IN OHMS (Ω) CAPACITANCE IS IN PICOFARADS (PF) INDUCTANCE IS IN MICROHENRIES (μH)
3. INDUCTOR L7 IS PART OF PC BOARD TRACE.

Figure 8-37. High Frequency Decade Assembly, A6 Schematic Diagram (CHANGE 10)

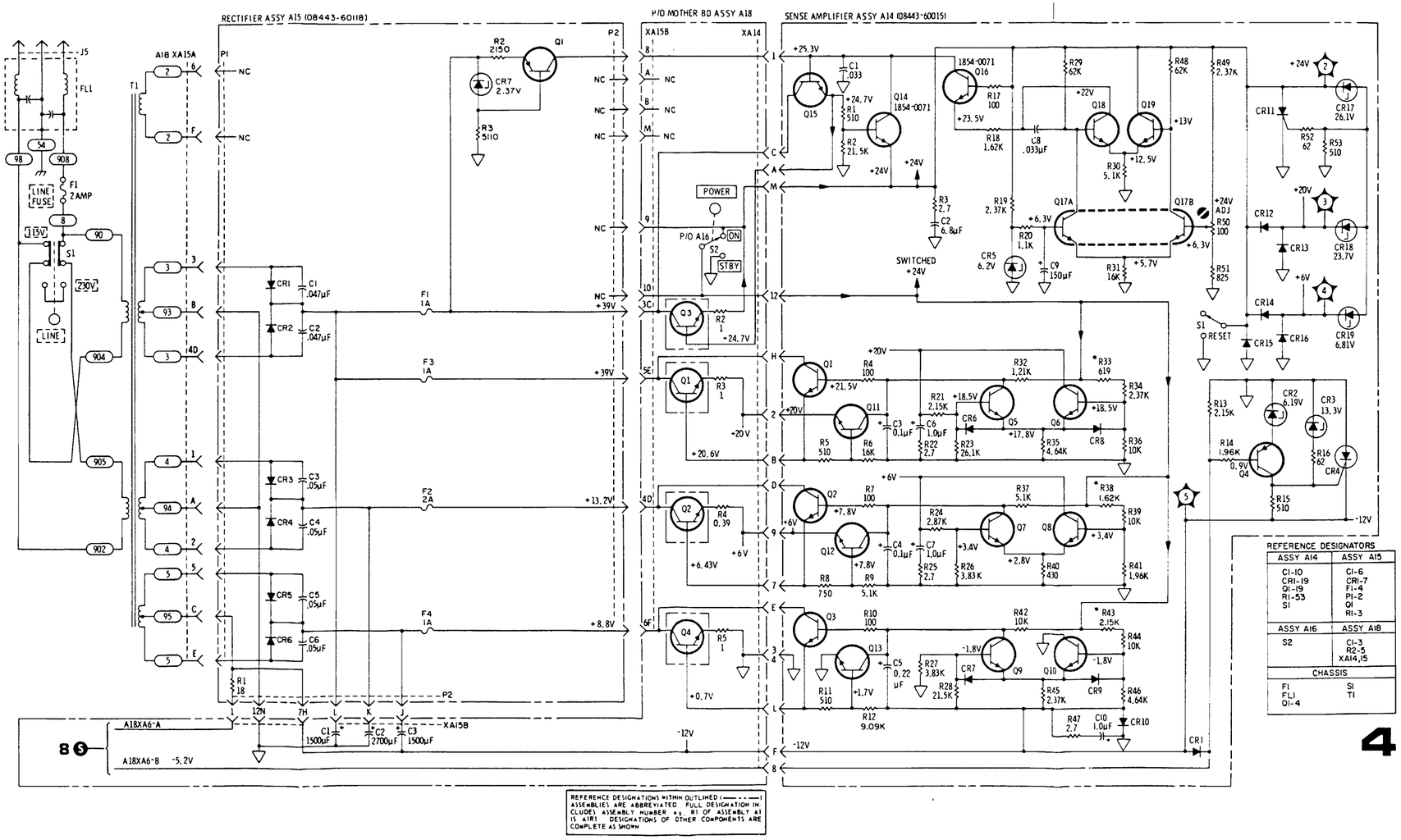


Figure 8-30. Power Supplies and Regulators, Schematic Diagram (CHANGE 12)

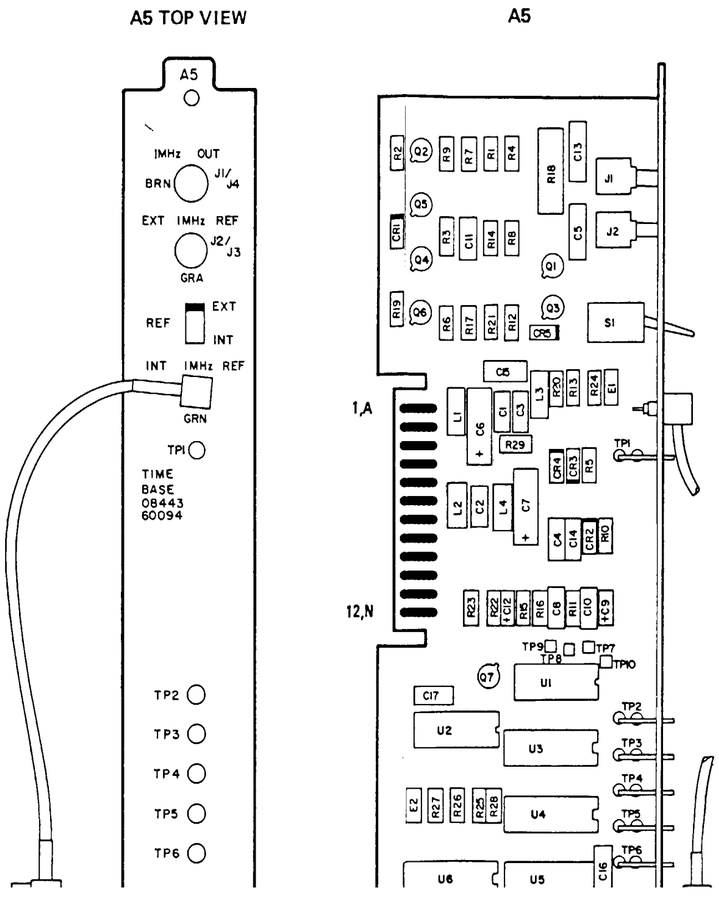


Figure 8-34. A5 Time Base Assembly, Cover and Components (CHANGE 13)

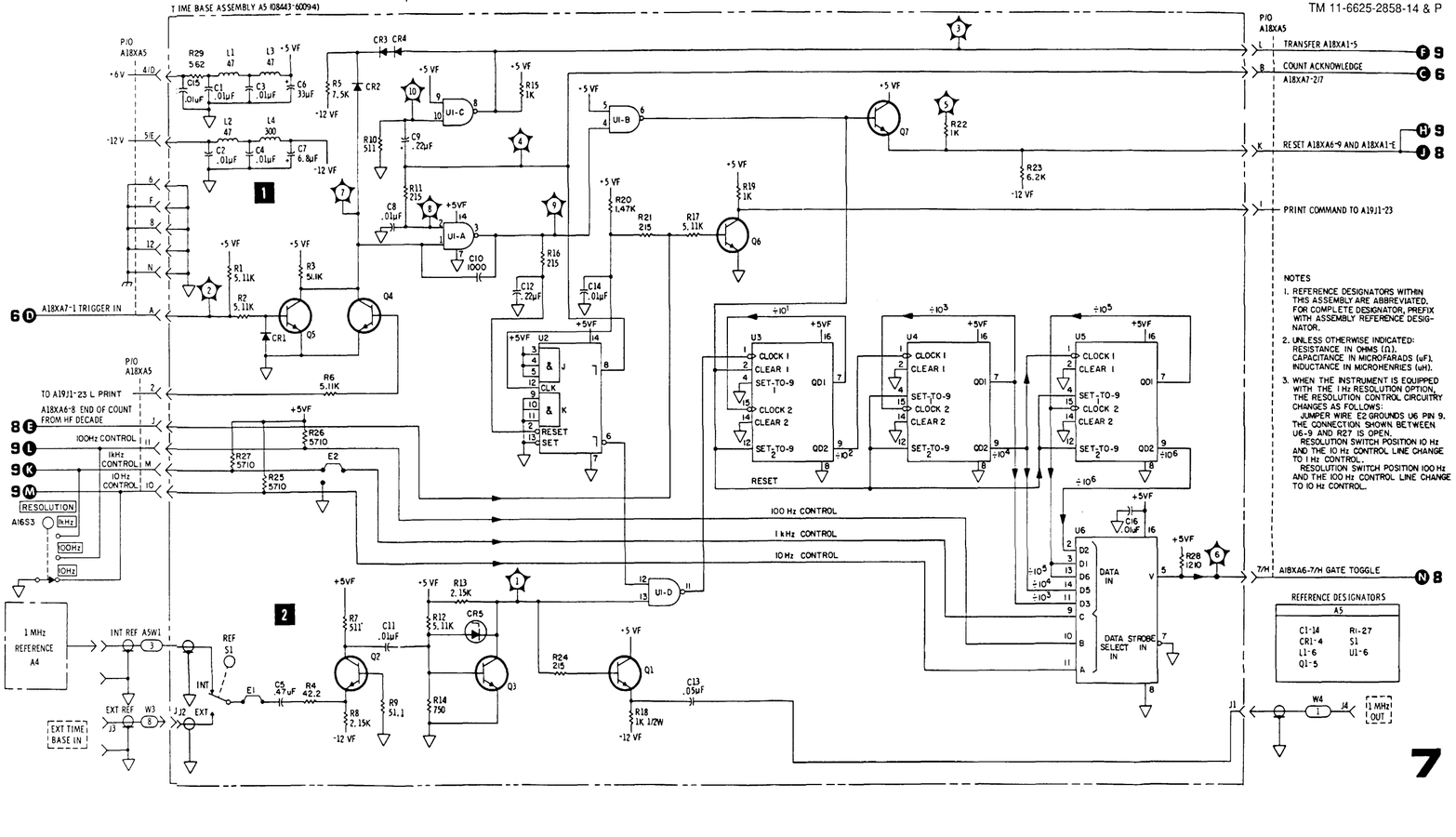


Figure 8-35. Time Base Circuit, Schematic Diagram (CHANGE 13)

APPENDIX A
REFERENCES

DA Pam 310-1	Consolidated Index of Army Publications and Blank Forms.
DA Pam 738-750	The Army Maintenance Management System (TAMMS)
TM 750-244-2	Procedures for Destruction of Electronics Materiel to Prevent Enemy Use (Electronics Command).

APPENDIX B
DIFFERENCE DATA SHEETS

B-1. Production Changes.
The following changes MUST be made to the technical manual as a result of instrument production changes. The extent of the manual changes depends upon the serial prefix of the instrument.

B-2. Technical Manual Changes.

a. Make all appropriate serial number related changes indicated in the table shown below:

Model 8443A		Model 8443B	
Serial prefix or number	Make Manual changes	Serial Prefix or number	Make Manual changes
1217A00786 through 1217A00910	1	1228A00151 through 1228A00190	1
1217A00911 through 1217A01010	1,2	1228A00191 through 1228A00310	1,2
1334A01011 through 1334A01585	1-3	1228A00311 through 1228A00330	1,2,4
1334A01586 through 1334A01785	1-4	1228A00331 through 1228A00350, 1633A, 1719A	1,2,4,5
1334A01786 through 1334A02035, 1631A, 1714A	1-5		
1732A	1-6		
1732A02436 through 1742A	1-7		
1821A	1-8		
2044A	1-9		
2101A	1-10		
2140A	1-11		
2141A	1-12		
2204A	1-13		

b. Errata for all models and serial numbers:

(1) Page 1-0, Figure 1-1:
Delete RACK MOUNTING KIT.

(1.1) Page 1-2, Table 1-1:

(a) Change Power specification under General to read: 115V ±10% 48-440 Hz or 230V ± 10% 4866 Hz, 75 Watts, (When the instrument is in standby, power consumption is 30 watts.)

(b) Change Time Base Aging Rate specification (number 8) to read: 3 x .000000001 per day (0.003 Hz/day) after warmup (seven days of continuous operation or 72 hours of continuous operation after an off time of less than 72 hours).

(2) Page 1-3, Paragraph 1-28:

(a) Delete all references to Rack Mounting Kit.

(3) Page 1-4, Paragraph 1-30: Add: "A Rack Mounting Kit is available to install the instrument in a 19-inch rack. Rack Mounting Kits may be obtained through your nearest Hewlett-Packard Office by ordering HP Part Number 5060-8739."

(4) Page 3-6, Figure 3-3: Add the following at the end of step O: "Return analyzer SCAN WIDTH to PER DIVISION."

(4.1) Page 4-2, Paragraph 4-10:

(a) Change Spectrum Analyzer SCAN WIDTH (step 1) to ZERO.

(b) Delete SCAN WIDTH PER DIVISION...5 kHz under Spectrum Analyzer in step 1.

(4.2) Page 4-3, Figure 4-2: Reverse the symbol for the 100 µF capacitor in the Low Pass Filter Detail. Show positive side (+) connected to ground and curved plate connected to VERT OUT line.

(5) Page 4-3, Paragraph 4-11:

(a) Change third item under EQUIPMENT to "RF Amplifier (20 dB gain, 30 MHz)."

(b) Add the following under step I of PROCEDURE, Tracking Generator/Counter: FUNCTION TRACK ANALYZER

(6) Page 4-4, Paragraph 4-11:

(a) Change RF Amplifier setting to "Power ON 20 dB gain."

(b) Change first sentence in step 4 of PROCEDURE to read: "Use the Model 8552 LOG REF LEVEL vernier control to set the digital voltmeter reading to 300 mV.

(c) Change first sentence in step 6 of PROCEDURE to read: "If necessary, reset the Model 8552 LOG REF LEVEL vernier control to obtain a reading of 300 mV on the digital voltmeter."

(d) Change Spectrum Analyzer BANDWIDTH to 100 Hz in step 1 of PROCEDURE.

(e) Change test limits of DVM reading in steps 5, 6, and 7 of PROCEDURE (ten places in step 7) to 294 mV 307 mV.

(7) Page 4-5, Paragraph 4-11:

(a) Change last sentence in step 8 of PROCEDURE to read: "Adjust the Model 8552 LOG REF LEVEL vernier control to obtain a reading of 300 mV on the digital voltmeter."

(b) Change test limits of DVM reading in steps 9 and 10 of PROCEDURE to 296 mV 304 mV.

(8) Page 4-6, Paragraph 4-12: Change MARKER POSITION in step 1 of PROCEDURE to "Full CW."

(9) Page 4-7, Paragraph 4-12: Change step 4 of PROCEDURE to read: "Set analyzer to SCAN WIDTH PER DIVISION at 10 MHz and tune the analyzer to approximately 50 MHz. If SCANNING light is on, press the SINGLE scan button on the analyzer. Set the 8443A MODE switch to SCAN HOLD and carefully tune the analyzer to indicate a 100 kHz readout on the Model 8443A. Make sure you have set the frequency to the positive side of zero frequency and not to negative 100 kHz. (On the 8443B, use..."

(9.1) Page 4-7, Paragraph 4-13: Change information in parentheses at end of DESCRIPTION to: (Rs by Zo if Rs is greater than Zo.)

(9.2) Page 4-8, Paragraph 4-13: Change information in parentheses for step 5 of PROCEDURE to read: (Rs/Zo if Rs is greater than Zo.)

(10) Page 4-9, Paragraph 4-15: Add the following between the first and second sentences of the PROCEDURE: "The rear-panel UNBLANKED/BLANKED switch should be in the BLANKED position."

(11) Page 6-1, Paragraph 6-2: Delete entire paragraph.

(12) Page 6-1, Table 6-1: Delete entire table.

(13) Page 6-3, Table 6-3:

(a) Delete third A1, HP Part Number 0844360101, REBUILT 08443-60071.

(b) Add A1MP14, HP Part Number 0460-0198, TAPE: CORK.

(c) Add A4W1, HP Part Number 08443-60067, Check Digit 2, CABLE +24V OSC PWR WHTBLK.

(14) Page 6-4, Table 6-3:

(a) Delete third A2, HP Part Number 0844360102, REBUILT 08443-60001.

(b) Delete third A3, 08443-60103, REBUILT 08443-60002.

(c) Delete third A5, 08443-60104, REBUILT 08443-60048.

(d) Change first A2 to HP Part Number 50867358, Check Digit 2.

(e) Change first A3 to HP Part Number 50867357, Check Digit 1.

(15) Page 6-5, Table 6-3:

(a) Change first ASU3 to A5U3A.

(b) Change second A5U3 to ASU3B.

(c) Change first A5U5 to A5U5A.

(d) Change second A5U5 to A5U5B.

(e) Delete third A6, HP Part Number 0855460105, REBUILT 08443-60047.

(16) Page 6-7, Table 6-3:

(a) Delete third A7, HP Part Number 0844360106, REBUILT 08443-60046.

(b) Change A7CR6 to HP Part Number 19010743, DIODE-PWR RECT 400V 750 MA DO41.

(17) Page 6-9, Table 6-3:

(a) Change A8A1U1 to HP Part Number 50867010.

(b) Change A8A1U1 to HP Part Number 50867099.

(c) Delete second A8, HP Part Number 0844360107, REBUILT 08443-60045.

(d) Delete second A9, HP Part Number 0844360108, REBUILT 08443-60044.

(17.1) Page 6-10, Table 6-3: Change last entry for A9A2 to HP Part Number 08443-00068, INSULATOR: 120 MHz FILTER (recommended replacement).

(18) Page 6-11, Table 6-3:

(a) Delete second A10, HP Part Number 0844360109, REBUILT 08443-60043.

(b) Delete second A11, HP Part Number 0844360110, REBUILT 08443-60842.

(19) Page 6-12, Table 6-3: Delete second A12, HP Part Number 0844360111, REBUILT 08443-60041.

(20) Page 6-13, Table 6-3: Delete second A12, HP Part Number 0844360115, REBUILT 08443-60077.

(21) Page 6-14, Table 6-3:

(a) Change A13R29 to HP Part Number 07570288, R:FXD MET FLM 9.09K OHM 1% 1/8W.

(b) Change A13R30 and A13R31 to HP Part Number 0757-0280, R:FXD MET FLM 1K OHM 1% 1/8W.

(c) Change A13R32 to HP Part Number 07570440, R:FXD MET FLM 7.50K OHM 1% 1/8W.

(d) Change A13R33 to HP Part Number 07570401, R:FXD MET FLM 100 OHM 1% 1/8W.

(e) Change A13R34 to HP Part Number 07570279, R:FXD MET FLM 3.16K OHM 1% 1/8W.

(f) Delete second A14, HP Part Number 0844360113, REBUILT 08443-60015.

(22) Page 6-15, Table 6-3:

(a) Change A14R8 to HP Part Number 07570420, R:FXD MET FLM 750 OHM 1% 1/8W.

(b) Change A14R11 to HP Part Number 06835115, R:FXD COMP 510 OHM 5% 1/4W.

(c) Change A14R12 to HP Part Number 07570288, R:FXD MET FLM 9.09K OHM 1% 1/8W.

(23) Page 6-16, Table 6-3:

(a) Delete second A15, HP Part Number 0844360114, REBUILT 08443-60014.

(b) Change A15CR1 thru CR4, CR9 and CR10 to HP Part Number 1901-0743, DIODE-PWR RECT 400V 750 MA DO-41.

(24) Page 6-17, Table 6-3:

(a) Add F1, HP Part Number 2110-0002, FUSE, CARTRIDGE 2A 3AG.

(b) Add E1, HP Part Number 0340-0140, INSULATOR TO-66 (FOR XSTR Q5).

(25) Page 6-18:

(a) Delete MP50 HP Part Number and change description to NOT ASSIGNED.

(b) Add "(8443A only)" after description for Q2.

(c) Delete second Q4 (entire line).

(25.1) Page 6-19, Table 6-3:

(a) Add to WS, HP Part Number 08443-60009: HP Part Number 5031-0906, SLEEVE, RF PIN POSITIONING.

(b) Delete HP Part Number 1400-0084 for fuseholder XF1 and add the following parts:

HP Part Number 2110-0564, BODY, HIGH PROFILE.

HP Part Number 2110-0565, CARRIER.

HP Part Number 2110-0569, NUT, HEX-PLASTIC.

(25.2) Page 6-20, Table 6-3: Delete the following items (entire line): First No. 4, first No. 5, first No. 6, first No. 11, first No. 12, second No. 12, first No. 13, first No. 14, first No. 15, No. 16, and first No. 17.

(26) Page 8-13, Figure 8-9: Change bottom "Q" of JK Flip Flop to "O".

(27) Page 8-27, Figure 8-23:

(a) Add R14 464 ohms to resistor located between A13TP4 and junction of A13R15 and A 13T2 center tap.

(b) Add CR1 to 8.25V breakdown diode on A11.

(28) Page 8-29, Figure 8-27:

(a) Change A8A1U1 to HP Part Number 50867010.

(b) Change A8A1U2 to HP Part Number 50867099.

(29) Page 8-31, Figure 8-30:

(a) Change chassis-mounted Q2 (between Q5 and Q1) to Q3.

(b) Change A14R47 to 2.7 ohms.

(c) Change A14R12 (bottom of A14 schematic) to 9.09K.

(30) Page 8-39, Figure 8-36:

(a) Change C19 in upper left corner to C14.

(b) Change CR3 between R16 and C18 to CR13.

(c) Change R29 located directly below CR12 to C29.

(d) Change C29 to R25.

(e) Change R25 to C25.

(31) Page 8-39, Figure 8-37:

(a) Change +20V to +24V on A16S1 (A18XA6 pin F).

(b) Change A6U3 bottom pin 11 (Vcc1) to pin 1.

(32) Page 8-44, Figure 8-43:

(a) Change A18R6 to 360 ohms.

(b) Change A18R7 to 200 ohms.

(c) Change the statement "TO CRYSTAL OSCILLATOR" to read "TO CRYSTAL OSCILLATOR VIA +24V OSCILLATOR POWER CABLE A4W1."

c. Change 1.

(1) Page 6-14, Table 6-3: Change A14C5 to HP Part Number 0180-1745, C:FXD ELECT 1.5UF 10% 20 VDCW.

(2) Page 8-31, Figure 8-30 (Service Sheet 4): Change A14C5 to 1.5 lF.

d. Change 2.

(1) Page 6-5, Table 6-3: Change A5R14 to HP Part Number 0698-0083, R:FXD MET FLM 1.96K OHM 1% 1/8W.

(2) Page 6-12, Table 6-3:

(a) Change A11R19 and A11R21 to HP Part Number 0698-3438, R:FXD MET FLM 147 OHM 1% 1/8W.

(b) Change A1 1R20 to HP Part Number 06983435, R:FXD MET FLM 38.3 OHM 1% 1/8W.

(3) Page 8-27, Figure 8-23 (Service Sheet 2):

(a) Change A11R19 and A11R21 to 147 ohms.

(b) Change A11R20 to 38.3 ohms.

(4) Page 8-37, Figure 8-35 (Service Sheet 7): Change A5R14 to 1960 ohms.

e. Change 3.

(1) Page 6-5, Table 6-3: Change A5U3A, ASU3B, ASU4, A5U5A, and A5U5B to HP Part Number 1820-0413.

(2) Page 8-37, Figure 8-35: Change A5U3A, A5U3B, A5U4, A5U5A, and A5U5B to HP Part Number 1820-0413.

f. Change 4.

(1) Page 6-18, Table 6-3:

(a) Change MP24 to HP Part Number 0844300061.

(b) Change MP25 to HP Part Number 0844300062.

(c) Change MP26 to HP Part Number 0844300063.

g. Change 5.

(1) Page 6-4, Table 6-3:

(a) Change A2W1 to HP Part Number 0035560005.

(b) Change A3W1 to HP Part Number 0035560004.

(c) Change A3W2 to HP Part Number 0035560006.

h. Change 6.

(1) Page 6-3, Table 6-3: Add A1E1, HP Part Number 08443-00069, INSULATOR FREQ COUNTER.

j. Change 7.

(1) Page 6-4, Table 6-3: Change A5CS to HP Part Number 0160-0174, C:FXD CER .47UF +80-20% 25VDC.

(2) Page 6-5, Table 6-3:

(a) Add A5CR5, HP Part Number 1901-0535, DIODE-SCHOTTKY.

(b) Add A5E1, HP Part Number 8159-0005, JUMPER (REPLACES A5L5).

(c) Delete A5L5 (entire line).

(d) Change A5Q1, A5Q2, and A5Q3 to HP Part Number 1854-0404 TSTR:SI NPN TO-18 PD 360MW.

(e) Change A5R4 to A5R4*, HP Part Number 0757-0316, R:FXD MET FLM 42.2 OHM 1% 1/8W FACTORY SELECTED PART.

(f) Change A5R14 to A5R14*, HP Part Number 0757-0420, R:FXD MET FLM 750 OHM 1% 1/8W FACTORY SELECTED PART.

(3) Page 8-37, Figure 8-35 (Service Sheet 7):

(a) Delete L5 (bottom left-hand side of schematic) and show as jumper E1.

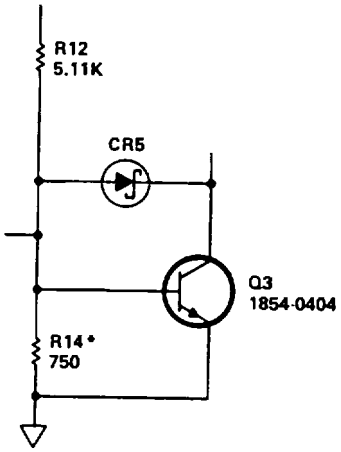
(b) Change value of C5 to .47 µF.

(c) Change A5R4 to A5R4* 42.2 ohms.

(d) Change A5R14 to A5R14* 750 ohms.

(e) Change A5Q1, A5Q2, and A5Q3 to HP Part Number 1854-0404.

(f) Add Schottky diode from base to collector of A5Q3 as shown below in the partial schematic.



P/O Figure 8-35. Time Base Circuit, Schematic Diagram (CHANGE 7)

k. Change 8.

(1) Page 6-17, Table 6-3: Change A19 to HP Part Number 08443-60089

(2) Page 8-37, Figure 8-35:

(a) Change information at A18XAS-2 (left-hand edge of AS schematic) to read: TO A19JI-23 L PRINT.

(b) Change connector information at A18XA5-1 (right-hand edge of AS schematic) to A19J148.

(3) Page 8-42, Table 8-8:

(a) Change HP Part Number of BCD Board A19 in table heading to 08443-60089.

(b) Change "Inhibit" to L Print in Signal column.

(c) Change Digital Output Connector Pin No. (A19) for L Print from 22 to 23.

l. Change 9.

(1) Pages 6-3 and 6-4, Table 6-3: Replace entire A1 listing (from Al thru A1A2R27) with new A1 Low Frequency Counter Assembly list (CHANGE 9) included in this appendix on pages B-7 and B-8.

(2) Page 6-4, Table 6-3: Change A5C10 to A5C10* HP Part Number 0160-3456, Check Digit 6, C:FXD 1000pF 1000V CER FACTORY SELECTED PART.

(3) Page 6-9, Table 6-3: Change A7R43 to HP Part Number 0757-0317, Check Digit 7, R:FXD 1.33K OHM 1% .125W.

(4) Page 8-20, Figure 8-17, Sheet 1 of 2: Delete Sheet 1 (Counter Troubleshooting Tree) of Figure 8-17.

(5) Page 8-32, SERVICE SHEET 5, General:

(a) Change the seventh and eighth paragraphs under "General" to read as follows: "The counter signal input is gated to the high frequency decade by the main gate flip-flop, which is toggled by the decade divider circuits in Time Base Assembly A5. Besides dividing the input frequency by 10, High Frequency Decade Board A6 provides BCD information (A, B, C, D) to Low Frequency Counter Board A1A1. Low Frequency Counter Board A1A1 uses the BCD inputs (A, B, C, D) to drive its timer and BCD driver circuit. The D Signal input also drives the prescaler, which develops four additional BCD inputs for the timer and BCD driver. The signals derived from the eight level BCD light segments in the numerical display IC's on Counter Display Board A1A2, and are supplied to Digital Output Assembly A19 on the rear of the 8443A."

(6) Page 8-32, SERVICE SHEET 5, Time Base Assembly A5: Change description starting with line 9 of paragraph 12 to "... 150 µsec one-shot which drives TP10 high and TP3 low to start the transfer pulse. The transfer input starts the transfer of information from the low frequency counter board to the counter display board (A1A2). It also initiates the transfer of digital information from the Low Frequency Counter Board (A1A1) to the Digital Output Assembly (A19) on the 8443A rear panel."

(7) Page 8-32, SERVICE SHEET 5, High Frequency Decade A6: Delete the fourth paragraph under "High Frequency Decade A6."

(8) Page 8-32, SERVICE SHEET 5, Low Frequency Counter A1: Delete all text pertaining to Low Frequency Counter A1 and insert new text, SERVICE SHEET 5 (CHANGE 9) Low Frequency Counter A1A1 and Counter Display A1A2, included in this appendix on pages B-9 and B-10.

(9) Page 8-33, Figure 8-31: Change Low Frequency Counter portion of Counter Section Logic Diagram as shown in partial P/O Fig 8-31, Low Frequency Counter portion of Logic Diagram (CHANGE 9), included in this appendix on page B-10.

(10) Page 8-35, Figure 8-33:

(a) Change R8 (in collector circuit of Q5B) so that its top end connects to cathode of CR4 instead of to +20VF.

(b) Change emitter of Q16 so that it connects to switched ground, same as Q17, instead of to circuit board ground.

(c) Change value of R43 to 1.33K ohms.

(11) Page 8-37, Figure 8-35: Change value of capacitor C10 to 1000pF and place an asterisk (*) next to it to indicate it is a factory selected part.

(12) Page 8-38, "Reset Translator and Divide-By-Ten Decade": Change third paragraph to read: "The decade dividers convert the 100KHz to 110MHz input frequency to an output frequency of 10KHz to 11MHz. The A, B, C, and D outputs are fed to the Low Frequency Counter."

(13) Page 8-40, SERVICE SHEET 9: Delete all text and the waveforms shown on page 8-40, and replace them with the new SERVICE SHEET (CHANGE 9) text included in this appendix on pages B-11 thru B-16.

(14) Page 8-40, Figure 8-38: Replace Figure 8-38 with the new parts locations diagrams, Figures 8-38A, 8-38B, and 8-38C (CHANGE 9) included in this appendix on pages B-17 and B-18.

(15) Page 8-41, Figure 8-39: Replace Figure 8-39/ with the new Figure 8-39 (CHANGE 9) included in this appendix on pages 8-35 and 8-37.

(16) Pages 8-42 and 8-43, SERVICE SHEET 10:

(a) Delete text and Table 8-8 on page 8-42.

(b) Delete Figures 8-40, 8-41, and 8-42 on page 8-43.

m. Change 10.

(1) Pages 6-5 thru 6-7, Table 6-3: Replace entire A6 listing (from A6 thru A6W1) with new A6 High Frequency Decade Assembly list (CHANGE 10) included in this appendix on pages B-19 and B-20.

(2) Page 8-33, Figure 8-31: Change High Frequency Decade A6 section of Counter Logic Diagram as shown in the partial logic diagram P/O Figure 8-31 (CHANGE 10) included in this appendix on page B-21.

(3) Page 8-38, SERVICE SHEET 8: Replace all text and waveforms shown in page 838, SERVICE SHEET 8, with the new SERVICE SHEET 8 (CHANGE 10) text and waveform illustrations included in this appendix on pages B-22 thru B-26.

(4) Page 8-39, Figure 8-36: Replace Figure 8-36 with new parts location diagram, Figure 8-36 (CHANGE 10) included in this appendix on page B-27.

(5) Page 8-39, Figure 8-37: Replace Figure 8-37 with new High Frequency Decade Assembly Schematic Diagram, Figure 837 (CHANGE 10) included in this appendix on page 8-39.

n. Change 11.

(1) Page 6-7, Table 6-3:

(a) Change A6R13 to HP Part Number 06980083, Check Digit 8, R:FXD MET FLM 1.96K OHMS 1% 1/8W.

(b) Change A6R14 to HP Part Number 06980085, Check Digit 0, R:FXD MET FLM 2.61K OHMS 1% 1/8W.

(c) Change A6R18 to HP Part Number 07570416, Check Digit 7, R:FXD MET FLM 511 OHMS 1% 1/8W.

(d) Change A6R25 to HP Part Number 06980082, Check Digit 7, R:FXD MET FLM 464 OHMS 1% 1/8W.

(e) Change A6R33 to HP Part Number 06987240, Check Digit 3, R:FXD MET FLM 1.47K OHMS 1% 1/20W.

p. Change 12.

(1) Page 6-16, Table 6-3: Replace entire A15 listing (from A15 thru A15XF5) with new A15 Rectifier Assembly list (CHANGE 12) included in this appendix on page B-28.

(2) Page 6-17, Table 6-3: Delete A18C4 and A18R1.

(3) Page 6-18, Table 6-3: Delete Q5.

(4) Page 8-30, Service SHEET 4: Replace all text following "Rectifier Assembly A15" with new SERVICE SHEET 4 (CHANGE 12) text included in this appendix on page 8-29.

(5) Page 8-31, Figure 8-29: Replace Figure 8-29 (A15 Rectifier Assembly) component location with new Figure 8-29 (CHANGE 12) included in this appendix on page 8-30.

(6) Page 8-31, Figure 8-30: Replace Figure 8-30 (Power Supplies and Regulators Schematic Diagram) with new Figure 8-30 (CHANGE 12) included in this appendix on page B-41.

(7) Page 8-44, Figure 8-43: Delete C4, Q5, and R1 from Motherboard Assembly A18 portion of wiring diagram.

q. Change 13.

(1) Pages 6-4 and 6-5, Table 6-3: Replace entire A5 listing (from A5 thru A5W1) with new A5 Time Base Assembly list (CHANGE 13) included in this appendix on page B-31.

(2) Page 8-37, Figure 8-34: Replace Figure 8-34 (A5 Time Base Assembly) Component location with new Figure 8-34 (CHANGE 13) included in this appendix on page 8-43.

(3) Page 8-37, Figure 8-35: Replace Figure 8-35 (A5 Time Base Assembly Schematic Diagram) with new Figure 8-35 (CHANGE 13) included in this appendix on page 8-43.

Table 6-3. Replaceable Parts (CHANGE 9)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1	08443-60117	3	1	LOW FREQUENCY COUNTER ASSEMBLY	28480	08443-60117
A1A1	08443-60090	1	1	LOW FREQUENCY COUNTER BOARD ASSEMBLY	28480	08443-0090
A1A1C1	0160--4084	8	6	CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A1C2	0180-2215	5	1	CAPACITOR-FXD 170UF+75-10% 15VDC AL	56289	30D177G015DD2
A1A1C3	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A1C4	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A1C5	0160-0127	2	1	CAPACITOR-FXD 1 UF *-20% 20VDC CER	28480	0160-0127
A1A1C6	0160-3879	7	1	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A1C7	0180-0197	8	1	CAPACITOR-FXD 2.2UF.+-10% 20VDC TA	56289	150D225X9020A2
A1A1C8	0160-3875	3	2	CAPACITOR-FXD 22PF+-5% 200VDC CER 0+-30	28480	0160-3875
A1A1C9	0160-3875	3		CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A1A1C10	0160-4084	8		CAPACITOR-FXD 01UF +-20% 50VDC CER	28480	0160-4084
A1A1C11	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A1C12	0160-4084	8		CAPACITOR-FXD .1UF +-20% 50VDC CER	28480	0160-4084
A1A1C13	0160-0575	4	1	CAPACITOR-FXD .047UF +-20% 50 VDC CER	28480	0160-0575
A1A1CH1	1901-0535	9	3	DIODE.SCHOTTKY	28480	1901-0535
A1A1CH2	1901-0535	9		DIODE.SCHOTTKY	28480	1901-0535
A1A1CH3	1901-0743	1	1	DIODE.SCHOTTKY 1N404 400v 1A DO-41	01295	1N4004
A1A1L1	9100-1616	9	2	INDUCTOR RF-CH-MLD 1.5UH 10%	28480	9100-1616
A1A1L2	9100-1618	1	1	INDUCTOR RF-CH-MLD 5.6UH 10%	28480	9100-1618
A1A1L3	9100-1616	9		INDUCTOR RF-CH-MLD 1.5UH 10%	28480	9100-1016
A1A1L4	9100-1621	6	1	INDUCTOR RF.-CH-MLD 18UH 10% .166DX.385LD	28480	9100-1621
A1A1Q1	1853-0281	9	9	TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A1Q2	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A1Q3	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	0713	2N2907A
A1A1Q4	1853.0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A1Q5	1854-0477	7	20	TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q6	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q7	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q8	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q9	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q10	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q11	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q12	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q13	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A1Q14	18S3-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A1Q15	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A1Q16	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	04713	2N2907A
A1A1Q17	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q18	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO.18 PD=500MW	04713	2N2222A
A1A1Q19	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q20	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q21	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q22	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q23	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q25	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q26	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q27	1854-0477	7		TRANSISTOR PNP 2N2222A SI TO-18 PD=500MW	04713	2N2222A
A1A1Q28	1853-0281	9		TRANSISTOR PNP 2N2907A SI TO-18 PD=400MW	071t3	2N2907A
A1A1R1	0757-0465	6	1	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1003-F
A1A1R2	0757-0465	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A1A1R3	0757-0465	9	3	RESISTOR 237 1% .125W F TC=0+-100	24S46	C4-1/8-TO-237R-F
A1A1R4	0757-0465	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-TO-237R-F
A1A1R5	0757-0465	9		RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-TO-237R-F
A1A1R6	0683-1555	0	1	RESISTOR1.5M 5% .25W F TC=900/+1000	01111	CS1555
A1A1R7	0757-0420	3	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-TO-750R-F
A1A1R8	0757-0420	3		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-TO-750R-F
A1A1R9	0698-3132	4	2	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-TO-261R-F
A1A1R10	0698-3132	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8.TO-3831-F
A1A1R11	0698-0085	0	1	RESISTOR 2.61K 1% .125W F TC=0+-100	24546	C4-1/8.TO-2611-F
A1A1R12	0698-3153	9		RESISTOR 3.83K 1% .125W F TC=0+-100	24546	C4-1/8.TO-3831-F
A1A1R13	0757-0280	3	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8.TO-1001-F
A1A1TP1	0360-0124	3	4	CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1A1TP2	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1A1TP3	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1A1TP4	0360-0124	3		CONNECTOR-SGL CONT PIN .04-IN-BSC-SZ RND	28480	0360-0124
A1A1U1	1810-0422	0	1	NETWORK-RES 10-SIP10.0 OHM X 9	01121	210A100
A1A1U2	1810-0037	3	1	NETWORK-RES 16-DIP1.0K OHM X 8	11236	761-3-R1K
A1A1U3	1820-1442	7	1	IC CNTR TTL LS DECO ASYNCHRO	01295	SN74LS290N
A1A1U4	1820-1644	1	1	IC DCDR TTL LS BCD-TO-7.SEG .4-TO-7-LINE	01295	SN74LS248N
A1A1U5	1820-1197	9	1	IC GATE TTL LS NAND QUAD 2-INP	01295	SN74LS00N

Table 6-3. Replaceable Parts (CHANGE 9)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A1A1U6	1820-1216	3	1	IC DCDR TTL LS 3-TO-8-LINE 3-1NP	01295	SN74LS138N
A1A1U7	1820-2271	2	1	IC MICPROC NMOS 8-B1T	34649	D8039
A1A1U8	1820-2102	8	1	IC LCN TTL LS D-TYPE OCTL	01295	SN74LS373N
A1A1U9	1820-80002	7	1	IC-PROGRAMMED ROM	28480	08443-80002
A1A1U10	1820-0735	4	1	IC 2K RAM 400-NS	34649	P8155
A1A1U11	1820-2177	7	1	IC MICPROC-ACCESS NMOS 4-BIT	34649	P8243
A1A1XA2	1251-2035	9	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	28480	1251-2035
A1A1XU7	1200-0694	5		SOCKET-IC 40.CONT DIP DIP-SLDR	28480	1200-0694
A1A1XU9	1200-0565	9	2	SOCKET-IC 24-CONT DIP-SLDR	28480	1200-0565
A1A1XU10	1200-0694	5	1	SOCKET-IC 40-CONT DIP DIP-SLDR	28480	1200-0694
A1A2	08443-60091	2	1	COUNTER DISPLAY BOARD ASSEMBLY	28480	08443.60091
A1A2DS1	1990-0725	6	8	DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28480	HDSP-4130
A1A2DS2	1990-0725	6		DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28480	HDSP-4130
A1A2DS3	1990-0725	6		DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28480	HDSP-4130
A1A2DS4	1990-0725	6		DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28480	HDSP-4130
A1A2DS5	1990-0725	6		DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28a80	HDSP-4130
A1A2DS6	1990-0725	6		DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28480	HDSP-4130
A1A2DS7	1990-0725	6		DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28480	HDSP-4130
A1A2DS8	1990-0725	6		DISPLAY-NUM-SEG 1-CHAR .43-H YEL	28480	HDSP-4130
				COUNTER DISPLAY MISCELLANEOUS PARTS		
	4040-0749	4	1	EXTR.PC BD BRN POLYC .062.BD.THKN8	28480	4040-0749
	4040-0749	7	1	EXTR.PC BD BRN POLYC .062.BD.THKN8	28480	4040-0750
	1480-0059	8	2	PIN ROLL .062-.IN-DIA .25-IN-LG STL	28480	1480-0059
A1A3	08443-60095	6	1	+6V SWITCHED BOARD ASSEMBLY	28480	08443-60095
A1A3C1	0180-2620	6	1	CAPACITOR-FXD 2.2UF+-10% 50VDC TA	25088	D2R2GS1B50K
A1A3CR1	1901-0050	3	1	DIODE-SWITCHING 80V 200 MA 2NS D0-35	28480	1901-0050
A1A3CR2	1901-0535	9		DIODE-SCHOTTKY	28480	1901-0535
A1A3MP1	0380-0885	5	2	STANDOFF-RVT-ON .156-IN-LG 4-40THD	00000	ORDER By DESCRIPTION
A1A3MP2	0380-0885	5		STANDOFF-RVT-ON .156-IN-LG 4-40THD	00000	ORDER By DESCRIPTION
A1A3Q1	1853-0213	7	1	TRANSISTOR PNP 2N4236 SI TO-5 PD=1W	04713	2N4236
A1A3Q2	1854-0477	7		TRANSISTOR NPN 2N2222A SI TO-18 PD-500MW	04713	2N2222A
A1A3R1	0757-1000	7	1	RESISTOR 51.1 1% .5F TC=0+-100	28480	0757-1000
A1A3R2	0757-1094	9	1	RESISTOR 1.47K 1% .125F TC=0+-100	24546	C4-1/8-TO-1471-F
A1A3R3	0698-3439	4	1	RESISTOR 178 1% .125F TC=0+-100	24546	C4-1/8-TO-178R-F
A1A3R4	0757-0405	4	1	RESISTOR 162 1% .125F TC=0+-100	24546	C4-1/8-TO-162R-F
A1A3R5	0757-0442	9		RESISTOR 10K 1% .125F TC=0+-100	24546	C4-1/8-TO-1002-F
A1A3R6	0757-0442	9		RESISTOR 10K 1% .125F TC=0+-100	24546	C4-1/8-TO-1002-F
A1A3R7	0698-3454	3	1	RESISTOR 215K 1% .125F TC=0+-100	24546	C4-1/8-TO-2153-F
A1A3TP1	1251-0600	0	4	CONNECTOR-SGL CONT PIN 1.14-BSC SZ SQ	28480	1251-0600
A1A3TP2	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-BSC SZ SQ	28480	1251-0600
A1A3TP3	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-BSC SZ SQ	28480	1251-0600
A1A3TP4	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-BSC SZ SQ	28480	1251-0600
A1A3U1	1826-0161	7		IC OP AMP GP QUAD 14-DIP-P	04713	SN74LS138N
A1A33VR1	1902-0126	6		DIODE-ZNP 2.61V 5% 00-7 PD=.4W TC=.072%	28480	1902-0126
A1A33VR1	1251-1887	7		CONNECTOR-PC EDGE 22.CONT/ROW 2.ROWS	28480	1251-1887
				MISC. MECHANICAL & ATTACHING PARTS		
A1MP1	08443-00072	3	1	LF COUNTER ENCLOSURE	28480	08443-00072
A1W1	08443-60064	9	1	CABLE ASSEMBLY HF DECADE D OUTPUT	28480	08443-60064
A1W2	8150-0453	4	1	WIRE-24AWG, HF DECADE D INPUT, 0.1FT.	28480	8150-0453
	08443-00044	9	1	GUIDE +-6v SWITCH B0ARD ASSEMBLY	28480	08443-60064
	0460-0079	9	1	BUSHING: RUBBER, ADHESIVE, 0.2 FT	28480	8150-0453
	2200-0103	2	6	SCREW-MACH 4-40 .25-IN-LG PAN.-HD-POZI	00000	ORDER BY DESCRIPTION
	2360-0121	2	2	SCREW-MACH 6-52 .5-IN-LG PAN-HD-POZI	00000	ORDER BY DESCRIPTION
	3050-0010	2	2	WASHER-FL MTLC NO. 6 .147-IN-ID	28480	3050-0010
	08443-40009	0	1	WINDOW, COUNTER DISPLAY, YELLOW	28480	08443-40009

SERVICE SHEET 5 (CHANGE 9)

Low Frequency Counter A1A1 and Counter Display A1A2 (Service Sheet 9)

The Low Frequency Counter develops two kinds of outputs using the inputs it receives from High Frequency Decade Assembly A6 and Time Base Assembly A5. Twenty-nine digital outputs make up the first group. These are supplied to Digital Output Assembly A19 on the 8443A rear panel for use in external equipment. The second group of outputs drives the numeric display ICs on Counter Display Assembly A1A2, which plugs into a socket on the Low Frequency Counter Board Assembly.

The functions of the inputs to the Low Frequency Counter are described below:

Transfer. The Transfer input is a negative-going pulse which interrupts the central processing unit (CPU) in microcomputer U7's microprocessor. This interruption permits the transfer of readout data from U7 to the readout decoders (U4 and U6), and digital data to rear-panel connector assembly A19. During the "write" portion of the CPU cycle, a negative-going WR (active-low write) input to transfer flip-flop U5A-U5B resets the interrupt function.

Resolution Control. There are three resolution inputs. In a standard 8443A they are 1000 Hz, 100 Hz, and 10 Hz. If, however, the 8443A has been modified to equip it with the 1 Hz resolution option, the resolution inputs are 100 Hz, 10 Hz, and 1 Hz. Notice that the 1 Hz resolution option deletes the 1000 Hz resolution selection available in the standard instrument.

These inputs determine the placement of the decimal point in the numerical display (display indicates frequency in MHz). If the front-panel RESOLUTION switch is set to 1000 Hz, the 1000 Hz line is grounded and the other two resolution input lines (100 Hz and 10 Hz) are open. In the display, the decimal point appears five places to the right of the far left numeral (e.g., 00105.555). Similarly, if 100 Hz or 10 Hz resolution is selected, the 100 Hz or 10 Hz line is grounded and the other two lines are open. For 100 Hz resolution the decimal point appears four places to the right of the far left numeral (e.g., 0105.5555), and for 10 Hz resolution it is three places to the right (e.g., 105.55555). The optional 1 Hz resolution sets the decimal point two places to the right of the far left numeral and is usable for frequency counts up to 99.999999 MHz.

Blanked/Unblanked. When the blanking selector switch on the 8443A rear panel is set to UNBLANKED, all eight of the numeric display ICs light, with those to the left of the most significant digit showing a zero.

If the blanking selector switch is set to BLANKED, numeric display ICs to the left of the most significant digit, or to the left of the decimal point if it precedes the most significant digit, are blanked. Thus, if the display in the UNBLANKED mode shows 00105.555 MHz, setting the blanking switch to BLANKED changes the display to 105.555 MHz. An unblanked display of 00000.500 MHz, if blanked, changes to .500 MHz.

Reset. The Reset input is a positive-going pulse approximately 50 microseconds wide that sets the counter to zero and holds it there for its 50-microsecond duration. At the end of the Reset pulse a new sampling of the input frequency is taken and the counter develops a new readout display.

$\overline{A}$, $\overline{B}$, $\overline{C}$, $\overline{D}$. Inputs $\overline{A}$, $\overline{B}$, $\overline{C}$, and $\overline{D}$ make up a 1-2-4-8 BCD input to Timer and BCD Driver circuit U10-U11.

The BCD represents the counter input frequency divided by 10. The D input is also fed to the Prescaler where it is transformed into four more BCD levels: 16, 32, 64, and 128, which are also fed to the Timer and BCD Driver (U10-U11). In the Timer and BCD Driver ICs, the eight-level BCD and the inputs from the microcomputer (U7) are translated into two groups of signals: the first group comprises 29 digital signals which are fed to rear-panel connector assembly A19. The second group consists of eight address signals which are fed via the counter address bus to microcomputer IC U7.

In U7 the signals received from the Timer and BCD Driver via the address bus are converted into two groups of BCD. The first group is a four-level BCD which is translated in the LED Segment Driver circuit into seven lines, each for a particular numerical display IC segment. These lines are connected in parallel to all eight of the numerical display ICs on the Counter Display Assembly (A1A2).

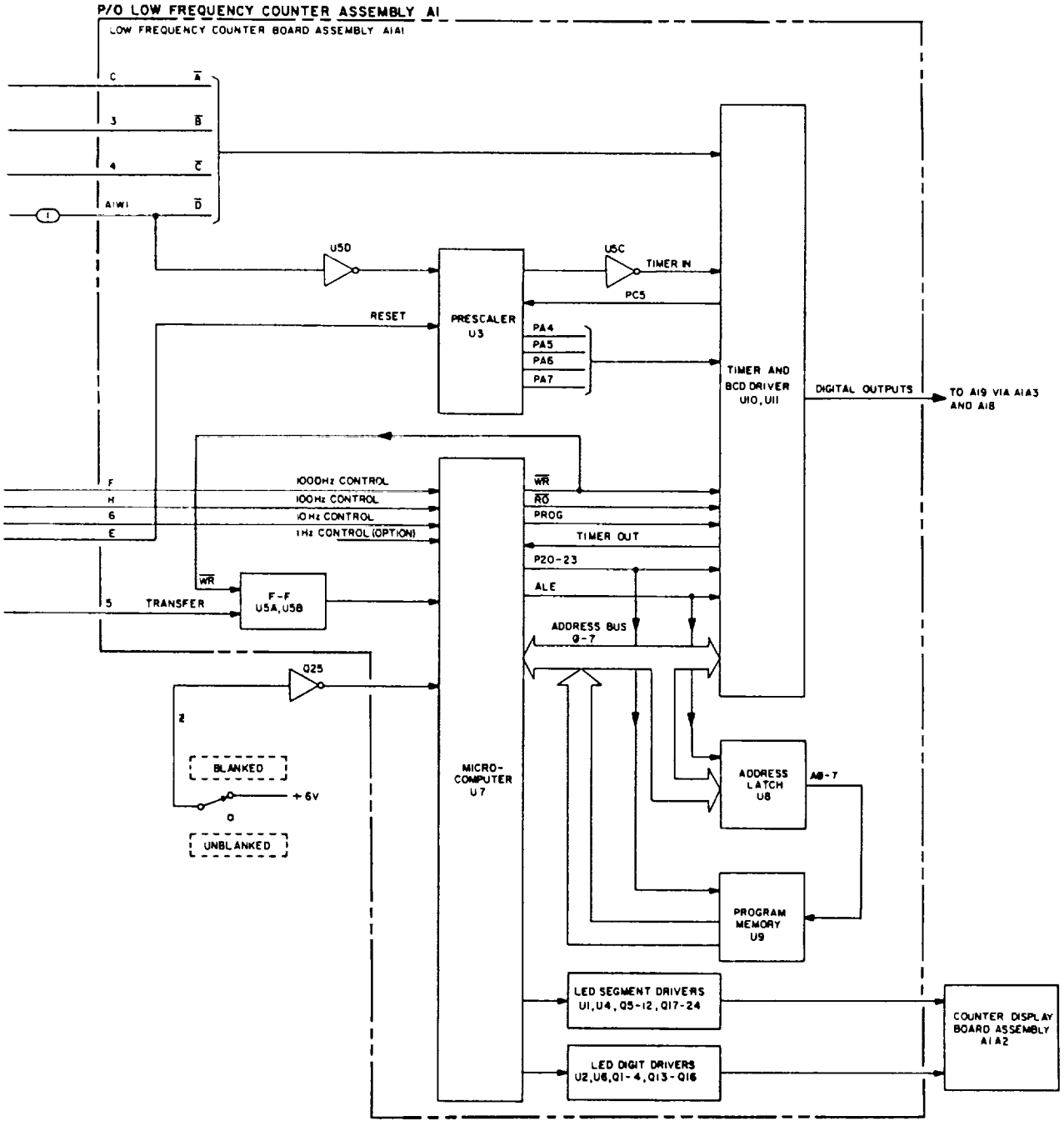
The second group is a three-level BCD which is converted into eight numerical display IC turn-on outputs. Each of these outputs is fed, one at a time, to a particular one of the eight numerical display ICs on the Counter Display Assembly. Their purpose is to turn the numerical display ICs on and off sequentially so that only one of the eight is on at a time. Thus, although the segment drives are applied simultaneously to all eight numerical display ICs, only one IC actually displays a numeral in a given instant.

For example, if the input to the counter is a frequency of 105.72348 MHz, the segments drive for a "1" is received at the eight display ICs at the same time as the turn-on signal for the far left IC. This causes the "1" to appear on the far left IC only. The next numeral generated by the BCD-to-7 Segment Decoder is the "0", and this output to

SERVICE SHEET 5 (CHANGE 9) (Cont'd)

the display ICs coincides with the enable signal to the second display IC. The second IC, therefore, displays an "0", and the seven other display ICs are blanked.

This sequence continues until the entire eight-digit number has been displayed. Then, following a brief delay (equal to the "on" period of one numerical display), the cycle starts over again. Although each display IC is turned on for only an instant during a single readout cycle, the sequencing occurs so fast that all eight display ICs appear to be on simultaneously.



P/O Figure 8-31. Counter Section Logic Diagram (Low Frequency Counter Portion) (CHANGE 9)

SERVICE SHEET 9 (CHANGE 9)

A malfunction in the Low Frequency Counter is normally brought to the attention of the operator by some abnormal behavior of the counter display or the digital output to external equipment. The nature of the abnormality usually indicates a possible source or sources of the failure; and in some events, it may point out the failed component. In all events, to successfully troubleshoot the Counter, you must be familiar with the Counter circuits and with digital troubleshooting techniques.

Equipment Required

Dual-Channel Oscilloscope
Digital Voltmeter
10:1 Oscilloscope Probes (2)

General

The complete Low Frequency Counter Assembly (A1) comprises three plug-in board assemblies surrounded by an aluminum shield. The board assemblies are:

Low Frequency Counter Board Assembly A1A1
Counter Display Board Assembly A1A2
+ 6V Switch Board Assembly A1A3

Counter Display Board Assembly A1A2 contains eight seven-segment digital display ICs. It plugs into a pc board edge connector on the front edge of the horizontally-mounted Low Frequency Counter Board Assembly A1A1. The Low Frequency Counter Board Assembly contains the electronic circuits that drive the counter digital display ICs, and which supply digital signals to the 8443A rear panel DIGITAL OUTPUT connector. It plugs into a pc board edge connector receptacle on + 6V Switch Board Assembly A1A3.

Board Assembly A1A3 plugs into a pc board edge connector receptacle on the 8443A Motherboard Assembly (A18). Its purpose is to provide interconnections between the Low Frequency Counter Board Assembly and the Motherboard. It also contains a +6V switching circuit. When the ac line POWER is switched on at the 8443A front panel, the +6V switching circuit delays the dc power input (+5.5V nominal) to the counter circuits until the dc power input to the switching circuits stabilizes.

For Counter troubleshooting, the A1A3 board, with the A1A1 board plugged into it, and with A1A2 plugged into A1 A1, is extended above the Motherboard on an extender board (included in the Service Kit).

Counter Circuits Operation

The Low Frequency Counter receives four BCD inputs, $\overline{A}$-$\overline{B}$-$\overline{C}$-$\overline{D}$, corresponding to 1-2-4-8, from High Frequency Decade Board Assembly A6; a reset and a transfer input from Time Base Board Assembly A5; three control inputs from the front-panel RESOLUTION switch; and a blanking input from the rear-panel BLANKED-UNBLANKED switch. In the Low Frequency Counter circuits, these inputs are transformed into signals which light the seven-segment numeric display ICs, and into digital signals for use in external equipment.

Prescaler U3 is a divide-by-ten counter which is clocked by the active-low D ($\overline{D}$) input. NAND gate U5D is connected as an inverter to reverse the polarity of the D input so it conforms with the active-high input requirements of U3. The four outputs of U3, corresponding to BCD 1-2-4-8, are fed to four port A inputs, PA4 through PA7, of U10 (pins 25-28). The BCD 8 (PA7) output is also fed through another NAND gate-turned-inverter, U5C, to the T.I. input (pin 3) of U10.

The reset input to U3 precedes each counting period to clear U3 of any count remaining in it. If the count remaining in U3 is any digit from 0 through 7, the reset operates normally to clear it out. If, however, U3 has a remaining count of 8 or 9, the reset input, in the act of clearing U3, toggles it an additional count. If this inconsistency were not compensated for, the next counting period would produce an erroneous number. To prevent such counting errors, the PC5 output of U10 is fed back to pin 3 of U3 at the end of each counting period to preset U3 to a count of 9. With this arrangement, the reset input always toggles U3 an additional count. Thus, the state of U3 immediately following the preset input and preceding the counting period is always the same, and the software program deletes the purposely-introduced error. For the duration of the preset (PC5) input, the U3 outputs are shut off.

In addition to the four BCD outputs of U3, which are derived from the D (MSB) input, port A of U10 receives the active-low A-B-C-D inputs at its PAO through PA3 input terminals (pins 21-24). The eight port A inputs are continually read by U10 and, subject to a "read" or "write" request from microcomputer U7, are available to the address data bus.

The input from NAND gate-inverter U5C to U10 pin 3 (T.I.) drives a 14-bit binary event counter which keeps track of the number of 8-bit counts received at port A. This particular counting function starts on the first D input and continues through successive D inputs until the 8443A is turned off. The event counter is reset to its count-start state each time the 8443A line POWER switch is set from STBY to ON by a sharply rising output from power-up circuit Q26, Q27, and Q28.

SERVICE SHEET 9 (CHANGE 9) (Cont'd)

The event counter overflows out U10 pin 6 (T.O.) to microcomputer U7 pin 39 (T.I.) where it feeds a software overflow register. The presence of the overflow output from U10 verifies proper operation of the event counter and of prescaler U3. The U7 software keeps track of the total event count. When the transfer input is received, the U7 software reads the event count for the new readout and does the arithmetic to determine how many counts have occurred since the last readout.

I/O expander and timer U10 communicates with microcomputer U7 over the two-way multiplex address data bus in response to read (RD), write (SR), and address latch enable (ALE) commands from the microcomputer.

The transfer input to the Low Frequency Counter Assembly is a negative-going pulse which signals the end of the counting period and the start of the "read" and display update period. It is latched low in a flip-flop made up of two cross-coupled NAND gates, U5A and U5B. At the end of the read and update period, the negative-going write pulse (WR) from U7 resets the transfer flip-flop.

The three control inputs to U7 pins 36, 37, and 38 originate at the front-panel RESOLUTION switch. The active input line is grounded through the switch; the two inactive control lines are open-circuited. Microcomputer U7 reads these three inputs at the beginning of each readupdate period to determine which numerical display IC requires a lighted decimal point. A fourth control input to U7 at pin 35 is unconnected unless the 1 Hz control option is built into the instrument.

Simultaneously grounding all four of the control input test points, TP1 through TP4, causes the counter to count from 00000000 through 99999999, lighting the decimal points on the even numbers, then blank the display, and finally show a four-character group on the four inner display ICs (DS3, DS4, DS5, and DS6), with the four outer ICs (DS1, DS2, DS7, and DS8) blank. This cycle continues as long as the four test points remain grounded. (The four-character display is shown below in the Low Frequency Counter Troubleshooting.)

The blanking input originates at the BLANKED/ UNBLANKED switch on the 8443A rear panel. With the switch set to BLANKED, the input is approximately +6 volts. When the switch is set to UNBLANKED, the input is an open circuit. The blanking input drives NPN transistor Q25, which inverts the input and drives pin I of microcomputer U7. By setting U7 pin 1 solidly to either (blanked) or +5 volts (unblanked), Q25 makes sure the open-circuit input is not misinterpreted by U7. An unblanked input causes all the numeric display ICs to be lighted during the display pdate. A blanked input, however, causes all zeros preceding the most significant digit or the decimal point (whichever occurs first) to be blanked. The microcomputer reads this input during each read-update period to determine whether or not to eliminate the leading zeros.

The multiplexed address data on the address data bus is latched into address latch U8 by the ALE (address latch enable) output from U7. U8 then provides 8 lines of the 11-line address required by programmed read-only memory (PROM) U9. The three upper address lines to U9 are from port 2 (P20, P21, P22) of U7. Shortly after the addresses are latched by U8, the address data bus clears and becomes ready to function as an input bus instead of an output bus. Next, the active-low PSEN output from U7 pin 9 is strobed low, which causes the 8-bit instruction from U9 to be placed on the address data bus and fed back to U7. U7 then performs the action dictated by the i-bit instruction output of U9.

There are 29 digit outputs from the I/O expander circuits in U10 and U1 11. Thirteen of these outputs are from ports B and C of U10; the remaining sixteen are from ports 4, 5, 6, and 7 of U11. Fed to a rear-panel connector through Digital Output Assembly A19, they provide seven and one-half digits to external equipment.

The eight numeric display ICs on Counter Display Assembly A1A2 are controlled by eight outputs from port 1 of microcomputer U7. U7 outputs P10, P11, P12, and P13 provide a four-line BCD input to BCD-to-7-segment decoder U4. Outputs P14, P15, and P16 drive 3-to-8 decoder U6; and P17 controls the lighting of the decimal point.

BCD-to-7-segment decoder U4 translates the levels on its four inputs into seven outputs, each one driving a particular alphabetically designated segment in all eight numerical display ICs. A dual-transistor current source in each segment drive line provides the segment turn-on power (U4 outputs are open-collector with internal pull-up resistors). This portion of the display drive circuitry determines the numeral that is to be displayed.

Decoder U6 translates the levels on its three inputs into eight digit-drive signals, each on at a different time. The "on" output turns on one of the eight display ICs, which then shows the numeral selected by the BCD-to-7-segment decoder circuit. The transistors in the digit drive outputs from U6 function as digit drive current switches.

Output P17 from U7 represents the most significant bit output from U7 port 1. It is fed in parallel to the decimal point inputs of the eight display ICs. Its state, on or off, determines whether or not the "on" display IC shows a

SERVICE SHEET 9 (CHANGE 9) (Cont'd)

decimal point. Transistors Q12 and Q24 make up a dual transistor current source for the decimal point drive.

Although there are eight numerical display ICs, and each is on for a different period, the counter is set to run as if there were nine display periods with the display blanked during the ninth.

There is also a short display blanking period that occurs with each transfer input. This allows the microcomputer to make the transfer without affecting the display.

When the 8443A line POWER switch is first on, and after a brief delay purposely introduced by the +6 volt switch circuit on board assembly A1A3, the counter automatically performs a confidence check. At the start of this check, the counter display shows all zeros, then it changes to all ones, then to all twos, and so on up through all nines. The counter does the confidence check once before displaying the frequency count.

If the confidence check repeats, it is because the software has detected an apparent error in the event count arithmetic. This sometimes happens when the event counter in U10 is not far enough along in the operation cycle to have produced an overflow output to the microcomputer when the count update begins, a condition regarded as an "underflow". Therefore, when the software overflow register in the microcomputer does the arithmetic required to determine the number of counts since the last readout, it obtains a negative number, an answer it views as an arithmetic error. It then returns the counter to its start-up condition, initiating another confidence check. Usually the period of one additional confidence check is enough to establish the event counter overflow and start normal counter operation.

+6 Volts Switch (Part of A1A3) Operation

Board assembly A1A3 serves as an interconnect device between the Low Frequency Counter and the 8443A Motherboard Assembly. It also contains a power-up switching circuit which supplies +5.5 volts to the Low Frequency Counter. The purpose of this power-up switch is to hold off the counter operating power until the power stabilizes and is relatively free of "switch-bounce" glitches.

When the ac line power is first turned on, the dc input to the switching circuit appears across two parallel resistive voltage dividers. Voltage divider R5-R6 applies a voltage equal to one-one-half the input level to the minus input (pin 2) of comparator U1A and the plus input (pin 5) of comparator U1B.

At the same time, voltage divider R3-R4 applies a voltage that is just slightly more than one-half the input level, but never exceeding +2.61 volts, to the minus input (pin 6) of U1B. Since at first (that is, until the input dc reaches about +5 volts) the minus input of U1B is more positive than its plus input, U1B produces a zero output. As a result of this zero output from U1B, the plus input of U1A is lower than its minus input. Thus, U1A also produces a zero output, which in turn holds Q2 off and prevents Q1 from conducting.

If, when the LINE power switch is turned on, the input dc rises cleanly to its nominal level of +6 volts, the circuit operates as follows: at an input level of approximately +5 volts, zener diode VR1 breaks down and sets the minus input of U1B at a maximum level of +2.61 volts. (At inputs less than approximately +5 volts, the input to the minus terminal of U1B is the voltage across R3.) As the input approaches +6 volts, the plus input of U1B becomes more positive than the minus input. Now, U1B produces a positive output which charges capacitor C1 across R7, developing a positive-going ramp at the plus input of U1A. As soon as the level of this ramp exceeds the level at the minus input of U1A, U1A produces a positive output which turns on Q2 and Q1. With Q1 conducting, approximately +5.5 volts is passed to the Low Frequency Counter Board.

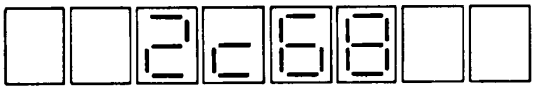
If, however, on initial power turn-on, the input dc fluctuates so that the output of U1B is turned on and off by polarity reverses at its inputs, C1, instead of charging, discharges through CR2 and U1B. (Remember, it requires approximately +5 volts input to hold the output of U1B above zero volts.) In this event, the plus input of U1A remains lower than its minus input, and the resulting zero output holds off Q2 and Q1.

Once the switch is closed so that dc is supplied to the Low Frequency Counter, the switching circuit is not affected by narrow, negative-going, widely-spaced glitches. A series of closely spaced glitches, however, may cause the switch to open until the input dc stabilizes.

8443A Low Frequency Counter Troubleshooting (CHANGE 9)

Symptom	Probable Cause
Display blanked or unintelligible	1. Failure of 3-to-8 decoder U6 (check U6 for BCD inputs and sequential outputs). 2. Failure of BCD-to-7-segment decoder U4 (check U4 for BCD inputs). 3. Failure of microcomputer U7 port 1 output circuitry (if possible, substitute another microcomputer IC for U7).
Counter display intermittently or successively repeats the start-up sequence confidence check. **NOTE** **In the start-up sequence, the counter cycles all the display ICs so that the read-out is all zeros, then all ones, then all twos, and so on up through all nines. The counter normally goes through this cycle once as a confidence check, each time the line POWER switch is turned on, before displaying the actual frequency count.**	1. Failure of the event counter in I/O expander and timer U10. You can check this by looking at the output signal on U10 pin 6 (T.O.), the event counter overflow to U7 pin 39. The signal should be toggling at some very low frequency. In the external mode with an input frequency of 55 MHz and the RESOLUTION control set to 10 Hz, you should see approximately 25 signal excursions per second. Because of the over-flow pulse timing, the excursions may appear some-what irregular. 2. Failure of the reset power-up circuitry (Q26, Q27, Q28) connected to U10 pin 4. 3. Failure of prescaler IC U3. 4. Failure of gate U5D or U5C.
One or more display ICs fail to light. **NOTE** **Make sure the unlighted display IC isn't just being blanked to eliminate leading zeros. Check the setting of the BLANKED/UNBLANKED switch on the 8443A rear panel.**	1. Partial failure of 3-to-8 decoder U6. Check U6 for BCD inputs and sequential outputs. 2. Failure of U7 port 1 outputs. 3. Failure of the unlighted display ICs on the Counter Display Board Assembly, or open connections between the Display Board Assembly and the Low Frequency Counter Board Assembly. 4. Failure of the current-source transistor(s) in the applicable digit drive output(s) from U6.
Display shows a count of 777215 and two random numerals.	1. Failure of I/O expander and timer U10. 2. Failure of Reset circuit Q26, Q27, and Q28.

8443 Low Frequency Counter Troubleshooting (CHANGE 9)

Symptom	Probable Cause
Displayed number does not agree with actual input frequency. Digital outputs from U10 and/or U11 also erroneous .	1. If the digital outputs from both U10 and U11 are in error, the fault can be in U7, U8, U9, or U10. To eliminate U8 and U9, ground test points TP1, TP2, TP3, and TP4; then look at the address data bus during the negative-going PSEN output from U7 pin 9. The signals on the bus should appear as distinct highs and lows. If, instead, the bus seems to be floating, there is probably a failure in U9. 2. If the bus appears normal, and there doesn't seem to be anything wrong with U8 or U9 at this point, the problem could be in U7. To check U7, ground the four control input test points, TP1 through TP4, just as in step I above. With the test points grounded, the display should count from 00000000 through 99999999, showing decimal points with the even numbers. Following the count of 99999999, the display should blank momentarily, exhibit the four-character group shown below for two to five seconds, again blank momentarily, then repeat the entire cycle from the zeros display through the four-character group. The display should continue to cycle in this manner as long as test points TP1 through TP4 are-grounded. (Note that if the test points are not solidly grounded to the 8443A chassis, the cycle will stop on the four-character group.)  The presence of the four-character group shown above is a fairly good indication that U7 is performing most of its required functions, and that the problem is most likely in U10. If a character group other than the one shown above is displayed, microcomputer U7 is the most likely suspect. Note that the signals for this character group should also be available at the DIGI TAL OUTPUT connector on the 8443A rear panel.
Digital outputs from U11 ports 4, 5, 6, and 7 missing or incorrect. Display is normal.	1. Failure of U 1.
Digital outputs from U10 ports B and C missing or incorrect. Display is normal.	1. Partial failure of U10.

+6 Volts Switching Circuitr Troubleshooting (CHANGE 9)

Symptom	Probable Cause
Zero dc at switch output test point TP4 with a steady +6 volts at input test point TP2.	1. Series switching transistor Q1 open. 2. Failure of control transistor Q2. 3. Failure of comparator U1A or U1B. 4. Zener diode VR1 open. 5. Capacitor C1 shorted. 6. Diode CR1 shorted.
Voltage at switch output test point TP4 is less than +5.5 volts with a steady +6 volts at input test point TP2.	1. Partial failure of series transistor Q1or control transistor Q2. 2. Partial failure of comparator U1A or U1B.
Switch fails to open with a significant reduction of the input voltage level.	1. Zener diode VR1 shorted.

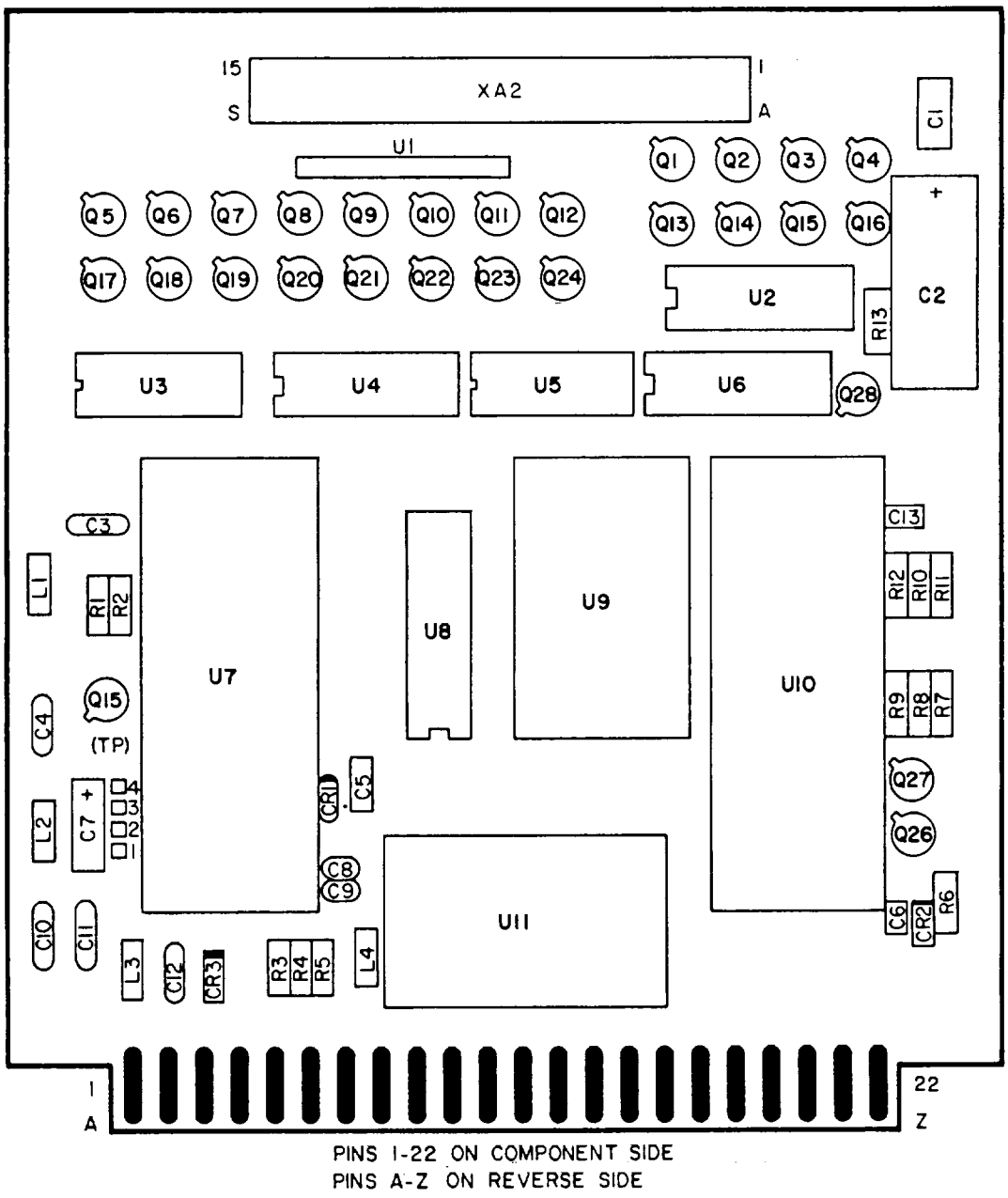


Figure 8-38A. A1A1, Low Frequency Counter Board Assembly, Components (CHANGE 9)

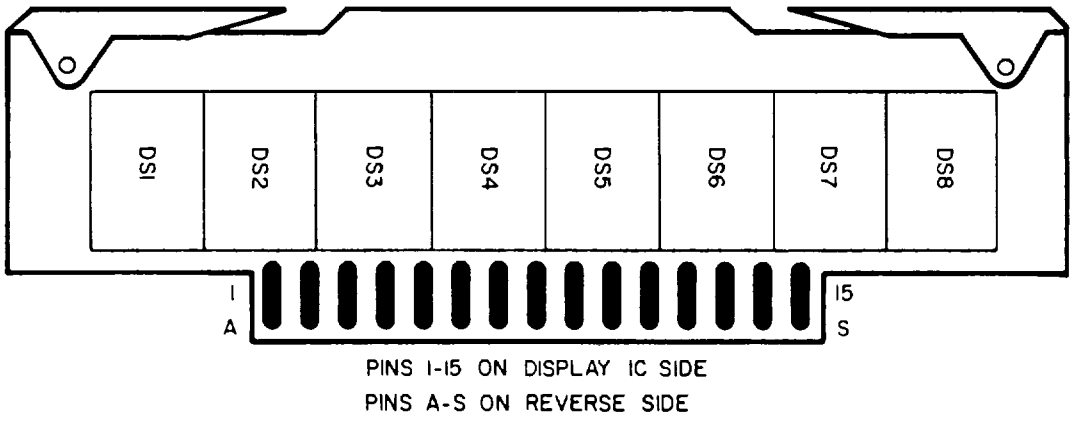


Figure 8-38B. A1A2, Counter Display Board Assembly, Components (CHANGE 9)

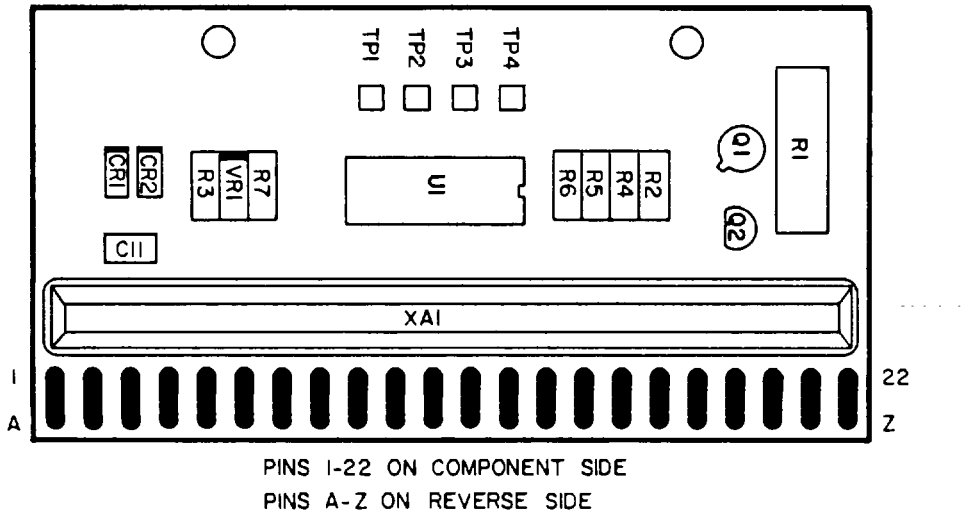


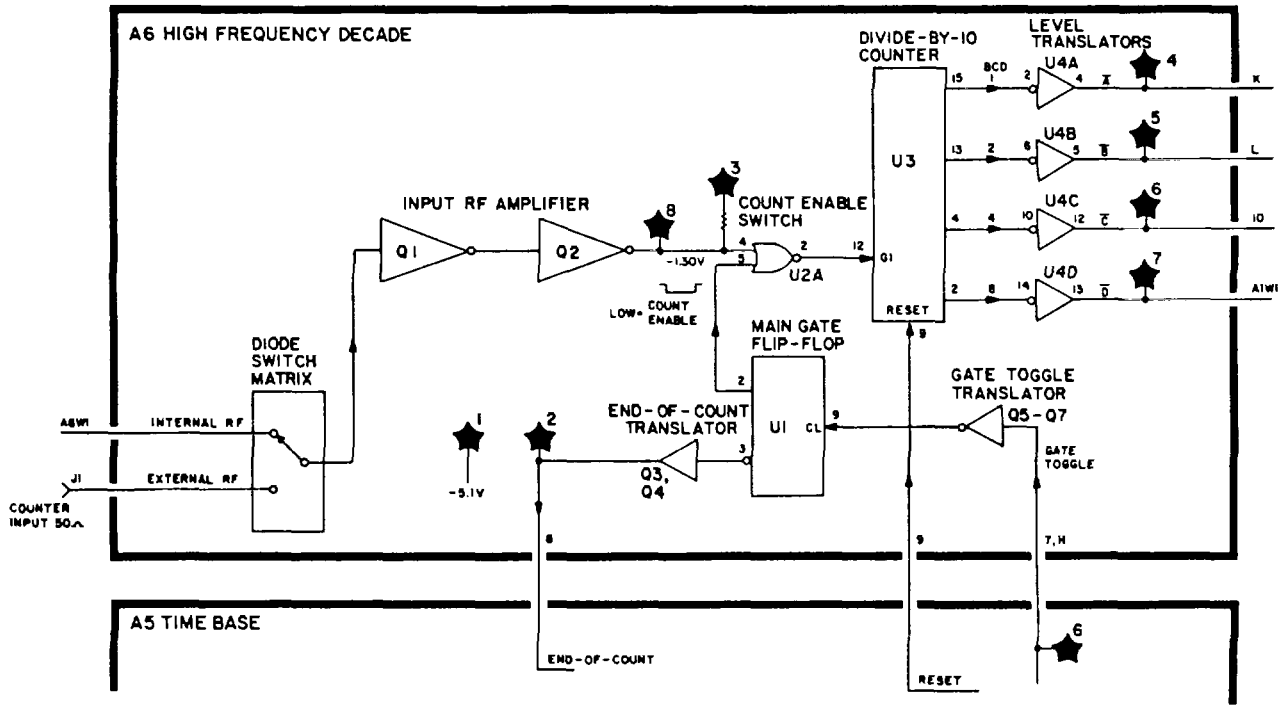
Figure 8-38C. A1A3, +6V Switched Board Assembly, Components (CHANGE 9)

Table 6-3. 8443A/B Replaceable Parts (CHANGE 10)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6	18443-60047	8	1	HIGH FREQUENCY DECADE ASSEMBLY (8443A ONLY)	28480	08443-60047
A6C1	0160-2327	8	9	CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-x5R-102M
A6C2	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-X5R-to2M
A6C3	0180-0376	5	5	CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6C4	0180-0197	8	7	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6C5	0160-2930	9	5	CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2930
A6C6	0160-2930	9		CAPACITOR-FXD 01UF +80-20% 100VDC CER	28480	0160-2930
A6C7	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-XSR-102H
A6C8	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-X5R-102M
A6C9	0180-0197	8		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56299	150D225X9020A2
A6C10	0180-0376	5		CAPACITOR-FXD .47UF +-10% 35VDC TA	56299	150D474X9035A2
A6C11	0180-0197	8		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9120A2
A6C12	0180-0116	1	1	CAPACITOR-FXD 6.8UF +-10% 35VDC TA	56289	150Db85X903592
A6C13	0160-2930	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28490	0160-2930
A6C14	0160-2930	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2930
A6C15	0160-3877	5	2	CAPACITOR-FXD 100PF +-20% 200VDC CER	29480	0160-3877
A6C16	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-XsR-102H
A6C17	0160-0376	5		CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6CIB	1810-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X902oA2
A6C19	0180-0376	5		CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6C20	0160-2938	9		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-2930
A4C21	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6C22	0100-0376	5		CAPACITOR-FXD .47UF+-10% 35VDC TA	56289	150D474X9035A2
A6C23	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A6C24	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-XSR-102M
A6C25	0160-3079	7	6	CAPACITOR-FXD .01UF +-20% 10VDC-CER	29400	0160-3879
A6C26	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-XSR-tO2H
A6C27	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-X5R-102M
A6C29	0160-2327	8		CAPACITOR-FXD 1000PF +-20% 100VDC CER	51642	150-110-XSR-102H
A6C29	0180-0197	8		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56299	150D225X9020A2
A6C30	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3979
A6C31	0160-2204	0	1	CAPACITOR-FXD 100PF +-5% 300VDC MICA	28490	0160-2204
A6C32	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	29480	0160-3879
A6C33	0160-3987	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6C34	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3979
AhC35	0160-3877	5		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A6C36	0160-3879	7		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A6CR1	1901-0047	8	6	DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A6CR2	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	29480	1901-0047
A6CR3	1901-I518	8	3	DIODE-SM SIG SCHOTTKY	29480	1901-0518
A6CR4	1901-0518	8		DIODE-SM SIG SCHOTTKY	29480	1901-1518
A6CR5	1901-0743	1	1	DIODE-PWR RECT 1N4004 400V 1A DO-41	01295	1N4004
A6CR6	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A6CR7	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	29480	1901-0047
A6CR8	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	29480	1901-0047
A6CR9	1911-0519	8		DIODE-SM SIG SCHOTTKY	28490	1901-0518
A6CR10	1901-0047	8		DIODE-SWITCHING 20V 75MA 10NS	28480	1901-0047
A6CR11	1901-0539	3	3	DIODE-SM SIG SCHOTTKY	29490	1901-0539
A6CR12	1901-0539	3		DIODE-SM SIG SCHOTTKY	29480	1901-0539
A6CR13	1901-0039	8	2	DIODE-SWITCHING 50V 300MA OHM	28480	1901-0039
A6CR14	1991-0039 a	8		DIODE-SWITCHING 50V 300MA OHM	28480	1901-0039
A6CR15	1901-0539	3		DIODE-SM SIG SCHOTTKY	29490	1901-0539
A6J1	1250-1194	7	3	CONNECTOR-RF SM-SLD M SGL-HOLE-FR 50-OHM	29490	1250-1194
A6J2	1250-1194	7		CONNECTOR-RF SM-SLD M SGL-HOLE-FR 50-OHM	29480	1250-1194
A6LI	9100-1616	9	5	INDUCTOR RF-CH-MLD 1.5UH 10%	29840	9100-1616
A6L2	9100-1616	9		INDUCTOR RF-CH-MLD 1.5UH 10%	28480	9100-1616
A6L3	9100-1630	7	2	INDUCTOR RF-CH-MLD 51UH 5% .166DX.385LG	29480	9100-1630
A6L4	9100-1623	8	1	INDUCTOR RF-CH-MLD 27UH 5% .166DX.385LG	29480	9100-1623
A6L5	9100-1616	9		INDUCTOR RF-CH-MLD 1.5UH 10%	29480	9100-1616
A6L6	9100-1616	9		INDUCTOR RF-CH-MLD 1.5UH 10%	29480	9100-1616
A6L7				COIL-,05UH (P.C. BOARD TRACE)		
A6L8	9100-1616	9		INDUCTOR RF-CH-MLD 1.5UH 10%	28480	9100-1616
A6L9	9110-1611	4	3	INDUCTOR RF-CH-NLD 220NH 20%	28480	9100-1611
A6L10	9100-1611	4		INDUCTOR RF-CH-NLD 220NH 20%	28480	9100-1611
A6L11	9100-1611	4		INDUCTOR RF-CH-MLD 220NH 20%	28490	9100-1611
A6L12	9100-1L30	7		INDUCTOR RF-CH-MLD 51UH 5% .166DX.385LG	28480	9100-1630
A6MP1	0443-20041	8	1	COVER-HF DECADE ASSEMBLY	29480	08443-20041
A6Q1	1954-0345	8	2	TRANSISTOR NPN 2N5179 SI TO-72 PD-200MW	04713	2N5179
A6Q2	1854-0345	8		TRANSISTOR NPN 2N5179 SI TO-72 PD-200MW	04713	2N5179
A6Q3	1954-0071	7	1	TRANSISTOR NPN SI PD=300MW FT=200MHZ	29480	1954-0071
A6Q4	1853-0020	4	1	TRANSISTOR PNP SI PD=300MW FT=150MHZ	29480	1953-0020
A6Q5	1854-0019	3	3	TRANSISTOR NPN SI TO-1B PD=360MW	28480	1854-0019

Table 6-3. 8443A/B Replaceable Parts (CHANGE 10)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A6Q6	1854-0019	3		TRANSISTOR NPN SI TO-18 PD-360MW	29480	1854-0019
A6Q7	1854-0019	3		TRANSISTOR NPN SI TO-18 PD-360MW	28480	1854-0019
A6R1	0698-7229	8	3	RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-T0-511R-G
A6R2	0757-0395	1	3	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-TO-56R2-F
A6R3	0757-0442	9	3	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R4	0698-7229	8		RESISTOR 511 1% .05W F TC=0+-100	24546	C3-1/8-TO-511R-G
A6R5	0757-0395	1		RESISTOR 56.2 1% .125W F TC=0+-100	24546	C3-1/8-TO-56R2-F
A6R6	0757-0442	9		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R7	0757-0438	3	5	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A6R8	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A6R9	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A6R10	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A6R11	0757-0441	7	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7501-F
A6R12	0757-0440	7		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7501-F
A6R13	0698-3151	7	2	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2971-F
A6R14	0698-3151	7		RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2871-F
A6R15	069s-0083	8	4	RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A6R16	0757-0405	4	2	RESISTOR 162 I% .125W F TC=0+-100	24546	C4-1/8-TO-162R-F
A6R17	0698-3434	9		RESISTOR 34,8 1% .125W F TC=0+-100	24546	C4-1/8-TO-34R8-F
A6R18	0698-3444	1	1	RESISTOR 316 1% .125W F TC-0*-00	24546	C4-1/8-TO-316R-F
A6R19	0698-0083	8		RESISTOR 1.96K I% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A6R20	0757-0279	0	1	RESISTOR 3.16K 1%.125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A6R21	1757-0405	4		RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-TD-162R-F
A6R22*	0698-3434	9	2	RESISTOR 34.8 1% .125W F TC-O*-10	24546	C4-1/8-TO-34RB-F
A6R23	0757-0416	7	1	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A6R24*	0698-3429	2	1	RESISTOR 19.6 1% .125W F TC=0+-100	03888	PME55-1/8-TO-19R6-F
A6R25	0698-3447	4	1	RESISTOR 422 1% .125W F TC=0+-100	24546	C4-1/8-TO-422R-F
A6R26	0698-0803	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A6R27	0757-0395	1		RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-TO-56R2-F
A6R28	0698-7236	7	8	RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/-TO-1001-C
A6R29	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-I001-C
A6R30	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1001-G
A6R31	0757-0442	9		RESISTOR 10K I% .t25W F TC=0+-100	24546	C4-1/8-TO-1002-F
A6R32	0698-0083	8		RESISTOR 1.96K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1961-F
A6R33	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-1001-G
A6R34	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1001-G
A6R35	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-T0-I001-G
A6R36	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1001-C
A6R37	0698-7236	7		RESISTOR 1K 1% .05W F TC=0+-100	24546	C3-1/8-TO-1001-C
A6R38	0757-0438	3		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/B-TO-5111-F
A6TP1	08443-00041	6	2	TEST POINT CONNECTOR	28480	08443-00041
A6TP2	08443-00041	6		TEST POINT CONNECTOR	28480	08443-00041
A6TP3	1250-1194	7		CONNECTOR-RF SM-SLD M SGL-HOLE-FR 50-OHM	28480	1250-1194
A6TP4	1251-0600	0	5	CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP5	1251-0610	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
AbTP6	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP7	1251-0600	0		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6TP8	1251-0600	o		CONNECTOR-SGL CONT PIN 1.14-MM-BSC-SZ SQ	28480	1251-0600
A6U1	1820-0820	3	1	IC FF ECL J-BAR K-BAR CON CLOCK DUAL	04713	MC10135L
A6U2	18200802	1	1	IC QUAD 2 INPUT NOR	04713	MC10102P
A6U3	1820-1383	5	1	IC CNTR ECL BCD POS-EDGE-TRIG	04713	MC10138L
A6U4	1920-1052	5	1	IC XLTR ECL ECL-TO-TTL QUAD 2-INP	04713	MC10125L
AbU5	1810-1204	6	1	NETWORK-RES 8-SIP1.0K OHM X 7	01121	20A102
A6VR1	1902-1291	8	1	DIODE-ZNR 1N5338B 5.1V 5% PD=5W IR=1UA	04713	1N53388
A6VR2	1902-0048	1	2	DIODE-ZNR 6.81V 5% DO-35 PD=.4W	28480	1902-0048
A6BR3	1902-0048	1		DIODE-ZNR 6.81V 5% DO-35 PD=.4W	28480	1902-0048
A6W1	08443-60056	9	1	CABLE ASSEMBLY-RF, TIME BASE INPUT	29480	08443-60056



P/O Figure 8-31. Counter Section Logic Diagram (High Frequency Decade Portion) (CHANGE 10)

SERVICE SHEET 8 (CHANGE 10)

High Frequency Decade Assembly A6 supplies a four-line BCD representation of the Tracking Generator frequency to the Low Frequency Counter. It also furnishes an end-of-count signal to Time Base Assembly A5. If the High Frequency Decade does not supply a correct BCD count to the Low Frequency Counter, the counter display shows an incorrect frequency. Test points on all four BCD outputs from the High Frequency Decade enable you to check for their presence. There is also a test point for the end-of-count output. To troubleshoot the High Frequency Decade successfully, you must be familiar with its circuits and with digital troubleshooting techniques.

Decade

The High Frequency Decade Assembly uses timing signals from Time Base Assembly A5 and divide-by-ten counter to convert the RF supplied to the counter section into four-line BCD (1-2-4-8) and end-of-count outputs. The BCD drives Low Frequency Counter Assembly A1, and the end-of-count output is fed to the timing circuits on A5.

When the High Frequency Decade is operating properly, and the Spectrum Analyzer and Tracking Generator/Counter controls are set as shown below, the BCD outputs to the Low Frequency Counter Assembly should appear as shown in Figure SS8-1. Connect oscilloscope channels A, B, C, and D to A6 assembly test points TP4, TP5, TP6, and TP7 respectively. Initial Control Setting (for waveform SS8-1)

Spectrum Analyzer (setting of controls not listed is unimportant)

SCAN WIDTH PER DIVISION ..... 10 MHz
SCAN WIDTH .....PER DIVISION
FREQUENCY .....10 MHZ
SCAN TIMER PER DIVISION.....1 msec
SCAN MODE .....INT
SCAN TRIGGER.....AUTO

Tracking Generator/Counter

MODE .....SCAN HOLD
RESOLUTION..... 100 Hz
MARKER CONTROL knob .....Pulled out

Oscilloscope

SYNC .....INTERNAL
TIME/DIV .....2 msec
VOLTS/DIV 0.2
SLOPE .....
TRIGGER.....ACF

Input Amplifier and Switching Matrix

Input RF amplifier Q1-Q2 provides flat amplification of signals with frequencies up to 120 MHz. Inductors L10 and L11 peak the gain at the high frequency end of the bandpass. Resistor R22 in the emitter circuit of Q2 is selected for a value that enables a nominal -18 dBm signal to toggle count-enable switch (NOR gate) U2A. The value of R24 is selected to provide a dc level at pin 4 of U2A that is -1.30 volts with no signal input.

Diodes CR1 through CR4 and CR6 through CR10 make up a switching matrix for the input RF signal. When the front-panel MODE switch is set to MARKER or SCAN HOLD, the switch inputs forward bias switching diodes CR1, CR4, CR6, and CR9, while back biasing CR2, CR3, CR7, CR8, and CR10. This allows the input RF signal to be coupled through C3, CR1, CR6, C17, and L9 to the base of RF amplifier transistor Q1. When the MODE switch is set to EXTERNAL, the bias on the switching diodes is the exact opposite of what it is for the MARKER and SCAN HOLD modes: diodes CR1, CR4, CR6, and CR9 are now back biased, while CR2, CR3, CR7, CR9, and CR10 are forward biased. Thus the internal RF signal is passed to Q1.

Input Amplifier and Switching Matrix Test Procedure

Connect a 1 MHz source at +10 dBm to the 8443A COUNTER INPUT and set the 8443A MODE switch to EXTERNAL. Connect the oscilloscope Channel A input to the base of Q1, the Channel B input to the base of Q2, and the Channel C input to pin 4 of U2. Set the oscilloscope VOLTS/DIV to .2 for each channel and the TIME/DIV to 1 µsec. Trigger INT, ACF, and SLOPE +. The displayed waveforms should be as shown in Figure SS8-2.

If the Channel A waveform is present, but the Channel B and Channel C waveforms are not, check transistor Q1 and its associated components. If waveforms A and B are present, but C is not, check transistor Q2 and its associated components. If all the waveforms are present, do the Gate Toggle Translator and Main Gate Flip-Flop Test Procedure described on this Service Sheet.

Gate Toggle Translator and Main Gate Flip-Flop

Main gate flip-flop U11 is clocked by the gate toggle input from Time Base Assembly A5. This input is a periodically interrupted series of square waves with a repetition rate (in a single series) of 1 kHz, 100 Hz, or 10 Hz, selectable with the front-panel RESOLUTION switch. It Is developed in the A5 assembly decade counter, and is started and stopped by the A5 assembly time base flip-flop.

SERVICE SHEET 8 (CHANGE 10) (Cont'd)

In the MARKER and SCAN HOLD modes of operation, the time base flip-flop starts the gate toggle square waves shortly after (less than 250 microseconds) the spectrum analyzer scan ramp is stopped at the frequency point set with the MARKER POSITION control. (The scan ramp is stopped by a signal fed to the spectrum analyzer from 8443A Marker Control Assembly A7.) The end-of-count output from the High Frequency Decade Assembly signals the end of the counting period. It is used to clock the time base flip-flop in A5 into the opposite state and thus stop the gate toggle square waves.

Gate Toggle Translator. The gate toggles is fed to U1 through a gate toggle translator circuit. This circuit inverts the gate toggle input and translates it from a TTL level to the ECL level required by U1. The translator consists of a comparator circuit, Q6-Q7, and an emitter follower, Q5. In addition to translating the gate toggle level, the comparator is a temperature compensation device. For this purpose, the base of comparator transistor Q7 is driven by a temperature-compensating dc voltage (VBB) output from pin 1 of the output level translators IC, U4. This dc voltage is also the noninverting input to each output level translator. Any ambient temperature change that affects the input requirements of main gate flip-flop U1 and the output levels from divide-by-10 counter U3 also causes a corresponding change in the VBB level applied to the base of Q7 and the non-inverting inputs of the output level translators. The gate toggle translator then changes the translated gate toggle signal level to compensate for the temperature-induced change in the clock input requirement of U1. Simultaneously, the level change at the noninverting inputs of the output level translators compensates for temperature-induced changes in the output levels from U3.

Main Gate Flip-Flop. Flip-flop U1 is connected so that its output state reverses each time a positive-going gate toggle pulse transition is applied to its clock input, pin 9. (Because the gate toggle input is inverted in translator Q5-Q6, the positive-going transitions that clock U1 are the negative-going transitions at the gate toggle input to the A6 board assembly.) The frequency counting period starts when output pin 2 of U1 is clocked low. It ends when the next positive-going transition at U1 pin 9 clocks U1 pin 2 high and U1 pin 3 low.

The duration of the counting period depends on the frequency of the gate toggle input, which in turn depends on the setting of the front-panel RESOLUTION switch. If the RESOLUTION switch is set to 1 kHz, the positive-going transitions at the clock input to U1 are 1 millisecond apart; therefore, the counting period (the period when U1 pin 2 is low) has a duration of 1 millisecond. For a RESOLUTION selection of 100 Hz, the counting period is 10 milliseconds, and for 10 Hz it is 100 milliseconds.

The length of the interval between counting periods depends on the mode in which the 8443A is being operated. In the MARKER mode, the spectrum analyzer scan ramp is allowed to continue when the counting period is over, and a new counting period is initiated on the next ramp. In the SCAN HOLD mode, the scan ramp is not allowed to continue when the counting period ends; the preliminary operations to set up a new counting period start immediately. Thus, in the SCAN HOLD mode, the counting periods are continual, separated only by the transfer and reset periods. If the 8443A is being operated in the EXTERNAL mode, the counting periods are separated by the combined widths of the transfer and reset pulses, a 200-millisecond delay, and the very short period required to start a new gate toggle output from Time Base Assembly A5.

Count Enable Switch. Count enable switch U2A is a NOR gate which switches the RF input through to U3 pin 12 (G1) during the count period, and blocks it at all other times. The dc level at input pin 4 of U2A is fixed at -1.30 volts; the other input, pin 5, follows the pin 2 output of main gate flip-flop U1. The enabling condition for U2A is both inputs low (in this regard, it functions as a negative-logic NAND gate). Thus, when U1 pin 2 is high, U2A blocks the RF input. When pin 2 of U1 is clocked low, U2A passes the RF to U3 where it toggles the G1 (pin 12) input at the RF rate.

End-of-Count Translator. Transistors Q3 and Q4, and their associated components make up the end-of-count translator circuit. The end-of-count signal is the low output from U1 pin 3, which occurs when U1 pin 2 is clocked high to end the counting period. The purpose of this circuit is to translate the ECL level of the U1 output into the TTL level required to drive the associated circuitry on Time Base Assembly A5.

Gate Toggle Translator and Main Gate Flip-Flop Test Procedure Set the 8443A MODE switch to MARKER and the RESOLUTION switch to 100 Hz. Set the spectrum analyzer SCAN TIME PER DIVISION to 1 MILLISECOND. Synchronize the oscilloscope to the spectrum analyzer scan, triggered on + slope, ACF. The waveforms you should obtain under these conditions at five points in the gate toggle signal path are shown in Figure SS8-3. Set the oscilloscope VOLTS/DIV as indicated in the illustration for each waveform.

NOTE

These tests are valid only if Time Base Assembly A5 is operating properly.

SERVICE SHEET 8 (CHANGE 10) (Cont'd)
If you obtain waveforms 1 and 2 (Q6 base, QS5emitter), but are unable to obtain waveforms 3, 4, and 5 (U1 pin 2, U1 pin 3, and TP2), U1 is probably defective.

If you obtain waveform 1, but cannot get waveform 2, check transistors Q5 and Q6, and the components associated with them.

If you obtain the first four waveforms, but get an abnormal indication for the fifth (at TP2), transistor Q3 or Q4 or an associated component is probably defective.

If the gate toggle input (waveform 1) is missing, try grounding test point TP2 on Time Base Assembly A5. Grounding A5TP2, in effect, provides a continuous count trigger. It should produce a square wave gate toggle input with a repetition rate that is much higher than the normal gate toggle, but which can be used to check the gate toggle signal path circuitry. You should note, however, that if grounding A5TP2 is necessary to produce a signal at the gate toggle input to the High Frequency Decade Assembly, there is very likely a problem with the count trigger output of Marker Control Assembly A7.

Divide-By-10 Counter and Output Level Translators Reset Input and Reset Translator. The reset input to the High Frequency Decade Assembly resets divide-by-10 counter U3 to zero before each counting period. It is a positive-going pulse approximately 50 microseconds wide. Its leading edge starts less than 200 microseconds after the scan ramp in the spectrum analyzer is stopped, coincidently with the negative-going count trigger supplied by Marker Control Assembly A7 to Time Base Assembly A5.

In the resistive voltage divider network of R38, R11, and R12, the reset pulse is translated from the TTL level at which is received to the ECL level required by the counter. About one microsecond after the end of the reset pulse, the decade counters in Time Base Assembly A5 start generating the gate toggle square waves that clock main gate flip-flop U1. (See Gate Toggle Translator and Main Gate Flip-Flop circuit description on this Service Sheet.) When the dc level at pin 2 of NOR gate U2A is clocked high to start the counting period, the RF passed through U2A starts toggling the clock 1 (GI) input (pin 12) to divide-by-10 counter U3.

Divide-By-10 Counter. Divide-by-10 counter U3 divides the RF input to provide the four-line BCD (1-2-4-8) required to drive the Low Frequency Counter. Because of the way the counter is connected, the BCD 8 output from U3 pin 2 is one-tenth the input RF rate. At the end of every 10th RF input cycle to pin 12, the count starts over again at 1. At the end of the counting period, the RF input stops and the counter outputs remain as they were at the last count. Before a new counting period starts, however, the reset input returns all four outputs to zero.

Output Level Translators. The outputs from the divide-by-10 counter are positive logic at ECL levels, while the requirements of the Low Frequency Counter are for negative logic at TTL levels. Therefore, the output level translators (U4A-D) have two primary functions: first, to invert the divide-by-10 counter outputs to convert them to negative logic, and second, to shift the outputs to TTL levels to make them conform to the Low Frequency Counter requirements.

The output level translators integrated circuit (IC) package, U4, contains a temperature-compensating dc reference supply (VBB), which maintains the IC outputs at a constant level. This supply responds to environmental temperature changes by altering the dc reference level sufficiently to cancel any level shifts that would otherwise be incurred in the IC circuitry as a result of the temperature variations.

The temperature-compensating dc reference (VBB) is available at pin 1 of U4. It is connected to the noninverting inputs of the level translators to compensate for temperature-induced variations in the counter output levels. It also drives comparator transistor Q7 in the gate toggle translator. In this instance, changes in the VBB level cause comparator Q6-Q7 to shift the gate toggle level in accordance with temperature-induced changes in the U1clock input level requirement.

Divide-By-10 Counter and Output Level Translators Test Procedure Check for the reset pulses with the oscilloscope at Motherboard socket XA6 pin 9, or at the junction of C15 and R38. The reset pulses should be positive-going, three to four volts in amplitude.

Set the 8443A controls for operation in the MARKER mode at 100 Hz RESOLUTION. Set the spectrum analyzer SCAN TIME PER DIVISION to 1 msec.

Connect the oscilloscope channel A, B, C, and D inputs to output test points 4, 5, 6, and 7 respectively on the High Frequency Decade Assembly. Set the oscilloscope TIME/DIV to 5 msec and the VOLTS/DIV to .5 for all four channels. The oscilloscope display should appear as shown in Figure SS8-4.

If the oscilloscope display shows a malfunction, and the input RF amplifier (Q1-Q2) circuits and main gate flip-flop (U1) are functioning normally, the problem is in NOR gate U2A, counter U3, or in the output level translators IC, U4. If only one output is missing, the problem is most likely a defective output level translator in U4. If all the outputs are missing, either U2 or U3 could be at fault.

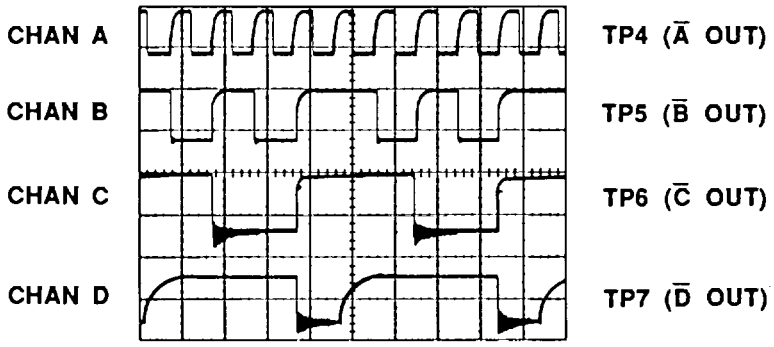


Figure SS8-1. Output Waveforms, SCAN HOLD Mode (CHANGE 10)

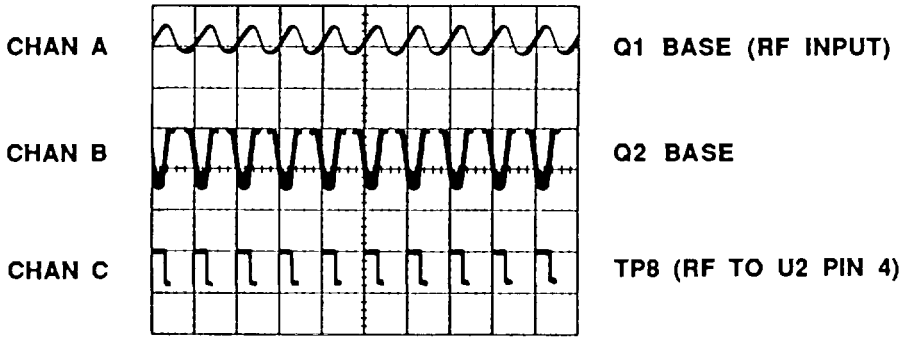


Figure SS8-2. RF Amplifier Waveforms (CHANGE 10)

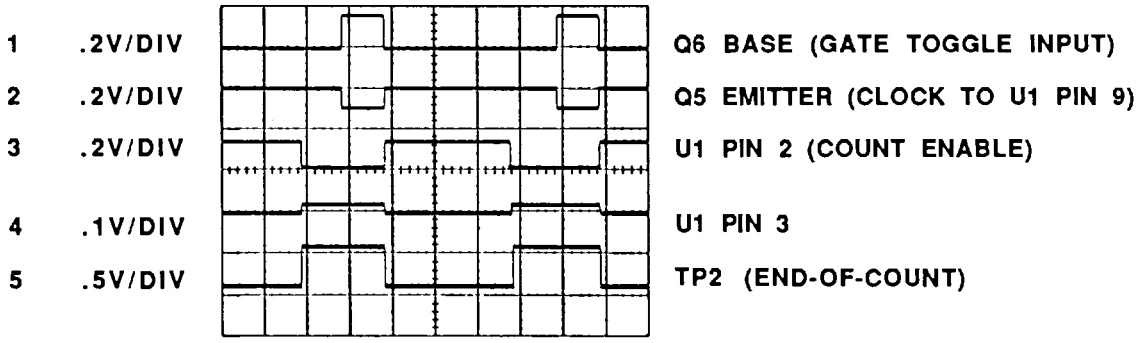


Figure SS8-3. Gate Toggle, Count Enable, and End-of-Count Waveforms (CHANGE 10)

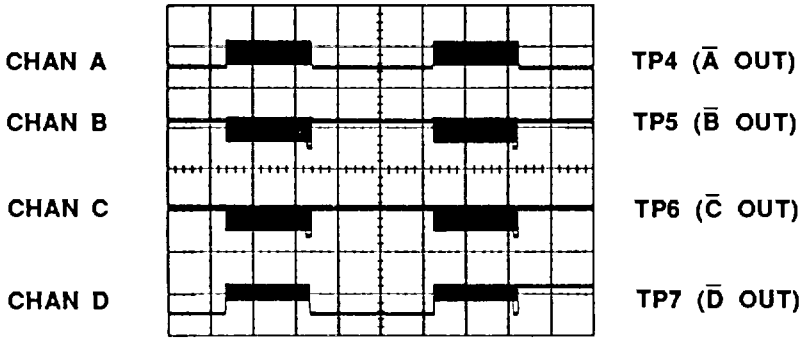


Figure SS84. Output Waveforms, MARKER Mode (CHANGE 10)

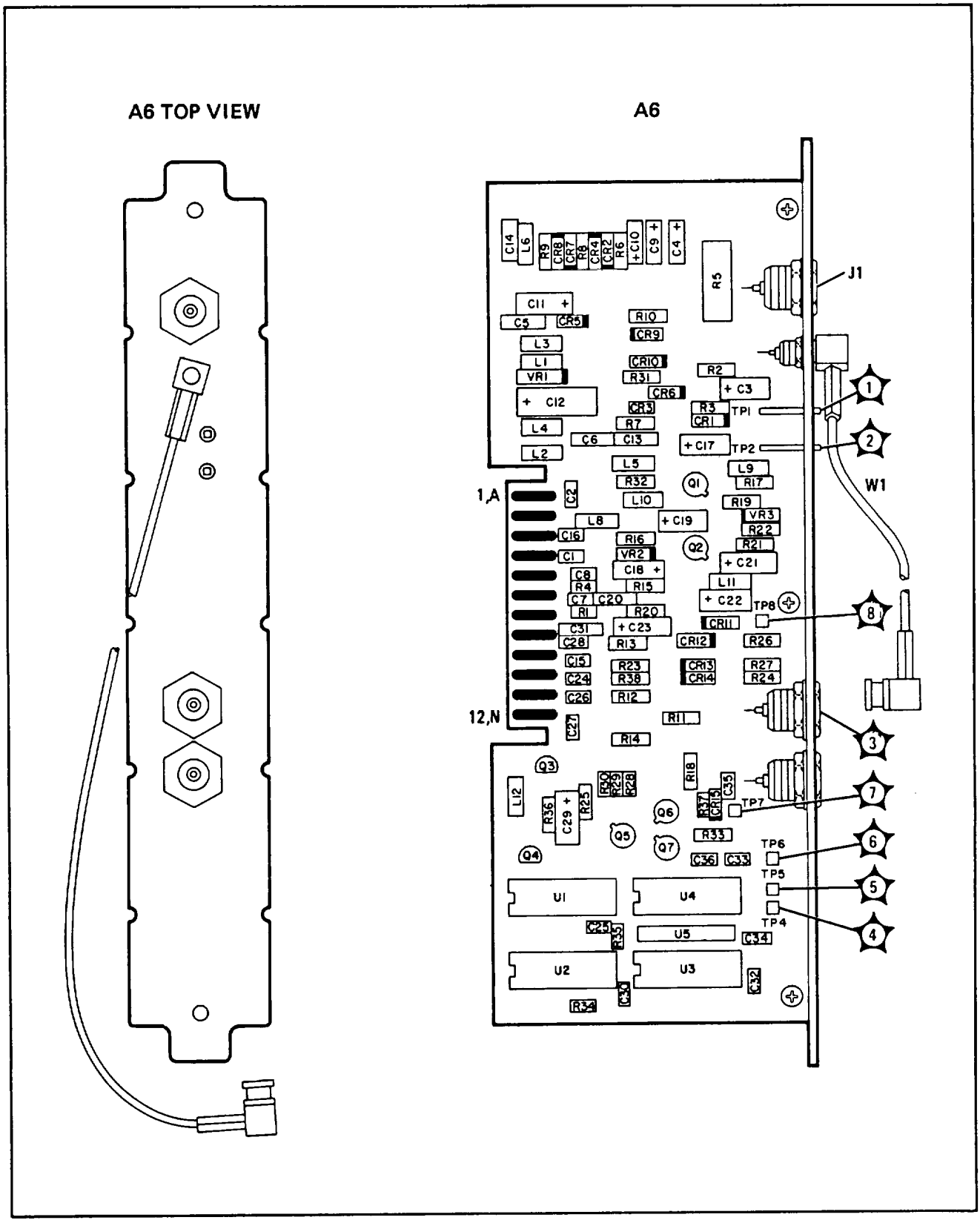


Figure 8-36. A6, High Frequency Decade Assembly, Cover and Components (CHANGE 10)

Table 6-3. Replaceable Parts (CHANGE 12)

Reference Designation	HP Part Number	C D	Qty	Description	Mfr Code	Mfr Part Number
A15	0844360118	4	1	BOARD ASSY: RECTIFIER	28480	08443-60118
A1SC1	0170-0040	9	2	C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A15C2	0170-0040	9		C:FXD MY 0.047 UF 10% 200VDCW	56289	192P47392-PTS
A15C3	0160-3453	3	4	C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD4
A15C4	0160-3453	3		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503Z525-CD4
A15C5	0160-3453	3		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD4
A15C6	0160-3453	3		C:FXD CER 0.05 UF +80-20% 100VDCW	56289	C023A101L503ZS25-CD4
A1SCR1	1901-0200	5	4	DIODE:SILICON 100 PIV 3A	02735	IN4998
A15CR2	1901-0200	5		DIODE:SILICON 100 PIV 3A	02735	IN4998
A15CR3	1901-0200	5		DIODE:SILICON 100 PIV 3A	02735	IN4998
A15CR4	1901-0200	5		DIODE:SILICON 100 PIV 3A	02735	IN4998
A15CR5	1901-0743	1	2	DIODE:SILICON 1A 400 PIV	28480	1901-0743
A15CR6	1901-0743	1		DIODE:SILICON 1A 400 PIV	28480	1901-0743
A15CR7	1902-3002	3	1	DIODE:ZENER 2.3V 5%	28480	1902-3002
A1SF1	2110-0001	8	3	FUSE:1 AMP 250V FB	75915	312001.
A15F2	2110-0001	8		FUSE:1 AMP 250V FB	75915	312001.
A15F3	2110-0002	9		FUSE:2 AMP 250V FB	75915	312.002
A15F4	2110-0001	8		FUSE:1 AMP 250V FB	75915	312001.
A15Q1	1853-0007	7	1	TSTR:SI PNP 2N3251	28480	1853-0007
A1SR1	0812-0012	7	1	R:FXD WW 18 OHM 5% 3W	28480	0812-012
A15R2	0698-0084	9	1	R:FXD MET FLM 2.15K OHM 1% .120W	28480	0698-0084
A15R3	0757-0833	2	1	R:FXD MET FLM 5.11K OHM 1% .05W	28480	0757-0833
A15XF1	2110-0269	0	8	CLIP:FUSE 0.250 IN DIA	91506	6008-32CN
A15XF2	2110-0269	0		CLIP:FUSE 0.250 IN DIA	91506	6008-32CN
A15XF3	2110-0269	0		CLIP:FUSE 0.250 IN DIA	91506	6008-32CN
A15XF4	2110-0269	0		CLIP:FUSE 0.250 IN DIA	91506	6008-32CN

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