Errata

Title & Document Type: **5341A Frequency Counter Operating and Service Manual**

Manual Part Number: **05341-90005**

Revision Date: **July 1977**

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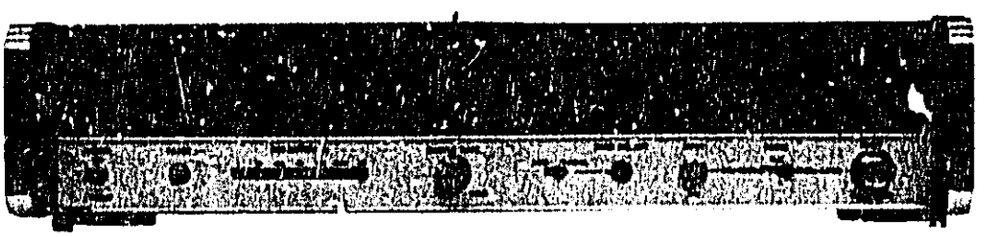
OPERATING AND SERVICE MANUAL

FREQUENCY COUNTER

5341A



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5341A
FREQUENCY COUNTER

OPERATING AND SERVICE MANUAL

SERIAL PREFIX: 1632A

This manual applies directly to Hewlett-Packard Model 5341A Frequency Counters with the serial prefix 1632A.

SERIAL PREFIXES NOT LISTED

For instruments with serial prefixes above 1632A, a "Manual Change" sheet should be included with this manual to give differences.

For instruments with serial prefixes before 1632A, refer to Section VII for backdating information.

MANUAL PART NUMBER 05341-90005
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SAFETY CONSIDERATIONS

GENERAL

This is a Safety Class I instrument. This instrument has been designed and tested according to IEC Publication 348, "Safety Requirements for Electronic Measuring Apparatus."

OPERATION

BEFORE APPLYING POWER verify that the power transformer primary is matched to the available line voltage and the correct fuse is installed (see Section II, Paragraph 2-6). Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, etc.) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

SERVICE

Although this instrument has been designed in accordance with international safety standards, this manual contains information, cautions, and warnings which must be followed to ensure safe operation and to retain the instrument in safe condition. Service and adjustments should be performed only by qualified service personnel.

Any adjustment, maintenance, and repair of the opened instrument under voltage should be avoided as much as possible and, when inevitable, should be carried out only by a skilled person who is aware of the hazard involved.

Capacitors inside the instrument may still be charged even if the instrument has been disconnected from its source of supply.

Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any unintended operation.

WARNING

IF THIS INSTRUMENT IS TO BE ENERGIZED VIA AN AUTOTRANSFORMER (FOR VOLTAGE REDUCTION) MAKE SURE THE COMMON TERMINAL IS CONNECTED TO THE EARTHED POLE OF THE POWER SOURCE.

WARNING

BEFORE SWITCHING ON THE INSTRUMENT, THE PROTECTIVE EARTH TERMINALS OF THE INSTRUMENT MUST BE CONNECTED TO THE PROTECTIVE CONDUCTOR OF THE (MAINS) POWER CORD. THE MAINS PLUG SHALL ONLY BE INSERTED IN A SOCKET OUTLET PROVIDED WITH A PROTECTIVE EARTH CONTACT. THE PROTECTIVE ACTION MUST NOT BE NEGATED BY THE USE OF AN EXTENSION CORD (POWER CABLE) WITHOUT A PROTECTIVE CONDUCTOR (GROUNDING).

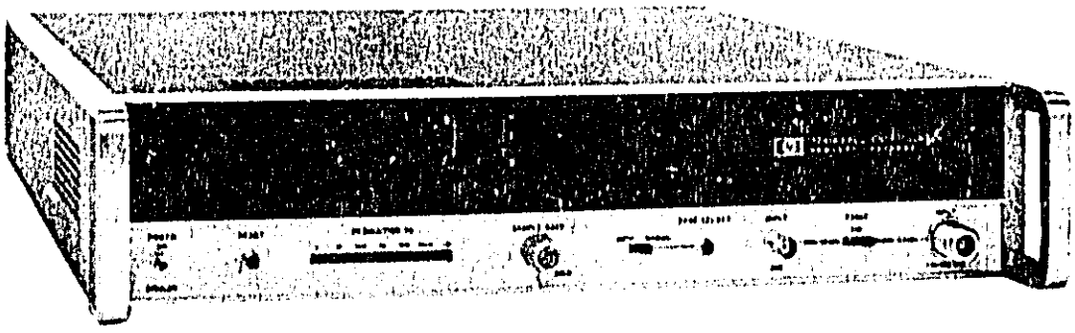
WARNING

THE SERVICE INFORMATION FOUND IN THIS MANUAL IS OFTEN USED WITH POWER SUPPLIED AND PROTECTIVE COVERS REMOVED FROM THE INSTRUMENT. ENERGY AVAILABLE AT MANY POINTS MAY, IF CONTACTED, RESULT IN PERSONAL INJURY.

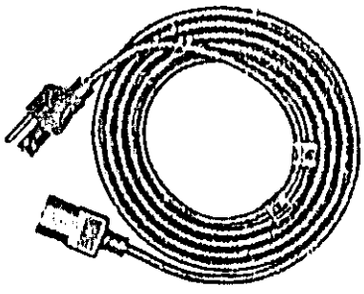
CAUTION

BEFORE SWITCHING ON THIS INSTRUMENT:

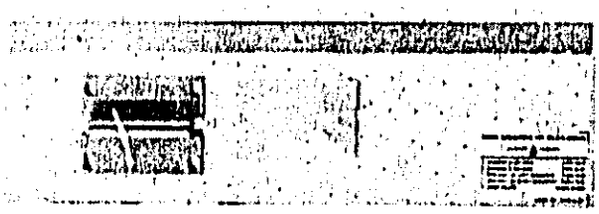
1. MAKE SURE THE INSTRUMENT IS SET TO THE VOLTAGE OF THE POWER SOURCE.
2. ENSURE THAT ALL DEVICES CONNECTED TO THIS INSTRUMENT ARE CONNECTED TO THE PROTECTIVE (EARTH) GROUND.
3. ENSURE THAT THE LINE POWER (MAINS) PLUG IS CONNECTED TO A THREE-CONDUCTOR LINE POWER OUTLET THAT HAS A PROTECTIVE (EARTH) GROUND. (GROUNDING ONE CONDUCTOR OF A TWO-CONDUCTOR OUTLET IS NOT SUFFICIENT.)
4. MAKE SURE THAT ONLY FUSES WITH THE REQUIRED RATED CURRENT AND OF THE SPECIFIED TYPE (NORMAL BLOW, TIME DELAY, ETC.) ARE USED FOR REPLACEMENT. THE USE OF REPAIRED FUSES AND THE SHORT-CIRCUITING OF FUSE HOLDERS MUST BE AVOIDED.



MODEL 5341A



POWER CORD 8120-1378

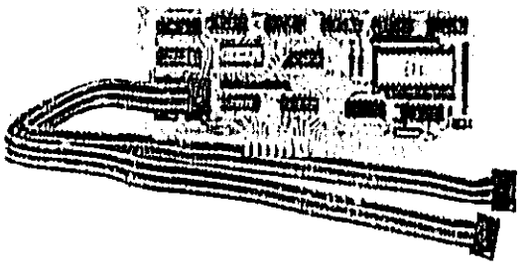


RACK MOUNTING KIT
05326-60046

5341A OPTION 003
1.56GHz FREQUENCY RANGE

5341A OPTION 001
10544A HI STABILITY
OSCILLATOR

5341A OPTION 011 REMOTE PROGRAM AND DIGITAL OUTPUT



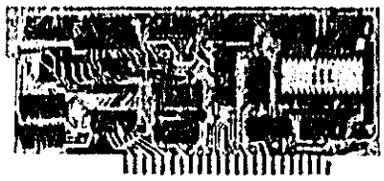


Figure 1-1. Model 5341A Frequency Counter and Options

SECTION I
GENERAL INFORMATION

1-1. SCOPE OF MANUAL

1-2. This manual contains operating and service information for the Hewlett-Packard Model 5341A Frequency Counter. The manual is divided into sections as described in the following paragraphs.

1-3. Section I, GENERAL INFORMATION, this section contains a description of the Counter applications, options, equipment supplied, available accessories, complementary equipment specifications, and safety considerations.

1-4. Section II, INSTALLATION, gives information for unpacking, inspection, preparation for use, and storage.

1-5. Section III, Part A, OPERATION, describes the operating characteristics, maximum input power, controls and indicators, and operating procedures for the standard 5341A Counter.

1-6. Section III, Part B, OPERATION, describes operation and programming capabilities, HP interface bus operation, programming setup procedures, programming, a program summary sheet, output process, and program examples for the 5341A Counter with Option 011.

1-7. Section IV, THEORY, describes how the 5341A functions electronically.

1-8. Section V, MAINTENANCE AND TROUBLESHOOTING, describes how to keep the counter operating properly, and how to find and repair the cause of malfunctions in the counter.

1-9. Section VI, REPLACEABLE PARTS, lists the 5341A replaceable parts with Hewlett-Packard part numbers and/or other manufacturers part numbers. An explanation of the Hewlett-Packard part numbering system is given in this section.

1-10. Section VII, MANUAL CHANGES, contains information necessary to adapt this manual to older instruments.

1-11. Section VIII, SCHEMATIC DIAGRAMS, contains schematic diagrams and parts location illustrations.

1-12. DESCRIPTION

1-13. The Hewlett-Packard Model 5341A Frequency Counter measures frequencies from 50 MHz to 4.5 GHz at the 50-ohm N input connector and signals from 10 Hz to 80 MHz at the 1-megohm BNC input. For the 50 MHz to 4.5 GHz input, two modes of operation can be selected, automatic and manual. In the automatic mode, the counter automatically searches, selects, measures, and displays the lowest frequency in the input spectrum. In the manual mode, a front panel switch allows the operator to restrict measurements to 1 of 10 bands from 50 MHz to 4.5 GHz. Manual band selection allows for several measurements in a complicated spectrum and has the added benefit of extremely fast acquisition times.

1-14. The 5341A employs a "switchable filter" heterodyne technique to make extremely fast measurements. Acquisition time in the automatic mode is 600 μs and 100 μs in the manual mode. The 50Ω input sensitivity is -15 dBm for auto operation and -20 dBm in the manual mode. Sensitivity for the 1-megohm input is 10 millivolts.

1-15. Other features of the 5341A include a 10-digit LED display, switch-selectable resolution, high stability time base, and exceptional FM tolerance.

1-16. When equipped with Option 011, all front panel functions including the frequency band selection can be remotely programmed. This option allows the 5341A to be connected to the Hewlett-Packard Interface Bus and provides for digital outputting.

1-17. APPLICATIONS

1-18. With its fast acquisition time, automatic operation, high sensitivity, and optional remote programmability, the 5341A is particularly adaptable to automatic systems, electronic counter measures, and high speed production testing.

1-19. OPTIONS

1-20. The 5341A can be ordered with the following options: Option 001 High Stability Time Base, Option 002 Rear Panel Input Connectors, Option 003 1.5 GHz Frequency Range, Option 011 Remote Programming-Digital Output. (Option 003 reduces the frequency range to 1.5 GHz.) Extra capacitance introduced by the added coaxial cable from the rear panel to the 80 MHz front panel input reduces sensitivity unless the unused (front or rear panel) BNC connector is terminated by a 50Ω load. Option 002 includes an HP Model 11593A 50Ω load which can be attached to the front or rear panel connector.

1-21. EQUIPMENT SUPPLIED, AVAILABLE ACCESSORIES, AND COMPLEMENTARY EQUIPMENT

1-22. *Table 1-1* lists equipment supplied, *Table 1-2* lists available accessories, and *Table 1-3* lists complementary equipment.

Table 1-1. Equipment Supplied

DESCRIPTION	HP PART NUMBER
Detachable Power Cord 231 cm (7½ ft.) long	8120-1378

Table 1-2. Accessories Available

DESCRIPTION	HP PART NUMBER
Transit Case	9211-1292
Extender Boards	5060-0049, -0630, -2041
Rack Mount Kit	05326-60046

Table 1-3. Complementary Equipment

MODEL NUMBER	FUNCTION
5150A Thermal Printer with Option 001 ASCII Interface	Records data output directly from 5341A's equipped with Option 011.
10631A/B/C Interface Bus Cable	One, two, and four meter cables respectively to connect 5341A Option 011 to ASCII programmable modules, 5150A printer, HP Programmable calculators, and other HP-IB equipment.
59303A Digital-to-Analog Converter	Converts any three consecutive digits from the 5341A Option 011 to analog outputs for use by other equipment such as an X-Y recorder
59304A Numeric Display	Auxiliary display unit for second remote readout.
59301A ASCII-to-Parallel Converter	ASCII-to-Parallel Converter converts ASCI coded data output from 5341A Option 011 to parallel BCD.
59306A Relay Actuator	Provides six form "C" relays controlled via front panel or HP Interface Bus. Ideal for selecting microwave switches and attenuators.
55307A VHF Switch	Contains two DC to 500 MHz 50Ω bidirectional coaxial switches, each with one input and four outputs. Controlled via front panel controls or HP Interface Bus.

1-23. SPECIFICATIONS

1-24. *Table 1-4* lists the specifications for the standard 5341A and options.

1-25. SAFETY CONSIDERATIONS

1-26. The HP 5341A is a Safety Class I instrument. This instrument has been designed and tested in accordance with IEC Publications 348 Safety Requirements for Electronic Measuring Apparatus and has been supplied in safe condition.

1-27. This manual contains information, cautions, and warnings which must be followed by the user to ensure safe operation and to retain the instrument in safe condition.

1-28. RECOMMENDED TEST EQUIPMENT

1-29. *Table 1-5* lists recommended test equipment for test, maintenance, and trouble analysis of the 5341A. This table will be referenced in other sections of this manual.

Table 1-4. Model 5341A Specifications

SIGNAL INPUT

INPUT 1:
- **Range:** 50 MHz to 4.5 GHz
- **Impedance:** 50Ω nominal
- **Connector:** Precision Type N
- **Sensitivity:** -15 dBm (AUTO operating mode); -20 dBm (MANUAL operating mode)
- **Maximum Input:** +20 dBm
- **Damage Level:** +30 dBm
- **Operating Modes:** AUTO; Counter automatically selects and displays lowest frequency within its sensitivity range; MANUAL: Measurement band is selected manually and counter measures within a 525 MHz range above displayed band number (in the 500 MHz and 750 MHz bands, counter measures within a 250 MHz range).
- **Measurement Time:** Acquisition time + gate time.
- **Acquisition Time:** 600 μs (AUTO operating mode); 100 μs (MANUAL operating mode).
- **FM Characteristics:** Tolerances ±250 MHz maximum deviation (0—500 MHz and 1.0—4.5 GHz) and ±125 MHz maximum deviation (500 MHz—1.0 GHz) in center of bands; bands overlap 20 MHz at band edges.

INPUT 2:
- **Range:** 10 Hz to 80 MHz
- **Impedance:** 1 MΩ shunted by 50 pF
- **Connector:** Type BNC female
- **Coupling:** AC
- **Sensitivity:** 10 millivolts
- **Maximum Input:** 5 volts peak-to-peak
- **Damage Level:** 400 volts dc; 250 volts rms ac, 10 Hz to 100 kHz, decreasing 6 dB per octave to 80 MHz.

TIME BASE

CRYSTAL FREQUENCY: 10 MHz

STABILITY:
- **Aging Rate:** $<1\times10^{-7}$ per month
- **Temperature:** $<\pm1\times10^{-8}$ over the range 0°C to 50°C
- **Line Variation:** $<\pm1\times10^{-9}$, ±10% from nominal.

OUTPUT FREQUENCY: 10 MHz, ≥2.4V square wave (TTL compatible) available from rear panel BNC.

EXTERNAL TIME BASE: Requires 10 MHz approximately 1.5V p-p sine wave or square wave into 1 kΩ via rear panel BNC. Switch selects either internal or external time base.

OPTIONAL TIME BASE (OPTION 001)

Option 001 provides an oven-controlled crystal oscillator time base with an aging rate near that of a time standard. This option results in better accuracy and longer periods between calibration. A separate power supply keeps the crystal oven on and up to temperature when the instrument is turned off as long as it remains connected to the power line.

FREQUENCY: 10 MHz

AGING RATE: $<5\times10^{-10}$/day after 24-hour warmup, for less than 24-hour off time, at $<1.50\times10^{-7}$/year.

SHORT TERM STABILITY:
- 1×10^{-11} for 1-second of average time
- 1×10^{-11} for 10 seconds of average time
- $\Delta10^{-11}$ for 100 seconds of average time

Line variation: $<1\times10^{-10}$ for ±10% change from nominal. A 10% voltage change will cause a frequency change of $<1\times10^{-11}$ for <2 minutes.

Temperature: $<7\times10^{-9}$ frequency change over the range 0°C to 50°C.

Warm-up: Within 5×10^{-8} of final value 20 minutes after turn-on, at 25°C

Frequency Adjustement Range: $>\pm1\times10^{-6}$ (>±10 Hz from 10 MHz) with 18-turn control.

Frequency Adjustment: 1×10^{-9} (0.01 Hz) 18-turn control.

GENERAL

ACCURACY: ±1 count ± time base error.

RESOLUTION: Front panel switch selects 1 MHz, 100 kHz, 10 kHz, 1 kHz, 100 Hz, or 1 Hz.

DISPLAY: Ten-digit sectionalized LED display and appropriate measurement units of kHz, MHz, or GHz.

SELF-CHECK: Counts and displays 1 GHz for resolution chosen.

SAMPLE RATE: Continuously adjustable from 40 ms to 10 s and HOLD.

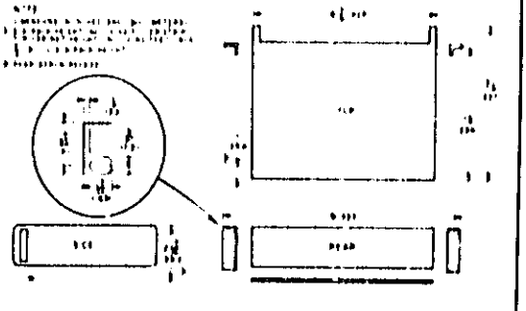
OPERATING TEMPERATURE: 0°C to 50°C.

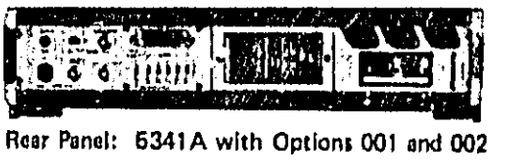
POWER: Four nominal ac line voltages selectable: 100, 120, 220, or 240 with +5% to -10% tolerance, 104 VA, 48 to 66 Hertz.

REMOTE PROGRAMMING AND DIGITAL OUTPUT: Optional (Option 011) via 24-pin, series 57 microribbon connector. Program and out information are 7-bit ASCII code.

WEIGHT: Net 10,5 kg (23 lb.). Shipping 13,2 kg (29 lb.).

DIMENSIONS:





Rear Panel: 5341A with Options 001 and 002

Table 1-5. Recommended Test Equipment

INSTRUMENT	CHARACTERISTICS	RECOMMENDED TYPE	WHEN USED
1. Spectrum Analyzer Display Section (Main Frame) RF Tuning Section IF Section	500 MHz to 4.0 GHz Coverage	HP 141T HP 8555A HP 8552B	 Calibration and Repair
2. Signal Sources a. Sweep Oscillator RF Section Plug-In Plug-In b. Signal Generator	10 Hz to 4.5 GHz 0.1—2.0 GHz 1.7—4.3 GHz 500 kHz to 512 MHz	 *HP 8620C HP 8621B HP 86320A HP 86331B HP 8640A	 Calibration, Repair, and Proof of Performance
3. Voltmeter	100 mV ±1 mV	HP 3469B	Calibration and Repair
4. Logic Probe Logic Pulser	TTL TTL	HP 10525T HP 10526T	Repair Repair
5. Logic State Analyzer Oscilloscope	TTL, 12 Channel	HP 1601L HP 182C	Repair Repair
6. Resistive Divider Probes	500 MHz Probe	HP 10020A or HP 1120A (with power source)	Calibration and Repair

*NOTE: A very wideband source such as the Model 8660A/B Synthesizer with 86602A Plug-In is not a recommended substitute for the Fundamental Oscillator type 8620C Signal Generator. Use of a wideband source may give miscounts.

SECTION II
INSTALLATION

2-1. INTRODUCTION

2-2. This section provides information for unpacking, inspection, preparation for use, storage, and shipment of the 5341A.

2-3. UNPACKING AND INSPECTION

2-4. If the shipping carton is damaged, inspect the counter for visible damage (scratches, dents, etc.). If the counter is damaged, notify the carrier and the nearest Hewlett-Packard Sales and Service Office immediately (offices are listed at the back of this manual). Keep the shipping carton and packing material for the carrier's inspection. The HP Sales and Service Office will arrange for repair or replacement of your instrument without waiting for the claim against the carrier to be settled.

2-5. PREPARATION FOR USE

CAUTION

Before connecting this instrument to an ac power line, be sure that the printed circuit line voltage selector in the rear panel power module is set to the proper position as shown in *Figure 2-1*.

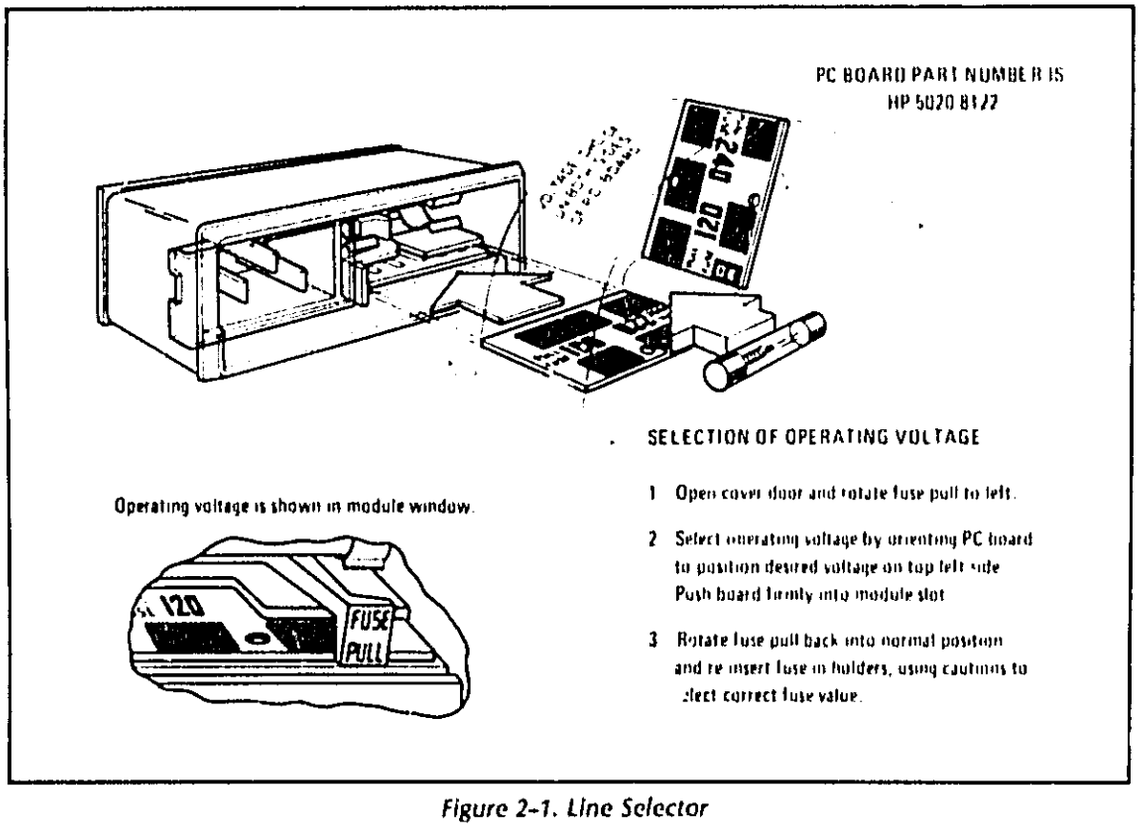


Figure 2-1. Line Selector

2-6. Power Requirements and Line Voltage

2-7. This instrument operates on single phase 100V, 120V, 220V, or 240V ac +5%, -10% volts at 48—66 Hertz. Power required is approximately 104 VA (150 VA max.). *Figure 2-1* shows the line selector and fuse holder. To avoid instrument damage, the printed circuit line must be set to the correct position and the correct fuse (as labeled on the rear panel) must be installed. When shipped, the selector is set for 120-volt operation.

2-8. Power Cables

WARNING

TO PROTECT OPERATING AND SERVICING PERSONNEL, THIS INSTRUMENT IS EQUIPPED WITH A THREE-PIN POWER RECEPTACLE. THE CENTER PIN OF THE RECEPTABLE CONNECTS THE INSTRUMENT CHASSIS AND PANELS TO EARTH GROUND WHEN USED WITH A PROPERLY WIRED THREE CONDUCTOR OUTLET AND POWER CABLE. IMPROPERLY GROUNDED EQUIPMENT CAN RESULT IN HAZARDOUS POTENTIALS BETWEEN EQUIPMENT.

WARNING

IF A 5341A COUNTER IS CONNECTED TO AN AUTO TRANSFORMER FOR LINE POWER FOR LINE POWER ADJUSTMENT, MAKE SURE THE COMMON CENTER POWER TERMINAL REMAINS CONNECTED TO EARTH GROUND AS DESCRIBED ABOVE.

2-9. To accommodate the different power receptacles used throughout the world, this HP instrument is supplied with one of the power cables shown in *Figure 2-2*. The cable supplied for use in the United States meets the specifications established by the International Electrotechnical Commission (IEC). The male connector of this cable is a NEMA type and the female connector is C.E.E. type.

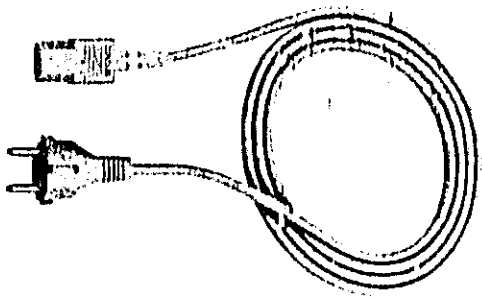
2-10. Connect the power cable to a power source receptacle that has a grounded third conductor. If the line power receptacle is a two-pin type instead of a three-pin receptacle, use a two-to-three pin type adaptor (HP Part No. 8120-1348 for USA applications) and connect the green lead on the adaptor to earth ground. See warning above.

2-11. Operating Environment

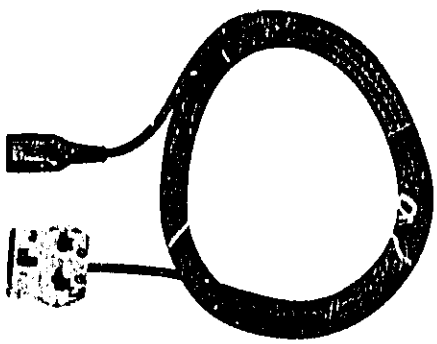
2-12. Maximum and minimum allowable operating temperatures are listed in *Table 1-4*. If these limits are exceeded at the installation site, auxiliary cooling or heating should be used to keep the environment within limits.

2-13. Operational Check

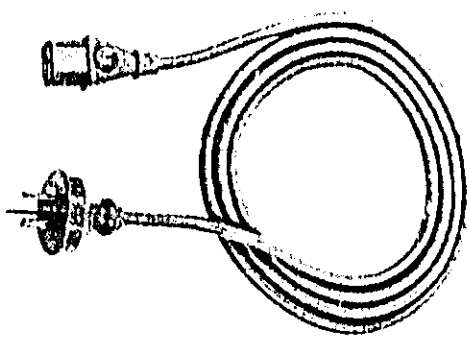
2-14. To determine if the instrument is operating properly, the self-check procedures in Section III may be used. Contact the nearest HP Sales and Service Office (see manual back cover) for information relative to warranty claims.



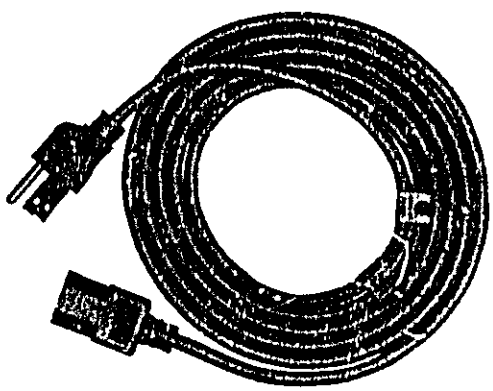
CORD SET HP NO. 8120-1689
(Germany, France, Sweden, Netherlands, Yugoslavia, Belgium, Norway, Finland)



CORD SET HP NO. 8120-1351
Great Britain



CORD SET HP NO. 8120-1369
Australia, New Zealand



CORD SET HP NO. 8120-1378
U.S.A., Canada

Figure 2-2. Power Cables

2-15. Bench Operation

2-16. The instrument cabinet has plastic feet and a foldaway tilt stand for convenience in bench operation. The tilt stand permits inclining the instrument for ease in using front panel controls and indicators. The plastic feet are shaped to provide clearance for air circulation and to make modular cabinet-width instruments self aligning when stacked.

2-17. Rack Operation

2-18. The instrument may be rack mounted by using the optional rack mounting kit. To convert the instrument for rack installation, proceed as follows:

a. Remove tilt stand by removing the two outside front feet from the bottom cover. The feet are removed by pressing the foot-release button and sliding the foot toward the center of the instrument.

b. Remove the remaining two feet from the bottom cover.

c. Remove the two adhesive-backed trim strips from the side frames.

d. Using the three screws provided, attach the filler strip from the rack mount kit along the front of the bottom cover.

e. Attach the flanges from the rack mount kit to the front end of the side frames. Orient the larger corner notch toward the bottom of the instrument.

2-19. PACKAGING FOR RESHIPMENT

2-20. Original Packaging

2-21. The same containers and materials used in factory packaging can be obtained through the Hewlett-Packard Sales and Service Offices listed at the rear of this manual.

2-22. If the instrument is being returned to Hewlett-Packard for service, attach a tag indicating the type of service required, your return address, HP model number, and full serial number. Mark the container FRAGILE to assure careful handling.

2-23. In any correspondence refer to the instrument by HP model number and full serial number.

2-24. Other Packaging Methods

2-25. If it becomes necessary to reship an instrument, good commerical packing should be used. Contract packing companies in many cities can provide dependable custom packaging on short notice. The following general instructions should be followed when repackaging with commerically available materials.

a. If shipping to a Hewlett-Packard Service Office or Center, attach a tag indicating the type of service required, your return address, HP model number, and full serial number.

b. Wrap the instrument in heavy paper or plastic.

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

d. Use enough shock-absorbing material (3- to 4-inch layer) around all sides of the instrument to provide a firm cushion and prevent movement inside the container. Protect the control panel with cardboard.

e. Seal the shipping container securely.

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

2-26. STORAGE

2-27. If the instrument is to be stored for an extended period of time, it should be enclosed in a clean, sealed container.

2-28. FIELD INSTALLATION OF OPTIONS

WARNING

THE FOLLOWING INSTALLATION PROCEDURES REQUIRE REMOVAL OF THE 5341A COVERS. IF THE LINE CORD IS CONNECTED AND THE COVER(S) IS REMOVED, 115/230 VOLTS AC IS PRESENT AT SEVERAL POINTS EVEN THOUGH THE LINE SWITCH IS SET TO OFF. CONTACT WITH 115/230 VOLTS AC CAN RESULT IN PERSONAL INJURY OR DEATH. THE INSTALLATION PROCEDURES SHOULD BE PERFORMED BY A QUALIFIED, SKILLED PERSON WHO IS AWARE OF THE DANGER INVOLVED.

2-29. Installation of Option 001 High Stability Time Base

2-30. The only part required for the installation of Option 001 is a 10544-60011 Crystal Oscillator Assembly and mounting hardware.

2-31. To install Option 001, refer to *Figure 8-4* and proceed as follows:

a. Disconnect power cord from the power source (safety precaution)

b. Remove top and bottom covers.

c. Locate XA14 and unplug the standard oscillator.

d. Install 10544 Oscillator assembly in XA14.

e. On bottom of chassis, secure 10544A as follows:

1. Using star washers, fasten the two 6-32 screws to oscillator studs.

f. Apply ac power to 5341A and note that the OVEN annunciator lights. The OVEN light should remain lit for approximately 20 minutes. Adjust oscillator as described in Paragraph 5-17.

2-32. Installation of Option 002, Rear Panel Connectors

2-33. The following parts are required:

J7 and ridgid coax 8120-2053
J8 BNC connector 1250-0083
Cable for J8 05341-60033
50 Termination 11593A
In addition, a 05341-00009 Front Panel Trim may be ordered if it is desired to have the field modification match a factory installed option. The 05341-00009 has no cutout for the J7 front panel jack

2-34. To install Option 002, proceed as follows:

a. Remove ac power (safety precaution). Remove top and bottom covers.

b. Remove right trim plate, right side cover, and right side frame.

c. Remove left trim plate, and remove the two screws that fasten the front panel to the left side frame.

d. If new front panel trim is to be installed, remove front panel and necessary front panel controls. Install 05341-00009 front panel trim.

e. Loosen and remove J2. Save the nut that secures the N connector to the front panel. This will be used for the rear panel N connector. Also save the aligning pin from the front panel N connector. Disconnect ridgid coax from A1J5.

f. On rear panel, remove plugs in holes for J7 and J8. If original front trim panel is retained, insert plug into hole left after removal of J2.

g. Install N connector of assembly 8120-2053 into rear panel hole marked J7. Dress rigid coax along right side of chassis. Use the nut from the front panel N connector and the aligning pin to orient and secure J7 to the rear panel. Do not overtighten the nut on J2.

h. Secure the other end of the rigid coax to A1J5.

i. Solder cable 05341-60033 to BNC connector J8. Push cable end through hole marked J8 on the rear panel. Use nut to secure connector to rear panel. Route low frequency cable from rear panel along the right side of chassis.

j. Solder the center conductor of the low frequency cable to the center pin of J1. Solder the shield to the ground post next to J1.

k. Install 50-ohm termination 11593A on front panel connector J1.

2-35. Installation of Option 003, 1.5 GHz Frequency Range

2-36. The following parts are required:

A2 High Pass Filter Assembly 05341-60023
A19U15 1818-2249 ROM for A19 Processor Assembly.

2-37. To install Option 003, proceed as follows:

a. Remove top and bottom covers.

b. Remove A1 and A2 assemblies.

c. Remove connector from A1P1 and unsolder wires from A13 RF Motherboard except for the + and -15 volt (violet and red wires) leads. If desired, A2P1 can be taped (to prevent shorts) and left in the instrument to facilitate easy conversion back to the standard instrument.

d. Remove cable from A2J1 and A13J1. This is not needed for the Option 003 operation.

e. Remove standard A2 assembly and install A2 Option 003 (05341-60023). Remove cable marked A2J2 from standard switchable filter and connect it to A2J1 on the Option 003 A2 filter. Remove ridgid cable from A2J3 (standard assembly) and connect to A2J2 on Option 003 HI-pass Filter.

f. On A19, replace A19U15 ROM (1818-2246) with a 1818-2249.

2-38. Installation of Option 011, Remote Programming Output

2-39. The following parts are required:

Socket Fasteners 1200-0547
Cable Assembly 8120-2047
Remote Output Assembly 05341-60028 (A25)
Remote Input Assembly 05341-60029 (A26)
Connector Assembly 05341-60032

2-40. To install Option 011, proceed as follows:

a. Remove top and bottom covers.

b. Install A25 in XA26 and A25 into XA25. See *Figure 8-4* for assembly locations.

c. Remove blank plate from rear panel. Install connector assembly 05341-60032 in place of blank panel. Connector assembly P1 mates with A26J1.

d. Using ribbon cables (8120-2047), connect A25J1 to A19J6. Connect the other ribbon cable from A25J2 to A19J5. Dress the ribbon cables between A1 and A20 assemblies.

e. After installation, perform HP-IB verification procedure in Section III. Programming information is contained in Section III, Part B.

SECTION III, PART A
OPERATION — STANDARD 5341A

3-1. INTRODUCTION

3-2. This section contains operating characteristics, a description of the controls and indicators, and operating procedures.

3-3. SECTION DIVISIONS

3-4. This section is divided into two parts to allow a separate description of the operation of the standard 5341A Counter and the 5341A Option 011 Remote Programming — Digital Output Counter. Part A of this section covers the Standard 5341A, and Part B covers the Option 011 Remote Programming — Digital Output version of the 5341A.

3-5. OPERATING CHARACTERISTICS

3-6. The following paragraphs describe the operating range, operating modes, resolution, sample rate, and FM characteristics.

3-7. Operating Ranges

3-8. Two different input connections are provided, a type N 50-ohm input connector and a 1-Megohm input connector. The 1-Megohm input is used to measure signal frequencies from 10 Hz to 80 MHz. Sensitivity is 10 millivolts and the input impedance is 1-Megohm shunted by 50 pF, coupling is ac.

3-9. The 50-ohm input is used to measure signal frequencies from 50 MHz to 4.5 GHz. Sensitivity is -15 dBm in AUTO mode and -20 dBm in MANUAL mode. Maximum recommended input is +20 dBm and the damage level is +30 dBm. Acquisition time is 600 μs in AUTO and 100 μs in MANUAL.

CAUTION

DO NOT exceed +30 dBm power input at 50 MHz—4.5 GHz INPUT connector. Damage to the internal circuits may occur.

3-10. Operating Modes

3-11. For the 50-ohm input range of 50 MHz to 4.5 GHz, two modes of operation are available. In the AUTO mode, the counter searches for, selects, measures, and displays the lowest signal frequency within its sensitivity range. In this mode, the counter automatically steps through 10 frequency bands (low to high) as shown in *Figure 3-1* until a signal within the counter's range is detected.

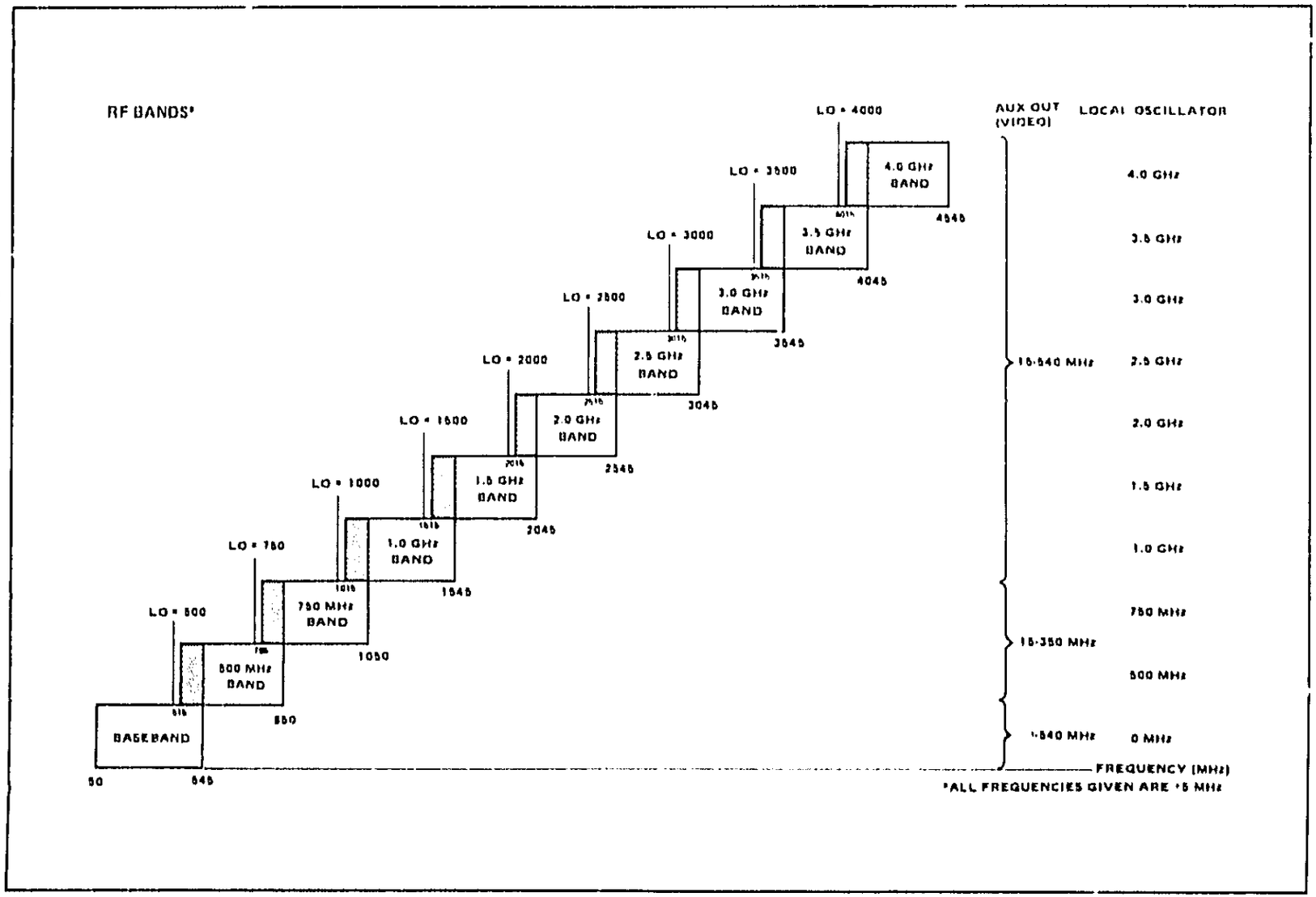


Figure 3–1. 50Ω Input Frequency Bands

3-12. In the MANUAL mode of operation, the counter is restricted to measurements within one of the 10 bands as determined by the operator with the BAND SELECT switch. Pressing this switch changes the bands from low to high with an accompanying display of the selected local oscillator frequency for each band. If a signal within the band range is present, the signal frequency is displayed. When the RESET switch is pressed, the counter returns to the lowest band (50 to 545 MHz). *Figure 3-1* shows the 10 frequency bands and the overlap between bands. This figure is useful for determining the proper band to select for a particular input frequency. For example, if an input signal frequency of 505 MHz is to be measured, the base band (50—545 MHz) must be selected since the next higher band covers 515 to 850 MHz. If the next higher band is selected an incorrect frequency can be displayed. The overlap between bands is shown in *Figure 3-1*, e.g., the overlap between the 1.5 GHz and 2.0 GHz bands is 2015 MHz to 2045 MHz. In other words, signals between 2015 MHz and 2045 MHz can be measured in either the 1.5 GHz band or 2.0 GHz band.

3-13. Resolution and Blanking

3-14. In this frequency counter, resolution is defined as the value represented by the least-significant-digit (LSD). In the 5341A, a maximum resolution of 1 Hz can be selected. Decade multiples of 1 Hz to 1 MHz are available. For example, with an input of 1,234,567,890 Hz, setting the RESOLUTION switch to 1, the counter displays the 0 in the LSD. Selecting 100 on the RESOLUTION switch places the 8 in the LSD.

3-15. Sample Rate, Measurement Time, and Reset

3-16. The sample rate control sets the interval between measurements, but not the interval of the measurement ("gate time" — see below). On the 5341A, the minimum sample rate is continuously adjustable from less than 40 milliseconds to more than 10 seconds. A hold feature can be selected to "freeze" a measurement display indefinitely.

3-17. The measurement time is the GATE time plus the acquisition time. Acquisition time is less than 600 μs for AUTO mode and less than 100 μs for MANUAL mode. GATE time is a function of the settings of the RESOLUTION switch. For the 1-Megohm input, GATE time is 2 seconds at 1 Hz resolution decreasing by decades to 2 μs at 1M resolution. For the 50Ω input, GATE time is 20 seconds at 1 Hz resolution decreasing by decades to 20 μs at 1M resolution. Also, the counter may take up to 1 millisecond additional processing time.

3-18. A new measurement cycle is initiated by reset. Reset is accomplished by pressing the RESET switch, or changing the RESOLUTION switch. When the counter is reset, the display shows all segments of each display lighted plus all decimal points lighted.

3-19. FM Characteristics

3-20. Because the 5341A measures within discrete 500 MHz bands, tolerance to frequency modulation is excellent. Specifications are ±250 MHz maximum deviation (0—500 MHz and 1.0—4.5 GHz) and ±125 MHz maximum deviation (500 MHz—1.0 GHz) in center of bands; bands overlap 30 MHz at band edges.

3-21. MAXIMUM INPUT SIGNAL POWER

CAUTION

DO NOT exceed +30 dBm at the 50Ω N connector. Damage to the internal circuits may occur.

3-22. Refer to *Figure 3-2* for a graph of input power limitations at the 50 MHz—4.5 GHz input. Both maximum and minimum usable input power levels are shown.

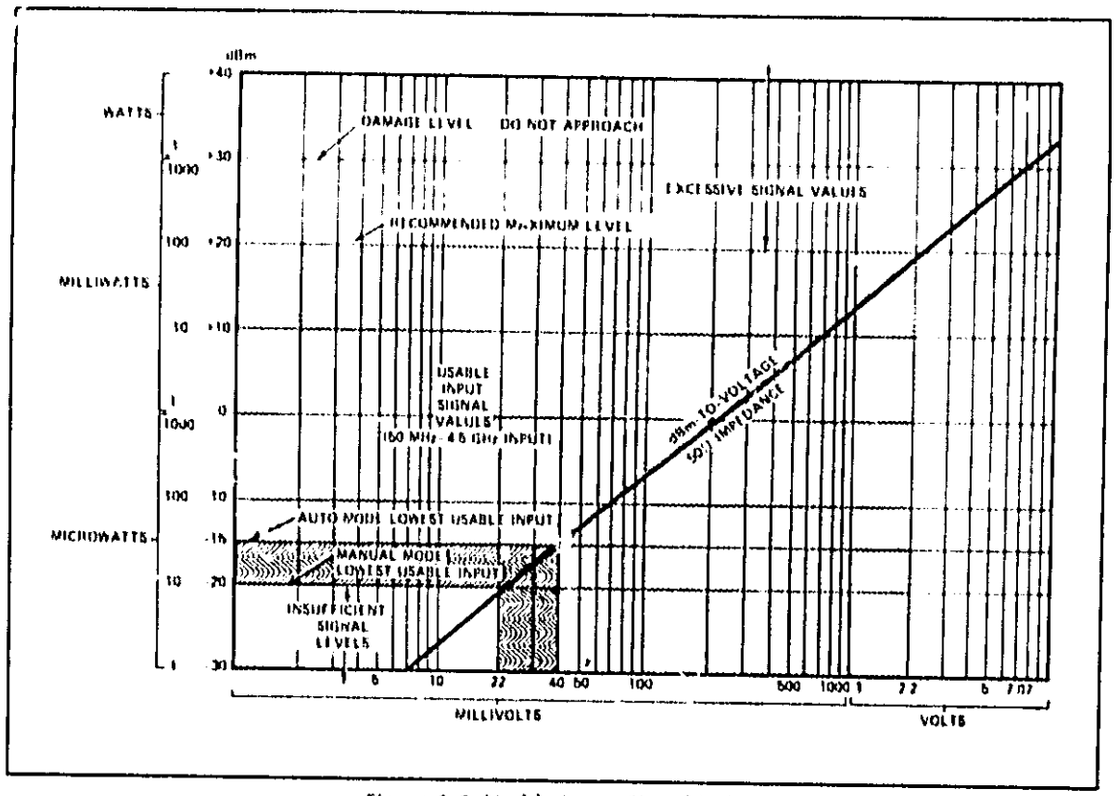


Figure 3-2. Usable Input Signal Values

3-23. The 5341A will function within specifications for input signals up to +20 dBm (2.236 volts into 50 ohms). Under no circumstances should the input level exceed +30 dBm, otherwise damage to the internal circuits may occur. If the input power exceeds +20 dBm, external attenuation should be used.

3-24. MEASUREMENT ACCURACY

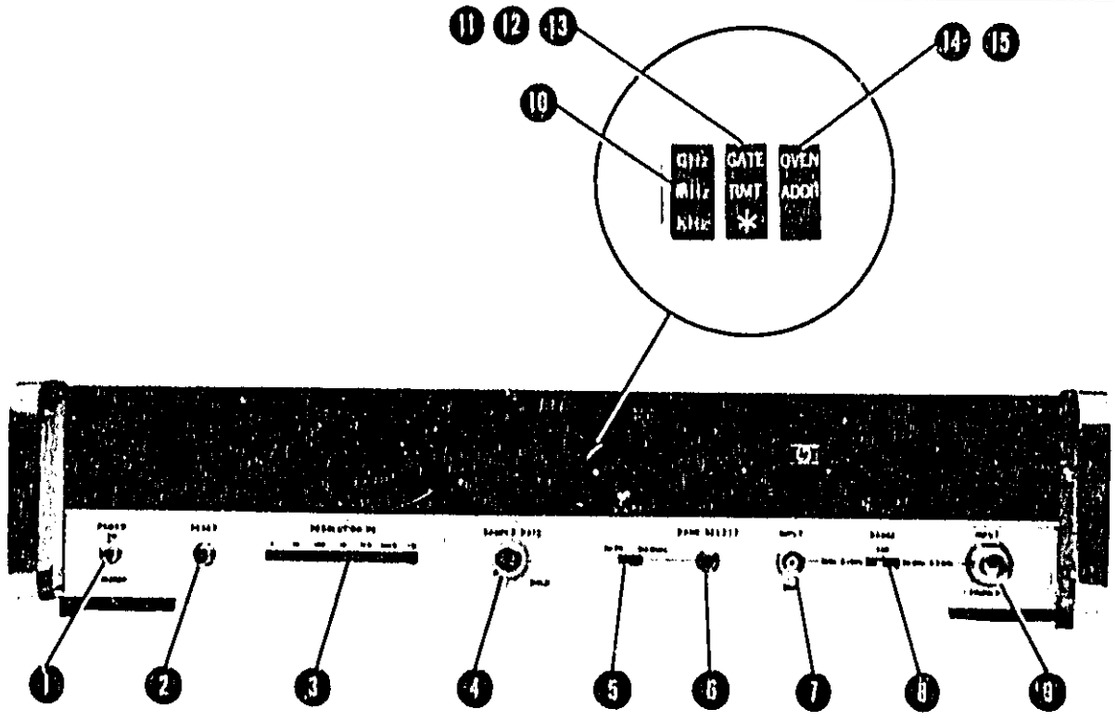
3-25. The accuracy of any frequency measurement is limited to ±1 count in the least-significant-digit plus the time base error.

3-26. CONTROLS, INDICATORS, AND CONNECTORS

3-27. *Figure 3-3* describes and illustrates the front panel controls, indicators, and connectors. *Figure 3-4* illustrates and describes the rear panel connectors and controls.

3-28. OPERATING PROCEDURES

3-29. *Figure 3-6* illustrates the operating procedures. Self-check procedures are given in *Figure 3-5*.



1. POWER-ON-STANDBY toggle switch.
   a. In the STANDBY position, ac power is applied to all internal power supplies. One of the power supplies provides dc power to the Option 001 for continuous crystal oven operation. For best accuracy with Option 001 the 5341A should be connected to line power at all times so the Option 001 crystal oven is stabilized at its correct temperature. A relay disconnects the other power supplies from the 5341A circuitry.
   b. In the ON position, an internal relay supplies power to all circuits including the blower motor.
2. RESET pushbutton switch. Resets display and internal count to zero and initiates a new measurement. While RESET is depressed, the display shows all segments (8) and decimal points lighted to test the display.
3. RESOLUTION Hz selector. Determines resolution of the measurement. See paragraph 3-13 for a detailed description. In general, the 1 kHz setting is a good starting point.
4. SAMPLE RATE-HOLD control. Adjusts the interval between measurements from approximately 40 milliseconds to 10 seconds. When rotated to the HOLD position, past the switch detent, the display will be held indefinitely.
5. AUTO-MANUAL slide switch. In the AUTO position, the 5341A automatically searches through the 10 bands and selects the lowest input signal frequency within its sensitivity range at the 50-ohm input connector. In the MANUAL position, the counter is restricted to measurements within one of its 10 bands as determined by the BAND SELECT switch. See paragraphs 3-11 and 3-12, and *Figure 3-1* for a description of band ranges and overlap.
6. BAND SELECT pushbutton switch. Selects band of operation when the AUTO-MANUAL switch is in MANUAL. Each time the switch is depressed, the band selection steps up one band from low to high. See *Figure 3-1* for band ranges and overlap.
7. INPUT 1 MΩ connector. Input for frequency measurements from 10 Hz to 80 MHz. Shunt input capacity is approximately 50 pF maximum. Measurements made at this input requires that the RANGE switch be set to 10 Hz—80 MHz. Sensitivity is 10 millivolts rms and the coupling is ac.

Figure 3-3. Front Panel Controls and Indicators

8 RANGE switch. Selects input connectors and ranges as indicated by the black leader lines. When set to the CHECK position, display reads 1 GHz which is the internal clock frequency (10 MHz) X50 added to a digital 500 MHz for a resultant 1 GHz display.

CAUTION

DO NOT exceed +30 dBm INPUT at the 50Ω N connector. Damage to internal circuits may occur.

9 INPUT +20 dBm MAX N connector. Input for measurements in the 50 MHz to 4.5 GHz range as determined by the RANGE switch. Sensitivity is -15 dBm in AUTO mode, and -20 dBm in MANUAL mode.

10 GHz, MHz, kHz annunciators. Indicates the units multiplier of the measurement. (The decimal point is correctly positioned automatically.

11 GATE annunciator. Indicates when the counter's main gate is open and a measurement is in progress.

12 RMT annunciator. For counters equipped with Option 011 only. Lights when counter is in remote operation.

13 * (asterisk or star) annunciator. Illuminates only under the following two conditions:

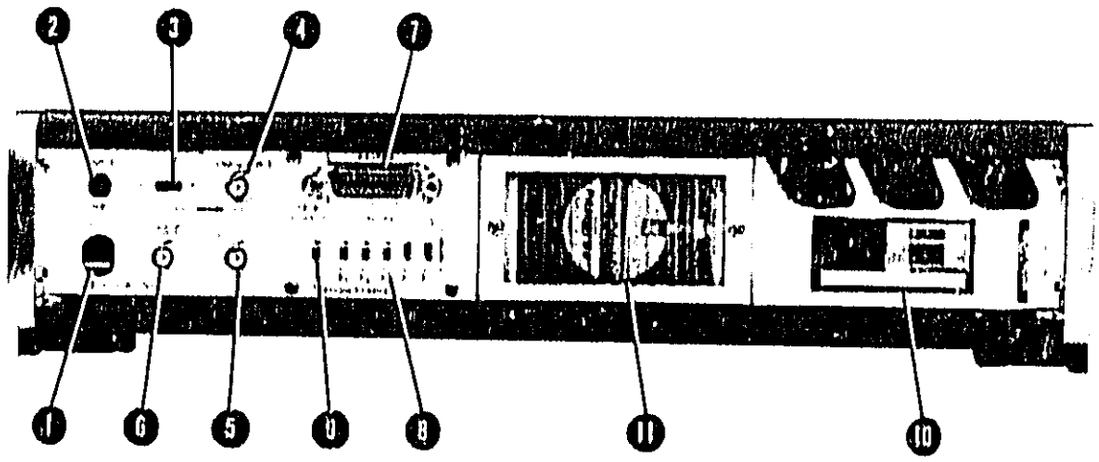
a. In check mode, during gate time.

b. If a signal at the 50Ω input is too weak to be acquired during AUTO but might possibly be acquired in MANUAL.

14 OVEN annunciator. Lights when the oscillator oven is heating to indicate oscillator is not stabilized. Four counters equipped with Option 001 only.

15 ADDR annunciator. For counters equippped with Option 011 only. Illuminates during the remote mode if the instrument is addressed.

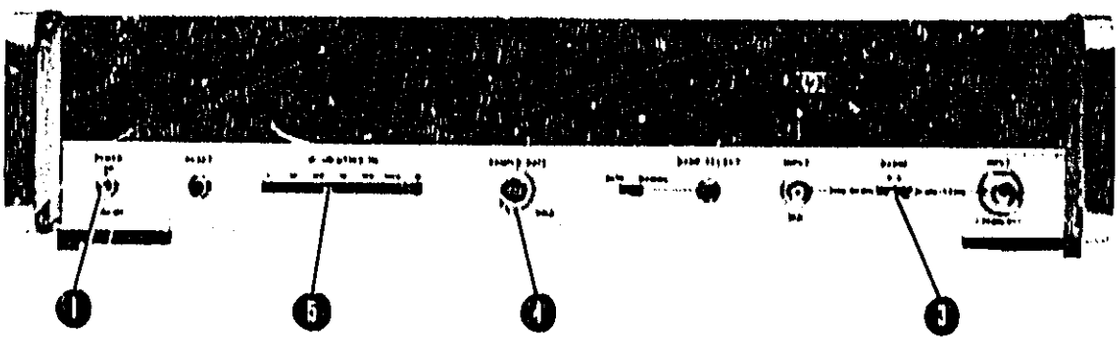
Figure 3-3. Front Panel Controls and Indicators (Continued)



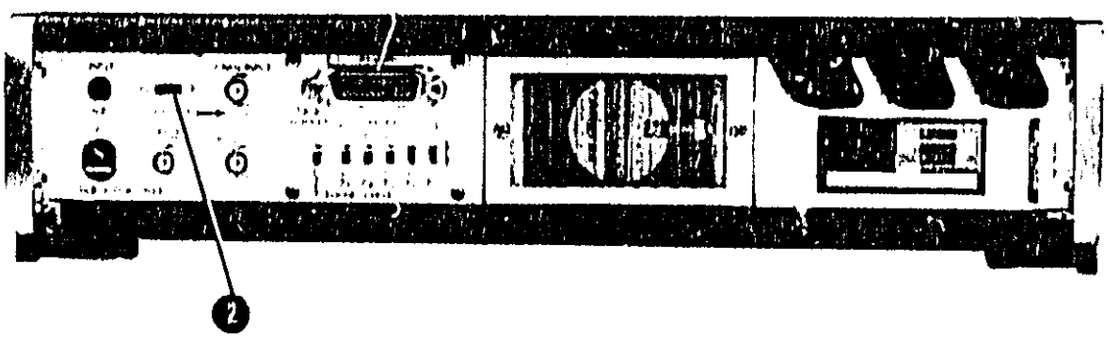
1. INPUT 1 MΩ connector. For Option 002 rear panel inputs. Same function as front panel 1 MΩ connector. (Input capacitance is slightly higher than front panel input.) Use Model 11593A 50Ω load on front panel 1 MΩ connector when using this rear panel connector.
2. INPUT 50Ω +20 dBm MAX connector. For Option 002 rear panel inputs. Same function as front panel 50Ω connector.
3. INT-EXT OSC switch. Selects time base source. When set to INT, the counter operates from its internal 10 MHz oscillator. When set to EXT, it allows an external sine wave or square wave at the 10 MHz INPUT jack to operate the counter.
4. 10 MHz INPUT jack. Accepts external time base signal. Requirements are a 10 MHz sine wave or square wave at approximately 1.5 volts peak-to-peak (1 KΩ impedance). The INT-EXT switch must be set to EXT to accept the external OSC input.
5. 10 MHz OUTPUT jack. Supplies a buffered 10 MHz square wave output at 2.4 volts peak-to-peak or greater for use in other equipment. Output is TTL compatible.
6. IF OUT (VIDEO) jack. Provides an intermediate frequency signal equal to the difference between the input signal and the counter local oscillator signal. This signal can be used for real time measurements in spectrum analyzers or oscilloscopes.
7. DIGITAL BUS (1.0 LOAD) connector. Installed in instrument equipped with Option 011. 24-pin standard connector for the Hewlett-Packard Interface Bus. The "1.0 Load" indicates that the 5341A presents a standard one-instrument-load to the bus. See Section III, Part B for HP-IB information. Also refer to "Hewlett-Packard Interface Bus User's Guide, Models 9820A and 9821A.
8. ADDRESS switches. Installed in instruments equipped with Option 011. Used to set the 5341A talk and listen addresses. See Section III, Part B for further details.
9. ADDRESSABLE-TALK ALWAYS switch. Installed in instrument equipped with Option 011. When set to the TALK ALWAYS position, the 5341A is addressed to TALK, it outputs ONLY. When set to ADDRESSABLE, the 5341A can either receive or output information on the bus. See Section III, Part B.
10. Power Line module. Contains ac power receptacle, fuse, and printed circuit line voltage selector. See Section II for instructions for power line connection.
11. Ventilation blower screen.

Figure 3-4. Rear Panel Controls and Connectors

FRONT PANEL



REAR PANEL

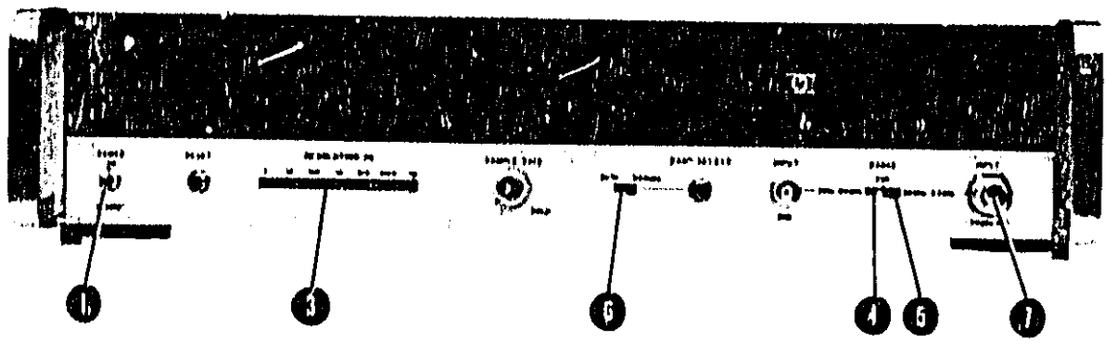


1. Set POWER switch to ON position.
2. On rear panel, set INT-EXT switch to INT position.
3. Set RANGE switch to CHK position.
4. Rotate SAMPLE RATE control slightly out of counterclockwise position.
5. Set RESOLUTION switch to the following positions and check for proper display. When the switch is between numbered positions, all decimal points should light and all segments of each display tube should light. The asterisk annunciator should flash on and off with the gate light.

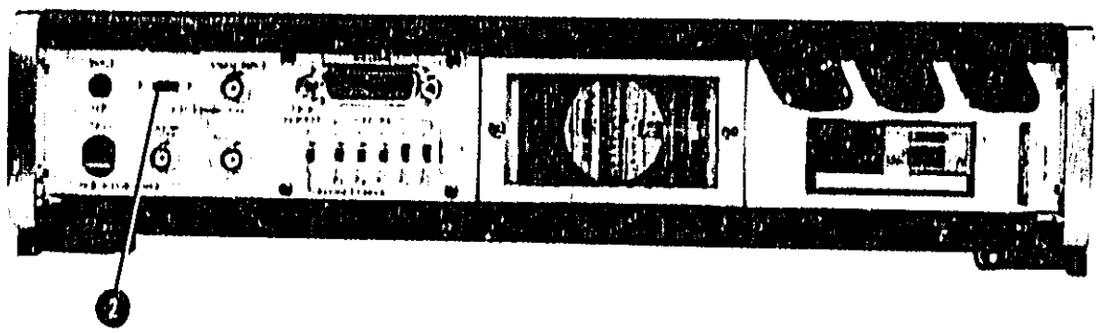
RESOLUTION switch	DISPLAY
1 Hz	1.000000000 GHz ±1 count
10 Hz	1.00000000 GHz ±1 count
100 Hz	1.0000000 GHz ±1 count
1 kHz	1.000000 GHz ±1 count
10 kHz	1.00000 GHz ±1 count
100 kHz	1.0000 GHz ±1 count
1 MHz	1.000 GHz ±1 count

Figure 3-5. Self-Check Procedures

FRONT PANEL



REAR PANEL



10 Hz to 80 MHz Measurements

1. Set POWER switch to ON position.
2. On rear panel, set INT-EXT switch to INT position.
3. Set RESOLUTION Hz switch to desired resolution, 1K is good starting point.
4. To measure frequencies at the 1 MΩ input, set the RANGE switch to 10 Hz to 80 MHz position. Connect input signal to 1 MΩ input connector. Adjust SAMPLE RATE and RESOLUTION switch for convenient display.

50 MHz to 4.5 GHz Measurements

5. Set RANGE switch to 50 MHz to 4.5 GHz position.
6. For automatic operation, set AUTO-MANUAL switch to AUTO. For manual operation, set AUTO-MANUAL switch to MANUAL and press BAND SELECT switch until display indicates desired frequency band. See paragraph 3-12 and *Figure 3-1* for frequency band selections
7. Connect input signal to 50Ω input connector. Adjust SAMPLE RATE and RESOLUTION controls for convenient display.

Figure 3-6. Operating Procedures

SECTION III, PART B
OPERATION, REMOTE PROGRAMMING, AND DATA OUTPUT (OPTION 011)

3-30. INTRODUCTION

3-31. This part of Section III contains programming information for 5341A counters equipped with Option 011. Option 011 provides capabilities to remotely-program the 5341A's operating modes and output measurement data via the Hewlett-Packard Interface Bus (HP-IB). Major subjects covered in this section include; programming capabilities, bus operation, programming setup procedures, programming, a program summary sheet, the output process, and programming examples.

3-32. All information in Part A of this section also applies to 5341A Option 011 counters.

3-33. PROGRAMMING CAPABILITIES

3-34. Operation of most front panel controls can be programmed. These are:

RANGE
RESOLUTION Hz
SAMPLE RATE (partially)
BAND SELECT
AUTO-MANUAL (combined with Band Select)
RESET
NORMAL/TEST (Self-Test switch (A19S1) inside instrument). Operation of this switch is described in Section V.

3-35. In addition, two functions can be programmed which are not manually controllable. These are:

Output Mode and Trigger Command (refer to paragraph 3-42, steps 8 and 11 for explanations).

3-36. BUS OPERATION

3-37. Prior to attempting to use the 5341A counter with Option 011, the reader should become familiar with the operation of the HP Interface Bus. The information is contained in separate manuals entitled "Hewlett-Packard Interface Bus Users Guide" (HP Part No. 59300-90001, Model 9820A and HP Part No. 59300-90002, Model 9830A).

3-38. PRELIMINARY PROCEDURES

3-39. The following are the steps necessary to setup the counter for operation on the HP Interface Bus:

STEP 1 ADDRESS MODE SELECTION

Set the rear panel TALK-ONLY-ADDRESSABLE switch as follows:

a. To TALK ONLY if the only function of the Bus system is to transfer measurement data from the counter to one or more Listener devices.

b. To ADDRESSABLE if counter is to be remotely programmed, and/or other Talker devices are to be part of the Bus system and a Controller device is to be used.

If the TALK ONLY MODE is selected, step 2 need not be done. The TALK ONLY position forces the counter to be addressed to Talk, so that whenever the Bus is in the Data Mode, it will output its measurement data if there is at least one addressed Listener. It cannot receive program codes in this mode. It cannot be unaddressed from Talking by a Controller.

The TALK ONLY mode is normally used without a Controller device connected to the system and all Listener devices must be put into the Listen Only mode. There may be only one Talk Only device per Bus.

The ADDRESSABLE mode requires the use of a Controller device to perform the addressing operation so that the counter can be addressed to Listen to receive its programming codes and addressed to Talk to send its measurement data.

STEP 2 ADDRESS ASSIGNMENT

If the Address Mode selected in step 1 is ADDRESSABLE, the counter's Bus Addresses (Listen and Talk) must be established by selecting its address codes and setting the rear panel ADDRESS switch A5, A4, A3, A2, and A1 to correspond with *Table 3-1*.

The ADDRESS switches may be set to any value (except 11111) shown in *Table 3-1*. The choice is arbitrary except for considerations of: ease of use, accessibility on the controller device, compatibility with application software and, conflict with other devices. If an application software package is being used, choose the address used by the program.

STEP 3 INTERCONNECTING CABLES

Connect the counter to the other devices using Bus cables as follows:

LENGTH (METRES/FEET)	HP PART NUMBER
1/3.28	10631A
2/6.56	10631B
4/13.12	10631C
.5/1.64	10631D

The cable has a "piggyback" connector on each end so that cables can be added to a device which already has a cable connected to it. The connectors are provided with lock-screws to secure them to the instrument and to each other.

Table 3-1. Program Summary Sheet

NOTE: Send One Code Pair From Each Group

Group	Programmed Function and Setting	ASCII Codes
1.	Range	
	*a. 50 MHz to 4.5 GHz (50Ω)	I0
	b. 10 Hz to 80 MHz (1 MΩ)	I1
	c. Check	I2
2.	Resolution	
	a. 1 Hz	E0
	b. 10 Hz	E1
	c. 100 Hz	E2
	*d. 1 kHz	E3
	e. 10 kHz	E4
	f. 100 kHz	E5
	g. 1 MHz	E6
3.	Band Select	
	a. 50—545 MHz	B0
	b. 515—850 MHz	B1
	c. 765—1050 MHz	B2
	d. 1015—1545 MHz	B3
	e. 1515—2045 MHz	B4
	f. 2015—2545 MHz	B5
	g. 2515—3045 MHz	B6
	h. 3015—3545 MHz	B7
	i. 3515—4045 MHz	B8
	j. 4015—4545 MHz	B9
	*k. Automatic	B?
4.	Sample Rate	
	*a. Front Panel Control	M0
	b. Fast (no delay)	M1
	c. Hold-A (delay after trigger)	M2
	d. Hold-B (measure on trigger)	M3
5.	Internal Self-Test	
	a. Test	S
	*b. Normal	N
6.	Trigger	T
7.	Preset	P (sets all other functions to starred (*) setting or condition.)
8.	Reset	R
9.	Output Mode	
	*a. ONLY IF. Hold in output phase only if addressed to talk	O
	b. WAIT. Wait in output phase after each measurement until result is outputted.	W
10.	POWER UP/PRESET	
	POWER UP causes PRESET (ASCII P), Local, Non Talk, Non Listen. PRESET initializes program code set to all starred value (*) conditions: I0, E3, B?, M0, N, O.	

In order to ensure proper operation of the Bus, two rules regarding the total length of Bus Cables connected together must be observed. These are:

1. The total length of cable permitted to be used in conjunction with one Bus System must be less than or equal to 2 metres times the number of devices connected together.

2. The total maximum length of cable must not exceed 51-feet.

Restriction (1) implies that there may be up to 4 metres of cable between the first two devices (2 units x 2 metres/device = 4 metres). Additional units may be added using 2-metre cables up to a total of 8 units (8 units x 2 metres/device = 16 metres) using one 4-metre and six 2-metre cables (4 + 6 x 2 = 16). A ninth device could be added using a 1-metre cable (4 + 6 x 2 + 1 = 17) and still comply with Restriction (2). If more than nine devices are to be connected together, shorter than 2-metre cables must be used between some of the devices. For example, 15 devices can be connected together using one 4-metre and thirteen 1-metre cables (4 + 13 x 1 = 17). Other combinations may be used as long as both of the requirements of Restriction (1) and (2) are met. In making calculations, don't forget to count all the devices including Controllers.

There are no restrictions as to the ways various cables may be connected together. It is recommended that no more than three or four piggyback connectors be stacked together on one device as the resulting cantilevered structure can exert force on the panels of the device where the connector is mounted and could cause physical damage.

The configuration may be linear (all cables connected end-to-end) or in a star all cables branching out from a central point or any combination of the above.

3-40. PROGRAMMING

3-41. DESCRIPTION. Programming of the 5341A is accomplished by sending a sequence of program codes to the counter via the HP Interface Bus. Because of the Bus structure, the counter must be designated as the device to receive the program codes. This is accomplished by addressing it to Listen. To complete the remote programming process, the counter must be told to respond to the programming codes instead of its local control, by switching it to Remote control. This is done by the combination of a Bus Remote Enable and Addressing the counter to listen. Generally, the remote operation of the counter is similar to operating the counter from its front and rear panel controls, with a few exceptions as noted in the following description of remote programming.

3-42. PROGRAMMING PROCEDURE. The following are the steps necessary to completely determine the 5341A operating modes, using the remote programming codes:

STEP 1 Put the Bus into the Remote Enable state by sending the Remote Enable Command (set REN low).

NOTE: The technique for sending the Remote Enable command is a function of the particular controller devices (i.e., calculator, computer, etc.).

STEP 2 Address the 5341A to Listen by sending the Listen Address assigned to it during setup. (The Listen Address switches the 5341A to REMOTE and the "RMT" indicator will be on.)

STEP 3 RANGE SELECT

Select the desired range by sending one of the following pairs of codes:

RANGE	PROGRAMMING CODES	
	ASCII	OCTAL
*50 MHz to 4.5 GHz (50Ω)	I0	111,060
10 Hz to 80 MHz (1 MΩ)	I1	111,061
CHK (check) (no signal should be applied to the 50 MHz—4.5 GHz Input)	I2	111,062

*See STEP 9

Range selection is related directly to the front panel control.

STEP 4 RESOLUTION SELECT

Select the desired resolution by sending one of the following pairs of codes:

RESOLUTION	PROGRAMMING CODES	
	ASCII	OCTAL
1 Hz	E0	105,060
10 Hz	E1	105,061
100 Hz	E2	105,062
*1 kHz	E3	105,063
10 kHz	E4	105,064
100 kHz	E5	105,065
1 MHz	E6	105,066

See STEP 9

STEP 5 BAND SELECT

Select the desired band by sending one of the following pairs of codes:

BAND SELECT	PROGRAMMING CODES	
	ASCII	OCTAL
*50–545 MHz	B0	102,060
515–850 MHz	B1	102,061
765–1050 MHz	B2	102,062
1015–1545 MHz	B3	102,063
1515–2045 MHz	B4	102,064
2015–2545 MHz	B5	102,065
2515–3045 MHz	B6	102,066
3015–3545 MHz	B7	102,067
3515–4045 MHz	B8	102,068
4015–4545 MHz	B9	102,069
Automatic	B:	102,077

*See STEP 9

A Band Select code programs the counter into the manual mode of operation and into the selected band. Automatic (ASCII:B:) programs the counter into automatic search.

STEP 6 SAMPLE RATE

Select the wait time between measurements by sending one of the following code sequences:

SAMPLE RATE	PROGRAMMING CODES	
	ASCII	OCTAL
*a. Front Panel Control	M0	115,060
b. Fast (no delay)	M1	115,061
c. Hold A (delay after trigger)	M2	116,062
d. Hold B (measure on trigger)	M3	115,063

*See STEP 9

a. Front Panel Control (ASCII M0) — In this mode sample rate is determined by the front panel sample rate control. Front panel HOLD can be in effect and the instrument will not obey a Trigger (ASCII T) command.

b. Fast (ASCII M1) — When in sample rate fast, there is no delay between measurements. The counter can process and output up to approximately 1000 measurements per second with a fast gate time. The front panel display could blank out if the gate time is very fast, but the counter will continue to output data. The measurement time can be approximated as follows:

RESOLUTION	GATE TIME 50 MHz TO 4.5 GHz INPUT	GATE TIME 10 Hz TO 80 MHz INPUT
1 MHz	20 µs	2 µs
100 kHz	0.2 ms	20 µs
10 kHz	2.0 ms	0.2 ms
*1 kHz	20.0 ms	2.0 ms
100 Hz	0.2 s	20 ms
10 Hz	2.0 s	0.2 s
1 Hz	20.0 s	2.0 s

c. HOLD-A (Delay after Trigger) ASCII M2 — Remote Hold-A is a combination of Hold and a delay determined by the front panel Sample Rate control. After receiving a Trigger (ASCII T) command, the counter will wait from 0 to 10 s before making another measurement. A Reset command will cause a measurement without delay.

d. HOLD-B (Measure on Trigger) ASCII M3 — Remote Hold-B programs the counter to take a measurement and wait until a Trigger (ASCII T) or Reset command appears.

STEP 7 INTERNAL SELF-TEST

The Internal Self-Test command is related directly to the internal self-test switch A19S1 located inside the counter on the A19 Processor Assembly.

NOTE: This command must be used for diagnosis of the counter only.

When in a self-test mode, the data output format changes. Refer to *Tables 3-2* and *3-3* for typical output formats.

	PROGRAMMING CODES	
INTERNAL SELF-TEST	ASCII	OCTAL
*Normal	N	116
*Test	S	123

*See STEP 9

For the Test (ASCII S) command to be effective, the following conditions must exist:

Resolution: 10 kHz, 100 kHz, or 1 MHz
AUTO/MANUAL: MANUAL
Range: Check or 50 MHz—4.5 GHz

STEP 8 OUTPUT MODE SELECTION

The counter may be directed to hold a measurement until outputted or to continue making measurements and output only if asked to, by sending one of the following codes:

	PROGRAMMING CODE	
OUTPUT MODE	ASCII	OCTAL
Only If Addressed	O	117
Wait Until Addressed	W	127

*See STEP 9

STEP 9 PRESET

	PROGRAMMING CODE	
PRESET	ASCII	OCTAL
Preset	P	120

The Preset command initializes program code set to all starred value (*) conditions, which are: I0, E3, B?, M0, N, output mode 0.

STEP 10 RESET

	PROGRAMMING CODE	
RESET	ASCII	OCTAL
Reset	R	122

The Reset command programs the counter to begin a new search and measurement cycle. A Reset condition occurs if any of the following commands are given: P, N, O, I0 through I3, E0 through E6, and B0 through B?

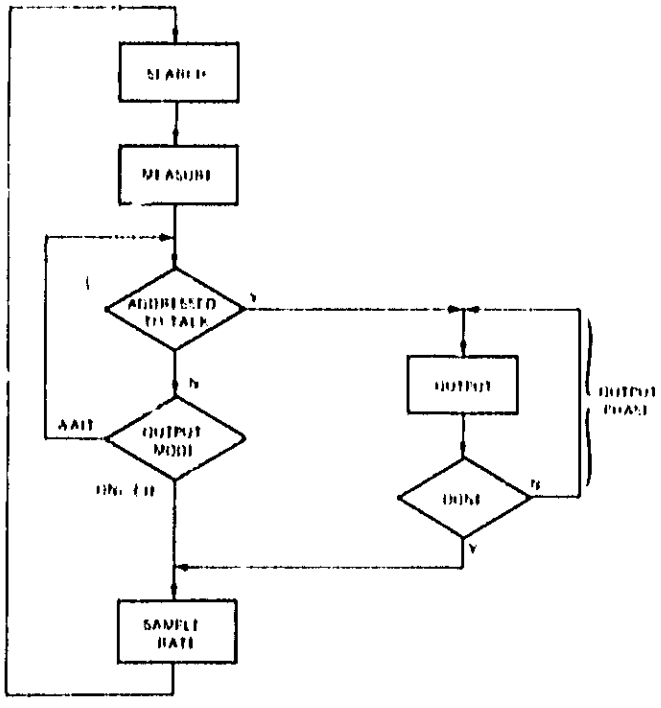
Resets do cause the counter to go into the Power Up/Preset conditions.

STEP 11 TRIGGER

	PROGRAMMING CODE	
TRIGGER	ASCII	OCTAL
Trigger	T	124

The Trigger command affects the instrument when it is in Remote Hold-A or -B. The command is not stored, therefore it must be given while the instrument is holding. A Trigger command is ignored if the counter is searching, measuring, or outputting.

A simplified flowchart of the 5341A operation is shown below.



a. ONLY IF (ASCII O). The 5341A will output each measurement if it has been addressed to talk. If not so addressed, it bypasses the entire output phase of its operating cycle.

b. WAIT (ASCII W). The 5341A will make a measurement, then wait until it is addressed to TALK. As soon as it is so addressed it will output and continue to SAMPLE RATE phase. The 5341A does **not** pull SRQ at the end of the measurement. The Service Request (SRQ) line is not used by the 5341A.

3-43. 5341A Counter Response to Bus Commands

3-44. The 5341A obeys three bus commands, which are:

Bus Command	ASCII	OCTAL
1. Group Execute Trigger (GET)	BS	10
2. Go To Local (GTL)	SOH	01
3. Local Lockout (LLO)	DC1	21

a. Group Execute Trigger (GET). GET is an Addressed Command, therefore it affects only devices that have been addressed to listen.

Group Execute Trigger can start a simultaneous action by several devices on the bus. The 5341A accepts GET when ATN is low and will act upon its receipt in the same manner as a trigger (T) command. To execute GET use

CMD "? ⟨Listen Address⟩ ⟨ASCII BS⟩ "

b. Go To Local (GTL). The Addressed Command GTL provides a convenient way to return control of selected devices to the system operator. GTL allows the operator to perform tasks that cannot be done solely under remote control. The statement for GTL is

CMD "? ⟨Listen Addresses⟩ ⟨ASCII SOH⟩ "

c. Local Lockout (LLO). Local Lockout is a universal command. All responding devices in a bus system will obey a universal command when it is issued whether they are addressed to listen or not. Thus the controller does not need to address devices on the bus before sending a universal command.

Local Lockout (LLO) disables the front panel RESET switch so that the unit will remain under remote control even if the switch is pressed. LLO prot[illegible] the instrument from an accidental return to local control during system operation. To execute the local lockout command use the statement

CMD "ASCII DC1"

Once the 5341A has been given the LLO command, it can return to local control if any of the following conditions exist:

1. REN High
2. Go To Local (GTL) command
3. Power Up.

3-45. PROGRAMMING NOTES

1. All remote programming codes and commands are only effective if the counter is in Remote.
2. The order of steps 3 through 8 is arbitrary. A new programming sequence may omit any one or more of steps 3 through 8. The previous value will remain in effect. If a previous value has not been sent, the counter will assume its respective PRESET condition (starred * condition).
3. Switching to Local does not alter the stored codes, except Band Select (B0 through B9).
4. The counter will ignore invalid codes sequences. Example: E0, B11, M5, I4. An exception is I3 which performs the same function as I1.
5. Bus Commands (GET, GTL, LLO) can only be given when the bus is in the command mode (ATN Low).
6. Power-Up restores the Preset conditions (B?, E3, I0, N, M0, 0), switches the 5341A to Local and unaddresses (Talk and Listen) the counter.
7. Both an alphabetic and a numeric (or other nonalphabetic) character must be sent as a code pair.
8. Any ASCII code group other than those listed will be ignored by the counter.

3-46. OUTPUT PROCESS

3-47. When addressed to TALK, the 5341A outputs according to the program (Local or Remote), provided there is an addressed listener on the bus. The transfer routine, necessary for passing

information on the data lines, cannot be started unless there is both an addressed listener and talker on the bus. The listener must be able to recognize LF (line feed) as the end of the 5341A's output data. As soon as the Listener accepts LF (sets DAC high) the 5341A leaves the output phase and continues through its operating cycle.

3-48. The output characters, their description, and the order in which they are outputted are shown in *Table 3-2*.

Table 3-2. 5341A Output Code Set

ORDER OUTPUTTED	CHARACTER	DESCRIPTION
1	SP	Space
2	0-9	1 to 3 digits may be outputted depending on the input signal and resolution
3	.	Decimal point
4	0-9	0 to 9 digits may be outputted depending on the input signal and resolution
5	E	Exponent Identifier
6	+	Exponent Sign
7	3, 6, or 9	Multiplier
8	CR	Carriage Return
9	LF	Line Feed (used as word terminator)

3-49. When the 5341A is in the Self-Test mode operation, the output code set is as shown in *Table 3-3*.

Table 3-3. Self-Test

ORDER OUTPUTTED	CHARACTER	DESCRIPTION
1	S	Self-Test
2	0-9	1 to 3 digits may be outputted depending on the input signal and resolution
3	.	Decimal point
4	0-9	0 to 5 digits may be outputted depending on the input signal and resolution
5	E	Exponent Identifier
6	+	Exponent Sign
7	3, 6, or 9	Multiplier
8	,	Comma
9	0 or 1 (Note 1)	High Level Peak Detector
10	,	Comma
11	0 to 1 (Note 2)	Low Level Peak Detector
12	,	Comma
13	0 or 1	Frequency Discriminator
14	CR	Carriage Return
15	LF	Line Feed

NOTE: 1) High Level Peak Detector = 1 indicates Mixer (A1) output to be at approximately +6 dBm.
2) Low Level Peak Detector = 1 indicates Mixer (A1) output to be at approximately -1 dBm.

3-50. PROGRAM EXAMPLE (9830A CALCULATOR)

3-51. Listed below is an example of programming a 9830A Calculator (used as a controller) to control a 5341A Electronic Counter. The functions performed are as follows:

a. Program 5341A into Remote and Check.
b. Program Calculator to receive and store data from counter.
c. Program calculator to accept and print 10 counter measurements.

3-52. EQUIPMENT SET-UP

a. Model 5341A counter with Option 011.
b. Model 9830A calculator with 59405A Option 030 HP-IB Calculator Interface and 11272B Extended I/O ROM.
c. Model 9866A Calculator Printer.

3-53. LOADING THE PROGRAM. Load the program into the calculator. (Refer to the calculator instruction manual for procedures.)

3-54. RUNNING THE PROGRAM. To run the program push the RUN and EXECUTE keys. The printout should compare with the calculator printout shown below:

PROGRAM LISTING

```
10 REM SEND HP-IB TALK ADDRESS, 5341 LISTEN ADDRESS, SEND TO PLOTTER
20 REM REMOTE FUNCTIONS, RESET, RANGE=CHECK, RESOLUTION=10CH2
30 OUTPUT "705";"P1R2;"
40 REM READ HP-IB TALK ADDRESS, 9830A LISTEN ADDRESS
50 ENTER "705"
60 REM TAKE 10 READINGS IN A LOOP
70 FOR I=1 TO 10
80 REM READ FROM UNIT 13 (59405A I/O CARD), FORMAT = FREE FORM, INTO VARIABLE A
90 ENTER 713;A
100 REM FORMAT FOR PRINTOUT IS FLOATING POINT WITH 7 DIGITS BEFOR DECIMAL POINT
110 FLOAT 7
120 REM PRINT THE VALUE OF THE VARIABLE A
130 PRINT A
140 REM END OF THE LOOP FOR TEN READINGS
150 NEXT I
160 PRINT "END OF PROGRAM"
170 PRINT
180 END
   1.0000000E 09
   1.0000000E 09
   1.0000000E 09
   1.0000001E 09
   1.0000000E 09
   1.0000001E 09
   1.0000000E 09
   1.0000001E 09
   1.0000001E 09
   1.0000001E 09
END OF PROGRAM
```

3-55. 5341A HP-IB VERIFICATION PROGRAM (9825A CALCULATOR)

3-56. The HP-IB verification program tests many of the programmable operating modes of the instrument. The following modes are exercised: CHECK range selection, RESOLUTION selection from 1 Hz to 1 MHz, BAND selection from 0 to 4 GHz, SAMPLE RATE selection, Trigger command, OUTPUT modes, Internal Self-Test mode, and the Universal commands: Group Execute Trigger, Go To Local, and Local Lockout.

3-57. EQUIPMENT SET-UP. To run the program, key into the 9825A Calculator (which has the 98214A GEN I/O, EXTENDED I/O ROM and the 98034A HP-IB Interface) the program given in the listing. Record the program on a cassette for future use. Connect the 98034A HP-IB Interface to the HP-IB connector on the rear panel of the 5341A. (Make sure that the 98034A HP-IB Interface is set to a select code of 7.) Set the rear panel address switches on the 5341A to A5=1, A4=0, A3=0, A2=0, A1=0, and select the addressable mode. Set the 5341A front panel controls as follows: 1 MHz RESOLUTION, SAMPLE RATE full counterclockwise (maximum rate), AUTO mode, and .05—4.5 GHz RANGE.

3-58. The program will go through a series of 10 different tests. At the end of each test, the calculator printer will print a CHECK POINT number. The operator should visually check the 5341A display for the actions and results which are described for the particular test. The following paragraphs describe each test:

3-59. TEST 1: Test 1 is an initialization step. If the 5341A has been setup according to paragraph 3-57, the display should read 0. MHz and all other annunciators should be off. Press CONTINUE on the 9825 to perform Test 2.

3-60. TEST 2: This test addresses the 5341A to listen and sends the codes to cause it to go to CHECK mode, 1 Hz RESOLUTION, and front panel SAMPLE RATE control. For approximately 20 seconds, the 5341A's display should read 0.000 kHz and the GATE, RMT, ADDR, and * annunciators should be lighted (since the 5341A prescales by 20, it takes 20 seconds to achieve 1 Hz resolution). After 20 seconds, the 5341A should display 1.000000000 GHz. After verifying proper operation, press CONTINUE to go to Test 3.

3-61. TEST 3: This test programs the 5341A to measure the 1 GHz CHECK signal with resolutions that vary from 10 Hz to 1 MHz in decade steps. Each time the calculator beeps, a new resolution code is sent. Verify that the resolution changes as expected. Press CONTINUE to perform Test 4.

3-62. TEST 4: Test 4 programs the various bands of the 5341A starting with the 0 band and ending with the 4 GHz band. The 5341A displays the LO frequency for each band. Each time the calculator beeps, a new band select code is sent. Verify that the 5341A display 0. kHz, 500.000 MHz, 750.000 MHz, 1.000000 GHz, 1.500000 GHz, 2.000000 GHz, 2.500000 GHz, 3.000000 GHz, 3.500000 GHz, and 4.000000 GHz.

3-63. TEST 5: This test puts the 5341A in HOLD and then sends four trigger commands. After each trigger, the measurement result is read into the 9825A and printed on the printer. Verify that after pressing CONTINUE, the 5341A GATE light remains off. After approximately 4 seconds, four trigger commands are sent (indicated by beeps from the calculator) and the 5341A GATE light should momentarily light after each. Verify that the printer output reads 1.000000 GHz ±1 count. Press CONTINUE to advance to Test 6.

3-64. TEST 6: Test 6 sends the Group Execute Trigger (GET) command to the counter. When CONTINUE is pressed, verify that the 5341A GATE lamp lights momentarily and that the printer prints 1.000000 GHz ±1 count.

3-65. TEST 7: The 5341A is programmed to the WAIT UNTIL ADDRESSED output mode (code W). A trigger command is sent to the 5341A and a measurement is made. In the ONLY IF ADDRESSED output mode, this measurement would be lost unless the 5341A were addressed to Talk before completion of the measurement. In the WAIT UNTIL ADDRESSED mode, the measurement is saved until it is addressed to output (of course, new measurements are not made until the old measurement is output). After the trigger command is sent and a measurement taken, the calculator waits for approximately 7 seconds. The measurement is then read into the calculator and printed on the printer. Verify that the printer prints 1.000000 GHz ±1 count. Press (CONTINUE) to perform Test 8.

3-66. TEST 8: Test 8 exercises the Local Lockout capability of the 5341A. In the first part of the test, the calculator requests the operator to push the 5341A's RESET pushbutton which causes the 5341A to return to local front panel control. (ADDR should remain lighted since the 5341A has not been unaddressed.) After verifying that the counter is under front panel control, press CONTINUE. The program now puts the counter under remote control and sends the local lockout universal command. Pushing the 5341A RESET now has no effect and the counter remains under remote control.

3-67. TEST 9: Test 9 sends the Go To Local universal command. When CONTINUE is pressed, verify that the RMT light goes off. Verify that the counter is under front panel control. Press (CONTINUE) to perform Test 10.

3-68. TEST 10: This test puts the 5341A into the diagnostic test mode (code 5) and causes the HPD, LPD, and FD qualifiers to be displayed. The program reads the display and prints out the values of the three qualifiers. Verify that HPD, LPD, and FD are all equal to one.

3-69. END OF TEST. After completion of Test 10, the calculator returns the HP-IB to local and addresses a nonexistent instrument which effectively unaddresses the 5341A. The RMT light and the ADDR light should both turn off. The calculator displays END OF TEST.

3-70. If the 5341A fails any test, check that the address switches are set as described in paragraph 3-57. Using a 59401A Bus System Analyzer, verify that the proper codes are coming from the 9825A interface. Refer to 5341A HP-IB Troubleshooting in paragraph 5-50.

5341A HP-IB Verification Program

```
0: dsp "5341 HP
 IB VER" CRTIO
 "¡wait 30¡
 dsp "Press CONT
 INUE-TEST 1"¡
 stp
1: prt "CHECK
 POINT 1"¡ici 7¡
 wrt 7¡1¡dsp
 "Press Continue
 -Test 2"¡stp
2: ren 7¡wrt
 716,"I2E0S2M0N0
 "¡red 716,2
3: prt "CHECK
 POINT 2"¡dsp
 "Press Continue
 -TEST 3"¡stp
4: 1→X
5: fmt 1,"E",f.0
6: fmt 2,"I2S2M0
 N0"¡z¡wrt 716,2
7: wrt 716,1,X¡
 red 716,2¡beep¡
 wait 2000¡
8: X+1→X¡if X<=6
 ¡gto 7
9: prt "CHECK
 POINT 3"¡dsp
 "Press Continue
 -TEST 4"¡stp
10: fmt 5,"B",
 f.0
11: 0→X
12: fmt 3,"I0E3M
 0N0"¡z¡wrt 716,
 3
13: wrt 716.5,X¡
 wait 2000¡beep
14: X+1→X¡if
 X<=9¡gto 13
15: prt "CHECK
 POINT 4"¡dsp
 "Press Continue
 -TEST 5"¡stp
16: wrt 7[illegible]12
 M3"¡dsp "WA
 ate"¡wait 4000
17: 1→X
18: wrt 716,"I"¡
 red 716,M¡beep¡
 fli 6¡wrt 0¡
 dsp M¡wait 2000
19: X+1→X¡if
 X<=4¡gto 18
20: prt "CHECK
 POINT 5"¡dsp
 "Press Continue
 -TEST 6"¡stp
21: trg 716¡red
 716,A¡wrt A;
 wait 500
22: prt "CHECK
 POINT 6"¡dsp
 "Press Continue
 -TEST 7"¡stp
23: wrt 716,"PI2
 M3WE1"¡trg 716¡
 dsp "WAIT"¡wait
  9000
24: red 716,0¡
 beep¡wrt A
25: prt "CHECK
 POINT 7"¡dsp
 "Press Continue
 -TEST 8"¡stp
26: dsp "Push
 5341 Local Rese
 t"¡wait 5000
27: dsp "5341
 in Local--Press
  CONTINUE"¡stp
28: wrt 716,"PI2
 "¡llo 7
29: dsp "Push
 5341 Local Rese
 t"¡wait 5000
30: prt "CHECK
 POINT 8"¡dsp
 "Local Lockout-
 Press Cont.-
 TEST 9"¡stp
31: lcl 716
32: prt "CHECK
 POINT 9"¡dsp
 "Pre[illegible]
 -TEST 10"¡stp
33: [illegible]
34: wrt 716,"I[illegible]
 E4S6N0"
35: [illegible]
 C;D
36: for i;prt
 "HPD=",A;prt
 "LPD=",C;prt
 "FD=",A/C¡wait
 4000
37: dsp "END O
 TEST"¡lcl 7
 wrt 710
38: end
*29446
```

SAMPLE OUTPUT

```
CHECK POINT 1
CHECK POINT 2
CHECK POINT 3
CHECK POINT 4
     1.000000E+00
     1.000000E+00
     1.000000E+00
     1.000000E+00
CHECK POINT 5
     1.000000E+00
CHECK POINT 6
     1.000000E+00
CHECK POINT 7
CHECK POINT 8
CHECK POINT 9
HPD=              1.0
LPD=              1.0
FD=               1.0
```

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section covers 5341A theory of operation on a block diagram level as well as to the component level on each assembly.

4-3. SIMPLIFIED BLOCK DIAGRAM DESCRIPTION

4-4. *Figure 4-1* is a simplified block diagram of the 5341A. The 5341A uses the heterodyne conversion technique to translate the unknown microwave input signal down to a lower frequency signal which is within the range of the low frequency counting circuits. This is accomplished by mixing the unknown frequency, f_X, with an accurately known frequency, f_{LO}, to produce sum and difference frequencies which are sent to an IF Amplifier whose bandwidth is such as to pass only the difference frequency f_X-f_{LO}. The difference frequency is counted by the low frequency counter. The control circuitry then adds the local oscillator frequency, f_{LO}, to the counted frequency and displays the unknown frequency (f_X-f_{LO}+f_{LO}=f_X) on the 5341A's display.

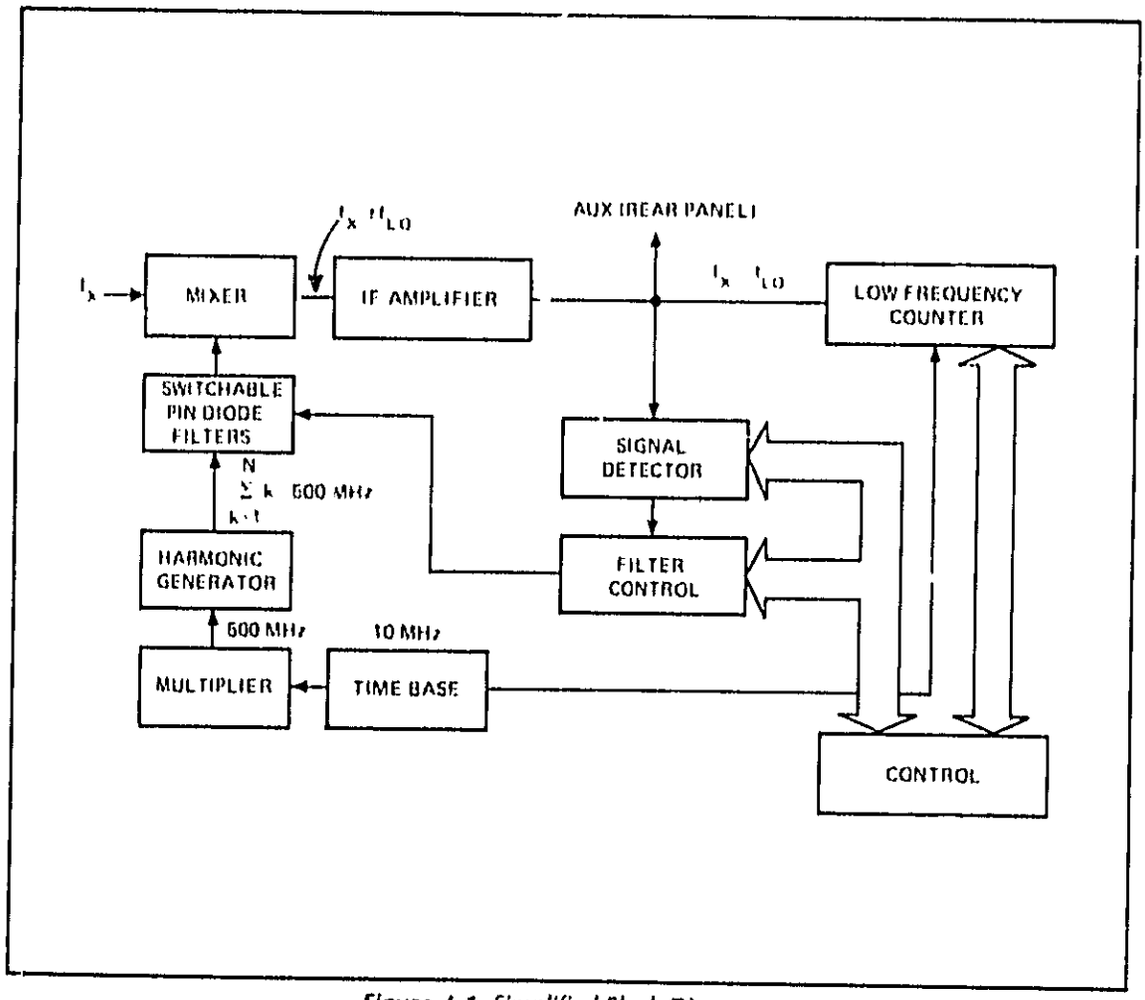


Figure 4-1. Simplified Block Diagram

4-5. The local oscillator frequency, f_{LO}, is generated by first multiplying the time base to 500 MHz (the bandwidth of the IF amplifer) and then passing this signal through a harmonic generator. The output of the harmonic generator, consisting of integer multiples of 500 MHz, goes to a matrix of switchable pin diode thin film filters whose pass bands are centered on multiples of 500 MHz. The local oscillator frequency is selected by activating one of the filter sections.

4-6 In automatic operation, the 5341A begins with the lowest local oscillator frequency and indexes to high local oscillator frequencies. When the signal detector detects the presence of a difference frequency in the range of 15 MHz—540 MHz, the Filter Control stops indexing through the bands and the measurement is made. Otherwise, the Filter Control selects the next higher local oscillator frequency and the process is repeated. For example, if a 2.35 GHz unknown were applied to the 5341A, the 500 MHz LO would be mixed with it to produce a 1.85 GHz difference frequency. Since this is beyond the bandwidth of the IF amplifier, the Controller selects the next local oscillator frequency. This process is repeated until the 2.0 GHz local oscillator is selected. In this case, the difference frequency of 350 MHz is within the bandwidth of the IF amplifier. The signal detector detects this, causes indexing to be stopped, and the measurement is made.

4-7. The difference frequency is available at the rear panel AUX OUT Connector. Since the heterodyne conversion process retains all the AM and FM of the original microwave signal, the difference frequency output may be used to measure the AM and FM on microwave signals using low frequency oscilloscopes and frequency discriminators.

4-8. OVERALL THEORY OF OPERATION

4-9. Input Circuits, *Figure 8-5*, is a detailed overall block diagram of the 5341A. Two input channels are available: a high impedance input for signals in the 10 Hz to 80 MHz range and a 50Ω input for signals in the 50 MHz to 4.5 GHz range.

4-10. Signals coming from the high impedance input are passed through the A12 80 MHz Amplifier Assembly which amplifies the signal and prescales the signal by two. The output of A12, which is in the range of 5 Hz to 40 MHz, goes to a multiplexer on the A4 Prescaler Assembly. When the front panel RANGE switch selects the high impedance input, the A19 Processor switches the multiplexer which routes the signal from the high impedance input to the A18 Counter Assembly where it is counted and displayed.

4-11. All signals at the 50Ω input are applied to the A1 Mixer Assembly. The input signal is mixed with a local oscillator signal from the A1 Switchable Filter. Filters on A1 exclude the sum frequency and only pass the difference frequency. One of two filter sections on A1 is selected: a 250 MHz low pass filter or a 500 MHz low pass filter. The reason for the 250 MHz filter is due to local oscillator feedthrough when using a 500 MHz local oscillator frequency. Since a 500 MHz IF is used, feedthrough from the 500 MHz local oscillator would be detected by the signal detectors and erroneously indicate a countable signal. To avoid this, the 500 MHz-1 GHz band is divided into two bands: a 500 MHz—750 MHz band and a 750 MHz—1 GHz band. In these two bands, the 250 MHz bandwidth filter on A1 is slected.

4-12. Local Oscillator Generation. The output of the A2 Switchable Filter is one of the following local oscillator frequencies: 500 MHz, 750 MHz, 1.0 GHz, 1.5 GHz, 2.0 GHz, 2.5 GHz, 3.0 GHz, 3.5 GHz, and 4.0 GHz. For the Option 003 5341A, the A2 switchable filter is replaced with the A2 High Pass Filter whose output is 500 MHz, 750 MHz, or 1.0 GHz.

4-13. The local oscillator frequencies are generated in the following manner: the 10 MHz output of the A11 Oscillator Buffer is multipled to 50 MHz by A9 and then to 250 MHz by A8. The A6 250—500 MHz Multiplier mutliplies this signal to 500 MHz and supplies 500 MHz to the A2 Switchable Filter, the A3 Doubler, and the A7 250—750 MHz Multiplier.

4-14. The 500 MHz signal at A2J1 drives a step recovery diode on A2 which generates harmonics of 500 MHz. The A2 Switchable Filter selects the 1.5 GHz, 2.0 GHz, 2.5 GHz, 3.0 GHz, 3.5 GHz, or 4.0 GHz harmonic by switching the appropriate filter section.

4-15. The A3 Doubler Assembly multiplies the 500 MHz by 2 to provide a 1.0 GHz output. A multiplexer on A3 selects either this 1.0 GHz signal or a signal from the A7 250—750 MHz Multiplier.

4-16. The A7 250—750 MHz Multiplier multiplies the 250 MHz signal from A8 to 750 MHz. A multiplexer on A7 selects either a 750 MHz output or a 500 MHz output. The 500 MHz signal originated on the A6 250—500 MHz multiplier.

4-17. The A10 Switch Drive Assembly controls selection of the local oscillator frequency under the control of the A19 Processor Assembly. For local oscillator frequencies greater than or equal to 1.5 GHz, it selects a particular thin-film filter section on the A2 Switchable Filter which filters out all but the selected harmonic of 500 MHz. For the 500 MHz, 750 MHz, and 1.0 GHz LO signals, A10 controls multiplexers on A3 and A7 to select the LO of interest. In the 1.5 GHz Option 003 5341A, the A2 Switchable Filter is replaced with a high pass filter and only the 500 MHz, 750 MHz, and 1.0 GHz local oscillator signals from A3 are used. The A10 Switch Drive also controls filter selection in the A1 Mixer Assembly by enabling the 250 MHz bandwidth filter for the 500 MHz and 750 MHz LO's and the 500 MHz bandwidth filter for all other LO's.

4-18. IF Amplifier and Detector. The output of the A1 mixer is a signal in the 15 MHz to 540 MHz range. This signal goes to the A5 IF Amplifier-Detector for wideband amplification and qualifier generation. Detector circuits on A5 detect power level and frequency range and generate three signals which are sent back to the A19 processor as qualifiers in the operating algorithm of the instrument. These qualifiers are FD (Frequency Discriminator), $\overline{\text{HPD}}$ (High level Peak Detector), and $\overline{\text{LPD}}$ (Low level Peak Detector). If the qualifiers indicate a signal of insufficient amplitude or an out-of-band signal, the A19 processor commands the A10 switch drive to select the next higher local oscillator signal. This process continues until the qualifiers indicate a countable signal.

4-19. The 15—540 MHz output of A5 goes to the A4 500 MHz Prescaler where it is prescaled by 20 and sent to the A18 Counter Assembly.

4-20. Since the IF has been prescaled by 20, the gate time generated in the A17 Time Base is extended by 20 to get equivalent direct count resolution. This means that if 10 Hz resolution is selected on the front panel and the 50Ω input is used, then the gate time will be 2 seconds instead of .1 second. If the high impedance input is used, the signal is prescaled by 2 so that 10 Hz resolution is achieved in .2 seconds of gate time.

4-21. AUTO MODE. In AUTO mode, the A19 Processor begins the search algorithm by selecting band 0 (50—545 MHz) and checking the FD, $\overline{\text{HPD}}$, and $\overline{\text{LPD}}$ qualifiers for a countable signal. Local oscillator frequencies from 500 MHz to 4.0 GHz are then selected until a countable signal is detected. To insure that a valid acquisition has been made, the algorithm specifies that after the first acquisition, the counter is reset and the search begins again. If the signal is again acquired in the same band, the IF is then measured and the frequency is displayed.

4-22. MANUAL MODE. In MANUAL mode, the LO frequency selected by the BAND SELECT switch is displayed by the counter unless there is a countable signal in the band, in which case the unknown frequency is measured and displayed. Two signal acquisitions are not performed in MANUAL.

4-23. CHECK MODE. When the CHECK mode of operation is selected, the 5341A displays 1.0000 GHz with the resolution determined by the RESOLUTION switch. For CHECK mode, the A10 Switch Drive selects the 500 MHz bandwidth filter on the A1 Mixer, regardless of LO frequency. When the 500 MHz local oscillator is selected, 500 MHz feedthrough from the mixer will be of sufficient amplitide to be detected by the detectors on the A5 IF Amplifier-Detector Assembly. The counter stops indexing the LO and makes a measurement on the 500 MHz feedthrough. Since the process stopped indexing on the 500 MHz LO, it adds the counted 500 MHz IF to the 500 MHz LO and displays 1.0 GHz. Consequently, CHECK mode not only tests the operation of the low frequency counter and prescaler, but also the IF detectors and the 5341A's measurement algorithm.

4-24. INTERNAL TEST MODE. When the internal test switch on the A19 Processor board is in the TEST position, with the counter in MANUAL mode and RESOLUTION is either 10 kHz, 100 KHz, or 1 MHz, the 5341A displays the three qualifiers detected by the A5 IF Amplifier Detector. The least-significant-digit of the qualifier display is FD (Frequency Discriminator), the most-significant-digit is $\overline{HPD}$ (High level Peak Detector), and the middle digit is $\overline{LPD}$ (Low level Peak Detector). These qualifiers are displayed in addition to the LO frequency (in absence of a countable signal) or input frequency.

4-25. $\overline{HPD}$ will be a 1 if the input signal level is greater than -15 dBm and must be 1 for a signal to be measured in the AUTO mode. $\overline{LPD}$ will be a 1 if the input signal level is greater than -20 dBm (-30 dBm typical) and must be 1 for a signal to be measured in MANUAL mode. FD will be a 1 if the IF is in the range of 15 MHz to 540 MHz and must be 1 for a measurement to be made in AUTO or MANUAL. If the counter is in AUTO mode and the qualifier display is 011 ($\overline{HPD}$=0, LPD=1, FD=1), the counter will display zeros and the asterisk (*) will light indicating that there is a signal of sufficient amplitide to be counted in MANUAL mode but not in AUTO mode.

4-26. A1 MIXER MODULE ASSEMBLY (05341-60001)

4-27. The A1 Mixer Module Assembly (*Figure 8-6*) consists of Input Switch A1A1, Mixer A1A2, and IF Filter/Amp A1A3. The local oscillator signal from A2 comes in at A1J2 and mixes with the unknown input frequency, from A1J5, on the A1A2 Mixer Assembly. A ZERO BAND control signal from the A10 Switch Drive routes inputs in the 50 MHz—540 MHz range around the mixer. The 250 MHz BW IF control signal from A10 selects a 250 MHz bandwidth filter for use when the 500 MHz and 750 MHz local oscillators are used. When counting a signal using the 500 MHz LO, the IF bandwidth is reduced from 500 MHz to 250 MHz so that feedthrough from the 500 MHz LO will not be considered a legitimate IF signal to be counted. Consequently, two bands are used to cover the range from 500 MHz to 1.0 GHz: a 515—850 MHz band and a 765 MHz—1.050 GHz band.

4-28. A1A1 Input Switch

4-29. The input signal is connected to the A1A1 Input Switch via a rigid coaxial cable at A1J5. After passing through ac coupling capacitor C1, signals in the range of 515 MHz to 4500 MHz are routed to the output of the A1A2 Mixer Assembly. For signals less than 515 MHz, the ZERO BAND control line from A10 goes high which turns on Q2 to forward-bias diodes A1A1CR3 and A1A2CR5. The input signal is consequently fed around the input of the A1A2 mixer. The other function of A1A1 is to switch in an additional stage of filtering at the output of the mixer module when the 500 MHz and 750 MHz LO are selected. For these bands, the 250 MHz BW IF control signal from A10 will be high which will forward-bias A1A1CR4 and shunt the output of U1 with C6, C7, and L1. This series resonant tank resonates at 513 MHz and provides 500 MHz LO rejection. Additional 500 MHz LO rejection is provided by a 250 MHz low pass filter and a 500 MHz notch on A1A3.

4-30. A1A1 Mixer Assembly (05341-60025)

4-31. The input signal is fed through a balun to convert from the unbalanced 50Ω microstrip transmission line to a balanced system with two outputs symmetrical with respect to ground. These outputs drive two mixer diodes, CR2 and CR3. This balanced mixer discriminates against second harmonic mixing. The local oscillator signal from A2 is applied to the junction of R3 and R4. Capacitors C2 and C3 bypass to ground any signals higher than 500 MHz. Capacitors C5, C6, C7, and C8 are dc blocking capacitors. Signals between 50 MHz and 515 MHz arrive at the junction of C7 and R9 via CR5 which has been forward-biased by the ZERO BAND control signal.

4-32. A1A3 IF Filter/Amplifier (05341-60002)

4-33. IF FILTER/AMP A1A3 is the first stage of IF amplification and filtering. Two different signal paths may be selected; a path with a 250 MHz low pass filter or a path with no filtering. The 250 MHz low pass filter consisting of C7, L1, L2, and C4 is switched into the IF signal path when the 500 MHz LO or the 750 MHz LO are being used. To provide adequate rejection of the 500 MHz LO, a 500 MHz notch is used in addition to the low pass filter. The 500 MHz notch is a series resonant tank consisting of L4, C3, and C2.

4-34. Filter switching is accomplished by biasing PIN diodes CR1, CR2, CR3, and CR4 on or off. Differential amplifier U1 will sink current at pin 8 when the 250 MHz BW IF signal is high and will sink current at pin 6 when this control line is low. When 250 MHz BW IF is high, CR1 and CR2 will be forward-biased and CR3, CR4 will be reversed-biased which will route the IF signal through the 250 MHz low pass filter and into U2. When 250 MHz BW IF is low, CR3 and CR4 are forward-biased and CR1, CR2 are reversed-biased which routes the IF signal directly into U2.

4-35. A2 SWITCHABLE FILTER ASSEMBLY (05341-60048)

4-36. The switchable filter (*Figure 8-7*) receives 500 MHz at J1 from the A6 multiplier and generates six harmonics (1.5, 2.0, 2.5, 3.0, 3.5, 4.0 GHz) which are used as local oscillator signals for the A1 mixer. The switchable filter also receives 500 MHz, 750 MHz, or 1.0 GHz signals at A2J2 and routes these signals to mixer A1 whenever the counter is in the 515—775 MHz, 765—1025 MHz, or 1.015—1.525 GHz bands respectively.

4-37. In the Option 003 5341A (counts signals to 1.5 GHz) the switchable filter is replaced with High Pass Filter Assembly A2. This assembly receives 500 MHz, 750 MHz, or 1.0 GHz from A3J1 for use as local oscillator signals on A1.

4-38. Transistor Q2 is a UHF amplifier for the 500 MHz signal, and Q1 is a temperature stabilizing transistor for Q2. Control R4 "SPEC GEN LEVEL SET" adjusts the gain of amplifier Q2. The S.R.D. MOD is a step recovery diode which functions as a nonlinearity for the 500 MHz signal and generates harmonics. On command from the A10 filter switch board, individual band-pass filters are enabled allowing the desired local oscillator signal to be sent to the A1 mixer.

4-39. The LO BAND control signal from the A10 band selector is TTL high when the 500 MHz, 750 MHz, or 1.0 GHz LO is to be used. This TTL high forward-biases PIN diode CR1 and thus routes 500 MHz, 750 MHz, or 1.0 GHz to the switchable filter output.

4-40. A3 500—1000 MHz DOUBLER ASSEMBLY (05341-60003)

4-41. The A3 double assembly (*Figure 8-8*) consists of the A3A1 Doubler Assembly and the A3A2 1 GHz Multiplex Assembly. A3A1 doubler takes a 500 MHz signal from multiplier A6, doubles it, and provides a 1.0 GHz output to A3A2. The A3A2 multiplexer selects the 1.0 GHz signal when the 1 GHz ENABLE control signal from A10 is TTL high or a 500 MHz/750 MHz signal from the multiplier A7 when the 500—750 MHz ENABLE control signal is TTL high. The selection of 500 MHz or 750 MHz takes place on A7.

4-42. A3A1 Doubler Assembly (05341-60027)

4-43. The 500 MHz signal comes into A3A1 from the A6 multiplier at XA3B6. If the 1 GHz ENABLE control line goes TTL high, Q4 starts conducting which will turn on Q3 and forward-bias CR1 by changing the voltage at the anode of CR1 from -15V to +3.2V. With PIN diode CR1 forward-biased, the 500 MHz signal will be amplified by Q2. The gain of Q2 is such as to cause the output to be amplitude-limited; thereby providing a signal rich in harmonics of the 500 MHz fundamental. The amount of limiting is controlled by R4 which is used to adjust the level of the 1 GHz harmonic. Transistor Q1 provides a negative feedback path around Q2 and compensates for gain changes as a function of temperature. The 1 GHz signal is selected by passing the output of Q2 through a 1 GHz hybrid band pass filter, A3U1.

4-44. Series resonant tank circuits L1, C4, L2, and C6 are tuned to 500 MHz and are used to attenuate the 500 MHz signal. When CR1 is reversed-biased, a voltage divider is formed by the OFF impedance of CR1 and the impedance of L1, C4. This occurs when the 1 GHz ENABLE signal is low so that a 1 GHz output is not wanted.

4-45. A3A2 1 GHz Multiplex Assembly (05341-60026)

4-46. If the 1 GHz ENABLE from A10 is TTL high, the 1 GHz ENABLE OUT into A3A2 will forward-bias PIN diode A3A2CR1 which passes the 1 GHz signal coming from the hybrid filter. If the 500 MHz or 750 LO is selected by A10, then the 1 GHz ENABLE line will be TTL low and the 500—750 MHz ENABLE line into A3A2 will be TTL high. The TTL high level turns on Q1 as well as Q2 and changes the voltage at the anode of CR2 from -15V to +.78V which forward-biases PIN diode CR2. The 500 MHz signal or 750 MHz signal comes in at XA3(A1) and passes through a parallel resonant 1 GHz notch made up of L4, C8 which filters out the 1 GHz harmonic generated in A7.

4-47. A4 PRESCALER ASSEMBLY (05341-60004)

4-48. The Prescaler (*Figure 8-9*) consists of Schmitt Trigger U4, ÷2 circuit U3, Decade Counter U1, EECL-to-MECL translator Q2 and Multiplexer U2.

4-49. The Schmitt Trigger circuit includes a feedback amplifier U5 to help sharpen the leading and trailing edge of the input waveform. R1 is adjusted for maximum sensitivity (see paragraph 5-34 for adjustment procedure). U4 supplies two outputs; the output at U4(16) feeds through 50Ω microstrip to the rear panel output jack. This signal can be displayed by external equipment such as spectrum analyzers or oscilloscopes. This IF is an intermediate frequency signal equal to the difference between the input signal and the counter's local oscillator. The IF will carry any AM or FM present on the input. The other input of U4 connects through 50Ω microstrip to D flip-flop U3 which is connected in a ÷2 configuration. This is followed by a ÷10 circuit so that the 15 to 540 MHz input is divided by a total factor of 20 to give a 750 kHz to 27 MHz output. Q2 provides level translation between the EECL output of U1 and the MECL input of U2. Miltiplexer U2 receives the divided by 20 IF, the 40 MHz (80 MHz ÷2 direct count input) from A12, and a mode control signal from processor A19. When the mode control line is high, the multiplexer routes the 80 MHz range signal to A18. When the mode control line is low, the 4.5 GHz signal or check signal is switched to A18. The multiplexer output is routed to A18 via cable W17 and A19J2.

4-50. A5 IF BOARD (05341-60005)

4-51. A5 (*Figure 8-10*) processes the IF signal (15—540 MHz) and detects three characteristics; high power level (high peak detector $\overline{\text{HPD}}$), low power level (low peak detector $\overline{\text{LPD}}$), and frequency discrimination FD.

4-52. The AGC circuit includes detector CR2, buffer U1, and attenuation driver U4. Threshold adjust R31 is set for the proper $\overline{\text{LPD}}$ detection (see paragraph 5-34 for adjustment procedures). R29 sets the level output to prescaler A4.

4-53. Band switch amplifier U5 receives a control signal from switch driver A10. When the control signal is low, the 540 MHz low pass filter is selected. With A5(B,$\overline{\text{B}}$) high, the 250 MHz low pass filter is used. Adder U3 sums the filter output with the CR9 discriminator output to determine the FD qualifier developed by U2. C14 is adjusted so that FD just switches from 1 to 0 with a 535 MHz ±5 MHz input. This adjustment procedure is covered in detail in Section V.

4-54. A6 250—500 MHz MULTIPLIER (05341-60006)

4-55. The schematic diagram for A8 is shown in *Figure 8-11*. The 250 MHz input signal from multiplier A8 is passed through a 250 MHz band pass filter consisting of L1, C3, C4. VHF transistor Q2 provides approximately 12 dB gain to the 250 MHz signal. Transistor Q1 provides dc feedback to set and stabilize the operating point of Q2. Transistor Q4 is driven out of its linear operating range such that its output contains harmonics of the 250 MHz input. The 500 MHz second harmonic is selected by a 500 MHz tank circuit consisting of L3, C12, C14, C11, and C10. Capacitor C13 couples the 500 MHz signal to a second 500 MHz tank circuit L4, C15, and C18. Transistor Q6 provides the first stage of amplification of the 500 MHz signal, and Q8 provides the second stage of amplification for an output level greater than +14 dBm.

4-56. The 500 MHz output is routed to the A2 filter assembly where it drives the harmonic generator. When the 1 GHz ENABLE input to A3 is high, A3A1CR1 and A6CR2 are forward-biased so that the 500 MHz signal is routed to the A3 500 MHz to 1 GHz multiplier. When the 500 MHz ENABLE input to A7 is high, A7CR4 and A6CR3 are foward-biased so that the 500 MHz signal is routed to the A7 board and appears at the A7 output.

4-57. A7 250—750 MHz MULTIPLIER (05341-60007)

4-58. Refer to *Figure 8-11* for the schematic diagram of A7. The purpose of A7 is to multiply the 250 MHz signal from multiplier A8 to 750 MHz which is used as the local oscillator when the counter is in the 765—1050 MHz band. It multiplexes this 750 MHz signal with a 500 MHz signal from A6 which is used as the local oscillator when the counter is in the 515—850 MHz band.

4-59. When the 750 MHz ENABLE control line from switch driver A10 goes TTL high, A7Q1 turns on which forward-biases CR1 and passes the 250 MHz signal to VHF amplifier Q4. The output of Q4 is fed through an impedance matching network to clipping diodes CR2 and CR3. The resultant signal, rich in odd harmonics of 250 MHz, passes through two parallel resonant circuits tuned to 750 MHz: L3, C16, and L4, C11. The 750 MHz signal exits A7 via XA7(2).

4-60. When the 500 MHz ENABLE control line from switch driver A10 goes TTL high, A7Q5 and Q6 turn on which forward-biases CR4. The 500 MHz output of A6 enters A7 at XA7(7) and exits at XA7(2).

4-61. A8 50—250 MHz MULTIPLIER (05341-60008)

4-62. A8 (*Figure 8-12*) multiplies the frequency of a 50 MHz input to 250 MHz. The 50 MHz input is first applied to band pass filter L1, C4, C5 centered on 50 MHz. The first transistor differential pair in U1 is used as a limiting amplifier to provide an output amplitude relatively independent of the input amplitude. The 50 MHz outputs of this first differential pair at U1(5,6)

are 180° out of phase with respect to one another and are used to drive the inputs of the second differential pair in U1. The constant current source in the emitters of the second differential pair causes the current through each transistor of the pair to alternately switch on and off in response to the 50 MHz inputs. The current square wave thus generated is flowing through C10, C11, L2 which is tuned to resonate at 250 MHz. Consequently, the 5th harmonic of 50 MHz is picked out of the 10 MHz current square wave and is coupled to a second tank circuit via C12. The 250 MHz output of the second tank circuit feeds VHF amplifier Q2. Transistor Q1 provides negative dc feedback to stablize the operating point of Q2. The output of Q2 feeds two VHF amplifiers Q4 and Q6. Both 250 MHz outputs are approximately at +3 dBm.

4-63. A9 10—50 MHz MULTIPLIER (05341-60009)

4-64. A9 (*Figure 8-12*) multiplies the 10 MHz reference frequency from the counter time base to 50 MHz. The 10 MHz from buffer A11 is passed through a 10 MHz band pass filter (L1, C3, C4) to strip-off unwanted noise sidebands. Transistor Q1 amplifies the 10 MHz to a level (~3V peak-to-peak) sufficient to drive the first differential transistor pair in U1. The constant current source in the emitters of the differential pair causes the current through each transistor of the pair to alternately switch on and off at a 10 MHz rate. The current square wave, which is rich in odd harmonics of 10 MHz, passes through the resonant circuit made up of L2, C11, and C13. Since this circuit is parallel resonant at 50 MHz, the voltage at A9U1(11) is a 50 MHz sine wave. The 50 MHz sine wave is coupled to the second differential pair via C14. The second pair provide amplitude limiting such that output amplitude at U1(5) is relatively independent of input amplitude.

4-65. A10 BAND SELECTOR AND SWITCH DRIVERS (05341-60010)

4-66. The A10 band selector (*Figure 8-13*) receives band increment and band zero information from the A19 processor assembly and provides driver outputs to the A2 switchable filter which selects the desired local oscillator frequency.

4-67. A TTL low on the $\overline{\text{BAND ZERO}}$ control line from A19 resets the output of counter U4 to all zeros. Thus, the zero output of BCD to decimal decoder U3 goes low, thereby enabling the ZERO BAND output to the A1 mixer. The $\overline{\text{BAND+1}}$ control line from A19 clocks U4 and advances its output by one. This occurs when a measurable IF signal has not been found in the previous band. The low output of U3 thus enables bands sequentially beginning with band zero and ending with the 4.0 GHz band in the following fashion:

CLOCK	U4(12)	U4(2)	U4(9)	U4(5)	LOW PIN ON U3	SELECTED LO FREQ.
($\overline{\text{BAND ZERO}}$ TTL low)						
0	0	0	0	0	1	BAND ZERO
1	0	0	0	1	2	500 MHz
2	0	0	1	0	3	750 MHz
3	0	0	1	1	4	1.0 GHz
4	0	1	0	0	5	1.5 GHz
5	0	1	0	1	6	2.0 GHz
6	0	1	1	0	7	2.5 GHz
7	0	1	1	1	9	3.0 GHz
8	1	0	0	0	10	3.5 GHz
9	1	0	0	1	11	4.0 GHz

For remote selection of band, $\overline{\text{REM BAND}}$ goes TTL low and counter U4's outputs will be preset to the inputs on $\overline{\text{DIO1}}$ through $\overline{\text{DIO4}}$ which comes from the Option 011 A26 ASCII input assembly.

4-68. Quad D flip-flop U2 stores the current band information present at the output of U4 when it is clocked by the $\overline{\text{LATCH BAND}}$ command from A19. The $\overline{\text{LATCH BAND}}$ command is given when a measurable IF signal is detected in the current band. The operating algorithm of the counter, implemented in the ROM on A19, specifies that after the first acquisition and the band is latched, the counter is reset and the signal is acquired again. After the second acquisition, the $\overline{\text{BAND EQUAL}}$ qualifier output is examined to see if the signal was acquired both times in the same band. If so, the measurement is made. Comparator U1 compares the output of the U2 latch with the current band to generate the $\overline{\text{BAND EQUAL}}$ qualifier.

4-69. The outputs of U4 (BAND A, BAND B, BAND C, BAND D) are sent to the A9 processor and are used in the ADD algorithm to add the local oscillator frequency to the counted IF.

4-70. A11 10 MHz BUFFER (05341-60011)

4-71. The A11 10 MHz buffer (*Figure 8-14*) provides the necessary gating to select either the internal 10 MHz reference or an external 10 MHz reference. With the rear panel OSC INT-EXT switch in the INT position, U1D is enabled and U1B is disabled. Feedback resistor R6 generates positive feedback around U1D and U1C and provides hysteresis for the input internal oscillator signal.

4-72. When the rear panel OSC INT-EXT switch is in the EXT position, U1B is enabled and U1D is disabled. Resistor R7 generates positive feedback around U1C and U1B to provide hysteresis for the external oscillator signal.

4-73. Transistors Q1 and Q2 provide buffering of the oscillator signal by presenting a relatively high input impedance to the output of U2B and a low driving point impedance for the 10 MHz outputs.

4-74. A12 80 MHz DIRECT AMPLIFIER (05341-60012)

4-75. A12 (*Figure 8-15*) consists of input network Q1-Q2, wideband amplifier U1, DC Feedback Amplifier U4D, AGC network U2, Schmitt Trigger U4, and ÷2 circuit U3.

4-76. Overall, A12 presents a high input impedance, provides amplification and prescales the signal by 2. Q1 and Q2 are connected as a high impedance amplifier with limiting circuit CR7, CR6, and CR5. The limiters provide limiting for signals over 5V peak-to-peak. The output of the input amplifier connects to wideband amplifier U1 which provides an open loop gain of at least 50,000. The wideband amplifier includes a dc feedback loop U4D, where R32 is adjusted to provide maximum sensitivity (at least 10 mV rms). Schmitt trigger U4 provides sharp square waves for U3. U3 is a D-edge flip-flop connected in a divide-by-2 configuration. U3 supplies a -8V to -16V signal in the 5 Hz to 40 MHz range to A4.

4-77. A13 RF MOTHERBOARD (05341-60013)

4-78. A13 provides the interconnection between the RF assemblies A3 through A9 and A11, A12. Parts on the board include 10 sockets XA3A, XA3B, XA4 through XA9, XA11, XA12, and C1 through C4. C1 through C4 are bypass capacitors and are shown on the schematics for A1 and the schematic for A6-A7.

4-79. A14 STANDARD 10 MHz OSCILLATOR ASSEMBLY (05341-60047)

4-80. See *Figure 8-16* for the A14 schematic diagram. The temperature compensated crystal oscillator (TCXO) supplies a 10 MHz sine wave on pins 1, $\overline{1}$. Input power of +5 volts dc is applied on pins 7, $\overline{7}$. The TCXO is not field repairable. Adjustments are contained in Section V.

4-81. A14 Option 001 10 MHz Oscillator Assembly (10544-60011)

4-82. The 10544A oscillator (*Figure 8-16*) is used when Option 001 is installed. It has an internal oven that maintains a constant temperature. The 10544A is not field repairable. Adjustments are contained in Section V.

4-83. A15 DISPLAY BOARD ASSEMBLY (05341-60015)

4-84. The A15 display (*Figure 8-17*) consists of ten 7-segment LED digits, and eight annunciator lamps. The A16 driver contains all the storage and logic for driving the display digits and the annunciator lights.

4-85. The ADDR annunciator indicates that the 5341A's talk or listen address has been sent and is lighted when $\overline{\text{ADDR}}$ from A26 is TTL low. The REMOTE annunciator indicates that the 5341A is operating according to program codes sent via HP-IB and is lighted when the $\overline{\text{REMOTE}}$ control line goes TTL low. Noninverting buffer U1F then sinks current through DS14. The OVEN annunciator, operative only when the Option 001 oven oscillator is installed, indicates that the oven is not up to temperature. The OVEN signal from A14 is a variable duty cycle oven control voltage. When the instrument is just turned on, this signal will have a high-duty cycle, which when filtered by C2 and R2, will cause the base of Q2 to rise to .6 volts. This turns on Q2, thereby sending a low level to the input of buffer U1D and causing the U1D output to sink current through DS13. After the oven has reached operating temperature, the duty cycle of OVEN decreases which turns Q2 off. The * (asterisk) annunciator is driven by a negative-going 3 μs pulse. This pulse drives the one-shot formed by C1, CR1, R1, and darlington transistor Q1. The * also indicates that there is a signal of sufficient amplitude to be measured in MANUAL mode but not in AUTO. The GATE annunciator is controlled by the negative-going $\overline{\text{GATE-LITE}}$ control line. The negative-going edge of $\overline{\text{GATE-LITE}}$ triggers retriggerable one-shot A16U10A for 50 ms. This causes A15U1B to sink current through DS18. The GHz, MHz, and kHz annunciators are controlled by the $\overline{\text{GIGA}}$, $\overline{\text{MEGA}}$, and $\overline{\text{KILO}}$ control lines through a three-state mutually exclusive latch on A16 formed by A16U12A, U12B, and U13A. A TTL low on any one line causes that output to go low and the other two outputs to go high.

4-86. A16 DRIVER DISPLAY BOARD (05341-60016)

4-87. See *Figure 8-17* for the schematic diagram of A16. The display used in the 5341A is strobed in that only one of the 10 digits is turned on at a time. The strobe rate of approximately 13 kHz is sufficiently fast, however, that it appears that all digits are on simultaneously. The A16 driver board contains all the storage and logic for strobing the digits and annunciators on A15.

4-88. The data which is to be placed into the display is stored in BCD format in 4-bit x 16-RAM U1. Of the 16 address locations in U1, 10 are used to store BCD digit information. The output of counter U5 drives the address inputs of U1. When the 5341A is displaying a reading, the U5 counter continually counts from 0 to 9. The counter's outputs enable one of the 10 digits and also select the data in U1 which is to be displayed by that digit. The U5 counter's outputs drive 1 of 10 decoder U4. When the counter starts at 0, all of its outputs are low which causes the 0 output (pin 1) of U4 to go low. When U4(1) goes low, its associated anode driver Q1 turns on which supplies +5 volts to the common anode display digit DS1. All of the other display digits are disabled. The 0 output of U5 also addresses the 0 location in RAM U1 so that the BCD code for the character which is to be displayed in DS1 appears at U1(9, 5, 7, 11). The output of U1 drives 7-segment decoder U11 which provides high levels at its outputs to turn on those segments of the LED to form the digit determined by the BCD code at U11's input. The high outputs of U11 turn on selected transistor switches Q11 through Q18 which provide low impedance paths to ground for the +5 volts applied to DS1, thus lighting selected segments of the LED. The

maximum total current through any one LED digits (occurs when .8 is selected) is approximately one ampere and lasts for a period of approximately 70 μs. Counter U5, which is clocked by 13 kHz oscillator formed by U10B and U9B, increments to 1 on the next clock pulse which enables DS2 and selects the contents of location 1 in RAM U1 to be displayed in DS2. After going through all 10 digits, the process repeats at 0 again.

4-89. The purpose of clock loss detector U2A is to prevent burn-out of an LED should the U10B clock drop out. U2A is a 5 ms retriggerable one-shot which is triggered once each cycle of 0 to 9 counted off by U5. If U5 should stop cycling, then U2A would time out and U2A(7) would go TTL high. The input to 1 of 10 line decoder U4 thus becomes 11xx (decimal 12 or greater). Since the input has addressed an output that doesn't exist, all outputs of U4 will be high and the entire display will be blanked.

4-90. One-shot U2B provides a 6 μs blanking pulse between displays of each digit in order to prevent ghosting in the display. This is necessary since the anode drivers Q1 through Q10 are relatively slow in turning off. The U2B(10) output addresses a nonexistent output of U4 so that all of U4's outputs are high and the entire display is blanked. U2B(10) also disables comparator U7 so that the decimal point is also blanked. The U2B(9) output disables the U11 7-segment decoder, thereby turning off all the segment drivers.

4-91. $\overline{\text{START RESET LAMP TEST}}$ low causes all seven outputs of U11 to go high as well as the output of U14C(8). This control signal from A19 lights all 7-LED segments and the decimal point.

4-92. The correct location of the decimal point is stored in quad latch U6 by the $\overline{\text{LATCH D.P.}}$ command from A19. Comparator U7 compares the current address select inputs of U1 with the address of the decimal point. When U5 counts up to the correct address, coincidence is achieved and U7(14) goes high which turns on decimal point driver Q11.

4-93. RS flip-flop U9D, U9C controls the clock. If $\overline{\text{RELEASE}}$ is low, then U9D(11) is high and the U10B clock is enabled. If $\overline{\text{GRAB}}$ is low, then U9D(11) is low and the clock is disabled. With $\overline{\text{GRAB}}$ low, the display is blanked by action of the clock loss detector and display data is loaded into the U1 RAM. $\overline{\text{GRAB}}$ low loads into counter U5 the data present at the data inputs which in this case is the zero state. $\overline{\text{ADD}}$ is the write-enable input to RAM U1; and it must be low for data ΣA, ΣB, ΣC, ΣD to be stored. Data is input to the RAM and is stored in the location specified by the outputs of up/down counter U5. $\overline{\text{COUNT UP}}$ and $\overline{\text{COUNT DOWN}}$ are used by the controller to increment or decrement the address by one for storing the next 4-bit word.

4-94. SUM=0 and COUNT=0 are qualifiers used by the ADD algorithm implemented on A19. SUM=0 indicates that the data input to the RAM is a zero and COUNT=0 indicates that the U5 counter is pointing to location zero in RAM. These qualifiers are used by ADD to blank non-significant leading zeros.

4-95. A17 TIME BOARD (05341-60017)

4-96 The A17 Time Board (*Figure 8-18*) provides three different functions: gate time generation, sample rate generation, and BCD addition. Each of these are discussed in the following paragraphs.

4-97. Gate time generation is performed by BCD adder U8, time base IC U10, U5A, U4A, and U3. Gate times from 2 μs to 20 seconds may be selected by sending the appropriate BCD code to time base IC U10. The input codes and corresponding gate times are in *Table 4-1*.

Table 4-1. Gate Time Codes

GATE TIME	U10(7)	U10(8)	U10(9)
20 seconds	1	1	1
2 seconds	1	1	0
.2 seconds	1	0	1
20 ms	1	0	0
2 ms	0	1	1
.2 ms	0	1	0
20 μs	0	0	1
2 μs	0	0	0

4-98. The resolution selected on the front panel as well as the signal origin determines the gate time. If the input signal is applied to the 1 MΩ 80 MHz input, then it is prescaled by 2 in the A12 80 MHz Amplifier so that 1 Hz resolution is achieved in 2 seconds of gate time (10 Hz in .2 seconds, etc.). If the signal is applied to the 50 MHz—4.5 GHz input, then the IF is prescaled by 20 in the A4 Prescaler so that 1 Hz resolution is achieved in 20 seconds of gate time (10 Hz in 2 seconds, 100 Hz in .2 seconds, etc.). Consequently, U9 is used to subtract 1 from the input resolution code whenever the 1 MΩ 80 MHz input is used. For example, if a signal is applied to the 50 MHz—4.5 GHz input and 1 Hz resolution is requested, RES A, RES B, and RES C into U9 would be 111. Since EIGHTY is low, 000 is added to 111 to give an input to the U10 time base IC of 111, which selects a 20-second gate time. If the signal were applied to the 1 MΩ 80 MHz input and 1 Hz resolution were requested, EIGHTY would be high which causes U9 to add 111 to 111, yielding 110 which selects a 2-second gate time. (By ignoring the carry, adding 111 is equivalent to subtracting 001.) In this way, EIGHTY high causes U10 to select the next lower gate time.

4-99. U10 is MOS eight-decade time base IC which provides time base outputs from 2 μs to 20 seconds in decade steps for a 5 MHz input. U10 has two outputs: LOG at U10(1), after RESET at U10=4) goes low, outputs one pulse to indicate zero time reference and then a pulse at 2 μs, 20 μs, 200 μs up to 20 seconds in decade steps; T.B. output pulses which are separated by the selected gate time according to the A, B, and C inputs. Since the T.B. output pulses are not very accurate, they are used as level inputs to U5A to select one of the very accurate LOG outputs. Transistors Q3, Q4, Q5 provide buffering and inversion for the U10 outputs. *Figure 4-2* illustrates basic operation for a 20 μs gate time.

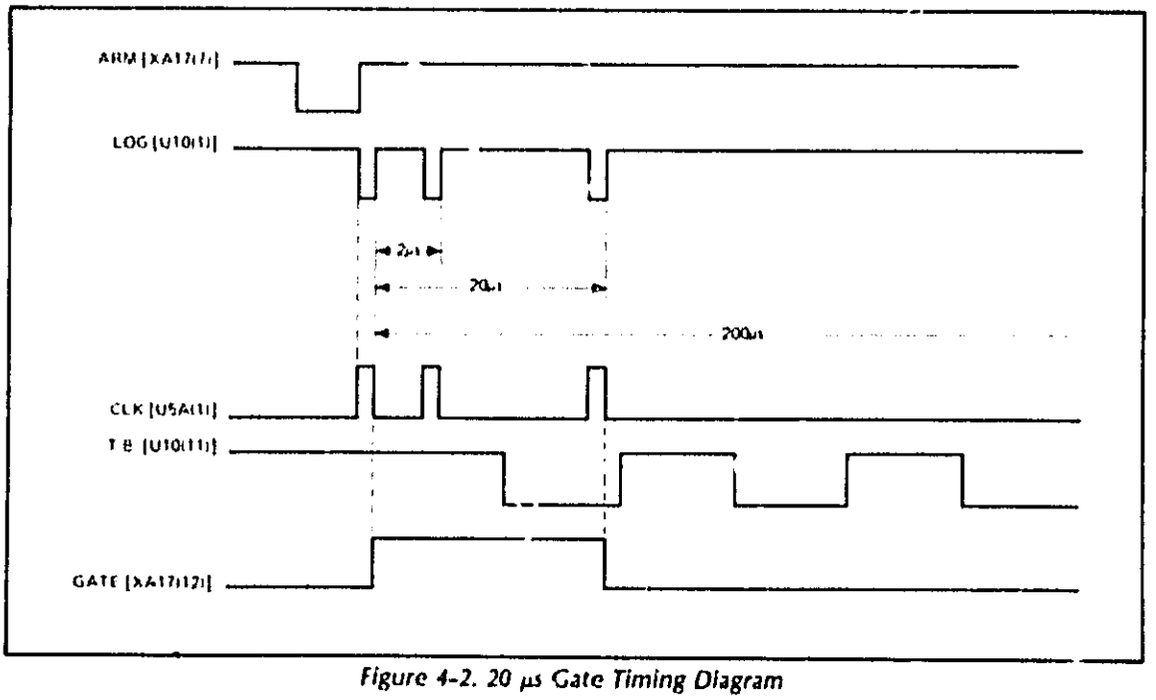


Figure 4-2. 20 μs Gate Timing Diagram

4-100. Command C16, $\overline{ARM}$, from the A19 processor resets time base IC U10, main gate flip-flop U5A, and flip-flop U5B. U5B is used to insure that the main gate flip-flop only sets high once after $\overline{ARM}$ goes low. If a 20 μs gate time were selected, the following sequence would occur after $\overline{ARM}$ returns high. U10(1) would output a negative-going pulse which serves as the reference time zero. This is inverted by Q4, Q3 so that U5A(1) receives a positive-going pulse. Since U5B was cleared by ARM, U5A(3) is high so that U5A(5) will clock high on the negative edge of the clock at U5A(1). U5A(5) is the $\overline{GATE}$ signal which opens the main gate on A18. U5A(6) goes low to set U5A(3) low and prevent U5A from being set again. $\overline{GATE}$ output is monitored as a qualifier on A19 to indicate when the gate time is over. U10(11) outputs a square wave with a 20 μs period. The 20 μs time pulse from U10(1) then clocks the high at U5A(2) such that U5A(5) goes low, thus closing the main gate.

4-101. SAMPLE RATE controls the "dead time" between measurements and is controlled by variable resistor R1 on the front panel. In operation, the START SAMPLE RATE command from A19 triggers one-shot U2 such that U2(8) goes TTL high for 4 ms. This high level saturates transistor Q1 so that capacitor C2 discharges through Q1. At the end of 4 ms, Q1 turns off which allows C2 to charge through R1 on the front panel toward +5 volts. Before the voltage on C2 reaches 5 volts, darlington transistor Q2 turns on and generates a TTL high level across R8. Since U2(6) is high, the output of U3D is a TTL low and is sent to the A19 processor as the $\overline{SR\ DONE}$ qualifier, indicating that the sample rate has timed out.

4-102. The BCD Adder takes two 4-bit BCD numbers, adds them, and outputs a BCD number. The numbers added are two serial BCD data strings. One serial string comes from the A18 counter and represents the IF actually counted by the counter. The other serial string comes from the A19 processor and represents the LO frequency. The sum is sent to the display as the measured input frequency.

4-103. The BCD adder is formed by binary adders U8 and U6. U7 and U4B are used to generate and store a carry when the results of the addition in U8 is greater than 10. The second binary adder, U6, adds binary 16 to the A input when there is no carry which means that the output of U6 is unchanged. When there is a carry, binary 6 is added to the A input which means that the output of U6 is equal to the input minus 10. Binary adder U8 adds the binary number at the A inputs to the binary number at the B inputs and also adds a carry from the previous addition at the C0 input. Each time data is shifted out of A18 to the BCD adder (least-significant-digit first), $\overline{ADD}$ clocks U4B which sets the carry input to U8. The C4 output of the U8 detects sums greater than or equal to 16. U7 is used to detect results greater than or equal to 10. When these carry, U7(8) goes low which causes U6 to add binary 6 and also sets U4B(8) high.

4-104. When the processor determines that nonsignificant leading zeros should be blanked, the digit 15 is sent by the A19 processor so that U8(4,16) are both high. This causes U3B(6) to go low which causes the $\overline{\Sigma A}$, $\overline{\Sigma B}$, $\overline{\Sigma C}$, and $\overline{\Sigma D}$ outputs to all go low. This is stored on A16 and causes the digit to be blanked.

4-105. As an example, suppose 750 from the ROM on A19 (representing 750 MHz LO) is to be added to 172 from the A18 counter (representing 172 MHz IF). The data is shifted into U8 serially with the least-significant digits first. First, 0010 at the A inputs to U8 is summed with 0000 at the B inputs to produce 0010. The result is less than 10_{10} so U7(8) is high. In U6, 0010 is added to 1111 along with the carry, represented as 0001 to yield 0010(2) at the output of U6. These outputs are inverted by U1 to give 1101 which is sent to A16. Next, 0111 at the A inputs to U8 is summed with 0101 at the B inputs to produce $1100(12_{10})$. Since this is greater than 9_{10}, U7(8) goes low such that U4B(8) is set high when $\overline{ADD}$ clocks it. This also causes U6 to add 0110 to 1100. This produces $0010(2_{10})$ at the output of U6. The last digits to be sent are 0001 from the counter and 0111 from the processor. These are summed along with the previous carry, to produce

$$\begin{array}{rr} & 0001 \\ & 0111 \\ \text{(carry)} & \underline{0001} \\ & 1001(9_{10}) \end{array}$$

So the result of the 750 + 172 addition is 922.

4-106. A18 COUNTER ASSEMBLY (05341-60018)

4-107. Counter assembly A18 (*Figure 8-19*) consists of: an ECL to TTL converter Q1, Q2, and U14B; first decade counter U10; main decade counter chain U1 through U8; multiplexer U9; and control gate logic U11, U12, and U14. The following paragraphs describe the basic functions of each of these, followed by descriptions of the sequence and phases of operation.

4-108. The 5 Hz to 40 MHz at pin 21 is either the IF ÷20 signal or the 80 MHz ÷2 signal in ECL form. The ECL to TTL converter converts -0.8V to -1.5.V ECL levels to 0V to +5V TTL levels. Q1 turns on to give a TTL high and Q2 is on to produce a TTL low. U14B serves as a buffer to drive main gate U14D. U14A is an unused gate, consequently it is tied to U10(1) to provide a TTL high.

4-109. The first decade U10 is a high-speed IC that gives a ÷10 output on the QD pin 12. U10 QA connects to the clock 2 input to configure the counter as a decade. All four outputs of U10 are routed to multiplexer U9. The QD output also connects to control gates which determine when the ÷10 output is routed to the remaining counters.

4-110. Main decade counter chain U1 through U8 are configured in a synchronous decade configuration with two basic modes of operation. In the count mode, the PE input is high. When PE is driven low, the counters operate in a shift mode. Both the CEP and CET inputs must be high to have the decade count. When PE is low, the P inputs are clocked by CP to the Q outputs. TC is a terminal count pin that goes high when the decade reaches a full count.

4-111. Multiplexer U9 determines whether the output of the first decade or the output of U8 is routed to the output lines to A17. When SO is high ($\overline{\text{SELECT}}$ low), the multiplexer routes the output of the main counter to the output lines DIGIT A through D.

4-112. The control gate logic U1 and U12 determine the modes for the counter and multiplexer as well as controlling the routing of the $\overline{\text{SHIFT}}$ pulses and signal pulses.

4-113. Dual inverters U13A-U13F and U11A-U11E provide sufficient fan-out driving power for the counter chain.

4-114. In a typical sequence of operation, $\overline{\text{ARM}}$ goes low momentarily to clear all counters. To accumulate counts, GATE goes high and $\overline{\text{SELECT}}$ goes high. With these two control lines high, the main gate U14D is enabled and U10 accumulates counts. When the count of U10 reaches 10, the QD output couples through U11F, U12D, and U12C to the CP line of the main counter chain. Since CEP and CET of U8 are high, U8 accumulates counts until 10 counts are reached. During this interval, U1 through U7 cannot accumulate pulses because the TC outputs of all counters are low. When U8 receives 10 counts, the TC pin gives a high pulse output causing U7 to accumulate one 10^1 pulse. As each of the decades receives 10 counts, the TC line goes high, to provide one pulse to the next decade.

4-115. The count accumulation continues until the GATE line goes low to close the main gate. At this point, Processor A19 takes over and first looks at the output of U10 (since U9 SO is low) and multiplexer U9 routes the output of U10 to the DIGIT A through D lines. Next, $\overline{\text{SELECT}}$ is driven low to disable U12D, enable U12A, set PE lines low to configure the counters in the shift mode, and drive SO high at U9 to configure the multiplexer to route the main counter output to DIGIT A through D lines.

4-116. Next in the sequence, the processor clocks the $\overline{\text{SHIFT}}$ line with ≈3 µs pulses. The F/10 test point may be used to check the shift pulses. On the first shift, U6 data shifts to U5, that is — the internal count of U6 appears at the Q_0 through Q_3 outputs of U6 and at the P_0 through P_3 inputs of U5. For each $\overline{\text{SHIFT}}$ pulse, a decade of the accumulated count is routed through multiplexer U9 to the DIGIT A through D output lines.

4-117. During certain operations, such as displaying the band number, a source of zeros is required. This is accomplished by setting $\overline{\text{SELECT}}$ low, then implementing the $\overline{\text{ARM}}$ function which clears all the counters. The main gate remains closed, thus the accumulated count is all zeros. The zeros are shifted out, and constants are supplied by the processor to display the appropriate band number.

4-118. The 470-ohm resistors at the inputs to U6 are used for factory testing and are not involved in the count operation.

4-119. A19 PROCESSOR ASSEMBLY (05341-60019)

4-120. A19 (*Figure 8-20*) consists of state machine circuits and interface circuits. The state machine consists of clock IC's U1 and U4B, state counters U16 and U19, ROM U15, programmable inverter U10B, qualifier decoders U3 and U13, qualifier storage U4A, and command decoders U2 and U20. The interface circuits interface the processor to other circuits in the instrument including the front panel controls and the HP-IB boards when installed.

4-121. State Machine Circuits

4-122. Clock oscillator U1 generates 3 μs pulses as determined by C4. The clock can be manually pulsed by shorting TP1 to TP2 and inputting pulses to the X-CLK test point. U4B is a ÷2 flip-flop which gives two 6 μs outputs out of phase. U11D functions a negative TTL pulse generator to clock state counters U19 and U16.

4-123. The state counters U16 and U19 are arranged to count from 0 to 255 using U16 to count the lower order bits and U19 for the higher order bits. When the MR input (master reset) is low, it overrides all other inputs and sets the counters to zero. The PE input determines whether the counters increment their count by 1 or accept parallel inputs at P_0 through P_3. The latter is used to perform jump routines. For jump routines, after PE is low, the next clock pulse causes the P_0 through P_3 inputs to transfer to the Q_0 through Q_3 outputs. During the count mode, when U16 receives 10 counts, the TC (pin 15) pin goes high momentarily to give a count in U19. The Q outputs of U16 and U19 determine the address for ROM U15. The truth table for the 256 outputs of U15 is given in *Table 5-10*.

4-124. U15 pin 13 is the command enable line. When the ROM output is to be used as a command, U15 pin 13 will be high. U5A and U5C select which command decoder is enabled for output. For example, with U15 pins 13 and 18 high, U5C(8) goes low to enable U2(18). When the clock goes low on U2(19), decoder U2 accepts the address generated by U15 pins 11, 19, 10, and 20, and drives the corresponding command output true.

4-125. The qualifier decoders U3 and U13 select a qualifier to examine as determined by its A through D inputs from U15. Only one qualifier decoder can be on at any one time. The selected qualifier is inverted and routed through to pin 10 of U3 or U13 when U13 or U3 pin 9 (S input) goes low. U4 accepts the qualifier which is inverted again by U10C. When the negative clock (output from U4BQ) clocks U4 the data is output on U4A (pin 5) to programmable inverter U10B, provided that U4A is not preset by U15(13) going high. The reason for clocking U4A on the negative clock is to allow the pulses to settle. Note that the positive clock (U4BQ) is used to clock the other circuits. The qualifier bit is stored in U4 so that the qualifier select can be changed. U4 stores the last result until the clock drives U4 to examine the latest D input.

4-126. U10B is a programmable inverter. Since it is an exclusive OR gate, the status of pin 5 determines if pin 6 input is inverted or not inverted at pin 4. For example, if pin 5 is high and pin 6 is high then pin 4 is low, also pin 5 high and pin 6 low gives a high at pin 4; thus, in this case, U10B acted as an inverter for the input at pin 6. If pin 5 is low, a high at pin 6 gives a high at pin 4. Also with pin 5 low and pin 6 low then pin 4 is low. In this case, U10B acted as a non-inverting gate. This is used to advantage to cause a jump for high qualifiers or low qualifiers as determined by the state of U15(17).

4-127. Overall, the state machine can perform four basic operations as determined by the status of U15 pins 13 and 17 as follows:

	O_{15} U15(13)=	O_{14} U15(17)=
1. Command and count	H	L
2. Command to GO TO	H	H
3. Examine qualifier and jump if Q=H	L	H
4. Examine qualifier and jump if Q=L	L	L

4-128. A forced jump can be implemented instead of "IF then GO TO" by presetting U4A. U4A will preset when U15(13) and U15(17) are both high. This drives U10B(4) low to preset the state counter to the ROM outputs.

4-129. State Machine Functions, Flowcharts, and ROM Listings

4-130. The following paragraphs describe how the state machine performs command and count, command and GO TO, examine qualifier, and jump IF Q=H. Except for the qualifier state, the examine qualifier and jump IF Q=L state is similar to the jump IF Q=H. The flowcharts in *Figure 5-3* and the ROM listing in *Table 5-10* will be used to illustrate these four functions.

4-131. COMMAND AND COUNT An example of command and count can be seen in *Figure 4-1*. Command C26 is RESET SYSYEM which is used to reset RS flip-flops in U6. Command C26 is located at octal address 015 (ØØ ØØ1 1Ø1 binary, 13 decimal). Referring to *Figure 8-20*, for C26, state counters U16 and U19 will give the following inputs to U15; I_7=Ø, I_6=Ø, I_5=Ø, I_4=Ø, I_3=1, I_2=1, I_1=Ø, I_0=1, where 1=H and Ø=L. When U15 is so addressed, its output, which can be found in *Table 5-10*, is O_{15}=1, O_{14}=Ø, O_{13}=1, O_{12}=1, O_{11}=1, O_{10}=Ø, O_9=1, O_8=Ø, O_7=Ø, O_6=Ø, O_5=Ø, O_4=Ø, O_3=Ø, O_2=Ø, O_1=Ø, O_0=Ø. Since O_{14} is low and O_{15} is high, the state machine is in the command and count mode. O_{15} high drives U5A(2) and U5C(10) high. O_{12} high is inverted by U11A and drives U5C(9) high. This results in U5C(8) driving U2(18) low, thus U2 is enabled. The input on U2 address lines is the output of U11F, C, E, B which is the inverted output of U15 O_8, O_9, O_{10}, and O_{11}. U2 will receive an address of A=H, B=L, C=H, and D=L. This corresponds to a decimal address of 5, thus U2 pin 6 is active to give command C26 RESET SYSTEM.

4-132. With O_{15} high, U4A is preset so that U4A(5) is high. This is routed to U10b which has pin 6 high and 5 low. This results in U10B(4) high which drives the PE lines of U16 and U19 high, thus the state counters will increment. Referring to *Figure 4-3*, the flowchart shows that C26 is followed by another command C22 at the next high address O_{16}.

4-133. COMMAND AND GO TO. *Figure 4-3* shows a portion of the flowchart which illustrates a command and GO TO routine at SET FLAG C23. Use the flowchart and ROM truth table in the same manner as the preceding example. U15 outputs for address O_{20} are O_{15}=H, O_{14}=H, O_{13}=H, O_{12}=H, O_{11}=L, O_{10}=H O_9=H, O_8=H, O_7=L, O_6=H, O_5=H, O_4=L, O_3=L, O_2=L, O_1=L, O_0=L. Since O_{14} is high and O_{15} is high, the state machine is in the command and GO TO mode. O_{15} high drives U5A(2) and U5C(10) high. O_{12} high is inverted by U11A and drives U5C(9) low. This results in U5C(16) driving U2(18) low. The input on U2 address lines will be A=L, B=L, C=L, D=H. This corresponds to a decimal address of 8 which gives an active output on the C23 command line. With O_{15} high, U4A is preset so that U4A(5) is high. This is routed to U10B which has pin 6 high and pin 5 high. This results in a low on U10B(4) which drives the PE lines of U16 and U19 high. Thus the state counters will jump to the address on their P_0—P_3 inputs on the next clock pulse. These address inputs for U15 are I_7=O_7=L, I_6=O_6=H, I_5=O_5=H, I_4=O_4=L, I_3=O_3=L, I_2=O_2=L, I_1=O_1=L, and I_0=O_0=L. This addresses the ROM to octal address 140. This is shown in the partial flowchart in *Figure 4-4*.

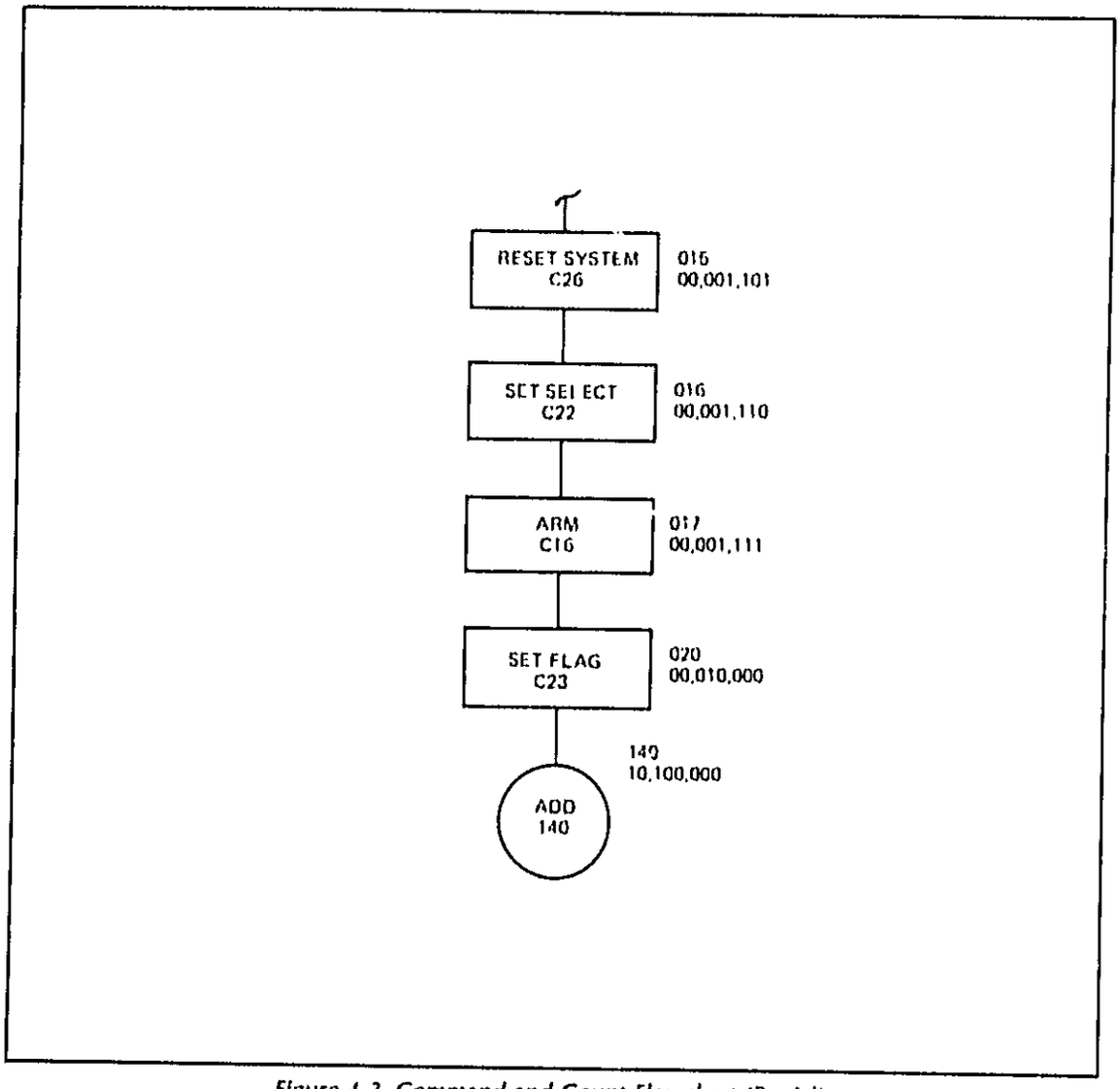


Figure 4-3. Command and Count Flowchart (Partial)

4-134. Examine Qualifier and Jump IF Q=H. *Figure 4-4* shows a portion of the flowchart which illustrates an "Examine Qualifier and Jump IF Q=H" at CHECK Q31. Use the flowchart and ROM truth table in the same manner as the preceding example. U15 outputs for address 003 are O_{15}=L, O_{14}=H, O_{13}=L, O_{12}=H, O_{11}=H, O_{10}=H, O_9=H, O_8=H, O_7=L, O_6=L, O_5=L, O_4=L, O_3=L, O_2=H, O_1=L, O_0=H. Since O_{14} is high and O_{15} is low, the state machine is in the "Examine Qualifier and Jump IF Q=H". O_{15} low disables U5A so neither of the command decoders are enabled. Also O_{15} low does not preset U4A so that it is free to store a qualifier. With O_{12} high, U11A inverts this to drive U13(9) low which selects U13 to examine a qualifier as selected on U13 address lines. The U13 address is A=L, B=L, C=L, D=L, this is decimal Ø so that U13(8) is active to select the Q31 qualifier. If Q31 is high, U13(10) is low. Since U10C(9) is high and U10C(8) is low, then U10C(10) will be high. When U4A clocks, U4A(5) and U10B(6) will be high. Since O_{14} is high, U10B pin 5 is high and U10B pin 6 is high. This gives a low at U10B(4) and the PE inputs of the state counters. Thus the counters will jump the address on their P_0—P_3 inputs. The address inputs for U15 are I_7=O_7=L, I_6=O_6=L, I_5=O_5=L, I_4=O_4=L, I_3=O_3=L, I_2=O_2=H, I_1=O_1=L, I_0=O_0=H. This addresses the ROM to octal address 005 (BAND $\overline{\text{O COMMAND}}$). Thus the state machine has examined a qualifier, determined if qualifier was 1, found that it was, and jumped rather than incremented.

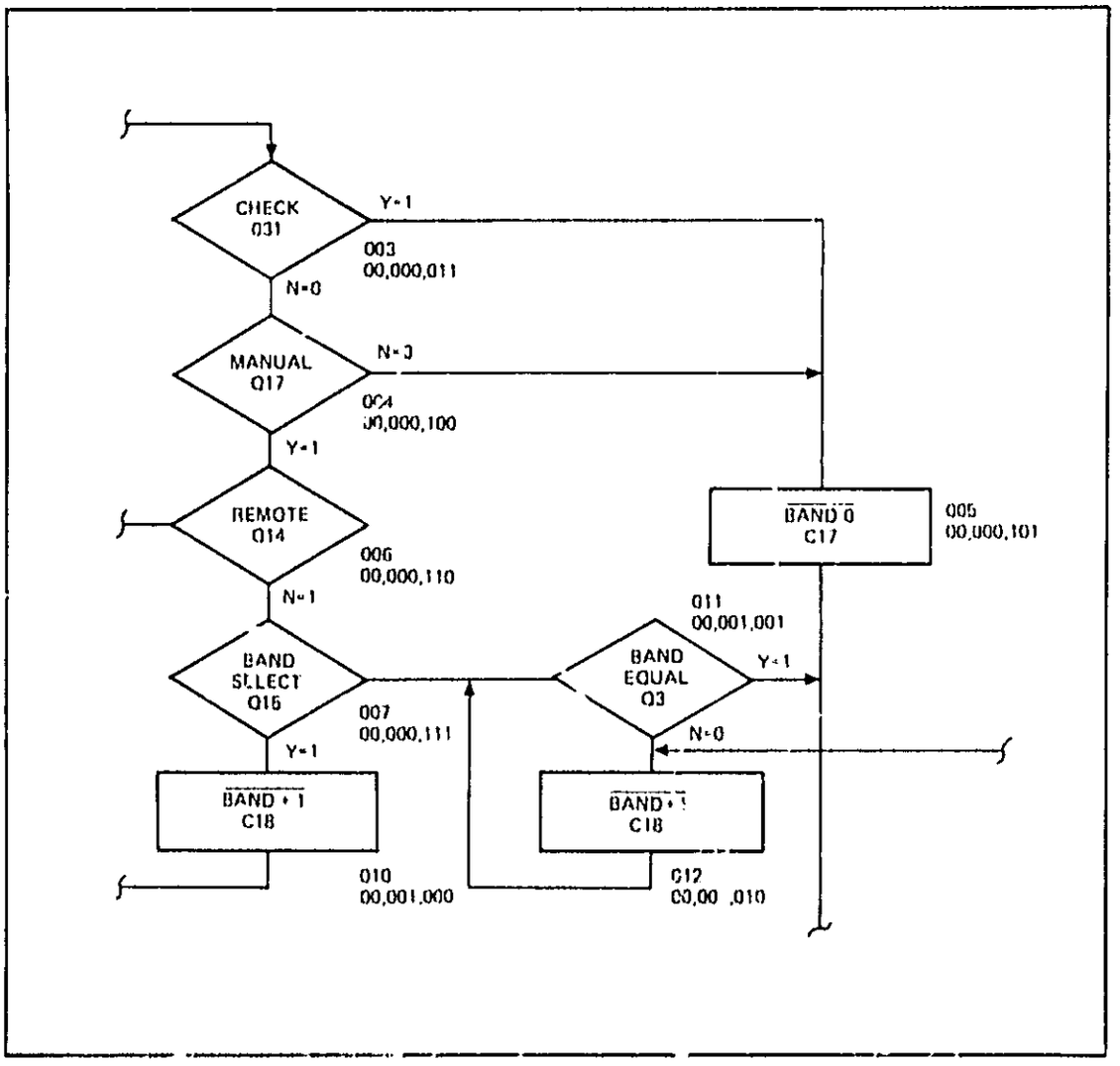


Figure 4-4. Qualifier Examination Flowchart (Partial)

4-135. Typical Flowchart Operation

4-136. The following paragraphs describe how the flowchart can be used to determine a typical sequence of operations. For this example, assume the following front panel control settings:

AUTO/MANUAL ..... AUTO
RANGE ..... 50 MHz to 4.5 GHz
RESOLUTION ..... 1 kHz
SAMPLE RATE ..... minimum

4-137. This starts the 5341A at the beginning of the flowchart at START and STATE RESET as shown in the upper left of *Figure 5-3* (Sheet 1). The command C12 $\overline{\text{RELEASE}}$ enables the display's internal clock. Next the state machine determines if the front panel RESET switch was pressed or if the power has been turned off then on. If so Q10=1 and the state machine goes through the add routine 140 to display zeros. The add routine is on sheet 2 and will be discussed later. At the end of the add routine, the state machine goes to sample rate 043. After the sample rate subroutine, the state machine goes to search 057 as shown in the lower right of *Figure 5-3* Sheet 1.

4-138. The search routine starts at address 057 shown toward the left center of *Figure 5-3* Sheet 1. Address 057 determines if the counter is in the 80 MHz mode, since the front panel switch is set to 50 MHz to 4.5 GHz, the qualifier for EIGHTY is NO=0, this increments the state machine to octal address 060 rather than jump to 021. Address 060 determines whether the counter is in MANUAL. Since the counter is in AUTO, the qualifier is N=0 and the state machine jumps to 077 $\overline{\text{BAND O}}$ C17 rather than increment to 061.

4-139. Command C17 $\overline{\text{BAND O}}$ resets the band counter A10U4 to the lowest band 15 MHz to 515 MHz. The state machine now increments to address 100 $\overline{\text{LATCH BAND}}$ command C20 which causes A10U1 to store the current band (BAND O). Next, the $\overline{\text{RESET SYSTEM}}$ command C26 is given to reset the 3 flip-flops A19U6A, C, D, and G. This includes the flag FF A19U6G and H. When the flag is reset (low) it indicates that the state machine must go through search twice, if flag is high then one search cycle has been completed.

4-140. After $\overline{\text{RESET SYSTEM}}$, qualifier LPD Q27 is examined. LPD is false if there is no signal or if the signal is too weak to measure. If LPD is false, the state machine increments to 103 which increments the band to band 1. Next the BAND D and the BAND A lines are examined to determine if the band is band 9. If not the LPD qualifier is examined again. This is the manner in which the counter steps through the bands looking for a signal. When the LPD qualifier is true, the HPD qualifier Q25 at address 115 is examined. If HPD is false, FD is examined and if FD is false, the $\overline{\text{BAND +1}}$ command is given. If FD is true, the $\overline{\text{BAND O}}$ command is given followed by 112, 113, and 114 to light the asterisk light. Overall, this loop found proper LPD and FD qualifiers but HPD was false, this indicated that a good low frequency signal was acquired but it was not sufficient to operate the counter in AUTO so the asterisk light was activated.

4-141. Going back to LPD at 102. If LPD, FD, and HPD are true, the FLAG qualifier is examined. If the search routine has gone through once, the FLAG will be false and the LATCH BAND command is executed to store the band number corresponding to where the first signal acquisition took place. Next the $\overline{\text{BAND O}}$ command returns the band to band O. Then the FLAG is set to indicate one successful search acquisition. After the set flag command, the state machine goes back to LPD at address 102. If LPD, HPD, and FD are proper, the flag is examined. Since the state machine has found the signal twice, Flag is true and Band Equal is examined. If the acquired signal is in the same band as the previous acquisition, Band Equal is true and the set signal command is executed. The set signal goes to signal flip-flop A19U6D. U6D AND's this with an AND'ed LPD, HPD, FD signal combination. This gives an output from U6D that "signal is true." After the set signal command, the state machine goes to address 021 to start the measure routine.

4-142. The measure routine gives command and check qualifiers as shown on *Figure 5-3* then goes to the add routine at address 140. To trace through the flow for these routines, use the flowcharts in *Figure 5-3*, and the qualifier and command lists in *Tables 5-3* and *5-4*.

4-143. For the add routine, addresses up to 200 determine the resolution. Addresses from 200 to 313 determine the constant to be added and from state 314 and upward handles the peak detectors and FD on the display.

4-144. *Table 5-5* gives a typical ASM sequence for a 1 GHz measurement in AUTO, 1 K RESOLUTION, and 50 MHz—4.5 GHz range.

4-145. A20, A21, A22 POWER SUPPLY CIRCUITS (05341-60020, 05341-60021, 05341-60022)

4-146. The power supply circuits are shown in *Figure 8-21*. Primary power connects to the power module via J3. The power module includes a fuse F1 and a printed circuit line selector. The schematic shows the line selector installed for 120V operation. Other line selections and their connections are shown on the schematic below the power module. The line selector determines the right combination of the primary winding connections of T1 for the various input power voltages.

4-147. Relay K1 is controlled by the main POWER switch S1. When S1 is in the STANDBY position, K1 is deenergized to disconnect all supplies from the regulator circuits except for the +12V line to A14(14) This line supplies oven power to Oscillator Assembly A14 and keeps the oven up to operating temperature provided that the counter's power plug is left connected to the power mains. This is true even through the primary POWER switch is STANDBY. When K1 is energized, the output of the rectifiers are connected to the regulators to develop +5V, -5V, -15V, and +15V.

4-148. A24 OPTION 001 REMOTE ADDRESS SWITCH (05341-60032) AND A26 OPTION 011 ASCII INPUT ASSEMBLY (05341-60029)

4-149. A24 (*Figure 8-22*) contains the address switches A1 through A5 and the ADDRESSABLE-TALK ONLY (ALWAYS) switch. When the switch is set to TALK ONLY, the counter is put in the TALK mode so that whenever the Bus is in the Data mode, it will output its measurement data if there is at least one addressed listener. In the TALK mode, it cannot receive program codes and cannot be unaddressed from talking by a controller. In the ADDRESSABLE mode, a controller is required so that the counter can be addressed to listen to receive its programming codes and addressed to talk to send its measurement data.

4-150. For addressing, the address switches A1 through A5 feed to A26U9 which also receives the DIO1 through DIO5 bus lines. When the address on the bus is the same as the setting on the address switch A26U9 gives an A=B true on pin 14 to indicate that the counter is addressed.

4-151. A26 contains state machine circuits to generate commands and examine qualifiers, address circuits, and HP-IB circuits.

4-152. The state machine circuit consist of ROM U13, address counters U16 and U6, qualifier selectors U1 and U10, command selector U2, and stored bit IC's U3 and U4. The address counter receives clock pulses from U14D and U14C which are driven by the clock from the processor board A19. The address counters can increment the ROM address by one or can jump when a jump statement is loaded into P_0 through P_3 inputs of U6 and U16. The operation of U6, U16, and U13 is similar to the state machine on the Processor Board A19. See paragraphs 4-121 through 4-128 for a detailed explanation of algorithmic state machine principles. U14B is a programmable inverter that is used to determine if U6 and U16 increment their count by 1 or jump on a high or low qualifier.

4-153. U15B receives the various qualifiers and functions as a synchronizer to latch the qualifier until a clock pulse arrives. Fifteen qualifiers are fed to U10 and U1. The S inputs of U1 and U10 select which qualifier will be routed to the Z output when the E input is true. U5F inverts the E line to U1 so that either U1 or U10 can be selected but not both at the same time. The selected qualifier from either U10 or U1 connects to U14A for routing to U15.

4-154. All commands are generated by U2. ROM U13 drives U2 pins 13, 14, and 15 to determine which command is selected. U12A determines when a command is to be given. When U12A(1) receives a clock pulse, U12A(3) goes low. The selected output of U2 goes low to produce a command. One of four commands can be given: LATCH REMOTE BAND, REMOTE RESET, and two stored bit commands for U3 and U4.

4-155. LATCH REMOTE BAND command C6 works in conjunction with the remote program code for a desired band. The band program code is sent to Band Selector A10 and when the LATCH REMOTE BAND command is executed, the band is latched into A10 for later use.

4-156. REMOTE RESET command C5 resets the counter. This occurs for several functions, for example, if the resolution is changed remotely, the REMOTE RESET command will be given in between resolution changes. See flowcharts in *Figure 5-4* for other examples.

4-157. The remaining commands are used for stored bits in U3 and U4. C_0 and C_1 enable U3 and U4 respectively. U3 and U4 are addressed by inverted outputs from U13 via U5. An example of the stored bits is RES A, B, C which are outputted in the proper combination, to determine the remotely-programmed resolution. Some of the stored bits are routed through U11, a tri-state converter. when U11(15,1) is high, it disables the inputs from appearing at the outputs.

4-158. Stored bit S_0 determines when the local controls are locked out. The front panel RESET switch acts as a return to local switch in addition to resetting the counter.

4-159. WAIT, HOLD, and FAST stored bits determine the sample rate modes. FAST configures the counter to make measurements as fast as possible. HOLD stores the measurement until triggered.

4-160. A25 OPTION 011 REMOTE OUTPUT ASSEMBLY (05341-60028)

4-161. The Remote Output Assembly (*Figure 4-23*) processes the measurement and converts it to the proper format in ASCII code for the HP-IB. The output format is shown in the 5341A output code set in *Table 3-2*.

4-162. RAM A25U7 stores the measurement digits which come in on J1(8, 9, 10, and 11). The digits are stored into the RAM as determined by address selector U1. U1 can be configured to count up or count down. U1(11) is the load-enable line and connects to the GRAB line from A19U20. When U1(11) is low, the low inputs on pins 1, 9, 10, and 15 are loaded into the counter. Count up and down pulses are used to write in or read out of the RAM.

4-163. The algorithmic state machine consists of ROM U10, U6, U5, and U9. Unlike the state machines described in A19 and A26, U10 has no address counter. The addresses for U10 are self generated by the O_0 through O_6 output lines being fed back to the I_0 through I_7 input lines via U6 and U5A and B. For a particular address, the O_0 through O_6 outputs are stored in U6-U5 until a clock pulse arrives to switch the stored address into the U10 inputs. Thus the ROM address does not increment but will jump to the stored address.

4-164. Qualifier inputs are routed to the I inputs of U9. The select inputs are determined by U10 and determine which qualifier is routed to the pin 15 of U9 and to U5A. This allows the ROM address to be modified by the state of the selected qualifier.

4-165. Qualifier definitions are as follows:

BLANK means that a blank digits is required and the RAM U7 outputs 1111. This is detected by U3B and sent as a qualifier to U9.

COUNT 9 indicates that the last digit of the display is being processed thus indicates completion of processing a particular measurement.

ZERO is obtained by tying U9(9) to ground. This causes branching to zero (never one) on the flowcharts where this is required. See *Figure 5-5*, sheet 1 of 4 for examples. The NP on the flowcharts indicates NOT POSSIBLE to branch to 1.

RES, A, B, C are qualifiers from the mainframe which is required in order to determine the exponent of the received measurement. This is used to determine whether to output E+6, E+9, or E+3.

RFD and DAC are HP-IB qualifiers used in the HP-IB handshake sequence. RFD is "ready for data" and indicates that the HP-IB is ready to receive data from the 5341A. DAC is "data accepted" and indicates that the HP-IB has received data from the 5341A.

4-166. RAM U7 is wired OR'ed with ROM U8 and outputted to the DIO lines. U7 outputs numbers for measurement values while U8 is used to supply other characters such as E, space, exponents 3, 6, and 9, carriage return, etc See *Table 5-6* for U8 output codes. U11 and U12 are high current drivers to drive the bus.

4-167. U3D determines when special characters are received and drives U13. U13 gives a delay until the clock arrives, then U13 produces a DAV output to indicate data is valid.

4-168. Flowcharts for the HP-IB Boards

4-169. The flowcharts for the HP-IB boards are shown in *Figure 5-5* Chart B sheets 1 through 4. For a fundamental discussion of ASM flowcharts, see paragraphs 4-129 through 4-141. The flowcharts for HP-IB are similar to those described previously. One difference is that *Figure 5-5* has blank command statements such as 001 This is because the state machine has no address counter and uses commands and decision blocks in pairs. Also the flowcharts have some forced branch statements such as ZERO where branching to 1 is not possible, thus the decision for ZERO is forced to 0.

4-170. Overall, the flowchart shows the decision making process involved in converting the counter measurement to an ASCII compatible output in the form 1.2345678E 0X where S can be 3, 6, or 9. Also an exponent + sign, spaces, and a carriage return and line feed must be generated. During self-test, additional characters are required which include S for self-test, commas, and 0 or 1's for the LPD, HPD, and FD qualifiers (see *Table 3-3*).

4-171. Many of the states are redundant and will be explained before examining the flow. RFD is ready for data and if false, causes looping until RFD is true. DAC is data accepted and "asks" if the bus has accepted the data; if not, it continues to output until DAC is true. Count down causes U1(4) on A25 to drive the RAM to the next lower address. There are several codes =XXXX. These generate characters such as decimal point, E, +, 9, 5, 6, 3. The digit code 0011 adds the necessary digits to convert numbers to the ASCII format. CR/LF is carriage return/line feed which serves as a terminator on the bus. RES A, B, C are resolution switch inputs to allow the circuits to determine data pertinent to the decimal point placement.

4-172 An easy way to trace through the flowcharts in a typical sequence of operation is to examine a typical output and trace backwards through the flowcharts. Referring to *Table 3-2*, the required output is: SP (space), 1 to 3 digits, . (decimal point), 0 to 9 digits, E (exponent), + (exponent sign), CR (carriage return), LF (line feed). To see how this is outputted, refer to *Figure 5-5*, sheet 4 of 4. At the lower right, starting with the DONE statement which results in a reset, tracing back shows the line feed generated at address 133. Preceding this is the carriage return generated at address 131. This is preceded by branching to 021 if in self-test or back to address 320 then 311. Tracing back further depends on whether a 3, 6, or 9 exponent was generated. If it was a 3, then the flow traces back to sheet 3, or sheet 2 for exponent 6, or back to sheet 1 for a 9 exponent.

4-173. Assuming that the exponent was a 9 and tracing back through sheet 1 shows a 9 generated at address 033, this is preceded by a + code at 031, then an E code at 027. Preceding this is a loop to generate measurement digits (addresses 024, 221, 222, etc.). Digits will be outputted until count 9 is true indicating that the RAM address counter has cycled through one measurement reading. This is preceded by a decimal point at 021, then the digit preceding the decimal point is generated at 017. Preceding this is examinations of the resolution codes and blanks to determine which sheet (exponent +3, +6, +9) to branch to.

4-174. In between the output codes are RFD and DAC examinations to determine if the bus has accepted data and if the RFD line indicates ready for data.

SECTION V
MAINTENANCE AND TROUBLESHOOTING

5-1. INTRODUCTION

5-2. This section contains maintenance and service information.

5-3. RECOMMENDED TEST EQUIPMENT

5-4. A list of recommended test equipment is given in Section I.

5-5. ASSEMBLY DESIGNATIONS

5-6. *Table 5-1* lists the designations, names, and Hewlett-Packard part numbers of all standard and optional assemblies in the 5341A.

Table 5-1. Assemblies in 5341A Counter

REFERENCE DESIGNATION	NAME	HP PART NUMBER (05341-OMITTED)
A1	Mixer (not field repairable, order factory rebuilt assembly 05341-60501).	-60001
A1A1	Input Switch	-60025
A1A2	Mixer	-60024
A1A3	Filter-Amplifier	-60002
A2	Switchable Filter (not field repairable, order factory rebuilt assembly, 05341-60548).	-60048
A2	High-Pass Filter (Option 003)	-60023
A3	500—1000 MHz Doubler	-60003
A3A1	500—750—1000 MHz Multiplier	-60026
A3A2	500—1000 MHz Doubler	-60027
A4	Prescaler	-60004
A5	IF (Video) Detector	-60005
A6	250—500 MHz Multiplier	-60006
A7	250—750 MHz Multiplier	-60007
A8	50—250 MHz Multiplier	-60008
A9	10—50 MHz Multiplier	-60009
A10	Switch Driver	-60010
A11	Buffer	-60011
A12	80 MHz Direct Amplifier	-60012
A13	RF Motherboard	-60013
A14	10 MHz Oscillator (Standard) (not field repairable).	-60047
A14	10 MHz High Stability Oscillator (Option 001) (not field repairable, order factory rebuilt assembly, 10544-60511)	10544-60011
A15	Display	-60015
A16	Display Driver	-60016
A17	Time Base	-60017
A18	Counter	-60018
A19	Processor	-60019
A20	Power Supply	-60020
A21	Power Supply Motherboard	-60021
A22	Voltage Regulator	-60022
A23	Resolution Switch	-60014
A24	Remote Address Switch (Option 011)	-60032
A25	Remote Output (Option 011)	-60028
A26	Remote Input (Option 011)	-60029

5-7. IN-CABINET PERFORMANCE TEST

5-8. The in-cabinet performance test given in *Table 5-2* may be used to verify proper operation of all circuits in the 5341A.

Table 5-2. In-Cabinet Performance Test

1. On rear panel of 5341A check that printed circuit line voltage selector board shows number (100 or 120 or 220 or 240) corresponding to line voltage to be used. (Refer to Section II for line voltage selection instructions if necessary.) Check that the correct fuse is installed for the available line voltage. Set 5341A POWER switch to STANDBY. Connect 5341A to power source.
2. Disconnect any signals from the 5341A.
3. Set 5341A controls as follows:

   RESOLUTION switch ..... 1 Hz
   SAMPLE RATE control indicator ..... UP
   RANGE switch ..... CHK
   AUTO-MANUAL switch ..... AUTO
   POWER switch ..... ON

4. The counter should display:
   a. 0.000000001 GHz for about 3 seconds. (This tests all the LED digits segments.)
   b. then 0000kHz GATE (•) is displayed for about 20 seconds.
   c. then 0.000000000 GHz (±1 count) is displayed for about 1 second.
   d. then 0.000000000 GHz (±1 count) GATE (•) is displayed.
   e. then displays c. and d. alternate.
5. Push the RESET switch and display a. b. c. d., and e. above will be repeated.
6. Slide the RESOLUTION switch through its other six positions, the results should be similar to step 3. above except that one less digit is illuminated for each switch position change, and the intermediate zeros only display is progressively shorter until it is not discernible.
7. With the RESOLUTION switch set to 1 MHz, check that the display is 0.000 GHz (±1 count) with the GATE (•) lamps flashing.
8. Set the RESOLUTION switch to 10 Hz. Turn SAMPLE RATE control clockwise stopping about every 10° of rotation. As the control is turned clockwise the interval when the GATE and • lamps are on remains the same, but the interval when the GATE and • lamps are off increases from almost no time off to about 10 seconds off.
9. Turn the SAMPLE RATE control to HOLD, the GATE and • lamps will be off and the GHz display will be "held" indefinitely.
10. Set the 5341A RANGE switch to 10 Hz—80 MHz.
11. Connect an appropriate signal generator to the 5341A 10 Hz--80 MHz 1MΩ INPUT. Set the signal generator for 10 millivolts output at 10 Hz. Vary the signal generator frequency from 10 Hz to 80 MHz with 10 millivolts output. The 5341A should display the correct output frequency of the signal generator for the entire 10 Hz to 80 MHz range.
12. Set the 5341A RANGE switch to the 50 MHz—4.5 GHz position.

NOTE

When making high frequency sensitivity checks, it is important to recognize that cable losses can be appreciable. Amplitude differences as high as 20 dB can exist between the generator output jack and the cable end connected to the 5341A. When determining sensitivity using generators with a calibrated output meter, include cable loss. A preferred method is to measure actual signal strength at the cable end (properly terminated) using a power meter capable of measuring the signal of interest.

Table 5-2. In-Cabinet Performance Test (Continued)

CAUTION

Do not exceed 1 watt of input power (+30 dBm) under any circumstances. Extensive internal damage may occur. See Section III for a complete explanation of input levels.

13. Set an appropriate signal generator for -15 dBm output at 50 MHz and connect the output to the 5341A 50 MHz—4.5 GHz INPUT. Vary the signal generator(s) frequency from 50 MHz to 4.5 GHz at -15 dBm. The 5341A should display the correct output frequency of the signal generator(s) for the entire 50 MHz to 4.5 GHz range.

14. Set the 5341A BAND SELECT AUTO-MANUAL switch to MANUAL. Press the 5341A RESET switch. Change the signal generator output level to -20 dBm. Change the signal generator output frequency and the 5341A BAND SELECT pushbutton according to the following table. Adjust the signal generator frequencies from low to high. The upper limit should be checked with increasing frequency as decreasing frequencies will result in a different switching point.

Number of Times 5341A BAND SELECT Button Pressed after RESET	Frequency of Signal at 5341A INPUT and Correct 5341A Display	
BAND NUMBER	LOW	HIGH*
0	50 MHz	530 to 565 MHz
1	515 MHz	780 to 850 MHz
2	765 MHz	1.03 to 1.15 GHz
3	1.015 GHz	1.53 to 1.56 GHz
4	1.515 GHz	2.03 to 2.06 GHz
5	2.015 GHz	2.53 to 2.56 GHz
6	2.515 GHz	3.03 to 3.06 GHz
7	3.015 GHz	3.53 to 3.56 GHz
8	3.515 GHz	4.03 to 4.06 GHz
9	4.015 GHz	4.53 to 4.56 GHz

*Note that the high frequency end of each band is specified as a range rather than a specific frequency. The counter will respond to at least the lowest end frequency in each "High" range.

15. On 5341A rear panel, set INT-EXT switch to EXT. Connect a 10 MHz signal at 1.5V p-p to 10 MHz INPUT BNC connector. Check that 5341A operates properly. Disconnect the 10 MHz signal, and set INT-EXT switch to INT.

16. On 5341A rear panel, measure signal at 10 MHz OUTPUT connector using 10:1 divider probe on an oscilloscope. Check that oscilloscope displays a 10 MHz signal with at least a 2.4V p-p amplitude.

5-9. PREVENTIVE MAINTENANCE

5-10. Preventive maintenance consists of cleaning the fan filter on the rear panel as required. The in-cabinet performance check should be made periodically to assure the 5341A is within specifications.

5-11. ADJUSTMENTS

5-12. Procedures for adjusting the counter so it will operate properly are given in the following paragraphs. These procedures should be used when the counter does not operate according to specifications, but it has been determined that no parts are faulty. Or if the in-cabinet test has been performed and the results indicate that adjustment is necessary.

5-13. Power Supply Adjustments (A20, A21, A22)

5-14. Use the following procedure to adjust the power supply for proper operation.

a. +5 Volt Adjustment
   1. Connect voltmeter to A20(6, 6).
   2. Adjust A20R8 for a +5V reading on voltmeter.

b. -5.2 Volt Adjustment
   1. Connect voltmeter to XA3(12) on motherboard A13.
   2. Adjust A22R2 to -5.2 volts on voltmeter.

c. -15 Volt Adjustment
   1. Connect voltmeter to the point on Power Supply Motherboard A21 labeled "-15V" (violet wire).
   2. Adjust A22R4 for -15 volts on voltmeter.

d. +15 Volt Adjustment
   1. Connect voltmeter to XA12(2, 2).
   2. Adjust A22R6 to +15 volts on voltmeter.

5-15. (1 MegΩ INPUT) Amplifier Adjustment (A12)

5-16. Use the following procedure to adjust the 80 MHz amplifier for proper operation.

a. Connect an 8640 Signal Generator to "10 Hz—80 MHz" input BNC on 5341A using a 50-ohm feedthrough termination.

b. Set 8640 to 1 MHz at 30 mV rms output.

c. Set 5341A RANGE switch to "10 Hz—80 MHz" and RESOLUTION switch to 100 Hz.

d. On A12 High Impedance Amplifier adjust potentiometer A12R32 for a stable count.

e. Continue to decrease input signal level and adjust A12R32 for maximum sensitivity.

f. Verify that the 5341A properly measures input signals of 10 mV rms or less. From 10 Hz to 80 MHz.

5-17. 10 MHz Oscillator Adjustment (A14)

5-18. For the standard oscillator (05341-60047), use the following procedure to adjust the 10 MHz oscillator for proper operation.

a. Connect J5 10 MHz output, available on the 5341A rear panel to the input of a high resolution frequency counter such as an HP 5345A. Connect a suitable external frequency standard (such as HP 5061A Cesium Beam) to the external oscillator input of the 5345A.

b. Remove the A14 Oscillator board from the 5341A and note the frequency marked on the top label (FREQ SET). Add the FREQ SET value to 10.000000 MHz and make note of it. Reinstall the board.

c. Use an insulated tuning tool to adjust the oscillator for a 5345A display of the frequency noted in step b.

5-19. Option 001 Optional Oscillator (10544-60011)

NOTE

The 5341A must have primary power applied for at least 24 hours to allow the oscillator temperature to stabilize.

a. Set controls on oscilloscope as follows:

Channel A 0.2V/cm, dc coupled; +up
Sweep 0.05 μs/cm
Trigger; Ext, +slope, ACF
Mode to Norm
Display to Channel A

b. Connect a suitable 1 MHz, 5 MHz, or 10 MHz frequency standard (such as an HP Cesium Beam) to the EXT Input on oscilloscope.

c. Connect oscilloscope Channel A to 10 MHz output (J5) available on 5341A rear panel.

d. Adjust oscillator FREQ ADJ for minimum sideways movement of the oscillator signal.

5-20. 10 to 50 MHz Multiplier Adjustment (A9)

5-21. Use the following procedure to adjust the A9 10 to 50 MHz multiplier for proper operation.

a. Set the 8555A spectrum analyzer as follows:

FREQUENCY ..... 50 MHz
BANDWIDTH ..... 100 kHz
SCAN WIDTH ..... 10 MHz/Div
INPUT ATTEN ..... 20 dB
SCAN TIME ..... 5 ms
LOG REF LEVEL ..... +10 dB

b. Place spectrum analyzer probe tip at XA9(7) with probe grounded at XA9(7).

c. Tune the variable capacitors A9C13 "50 MHz 1," A9C15 "50 MHz 2," and A9C19 "50 MHz," for a maximum 50 MHz signal as observed on the spectrum analyzer. Repeat the procedure to obtain an optimum setting.

d. Tune the variable capacitor A9C4 "10 MHz" for maximum 50 MHz output level.

e. The 50 MHz signal should be at least 0 dBm, with sidebands down 50 dB.

f. Using a tuning wand or other insulated tool press lightly on the side of each variable capacitor. The output must remain constant.

5-22. 50 to 250 MHz Mutliplier Adjustment (A8)

5-23. Use the following procedure to adjust the A8 50—250 MHz multiplier for proper operation.

a. Set the 8555A spectrum analyzer as follows:

FREQUENCY ..... 250 MHz
BANDWIDTH ..... 300 kHz
SCAN WIDTH ..... 50 MHz/Div
INPUT ATTEN ..... 20 dB
SCAN TIME ..... 5 ms
LOG REF LEVEL ..... +10 dB

b. Connect spectrum analyzer probe through a 50Ω load to XA8(2). Ground probe at XA8(3).

c. Tune the variable capacitors A8C5 "50 MHz," C11 "250 MHz 1," and C13 "250 MHz 2" for a maximum 250 MHz output level as observed on the spectrum analyzer. Repeat so as to obtain an optimum setting. The signal should be approximately +3 dB with the 200 and 300 MHz sidebands at least 40 dB below the 250 MHz level.

d. Connect the spectrum analyzer probe to XA8(14) and ground probe at XA8(14). The 250 MHz signal should be +3 dBm.

5-24. 250 to 500 MHz Multiplier Adjustment (A6)

5-25. Use the following procedure to adjust the A6 250—500 MHz multiplier for proper operation.

a. Set the 8555A spectrum analyzer as follows:

FREQUENCY	500 MHz
BANDWIDTH	300 kHz
SCAN WIDTH	100 MHz/div
INPUT ATTEN	30 dB
SCAN TIME	5 ms
LOG REF LEVEL	+20 dBm

b. Remove coaxial cable from A13J1 to A2J1 and connect the spectrum analyzer to A13J1. Adjust A6C5 "250 MHz," C14 "500 MHz 1," and C18 "500 MHz 2" for a maximum 500 MHz signal. Output level should be at least +14 dBm. Sidebands should be 40 dB down from the 500 MHz signal. Return circuit to original configuration.

c. Disconnect rigid coax from A1J2 and loosen connection at A2J3. Connect spectrum analyzer to A2J3 output. Set 5341A:

AUTO/MANUAL	MANUAL
RANGE	50 MHz—4.5 GHz
BAND SELECT	500 MHz Band

d. 500 MHz signal out of A2 should be at least -11 dBm ±1 dB.

e. Do not disconnect spectrum analyzer from A2 assembly output (A2J3) until after performing following adjustments on other assemblies.

5-26. 250 to 750 MHz Multiplier (A7)

5-27. Use the following procedure to adjust the A7 250—750 MHz multiplier for proper operation.

a. Set the 8555A spectrum analyzer as follows:

FREQUENCY	750 MHz
BANDWIDTH	300 kHz
SCAN WIDTH	100 MHz/div
INPUT ATTEN	10 dB
SCAN TIME	5 ms
LOG REF LEVEL	0 dBm

b. Connect spectrum analyzer input to the disconnected rigid coax at A1J2.

c. Place the 5341A in MANUAL mode of operation. Set the 5341A into the 750 MHz band.

d. Adjust A7C16 "750 MHz 1" and A7C11 "750 MHz 2" for a maximum output level at 750 MHz as observed on the spectrum analyzer.

e. Adjust A7R5 "Level Set" for -16 dBm at 750 MHz.

f. Push 5341A RESET switch.

g. Push BAND SELECT switch once. Instrument is now in the 500 MHz band.

h. Disconnect coax from A2J3 and connect RF millivoltmeter HP 3406A to A2J3 using a 50Ω T connector and a 50Ω termination.

i. Check that millivoltmeter reads 11 dBm ±1 dBm.

j. If not, A6R22, R23, and R24 should be changed. To determine the proper values, start with R23 and R24 at 91Ω (HP Part No. 0698-7026) and R22 at 82Ω (HP Part No. 0698-8368). Measure and record the millivoltmeter reading and adjust the values as follows:

IF MILLIVOLTMETER READS	CHANGE A6R23 AND A6R24 FROM 90Ω TO:	CHANGE A6R22 FROM 82Ω to:
-18 to -16 dBm	120Ω (0698-5562)*	51Ω (0698-3378)
-16 to -14 dBm	100Ω (0698-3113)	68Ω (0698-3379)
-12 to -10 dBm	75Ω (0698-3380)	120Ω (0698-5562)
-10 to -8 dBm	68Ω (0698-3379)	150Ω (0698-3381)

*HP Part Numbers.

k. Reconnect spectrum analyzer to A2J3.

l. Push RESET switch. Spectrum Analyzer should indicate a maximum of -60 dBm at 500 MHz.

m. Do not disconnect spectrum analyzer from A2J3.

5-28. 500 to 1000 MHz Doubler Assembly (A3)

5-29. Use the following procedure to adjust the 500—1000 MHz Doubler.

a. Push BAND SELECT switch to the 1.0 GHz band.

b. Adjust A3R4 "1 GHz LEVEL SET" so displayed 1 GHz signal is -7 dBm.

c. 500 MHz and 750 MHz signals should be down approximately 35 dB.

d. Push BAND SELECT switch to the 500 MHz band. Adjust A3A2C8 "NOTCH ADJ 1 GHz" for a minimum 1 GHz level as seen on the spectrum analyzer.

5-30. Filter Assembly (A2) and Switch Drive Assembly (A10) Adjustments

a. Set the 8555A spectrum analyzer as follows:

BANDWIDTH ..... 300 kHz
SCAN WIDTH ..... 100 MHz/div
SCAN TIME ..... 10 ms
INPUT ATTEN ..... 20 dB
LOG REF LEVEL ..... 0 dBm

b. Connect spectrum analyzer to rigid coaxial cable connecting A2J3 and A1J2 so as to observe A2 assembly output.

c. Place the 5341A in the MANUAL mode. Push the BAND SELECT switch to the 4.0 GHz band.

d. Set the spectrum analyzer frequency to 4.0 GHz.

e. Adjust A2 "SPEC GEN LEVEL SET" for a -16 dBm 4 MHz level as seen on Spectrum Analyzer. (This may have to be readjusted if the 1.5 GHz to 3.5 GHz bands cannot be set to -17 dBm.)

f. Press BAND SELECT switch to the bands below and make adjustments as indicated. If the 1.5 to 3.5 GHz levels cannot be set to -17 dBm, repeat procedure with 4 MHz level set to no lower than -18 dBm.

BAND	SIGNAL LEVEL ON SPECTRUM ANALYZER	ADJUSTMENT
1.5 GHz	-17 dBm	A10R20
2.0 GHz	-17 dBm	A10R21
2.5 GHz	-17 dBm	A10R22
3.0 GHz	-17 dBm	A10R23
3.5 GHz	-17 dBm	A10R24

5-31. Mixer Module Adjustment

5-32. The A1 Mixer Assembly is adjusted at the factory. The unit should be adjusted only when necessary. A rebuilt Mixer Assembly (05341-60501) can be ordered as an exchange module if a failure should occur.

5-33. Use the following procedure to adjust the mixer for proper operation.

a. Set the 8555A spectrum analyzer as follows:

BANDWIDTH ..... 300 kHz
SCAN WIDTH ..... 100 MHz/div
SCAN TIME ..... 5 ms
INPUT ATTEN ..... 20 dB
LOG REF LEVEL ..... +10 dBm
FREQUENCY ..... 500 MHz

b. Disconnect coaxial cable between A1J1 to A13J2 and connect mixer output to spectrum analyzer.

c. Set signal generator to 513 ±1 MHz, -13 dBm and insert into 5341A front panel 50-ohm input. Connect +5V to A1C1, available at A20TP1.

d. Adjust A1A1C7 (NOTCH ADJ) for a minimum 513 MHz level on spectrum analyzer. Should be at least -35 dBm.

e. Set signal generator to 500 ±1 MHz, -13 dBm.

f. Adjust A1A3C2 (500 MHz NOTCH ADJ) for a minimum 500 MHz level on spectrum analyzer. Should be at least -35 dBm.

g. Return circuit to original configuration.

5-34. IF and Prescaler Adjustments

NOTE

During the following procedures, use a power meter to measure the input level to the counter.

5-35. All of the following adjustments are interactive so they must be performed in the order given. First the best prescaler sensitivity is set, then the attenuator is adjusted to present the correct drive level to the prescaler, and finally the IF board qualifiers are set.

NOTE

Steps a through d adjust the A4 Prescaler for maximum sensitivity.

a Set 5341A control as follows:

AUTO-MANUAL	MANUAL
TEST-NORMAL (A19)	TEST
RESOLUTION	10K
BAND	0 BAND
RANGE	50 MHz—4.5 GHz RANGE

b. Disconnect coax from A13J2 and connect the signal generator to the A13J2 connector located on the motherboard. Set the signal generator to 100 MHz.

c. Remove 5341A bottom cover; using a clip lead, ground LPD on the underside of the motherboard (LPD is available at XA5(1) and connect to WHT-YEL wire).

d. Adjust A4R1 OFFSET ADJ for maximum sensitivity by observing the 5341A display and adjusting A4R1 for a stable 100 MHz count for decreasing input signal levels. Record the lowest generator output level which gives a stable display at 100 MHz.

NOTE

Steps e through n set the ATTENUATOR pot on the A5 IF board for the proper signal level to the A4 Prescaler board.

e. Unsolder FD on bottom of A13 motherboard. This is the WHT-GRN wire connected to XA5(2).

f. Set the signal generator to 540 MHz. Adjust the generator output for the lowest signal level which just produces a stable 540 MHz display. Record the lowest generator output level which gives a stable display at 540 MHz.

g. If the 100 MHz signal level recorded in step (d.) is lower than the 540 MHz signal level recorded in step (f.), set the signal generator to 540 MHz at -1 dBm and adjust the ATTENUATOR A5R29 until the counter just produces a stable 540 MHz display. Check that 100 MHz at -2 dBm produces a stable count.

If the 540 MHz signal level recorded in step (f.) is lower than the 100 MHz signal level recorded in step (d.), set the signal generator to 100 MHz at -2 dBm and adjust the ATTENUATOR A5R29 until the counter just produces a stable 100 MHz display. Check that 540 MHz at -1 dBm produces a stable count.

h. Resolder FD and disconnect the clip lead from LPD.

NOTE

Steps i through l adjust the threshold set pot A5R31 so that qualifiers LPD and HPD come on at the proper signal levels.

i. Set generator to 50 MHz and -5 dBm.

j. Slowly increase the generator output signal level and adjust the THRESHOLD SET pot A5R31 so that the low level peak detector, LPD, just changes from 0 to 1 when the signal level reaches -2 dBm. LPD is the middle digit of the qualifier display.

k. Decrease generator level by 1 dB. LPD should change from 1 to 0.

l. If necessary, adjust A5R31 until the 5341A passes steps j and k.

NOTE

Steps m and n check HPD (high level peak detector) for proper operation. The previous adjustment sets both LPD and HPD simultaneously.

m. Increase generator output level until HPD (most-significant-digit of the 3 qualifier digits on the display) just changes from 0 to 1. This must occur at +6 dBm ±1 dBm (at 50 MHz).

n. Decrease level by 1 dB. HPD must change from 1 to 0.

NOTE

Steps o through t adjust the FD (frequency discriminator) qualifier to change from 1 to 0 at the correct frequency. When the 5341A is in the 500 MHz or 750 MHz bands, the IF bandwidth is 350 MHz and FD must change between an IF frequency of 280 MHz to 350 MHz. When the 5341A is in any of the other bands, the IF bandwidth is 540 MHz and FD must change between 530 MHz to 540 MHz.

NOTE

The crossover frequency changes with the input power level so it must be checked at both 0 dBm and +1 dBm into the IF board.

o. Set 5341A to the 0 Band (540 MHz IF bandwidth) by pressing the reset switch.

p. Set the signal generator (still connected to A13J2) to 520 MHz at 0 dBm. Increase the generator frequency until FD changes from 1 to 0. Adjust A5C14 such that FD changes from 1 to 0 at 535 MHz ±5 MHz. (FD is the least-significant-digit in the qualifier display.) Repeat above for a generator level of +10 dBm.

q. Set 5341A to the 500 MHz band (350 MHz IF bandwidth) by pushing the BAND SELECT button on the front panel. With no input signal, the display will read 500 MHz.

r. Set signal generator output to 240 MHz at 0 dBm and then sweep frequency up until FD changes from 1 to 0. This must occur between 280 MHz and 350 MHz.

s. Repeat step r with +10 dBm signal generator output level.

t. Set signal generator output to 400 MHz at 0 dBm and sweep down in frequency until FD changes from 0 to 1. This must occur before 265 MHz.

u. Repeat step t with +10 dBm signal generator output level.

v. If steps r through u do not crossover properly, first try readjusting A5C14 for proper operation. Be sure to repeat steps o through q if A5C14 is readjusted.

NOTE

If readjusting A5C14 doesn't work, it may be necessary to adjust A5R30 to compensate for component variations (particularly aging and the matching between diodes A5CR10 and A5CR9). Perform the adjustment for A5R30 as follows:

1. Place A5 on extender board. Disconnect signal generator.
2. Using VTVM, measure and record the dc voltage at A5U2(5); it should be 105 mV ±5 mV.
3. Measure the voltage at A5U2(4) and adjust A5R30 until it is 10 mV ±1 mV more positive than the voltage at A5U2(5).
4. Repeat entire FD procedure from step o. If this doesn't work, reduce the voltage at U2 pin 4 until it is 5 mV ±1 mV more positive than the voltage at A5U2 pin 5 and repeat FD adjustment procedure.

w. Reconnect A1J1 to A13J2 and disconnect test equipment.

5-36. TROUBLESHOOTING

5-37. The following paragraphs describe troubleshooting procedures for the 5341A. With the exception of Mixer Assembly A and Switchable Filter A2, the instrument is repaired to the component level. A1 and A2 are board exchange assemblies.

5-38. Troubleshooting consists of an overall trouble isolation chart shown in *Figure 5-1*. *Figure 5-2* covers trouble isolation of the Mixer and Switchable Filter assemblies. *Figure 5-3* covers troubleshooting of the processor A19. For instruments equipped with Option 011 Remote Programming, refer to *Figure 5-4*. *Figure 5-5* is a step-by-step checkout of Option 011 using an HP Model K08-59992A Bus exerciser.

5-39. To troubleshoot the 5341A, recommended steps are as follows:

a. Use *Figure 5-1* (Chart 1) for trouble isolation to the board level. Chart 1 recommends repair or gives directions to use Charts 2 or 3.

b. Charts 4 and 5 are used to troubleshoot Option 011 Remote Programming.

5-40. A19 Processor Troubleshooting

5-41. The Hewlett-Packard Model 1601L Logic State Analyzer can be used to check the 5341A A19 Processor. Use the following procedure to connect the 1601L to check the 5341A A19 Processor operation.

a. Disconnect the 5341A power cord, and remove the cabinet covers.

b. Remove 5341A display casting from the mainframe. The casting is held to mainframe by two screws, one on each side.

c. Connect 10231A six-bit data probes to 5341A A19 processor as follows:

Bit 0	A19U16 pin 14
Bit 1	13
Bit 2	12
Bit 3	11
Bit 4	A19U19 pin 14
Bit 5	13
Bit 6	12
Bit 7	11
GND	A19U10 pin 8 A19U16 pin 8

d. Connect 10230A CLOCK probe ⊥*GND to A19U4 pin 7 and CLOCK to A19TP3.*

e. *Connect a logic pulse to the white wire that connects to the RESET switch.*

f. *Set 1601 Logic State Analyzer controls as follows:*

SAMPLE MODE	SGL
DELAY TO ON	00000
TABLE TO	A
START DISP	ON
TRIGGER MODE	NORM, LOCAL, WORD
TRIGGER WORD SWITCHES 0 through 8	LO
LOGIC BYTE	POS and 3 BIT
QUALIFIER SWITCHES	OFF

g. Connect power to 5341A and 1601A.

h. On 1601A, press RESET switch.

i. Press Logic Pulser switch. The 1601A will display the first 16 addresses of the state machine starting with octal address 000.

j. To display the next 16 addresses, set the DELAY thumbwheel switches to 00016. Press 1601A RESET and then the Logic Pulser switch.

k. To check any particular octal address set the TRIGGER WORD switches to the desired address and the 1601A will display that address first, followed by the next 15 sequences. If the 1601A does not display when using this procedure, either the ASM does not normally step to that address or trouble exists.

l. *Table* 5-5 gives the ASM sequence for the 5341A with a 500 MHz signal input and the controls set as follows:

RESOLUTION 1K
SAMPLE RATE ..... Fully CCW
AUTO-MANUAL ..... AUTO
RANGE ..... 50 MHz—4.5 GHz

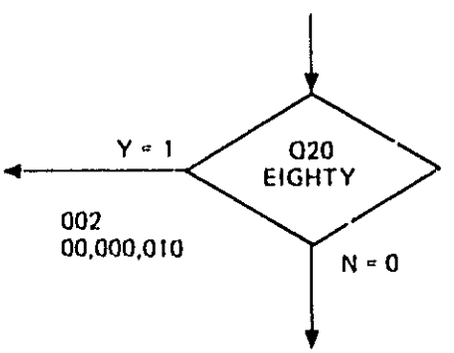
5-42. Slow or Manual Clock

5-43. The 5341A A19 processor can accept a slower clock signal than the internal 5341A clock provided by U1. The processor can be manually clocked using a logic pulser. To disable the internal clock short A19TP1 to A19TP2. An external clock can be applied at X/CLK (A19U4 pin 11).

5-44. Use of Flowchart No. 3 with 1601L Display

5-45. All 5341A flowcharts are arranged such that it is relatively easy to relate flowchart to display. Below is an example of a typical flowchart section.

PROGRAM ADDRESS 002



a. Q20 is the qualifier examined at program address 002. The meaning of EIGHTY Q20 can be found by looking up the mnemonic listing. Q20 EIGHTY: indicates the direct count (10 Hz—80 MHz) amplifier assembly is active.

b. Y=1 indicates the qualifier Q20 at A19U13 pin 20 is TTL high and the qualifier is true (Y=YES) when TTL high.

c. 002: 00,000,010: is the program address given in both octal (002) and binary form (000,000,010). The 1601A logic analyzer can display the binary program address if the BYTE, OCT-BCD switch is in the OCT position.

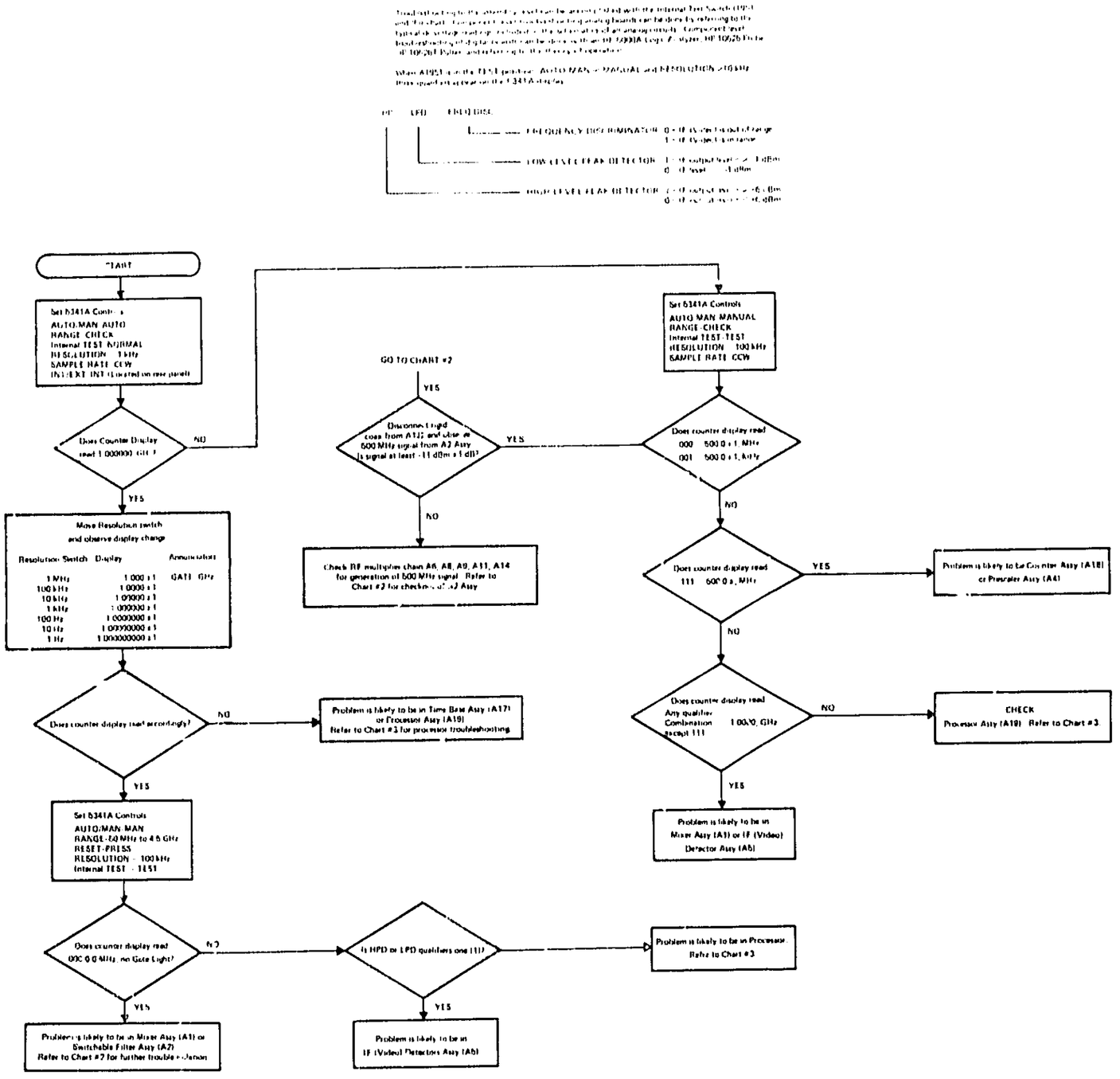
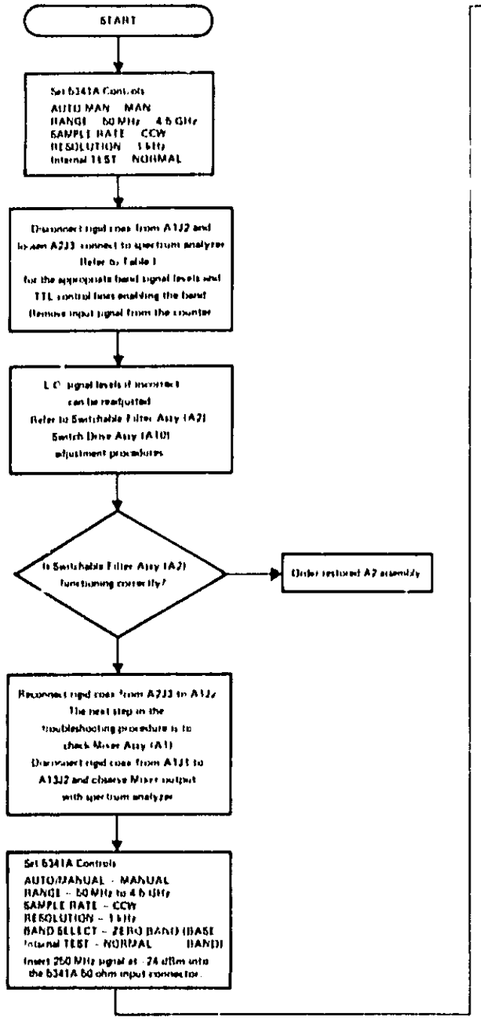


Figure 5-1. Overall Troubleshooting Chart 1



This chart covers troubleshooting Mixer Assy (A1) and Switchable Filter (A2), to the assembly level. The HP part number for the replaceable units are as follows:

Mixer Assy (A1) [illegible]
Switchable Filter Assy (A2) [illegible]

TABLE I

Band Range	L O Signal Level & Freq	5341A Display	L O Control Lines Enabled on Switch Drive Assy (A10) (Measure with voltmeter)
1.0 1.65 MHz		0 kHz	
1.65 [illegible] MHz	1650 MHz 17 ± 1 dBm	1650.000 MHz	LO BAND: >A10 Pin 14
765 1650 MHz	765 MHz 17 ± 1 dBm	765.000 MHz	
1650 1945 MHz	1.0 GHz 17 ± 1 dBm	1.000000 GHz	
1945 2445 MHz	1.5 GHz 17 ± 1 dBm	1.500000 GHz	1.5 >A10 Pin 16
2000 2545 MHz	2.0 GHz 17 ± 1 dBm	2.000000 GHz	2.0 >A10 Pin 12
2545 3045 MHz	2.5 GHz 17 ± 1 dBm	2.500000 GHz	2.5 >A10 Pin 12
3045 3545 MHz	3.0 GHz 17 ± 1 dBm	3.000000 GHz	3.0 >A10 Pin 13
3545 4045 MHz	3.5 GHz 17 ± 2 dBm	3.500000 GHz	3.5 >A10 Pin 13
4045 4545 MHz	4.0 GHz 17 ± 2 dBm	4.000000 GHz	4.0 >A10 Pin 14

TABLE II

Input Signal to Counter	Output Signal at A12J1 as seen on Spectrum Analyzer	250 MHz Bandwidth IF TTL Level at A1C1 from >A10(7)	Zero Band TTL Level at A1C2 from >A10(8)	Band Range Selected
250 MHz -24 dBm	250 MHz -0 dBm	Low	High	1.0 1.65 MHz
650 MHz	100 MHz	High	Low	1.65 765 MHz
900 MHz	150 MHz	High		765 1650 MHz
1.3 GHz	300 MHz	Low		1650 1945 MHz
1.8 GHz	350 MHz			1945 2445 MHz
2.3 GHz	400 MHz			2445 3045 MHz
2.8 GHz	300 MHz			3045 3545 MHz
3.3 GHz	300 MHz			3545 4045 MHz
3.8 GHz	300 MHz			4045 4545 MHz
4.3 GHz -24 dBm	300 MHz -0 dBm	Low	Low	

Figure 5-2. A1 and A2 Troubleshooting Chart 2

5-46. Qualifier and Commands for A19 Processor Flowchart (3)

5-47. *Table* 5-3 lists the definitions of the "qualifiers" used in the A19 Processor Flowchart, Chart 3. *Table 5-4* lists the definitions of the commands used in Chart 3.

Table 5-3. Qualifiers for Chart No. 3

NUMBER	QUALIFIER
Q0	"Band-C" is the "C" line output of the band counter A10U4. Corresponds to the "4" position in 8421 BCD.
Q1	"Band-A" is the "A" line output of the band counter A10U4. Corresponds to the "1" position in 8421 BCD.
Q2	"Band-B" is the "B" line output of the band counter A10U4. Corresponds to the "2" position in 8421 BCD.
Q3	"Band Equal" is the output of comparator A10U1. This indicates that the current band number is the same as the band which was stored by a "latch band" command C20.
Q4	"Band-D" is the "D" line output of the band counter A10U4. Corresponds to the "8" position in 8421 BCD.
Q5	"Test" indicates the position of the internal self-test switch. A high level is normal a low level is test.
Q6	"S.R. Done" (Sample Rate Done) indicates that the sample rate one-shot on A17 has timed out.
Q7	"Gate" indicates the gate is open for counting. Comes from A17U5A.
Q8	Not used.
Q9	"Flag" is the output of R-S flip-flop A19U6D. This flip-flop is set by "SET FLAG," C23 and reset by "RESET SYSTEM," C26.
Q10	"Reset Button" indicates that the reset button was pushed or that the power was turned off. The condition is set by setting flip-flop A19U6A, and reset by a RESET SYSTEM, C26. Q10 is the output of this flip-flop.
Q11	"Signal" is the output of R-S flip-flop A19U6B. After a SET SIGNAL (C27) Q11 indicates whether the signal peak detectors have remained steady. A high on "SIGNAL" indicates a steady (cw) IF output of countable amplitude and frequency. A low on "signal" indicates the IF has dropped out for some time.
Q12, Q13	Not used.
Q14	"REMOTE" indicates the 5341A is operating under remote control.
Q15	"Band Select" indicates that the band select pushbutton is being pressed.
Q16	"RES C" indicates the C-bit of the resolution code. May be generated on the front panel switch or on the remote control board (A20). For significance, see table on A17 schematic.
Q17	"Manual" indicates counter is in manual band selection mode (either front panel or remote board can cause this). Q17 HI indicates manual true. Q17 LOW is manual=false or automatic=true.
Q18	"RES B" indicates the B-bit of the resolution code. See Q16.
Q19	"RES A" indicates the A-bit of the resolution code. S Q16.
Q20	"EIGHTY" indicates the direct count amplifier is active (10 Hz to EIGHTY MHz).
Q21	"Count 0" (Count zero) indicates that the display counter is at the zero position. This is the least-significant-digit of the display (far right). Source: A16U8B.
Q22	"FD" (FREQUENCY DISCRIMINATOR). Sent from the IF board A5 to indicate that the IF frequency is with the correct bandwidth limits. (15 MHz to 300 MHz in 500 MHz, 750 MHz bands, and 15 MHz to 540 MHz all other bands.)
Q23	"Sum 0" indicates that the digit in the display, stored in the location pointed at by the display counter is a zero (0000 binary). Used with blanking leading zeros. Source: A16U8A.

Table 5-3. Qualifiers for Chart No. 3 (Continued)

NUMBER	QUALIFIER
Q24	"OUTPUTTING" sent from A28U13B to indicate that the remote output board is attempting to output a measurement.
Q25	"HPD" (High level Peak Detector) sent by the IF Board (A5) to indicate the presence of a high level IF.
Q26	"Remote Test" sent from A29U4 pin 6 to indicate that the remote test function is on.
Q27	"LPD" (Low level Peak Detector) sent by the IF board (A5) to indicate the presence of a medium or high level signal.
Q28	"Fast" sent from A29U4 pin 10 causes 5341A to by pass the sample rate delay. When in remote control.
Q29	"Hold" indicates the position of the hold switch. This is an active low signal when the sample rate pot is in the hold detent position.
Q30	"Remote Hold" sent from A29U4 pin 7 when in remote, causes 5341A to wait until triggered, before measuring.
Q31	"Check" indicates that the 5341A is in self-check mode. This can be a front panel switch setting or a remote control setting.

Table 5-4. Commands for Chart No. 3

NUMBER	COMMANDS
C0	GATE LITE. Triggers one-shot A16U10A which lights the "Gate" light for 100 ms.
C1	ADD stores the output of the adder A17U1 in the display memory (A16U1) and in the remote output memory (A18U7) one-digit to the adder comes from the counter board. The other comes from the ROM A19U15 pins 9, 21, 8, 22 via U12 inverters. This number is shown on the flowchart, for example "ADD 7" means send a 7 0111 binary to the adder and store the sume of 7 and the counter output in the display memory and the remote memory.
C2 thru C5	Are not used.
C6	OUTPUT TOGGLE sends a clock pulse to A26U13 (remote output board). This signals A8 that a measurement has been completed and is available for outputting. The same pulse can be used to terminate an output cycle if a new measurement has begun.
C7	COUNT DOWN sends a clock pulse to the display counter A16U5 and A28U1 to cause both of these counters to count down one value.
C8	GRAB sends a pulse to the R-S flip-flop A16U9C on display. This disables the displays internal clock (A16U10B) and also resets the display counter (A16U5) to zero (0000). The remote output counter also is reset to zero.
C9	COUNT UP sends a clock pulse to the display counter (A16U5) and to the remote output counter (A28U1) to cause both of these counters to count up one value.
C10	* or ASTERISK sends a pulse to the asterisk one-shot (A15Q2, C2). This lights the * symbol for 50 ms.
C11	Latch D.P. (D.P. stands for decimal point) clocks decimal point storage (A16U6) stores location for decimal point in display.
C12	RELEASE sends a pulse to the R-S flip-flop A16U9D on the display driver. This enables the display's internal clock. And so begins the display of information in the display memory.
C13	KILO sets the units of the display to kHz by pulsing A16U12A and U12B. This shuts off both "MHz" and "GHz" lights and turns on the "kHz" annunciator.
C14	MEGA sets the units of the display to MHz by pulsing A16U12A and A16U13A. This shuts off both "kHz" and "GHz" lights and turns on the "MHz" annunciator.
C15	GIGA sets the units of the display to GHz by pulsing A16U12B and A16U13A. This shuts off both "kHz" and "MHz" lights and turns on the "GHz" annunciator.
C16	ARM resets the time base and the counters (on A17, A18). Following the end of ARM, the gate opens.
C17	BAND 0 resets the band counter A10U4 to the lowest band, 15 MHz to 515 MHz.
C18	BAND +1 causes the band counter A10U4 to step to the next band.
C19	Not used.
C20	LATCH BAND causes A10U1 to store the current band (stores the outputs of A10U4).
C21	SHIFT causes the counter/shift register on A18 to shift one location.
C22	SET SELECT sets R-S flip-flop A19U6C. This causes the counter board to output the counter/shift register instead of the high frequency decade. The select flip-flop is reset by a RESET SYSTEM, C26.
C23	SET FLAG sets R-S flip-flop A19U6D. The output of this flip-flop is fed to Q9 as "FLAG." Flag is reset (made false) by a RESET SYSTEM, C26.
C24	RESET CARRY reset (clears) the carry flip-flop A17U4B.
C25	START S.R. (start sample rate) triggers one-shot A17U2. This initiates a delay before the next measurement. The length of the delay is controlled by the sample rate pot setting.
C26	RESET SYSTEM resets 3 R-S flip-flops A19U5A, C, D. These flip-flops indicate (A) the reset pushbutton, (C) select high frequency decade or counter/shift register on A18, (D) flag.
C27	SET SIGNAL sets R-S flip-flop A19U6D the output of A19U6D indicates that the signal has not dropped out since SET SIGNAL was pulsed.
C28 thru C30	Not used.
C31	DUMMY not connected but used in program as a NO-OP. Allows a jump in program with no action occurring.

Table 5-5. Typical ASM Flowchart Sequence

This table shows the flowchart sequence with a 1 GHz input and the 5341A set for 1 kHz RESOLUTION, AUTO mode, and RANGE set to 50 MHz to 4.5 GHz. See paragraph 5-39 for detailed step-by-step procedure for using the HP 1601A to check the flowchart sequence.

WORD	OCTAL ADDRESS	COMMENTS	WORD	OCTAL ADDRESS	COMMENTS
1	000		81	314	
2	001		82	043	RELEASE causes display
3	013	Initializes			to read 0. kHz.
4	014	counter	83	044	
5	015	and ASM	84	057	Search Subroutine
6	016		85	060	
7	017		86	077	sets Band to 0
8	020		87	100	
9	140	Starts Add Subroutine	88	101	
10	142		89	102	Checks LPD (no)
11	143	GRAB blanks display	90	103	Increments Band
12	144		91	104	Checks Band D (no)
13	145		92	102	Checks LPD (no)
14	146		93	103	Increments Band
15	147		94	104	
16	150		95	102	Checks LPD (yes)
17	151		96	115	Checks HPD (yes)
18	161		97	120	Checks FD (yes)
19	165		98	121	Checks Flag (no)
20	166		99	122	Latches Band
21	167		100	123	Sets Band to 0
22	172		101	124	Sets Flag
23	173		102	102	
24	174		103	103	Repeats search
25	175		104	104	checking if signal
26	176		105	102	can be found in
27	177		106	103	same band for the
28	200		107	104	second time
29	201		108	102	
30	235		109	115	
31	236		110	120	
32	237		111	121	Checks Flag (yes)
33	202		112	125	Checks IF Band is equal
34	203		113	126	
35	204		114	021	
36	205		115	022	
37	206		116	023	
38	207		117	024	
39	210		118	033	
40	211		119	034	
41	212		120	035	
42	213		121 thru	Repeats 032,	Repeats Loop until the
43	214		approx 2,484*	033, 034, 035	main Gate Closes
44	215				(times out)
45	216		2,485	036	
46	217		2,486	037	
47	220		2,487	140	Starts Add Subroutine
48	221		2,488	142	
49	222		2,489	143	GRAB blanks display
50	223		2,490	144	
51	310		2,491	145	
52	312		2,492	146	
53	313		2,493	147	
54	311	Blanks leading zeros	2,494	150	
55	312		2,495	151	
56	313		2,496	161	
57 thru 80	311,312,213		2,497	165	

Table 5-5 Typical ASM Flowchart Sequence (Continued)

WORD	OCTAL ADDRESS	COMMENTS	WORD	OCTAL WORD	COMMENTS
2,498	166		2,519	250	
2,499	167		2,520	263	GIGA light
2,500	172		2,521	310	
2,501	173		2,522	312	Blanks a leading zero
2,502	174		2,523	313	
2,503	175		2,524	311	
2,504	176		2,525	312	Blanks a leading zero
2,505	177		2,526	313	
2,506	200		2,527	311	
2,507	201		2,528	312	Blanks a leading zero
2,508	235		2,529	313	
2,509	236		2,530	310	
2,510	237		2,531	043	RELEASE enables 13 kHz clock for strobing data into display Display reads ~1 GHz
2,511	240				
2,512	241				
2,513	242				
2,514	243				
2,515	244				
2,516	245				
2,517	246				
2,518	247				

*Since the ASM clock and the counter time base are independent and not synchronous, the word at which the looping stops cannot be defined.

5-48. Troubleshooting Option 011 (A25) Digital Output

5-49. The Hewlett-Packard Model 1601L Logic State Analyzer can be used to check the 5341A Option 011 (A25) Digital Output. Use the following procedure to connect the 1601L to check the A25 boards.

a. Disconnect the 5341A power cable and remove the cabinet covers.

b. Remove the A25 board from its socket and use an extender board to connect the A25 to its socket.

c. Connect two 10231A six-bit data probes and one 10230A clock probe to the A25 board as follows:

10231A PROBE BIT	CONNECT TO PIN	CONNECT 10230A	TO PIN
0	U6(2)	CLOCK	U6(9)
1	U6(10)	GND	U4(7)
2	U6(5)		
3	U6(12)		
4	U6(7)		
5	U6(15)		
6	U6(9)		
7	U5(5)		
GND	U6(8)		
GND	U5(7)		
CLOCK	U6(9)		

d. Disable the 5341A internal clock by connecting A19TP1 to A19TP2.

e. Use an HP Logic Pulser or other slow clock device to step the 5341A clocking circuits at A19U4(11).

f. Connect power to the 5341A and proceed with checks.

g. Refer to paragraph 5-51 to relate the flowchart to the logic display. (Use flowchart 4, Part A.)

h. After the tests, disconnect the test equipment and return all 5341A assemblies and parts to the standard correct arrangement.

5-50. Qualifiers and Commands for A25 Flowchart 4, Part A

5-51. *Table* 5-6 lists the definitions of qualifiers used in the A25 Flowchart 4, Part A. *Table* 5-7 lists the definitions of commands used in Chart 4, Part A.

Table 5-6. Qualifiers for Chart 4, Part A

QUALIFIERS	INPUTS TO U9
10	RFD — (Ready for Data) indicates that the HP-IB is ready to receive data from the 5341A.
11	DAC — (Data Accepted) indicates that the HP-IB has received data from the 5341A.
12 13 14	RES A — (Resolution Bit A) RES B — (Resolution Bit B) Indicates the Resolution code RES C — (Resolution Bit C)
15	COUNT 9 detects when counter U1 is at nine (1001).
16	BLANK detects a BLANK (code 1111) at the output of RAM U7.
17	ZERO — this qualifier is always zero since it is grounded. It is used to force a branch in the flowcharts.

Table 5-7. Commands for Chart 4, Part A

COMMANDS	DEFINITIONS
DONE	Output of U14 pin 11. Presets U13B. This indicates to 5341A main processor (A19) that the outputting of the answer is done.
COUNT-DOWN	Causes counter U1 to count down one value.
	All other commands cause an ASCII character to be outputted onto the HP-IB. The character is selected using inputs 10-13 of U8 ROM. The table below gives the characters ASCII code, and the four-bit input to U8.

CHARACTER	U8				ASCII OUTPUT OF U8							
					PINS							
	13	12	11	10	7	6	5	4	3	2	1	
SPACE =	0	0	0	0	0	1	0	0	0	0	0	
.	0	0	0	1	0	1	0	1	1	1	0	Decimal Point
DIGIT*=	0	0	1	0	0	1	d	d	d	d	*	
3	0	0	1	1	0	1	1	0	0	1	1	
,	0	1	0	0	0	1	0	1	1	0	0	Comma
E	0	1	0	1	1	0	0	0	1	0	1	
6	0	1	1	0	0	1	1	0	1	1	0	
5	0	1	1	1	1	0	1	0	0	1	1	
CR	1	0	0	0	0	0	0	1	1	0	1	Carriage Return
9	1	0	0	1	0	1	1	1	0	0	1	
LF	1	0	1	0	0	0	0	1	0	1	0	Line Feed
+	1	0	1	1	0	1	0	1	0	1	1	

*DIGIT provides only three bits from ROM U8. The lower four bits come from RAM U7. When none of the characters is being set on the HP-IB, code 1111 is sent to U8. This enables the U7 outputs.

5-52. Troubleshooting Option 011 (A26) Remote Programming

5-53. The Hewlett-Packard Model 1601L Logic State Analyzer can be used to check the 5341A Option 011 (A26) Remote Programming. Use the following procedure to connect the 1601L to check the A26 board.

PROCEDURE TO CHECK A26

a. Disconnect the 5341A power cable, and remove the cabinet covers.

b. For access to the A26 board remove the A25 board from its socket.

c. Connect two 10231A six-bit data probes and one 10230A clock probe to the A26 board as follows:

10231A PROBE BIT	CONNECT TO PIN	CONNECT 10230A	TO PIN
0	U6(14)	CLOCK	U6(2)
1	U6(13)		
2	U6(12)	CLOCL GND	U127
3	U6(11)		
4	U16(14)		
5	U16(13)		
6	U16(12)		
7	U16(11)		
GND	U6(8)		
GND	U16(8)		

d. Reinstall the A25 board with an extender board to make room for the probes on A26.

e. Disable the 5341A internal clock by connecting A19TP1 to A19TP2.

f. Use an HP Logic Pulser or other slow clock device to step the 5341A clocking circuits at A19U4(11).

g. Connect power to the 5341A and proceed with checks.

h. Refer to paragraph 5-54 to relate the flowchart to the logic display.

(Use Flowchart 4, Part B)

i. After the tests, disconnect the test equipment and return all 5341A assemblies and parts to the standard correct arrangement.

5-54. Qualifiers, Stored Bits, and Command for A26 Flowchart 4, Part B

5-55. *Table 5-8* lists the definitions of qualifiers used in A26 Flowchart 4, Part B. *Table* 5-9 lists definitions of stored bits used in A26 Flowchart 4, Part B. *Table 5-10* lists definitions of commands used in A26 Flowchart 4, Part B.

5-56. Troubleshooting Option 011 with HP Model K08-59992A Bus Exerciser

5-57. The Hewlett-Packard Model K08-59992A Bus Exerciser can be used to check the 5341A Option 011 A25 and A26 boards. Use the procedures in Chart 5 to check Option 011 with the K08-59992A.

Table 5-8. Qualifiers for Chart 4, Part B

QUALIFIERS	DEFINITIONS
Q's	Qualifiers, Inputs to U1 or U10
Q0	D4 — Data input 4, from bus line DIO4
Q1	D5 — Data input 5, from bus line DIO5
Q2	D3 — Data input 3, from bus line DIO3
Q3	D2 — Data input 2, from bus line DIO2
Q4	D1 — Data input 1, from bus line DIO1
Q5	D6 — Data input 6, from bus line DIO6
Q6	D7 — Data input 7, from bus line DIO7
Q7	RESET BUTTON, from front panel reset pushbutton
Q8	LISTEN — indicates addressed to listen from A26 U3—U4.
Q9	ATN — Attention line from bus.
Q10	EQUAL — indicates address on DIO1—DIO5 equals setting on address switches from A26 U9—U14
Q11	DAV — indicates that the data on the bus is valid.
Q12	REN — indicates remote enable condition of the bus.
Q13	IFC — indicates interface clear from the bus.
Q14	Not used.
Q15	LLO — indicates local lockout condition.

Table 5-9. Stored Bits for Chart 4, Part B

NUMBER	DEFINITIONS
S0	LLO - Local lockout.
S1	ATALK — addressed to talk
S2	RES B — remote resolution switch, line B.
S3	RES C — remote resolution switch, line C.
S4	RES A — remote resolution switch, line A.
S5	REMOTE — instrument is in remote control.
S6	RFD/DAC — high indicates ready for data. Low indicates data accepted.
S7	LISTEN -- indicates addressed to listen.
S8	CHECK — remote check switch.
S9	TRIGGER — remote trigger
S10	FAST — indicates bypass sample rate mode.
S11	WAIT — wait until address mode.
S12	HOLD — indicates remote hold mode.
S13	REMOTE TEST — remote self-test switch.
S14	EIGHTY — remote 80 MHz switch.
S15	MANUAL — remote manual switch.

Table 5-10. Command for Chart 4, Part B

COMMANDS = OUTPUTS OF U2	
NUMBER	DEFINITIONS
C0	Used to set or clear S0 through S7.
C1	Used to set or clear S8 through S15.
C5	REMOTE RESET — resets 5341A main processor.
C6	LATCH REMOTE BAND — stores a band number on A10.

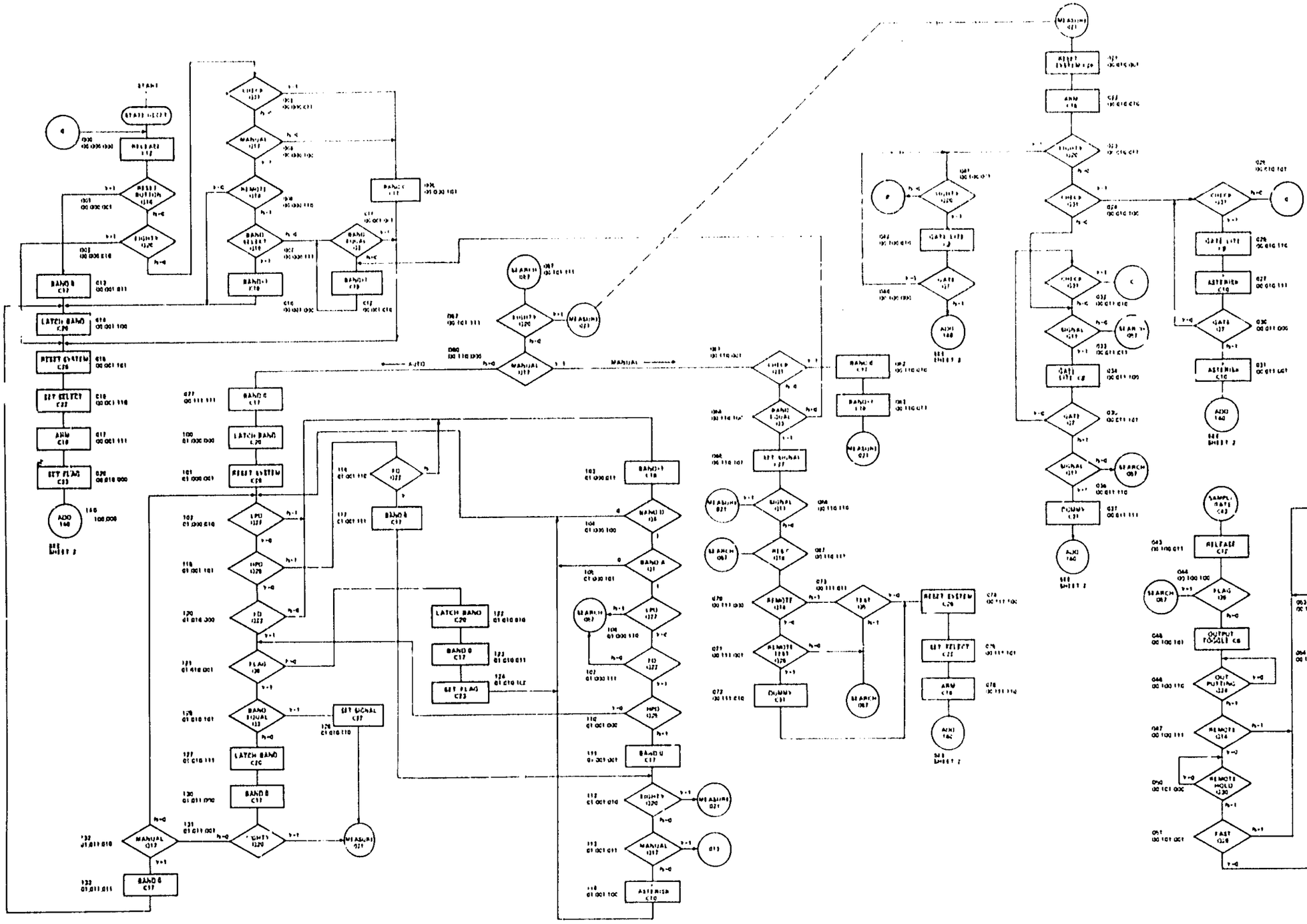


Figure 5-3. ASM Troubleshooting Chart 3
(Sheet 1 of 2)

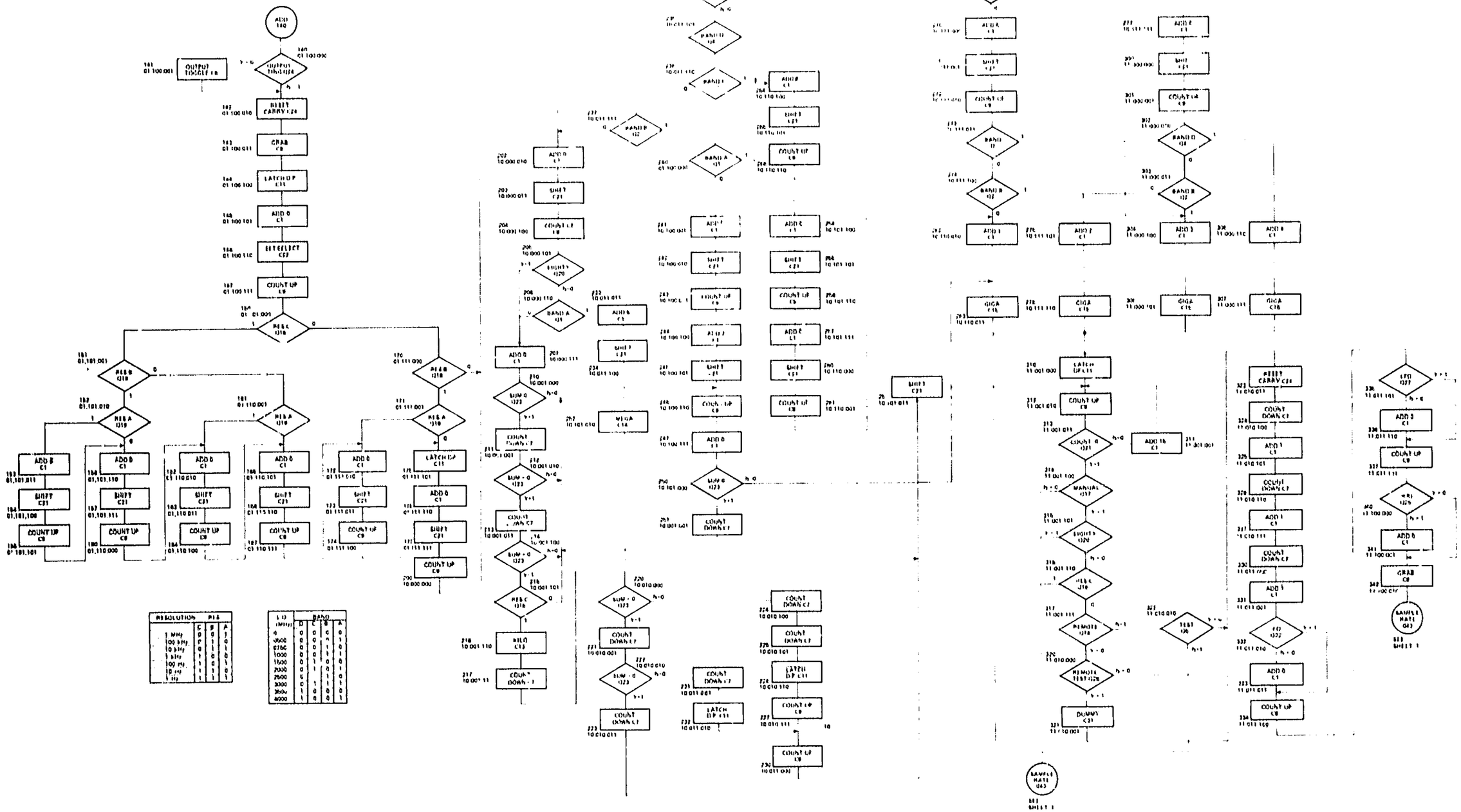


Figure 5-3. ASM Troubleshooting Chart 3
(Sheet 2 of 2)

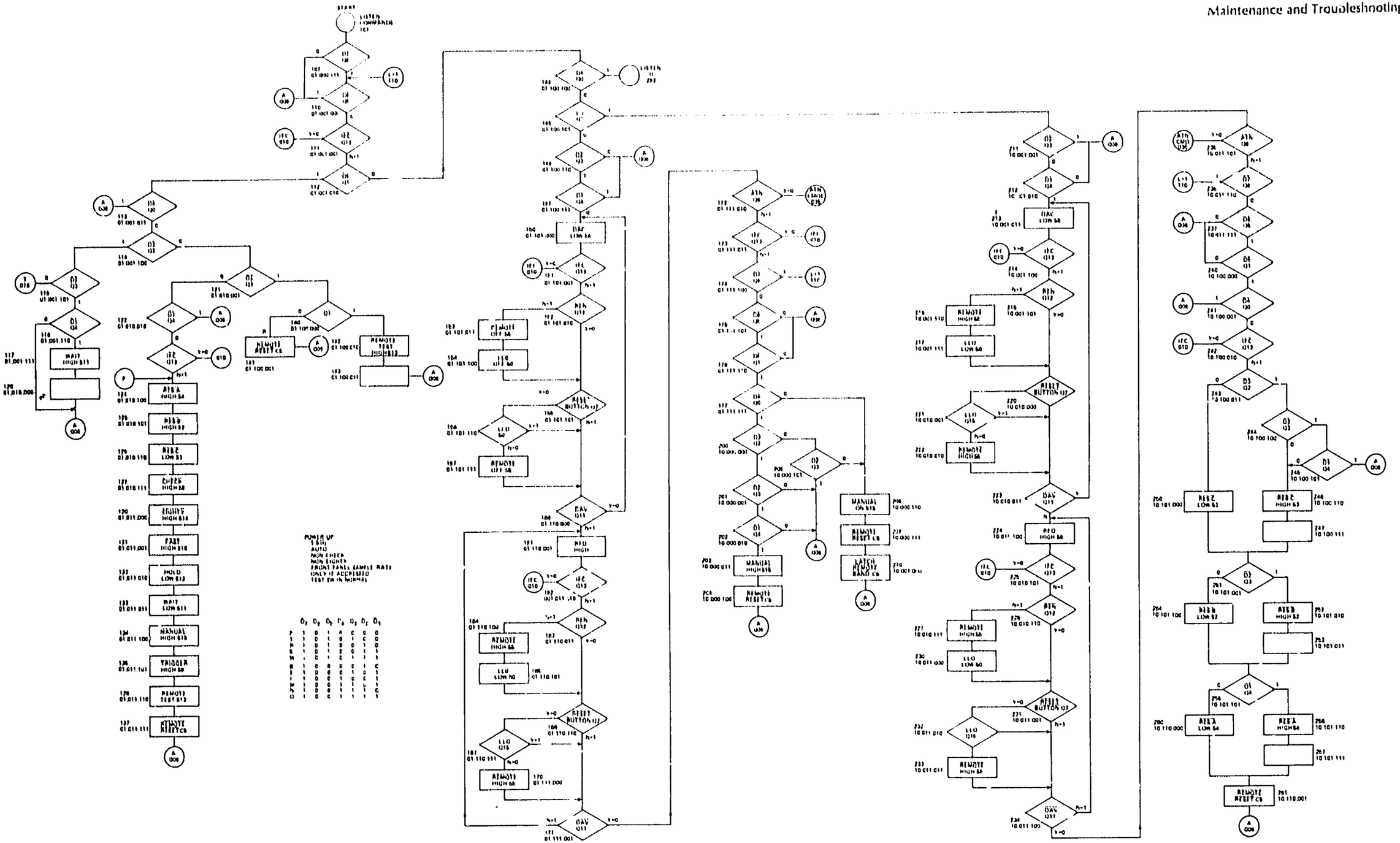


Figure 5-4. HP-IB Input Troubleshooting Chart 4 Part A
(Sheet 1 of 3)

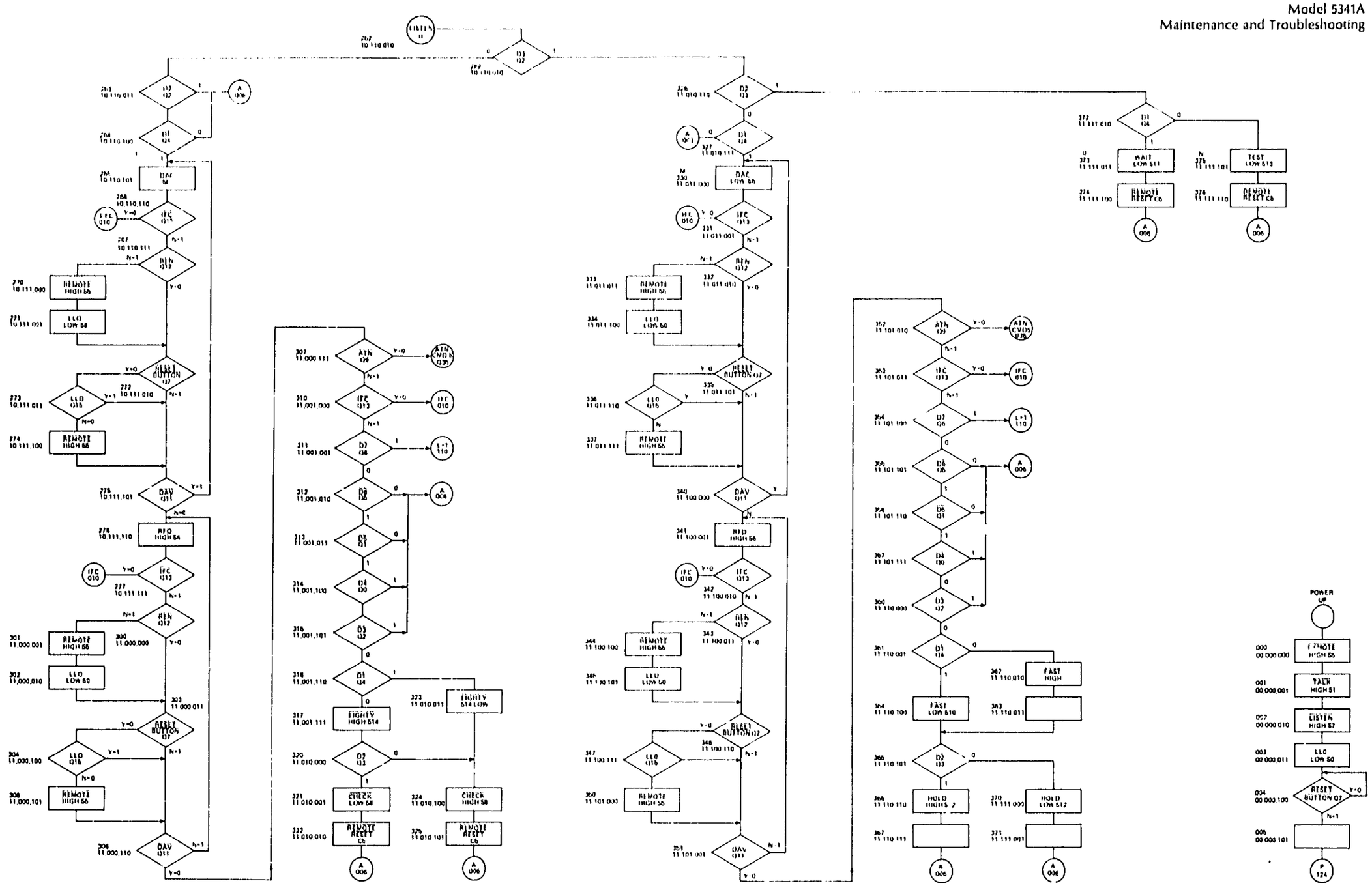
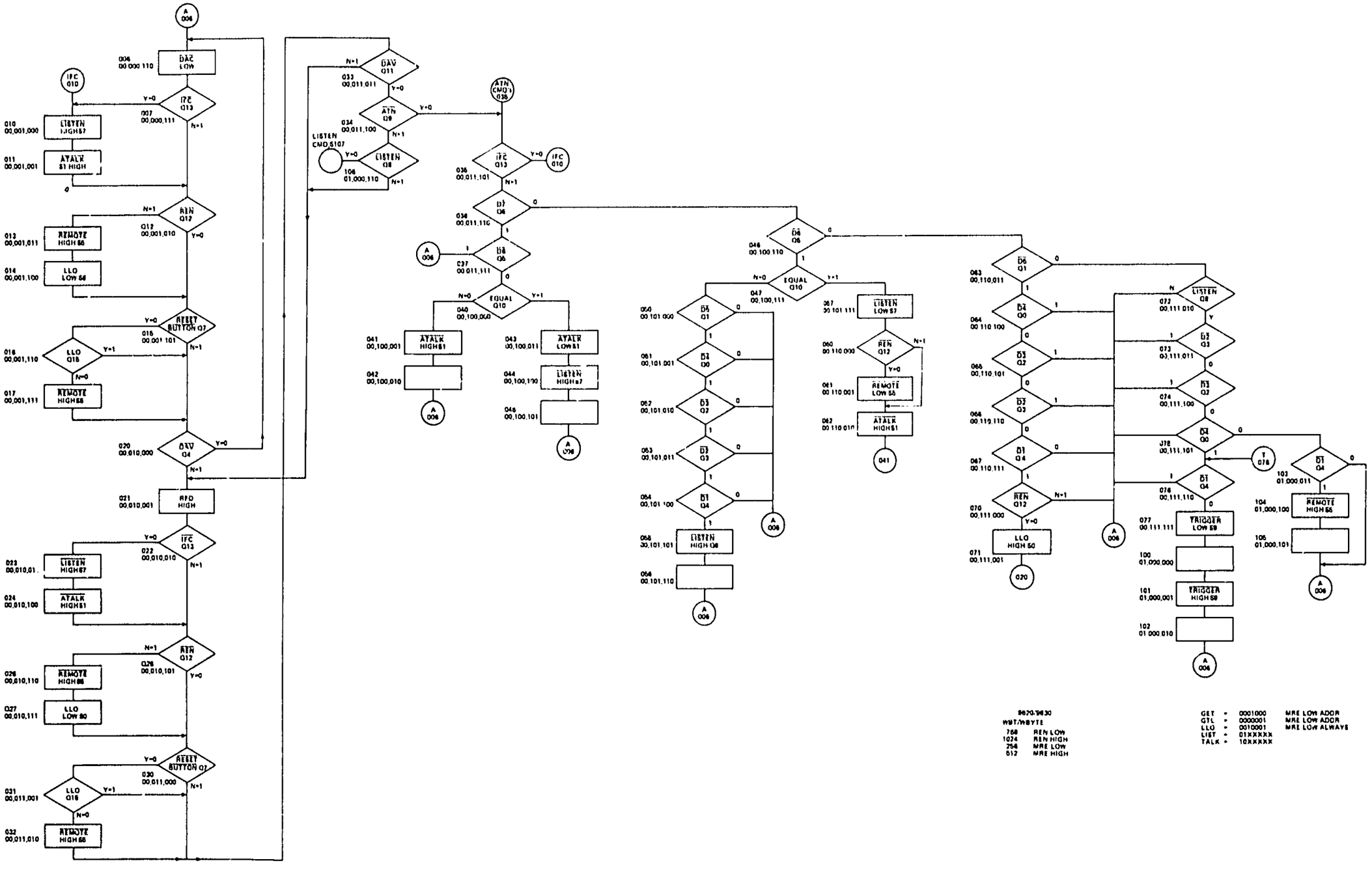


Figure 5-4. HP-IB Input Troubleshooting Chart 4 Part A
(Sheet 2 of 3)



9870-9830
WBT/WBYTE
768 REN LOW
1024 REN HIGH
256 MRE LOW
512 MRE HIGH

GET = 0001000 MRE LOW ADDR
GTL = 0000001 MRE LOW ADDR
LLO = 0010001 MRE LOW ALWAYS
LIST = 01XXXXX
TALK = 10XXXXX

Figure 5-4. HP-IB Input Troubleshooting Chart 4 Part A (Sheet 3 of 3)

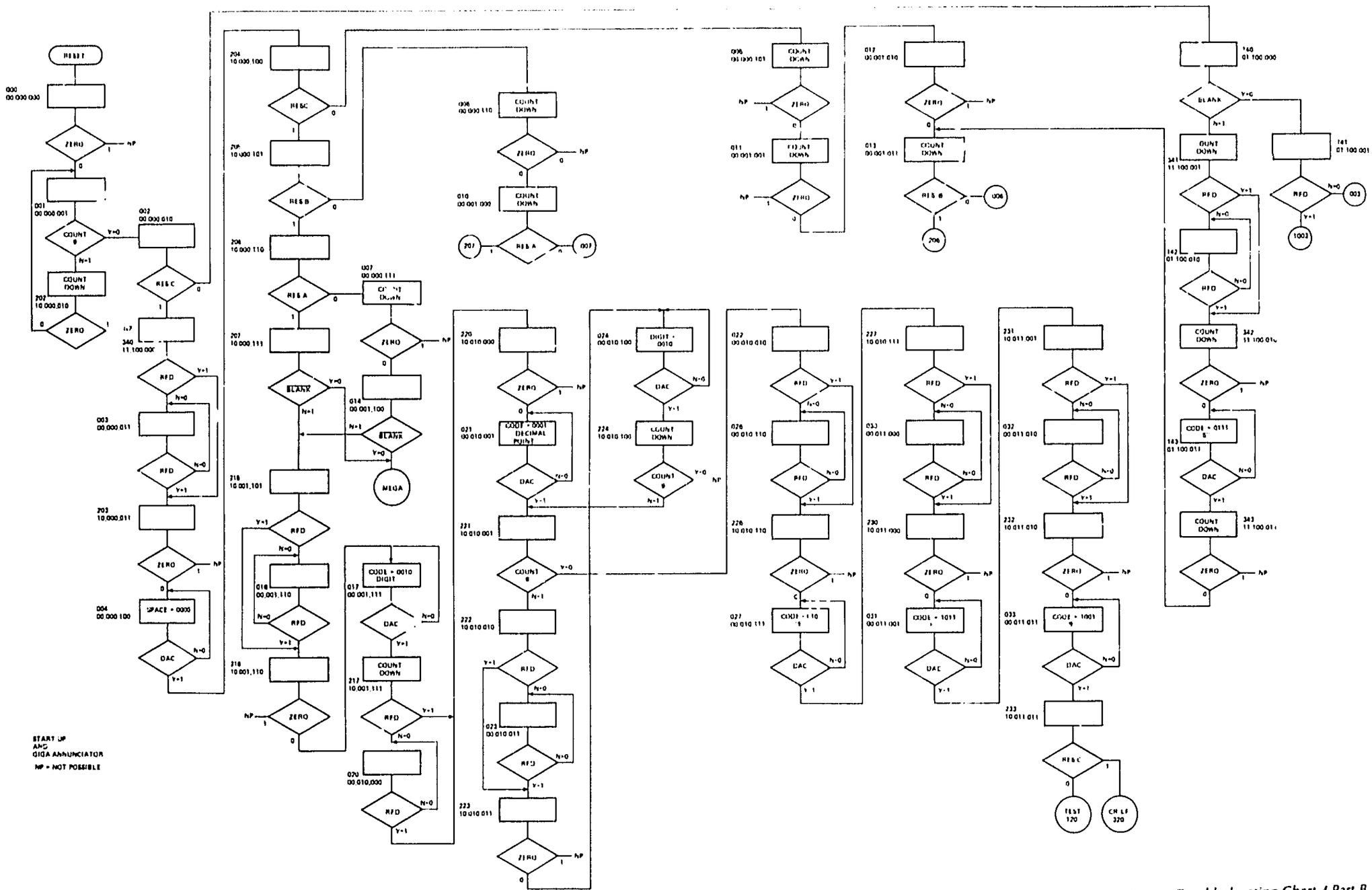


Figure 5-5. HP-IB Output Troubleshooting Chart 4 Part B (Sheet 1 of 4)

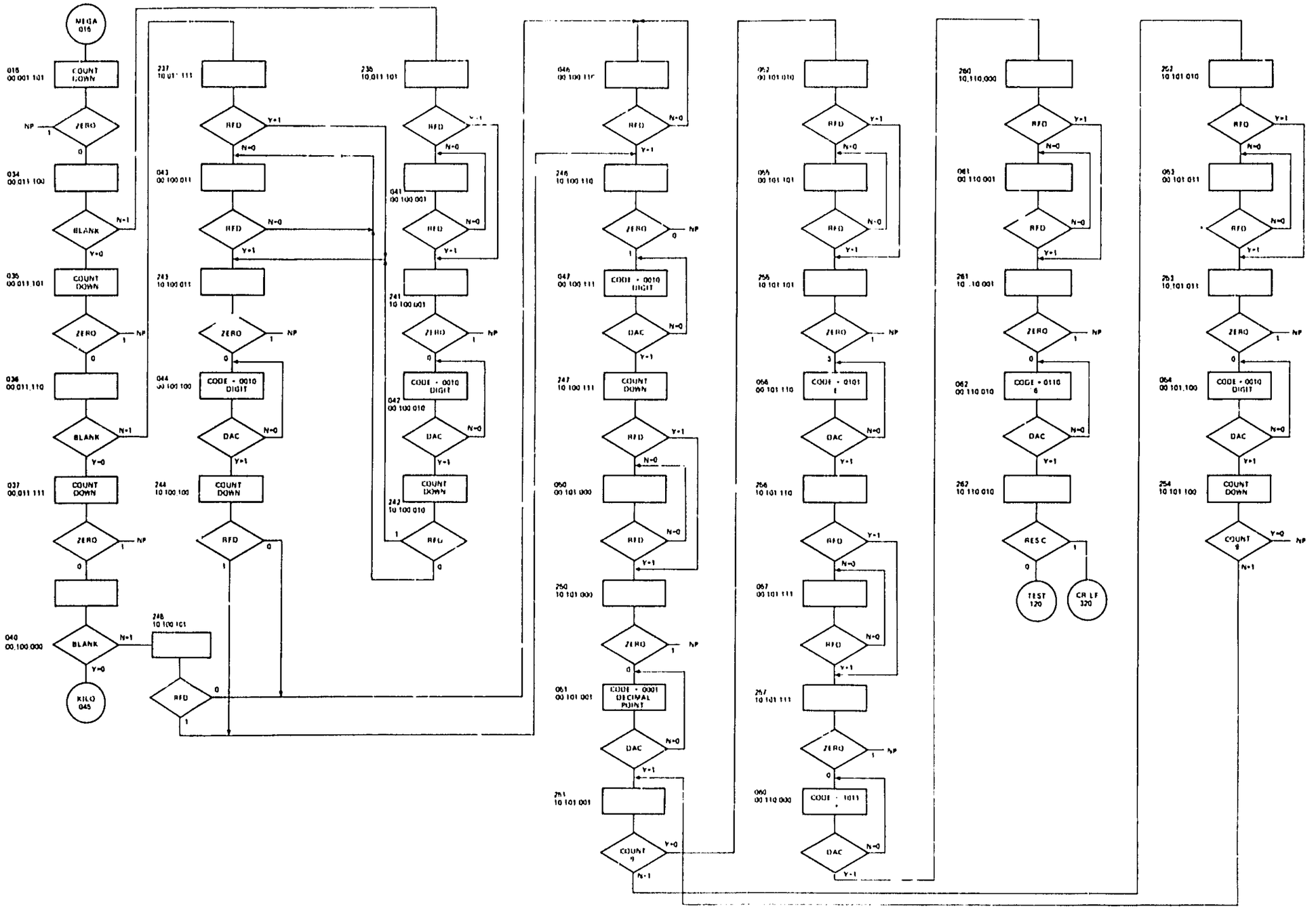


Figure 5-5. HP-IB Output Troubleshooting Chart 4 Part B
(Sheet 2 of 4)

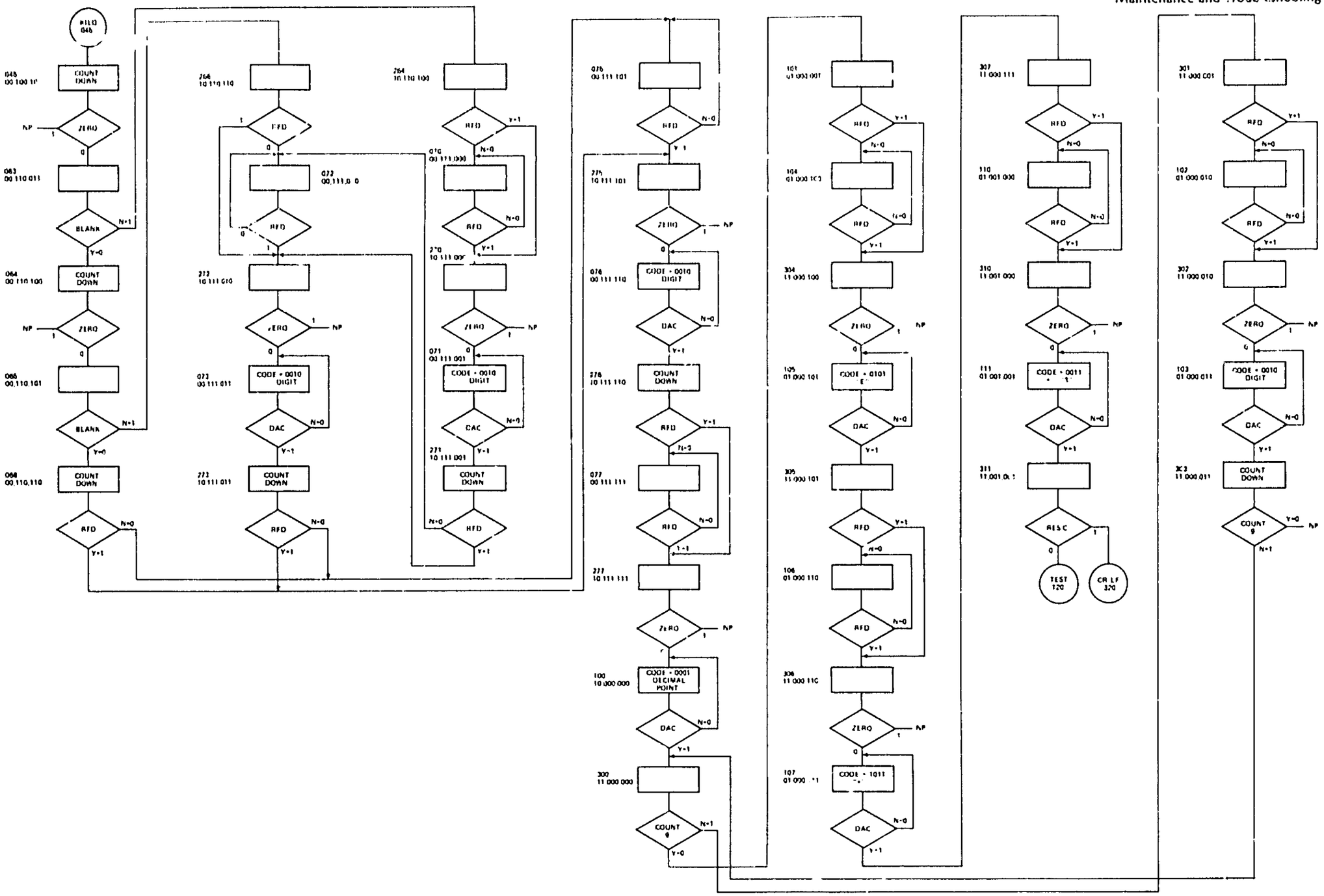


Figure 5-5. HP-IB Output Troubleshooting Chart 4 Part B
(Sheet 3 of 4)

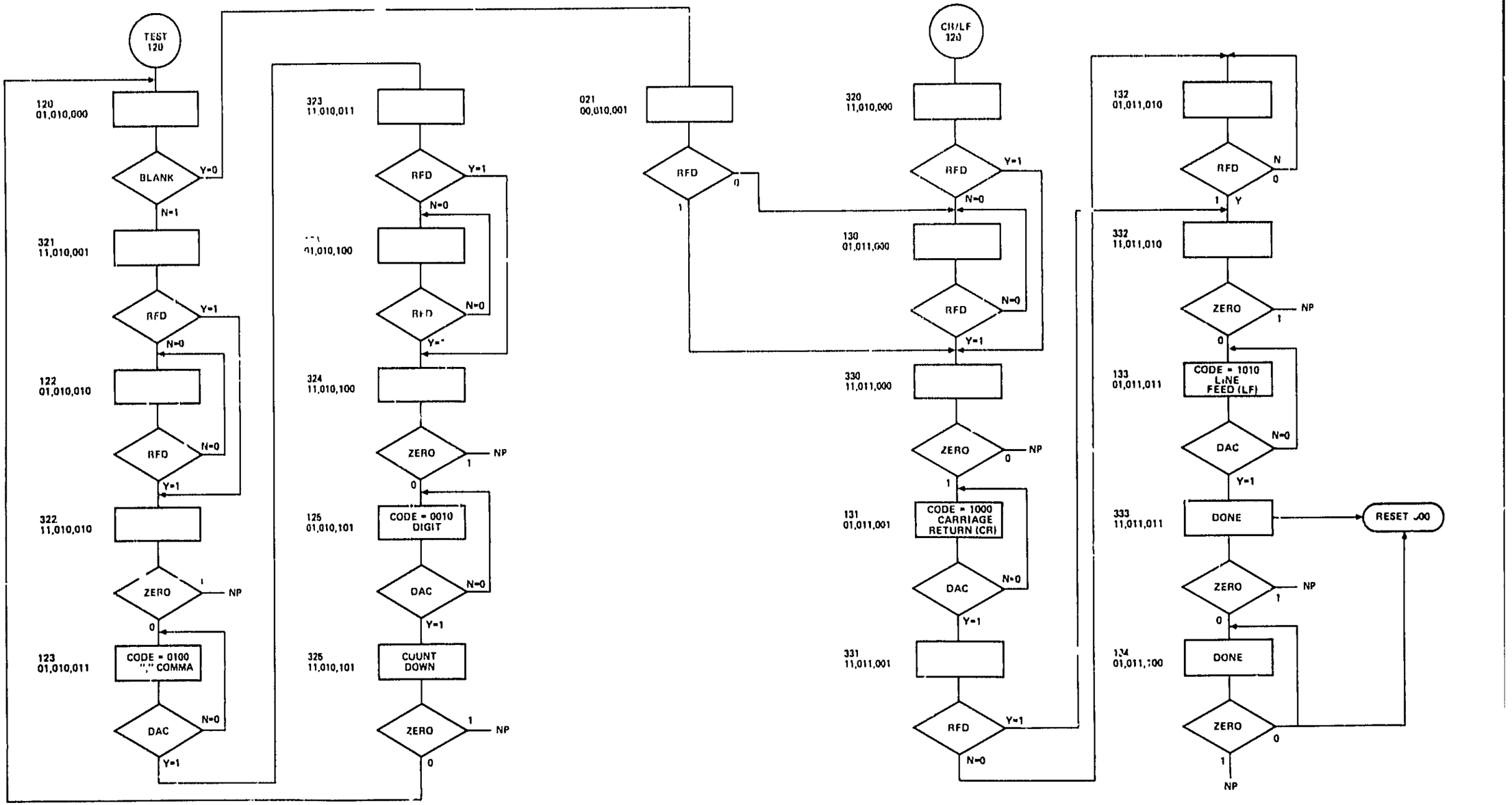


Figure 5-5. HP-IB Output Troubleshooting Chart 4 Part B
(Sheet 4 of 4)

Checking output Code Set Using K08 59992A HP Bus Exercise

Set 5341A Controls as follows

Front Panel	RESOLUTION	1M
	SAMPLE RATE	MID POSITION
	AUTO MANUAL	AUTO
	RANGE	50 MHz 4.5 GHz
	INTERNAL TEST	NORMAL
Rear Panel	Address Switches A1 A2 A3 A4 A5	0
	TALK ALWAYS ADDRESSABLE	ADDRESSABLE
	OSCILLATOR	INTERNAL

2 Connect 5341A to K08 59992A via HP-IB Cable

3 Set K08 59992A Controls as follows

CTL EN	UP
BCL	MID POSITION
REN	UP
SRQ	DOWN
EOI	DOWN

4 Using K08 59992A perform the following sequence of events

TALK ENABLE	TALK: FREE RUN / SINGLE CYCLE / EXT CLK	TALK: SEND*	LISTEN ENABLE	LISTEN: FREE RUN / SINGLE CYCLE / EXT CLK	LISTEN: ACCEPT*	MNE	DIO Lines (Light ON = 1, Light OFF = 0) 7 6 5 4 3 2 1	ASCII Code	Description of Program Sequence
UP	SINGLE CYCLE	Press Down	Down	SINGLE CYCLE	Center	UP	0 1 0 0 0 0 0	SP	5341A Listen Address
On 5341A display, PMT and ADDR lights should illuminate									
		Press Down				Down	1 0 1 0 0 0 0	P	Preset
		Press Down					1 0 0 1 0 0 1	1	
		Press Down				Down	0 1 1 0 0 1 0	2	Check
5341A display should read 1.000000 GHz RMT, ADDR with GATE light flashing									
		Press				Up	1 0 0 0 0 0 0		
Down			Up			Down			5341A Talk Address
Press LISTEN, ACCEPT switch down several times until ET 7717 displays the following:									
						Press Down	0 1 0 0 0 0 0	SP	Space
						Press Down	0 1 1 0 0 0 1	1	Measurement
						Press Down	0 1 0 1 1 1 0		Answer as seen
						Press Down	0 1 1 0 0 0 0	0	on 5341A dis-
						Press Down	0 1 1 0 0 0 0	0	play**
						Press Down	0 1 1 0 0 0 0	0	
						Press Down	0 1 1 0 5 0 0	0	
					Output Code Sequence	Press Down	0 1 1 0 0 0 0	0	
						Press Down	0 1 1 0 0 0 0 or 1 Dec 1		
						Press Down	1 0 0 1 0 0 1	E	Exponent
						Press Down	0 1 0 1 0 1 1	+	Plus
						Press Down	0 1 1 1 0 0 1	9	Exponent
						Press Down	0 0 0 1 1 0 1	CR	Carriage Return
						Press Down	0 0 0 1 0 1 0	LF	**On CHECK measurement answer could be 999.999 MHz

5 If instrument does not follow Output Code Sequence refer to HP-IB Output Flowchart

The above output code set is standard for the 5341A. When the instrument is in Self Test output code set is as follows

Space/Measurement Answer E + Exponent . HPD . LD . FD CR LF

Front Panel Qualifiers

Figure 5-6. Output Code Set Troubleshooting Chart 5

5-58. Read Only Memories (ROM's) Addresses and Outputs

5-59. Several read-only-memories (ROM's) in integrated circuits are used in the 5341A. *Tables 5-10, 5-11, 5-12, 5-13,* and *5-14* list the addresses and outputs of these ROM integrated circuits for use in troubleshooting.

NOTE

The ROM IC used in A19U15 has two alternatives: one for the standard 5341A and a second for 5341A Option 003.

5-60. A manual clock is necessary to use the ROM tables to troubleshoot the ROM's. Refer to paragraph 5-42, Slow or Manual Clock, for procedure to use a manual clock with the 5341A.

Table 5-11. 5341A Main Control ROM

```
5341  5341 MAIN CONTROL ROM
 A19-U15      HP PARTNUMBER 1816-2246A
 ADDRESSES (LEFT COLUMN) ARE IN OCTAL (I7,I6),(I5,I4,I3),(I2,I1,I0)
 OUTPUTS (RIGHT COLUMN) ARE IN BINARY, 1=HIGH, 0=LOW
 OUTPUTS ARE O15,O14,O13,......,O2,O1,O0
```

000	1110110000000001
001	0100101000001011
002	0101010000001101
003	0101111100000101
004	0101000100000110
005	1111000100001101
006	0000111000001100
007	0000111100001001
010	1111001000001100
011	0100001100001101
012	1111001000001001
013	1011000100000000
014	1011010000000000
015	1011101000000000
016	1011011000000000
017	1011000000000000
020	1111011101100000
021	1011110100000000
022	1011000000000000
023	01[illegible]10000100001
024	0001111100011011
025	0001111100000000
026	1010000000000000
027	1010101000000000
030	0000011100010100
031	1110101001100000
032	0101111100000000
033	0000101100101111
034	1010000000000000
035	0000011100011010
036	0000101100101111
037	1111111101100000
040	0100011101100000
041	0001010000000000
042	1110000000100000
043	1010110000000000
044	0100100100101111
045	1010011000000000
046	0001100000100110
047	0100111000101010
050	0001111000101000
051	0001110000101101
052	1011100100000000
053	0001110100101010
054	0100011000101011
055	0101111100101111
056	0100101100010001
057	0101010000010001
060	0001000100111111
061	0001111100110100
062	1011000100000000
063	1111001000010001
064	0000001100001010
065	1011101100000000
066	0100101100010001
067	0101000000101111
070	0100111000111011
071	0001101000101111
072	1111111100111100
073	0100010100101111
074	1011101000000000
075	1011011000000000
076	1111000001100000
077	1011000100000000
100	1011010000000000
101	1011101000000000
102	0101101101001101
103	1011001000000000
104	0000010001000010
105	0000000101000010
106	0001101100101111
107	0001011000101111
110	0001100101010001
111	1011000100000000
112	0101010000010001
113	0101000100001011
114	1110101001000010
115	0001100101010000
116	0001011001000011
117	1111000101001010
120	0001011001000011
121	0100100101010101
122	1011010000000000
123	1011000100000000
124	1111011101000010
125	0000001101010111
126	1111101100010001
127	1011010000000000
130	1011000100000000
131	0101010000010001
132	0001000101000010
133	1111000100001100
134	1110101000000000
135	1110101000000000
136	1110101000000000
137	1110101000000000

Table 5-11. 5341A Main Control ROM (Continued)

140	0101110000110010	227	1010100100000000
141	1010011000000100	230	1110100110101011
142	1011100000000100	231	1010011100000000
143	1010100000000000	232	1110101110011000
144	1010101100000000	233	1010000100001010
145	1010000100001111	234	1111010110100110
146	1011011000000000	235	0100001010110100
147	1010100100000000	236	0100000010110100
150	0000100000111000	237	0000000101000010
151	0001000100111001	240	0100000011010100
152	0001001101101110	241	1010000100001010
153	1010000100001111	242	1011010100000000
154	1011010100000000	243	1010100100000100
155	1010100100000000	244	1010000100001000
156	1010000100001111	245	1011010100000000
157	1011010100000000	246	1010100100000000
160	1110100101110010	247	1010000100001111
161	0001001101110101	250	0001010111101011
162	1010000100001111	251	1010011100000000
163	1011010100000000	252	1010111100000000
164	1010100100000000	253	1111010111001010
165	1010000100001111	254	1010000100001111
166	1011010100000000	255	1011010100000000
167	1110100101111010	256	1010100100000000
170	0001001001000001	257	1010000100001111
171	0001001101111101	260	1011010100000000
172	1010000100001111	261	1010100100000000
173	1011010100000000	262	1010000100001110
174	1010100100000000	263	1110111111001000
175	1010101100000000	264	1010000100001111
176	1010000100001111	265	1011010100000000
177	1011010100000000	266	1010100100000000
200	1010100100000000	267	0100000011011111
201	0001010010011101	270	1010000100001010
202	1010000100001111	271	1011010100000000
203	1011010100000000	272	1010100100000000
204	1010100100000000	273	0100001001100100
205	0101010001000111	274	0000001010110010
206	0100000011001101	275	1010000100001101
207	1010000100001111	276	1110111111001000
210	0001011110101010	277	1010000100001111
211	1010011100000000	300	1011010100000000
212	0001011110101010	301	1010100100000000
213	1010011100000000	302	0100001001100010
214	0001011110101010	303	0000001010111101
215	0001000010101010	304	1010000010000110
216	1010110100000000	305	1110111111001000
217	1010011100000000	306	1010000100001011
220	0001011110010100	307	1110111111001000
221	1010011100000000	310	1110101111001010
222	0001011110011001	311	1010000100000000
223	1110011110001000	312	1010100100000000
224	1010011100000000	313	0001010111001001
225	1010011100000000	314	0001000100100011
226	1010100100000000	315	0100100100100011

Table 5-11. 5341A Main Control ROM (Continued)

Table 5-12. 5341A Remote Output ROM

```
5341A REMOTE OUTPUT ROM
 A28-U10    HP PARTNUMBER 1816-2248
 ADDRESSES (LEFT COLUMN) ARE IN OCTAL (I7,I6),(I5,I4,I3),(I2,I1,I0)
 OUTPUTS (RIGHT COLUMN) ARE IN BINARY, 1=HIGH, 0=LOW
 OUTPUTS ARE O16,O14,O13,.....O2,O1,O0

000 1111001110000001
001 1111001110000010
002 1111001011100000
003 1111000000000011
004 0000000010000100
005 1111101110001001
006 1111101110001000
007 1111101110001100
010 1111100100000111
011 1111101110001010
012 1111101110001011
013 1111100110000110
014 1111001100001101
015 1111101110011100
016 1111000000001110
017 0010000010001111
020 1111000000010000
021 0001000010010001
022 1111000000010110
023 1111000000010011
024 0010000010010100
025 1111101110001001
026 1111000000010110
027 0101000010010111
030 1111000000011000
031 1011000010011001
032 1111000000011010
033 1001000010011011
034 1111001100011101
035 1111101110011110
036 1111001100011111
037 1111101110100000
040 1111001100100101
041 1111000000100001
042 0010000010100010
043 1111000000100011
044 0010000010100100
045 1111101110110011
046 1111000000100110
047 0010000010100111
050 1111000000101000
051 0001000010101001
052 1111000000101101
053 1111000000101011
054 0010000010101100
055 1111000000101101
056 0101000010101110
057 1111000000101111
060 1011000010110000
061 1111000000110001
062 0110000010110010
063 1111001100110100
064 1111101110110101
065 1111001100110110
066 1111100000111101
067 1111000000000000
070 1111000000111000
071 0010000010111001
072 1111000000111010
073 0010000010111011
074 1111000000111101
075 1111000000111101
076 0010000010111110
077 1111000000111111
100 0001000011000000
101 1111000001000100
102 1111000001000010
103 0010000011000011
104 1111000001000100
105 0101000011000101
106 1111000001000110
107 1011000011000111
110 1111000001001000
111 0011000011001001
112 1111011111000000
113 1111011111000000
114 1111011111000000
115 1111011111000000
116 1111011111000000
117 1111011111000000
120 1111001101010001
121 1111000001011000
122 1111000001010010
123 0100000011010011
124 1111000001010100
125 0010000011010101
126 1111001101010001
127 1111011111000000
130 1111000001011000
131 1000000011011001
132 1111000001011010
133 1010000011011011
134 1111011111011100
135 1111011111000000
136 1111011111000000
137 1111011111000000
```

Table 5-12. 5341A Remote Output ROM (Continued)

```
140 1111011111110000
141 1111000000000111
142 1111000011100010
143 0111000011100011
144 1111011110000000
145 1111011110000000
146 1111011110000000
147 1111011110000000
150 1111011110000000
151 1111011110000000
152 1111011110000000
153 1111011110000000
154 1111011110000000
155 1111011110000000
156 1111011110000000
157 1111011110000000
160 1110111110000000
161 1111011110000000
162 1111011110000000
163 1111011110000000
164 1111011110000000
165 1111011110000000
166 1111011110000000
167 1111011110000000
170 1111011110000000
171 1111011110000000
172 1111011110000000
173 1111011110000000
174 1111011110000000
175 1111011110000000
176 1111011110000000
177 1111011110000000
200 1111011110000000
201 1111011110000000
202 1111100111000001
203 1111001110000100
204 1111001000000101
205 1111000110000110
206 1111000100000111
207 1111001100001101
210 1111011110000000
211 1111011110000000
212 1111011110000000
213 1111011110000000
214 1111011110000000
215 1111000000001110
216 1111001110001111
217 1111:000000010000
220 1111001110010001
221 1111001010010010
222 1111000000010011
223 1111001110010100
224 1111101010010001
225 1111100001100100
226 1111001110010111
227 1111000000011000
230 1111001110011001
231 1111000000011010
232 1111001110011011
233 1111001010100000
234 1111011110000000
235 1111000000100001
236 1111000000000000
237 1111000010100011
240 1111000000000000
241 1111001110100010
242 1111000000100011
243 1111001110100100
244 1111000000100110
245 1111000000100110
246 1111001110100111
247 1111000010101000
250 1111001110101001
251 1111001010101010
252 1111000000101011
253 1111001110101100
254 1111101010101001
255 1111001110101110
256 1111000000101111
257 1111001110110000
260 1111000000110001
261 1111001110110010
262 1111101010100000
263 1111011110000000
264 1111000000111000
265 1111000000000000
266 1111000000111010
267 1111000000000000
270 1111001110111001
271 1111000000111010
272 1111001110111011
273 1111000000111101
274 1111000000000000
275 1111001110111110
276 1111100000111111
277 1111001110000000
300 1111001010110001
301 1111000000100010
302 1111001110000011
303 1111101010000000
304 1111001110000101
305 1111000000100110
306 1111001110000111
307 1111000000100000
310 1111001110010001
311 1111001001010000
312 1111011110000000
313 1111011110000000
```

Table 5-12. 5341A Remote Output ROM (Continued)

314	111101111[illegible]
315	111101111[illegible]
316	111101111[illegible]
317	111101111[illegible]
320	111[illegible]
321	111[illegible]
322	111[illegible]
323	111[illegible]
324	111[illegible]
325	111[illegible]
326	111[illegible]
327	111[illegible]
330	111[illegible]
331	111[illegible]
332	111[illegible]
333	111[illegible]
334	111[illegible]
335	111[illegible]
336	111[illegible]
337	111[illegible]
340	111[illegible]
341	111[illegible]
342	111[illegible]
343	111[illegible]
344	111[illegible]
345	111[illegible]
346	111[illegible]
347	111[illegible]
350	111[illegible]
351	111[illegible]
352	111[illegible]
353	111[illegible]
354	111[illegible]
355	111[illegible]
356	111[illegible]
357	111[illegible]
360	111[illegible]
361	111[illegible]
362	111[illegible]
363	111[illegible]
364	111[illegible]
365	111[illegible]
366	111[illegible]
367	111[illegible]
370	111[illegible]
371	111[illegible]
372	111[illegible]
373	111[illegible]
374	111[illegible]
375	111[illegible]
376	111[illegible]
377	111[illegible]

Table 5-13. 5341A Remote Input ROM

5341A REMOTE INPUT ROM
A27-U13   HP PARTNUMBER 1818-2247
ADDRESSES (LEFT COLUMN) ARE IN OCTAL (I7,I6),(I5,I4,I3),(I2,I1,I0)
OUTPUTS (RIGHT COLUMN) ARE IN BINARY, 1=HIGH, 0=LOW
OUTPUTS ARE O15,O14,O13,....,O2,O1,O0

000	1000001100000101	060	0111000000110010
001	1000001100000001	061	1000001100001101
002	1000001100000111	062	1100000000100001
003	1000001100001000	063	0100010000111010
004	0001110000000100	064	0000000000000110
005	1101110001010100	065	0000100000000110
006	1000001100001110	066	0000110000000110
007	0111010000001010	067	0101000000000110
010	1000001100000111	070	0111000000000110
011	1000001100000001	071	1100000000010000
012	0011000000001101	072	0110000000000110
013	1000001100000101	073	0000110000000110
014	1000001100001000	074	0000100000000110
015	0101110000010000	075	0100000001000011
016	0111110000010000	076	0001000000000110
017	1000001100000101	077	1000011100001001
020	0010110000000110	100	1001110000000000
021	1000001100000110	101	1000011100000001
022	0111010000010101	102	1101110000000110
023	1000001100000111	103	0101000000000110
024	1000001100000001	104	1000001100000101
025	[illegible]000000011000	105	1101110000000110
026	1000001100000101	106	0110000000010001
027	1000001100001000	107	0101100000000110
030	0101110000011011	110	0001010000000110
031	0111110000011011	111	0011010000001000
032	1000001100000101	112	0100010001100100
033	0110110000010001	113	0000000000000110
034	0110010001000110	114	0100100001010001
035	0011010000001000	115	0100110000111110
036	0101100000100110	116	0101000000000110
037	0001010000000110	117	1000011100000011
040	0110100000100011	120	1101110000000110
041	1000001100000001	121	0000110001100000
042	1101110000000110	122	0001000000000110
043	1000001100001001	123	0011010000001000
044	1000001100000111	124	1000001100000100
045	1101110000000110	125	1000001100000010
046	0101010000110011	126	1000001100001011
047	0110100000101111	127	1000011100000000
050	0100010000000110	130	1000011100000110
051	0100000000000110	131	1000011100000010
052	0100100000000110	132	1000011100001100
053	0100110000000110	133	1000011100001011
054	0101000000000110	134	1000011100000111
055	1000001100000111	135	1000011100000001
056	1101110000000110	136	1000011100001101
057	1000001100001111	137	1101010000000110

Table 5-11. 5341A Remote Input ROM (Continued)

Table 5-13. 5341A Remote Input ROM (Continued)

```
314 0000000000000110
315 0002100000000110
316 0001000011010011
317 1000011100000110
320 0100110011101000
321 1000011100001000
322 1101010000000110
323 1000011100001110
324 1000011100000000
325 1101010000000110
326 0000110011111010
327 0101000000000110
330 1000001100000110
331 0011010000010000
332 0011000011011101
333 1000001100000101
334 1000001100001000
335 0101110011100000
336 0111110011100000
337 1000001100000101
340 0010110011011000
341 1000001100000110
342 0011010000010000
343 0011000011100110
344 1000001100000101
345 1000001100001000
346 0101110011101001
347 0111110011101001
350 1000001100000101
351 0110110011100001
352 0010010000011101
353 0011010000010000
354 0001100001000000
355 0101010000000110
356 0100001000000110
357 0000000000000110
360 0000100000000110
361 0000000011110100
362 1000011100000010
363 1101110011110101
364 1000011100001010
365 0100110011111000
366 1000011100000100
367 1101110000000110
370 1000011100000100
371 1101110000000110
372 0101000011111101
373 1000011100000101
374 1101010000000110
375 1000011100000101
376 1101010000000110
377 1101010000000000
```

Table 5-14. 5341A Option 003 Control ROM

```
5341A OPT.3 CONTROL ROM
 A19-U15  HP PARTNUMBER 1818-2249
 ADDRESSES (LEFT COLUMN) ARE IN OCTAL, (I7,I6),(I5,I4,I3),(I2,I1,I0)
 OUTPUTS (RIGHT COLUMN) ARE IN BINARY, 1=HIGH, 0=LOW
 OUTPUTS ARE O15,O14,O13,.....,O2,O1,O0
```

000	1110110000000001	060	0001000100111111
001	0100101000001011	061	0101111101011100
002	0101010000001101	062	0100000000001011
003	0101111100000101	063	0100010000001011
004	0101000100000110	064	0000000110001010
005	1111000100001101	065	1011101100000000
006	0000111000001100	066	0100101100010001
007	0000111100001001	067	0101000000101111
010	1111001011110000	070	0100111000111011
011	0100001100001101	071	0001101000101111
012	1111001000001001	072	1111111100111100
013	1011000100000000	073	0100010100101111
014	1011010000000000	074	1011101000000000
015	1011110100000000	075	1011011000000000
016	1011011000000000	076	1111000001100000
017	1011000000000000	077	1011000100000000
020	1111011101100000	100	1011010000000000
021	1011101000000000	101	1011101000000000
022	1011000000000000	102	0101101101001101
023	0101010000100001	103	1011001000000000
024	0001111100011011	104	0000000001000010
025	0001111100000000	105	1111000100101111
026	1010000000000000	106	1110101000000000
027	1010101000000000	107	1110101000000000
030	0000011100010101	110	1110101000000000
031	1110101001100000	111	1110101000000000
032	0101111100000000	112	0101010000010001
033	0000101100101111	113	0101000100001011
034	1010000000000000	114	1110101001000010
035	0000011100011010	115	0001101010101000
036	0000101100101111	116	0001011001000011
037	1111111101100000	117	1111000101001010
040	0100011101100000	120	0001011001000011
041	0001010000000000	121	0100101010010101
042	1110000000100000	122	1011010000000000
043	1010110000000000	123	1011000100000000
044	0100100100101111	124	1111011101000010
045	1010011000000000	125	0000001101010111
046	0001100000100111	126	1111101100010001
047	0100111000101010	127	1011010000000000
050	0001111000101000	130	1011000100000000
051	0001110000101101	131	0101010000010001
052	1011100100000000	132	0001000101000010
053	0001110100101010	133	1111000100001100
054	0100011000101011	134	1011000100000000
055	0101111100101111	135	1111001000010001
056	0100101100010001	136	1110101000000000
057	0101010000010001	137	1110101000000000

Table 5-14. 5341A Option 003 Control ROM (Continued)

```
140 0101110000110001
141 1010011000000000
142 1011100000000000
143 1010100000000000
144 1010101100000000
145 1010000100001111
146 1011101100000000
147 1010100100000000
150 0000100000111100
151 0000100110111000
152 0000100110110110
153 1010000100001111
154 1011101000000000
155 1010100100000000
156 1010000100001111
157 1011101000000000
160 1110100101110010
161 0000100110111010
162 1010000100001111
163 1011101000000000
164 1010100100000000
165 1010000100001111
166 1011101000000000
167 1110100101111010
170 0000100101000001
171 0000100111111101
172 1010000100001111
173 1011101000000000
174 1010100100000000
175 1010101100000000
176 1010000100001111
177 1011101000000000
200 1010100100000000
201 0000101001011101
202 1010000100001111
203 1011101000000000
204 1010100100000000
205 0100101001000111
206 0100000110110111
207 1010000100001111
210 0000101111101010
211 1010011100000000
212 0000101111010010
213 1010011100000000
214 0000101111010010
215 0000100001010010
216 1010111010000000
217 1010011100000000
220 0000101111001000
221 1010011100000000
222 0000101111001001
223 1110011111001000
224 1010011100000000
225 1010011100000000
226 1010101100000000
227 1010100100000000
230 1110100101010111
231 1010011100000000
232 1110101110011000
233 1010000100001010
234 1110101100100110
235 0100010010110100
236 0100000010110100
237 0000000100000010
240 0100000110100100
241 1010000100001010
242 1011101000000000
243 1010100100000000
244 1010000100001100
245 1011101000000000
246 1010100100000000
247 1010000100001111
250 0000101111010011
251 1010011100000000
252 1010111000000000
253 1110101110010010
254 1010000100001111
255 1011101000000000
256 1010100100000000
257 1010000100001111
260 1011101000000000
261 1010100100000000
262 1010000100001110
263 1110111100100100
264 1010000100000000
265 1011101000000000
266 1010000100001111
267 1011101000000000
270 1110100110000111
271 1110101000000000
272 1110101000000000
273 1110101000000000
274 1110101000000000
275 1110101000000000
276 1110101000000000
277 1110101000000000
300 1110101000000000
301 1110101000000000
302 1110101000000000
303 1110101000000000
304 1110101000000000
305 1110101000000000
306 1110101000000000
307 1110101000000000
310 1110101111010010
311 1010000100000000
312 1010100100000000
313 0000101011001001
```

Table 5-14 5341A Option 003 Control ROM (Continued)

Table 5-15. A25 U8 Bit Pattern

WORD	INPUTS						OUTPUTS							
	BINARY SELECT					ENABLE								
	E	D	C	B	A	G	Y8	Y7	Y6	Y5	Y4	Y3	Y2	Y1
0	L	L	L	L	L	L	H	L	H	L	L	L	L	L
1	L	L	L	L	H	L	H	L	H	L	H	H	H	H
2	L	L	H	L	L	L	L	L	H	H	H	H	H	H
3	L	L	L	H	H	L	H	L	H	H	L	L	H	H
4	L	L	H	L	L	L	H	L	H	L	H	H	L	L
5	L	L	H	L	H	L	H	H	L	L	L	H	L	H
6	L	L	H	H	L	L	H	L	H	H	L	H	H	L
7	L	L	H	H	H	L	H	H	L	H	L	L	H	H
8	L	H	L	L	L	L	H	L	L	L	H	H	L	H
9	L	H	L	L	H	L	H	L	H	H	H	L	L	H
10	L	H	L	H	L	L	H	L	L	L	H	L	H	L
11	L	H	L	H	H	L	H	L	H	L	H	L	H	H
12	L	H	H	L	L	L	L	L	L	L	L	L	L	L
13	L	H	H	L	H	L	L	L	L	L	L	L	L	L
14	L	H	H	H	L	L	L	L	L	L	L	L	L	L
15	L	H	H	H	H	L	L	L	L	L	H	H	H	H
16	H	L	L	L	L	L	L	L	L	L	L	L	L	L
17	H	L	L	L	H	L	L	L	L	L	L	L	L	L
18	H	L	L	H	L	L	L	L	L	L	L	L	L	L
19	H	L	L	H	H	L	L	L	L	L	L	L	L	L
20	H	L	H	L	L	L	L	L	L	L	L	L	L	L
21	H	L	H	L	H	L	L	L	L	L	L	L	L	L
22	H	L	H	H	L	L	L	L	L	L	L	L	L	L
23	H	L	H	H	H	L	L	L	L	L	L	L	L	L
24	H	H	L	L	L	L	L	L	L	L	L	L	L	L
25	H	H	L	L	H	L	L	L	L	L	L	L	L	L
26	H	H	L	H	L	L	L	L	L	L	L	L	L	L
27	H	H	L	H	H	L	L	L	L	L	L	L	L	L
28	H	H	H	L	L	L	L	L	L	L	L	L	L	L
29	H	H	H	L	H	L	L	L	L	L	L	L	L	L
30	H	H	H	H	L	L	L	L	L	L	L	L	L	L
31	H	H	H	H	H	L	L	L	L	L	L	L	L	L
ALL	X	X	X	X	X	H	H	H	H	H	H	H	H	H

H = High Level, L = Low Level, X = Irrelevant

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains information for ordering replacement parts. *Table 6-1* lists parts in alphanumerical order of their reference designators and indicates the description and HP Part Number of each part, together with any applicable notes. The table includes the following information.

a. Description of part (see abbreviations below).

b. Typical manufacturer of the part in a five-digit code; see list of manufacturers in *Table 6-2*.

c. Manufacturer's part number.

d. Total quantity used in the instrument (Qty column).

6-3. HP 5341A options are listed at the end of *Table 6-1*.

6-4. ORDERING INFORMATION

6-5. To obtain replacement parts, address order of inquiry to your local Hewlett-Packard Sales and Service Office (see lists at rear of this manual for addresses). Identify parts by their Hewlett-Packard part numbers, and reference designation (including instrument model number).

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

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

REFERENCE DESIGNATIONS

A	assembly	F	fuse	P	plug	TB	terminal board
B	fan motor	FL	filter	Q	transistor	W	cable
BT	battery	H	hardware	R	resistor	X	socket
C	capacitor	HY	circulator	RT	thermistor	Y	crystal
CR	diode, diode thyristor, varactor	J	jack	S	switch	Z	tuned cavity, waveguide assembly
DC	directional coupler	K	relay	T	transformer		
DL	delay line	L	coil, inductor	TC	thermocouple		
DS	annunciator, lamp, LED	M	motor	TP	test point		
		MP	mechanical part	U	integrated circuit, microcircuit		

ABBREVIATIONS

A	ampere	BAL	balance	CCW	counterclockwise	DPDT	double-pole double-throw
ac	alternating current	BCD	binary-coded decimal	CER	ceramic	DPST	double-pole single-throw
ACCESS	accessory	BD	board	CHAN	channel	DR	drive
ADJ	adjustment	BE CU	beryllium copper	CMO	cabinet mount only	DSB	double sideband
A/D	analog-to-digital	BFO	beat frequency oscillator	COAX	coaxial	DTL	diode transistor logic
AF	audio frequency	BH	binder head	COM	common	DVM	digital voltmeter
AFC	automatic frequency control	BRS	brass	COMP	composition	ECL	emitter coupled logic
AGC	automatic gain control	BRZ	bronze	CP	cadmium plate	EDP	electronic data processing
AL	aluminum	BT	binder or fillister head	CRT	cathode ray tube	ELECT	electrolytic
ALC	automatic level control	BWO	backward wave oscillator	CTL	complementary transistor logic	ENCAP	encapsulated
AM	amplitude modulation	CAL	calibrate	CW	continuous wave	EXT	external
AMPL	amplifier	CCW	counterclockwise	cw	clockwise	F	farad
AFC	automatic phase control	CER	ceramic	D/A	digital-to-analog	FET	field-effect transistor
ASSY	assembly	CHAN	channel	DBM	decibels referenced to 1 mW	FH	flat head
AUX	auxiliary	CMO	cabinet mount only	dc	direct current	FIL H	fillister head
avg	average	COAX	coaxial	deg	degree (temperature interval or difference)	FM	frequency modulation
AWG	american wire gauge	COM	common		degree (plane angle)	FP	front panel
		COMP	composition			FREQ	frequency

ABBREVIATIONS (CONTINUED)

PMI	• pertaining to the	mtr	• monitor	PIV	• peak inverse voltage	TERM	• terminal
POS	• positive; data	mtrl	• metal	PK	• peak	TFT	• thin film transistor
	processing	MUX	• multiplex	PL	• phase lock	TGL	• toggle
PLSTC	• plastic	myn	• multiplier;	PLO	• phase lock oscillator	THRD	• thread
PNCAP	• encapsulated		multiplying	PM	• phase modulator	THRU	• through
PNP	• polymer	NANAR	• nanofarad	PNP	• positive negative	TI	• titanium
P	• farad	nav	• nanometer		positive	TOL	• tolerance
PET	• hard wired transistor	NCD	• neodymium	P O	• part of	TORO	• toroidal
PF	• right flag	NCRV	• neon lamp	PCBA	• printed circuit	TRIM	• trimmer
PH	• right hand	NCS	• negative temperature		board assembly	TSTR	• transistor
POLY	• positive polarity		coefficient	PCBL	• printed circuit	TV	• television
PM	• frequency modulation	ne	• neutral	PCB	• printed circuit board	TWT	• traveling wave tube
PT	• hard paper	NHsi	• nonsilicon		• printed circuit	U	• microcircuit, multiple unit
PREQ	• frequency	NPN	• negative positive		board assembly		• parts kit
PSD	• hand		negative	PCMCIA	• personal computer	UF	• microfarad • ultra fast
g	• gram	ns	• nanosecond	PCT	• percent		• parts kit
GA	• gauge; gallium	nsec	• nanosecond	PF	• peak to peak	UHF	• ultra high frequency
GHz	• gigahertz	NSR	• nonsolder	PF	• peak to peak • positive	UNREG	• unregulated
GL	• glass	NTC	• nominal peak		• parts kit	V	• volt
GND	• grounded	NTPT	• nominal peak to peak	PFM	• pulse frequency	VA	• voltampere
H	• henry	NUMB	• number; numb		modulation	VAC	• vacuum
h	• hour	NW	• nonwall	PHILAMRY	• philamonic	VAR	• varactor
HET	• heterodyne	NUP	• multiple	PHS	• pulse regenerator	VATR	• variator
HEX	• hexagonal	NY	• nylon		flip, body	VCO	• voltage controlled
HD	• head	µA	• micro gate	PHS	• pulse repetition rate		oscillator
HDW	• hardware	µF	• microfarad	PS	• picosecond	VDC	• volt dc
HF	• high frequency	µH	• microhenry	PT	• point	VDCW	• volts dc working (voltage
HG	• mercury	µmho	• micromho	PTM	• pulse time modulation		• parts kit)
HI	• high	µs	• microsecond	PWM	• pulse width modulation	VEE	• volts (dipole)
HF	• hexagon head panel	µV	• microvolt	PWV	• peak working voltage	VHF	• very high frequency
HPF	• high pass filter	µVac	• microvolt ac	RC	• resistance capacitance		• oscillator
HR	• hour (used in parts list)	µVdc	• microvolt dc	RECT	• rectifier	VHF	• very high frequency
HV	• high voltage	µVpk	• microvolt peak	REF	• reference	VIA	• via hole
Hz	• hertz	µVp-p	• microvolt peak to	REG	• regulated	VPO	• variable peak to peak
IC	• integrated circuit		peak	REPL	• replaceable	VRM	• voltage regulator module
ID	• inside diameter	µVrms	• microvolt rms	RF	• radio frequency	VSWR	• voltage standing wave
IF	• intermediate frequency	µW	• microwatt	RFI	• radio frequency		ratio
IMPG	• impregnated	mA	• milliampere		interference	VTO	• voltage tuned oscillator
in	• inch	NC	• no connection	RH	• round head • right hand	VTVM	• vacuum tube voltmeter
INCD	• incandescent	NE	• normally closed	RLC	• resistance inductance	WDI	• width modulation
INCL	• included	NI	• near		capacitance	W	• watt
INP	• input	NPO	• negative	RMO	• rack mount only	W	• with
INS	• insulation	NR	• rare earth	rms	• root mean square	WIV	• working inverse voltage
INT	• internal	NTC	• molybdate	RND	• round	WW	• wirewound
kg	• kilogram	NO	• normally open	RQM	• read only memory	WY	• wideband
kHz	• kilohertz	NOM	• nominal	R&P	• rack and panel	YIG	• yttrium iron garnet
kΩ	• kilohm	NORM	• normal	RWV	• reverse working voltage	Zo	• characteristic
kV	• kilovolt	NPN	• negative positive	S	• scattering parameter		impedance
lb	• pound		negative	s	• second (time)		
LC	• inductive capacitance	NPO	• negative positive zero		• second (plane angle)		
LED	• light emitting diode		(zero temperature	S H	• slow blow (fuse used		
LF	• low frequency		coefficient)		in parts list)		
LG	• long	NRFD	• not recommended for	SCR	• silicon controlled		
LH	• left hand		field replacement		rectifier; screw		
LIM	• limit	NSR	• not separately	SE	• selenium		
LIN	• linear taper (used in		replaceable	SECT	• section		
	parts list)	ns	• nanosecond	SEMICON	• semiconductor		
lin	• linear	nW	• nanowatt	SHF	• superhigh frequency		
LK WASH	• lockwasher	OBD	• order by description	SI	• silicon		
LO	• low; local oscillator	OD	• outside diameter	SIL	• silver		
LOG	• logarithmic taper	OH	• oval head	SL	• slide		
	(used in parts list)	OP AMP	• operational amplifier	SNR	• signal to noise ratio		
log	• logarithmic	OPT	• option	SPDT	• single pole double		
LPF	• low pass filter	OSC	• oscillator		throw		
LV	• low voltage	OX	• oxide	SPST	• single pole single		
m	• meter (distance)	oz	• ounce		throw		
mA	• milliampere	Ω	• ohm	SPG	• spring		
MAX	• maximum	P	• peak (used in parts	SR	• split ring		
MΩ	• megohm		list)	SPST	• single pole single		
MEG	• meg (Ω) (used in	PAM	• pulse amplitude		throw		
	parts list)		modulation	SSB	• single sideband		
MET FLM	• metal film	PC	• printed circuit	SST	• stainless steel		
MET OX	• metal oxide	PCM	• pulse code modulation	STL	• steel		
MF	• medium frequency		• pulse count modulation	SQ	• square		
	• microfarad (used in	PDM	• pulse duration	SWR	• standing wave ratio		
	parts list)		modulation	SYNC	• synchronize		
MFR	• manufacturer	pF	• picofarad	T	• timed (slow blow fuse)		
mg	• milligram	PHBRZ	• phosphor bronze	TA	• tantalum		
MHz	• megahertz	PHL	• Philips	TC	• temperature		
					compensating		
				TD	• time delay		

NOTE

All abbreviations in the parts list are in upper case.

MULTIPLIERS

Abbreviation	Prefix	Multiple
T	tera	10^{12}
G	giga	10^{9}
M	mega	10^{6}
k	kilo	10^{3}
da	deka	10^{1}
d	deci	10^{-1}
c	centi	10^{-2}
m	milli	10^{-3}
µ	micro	10^{-6}
n	nano	10^{-9}
p	pico	10^{-12}
f	femto	10^{-15}
a	atto	10^{-18}

6-7. HP PART NUMBER ORGANIZATION

6-8. Following is a general description of the HP part number system.

6-9. Component Parts and Materials

6-10. Generally, the prefix of HP part numbers identifies the type of device. Eight-digit part numbers are used, where the four-digit prefix identifies the type of component, part, or material and the four-digit suffix indicates the specific type. Following is a list of some of the more commonly used prefixes for component parts. The list includes HP manufactured parts and purchased parts.

Prefix	Component/Part/Material
0121-	Capacitors, Variable (mechanical)
0122-	Capacitors, Voltage Variable (semiconductor)
0140-	Capacitors, Fixed
0150-	Capacitors, Fixed Non-Electrolytic
0160-	Capacitors, Fixed
0180-	Capacitors, Fixed Electrolytic
0330-	Insulting Materials
0340-	Insultors, Formed
0370-	Knobs, Control
0380-	Spacers and Standoffs
0410-	Crystals
0470-	Adhesives
0490-	Relays
0510-	Fasteners
0674- thru 0778-	Resistors, Fixed (non wire wound)
0811- thru 0831-	Resistors (wire wound)
1200-	Sockets for components
1205-	Heat Sinks
1250-	Connectors (RF and related parts)
1251-	Connectors (non RF and related parts)
1410-	Bearings and Bushings
1420-	Batteries
1820-	Monolithic Digital Integrated Circuits
1826-	Monolithic Linear Integrated Circuits
1850-	Transistors, Germanium PNP
1851-	Transistors, Germanium NPN
1853-	Transistors, Silicon PNP
1854-	Transistors, Silicon NPN
1855-	Field-Effect-Transistors
1900- thru 1912-	Diodes
1920- thru 1952-	Vacuum Tubes
1990-	Semiconductor Photosensitive and Light-Emitting Diodes
3100- thru 3106-	Switches
8120-	Cables
9100-	Transformers, Coils, Chokes, Inductors, and Filters

6-11. For example, 1854-0037, 1854-0221, and 1851-0192 are all NPN transitors. The first two are silicon and the last is germanium.

6-12. General Usage Parts

6-13. The following list gives the prefixes for HP manufactured parts used in several instruments, e.g., side frames, feet, top and bottom covers, etc. These are eight-digit part numbers with the four- digit prefix identifying the type of parts as shown below:

Type of Part	Prefix
Sheet Metal	5000- to 5019-
Machined	5020- to 5039-
Molded	5040- to 5059-
Assemblies	5060- to 5079-
Components	5080- to 5099-

6-14. Specific Instrument Parts

6-15. These are HP manufactured parts for use in individual instruments or series of instruments. For these parts, the prefix indicates the instrument and the suffix indicates the type of parts. For example, 05341-60001 is an assembly used in the 5341A. Following is a list of suffixes commonly used.

Type of Part	P/N Suffix
Sheet Metal	-00000 to -00499
Machined	-20000 to -20499
Molded	-40000 to -40499
Assemblies	-60000 to -60499
Components	-80000 to -80299
Documentation	-90000 to -90249

Table 6-1. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05341-60001	1	MIXER MODULE SERIES 1532	28480	05341-60001
A1C1	0160-2436	2	CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
A1C2	0160-2436		CAPACITOR-FDTHRU 10PF 20% 200V CER	28480	0160-2436
A1C3	0160-2437	2	CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A1C4	0160-2437		CAPACITOR-FDTHRU 5000PF +80 -20% 200V	28480	0160-2437
A1J1	1250-0911	1	CONNECTOR	28480	1250-0911
A1J2	1250-0912	4	CONNECTOR, COAX	28480	1250-0912
A1J3	1250-0912		CONNECTOR, COAX	28480	1250-0912
A1J4	1250-0912		CONNECTOR, COAX	28480	1250-0912
A1J5	1250-0912		CONNECTOR, COAX	28480	1250-0912
A1W1			PART OF CHASSIS PARTS (W4)		
A1W2	8120-0037	1	CABLE ASSY-COAX 50-OHM 2,3-LG	28480	8120-0037
		1	A1 MISCELLANEOUS		
	9170-0029	10	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
	05341-00019	1	COVER, MIXER	28480	05341-00019
	05341-20035	1	BODY, MIXER	28480	05341-20035
	05350-00012	1	COVER, MIXER ASSY, BLANK	28480	05350-00012
A1A1	05341-60025	1	INPUT SWITCH ASSY SERIES 1532	28480	05341-60025
A1A1C1	0160-4082	3	CAPACITOR-FXD 470PF +-10% 50VDC CER0+-25	28480	0160-4082
A1A1C2	0150-0073	6	CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0150-0073
A1A1C3	0160-3879	50	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A1C4	0160-3876	9	CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1A1C5	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A1C6	0160-3872	7	CAPACITOR-FXD 2.2PF +-.25PF 200VDC	28480	0160-3872
A1A1C7	0121-0446	2	CAPACITOR-V TRMR-CER 2.5-9PF 63V PC-MTG	51404	58-TMIXC-04 2.5-9 PF-N033
A1A1C8	0160-0700	2	CAPACITOR-FXD 150PF +-10% 100VDC	28480	0160-0700
A1A1C9	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A1C10	0160-4028	1	CAPACITOR-FXD 120PF +-10% 100VDC	28480	0160-4028
A1A1C11	0160-0700		CAPACITOR-FXD 150PF +-10% 100VDC	28480	0160-0700
A1A1C12			NOT ASSIGNED		
A1A1C13	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A1CR1	1901-0518	4	DIODE-SCHOTTKY	28480	1901-0518
A1A1CR2	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A1A1CR3	1901-0639	16	DIODE-PIN 110V	28480	5082-3080
A1A1CR4	1901-1097	1	DIODE-PIN	28480	1901-1097
A1A1L1			ETCHED ON PRINTED CIRCUIT BOARD		
A1A1L2	9100-0181	3	COIL-MLD 680NH 10% Q=33 .095DX.25LG	02178	09-4420-1K
A1A1L3	9100-0181		COIL-MLD 680NH 10% Q=33 .095DX.25LG	02178	09-4420-1K
A1A1L4	9100-0181		COIL-MLD 680NH 10% Q=33 .095DX.25LG	02178	09-4420-1K
A1A1Q1	1854-0215	3	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A1A1Q2	1854-0071	5	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1A1Q3	1853-0036	7	TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A1A1Q4	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A1A1R1	0683-1035	20	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1A1R2	0683-3025	5	RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
A1A1R3	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A1A1R4	0698-3113	9	RESISTOR 100 5% .125W CC TC=-270/+540	01121	BB1015
A1A1R5	0683-7515	6	RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A1A1R6	0683-2025	7	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A1A1R7	0698-3426	2	RESISTOR 10K 10% .125W CC TC=-350/+857	01121	BB1031
A1A1R8	0698-3426		RESISTOR 10K 10% .125W CC TC=-350/+857	01121	BB1031
A1A1R9	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A1A1R10	0683-4725	1	RESISTOR 4.7K 5% .25W FC TC=-400/+700	01121	CB4725
A1A1U1	1813-0075	1		28480	1813-0075
A1A2	05341-60024	1	MIXER BOARD ASSY SERIES 1532	28480	05341-60024
A1A2C1			NOT ASSIGNED		
A1A2C2	0160-4040	2	CAPACITOR-FXD 10PF +-10% 50VDC CER0+-25	28480	0160-4040
A1A2C3	0160-4040		CAPACITOR-FXD 10PF +-10% 50VDC CER0+-25	28480	0160-4040
A1A2C4			NOT ASSIGNED		
A1A2C5	0160-4082		CAPACITOR-FXD 470PF +-10% 50VDC CER0+-25	28480	0160-4082
A1A2C6	0160-4082		CAPACITOR-FXD 470PF +-10% 50VDC CER0+-25	28480	0160-4082
A1A2C7	0160-3878	27	CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1A2C8	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A1A2C9			NOT ASSIGNED		
A1A2C10			NOT ASSIGNED		
A1A2C11			NOT ASSIGNED		
A1A2C12	0180-0210	8	CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1A2CR1			NOT ASSIGNED		
A1A2CR2	1900-0028	2	DIODE, STRIPLINE	28480	1900-0028
A1A2CR3	1900-0028		DIODE, STRIPLINE	28480	1900-0028
A1A2CR4			NOT ASSIGNED		
A1A2CR5	1901-0639		DIODE-PIN 110V	28480	5082-3080
A1A2Q1	358218	1	TRANSISTOR	28480	358218
A1A2R1	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01121	BB1015
A1A2R2			NOT ASSIGNED		
A1A2R3	05354-80003	2	RESISTOR CHIP, 100 OHM	28480	05354-80003
A1A2R4	05354-80003		RESISTOR CHIP, 100 OHM	28480	05354-80003
A1A2R5	0698-4496	2	RESISTOR 47K 5% .125W CC TC=-466/+875	01121	BB4735
A1A2R6	0698-4496		RESISTOR 47K 5% .125W CC TC=-466/+875	01121	BB4735
A1A2R7	0698-7101	1	RESISTOR 3K 5% .125W CC TC=-350/+857	01121	BB3025
A1A2R8	0675-1021	4	RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A1A2R9	0698-3367	1	RESISTOR 18 5% .125W CC TC=-270/+540	01121	BB1805
A1A2R10	0698-3114	2	RESISTOR 300 5% .125W CC TC=-330/+800	01121	BB3015
A1A2R11	0698-3114		RESISTOR 300 5% .125W CC TC=-330/+800	01121	BB3015
A1A2R12			NOT ASSIGNED		
A1A2R13	0686-1005	1	RESISTOR 10 5% .5W CC TC=0+412	01121	EB1005
A1A2R14	05354-80002	1	RESISTOR CHIP, 68 OHM	28480	05354-80002
A1A3	05341-60002	1	IF FILTER/AMPLIFIER BOARD ASSY SERIES 1632	28480	05341-60002
A1A3C1	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A3C2	0121-0446		CAPACITOR-V TRMR-CER 2.5-9PF 63V PC-MTG	[illegible]	[illegible]
A1A3C3	0160-3029	5	CAPACITOR-FXD 7.5PF +-.5PF 100VDC	28480	0160-3029
A1A3C4	0160-3029		CAPACITOR-FXD 7.5PF +-.5PF 100VDC	28480	0160-3029
A1A3C5	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A3C6	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A3C7	0160-3029		CAPACITOR-FXD 7.5PF +-.5PF 100VDC	28480	0160-3029
A1A3C8			NOT ASSIGNED		
A1A3C9	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A3C10	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A3C11	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A1A3C12			NOT ASSIGNED		
A1A3C13	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A1A3CR1	1901-0639		DIODE-PIN 110V	28480	5082-3080
A1A3CR2	1901-0639		DIODE-PIN 110V	28480	5082-3080
A1A3CR3	1901-0639		DIODE-PIN 110V	28480	5082-3080
A1A3CR4	1901-0639		DIODE-PIN 110V	28480	5082-3080
A1A3L1			ETCHED ON PRINTED CIRCUIT BOARD		
A1A3L2			ETCHED ON PRINTED CIRCUIT BOARD		
A1A3L3	9100-2272	1	COIL-MLD 4TUR 10% Q=65 .095DX.25LG	02178	C9-1320-3
A1A3R1	0757-0458	1	RESISTOR 51.1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5112-F
A1A3R2	0757-0416	5	RESISTOR 511 1% .125W F TC=0+-100	03292	C4-1/8-T0-511-F
A1A3R3	0757-0438	6	RESISTOR 5.11K 1% .125W F TC=0+-100	03292	C4-1/8-T0-5111-F
A1A3R4	0757-0280	11	RESISTOR 1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1001-F
A1A3R5	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1001-F
A1A3R6	0757-0429	3	RESISTOR 1.82K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1821-F
A1A3R7	0757-0199	1	RESISTOR 21.5K 1% .125W F TC=0+-100	03292	C4-1/8-T0-2152-F
A1A3R8	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	03292	C4-1/8-T0-511-F
A1A3R9	0698-3378	10	RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A1A3R10	0757-0442	10	RESISTOR 10K 1% .125W F TC=0+-100	03292	C4-1/8-T0-1002-F
A1A3U1	1820-0306	1	IC DIFF AMPL	02735	CA3028A
A1A3U2	1813-0076	1		28480	1813-0076
A2	05341-60030		FILTER ASSY, HIGH-PASS (OPTION 003 ONLY)	28480	05341-60030
A2	05341-60048		FILTER ASSY, SWITCHABLE(EXCEPT OPT 003)	28480	05341-60048
A3	05341-60003	1	500-1000 MHZ DOUBLER ASSY	28480	05341-60003
A3J1	1250-0544	1	CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	03424	700019
A3U1	5088-2015	1	FILTER, 1.0 GHZ	28480	5088-2015
			A3 MISCELLANEOUS		
	9170-0029		CORE-SHIELDING BEAD	02114	56-590-65A2/4A
	05341-00012	1	COVER, TOP DOUBLER	28480	05341-00012
	05341-00013	1	COVER, BOTTOM DOUBLER	28480	05341-00013
	05341-00020	2	BRACKET, HOUSING	28480	05341-00020
	05341-20033	1	HOUSING, DOUBLER	28480	05341-20033
A3A1	05341-60027	1	500-1000 MHZ DOUBLER BOARD ASSY	28480	05341-60027

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3A1C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A3A1C2	0150-0073		CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0150-0073
A3A1C3	0160-2743	6	CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A3A1C4	0160-3877	1	CAPACITOR-FXD 3.6PF +-.1PF 200VDC	28480	0160-3877
A3A1C5	0160-2743		CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A3A1C6	0160-2257	1	CAPACITOR-FXD 10PF +-5% 500VDC CER0+-60	28480	0160-2257
A3A1C7	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A3A1C8	0150-0073		CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0150-0073
A3A1C9	0150-0073		CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0150-0073
A3A1C10	0160-2743		CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A3A1CR1	1901-0639		DIODE-PIN 110V	28480	5082-3080
A3A1Q1	1853-0020	4	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A3A1Q2	1854-0345	2	TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0345
A3A1Q3	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A3A1Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3A1R1	0757-0438	1	RESISTOR 3.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3901-F
A3A1R2	0757-0443	1	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1102-F
A3A1R3	0757-0422	4	RESISTOR 910 1% .125W F TC=0+-100	24546	C4-1/8-T0-911-F
A3A1R4	2100-2521	1	RESISTOR-TRMR 2K 10% C SIDE-ADJ 1-TRN	02111	ET50X202
A3A1R5	0757-0422		RESISTOR 910 1% .125W TC=0+-100	24546	C4-1/8-T0-911-F
A3A1R6	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A1R7	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A1R8	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A1R9	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A1R10	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A1R11	0757-0422		RESISTOR 910 1% .125W F TC=0+-100	24546	C4-1/8-T0-911-F
A3A1R12	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A3A2	05341-60026	1	MULTIPLEXER BOARD ASSY	28480	05341-60026
A3A2C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A3A2C2	0160-2743		CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A3A2C3	0150-0073		CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0150-0073
A3A2C4	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200VDC	28480	0160-3872
A3A2C5	0160-3873	4	CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A3A2C6	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200VDC	28480	0160-3872
A3A2C7	0160-2743		CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A3A2C8	0121-0046	1	CAPACITOR-V TRMR-PSTN .8-5.5PF 750V	04/0C	521-000
A3A2C9	0160-2743		CAPACITOR-FXD 33PF +-10% 200VDC CER	28480	0160-2743
A3A2C10	0150-0073		CAPACITOR-FXD 100PF +-10% 1KVDC CER	28480	0150-0073
A3A2CR1	1901-0639		DIODE-PIN 110V	28480	5082-3080
A3A2CR2	1901-0639		DIODE-PIN 110V	28480	5082-3080
A3A2L1	9100-2249	2	COIL-MLD 150NH 10% Q=34 .095DX.25LG	02178	09-4410-1K
A3A2Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3A2Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A3A2R1	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A2R2	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A2R3	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A3A2R4	0683-1225	2	RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A3A2R5	0683-1225		RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A3A2R6	0683-2225	1	RESISTOR 2.2K 5% .25W FC TC=-400/+700	01121	CB2225
A4	05341-60004	1	500 MHZ PRESCALER ASSY SERIES 1508	28480	05341-60004
A4C1	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C2	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C3	0160-3874	5	CAPACITOR-FXD 10PF +-.5PF 200VDC	28480	0160-3874
A4C4	0160-3874		CAPACITOR-FXD 10PF +-.5PF 200VDC	28480	0160-3874
A4C5	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C6	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C7	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C8	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C9	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C10	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C11	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C12	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C13	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4C14	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C15	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C16	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A4J1	1250-0835	2	CONNECTOR-RF SMC M PC 50-OHM	0331F	37JR1C6-2
A4J2	1250-0835		CONNECTOR-RF SMC M PC 50-OHM	0331F	37JR1C6-2

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4Q1	1853-0016	1	TRANSISTOR PNP 2N3906 SI TO-92 PD=310MW	04713	[illegible]
A4Q2	1854-0092	1	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A4R1	2100-3486	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 1-TRN	[illegible]	[illegible]
A4R2	0698-8180	1	RESISTOR 2K 5% .125W CC TC=-270/+540	01121	BB2025
A4R3	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R4	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R5	0686-5105	1	RESISTOR 51 5% .5W CC TC=0+412	01121	EB5105
A4R6	0698-7308	3	RESISTOR 1.1K 5% .125W CC TC=-330/+857	01121	BB1125
A4R7	0698-7308		RESISTOR 1.1K 5% .125W CC TC=-330/+857	01121	BB1125
A4R8	0686-1125	1	RESISTOR 1.1K 5% .5W CC TC=0+647	01121	EB1125
A4R9	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R10	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R11	0698-7308		RESISTOR 1.1K 5% .125W CC TC=-330/+857	01121	BB1125
A4R12	0698-3145	1	RESISTOR 15K 5% .125W CC TC=-466/+877	01121	BB1535
A4R13	0698-3177	1	RESISTOR 820 5% .125W CC TC=-330/+800	01121	BB8215
A4R14	0698-8127	1	RESISTOR 22 5% .125W CC TC=-270/+540	01121	BB2205
A4R15	0698-5563	1	RESISTOR 180 5% .125W CC TC=-330/+800	01121	BB1815
A4R16	0698-5176	1	RESISTOR 510 5% .125W CC TC=-330/+800	01121	BB5115
A4R17	0698-5240	1	RESISTOR 75 5% .125W CC TC=-270/+540	01121	BB7505
A4R18	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01121	BB1015
A4R19	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R20	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R21*	0698-8673	1	RESISTOR 1.8K 5% .125W CC TC=-350/+857 *FACTORY SELECTED PART	01121	BB1825
A4R22	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R23	0683-2405	1	RESISTOR 24 5% .25W FC TC=-400/+500	01121	CB2405
A4R24	0683-4715	6	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A4R25	0683-2425	2	RESISTOR 2.4K 5% .25W FC TC=-400/+700	01121	CB2425
A4R26	0683-3925	1	RESISTOR 3.9K 5% .25W FC TC=-400/+700	01121	CB3925
A4R27	0683-8205	2	RESISTOR 82 5% .25W FC TC=-400/+500	01121	CB8205
A4R28	0683-1315	2	RESISTOR 130 5% .25W FC TC=-400/+600	01121	CB1315
A4R29	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A4R30	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A4R31*	0683-5115	24	RESISTOR 510 5% .25W FC TC=-400/+600 *FACTORY SELECTED PART	01121	CB5115
A4R32*	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600 *FACTORY SELECTED PART	01121	CB5115
A4U1	1820-1019	1	IC CNTR ECL BI-QUINARY	28480	1820-1019
A4U2	1820-0802	1	IC GATE ECL NOR QUAD 2-INP	04713	10102P
A4U3	1820-0736	1	IC CNTR ECL BIN DUAL	28480	1820-0736
A4U4	1826-0297	1		28480	1826-0297
A4U5	1826-0216	2	IC OP AMP	28480	1826-0216
A5	05341-60005	1	IF AMPLIFIER/DETECTOR ASSY SERIES 1540	28480	05341-60005
A5C1	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C2	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C3	0160-3877	4	CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A5C4	0160-3877		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A5C5	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200VDC	28480	0160-3872
A5C6	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A5C7	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200VDC	28480	0160-3872
A5C8	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C9	0160-3874		CAPACITOR-FXD 10PF +-.5PF 200VDC	28480	0160-3874
A5C10	0160-2264	1	CAPACITOR-FXD 20PF +-5% 500VDC CER 0+-30	28480	0160-2264
A5C11	0160-3029		CAPACITOR-FXD 7.5PF +-.5PF 100VDC	28480	0160-3029
A5C12	0160-3877		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A5C13	0160-3877		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A5C14	0132-0007	4	CAPACITOR-V TRMR-PSTN .7-3PF 350V	[illegible]	535-033-4A
A5C15	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C16	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C17	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C18	0180-0230	4	CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A5C19	0180-0374	4	CAPACITOR-FXD 10UF+-10% 20VDC TA	56289	150D106X9020B2
A5C20	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5C21	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A5CR1	1901-0535	5	DIODE-SCHOTTKY	28480	1901-0535
A5CR2	05341-80005		DIODES, MATCHED PAIR	28480	05341-80005
A5CR3			PART OF A5CR2		
A5CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A5CR5	1901-0639		DIODE-PIN 110V	28480	5082-3080
A5CR6	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A5CR7	1901-0639		DIODE-PIN 110V	28480	5082-3080
A5CR8	1901-0639		DIODE-PIN 110V	28480	5082-3080
A5CR9	05341-80005		DIODES, MATCHED PAIR	28480	05341-80005
A5CR10			PART OF A5CR9		

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5L1			ETCHED ON PRINTED CIRCUIT BOARD		
A5L2			ETCHED ON PRINTED CIRCUIT BOARD		
A5L3			ETCHED ON PRINTED CIRCUIT BOARD		
A5L4	9100-2491	2	COIL-MLD 50NH 10% Q=40 .095DX.25LG	28480	9100-2491
A5L5	9100-2491		COIL-MLD 50NH 10% Q=40 .095DX.25LG	28480	9100-2491
A5L6			ETCHED ON PRINTED CIRCUIT BOARD		
A5R1	0683-2015	2	RESISTOR 200 5% .25W FC TC=-400/+600	01121	CB2015
A5R2	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A5R3	0683-7515		RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A5R4	0683-7515		RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A5R5	0683-7515		RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A5R6	0757-0439	1	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A5R7	0757-0420	1	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A5R8	0757-0465	2	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R9	0757-0280	1	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A5R10	0757-0427	1	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A5R11	0757-0446	3	RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A5R12	0683-8235	1	RESISTOR 82K 5% .25W FC TC=-800/+900	01121	CB8235
A5R13					
A5R14	0757-0418	1	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A5R15	0683-1245	1	RESISTOR 120K 5% .25W FC TC=-800/+900	01121	CB1245
A5R16	0757-0446		RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A5R17	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A5R18	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A5R19	0683-3605	1	RESISTOR 36 5% .25W FC TC=-400/+500	01121	CB3605
A5R20	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A5R21	0683-1025	20	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R22	0675-1021		RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A5R23	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A5R24	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A5R25	0683-1625	2	RESISTOR 1.6K 5% .25W FC TC=-400/+700	01121	CB1625
A5R26	0683-2035	3	RESISTOR 20K 5% .25W FC TC=-400/+800	01121	CB2035
A5R27	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A5R28	0683-1015	5	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A5R29	2100-2632	1	RESISTOR-TRMR 100 10% C SIDE-ADJ 1-TRN	02111	43P101
A5R30	2100-2413	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 1-TRN	02111	43P201
A5R31	2100-3352	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	73138	72-103-0
A5R32	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A5R33			NOT ASSIGNED		
A5R34	0683-5125	6	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A5R35	0683-5125		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A5R36	0683-5125		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A5R37	0683-1055	3	RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A5R38	0683-1045	8	RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A5R39	0675-1021		RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A5R40	0675-1021		RESISTOR 1K 10% .125W CC TC=-330/+800	01121	BB1021
A5R41	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A5R42	0757-0283	6	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A5R43	0683-5105	1	RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A5R44	0683-1045		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A5R45	0757-0446		RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A5R46	0757-0401	2	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A5R47	0683-1545	4	RESISTOR 150K 5% .25W FC TC=-800/+900	01121	CB1545
A5R48	0683-1055		RESISTOR 1M 5% .25W FC TC=-800/+900	01121	CB1055
A5R49	0683-1045		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A5R50	0683-1045		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A5U1	1826-0081	1	IC 318 OP AMP	27014	LM318
A5U2	1826-0138	1	IC COMPARATOR	27014	LM339N
A5U3	1826-0172	1	IC 308 OP AMP	27014	LM308N
A5U4	1826-0230	2	IC DIFF AMPL	02735	CA3053
A5U5	1826-0230		IC DIFF AMPL	02735	CA3053
			A5 MISCELLANEOUS		
	0361-0241	10	RIVET,STL, OVAL HD 0.061 DIA	12610	N-3TCC
	5000-9043	5	PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	5040-6848	5	EXTRACTOR	28480	5040-6848
	05335-00009	10	SPRING, PC GROUND	28480	05335-00009
A6	05341-60006	1	250-500 MHZ MULTIPLIER ASSY	28480	05341-60006
A6C1	0160-0494	4	CAPACITOR-FXD 1.5PF +-.1PF 100VDC	28480	0160-0494
A6C2	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A6C3	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A6C4	0132-0007		CAPACITOR-V TRMR-PSTN .7-.8PF 350V	04566	535-033-4R
A6C5	0160-0494		CAPACITOR-FXD 1.5PF +-.1PF 100VDC	28480	0160-0494

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4C6	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A4C7	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C8	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A4C9	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A4C10	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C11	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C12	0160-3873		CAPACITOR-FXD 4.7PF +-.5PF 200VDC	28480	0160-3873
A4C13	0160-0699	1	CAPACITOR-FXD 18PF +-1PF 100VDC	28480	[illegible]
A4C14	0121-0007		CAPACITOR-V TRMR-PSTN .7-3PF 350V	52763	530-000-4R
A4C15	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200VDC	28480	0160-3872
A4C16	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A4C17	0160-0?4?		CAPACITOR-FXD 1.5PF +-.1PF 100VDC	28480	0160-0?4?
A4C18	0121-0007		CAPACITOR-V TRMR-PSTN .7-3PF 350V	52763	530-000-4R
A4C19	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A4C20	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A4C21	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A4C22	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A4C23	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A4C24	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A4C25	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A4CR1	1901-0539		DIODE-PIN 110V	28480	5082-3080
A4CR2	1901-0539		DIODE-PIN 110V	28480	5082-3080
A4CR3	1901-0539		DIODE-PIN 110V	28480	5082-3080
A4L1			ETCHED ON PRINTED CIRCUIT BOARD		
A4L2	9140-0158	1	COIL-MLD 1UH 10% Q=55 .095DX.25LG	24226	09-4426-0K
A4L3			ETCHED ON PRINTED CIRCUIT BOARD		
A4L4			ETCHED ON PRINTED CIRCUIT BOARD		
A4L5	9100-2251	3	COIL-MLD 220NH 10% Q=34 .095DX.25LG	24226	09-4416-5K
A4L6	9100-2251		COIL-MLD 220NH 10% Q=34 .095DX.25LG	24226	09-4416-5K
A4L7			ETCHED ON PRINTED CIRCUIT BOARD		
A4L8			ETCHED ON PRINTED CIRCUIT BOARD		
A4L9	9100-2251		COIL-MLD 220NH 10% Q=34 .095DX.25LG	24226	09-4416-5K
A4Q1	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q2	1854-0345	7	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4Q3	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q4	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4Q5	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q6	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A4Q7	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q8	1854-0438		TRANSISTOR NPN SI TO-72 PD=200MW	28480	1854-0438
A4R1	0757-0397	1	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-G
A4R2	0757-0???	2	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A4R3	0757-0???		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A4R4	0757-0440		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R5	0757-0???	2	RESISTOR 680 1% .125W F TC=0+-100	24546	C4-1/8-T0-681-F
A4R6	0757-0???	1	RESISTOR 6.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6801-F
A4R7	0757-0???	2	RESISTOR 8.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8201-F
A4R8	0757-0440		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R9	0757-0420		RESISTOR 680 1% .125W F TC=0+-100	24546	C4-1/8-T0-681-F
A4R10	0757-0???		RESISTOR 8.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8201-F
A4R11	0757-0???	1	RESISTOR 12K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1202-F
A4R12	0757-0???		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R13	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-T0-562R-F
A4R14	0757-0???	2	RESISTOR 1.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1201-F
A4R15	0757-0???		RESISTOR 5.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5101-F
A4R16	0757-0???		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R17	0757-0???	1	RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A4R18	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
A4R19			NOT ASSIGNED		
A4R20	0698-5562	2	RESISTOR 120 5% .125W CC TC=-330/+800	01121	BB1215
A4R21	0757-0???		RESISTOR 1.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1201-F
A4R22	0698-3379	1	RESISTOR 68 5% .125W CC TC=-270/+540	01121	BB6805
A4R23	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01121	BB1015
A4R24	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01121	BB1015
A4R25	0698-5562		RESISTOR 120 5% .125W CC TC=-330/+800	01121	BB1215
A4R26	0698-3378		RESISTOR 51 5% .125W CC TC=-270/+540	01121	BB5105
			A4 MISCELLANEOUS		
	0361-0291		RIVET,STL- OVAL HD 0.094 DIA	12610	R-3700
	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	5040-6848		EXTRACTOR	28480	5040-6848
	05354-00009		SPRING, PC GROUND	28480	05354-00009

See introduction to this section for ordering information.

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A7	05341-60007	1	250-750 MHZ MULTIPLIER ASSY	28480	05341-60007
A7C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A7C2	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A7C3	0160-2201	5	CAPACITOR-FXD 51PF +-5% 300VDC	28480	0160-2201
A7C4	0160-3875	1	CAPACITOR-FXD 22PF +-5% 200VDC CER 0+-30	28480	0160-3875
A7C5			NOT ASSIGNED		
A7C6	0160-3876		CAPACITOR-FXD 47PF +-20% 200VDC CER	28480	0160-3876
A7C7	0160-0699		CAPACITOR-FXD 1PF +-.1PF 100VDC	04500	8101-A112-C0K-109
A7C8	0160-0699		CAPACITOR-FXD 1PF +-.1PF 100VDC	04500	8101-A112-C0K-109
A7C9	0160-0699		CAPACITOR-FXD 1PF +-.1PF 100VDC	04500	8101-A112-C0K-109
A7C10	0121-0488	2	CAPACITOR-V AIR DIEL .8-8PF 250V PC-MTG	91293	5701
A7C11	0160-2201		CAPACITOR-FXD 51PF +-5% 300VDC	28480	0160-2201
A7C12	0160-0699		CAPACITOR-FXD 1PF +-.1PF 100VDC	04500	8101-A112-C0K-109
A7C13	0160-2201		CAPACITOR-FXD 51PF +-5% 300VDC	28480	0160-2201
A7C14	0121-0488		CAPACITOR-V AIR DIEL .8-8PF 250V PC-MTG	91293	5701
A7C15	0160-0134	1	CAPACITOR-FXD 220PF +-5% 300VDC MICA+TC	28480	0160-0134
A7C16	0160-3029		CAPACITOR-FXD 7.5PF +-.5PF 100VDC	28480	0160-3029
A7CR1	1901-0639		DIODE-PIN 110V	28480	5082-3080
A7CR2	1901-0179	3	DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A7CR3	1901-0179		DIODE-SWITCHING 15V 50MA 750PS DO-7	28480	1901-0179
A7CR4	1901-0639		DIODE-PIN 110V	28480	5082-3080
A7CR5	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A7CR6	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A7L1	9140-0158		COIL-MLD 1UH 10% Q=32 .095DX.25LG	02170	09-4428-4K
A7L2	9100-2240	4	COIL-MLD 120NH 10% Q=34 .095DX.25LG	02170	09-4410-2K
A7Q1	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q2			NOT ASSIGNED		
A7Q3	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A7Q4	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A7Q5	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q6	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A7R1	0683-2035		RESISTOR 20K 5% .25W FC TC=-400/+800	01121	CB2035
A7R2	0757-0421	2	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A7R3	0757-0421		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A7R4	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A7R5	2100-2633	1	RESISTOR-TRMR 1K 10% C SIDE-ADJ 1-TRN	30983	ET50X102
A7R6			NOT ASSIGNED		
A7R7			NOT ASSIGNED		
A7R8			NOT ASSIGNED		
A7R9	0683-5125		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A7R10	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R11			NOT ASSIGNED		
A7R12	0757-0416	2	RESISTOR 390 1% .125W F TC=0+-100	24546	C4-1/8-T0-391-F
A7R13	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A7R14	0757-0422		RESISTOR 910 1% .125W F TC=0+-100	24546	C4-1/8-T0-911-F
A7R15	0683-5125		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A7R16	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A7R17			NOT ASSIGNED		
A7R18	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A7R19	0683-5125		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A7R20	0683-2035		RESISTOR 20K 5% .25W FC TC=-400/+800	01121	CB2035
			A7 MISCELLANEOUS		
	0361-0201		RIVET,STL, OVAL HD 0.061 DIA	11010	R-3700
	5000-9043		PIN:P.C. BOARD EXTRACTOR	28480	5000-9043
	5040-6848		EXTRACTOR	28480	5040-6848
	05354-00009		SPRING, PC GROUND	28480	05354-00009
A8	05341-60008	1	50-250 MHZ MULTIPLIER ASSY	28480	05341-60008
A8C1	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A8C2	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A8C3	0140-0209	4	CAPACITOR-FXD 5PF +-10% 500VDC	72136	DM15C050C500WV1CR
A8C4	0140-0201	2	CAPACITOR-FXD 12PF +-5% 500VDC	72136	DM15C120J0500WV1CR
A8C5	0121-0059	2	CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	73899	DV11PR8A
A8C6	0140-0209		CAPACITOR-FXD 5PF +-10% 500VDC	72136	DM15C050C500WV1CR
A8C7	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878
A8C8	0160-0945	2	CAPACITOR-FXD 910PF +-5% 100VDC MICA+TC	28480	0160-0945
A8C9	0160-0945		CAPACITOR-FXD 910PF +-5% 100VDC MICA+TC	28480	0160-0945
A8C10			NOT ASSIGNED		
A8C11	0121-0059		CAPACITOR-V TRMR-CER 2-8PF 350V PC-MTG	73899	DV11PR8A
A8C12	0160-0696		CAPACITOR-FXD 1.5PF +-.1PF 100VDC	28480	0160-0696
A8C13	0121-0036	4	CAPACITOR-V TRMR-CER 5.5-18PF 350V	73899	DV11PR18A
A8C14	0160-3506	1	CAPACITOR-FXD 5.6PF +-.5PF 100VDC	28480	0160-3506
A8C15	0160-3878		CAPACITOR-FXD 1000PF +-20% 100VDC CER	28480	0160-3878

See introduction to this section for ordering information

Table 6-1 Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9C10	0160-3879		CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-3879
A9C11	0160-3879		CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-3879
A9C12	0160-3879		CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-3879
A9C13	0180-0291		CAPACITOR-FXD 3.3UF+-10% 10VDC TA	56289	150CE3R3D0C1V6A2
A9C14	0180-0291		CAPACITOR-FXD 3.3UF+-10% 10VDC TA	56289	150CE3R3D0C1V6A2
A9C15	0180-0291		CAPACITOR-FXD 3.3UF+-10% 10VDC TA	56289	150CE3R3D0C1V6A2
A9C16	0160-3879		CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-3879
A9C17	0160-3879		CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-3879
A9C18	0160-3879		CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-3879
A9C19			NOT ASSIGNED		
A9C20			NOT ASSIGNED		
A9C21	0160-3874		CAPACITOR-FXD 1000PF +-5% 200VDC MICA	28480	0160-3874
A9CR1	9100-1018	4	DIODE-SW 30V 200MA 4NS DO-35 PD=.4W	28480	9100-1018
A9CR2	9100-0636	1	DIODE-ZNR 6.49V 5% 1W DO-41 TC=+.06%	28480	9100-0636
A9CR3			ETCHED CIRCUIT BOARD		
A9CR4	9100-0158		DIODE-SW 30V 100MA 4NS DO-35 PD=.4W	28480	9100-0158
A9CR5	9100-2288		DIODE-SW 30V 100MA 4NS DO-35 PD=.4W	28480	9100-2288
A9CR6	9100-0197		DIODE-SW 30V 100MA 4NS DO-35 PD=.4W	28480	9100-0197
A9CR7	9100-2268		DIODE-SW 30V 100MA 4NS DO-35 PD=.4W	28480	9100-2268
A9CR8	9100-0158		DIODE-SW 30V 100MA 4NS DO-35 PD=.4W	28480	9100-0158
A9CR9	9100-2288		DIODE-SW 30V 100MA 4NS DO-35 PD=.4W	28480	9100-2288
A9CR10			ETCHED CIRCUIT BOARD		
A9D1	1853-1026		TRANSISTOR PNP SI PD=350MW FT=150MHZ	28480	1853-0026
A9D2	1854-0369		TRANSISTOR NPN 2N5179 SI TC=+.7% PD=200MW	28480	2N5179
A9D3	1853-0026		TRANSISTOR PNP SI PD=350MW FT=150MHZ	28480	1853-0026
A9D4	1854-0369		TRANSISTOR NPN 2N5179 SI TC=+.7% PD=200MW	28480	2N5179
A9D5	1853-0026		TRANSISTOR PNP SI PD=350MW FT=150MHZ	28480	1853-0026
A9D6	1854-0369		TRANSISTOR NPN 2N5179 SI TC=+.7% PD=200MW	28480	2N5179
A9D7			NOT ASSIGNED		
A9D8			NOT ASSIGNED		
A9D9	0757-0427	1	RESISTOR 1.24K 1% .125W F TC=0+-100	28480	0757-0427
A9D10	0757-0433	1	RESISTOR 2.49K 1% .125W F TC=0+-100	28480	0757-0433
A9D11	0757-0422	1	RESISTOR 1.05K 1% .125W F TC=0+-100	28480	0757-0422
A9D12	0757-0411	1	RESISTOR 511 1% .125W F TC=0+-100	28480	0757-0411
A9D13	0757-0407	1	RESISTOR 301 1% .125W F TC=0+-100	28480	0757-0407
A9D14	0757-0451		RESISTOR 2K 1% .125W F TC=0+-100	28480	0757-0451
A9D15	0757-0424		RESISTOR 1K 1% .125W F TC=0+-100	28480	0757-0424
A9D16	0757-0435	3	RESISTOR 3K 1% .125W F TC=0+-100	28480	0757-0435
A9D17	0683-1035		RESISTOR 10M 5% .25W FC TC=-400/+800	01121	CB1035
A9D18	0757-0893		RESISTOR 51 1% .125W F TC=0+-100	28480	0757-0893
A9D19	0757-0424		RESISTOR 1K 1% .125W F TC=0+-100	28480	0757-0424
A9D20	0683-2055	1	RESISTOR 2C 5% .25W FC TC=-400/+850	01121	CB2055
A9D21			NOT ASSIGNED		
A9D22	0757-0431		RESISTOR 2K 1% .125W F TC=0+-100	28480	0757-0431
A9D23	0757-0439		RESISTOR 5K 1% .125W F TC=0+-100	28480	0757-0439
A9D24	0683-1035		RESISTOR 10M 5% .25W FC TC=-400/+800	01121	CB1035
A9D25	0757-0424		RESISTOR 1K 1% .125W F TC=0+-100	28480	0757-0424
A9D26	0757-0442	9	RESISTOR 10K 1% .125W F TC=0+-100	28480	0757-0442
A9D27			NOT ASSIGNED		
A9D28	0683-1035		RESISTOR 10M 5% .25W FC TC=-400/+800	01121	CB1035
A9D29	0757-0893		RESISTOR 51 1% .125W F TC=0+-100	28480	0757-0893
A9J1	1258-0029	2	TRANSISTOR ARRAY	01928	CA3039
			SEE MISCELLANEOUS		
	5180-1582	10	TERMINAL-STUD BGL-TOP PHBSS-4*6	28480	5180-1582
	0361-0881		OBJECT,BTL, CYAL MO 6,COL DIA	18612	M-3762
	9220-0040		STANDOFF,C, BOARD EXTRACTOR	28480	9220-0040
	9220-0040		EXTRACTOR	28480	9220-0040
	0590-0002		SPRING, PC BOARD	28480	0590-0002
A9	5951-0029	1	IC 4* 2C MHZ MULTIPLIER ASSY	28480	5951-0029
A9C1	0160-3879		CAPACITOR-FXD .01UF +80-20% 100VDC CER	28480	0160-3879
A9C2	0160-2261		CAPACITOR-FXD 51PF +-5% 300VDC	28480	0160-2261
A9C3	0140-0196	1	CAPACITOR-FXD 150PF +-5% 300VDC MICA	72136	DM15F151J3C3CP
A9C4	0121-0165	1	CAPACITOR-VAR 4-35PF 200V PC	73809	CV11PM35C
A9C5	0160-2261		CAPACITOR-FXD 51PF +-5% 300VDC	28480	0160-2261

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]			NOT ASSIGNED		
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]			NOT ASSIGNED		
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2	COIL-MLD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		COIL-MLD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		COIL-MLD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		COIL-MLD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		COIL-MLD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	TRANSISTOR NPN [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3	RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	3	RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	1	RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		TRANSISTOR ARRAY	[illegible]	[illegible]
			A8 MISCELLANEOUS		
	[illegible]		[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	[illegible]
	[illegible]		[illegible]	[illegible]	[illegible]
	[illegible]		EXTRACTOR	[illegible]	[illegible]
	[illegible]		SPRING, PC GROUND	[illegible]	[illegible]
[illegible]	[illegible]	1	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	4	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
[illegible]	[illegible]	6	TRANSISTOR PNP SI [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		TRANSISTOR PNP SI [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		TRANSISTOR PNP SI [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		TRANSISTOR PNP SI [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		TRANSISTOR PNP SI [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		TRANSISTOR PNP SI [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]
[illegible]	[illegible]		RESISTOR [illegible]	[illegible]	[illegible]

See introduction to this section for ordering information.

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10R11	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A10R12	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A10R13	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A10R14	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A10R15	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A10R16	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A10R17	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A10R18	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A10R19	0683-5115		RESISTOR 510 5% .25W FC TC=-400/+600	01121	CB5115
A10R20	2100-2574	5	RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A10R21	2100-2574		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A10R22	2100-2574		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A10R23	2100-2574		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A10R24	2100-2574		RESISTOR-TRMR 500 10% C SIDE-ADJ 1-TRN	30983	ET50X501
A10R25	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A10U1	1820-0708	1	IC CMPTR TTL MAGTD 5-BIT	07263	9324PC
A10U2	1820-0629	2	IC FF TTL S J-TYPE NEG-EDGE-TRIG CLEAR	01295	SN74S112N
A10U3	1820-0214	2	IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	01295	SN7442N
A10U4	1820-0751	2	IC CNTR TTL DECD ASYNCHRO NEG-EDGE-TRIG	01295	SN74196N
A10U5	1820-0538	2	IC INV TTL L HEX 1-INP	01295	SN74L04N
A10U6	1820-0174	4	IC INV TTL HEX 1-INP	07263	7404PC
A10U7	1820-0068	1	IC GATE TTL NAND TPL 3-INP	07263	7410PC
	0360-1482		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1482
			A10 MISCELLANEOUS		
	1200-0548	6	SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0548
A11	05341-60011	1	10 MHZ OSCILLATOR BUFFER ASSY	28480	05341-60011
A11C1	0160-3277	7	CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3277
A11C2	0160-3277		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3277
A11C3	0160-3277		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3277
A11C4	0160-3277		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3277
A11C5	0160-3277		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3277
A11C6	0160-3277		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3277
A11C7	0160-3277		CAPACITOR-FXD .01UF +-20% 50VDC CER	28480	0160-3277
A11CR1	1902-0041	1	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A11L1	9140-0114	1	COIL-MLD 10UH 10% Q=55 .155DX.375LG	02175	15-4445-2[illegible]
A11L2	9140-0142	1	COIL-MLD 2.2UH 10% Q=32 .095DX.25LG	02175	[illegible]
A11L3	9100-2265	1	COIL-MLD 10UH 10% Q=60 .095DX.25LG	02175	[illegible]
A11L4	9100-2247	1	COIL-MLD 100NH 10% Q=34 .095DX.25LG	02175	[illegible]
A11Q1	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11Q2	1853-0036		TRANSISTOR PNP SI PD=310MW FT=250MHZ	28480	1853-0036
A11R1	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-G
A11R2	0757-0910	2	RESISTOR 270 1% .125W F TC=0+-100	03298	C4-1/8-T0-271-G
A11R3	0757-0924	2	RESISTOR 2.7K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2701-G
A11R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	03298	C4-1/8-T0-1001-G
A11R5	0757-0910		RESISTOR 270 1% .125W F TC=0+-100	03298	C4-1/8-T0-271-G
A11R6	0757-0931		RESISTOR 2K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2001-G
A11R7	0757-0931		RESISTOR 2K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2001-G
A11R8	0757-0935		RESISTOR 3K 1% .125W F TC=0+-100	03298	C4-1/8-T0-3001-G
A11R9	0757-0940		RESISTOR 4.7K 1% .125W F TC=0+-100	03298	C4-1/8-T0-4701-G
A11R10	0757-0900		RESISTOR 100 1% .125W F TC=0+-100	03298	C4-1/8-T0-101-G
A11R11	0757-0893		RESISTOR 51 1% .125W F TC=0+-100	03298	C4-1/8-T0-51R0-G
A11R12	0757-0931		RESISTOR 2K 1% .125W F TC=0+-100	03298	C4-1/8-T0-2001-G
A11R13	0757-0900	[illegible]	RESISTOR 220 1% .125W F TC=0+-100	03298	C4-1/8-T0-221-G
A11R14	0757-0893		RESISTOR 51 1% .125W F TC=0+-100	03298	C4-1/8-T0-51R0-G
A11R15	0757-0907		RESISTOR 200 1% .125W F TC=0+-100	03298	C4-1/8-T0-201-G
A11R16	0757-0911		RESISTOR 300 1% .125W F TC=0+-100	03298	C4-1/8-T0-301-G
A11U1	1820-0054	7	IC GATE TTL NAND QUAD 2-INP	07263	7400PC
A11U2	1820-0174		IC INV TTL HEX 1-INP	07263	7404PC
A12	05341-60012	1	50 MHZ AMPLIFIER ASSY	28480	05341-60012
A12C1	0150-0052	1	CAPACITOR-FXD .05UF +-20% 400VDC CER	28480	0150-0052
A12C2	0160-3877		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A12C3	0160-3877		CAPACITOR-FXD 100PF +-20% 200VDC CER	28480	0160-3877
A12C4	0180-0428	4	CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0428
A12C5	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C6	0180-0570	1	CAPACITOR-FXD 100UF+-20% 4VDC TA	56289	150D107X0004[illegible]
A12C7	0180-0428		CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0428
A12C8	0180-0428		CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0428
A12C9	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C10	0180-0116	2	CAPACITOR-FXD 22UF+-20% 15VDC TA	28480	0180-0116

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12C11	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C12	0180-0018	1	CAPACITOR-FXD 10UF+-20% 25VDC TA	28480	0180-0018
A12C13	0180-0582	2	CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X9010HA1
A12C14	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C15	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C16	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C17	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C18	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C19	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C20	0180-0418		CAPACITOR-FXD 22UF+-20% 15VDC TA	28480	0180-0418
A12C21	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12C22	0180-0582		CAPACITOR-FXD 33UF+-20% 10VDC TA	56289	196D336X9010HA1
A12C23	0180-0058	1	CAPACITOR-FXD 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A12C24	0180-0438		CAPACITOR-FXD 68UF+-20% 6VDC TA	28480	0180-0438
A12C25			NOT ASSIGNED		
A12C26	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A12CR1	1901-0179		DIODE-SWITCHING 15V 50MA 250PS DO-7	28480	1901-0179
A12CR2	1901-0639		DIODE-PIN 100V	28480	5082-3080
A12CR3	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A12CR4	1901-0535		DIODE-SCHOTTKY	28480	1901-0535
A12CR5	1902-0025	1	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ10462
A12CR6	1901-0040	4	DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12CR7	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A12CR8	1902-0079	1	DIODE-ZNR 5.11V 5% DO-35 PD=1W TC=+.039%	28480	1902-0079
A12L1	9100-2555	1	COIL-MLD 27UH 10% Q=45 .156DIA,.375LG	03797	10/279
A12Q1	1855-0081	1	TRANSISTOR J-FET 2N5245 N-CHAN D-MODE DI	01295	2N5245
A12Q2	1853-0015	1	TRANSISTOR PNP SI PD=200MW FT=50MHZ	28480	1853-0015
A12R1	0683-1045		RESISTOR 100K 5% .25W FC TC=-400/+800	01606	CB1045
A12R2	0683-2015		RESISTOR 200 5% .25W FC TC=-800/+800	01606	CB2015
A12R3	0683-7515		RESISTOR 750 5% .25W FC TC=-400/+400	01606	CB7515
A12R4	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A12R5	0683-2425		RESISTOR 2.4K 5% .25W FC TC=-400/+700	01606	CB2425
A12R6	0683-6845	1	RESISTOR 6.8M 5% .25W FC TC=-400/+700	01606	CB6845
A12R7	0683-0275	1	RESISTOR 2.7 5% .25W FC TC=-800/+500	01606	CB27G5
A12R8	0683-1035		RESISTOR 10K 5% .25W FC TC=-800/+700	01606	CB1035
A12R9	0698-8176		RESISTOR 910 1% .125W CC TC=-330/+800	01606	MBB1119
A12R10	0683-1045		RESISTOR 100K 5% .25W FC TC=-400/+800	01606	CB1045
A12R11	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01606	CB1015
A12R12	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01606	RN1C19
A12R13	0683-1045		RESISTOR 100K 5% .25W FC TC=-400/+800	01606	CB1045
A12R14	0698-8869	1	RESISTOR 39K 1% .125W CC TC=-330/+800	01606	MBB3919
A12R15	0683-1319		RESISTOR 130 5% .25W FC TC=-400/+600	01606	CB1319
A12R16	0683-9119		RESISTOR 910 5% .25W FC TC=-400/+470	01606	CB9119
A12R17	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A12R18	0811-1202	1	RESISTOR 90 5% 3W PW TC=0/+30	09922	RS-2B
A12R19	0683-1265	1	RESISTOR 1.2M 5% .25W FC TC=-400/+1100	01606	CB1255
A12R20	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01606	CB1035
A12R21	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A12R22	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01606	CB1035
A12R23	0683-9119		RESISTOR 910 5% .25W FC TC=-400/+800	01606	CB9119
A12R24	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01606	RN1C19
A12R25	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01606	RN1C19
A12R26	0698-8174	3	RESISTOR 200 1% .125W CC TC=-330/+800	01606	MBB2019
A12R27	0683-9119		RESISTOR 910 5% .25W FC TC=-400/+800	01606	CB9119
A12R28	0683-9119		RESISTOR 910 5% .25W FC TC=-400/+800	01606	CB9119
A12R29	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01606	CB1015
A12R30	0698-3113		RESISTOR 100 5% .125W CC TC=-270/+540	01606	RN1C19
A12R31	0698-8174		RESISTOR 200 1% .125W CC TC=-330/+800	01606	MBB2019
A12R32	2100-2514	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 1-TRN	01686	ET50X203
A12R33	0683-9119		RESISTOR 910 5% .25W FC TC=-400/+800	01606	CB9119
A12R34	0683-9119		RESISTOR 910 5% .25W FC TC=-400/+800	01606	CB9119
A12R35	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A12R36	0698-8183	1	RESISTOR 20K 1% .125W CC TC=-100/+270	01606	MBB2039
A12R37	0698-8128	1	RESISTOR 220 1% .125W CC TC=-330/+800	01606	MBB2219
A12R38	0698-8174		RESISTOR 200 1% .125W CC TC=-330/+800	01606	MBB2019
A12R39	0683-9119		RESISTOR 910 5% .25W FC TC=-400/+800	01606	CB9119
A12R40	0698-8176		RESISTOR 910 1% .125W CC TC=-330/+800	01606	MBB1119
A12R41	0683-8205		RESISTOR 82 5% .25W FC TC=+0/+500	01606	CB8205
A12U1	1820-0210		IC OP AMP	28480	1820-0210
A12U2	1820-1284	1	IC RCVR ECL LINE RCVR TPL 2-INP	02036	MC10216P
A12U3	1820-2409	1	IC RCVR ECL LINE RCVR QUAD 2-INP	02911	100158
A12U4	1820-0817	1	IC FF ECL D-M/S DUAL	02911	100131

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A13	05341-60013	1	RF MOTHER BOARD ASSY	28480	05341-60013
A13C1	0160-2327	2	CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-2327
A13C2	0160-2327		CAPACITOR-FXD 1000PF +80-20% 100VDC CER	28480	0160-2327
A13C3	0160-3136	1	CAPACITOR-FXD 3.3PF +-5% 300VDC CER 0+-100	28480	0160-3136
A13C4	0160-3872		CAPACITOR-FXD 2.2PF +-.25PF 200VDC	28480	0160-3872
A13J3A	1251-0478	3	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	04500	252-06-30-340
A13J3B	1251-0478		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	04500	252-06-30-340
A13J4	1251-1886	7	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-340
A13J5	1251-1886		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-340
A13J6	1251-1886		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-340
A13J7	1251-1886		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-340
A13J8	1251-1886		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-340
A13J9	1251-1886		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-340
A13J11	1251-1886		CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-340
A13J12	1251-0478		CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	04500	252-06-30-340
			A13 MISCELLANEOUS		
	1250-0257	5	CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
	1251-1487	2	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	04500	252-22-30-340
	1251-2134	1	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	04500	252-18-30-340
A14	05341-60007	1	10 MHZ OSCILLATOR ASSY	28480	05341-60007
A14C1	0160-2143	1	CAPACITOR-FXD 2000PF +80-20% 1KVDC CER	28480	0160-2143
A14L1	9140-0179	1	COIL-MLD 22UH 10% Q=75 .155DX.375LG	02178	15-4445-7J
A14Y1	0960-0394	1	CRYSTAL OSCILLATOR	28480	0960-0394
A15	05341-60015	1	DISPLAY BOARD ASSY	28480	05341-60015
A15C1	0160-3060	2	CAPACITOR-FXD .1UF +80-20% 25VDC CER	28480	0160-3060
A15C2	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A15CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A15DS1	1990-0437	10	DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS2	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS3	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS4	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS5	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS6	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS7	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS8	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS9	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS10	1990-0437		DISPLAY-NUM SEG 1-CHAR .43-H	28480	1990-0437
A15DS11	2140-0221	8	LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15DS12	2140-0221		LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15DS13	2140-0221		LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15DS14	2140-0221		LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15DS15	2140-0221		LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15DS16	2140-0221		LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15DS17	2140-0221		LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15DS18	2140-0221		LAMP-INCAND 683 5VDC 60MA T-1-BULB	00001	683-AS 15
A15Q1	1854-0500	2	TRANSISTOR NPN SI DARL PD=310MW	03508	SPS4706
A15Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A15R1	0683-1045		RESISTOR 100K 5% .25W FC TC=-400/+800	01121	CB1045
A15R2	0683-7515		RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A15R3	0683-1515	1	RESISTOR 150 5% .25W FC TC=-400/+600	01121	CB1515
A15R4	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A15R5	0683-2725	4	RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A15R6	0683-2725		RESISTOR 2.7K 5% .25W FC TC=-400/+700	01121	CB2725
A15R7	1810-0041	2	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0041
A15U1	1820-0668	1	IC BFR TTL NON-INV HEX 1-INP	07263	7407PC
A15XA15	1251-2026	2	CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	04500	252-18-30-300
A15XDS1	05341-80006	10	SOCKET,IC-16-PIN	28480	05341-80006
A15XDS2	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS3	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS4	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS5	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS6	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS7	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS8	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS9	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006
A15XDS10	05341-80006		SOCKET,IC-16-PIN	28480	05341-80006

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			A19 MISCELLANEOUS		
	[illegible]	1	INDICATOR, FUNCTION	[illegible]	[illegible]
	[illegible]	1	BLOCK, ANNUNCIATOR	[illegible]	[illegible]
	[illegible]	1	BLOCK, ANNUNCIATOR	[illegible]	[illegible]
	[illegible]	1	INDICATOR, FUNCTION	[illegible]	[illegible]
	[illegible]	1	INDICATOR, FUNCTION	[illegible]	[illegible]
A19	[illegible]	1	DRIVER DISPLAY BOARD ASSY	[illegible]	[illegible]
A19C1	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A19C2	[illegible]	8	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A19C3	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A19C4	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A19C5	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A19Q1	[illegible]	10	TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q2	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q3	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q4	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q5	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q6	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q7	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q8	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q9	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q10	[illegible]		TRANSISTOR PNP SI PD=[illegible]	[illegible]	[illegible]
A19Q11	[illegible]	8	TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19Q12	[illegible]		TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19Q13	[illegible]		TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19Q14	[illegible]		TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19Q15	[illegible]		TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19Q16	[illegible]		TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19Q17	[illegible]		TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19Q18	[illegible]		TRANSISTOR NPN SI PD=350MW FT=250MHZ	03508	2N3843
A19R1	[illegible]	16	RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R2	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R3	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R4	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R5	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R6	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R7	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R8	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R9	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R10	[illegible]		RESISTOR 180 5% .25W FC TC=-400/+800	01606	CB1815
A19R11	[illegible]		RESISTOR 150K 5% .25W FC TC=-800/+900	01606	CB1545
A19R12	[illegible]		RESISTOR 150K 5% .25W FC TC=-800/+900	01606	CB1545
A19R13	[illegible]		RESISTOR 150K 5% .25W FC TC=-800/+900	01606	CB1545
A19R14	[illegible]	1	RESISTOR 10K 1% .125W F TC=0+-100	03888	C4-1/8-T0-1002-F
A19R15	[illegible]		RESISTOR 2K 5% .25W FC TC=+400/+700	01606	CB2025
A19R16	[illegible]	8	RESISTOR 20 5% .5W CC TC=0+-912	01606	EB2005
A19R17	[illegible]		RESISTOR 20 5% .5W CC TC=0+-912	01606	EB2005
A19R18	[illegible]		RESISTOR 20 5% .5W CC TC=0+-912	01606	EB2005
A19R19	[illegible]		RESISTOR 20 5% .5W CC TC=0+-912	01606	EB2005
A19R20	[illegible]		RESISTOR 20 5% .5W CC TC=0+-912	01606	EB2005
A19R21	[illegible]		RESISTOR 20 5% .5W FC TC=0+-912	01606	EB2005
A19R22	[illegible]		RESISTOR 20 5% .5W CC TC=0+-912	01606	EB2005
A19R23	[illegible]		RESISTOR 20 5% .5W CC TC=0+-912	01606	EB2005
A19R24	[illegible]		RESISTOR 2.7K 5% .25W FC TC=+400/+700	01606	CB2725
A19R25	[illegible]		RESISTOR 2.7K 5% .25W FC TC=+400/+700	01606	CB2725
A19R26	[illegible]		NETWORK-RES 9-PIN-BIP .15-PIN-SPCG	28480	1810-0041
A19R27	[illegible]	5	NETWORK-RES 9-PIN-BIP .15-PIN-SPCG	28480	1810-0095
A19U1	[illegible]	1	IC BATWRON 64-BIT RAM TTL	03508	DM74S89
A19U2	[illegible]	3	IC MV TTL L MONOSTBL RETRIG/RESET DUAL	03790	9LS20C
A19U3	[illegible]	1	IC GATE TTL OR QUAD 2-INP	03508	DM74S32
A19U4	[illegible]	1	IC DCDR TTL BCD-TO-DEC 4-TO-10-LINE	03508	DM74S42
A19U5	[illegible]	1	IC CNTR TTL DECD UP/DOWN SYNCHRO	01295	SN74193N
A19U6	[illegible]		IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	01295	SN74175N
A19U7	[illegible]	1	IC COMPTR TTL L MAGIC 5-BIT	02235	93L24PC
A19U8	[illegible]	1	IC GATE TTL NOR DUAL 4-INP	27014	8+74S25N
A19U9	[illegible]		IC GATE TTL NAND QUAD 2-INP	02235	74S00PC
A19U10	[illegible]		IC MV TTL L MONOSTBL RETRIG/RESET DUAL	03790	9LS20C
A19U11	[illegible]	1	IC DCDR TTL BCD-TO-7-SEG 4-TO-7-LINE	02235	9307PC
A19U12	[illegible]	2	IC GATE TTL L NAND DUAL 4-INP	03508	DM74L20N
A19U13	[illegible]		IC GATE TTL L NAND DUAL 4-INP	03508	DM74L20N
A19U14	[illegible]		IC GATE TTL NAND QUAD 2-INP	02235	74S00PC

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			A16 MISCELLANEOUS		
	0360-1682		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
	1200-0433	2	SOCKET-IC 20-CONT	0B911	3M-AA/P
A17	05341-60017	1	TIME BASE BOARD ASSY	28480	05341-60017
A17C1	0180-1735	1	CAPACITOR-FXD ,22UF+-10% 35VDC TA	04713	150D224X9035A2
A17C2	0160-0374		CAPACITOR-FXD 150UF+-10% 20VDC TA	04713	150D156X9020B2
A17C3	0160-3879		CAPACITOR-FXD ,01UF +-20% 100VDC CER	28480	0160-3879
A17C4	0160-3879		CAPACITOR-FXD ,01UF +-20% 100VDC CER	28480	0160-3879
A17C5	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	04713	150D106X9020B2
A17C6	0180-0374		CAPACITOR-FXD 10UF+-10% 20VDC TA	04713	150D106X9020B2
A17C7	0160-3879		CAPACITOR-FXD ,01UF +-20% 100VDC CER	28480	0160-3879
A17Q1	1854-0094	6	TRANSISTOR NPN SI PD=200MW FT=350MHZ	28480	1854-0094
A17Q2	1854-0360		TRANSISTOR NPN SI GAAL PD=310MW	02C3G	BFR74G
A17Q3	1854-0094		TRANSISTOR NPN SI PD=200MW FT=350MHZ	28480	1854-0094
A17Q4	1854-0094		TRANSISTOR NPN SI PD=200MW FT=350MHZ	28480	1854-0094
A17Q5	1854-0094		TRANSISTOR NPN SI PD=200MW FT=350MHZ	28480	1854-0094
A17R1	0683-1025		RESISTOR 1.0K 5% .25W FC TC=-400/+700	01606	CB1025
A17R2	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+700	01606	CB1025
A17R3	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A17R4	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A17R5	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A17R6	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A17R7	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A17R8	0683-3315	1	RESISTOR 330 5% .25W FC TC=-400/+800	01606	CB3315
A17R9	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01606	CB1015
A17R10	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01606	CB1015
A17R11	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+800	01606	CB1025
A17R12	0683-3025		RESISTOR 1K 5% .25W FC TC=-400/+700	01606	CB3025
A17R13	0683-1235	2	RESISTOR 12K 5% .25W FC TC=-400/+800	01606	CB1235
A17R14	0683-5135	1	RESISTOR 51K 5% .25W FC TC=-400/+800	01606	CB5135
A17R15	0683-3915	1	RESISTOR 390 5% .25W FC TC=-400/+800	01606	CB3915
A17U1	1820-0328	1	IC GATE TTL NOR QUAD 2-INP	02735	TN02PC
A17U2	1820-0878	1	IC MV TTL MONOSTBL RETRIG/RESET	02210	9602DC
A17U3	1820-0054		IC GATE TTL NAND QUAD 2-INP	02210	TN00PC
A17U4	1820-0077	2	IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	02210	TN74PC
A17U5	1820-0829	1	IC FF TTL J-K NEG-EDGE-TRIG	02210	TN76112PC
A17U6	1820-0910	3	IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN74LS83N
A17U7	1820-0054	1	IC GATE TTL AND-OR-INV	01295	SN74S51N
A17U8	1820-0910		IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN74LS83N
A17U9	1820-0910		IC ADDR TTL LS BIN FULL ADDR 4-BIT	01295	SN74LS83N
A17U10	1820-0833	1	IC MISC	28480	1820-0833
A17XU10	1200-0873	1	SOCKET-IC 16-CONT DIP-SLDR	28480	1200-0873
	0360-1682		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A18	05341-60018	1	COUNTER	28480	05341-60018
A18C1	0160-3879		CAPACITOR-FXD ,01UF +-20% 100VDC CER	28480	0160-3879
A18C2	0160-3879		CAPACITOR-FXD ,01UF +-20% 100VDC CER	28480	0160-3879
A18C3	0180-0106		CAPACITOR-FXD 68UF+-20% 6VDC TA	04713	150D686X9006B2
A18C4	0160-3879		CAPACITOR-FXD ,01UF +-20% 100VDC CER	28480	0160-3879
A18C5	0180-0106		CAPACITOR-FXD 68UF+-20% 6VDC TA	04713	150D686X9006B2
A18C6	0160-3879		CAPACITOR-FXD ,01UF +-20% 100VDC CER	28480	0160-3879
A18Q1	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A18Q2	1854-0092		TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A18R1	0757-0424		RESISTOR 1K 1% .125W F TC=0+-100	03888	C4-1/8-T0-1001-G
A18R2	0757-0934		RESISTOR 2.7K 1% .125W F TC=0+-100	03888	C4-1/8-T0-2701-G
A18R3	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+800	01606	CB4715
A18R4	0683-2215	2	RESISTOR 220 5% .25W FC TC=-400/+800	01606	CB2215
A18R5	0757-0898	1	RESISTOR 82 1% .125W F TC=0+-100	03888	C4-1/8-T0-82R0-G
A18R6	0757-0903	1	RESISTOR 130 1% .125W F TC=0+-100	03888	C4-1/8-T0-131-G
A18R7	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+800	01606	CB4715
A18R8	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+800	01606	CB4715
A18R9	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+800	01606	CB4715
A18R10	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+800	01606	CB4715
A18R11	0683-2215		RESISTOR 220 5% .25W FC TC=-400/+800	01606	CB2215
	0360-1682		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
	0360-1682		TERMINAL-STUD SGL-TUR PRESS-MTG	28480	0360-1682
A18U1	1820-0899	8	IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01295	SN74160N
A18U2	1820-0899		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01295	SN74160N
A18U3	1820-0899		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01295	SN74160N
A18U4	1820-0899		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01295	SN74160N
A18U5	1820-0899		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01295	SN74160N

See Introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A18U6	1820-0899		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01698	SN74160N
A18U7	1820-0899		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01698	SN74160N
A18U8	1820-0899		IC CNTR TTL DECD SYNCHRO POS-EDGE-TRIG	01698	SN74160N
A18U9	1820-0716	1	IC MUXR/DATA-SEL TTL L 8-TO-1-LINE QUAD	07263	93L22PC
A18U10	1820-0781		IC CNTR TTL DECD ASYNCHRO NEG-EDGE-TRIG	01698	SN74196N
A18U11	1820-0174		IC INV TTL HEX 1-INP	07263	7404PC
A18U12	1820-0054		IC GATE TTL NAND QUAD 2-INP	07263	7400PC
A18U13	1820-0174		IC INV TTL HEX 1-INP	07263	7404PC
A18U14	1820-0681	1	IC GATE TTL S NAND QUAD 2-INP	07263	74S00PC
A19	05341-60019	1	PROCESSOR	28480	05341-60019
A19C1	0180-0230		CAPACITOR-FXD 1UF+-20% 50VDC TA	56289	150D105X0050A2
A19C2	0180-0228	9	CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A19C3	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A19C4	0160-0300	1	CAPACITOR-FXD 2700PF +-10% 200VDC POLYE	56289	292P27292
A19C5	0140-0303	1	CAPACITOR-FXD 820PF +-5% 300VDC MICA-TC	28480	0140-0303
A19C6	0180-1714		CAPACITOR-FXD 330UF+-10% 6VDC TA	56289	150D337X9006S2
A19C7	0180-1714		CAPACITOR-FXD 330UF+-10% 6VDC TA	56289	150D337X9006S2
A19CR1	1901-0040		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0040
A19J1	1250-0257		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A19J2	1250-0257		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A19J3	1200-0548		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0548
A19J4	1200-0633		SOCKET-IC 24-CONT	05514	324-AG2D
A19J5	1200-0548		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0548
A19J6	1200-0548		SOCKET-IC 14-CONT DIP DIP-SLDR	28480	1200-0548
A19Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A19R1	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A19R2	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A19R3	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A19R4	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A19R5	0683-2045	1	RESISTOR 200K 5% .25W FC TC=-800/+900	01121	CB2045
A19R6	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A19R7	0683-2715	1	RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A19R8	0683-3025		RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
A19R9	0683-3025		RESISTOR 3K 5% .25W FC TC=-400/+700	01121	CB3025
A19R10	0683-1535		RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A19R11	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A19R12	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A19R13	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A19R14	0683-9115	1	RESISTOR 910 5% .25W FC TC=-400/+600	01121	CB9115
A19R15	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A19R16	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A19R17	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A19R18	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A19S1	3101-1381	1	SWITCH-SL SPDT-NS SUBMIN .5A 125VAC/DC	[illegible]	GF-111-0004
A19U1	1820-0567	1	IC MV TTL DUAL	04713	MC4024P
A19U2	1820-0495	2	IC DCDR TTL 4-TO-16-LINE 4-INP	07263	9311PC
A19U3	1820-0660	2	IC MUXR/DATA-SEL TTL 16-TO-1-LINE 16-INP	18324	N74150N
A19U4	1820-0077		IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR	07263	7474PC
A19U5	1820-1303	1	IC GATE TTL L NAND QUAD 2-INP	27014	DM74L00N
A19U6	1820-1089	1	IC LCH TTL QUAD	01295	SN74279N
A19U7	1820-0730		IC MV TTL L MONOSTBL RETRIG/RESET DUAL	07263	96L02DC
A19U8	1820-0054		IC GATE TTL NAND QUAD 2-INP	07263	7400PC
A19U9	1820-1053	2	IC SCHMITT-TRIG TTL HEX 1-INP	01295	SN7414N
A19U10	1820-0598	1	IC GATE TTL L EXCL-OR QUAD 2-INP	27014	DM74L86N
A19U11	1820-1053		IC SCHMITT-TRIG TTL HEX 1-INP	01295	SN7414N
A19U12	1820-0586		IC INV TTL L HEX 1-INP	27014	DM74L04N
A19U13	1820-0660		IC MUXR/DATA-SEL TTL 16-TO-1-LINE 16-INP	18324	N74150N
A19U14	1820-1255	1	IC INV TTL HEX 1-INP	27014	DM8098N
A19U15	1818-2244	1	IC, ROM 256 X 16	28480	1818-2244
	1818-2249		IC, ROM 256 X 16 (OPTION 003 ONLY)	28480	1818-2249
A19U16	1820-0778	2	IC CNTR TTL L BIN SYNCHRO POS-EDGE-TRIG	07263	93L16PC
A19U17	1820-0054		IC GATE TTL NAND QUAD 2-INP	07263	7400PC
A19U18	1820-0069	1	IC GATE TTL NAND DUAL 4-INP	07263	7420PC
A19U19	1820-0778		IC CNTR TTL L BIN SYNCHRO POS-EDGE-TRIG	07263	93L16PC
A19U20	1820-0495		IC DCDR TTL 4-TO-16-LINE 4-INP	07263	9311PC
A19XA17	1251-2026		CONNECTOR-PC EDGE 18-CONT/ROW 2-ROWS	04506	252-18-30-300
A19XA18	1251-1365	1	CONNECTOR-PC EDGE 22-CONT/ROW 2-ROWS	04506	252-22-30-300
A19XU15	1200-0469	1	SOCKET-IC 28-CONT DIP-SLDR	06776	IC-286-02

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20	05341-60020	1	+5 VOLT REGULATOR	28480	05341-60020
A20C1	0180-0291	5	CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A20C2	0180-0229	1	CAPACITOR-FXD 33UF+-10% 10VDC TA	56289	150D336X9010B2
A20C3	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A20C4	0160-2206	1	CAPACITOR-FXD 330PF +-5% 300VDC MICA	28480	0160-2206
A20C5	0140-0204	1	CAPACITOR-FXD 47PF +-5% 500VDC	72136	DM15E470J0500WV1CR
A20CR1	1902-3104	1	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A20F1	2110-0476	2	FUSE 4A 125V NORM-BLO .25X.27	04ABJ	GMW-4
	2110-0269	1	FUSEHOLDER-CLIP TYPE .250-FUSE	28480	2110-0269
A20Q1	1853-0037	1	TRANSISTOR PNP SI TO-39 PD=1W FT=10MHZ	28480	1853-0037
A20R1	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A20R2	0757-0397	1	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A20R3	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	24546	C4-1/8-T0-237R-F
A20R4	0811-1827	1	RESISTOR .1 10% 3W PW TC=0+-90	05520	PR-3E
A20R5	0698-3132	1	RESISTOR 261 1% .125W F TC=0+-100	24546	C4-1/8-T0-2610-F
A20R6	0757-0346	1	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A20R7	0698-3151	1	RESISTOR 2.87K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2871-F
A20R8	2100-2931	6	RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	03740	3009P-1-501
A20R9	0757-0428	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1621-F
A20U1	1820-0247	1	IC V RGLTR	03407	LM305H
A21	05341-60021	1	POWER SUPPLY MOTHER BOARD	28480	05341-60021
A21C1	0180-2385	2	CAPACITOR-FXD 4000UF+75-10% 15VDC AL	04200	40DH402G015AA2A
A21C2	0180-2387	2	CAPACITOR-FXD 2200UF+75-10% 30VDC AL	04200	40D222G030CA2A
A21C3	0180-2385		CAPACITOR-FXD 4000UF+75-10% 15VDC AL	04200	40DH402G015AA2A
A21C4	0180-2387		CAPACITOR-FXD 2200UF+75-10% 30VDC AL	04200	40D222G030CA2A
A21C5	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A21C6	0180-0141	1	CAPACITOR-FXD 3.3UF+-20% 35VDC TA	56289	150D335X0035B2
A21C7	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25VDC CER	28480	0160-0127
A21CR1	1901-0638	3	DIODE-PWR RECT 100V 6A	02036	MDA-970-2
A21CR2	1901-0638		DIODE-PWR RECT 100V 6A	02036	MDA-970-2
A21CR3	1901-0638		DIODE-PWR RECT 100V 6A	02036	MDA-970-2
A21F1	2110-0476		FUSE 4A 125V NORM-BLO .25X.27	04ABJ	GMW-4
A21J1	1250-0257		CONNECTOR-RF SMB M PC 50-OHM	28480	1250-0257
A21L1	9140-0096		COIL-MLD 1UH 10% Q=30 .155DX.375LG	02178	15-4425-6K
A21R1	0757-0948		RESISTOR 10K 2% .125W F TC=0+-100	24546	C4-1/8-T0-1002-G
A21R2	0757-0948		RESISTOR 10K 2% .125W F TC=0+-100	24546	C4-1/8-T0-1002-G
A21R3	0757-0948		RESISTOR 10K 2% .125W F TC=0+-100	24546	C4-1/8-T0-1002-G
A21R4	0757-0948		RESISTOR 10K 2% .125W F TC=0+-100	24546	C4-1/8-T0-1002-G
A21R5	0757-0900		RESISTOR 100 2% .125W F TC=0+-100	24546	C4-1/8-T0-101-G
A21U1	1826-0099	1	IC V RGLTR	02236	7812UC
A21XA18	1251-2035	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	04500	252-15-30-300
A21XA20	1251-0472	1	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	04500	252-06-30-300
A21XF1	1251-3062	2	CONNECTOR-SGL CONT SKT .04-IN-BSC-SZ RND	00779	98-401-75
A21XK1	0490-0907	1	SOCKET-RLY 15-CONT DIP-SLDR	28480	0490-0907
A21XK1	0490-0881	1	RELAY RETAINER SET	04779	2CC252
A22	05341-60022	1	POWER REGULATOR (+5V,-15V AND +15V)	28480	05341-60022
A22C1	0180-0197	3	CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C2	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A22C3	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22C4	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C5	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A22C6	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22C7	0180-0197		CAPACITOR-FXD 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A22C8	0180-0228		CAPACITOR-FXD 22UF+-10% 15VDC TA	56289	150D226X9015B2
A22C9	0180-0291		CAPACITOR-FXD 1UF+-10% 35VDC TA	56289	150D105X9035A2
A22R1	0757-0941		RESISTOR 5.1K 2% .125W F TC=0+-100	24546	C4-1/8-T0-5101-G
A22R2	2100-2931		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	03740	3009P-1-501
A22R3	0757-0928		RESISTOR 1.5K 2% .125W F TC=0+-100	24546	C4-1/8-T0-1501-G
A22R4	2100-2931		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	03740	3009P-1-501
A22R5	0757-0928		RESISTOR 1.5K 2% .125W F TC=0+-100	24546	C4-1/8-T0-1501-G
A22R6	2100-2931		RESISTOR-TRMR 500 10% C SIDE-ADJ 17-TRN	03740	3009P-1-501
	0380-0966	6	STANDOFF-RVT-ON .08LG 4-40THD .25CC BRS	28480	0380-0966

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23	05341-60014	1	RESOLUTION SWITCH	28480	05341-60014
	5020-3440	1	SPRING:DETENT	28480	5020-3440
	05340-20013	1	GUIDE, SWITCH	28480	05340-20013
	05340-20017	1	GUIDE, SWITCH	28480	05340-20017
	05340-60049	1	SLIDE ASSY	28480	05340-60045
A24	05341-60032		REMOTE ADDRESS SWITCH ASSY (OPTION 011 ONLY)	28480	05341-60032
A25	05341-60028		REMOTE OUTPUT ASSY (OPT 011 ONLY)	28480	05341-60028
A26	05341-60029		ASCII INPUT ASSY (OPT 011 ONLY)	28480	05341-60029
A27			NOT ASSIGNED		
A28			NOT ASSIGNED		
A29			NOT ASSIGNED		
A30			NOT ASSIGNED		
A31	05341-60031	1	CABLE ASSY, AC LINE	28480	05341-60031
A31S1	3101-1894	1	SWITCH-TGL SUBMIN DPDT NS 2A 250VAC	08398	U318-PH1
A31W1	8120-1425	1	CABLE-SHLD 22AWG 4-CNDCT JGK-JKT .215-OD	28480	8120-1425
W10	05341-60035	1	CABLE ASSY, CENTER MB	28480	05341-60035
	1251-0333	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROWS	04500	251-10-30-261
W11	05341-60046	1	CABLE ASSY, FILTER MB	28480	05341-60046
	1251-1115	1	POLARIZING KEY-PC EDGE CONN	28480	1251-1115
	1251-2500	1	CONNECTOR-PC EDGE 6-CONT/ROW 2-ROWS	04500	251-06-30-400
W13	05341-60036	1	CABLE ASSY, SWITCH FILTER MB	28480	05341-60036
	1250-0857	2	FERRULE CLAMP:RF CONNECTOR	77068	30994-6
	1250-0848	5	CONNECTOR-RF SMC FEM UNMTD 50-OHM	05761	50-028-0139
	1250-1381	2	CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-1381
	8120-0789	14	CABLE-COAX 50-OHM 1KV	28480	8120-0789
	8120-9026	1		28480	8120-9026
W14	05341-60037	1	CABLE ASSY, SWITCH FILTER IG	28480	05341-60037
	1250-0848		CONNECTOR-RF SMC FEM UNMTD 50-OHM	05761	50-028-0139
	8120-0789		CABLE-COAX 50-OHM 1KV	28480	8120-0789
W15	05341-60038	1	CABLE ASSY, MIXER TO MB	28480	05341-60038
	1250-0857		FERRULE CLAMP:RF CONNECTOR	77068	30994-6
	1250-0887	1	CONNECTOR-RF SMC FEM UNMTD 50-OHM	28480	1250-0887
	1250-1381		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-1381
	8120-0789		CABLE-COAX 50-OHM 1KV	28480	8120-0789
W16	05341-60039	1	CABLE ASSY, A1" TO FRONT	28480	05341-60039
	0362-0007	5	SLEEVE-METAL .152-OD BRZ .128-ID .312-LG	59730	688-128
	1250-0877	5	CONNECTOR-RF CA-TERMN-CRP PC	28480	1250-0877
	8120-1946	6	CABLE-COAX 50-OHM 1KV 29PF/FT	28480	8120-1946
W17	05341-60040	1	CABLE ASSY, PRECISION CONTROL	28480	05341-60040
	1250-0259	3	CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0259
	1250-0260	3	CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
	1250-0261	3	INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
	1250-0262	3	FERRULE FOR RF CONNECTOR	28480	1250-0262
	1250-0263	3	WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
	1250-0264	3	WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
	1250-0265	3	NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
	1250-0848		CONNECTOR-RF SMC FEM UNMTD 50-OHM	05761	50-028-0139
	8120-1946		CABLE-COAX 50-OHM 1KV 29PF/FT	28480	8120-1946
W18	05341-60041	1	CABLE ASSY, PRECISION, REAR	28480	05341-60041
	0362-0007		SLEEVE-METAL .152-OD BRZ .128-ID .312-LG	59730	688-128
	1250-0848		CONNECTOR-RF SMC FEM UNMTD 50-OHM	05761	50-028-0139
	8120-0789		CABLE-COAX 50-OHM 1KV	28480	8120-0789
	1250-0877		CONNECTOR-RF CA-TERMN-CRP PC	28480	1250-0877
W19	05341-60042	1	CABLE ASSY, 10 MHZ CTR	28480	05341-60042
	1250-0259		CONNECTOR-RF SMB FEM UNMTD 50-OHM	28480	1250-0259
	1250-0260		CENTER CONTACT:FEMALE CONNECTOR	28480	1250-0260
	1250-0261		INSULATOR:BACK FOR RF CONNECTOR	28480	1250-0261
	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
	1250-0263		WASHER,RECESSED FOR RF CONNECTOR	28480	1250-0263
	1250-0264		WASHER:CLAMP FOR RF CONNECTOR	28480	1250-0264
	1250-0265		NUT:CLAMP FOR RF CONNECTOR	28480	1250-0265
	8120-1946		CABLE-COAX 50-OHM 1KV 29PF/FT	28480	8120-1946

See introduction to this section for ordering information

Table 6-1 Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
#20	05341-60043	1	CABLE ASSY, 7 8 , 10 MHZ	28480	05341-60043
	0362-0006		SLEEVE-METAL ,150-CD BRZ ,128-ID ,312-LG	59730	0362-0006
	1250-0029		CONNECTOR-RF BNC FEM UNMTD 50-OHM	28480	1250-0029
	1250-0260		CONTACT-PIN,MALE CONNECTOR	28480	1250-0260
	1250-0261		INSULATOR,BACK PCB RF CONNECTOR	28480	1250-0261
	1250-0262		FERRULE FOR RF CONNECTOR	28480	1250-0262
	1250-0263		WASHER,RECESSED PCB RF CONNECTOR	28480	1250-0263
	1250-0264		PERIPHERAL CLAMP PCB RF CONNECTOR	28480	1250-0264
	1250-0265		NUT,CLAMP FOR RF CONNECTOR	28480	1250-0265
	1250-0877		CONNECTOR-RF CA-TERMNA-CRP PC	28480	1250-0877
	8120-1946		CABLE-COAX 50-OHM LRV 29PF/FT	28480	8120-1946
#21	05341-60044	1	CABLE ASSY, IC MHZ REM	28480	05341-60044
	0362-0007		SLEEVE-METAL ,150-CD BRZ ,128-ID ,312-LG	59730	0362-0007
	1250-0877		CONNECTOR-RF CA-TERMNA-CRP PC	28480	1250-0877
	8120-1946		CABLE-COAX 50-OHM LRV 29PF/FT	28480	8120-1946
#22	05341-60045	1	CABLE ASSY, EXT TB	28480	05341-60045
	0362-0007		SLEEVE-METAL ,150-CD BRZ ,128-ID ,312-LG	59730	0362-0007
	1250-0877		CONNECTOR-RF CA-TERMNA-CRP PC	28480	1250-0877
	8120-1946		CABLE-COAX 50-OHM LRV 29PF/FT	28480	8120-1946

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			5341A, OPTION 001, HIGH STABILITY OSC.		
A14	05341-60047		BOARD ASSY, OSCILLATOR	28480	05341-60047
A14	10544-60011	1	CRYSTAL OSCILLATOR ASSY	28480	10544-60011
			5341A, OPTION 002, REAR PANEL CONNECTORS		
	05341-00002		PANEL, EXTRUDED	28480	05341-00002
W2	05341-00009		PANEL, EXTRUDED	28480	05341-00009
W3	8120-2029		CABLE ASSY, COAX	28480	8120-2029
W25	8120-2053	1	CABLE, COAXIAL	28480	8120-2053
W26	05341-60033	1	CABLE ASSY, REAR	28480	05341-60033
	8120-1946	1	CABLE, RF 21" LONG	28480	8120-1946
	11593A	1	TERMINATION, 50OHM	28480	11593A
			5341A, OPTION 003, 1.5 GHZ FREQ. RANGE		
A2	05341-60023	1	FILTER ASSY, HIGH PASS (OPT. 003)	28480	05341-60023
A2C1	0160-4041	2	CAPACITOR-FXD 5.6PF +-.5PF 50VDC	28480	0160-4041
A2C2	0160-4041		CAPACITOR-FXD 5.6PF +-.5PF 50VDC	28480	0160-4041
A2R1	0698-8346	1	RESISTOR 16 5% .125W CC TC=-270/+540	01607	BB1605
A2R2	0698-3118	2	RESISTOR 300 5% .125W CC TC=-330/+800	01607	BB3015
A2R3	0698-3118		RESISTOR 300 5% .125W CC TC=-330/+800	01607	BB3015
	1250-0556	1		28480	1250-0556
	1250-0566	1	CONNECTOR-RF SMC M SGL-HOLE-FR 50-OHM	[illegible]	[illegible].0C15
	05341-00021	1	COVER, HIGH PASS FILTER	28480	05341-00021
	05341-20039	1	HOUSING	28480	05341-2[illegible]
A19U1	1818-2249	1	IC, DIGITAL ROM 256 X 16	28480	1818-2249
A19U1	1818-2246		IC, DIGITAL ROM 256 X 16	28480	1818-2246
W11	05341-60046		CABLE ASSY, FILTER, HB	28480	05341-60046
W13	05341-60036		CABLE ASSY, SWITCH FILTER HB	28480	05341-60036
			5341A, OPTION 011, REMOTE PROGRAMMING-DIGITAL OUTPUT		
A24	05341-60032	1	REMOTE ADDRESS SWITCH ASSY	28480	05341-60032
A24J1	1251-3283	1	CONNECTOR, 24-PIN	28480	1251-3283
A24S1	3101-1787	6	SWITCH, SLIDE	28480	3101-1787
A24S2	3101-1787		SWITCH, SLIDE	28480	3101-1787
A24S3	3101-1787		SWITCH, SLIDE	28480	3101-1787
A24S4	3101-1787		SWITCH, SLIDE	28480	3101-1787
A24S5	3101-1787		SWITCH, SLIDE	28480	3101-1787
A24S6	3101-1787		SWITCH, SLIDE	28480	3101-1787
			A24 MISCELLANEOUS		
	0380-0643	2	STANDOFF, LG STUD MOUNT(METRIC THREAD)	00000	OBD
	2190-0017	2	WASHER-LK HLCL NO. 8 .168-IN-ID	28480	2190-0017
	05341-00016	1	PLATE, CONNECTOR	28480	05341-00019
A25	05341-60078	1	REMOTE OUTPUT ASSY (OPT 011)	28480	05341-60028
A25C1	0160-2204	2	CAPACITOR-FXD 100PF +-5% 300VDC MICA+TC	28480	0160-2204
A25C2	0160-3879	2	CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A25C3	0180-0106	3	CAPACITOR-FXD 60UF+-20% 6VDC TA	56289	150D606X0006B2
A25J1	1200-0548	2	SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0548
A25J2	1200-0548		SOCKET-IC 16-CONT DIP DIP-SLDR	28480	1200-0548
A25R1	0683-3025	2	RESISTOR 3K 5% .25W FC TC=-400/+700	01607	CB3025
A25R2	0683-1235	1	RESISTOR 12K 5% .25W FC TC=-400/+800	01607	CB1235
A25R3	0683-3025		RESISTOR 3K 5% .25W FC TC=-400/+700	01607	CB3025
A25R4	0683-2025	1	RESISTOR 2K 5% .25W FC TC=-400/+700	01607	CB2025
A25R5	1810-0055	4	NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A25R6	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A25R7	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A25R8	1810-0055		NETWORK-RES 9-PIN-SIP .15-PIN-SPCG	28480	1810-0055
A25U1	1820-0911	1	IC CNTR TTL L DECD UP/DOWN SYNCHRO	01295	SN74LS192N
A25U2	1820-0511	1	IC GATE TTL AND QUAD 2-INP	07263	7408PC
A25U3	1820-0683	4	IC GATE TTL L NAND QUAD 2-INP	01295	SN74LS00N
A25U4	1820-1053	1	IC SCHMITT-TRIG TTL HEX 1-INP	01295	SN7414N
A25U5	1820-0996	3	IC FF TTL L D-TYPE POS-EDGE-TRIG	01295	SN74LS74N

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A29U6	1820-0730	1	IC FF TTL D-TYPE POS-EDGE-TRIG CLEAR MED	28480	1820-0730
A29U7	1820-0820	1	IC BFR TTL NAND GUAD 2-INP	28480	1820-0820
A29U8	1818-0597	1		28480	1818-0597
A29U9	1820-0688	1	IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE 8-INP	28480	1820-0688
A29U10	1818-0708	1		28480	1818-0708
A29U11	1820-0821	1	IC BFR TTL NAND GUAD 2-INP	28480	1820-0821
A29U12	1820-0821		IC BFR TTL NAND GUAD 2-INP	28480	1820-0821
A29U13	1820-0576		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74AN
A29U14	1820-0803		IC GATE TTL LS NAND GUAD 2-INP	01295	SN74LS00N
A29U15	1200-0473	1	RCC-KEY-IC 16-CONT DIP-SLDR	28480	1200-0473
A29U16	1200-0660	2	SOCKET-IC 28-CONT DIP-SLDR	00779	IC-228-00
A30	05341-60029	1	ASSY INPUT (OPTION 011)	28480	05341-60029
A30C1	0160-3879		CAPACITOR-FXD .01UF +-20% 100VDC CER	28480	0160-3879
A30C2	0160-0106		CAPACITOR-FXD 82UF+-20% 6VDC TA	56289	150D826X0006B2
A30C3	0180-0106		CAPACITOR-FXD 82UF+-20% 6VDC TA	56289	150D826X0006B2
A30C4	0160-2204		CAPACITOR-FXD 1000PF +-5% 300VDC MICA	28480	0160-2204
A30CR1	1901-0644	2	DIODE-SWITCHING 30V 5MA 2NS DO-35	28480	1901-0644
A30CR2	1901-0644		DIODE-SWITCHING 30V 50MA 2NS DO-35	28480	1901-0050
A30J1	1251-1020	1	CONNECTOR-PC EDGE 10-CONT/ROW 2-ROW	00779	552-10-30-300
A30R1	0683-1025	1	RESISTOR 1K 5% .25W FC TC=-400/+800	01121	CB1025
A30R2	1810-0136	2	NETWORK-RES 10-PIN-BIP ,1-PIN-BPCG	28480	1810-0136
A30R3	1810-0055		NETWORK-RES 9-PIN-BIP ,15-PIN-BPCG	28480	1810-0055
A30R4	1810-0055		NETWORK-RES 9-PIN-BIP ,15-PIN-BPCG	28480	1810-0055
A30R5	1810-0055		NETWORK-RES 9-PIN-BIP ,15-PIN-BPCG	28480	1810-0055
A30R6	0683-3015	1	RESISTOR 300 5% .25W FC TC=-400/+800	01121	CB3015
A30R7	0698-7101	2	RESISTOR 3K 5% .125W CC TC=-359/+857	01121	CB3025
A30R8	0698-8180	1	RESISTOR 8K 5% .125W CC TC=-359/+857	01121	CB8025
A30R10	0698-7101		RESISTOR 3K 5% .125W CC TC=-359/+857	01121	CB3025
A30R11	0698-9999	1	RESISTOR 12K 5% .125W CC TC=0+600/+875	01121	CB1235
A30R12	1810-0136		NETWORK-RES 10-PIN-BIP ,1-PIN-BPCG	28480	1810-0136
A30U1	1820-0690		IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE 8-INP	03508	SN74LS151N
A30U2	1820-1047		IC DCDR TTL LS BCD-TO-DEC 4-TO-10-LINE	01295	SN74LS42AN
A30U3	1820-0833		IC LCH TTL DCM CLEAR D-FLIP	02235	9334PC
A30U4	1820-0833		IC LCH TTL DCM CLEAR D-FLIP	02235	9334PC
A30U5	1820-0580	1	IC INV TTL LS HEX 1-INP	01295	SN74LS04N
A30U6	1820-0778	2	IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	02235	93L10PC
A30U7	1820-0503		IC GATE TTL LS NAND GUAD 2-INP	01295	SN74LS00N
A30U8	1820-0821		IC BFR TTL NAND GUAD 2-INP	02235	7438PC
A30U9	1820-0906	1	IC COMPTR TTL LS MAGTD 8-BIT	02235	93L24PC
A30U10	1820-0690		IC MUXR/DATA-SEL TTL LS 8-TO-1-LINE 8-INP	03508	SN74LS151PC
A30U11	1820-1858	1	IC INV TTL HEX 1-INP	01295	SN74LS14N
A30U12	1820-0503		IC GATE TTL LS NAND GUAD 2-INP	01295	SN74LS00N
A30U13	1818-2247	1		28480	1818-2247
A30U14	1820-0882	1	IC GATE TTL EXCL-OR GUAD 2-INP	02235	7486PC
A30U15	1820-0576		IC FF TTL LS D-TYPE POS-EDGE-TRIG	01295	SN74LS74N
A30U16	1820-0778		IC CNTR TTL LS BIN SYNCHRO POS-EDGE-TRIG	02235	93L10PC
A30U13	1200-0449		SOCKET-IC 28-CONT DIP-SLDR	00779	IC-228-02
W26	8120-2047	2	CABLE ASSY	28480	8120-2047

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	05341-60001	1	MIXER MODULE	28480	05341-60001
A2	05341-60040		FILTER ASSY, SWITCHABLE	28480	05341-60040
A2	05341-60033		FILTER ASSEMBLY, HIGH PASS (OPTION 003)	28480	05341-60033
A3	05341-60003	1	500-1000 MHZ DOUBLER	28480	05341-60003
A4	05341-60004	1	500 MHZ PRESCALER	28480	05341-60004
A5	05341-60005	1	IF AMPLIFIER-DETECTOR	28480	05341-60005
A6	05341-60006	1	250-500 MHZ MULTIPLIER	28480	05341-60006
A7	05341-60007	1	250-750 MHZ MULTIPLIER	28480	05341-60007
A8	05341-60008	1	50 TO 250 MHZ MULTIPLIER	28480	05341-60008
A9	05341-60009	1	10 TO 50 MHZ MULTIPLIER	28480	05341-60009
A10	05341-60010	1	BAND SELECTOR/SWITCH DRIVER	28480	05341-60010
A11	05341-60011	1	10 MHZ OSCILLATOR BUFFER	28480	05341-60011
A12	05341-60012	1	40 MHZ AMPLIFIER	28480	05341-60012
A13	05341-60013	1	RF MOTHER BOARD	28480	05341-60013
A14	05341-60047	1	10 MHZ OSCILLATOR	28480	05341-60047
A15	05341-60015	1	DISPLAY BOARD	28480	05341-60015
A16	05341-60016	1	DRIVER DISPLAY BOARD	28480	05341-60016
A17	05341-60017	1	TIME BASE	28480	05341-60017
A18	05341-60018	1	COUNTER	28480	05341-60018
A19	05341-60019	1	PROCESSOR	28480	05341-60019
A20	05341-60020	1	+5 VOLT REGULATOR	28480	05341-60020
A21	05341-60021	1	POWER SUPPLY MOTHER BOARD	28480	05341-60021
A22	05341-60022	1	POWER REGULATOR (-5V, +15V AND -15V)	28480	05341-60022
A23	05341-60014	1	RESOLUTION SWITCH	28480	05341-60014
A24	05341-60032		REMOTE ADDRESS SWITCH (OPT 011)	28480	05341-60032
A25	05341-60028		REMOTE OUTPUT ASSY (OPT 011)	28480	05341-60028
A26	05341-60029		ASCII INPUT ASSY (OPT 011)	28480	05341-60029
A27			NOT ASSIGNED		
A28			NOT ASSIGNED		
A29			NOT ASSIGNED		
A30			NOT ASSIGNED		
A31	05341-60031	1	CABLE ASSY, AC LINE	28480	05341-60031
			MAIN ASSEMBLY ELECTRONIC PARTS		
B1	3160-0209	1	FAN-TBAX 45-CFM 115V 50/60-HZ 1.5-THK	28480	3160-0209
C1A	0160-3043	1	CAPACITOR-FXD 5000PF/5000PF +-20%	28480	0160-3043
C1B	0160-3043		CAPACITOR-FXD 5000PF/5000PF +-20%	28480	0160-3043
CR1	1884-0024	1	THYRISTOR-SCR VRRM=200	28480	1884-0024
CR2	1901-1001	1	DIODE-CT-TAP RECT 50V 10A	28480	1901-1001
F1	2110-0304	1	FUSE 1.5A 250V SLO-BLO 1.25X.25 UL IEC (FOR 115V OPERATION)	04482	MDX-1-1/2A
F1	2110-0379	1	FUSE .75A 250V SLO-BLO 1.25X.25 UL IEC (FOR 230V OPERATION)	04703	313.750
J2	1250-0118	1	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	3311F	28JR128-1
J3	1250-0083	4	CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	02311F	28JR-130-1
J4	1250-0083		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	02311F	28JR-130-1
J5	1250-0083		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	02311F	28JR-130-1
J6	1250-0083		CONNECTOR-RF BNC FEM SGL-HOLE-FR 50-OHM	02311F	28JR-130-1
K1	0490-0909	1	RELAY AC 24VDC-COIL 5A 115VAC	04777	HAC-L1-AAA-800
Q1	1854-0063	1	TRANSISTOR NPN 2N3055 SI TO-3 PD=115W	28480	1854-0063
R1-R3	2100-3171	1	RESISTOR-VAR W/SW 1M 30% LOG SPST-NC	28480	2100-3171
S1	3101-1327	1	SWITCH-SL DPST-NS MINTR .5A 125VAC/DC	04879	G128S-0000A
S2	3101-1216	2	SWITCH-PB SPST-NO MOM .25A BLK-LENS	28480	3101-1216
S3			PART OF R1 (CHASSIS PART)		
S4	3101-1593	1	SWITCH-SL DPDT-NS MINTR 1A 125VAC	28480	3101-1593
S6	3101-1216		SWITCH-PB SPST-NO MOM .25A BLK-LENS	28480	3101-1216
S7	3101-0070	1	SWITCH-SL DPDT-NS MINTR .5A 125VAC/DC	04877	GF-126-0000
T1	9100-3642	1	TRANSFORMER	28480	9100-3642
U1	1826-0117	1	IC 7812 V RGLTR	02230	7812KC
U2	1826-0123	1	IC V RGLTR	03407	LM320K-12
U3	1826-0202	1	IC V RGLTR	03407	LM320K-05
	8120-2053	1	CABLE ASSY-COAX 14.5-LG	28480	8120-2053
	8120-2029	1	CABLE ASSY-COAX 50-OHM 29.1PF/FT	28480	8120-2029
	8120-2047	2	CABLE ASSY 28AWG 14-CNDCT	28480	8120-2047
W1	8120-1378	1	CABLE ASSY 18AWG 3-CNDCT JGK-JKT .25-OD	28480	8120-1378
W3	8120-2029		CABLE ASSY-COAX 50-OHM 29.1PF/FT	28480	8120-2029

See introduction to this section for ordering information

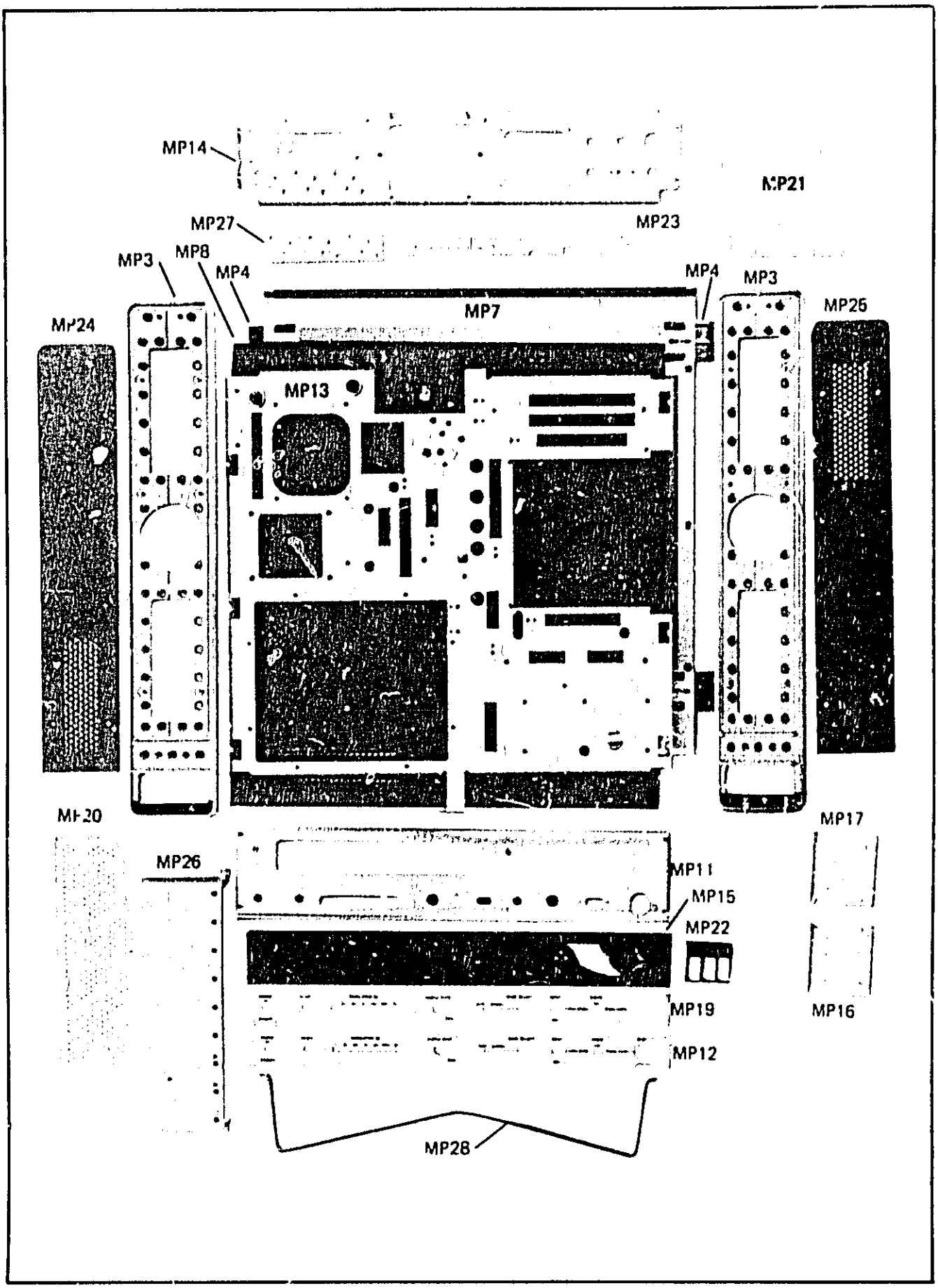


Figure 6-1. 5341A Mechanical Parts

Table 6-1 Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
W6	8120-2826	1	CABLE ASSY-COAX SC-CON [illegible]	28480	8120-2826
W7	8120-2582	1	CABLE ASSY 26AWG 16-CNDCT	28480	8120-2582
W8	[illegible]	1	CABLE ASSY 26AWG 26-CNDCT	[illegible]	[illegible]
W9	05341-60034	1	CABLE ASSY, POWER SUPPLY	28480	05341-60034
W10	05341-60035	1	CABLE ASSY, CENTER HB	28480	05341-60035
W11	05341-60040		CABLE ASSY, FILTER HB	28480	05341-60040
W12	05341-60049	1	CABLE ASSY, POWER SUPPLY REGULATOR	28480	05341-60049
W13	05341-60038		CABLE ASSY, SWITCH FILTER HB	28480	05341-60038
W14	05341-60037	1	CABLE ASSY, SWITCH FILTER, IS	28480	05341-60037
W15	05341-60038	1	CABLE ASSY, MIXER TO HB	28480	05341-60038
W16	05341-60039	1	CABLE ASSY, AMP TO FRONT	28480	05341-60039
W17	05341-60040	1	CABLE ASSY, PRECISION CNTR	28480	05341-60040
W18	05341-60041	1	CABLE ASSY, PRECISION, REAR	28480	05341-60041
W19	05341-60042	1	CABLE ASSY, 10 MHZ CTR	28480	05341-60042
W20	05341-60043	1	CABLE ASSY, T B ,10 MHZ	28480	05341-60043
W21	05341-60044	1	CABLE ASSY, 10 MHZ, REP	28480	05341-60044
W22	05341-60045	1	CABLE ASSY, EXT T B	28480	05341-60045
X1	1200-0567		SOCKET, DIP	28480	1200-0567
X1	1251-3402	4	CONNECTOR-SGL CONT SKT ,04-IN-BSC-SZ RND	00779	98-4311-75
XS1	1200-0498	1	SOCKET-XSTR 3-CONT TO-3	91833	4402
			MECHANICAL PARTS		
	0340-0486	4	INSULATOR-COVER NYLON	00PHL	A22-2003
	0370-1099	1	KNOB-BASE-PTR 1/2 JGK ,25-IN-ID	28480	0370-1099
	0380-0974	4	SPACER-RND ,438LG ,1150D ,188DD BRS	02173	4712-P115
	0590-0505	1	NUT, KNURLED 5/8-24 UNEF-2B THREAD	73743	TU-801
	1205-0043	4	INSULATOR-XSTR ALUMINUM	04736	2220AT
	1200-0080	2	INSULATOR-DIO ALUMINUM HC-ANDZ	28480	1200-0080
	1490-0030	1	TILT STAND 3-IN-H 13.75-IN-LG SST	28480	1490-0030
MP1	3150-0039	1	FILTER-AIR EXP-AL 2.281-WD 4.150-LG	28480	3150-0039
MP2	5040-0170	10	SUPPORT, BOARD	28480	5040-0170
MP3	5060-0730	2	FRAME ASSY, 3 X 16 FM	28480	5060-0730
MP4	5060-0767	5	FOOT ASSY-FM	28480	5060-0767
MP5	0960-0444	1	POWER LINE MODULE, BL	28480	0960-0444
MP6	05328-60040	1	KIT, RACK MOUNTING, H,D,	28480	05328-60040
MP7	05340-00011	1	COVER, BOTTOM	28480	05340-00011
MP8	05340-00013	1	INSULATOR CO ER	28480	05340-00013
MP9	05340-00023		COVER CONNECTOR	28480	05340-00023
MP11	05341-00001	1	PANEL, FRONT	28480	05341-00001
MP12	05341-00002		PANEL, EXTR	28480	05341-00002
MP13	05341-00003	1	CHASSIS	28480	05341-00003
MP14	05341-00004	1	PANEL, REAR	28480	05341-00004
MP15	05341-00005	1	PANEL, TRIM	28480	05341-00005
MP16	05341-00006	1	BRACKET, FILTER, LEFT	28480	05341-00006
MP17	05341-00007	1	BRACKET, FILTER, RIGHT	28480	05341-00007
MP18	05341-00008	1	COVER, TOP	28480	05341-00008
MP19	05341-00009		PANEL, EXTR	28480	05341-00009
MP20	05341-00010	1	COVER, HOUSING DISPLAY	28480	05341-00010
MP21	05341-00011	1	COVER, MULTIPLIER	28480	05341-00011
MP22	05341-00014	1	BRACKET, ANNUNCIATOR	28480	05341-00014
MP23	05341-00015	1	BRACKET, CHASSIS	28480	05341-00015
MP24	05341-00017	1	COVER, SIDE, LEFT	28480	05341-00017
MP25	05341-00018	1	COVER, SIDE, RIGHT	28480	05341-00018
MP26	05341-20034	1	HOUSING, DISPLAY	28480	05341-20034
	05341-20038	1	PLATE, TRANSISTOR	28480	05341-20038
	05341-90004	1	MANUAL-OPERATING & SERVICE	28480	05341-90004
	08660-40002	3	INSULATOR, TRANSISTOR	28480	08660-40002
			OPTION DELETIONS		
	05341-60048	1	FILTER ASSY, SWITCHABLE	28480	05341-60048
	05340-00023	1	COVER, CONNECTOR	28480	05340-00023
	05341-00002	1	PANEL, EXTR	28480	05341-00002
	8120-2829		CABLE ASSY, COAX	28480	8120-2829
	05341-60046	1	CABLE ASSY, FILTER, HB	28480	05341-60046
	05341-60036	1	CABLE ASSY, SWITCH FILTER HB	28480	05341-60036
			OPTION ADDITIONS		
	10544-60011	1	CRYSTAL OSCILLATOR ASSY	28480	10544-60011
	05341-60032	2	REMOTE ADDRESS SWITCH	28480	05341-60032
	05341-60028	2	REMOTE OUTPUT ASSY	28480	05341-60028

See introduction to this section for ordering information

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	05341-60024	2	REMOTE INPUT ASSY	28480	05341-60024
	1200-0567	6	SOCKET, DIP	28480	1200-0567
	8120-2047		CABLE ASSY	28480	8120-2047
	8120-2053		CABLE, COAX	28480	8120-2053
	05341-00009	2	PANEL, EXTR	28480	05341-00009
	05341-60023	2	FILTER ASSY, HIGH PASS	28480	05341-60023
	05341-60033	1	CABLE ASSY, REAR	28480	05341-60033

See introduction to this section for ordering information

Table 6-2. Manufacturers Code List

MFR NO.	MANUFACTURER NAME AND ADDRESS	ZIP CODE
00001	GTE Sylvania Miniature Lt Prod., Hillsboro, NH	03244
0024E	Jermyn Industries	
0046A	Inquiry at Hewlett-Packard	
0146H	Stettner-Trush, Inc., Cazenovia, NY	
0160G	Allen-Bradley, Co., Milwaukee, WI	
0169H	Texas Instr. Inc., Semicond. Cmpnt. Div., Dallas, TX	
0188G	Ferroxcube Corp., Saugerties, NY	
0192A	RCA Corp. Solid State Div., Somerville, NJ	
0203G	Motorola Semiconductor Products, Phoenix, AZ	
0217B	Airco Speer Elect. Div Air Rdcn Co., Nogales, AZ	
0217J	Amatom Elek Hardware Div. of Mite, New Rochelle, NY	
0223G	Fairchild Semiconductor Div., Mountain View, CA	
0239B	C and K Components Inc., Watertown, MA	
0291J	Signetics Corp., Sunnyvale, CA	
0327C	Gowanda Electronics Corp., Gowanda, NY	
0329B	Corning Glass Works (Bradford), Bradford, PA	
0331F	Specialty Connector Co., Inc., Indianapolis, IN	
0340F	National Semiconductor Corp., Santa Clara, CA	
0362A	Cablewave Systems, Inc., North Haven, CT	
0365A	Mepco/Electra Corp., San Diego, CA	
0374D	Bourns Inc., Trimpot Prod. Div., Riverside, CA	
0379D	Advanced Micro Devices, Inc., Sunnyvale, CA	
0420J	Sprague Electric Co., North Adams, MA	
0448J	Bussman Mfg. Div. of McGraw-Edison Co., St. Louis, MO	
0450G	TRW Elect Components Cinch Div., Elk Grove Vlge., IL	
0456C	Erie Technological Products, Inc., Erie, PA	
0470C	Littelfuse, Inc., Des Plaines, IL	
0473G	TRW Elect Cmpnt Cinch-Monadnock Div., City of Ind., CA	
0477F	Potter & Brumfield Div. Amf Inc., Princetone, IN	
0487F	C-W Industries, Warminster, PA	
0551H	Augat Inc., Attleboro, MA	
0552D	Dale Electronics Inc., Columbus, NE	
0576I	Sealectro Corp., Mamaroneck, NY	
06776	Robinson Nugent Inc., New Albany, IN	
1201D	Inquiry at Hewlett-Packard	
27318	Stewart-Warner Microcircuits Inc., Sunnyvale, CA	94086
28480	Hewlett-Packard Div. 00 Corporate, Palo Alto, CA	
52072	Circuit Assembly Corp., Costa Mesa, CA	92626
59730	Thomas & Betts Co., The, Elizabeth, NJ	07207
72136	Electro Motive Corp., Sub. IEC, Willimantic, CT	06226
73138	Beckman Instruments Inc., Helipot Div., Fullerton, CA	92634
7374C	Inquiry at Hewlett-Packard	
73899	J F D Electronics Corp., Brooklyn, NY	11219
7706H	Inquiry at Hewlett-Packard	
91293	Johanson Mfg. Co., Boonton, NJ	07005
91833	Keystone Electronics Corp., New York, NY	10012

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-1. This section contains information necessary to adapt this manual to older instruments.

7-3. MANUAL CHANGES

7-4. This manual applies directly to Model 5341A with serial prefix 1504A.

7-5. NEWER INSTRUMENTS

7-6. As changes are made, newer instruments may have serial prefixes that are not listed in this manual. The manuals for these instruments are supplied with a manual change sheet, containing the required information. Contact the nearest Hewlett-Packard Sales and Service Office for information if this sheet is missing.

7-7. OLDER INSTRUMENTS

7-8. To adapt this manual to instruments having a serial prefix prior to 1504A, perform the backdating changes that apply to your instrument serial prefix, as listed in table below.

SERIAL PREFIX	BACKDATING CHANGE
1432A	1,2
1440A	2

CHANGE 1 (1432A)

Page 6-12, Table 6-1:
Change A5R29 to * 0757-0902 Resistor 12Ω 2% .125W; Mfr. & No. 28480/0757-0902.
Add asterisk to A5R33 *.
Add at bottom of page: *Factory selected value, average value shown.

Page 8-15, Figure 8-10:
Change R29 to fixed 120 and add *.
Add * to R33.
Change Series from 1504A to 1440A.

Page 6-14, Table 6-1:
Delete A10R20 and A10R24.

Page 8-21, Figure 8-13:
Delete A10R20 and A10R24 and replace with a line.
Change Series from 1504A and 1432A.

Page 6-18, Table 6-1:
Change A12R7 from 0683-0275 to 0683-1005 Resistor 10 ±5% .25W; Mfr. & No. 28480/0638-1005.
Change A12R6 from 0698-5174 to 0674-3315 Resistor 330 ±5% .125W; Mfr. & No. 28480/0674-3315.
Change A12R31 from 0698-5174 to 0674-3315 Resistor 330 ±5% .125W; Mfr. & No. 28480/0674-3315.

Change A12R32 from 2100-2514 to 0683-2035 Resistor 30K ±5% .25W; Mfr. & No. 01121-CB2035.
Change A12R37 from 0698-8128 to 0683-3015 Resistor 300 ±5% .25W; Mfr. & No. 28480-0683-3015.

Page 8-25, Figure 8-15:
Change A12R7 to 10.
Change A12R26 to 330.
Change A12R31 to 330.
Change A12R32 to 20K fixed.
Change A12R37 to 300.
Change Series from 1504A to 1440A.

CHANGE 2 (1440A and 1432A)

Page 6-8, Table 6-1:
Change A1A1R4 in 05341-60025 assembly from 0698-3113 (100 OHM) to 0698-5174; RESISTOR 200 OHM 5% .125W CC TUBULAR; Mfr. & No. 01121/BB2015.

Page 6-14, Table 6-1:
Delete A7CR5 1901-0535 Diode.
Delete A7CR6 1901-0535 Diode.
Change A7Q1 from 1854-0215 to 1854-0071 Transistor; Mfr. & No. 28480/1854-0071.
Change R13 from 0683-5125 to 0683-1035 Res 10K 5% .25W; Mfr. & No. 01121/CB1035.
Change R18 from 0683-1035 to 0683-5125 Res 5.1K 5% .25W; Mfr. & No. 01121/CB5125.

Page 6-18, Table 6-1:
Change A12R15 from 0683-1315 to 0683-5115 Resistor Fxd 510 ±5% .25W; Mfr. & No. 28480/0683-5115.
Delete A12R41 0683-8205 Resistor.

Page 8-17, Figure 8-11:
Delete A7CR5 and A7CR6.
Change A7R13 from 5.1K to 10K.
Change A7R18 from 10K to 5.1K.
Change Series from 1504A to 1432A.

Page 8-25, Figure 8-15:
Change A12R15 from 130 to 510.
Delete A12R41.
Change Series from 1504A to 1440A.

SECTION VIII
SCHEMATIC DIAGRAMS

8-1. SCHEMATIC DIAGRAMS

8-2. This section contains schematic diagrams assembly and chassis part locators, component locators, block diagram. The schematics are presented in assembly number order A1 through A26. The component, chassis, and assembly locators show the location by reference designator.

8-3. SCHEMATIC DIAGRAM NOTES, ASSEMBLY NUMBERS, AND REFERENCE DESIGNATORS

8-4. *Figure 8-1* shows the symbols used on the schematic diagrams. At the bottom of *Figure 8-1*, the system for reference designators, assemblies, and subassemblies are shown.

8-5. Reference Designations

8-6. Assemblies such as printed circuit boards are assigned numbers in sequence, A1, A2, etc. As shown in *Figure 8-1*, subassemblies within an assembly are given a subordinate A number. For example, rectifier subassembly A1 has the complete designator of A25A1. For individual components, the complete designator is determined by adding the assembly number and subassembly number if any. For example CR1 on the rectifier assembly is designated A25A1CR1.

8-7. Identification Markings on Printed Circuit Boards

8-8. HP printed circuit boards (see *Figure 8-1*) have four identifications numbers, an assembly part number, a series number, a revision letter, and a production code.

8-9. The assembly part number has 10 digits (such as 05341-60017) and is the primary identification. All assemblies with the same part number are interchangeable. When a production change is made on an assembly that makes it incompatible with previous assemblies, a change in part number is required. The series number (such as 1432A) is used to document minor electrical changes. As changes are made, the series number is incremented. When replacement boards are ordered, you may receive a replacement with a different series number. If there is a difference between the series number marked on the board and the schematic in this manual, a minor electrical difference exists. If the number on the printed circuit board is lower than that on the schematic, refer to Section VII for backdating information. If it is higher, refer to the loose leaf manual change sheets for this manual. If the manual change sheets are missing, contact your local Hewlett-Packard Sales and Service Office. See the listing on the back cover of this manual.

8-10. Revision letters (A, B, etc.) denote changes in printed circuit layout. For example, if a capacitor type is change (electrical value may remain the same) and requires different spacing for its leads, the printed circuit board layout is changed and the revision letter is incremented to the next letter. When a revision letter changes, the series number is also usually changed. The production code is the four-digit, seven-segment number used for production purposes.

8-11. ASSEMBLY LOCATIONS AND COMPONENT LOCATORS

8-12. *Figures 8-2* through *8-4* show the front, rear, and top views of the 5341A. Following these is an overall block diagram and schematic diagrams for the instrument. Component locations for each printed circuit assembly are located next to the schematics.

SYMBOLS

FRONT PANEL

REAR PANEL

INTERIOR AND PC BOARDS

WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE

POWER LINE GROUND

CIRCUIT COMMON GROUND

FLOATING GROUND

CHASSIS GROUND

KNOB CONTROL

SCREWDRIVER ADJUST

MAIN SIGNAL PATH

FEEDBACK PATH

TEST POINT

"AND" GATE

"OR" GATE

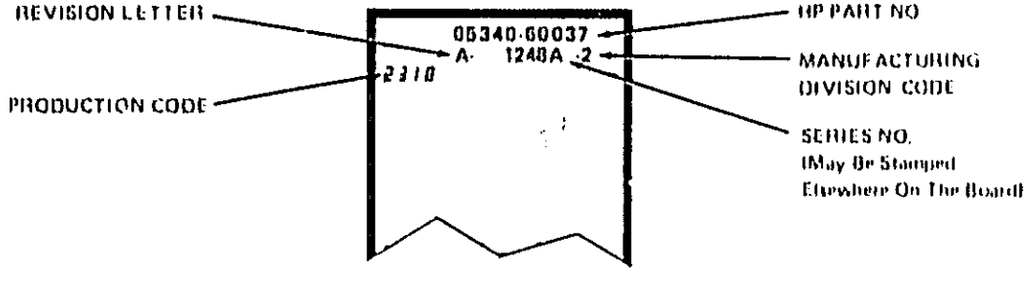
INVERTER

NAND GATE

NOR GATE

EXCLUSIVE NOR

PRINTED CIRCUIT BOARD IDENTIFICATION



REFERENCE DESIGNATIONS

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION. JACKS ARE THE STATIONARY CONNECTORS AND PLUGS ARE THE MORE MOVEABLE OF TWO CONNECTORS.

ASSEMBLY	ABBREVIATION	COMPLETE DESCRIPTION
A25	C1	A25C1
A25A1	CR1	A25A1CR1
NO PREFIX	J3	J3

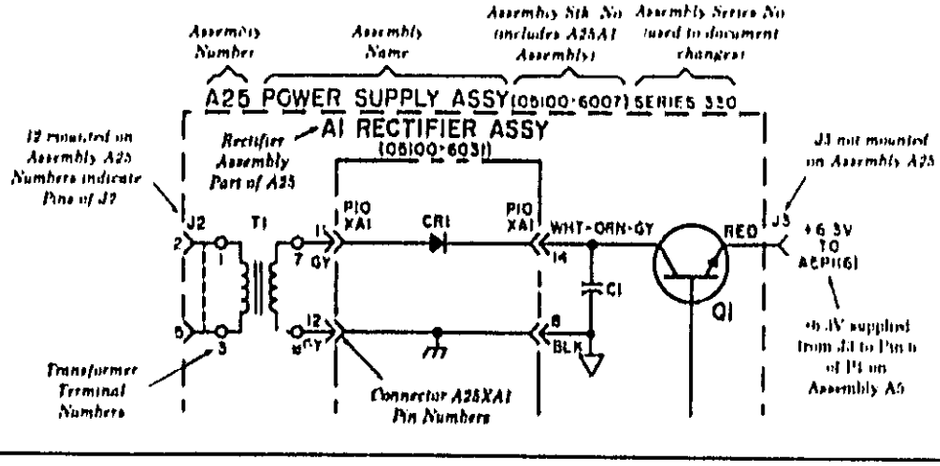


Figure 8-1. Schematic Diagrams Notes

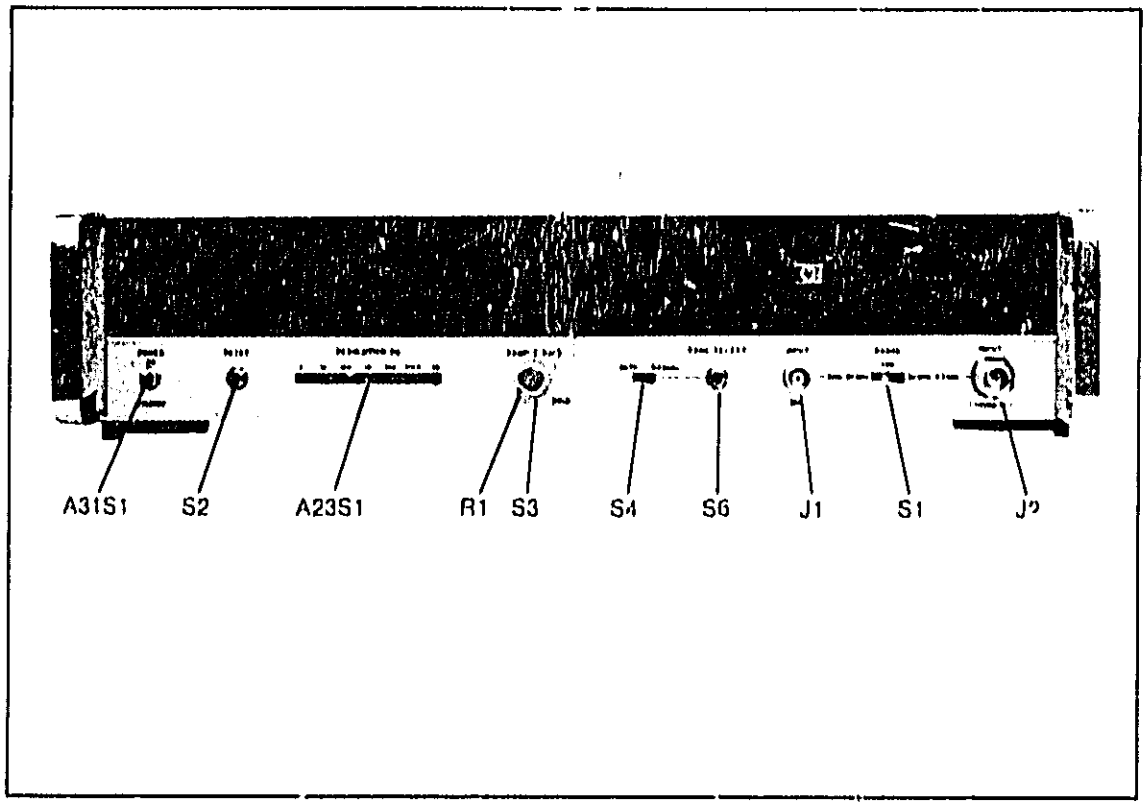


Figure 8-2. Front Panel Designations

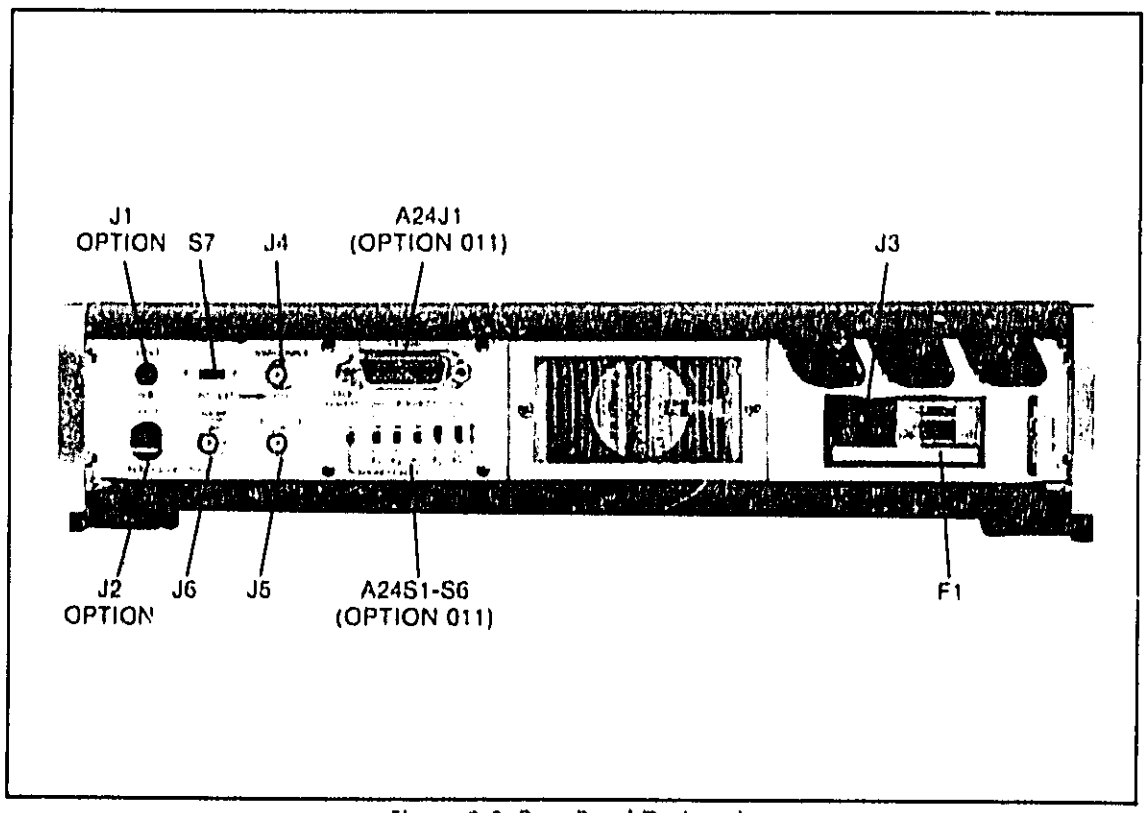


Figure 8-3. Rear Panel Designations

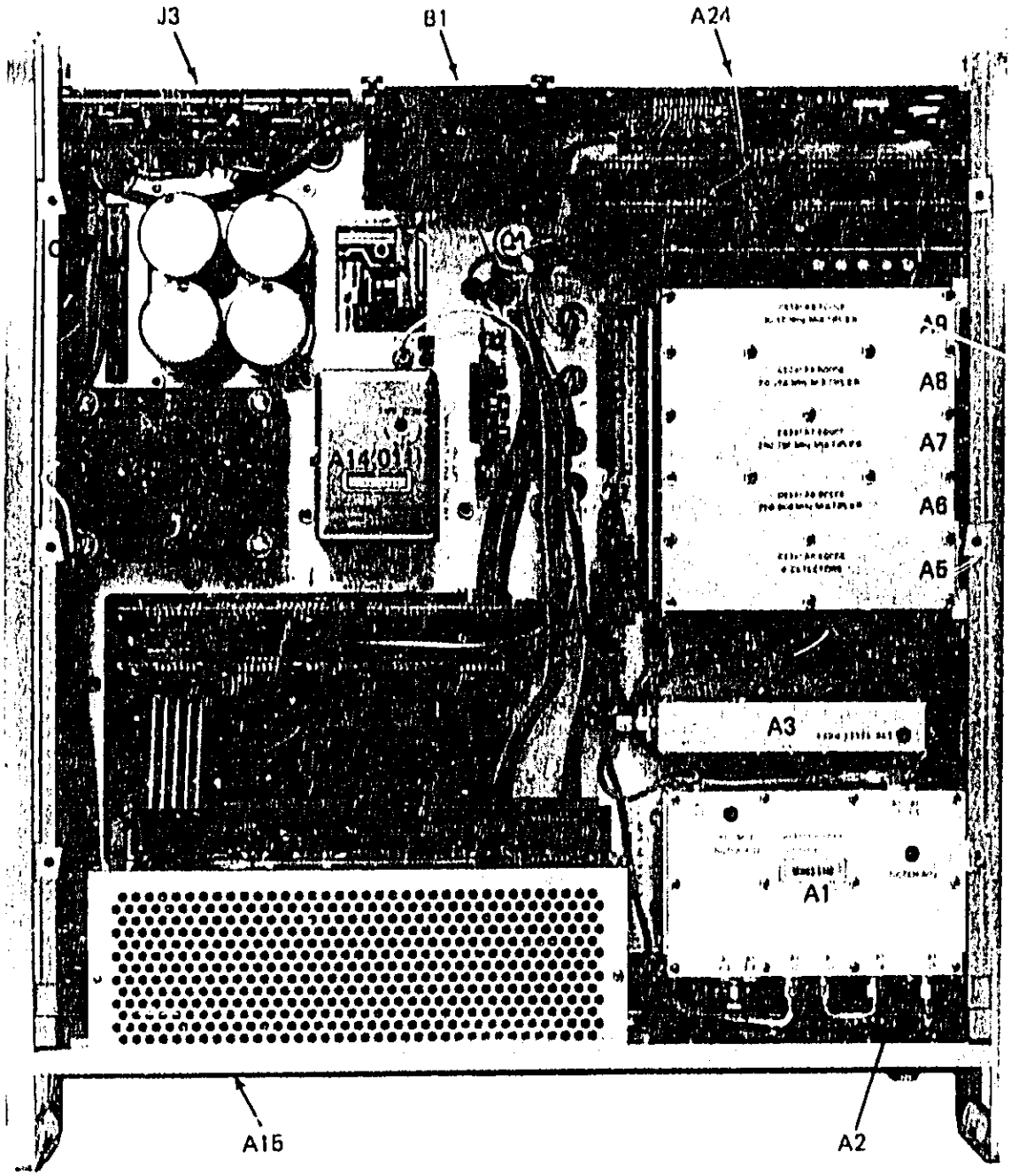


Figure 8-4. Top Internal View

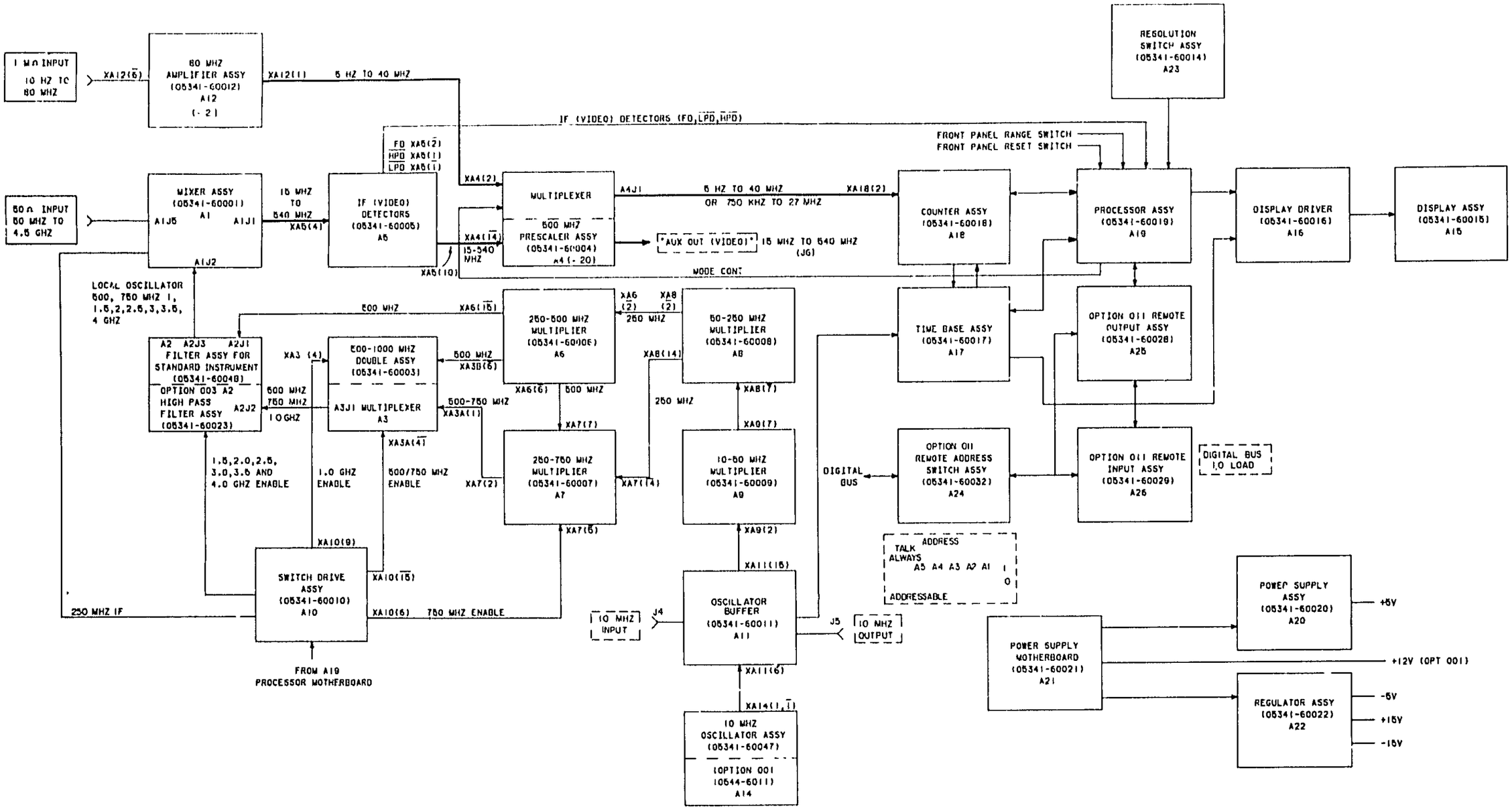
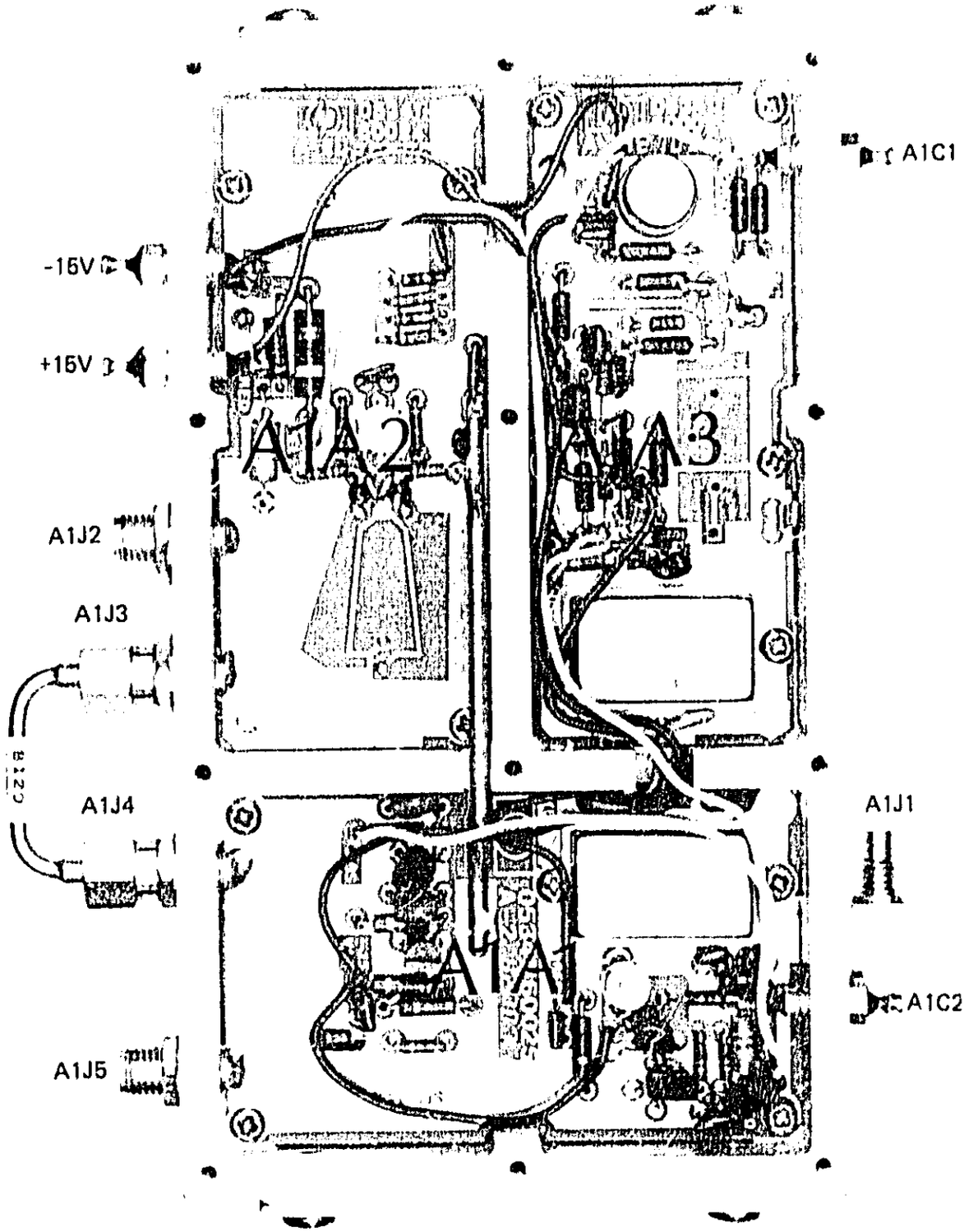


Figure 8-5. Overall Block Diagram



Part of Figure 8-6. A1 Mixer Module Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. L1 IS AN ETCHED INDUCTOR ON A13 PC BOARD

REFERENCE DESIGNATIONS

A1	A1A1	A1A2	A1A3
C1-4	C1-13	C1-12	C1-13
J1-5	CR1-4	CR2,3,5	CR1-4
W1, 2	L1-4	Q1	L1-3
	Q1-4	R1-14	R1-10
	R1-10		U1, 2
	U1		

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A1A1		
CR1, 2	1901-0518	1901-0518
CR3	1901-0639	1901-0639
CR4	1901-1099	1901-1099
Q1	1854-0215	SPS3611
Q2	1854-0071	1854-0071
Q3, 4	1853-0036	1853-0036
U1	1813-0044	1813-0044
A1A2		
CR2, 3	1900-0024	1900-0024
Q1	35821B	35821B
A1A3		
CR1-4	1901-0639	1901-0639
U1	1820-0306	CA3028A
U2	1813-0076	1813-0076

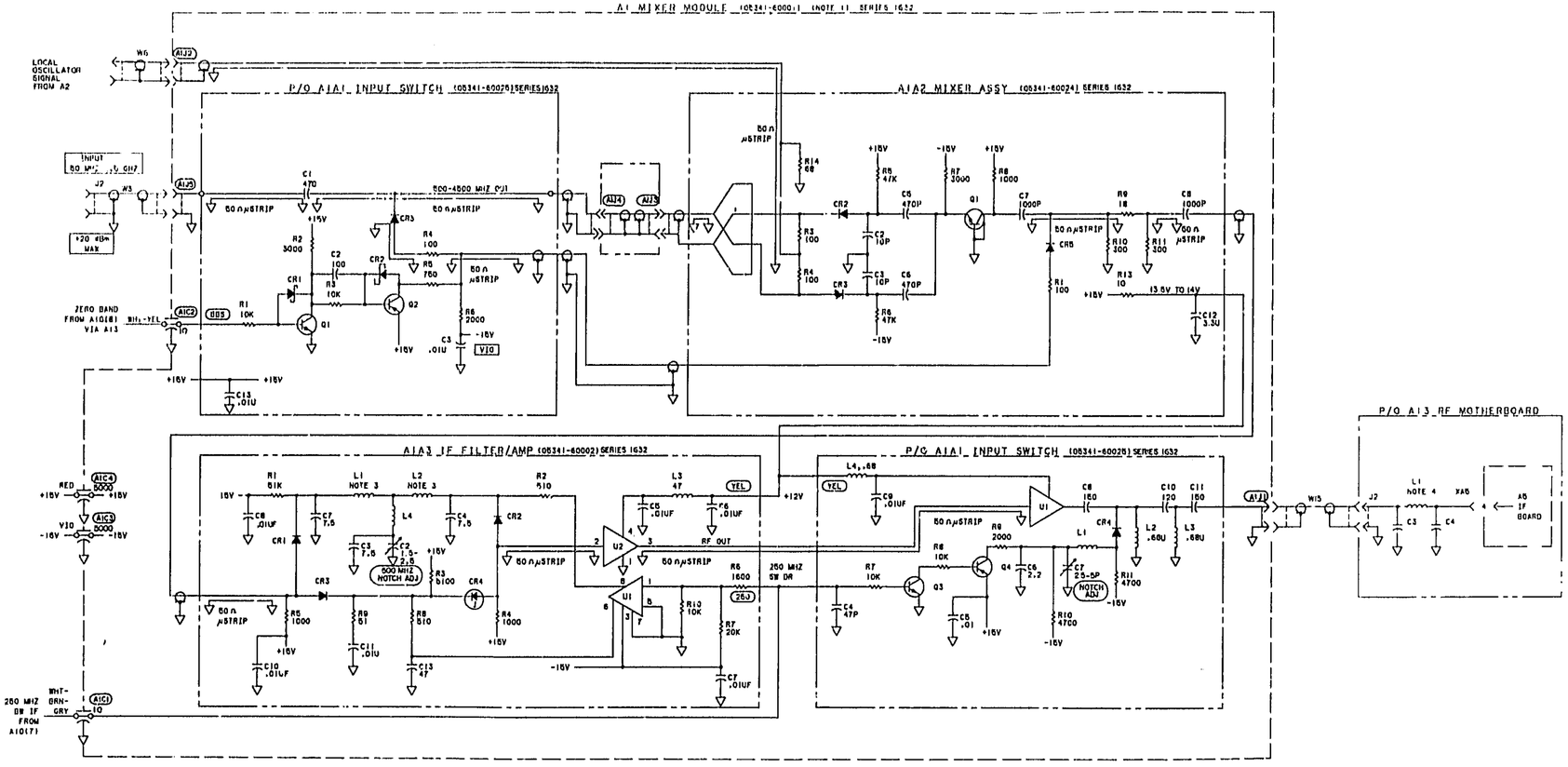
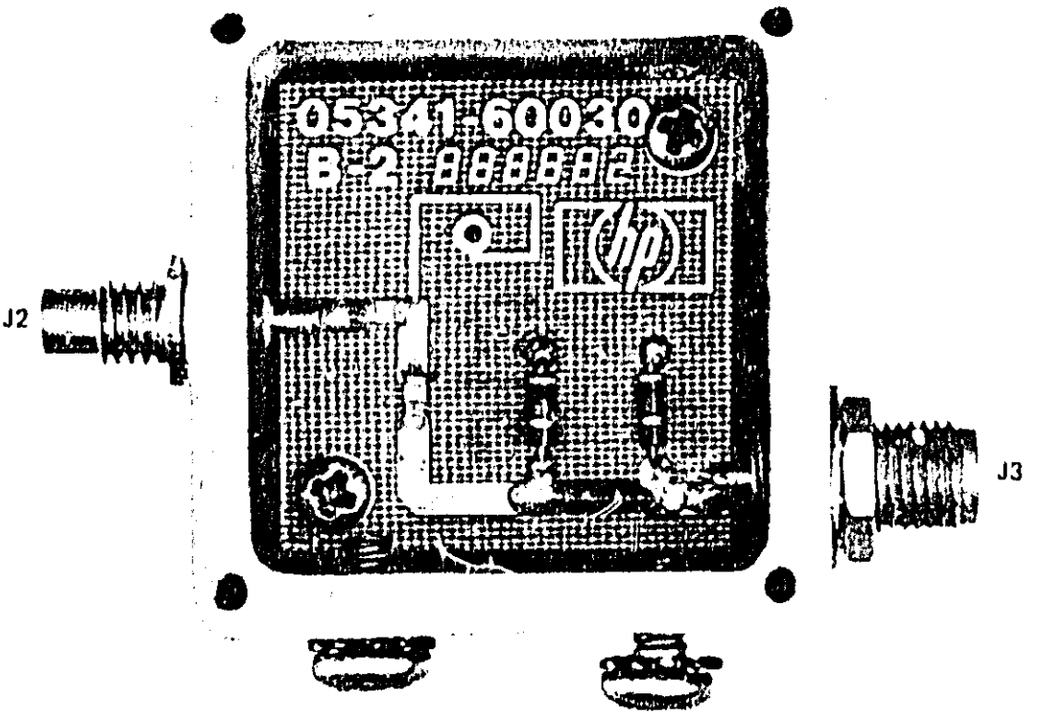


Figure 8-6. A1 Mixer Module Assembly



Part of Figure 8-7. A2 Switchable Filter Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
3. CAUTION:
   THE A2 (05341-60048) ASSEMBLY IS NOT FIELD REPAIRABLE. FOR REPLACEMENT, ORDER REBUILT ASSEMBLY 05341-60548 SCHEMATIC, COMPONENT LOCATOR AND PARTS LIST ARE GIVEN FOR REFERENCE PURPOSES ONLY. ATTEMPTS TO REPAIR THIS ASSEMBLY MAY RESULT IN PERMANENT DAMAGE TO THE UNIT.

REFERENCE DESIGNATIONS

A2 STANDARD INSTRUMENT
C1-9 CR1 FL1-9 L1-11 Q1-2 R1-8 U1
A2 OPTION 002
C1-2 L1 R1-3

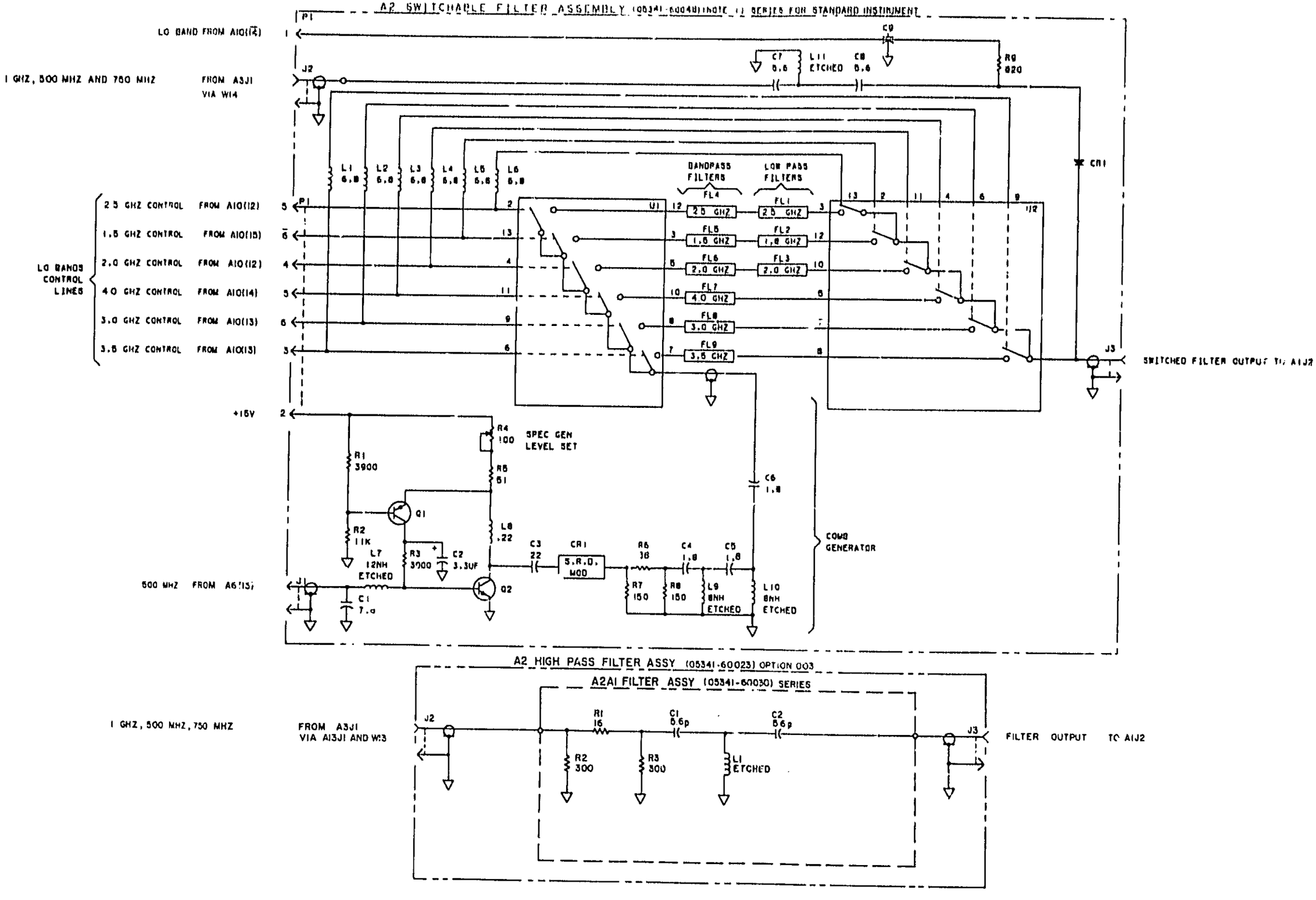
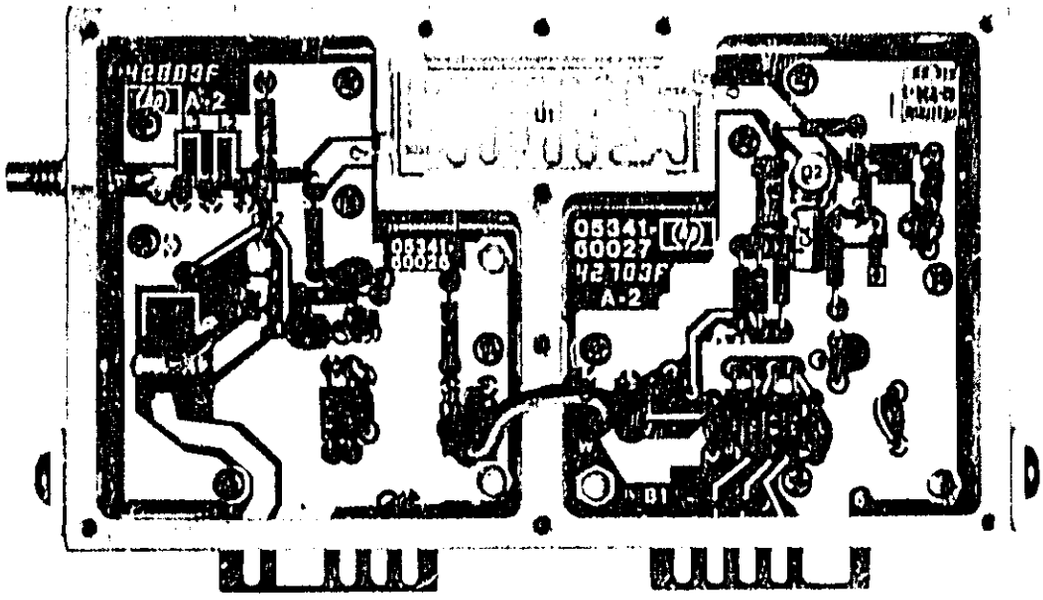


Figure 8-7. A2 Switchable Filter Assembly



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. A1L1, A1L2 ARE ETCHED ON PC BOARD
4. TWO SIX PIN EXTENDER BOARDS HP/PN 5060-0050 ARE NECESSARY TO TROUBLESHOOT THIS BOARD.

REFERENCE DESIGNATIONS

A3	A3A1	A3A2
J1 U1	C1-10 CR1 Q1-4 R1-12	C1-10 CR1, 2 L1 Q1, 2 R1-6

Part of Figure 8-8. A3 500—1000 MHz Doubler Assembly

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
	A3A1	
CR1	1901-0639	1901-0639
Q1	1853-0020	1853-0020
Q2	1854-0638	1854-0638
Q3	1853-0036	1853-0036
Q4	1854-0071	1854-0071
	A3A2	
CR1, 2	1901-0639	1901-0639
Q1	1854-0071	1854-0071
Q2	1853-0036	1853-0036

A3 TYPICAL DC VOLTAGE MEASUREMENTS

5341A CONTROL SETTINGS
RESOLUTION – 1M
SR – CCW
RANGE – CHECK
AUTO/MANUAL – MANUAL
Int TEST – TEST

Measurements taken with HP 200B/5306A

A3A1

Q1	E = +11.6V	B	= +11V	C	= +1.14V
Q2	E = 0V	B	= +0.76V	C	= +9.86V
Q3	E = +15V	B	= +14.96V	C	= -15V
Q4	E = 0V	B	= +0.05V	C	= +14.97

A3A2

Q1	E = 0V	B	= +0.65	C	= 0V
Q2	E = +15V	B	= +14.2V	C	= +14.9V

A3A2

CR1 Anode	+0.78V	1 GHz Enable XA3B(4) TTL High
	-15V	1 GHz Enable XA3B(4) TTL Low
CR2 Anode	+0.76V	500-750 MHz Enable XA3A(4) TTL High
	-15V	500-750 MHz Enable XA3A(4) TTL Low

A3A1

1 GHz Enable XA3B4 TTL Low	CR1 Cathode = -0.6V Anode = -15V
1 GHz Enable XA3B4 TTL High	CR1 Cathode = +2.4V Anode = +3.2V

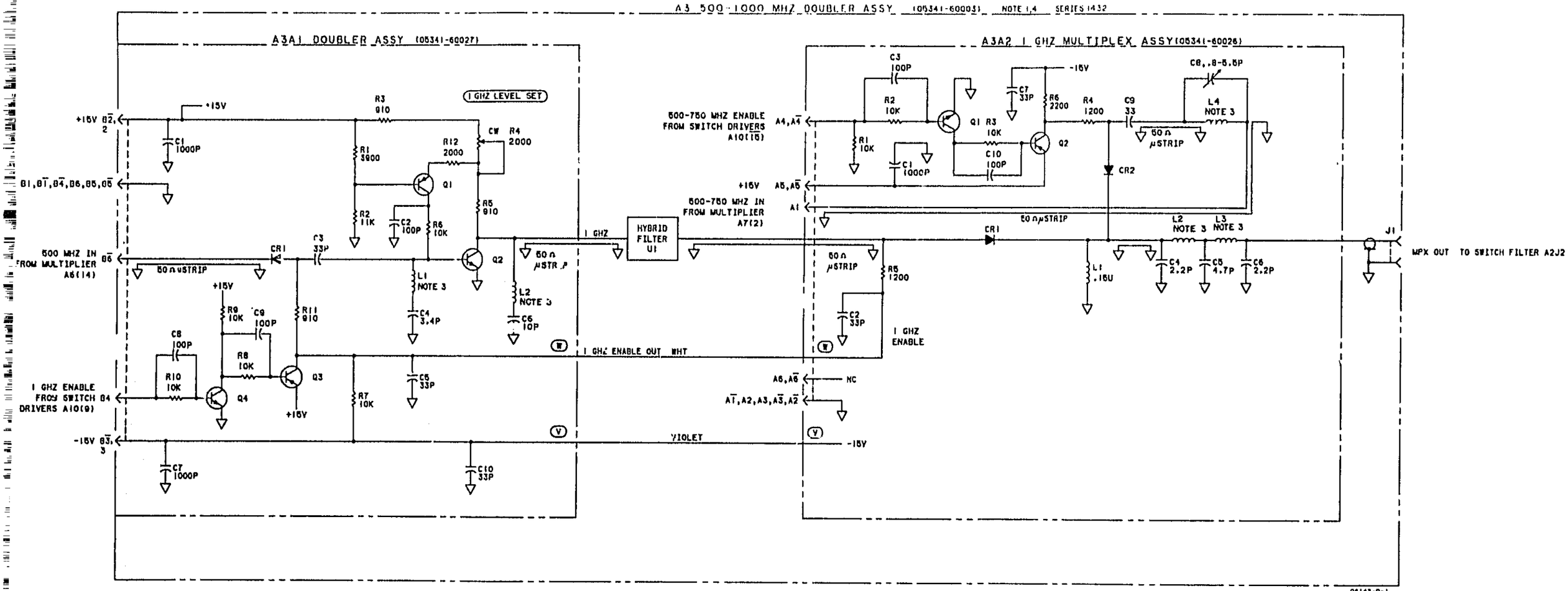
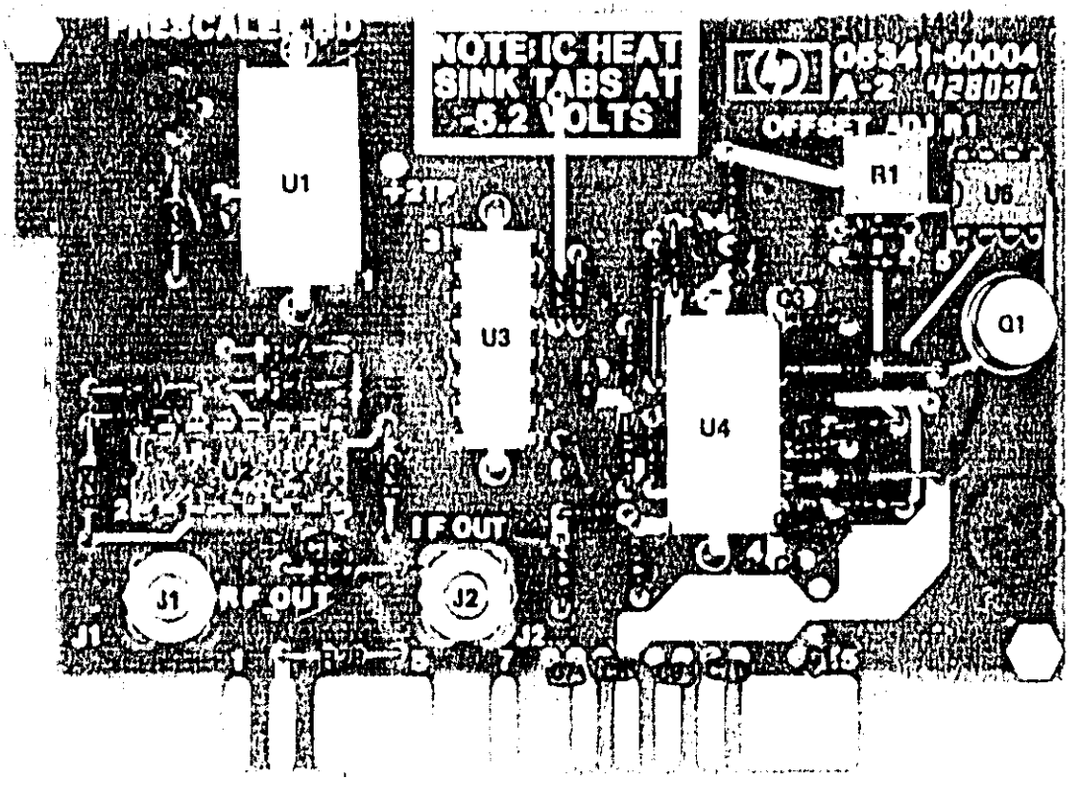


Figure 8-8. A3 500—1000 MHz Double Assembly



N O T E S

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. RESISTOR LEAD INDUCTANCE
4. C3 AND C4 NOT NORMALLY LOADED. USED ONLY FOR SUPPRESSING OSCILLATIONS.
5. ASTERISK(•) INDICATES SELECTED COMPONENT, AVERAGE VALUE SHOWN.

REFERENCE DESIGNATIONS

A4
C1-16
J1, 2
Q1, 2
R1-33
U1-5

Part of Figure 8-9. A4 500 MHz Prescaler Assembly

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1	1853-0012	2N2904A
Q2	1854-0092	1854-0092
U1	1820-1019	1820-1019
U2	1820-0802	MC10102P
U4	1826-0297	1826-0297
U5	1820-0216	1820-0216

TYPICAL DC VOLTAGE MEASUREMENTS

5341A CONTROL SETTINGS
RESOLUTION – 1 MHz
SR – CW
AUTO/MANUAL – MANUAL
SELF-TEST – TEST
RANGE – CHECK

A4U1

PIN	1	2	3	4	5	6	7	8
V	-0.28	-0.16	0	-5	-0.15	-0.36	-5.02	-0.88
PIN	9	10	11	12	13	14	15	16
V	-0.33	-0.34	0	0	-5.07	-0.27	0	-0.12

A4U4

PIN	1	2	3	4	5	6	7	8
V	-4.15	5.12	0.8	0.03	0	-2.62	-5.07	-4.04
PIN	9	10	11	12	13	14	15	16
V	-4.14	5.12	-0.52	0	-0.35	-1.63	-0.12	-0.33

A4U5

PIN	1	2	3	4	5	6	7	8
V	-15	0.77	0.8	-15	-15	-5.27	14.85	-0.18

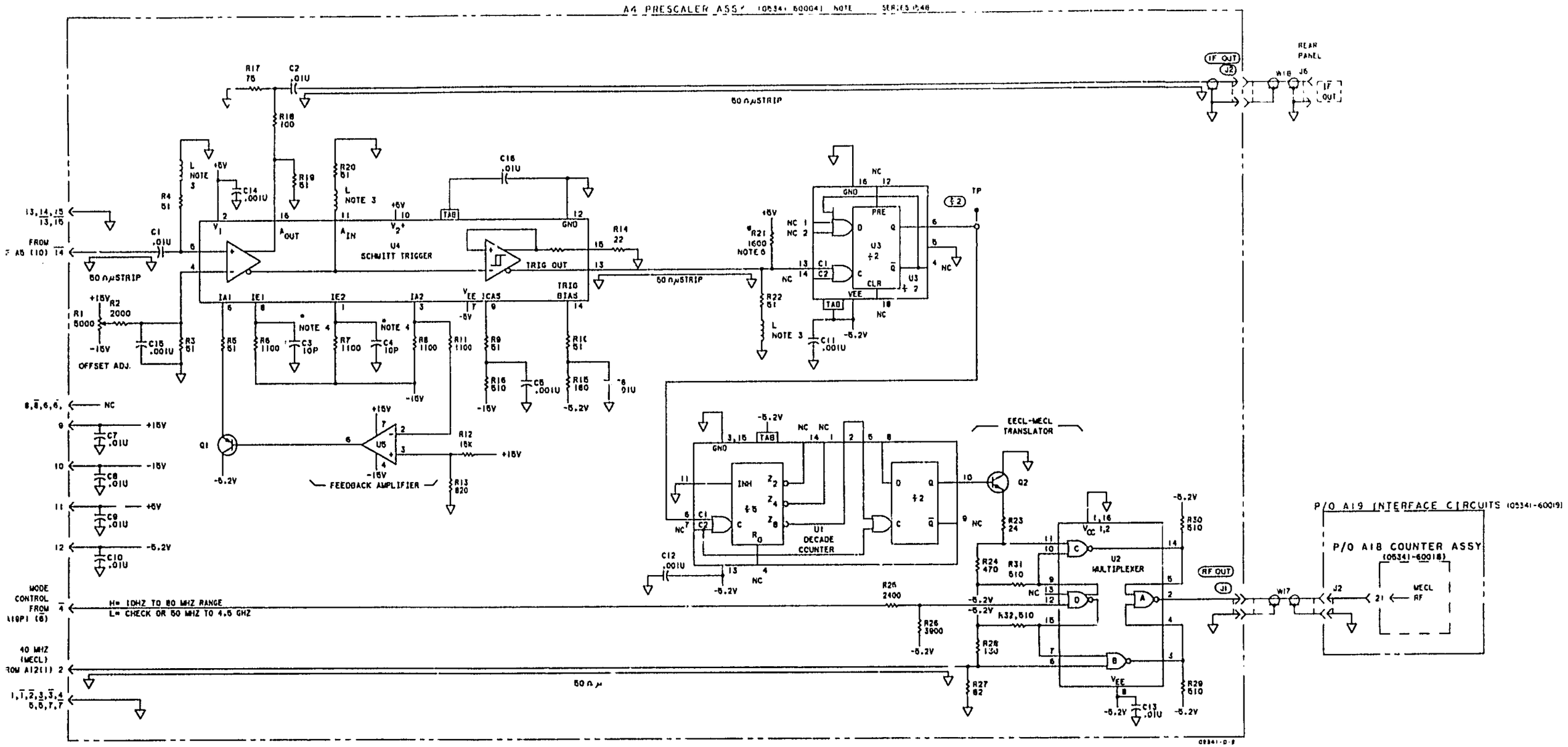
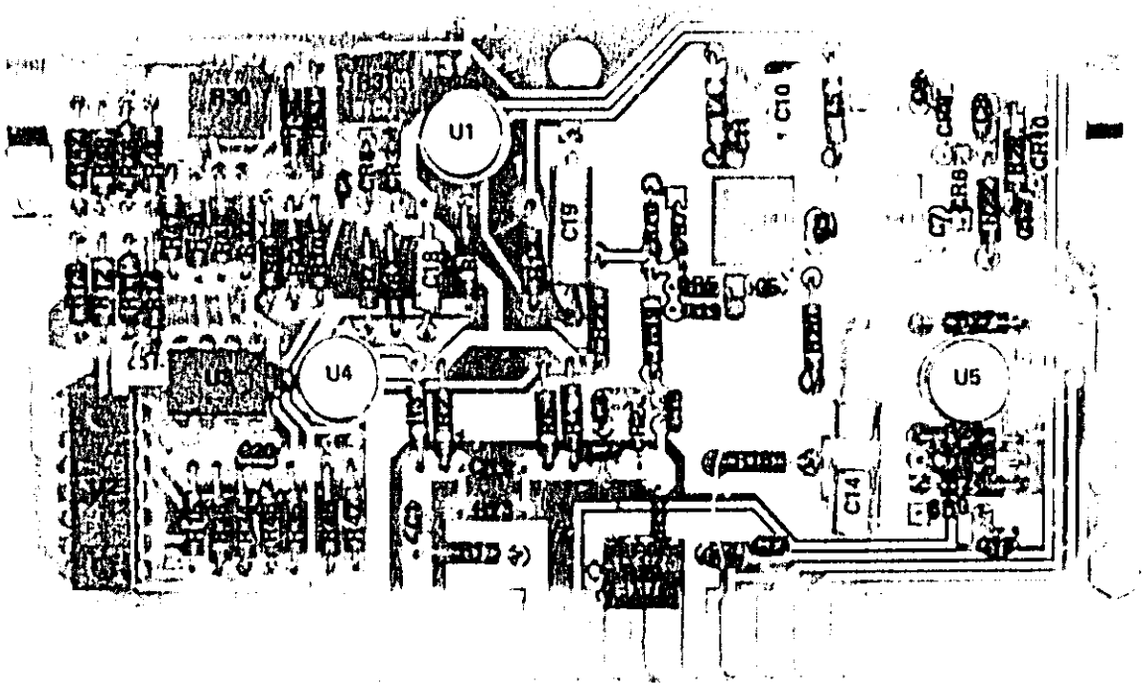


Figure 8-9. A4 500 MHz Prescaler Assembly



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK(*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A5
CR-21 CR1-10 L1-6 R1-50 U1-5

Part of Figure 8-10. A5 IF Amplifier-Detector Assembly

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1, 4, 6	1901-0535	1901-0535
CR2, 3**	05341-80005	05341-80005
CR5, 7, 8	1901-0639	1901-0039
CR9, 10**	05341-8005	05341-80005
U1	1826-0081	LM318H
U2	1826-0138	LM339N
U3	1826-0172	LM308N
U4, 5	1826-0230	1826-0230

**Matched pair

TYPICAL DC VOLTAGE MEASUREMENTS

RESOLUTION – 1M
SAMPLE RATE – CCW
AUTO/MANUAL – MANUAL
SELF TEST – ON
RANGE – CHECK

A5U1

PIN	1	2	3	4	5	6	7	8
V	+8.4	-0.4	+0.1	-15	+8.7	-0.9	+15	-14

A5U2

PIN	1	2	3	4	5	6	7	8
V	+0.11	+0.15	+15	+0.01	+0.07	-0.9	+0.16	-0.9
PIN	9	10	11	12	13	14		
V	+0.5	0	0	0	0	+0.12		

A5U3

PIN	1	2	3	4	5	6	7	8
V	+14.2	+0.06	+0.06	-15	0	+0.01	+15	+0.(

A5U4

PIN	1	2	3	4	5	6	7	8
V	+1.4	-9.8	-15	-10.6	-0.9	+11.3	0	+5.3

A5U5

PIN	1	2	3	4	5	6	7	8
V	0	-9.9	-15	-10.6	-0.9	+11.3	0	+7.0

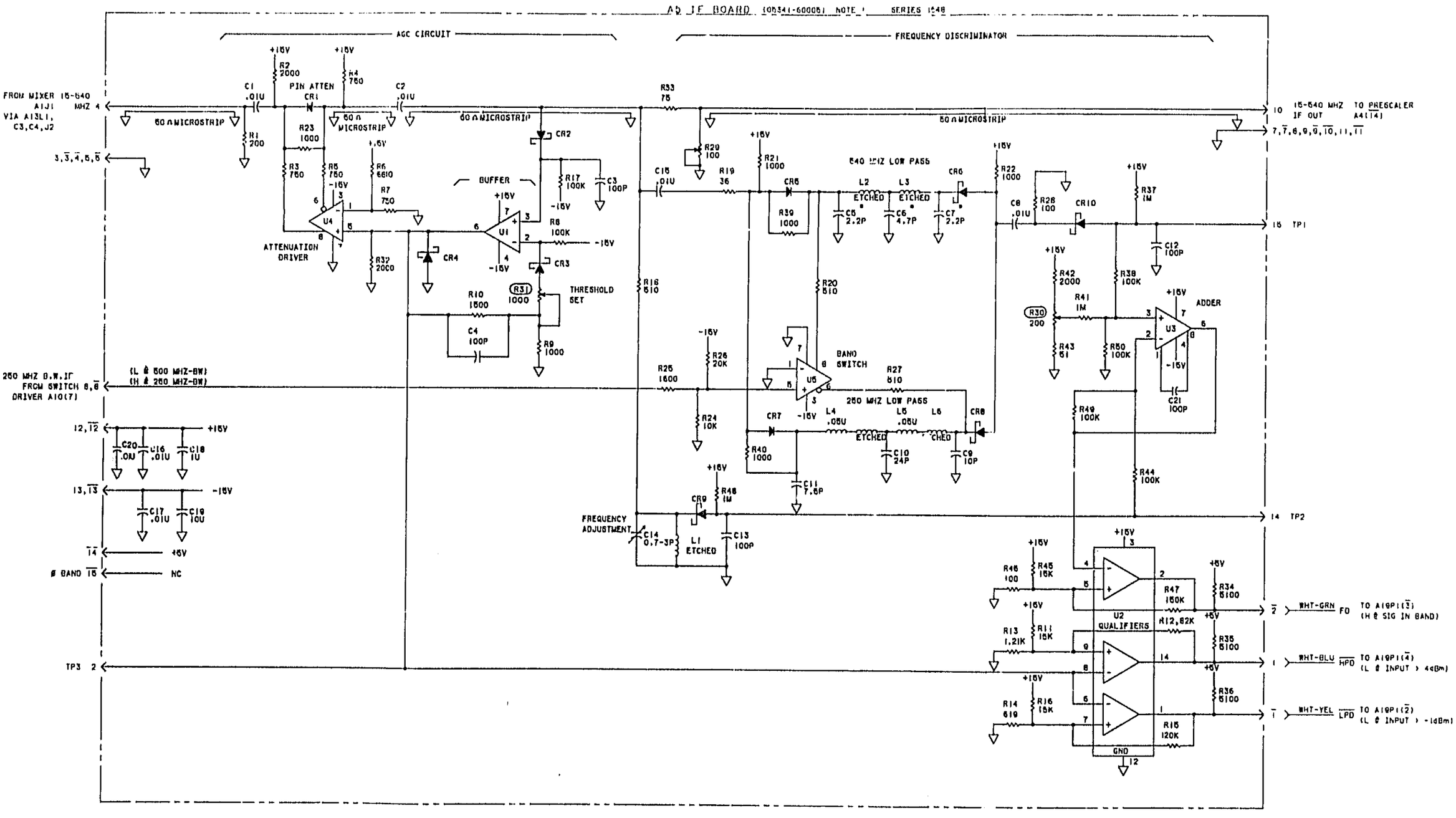
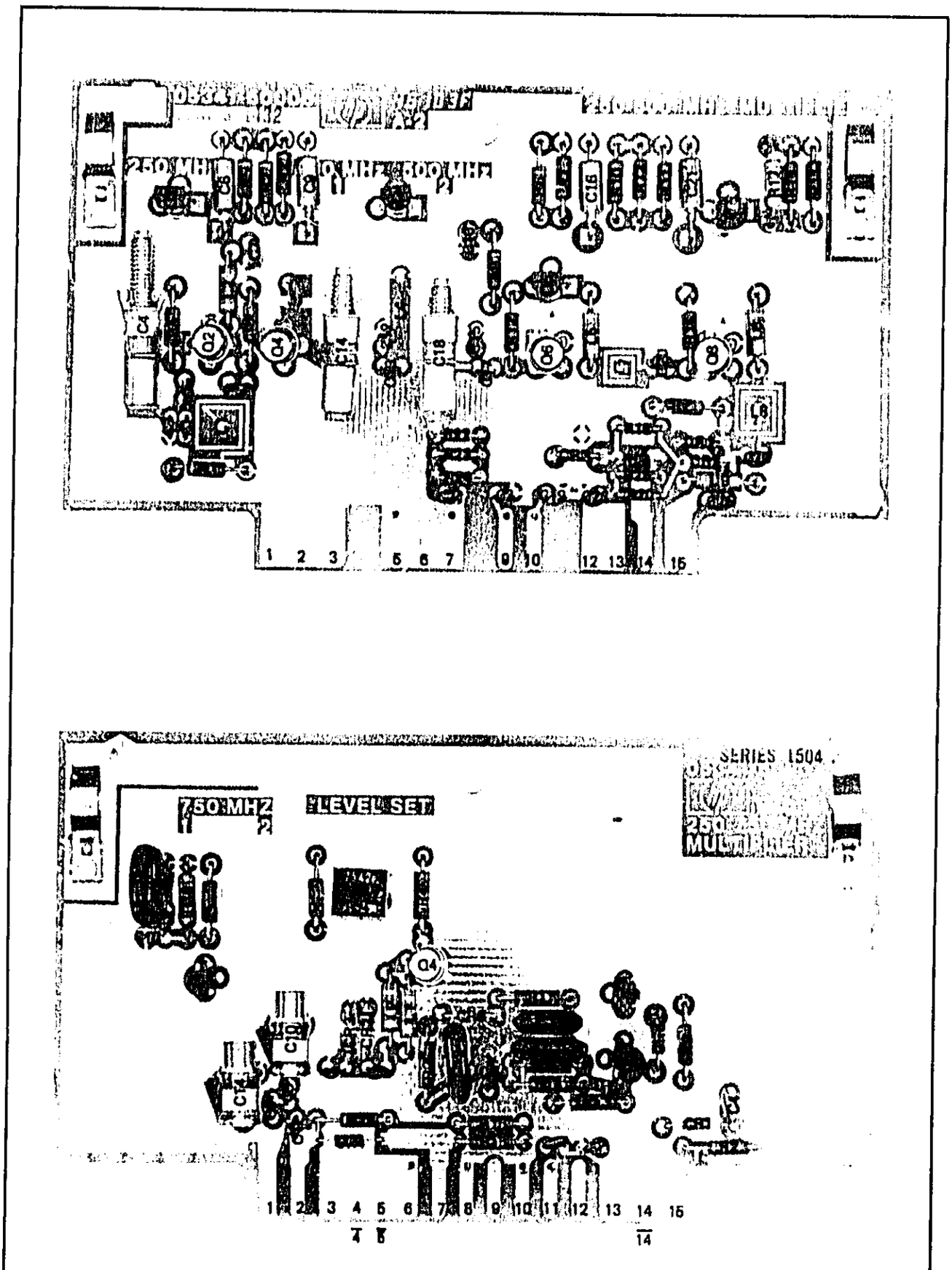


Figure 8-10. A5 IF Amplifier-Detector Assembly



Part of Figure 8-11. A6 250—500 MHz Multiplier Assembly, A7 250—750 MHz Multiplier Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. A7L3, A7L4, A6L1, A6L3, A6L4, A6L7, A6L8 ARE ETCHED INDUCTORS. A6L3 AND A6L4 ON CONDUCTOR SIDE.

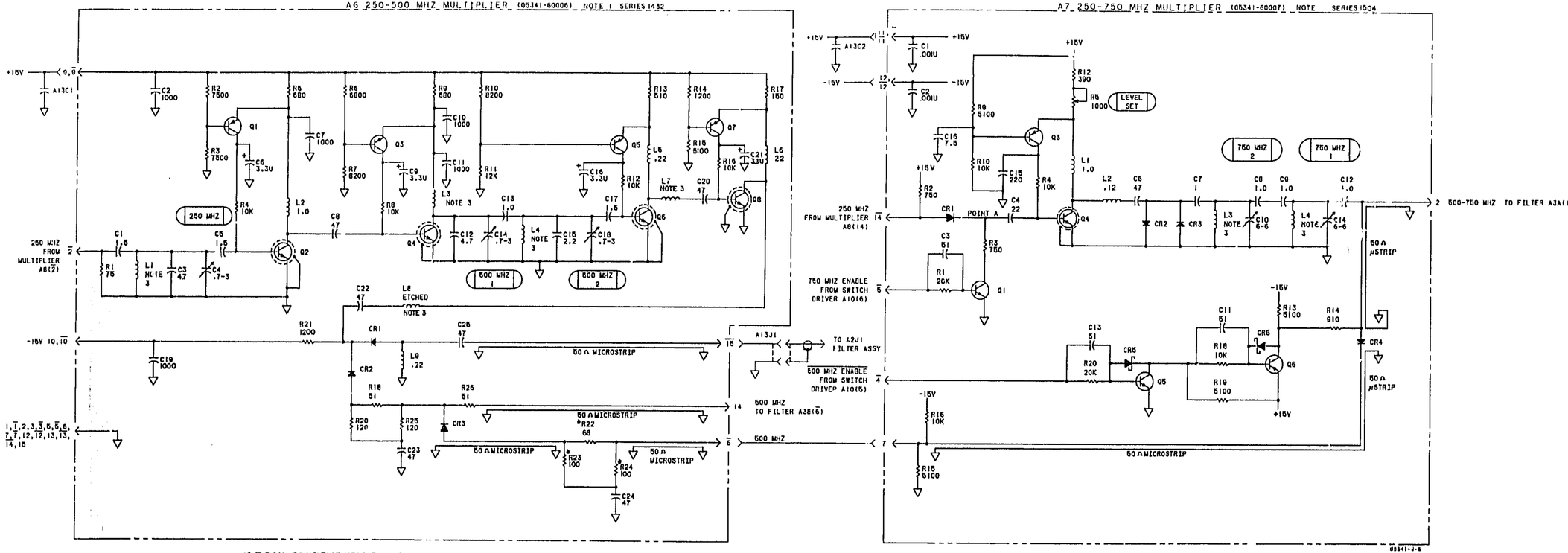
REFERENCE DESIGNATIONS

A6	A7
C1-25	C1-4, 6-16
CR1-3	CR1-6
L1-9	L1-4
Q1-8	Q1, 3-6
R1-26	R1-5,9,10,12-16, 18-20

A7Q2 not used

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A6		
CR1-3	1901-0639	1901-0639
Q1,3,5,7	1853-0020	1853-0020
Q2,4,6	1854-0345	2N5179
Q8	1854-0638	SN6178
A7		
CR1, 4	1901-0639	1901-0639
CR5, 6	1901-0535	1901-0535
Q1, 5	1854-0215	SPS3611
Q3	1853-0020	1853-0020
Q4	1854-0345	SN5179
Q6	1853-0036	1853-0036



A6 TYPICAL DC VOLTAGE MEASUREMENT

	E	B	C
Q1	8.06	7.5	2.67
Q2	0	0.66	9.4
Q3	8.75	8.2	2.22
Q4	0	0.24	8.75
Q5	9.36	8.8	2.84
Q6	0	0.66	9.4
Q7	12.47	12.06	3.59
Q8	0	0.27	12.62

A7 TYPICAL DC VOLTAGE MEASUREMENTS

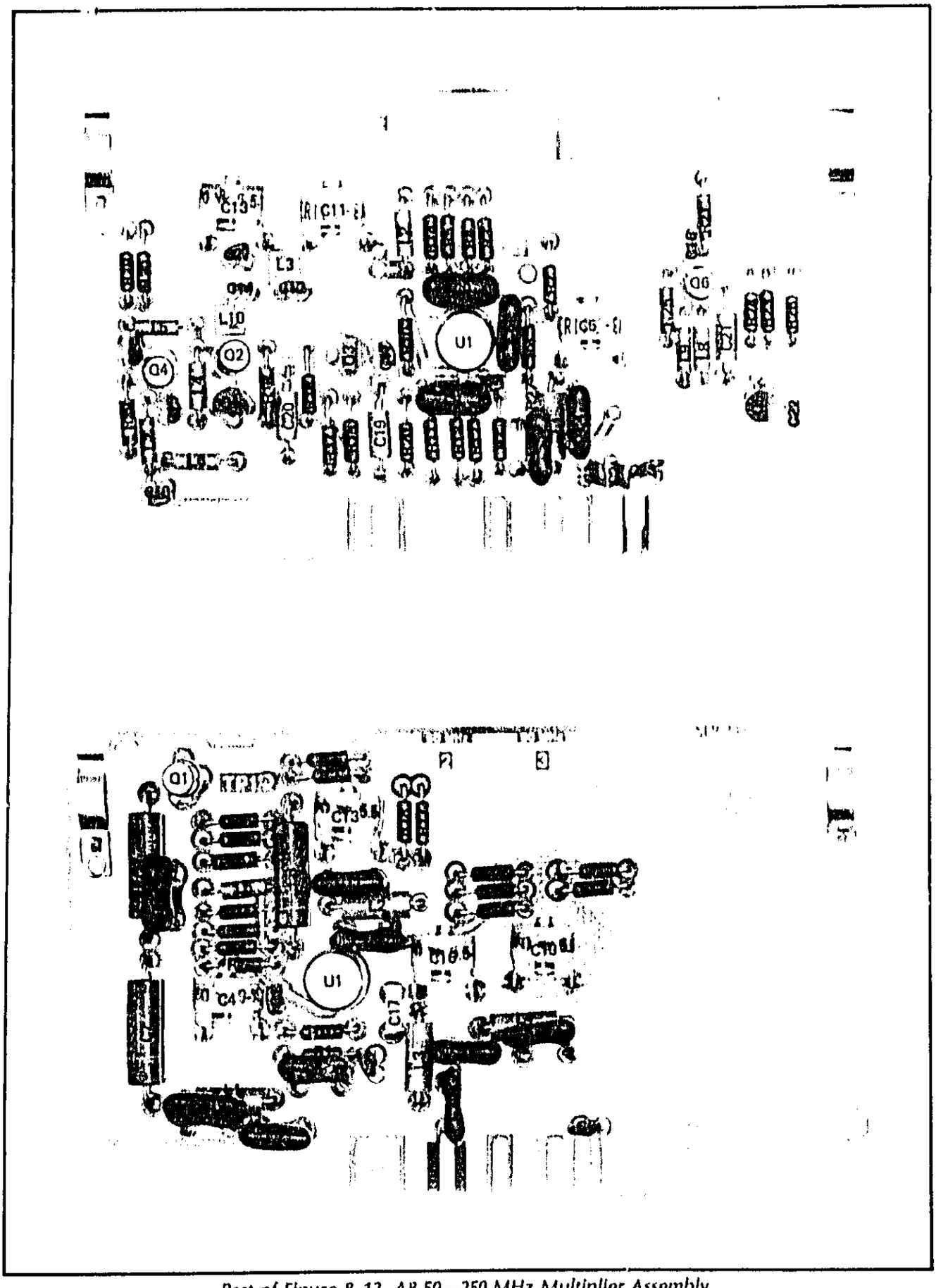
POINT A JUNCTION CR1,R3,C4)

750 MHz BAND = 7.07V

ALL OTHER BANDS = 14.59

	E	B	C	
Q3	10.42	9.65	1.52	
Q6	+14.67	+14.87	-15	All other bands
	+14.67	+14.06	+14.8	500 MHz band

Figure 8-11. A6 250—500 MHz Multiplier Assembly, A7 250—750 MHz Multiplier Assembly



Part of Figure 8-12. A8 50—250 MHz Multiplier Assembly, A9 10—50 MHz Multiplier Assembly

NOTES

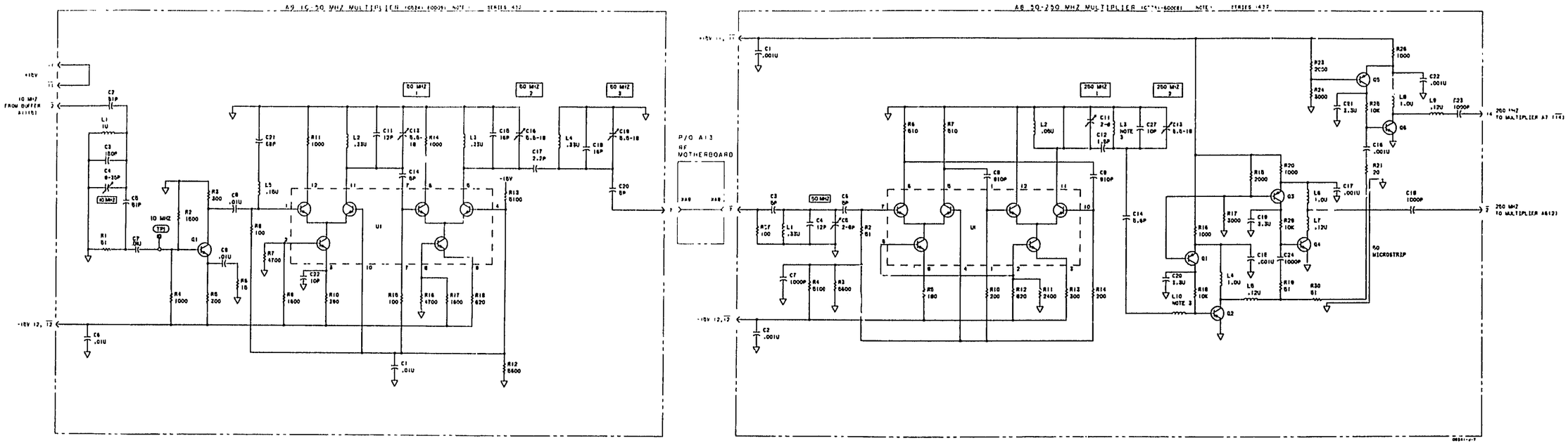
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. A8L3, L10 ARE ETCHED ON PC BOARD

REFERENCE DESIGNATIONS

A8	A9
C1-27	C1-22
L1-10	L1-5
Q1-6	Q1
R1-30	R1-18
U1	U1

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A8		
Q1, 3, 5	1853-0020	1853-0020
Q2, 4, 6	1854-0345	2N5179
U1	1858-0004	CA3049
A9		
Q1	1854-0009	2N709
UI	1858-0004	CA3049



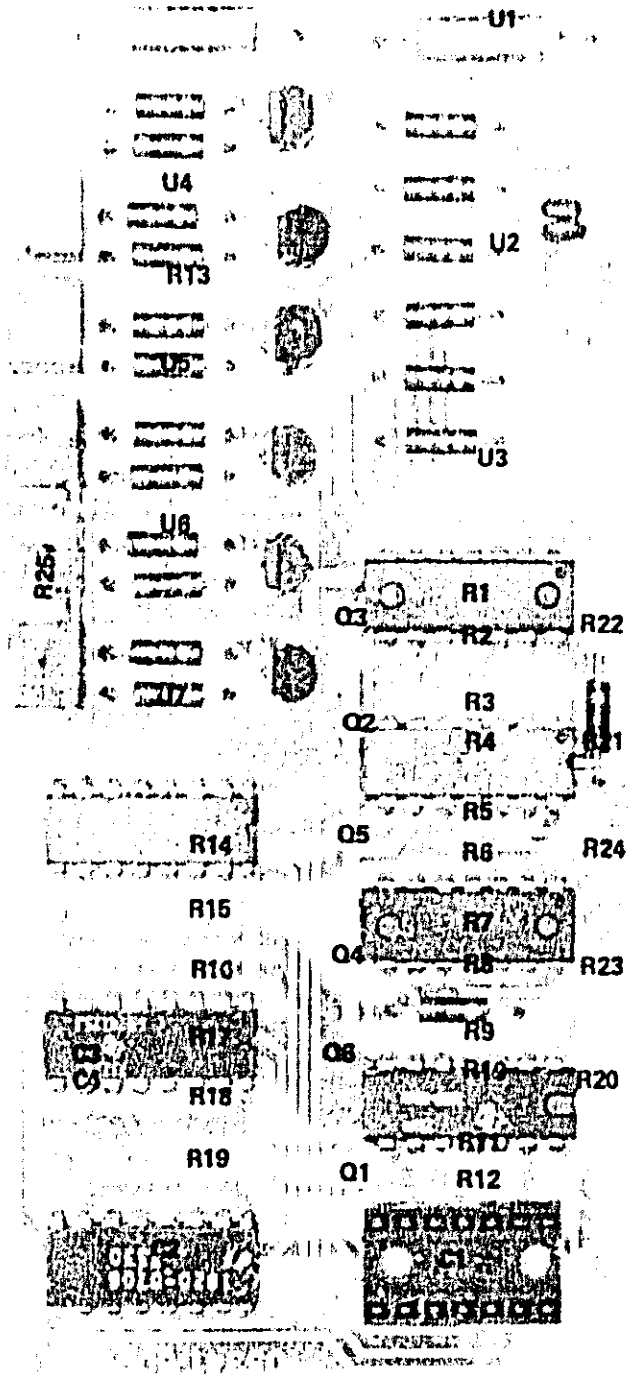
A9 TYPICAL VOLTAGE READINGS

Q1			U1											
E	B	C	1	2	3	4	5	6	7	8	9	10	11	12
10.0	9.2	5.0	8.4	11.3	12.1	8.4	C	1.8	8.4	11.3	12.1	8.4	0	5.5

A8 TYPICAL DC VOLTAGE READINGS

U1							Q6 Q4 Q2		Q5 Q3 Q1		
1		3	6	7	9		B	C	E	B	C
-8.0	3	-12.4	-3.26	-9	12.5		+0.74	+8.8	+9.5	+9.0	+11.8

Figure 8-12. A8 50—250 MHz Multiplier Assembly, A9 1—50 MHz Multiplier Assembly



Part of Figure 8-13. A10 Band Selector/Switch Driver Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A10
C1-4 Q1-6 R1-25 U1-7

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1-6	1853-0058	S32248
U1	1820-0706	9324DC
U2	1820-0839	SN74175N
U3	1820-0214	SN7442N
U4	1820-0751	SN74196N
U5	1820-0586	DM74L04N
U6	1820-0174	SN7404N
U7	1820-0068	SN7410N

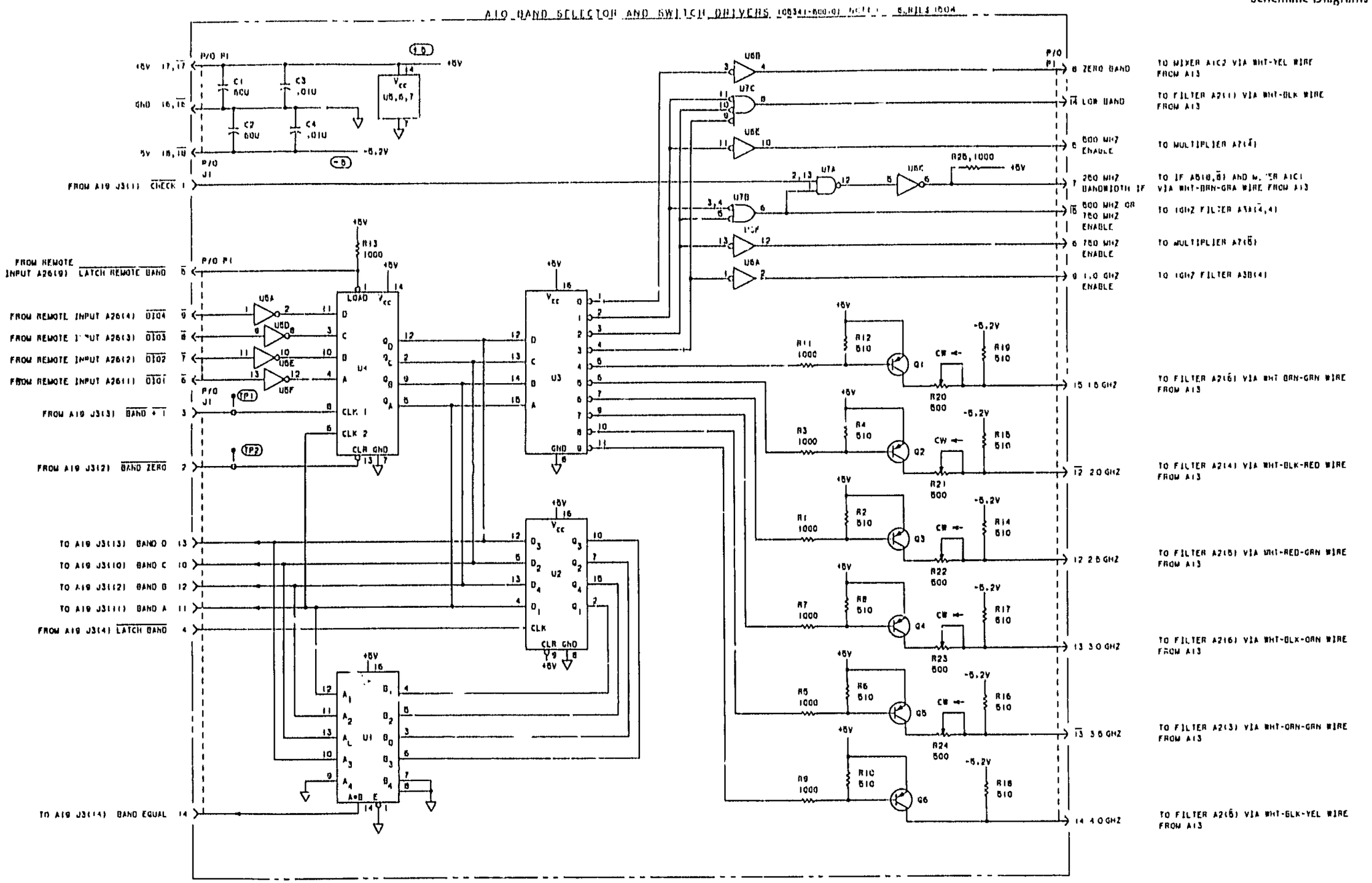


Figure 8-13. A10 Band Selector/Switch Driver Assembly

Part of Figure 8-14. A11 10 MHz Oscillator Buffer Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A11
C1-7 CR1 L1-4 Q1-2 R1-16 U1, 2

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1	1902-0041	SZ 10939-98
U1	1820-0054	SN7400N
U2	1820-0174	SN7404N

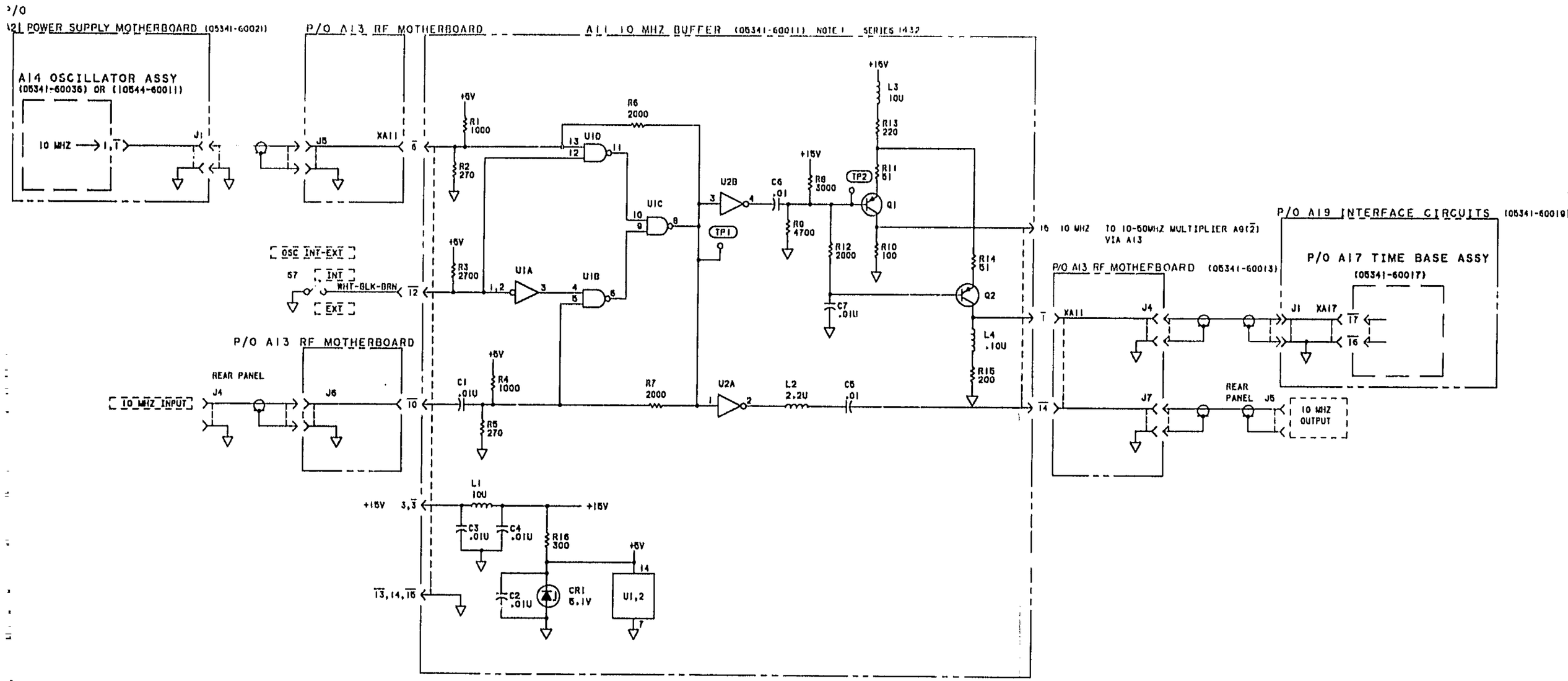
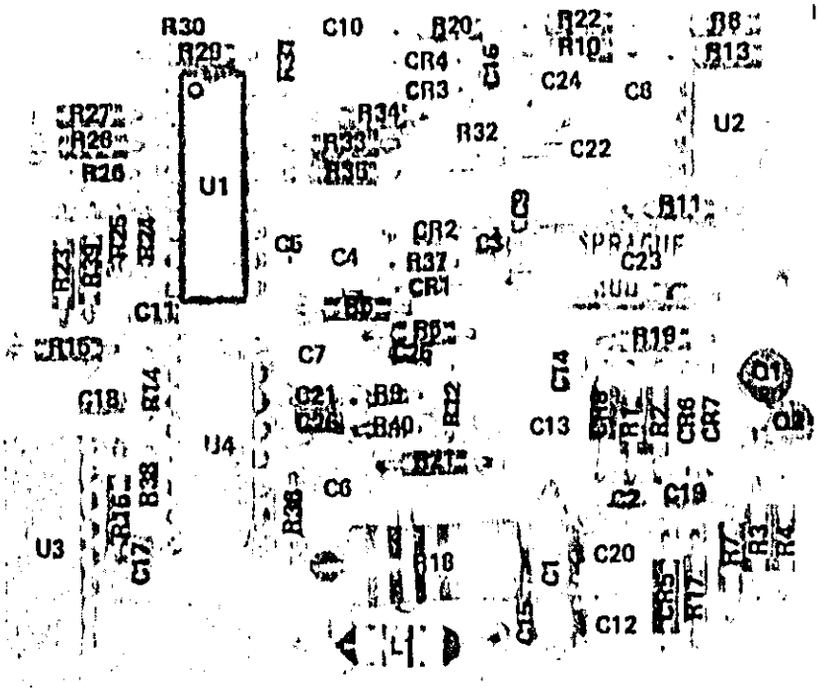


Figure 8-14. A11 10 MHz Oscillator Buffer Assembly



Part of Figure 8-15. A12 80 MHz Amplifier Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.

REFERENCE DESIGNATIONS

A12
C1-26 CR1-8 L1 Q1, 2 R1-41 U1-4

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1	1901-0179	1901-0179
CR2	1901-0639	1901-0639
CR3, 4	1901-0535	1901-0535
CR5	1902-0025	SZ 10939-182
CR6, 7	1901-0040	1901-0040
CR8	1902-0579	SZ 11213-56
Q1	1855-0081	2N5245
Q2	1853-0015	1853-0015
U1	1820-0216	1820-0216
U2	1820-1224	MC10216P
U3	1820-0809	MC10115P
U4	1820-0817	MC10131P

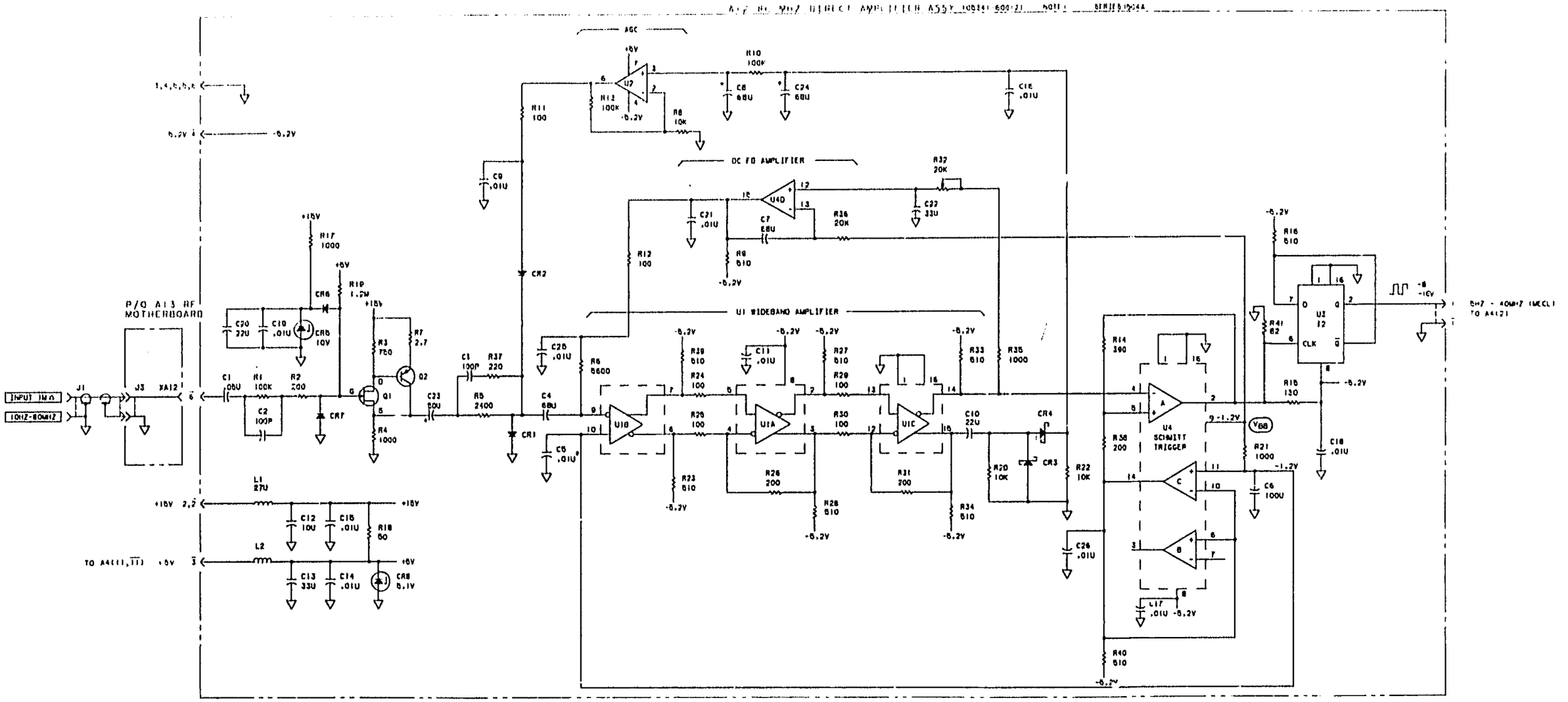


Figure 8-15. A12 80 MHz Amplifier Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. PINS $2,\overline{2},4,\overline{4},5,\overline{5},\overline{6},6,9,\overline{9},12,\overline{12},13,\overline{13},15,\overline{15}$ ARE CONNECTED TO GROUND
4. THE FOLLOWING ASSEMBLIES ARE NOT FIELD REPAIRABLE
   a. CRYSTAL OSCILLATOR 0960-0394
   b. A14 OPTION 001 10 MHz OSCILLATOR 10544-60011
   c. REFER TO PARTS LIST FOR FACTORY REBUILT PART NUMBER.

REFERENCE DESIGNATIONS

NO PREFIX	A14 STD	A14 OPT 001
C2 L1 XA14	C1 L1	R1

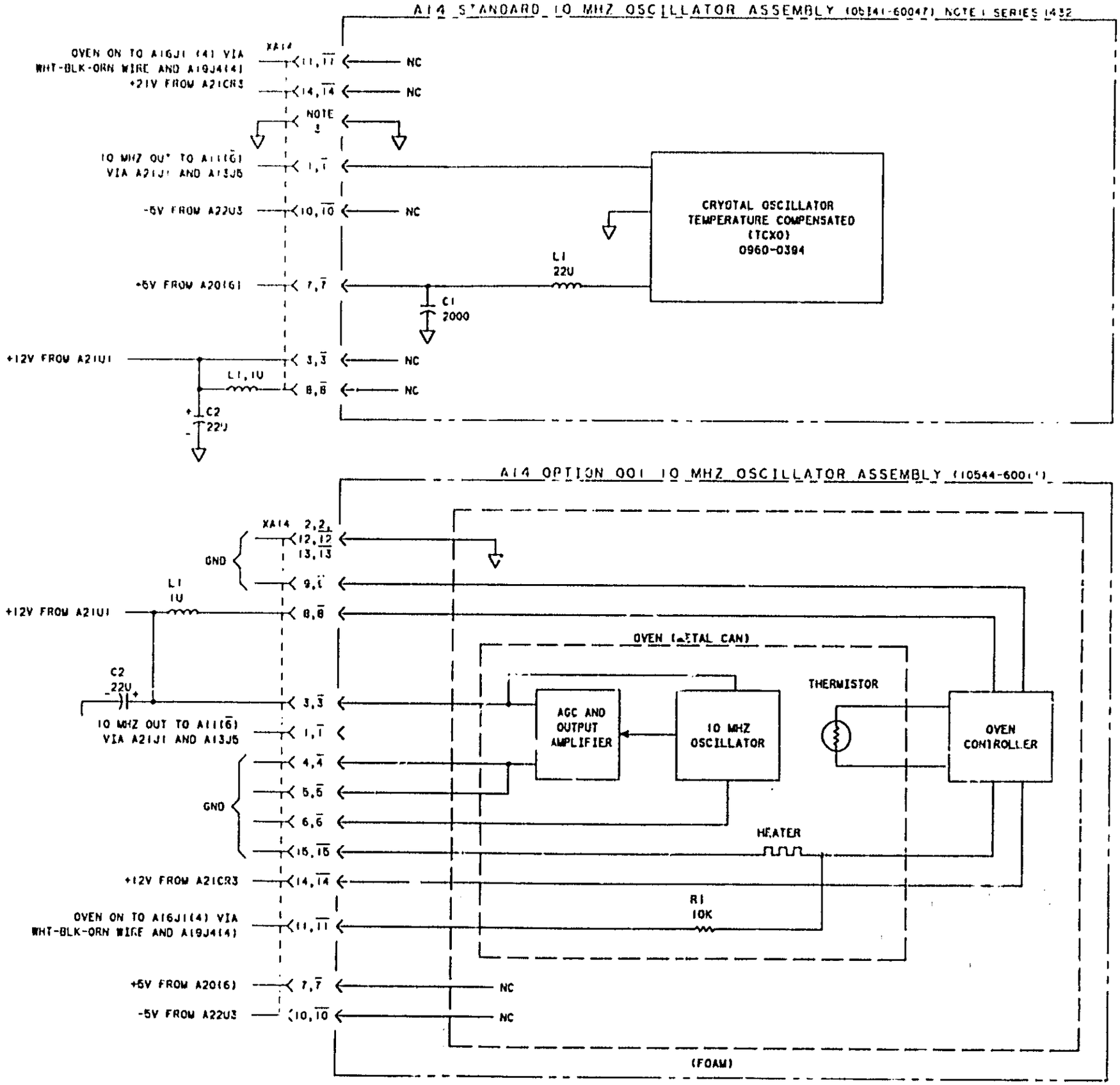
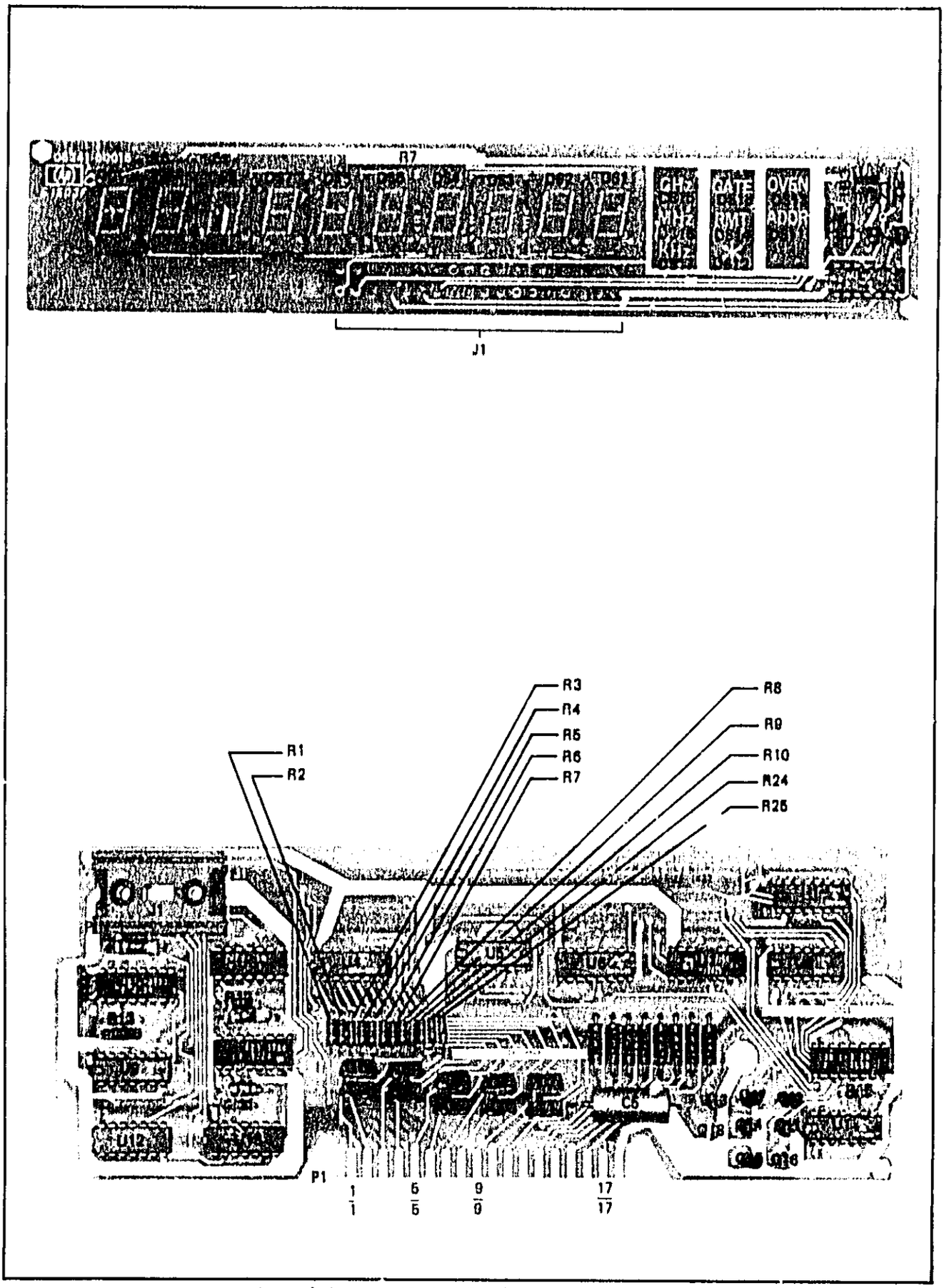


Figure 8-16. A14 10 MHz Oscillator Assembly



Part of Figure 8-17. A15 Display Board Assembly, A16 Driver Display Board Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A15	A16
C1-2	C1-5
CR1	Q1-18
DS1-18	R1-27
Q1-2	U1-14
R1-7	
U1	
XA15	
XDS1-10	

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A15		
CR1	1901-0040	1901-0040
Q1	1854-0560	1854-0560
Q2	1854-0071	1854-0071
U1	1820-0668	SN7407N
A16		
Q1-10	1853-0326	1854-0326
Q11-18	1854-0246	SPS233
U1	1820-0628	SN7489N
U2, 10	1820-0730	96L02DC
U3	1820-0661	SN7432N
U4	1820-0214	SN7442N
U5	1820-0546	SN74192N
U6	1820-0839	SN74175N
U7	1820-0904	93L24DC
U8	1820-0655	SN7426N
U9, 14	1820-0054	SN7400N
U11	1820-0914	9307DC
U12, 13	1820-0688	DM74L20N

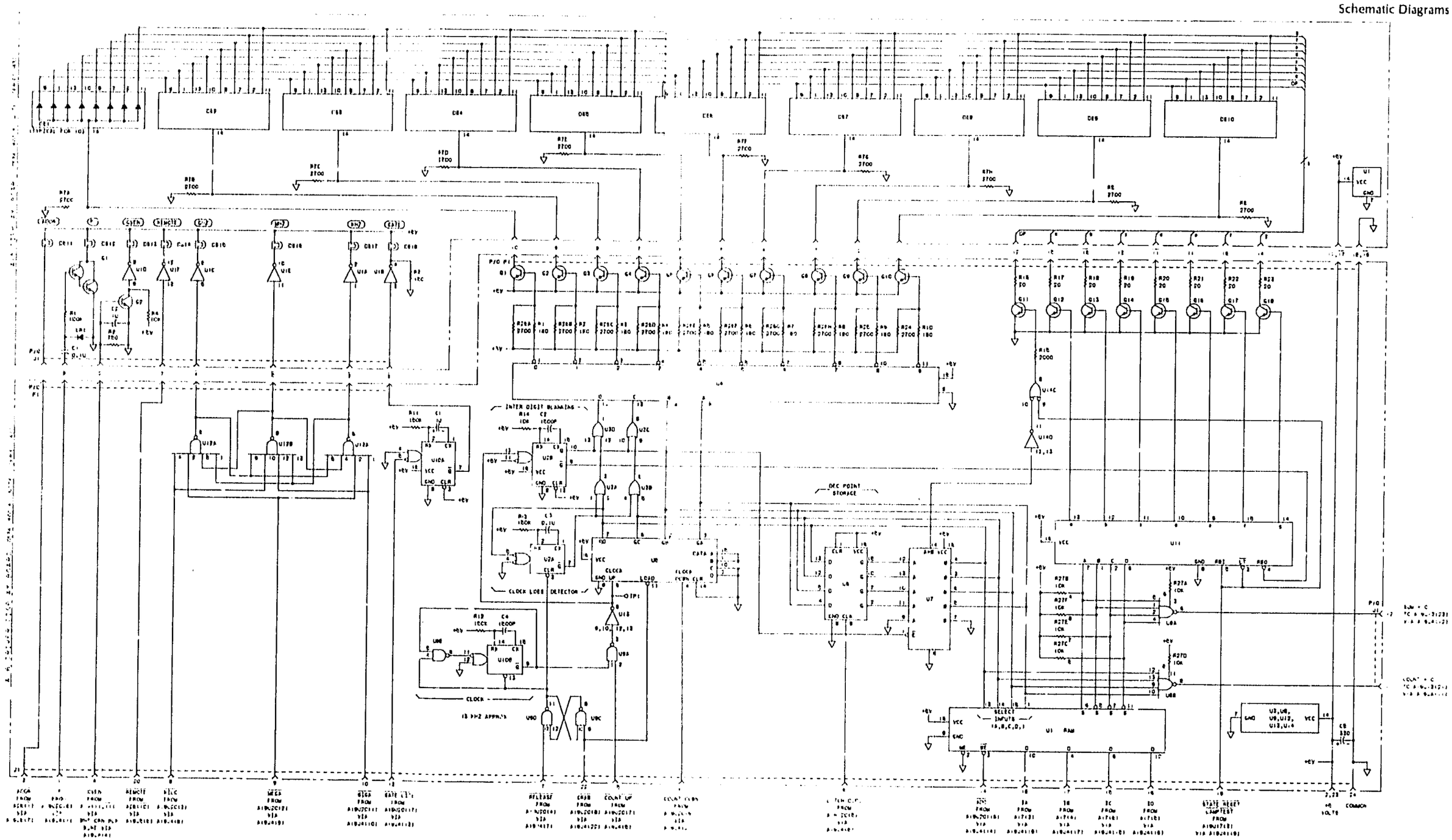
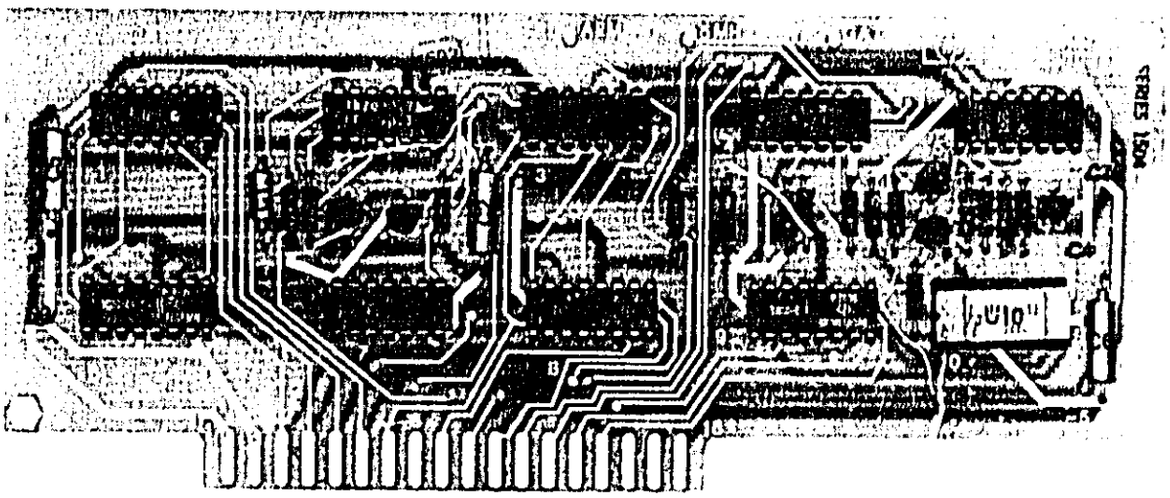


Figure 8-17. A15 Display Board Assembly, A16 Driver Display Board Assembly



Part of Figure 8-18. A17 Time Base Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   NO INDUCTORS
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A17
C1-7 Q1-5 R1-15 U1-10

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1, 3-5	1854-0094	2N3646
Q2	1854-0560	1854-0560
U1	1820-0328	SN7402AN
U2	1820-0875	9600
U3	1820-0054	SN7400N
U4	1820-0077	7474
U5	1820-0629	SN74S112N
U6	1820-0910	SN74LS83AN
U7	1820-0084	7453
U8	1820-0910	SN74LS83AN
U9	1820-0910	SN74LS83AN
U10	1820-0633	1820-0633

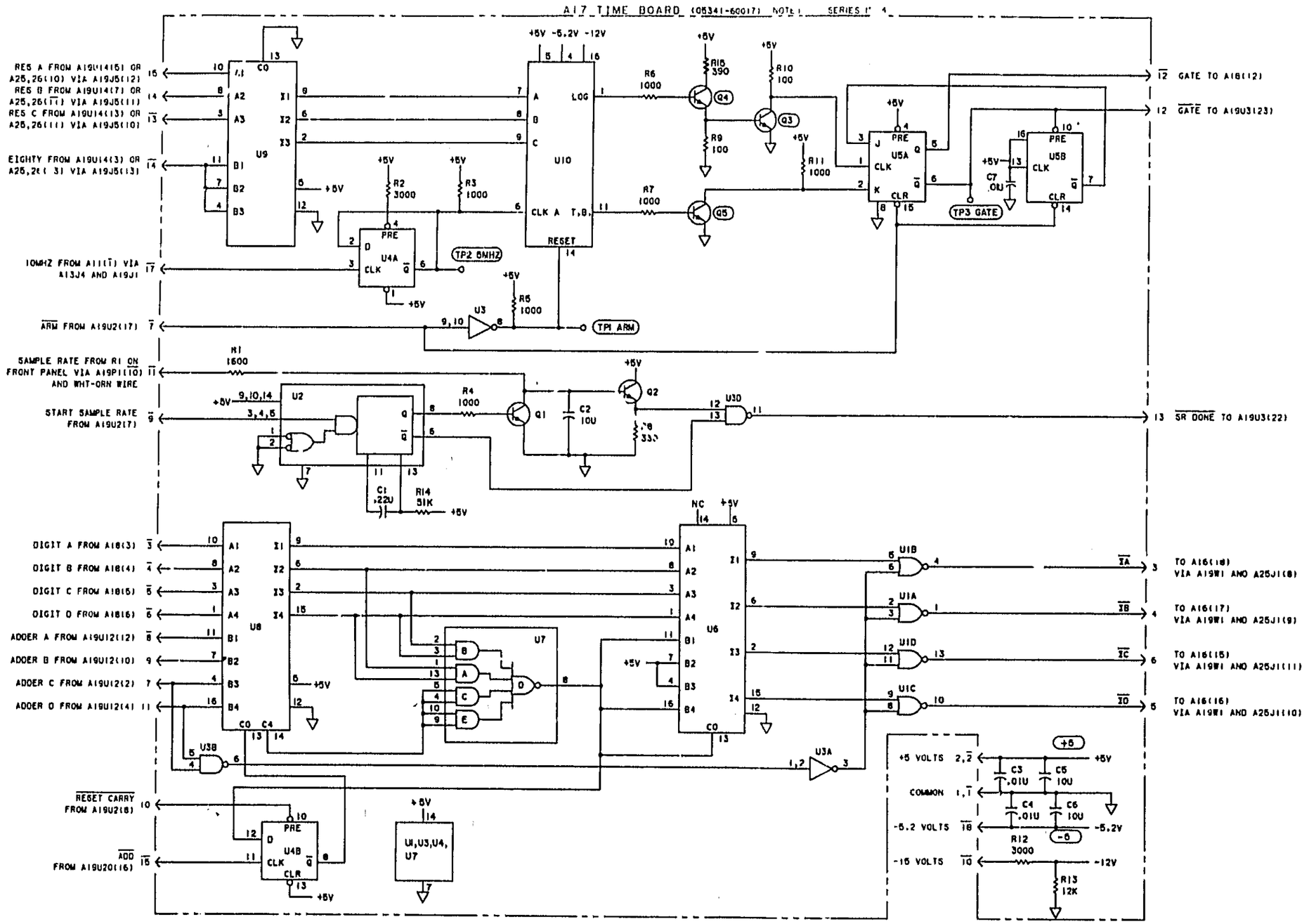
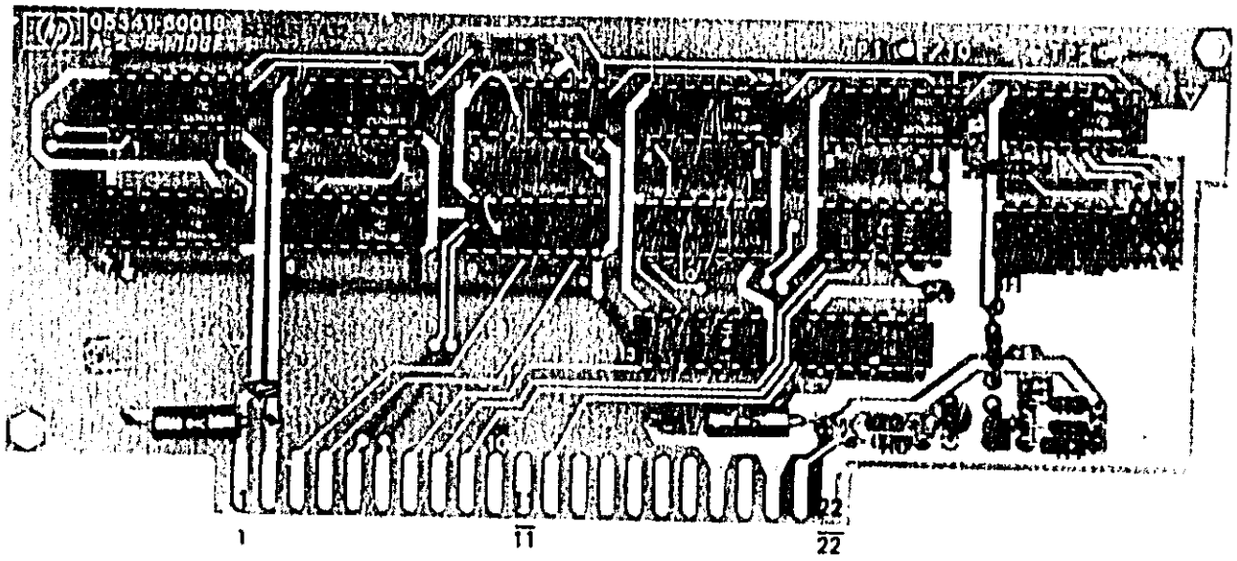


Figure 8-18. A17 Time Base Assembly



Part of Figure 8-19. A18 Counter Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A18
C1-6 Q1, 2 R1-11 TP1, 2 U1-14

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1, 2	1854-0092	2N3563A
U1-8	1820-0899	74160
U9	1820-0710	93L22
U10	1820-0751	74196
U11, 13	1820-0174	7404A
U12	1820-0054	SN7400N
U14	1820-0681	74500

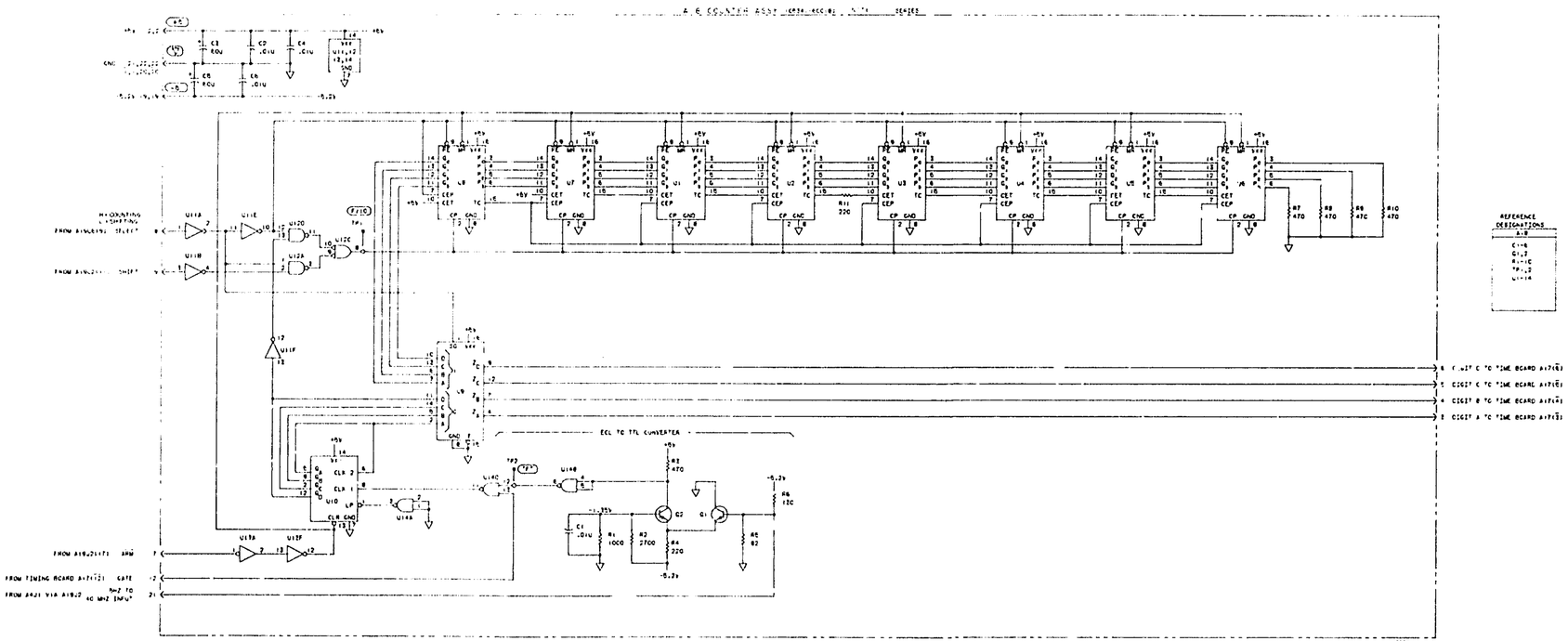


Figure 8-19. A18 Counter Assembly

Table 6-1. Replaceable Parts (Continued)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
	05341-60029	2	REMOTE INPUT ASSY	28480	05341-60029
	1200-0547	6	SOCKET, DIP	28480	1200-0547
	8120-2047		CABLE ASSY	28480	8120-2047
	8120-2093		CABLE, COAX	28480	8120-2053
	05341-00009	2	PANEL, EXTR	28480	05341-00009
	05341-60023	2	FILTER ASSY, HIGH PASS	28480	05341-60023
	05341-60033	1	CABLE ASSY, REAR	28480	05341-60033

See introduction to this section for ordering information

Table 6-2. Manufacturers Code List

MFR NO.	MANUFACTURER NAME AND ADDRESS	ZIP CODE
00000	GTE Sylvania Miniature Lt. Prod., Hillsboro, NH	03244
0024E	Jermyn Industries	
0046A	Inquiry at Hewlett-Packard	
0146H	Stettner-Trush, Inc., Cazenovia, NY	
0160G	Allen-Bradley, Co., Milwaukee, WI	
0169H	Texas Instr. Inc., Semicond. Cmpnt. Div., Dallas, TX	
0186G	Ferroxcube Corp., Saugerties, NY	
0192A	RCA Corp. Solid State Div., Somerville, NJ	
0203G	Motorola Semiconductor Products, Phoenix, AZ	
0217B	Airco Speer Elect. Div Air Rdcn Co., Nogales, AZ	
0217J	Amatom Elek Hardware Div. of Mite, New Rochelle, NY	
0223G	Fairchild Semiconductor Div., Mountain View, CA	
0239B	C and K Components Inc., Watertown, MA	
0291J	Signetics Corp., Sunnyvale, CA	
0327C	Gowanda Electronics Corp., Gowanda, NY	
0329B	Corning Glass Works (Bradford), Bradford, PA	
0331F	Specialty Connector Co., Inc., Indianapolis, IN	
0340F	National Semiconductor Corp., Santa Clara, CA	
0362A	Cablewave Systems, Inc., North Haven, CT	
0365A	Mepco/Electra Corp., San Diego, CA	
0374D	Bourns Inc., Trimpot Prod. Div., Riverside, CA	
0379D	Advanced Micro Devices, Inc., Sunnyvale, CA	
0420J	Sprague Electric Co., North Adams, MA	
0448J	Bussman Mfg. Div. of McGraw-Edison Co., St. Louis, MO	
0450G	TRW Elect Components Cinch Div., Elk Grove Vlge., IL	
0456C	Erie Technological Products, Inc., Erie, PA	
0470C	Littelfuse, Inc., Des Plaines, IL	
0473G	TRW Elect Cmpnt Cinch-Monadnock Div., City of Ind., CA	
0477F	Potter & Brumfield Div. Amf Inc., Princetone, IN	
0487F	C-W Industries, Warminster, PA	
0551H	Augat Inc., Attleboro, MA	
0552D	Dale Electronics Inc., Columbus, NE	
0576J	Sealectro Corp., Mamaroneck, NY	
06776	Robinson Nugent Inc., New Albany, IN	
1201D	Inquiry at Hewlett-Packard	
27318	Stewart-Warner Microcircuits Inc., Sunnyvale, CA	94086
28480	Hewlett-Packard Div. 00 Corporate, Palo Alto, CA	
52072	Circuit Assembly Corp., Costa Mesa, CA	92626
59730	Thomas & Betts Co., The, Elizabeth, NJ	07207
72136	Electro Motive Corp., Sub. IEC, Willimantic, CT	06226
73138	Beckman Instruments Inc., Helipot Div., Fullerton, CA	92634
7374C	Inquiry at Hewlett-Packard	
73899	J F D Electronics Corp., Brooklyn, NY	11219
7706H	Inquiry at Hewlett-Packard	
91293	Johanson Mfg. Co., Boonton, NJ	07005
91833	Keystone Electronics Corp., New York, NY	10012

SECTION VII
MANUAL CHANGES

7-1. INTRODUCTION

7-1. This section contains information necessary to adapt this manual to older instruments.

7-3. MANUAL CHANGES

7-4. This manual applies directly to Model 5341A with serial prefix 1504A.

7-5. NEWER INSTRUMENTS

7-6. As changes are made, newer instruments may have serial prefixes that are not listed in this manual. The manuals for these instruments are supplied with a manual change sheet, containing the required information. Contact the nearest Hewlett-Packard Sales and Service Office for information if this sheet is missing.

7-7. OLDER INSTRUMENTS

7-8. To adapt this manual to instruments having a serial prefix prior to 1504A, perform the backdating changes that apply to your instrument serial prefix, as listed in table below.

SERIAL PREFIX	BACKDATING CHANGE
1432A	1,2
1440A	2

CHANGE 1 (1432A)

Page 6-12, Table 6-1:
Change A5R29 to * 0757-0902 Resistor 12Ω 2% .125W; Mfr. & No. 28480/0757-0902.
Add asterisk to A5R33 *.
Add at bottom of page: *Factory selected value, average value shown.

Page 8-15, Figure 8-10:
Change R29 to fixed 120 and add *.
Add * to R33.
Change Series from 1504A to 1440A.

Page 6-14, Table 6-1:
Delete A10R20 and A10R24.

Page 8-21, Figure 8-13:
Delete A10R20 and A10R24 and replace with a line.
Change Series from 1504A and 1432A.

Page 6-18, Table 6-1:
Change A12R7 from 0683-0275 to 0683-1005 Resistor 10 ±5% .25W; Mfr. & No. 28480/0638-1005.
Change A12R6 from 0698-5174 to 0674-3315 Resistor 330 ±5% .125W; Mfr. & No. 28480/0674-3315.
Change A12R31 from 0698-5174 to 0674-3315 Resistor 330 ±5% .125W; Mfr. & No. 28480/0674-3315.

Change A12R32 from 2100-2514 to 0683-2035 Resistor 30K ±5% .25W; Mfr. & No. 01121/CB2035.
Change A12R37 from 0698-8128 to 0683-3015 Resistor 300 ±5% .25W; Mfr. & No. 28480/0683-3015.

Page 8-25, Figure 8-15:
Change A12R7 to 10.
Change A12R26 to 330.
Change A12R31 to 330.
Change A12R32 to 20K fixed.
Change A12R37 to 300.
Change Series from 1504A to 1440A.

CHANGE 2 (1440A and 1432A)

Page 6-8, Table 6-1:
Change A1A1R4 in 05341-60025 assembly from 0698-3113 (100 OHM) to 0698-5174; RESISTOR 200 OHM 5% .125W CC TUBULAR; Mfr. & No. 01121/BB2015.

Page 6-14, Table 6-1:
Delete A7CR5 1901-0535 Diode.
Delete A7CR6 1901-0535 Diode.
Change A7Q1 from 1854-0215 to 1854-0071 Transistor; Mfr. & No. 28480/1854-0071.
Change R13 from 0683-5125 to 0683-1035 Res 10K 5% .25W; Mfr. & No. 01121/CB1035.
Change R18 from 0683-1035 to 0683-5125 Res 5.1K 5% .25W; Mfr. & No. 01121/CB5125.

Page 6-18, Table 6-1:
Change A12R15 from 0683-1315 to 0683-5115 Resistor Fxd 510 ±5% .25W; Mfr. & No. 28480/0683-5115.
Delete A12R41 0683-8205 Resistor.

Page 8-17, Figure 8-11:
Delete A7CR5 and A7CR6.
Change A7R13 from 5.1K to 10K.
Change A7R18 from 10K to 5.1K.
Change Series from 1504A to 1432A.

Page 8-25, Figure 8-15:
Change A12R15 from 130 to 510.
Delete A12R41.
Change Series from 1504A to 1440A.

SECTION VIII
SCHEMATIC DIAGRAMS

8-1. SCHEMATIC DIAGRAMS

8-2. This section contains schematic diagrams, assembly and chassis part locators, component locators, block diagram. The schematics are presented in assembly number order A1 through A26. The component, chassis, and assembly locators show the location by reference designator.

8-3. SCHEMATIC DIAGRAM NOTES, ASSEMBLY NUMBERS, AND REFERENCE DESIGNATORS

8-4. *Figure 8-1* shows the symbols used on the schematic diagrams. At the bottom of *Figure 8-1*, the system for reference designators, assemblies, and subassemblies are shown.

8-5. Reference Designations

8-6. Assemblies such as printed circuit boards are assigned numbers in sequence, A1, A2, etc. As shown in *Figure 8-1*, subassemblies within an assembly are given a subordinate A number. For example, rectifier subassembly A1 has the complete designator of A25A1. For individual components, the complete designator is determined by adding the assembly number and subassembly number if any. For example CR1 on the rectifier assembly is designated A25A1CR1.

8-7. Identification Markings on Printed Circuit Boards

8-8. HP printed circuit boards (see *Figure 8-1*) have four identifications numbers, an assembly part number, a series number, a revision letter, and a production code.

8-9. The assembly part number has 10 digits (such as 05341-60017) and is the primary identification. All assemblies with the same part number are interchangeable. When a production change is made on an assembly that makes it incompatible with previous assemblies, a change in part number is required. The series number (such as 1432A) is used to document minor electrical changes. As changes are made, the series number is incremented. When replacement boards are ordered, you may receive a replacement with a different series number. If there is a difference between the series number marked on the board and the schematic in this manual, a minor electrical difference exists. If the number on the printed circuit board is lower than that on the schematic, refer to Section VII for backdating information. If it is higher, refer to the loose leaf manual change sheets for this manual. If the manual change sheets are missing, contact your local Hewlett-Packard Sales and Service Office. See the listing on the back cover of this manual.

8-10. Revision letters (A, B, etc.) denote changes in printed circuit layout. For example, if a capacitor type is change (electrical value may remain the same) and requires different spacing for its leads, the printed circuit board layout is changed and the revision letter is incremented to the next letter. When a revision letter changes, the series number is also usually changed. The production code is the four-digit, seven-segment number used for production purposes.

8-11. ASSEMBLY LOCATIONS AND COMPONENT LOCATORS

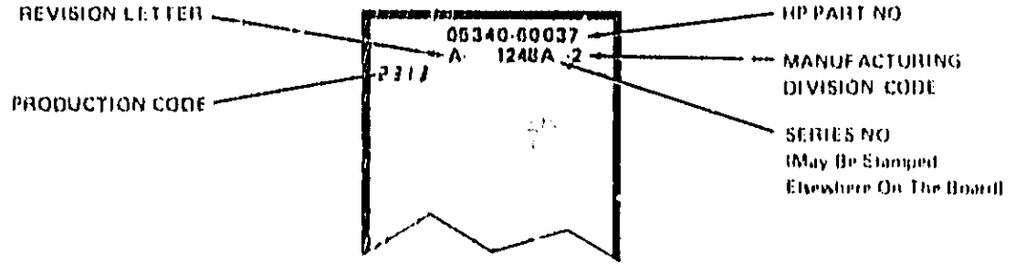
8-12. *Figures 8-2* through *8-4* show the front, rear, and top views of the 5341A. Following these is an overall block diagram and schematic diagrams for the instrument. Component locations for each printed circuit assembly are located next to the schematics.

SYMBOLS

FRONT PANEL
REAR PANEL
INTERIOR AND PC BOARDS
WIPER MOVES TOWARD "CW" WHEN CONTROL IS ROTATED CLOCKWISE
POWER LINE GROUND
CIRCUIT COMMON GROUND
FLOATING GROUND
CHASSIS GROUND
KNOB CONTROL
SCREWDRIVER ADJUST

MAIN SIGNAL PATH
FEEDBACK PATH
TEST POINT
"AND" GATE
"OR" GATE
INVERTER
NAND GATE
NOR GATE
EXCLUSIVE NOR

PRINTED CIRCUIT BOARD IDENTIFICATION



REFERENCE DESIGNATIONS

REFERENCE DESIGNATIONS WITHIN ASSEMBLIES ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION. JACKS ARE THE STATIONARY CONNECTORS AND PLUGS ARE THE MORE MOVEABLE OF TWO CONNECTORS.

ASSEMBLY	ABBREVIATION	COMPLETE DESCRIPTION
A25	C1	A25C1
A25A1	CR1	A25A1CR1
NO PREFIX	J3	J3

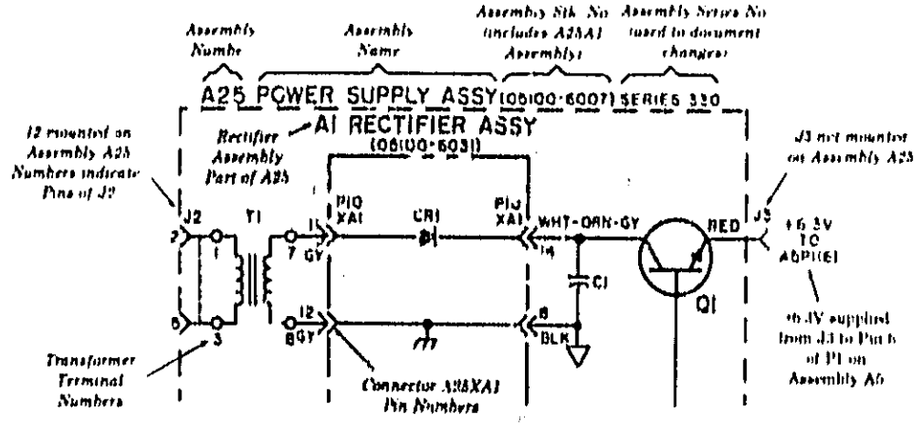


Figure 8-1. Schematic Diagrams Notes

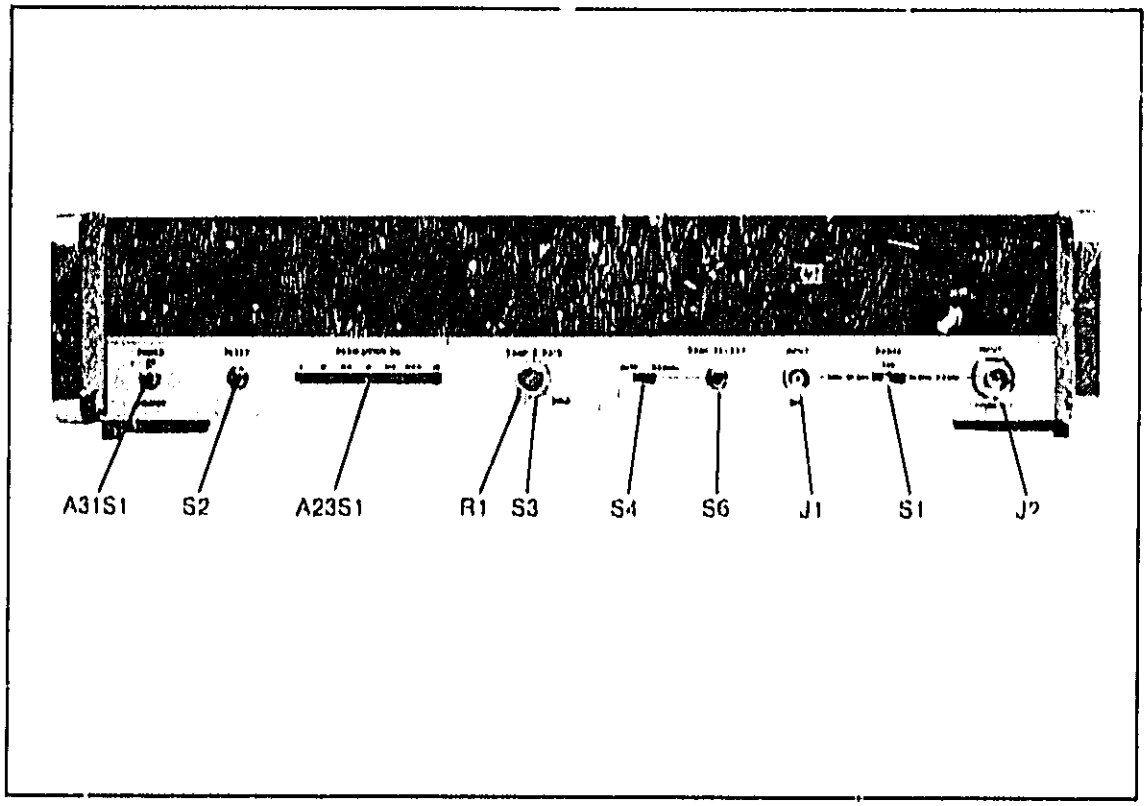


Figure 8-2. Front Panel Designations

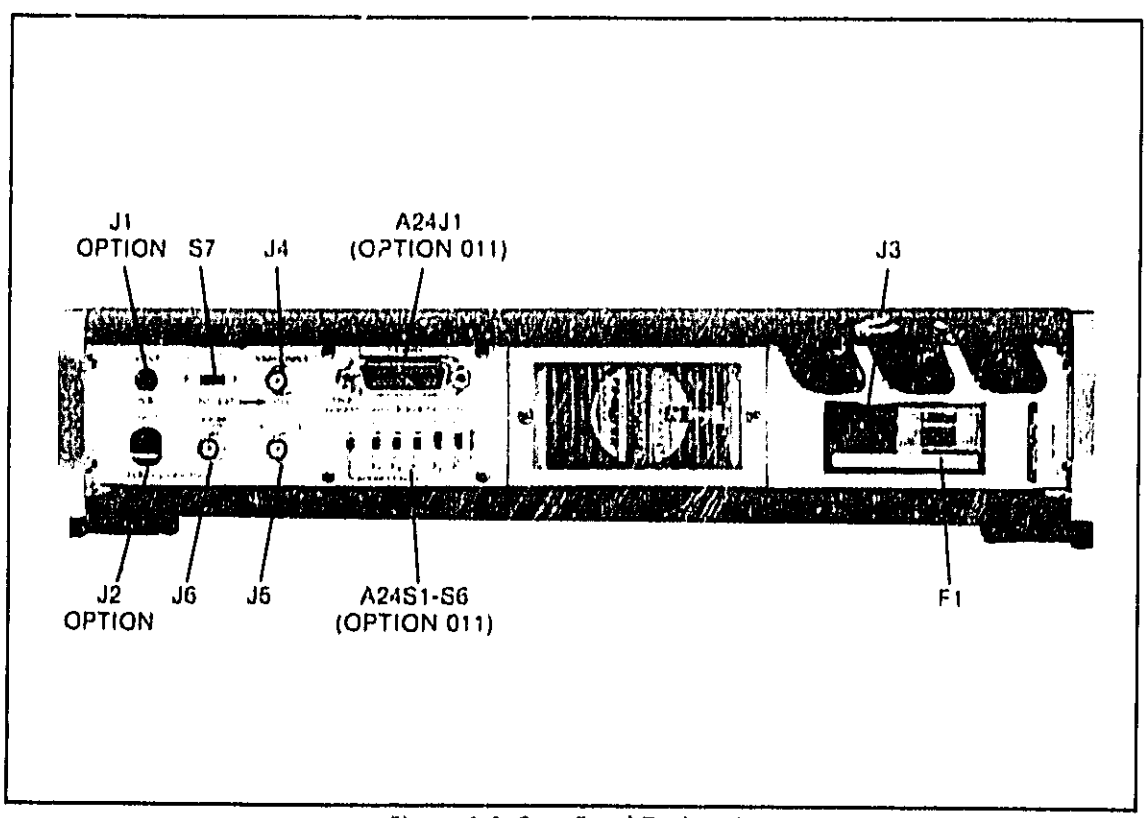


Figure 8-3. Rear Panel Designations

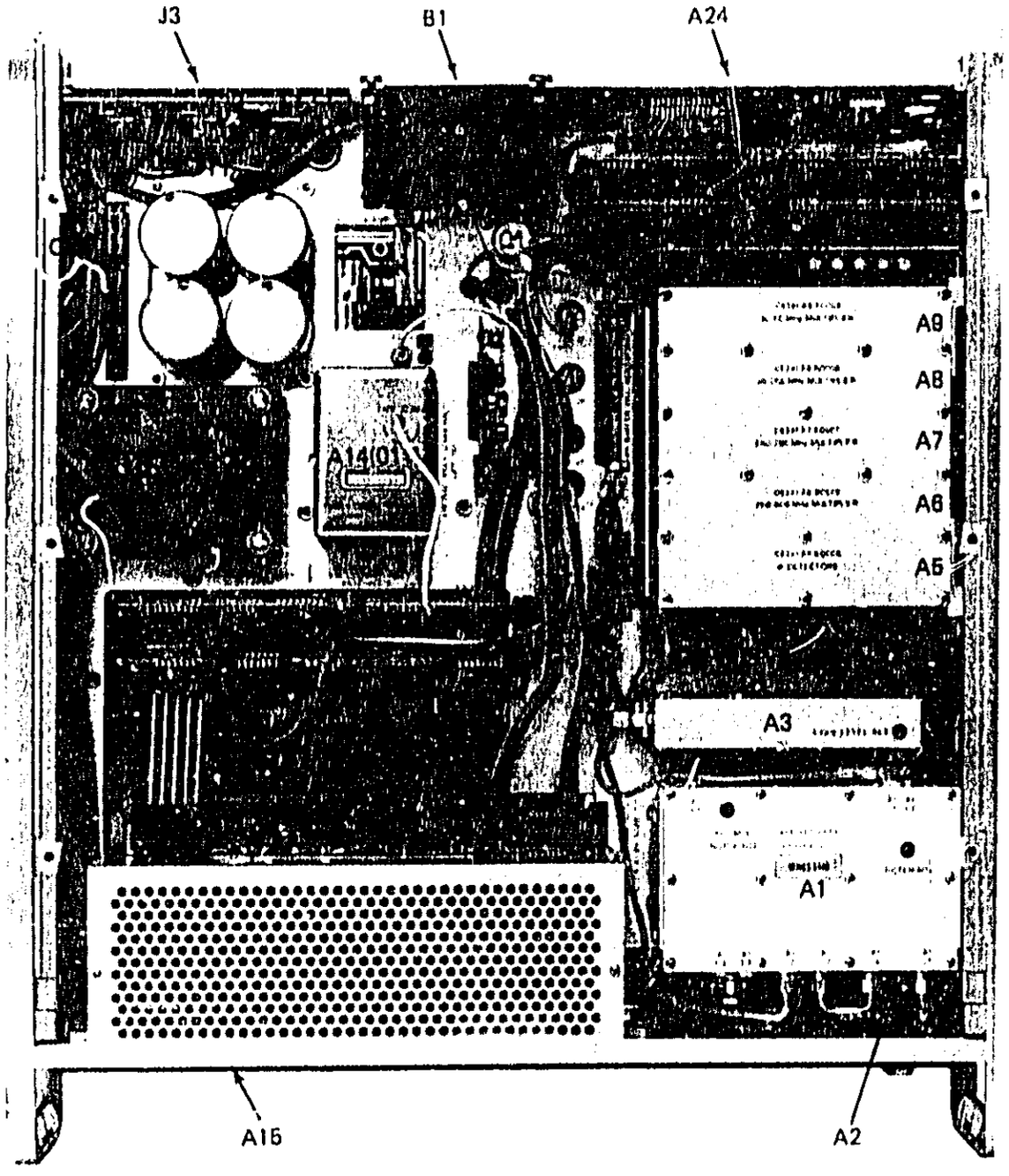


Figure 8-4. Top Internal View

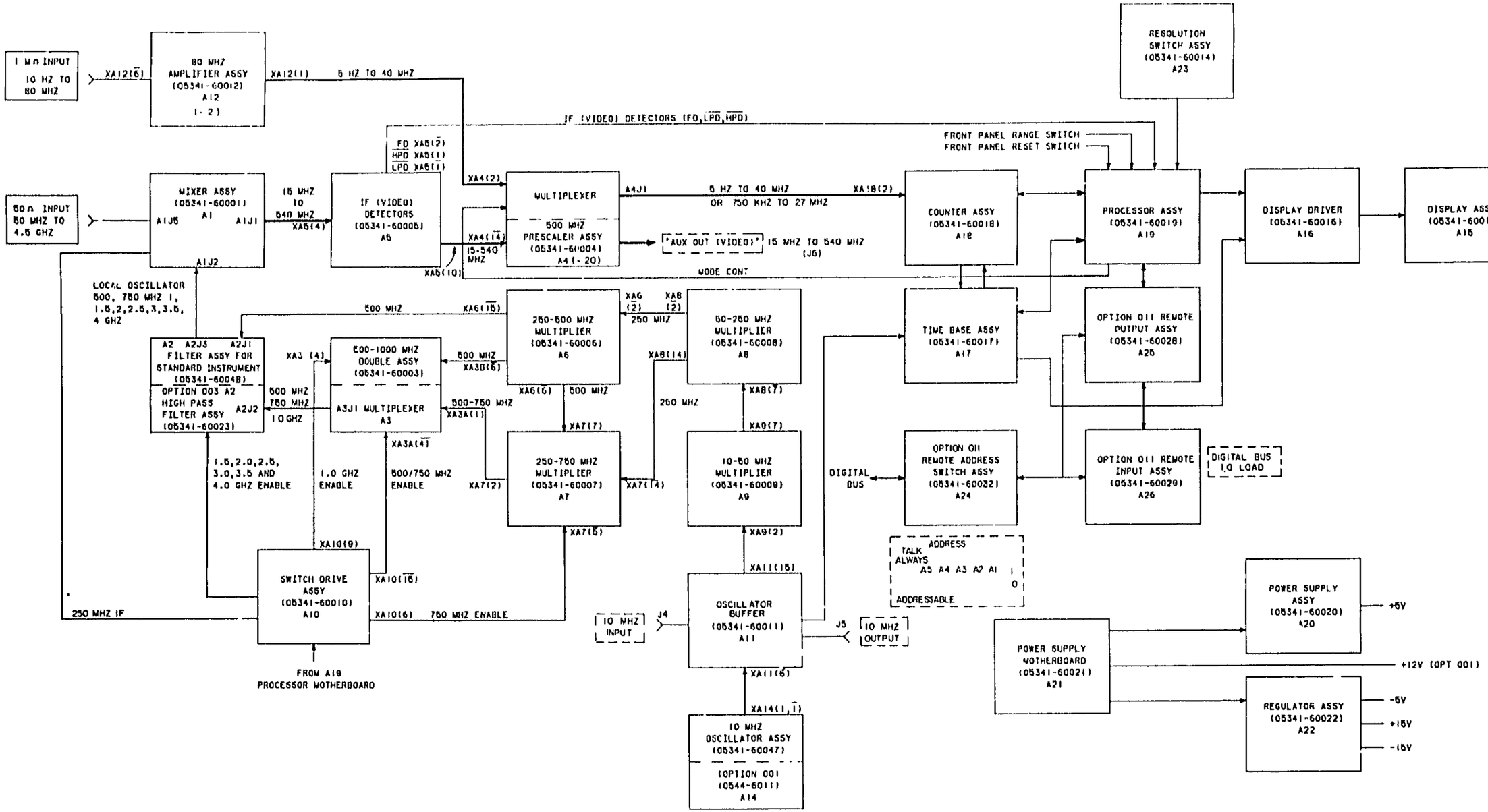
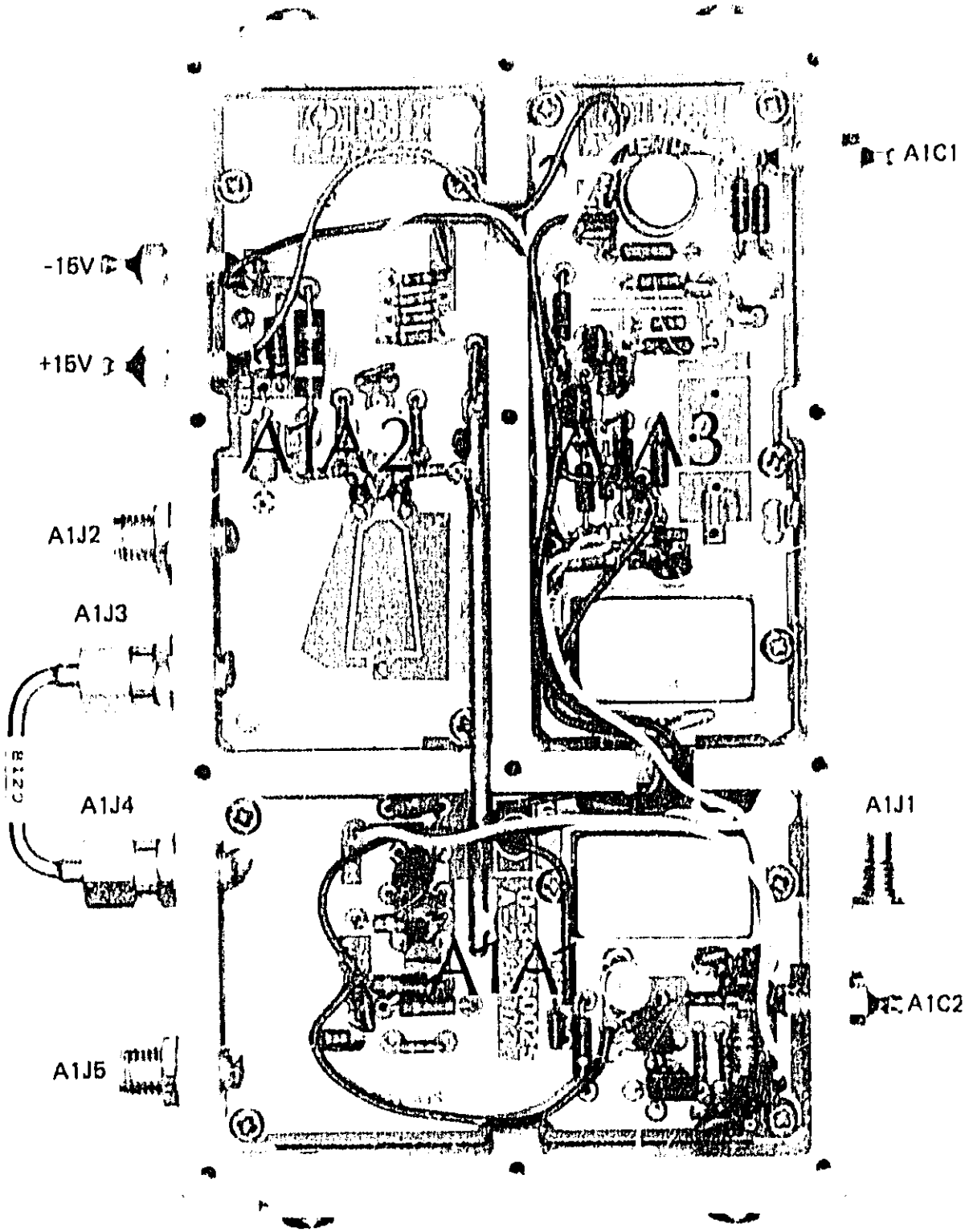


Figure 8-5. Overall Block Diagram



Part of Figure 8-6. A1 Mixer Module Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN
4. L1 IS AN ETCHED INDUCTOR ON A13 PC BOARD

REFERENCE DESIGNATIONS

A1	A1A1	A1A2	A1A3
C1-4	C1-13	C1-12	C1-13
J1-5	CR1-4	CR2,3,5	CR1-4
W1, 2	L1-4	Q1	L1-3
	Q1-4	R1-14	R1-10
	R1-10		U1, 2
	U1		

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A1A1		
CR1, 2	1901-0518	1901-0518
CR3	1901-0639	1901-0639
CR4	1901-1099	1901-1099
Q1	1854-0215	SPS3611
Q2	1854-0071	1854-0071
Q3, 4	1853-0036	1853-0036
U1	1813-0044	1813-0044
A1A2		
CR2, 3	1900-0024	1900-0024
Q1	35821B	35821B
A1A3		
CR1-4	1901-0639	1901-0639
U1	1820-0306	CA3028A
U2	1813-0076	1813-0076

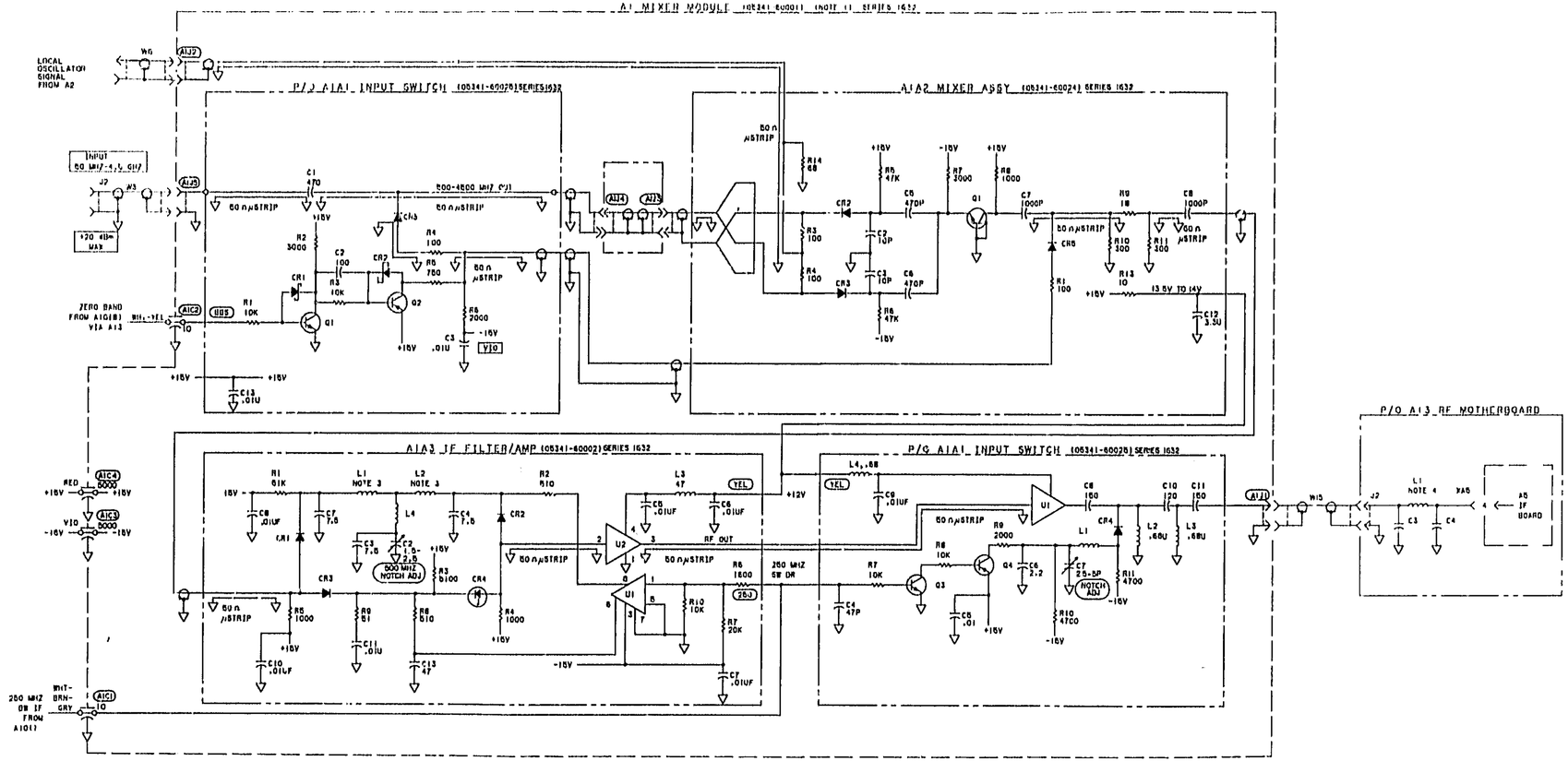
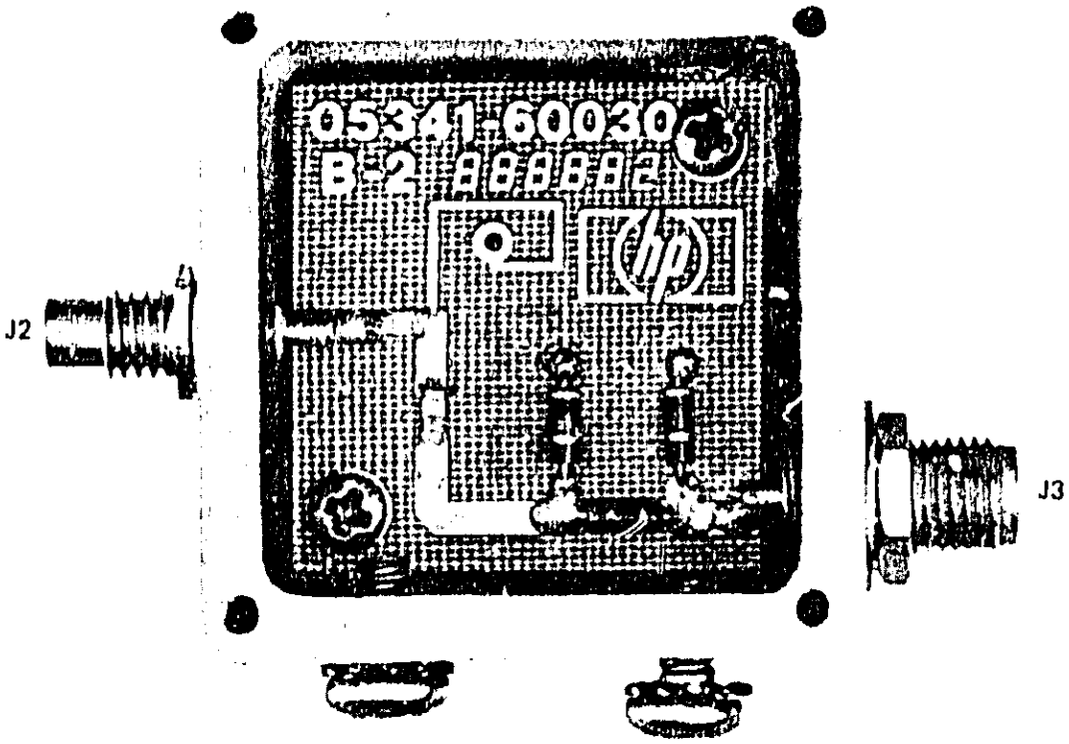


Figure 8-6. A1 Mixer Module Assembly



Part of Figure 8-7. A2 Switchable Filter Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
3. CAUTION:
   THE A2 (05341-60048) ASSEMBLY IS NOT FIELD REPAIRABLE. FOR REPLACEMENT, ORDER REBUILT ASSEMBLY 05341-60548 SCHEMATIC, COMPONENT LOCATOR AND PARTS LIST ARE GIVEN FOR REFERENCE PURPOSES ONLY. ATTEMPTS TO REPAIR THIS ASSEMBLY MAY RESULT IN PERMANENT DAMAGE TO THE UNIT.

REFERENCE DESIGNATIONS

A2 STANDARD INSTRUMENT
C1-9 CR1 FL1-9 L1-11 Q1-2 R1-8 U1
A2 OPTION 002
C1-2 L1 R1-3

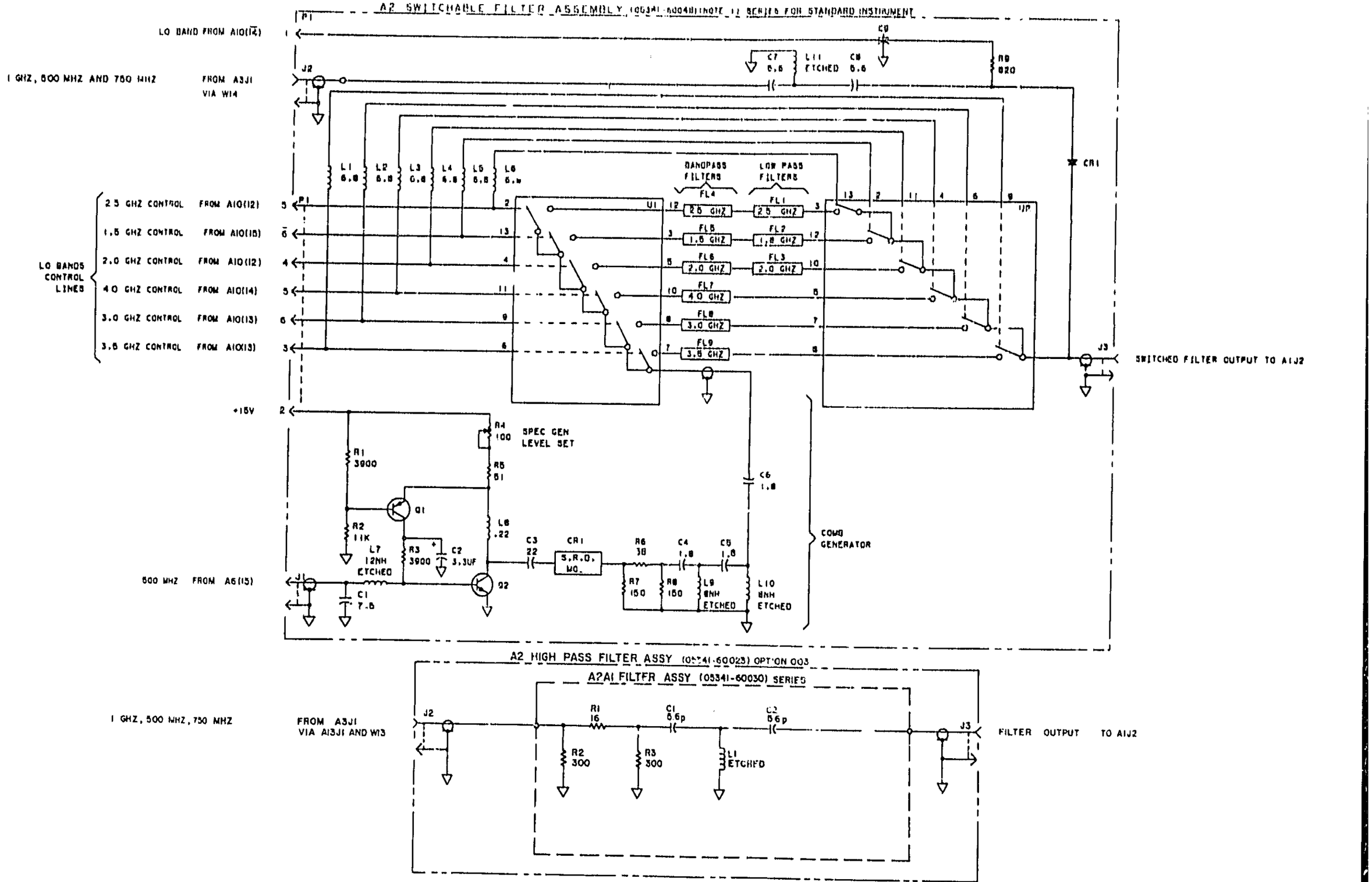
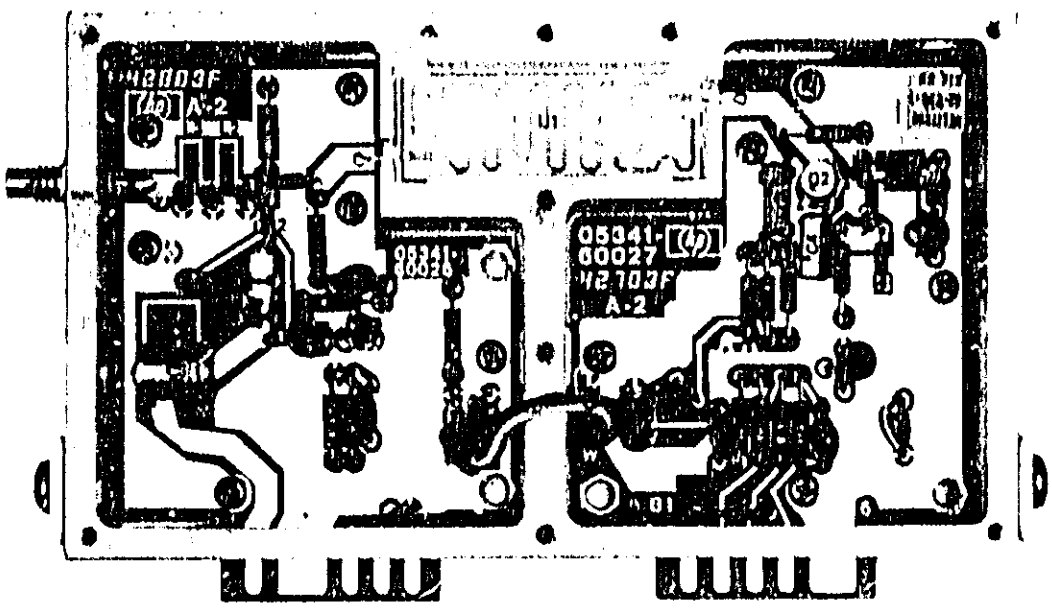


Figure 8-7. A2 Switchable Filter Assembly



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. A1L1, A1L2 ARE ETCHED ON PC BOARD
4. TWO SIX PIN EXTENDER BOARDS HP/PN 5060-0050 ARE NECESSARY TO TROUBLESHOOT THIS BOARD.

REFERENCE DESIGNATIONS

A3	A3A1	A3A2
J1 U1	C1-10 CR1 Q1-4 R1-12	C1-10 CR1, 2 L1 Q1, 2 R1-6

Part of Figure 8-8. A3 500—1000 MHz Doubler Assembly

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A3A1		
CR1	1901-0639	1901-0639
Q1	1853-0020	1853-0020
Q2	1854-0638	1854-0638
Q3	1853-0036	1853-0036
Q4	1854-0071	1854-0071
A3A2		
CR1, 2	1901-0639	1901-0639
Q1	1854-0071	1854-0071
Q2	1853-0036	1853-0036

A3 TYPICAL DC VOLTAGE MEASUREMENTS

5341A CONTROL SETTINGS
RESOLUTION – 1M
SR – CCW
RANGE – CHECK
AUTO/MANUAL – MANUAL
Int TEST - TEST

Measurements taken with HP 8300B/5306A

A3A1

Q1	E = +11.6V	B =	+11V	C =	+1.14V
Q2	E = 0V	B =	+0.75V	C =	+9.85V
Q3	E = +15V	B =	+14.96V	C =	-15V
Q4	E = 0V	B =	+0.05V	C =	+14.97

A3A2

Q1	E = 0V	B =	+0.65	C =	0V
Q2	E = +15V	B =	+14.2V	C =	+14.9V

A3A2

CR1 Anode	+0.78V	1 GHz Enable XA3B(4) TTL High
	-15V	1 GHz Enable XA3B(4) TTL Low
CR2 Anode	+0.78V	500-750 MHz Enable XA3A(4) TTL High
	-15V	500-750 MHz Enable XA3A(4) TTL Low

A3A1

1 GHz Enable XA3B4 TTL Low	CR1 Cathode = -0.6V Anode = -15V
1 GHz Enable XA3B4 TTL High	CR1 Cathode = +2.4V Anode = +3.2V

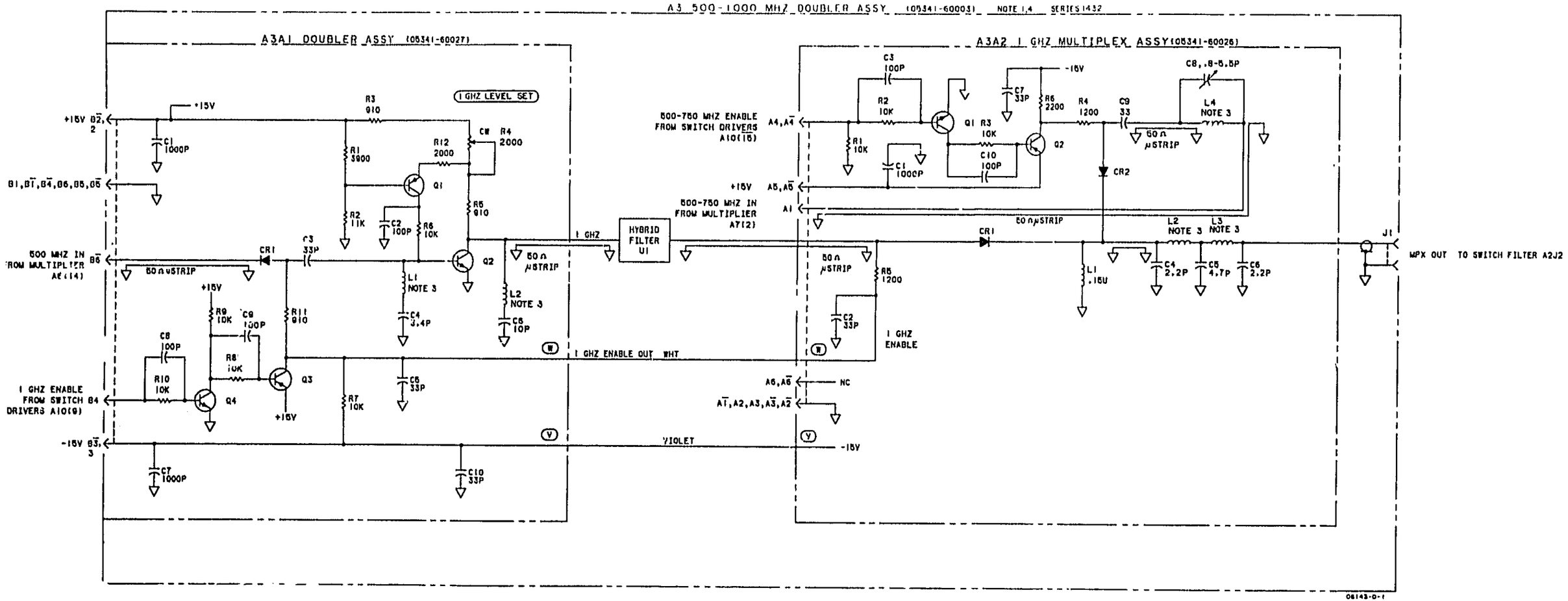
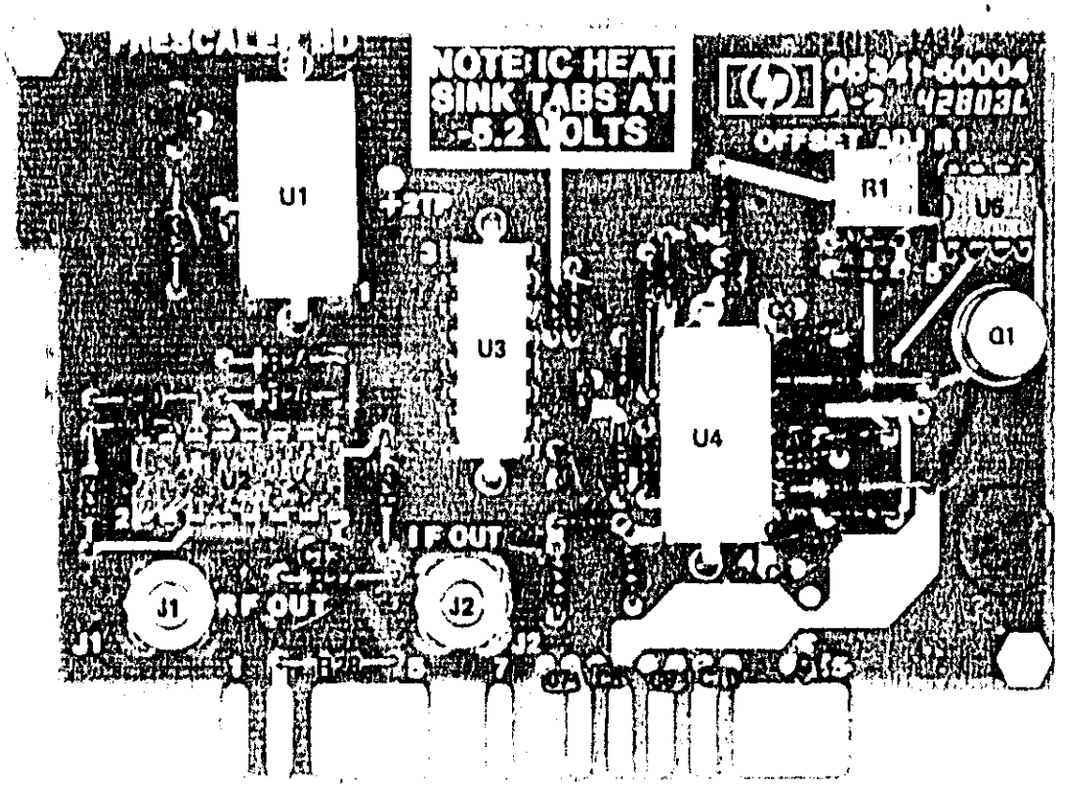


Figure 8-8. A3 500—1000 MHz Double Assembly



N O T E S

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. RESISTOR LEAD INDUCTANCE
4. C3 AND C4 NOT NORMALLY LOADED. USED ONLY FOR SUPPRESSING OSCILLATIONS.
5. ASTERISK(*) INDICATES SELECTED COMPONENT, AVERAGE VALUE SHOWN.

REFERENCE DESIGNATIONS

A4
C1-16
J1, 2
Q1, 2
R1-33
U1-5

Part of Figure 8-9. A4 500 MHz Prescaler Assembly

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1	1853-0012	2N2904A
Q2	1854-0092	1854-0092
U1	1820-1019	1820-1019
U2	1820-0802	MC10102P
U4	1826-0297	1826-0297
U5	1820-0216	1820-0216

TYPICAL DC VOLTAGE MEASUREMENTS

5341A CONTROL SETTINGS
RESOLUTION – 1 MHz
SR – CW
AUTO/MANUAL – MANUAL
SELF-TEST – TEST
RANGE – CHECK

A4U1

PIN	1	2	3	4	5	6	7	8
V	-0.28	-0.15	0	-5	-0.15	-0.36	-5.02	-0.88
PIN	9	10	11	12	13	14	15	16
V	-0.33	-0.34	0	0	-5.07	-0.27	0	-0.12

A4U4

PIN	1	2	3	4	5	6	7	8
V	-4.15	5.12	0.8	0.03	0	-2.62	-5.07	-4.04
PIN	9	10	11	12	13	14	15	16
V	-4.14	5.12	-0.52	0	-0.36	-1.63	-0.12	-0.33

A4U5

PIN	1	2	3	4	5	6	7	8
V	-15	0.77	0.8	-15	-15	-5.27	14.85	-0.18

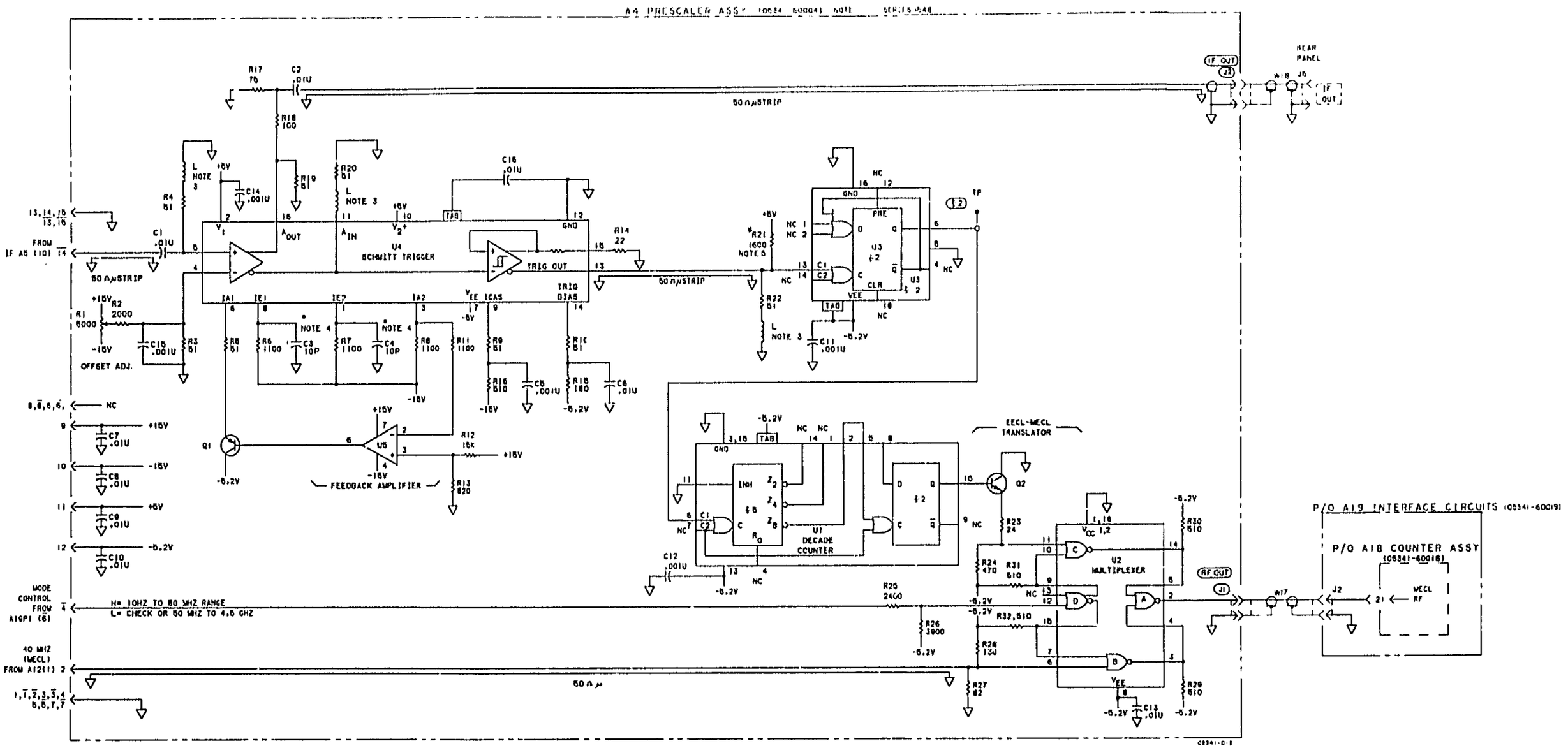
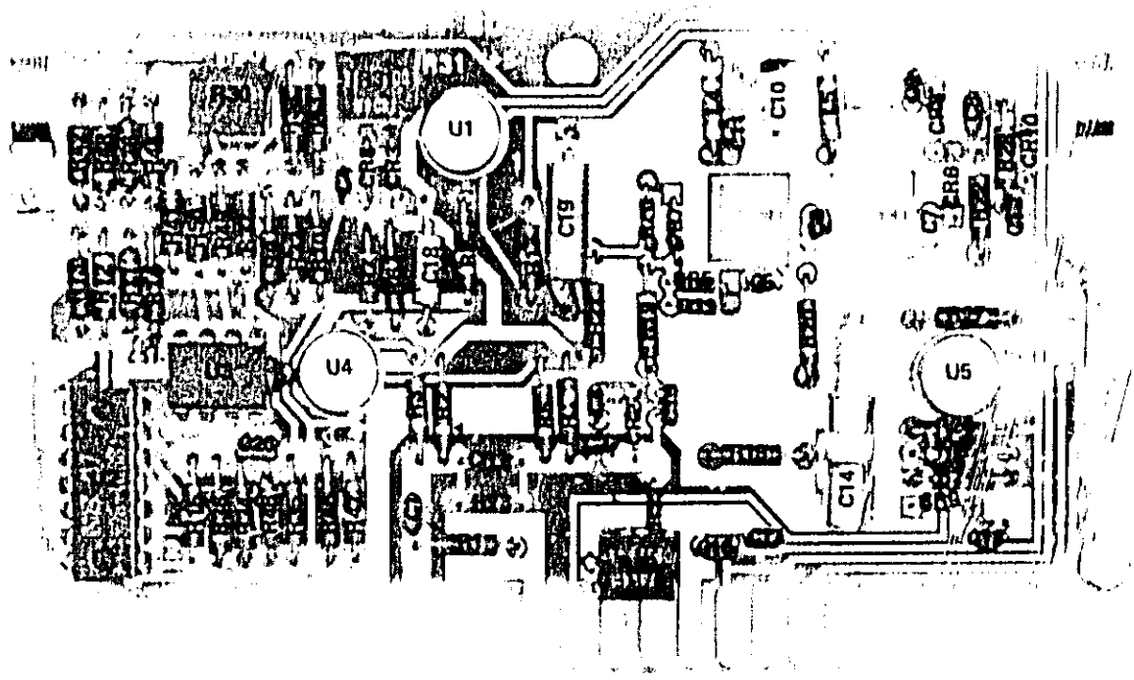


Figure 8-9. A4 500 MHz Prescaler Assembly



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK(*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A5
CR-21 CR1-10 L1-6 R1-50 U1-5

Part of Figure 8-10. A5 IF Amplifier-Detector Assembly

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1, 4, 6	1901-0535	1901-0535
CR2, 3**	05341-80005	05341-80005
CR5, 7, 8	1901-0639	1901-0639
CR9, 10**	05341-8005	05341-80005
U1	1826-0081	LM318H
U2	1826-0138	LM339N
U3	1826-0172	LM308N
U4, 5	1826-0230	1826-0230

**Matched pair

TYPICAL DC VOLTAGE MEASUREMENTS

RESOLUTION – 1M
SAMPLE RATE – CCW
AUTO/MANUAL – MANUAL
SELF TEST – ON
RANGE – CHECK

A5U1

PIN	1	2	3	4	5	6	7	8
V	+8.4	-0.4	+0.1	-15	+8.7	-0.9	+15	-14

A5U2

PIN	1	2	3	4	5	6	7	8
V	+0.11	+0.15	+15	+0.01	+0.07	-0.9	+0.16	-0.9
PIN	9	10	11	12	13	14		
V	+0.6	0	0	0	0	+0.12		

A5U3

PIN	1	2	3	4	5	6	7	8
V	+14.2	+0.06	+0.06	-15	0	+0.01	+15	+0.09

A5U4

PIN	1	2	3	4	5	6	7	8
V	+1.4	-9.8	-15	-10.6	-0.9	+11.3	0	+5.3

A5U5

PIN	1	2	3	4	5	6	7	8
V	0	-9.9	-15	-10.6	-0.9	+11.3	0	+7.0

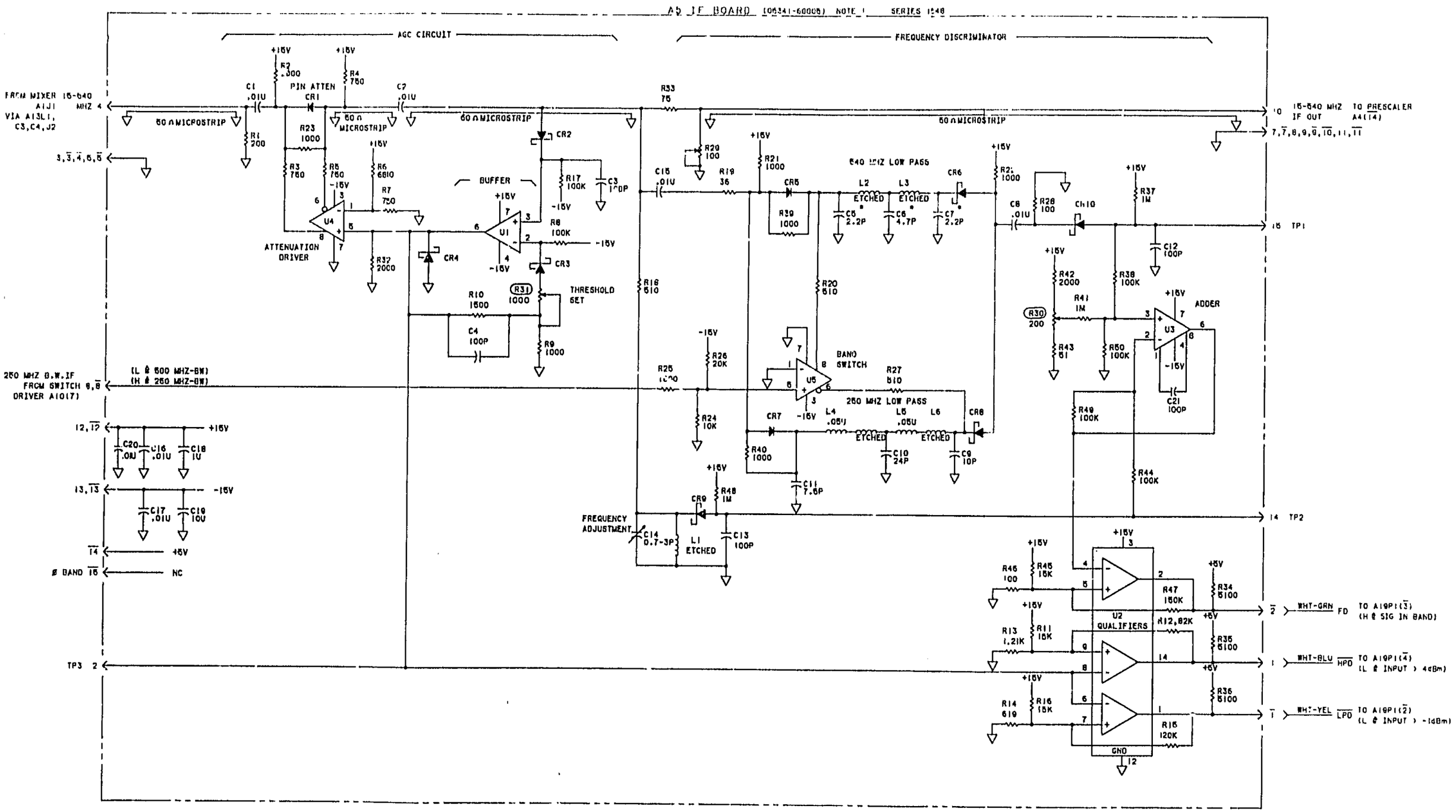
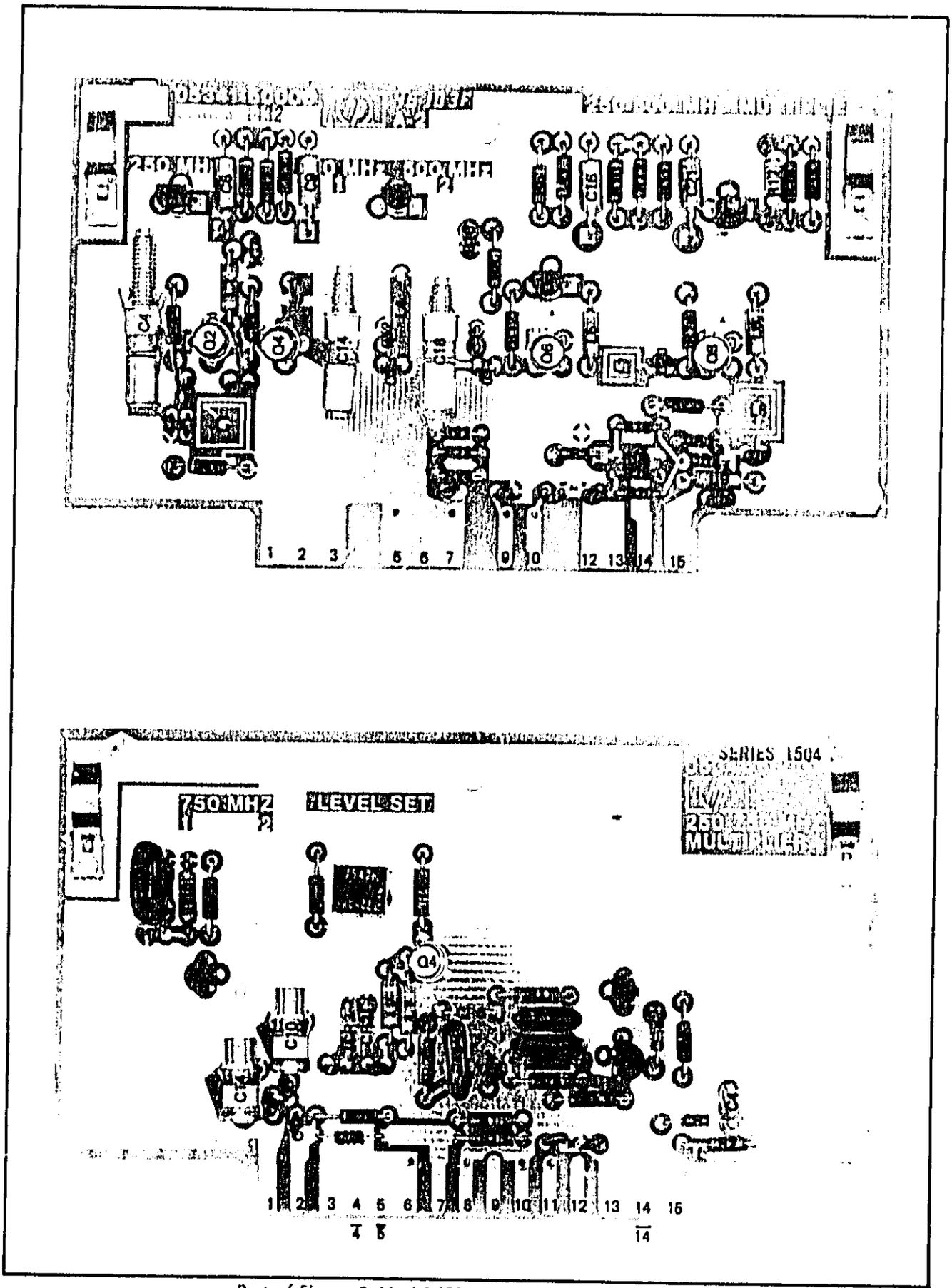


Figure 8-10. A5 IF Amplifier-Detector Assembly



Part of Figure 8-11. A6 250—500 MHz Multiplier Assembly, A7 250—750 MHz Multiplier Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES
3. A7L3, A7L4, A6L1, A6L3, A6L4, A6L7, A6L8 ARE ETCHED INDUCTORS. A6L3 AND A6L4 ON CONDUCTOR SIDE.

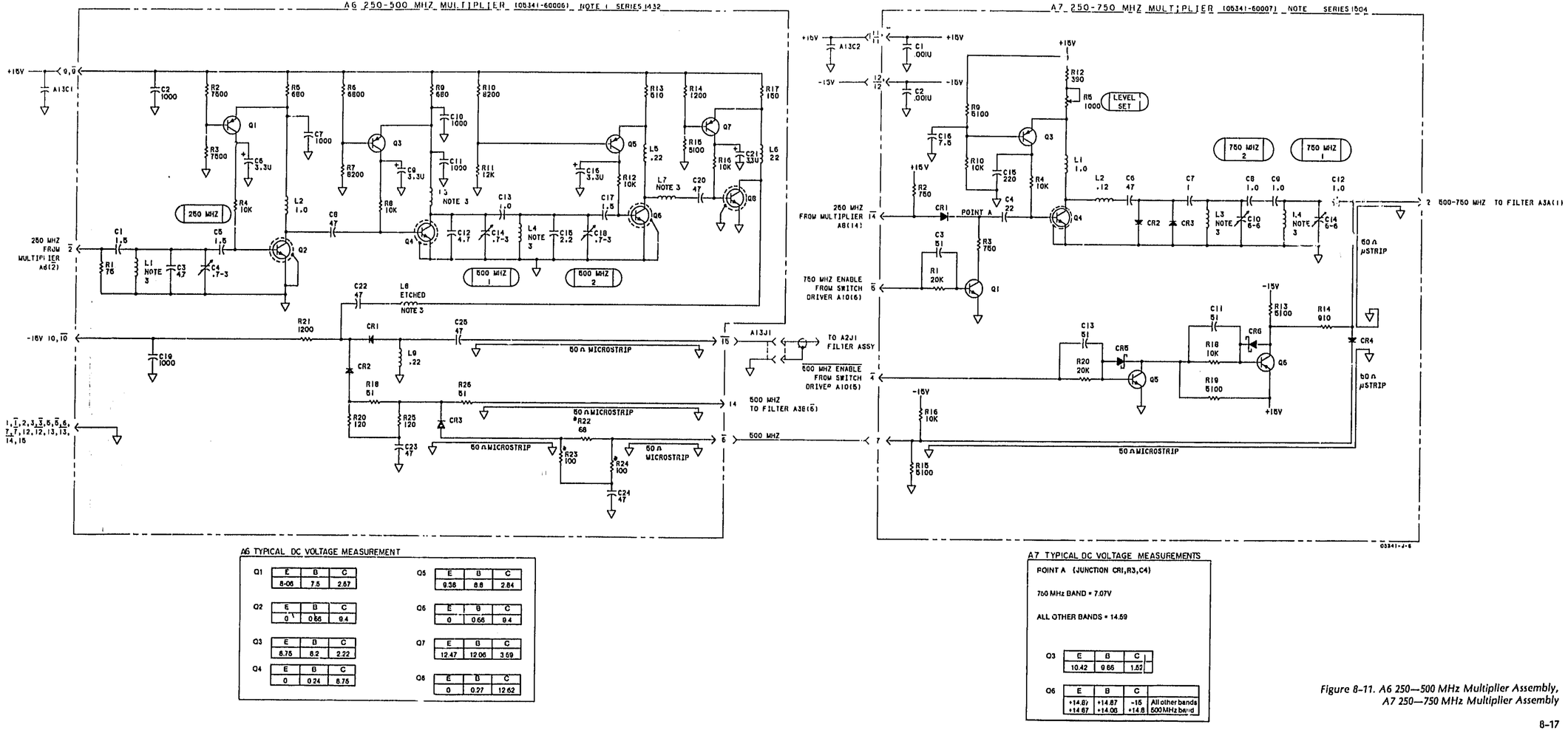
REFERENCE DESIGNATIONS

A6	A7
C1-25	C1-4, 6-16
CR1-3	CR1-6
L1-9	L1-4
Q1-8	Q1, 3-6
R1-26	R1-5,9,10,12-16, 18-20

A7Q2 not used

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A6		
CR1-3	1901-0639	1901-0639
Q1,3,5,7	1853-0020	1353-0020
Q2,4,6	1854-0345	2N5179
Q8	1854-0638	SN6178
A7		
CR1, 4	1901-0639	1901-0639
CR5, 6	1901-0535	1901-0535
Q1, 5	1854-0215	SPS3611
Q3	1853-0020	1853-0020
Q4	1854-0345	SN5179
Q6	1853-0036	1853-0036



A6 TYPICAL DC VOLTAGE MEASUREMENT

	E	B	C
Q1	8.06	7.5	2.67
Q2	0	0.66	9.4
Q3	6.75	6.2	2.22
Q4	0	0.24	8.75
Q5	9.36	8.8	2.84
Q6	0	0.66	9.4
Q7	12.47	12.06	3.69
Q8	0	0.27	12.62

A7 TYPICAL DC VOLTAGE MEASUREMENTS

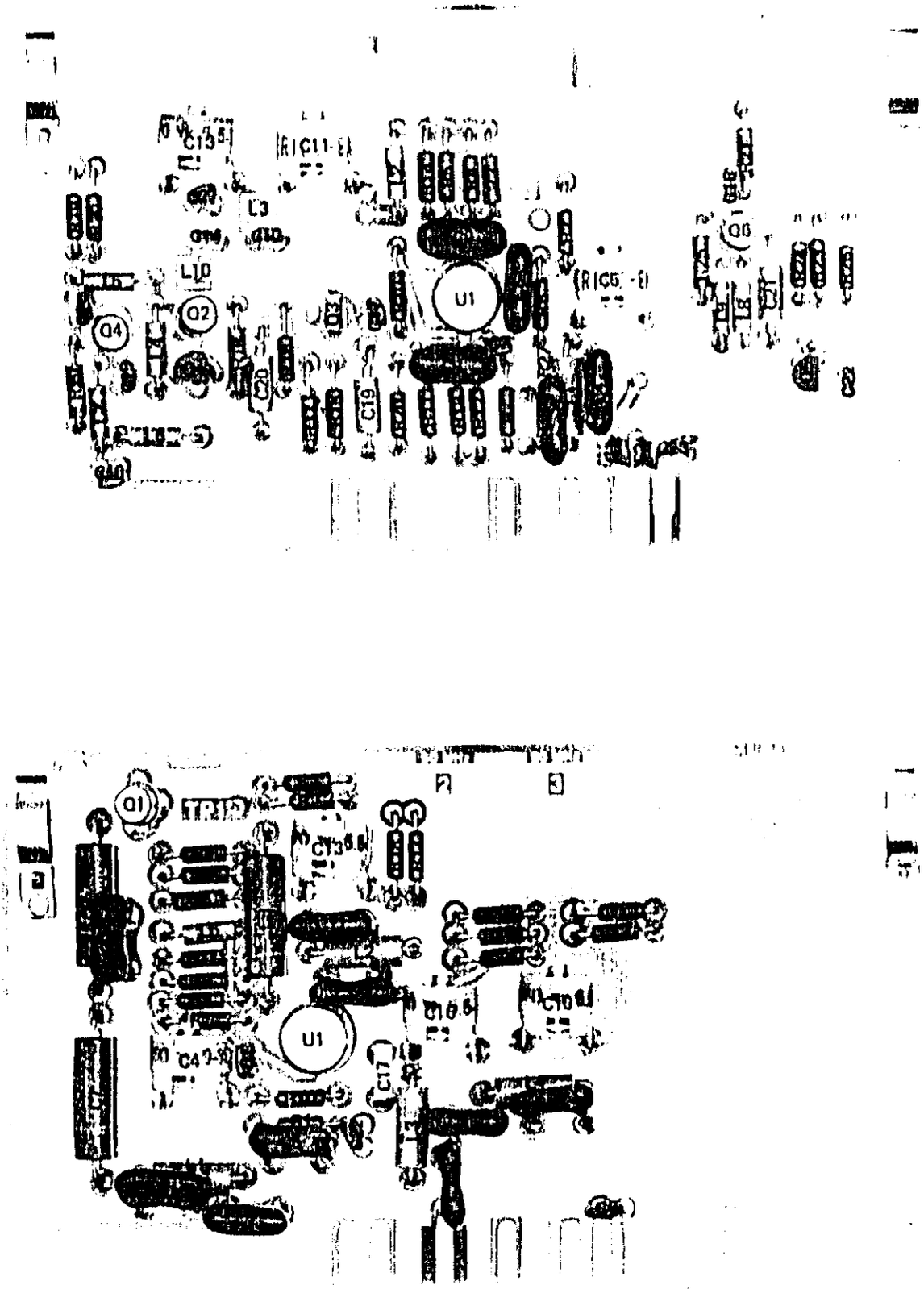
POINT A (JUNCTION CR1,R3,C4)

750 MHz BAND = 7.07V

ALL OTHER BANDS = 14.59

	E	B	C	
Q3	10.42	9.86	1.52	
Q6	+14.87	+14.87	-15	All other bands
	+14.67	+14.06	+14.8	500 MHz band

Figure 8-11. A6 250—500 MHz Multiplier Assembly, A7 250—750 MHz Multiplier Assembly



Part of Figure 8-12. A8 50—250 MHz Multiplier Assembly, A9 10—50 MHz Multiplier Assembly

NOTES

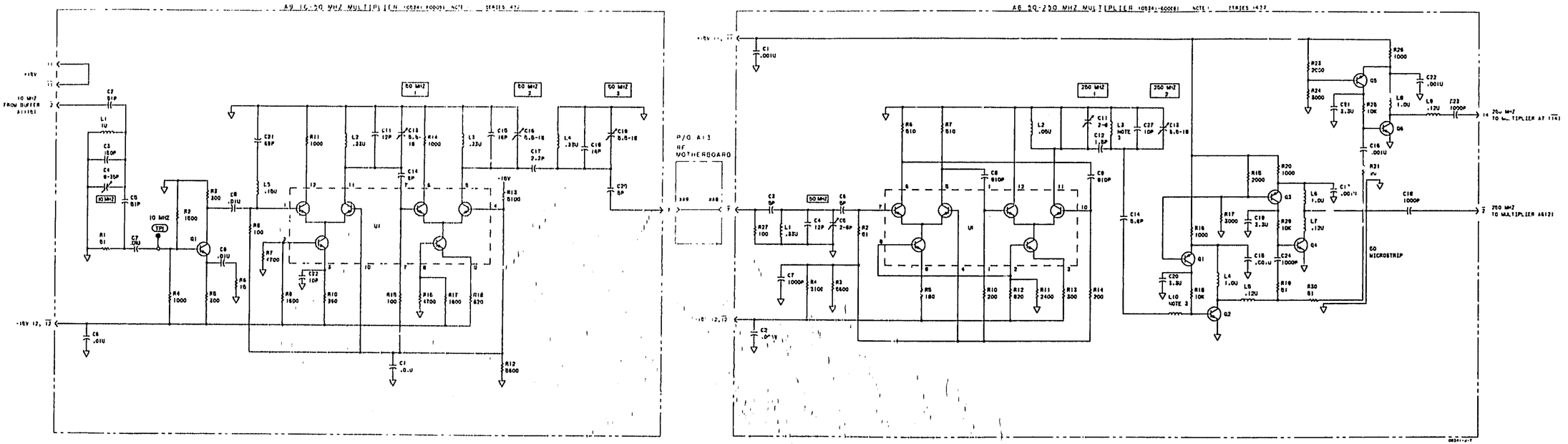
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. A8L3, L10 ARE ETCHED ON PC BOARD

REFERENCE DESIGNATIONS

A8	A9
C1-27	C1-22
L1-10	L1-5
Q1-6	Q1
R1-30	R1-18
U1	U1

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A8		
Q1, 3, 5 Q2, 4, 6 U1	1853-0020 1854-0345 1858-0004	1853-0020 2N5179 CA3049
A9		
Q1 U1	1854-0009 1858-0004	2N709 CA3049



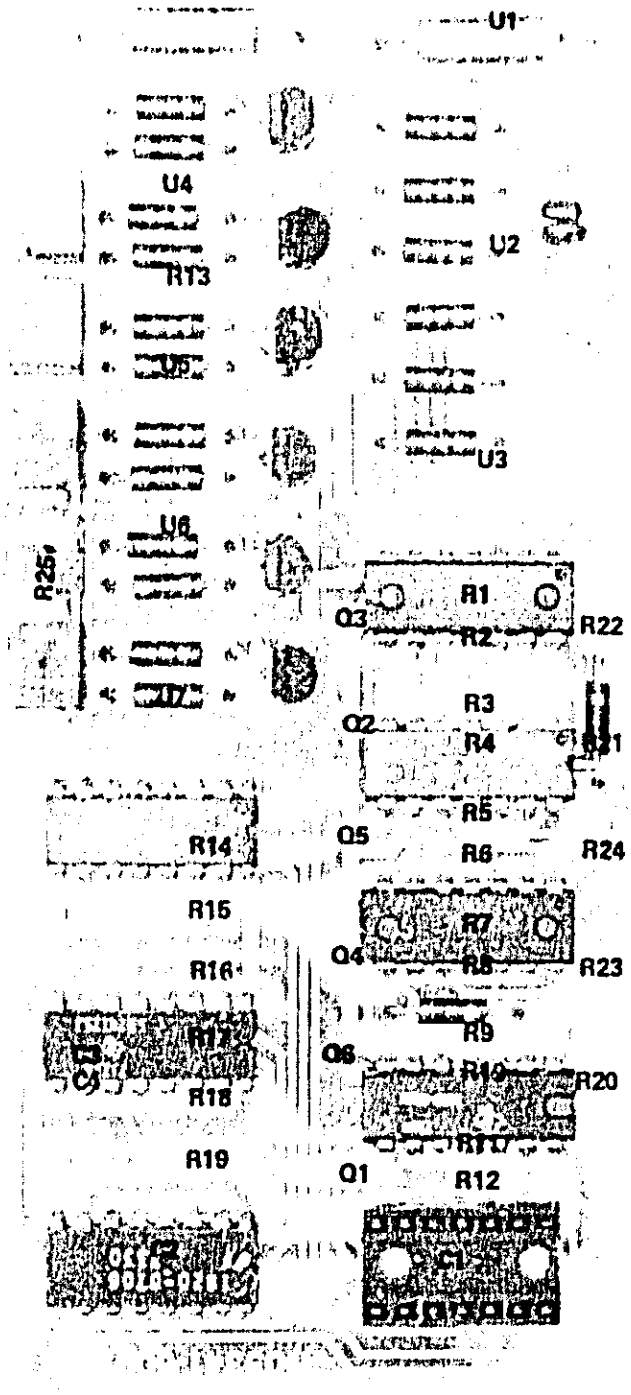
A9 TYPICAL VOLTAGE READINGS

Q1			U1											
E	B	C	1	2	3	4	5	6	7	8	9	10	11	12
10.0	6.2	0.0	8.4	11.3	12.1	8.4	0	1.9	8.4	11.3	12.1	8.4	0	3.5

A8 TYPICAL DC VOLTAGE READINGS

J1						Q6 Q4 Q2		Q5 Q3 Q1		
1	2	3	6	7	9	B	C	E	B	C
RC	1	-12.4	-3.26	-8	-12.5	+0.74	+9.5	+9.5	+8.0	+11.8

Figure 8-12. A8 50—250 MHz Multiplier Assembly, A9 1—50 MHz Multiplier Assembly



Part of Figure 8-13. A10 Band Selector/Switch Driver Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A10
C1-4 Q1-6 R1-26 U1-7

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1-6	1853-0058	S32248
U1	1820-0706	9324DC
U2	1820-0839	SN74176N
U3	1820-0214	SN7442N
U4	1820-0761	SN74196N
U5	1820-0586	DM74L04N
U6	1820-0174	SN7404N
U7	1820-0068	SN7410N

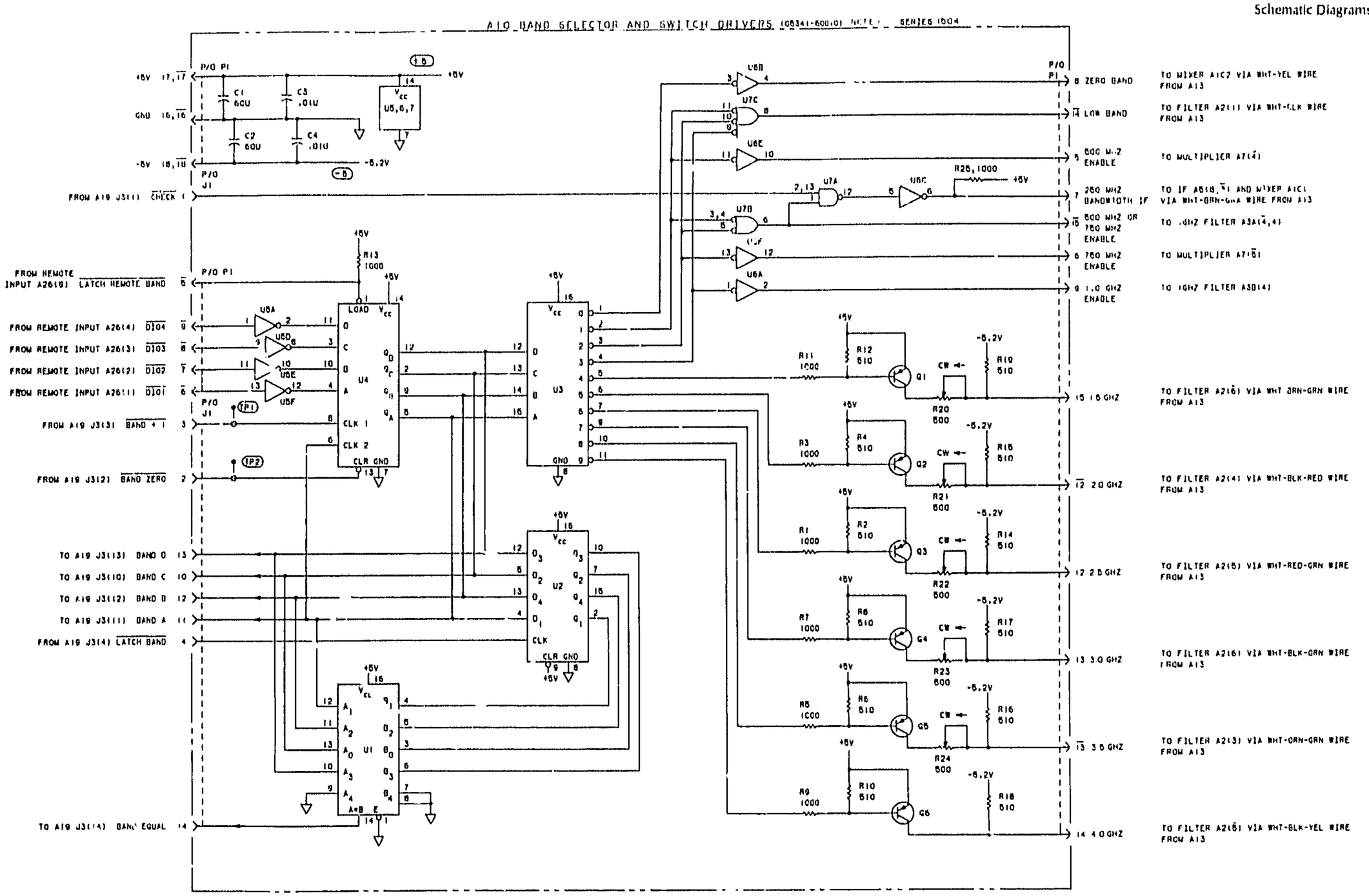
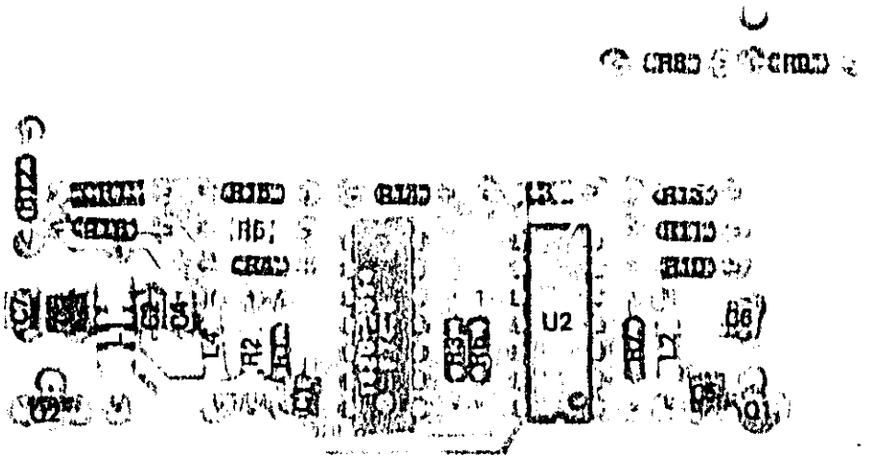


Figure 8-13. A10 Band Selector/Switch Driver Assembly



Part of Figure 8-14. A11 10 MHz Oscillator Buffer Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A11
C1-7 CR1 L1-4 Q1-2 R1-16 U1, 2

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1	1902-0041	SZ 10939-98
U1	1820-0064	SN7400N
U2	1820-0174	SN7404N

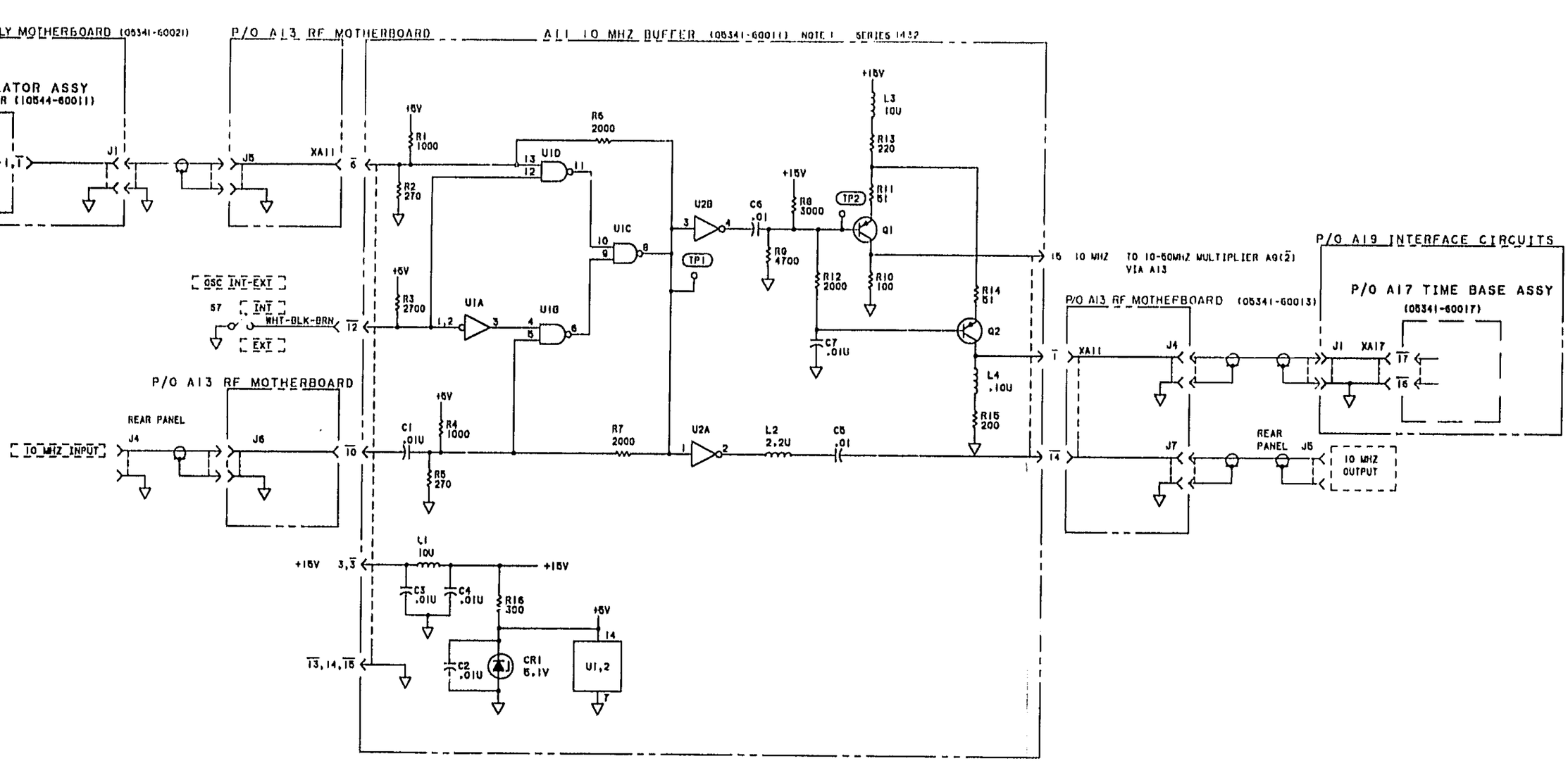
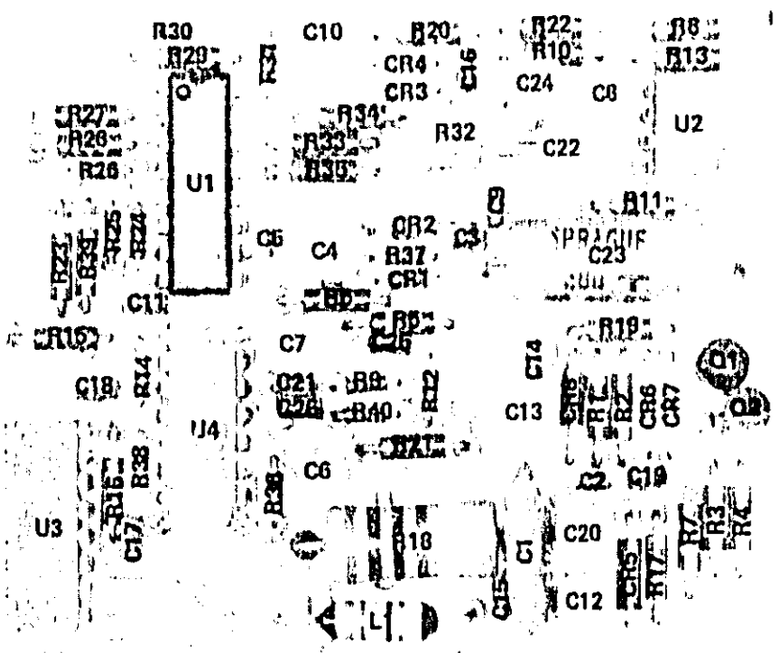


Figure 8-14. A11 10 MHz Oscillator Buffer Assembly



Part of Figure 8-15. A12 80 MHz Amplifier Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN.

REFERENCE DESIGNATIONS

A12
C1-26 CR1-8 L1 Q1, 2 R1-41 U1-4

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1	1901-0179	1901-0179
CR2	1901-0639	1901-0639
CR3, 4	1901-0535	1901-0535
CR5	1902-0025	SZ 10939-182
CR6, 7	1901-0040	1901-0040
CR8	1902-0579	SZ 11213-56
Q1	1855-0081	2N5245
Q2	1853-0015	1853-0015
U1	1820-0216	1820-0216
U2	1820-1224	MC10216P
U3	1820-0809	MC10115P
U4	1820-0817	MC10131P

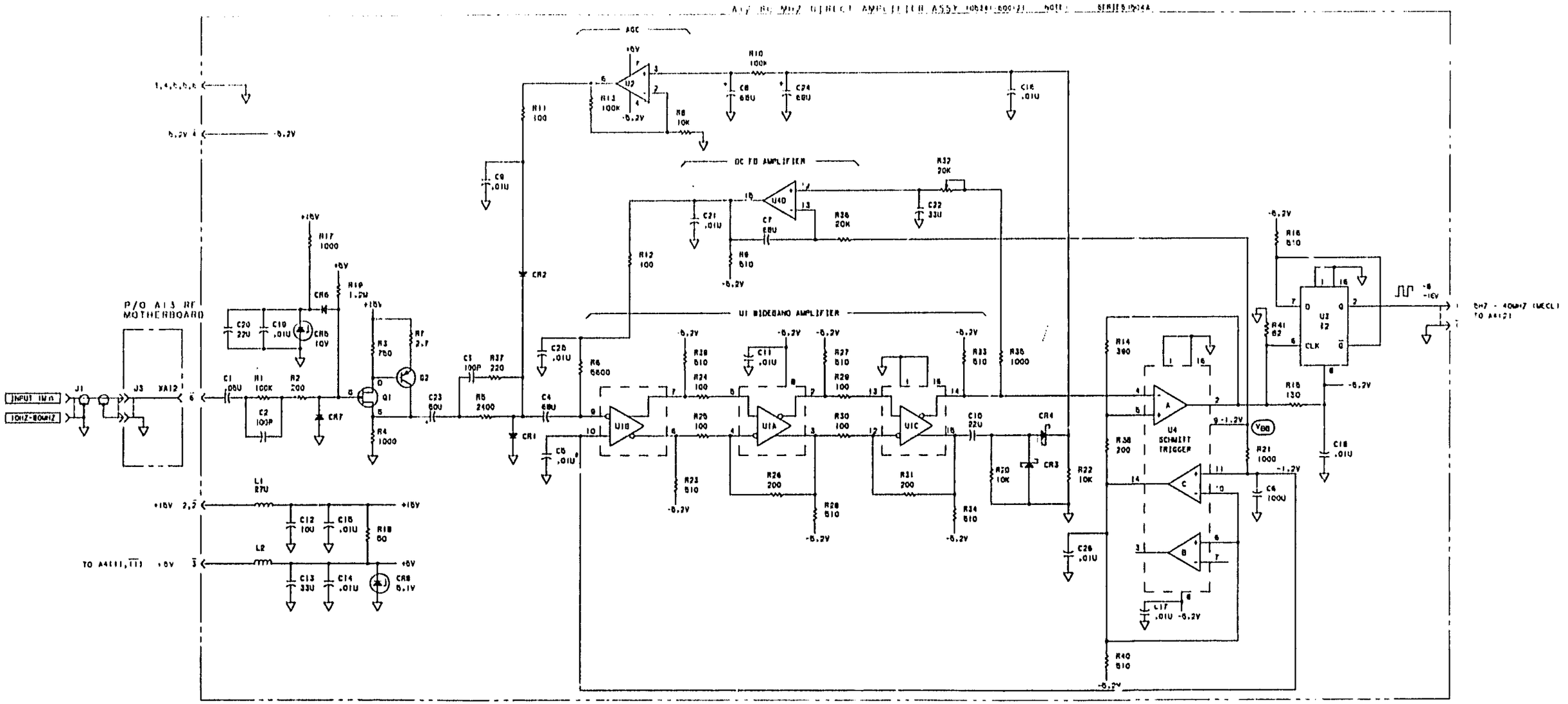


Figure 8-15. A12 80 MHz Amplifier Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. PINS 2,$\overline{2}$,4,$\overline{4}$,5,$\overline{5}$,6,$\overline{6}$,9,$\overline{9}$,12,$\overline{12}$,13,$\overline{13}$,15,$\overline{15}$ ARE CONNECTED TO GROUND
4. THE FOLLOWING ASSEMBLIES ARE NOT FIELD REPAIRABLE
   a. CRYSTAL OSCILLATOR 0960-0394
   b. A14 OPTION 001 10 MHz OSCILLATOR 10544-60011
   c. REFER TO PARTS LIST FOR FACTORY REBUILT PART NUMBER.

REFERENCE DESIGNATIONS

NO PREFIX	A14 STD	A14 OPT 001
C2 L1 XA14	C1 L1	R1

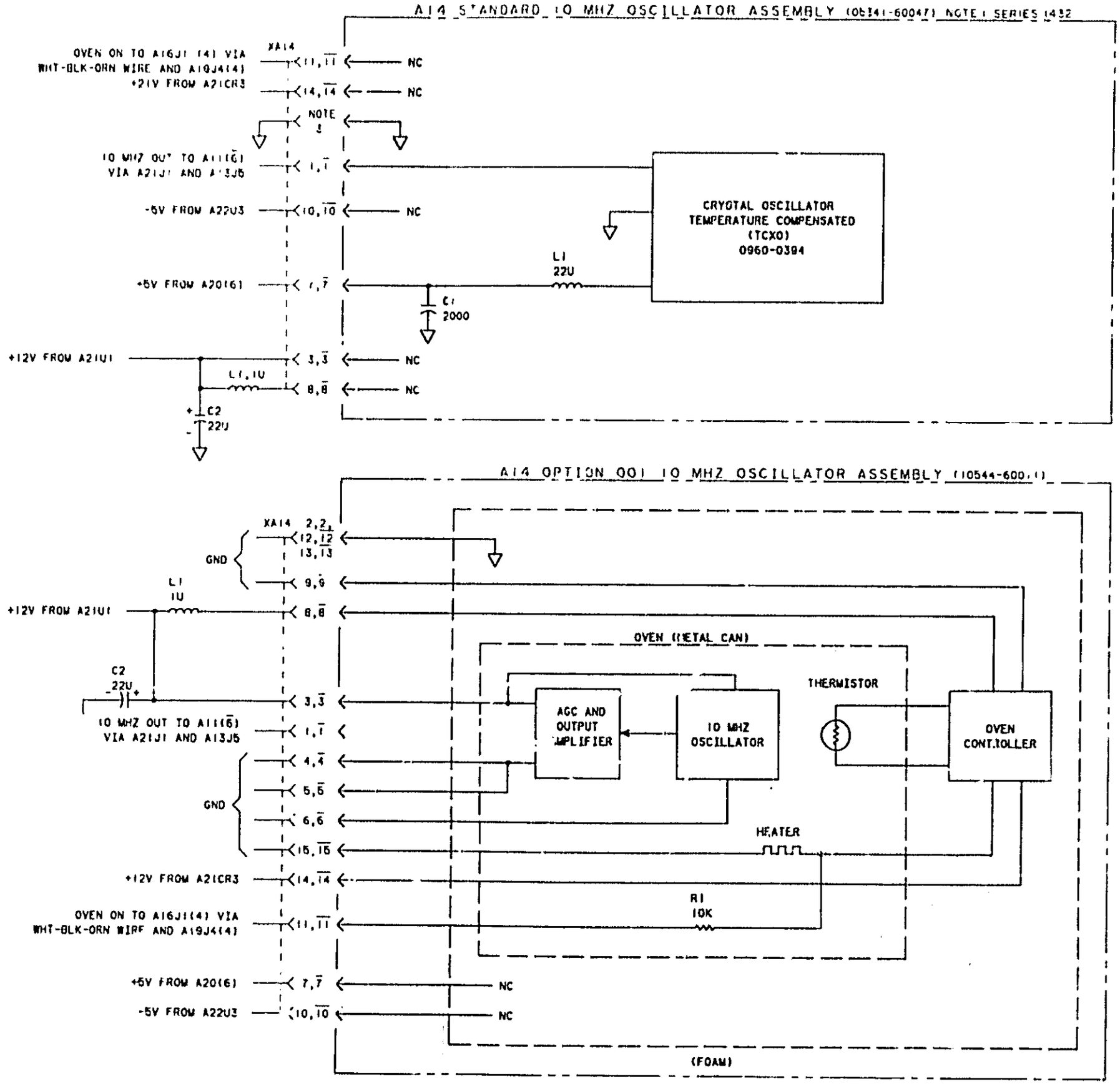
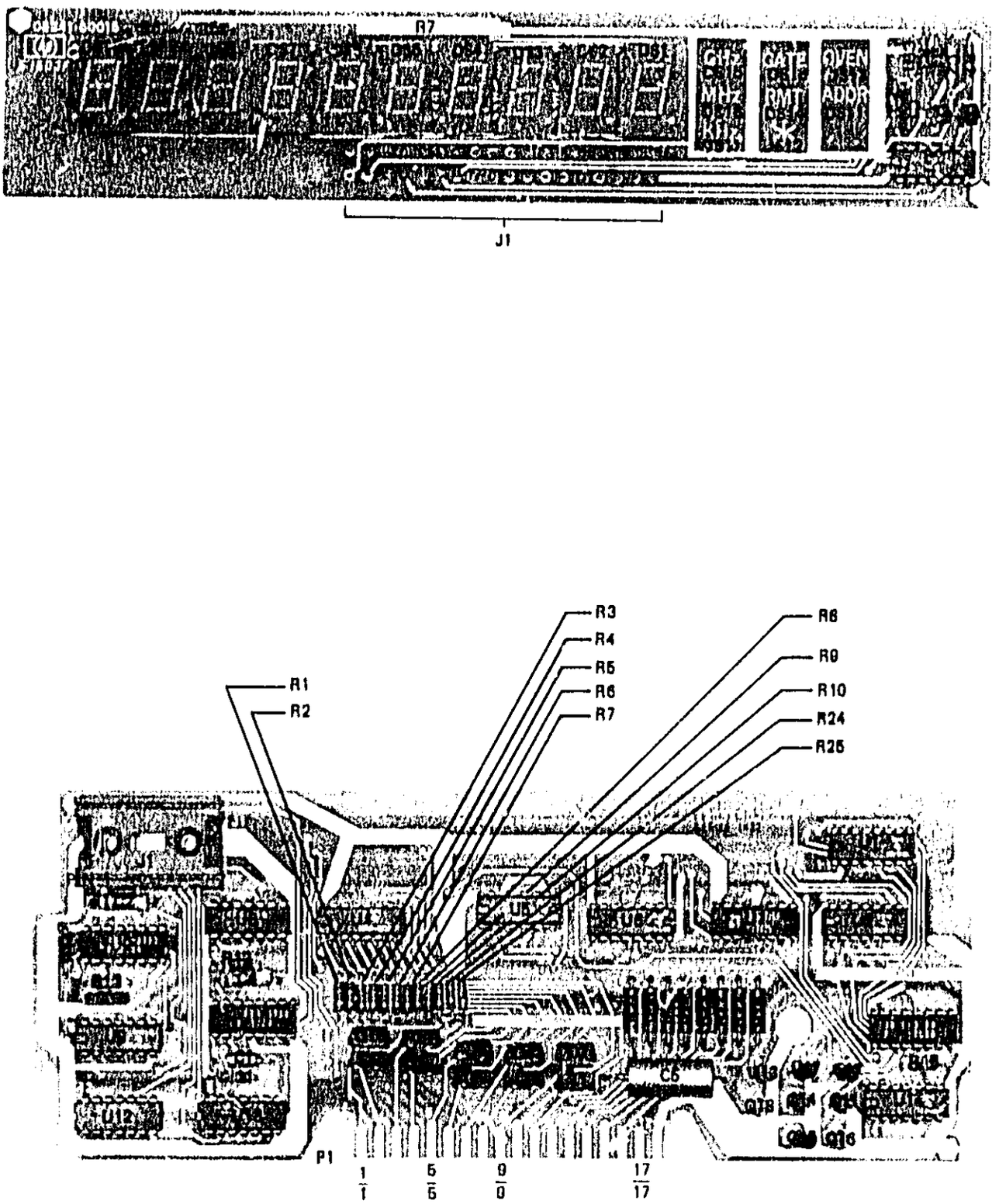


Figure 8-16. A14 10 MHz Oscillator Assembly



Part of Figure 8-17. A15 Display Board Assembly, A16 Driver Display Board Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A15	A16
C1-2	C1-5
CR1	Q1-18
DS1-18	R1-27
Q1-2	U1-14
R1-7	
U1	
XA15	
XDS1-10	

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A15		
CR1	1901-0040	1901-0040
Q1	1854-0560	1854-0560
Q2	1854-0071	1854-0071
U1	1820-0668	SN7407N
A16		
Q1-10	1853-0326	1854-0326
Q11-18	1854-0246	SPS233
U1	1820-0628	SN7489N
U2, 10	1820-0730	96L02DC
U3	1820-0661	SN7432N
U4	1820-0214	SN7442N
U5	1820-0546	SN74192N
U6	1820-0839	SN74175N
U7	1820-0904	93L24DC
U8	1820-0655	SN7425N
U9, 14	1820-0054	SN7400N
U11	1820-0914	9307DC
U12, 13	1820-0588	DM74L20N

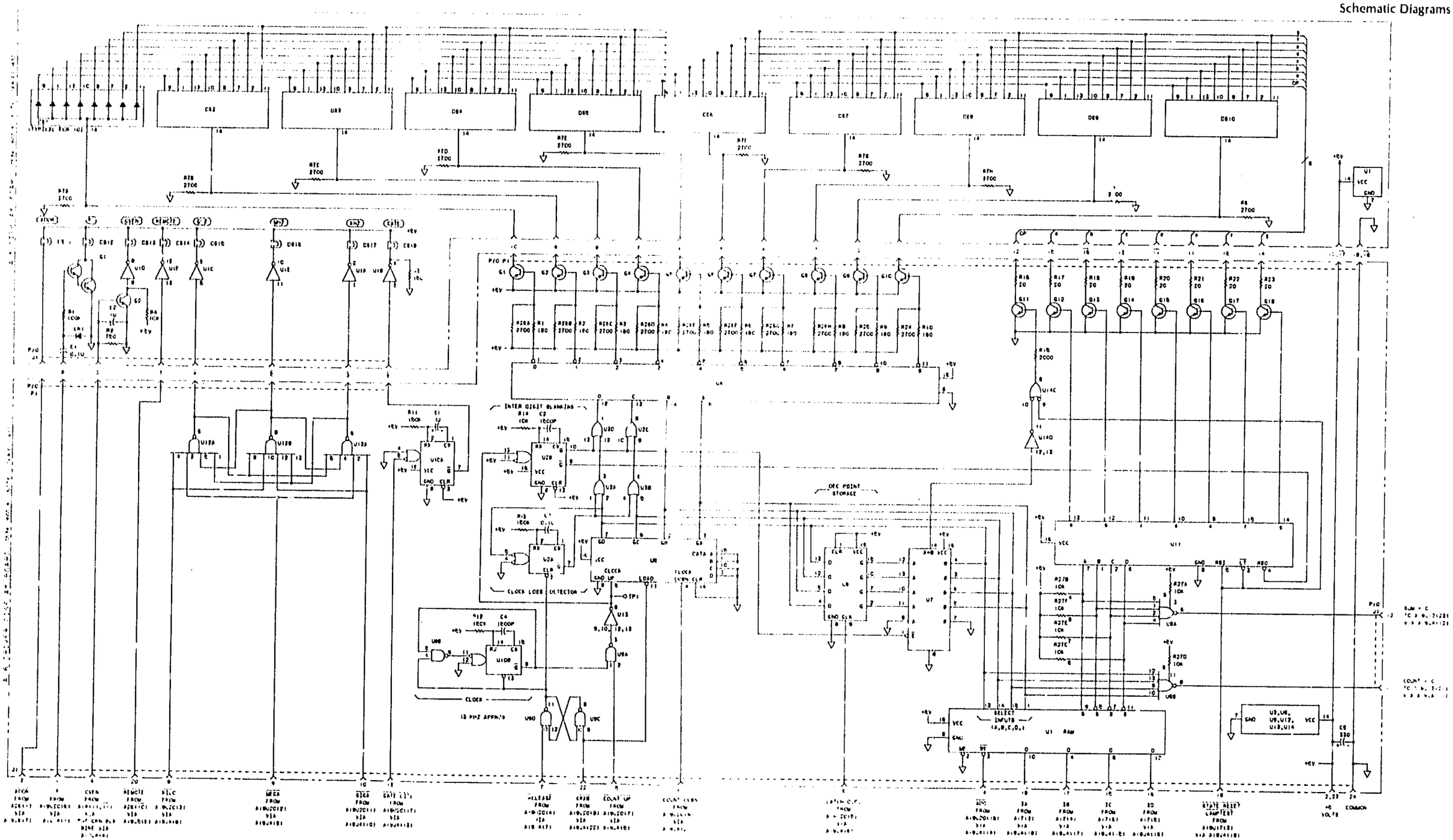
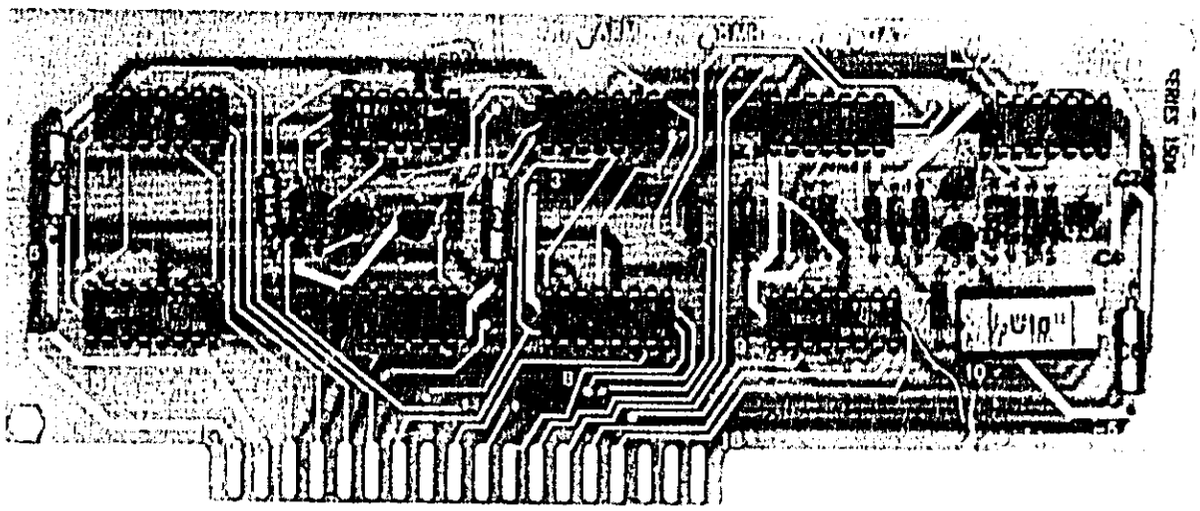


Figure 8-17. A15 Display Board Assembly, A16 Driver Display Board Assembly



Part of Figure 8-18. A17 Time Base Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   NO INDUCTORS
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A17
C1-7 Q1-5 R1-15 U1-10

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1, 3-5	1854-0094	2N3646
Q2	1854-0560	1854-0560
U1	1820-0328	SN7402AN
U2	1820-0875	9600
U3	1820-0054	SN7400N
U4	1820-0077	7474
U5	1820-0629	SN74S112N
U6	1820-0910	SN74LS83AN
U7	1820-0084	7453
U6	1820-0910	SN74LS83AN
U9	1820-0910	SN74LS83AN
U10	1820-0633	1820-0633

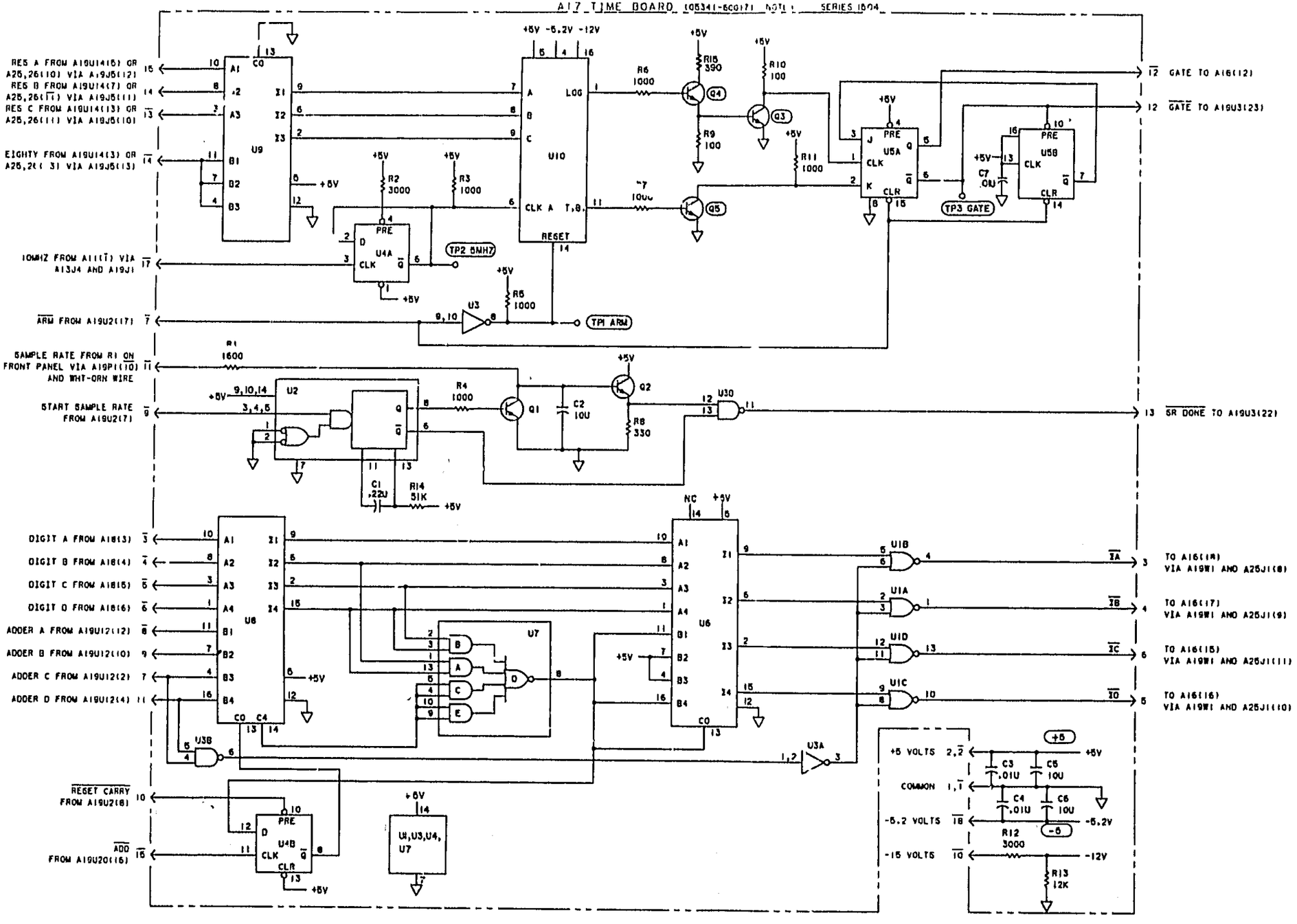
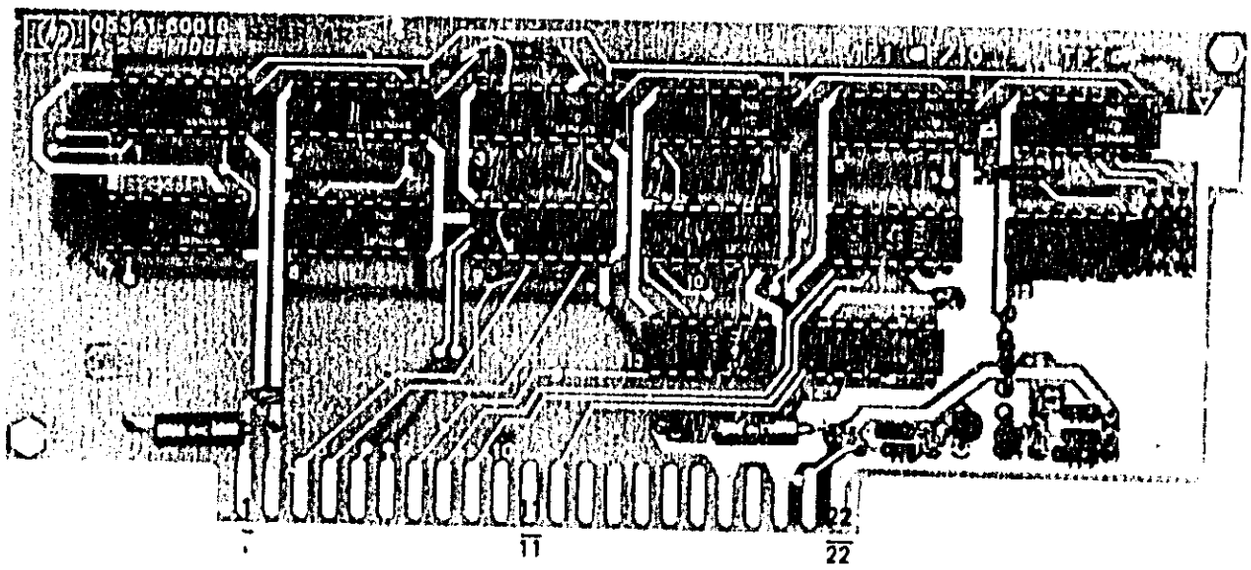


Figure 8-18. A17 Time Base Assembly



Part of Figure 8-19. A18 Counter Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A18
C1-6
Q1, 2
R1-11
TP1, 2
U1-14

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
Q1, 2	1854-0092	2N3563A
U1-8	1820-0899	74160
U9	1820-0710	93L22
U10	1820-0751	74196
U11, 13	1820-0174	7404A
U12	1820-0054	SN7400N
U14	1820-0681	74500

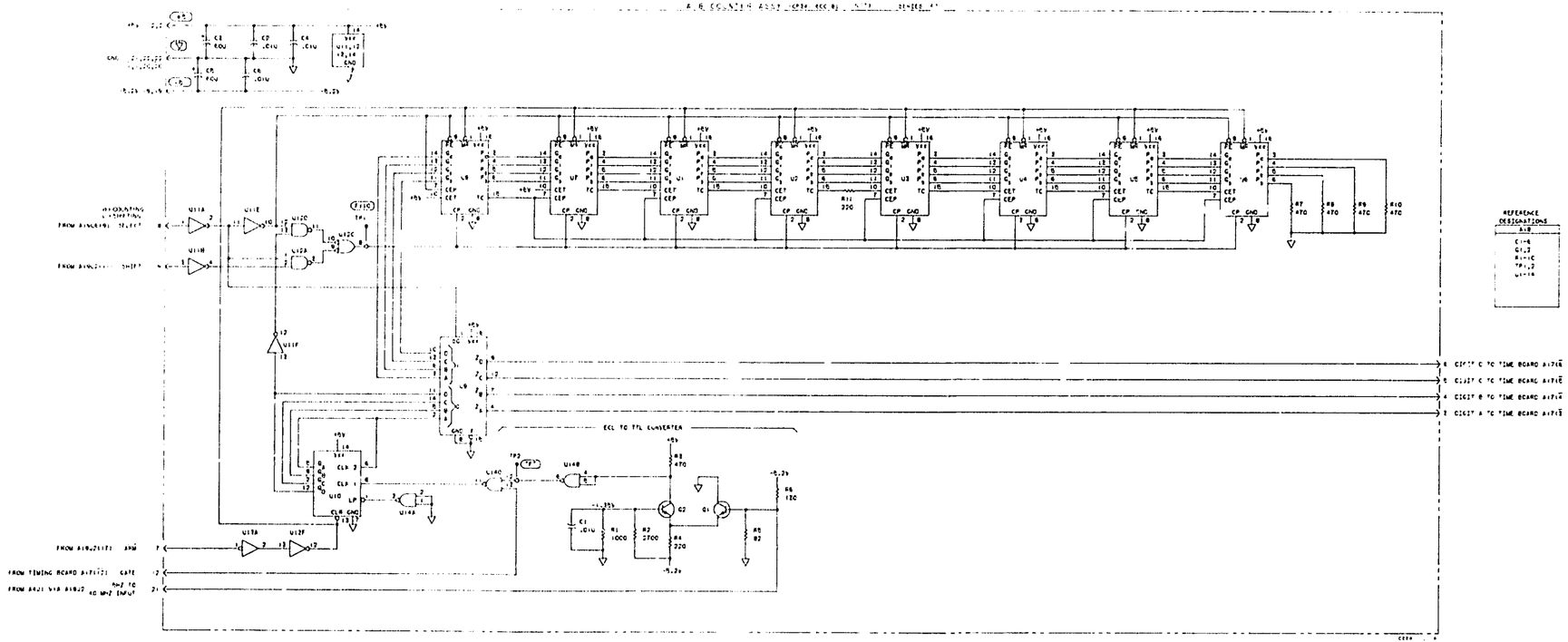
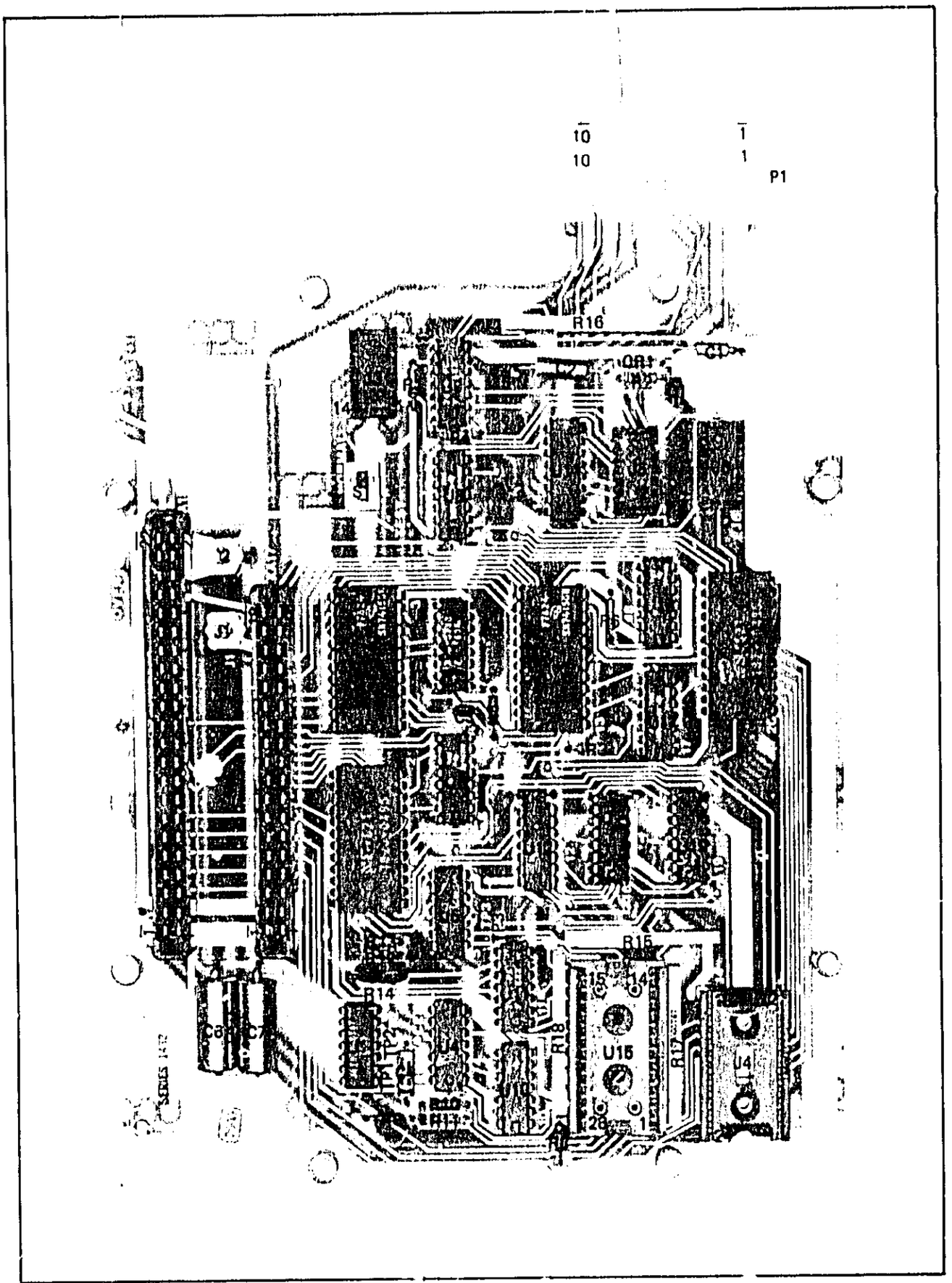


Figure 8-19. A18 Counter Assembly



Part of Figure 8-20. A19 Processor Assembly, A23 Resolution Switch Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A19
C1-7
CR1
J1-6
Q1
R1-18
S1
U1-20
XA17-18
XU15

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1	1901-0040	1901-0040
Q1	1854-0071	1854-0071
U1	1820-0567	MC4024P
U2, 20	1820-0495	9311DC
U3, 13	1820-0640	SN74150N
U4	1820-0077	SN7474N
U5	1820-0583	DM74L00N
U6	1820-1089	SN74279N
U7	1820-0730	96L02DC
U8, 17	1820-0054	SN7400N
U9, 11	1820-1053	SN7414N
U10	1820-0598	DM74L86N
U12	1820-0586	DM74L04N
U14	1820-1255	DM8098N
U15	1818-2246	1818-2246
U15 Opt 003	1818-2249	1818-2249
U16, 19	1820-0778	93L16DC
U18	1820-0069	SN7420N
U20	1820-0495	9311DC

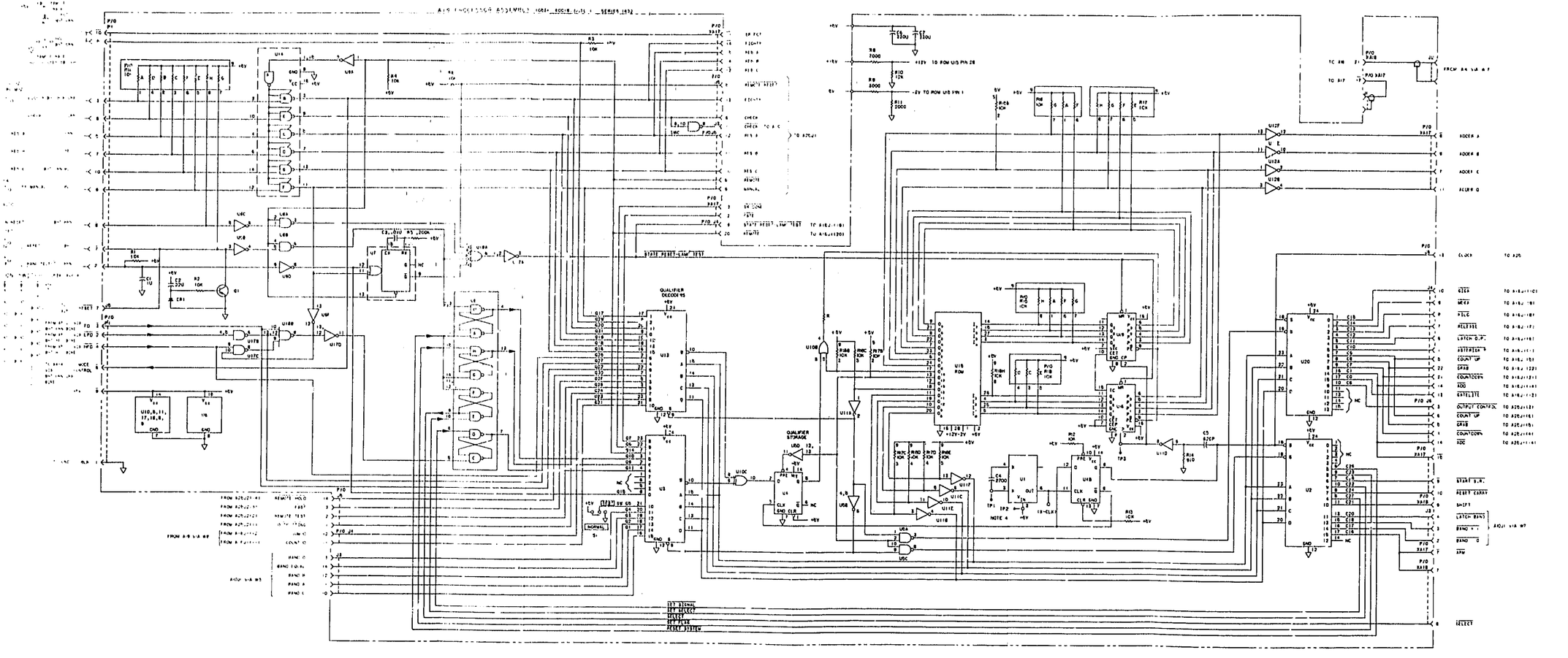
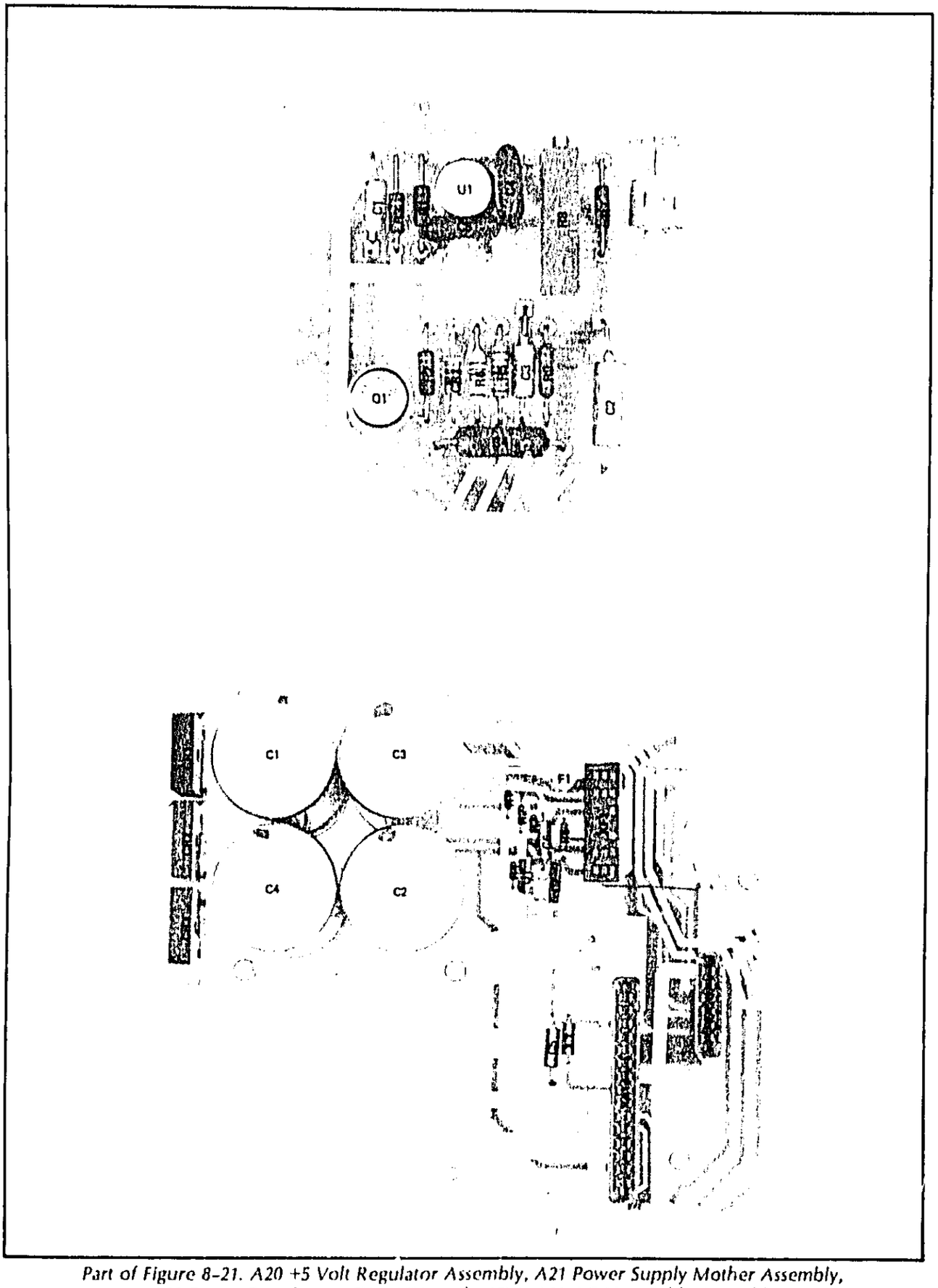
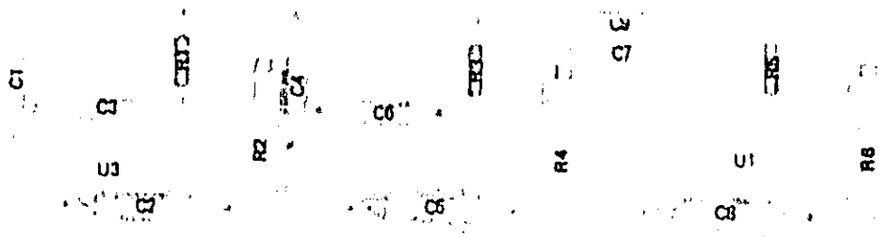


Figure 8-20. A19 Processor Assembly, A23 Resolution Switch Assembly



Part of Figure 8-21. A20 +5 Volt Regulator Assembly, A21 Power Supply Mother Assembly, A22 Power Regulator (-5V, -15V, and +15V), A31 AC Line Cable Assembly



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A20	A21	A22	A31
C1-5	C1-7	C1-9	S1
CR1	CR1-3	R1-6	W1
F1	F1		
Q1	J1		
R1-9	U1		
U1	XA14		
	XA20		
	XF1		
	XK1		

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A20		
CR1	1902-3104	SZ 10939-110
Q1	1853-0037	1853-0037
U1	1820-0247	LM305
A21		
CR1-3	1901-0638	1901-0638
UI	1826-0099	7812UC

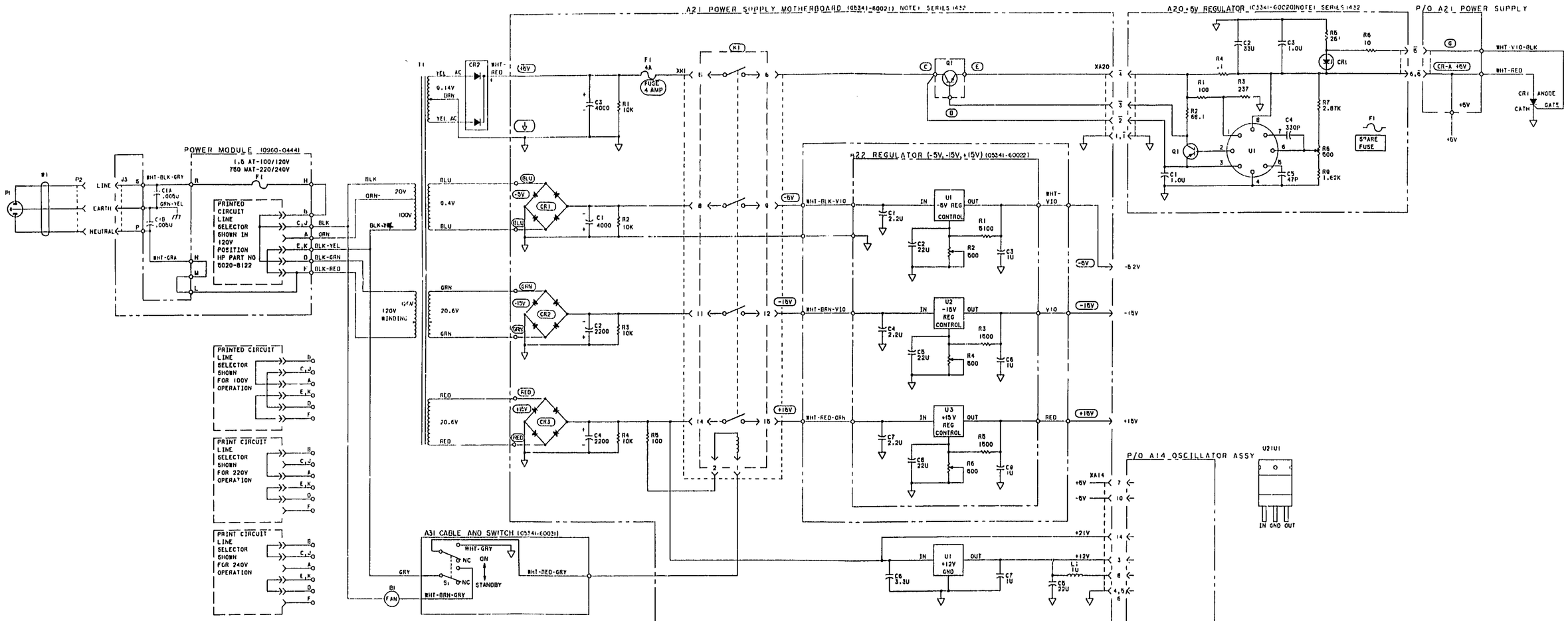
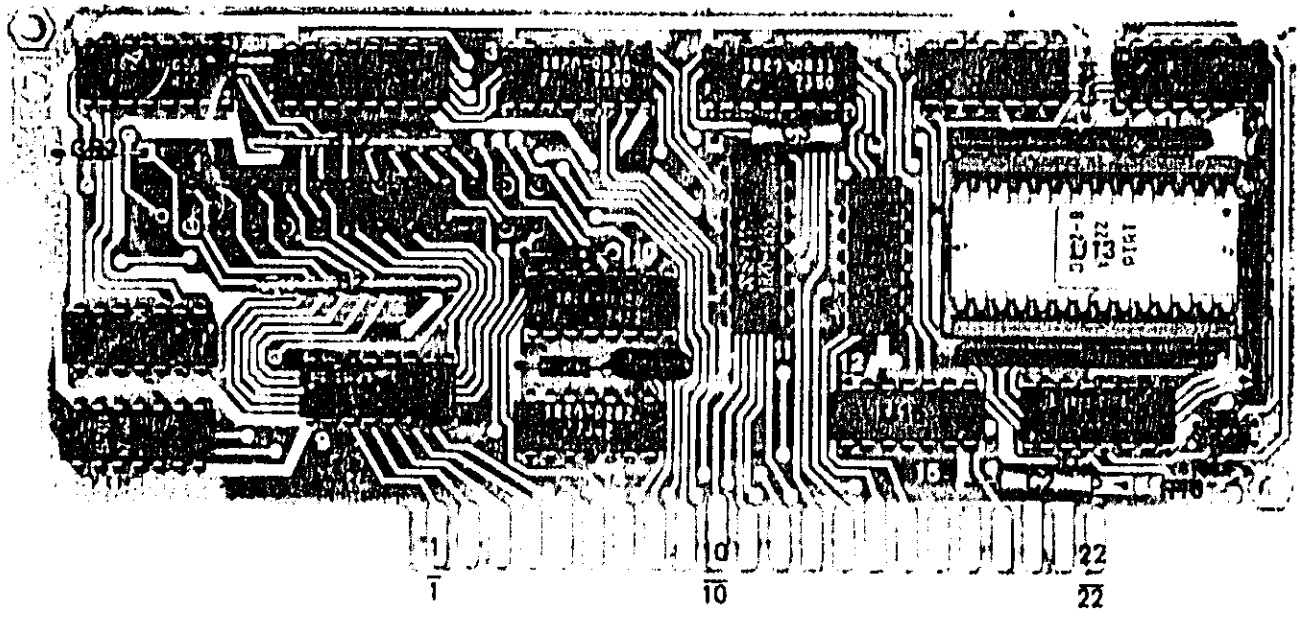


Figure 8-21. A20 +5 Volt Regulator Assembly, A21 Power Supply Motherboard Assembly, A22 Power Regulator (-5V, -15V, and +15V), A31 AC Line Cable Assembly



Part of Figure 8-22. A24 Option 011 Remote Address Switch, A26 Option 011 ASCII Input Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES

REFERENCE DESIGNATIONS

A24
J1 S1-6
A26
C1-4 CR1, 2 J1 R1-12 U1-16 XU13

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A26		
CR1, 2	1901-0040	1901-0040
U1, 10	1820-0658	93L12DC
U2	1820-1047	DM74L42AN
U3, 4	1820-0833	9334DC
U5	1820-0586	DM74L04N
U6, 16	1820-0778	93L16DC
U7, 12	1820-0583	DM74L00N
U8	1820-0621	SN7438N
U9	1820-0904	93L24DC
U11	1820-1255	DM8038N
U13	1818-2247	1818-2247
U14	1820-0282	SN7486N
U15	1820-0596	DM74L74N

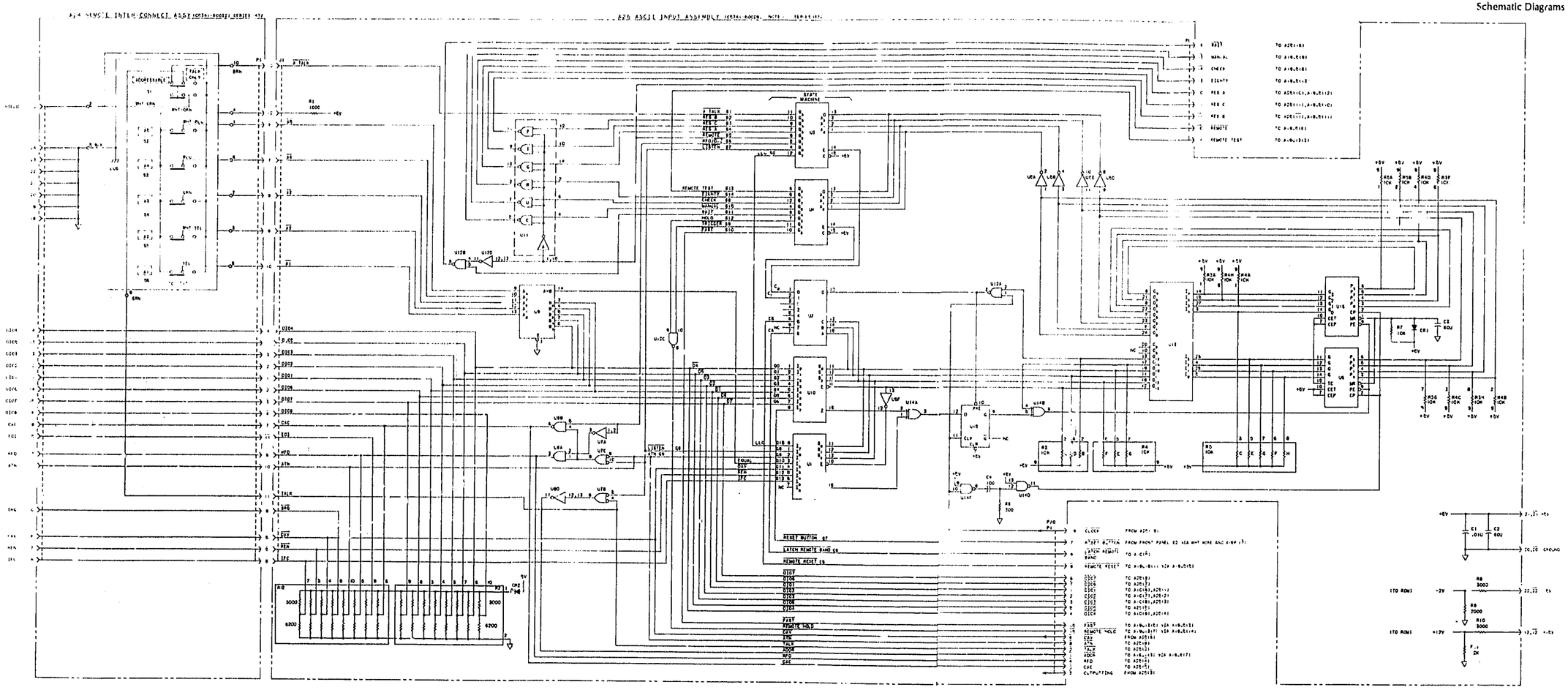
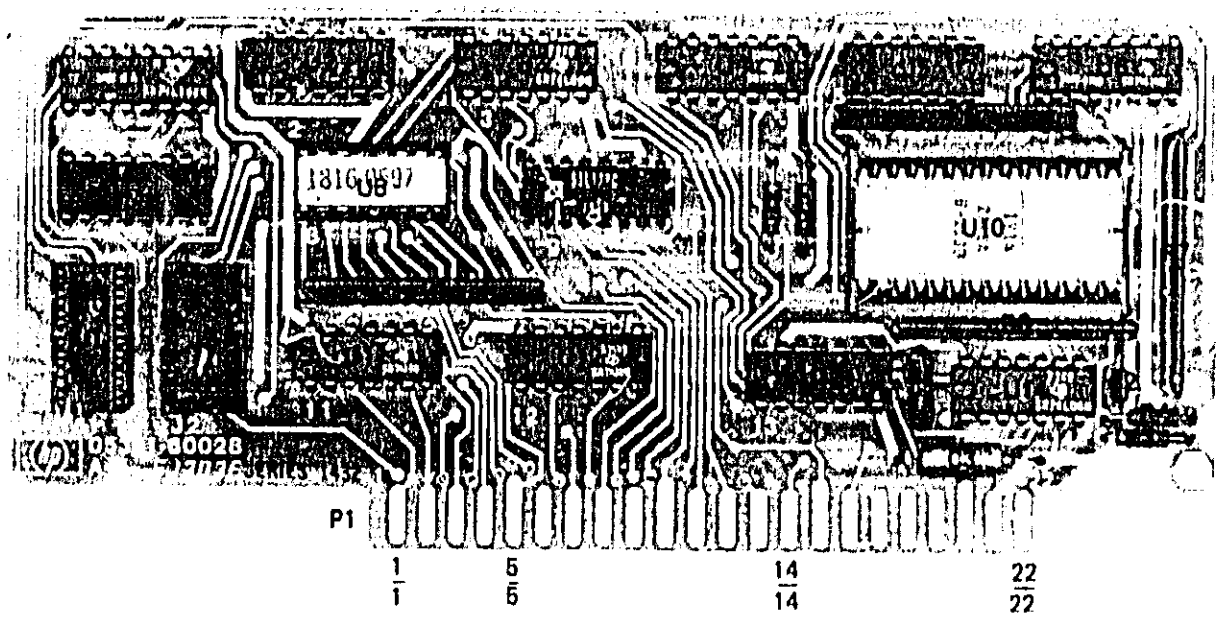


Figure 8-22. A24 Option 011 Remote Address Swit :h, A26 Option 011 ASCII Input Assembly



Part of Figure 8-23. A25 Option 011 Remote Output Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A25
C1-3
J1-2
R1-8
U1-14
XU8
XU10

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
U1	1820-0911	SN74L192N
U2	1820-0511	SN7408N
U3, 14	1820-0583	DM74L00N
U4	1820-1053	SN7414N
U5, 13	1820-0596	DM74L74N
U6	1820-0788	SN74174N
U7	1820-0628	SN7489N
U8	1820-0597	1820-0597
U9	1820-0658	93L12DC
U10	1820-2248	1820-2248
U11, 12	1820-0621	SN7438N

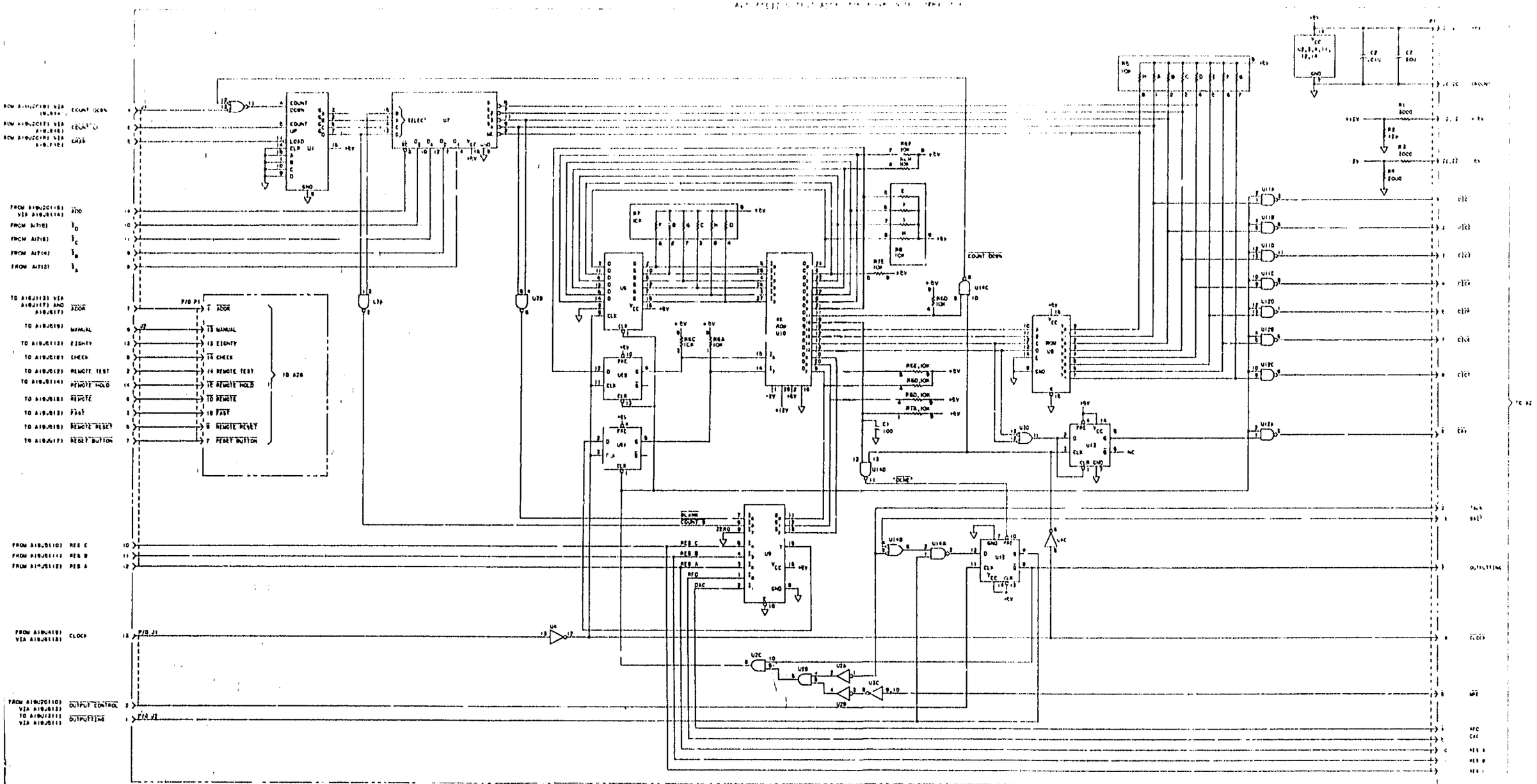


Figure 8-23. A25 Option 011 Remote Output Assembly

MANUAL CHANGES

MANUAL DESCRIPTION

INSTRUMENT: 5341A Frequency Counter
Operating and Service Manual
SERIAL PREFIX: 1632A

DATE PRINTED: JULY 1977
HP PART NO: 05341-90005
MICROFICHE NO: 05341-90006

CHANGE DATE April 17, 1980

(This change supercedes all earlier dated changes)

- Make all changes listed as ERRATA.
- Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL	IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL
1748A	1	1920A	1,2,3,4,5
1804A	1, 2	1936A	1,2,3,4,5,6
1840A	1, 2, 3	■2020A	1,2,3,4,5,6,7
1904A	1, 2, 3, 4		

■NEW OR REVISED ITEM

The following Service Notes are available from your local HP Sales and Service Office.

Service Note No.	Description
5341A-2	Revision of Adjustment Procedures for A5 IF Board and A4 Prescaler Board
5341A-3	Application Problems Under High Input Signal Levels
5341A-4	Miswired Address Switches on 5341A With HP-IB Option (Opt. 011)
5341A-5	A4 Part Replacement Information

ERRATA

Page iii, Table of Contents, Section II:
Add the following:

2-35. Installation of Option 003 1.5 GHz Frequency Range 2-6
2-38. Installation of Option 011 Remote Programming Output 2-7

Page 5-5, Paragraph 5-21, step 21 b. :
Change step "b." to the following:
Place spectrum analyzer probe tip at XA9(7) with probe grounded at XA9(7).

Pages 6-5 and 6-6, Table 6-1, A1A1 (05341-60026) Replaceable Parts:
Change "Mfr Part Number" for A1A1CR3 to 1901-0639.

Add "MICROCIRCUIT, HYBRID" for Description of A1A1U1.

Add "IC LINEAR AMP" for description of A1A3U2.

Page 6-8, Table 6-1, A4 (05341-60004) Replaceable Parts:
Add "IC AMPLIFIER" for description of A4U4.

Page 6-8, Table 6-1, A4 (05341-60004) Replaceable Parts:
Add A4R33; 0698-3113; RESISTOR 100 5% .125W CC TC=270/+540; 01121; BB1015.

Page 8-13, Figure 8-9, A4 Schematic Diagram:
Add 100 ohm resistor A4R33 in series between A4U4 pin 10 and the +5V dc supply.

Page 8-41, Figure 8-23:
Change A25U8 in TABLE OF ACTIVE ELEMENTS from 1820-0597 to 1816-0597.

7920/2-8219/8249/8462/8641/9082-9112/9461-9595/7-8509

HEWLETT PACKARD

ERRATA (Cont'd)

Page 8-20, Part of Figure 8-13:
Replace A10 component locator illustration with corrected illustration in attached Figure 1.

Page 8-7, Figure 8-6:
Change A1A1U1 in TABLE OF ACTIVE ELEMENTS to 1813-0075.

Page 6-11, Table 6-1, A7 Replaceable Parts:
Add SERIES 1632 to "Description" for A7.

Page 8-17, Figure 8-11:
Change A7 series number (top of diagram) from 1504 to 1632.

Change "A7CR5, 6" in TABLE OF ACTIVE ELEMENTS to Part Number 1901-0518.

Page 5-7, Paragraph 5-30, step e:
Change step e to the following:
Adjust A2 "SPEC GEN LEVEL SET" for a -16 dBm 4 GHz . . . . . .

Page 5-8, Paragraph 5-30, step f:
Change the second sentence in step f to the following:
------ repeat procedure with 4 GHz level set to no lower than -18 dBm.

Page 6-16, Table 6-1, A13 (05341-60013) Replaceable Parts:
Change A13XA3A, XA3B, and XA12 from HP Part No. 1251-0478 to 1251-0472; Mfr Code to 28480; Mfr Part Number to 1251-0472.

Change A13XA4 through XA11 from HP Part No. 1251-1886 to 1251-2035; Mfr Code to 28480; Mfr Part Number to 1251-2035.

Change 22 contact connector under "A13 MISCELLANEOUS" from 1251-1887 to 1251-1365; Mfr Code to 28480; Mfr Part Number to 1251-1887.

Change 18 contact connector under "A13 MISCELLANEOUS:: from 1251-2134 to 1251-2026; Mfr Code to 28480; Mfr Part Number to 1251-2134.

Page 8-15, Figure 8-10, A5 Schematic Diagram:
Change TABLE OF ACTIVE ELEMENTS as follows:

REF. DES.	HP PART NO.	MFR OR INDUSTRY PART NO.
CR1, 5, 7	1901-0639	1901-0639
CR2, 3	05341-80005	05341-80005 MATCHED PAIR
CR4, 6, 8	1901-0535	1901-0535
CR9, 10	05341-80005	05341-80005 MATCHED PAIR
U1	1826-0081	LM 318H
U2	1826-0138	LM 339N
U3	1826-0172	LM 308N
U4, U5	1826-0230	1826-0230

Page 6-20, Table 6-1, A22 Replaceable Parts:
Add A22U1; 1826-0117; IC 7812 V RGLTR; 0223G; 7812KC.
Add A22U2; 1826-0123; IC V RGLTR; 0340F; LM320K-12.
Add A22U3; 1826-0202; IC V RGLTR; 0340F; LM320K-5.

NOTE – The above three integrated circuits are also listed on page 6-25.

Page 8-37, Figure 8-21, A22 Schematic Diagram:
Change reference designator for "-5V REG" from U1 to U3.
Change reference designator for "+15V REG" from U3 to U1.

ERRATA (Cont'd):

SECTION VII MANUAL CHANGES

Page 7-1, Paragraph 7-4:
Change 1604A to 1632A.

Page 7-1, Paragraph 7-8:
Change 1604A to 1632A.

Change backdating table to the following:

SERIAL PREFIX	BACKDATING CHANGE
1432A	1, 2, 3, 4, 5
1440A	2, 3, 4, 5
1604A	3, 4, 5
1632A	4, 5
1648A	5

Page 7-2, Manual Backdating Changes:
Add the following:

BACKDATING CHANGE 3 (1440A thru 1604A)

Pages 6-5 and 6-6, Table 6-1:
Change A1A2 series number to 1432.

Add A1A2CR4; 1902-3182; 1; DIODE-ZNR 12.1V 5% DO-7 PD = 400 mW.

Change A1A2R13 to 0686-2405; RESISTOR 24 OHM 5% .5W CC TUBULAR.

Page 8-7, Figure 8-6:
Change A1A2 series number to 1432.

Add A1A2CR4 in parallel with A1A2C12. Connect cathode of this breakdown diode to the junction of A1A2R13 and A1A2C12.

Change A1A2R13 to 24 ohms and change dc output from "+13.5 to +14V" to "+12V".

BACKDATING CHANGE 4 (1440A thru 1632A)

Pages 6-7 and 6-8, Table 6-1:
Change A4 from SERIES 1648 to SERIES 1604.

Change A4R21 to 0698-5180; RESISTOR 2000 OHM 5% .125W CC TUBULAR; 01121; BB2025.

Delete A4R33 resistor HP Part No. 0698-3113.

Page 8-13, Figure 8-9:
Change A4 series number (top of diagram) to 1604.

Change A4R21 to 2000 ohms.

Delete asterisk (*) adjacent to A4R21.

Delete A4R (100Ω) and connect +5V dc supply directly to A4U4 pin 10.

Pages 6-8 and 6-9, Table 6-1:
Change A5 series number to 1604.

Change A5R8 and R17 to 0683-1045; RESISTOR 100K 5% .25W CC TUBULAR; 01121; CB1045.

Change A5R31 to 2100-2674; RESISTOR VAR TRMR 500 10% C; 19701; ET50X501.

Page 8-15, Figure 8-10:
Change A5 series number (top of diagram) to 1604.

Change A5R31 to 500 ohms.

ERRATA (Cont'd):

SECTION VII MANUAL CHANGES (Cont'd)

BACKDATING CHANGE 4 (1440A thru 1532A) (Cont'd)

Page 6-23, Table 6-1, A24 Miscellaneous:
Change 0380-0643 to 0380-1036.

The two mounting stubs for the Option 011 HP-IB connections, on A24 rear output assembly formerly used the 0380-1036 studs with 6-32 threads. These studs have a bright finish.

Metric hardware supplied by HP for HP-IB connectors can be identified by the black finish. Conversion kits for converting earlier instruments to use the metric lock screws are available through any HP Sales or Service Office.

CAUTION

THE THREADS OF THE METRIC HARDWARE WILL NOT FIT THE 6-32 UNC THREADS ON HARDWARE WITH A SILVER FINISH. THE THREADS WILL STRIP IF THE HARDWARE IS INTERMIXED.

BACKDATING CHANGE 5 (1440A thru 1548A)

Pages 6-5 and 6-6, Table 6-1:
Change "SERIES" number for A1 (05341-60001) Mixer Module and A1A1 (05341-60025) Input Switch Assembly to SERIES 1504.

Change A1A1U1 Part Number 1813-0075 in "HP" and "Mfr" columns to 1813-0044.

Pages 6-5 and 6-6, Tables 6-1: (Cont'd)
Change "SERIES" number for A1A3 (05341-60002) to SERIES 1504.

Change A1A3U2 Part Number 1813-0076 in "HP" and "Mfr" columns to 1813-0018.

Page 8-7, Figure 8-6:
Change SERIES number at top of schematics for A1, A1A1, and A1A3 to SERIES 1504.

Change A1A1U1 to 1813-0044 and A1A1U2 to 1813-0018 in TABLE OF ACTIVE ELEMENTS.

Page 6-11, Table 6-1:
Change A7 series number to 1504.

Change A7CR5 and A7CR6 Part Number 1901-0518 to 1901-0535.

NOTE: The 1901-0535 Schottky diode is recommended for replacement of CR5 and CR6 in all A7 circuit boards.

Page 8-17, Figure 8-11:
Change A7 series number to 1504.

Change "A7CR5, 6" in TABLE OF ACTIVE ELEMENTS to Part No. 1901-0535. See above NOTE.

Change symbol for A7CR5 and A7CR6 to the same symbol used for A7CR1, CR2, and CR3.

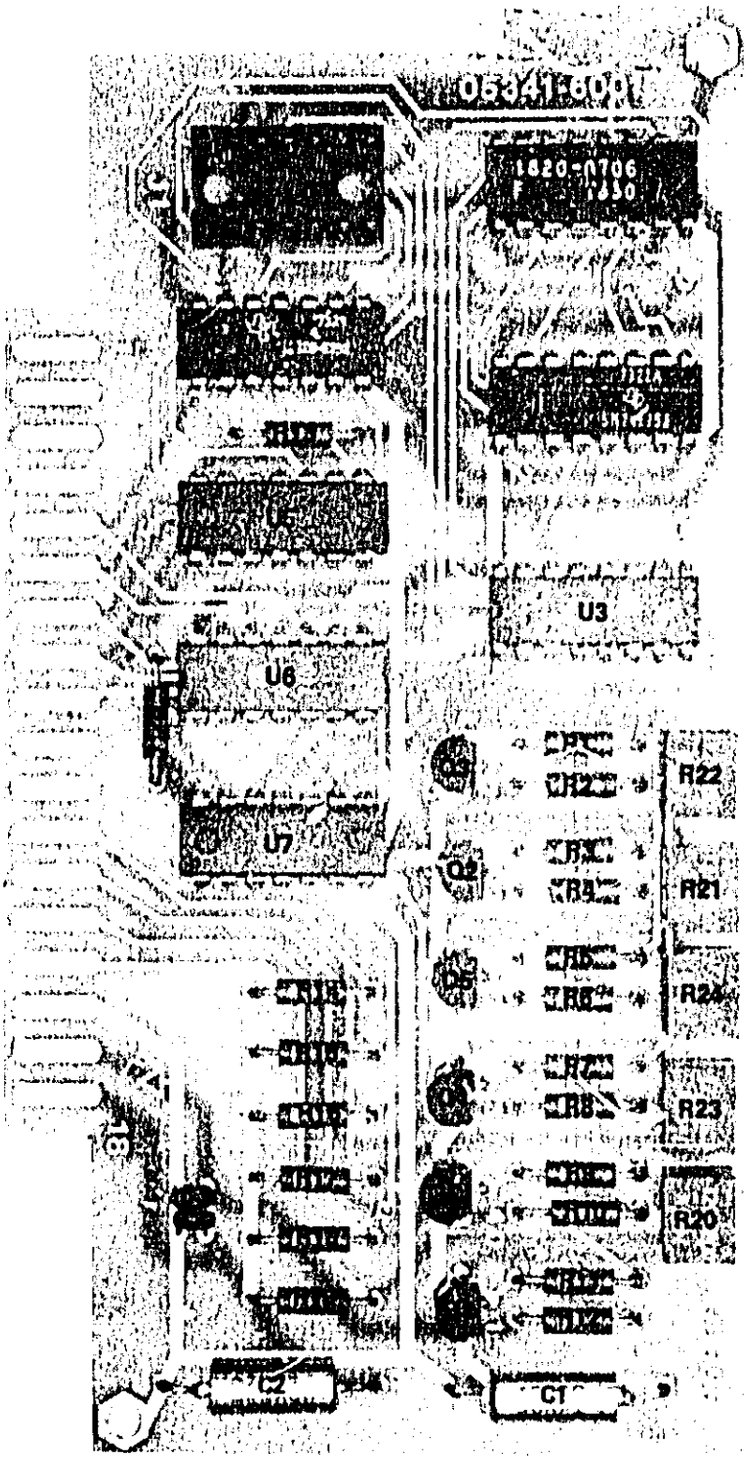


FIGURE 1. A10 BAND SELECTOR/SWITCH DRIVER ASSEMBLY

CHANGE 1 (1748A)

Page 6-17, Table 6-1, A16 (05341-60016) Replaceable Parts:
Add (SERIES 1748) to A16 Description.

Change A16U12 and U13 from 1820-0588 (74L20N) to 1820-1204; IC GATE TTL LS NAND DUAL 4-INP; 0169H; 74LS20N.

Page 8-29, Figure 8-17, A16 (05341-05341) Schematic Diagram:
Change A16 series number (left side of schematic) from 1432 to 1748.

Change Table of Active Elements for A16 by changing "U12, 13" to "1820-1204" and SN74LS20N.

CHANGE 2 (1804A)

Page 6-16, Table 6-1, A14 (05341-60047) Replaceable Parts:
Add (SERIES 1804) to A14 Description.

Change A14L1 from 9140-0179 to 9100-2430; COIL-MLD 220UH 10% Q=55 .156DX .375LG-NOM; 28480; 9100-2430.

Add A14C2; 0180-0552; CAPACITOR-FXD 220UF +-20% 10VDC TA; 28480; 0180-0552.

Page 8-27, Figure 8-16, A14 (05341-60047) Schematic Diagram:
Change series from 1432 to 1804.

Change L1 from 22U to 220UH.

Add C2 (220UF) between the junction of L1 and the TCXO, and circuit common with the negative lead to circuit common.

CHANGE 3 (1840A)

Page 6-21, Table 6-1, A31 (05341-60031) Replaceable Parts:
Change A31S1 from 3101-1694 to 3101-2269; SWITCH-TGL SUBMIN DPDT NS 3A 250VAC (AC ON/STANDBY); 28480; 3101-2269.

Instrument serial prefix changes from 1804A to 1840A with this switch change.

CHANGE 4 (1904A)

Page 6-8, Table 6-1, A5 (05341-60005) Replaceable Parts:
Change A5 series from 1548 to 1904.

Change A5C6 from 0160-3873 (4.7 pF) to 0121-0448; CAPACITOR-VAR TRMR-CER 2.5-5 PF 63V PC-MTG; 28480; 0121-0448.

Page 8-15, Figure 8-10, A5 Schematic Diagram:
Change A5 series number (top of diagram) from 1548 to 1904.

Change A5 C6 from a fixed 4.7 P capacitor to a variable "2.5-5P" capacitor and delete asterisk (*) adjacent to C6.

See NOTE in CHANGE 5.

CHANGE 5 (1920A)

Page 6-19, Table 6-1, A19 (05341-60019) Replaceable Parts:
Add (SERIES 1932) to A19 Description.

Change A19S1 from 3101-1341 to 3101-2039; SWITCH-SL SPDT SUB-MIN 0.3A 125VAC; 28480; 3101-2039.

Page 6-8, Table 6-1, A4 Replaceable Parts:
Add A4U4*; 1826-0085 IC WIDE-BAND AMPLIFIER; 28480; 1826-0085.

NOTE – The 1826-0085 IC is used as a factory substitution for 1826-0297. Capacitors A4C3 and A4C4 must be added when the 1826-0085 is used for A4U4. Some instruments with serial prefix 1904A also have the 1826-0085 IC used as a factory substitute for 1826-0297.

The 1826-0297 IC is the recommended replacement part for all instruments. Capacitors A4C3 and A4C4 may or may not be required to eliminate oscillations. See Note 4 in Figure 8-9 of the Operating and Service Manual.

CHANGE 6 (Serial Prefix 1936A)

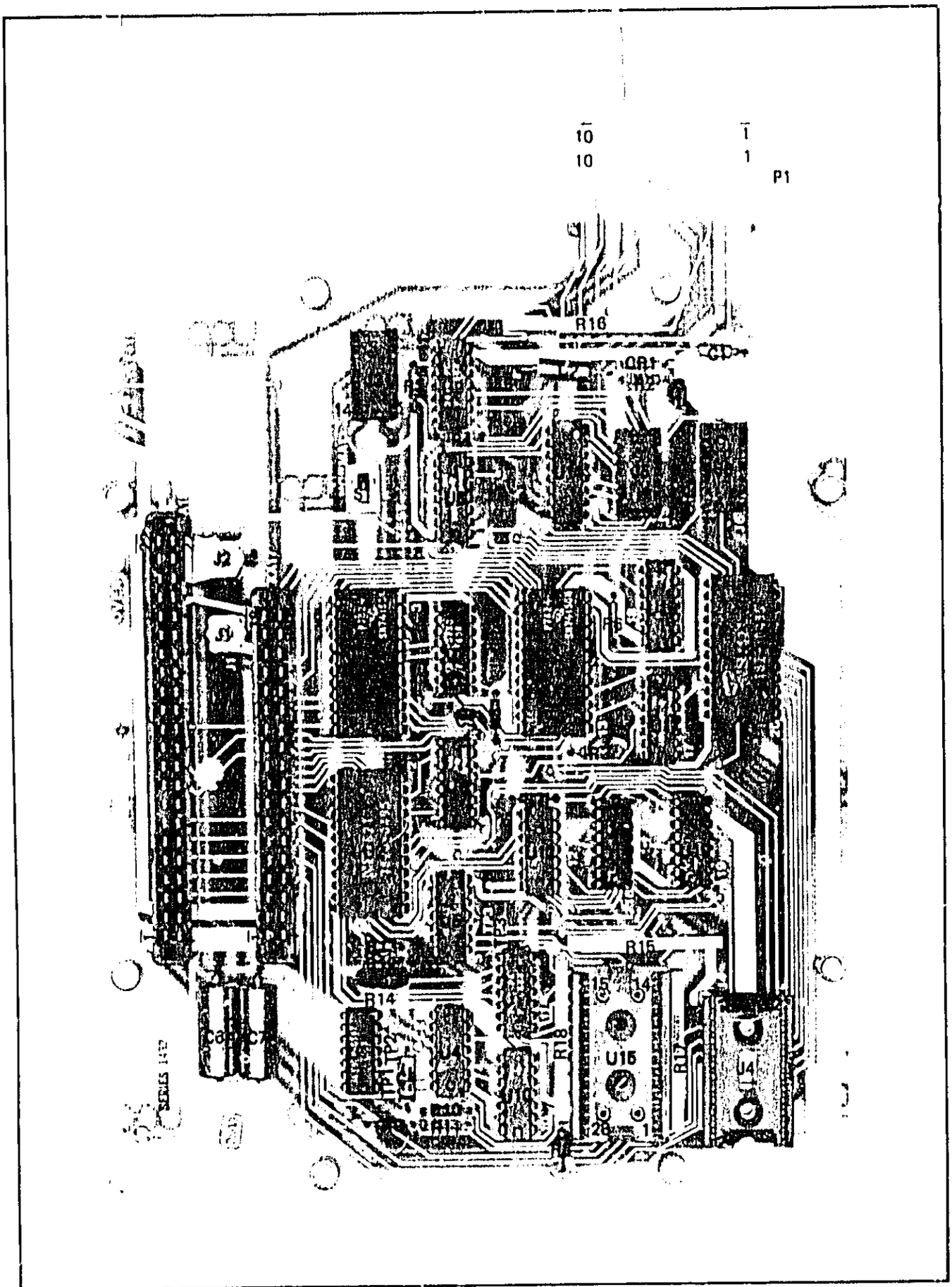
Page 6-25, Table 6-1, Replaceable Parts:
Change S2 and S6 from 3101-1216 to 3101-0062 in "HP" and "Mfr Part Number" columns.
Delete C1A and C1B HP Part No. 0160-3043 and change Description to NOT ASSIGNED.
Add C2 and C3; 0160-4439; CAPACITOR-FXD 4700PF ±20% 250VAC (RMS) CER; 28480; 0160-4439.

Page 8-37, Figure 8-21, Schematic Diagram:
Change C1A to C2 with a value of 4700PF.
Change C1B to C3 with a value of 4700 PF.

■CHANGE 7

Page 6-20, Table 6-1, A21 Replaceable Parts:
Add A21F2; 2110-0540; FUSE 2A 125V .281 x .093 AXIAL LEADS; 28480; 2110-0540

Page 8-37, Figure 8-21, A21 Schematic Diagram:
Add A21F2 (2A) on circuit board A21 in series with the upper blue wire from T1 and the top of bridge rectifier A21CR1.
Change A21 series number to Serial Prefix Number for CHANGE 7.



Part of Figure 8-20. A19 Processor Assembly, A23 Resolution Switch Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A19
C1-7 CR1 J1-6 Q1 R1-18 S1 U1-20 XA17-18 XU15

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
CR1	1901-0040	1901-0040
Q1	1854-0071	1854-0071
U1	1820-0567	MC4024P
U2, 20	1820-0495	9311DC
U3, 13	1820-0640	SN74150N
U4	1820-0077	SN7474N
U5	1820-0583	DM74L00N
U6	1820-1089	SN74279N
U7	1820-0730	96L02DC
U8, 17	1820-0054	SN7400N
U9, 11	1820-1053	SN7414N
U10	1820-0598	DM74L86N
U12	1820-0586	DM74LC4N
U14	1820-1255	DM8098N
U15	1818-2246	1818-2246
U15 Opt 003	1818-2249	1818-2249
U16, 19	1820-0778	93L16DC
U18	1820-0069	SN7420N
U20	1820-0495	9311DC

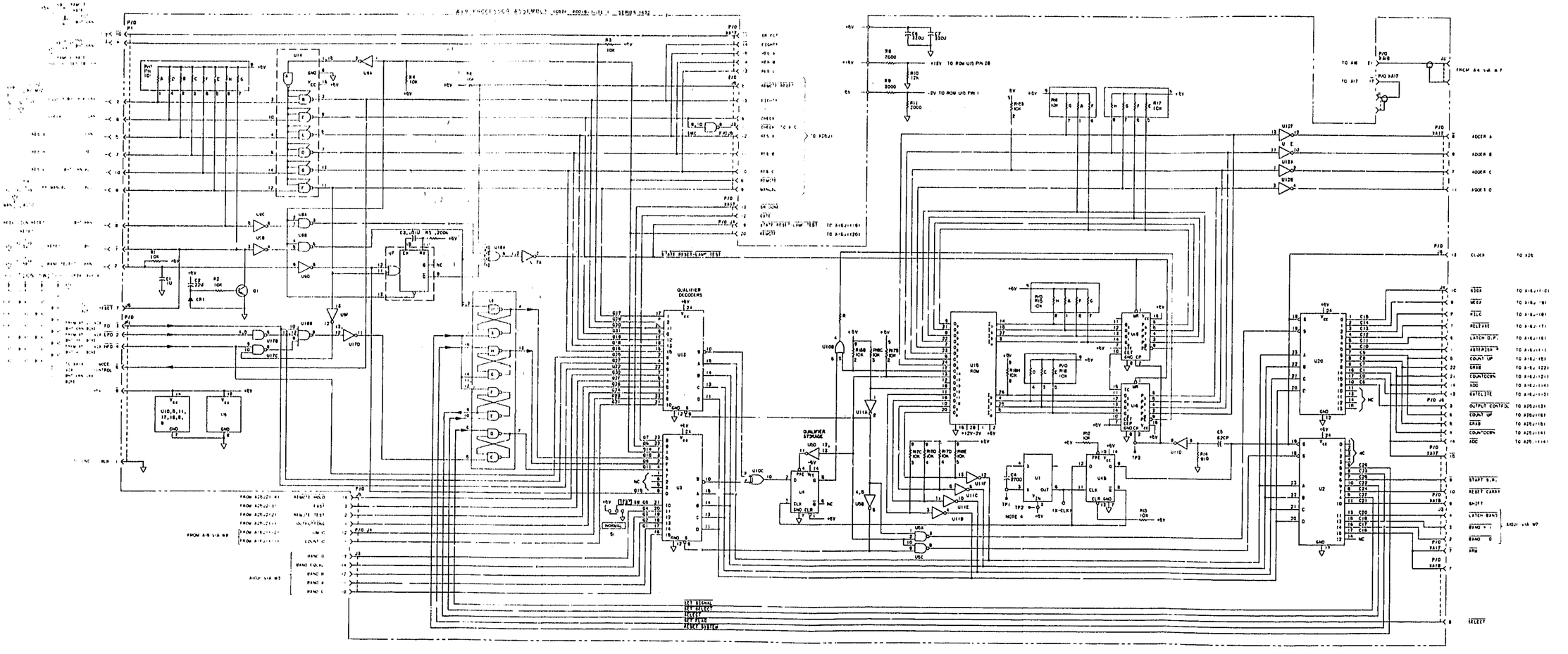
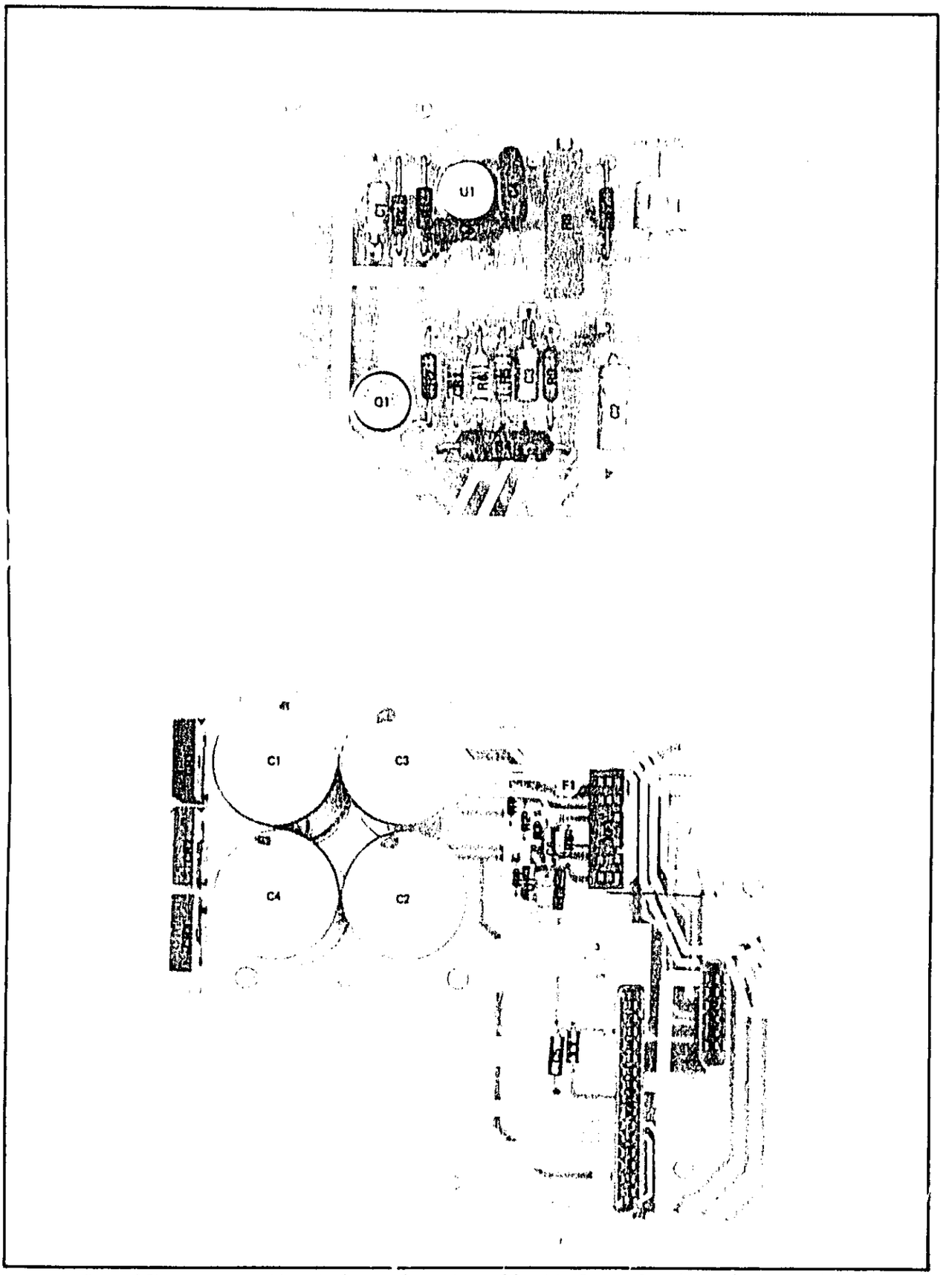
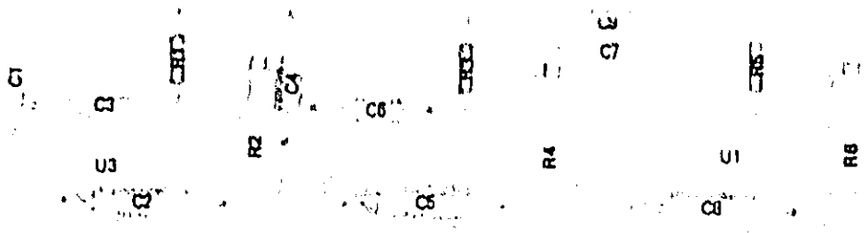


Figure 8-20. A19 Processor Assembly, A23 Resolution Switch Assembly



Part of Figure 8-21. A20 +5 Volt Regulator Assembly, A21 Power Supply Mother Assembly, A22 Power Regulator (-5V, -15V, and +15V), A31 AC Line Cable Assembly



NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES

REFERENCE DESIGNATIONS

A20	A21	A22	A31
C1-5	C1-7	C1-9	S1
CR1	CR1-3	R1-6	W1
F1	F1		
Q1	J1		
R1-9	U1		
U1	XA14		
	XA20		
	XF1		
	XK1		

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A20		
CR1 Q1 U1	1902-3104 1853-0037 1820-0247	SZ 10939-110 1853-0037 LM305
A21		
CR1-3 UI	1901-0638 1826-0099	1901-0638 7812UC

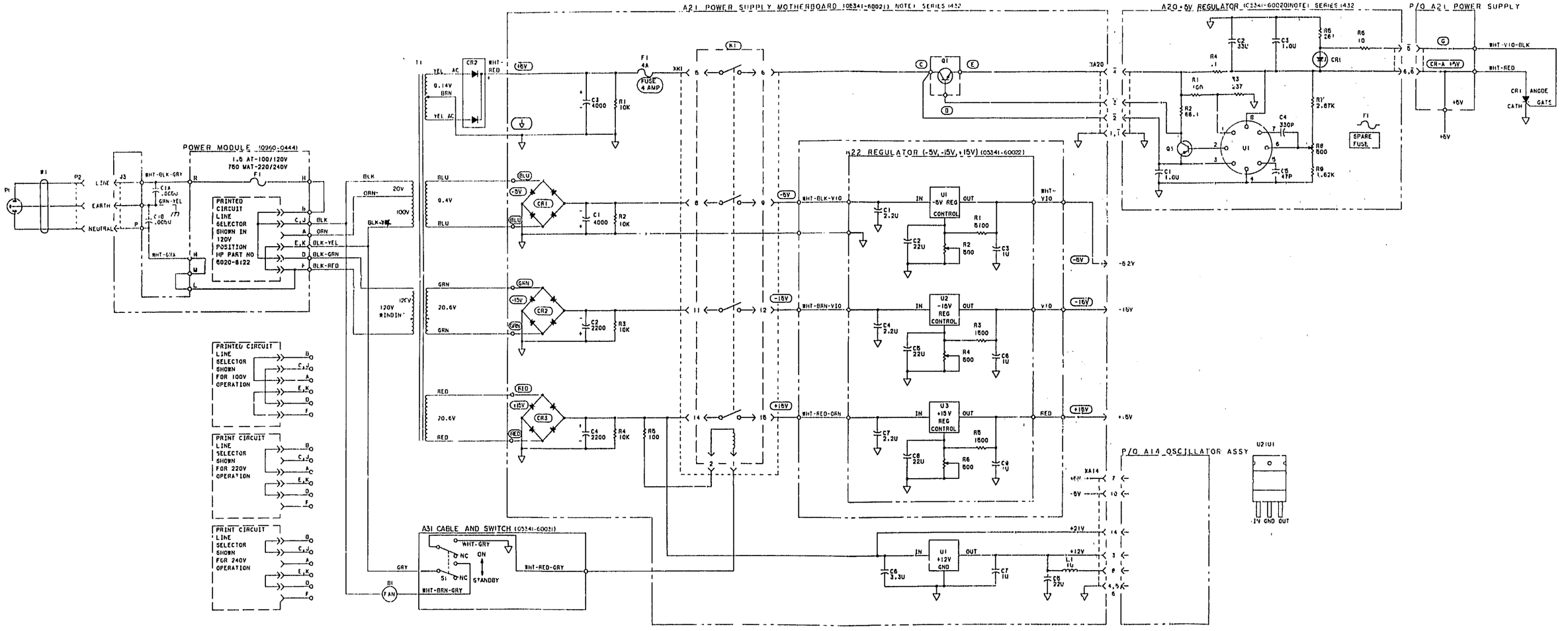
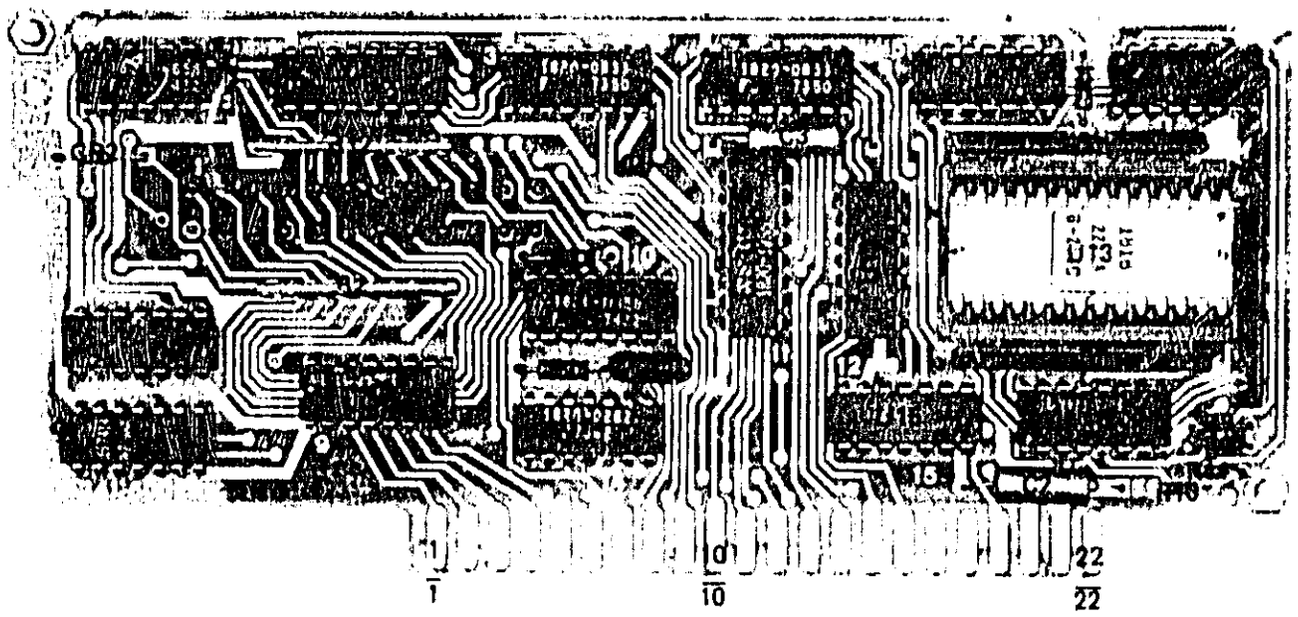


Figure 8-21. A20 +5 Volt Regulator Assembly, A21 Power Supply Motherboard Assembly, A22 Power Regulator (-5V, -15V, and +15V), A31 AC Line Cable Assembly



Part of Figure 8-22. A24 Option 011 Remote Address Switch, A26 Option 011 ASCII Input Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;
   INDUCTANCE IN MICROHENRIES

REFERENCE DESIGNATIONS

A24
J1 S1-6
A26
C1-4 CR1, 2 J1 R1-12 U1-16 XU13

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
A26		
CR1, 2	1901-0040	1901-0040
U1, 10	1820-0668	93L12DC
U2	1820-1047	DM74L42AN
U3, 4	1820-0833	9334DC
U5	1820-0586	DM74L04N
U6, 16	1820-0778	93L16DC
U7, 12	1820-0693	DM74L00N
U8	1820-0621	SN7438N
U9	1820-0904	93L24DC
U11	1820-1265	DM8096N
U13	1818-2247	1818-2247
U14	1820-0282	SN7486N
U15	1820-0696	DM74L74N

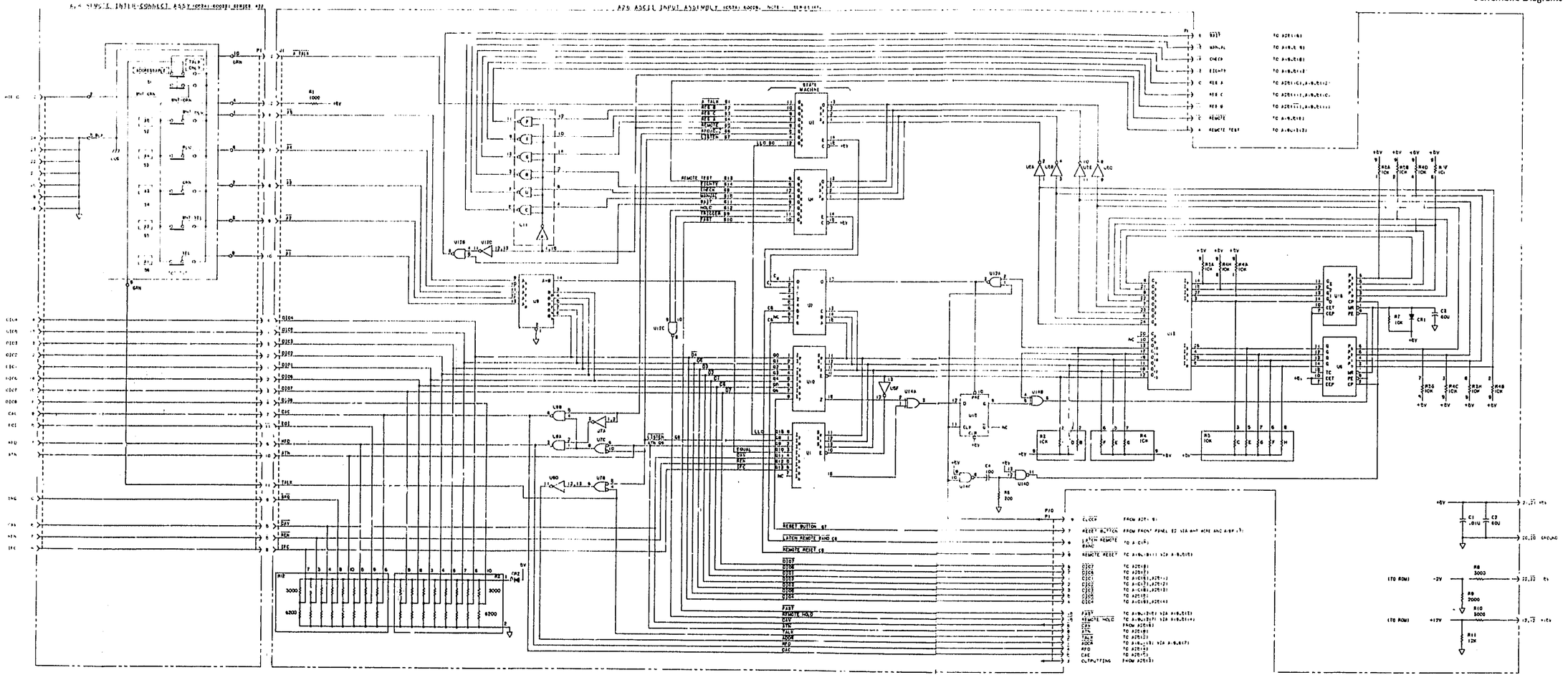
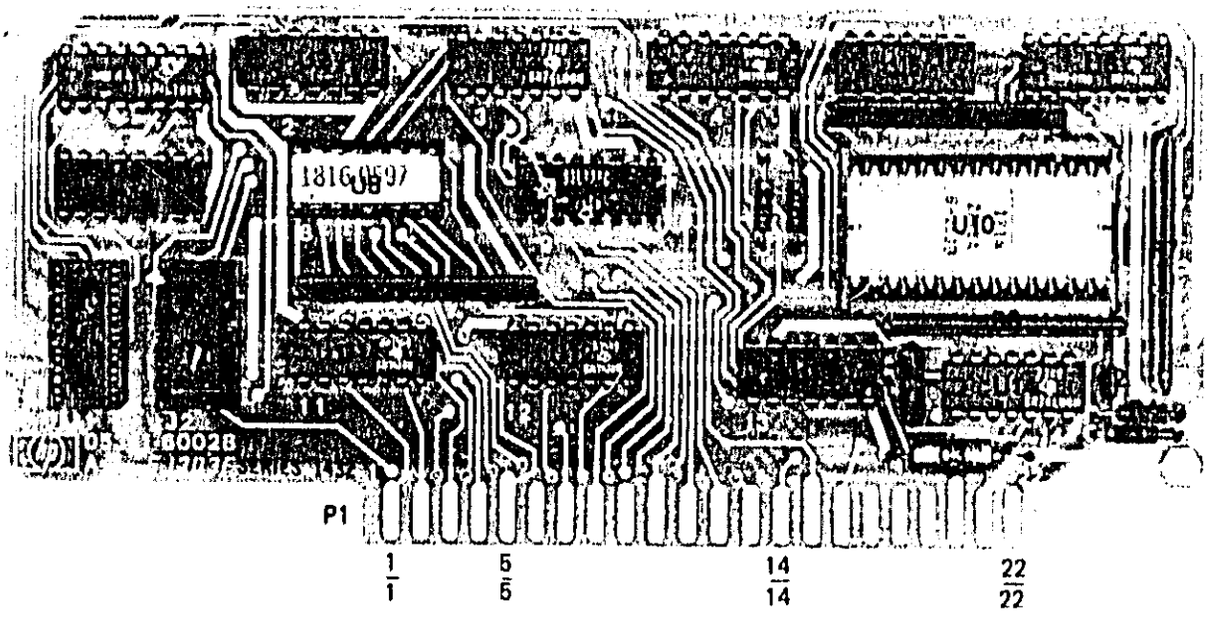


Figure 8-22. A24 Option 011 Remote Address Switch, A26 Option 011 ASCII Input Assembly



Part of Figure 8-23. A25 Option 011 Remote Output Assembly

NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN FARADS;
   INDUCTANCE IN HENRIES
3. ASTERISK (*) INDICATES SELECTED COMPONENT, AVERAGE VALUES SHOWN

REFERENCE DESIGNATIONS

A25
C1-3
J1-2
R1-8
U1-14
XU8
XU10

TABLE OF ACTIVE ELEMENTS

REF. DES.	HP PART NO.	MFG OR INDUSTRY PART NUMBER
U1	1820-0911	SN74L192N
U2	1820-0511	SN7408N
U3, 14	1820-0583	DM74L00N
U4	1820-1053	SN7414N
U5, 13	1820-0596	DM74L74N
U6	1820-0788	SN74174N
U7	1820-0628	SN7489N
U8	1820-0597	1820-0597
U9	1820-0658	93L12DC
U10	1820-2248	1820-2248
U11, 12	1820-0621	SN7438N

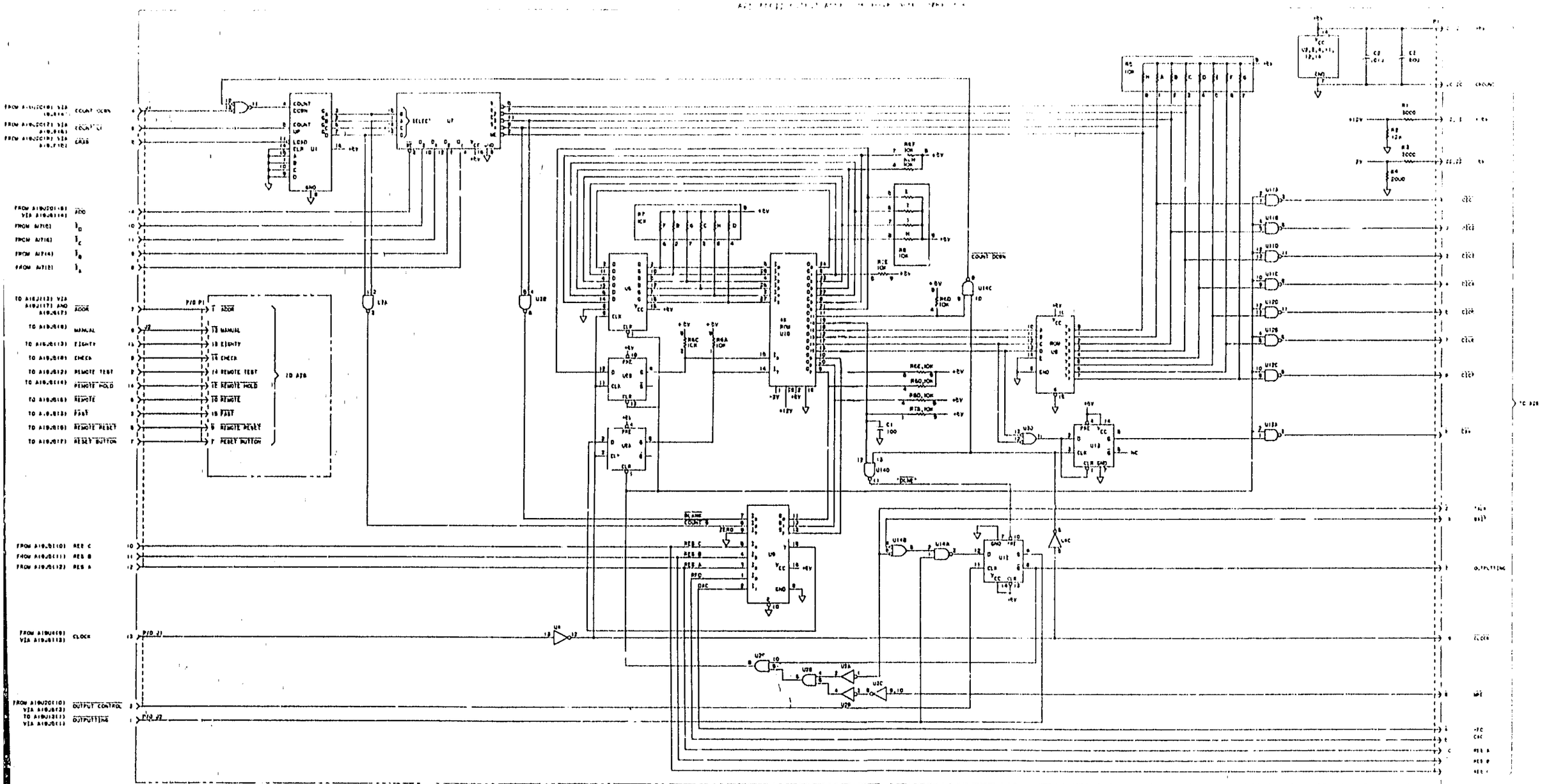


Figure 8-23. A25 Option 011 Remote Output Assembly

MANUAL CHANGES

MANUAL DESCRIPTION

INSTRUMENT: 5341A Frequency Counter
Operating and Service Manual
SERIAL PREFIX: 1632A

DATE PRINTED: JULY 1977
HP PART NO: 05341-90005
MICROFICHE NO: 05341-90006

CHANGE DATE April 17, 1980

(This change supercedes all earlier dated changes)

- Make all changes listed as ERRATA.
- Check the following table for your instrument's serial prefix or serial number and make listed change(s) to manual.

IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL	IF YOUR INSTRUMENT HAS SERIAL PREFIX OR SERIAL NUMBER	MAKE THE FOLLOWING CHANGES TO YOUR MANUAL
1748A	1	1920A	1,2,3,4,5
1804A	1, 2	1936A	1,2,3,4,5,6
1840A	1, 2, 3	■2020A	1,2,3,4,5,6,7
1904A	1, 2, 3, 4		

■NEW OR REVISED ITEM

The following Service Notes are available from your local HP Sales and Service Office.

Service Note No.	Description
5341A-2	Revision of Adjustment Procedures for A5 IF Board and A4 Prescaler Board
5341A-3	Application Problems Under High Input Signal Levels
5341A-4	Misw red Address Switches on 5341A With HP-IB Option (Opt. 011)
5341A-5	A4 Part Replacement Information

ERRATA

Page iii, Table of Contents, Section II:
Add the following:

2-35. Installation of Option 003 1.5 GHz Frequency Range 2-6
2-38. Installation of Option 011 Remote Programming Output 2-7

Page 5-5, Paragraph 5-21, step 21 b. :
Change step "b." to the following:
Place spectrum analyzer probe tip at XA8(7) with probe grounded at XA8(7).

Pages 6-5 and 6-6, Table 6-1, A1A1 (05341-60025) Replaceable Parts:
Change "Mfr Part Number" for A1A1CR3 to 1901-0639.

Add "MICROCIRCUIT, HYBRID" for Description of A1A1U1.

Add "IC LINEAR AMP" for description of A1A3U2.

Page 6-8, Table 6-1, A4 (05341-60004) Replaceable Parts:
Add "IC AMPLIFIER" for description of A4U4.

Page 6-8, Table 6-1, A4 (05341-60004) Replaceable Parts:
Add A4R33; 0698-3113; RESISTOR 100 5% .125W CC TC=270/+540; 01121; CB1015.

Page 8-13, Figure 8-9, A4 Schematic Diagram:
Add 100 ohm resistor A4R33 in series between A4U4 pin 10 and the +5V dc supply.

Page 8-41, Figure 8-23:
Change A25U8 in TABLE OF ACTIVE ELEMENTS from 1820-0597 to 1816-0597.

7920/2-8218/8249/8462/8641/9082-9112/9461-9595/7-9509

HEWLETT PACKARD

ERRATA (Cont'd)

Page 8-20, Part of Figure 8-13:
Replace A10 component locator illustration with corrected illustration in attached Figure 1.

Page 8-7, Figure 8-6:
Change A1A1U1 in TABLE OF ACTIVE ELEMENTS to 1813-0075.

Page 6-11, Table 6-1, A7 Replaceable Parts:
Add SERIES 1632 to "Description" for A7.

Page 8-17, Figure 8-11:
Change A7 series number (top of diagram) from 1504 to 1632.

Change "A7CR5, 6" in TABLE OF ACTIVE ELEMENTS to Part Number 1901-0518.

Page 5-7, Paragraph 5-30, step e:
Change step e to the following:
Adjust A2 "SPEC GEN LEVEL SET" for a -16 dBm 4 GHz . . . . . .

Page 5-8, Paragraph 5-30, step f:
Change the second sentence in step f to the following:
------ repeat procedure with 4 GHz level set to no lower than -16 dBm.

Page 6-16, Table 6-1, A13 (05341-60013) Replaceable Parts:
Change A13XA3A, XA3B, and XA12 from HP Part No. 1251-0478 to 1251-0472; Mfr Code to 28480; Mfr Part Number to 1251-0472.

Change A13XA4 through XA11 from HP Part No. 1251-1886 to 1251-2035; Mfr Code to 28480; Mfr Part Number to 1251-2035.

Change 22 contact connector under "A13 MISCELLANEOUS" from 1251-1887 to 1251-1365; Mfr Code to 28480; Mfr Part Number to 1251-1887.

Change 18 contact connector under "A13 MISCELLANEOUS:: from 1251-2134 to 1251-2026; Mfr Code to 28480; Mfr Part Number to 1251-2134.

Page 8-15, Figure 8-10, A5 Schematic Diagram:
Change TABLE OF ACTIVE ELEMENTS as follows:

REF. DES.	HP PART NO.	MFR OR INDUSTRY PART NO.
CR1, 5, 7	1901-0639	1901-0639
CR2, 3	05341-80005	05341-80005 MATCHED PAIR
CR4, 6, 8	1901-0535	1901-0535
CR9, 10	05341-80005	05341-80005 MATCHED PAIR
U1	1826-0081	LM 318H
U2	1826-0138	LM 339N
U3	1826-0172	LM 308N
U4, U5	1826-0230	1826-0230

Page 6-20, Table 6-1, A22 Replaceable Parts:
Add A22U1; 1826-0117; IC 7812 V RGLTR; 0223G; 7812KC.
Add A22U2; 1826-0123; IC V RGLTR; 0340F; LM320K-12.
Add A22U3; 1826-0202; IC V RGLTR; 0340F; LM320K-5.

NOTE – The above three integrated circuits are also listed on page 6-25.

Page 8-37, Figure 8-21, A22 Schematic Diagram:
Change reference designator for "-5V REG" from U1 to U3.
Change reference designator for "+15V REG" from U3 to U1.

ERRATA (Cont'd):

SECTION VII MANUAL CHANGES

Page 7-1, Paragraph 7-4:
Change 1504A to 1632A.

Page 7-1, Paragraph 7-8:
Change 1504A to 1632A.

Change backdating table to the following:

SERIAL PREFIX	BACKDATING CHANGE
1432A	1, 2, 3, 4, 5
1440A	2, 3, 4, 5
1504A	3, 4, 5
1532A	4, 5
1548A	5

Page 7-2, Manual Backdating Changes:
Add the following:

BACKDATING CHANGE 3 (1440A thru 1504A)

Pages 6-5 and 6-6, Table 6-1:
Change A1A2 series number to 1432.

Add A1A2CR4; 1902-3182; 1; DIODE-ZNR 12.1V 5% DO-7 PD = 400 mW.

Change A1A2R13 to 0686-2405; RESISTOR 24 OHM 5% .5W CC TUBULAR.

Page 8-7, Figure 8-6:
Change A1A2 series number to 1432.

Add A1A2CR4 in parallel with A1A2C12. Connect cathode of this breakdown diode to the junction of A1A2R13 and A1A2C12.

Change A1A2R13 to 24 ohms and change dc output from "+13.5 to +14V" to "+12V".

BACKDATING CHANGE 4 (1440A thru 1532A)

Pages 6-7 and 6-8, Table 6-1:
Change A4 from SERIES 1548 to SERIES 1504.

Change A4R21 to 0698-5180; RESISTOR 2000 OHM 5% .125W CC TUBULAR; 01121; BB2025.

Delete A4R33 resistor HP Part No. 0698-3113.

Page 8-13, Figure 8-9:
Change A4 series number (top of diagram) to 1504.

Change A4R21 to 2000 ohms.

Delete asterisk (*) adjacent to A4R21.

Delete A4R (100Ω) and connect +5V dc supply directly to A4U4 pin 10.

Pages 6-8 and 6-9, Table 6-1:
Change A5 series number to 1504.

Change A5R8 and R17 to 0683-1045; RESISTOR 100K 5% .25W CC TUBULAR; 01121; CB1045.

Change A5R31 to 2100-2574; RESISTOR VAR TRMR 500 10% C; 19701; ET50X501.

Page 8-15, Figure 8-10:
Change A5 series number (top of diagram) to 1504.

Change A5R31 to 500 ohms.

ERRATA (Cont'd):

SECTION VII MANUAL CHANGES (Cont'd)

BACKDATING CHANGE 4 (1440A thru 1532A) (Cont'd)

Page 6-23, Table 6-1, A24 Miscellaneous:
Change 0380-0643 to 0380-1036.

The two mounting stubs for the Option 011 HP-IB connections, on A24 rear output assembly formerly used the 0380-1036 studs with 6-32 threads. These studs have a bright finish.

Metric hardware supplied by HP for HP-IB connectors can be identified by the black finish. Conversion kits for converting earlier instruments to use the metric lock screws are available through any HP Sales or Service Office.

CAUTION

THE THREADS OF THE METRIC HARDWARE WILL NOT FIT THE 6-32 UNC THREADS ON HARDWARE WITH A SILVER FINISH. THE THREADS WILL STRIP IF THE HARDWARE IS INTERMIXED.

BACKDATING CHANGE 5 (1440A thru 1548A)

Pages 6-5 and 6-6, Table 6-1:
Change "SERIES" number for A1 (05341-60001) Mixer Module and A1A1 (05341-60025) Input Switch Assembly to SERIES 1504.

Change A1A1U1 Part Number 1813-0075 in "HP" and "Mfr" columns to 1813-0044.

Pages 6-5 and 6-6, Tables 6-1: (Cont'd)
Change "SERIES" number for A1A3 (05341-60002) to SERIES 1504.

Change A1A3U2 Part Number 1813-0076 in "HP" and "Mfr" columns to 1813-0018.

Page 8-7, Figure 8-6:
Change SERIES number at top of schematics for A1, A1A1, and A1A3 to SERIES 1504.

Change A1A1U1 to 1813-0044 and A1A1U2 to 1813-0018 in TABLE OF ACTIVE ELEMENTS.

Page 6-11, Table 6-1:
Change A7 series number to 1504.

Change A7CR5 and A7CR6 Part Number 1901-0518 to 1901-0535.

NOTE: The 1901-0535 Schottky diode is recommended for replacement of CR5 and CR6 in all A7 circuit boards.

Page 8-17, Figure 8-11:
Change A7 series number to 1504.

Change "A7CR5, 6" in TABLE OF ACTIVE ELEMENTS to Part No. 1901-0535. See above NOTE.

Change symbol for A7CR5 and A7CR6 to the same symbol used for A7CR1, CR2, and CR3.

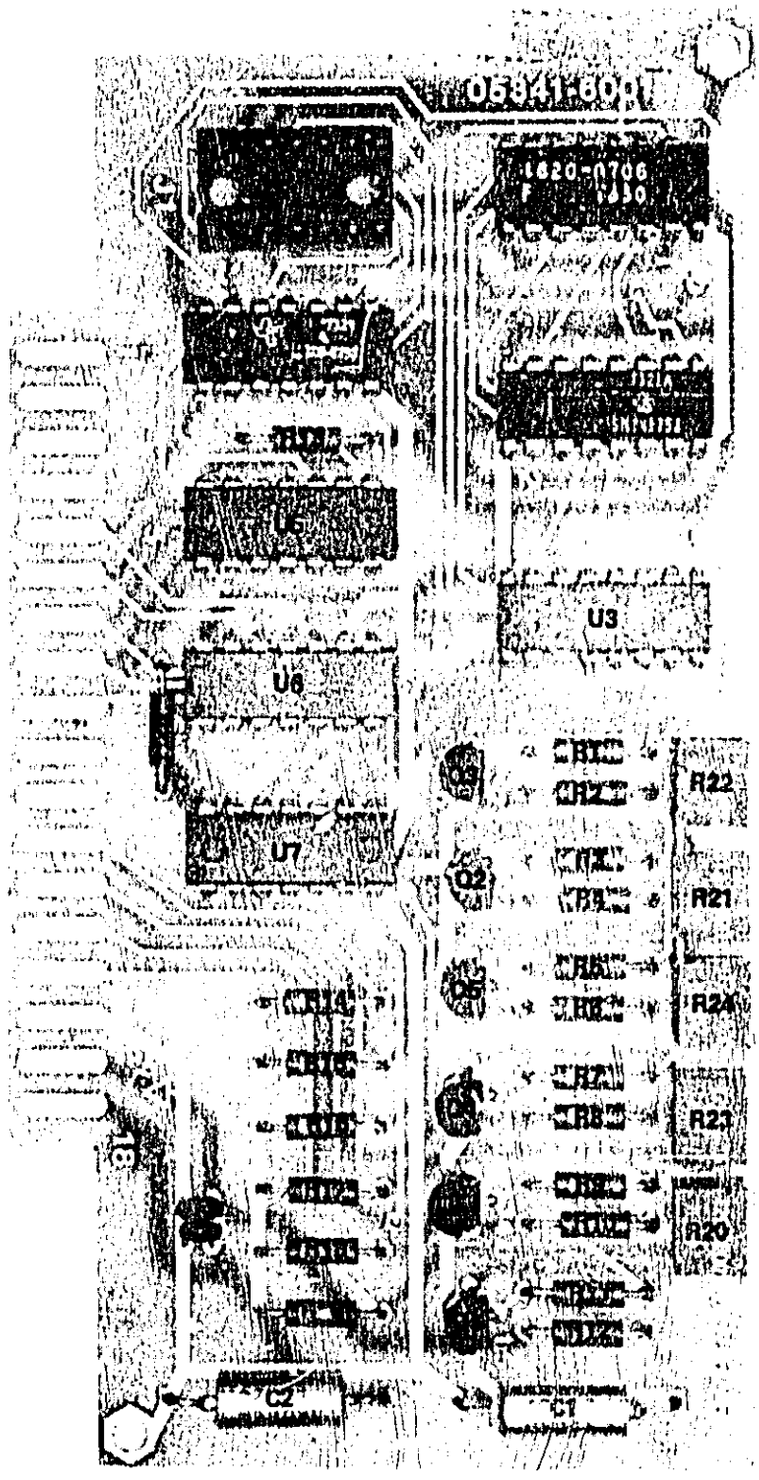


FIGURE 1. A10 BAND SELECTOR/SWITCH DRIVER ASSEMBLY

CHANGE 1 (1748A)

Page 6-17, Table 6-1, A16 (05341-60016) Replaceable Parts:
Add (SERIES 1748) to A16 Description.

Change A16U12 and U13 from 1820-0588 (74L20N) to 1820-1204; IC GATE TTL LS NAND DUAL 4-INP; 0169H; 74LS20N.

Page 6-29, Figure 8-17, A16 (05341-05341) Schematic Diagram:
Change A16 series number (left side of schematic) from 1432 to 1748.

Change Table of Active Elements for A16 by changing "U12, 13" to "1820-1204" and SN74LS20N.

CHANGE 2 (1804A)

Page 6-16, Table 6-1, A14 (05341-60047) Replaceable Parts:
Add (SERIES 1804) to A14 Description.

Change A14L1 from 9140-0179 to 9100-2430; COIL-MLD 220UH 10% Q=65 .156DX .375LG-NOM; 28480; 9100-2430.

Add A14C2; 0180-0562; CAPACITOR-FXD 220UF +-20% 10VDC TA; 28480; 0180-0562.

Page 8-27, Figure 8-16, A14 (05341-60047) Schematic Diagram:
Change series from 1432 to 1804.

Change L1 from 22U to 220UH.

Add C2 (220UF) between the junction of L1 and the TCXO, and circuit common with the negative lead to circuit common.

CHANGE 3 (1840A)

Page 6-21, Table 6-1, A31 (05341-60031) Replaceable Parts:
Change A31S1 from 3101-1694 to 3101-2269; SWITCH-TGL SUBMIN DPDT NS 3A 250VAC (AC ON/STANDBY); 28480; 3101-2269.

Instrument serial prefix changes from 1804A to 1840A with this switch change.

CHANGE 4 (1904A)

Page 6-8, Table 6-1, A5 (05341-60005) Replaceable Parts:
Change A5 series from 1548 to 1904.

Change A5C6 from 0160-3873 (4.7 pF) to 0121-0448; CAPACITOR-VAR TRMR-CER 2.5-5 PF 63V PC-MTG; 28480; 0121-0448.

Page 8-15, Figure 8-10, A5 Schematic Diagram:
Change A5 series number (top of diagram) from 1548 to 1904.

Change A5 C6 from a fixed 4.7 P capacitor to a variable "2.5-5P" capacitor and delete asterisk (*) adjacent to C6.

See NOTE in CHANGE 5.

CHANGE 5 (1920A)

Page 6-19, Table 6-1, A19 (05341-60019) Replaceable Parts:
Add (SERIES 1932) to A19 Description.

Change A19S1 from 3101-1341 to 3101-2039; SWITCH-SL SPDT SUB-MIN 0.3A 125VAC; 28480; 3101-2039.

Page 6-8, Table 6-1, A4 Replaceable Parts:
Add A4U4*; 1826-0085 IC WIDE-BAND AMPLIFIER; 28480; 1826-0085.

NOTE – The 1826-0085 IC is used as a factory substitution for 1826-0297. Capacitors A4C3 and A4C4 must be added when the 1826-0085 is used for A4U4. Some instruments with serial prefix 1904A also have the 1826-0085 IC used as a factory substitute for 1826-0297.

The 1826-0297 IC is the recommended replacement part for all instruments. Capacitors A4C3 and A4C4 may or may not be required to eliminate oscillations. See Note 4 in Figure 8-9 of the Operating and Service Manual.

CHANGE 6 (Serial Prefix 1936A)

Page 6-25, Table 6-1, Replaceable Parts:
Change S2 and S6 from 3101-1216 to 3101-0052 in "HP" and "Mfr Part Number" columns.
Delete C1A and C1B HP Part No. 0160-3043 and change Description to NOT ASSIGNED.
Add C2 and C3; 0160-4439; CAPACITOR-FXD 4700PF ±20% 250VAC (RMS) CER; 28480; 0160-4439.

Page 8-37, Figure 8-21, Schematic Diagram:
Change C1A to C2 with a value of 4700PF.
Change C1B to C3 with a value of 4700 PF.

■CHANGE 7

Page 6-20, Table 6-1, A21 Replaceable Parts:
Add A21F2; 2110-0540; FUSE 2A 125V .281 x .093 AXIAL LEADS; 28480; 2110-0540

Page 8-37, Figure 8-21, A21 Schematic Diagram:
Add A21F2 (2A) on circuit board A21 in series with the upper blue wire from T1 and the top of bridge rectifier A21CR1.
Change A21 series number to Serial Prefix Number for CHANGE 7.