Errata

Title & Document Type: **5354A Automatic Frequency Converter Operating and Service Manual**

Manual Part Number: **05354-90006**

Revision Date: **October 1975**

About this Manual

We've added this manual to the Agilent website in an effort to help you support your product. This manual provides the best information we could find. It may be incomplete or contain dated information, and the scan quality may not be ideal. If we find a better copy in the future, we will add it to the Agilent website.

HP References in this Manual

This manual may contain references to HP or Hewlett-Packard. Please note that Hewlett-Packard's former test and measurement, life sciences, and chemical analysis businesses are now part of Agilent Technologies. The HP XXXX referred to in this document is now the Agilent XXXX. For example, model number HP8648A is now model number Agilent 8648A. We have made no changes to this manual copy.

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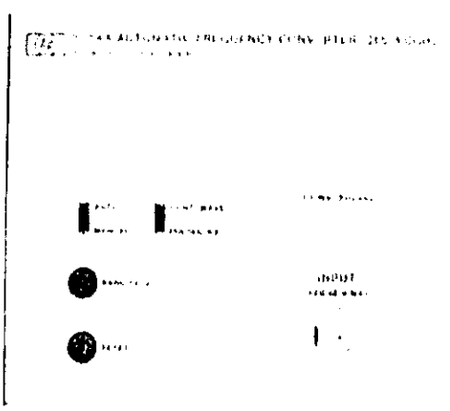
HP 5354A

OPERATING AND SERVICE MANUAL

AUTOMATIC FREQUENCY CONVERTER

5354A



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HP 5354A

CERTIFICATION

Hewlett-Packard Company certifies that this instrument met its published specifications at the time of shipment from the factory. Hewlett-Packard Company further certifies that its calibration measurements are traceable to the United States National Bureau of Standards, to the extent allowed by the Bureau's calibration facility, and to the calibration facilities of other International Standards Organization members.

WARRANTY AND ASSISTANCE

This Hewlett-Packard product is warranted against defects in materials and workmanship for a period of one year from the date of shipment. Hewlett-Packard will, at its option, repair or replace products which prove to be defective during the warranty period provided they are returned to Hewlett-Packard, and provided the preventive maintenance procedures in this manual are followed. Repairs necessitated by misuse of the product are not covered by this warranty. NO OTHER WARRANTIES ARE EXPRESSED OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. HEWLETT-PACKARD IS NOT LIABLE FOR CONSEQUENTIAL DAMAGES.

If this product is sold as part of a Hewlett-Packard integrated instrument system, the above warranty shall not be applicable, and this product shall be covered only by the system warranty.

Service contracts or customer assistance agreements are available for Hewlett-Packard products.

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

5354A

AUTOMATIC FREQUENCY CONVERTER

OPERATING AND SERVICE MANUAL

SERIAL PREFIX: 1516A

This manual applies directly to Hewlett-Packard Model 5354A Automatic Frequency Converters with serial prefix 1516A.

OTHER SERIAL PREFIXES

For serial prefixes above 1516A a "Manual Change" sheet is included with this manual. For serial prefixes below 1516A refer to Section VII in this manual.

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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. 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 is 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

115/230 VOLTS AC AND 200 VOLTS DC ARE USED IN THE 5345A. MAINTENANCE AND SERVICING SHOULD BE PERFORMED BY QUALIFIED SERVICE PERSONNEL ONLY. SOME OF THE MAINTENANCE AND SERVICING OPERATIONS DESCRIBED HEREIN ARE PERFORMED WITH POWER SUPPLIED TO THE INSTRUMENT WHILE PROTECTIVE COVERS ARE REMOVED. EXERCISE EXTREME CARE WHEN PERFORMING THESE OPERATIONS. LINE VOLTAGE IS ALWAYS PRESENT ON SOME TERMINALS INCLUDING THE POWER INPUT CONNECTOR, FUSE HOLDER, POWER SWITCH, AND OTHER POINTS. ENERGY AVAILABLE AT MANY POINTS MAY RESULT IN DEATH OR PERSONAL INJURY WHEN CONTACTED.

WARNING

TO PROTECT OPERATING AND SERVICING PERSONNEL, THE 5345A IS SUPPLIED WITH A THREE-PIN POWER RECEPTACLE. THE CENTER PIN OF THE RECEPTACLE CONNECTS THE INSTRUMENT'S CHASSIS, CABINET, AND PANELS TO EARTH GROUND WHEN USED WITH A PROPERLY WIRED THREE-CONDUCTOR OUTLET AND CABLE. IMPROPERLY GROUNDED EQUIPMENT CAN RESULT IN HAZARDOUS POTENTIALS BETWEEN EQUIPMENT.

CAUTION

THE 5345A IS EQUIPPED WITH A 115V/230V LINE SELECTOR SWITCH. BEFORE CONNECTING THE INSTRUMENT TO AC POWER LINES, BE SURE THE LINE SELECTOR SWITCH IS SET PROPERLY.

CAUTION

INPUT CIRCUIT AT THE 50 OHM INPUT CONNECTOR CAN BE DESTROYED WITH INPUT LEVELS EXCEEDING 300 MILLIWATTS. PLEASE READ PARAGRAPH 3-21 REGARDING ACCEPTABLE INPUT LEVELS.

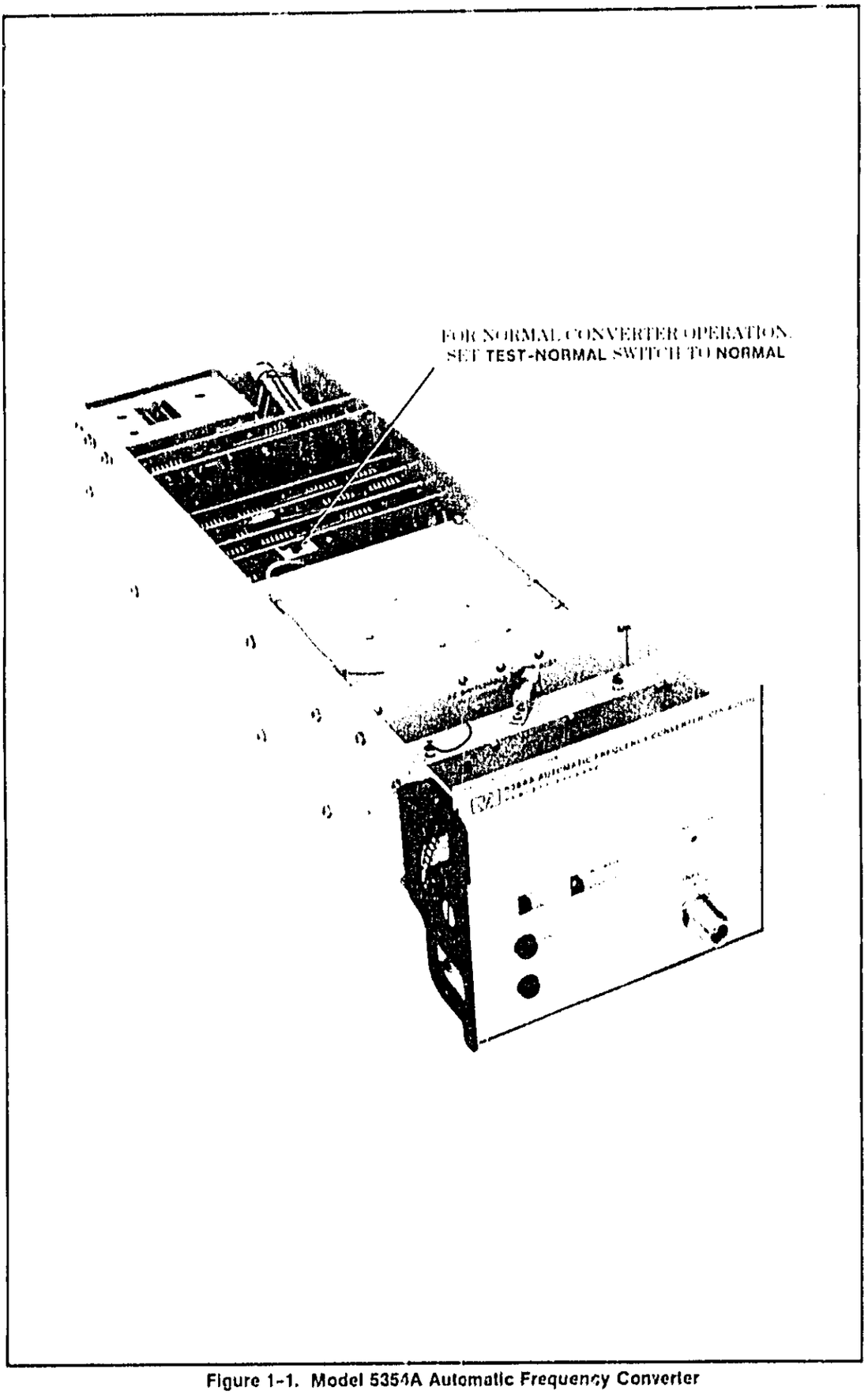


Figure 1-1. Model 5354A Automatic Frequency Converter

SECTION I

GENERAL INFORMATION

1-1. INTRODUCTION

1-2. This manual has installation, operating, and service information for the Hewlett-Packard Model 5354A Automatic Frequency Converter. The manual is divided into sections to describe different aspects of the 5354. The first section is general introductory information. The other sections are listed here:

SECTION	TITLE
II	Installation Instructions
III	Operating Instructions
IV	Theory of Operation
V	Maintenance (Repair and Adjustments)
VI	Parts List
VII	Manual Changes
VIII	Schematic Diagrams

1-3. MODEL 5354A AUTOMATIC FREQUENCY CONVERTER

1-4. The 5354A Automatic Frequency Converter extends the basic frequency measurement range of a 5345A Electronic Counter to include the 500 MHz to 4 GHz range. The converter will accept a signal in the 15 to 525 MHz range and pass it directly to the 5345A. The converter will change an input signal in the 510 MHz to 4 GHz range to a video (IF) signal of 15 to 525 megahertz and pass it to the 5345A for measurement. Frequencies of AM, FM, CW, and pulsed RF input signals can be measured by the converter with the 5345A. The converter must be installed in a 5345A and receives operating power and an accurate 10 MHz local oscillator signal from the 5345A. Accuracy of measurements with the 5354-5345A depend on the 10 MHz signal accuracy. The converter can automatically find and measure the frequency of an adequate input signal in its range. In the MANUAL mode, any one of nine frequency range bands can be selected. If an adequate signal exists in the selected band it will be measured and displayed.

1-5. OPTIONS

1-6. Option 011 allows two functions to be added to the converter.

1. LO±IF (display of local oscillator signal frequency with IF signal frequency of a radio receiver, added or subtracted).

2. HP Digital Bus Interface direct to converter through rear panel connector.

1-7. MANUAL MICROFICHE

1-8. On the title page of this manual, below the manual part number, is a "Microfiche" part number. This number may be used to order 4x6-inch microfilm transparencies of the manual. The microfiche package also includes the latest Manual Changes supplement as well as all pertinent Service Notes.

1-9. INSTRUMENT IDENTIFICATION

1-10. Hewlett-Packard instruments have a 2-section, 10-character serial number (0000A00000), which is usually located on the rear panel. The 4-digit serial prefix (first four digits from the left) identifies instrument changes. If the serial prefix of your instrument differs from that listed on

the title page of this manual, there are differences between this manual and your instrument. Instruments having lower serial prefixes than that listed on the title page are described in Section VII, and higher serial prefixes are described with manual change sheets included with the manual. If the change sheet is missing, contact the nearest Hewlett-Packard Sales and Service Office listed on the inside rear cover of this manual. The alphabet letter after the serial prefix indicates assembly plant location. The five-digit number after the letter is a serial number unique for each instrument.

1-11. ACCESSORIES

1-12. Table 1-1 lists the accessories available for use with the converter.

Table 1-1. Available Accessories

Accessory Description	HP Part Number
HP Interface Bus Cable* (1 metre)	10631A
HP Interface Bus Cable* (2 metres)	10631B
HP Interface Bus Cable* (3 metres)	10631C

*Each cable has piggy-back connectors to facilitate multiple connections at the same point

1-13. INSTRUMENT SPECIFICATIONS

1-14. The specifications for the converter are listed in Table 1-2.

Table 1-2. Specifications

RANGE: 15 MHz to 4 GHz
IMPEDANCE: 50Ω nominal
COUPLING: AC
SENSITIVITY: -10 dBm (70 mV rms) Auto mode
-20 dBm (22 mV rms) Manual and Pulse mode
MAXIMUM INPUT: +20 dBm (2.2V rms)
DAMAGE LEVEL: +25 dBm (4V rms), 10V peak-to-peak
INPUT SIGNAL CAPABILITY: CW signals. Pulsed microwave signals, signals with very high FM content
RF PULSE WIDTH: Use PULSE mode. Determined by mainframe GATE TIME
AUTO mode: >250 nsec
MANUAL mode: >100 nsec
MINIMUM RF PULSE FREQUENCY: Use PULSE mode
AUTO mode: 40 Hz
MANUAL mode: Single shot
FREQUENCY AVERAGING can be used with repetative events in either mode
FM SENSITIVITY: Maximum deviation at band edges 20 MHz peak-to-peak (or ±10 MHz). Maximum deviation at band center 500 MHz peak-to-peak (or ±250 MHz), below 500 MHz and above 1 GHz 250 MHz peak-to-peak (or ±125 MHz), between 500 MHz and 1 GHz.
OPERATING MODES: AUTOMATIC and MANUAL.
AUTO: Measures lowest frequency signal of sufficient amplitude to trigger counter
MANUAL: Measures signal within selected band. Signals of sufficient amplitude below 525 MHz will also be counted. Local Oscillator (comb line) can be selected to be above or below input frequency.
ACQUISITION TIME:
AUTO: CONT. WAVE, <2 msec, pulse R.F., <1 sec.
MANUAL: With proper band selection CONT. WAVE, <5 μsec; PULSED R.F., <20 nsec.
MIXING FREQUENCIES: (Local Oscillator Frequencies) 0, 0.5, 0.75, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 GHz
ACCURACY: Maintains counter accuracy
DISPLAY: Counter displays correct frequency automatically
LEVEL INDICATOR: Front panel light indicates usable signal.
AUXILIARY OUTPUT: Microwave signals translated down in frequency to between 10 MHz and 510 MHz are available at a rear panel BNC connector. Level >-30 dBm into 50Ω
INPUT CONNECTOR: Type N female
OPTION 011: HP Interface Bus capability for remote control. Also includes L.O.±I.F. (frequency applied to plug-in = frequency applied to channel A) capability.
ACCESSORIES AVAILABLE:
11697A, B, and C Band pass Filters
11693A Microwave Limiter
5354 DIMENSIONS:
5 in. H x 6 in. W x 20 in. D

SECTION II

INSTALLATION AND REMOTE PROGRAMMING

2-1. INTRODUCTION

2-2. This section tells how to unpack, inspect, and install the converter in a 5345A, and how to remote-program the converter. How to set the back panel controls of the converter before it is installed in the 5345A is described in Section III.

2-3. UNPACKING AND INSPECTION

2-4. If the instrument shipping carton shows any indication of damage or rough handling ask the carrier's agent to witness unpacking of the instrument. Inspect the instrument for damage (scratches, dents, broken parts). If the instrument is damaged or will not properly CHECK (see Section III) notify the carrier and your nearest Hewlett-Packard Sales and Service Office immediately (HP offices are listed at the back of this manual). Keep the shipping carton and padding 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. PACKAGING FOR RESHIPMENT OR STORAGE

2-6. Original Packaging

2-7. 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.

2-8. If the instrument is being returned to Hewlett-Packard for service, attach a tag indicating the type of service required, return address, model number, and full serial number. Mark the container FRAGILE to assure careful handling.

2-9. In any correspondence refer to the instrument by model number and full serial number.

2-10. Other Packaging Methods

2-11. If it becomes necessary to reship an instrument, good commercial packing should be used. Contract packaging companies in many cities can provide dependable custom packaging on short notice. The following general instructions should be followed when repackaging with commercially available materials.

a. If you are shipping the instrument to a Hewlett-Packard Service Office or Service Center, attach a tag indicating the type of service required, return address, 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.

2-12. STORAGE

2-13. If the instrument is to be stored for an extended period of time, it should be enclosed in a clean, sealed container. The storage location should be clean, dry, and at a moderate temperature.

2-14. STORAGE AND SHIPMENT ENVIRONMENT

2-15. Environmental atmospheric conditions during storage and shipment should be limited as follows:

Atmospheric Air Pressure Range ..... 10 to 32 inches of Mercury
Temperature Range ..... -40° to +75° Celsius

2-16. POWER REQUIREMENTS

2-17. All electric power requirements of the converter are supplied by the 5345A.

2-18. CONVERTER INSTALLATION AND REMOVAL

2-19. Correct installation of the converter in a 5345A Counter is described in the following steps:

a. Put the 5345A POWER switch in the STANDBY position.

b. On the top of the Converter, check that the NORMAL-TEST switch on A8 is set to NORMAL.

c. Remove the 5345A accessory compartment door by turning the knob counterclockwise ¼-turn.

d. Lift the converter lock handle up.

CAUTION

BE CAREFUL WHEN YOU PUT THE CONVERTER IN THE COUNTER. THE CONNECTORS THAT TIE THE CONVERTER AND COUNTER TOGETHER ELECTRICALLY CAN BE DAMAGED BY ROUGH HANDLING DURING INSTALLATION.

e. Carefully slide the converter into the 5345A counter accessory compartment until the lock handle engages the pin in the side of the 5345A compartment.

NOTE

The pin in the 5345A compartment and the track in the converter lock handle must be aligned.

f. Push the converter front panel and simultaneously push down on the lock handle until the converter front panel is flush with the counter front panel and the lock handle is down. Installation of the 5354A converter is complete.

g. When necessary, remove the converter by pushing upper bump on lock handle until handle is accessible at bottom. Remove converter by reversing steps f, e, and d.

2-20. OPERATIONAL CHECK

2-21. To determine if the instrument is operating properly, the self-check procedures in Section III or in the in-cabinet performance check in Section V may be used. Contact the nearest HP Sales and Service Office (see manual back cover) for information relative to warranty claims.

2-22. REMOTE PROGRAMMING (PART OF OPTION 011)

NOTE

Option 011 also includes the LO±IF operating mode capability. LO±IF is described in Section III.

2-24. Option 011 adds remote programming capability to the 5354A Automatic Frequency Converter and makes it compatible with the HP Interface Bus. More detailed explanations on theory of the HP Interface Bus can be found in the 5345A counter manual. The counter must be in remote operation mode before the converter can be operated in remote mode of operation. Both instruments are separately addressable. The converter has five address switches on the Bus Interface Board (05340-60013). A converter can only be addressed to *accept* program information hence it can function only as a Listener.

2-25. All front panel switch functions are programmable. In the remote manual mode, it is not necessary to step through each band until the desired band is selected. The program code for a desired band can be sent through the bus direct.

2-26. The converter's digital input input connector (labelled DIGITAL BUS INTF) is on the rear panel.

2-27. Programming the 5354A Automatic Frequency Converter

2-28. Program codes for the converter and other instruments compatible with the HP Interface Bus make use of the widely used ASCII code. The converter program codes are shown in Table 2-1.

2-29. 5354A Converter Remote Programming Summary

a. Program Codes:

BANDS.	These program codes allow any of the instrument's bands to be selected. The function is analogous to the MANUAL mode of operation and the BAND SELECT pushbutton.
RESET.	Same as front panel RESET pushbutton.
AUTO.	Same as front panel AUTO switch.
PULSED RF & CW.	Same as front panel PULSED RF/CONT. WAVE switch.
SUB K	LO-VIDEO position of rear panel DISPLAY CONTROL switch.
ADD K.	NORM LO+VIDEO position of the DISPLAY CONTROL switch.
LO±IF.	ON position of rear panel LO±IF switch.
LO±IF OFF.	OFF position of rear panel LO±IF switch.
SUB IF.	-IF position of rear panel +IF/-IF switch.
ADD IF.	+IF position of rear panel +IF/-IF switch.

b. Remote. The converter will operate in a remote only ONLY when the counter is in the remote mode.

c. Service Request (SRQ). The converter does not use this management line.

d. Universal Commands. The converter does not respond to Universal Commands.

e. Multiple Address. The converter does not use Multiple Address.

f. Addressing. Address switches are mounted on the converter HP Interface I/O board (05354-60013). See illustration below.

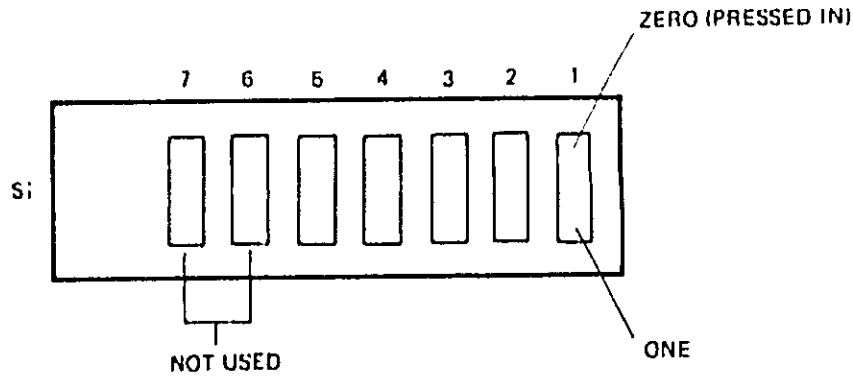
Address switches, bus data lines, and code relationships are as follows:

Standard Code (bits)	Bus Data Lines	A13 Address Switch*
b_1	DIO1	S1-1
b_2	DIO2	S1-2
b_3	DIO3	S1-3
b_4	DIO4	S1-4
b_5	DIO5	S1-5
		S1-6, S1-7 } Not used

*Dot In (closed = 0)
Dot Out (open = 1)

For example, if we assign $ as the address for the 5354A S1-1 → S1-5 positions would be as follows:

Bits	b_1	b_2	b_3	b_4	b_5
Code $	0	0	1	0	0
Switch	S1-1	S1-2	S1-3	S1-4	S1-5
Switch Position	Dot In	Dot In	Dot Out	Dot In	Dot In



BUS ADDRESS SWITCH

Table 2-1. 5354A Converter Program Code Set

Program Code	ASCII Character	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	Octal
BANDS									
515-775 MHz	0	0	1	1	0	0	0	0	060
765-1025 MHz	1	0	1	1	0	0	0	1	061
1015-1525 MHz	2	0	1	1	0	0	1	0	062
1515-2025 MHz	3	0	1	1	0	0	1	1	063
2015-2525 MHz	4	0	1	1	0	1	0	0	064
2515-3025 MHz	5	0	1	1	0	1	1	0	065
3015-3525 MHz	6	0	1	1	0	1	1	0	066
3515-4025 MHz	7	0	1	1	0	1	1	1	067
MANUAL	8	0	1	1	1	0	0	0	070
RESET	9	0	1	1	1	0	0	1	071
AUTO*	A	1	0	0	0	0	0	1	101
PRF	F	1	0	0	0	1	1	0	106
CW*	N	1	0	0	1	1	1	0	116
ADD K*	O	1	0	0	1	1	1	1	117
SUB K	G	1	0	0	0	1	1	1	107
LO±IF	E	1	0	0	0	1	0	1	105
LO±IF OFF*	M	1	0	0	1	1	0	1	115
SUB IF	B	1	0	0	0	0	1	0	102
ADD IF*	J	1	0	0	1	0	1	0	112

*These are the initial conditions when the 5354A is set to REMOTE.

Explanation of Program Code Sets:

BANDS.	These program codes allow any of the converter bands to be selected. This function is analogous to the MANUAL mode of operation and BAND SELECT pushbutton.
RESET.	Same as front panel RESET pushbutton.
AUTO.	Same as front panel AUTO switch.
PULSED RF & CW.	Same as front panel PULSED RF/CONT. WAVE.
ADD K.	NORM LO+VIDEO position of the DISPLAY CONTROL switch.
SUB K.	LO-VIDEO position of rear panel DISPLAY CONTROL switch.
LO±IF	ON position of rear panel LO±IF switch.
LO±IF OFF.	OFF position of rear panel LO±IF switch.
SUB IF.	-IF position of rear panel +IF/-IF switch.
ADD IF.	+IF position of rear panel +IF/-IF switch.

SECTION III

OPERATING INSTRUCTIONS

3-1. INTRODUCTION

3-2. This section tells how to operate the 5354A converter. Operating modes are described. Front and rear panel connector controls and indicators are described and explained.

3-3. OPERATING MODES

3-4. The modes of converter operation are described in the following paragraphs.

3-5. AUTO (Automatic) Mode

3-6. In the AUTO mode of operation the converter automatically steps through nine frequency bands (see Figure 3-1) repetitively until a signal within the converter range is detected. When a signal is detected, the converter provides the proper signals for the counter to display the frequency of the input signal.

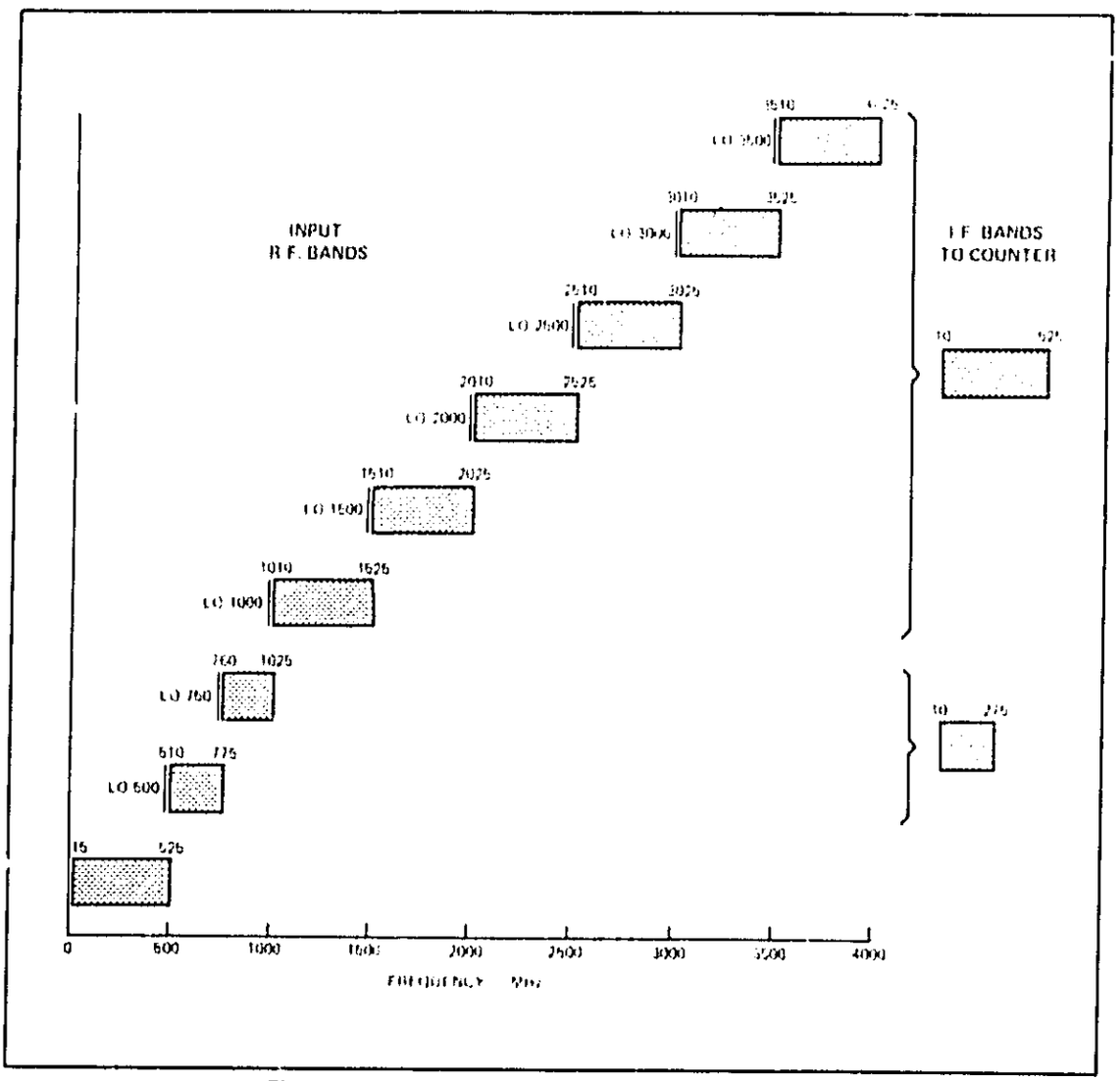


Figure 3-1. 5354A Input Frequency Ranges (Bands)

3-7. MANUAL Mode

3-8. In the MANUAL mode of operation the converter remains in one of the frequency range bands until the BAND SELECT switch or RESET switch is pressed. Each time the BAND SELECT switch is pressed the next higher frequency band is selected until the highest band is reached. Then pressing the BAND SELECT switch starts the sequence again at the lowest band. When the frequency range for an input signal is selected, the converter sends signals for the 5345A to display the frequency of the input signal.

3-9. CONT. WAVE Mode

3-10. In the CONT. WAVE (continuous wave) mode of operation the stepping from band-to-band of the AUTO operation occurs at 125 microsecond intervals. The CONT. WAVE switch has no effect in the MANUAL mode.

3-11. PULSED R.F. Mode

3-12. In the PULSED R.F. mode of operation the stepping from band-to-band of the AUTO operation occurs at 30 millisecond intervals. The longer search time for pulsed signals increases the probability of detection.

3-13. Remote Programming (Part of OPTION 011) Mode

3-14. The optional remote programming mode of operation is controlled through a rear panel connector. Remote programming is described in detail in Section II.

3-15. LO-IF Mode (Part of Option 011)

3-16. This mode of operation is a special application provision option of the converter. With this option, the 5345-5354A combination can measure the frequency of a weak microwave signal received by a microwave receiver. In this mode, the receiver local oscillator signal is applied to the converter INPUT connector and the receiver IF signal is applied to the 5345A INPUT. The 5345A will display the sum or difference (+IF or -IF) of the receiver local oscillator frequency and the receiver IF.

3-17. Normal Local Oscillator + Video Mode

3-18. In this mode of operation, the 5345A counter is instructed to arithmetically sum the converter local oscillator signal frequency with the converter video (IF) signal frequency and display the result.

3-19. Local Oscillator - Video Mode

3-20. In this mode of operation, the 5345A counter is instructed to arithmetically subtract the converter video (IF) signal frequency from the converter local oscillator signal frequency and display the result.

3-21. MAXIMUM INPUT SIGNAL POWER

CAUTION

DO NOT EXCEED 300 MILLIWATTS (+25 dBm) AT THE 5354A INPUT CONNECTOR. THE INPUT MIXER CAN BE DAMAGED BY EXCESSIVE INPUT POWER. REFER TO FIGURE 3-2 FOR POWER INPUT LIMITATIONS.

3-22. INPUT CABLE ATTENUATION

3-23. Input signal attenuation by the connecting cable must be considered at higher frequencies. If a signal to be measured is low power at its source, even a short cable may attenuate the signal level to below the input threshold of the converter.

3-24. STATIC CHARGE CAUTION

CAUTION

BEFORE CONNECTING A CABLE TO THE COUNTER INPUT CONNECT THE CABLE TO THE SIGNAL SOURCE. THE SOURCE LOAD RESISTANCE WILL DRAIN ANY DC OR STATIC CHARGE. ALL ULTRA HIGH FREQUENCY INPUT CIRCUITS LIKE THE CONVERTER'S ARE PHYSICALLY SMALL TO AVOID RESONANT FREQUENCIES WITHIN THEIR OPERATING RANGES. THESE CIRCUIT DO NOT HAVE LARGE THERMAL CAPACITIES, AND THEY CAN BE MORE EASILY DAMAGED BY VOLTAGE SPIKES THAN LOW-FREQUENCY CIRCUITS.

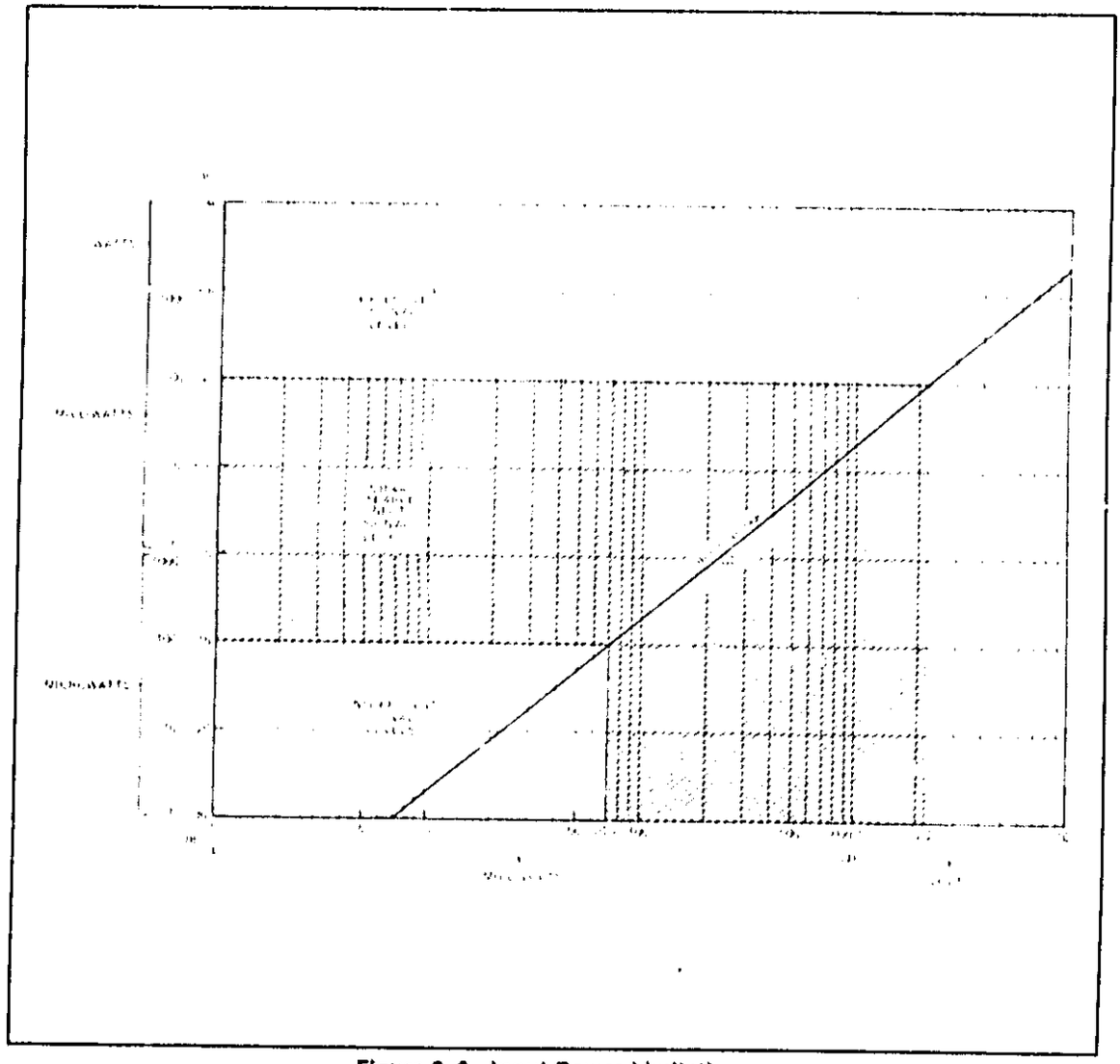


Figure 3-2. Input Power Limitations

3-25. SELF-CHECK

3-26. The procedure for self-checking the operation of the 5354A converter installed in the 5345A counter is given in the following steps:

a. Set the counter and converter controls as listed in paragraph 3-29 except as changed here:

5345A
POWER: ON
CHECK, COM A, SEP: CHECK
GATE TIME: 1 mS
DISPLAY POSITION: AUTO
FUNCTION: PLUG-IN

5354A
AUTO, MANUAL: MANUAL
CONT. WAVE, PULSED R.F.: CONT. WAVE
DISPLAY CONTROL: NORM LO+VIDEO
LO±IF: OFF
A8 NORMAL, TEST switch: TEST located on top of 5354 on circuit board A8 (05354-60008)

b. Push both the 5345A and 5354A RESET switches once.

c. Refer to Table 3-1 and successively push the converter BAND SELECT switch as listed in the first column, and check that the counter display is as listed in columns two and three.

Table 3-1. Self-Check

Number of times BAND SELECT Pushed After RESET	Position of 5354A Rear Panel DISPLAY CONTROL Switch	
	NORM LO+VIDEO	LO-VIDEO
	Counter Display	
0	100.00000 MHz	100.00000 MHz
1	600.00000 MHz	400.00000 MHz
2	850.00000 MHz	650.00000 MHz
3	1.10000000 GHz	900.00000 MHz
4	1.60000000 GHz	1.40000000 GHz
5	2.10000000 GHz	1.90000000 GHz
6	2.60000000 GHz	2.40000000 GHz
7	3.10000000 GHz	2.90000000 GHz
8	3.60000000 GHz	3.40000000 GHz

NOTE

The counter GATE lamp will flash on and off. The converter CONV. SIGNAL lamp will be on when 3.6 GHz is displayed.

d. On rear panel, set the converter DISPLAY CONTROL switch to NORM (LO+VIDEO). On the front panel, set the AUTO/MANUAL switch to AUTO. The counter display should be 3.60000000 GHz, and the GATE lamp should flash on and off.

e. Set the converter CONT. WAVE/PULSED R.F. switch to PULSED R.F. Push the converter RESET switch. The CONV. SIGNAL lamp should flash twice and then stay on.

f. On the rear panel, set the LO±IF to ON, and set the +IF/-IF switch to +IF. The counter display should be 3.70000000 GHz, and the GATE lamp should be flashing on and off.

g. On rear panel, set the +IF -IF switch to -IF. The counter display should be 3.500000000 GHz, and the GATE lamp should be flashing on and off.

h. Set the A8 TEST, NORMAL switch to NORMAL.

i. The self-check is complete.

3-27. OPERATING PROCEDURES

NOTE

For normal converter operation, make sure that the NORMAL-TEST switch on A8 is set to NORMAL. This switch is located at the top of the 5354A on circuit board A8 (05354-60008).

3-28. Operating procedures for the converter are given in the following paragraphs. Refer to the illustrations of the front and rear panel (Figures 3-3 and 3-4) for descriptions of the controls, connectors, and indicators referenced in the following paragraphs. Refer to the 5345A manual for descriptions and operating procedures of the 5345A counter.

3-29. Standard Control Settings and Conditions

3-30. Unless stated otherwise, the following are standard control settings and other conditions for operating the converter and 5345A combined.

a. Set the counter POWER switch to STANDBY.

b. Set the counter for PLUG-IN operation.

c. On the top of the converter, set NORMAL-TEST switch to NORMAL. This switch is located on circuit board A8 (05354-60008).

d. Install the converter properly as described in Section II.

e. Set the counter SAMPLE RATE full counterclockwise.

f. Set the counter Input Amplifier Control switch to SEP.

g. Set counter rear panel Gate Control switch to INTERNAL.

h. Set the converter rear panel DISPLAY CONTROL switch to NORM LO-VIDEO

i. If Option 011 is installed, set the converter rear panel LO-IF switch to OFF.

j. Set the counter GATE TIME, DISPLAY POSITION, controls to the desired positions as described in the 5345A manual.

3-31. Automatic-Continuous Wave Signal Operation

a. Set the counter and converter controls to the standard positions as given in paragraph 3-30.

b. Set the converter AUTO MANUAL switch to AUTO.

c. Set the converter CONT. WAVE PULSED R.F. switch to CONT. WAVE.

d. Set the counter POWER switch to ON.

CAUTION

DO NOT CONNECT SIGNALS WITH EXCESSIVE POWER LEVELS TO THE CONVERTER INPUT CONNECTOR. (REFER TO PARAGRAPH 3-21.)

e. Connect the signal-to-be-measured cable to the converter INPUT connector.

f. If the lowest frequency signal in the 15 MHz - 4 GHz range is of sufficient amplitude to turn on the CONV. SIGNAL lamp, the signal will be measured and displayed by the counter.

3-32. Automatic-Pulsed R.F. Signal Operation

3-33. Use the same procedures as in Automatic-Continuous Wave Signal Operation except set the CONT. WAVE PULSED R.F. switch to PULSED R.F.

3-34. Manual-Continuous Wave Operation

a. Set the counter and converter controls to the standard positions as given in paragraph 3-30

b. Set the converter AUTO MANUAL switch to MANUAL.

c. Set the converter CONT. WAVE PULSED R.F. switch to CONT. WAVE.

d. Set the counter POWER switch to ON.

CAUTION

DO NOT CONNECT SIGNALS WITH EXCESSIVE POWER LEVELS TO THE CONVERTER INPUT CONNECTOR. (REFER TO PARAGRAPH 3-21.)

e. Connect the signal-to-be-measured cable to the converter INPUT connector.

f. Push the converter RESET switch. (The counter converter should be in the 15-525 MHz band.)

g. Observe the CONV. SIGNAL lamp and counter display. If the signal-to-be-measured is in the 15-525 MHz band the CONV. SIGNAL lamp should be on and the signal frequency should be displayed. If the signal power level is insufficient or the signal is not in the 15-525 MHz band, the CONV. SIGNAL lamp will be off and all zeroes will be disnlayed by the counter.

h. Press the BAND SELECT switch to step the converter frequency range up. If the CONV. SIGNAL lamp remains off and only the normal local oscillator frequency is displayed, continue to slowly press and release the BAND select switch until the CONV. SIGNAL lamp glows and the signal frequency is displayed. If after all nine bands have been tried there is no CONV. SIGNAL lamp indication and no signal frequency display by the counter, then the signal is either not of sufficient power or not within the 15 MHz to 4 GHz range of the counter-converter combination.

NOTE

In the MANUAL and NORMAL modes the correct signal frequency is displayed the first time the CONV. SIGNAL lamp glows after the RESET switch has been pressed. If after the correct frequency is displayed the BAND SELECT switch is pressed one or two more times, a second frequency will be displayed.

3-35. LO÷IF Operation (Part of Option 011)

a. Set the counter and converter controls to the standard positions as given in paragraph 3-30 except set the LO÷IF switch to ON.

b. Set the converter AUTO MANUAL switch to AUTO.

c. Set the CONT. WAVE PULSED R.F. switch to CONT. WAVE.

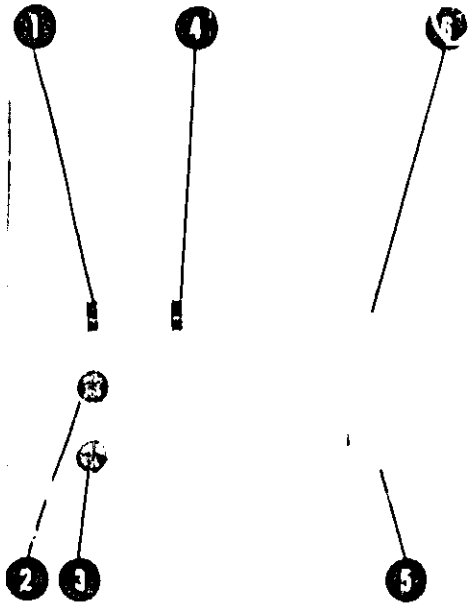
d. Set the counter POWER switch to ON.

CAUTION

DO NOT CONNECT SIGNALS WITH EXCESSIVE POWER LEVELS TO THE CONVERTER INPUT CONNECTOR.

e. Connect the receiver IF output to the 5345A INPUT.

f. Connect the receiver local oscillator signal to the converter INPUT connector.



NOTE

For normal converter operation, set NORMAL TEST switch on A5 to NORMAL. This switch is located on pc board A5 (see Figure 6-6).

The front panel controls, connectors, and indicators of the converter are described here with numbers corresponding to the numbers in the photo above.

a. AUTO-MANUAL Operating Mode mode switch (1). This switch is used to select either automatic or manual mode of operation. In the AUTO position the converter will start from zero then sequence through the nine frequency bands until an input signal frequency is acquired that has sufficient amplitude to produce an output signal. In the MANUAL position, the converter will remain in one frequency range until the BAND SELECT switch is pushed. In the AUTO position the rear panel DISPLAY CONTROL switch should be at NORMAL or VIDEO.

b. BAND SELECT switch (2). This switch is used in the MANUAL mode of the AUTO-MANUAL switch to step the converter through the nine frequency range bands. Each time the BAND SELECT switch is pressed the converter steps up one band. When the highest frequency band is selected and then the button is pressed again the lowest frequency band is selected. The BAND SELECT switch (2) is enabled only when the AUTO-MANUAL switch (1) is in the MANUAL mode position.

BAND SELECT Switch Indications

In the MANUAL position of the mode switch (1) the BAND SELECT switch (2) is enabled. If there is no INPUT signal to the converter and the BAND SELECT switch is pressed after the RESET switch (3) is pressed, the 5445A will display which converter band is selected according to Table 3-1.

c. RESET pushbutton switch (3). This control operates in either position of the AUTO-MANUAL switch. If the RESET switch is pressed momentarily, the converter is set to the lowest frequency band and the display is all zeroes if no signal is present at the converter INPUT connector.

d. CONT WAVE-PULSED RF Switch (4). This switch is used to select either continuous wave or pulsed RF mode of operation. The CONT WAVE mode set the automatic band sweeping rate for 2 milliseconds per band. The PULSED RF mode set the automatic band sweeping rate for 20 milliseconds per band. The slower 20 millisecond period for the PULSED RF mode increases the probability that a pulse signal will be detected, measured, and displayed by the counter. The CONT WAVE-PULSED RF switch and AUTO-MANUAL switch control signal acquisition times as follows:

ACQUISITION TIME

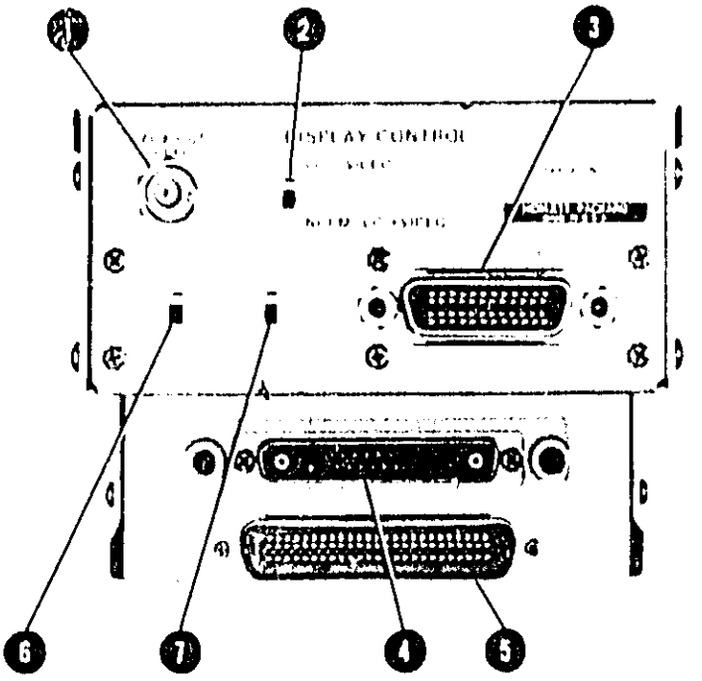
	CONT WAVE	PULSED R F
AUTO	milliseconds	1 second
MANUAL	microseconds	1 minute seconds*

*In the MANUAL PULSED RF mode the converter sensitivity is typically better than -25 dBm. Measurement can be made even though the CONV SIGNAL indicator is OFF.

e. INPUT connector MAY type N connector (5). This connector accepts input signals to be measured. As indicated the maximum acceptable input signal level is +20 dBm. The minimum level input signal which will produce a stable display on the counter is given in the Specifications Table of Section I.

f. CONV SIGNAL lamp (6). This lamp indicates that a useable signal is applied to the INPUT connector. For a lamp check on the SELF CHECK mode and the converter MANUAL mode the CONV SIGNAL light will be on in the 2.4 to 4.0 GHz band.

Figure 3-3. Front Panel Controls, Connectors, and Indicators



The rear panel controls and connectors of the converter are described here with numbers corresponding to numbers in the photo above.

1. AUX OUT BNC connector (1). The analog intermediate frequency output signal is present here when a signal is being processed in the 5345A. This is a buffered version of the voltage signal sent to the counter.

2. DISPLAY CONTROL Slide Switch (2). This two-position switch controls the processing by the 5345A of the converter output signals.

   NORM (LO-A VIDEO) position. In this position the 5345A is instructed to add the frequency of the converter local oscillator signal to the frequency of the converter IF signal and display the result.

   LO-A VIDEO position. In this position the 5345A counter is instructed to subtract the frequency of the converter IF signal from the converter local oscillator signal frequency and display the result. The front panel AUTO MANUAL switch should be in MANUAL for this mode.

   The DISPLAY CONTROL can be used for pulsed RF measurements to increase measurement accuracy as described in the following example.

EXAMPLE

NORM (LO-A VIDEO). If the converter RESET and BAND SELECT switches are pressed (1-2) and the DISPLAY CONTROL switch (2) is set to NORM (LO-A VIDEO), and a pulsed 2.55 MHz signal is applied to the INPUT in MANUAL mode, the converter will provide a 500 MHz local oscillator and a 25 MHz IF signal to the counter to be added and displayed. The 25 MHz signal will be "on" for the duration of the pulsed 2.55 MHz input signal.

LO-A VIDEO. If instead of NORM (LO-A VIDEO) the switch is set to LO-A VIDEO and the BAND SELECT is pressed twice for the 500-1025 MHz band, the converter will provide a 750 MHz local oscillator signal and a 275 MHz IF signal to the counter to be *subtracted* and displayed. The 275 MHz signal will be "on" for the same time as the 25 MHz signal was, but the 275 MHz signal will provide many more zero crossings for the counter and so allow greater accuracy.

3. DIGITAL BUS INTF connector (3). External programming signals to control the converter remotely can be applied to this connector. Refer to Section II Installation for details about this option.

4. Converter to 5345A Interface connectors (4, 5). These two connectors are the points that umbilically connect the converter to the 5345A counter.

5. LO/IF ON OFF Selector Switch (6) and +IF IF Slide switch (7) (Part of Option 011). The 5345A switch controls the optional two input signal addition or subtraction capability of the converter. This function allows the 5345A and converter to measure frequencies of weak microwave signals. (For example. A microwave superheterodyne receiver is tuned to a weak signal. The receiver IF signal is applied to the 5345A Channel A INPUT. The receiver local oscillator signal is applied to the converter INPUT. Switch 6 is set to ON. The +IF IF switch is set to +IF when the receiver local oscillator frequency is known to be below the received signal frequency or the switch is set to -IF when the local oscillator frequency is known to be above the received signal frequency. The 5345A display will indicate the sum of or difference between the receiver local oscillator frequency and the IF amplifier frequency. This is the frequency of the signal at the receiver input.)

Figure 3-4. Rear Panel Controls and Connectors

SECTION IV

THEORY OF OPERATION

4-1. INTRODUCTION

4-2. This section describes the theory of operation of the 5354A Converter.

4-3. SECTION ARRANGEMENT OF MAJOR DIVISIONS

4-4. This section covers the following major subjects in the sequence given:

General Description
Block Diagram Description
Assembly Descriptions
Abbreviations Glossary
Unique integrated circuits descriptions

4-5. GENERAL DESCRIPTION

4-6. The 5354A Automatic Frequency Converter extends the frequency range of the 5345A Electronic Counter to 4.0 GHz, by heterodyning techniques. The frequency range of the converter is 15 MHz to 4.0 GHz.

4-7. The stability and accuracy of the counter are retained in the converter by using a 10 MHz signal from the counter time base. The 10 MHz signal is multiplied to 500 MHz and applied to a comb generator. Six harmonics from the comb generator are used as local oscillator signals by the mixer. The video (IF) output of the converter is a signal between 15 MHz and 525 MHz, which is within the counting capability of the 5345 counter. The counter adds the converter local oscillator frequency to the video (IF) frequency. The result is F_{in}, the frequency of the input signal.

4-8. BLOCK DIAGRAM DESCRIPTION

4-9. Multipliers A7, A6, and A4 multiply the 10 MHz signal from the counter by 50 to generate a 500 MHz signal. The 500 MHz signal is applied to a comb generator in the A2 switchable filter. Multiplier A5 generates a 750 MHz signal which is also applied to A2. The switchable filter (A2) consists of a comb generator, a high frequency switch and band pass filters, it provides Mixer (A1) with eight discrete local oscillator signals. The local oscillator signal frequencies and corresponding input R.F. bands are as follows:

Band No.	Input Signal Freq. Range	Local Osc. Freq.		Video (IF) Freq.
1	15 MHz - 525 MHz	0 MHz		15 MHz - 525 MHz
2	515 MHz - 775 MHz	500 MHz	From A5 via A2	15 MHz - 275 MHz
3	765 MHz - 1025 MHz	750 MHz	From A5 via A2	15 MHz - 275 MHz
4	1015 MHz - 1525 MHz	1.0 GHz	A2 Comb Generator	15 MHz - 525 MHz
5	1515 MHz - 2025 MHz	1.5 GHz	A2 Comb Generator	15 MHz - 525 MHz
6	2015 MHz - 2525 MHz	2.0 GHz	A2 Comb Generator	15 MHz - 525 MHz
7	2515 MHz - 3025 MHz	2.5 GHz	A2 Comb Generator	15 MHz - 525 MHz
8	3015 MHz - 3525 MHz	3.0 GHz	A2 Comb Generator	15 MHz - 525 MHz
9	3515 MHz - 4025 MHz	3.5 GHz	A2 Comb Generator	15 MHz - 525 MHz

4-10. The filter select board (A9) has a +9 counter and provides digital signals DQA, DQB, DQC, and DQD which are decoded by the A8 filter switch board. The A8 filter switch controls the eight local oscillator signals which can be switched by the A2 switchable filter. The input control board (A10) serves as an interface between front panel and remote controls. The A10 input control has

a 7.5 kHz clock used in the CW mode of operation and a 10 Hz clock used in the PULSED RF mode. The counter interface board (A11) is the connection and interchange between the counter and converter.

4-11. The mixer assembly (A1) is composed of three submodules:

Attenuator-Detector (A1A1)
Mixer-Amplifier (A1A2)
Filter-Amplifier (A1A3)

4-12. The attenuator-detector (A1A1) detects when a signal greater than approximately -13 dBm is present at the converter INPUT, and it sets qualifier S3 (A1C2) to a TTL high. The mixer-amplifier (A1A2) Video (IF) output is fed to Video (IF) filter amplifier (A1A3). Band 2 and 3 have Video (IF) frequencies of (15 to 275 MHz) and require a different filter configuration than the other bands. The filter-amplifier switches in a 15 to 275 MHz filter whenever the level at A1C1, "250 IF" digital sig. ' goes high. The Video (IF) board (A3) detects a mixer output of 0 to +2 dBm and sets qualifie. .2 to a TTL high. Qualifier S1 remains high as long as the Video (IF) signal frequency is below 525 MHz. When all three qualifiers S1, S2, and S3 are high, the front panel CONV. SIGNAL light will be switched on.

4-13. The Schmitt trigger board (A15) reshapes the output of S3, and it provides ECL signals to the counter.

4-14. Option 011 adds two functional boards, A12 and A13 to the standard 5354A converter. The HP Bus interface board (A13) provides remote programming capability. The LO-IF board (A12) allows frequency measurement of weak radio signals by measuring a radio receiver's IF signal frequency and local oscillator signal frequency. The receiver IF signal is fed to the 5345A and the receiver local oscillator is fed to the 5354A, addition or subtraction of both signals is performed in the 5345A counter.

4-15. A1 THROUGH A15 THEORY

4-16. In the following paragraphs the theory of operation of individual printed circuit boards from A1 to A15 is given.

4-17. A1 MIXER

4-18. The A1 Mixer Assembly has three subassemblies: A1A1 Attenuator Detector, A1A2 Mixer-Amplifier, and A1A3 Video (IF) Filter-Amplifier.

4-19. A1A1 Attenuator-Detector

4-20. The input signal is connected through a rigid coaxial cable to the A1A1 attenuator-detector. This assembly has two functions:

1) A1A1 attenuates the input signal by 6 dB; this decreases the VSWR and presents a better 50Ω load to the input signal. The π attenuator network is composed of R4, R6, and R8. For signals at frequencies below 500 MHz, resistor R4 leaks some of the signal past the mixer and directly into the A1A2 input.

2) A1A1CR1 detects the level of the input signal. When the input signal rises above a value set by R2 (which is nominally -13 dBm for signals at frequencies between 15 MHz and 4 GHz) a TTL high signal (S3) appears at the output of comparator U1.

4-21. The input signal is detected by a hot-carrier peak-detector diode CR1. Capacitor C2 is a holding capacitor for CR1; its dc voltage is applied directly to one input of comparator U1. Diode CR2 provides temperature compensation for the other input to the comparator. Zener diode CR3 clamps the TTL level to +5 volts. Diode CR1 is dc forward-biased to conduct about 5 microamperes; this increases the sensitivity of CR1 for the low level RF signals. With no signal at the

input, the voltage at the cathode of CR1 is approximately -240 mV. CR2 is forward biased to conduct about 15 microamperes, and the voltage on pin 3 of the comparator is approximately -200 mV. Potentiometer R2 sets the reference voltage level for the voltage comparator.

4-22. A1A2 Mixer-Amplifier

4-23. The input signal is fed through a balun transformer which provides proper phase balancing to the mixer diodes CR1 and CR2. The balanced mixer discriminates against second harmonic mixing. The local oscillator signal from A2 is applied to the junction of R1 and R2. Capacitors C1 and C2 comprise a low pass filter. They bypass to ground any RF signals higher than 500 MHz. Capacitors C3 and C4 block dc. Transistor Q1 is a common base amplifier which presents a low impedance to the mixer and drives a 50Ω output. Capacitor C5 blocks dc to separate the bias on the collector of Q1 from going back to the Attenuator-Detector Assembly.

4-24. Capacitors C6, C7, C8, L2, and L3 comprise a high-pass filter to cut off below 12 MHz. U2, the first stage of IF amplification has 20 dB of gain. Components R9, CR3, and C10 form a +12 volt power supply used to power A1A2U1 and A1A3U1.

4-25. A1A3 Video (IF) Filter-Amplifier

4-26. This is the second stage of amplification and filtering. Two different signal paths can be selected, a path with a 250 MHz low-pass filter (L2 and L3) and series resonant tanks (L1, L4, L5), or a path with no filtering when the signal from the mixer is fed via CR2, CR3 directly into U1. When counting a signal between 515 and 775 MHz, the converter local oscillator frequency is 500 MHz; and because it is in the same frequency range as the normal IF, it could leak through the IF path and appear at the output of the Filter-AMP as a legitimate Video (IF) signal. To prevent this from happening the converter generates a 500 and a 750 MHz local oscillator signal. The 515 MHz to 1025 GHz input frequency band is split into two overlapping bands with an IF bandwidth in each band of 15 MHz to 275 MHz. The 250 MHz low-pass filter in A1A3 is activated in the 515-775 MHz band and the 765-1025 MHz band.

4-27. Filter switching is accomplished by biasing PIN diodes CR1, CR4, or CR2, CR3 on or off and routing the signal through the low-pass filter to directly into U1. Differential amplifier U2 can draw 10 mA into pin 8 or 6. When the digital signal "250 MHz IF" from the filter switch, A8, goes TTL high, U2 turns on CR1 and CR4. The current path for CR1 is through R2, CR1, L2, L3, and R10. The current path for CR4 is R9, CR4, and R10. When the "250 MHz IF" signal goes low, CR1 and CR4 are turned off, and CR2 and CR3 are turned on.

4-28. A2 SWITCHABLE FILTER

4-29. The switchable filter receives 500 MHz from the A4 multiplier and generates six harmonics which are used as local oscillator signals for A1 mixer. The switchable filter also receives 500 MHz and 750 MHz signals at A2J2 and routes these signals to mixer A1 whenever the converter is in either the 515-775 MHz or 765-1025 MHz bands respectively.

4-30. 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 A8 filter switch board, individual bandpass filters are enabled allowing the desired local oscillator signal to be sent to the A1 mixer.

4-31. The "250 IF" signal at XA2($\overline{10}$), is a digital control signal which switches on diode CR1 and allows 500 MHz and 750 MHz signals to go through the A2 switchable filter. They function as the 500 MHz and 750 MHz local oscillator signals.

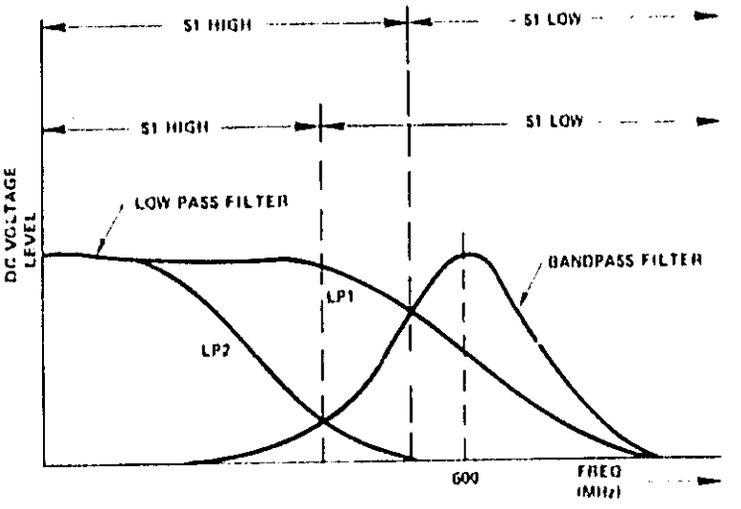
4-32. A3 VIDEO (IF) ASSEMBLY

4-33. The Video (IF) assembly performs two functions:

1) Provide qualifier signals S1 and S2.
2) Serves as an analog-to-ECL converter and trigger.

4-34. Qualifier S1

4-35. Qualifier S1, U4(7), indicates the signal out of mixer assembly A1 is at the correct frequency. Comparator U4 is connected to two arms of a frequency discriminator circuit. U4(2) receives a signal from band pass filter (600 MHz) C7, L7. CR3 is a hot-carrier peak-detector diode which detects any signal out of the filter. C13 is a holding capacitor for CR3. U4(3) receives a signal from the other arm which consists of low pass filter C8, L5, C11, L6, C14, and peak detector diode CR6. C16 is a holding capacitor for CR6. Figure 4-1 shows a dc voltage level versus frequency plot of the frequency discriminator.



LP2 for 515-775 MHz and 765-1025 MHz bands.
LP1 for the 1.015-1.525 GHz and up.

Figure 4-1. Frequency Discriminator Voltage versus Frequency

4-38. Qualifier S2

4-39. Qualifier S2, U3(7), ensures the Video (IF) signal is of sufficient amplitude. Qualifier S2 will go high whenever the signal detected by CR6 is strong enough to switch comparator U3. Typically the input signal level at which U3(7) goes high is 0 dBm. The Video (IF) signal from mixer A1 must go through the 500 MHz or 250 MHz low pass filter depending on what band the instrument is on. CR7 is a temperature compensation diode for CR3 and CR6.

NOTE

CR3, CR6, and CR7 are a matched set of diodes. If any one diode fails, all three must be replaced (Hewlett-Packard part number: 05354-80005).

4-40. Analog-to-EECL Converter and Trigger

4-41. The Video (IF) signal at XA3(8) is routed to Schmitt Trigger U1 via R7, R17, and C20. The "TRIG SENS" control, R17, adjusts the sensitivity of the Schmitt Trigger for operation at room temperature on an input signal of 0 dBm. The 3 dB difference between the adjustment of qualifier S2 (S2 SET) and the Schmitt Trigger is for high temperature compensation (ambient temperature around U1 of approximately 75°C).

4-42. U1 is enabled by $\overline{SON}$ XA3(15). $\overline{SON}$ goes low when all three qualifiers S1, S2, and S3 are high.

4-43. The Video (IF) printed circuit board has two ground planes. One is connected to the 5354A chassis and the other (middle layer ground plane) is connected to the coaxial cable which routes the signal to the Schmitt Trigger Assembly (A15). The reason for having a separate ground for the EECL output of A3 is to reject noise which would otherwise cause miscounts at the 5345 counter.

4-44. "TRIG BAL" A3R28 adjusts the offset of the differential input to the Schmitt Trigger. A3R28 matches the base emitter voltages of the differential pair transistors.

4-45. A4 MULTIPLIER (250 TO 500 MHz)

4-46. The input 250 MHz signal goes through a 250 MHz bandpass filter consisting of L1, C3, C4. Transistor Q2 is a VHF amplifier with a gain of 12 dB, and Q1 is a temperature stabilizing transistor. Transistor Q4 multiplies the 250 MHz signal by two, generating a 500 MHz signal which is fed to a 500 MHz tank circuit L3, C10, C11, C12, C14. Capacitor C13 couples the 500 MHz signal to a second 500 MHz tank circuit L4, C15, C18. Transistor Q6 is an amplifier for the 500 MHz signal. The primary of transformer T1 matches the output of Q6 to the input of amplifier Q8. The secondary of T1 couples some of the 500 MHz signal (-10 dBm) to the 250 to 750 MHz multiplier A5 board. Diode CR1 is a PIN switch, which is enabled in the A5 board. The output of amplifier Q8 is a 500 MHz signal at +15 dBm (typical).

4-47. A5 MULTIPLIER (250 TO 750 MHz)

4-48. The purpose of A5 is to multiply a 250 MHz signal by three, which provides the 750 MHz local oscillator signal when the converter is in the 760-1025 MHz band. A second function of A5 sends a 500 MHz signal from the A5 multiplier to the A2 switchable filter when the converter is in the 15 to 525 MHz band.

4-49. When the digital ".75LO" signal at XA5($\overline{5}$) goes high, Q1 saturates and CR1 turns on, allowing the 250 MHz signal to go through amplifier Q2. The output of Q2 is fed through an impedance matching netweork to diodes CR2, CR3 which limit the 250 MHz signal and generate a square wave rich in harmonics. Components L3 and C9 are a 1.0 GHz trap. The third harmonic is selected by two filter networks "750 MHz 1" C11, L4, C14, and "750 MHz 2" C13, C15, C16, L5. The 750 MHz signal is then sent to the A2 switchable filter via A14J4.

4-50. When digital signal ".5LO" is high at XA5($\overline{4}$), the 515-775 MHz band is selected. Transistor Q4 and Q5 are turned on, switching on CR4 and A4 CR1. This allows a 500 MHz signal from the 250-500 MHz Multiplier, XA5(7), to be routed to switchable filter A2 and then to mixer A1. The ".5LO" signal, XA5($\overline{4}$), goes high when the converter is in the 515 to 775 MHz band.

4-51. A6 MULTIPLIER (50 TO 250 MHz)

4-52. A6 multiplies the frequency of the 50 MHz input signal to 250 MHz. The signal is first applied to a bandpass filter C2, L1, C5, C6, C7 tuned to 50 MHz. U1B is a limiting amplifier whose output on pins 5 and 6 is an out-of-phase 50 MHz square wave. U1A performs the actual multiplication, its output is fed to two 250 MHz tank circuits, "250 MHz 1" L2, C10, C11, and "250 MHz 2" L3, C14, and C16. The 250 MHz signal is amplified by VHF amplifier Q2 which

increases the signal level to about +5 dBm. Transistor Q1 is a temperature stabilizing element for Q2, it senses how much current flows through Q2 and keeps it constant by providing negative feedback to the base whenever Q2 draws more current. Electrolytic capacitor C15 prevents the circuit from oscillating. Inductor L6 matches the high impedance out of Q2 to the low input impedance of Q4.

4-53. Power is split at the output of Q2 and is fed to amplifiers Q4 and Q2. Transistor Q3 and Q5 are temperature stabilizing elements which operate similarly to Q1.

4-54. A7 MULTIPLIER (15 TO 50 MHz)

4-55. A7 multiplies a 10 MHz standard signal from the 5345 counter to 50 MHz. The 10 MHz signal from the counter goes through a filter (C1, L1, C2, C3, and C5) to remove any unwanted noise which the signal has picked up. Transistor Q1 is an amplifier which increases the signal level enough to drive multiplier U1. The output of the first section of U1 is a 10 MHz current square wave which is applied to a 50 MHz tuned tank circuit L2, L9, C10. The second half of U1 is a limiting amplifier which has an output amplitude independent of the input amplitude. A second 50 MHz tank circuit is composed of L3, C13, and C14 and a third tank circuit is L4, C16, and C17. The output 50 MHz signal at XA7(7) is approximately +3 dBm and is applied to the 50 to 250 MHz Multiplier Assembly A6.

4-56. A8 FILTER SWITCH

4-57. The filter switch digitally selects the local oscillator frequency to be mixed with the input signal in the A1 mixer assembly.

4-58. A8U2 is a BCD-to-decimal decoder; its sequential input consist of one of the nine BCD bands. Each decoded output selects a different local oscillator frequency in the A2 switchable Filter.

XA8($\overline{5}$) DQA	XA8(4) DQB	XA8($\overline{4}$) DQC	XA8(3) $\overline{\text{DQD}}$	Decimal Equivalent	Band
0	0	0	1	8	15-525 MHz
0	0	0	0	0	515-775 MHz
1	0	0	0	1	765-1025 MHz
0	1	0	0	2	1.015-1.525 GHz
1	1	0	0	3	1.515-2.025 GHz
0	0	1	0	4	2.015-2.525 GHz
1	0	1	0	5	2.515-3.025 GHz
0	1	1	0	6	3.015-3.525 GHz
1	1	1	0	7	3.515-4.025 GHz

4-59. S3 XA8(7) indicates that an input signal of sufficient amplitude is present at the A1 mixer. S2 XA8(6) and S1 XA8(5) indicate a correct Video (IF) signal is being sent to the A3 detector. When all three qualifiers are present "IF DET" at XA8($\overline{6}$) goes high and front panel CONV. SIGNAL lamp will be illuminated. When the TEST-NORMAL switch A8S1 is in the TEST position the IF DET signal is forced to go high in the 3.515-4.025 GHz band regardless of the state of qualifiers S1, S2, and S3. Signal $\overline{\text{SEL A\&B}}$ at (XA8($\overline{12}$)) switches the Schmitt trigger in Video (IF) Assembly off when the converter is not selected. Signal $\overline{\text{SON}}$ at (XA8(13)) switches the Schmitt trigger on. When the converter is in the PRF mode it is on all the time.

4-60. Q13 and Q14 comprise the Initial Reset circuit. At first, Q14 is on and $\overline{\text{INRES}}$ is low. When C5 charges up to a positive voltage Q13 switches on and Q14 switches off, $\overline{\text{INRES}}$ goes high.

4-61. XA8(18) $\overline{\text{IFC}}$ goes high after the second search. Q1 through Q10, Q11, and Q12 are level shifters for the output of U2. Whenever a band is selected the appropriate pin will go TTL high, otherwise it remains at approximately -2 Vdc.

4-62. A9 FILTER SELECTOR

4-63. The A9 filter selector sends the selected Local Oscillator signal (K) in BCD form to the 5315 counter or to A12, the LO-IF board.

4-64. U1B, U1A, U5A, U2B, U6D, and U5B comprise a ÷9 counter. The clock input on XA9(3) is either 40 Hz or 7.5 kHz depending on whether the instrument is in CONT. WAVE (7.5 kHz) or PULSED R.F. (40 kHz) mode. The logic levels from the ÷ counter are as follows:

Clock	U1BQ	U1AQ	U5AQ	U5BQ	U5B$\overline{Q}$	Local Osc. Freq.	R.F. Band
1	0	0	0	0	1	—	15-525 MHz
2	0	0	0	1	0	500 MHz	515-775 MHz
3	1	0	0	1	0	750 MHz	765-1025 MHz
4	0	1	0	1	0	1 GHz	1.015-1.525 GHz
5	1	1	0	1	0	1.5 GHz	1.515-2.025 GHz
6	0	0	1	1	0	2.0 GHz	2.015-2.525 GHz
7	1	0	1	1	0	2.5 GHz	2.515-3.025 GHz
8	0	1	1	1	0	3.0 GHz	3.015-3.525 GHz
9	1	1	1	1	0	3.5 GHz	3.515-4.025 GHz
10	0	0	0	0	1	—	— — —

Feedback

4-65. U9 is a multiplexer which selects a local input from the ÷9 counter or remote input from the Bus Interface board (A13). The multiplexer, U9, logic levels related to R.F. band are as follows:

DQA U9(12)	DQB U9(9)	DQC U9(4)	$\overline{\text{DQD}}$ U9(7)	Local Osc. Freq.	R.F. Band
0	0	0	1	None	15-525 MHz
0	0	0	0	500 MHz	515-775 MHz
1	0	0	0	750 MHz	765-1025 MHz
0	1	0	0	1 GHz	1.015-1.525 GHz
1	1	0	0	1.5 GHz	1.515-2.025 GHz
0	0	1	0	2.0 GHz	2.015-2.525 GHz
1	0	1	0	2.5 GHz	2.515-3.025 GHz
0	1	1	0	3.0 GHz	3.015-3.525 GHz
1	1	1	0	3.5 GHz	3.515-4.025 GHz

4-66. U2A, U3A, U3B, U10A, U10B, U11F, U6C, U6B, U6A, U11C, and output buffer/decoders U7A, B, C, comprise a decoding circuit which generates the band number (K) during the ninth, tenth, and eleventh PI CLK pulse from the counter. The counter sends 16 PI CLK pulses to the converter.

4-67. Whenever data is to be transferred between counter and converter, the A11 counter interface generates the A, B, C, D inputs to A9 after the pulses have gone through a ÷16 counter. The "500IF" signal, XA9(14), is high for all bands except the 765-1025 MHz band. The ".75LO" signal, XA9(15), is high only for the 765-1025 MHz band.

4-68. The PI XMT line, XA9($\overline{13}$), goes high when the counter sends data to the converter and is low when the converter sends data to the counter.

4-69. The $\overline{\text{SIGN}}$ line, XA9($\overline{7}$), control signal inverts the signal of the selected bank (K). When low it's a negative sign and when high it's a positive sign.

4-70. Normally the counter will add the local oscillator and Video (IF) frequencies. If the instrument were to lock onto the wrong sideband (possible in MANUAL mode only), by placing switch S5 in the LO-VIDEO position, the correct answer can be obtained by mathematical manipulations in the counter. The KS signal at XA9 (18) is what causes $\overline{\text{SIGN}}$ to go low and subtract

the Video (IF) from the local oscillator frequency. The KS signal is disabled by either of three conditions:

1) When switching through band one.
2) When in remote.
3) When $\overline{\text{OPT A}}$ goes low. This occurs in the LO-IF cycle when the IF signal present at the 5345 counter is being measured.

PI CLK to A11 from 5345 Counter	A XA9($\overline{9}$)	B XA9(9)	C XA9($\overline{10}$)	D XA9(10)	
1	0	0	0	0	
2	1	0	0	0	
3	0	1	0	0	
4	1	1	0	0	
5	0	0	1	0	
6	1	0	1	0	
7	0	1	1	0	
8	1	1	1	0	Band
9	0	0	0	1	data
10	1	0	0	1	is
11	0	1	0	1	trans-
12	1	1	0	1	mitted
13	0	0	1	1	
14	1	0	1	1	
15	0	1	1	1	
16	1	1	1	1	

4-71. $\overline{\text{PI INV SIGN}}$ XA9(17). When $\overline{\text{SIGN}}$ goes low U13D inverts the signal and feeds a high to the J&K inputs of U12. U12 is clocked by a 100 kHz free running oscillator U13A, B, C, and R4, R5, and C3. When $\overline{\text{SIGN}}$ goes high, U12 will toggle until $\overline{\text{PI INV SIGN}}$ goes Low.

4-72. A10 INPUT CONTROL

4-73. The Input Control A10 interfaces local front and rear panel switches with control circuitry in the converter. When the 5345 goes into remote mode of operation A10 interfaces remote commands from Bus Interface Assembly A13 with circuitry in the 5354.

4-74. Multiplexer U7 allows the converter to be operated from the front panel or remotely through the interface bus. Remote or Local modes of operation are controlled at the 5345. When $\overline{\text{RMT}}$ is received from the counter, U7 switches from Local to Remote. The front panel AUTO/MANUAL switch S1 is fed to U7(3) via U8A to eliminate switch bounce. The remote input for AUTO/MANUAL is fed to U7(2). U7(4) ZA is the AUTO/MANUAL multiplexer output. Flip-flop U8B synchronizes the internal clock from U1 or U10 to the AUTO/MANUAL selection in order to not lose a selected band when switching from AUTO to MANUAL.

4-75. Latches U13A and B eliminate switch bounce from the BAND SELECT switch S3. The latch output is fed to U7(10). The BAND SELECT switch manually steps through the R.F. bands. In the MANUAL mode U8B(8) is high enabling U9A and the BAND SELECT switch S3. When S3 is depressed U9A(3) goes low and a clock pulse is generated in U12A(6). U1 is a 40 Hz clock used in the PULSED R.F. operation mode, and U10 is an7.5 kHz clock used in the CONT. WAVE operation mode. The front panel CONT. WAVE/PULSED R.F. switch determines which clock is selected.

4-76. Whenever an Video (IF) signal has been detected by the A1 mixer and A3 detector, the IF-DET signal (XA10-9, $\overline{9}$) goes high, U11D(11) goes high and switches Q1 on. With Q1 on, the front panel CONV. SIGNAL light is on.

4-77. U2 is a pulse stretcher used in the PULSED R.F. mode to make the instrument believe there is a CW Video (IF) signal present. It is enabled only when front panel switch S2 is in the PULSED R.F. mode of operation. The repetition rate of the received signal PRF must be within 40 ms for the circuitry to be effective.

4-78. S4 is the front panel RESET button. When pressed it stops the IF DET signal from going through U5B. In the AUTOMATIC mode a low at U5B(6) disables the clock signal generated in U12A. Once an IF signal has been detected the converter will go through a second sweep cycle, redetecting the input signal and ensuring the measurement was legitimate. A second cycle is accomplished by U6B and U3B. The first time an IF DET signal is present U6A synchronizes it with the internal clock from U1, U10. U6A toggles U6B. U6B(8) goes high activating 200 NS one-shot U12B and U11A. A low at XA10(3) RESET causes the A9 filter select to be reset to the first band. The IF DET signal disappears and U5B(6) goes high, the next clock pulse will cause U6A(5) to go high and enable U12A allowing clock pulses to go through and generate a new sweep search. When a new signal is detected U6A(6) goes low or U6A goes high, this toggles U6B, U6B(8) clocks U3B and $\overline{\text{UFQ}}$ goes low. $\overline{\text{UFQ}}$ is valid and active only in the AUTOMATIC mode. Once the second sweep has been completed, $\overline{\text{UFQ}}$ should be low. When a signal is not detected during the second sweep, U6B(9) is sent to U3A(2) and whenever DQD goes high this information is transferred to U13C. $\overline{\text{DQD}}$ goes high only on the first band, it acts as a reset whenever a signal has not been detected during a sweep. U4B(6) goes high and U4C(8) goes low resetting all the flip-flops. In the case where a signal is lost, U5B(6) goes high, U6A(5) goes high, U4A(12) goes low, U4B(6) goes high U4C(8) goes low, resetting all the flip-flops. The purpose of two sweep cycles is to ensure the converter has locked onto the lower sideband (LO-FIN).

4-79. IFC XA10($\overline{18}$) controls a Schmitt trigger in A3. The Schmitt trigger is switched on whenever an IF (Video) signal is present. The BSR signal, XA19($\overline{4}$), is active only in the manual mode. BSR goes high whenever BAND SELECT SW S3 or RESET SW S4 are pressed. The $\overline{\text{PRF}}$ signal, XA10($\overline{8}$), indicates if the converter is in the PULSED R.F. operation mode.

4-80. A11 COUNTER INTERFACE

4-81. The counter interface board serves as a control interface between the 5345 counter and 5354 converter.

4-82. In the auto mode if no Video (IF) is present $\overline{\text{UFQ}}$ XA11(9) goes high and U7B(6) $\overline{\text{PI INH ARM}}$ will go low inhibiting the counter from going into a measurement cycle. The converter will sweep through the R.F. bands until a new Video (IF) signal is detected. When in the LO±IF mode of operation $\overline{\text{ADV A\&B}}$ XA11($\overline{8}$) goes low during the measurement cycle of the 5345 (see LO±IF A12 theory). When $\overline{\text{ADV A\&B}}$ XA11($\overline{8}$) goes low, ($\overline{\text{SEL A\&B}}$) XA11(5) goes high and the 5345 counter will measure the signal present at its input.

4-83. $\overline{\text{K DATA}}$ XA11($\overline{6}$) is active whenever $\overline{\text{PI DATA}}$ XA11(7) is inactive. $\overline{\text{K DATA}}$ tells the 5345 counter to add the Video (IF) frequency to the local oscillator frequency. $\overline{\text{PI DATA}}$ tells the counter to display K, the selected local oscillator signal when no signal is present at the input.

4-84. Whenever the bands are being stepped through BSR XA11(10) goes high, firing one-shot U9B which causes XA11(8) $\overline{\text{RESET 5345}}$ to go low and resets the counter. The low at U9B($\overline{\text{Q}}$) causes U8 to reset. U10A and B are enabled when DQD is high. DQD goes high when the converter is not in the first band. $\overline{\text{PI DATA}}$ forces the counter to go into a PI Data Mode and it will display the harmonic number. $\overline{\text{PI INH ARM}}$ causes the counter to go directly into its processing cycle.

4-85. At the end of the 5345 Processor Cycle the $\overline{\text{PROC BUSY}}$ signal at XA11($\overline{17}$) goes high clocking U8 and disabling U10A & B. When U8 is clocked, one-shot U9A fires and a 34µs pulse is present at XA11(4), $\overline{\text{PI ARM}}$. If a signal is present at the input it will be counted. At XA11($\overline{16}$), the $\overline{\text{OPT A}^2}$ signal inhibits $\overline{\text{PI-ARM}}$, XA11(4), when in the second cycle of the LO±IF mode of operation because at that time the signal present at the 5345 input must be measured. (Refer to A12 LO±IF Assembly theory for a more detailed explanation of the LO±IF operating cycle).

4-86. Whenever the converter sends or receives data, the counter generates a set of 16 pulses called PI CLK (XA1J610). When the converter sends data to the counter flip-flop, U1 inhibits the first PI CLK and the ÷16 counter U4(12) receives only 15 clock pulses. The output of ÷16 counter U4 is as follows.

	Receive Mode				Transmit Mode			
PI CLK	U4(12)	U4(9)	U4(8)	U4(11)	U4(12)	U4(9)	U4(8)	U4(11)
1	0	0	0	0				
2	1	0	0	0	1	0	0	0
3	0	1	0	0	0	1	0	0
4	1	1	0	0	1	1	0	0
5	0	0	1	0	0	0	1	0
6	1	0	1	0	1	0	1	0
7	0	1	1	0	0	1	1	0
8	1	1	1	0	1	1	1	0
9	0	0	0	1	0	0	0	1
10	1	0	0	1	1	0	0	1
11	0	1	0	1	0	1	0	1
12	1	1	0	1	1	1	0	1
13	0	0	1	1	0	0	1	1
14	1	0	1	1	1	0	1	1
15	0	1	1	1	0	1	1	1
16	1	1	1	1	1	1	1	1

4-87. U3B and U3A keep track of the number of times a set of PI CLK pulses has been received and generate digital signals A', B'. The A12 LO±IF board has two RAMs for data storage. The state of the RAMs is controlled by signals A', B'. Initially U3B and U3A outputs A' and B' are low. The trailing edge of $\overline{\text{PI CLK EN}}$ clocks U3B and U3A. Initially when A' is low, U1 is set and the first PI CLK pulse is not inhibited. On the next set of 16 pulses, A' is high; and with the trailing edge of the first clock pulse U1 is set and only 15 clock pulses will appear at the input to ÷16 counter U4.

4-88. Below is a timing diagram showing the relationship between PI CLK, $\overline{\text{PI CLK EN}}$, A' and the sequence of pulses.

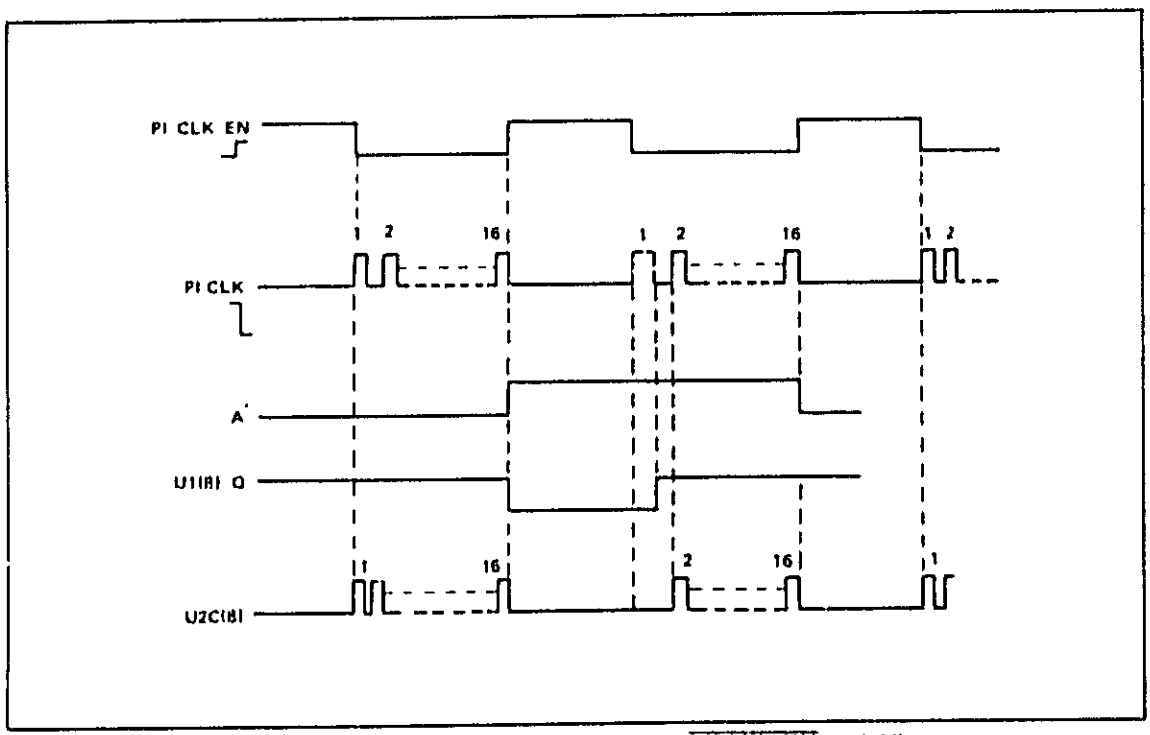


Figure 4-2. Timing Diagram (PI CLK, $\overline{\text{PI CLK EN}}$ and A')

4-89. When DATA INHIBIT at XA11U7J goes high, data transfer from the converter to the counter is stopped.

4-90. Decimal point information is shifted out from the decimal point storage latches in the A12 board at the tenth digit. A11U5 pulls DPA, C, E, F down simultaneously at the appropriate time for the decimal point to shift out.

4-91. A12 LO±IF

4-92. The A12 LO±IF board is part of Option 011. Functionally, A12 implements the two-signal input measurement capability of the converter and counter. This option allows the counter and converter to measure the frequency of a weak microwave signal as received by a separate microwave superheterodyne receiver. The 5354 rear panel LO±IF switch is set to the ON position. The receiver IF signal is applied to the 5345A CHANNEL A input, and the receiver local oscillator signal is applied to the 5354 INPUT. (The setting of the 5354A rear panel +IF/-IF switch depends on the receiver local oscillator. If the receiver local oscillator frequency is below the received signal frequency, the switch is set to +IF; but if the receiver local oscillator frequency is above the received signal frequency, the switch is set to -IF.) The 5354 and 5345 process the two signals and display the received microwave signal frequency.

4-93. The LO±IF function is described in Figure 4-3, LO±IF Timing Diagram; and Table 4-1, LO±IF Operating Cycle.

4-94. The 5345 counter controls the timing of the LO±IF operating cycle. Intermediate results are stored in RAM's A12U9 and U16. Decimal point information is stored in latches A12U2, U6, and U7.

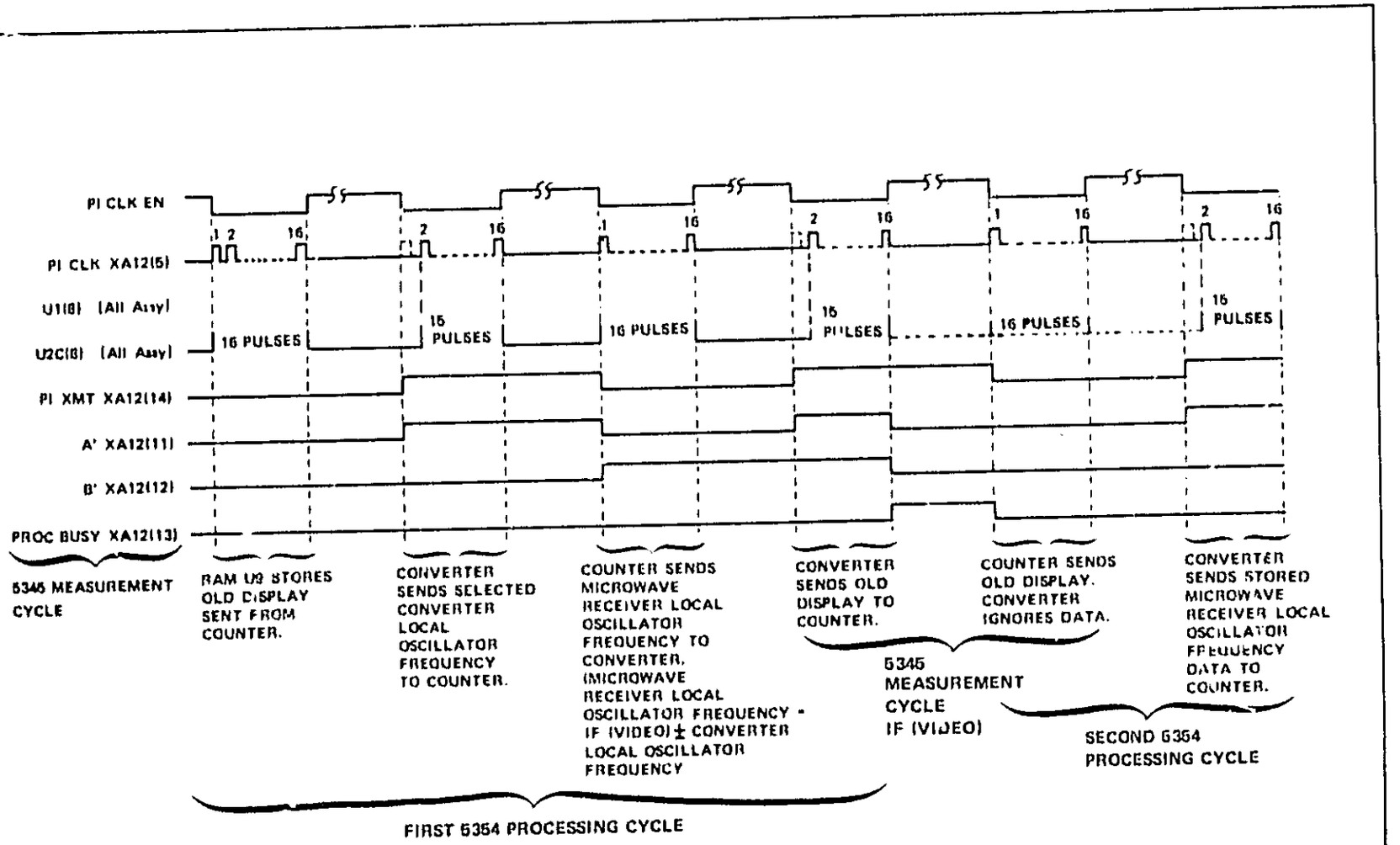


Figure 4-3. LCD Timing Diagram

Table 4-1. LO±IF Operating Cycle

5345 Counter ARMED	5354 Converter
Measurement Cycle	1) a) Assume the 5354A is in the LO±IF mode and local mode of operation. LOC LO±IF XA12($\overline{17}$) is high, $\overline{\text{RMT}}$' XA12($\overline{15}$) is high, and PI INIT ARM XA12(17) is high. b) U11A(3) is high and flip-flop U10B is enabled to be toggled by $\overline{\text{PROC BUSY}}$ XA12($\overline{13}$). Initially U10B(9) is low. c) Converter heterodynes the signal applied to its input connector (LO) and sends the Video (IF) signal to the counter.
	5354 First Processing Cycle
Processing Cycle	2) a) $\overline{\text{PROC BUSY}}$ XA12($\overline{13}$) and DISP STR XA12($\overline{5}$) go Low, U10B(9) toggles high on the trailing (+) edge of $\overline{\text{PROC BUSY}}$ $\overline{\text{DISP STR}}$ XA12($\overline{5}$) remains low during the first proc. cycle. It's inactive during the 2nd cycle. b) Initially A'=0, XA12($\overline{11}$) and B'=0 XA12(12). This enables RAM U9 to WRITE one digit each time PI CLK XA12(5) goes low. The counter is sending the old display to be stored in RAM U9. The information is entering on XA12(13, 14, 15, 16) as 16 BCD bytes. For RAM U9 to both ME and WE inputs must be low. The RAM addresses are being selected on the trailing edge of each PI CLK by A XA12(9), B XA12(10), C XA12($\overline{10}$) and D XA12(11). The most significant digit is sent in on the trailing edge of pulse 15. At pulse 15 A, B, C, D are all high and U4A(6) goes low. U10A(6) goes high, disabling the PI CLK strobing of RAM U9. Whenever data is read into the RAM, decimal point information is stored in the decimal point storage circuits U2, U6, and U7. The decimal point is strobed in on the 15th pulse, at that time U10A(5) goes low and gate U1C(8) goes high enabling the first row of latches U6A, U6B, U6C, U6D, U2C, U2D. If a decimal point is located between the 10th and 11th digit the stored data would be: XA12($\overline{3}$) $\overline{\text{DPA}}$ = 0 binary 2^0 XA12($\overline{8}$) $\overline{\text{DPB}}$ = 0 binary 2^1 XA12(8) $\overline{\text{DPC}}$ = 0 binary 2^2 XA12(3) $\overline{\text{DPD}}$ = 1 binary 2^3 XA12(4,$\overline{4}$) DPE = 0 binary 2-4 XA12($\overline{9}$) $\overline{\text{DPF}}$ = 0 binary 2-5 *Decimal equivalent is 10 3) a) The converter sends selected band information from A9 Filter Select Amplifier to the 5345 counter. A' becomes one and B' zero, A'=1, B'=0. Decimal point information is strobed from the first set of latches to the second set. The first of the 16 PI CLK pulses is inhibited because the converter is sending data. 4) a) The counter adds the Video (IF) frequency to the converter local oscillator signal. The result is the microwave receiver local oscillator frequency.

Table 4-1. LO±IF Operating Cycle (Continued)

5345 Counter ARMED	5354 Converter
Processing Cycle Cont'd	5) a) During the next set of PI CLK pulses the counter transmits the receiver local oscillator frequency to the converter. At this time A'=0 and B'=1 which enables the receiver local oscillator frequency data to be stored in RAM U16. b) The receiver local oscillator frequency decimal point information is stored in the first set of latches. 6) a) The counter will send a new set of 16 pulses. A'=1, B'=1. RAM U9 is in a READ mode (WE is high and ME is low) and will output a digit whenever an address code is received from A11. The first PI CLK pulse is inhibited because the address code remains at zero. The first digit sent out is the least significant digit of the old display. The decimal point is sent out of the second set of latches (U2, U7). $\overline{\text{PI XMT}}$ is high when the converter is sending data, this enables output buffers U17A, B, C, D. **End of First 5354A Processing Cycle**
Measurement Cycle	7) a) After the old display is outputted, $\overline{\text{PROC BUSY}}$ goes high. U10B(Q) will toggle high at the trailing edge of $\overline{\text{PROC BUSY}}$. U12A is clocked by the leading edge of PROC BUSY and $\overline{\text{ADV A\&B}}$ goes low. $\overline{\text{ADV A\&B}}$ causes the next signal to be measured, the signal present at the 5345 counter. When switching between converter and counter occurs the counter is forced to ARM, overriding the sample rate with a signal generated in the converter called $\overline{\text{PI ARM}}$ XA11(4). The signal present at the 5345 input (IF) is measured. **2nd 5354 Processing Cycle**
Processing Cycle	8) a) Withe the trailing edge of $\overline{\text{PROC BUSY}}$ U10B(9) and U12A(6) toggle high Then 16 pulses are sent to the converter, and counter sends the old display, but the converter ignores this information. A'=0, B'=0. 9) a) During the following 16 pulses the converter sends the receiver local oscillator frequency to the counter. A'=1, B'=0. RAM U16 is programmed to READ; it outputs the receiver local oscillator frequency which was stored during Step 5.

4-95. A13 HP INTERFACE I/O BOARD (OPTION 011)

4-96. The optional A13 interface input-output board connects the converter to the HP Interface Bus. With the A13 board, all front and rear panel control functions of the converter are available for remote control through the HP Interface Bus.

NOTE

Remote Programming is described in Section II.

4-97. All interface signals to and from the bus are made through the 24-pin receptacle, J1, at the left side of the schematic. The multisection resistors R1 and R2 terminate the bus lines. Table 4-2, 5354A Converter Program Code Set, is a repetition from Section II. The table can be used to trace a converter control function through the A13 board.

4-98. The ADDRESS switch, S1, must be set for a particular address in the system so bus talkers can talk to the converter when it is necessary. When the correct address in the form of highs and lows on the DIO, 1, 2, 3, 4, and 5 lines is received by comparator U3, the codes are compared with the S1 switch settings.

4-99. The RANDOM BAND SELECT shift register, U13, functions in the MANUAL mode of converter remote operation. Any of the converter bands not necessarily in any sequence may be selected by applying the correct codes to the DI0, 1, 2, 3, and 4 lines. Refer to Table 4-2 for a listing of the manual band select codes.

4-100. The ADD or SUBTRACT IF LOGIC, IC U12, and associated elements operates to allow the converter functions RKS, $\overline{\text{OPT A}}$, RMT (LO IF), RMT-CW/$\overline{\text{PRF}}$, and RMT-MAN/AUTO to be selected or not selected through the bus. (Refer to the abbreviations list at the end of this section for the meaning of these function abbreviations.)

4-101. A15 SCHMITT TRIGGER

4-102. The A15 board consists of a Schmitt trigger identical to the one in the A3 Video (IF) board. The second Schmitt trigger provides the counter with a symmetrical signal with a 50/50% duty cycle. The output of A15U2 goes through a low-pass filter C10, L1, C12 with a cutoff frequency of approximately 600 MHz to attenuate harmonics. The "OUT BAL" control, A15R19, sets the reference dc level of the output Video (IF) trigger signal. The dc level must be exactly -400 mV ±50 mV with a voltage swing of 750 mV (see Figure 4-4) from 400 MHz to 530 MHz and a voltage swing of 500 mV below 400 MHz.

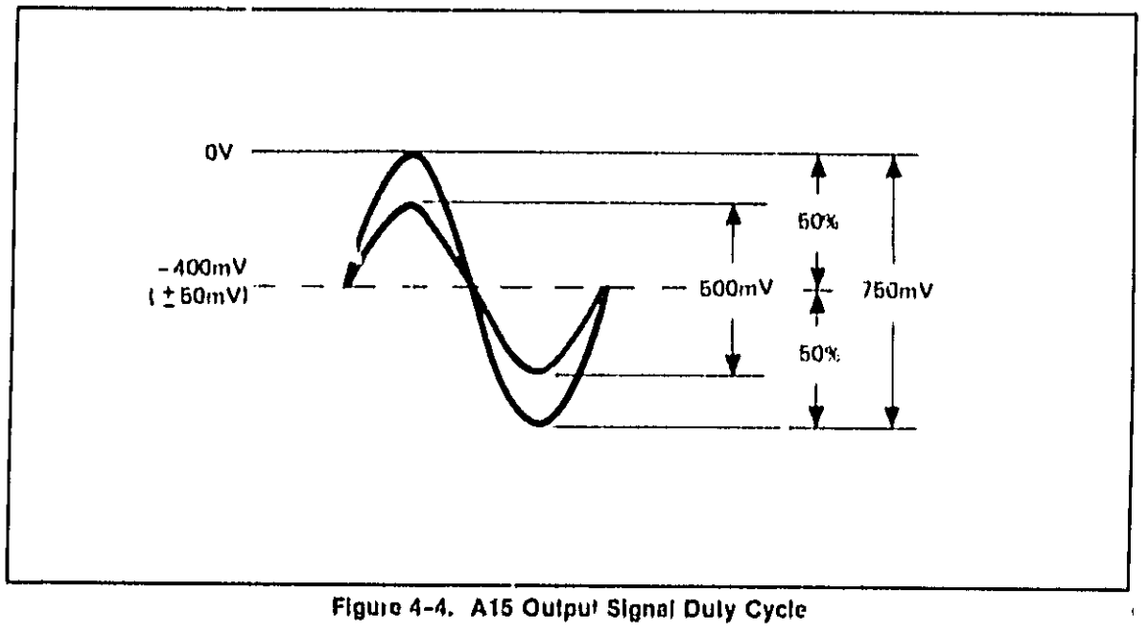


Figure 4-4. A15 Output Signal Duty Cycle

Table 4-2. 5354A Converter Program Code Set

Program Code	ASCII Character	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO1	Octal
Bands									
Reset 0 MHz	C	1	0	0	0	0	1	1	103
Manual 500 MHz	0	0	0	1	1	0	0	0	060
Manual 750 MHz	1	0	0	1	1	0	0	1	061
Manual 1.0 GHz	2	0	0	1	1	0	1	0	062
Manual 1.5 GHz	3	0	0	1	1	0	1	1	063
Manual 2.0 GHz	4	0	0	1	1	0	0	0	064
Manual 2.5 GHz	5	0	0	1	1	0	0	1	065
Manual 3.0 GHz	6	0	0	1	1	0	1	0	066
Manual 3.5 GHz	7	0	0	1	1	0	1	1	067
RESET	C	1	0	0	0	0	1	1	103
AUTO	A	1	0	0	0	0	0	1	101
PRF	F	1	0	0	0	0	1	1	106
CW	N	1	0	0	0	1	1	0	116
LO±IF	E	1	0	0	0	0	1	0	105
LO±IF OFF	M	1	0	0	0	1	1	0	115
SUB K	G	1	0	0	0	0	1	1	107
ADD K	O	1	0	0	0	1	1	1	117
SUB IF	B	1	0	0	0	0	1	0	102
ADD IF	J	1	0	0	0	0	1	0	112

Explanation of Program Code Sets

BANDS. These program codes allow any of the Converter bands to be selected. This function is analogous to the MANUAL mode of operation and BAND SELECT pushbutton.

RESET. Same as front panel RESET pushbutton.

AUTO. Same as front panel AUTO switch.

PULSED RF & CW. Same as front panel CONT. WAVE/PULSED R.F. switch.

SUB K. -LO-Video position of rear panel DISPLAY CONTROL switch.

ADD K. NORM LO+Video position of the DISPLAY CONTROL switch.

LO±IF. On position of rear panel LO±IF switch.

LO±IF OFF. OFF position of rear panel LO±IF switch.

SUB IF. -IF position of rear panel +... -IF switch.

ADD IF. +IF position of rear panel +IF/-IF switch.

4-103. The Schmitt trigger board A15 is completely isolated from the converter's chassis ground and is grounded only at the 5345 counter. The separate grounds eliminate noise which could otherwise cause false triggering of the 5345.

4-104. SIGNAL ABBREVIATIONS

4-105. Table 4-3 is a list of signal abbreviations and their meanings for signals in the converter.

Table 4-3. Signal Abbreviations and Meanings

Abbreviations	Meanings
A	Output from digit counter XA11(13). Counts each pulse (total 16 pulses) and associates the appropriate digit.
A'	Output from U3B on XA11. Counts how many times 16 pulses have been received by converter.
$\overline{\text{ADV-A\&B}}$	Advanced select A and B. Selects channel A&B in 5345. Only valid for LO±IF measurements
$\overline{\text{AUTO}}$	Automatic operation. Selectable from converter front panel or remote via HP Bus.
B	BCD output from digit counter XA11(14). (Same as A).
B'	Output from U3A on XA11. (Same as A').
BSR	Bypass Sample Rate. In the manual mode when RESET or BAND SELECT are pushed the counter will display the band before taking a measurement.
C	BCD output from digit counter XA11($\overline{14}$). (Same as A).
CLOCK	Clock generated in converter to step through the bands.
$\overline{\text{CW/PRF}}$	Continuous Wave/Pulsed R.F. Select Line.
D	BCD output from digit counter XA11(15). (Same as A).
DATA INHIBIT	If Low, data is inhibited from being transmitted to 5345.
DQA, DQB, DQC, DQD	BCD format for selected band. D = Data, Q = Q output of flip-flop. ABCD = 1, 2, 4, 8 binary weight.
DRA, DRB, DRC	Display register A, B, C, D. BCD format of data to or from 5345.
$\overline{\text{DATA INHIBIT}}$	Same as Data Inhibit
$\overline{\text{DISP STR}}$	Display stored. Active low during the first processing cycle of the LO±IF measurement.
$\overline{\text{DPA}}$, $\overline{\text{DPB}}$, $\overline{\text{DPC}}$, $\overline{\text{DPD}}$, $\overline{\text{DPE}}$, $\overline{\text{DPF}}$	Decimal Point A, B, C, D, E, F Binary format for decimal point position.
$\overline{\text{DQD}}$	Same as DQD, but negative logic.
F-IN	Signal applied to converter INPUT connector.
IFD	IF-Display. Signal to IF indicator driver.

Table 4-3. Signal Abbreviations and Meanings

Abbreviations	Meanings
IF DET	IF Detector. Active high when all IF detectors indicate IF signal is present.
$\overline{\text{IFC}}$	IF controlled. Active low when IF signal is present. Same signal as IF-DET but combined with RESET function.
$\overline{\text{IN RES}}$	INITAL RESET. When power is switched on, will stay low until full power is applied to converter.
KS	Constant sign. Sign on converter-Data to be transmitted to 5345.
$\overline{\text{K DATA}}$	Constant K is present. Indicates that converter has constant K stored.
LOC (LO±IF,	Local Control. To select LO±IF mode of operation.
M-AUTO	Manual select AUTO. Input from front panel switch, MANUAL/AUTO.
$\overline{\text{M-MAN}}$	Manual Select Manual. Manual mode of operation. (Front panel switch.)
M-RST	Manual Reset. Input from front panel RESET switch
$\overline{\text{M-RST}}$	Same as M-RST but negative true.
$\overline{\text{OPS}}$	Option select line. Active low when LO±IF option has been selected.
$\overline{\text{OPT A}^{\text{c}}}$	Option and A$^{\text{c}}$. Active low when LO±IF option has been selected and IF converter is in second processing cycle.
PI CLK	Plug-In Clock. 16 pulses from 5345.
PI CLK EN	Plug-In Clock Enable. Active when 16 pulses are transmitted from 5345.
PI XMT	Plug-In transmit. Control signal from 5345; when low, PI (converter) will transmit data; when high, 5345 transmits data.
$\overline{\text{PI ARM}}$	Plug-In ARM. When low it arms the 5345 overriding the sample rate.
$\overline{\text{PI DATA}}$	Plug-In DATA. Active low for one processing cycle when plug-in (converter) is in MANUAL-mode of operation and no "IF" signal is present.
$\overline{\text{PI INH ARM}}$	Plug-in inhibit arm. Inhibits the 5345 from arming when low.
$\overline{\text{PI INV SIGN}}$	Plug-in invert sign. Active low to invert displayed signal of 5345.
$\overline{\text{PI SEL}}$	Plug-in select. Control signal from 5345 to select plug-in function. Active low.
$\overline{\text{PI XMT}}$	Plug-in transmit. Buffered and inverted PI XMT signal from 5345.
$\overline{\text{PRF}}$	"Pulsed R.F.". Active low when in pulsed R.F. mode of operation has been selected.
$\overline{\text{PROC BUSY}}$	Processor busy. From 5345. Active low when processor is busy.
REM (LO±IF) or RMT (LO±IF)	Remote LO±IF. Remote control to select LO±IF operation of plug-in.
RMT CW/$\overline{\text{PRF}}$	Remote CW/$\overline{\text{PRF}}$. Remote control signal to select continuous wave or pulsed R. F. mode of operation.
RKS	Rear Panel Select line or signal of constant K. Upper or lower side-band and ±IF can be selected.

Table 4-3. Signal Abbreviations and Meanings

Abbreviations	Meanings
RMT DQA RMT DQB RMT DQC RMT DQD	Remote BCD-code for band selection.
$\overline{\text{RMT MAN AUTO}}$	Remote MANUAL/AUTO. Remote select line for manual or auto mode of operation.
RESET	Resets the band select counter to "zero" (first) band.
$\overline{\text{RESET 5345}}$	Reset line to 5345. Active low whenever band is changed or RESET is pushed in the MANUAL mode of operation.
$\overline{\text{RMT}}$	Remote. Control line from 5345. Active low when in remote. Puts converter in remote mode of operation.
$\overline{\text{RMT RESET}}$	Remote Reset.
S1, S2, S3 — Qualifiers applied to A8 Filter swit	S1 indicates Video (IF) signal out of A1 is correct frequency. S2 indicates Video (IF) signal has sufficient amplitude. S3 indicates converter input signal level is above -16 dBm (approx.).
$\overline{\text{SEL A\&B}}$	Select A&B from converter to select channels A&B in 5345.
$\overline{\text{SIGN}}$	Sign of constant "k", to 5345.
$\overline{\text{SON}}$	"Schmitt Trigger ON". Turns Schmitt trigger in converter on or off.
TUNE-UP	Band Select switch pressed from front panel to select any band in manual mode of operation.
$\overline{\text{TUNE UP}}$	Band Select switch pressed.
$\overline{\text{UFQ}}$	XA10 U3B Flip-Flop $\overline{Q}$ Output. When low-in AUTO mode of operation indicates converter has found correct band.

4-106. INTEGRATED CIRCUIT DESCRIPTIONS

4-107. Under this heading the integrated circuits used in the converter that are not common logic elements (AND, OR, NAND, NOR, etc.) are described in Hewlett-Packard part number order.

4-108. Thin Film Very Wide-Band Amplifiers 1813-0018, 1813-0044

4-109. These are .5 to 550 MHz amplifiers with up to 31 dB gain.

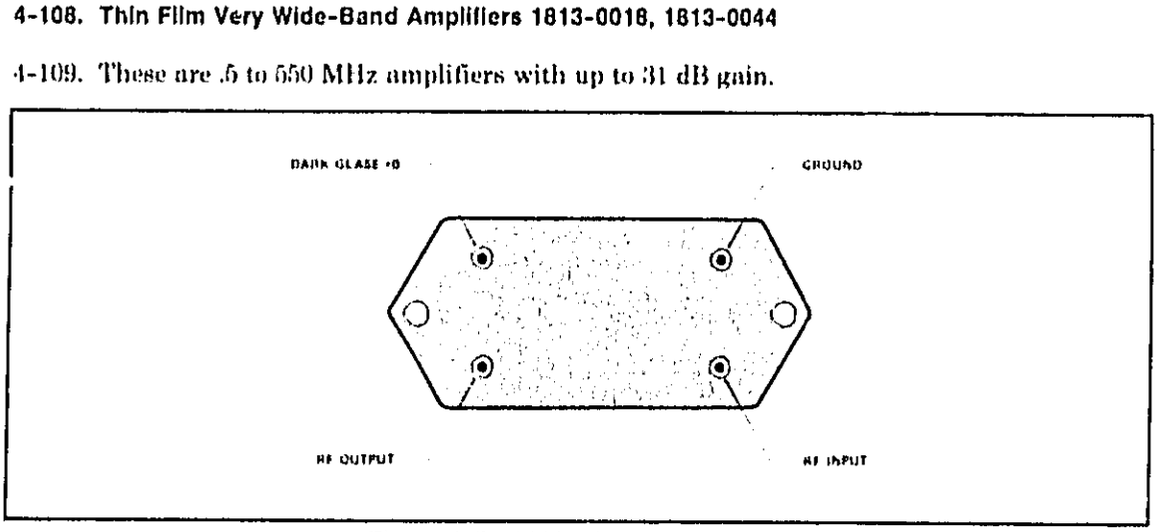
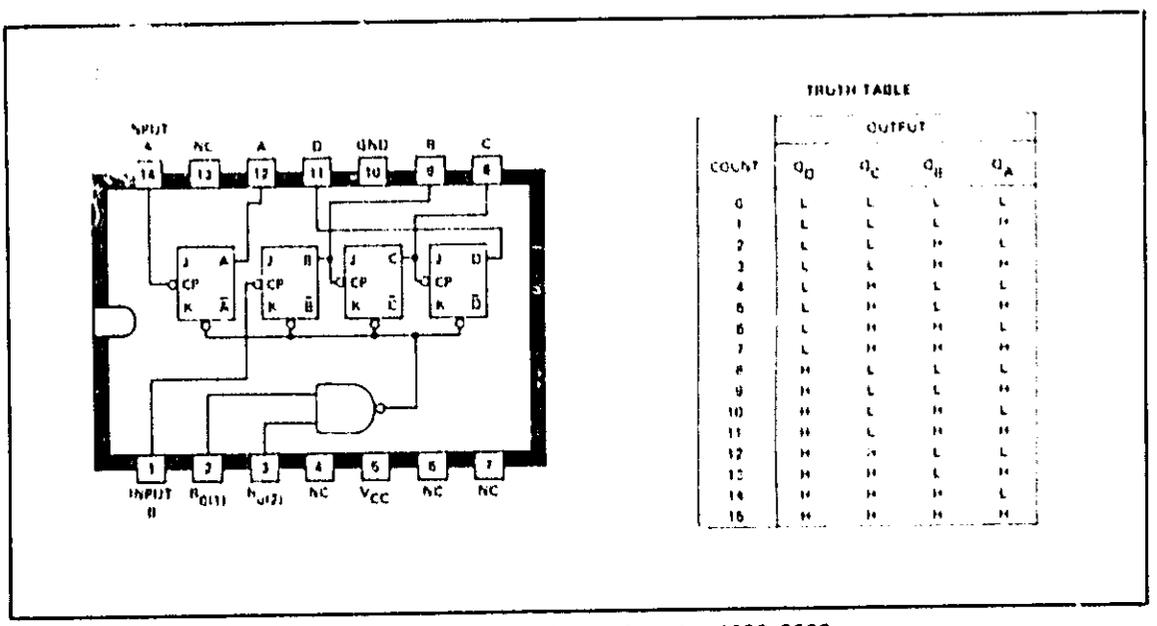


Figure 4-5. 1813-0013 Bottom View

4-110. Four-Bit Binary Counter 1820-0099

4-111. The binary counter (Figure 4-6) consists of four J-K flip-flops connected to provide a ÷2 counter and a ÷8 counter. When pin 12 is connected to pin 1, the unit is a four-bit binary counter. The input pulses are applied at pin 14 and simultaneous divisions of 2, 4, 8, and 16 are available at the output pins as shown in the truth table. Thus, the counter converts the input pulses to an equivalent binary output. To reset the counter to zero, both pins 2 and 3 must be high.



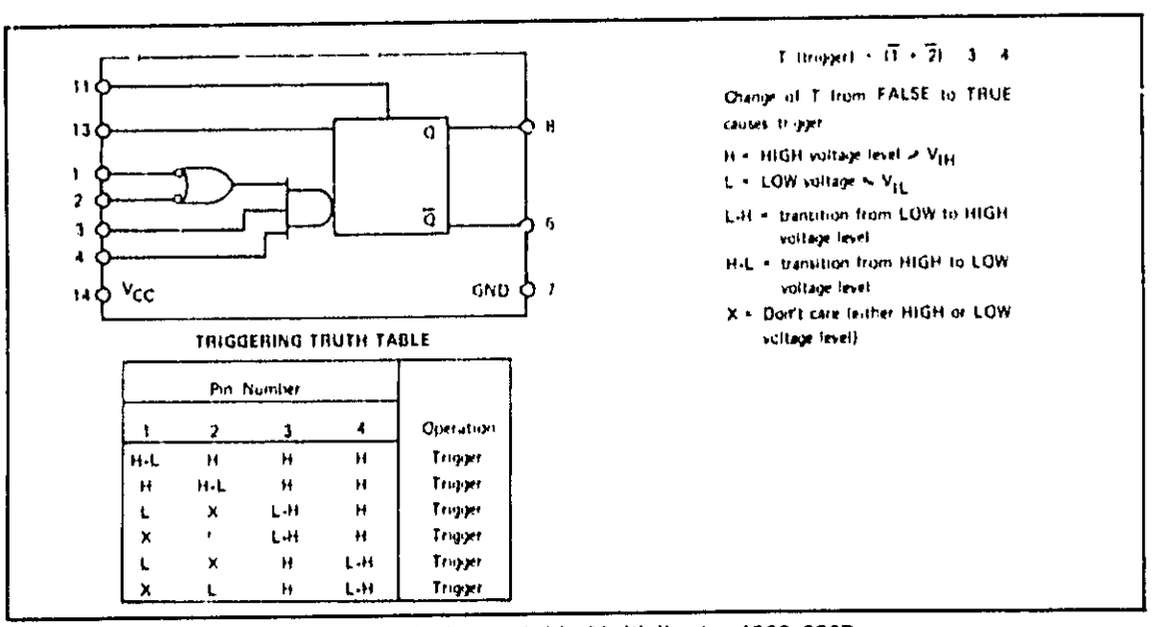
TRUTH TABLE

COUNT	OUTPUT Q_D	Q_C	Q_B	Q_A
0	L	L	L	L
1	L	L	L	H
2	L	L	H	L
3	L	L	H	H
4	L	H	L	L
5	L	H	L	H
6	L	H	H	L
7	L	H	H	H
8	H	L	L	L
9	H	L	L	H
10	H	L	H	L
11	H	L	H	H
12	H	H	L	L
13	H	H	L	H
14	H	H	H	L
15	H	H	H	H

Figure 4-6. Four-Binary Counter 1820-0099

4-112. Monostable Multivibrator 1820-0207

4-113. This IC (Figure 4-7) contains a retriggerable monostable multivibrator. The inputs are dc level sensitive, i.e., triggering occurs on the rising or trailing edges of the input waveform. For triggering on the rising edge, the input can be applied to pins 3 and 4. For trailing edge triggering, pin 1 or 2 is used. The logic diagram shows the input logic. When the multivibrator is triggered, the external resistor and capacitor determine the output pulse width; however, successive inputs with a period shorter than the delay time will retrigger the multivibrator.



T (trigger) = $(\overline{1} + \overline{2})$ 3 4

Change of T from FALSE to TRUE causes trigger

H = HIGH voltage level ≥ V_{IH}

L = LOW voltage ≤ V_{IL}

L-H = transition from LOW to HIGH voltage level

H-L = transition from HIGH to LOW voltage level

X = Don't care (either HIGH or LOW voltage level)

TRIGGERING TRUTH TABLE

Pin Number 1	2	3	4	Operation
H-L	H	H	H	Trigger
H	H-L	H	H	Trigger
L	X	L-H	H	Trigger
X	'	L-H	H	Trigger
L	X	H	L-H	Trigger
X	L	H	L-H	Trigger

Figure 4-7. Monostable Multivibrator 1820-0207

4-114. Four-Line to Ten-Line Decoder 1820-0214

4-115. The 1820-0214 decoder (Figure 4-8) consists of eight inverters and 10 four-input NAND gates. As shown in the truth table, the unit accepts BCD inputs and provides the equivalent decimal output. The activated output will be a logic low. For example, if the BCD input is DCBA = 0111, then the decimal 7 output will go low and all others will be high.

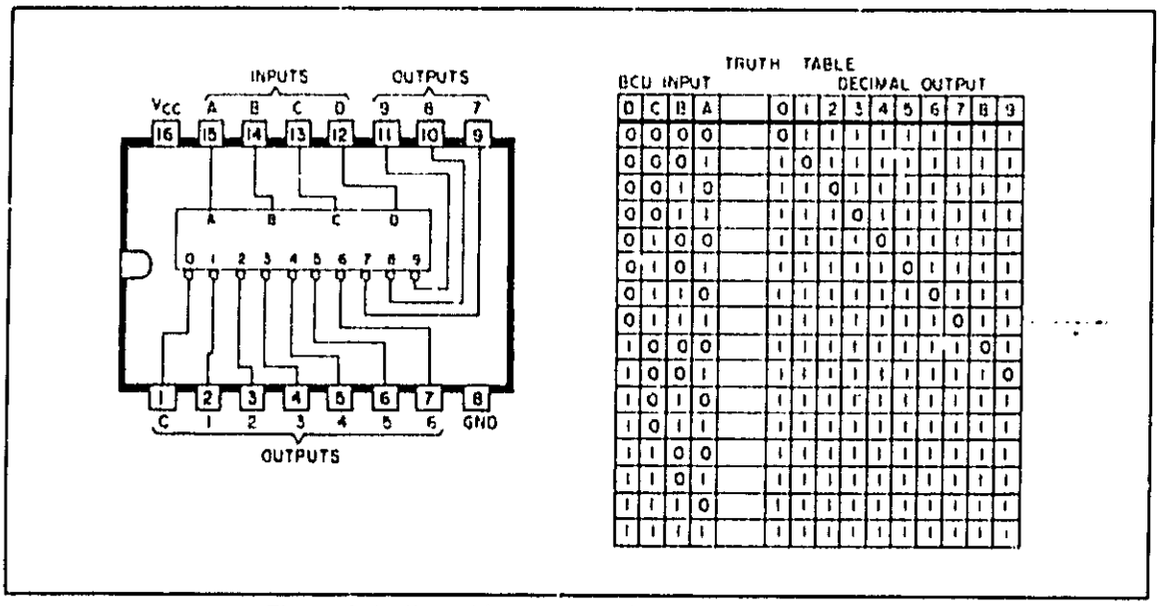


Figure 4-8. Four-Line to Ten-Line Decoder 1820-0214

4-116. Dual J-K Master-Slave Flip-Flops 1820-0281

4-117. These IC's (Figure 4-9) are separate dual J-K flip-flops with asynchronous CLEAR inputs. They will operate at 25 MHz toggling, and the clock line is clamped to reduce ringing.

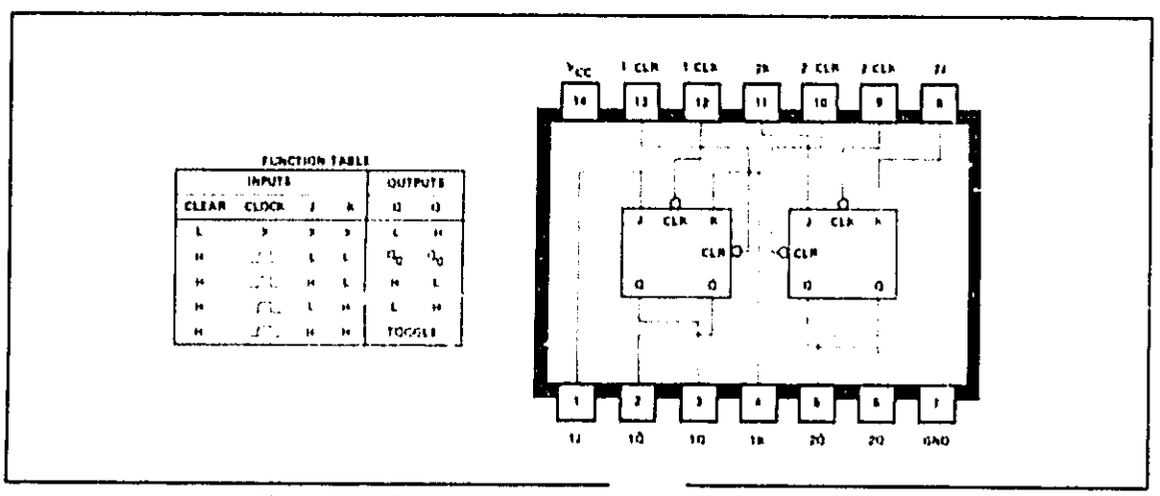


Figure 4-9. Dual J-K Master-Slave Flip-Flops 1820-0281

4-118. Four-Bit Parallel-Access Shift Registers 1820-0497

4-119. These 4-bit registers have parallel and serial inputs, parallel outputs, mode control, and two clock inputs. The registers have three modes of operation:

Parallel (Broadside) load
Shift right (the direction Q_A toward Q_D)
Shift left (the direction Q_D toward Q_A)

4-120. Parallel loading is accomplished by applying the four bits of data and taking the mode control input high. The data is loaded into the associated flip-flops and appears at the outputs after the high-to-low transition of the clock-2 input. During loading, the entry of serial data is inhibited.

4-121. Shift right is accomplished on the high-to-low transition of clock-1 when the mode control is low; shift left is accomplished on the high-to-low transition of clock-2 when the mode control is high by connecting the output of each flip-flop to the parallel input of the previous flip-flop (Q_n to input C, etc.) and serial data is entered at input D. The clock input may be applied commonly to clock-1 and clock-2 if both modes can be clocked from the same source. Changes at the mode control input should normally be made while both clock inputs are low; however, conditions described in the last three lines of the function table will also ensure that register contents are protected.

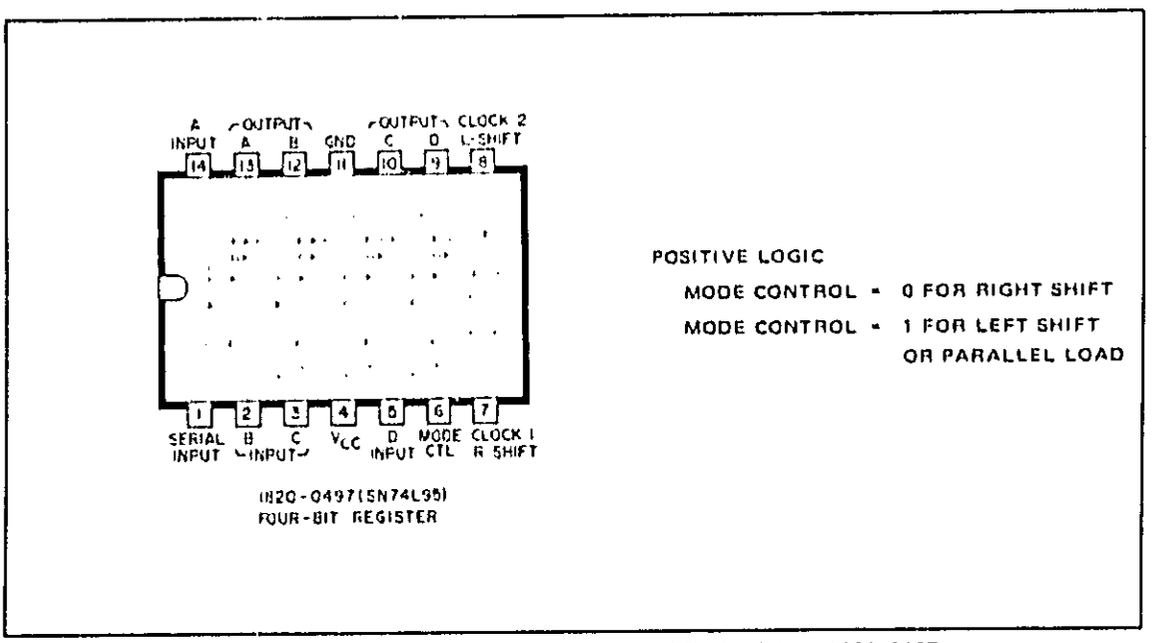


Figure 4-10. Four-Bit Parallel-Access Shift Registers 1820-0497

4-122. Dual D-Type Edge-Triggered Flip-Flops 1820-0596

4-123. This IC contains low-power dual edge-triggered flip-flops as shown in Figure 4-11. Information at the D-input is transferred to the Q output on the positive-going edge of the clock pulse. Clock triggering occurs at a voltage level of the clock pulse and is not directly related to the transition time of the positive-going pulse. When the clock is at either a high or low level, the D-input signal has no effect. Maximum clock frequency is typically 3 MHz with a typical power dissaption of 4.25 milliwatts per flip-flop.

4-124. Quad 2-Input Multiplexer 1820-0616

4-125. The 1820-0616 (Figure 4-12) consists of four 2-input multiplexers with common input select logic, common active low enable and active high outputs. This allows four bits of data to be switched in parallel to the appropriate outputs from four 2-bit data sources. When the enable input is high (inactive), all outputs are held low. When the S input is high, the I_1a, I_1b, I_1c, and I_1d inputs are transferred to the Z_a, Z_b, Z_c, and Z_d outputs respectively. The transfer takes place without polarity inversion. For example, if S is high and I_1a is low, then Z_a will be low, conversely if I_1a is high (with S=H) then Z_a will go high. When S is low, the I_0 outputs will appear at the Z outputs.

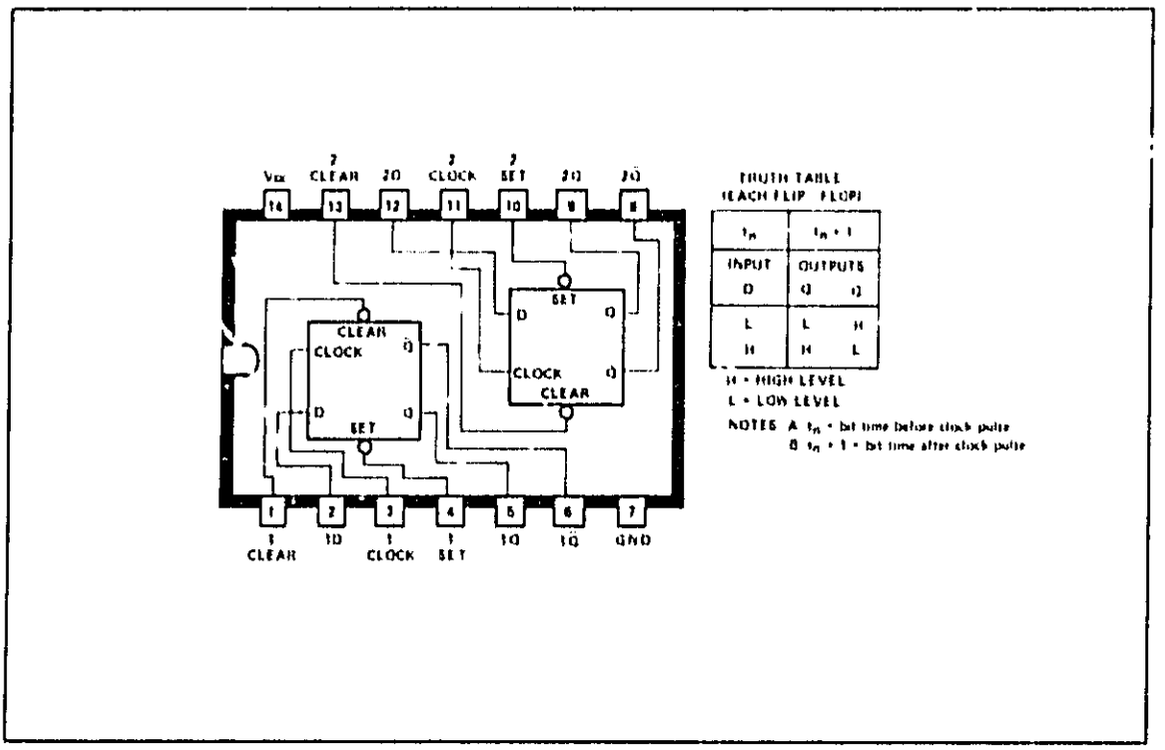


Figure 4-11. Dual D-Type Edge Trigger Flip-Flops 1820-0596

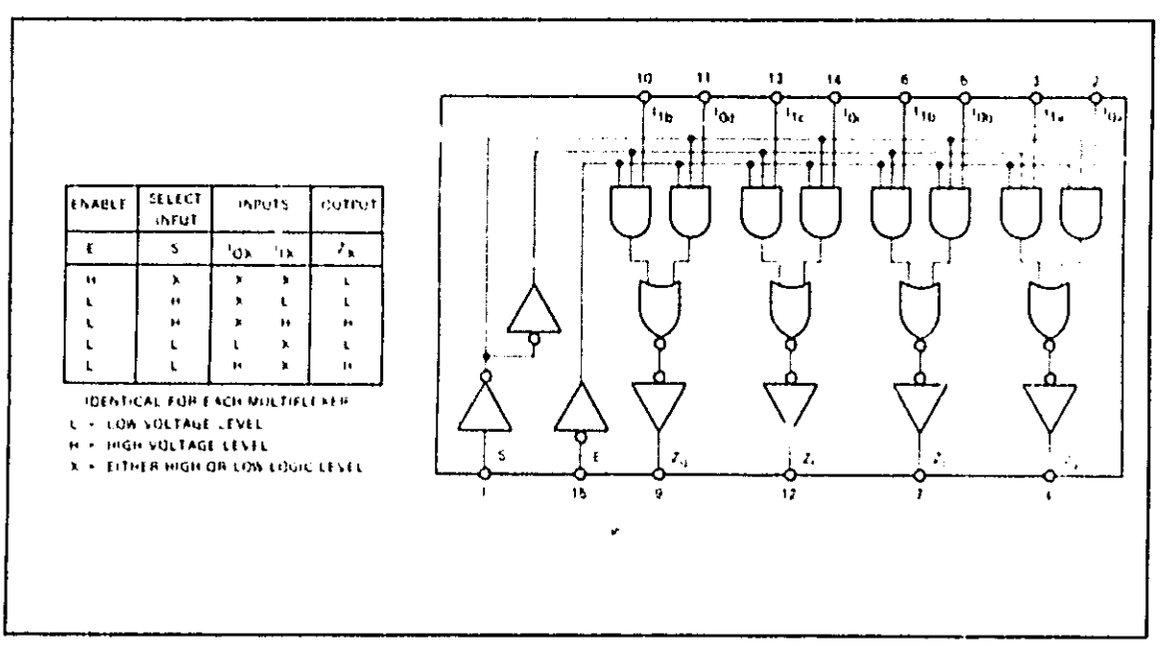


Figure 4-12. Quad 2-Input Multiplexer 1820-0616

4-126. 64-Bit Read-Write Memory 1820-0628

4-127. This 64-bit memory (Figure 4-13) is an array of 64 flip-flop memory cells organized in a matrix to provide 16 words of four bits each. Each of the 16 words is addressed in straight binary with full on-chip decoding.

4-128. The buffered memory inputs consist of four address lines, four data inputs, a write enable, and a memory enable for controlling the entry and access of data. The memory has open-collector outputs which may be wire-AND connected to permit expansion up to 4704 words of N-bit length without additional output buffering.

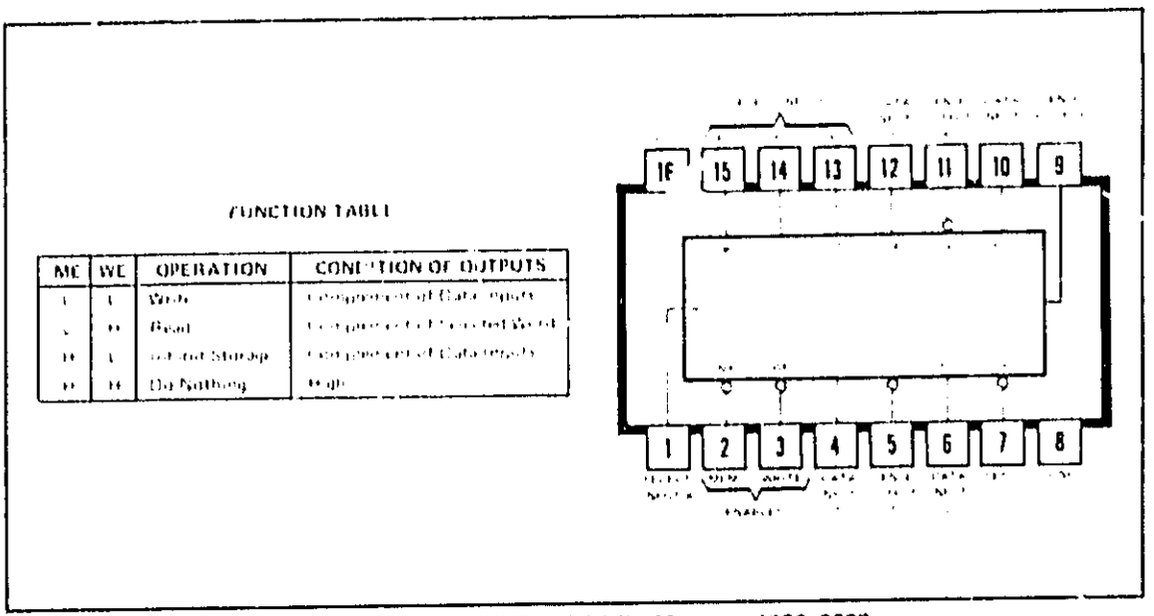


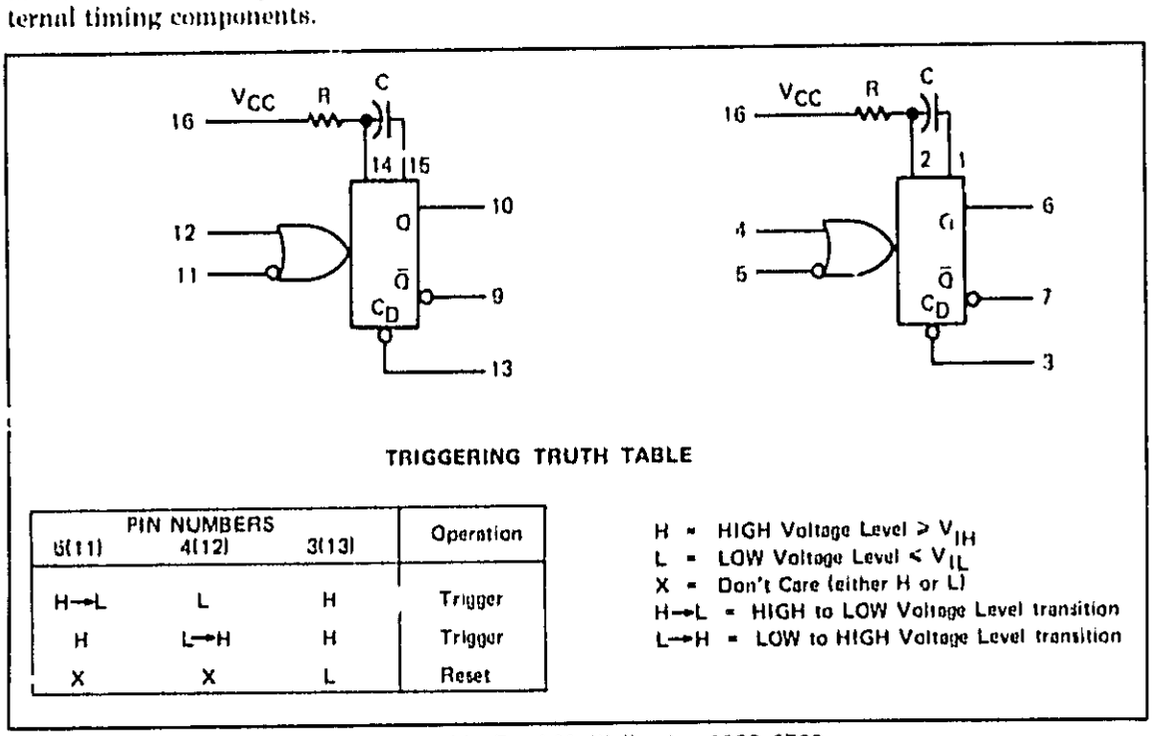
Figure 4-13. 64-Bit Read-Write Memory 1820-0628

4-129. WRITE OPERATION. Information present at the data inputs is written into the memory by addressing the desired word and holding both the memory enable and write enable low. Since the internal output of the data input gate is common to the input of the sense amplifier, the sense output will assume the opposite state of the information at the data inputs when the write enable is low.

4-130. READ OPERATION. The complement of the information which has been written into the memory is nondestructively read out at the four sense outputs. This is accomplished by holding the memory enable low, the write enable high, and selecting the desired address.

4-131. Dual Multivibrator 1820-0730

4-132. This dual multivibrator (Figure 4-14) is a Dual Retriggerable, Resettable Monostable Multivibrator which provides an output pulse whose duration and accuracy is a function of external timing components.



TRIGGERING TRUTH TABLE

PIN NUMBERS 5(11)	4(12)	3(13)	Operation
H→L	L	H	Trigger
H	L→H	H	Trigger
X	X	L	Reset

H = HIGH Voltage Level > V_{IH}
L = LOW Voltage Level < V_{IL}
X = Don't Care (either H or L)
H→L = HIGH to LOW Voltage Level transition
L→H = LOW to HIGH Voltage Level transition

Figure 4-14. Dual Multivibrator 1820-0730

4-133. Low-Power Quad Two-Input Multiplexer 1820-0710

4-134. The multiplexer consists of four multiplexing circuits with common select and enable logic. Each circuit contains two inputs and one output. The logic symbol and truth table are shown in Figure 4-15.

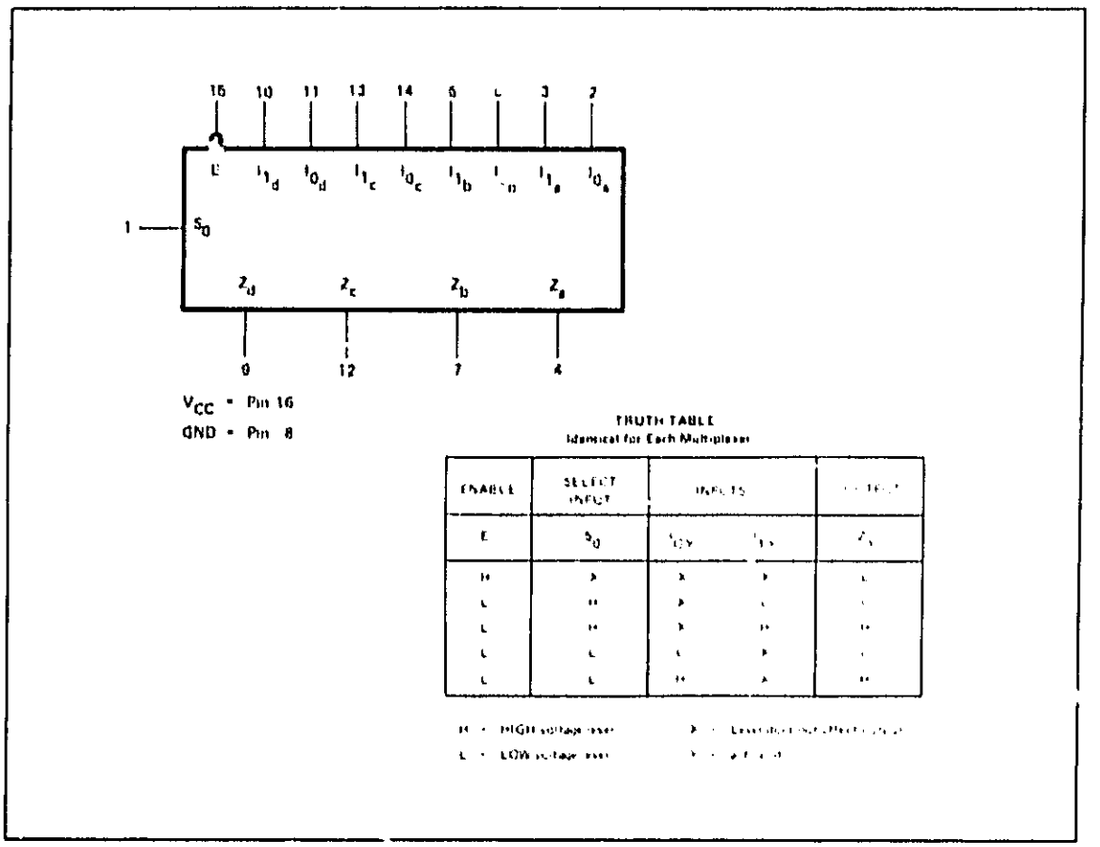


Figure 4-15. Low-Power Quad Two-Input Multiplexer 1820-0710

4-135. Four-Bit Bistable Latches 1820-0876

4-136. This IC (Figure 4-16) is a four-bit bistable latch. Information present at a data (D) input is transferred to the Q output when the enable (G) is high and the Q output will follow the data input as long as the enable remains high. When the enable goes low, the information (that was present at the data input at the time the transition occurred) is retained at the Q output until the enable is permitted to go high.

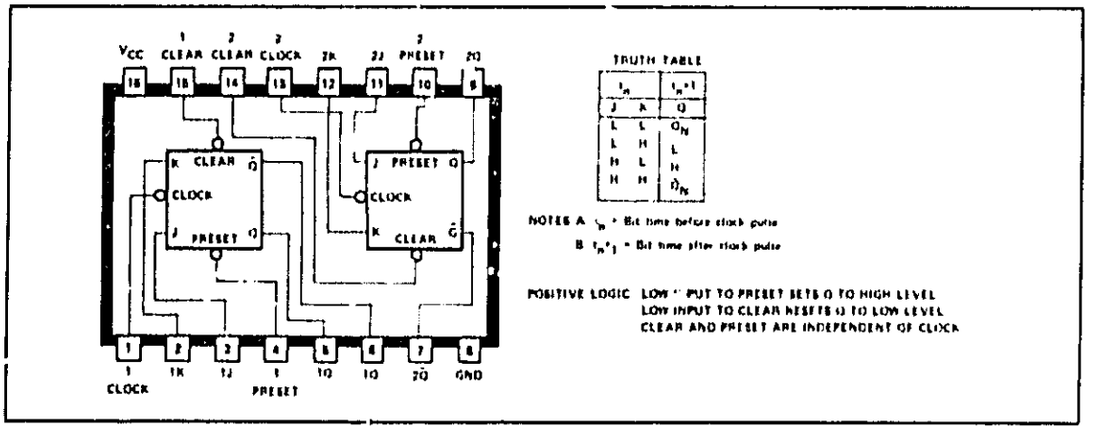


Figure 4-16. Four-Bit Bistable Latches 1820-0876

4-137. Five-Bit Comparator 1820-0904

4-138. This IC (Figure 4-17) is a high-speed expandable comparator which compares two 5-bit words to give one of three outputs: "equal to", "less than", or "greater than". An active low enable line is provided to enable the comparator function. When the enable line is high, all three outputs are held low. For words containing more than 5-bits, comparators can be connected in series by respectively connecting the A>B and A<B outputs of the first comparator to the A0 and B0 inputs of the next comparator. The truth table shows the logic operation.

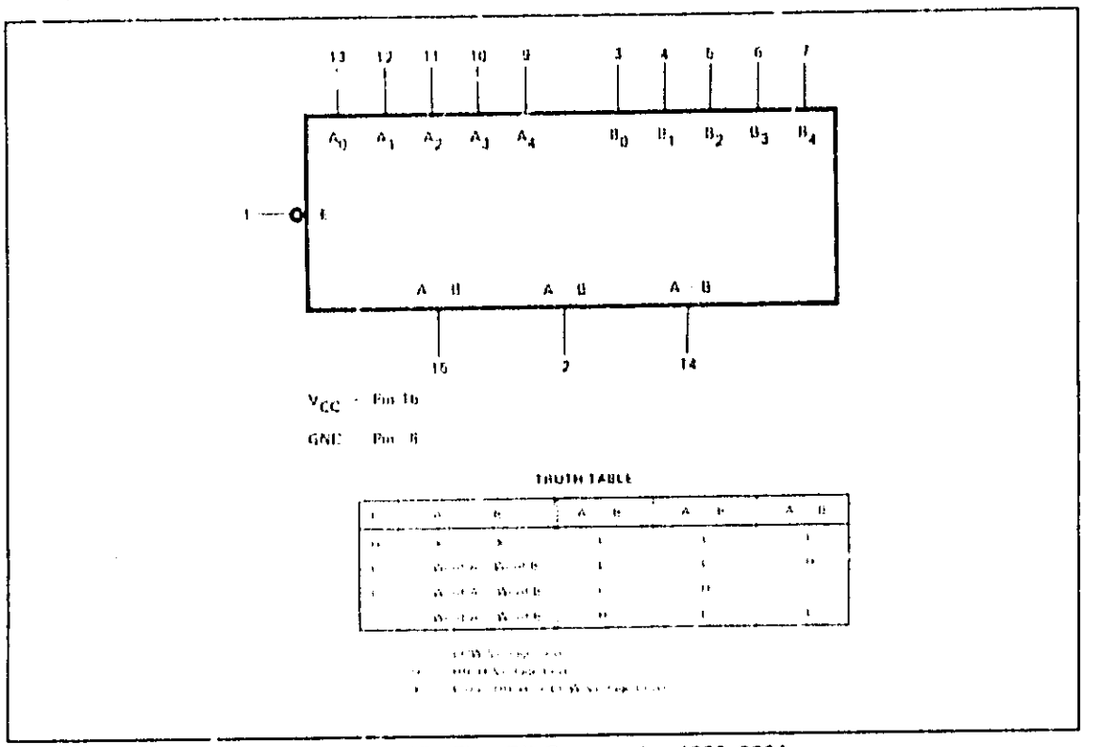


Figure 4-17. Five-Bit Comparator 1820-0904

4-139. Voltage Comparator/Buffer 1826-0026

4-140. The 1826-0026 (Figure 4-18) is a voltage comparator capable of handling differential input voltages up to ±30 volts. Provision is included for offset balancing.

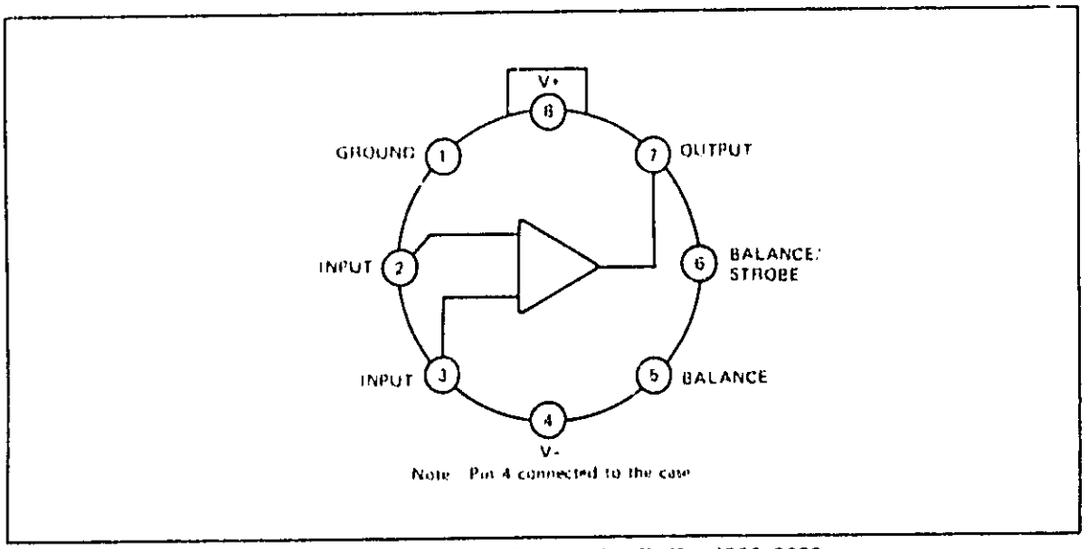


Figure 4-18. Voltage Comparator/Buffer 1826-0026

4-141. Schmitt Trigger and Amplifier 1826-0085

4-142. This IC (Figure 4-19) is a combination wideband amplifier and Schmitt trigger. All biasing is external.

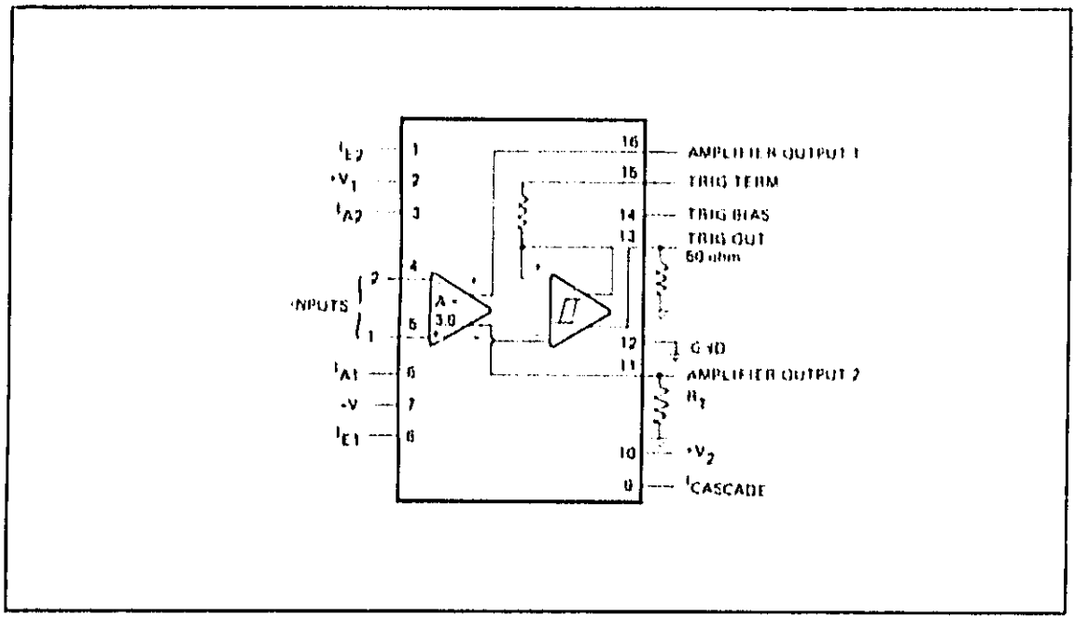


Figure 4-19. Schmitt Trigger/Amplifier 1826-0085

SECTION V

MAINTENANCE AND SERVICE

5-1. INTRODUCTION

5-2. This section contains maintenance and service information needed to keep the converter in good operating condition or to repair a defect. Information in all other sections of this manual will also be needed to maintain and service the converter.

5-3. ASSEMBLY IDENTIFICATION

5-4. Table 5-1 lists the assemblies used in the converter with reference designations descriptions and HP part numbers.

Table 5-1. Assembly Identification

Reference Designation	Description	HP Part Number
A1	Mixer (Input Amplifier Detector)	05354-60001
A2	Switchable Filter (Spectrum Generator)	05354-60002
A3	Video (IF) (Detector-Schmitt Trigger)	05354-60003
A4	250 to 500 MHz Multiplier	05354-60004
A5	250 to 750 MHz Multiplier	05354-60005
A6	50 to 250 MHz Multiplier	05354-60006
A7	10 to 50 MHz Multiplier	05354-60007
A8	Filter Switch	05354-60008
A9	Filter Selector	05354-60009
A10	Input Control	05354-60010
A11	Counter (-Converter) Interface	05354-60011
A12	LO±IF (Local Oscillator ±IF) (Option 011)	05354-60012
A13	Bus Interface (Option 011)	05354-60013
A14	Motherboard	05354-60014
A15	Schmitt Trigger	05354-60025

5-5. IN-CABINET PERFORMANCE CHECK AND SELF-CHECK

5-6. In-Cabinet Performance Check

5-7. The performance check (Table 5-3) and test card can be used to verify proper operation of all circuits of the converter and may also be used:

a. As part of an incoming inspection check of instrument specifications.

b. Periodically, for instruments used in systems where maximum reliability is important.

c. As part of a procedure to locate defective circuits.

d. After any repairs or adjustments and before returning instrument to regular service.

e. As a permanent record of instrument maintenance performed. The test record pages are perforated and may be removed.

5-8. Self-Check

5-9. A self-check procedure is given in Section III of this manual. The self-check procedure does not require any test equipment, and it can be used to determine the general condition of the converter without input test signals.

5-10. RECOMMENDED TEST EQUIPMENT

5-11. Table 5-2 lists the recommended test equipment for the converter maintenance.

Table 5-2. Recommended Test Equipment

Instrument	Characteristics	Recommended Type
Spectrum Analyzer (includes a, b, c)	500 MHz to 3.5 GHz Range	
a. Display	— —	HP 141T
b. R.F. Tuning Section	10 MHz to 40 Ghz	HP 8555A
c. IF Section	— —	HP 8552B
Sweep Oscillator (includes d, e, f)	— —	HP 8620A*
d. R.F. Drawer	— —	HP 8621B
e. R.F. Module	0.1 to 2 GHz	HP 86320A
f. R.F. Module	1.8 to 4.2 GHz	HP 86330A
Signal Generator	50 kHz to 65 MHz	HP 606A
Logic Probe	Detects TTL Levels	HP 10525T
Resistive Divider Probes	500Ω Input Resistance (when terminated by 50Ω)	HP 10020A or HP 1120A (with power source)
Non-Metallic Tuning Wand	Any length	— —
Non-Metallic Tuning Wand	1.5 inch	— —
50Ω Coaxial Cable	(1) male SMA connector (1) male N connector	— —
50Ω Coaxial Cable	(1) female right angle SMC connector (1) male N connector	— —

*See Note in Table 5-4

Table 5-3. In-Cabinet Performance Test

1. Set the 5345A POWER switch to ON.
2. Press the 5345A RESET switch.
3. Perform the Self-Check procedure given in the 5345A Operation Manual.

NOTE

In all following tests the Converter CONV SIGNAL lamp should be on when an adequate level and frequency signal is applied to the INPUT connector.

4. AUTO AND MANUAL FREQUENCY AND SENSITIVITY

SPECIFICATIONS TEST
Range: 15 MHz to 4 GHz
Sensitivity: 70 mV (-10 dBm) minimum

a. Set the 5345A and Converter controls to the standard positions as listed in Paragraph 3-29. Set the Converter AUTO/MANUAL switch to AUTO, and set the CONT WAVE/PULSED R.F. switch to CONT WAVE. Set the 5345A POWER switch to ON. Set the GATE TIME to 100 ms and set the DISPLAY POSITION to AUTO.

CAUTION

DO NOT APPLY A SIGNAL WITH A POWER LEVEL EXCEEDING +20 dBm (2.2 VOLTS) TO THE CONVERTER INPUT CONNECTOR.

b. Connect an appropriate signal source for 15 MHz to 4 GHz range at -10 dBm output level to the Converter INPUT connector. Vary the frequency of the signal source from 15 MHz to 4 GHz. The 5345A should display the signal source frequency.

c. Repeat step b with the Converter CONT WAVE/PULSED R.F. switch set to PULSED R.F. The 5345A should display the input signal frequency.

d. Set the Converter CONT WAVE/PULSED R.F. switch to CONT WAVE. Set the AUTO/MANUAL switch to MANUAL. Press the Converter RESET switch. Change the signal source frequency settings and the Converter BAND SELECT switch according to the following table.

Signal Frequency at INPUT and Correct 5345A Display*	Number of Times BAND SELECT Switch Pushed After RESET
15 MHz	None
500 MHz	None
515 MHz	1
775 MHz	1
760 MHz	2
1.025 MHz	2
1.010 GHz	3
1.525 GHz	3
1.510 GHz	4
2.025 GHz	4
2.010 GHz	5
2.525 GHz	5
2.510 GHz	6
3.025 GHz	6
3.010 GHz	7
3.525 GHz	7
3.510 GHz	8
4.025 GHz	8

*Only significant digits shown.

Table 5-3. In-Cabinet Performance Test (Continued)

5. LO±IF (OPTION 011) TEST

If the Converter to be tested has the optional A12 Local Oscillator ± IF assembly installed, the following test should be performed to determine if the A12 assembly will operate correctly.

a. Set the 5345A and Converter controls to the standard positions given in Paragraph 3-29 except set the Converter rear panel LO±IF switch to ON and set the +IF/-IF switch to -IF.

b. Set the Converter AUTO/MANUAL switch to AUTO.

c. Set the Converter CONT WAVE/PULSED R. F. switch to CONT WAVE.

d. Set the 5345A POWER switch to ON.

e. Connect a signal generator set to 100 MHz at 1 dBm to the 5345A CHANNEL A input connector.

f. Connect a signal generator set to 2.7 GHz at 1 dBm to the Converter INPUT connector.

g. Press the 5345A and Converter RESET switches. The 5345A should display 2.6 GHz.

In the preceding test the 100 MHz signal represents the intermediate frequency of a microwave receiver and the 2.7 GHz signal represents the receiver local oscillator. The 2.6 GHz display represents the tuned frequency of the receiver. In this case, the receiver local oscillator is assumed to be above the tuned frequency. If the +IF/-IF, 5354A switch had been set to +IF, the display would have been 2.8 GHz and the receiver local oscillator would have been below the tuned frequency.

5-12. PERFORMANCE TEST CARD

5-13. The performance test card may be used to record results of the performance tests.

5-14. ADJUSTMENT PROCEDURES

5-15. The procedures for all adjustments required to obtain optimum performance with the converter are given in the following paragraphs.

5-16. Recommended Test Equipment

5-17. Table 5-4 is a list of recommended test equipment for the converter adjustments.

5-18. Test Point and Adjustment Locations

5-19. Photographs in Section VIII show the locations of all test points and adjustment locations.

PERFORMANCE TEST CARD

HEWLETT-PACKARD MODEL 5354A
AUTOMATIC F[illegible]QUENCY CONVERTER

Tests Performed by _____
Date _____

Serial No. _____

DESCRIPTION	CHECK

4. AUTO AMD MANUAL FREQUENCY AND SENSITIVITY SPECIFICATIONS TEST

Test	Result
b. 15 MHz to 4 GHz input at -10 dBm AUTO - CONT. WAVE	_____
c. 15 MHz to 4 GHz input at -10 dBm AUTO - PULSED R.F.	_____

d. Manual:

BAND SELECT	INPUT FREQ	
0	15 MHz	_____
0	500 MHz	_____
1	515 MHz	_____
1	775 MHz	_____
2	760 MHz	_____
2	1.025 MHz	_____
3	1.010 GHz	_____
3	1.525 GHz	_____
4	1.510 GHz	_____
4	2.025 GHz	_____
5	2.010 GHz	_____
5	2.525 GHz	_____
6	2.510 GHz	_____
6	3.025 GHz	_____
7	3.010 GHz	_____
7	3.525 GHz	_____
8	3.510 GHz	_____
8	4.025 GHz	_____

5. LO±IF (OPTION 011) TEST

g. 100 MHz at 5345 input, 2.7 GHz at 5354 input _____

Table 5-4. Recommended Adjustment Test Equipment

Instrument	Required Characteristics	Recommended Type
Spectrum Analyzer	500 MHz to 4 GHz	8555, 8552, and 141T Display Section
Signal Generators	10 MHz to 4 GHz	1) *8620A/B Sweep Osc. with 8621A RF Section 2) 8640A/B
Logic Probe	Logic State Tests	HP 10525T
Resistive Divider Probes	Input impedance of 500Ω or greater when terminated in 50Ω. 500 MHz freq. range.	10020A (700 MHz Passive Probe) or 1120A (500 MHz Active Probe) with power source
Tuning Wand	Any length, nonmetallic	
Tuning Wand	approx. 1-½" long, nonmetallic	
Cable	50 ohm coax, male SMC to N	
Cable	50 ohm coax, female SMC (right angle) to N or BNC	
Cable	50 ohm coax, male SMA to N	
50Ω feedthrough		In BNC housing
100 pf capacitor		In BNC housing
Sampling Scope	4 GHz	1811A 18 GHz Plug-in (Sampling)
Oscilloscope	Display	180C/182C Oscilloscope
Vertical Amplifier Plug-In	50 MHz	1801A Dual Channel Vertical Amplifier (50 MHz)
Time Base Plug-In	Compatible with Vertical Amplifier	1821A Time Base and Delay Generator
Feed thru Sampling Head	4 GHz	1432A Sampling Head
OPEN END WRENCH	7/32"	HP Part No. 8710-0534
OPEN END WRENCH	5/16"	HP Part No. 8720-0015

*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 8620A signal generator. With such a wideband source applied to the wideband plug-in, any instantaneous random event from the synthesizer noise floor will be measured as a count if above the plug-in triggering threshold.

5-20. A7 10 to 50 MHz Multiplier Adjustment Procedure

5-21. Use the following procedure to adjust the A7 10 to 50 MHz multiplier for proper operation.

a. Set the 8555A spectrum analyzer as follows:

Frequency	MHz
Bandwidth	100 kHz
Scan Width	10 MHz/Div
Input Atten	20 dB
Scan Time	5 msec
Log Ref Level	+10 dB

b. Switch 5345 counter off and disconnect the 5345A 10 MHz input to the 5354A converter located in the counter 05345-60008 J3 "PLUG-IN".

c. Insert a 10 MHz, +7 dBm signal to the converter by connecting the signal generator to the coaxial cable disconnected in the previous step. (Male SMC to N)

d. Switch 5345A on. Place spectrum analyzer probe tip at XA6($\overline{7}$) with probe grounded at XA6(6).

e. Tune the variable capacitors A7 C10 "50 MHz 1", A7 C14 "50 MHz 2", and A7 C17 "50 MHz 3" for a maximum 50 MHz signal as observed on the spectrum analyzer. Repeat the procedure to obtain an optimum setting.

f. Decrease the 10 MHz signal generator amplitude to -10 dBm and ajust A7C3 "10 MHz" for maximum 50 MHz output level.

g. Increase the 10 MHz signal generator amplitude to 0 dBm. Adjust A7 C14 "50 MHz 2" and A7 C17 "50 MHz 3" for a maximum 50 MHz output. The 50 MHz signal should be approximately 0 dBm.

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

i. Disconnect signal generator and return circuit connections to original condition.

5-22. A6 50 to 250 MHz Multiplier Adjustment Procedure

5-23. Use the following procedure to adjust the A6 10 to 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 msec
Log Ref Level	+10 dB

b. Connect spectrum analyzer probe through a 50Ω load to XA4($\overline{2}$). Ground probe at XA4($\overline{3}$).

c. Tune A6 C6 "50 MHz", C11 "250 MHz 1", and C14 "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 dBm with the 200 and 300 MHz sidebands at least 40 dB below the 250 MHz level. (Allow for probe attenuation.)

d. Connect the spectrum analyzer probe to XA5($\overline{14}$) and ground probe at XA5($\overline{13}$). The 250 MHz signal should be at least +3 dBm.

5-24. A4 250 to 500 MHz Multiplier Adjustment Procedure

5-25. Use the following procedure to adjust the A4 250 to 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 msec
Log Ref Level	+20 dBm

b. Remove rigid coaxial cable from A14J3 to A2J1 and connect the spectrum analyzer to A14J3. Adjust A4 C4 "250 MHz", C14 "500 MHz 1", and C18 "500 MHz 2" for a maximum 500 MHz signal. Output level should be at least +15 dBm. Sidebands should be 40 dB down from 500 MHz signal.

c. Disconnect the spectrum analyzer and replace rigid coaxial cable to its original position.

d. Disconnect the rigid coaxial cable from A14J4 and connect the spectrum analyzer to A14J4. The spectrum analyzer must be ac coupled with 100 pf or greater. (A list of parts to make a signal coupler are listed after this procedure.) (Female SMC to BNC.)

e. Place 5354A in the MANUAL mode of operation.

f. Push RESET switch and BAND SELECT switch once.

g. 500 MHz signal as observed on spectrum analyzer should be at least -12 dBm.

h. Do not reconnect rigid coaxial cable to A14J4 until after the 250 to 750 MHz multiplier adjustment.

5-26. Signal coupler parts lists:

a. 100 pf capacitor ±10%, HP Part No. 0150-0073.

b. Housing HP Part No. 5020-0420.

c. BNC receptacle HP Part No. 1250-0118.

d. BNC crimp pin male HP Part No. 1250-0089.

e. BNC R.F. connector HP Part No. 1250-0052.

5-27. A5 250 to 750 MHz Multiplier Adjustment Procedure

5-28. Use the following procedure to adjust the A5 250 to 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 msec
Log Ref Level	0 dBm

b. Connect spectrum analyzer to A14J4. The signal must be ac coupled (100 pf or greater) to the spectrum analyzer.

e. Place the 5354A in the MANUAL mode of operation, push the RESET switch one. Push the BAND SELECT switch twice. The instrument is now in the 750 MHz band.

d. Adjust A5C14 "750 MHz 1" and C15 "750 MHz 2" for a maximum output level at 750 MHz as observed on the spectrum analyzer.

e. Adjust A5R7 "LEVEL SET" for -15 dBm at 750 MHz. 1000 and 1250 MHz signals should be no greater than -50 dBm.

f. Push 5354 RESET switch.

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

h. Spectrum analyzer should read 500 MHz at -12 dBm minimum.

i. Push RESET switch. The spectrum analyzer should indicate a maximum level of -45 dBm at 500 MHz.

j. Disconnect spectrum analyzer from A14J4 and reconnect rigid coaxial cable.

5-29. A3 Video (IF) Adjustment Procedure

5-30. Use the following procedure to adjust the A3 Video (IF) for proper operation.

a. Disconnect rigid coaxial cable from A1J1 and insert a 530 MHz, 0 dBm CW signal into the rigid coax (Male SMC to N).

b. Set the CONT. WAVE/PULSED R.F. switch to PULSED R.F.

c. Disconnect flexible coax from A3J1 and connect A3 Assembly output to sampling scope (Female SMC to N).

d. Turn instrument on. Decrease 530 MHz input signal level to adjust A3R28 "TRIG BAL" for maximum sensitivity.

e. Insert 530 MHz (0 dBm) to A3J1. Turn A3R17 "TRIG SENS" CCW. Turn A3R17 CW to the point where a clean and stable signal is observed on the sampling oscilloscope. The signal level should be approximately 600 mV peak-to-peak.

f. Decrease input frequency to 500 MHz (0 dBm). Connect TTL logic probe to XA3($\overline{15}$). Increase the signal level to the point where the logic level goes high. The 500 MHz input signal should be between 0 dBm and +1 dBm.

g. Increase the input frequency to 521 MHz (0 dBm) and connect logic probe to XA3($\overline{14}$). Adjust A3C7 "FREQ ADJ" until the logic level goes low. Readjust A3C7 to the point where the logic level first goes high.

h. Disconnect signal generator and sampling oscilloscope. Return circuit connections to original state with the exception of A1J1. Do not reconnect A1J1 until after adjustment of the A1 mixer.

5-31. A15 Schmitt Trigger Adjustment Procedure

5-32. Use the following procedure to adjust the A15 Schmitt trigger for proper operation.

NOTE

Instruments with serial #1332A00051 through #1332A00068 require a modification in order to perform adjustments. Refer to paragraph 5-34 Test Point Addition.

5-33. Test equipment used:

HP 8620A Sweep Oscillator
HP 8621A R.F. Section
HP 180A Oscilloscope
HP 1801A Vertical Amplifier
HP 1820B Time Base

a. Set converter CONT. WAVE/PULSED R.F. switch to PULSED R.F., AUTO/MANUAL to MANUAL. Push RESET switch so converter is in the 15-525 MHz band.

b. Set sweeper to sweep between 400 and 530 MHz, 0.01 second sweep time and the R.F. OUTPUT to 0 dBm.

c. Connect signal generator SWEEP OUT to EXT INPUT of oscilloscope. Set oscilloscope to EXT DISPLAY and adjust EXT SENS control to get a horizontal trace 10 divisions wide centered vertically on the screen. Ground Channel A so display is midposition on screen. Set oscilloscope Channel A to dc coupling and vertical amp to .005 V/div.

d. Connect oscilloscope Channel A to A15TP1.

e. Disconnect rigid coaxial cable from A1J1 and connect the sweeper R.F. OUTPUT signal into the rigid coaxial cable.

f. Connect sampling oscilloscope to A15J2 (right angle Female SMC to N).

g. Adjust "TRIG BAL" (A15R6) for maximum linearity on scope display. Increase level to +10 dBm and readjust "TRIG BAL" again for maximum linearity. Maximum allowable display excursions is 80 mV above or below ground between 400 MHz and 530 MHz for drive levels of 0 dBm and +10 dBm. See Figure 5-1 for typical waveshape.

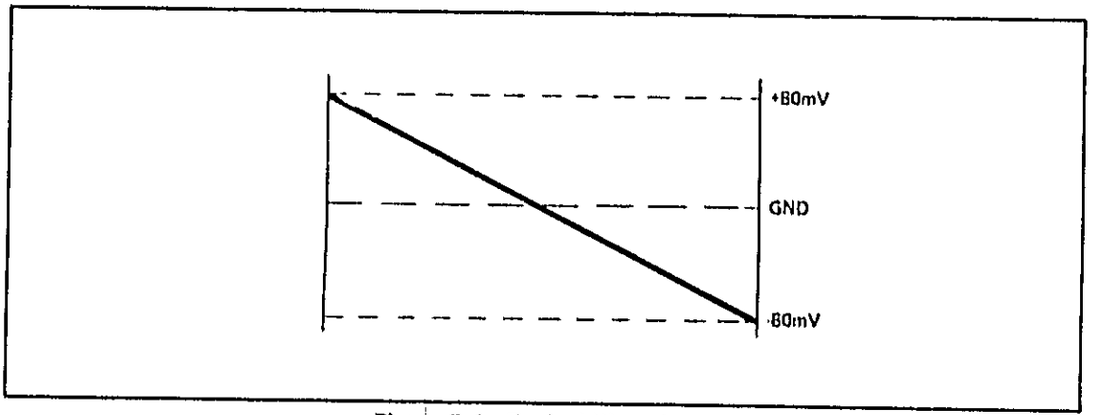


Figure 5-1. Typical Waveshape

h. Set signal generator to CW (250 MHz, 0 dBm). The displayed signal should have swings of at least 250 mV above and below -400 mV. If necessary adjust "OUT BAL (A15R19) to obtain proper swings.

i. Increase signal generator frequency from 400 MHz to 450 MHz (CW, 0 dBm). Output should be at least 700 mV peak-to-peak.

j. Increase frequency from 450 MHz to 530 MHz (CW, 0 dBm). Output should be at least 800 mV peak-to-peak, but less than 1.0V peak-to-peak.

k. Set signal generator to sweep between 400 and 530 MHz (-3 dBm) and observe signal on the oscilloscope. Change signal generator level from 0 dBm to +10 dBm. Display should be as in step g. If necessary readjust "TRIG BAL" (A15R6) so display is linear.

l. Return circuit to original configuration.

5-33 Addition of Test Point for Adjustment of A15 Schmitt Trigger (For Instruments with Serial Numbers 1332A-00051 through 1332A-00068)

5-34. In order to perform adjustments of assembly A15 and improve accuracy of calibration, a test point (A15TP1) must be added to the circuit.

PARTS REQUIRED

Quantity	Ref. Desig.	Description	HP Part No.
1	A15R21	Resistor R.F. 3.16K 1%	0757-0279
1	A15R22	Resistor R.F. 39.2K 1%	0757-0124
1	A15C16	Capacitor 0.01 μf	0160-3879

5-35. Installation Procedure

1. Remove A15 assembly casting cover.
2. Cut one lead of R21 (3.16K) 1/16" long.
3. Solder the 1/16" lead of R21 to the junction of A15L1, L3, and R20. (See Figure 5-2.)
4. Solder R22 (39.2K) to C13 (+5V side). (See Figure 5-2.)
5. Wrap one lead of C16 (0.01 μf) around fastening screw to ground. (See Figure 5-2.)
6. Connect the unsoldered leads of R21, R22, and C16 together. Solder their junction.
7. The junction of R21, R22, and C16 is Test Point #1 (TP1).

5-36. A1 Mixer Adjustment Procedure

5-37. Use the following procedure to adjust the A1 mixer for proper operation.

a. Set signal generator frequency to CW, 1 GHz and power level to -14 dBm.

b. Connect signal generator to input connector of 5354A.

c. Turn A1 "S3 SET" control fully counterclockwise.

d. Connect TTL Logic Probe to A14J7(13). The indication should be a TTL low.

e. Adjust A1 "S3 SET" clockwise until a TTL high is observed on the logic probe.

f. Disconnect the signal generator from the input.

g. Set the 8555A spectrum analyzer as follows:

Frequency	500 MHz
Bandwidth	300 kHz
Scan Width	100 MHz/div
Input Atten	20 dB
Scan Time	5 msec
Log Ref Level	+10 dBm

h. Connect the spectrum analyzer to A1J1. (Right angle female SMC to N.)

i. Set the converter to MANUAL mode and push the RESET and BAND SELECT switches once so the counter is in the 515-775 MHz band.

j. Adjust A1C27 "500 MHz NOTCH ADJ" for a minimum level 500 MHz signal on the spectrum analyzer. The signal should be less than -25 dBm. If the level is less than -25 dBm do no adjust A1C27. Access to this adjustment is difficult.

k. Insert a 2.3 GHz signal at -20 dBm to converter INPUT connector.

l. Push BAND SELECT switch five times to the 2.0 GHz band. The signal as observed on spectrum analyzer should be 300 MHz at 0 dBm.

m. Push BAND SELECT switch to the 0 MHz band and insert 15 MHz at -20 dBm. Signal as observed on spectrum analyzer should be 0 dBm.

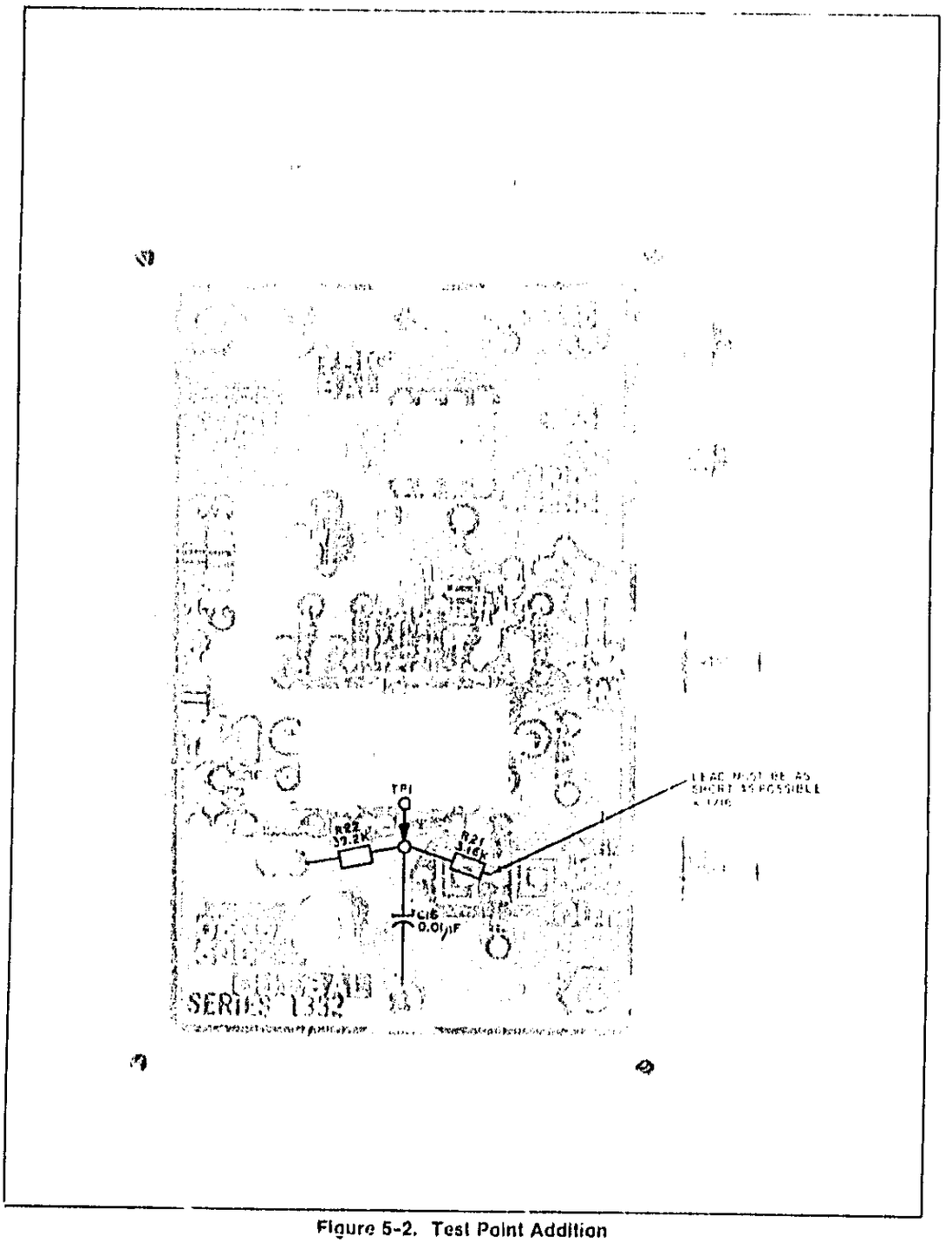


Figure 5-2. Test Point Addition

5-38. A2 Switchable Filter Adjustment Procedure

5-39. Use the following procedure to adjust the A2 switchable filter for proper operation.

a. Set the 8566A spectrum analyzer as follows:

Bandwidth	300 kHz
Scan Width	100 MHz/div
Scan Time	10 msec
Input Atten	20 dB
Log Ref Level	0 dBm

b. Disconnect rigid coaxial cable from A1J2. Connect spectrum analyzer to rigid coaxial cable so as to observe A2 filter output at A2J3. (Male SMA to N.)

c. Place the 5354A in the manual mode. Push the RESET switch and BAND SELECT switch once.

d. Set the spectrum analyzer frequency to 500 MHz. The switchable filter signal should be 500 MHz at -20 dBm, -0, +4 dBm.

e. Push the BAND SELECT switch once. Set the spectrum analyzer frequency to 750 MHz The display should read 750 MHz at -20 dBm ±2 dBm.

f. Push the BAND SELECT switch once. Set the spectrum analyzer frequency to 1.0 GHz. The display should indicate 1.0 GHz at -20 dBm. 500 MHz sidebands should be down at least 40 dB.*

g. Push the BAND SELECT switch once. Set the spectrum analyzer to 1.5 GHz. The level should be at least -20 dBm -2, +4 dBm with 500 MHz sidebands down at least 40 dB.

h Push the BAND SELECT switch once. Set the spectrum analyzer to 2.0 GHz. The level should be at least -20 dBm, -2, +4 dBm, and the 500 MHz sidebands should be at least 40 dB.

i. Push the BAND SELECT switch once. Set the spectrum analyzer to 2.5 GHz. The level should be at -20 dBm, -2, +4 dBm with 500 MHz sidebands down at least 35 dB.

j. Push the BAND SELECT switch once. Set the spectrum analyzer to 3.0 GHz. The level should be at -20 dBm, -2, +4 dBm with 500 MHz sidebands down at least 35 dB.

k. Push the BAND SELECT switch once. Set the spectrum analyzer to 3.5 GHz. The level should be at -20 dBm, -2, +4 dBm with 500 MHz sidebands down at 35 dB.

5-40. A2R4 SPEC GEN LEVEL SET Adjustment Procedure

5-41. Use the following procedure to adjust A2R4 for proper operation of the A2 comb generator (spectrum generator).

a. Remove converter from counter.

b. Disconnect rigid coaxial cable from A1J5, A1J1, and A1J2.

c. Unsolder the four wire connections to the A1 mixer.

d. Remove the 4 screws that secure the A1 mixer to the converter chassis.

e. Remove the A1 mixer from the converter.

*If the signal level at 1.0 GHz is less than -20 dBm an adjustment of A2R4 is necessary. Refer to SPEC GEN LEVEL SET Adjustment Procedure (A2R4).

f. Connect the spectrum analyzer to A2J3. The spectrum analyzer should be already set according to the A2 switchable filter adjustment procedure, step (a)

g. Switch the 5345 POWER switch to ON. Push RESET switch once and BAND SELECT switch to 1.0 GHz band.

h. Adjust A2R4 for a 1.0 GHz signal at -20 dBm with 500 MHz sidebands at least 40 dB down.

i. This completes the adjustment. Disconnect all test equipment, reconnect all wires and cables in the converter.

5-42. TESTING CONVERTER DIGITAL OPERATION WITH THE ASM (ALGORITHMIC STATE MACHINE) TESTER

5-43. The ASM (Algorithmic State Machine) Tester (part of the 10596A Service Kit) may be used to test the digital sections of the converter.

5-44. The converter test with the ASM tester uses three 5345 program routines, PI DATA, K DATA, and DISPLAY STORED. The routines are used by the counter as follows:

a. PI DATA Routine (Program Address 150). The PI DATA routine is triggered for execution during the first 5345A processing cycle when the converter is in MANUAL mode and the BAND SELECT switch is pressed, or anytime the 5345A RESET switch is pressed. This holds for all converter bands except the 15-525 MHz band, in which case the K DATA routine is executed. If an Video (IF) signal is present at the output of the converter, the counter will go into its K DATA routine after the first processing cycle.

Table 5-5. ASM Tester INPUT TO DR Address 150

Data Bit	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	5354A LO Band
ASM	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	500 MHz
Tester	0	0	0	0	0	0	7	5	0	0	0	0	0	0	0	0	750 MHz
Display	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1.0 GHz
	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	2.5 GHz
	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2.0 GHz
	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	2.5 GHz
	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3.0 GHz
	0	0	0	0	0	3	5	0	0	0	0	0	0	0	0	0	3.5 GHz

b. K DATA (Program Address 521). In MANUAL mode the K DATA routine is executed after the first 5345A processing cycle whenever the counter is to make a measurement of the Video (IF) from the converter or when the converter is in the 15-525 MHz band. When the converter is in AUTO mode K DATA is executed at all times. Data is transferred as shown in Table 5-6.

Table 5-6. ASM Tester INPUT TO DR Address 521

Data Bit	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	5354A LO Band
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 MHz
ASM	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	500 MHz
Tester	0	0	0	0	0	0	7	5	0	0	0	0	0	0	0	0	750 MHz
Display	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1.0 GHz
	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	1.5 GHz
	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	2.0 GHz
	0	0	0	0	0	2	5	0	0	0	0	0	0	0	0	0	2.5 GHz
	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	3.0 GHz
	0	0	0	0	0	3	5	0	0	0	0	0	0	0	0	0	3.5 GHz

e. DISPLAY STORED (program Address 560). The Display Stored routine is executed during the first processing cycle when the converter is in the LO+IF mode of operation.

5-45. Checking LO±IF Operating Cycle

5-46. To check the LO±IF operating cycle perform the following steps:

a. Set 5345A controls as follows:

CHECK/COM A/SEP	CHECK
GATE time	1 sec
DISPLAY POSITION	AUTO

b. Set 5354A controls as follows:

AUTO/MANUAL	MANUAL
LO±IF	ON
+IF/-IF	+IF
A8 NORMAL TEST switch	NORMAL
DISPLAY CONTROL	NORM (LO+VIDEO)

c. Proceed with Table 5-7:

Table 5-7. Checking LO-IF Operating Cycle

ASM Tester Display	Program Address	LO-IF Operating Cycle
1 CONTENTS OF DR Same as 5345 display	211	Ram A12U9 stores old display sent from counter during first first converter processing cycle. During second processing cycle the old display is ignored
2 INPUT TO DR Data Bit* 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 — Converter LO Band 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 * 0 MHz 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 6 0 0 0 0 0 0 0 0 0 * 500 MHz 0 0 0 0 0 0 7 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 8 5 0 0 0 0 0 0 0 0 * 750 MHz 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 * 1.0 GHz 0 0 0 0 0 1 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 6 0 0 0 0 0 0 0 0 0 * 1.5 GHz 0 0 0 0 0 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 1 0 0 0 0 0 0 0 0 0 * 2.0 GHz 0 0 0 0 0 2 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 6 0 0 0 0 0 0 0 0 0 * 2.5 GHz 0 0 0 0 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 1 0 0 0 0 0 0 0 0 0 * 3.0 GHz 0 0 0 0 0 3 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 6 0 0 0 0 0 0 0 0 0 * 3.5 GHz	521 K DATA Routine	Converter sends selected LO band to counter during first converter processing cycle. Opt A (XA12 pin 12 is high). Converter sends stored LO data to counter during second processing cycle. Opt A (XA12 pin 12 is low).
3 CONTENTS OF DR The display alternates between two sets of data. The only one accepted by the converter is that transferred during the first processing cycle. Data Bit* 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 — Converter LO Band 0 0 0 0 0 0 1 3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 0 0 0 0 0 0 0 0 * 0 MHz 0 0 3 0 0 0 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 7 0 0 0 0 0 0 0 0 * 500 MHz 0 0 0 0 0 0 8 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 9 5 0 0 0 0 0 0 0 * 750 MHz 0 0 0 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 2 0 0 0 0 0 0 0 0 * 1.0 GHz 0 0 0 0 0 1 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 7 0 0 0 0 0 0 0 0 * 1.5 GHz 0 0 0 0 0 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 2 0 0 0 0 0 0 0 0 * 2.0 GHz 0 0 0 0 0 2 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 2 7 0 0 0 0 0 0 0 0 * 2.5 GHz 0 0 0 0 0 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 2 0 0 0 0 0 0 0 0 * 3.0 GHz 0 0 0 0 0 3 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 3 7 0 0 0 0 0 0 0 0 * 3.5 GHz	151	Counter sends LO data to converter during the first processing cycle. Counter sends LO data "H" to converter during second processing cycle. Converter ignores data.
4. INPUT TO DR Same as 5345 Display	560 Display Stored Routine	Converter sends old display to counter during first processing cycle.

*First (upper) display occurs during first processing cycle, and second (lower) display occurs during second processing cycle.

5-47. TROUBLESHOOTING PROCEDURES

5-48. Troubleshooting procedures for the converter are given in the following charts and tables.

Table 5-8. Troubleshooting Checkout Procedure

1. Ensure that a known working 5345 counter is used.
   Set 5345 as follows:

FUNCTION switch	PLUG IN
CHECK/COM A/SEP	SEP
DISPLAY POSITON	AUTO
GATE TIME	1 ms
SAMPLE RATE	Midposition

2. Set 5354 as follows:

AUTO/MANUAL	MANUAL
CONT. WAVE/PULSED RF	CONT. WAVE
DISPLAY CONTROL	NORM (LO-VIDEO)
LO±IF	OFF

3. Push RESET button. 5345 display should be all zeros, ARM, Hz.

4. Push BAND SELECT pushbutton switch once counter display should be:
   500.0000000 MHz, ARM
   Repeat step 4 for the following bands:
   750.0000000 MHz, ARM
   1.000000000 GHz, ARM
   1.500000000 GHz, ARM
   2.000000000 GHz, ARM
   2.500000000 GHz, ARM
   3.000000000 GHz, ARM
   3.500000000 GHz, ARM

5. If the 5354 fails any of the above tests go to CHART #1.

6. Push RESET button once.

7. Insert 250 MHz (-10 dBm) into the converters INPUT connector. Display should read 250 MHz, Gate light flashing, CONV. SIGNAL light on. Repeat for the signals listed below. Push the BAND SELECT switch for the appropriate band.

   600 MHz (-10 dBm) 500 MHz LO Band
   900 MHz (-10 dBm) 750 MHz LO Band
   1.3 GHz (-10 dBm) 1.0 GHz LO Band
   1.8 GHz (-10 dBm) 1.5 GHz LO Band
   2.3 GHz (-10 dBm) 2.0 GHz LO Band
   2.8 GHz (-10 dBm) 2.5 GHz LO Band
   3.3 GHz (-10 dBm) 3.0 GHz LO Band
   3.8 GHz (-10 dBm) 3.5 GHz LO Band

8. If the instrument fails the above test go to CHART #2.

9. Change AUTO/MANUAL switch to AUTO. Repeat Step 7 without pushing BAND SELECT switch.

11. Set DISPLAY CONTROL switch on rear panel to LO-VIDEO. A 3.8 GHz signal is already present at the converters input from Step 9. 5345 display should read 3.2 GHz.

12. If instrument fails step #11 go to CHART #6.

SECTION VI

REPLACEABLE PARTS

6-1. INTRODUCTION

6-2. This section contains lists of replaceable parts, information for ordering, and a general description of the HP part numbering system. Also included is a list of abbreviations used in the parts lists.

6-3. REPLACEABLE PARTS LIST

6-4. Table 6-1 lists replaceable parts for the standard instrument without options. Parts are listed in alpha-numerical order by reference designation starting with A1 and ending with chassis and miscellaneous parts. Table 6-2 lists replaceable parts for Option 011. Table 6-3 contains a list of manufacturers and their codes. Figure 6-1 shows the mechanical parts.

6-5. The replaceable parts include the following information:

a. Reference designator (when applicable).

b. HP part number.

c. Total quantity (QTY) used in the instrument. The quantity appears in the QTY column the first time that the part is listed. Table 6-1 gives QTY for the standard instrument only. To tabulate a parts list for an instrument equipped with options, add and delete the parts described in the option tables.

d. Description of the part (see list of abbreviations).

e. Typical manufacturer of the part in a five-digit code (see list of manufacturers in Table 6-3).

f. Manufacturer's part number.

REFERENCE DESIGNATIONS

A	assembly	E	miscellaneous electrical part	MP	miscellaneous mechanical part	TP	test point
AT	attenuator, isolator, termination	F	fuse	P	electrical connector (movable portion)	U	integrated circuit, microcircuit
B	fan, motor	FL	filter		plug	V	electron tube
BT	battery	H	hardware	Q	transistor, SCR, triode thyristor	VR	voltage regulator, breakdown diode
C	capacitor	HY	circulator	R	resistor	W	cable, transmission path, wire
CP	coupler	J	electrical connector (stationary portion), jack	RT	thermistor	X	socket
CR	diode, diode thyristor, varactor			S	switch	Y	crystal unit, piezoelectric
DC	directional coupler	K	relay	T	transformer	Z	tuned cavity, tuned circuit
DL	delay line	L	coil, inductor	TB	terminal board		
DS	annunciator, signaling device (audible or visual), lamp, LED	M	meter	TC	thermocouple		

ABBREVIATIONS

A	ampere	BCD	binary coded decimal	COMP	composition	K	degree Kelvin
ac	alternating current	BD	board	COMPL	complete	DEPC	deposited carbon
ACCESS	accessory	BE CU	beryllium copper	CONN	connector	DET	detector
ADJ	adjustment	BFO	beat frequency oscillator	CP	cadmium plate	diam	diameter
A/D	analog-to-digital			CRT	cathode ray tube	DIA	diameter (used on parts list)
AF	audio frequency	BH	binder head	CTL	complementary transistor logic		
AFC	automatic frequency control	BKDN	breakdown	CW	continuous wave	DIFF AMPL	differential amplifier
AGC	automatic gain control	BP	bandpass	cw	clockwise	div	division
AL	aluminum	BPF	bandpass filter	D/A	digital to analog	DPDT	double pole, double throw
ALC	automatic level control	BRS	brass	dB	decibel	DR	drive
AM	amplitude modulation	BWO	backward wave oscillator	dBm	decibel referred to 1 mW	DSB	double sideband
AMPL	amplifier	CAL	calibrate	dc	direct current	DTL	diode transistor logic
APC	automatic phase control	ccw	counterclockwise	deg	degree (temperature interval or difference)	DVM	digital voltmeter
ASSY	assembly	CER	ceramic	°	degree (plane angle)	ECL	emitter coupled logic
AUX	auxiliary	CHAN	channel	°C	degree Celsius (centrigrade)	EMF	electromotive force
avg	average	cm	centimeter	°F	degree Fahrenheit	EDP	electronic data processing
AWG	american wire gauge	CNO	coaxial			ELECT	electrolytic
BAL	balance	COEF	coefficient				
		COM	common				

ABBREVIATIONS (CONTINUED)

ENCAP	encapsulated
EXT	external
F	farad
FET	field effect transistor
FF	flat fillister
FH	flat head
FOLH	folded horn
FM	frequency modulation
FP	front panel
FREQ	frequency
FXD	fixed
g	gram
GE	germanium
GHz	gigahertz
GL	glass
GND	ground
H	henry
h	hour
HEX	hexagonal
HD	head
HDW	hardware
hf	high frequency
HG	mercury
HI	high
HP	Hewlett-Packard
HPF	high pass filter
HR	hour used in parts list
HV	high voltage
Hz	hertz
IC	integrated circuit
ID	inside diameter
IF	intermediate frequency
IMPG	impregnated
in	inch
INCD	incandescent
INCL	including
INP	input
INS	insulation
INT	internal
kg	kilogram
kHz	kilohertz
kΩ	kilohm
kV	kilovolt
lb	pound
LC	inductance-capacitance
LED	light emitting diode
LF	low frequency
LG	long
LH	left hand
LIM	limit
LIN	linear taper used in parts list
lin	linear
LK WASH	lock washer
LO	local oscillator
LOG	logarithmic taper used in parts list
log	logarithmic
LPF	low pass filter
LV	low voltage
m	meter (distance)
mA	milliampere
MAX	maximum
MΩ	megohm
MEG	megohm (used in parts list)
MET FLM	metal film
MET OX	metal oxide
MF	medium frequency microfarad (used in parts list)
MFR	manufacturer
mg	milligram
MHz	megahertz
mH	millihenry
mho	mho
MIN	minimum
min	minute (time) minute (plane angle)
MINIAT	miniature
mm	millimeter
MOLD	molded
MOM	momentary
MOS	metal-oxide semiconductor
mtg	mounting
MTR	meter
MTG	mounting
MTR	motor (electrical) meter (measuring device)
mV	millivolt
mVdc	millivolt dc
mVpk	millivolt peak
mVp-p	millivolt peak-to-peak
mVrms	millivolt rms
mW	milliwatt
MXD	mixed
MY	Mylar
μA	microampere
μF	microfarad
μH	microhenry
μmho	micromho
μs	microsecond
μV	microvolt
μVdc	microvolt dc
μVpk	microvolt peak
μVp-p	microvolt peak-to-peak
μVrms	microvolt rms
μW	microwatt
nA	nanoampere
NC	no connection
NC	normally closed
NE	never
NEG	negative
nF	nanofarad
NI PL	nickel plate
NO	normally open
NOM	nominal
NORM	normal
NPN	negative positive negative
NPO	negative positive zero (zero temperature coefficient)
NRFR	not recommended for field replacement
NSR	not separately replaceable
ns	nanosecond
nW	nanowatt
OBD	order by description
OD	outside diameter
OH	oval head
OP AMPL	operational amplifier
OPT	option
OSC	oscillator
OX	oxide
oz	ounce
Ω	ohm
P	peak (used in parts list)
PAM	pulse amplitude modulation
PC	printed circuit
PCM	pulse code modulation pulse count modulation
PDM	pulse duration modulation
pF	picofarad
PH BRZ	phosphor bronze
PHL	Phillips
PIN	positive intrinsic negative
piv	peak inverse voltage
pk	peak
PL	plate (mech)
PLST	plastic (not elastomer)
PM	phase modulation
PN	positive negative (semiconductor)
p-n	positive-negative
POLYPROP	polypropylene
POS	positive (position)
p-p	peak-to-peak
PPM	pulse position modulation
PREAMPL	preamplifier
PRF	pulse repetition frequency
PRR	pulse repetition rate
pt	pint (liquid)
PT	point
PTM	pulse time modulation
PWM	pulse width modulation
PWV	peak working voltage
RC	resistance-capacitance
RECT	rectifier
REF	reference
REG	regulated
REPL	replaceable
RF	radio frequency
RFI	radio frequency interference
RH	round head (right hand)
RLC	resistance-inductance-capacitance
RMO	rack mount only
rms	root mean square
RND	round
ROM	read only memory
RAP	rack and panel
RWV	reverse working voltage
S	scattering parameter
s	second (time) second (plane angle)
SAE	slow blow (fuse used in parts list)
SCR	silicon controlled rectifier screw
SE	screen
SECT	section
SEMICON	semiconductor
SHF	superhigh frequency
SI	silicon
SIL	silver
Sk	skin
S/N	signal to noise ratio
SPDT	single pole double throw
SPG	spring
SP	spotface
SPST	single pole single throw
SSB	single sideband
SST	stainless steel
STL	steel
SQ	square
SWR	standing wave ratio
SYNC	synchronize
T	tuned (also fuse type)
TA	tantalum
TC	temperature compensating
TD	time delay
TERM	terminal
TEST	test (for diagnostics)
TGL	toggle
THD	thread
THRU	through
T	titanium
TOL	tolerance
TRIM	trimmer
TSTR	transistor
TTL	transistor transistor logic
TV	television
T_A	free-air ambient temperature
TWT	traveling wave tube
UF	unfinished (used in parts list)
UHF	ultrahigh frequency
UNREG	unregulated
V	volt
μA	microampere
VAC	volts ac
VAR	varistor
VCO	voltage controlled oscillator
VDC	volts dc
VF	volt fluorescent
VFO	variable frequency oscillator
VHF	very high frequency
VPK	volts peak
VP-P	volts peak-to-peak
VRMS	volts rms
VSWR	voltage standing wave ratio
VTO	voltage tuned oscillator
VTVM	vacuum tube voltmeter
W/	with
W	watt
W	watt
WV	working (dc) voltage
WW	wirewound
W/O	without
YIG	yttrium iron garnet
Z	characteristic impedance

NOTE

All abbreviations in the parts list will be 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}

6-6. ORDERING INFORMATION

6-7. To obtain replacement parts, address order or 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 number.

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

a. Instrument model number.

b. Instrument serial number.

c. Description of the part.

d. Function and location of the part.

6-9. HP PART NUMBER ORGANIZATION

6-10. Although there are some variations and exceptions, the following number categories generally describe the current HP system of parts identification.

6-11. Component Parts and Materials

6-12. 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-	Insulating Materials
0340-	Insulators, 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

1906- 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

6-13. For example, 1854-0037, 1854-0221, and 1851-9102 are all NPN transistors. The first two are silicon and the last is germanium.

6-14. General Usage Parts

6-15. 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 4079-
Components	5080- to 5099-

6-16. For example, power splitter 5088-7003 is a component and pc board support 5040-0170 is a molded part.

6-17. Specific Instrument Parts

6-18. 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 part. For example, 05340-60001 is an assembly used in the 5340A. 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
Assembly	-60000 to -60499
Component	-80000 to -80299
Documentation	-90000 to -90249

Table 6-1. Replaceable Parts, Standard Instrument

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	[illegible]	1	MIXER ASSY	28480	[illegible]
A1C1	0160-0576	2	CAPACITOR-FXD 10PF +-10% 200WVDC	28480	0160-0576
A1C2	0160-0576		CAPACITOR-FXD 10PF +-10% 200WVDC	28480	0160-0576
A1C3	0160-0637	4	CAPACITOR-FXD .001UF +-20% 200WVDC	28480	0160-0637
A1C4	0160-0637		CAPACITOR-FXD .001UF +-20% 200WVDC	28480	0160-0637
A1J1	1250-0831	1	CONNECTOR	28480	1250-0831
A1J2	1250-0832	4	CONNECTOR, CORA	28480	1250-0832
A1W1	8121-0837	1	CABLE ASSY	28480	8120-0837
	05354-60011	1	CONTROL, MIXER ASSY, PROBE	28480	05354-60011
	05354-60012	1	CONTROL, MIXER ASSY, HELPS	28480	05354-60012
	05354-20035	1	CHASSIS, MIXER	28480	05354-20035
A1A1	05354-60014	1	BOARD ASSY ATTENUATOR DETECTOR	28480	05354-60014
A1A1C1	0160-4074	3	CAPACITOR-FXD 470PF +-10% 50WVDC	28480	0160-4074
A1A1C2	0160-4065		CAPACITOR-FXD 100PF +-10% 50WVDC	28480	0160-4065
A1A1C3	0180-0104	2	CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020B2
A1A1C4	0180-0104		CAPACITOR-FXD 2.2UF +-10% 20VDC TA	56289	150D225X9020B2
A1A1C5	0160-3878	10	CAPACITOR-FXD .001UF +-20% 100WVDC	28480	0160-3878
A1A1C6	0160-3878		CAPACITOR-FXD .001UF +-20% 100WVDC	28480	0160-3878
A1A1CR1	1901-0023	1	DIODE, SCHOTTKY QUAD	28480	1901-0023
A1A1CR2	1901-0535	3	DIODE SCHOTTKY	28480	1901-0535
A1A1CR3	1902-3041		DIODE ZENER 5.11V 5% 4W MAX PD	04713	SZ 10939-99
A1A1R1	CR83-1055	1	RESISTOR-FXD 1M 5% .25W CC TUBULAR	01121	CR1055
A1A1R2	2100-1771	1	RESISTOR, VAR, TRMR, 200 OHM 5% 4W	28480	2100-1771
A1A1R3	C3F3-0999	1	RESISTOR-FXD 10K 2% .125W T TUBULAR	[illegible]	[illegible]
A1A1R4	05354-60003	1	RESISTOR CHIP, 100 OHM	28480	05354-60003
A1A1R5	CR83-1055	4	RESISTOR-FXD 1M 5% .25W CC TUBULAR	01121	CR1055
A1A1R6	05354-60001	1	RESISTOR CHIP, 10.1 OHM	28480	05354-60001
A1A1R7	CR83-5055	1	RESISTOR-FXD 5.6M 5% .25W CC TUBULAR	01121	CR5055
A1A1R8	C3F3-6004	1	RESISTOR CHIP, 147 OHM	28480	3F354-60004
A1A1R9	CR83-5105	5	RESISTOR-FXD 5.1K 5% .25W CC TUBULAR	01121	CB5125
A1A1U1	1826-0026	1	INTEGRATED CIRCUIT, COMP, VOLTAGE	27014	LM111N
A1A2	05354-60016	1	BOARD ASSY MIXER AMPLIFIER	28480	05354-60016
A1A2C1	0160-4066		CAPACITOR-FXD 10PF +-10% 50WVDC	28480	0160-4066
A1A2C2	0160-4066		CAPACITOR-FXD 10PF +-10% 50WVDC	28480	0160-4066
A1A2C3	0160-4062		CAPACITOR-FXD 470PF +-10% 50WVDC	28480	0160-4062
A1A2C4	0160-4062		CAPACITOR-FXD 470PF +-10% 50WVDC	28480	0160-4062
A1A2C5	0160-3875	13	CAPACITOR-FXD .01UF +-20% 100WVDC	28480	0160-3875
A1A2C6	0160-0700	2	CAPACITOR-FXD 150PF +-10% 100WVDC	28480	0160-0700
A1A2C7	0160-4028	1	CAPACITOR-FXD 120PF +-10% 100WVDC	28480	0160-4028
A1A2C8	0160-0700		CAPACITOR-FXD 150PF +-10% 100WVDC	28480	0160-0700
A1A2C9	0160-3875		CAPACITOR-FXD .01UF +-20% 100WVDC	28480	0160-3875
A1A2C10	0160-0210	11	CAPACITOR-FXD 3.3UF +-20% 15VDC TA	56289	150D335X9015A2
A1A2CR1	1901-0026	3	DIODE, MW STRIPLINE PAIR MIXER	28480	1901-0026
A1A2CR2	1901-0026		DIODE, MW STRIPLINE PAIR MIXER	28480	1901-0026
A1A2CR3	1902-3182	1	DIODE ZENER 12.1V 5% 4W MAX PD	04713	SZ 10939-296
A1A2L1	9100-2247	1	COIL, FXD, MOLDED RF CHOKE, 10UH 10%	24226	10100
A1A2L2	9140-0141	2	COIL, FXD, MOLDED RF CHOKE, .68UH 10%	24226	10680
A1A2L3	9140-0141		COIL, FXD, MOLDED RF CHOKE, .68UH 10%	24226	10680
A1A2L4	9100-2269	1	COIL, FXD, MOLDED RF CHOKE, 27UH 10%	24226	10270
A1A2Q1	1854-0641	1	TRANSISTOR, SI NPN	28480	1854-0641
A1A2R1	05354-60003		RESISTOR CHIP, 100 OHM	28480	05354-60003
A1A2R2	05354-60003		RESISTOR CHIP, 100 OHM	28480	05354-60003
A1A2R3	C6S8-6294	2	RESISTOR-FXD 47K 5% .125W CC TUBULAR	01121	CB4735
A1A2R4	C6S8-6294		RESISTOR-FXD 47K 5% .125W CC TUBULAR	01121	CB4735
A1A2R5	C6S8-7101	2	RESISTOR-FXD 3K 5% .125W CC TUBULAR	01121	CB3025
A1A2R6	C6S8-1021	2	RESISTOR-FXD 1K 10% .125W CC TUBULAR	01121	AB1021
A1A2R7	C6S8-5174	1	RESISTOR-FXD 200 OHM 5% .125W CC	01121	CB2015
A1A2R8	C6S8-6131	1	RESISTOR-FXD 96.2 OHM 5% .125W CC TUBULAR	01121	CB9625
A1A2R9	C6S8-2465	1	RESISTOR-FXD 24 OHM 5% .5W CC TUBULAR	01121	EB2405
A1A2U1	1813-0044	1	MICROCIRCUIT, HYBRID	28480	1813-0044

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1C1	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A1C2	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A1C3	0160-3029	4	CAPACITOR-FXD 7.5PF+-.5PF 100WVDC	28480	0160-3029
A1C4	0160-3029		CAPACITOR-FXD 7.5PF+-.5PF 100WVDC	28480	0160-3029
A1C5	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A1C6	0160-3876	6	CAPACITOR-FXD 470PF+-20% 200WVDC	28480	0160-3876
A1C7	0121-0448	1	CAPACITOR-VAR-TRMR-GLASS 2.5-57PF	28480	0121-0448
A1C8	0160-3029		CAPACITOR-FXD 7.5PF+-.5PF 100WVDC	28480	0160-3029
A1C9	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A1C10	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A1C11	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A1CR1	1901-0639	4	DIODE, PIN 1 100V MAX VRM	28480	1901-0639
A1CR2	1901-0639		DIODE, PIN 1 100V MAX VRM	28480	1901-0639
A1CR3	1901-0639		DIODE, PIN 1 100V MAX VRM	28480	1901-0639
A1CR4	1901-0639		DIODE, PIN 1 100V MAX VRM	28480	1901-0639
A1L1	9100-2472	1	COIL, FXD, MOLDED RF CHOKE, 470UH 10%	24226	10A472
A1R1	0757-0465	1	RESISTOR-FXD 51K 2% .125W F TUBULAR	24546	C4-1/8-T0-5102-G
A1R2	0757-0465	11	RESISTOR-FXD 1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A1R3	0757-0442	5	RESISTOR-FXD 1.00K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-F
A1R4	0698-3156	11	RESISTOR-FXD 51.0OHM 5% .125W CC TUBULAR	01 21	RN55D5
A1R5	0757-0417	17	RESISTOR-FXD 510 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-511-G
A1R6	0757-0465		RESISTOR-FXD 51K 2% .125W F TUBULAR	24546	C4-1/8-T0-5102-G
A1R7	0757-0455	5	RESISTOR-FXD 20K 2% .125W F TUBULAR	24546	C4-1/8-T0-2002-G
A1R8	0757-0443	13	RESISTOR-FXD 10K 2% .125W F TUBULAR	24546	C4-1/8-T0-1002-G
A1R9	0757-0442		RESISTOR-FXD 1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A1R10	0757-0417		RESISTOR-FXD 510 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51.. G
A1U1	1813-0018	1	AMPLIFIER, HYBRID	28480	1813-0018
A1U2	1820-0136	2	IC-LINEAR DIFFERENTIAL AMPLIFIER	27735	CA3221
A2	05354-60002	1	SWITCHABLE FILTER ASSY NO REPLACEABLE PARTS	28480	05354-60002
A3	05354-60003	1	BOARD ASSY IF IV DIODE SCHMITT TRIG	28480	05354-60003
A3C1	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A3C2	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C3	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C4	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A3C5	0160-3874	10	CAPACITOR-FXD 10PF+-.5PF 200WVDC	28480	0160-3874
A3C6	0132-0007	4	CAPACITOR-VAR-TRMR-PSTN .7/3PF	32997	535-033-4R
A3C7	0160-3877		CAPACITOR-FXD 2.2PF+-.25PF 200WVDC	28480	0160-3877
A3C8	0160-2261	1	CAPACITOR-FXD 15PF+-5% 500WVDC	28480	0160-2261
A3C11	0160-3873	5	CAPACITOR-FXD 4.7PF+-.5PF 200WVDC	28480	0160-3873
A3C12	0160-3874		CAPACITOR-FXD 10PF+-.5PF 200WVDC	28480	0160-3874
A3C13	0160-3877	2	CAPACITOR-FXD 100PF+-20% 200WVDC	28480	0160-3877
A3C14	0160-3877		CAPACITOR-FXD 2.2PF+-.25PF 200WVDC	28480	0160-3877
A3C15	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C16	0160-3877		CAPACITOR-FXD 100PF+-20% 200WVDC	28480	0160-3877
A3C17	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C18	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C19	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C20	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C21	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C22	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C23	0160-3874		CAPACITOR-FXD 10PF+-.5PF 200WVDC	28480	0160-3874
A3C24	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C25	0160-3874		CAPACITOR-FXD 10PF+-.5PF 200WVDC	28480	0160-3874
A3C26	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C27	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C28	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C29	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C30	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3C31	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A3CR1	1901-1096	4	DIODE,	28480	1901-1096
A3CR2	1901-1096		DIODE,	28480	1901-1096
A3CR3	05354-60005	3	DIODE-MATCHED SET(1901-0535)	28480	05354-60005
A3CR4	1901-1096		DIODE,	28480	1901-1096
A3CR5	1901-1096		DIODE,	28480	1901-1096
A3CR6	05354-60005		DIODE-MATCHED SET(1901-0535)	28480	05354-60005
A3CR7	05354-60005		DIODE-MATCHED SET(1901-0535)	28480	05354-60005
A3CR8	1902-3041		DIODE ZENER 5.11V 5% .4W MAX PD	04713	SZ 10939-98

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A3CR5	1902-0041		DIODE-ZENER 5.11V 5% .4W MAX PD	04713	SZ 10939-58
A3CR10	1902-0551	1	DIODE-ZENER 6.19V 5% 1W MAX PD	04713	SZ 11211-63
A3L1	9100-0346	1	COIL-RF MOLDED RF CHOKE .09UH 20%	24226	4372
A3L2	9100-0346		COIL-RF MOLDED RF CHOKE .09UH 20%	24226	4372
A3Q1	1853-0016	2	TRANSISTOR PNP SI TO-18 PD=300MW	28480	1853-0016
A3Q2	1854-0071	6	TRANSISTOR NPN SI TO-92 PD=350MW FT=300MHZ	04713	SZ 10939-58
A3R1	C757-0454		RESISTOR-FXD 1K OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-1001-F
A3R2	C698-3390	2	RESISTOR-FXD 75 OHM 5% .125W CC TUBULAR	01121	CB7505
A3R3	C757-0417		RESISTOR-FXD 511 OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-511-F
A3R4	C757-0417		RESISTOR-FXD 511 OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-511-F
A3R5	C757-0417		RESISTOR-FXD 511 OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-511-F
A3R6	C757-0415		RESISTOR-FXD 470 OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-471-F
A3R7	C698-3390		RESISTOR-FXD 75 OHM 5% .125W CC TUBULAR	01121	CB7505
A3R8	C757-0429		RESISTOR-FXD 1.5K OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-1501-F
A3R9	C757-0468		RESISTOR-FXD 10K OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-1002-F
A3R10	C698-3113	1	RESISTOR-FXD 100 OHM 5% .125W CC	01121	CB1015
A3R11	C683-1055		RESISTOR-FXD 1M 5% .25W CC TUBULAR	01121	CB1055
A3R12	C757-0417		RESISTOR-FXD 511 OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-511-F
A3R13	C683-1055		RESISTOR-FXD 1M 5% .25W CC TUBULAR	01121	CB1055
A3R14	C757-0424		RESISTOR-FXD 1K OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-1001-F
A3R15	2100-2413	1	RESISTOR, VAR, TRMR, 200 OHM 10% C	32997	3352W-201
A3R16	2100-2632	1	RESISTOR, VAR, TRMR, 100 OHM 10% C	73138	82PR100
A3R17	C757-0442	1	RESISTOR-FXD 15K OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-1502-F
A3R18	C683-1055		RESISTOR-FXD 1M 5% .25W CC TUBULAR	01121	CB1055
A3R19	C698-3106	4	RESISTOR-FXD 1.1K 5% .125W CC TUBULAR	01121	CB1125
A3R20	C757-0450		RESISTOR-FXD 1K OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-1002-F
A3R21	C757-0422	1	RESISTOR-FXD 820 OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-821-F
A3R22	C683-8245	2	RESISTOR-FXD 820K 5% .25W CC TUBULAR	01121	CB8245
A3R23	C683-8245		RESISTOR-FXD 820K 5% .25W CC TUBULAR	01121	CB8245
A3R24	C757-0441	5	RESISTOR-FXD 5.1K 1% .125W F TUBULAR	28480	C4-1/8-T0-5101-F
A3R25	C698-3106		RESISTOR-FXD 1.1K 5% .125W CC TUBULAR	01121	CB1125
A3R26	C753-0730	1	RESIS 750 OHM 1% .25W F TUBULAR	28480	C5-1/4-T0-751-F
A3R27	2100-2485	1	RESIS, VAR, TRMR, 2K OHM 10% C	73138	82PR2K
A3R28	C698-3106		RESISTOR-FXD 1.1K 5% .125W CC TUBULAR	01121	CB1125
A3R29	C757-0417		RESISTOR-FXD 511 OHM 1% .125W F TUBULAR	28480	C4-1/8-T0-511-F
A3R30	C698-3180	1	RESISTOR-FXD 2K 5% .125W CC TUBULAR	01121	CB2025
A3R31	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	CB5105
A3R32	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	CB5105
A3R33	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	CB5105
A3R34	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	CB5105
A3R35	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	CB5105
A3R36	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	CB5105
A3R37	C698-8127	2	RESISTOR-FXD 22 OHM 5% .125W CC TUBULAR	01121	CB2205
A3R38	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	CB5105
A3R39	C698-8128	1	RESISTOR-FXD 220 OHM 5% .125W CC	01121	CB2215
A3R40	C698-3111	2	RESISTOR-FXD 30 OHM 5% .125W CC TUBULAR	01121	CB3005
A3R41	C757-0441		RESISTOR-FXD 5.1K 1% .125W F TUBULAR	28480	C4-1/8-T0-5101-F
A3U1	1826-0151	2	IC, AMPLIFIER	28480	1826-0151
A3U2	1820-0216	2	ICILINEOPERATIONAL AMPLIFIER	28480	1820-0216
A3U3	1826-0026		INTEGRATED CIRCUIT, DGTL, VOLTAGE	27014	LM111H
A3U4	1826-0026		INTEGRATED CIRCUIT, DGTL, VOLTAGE	27014	LM111H
A3U5	1820-0136		ICILINEIDIFFERENTIAL AMPLIFIER	02735	CA3028A
FOR A3	1200-0475	16	CONNECTOR-CONT SKT .016 DIA	22526	75060-007
FOR A3	1250-0836	1	CONNECTOR-COAAX SMC 50 OHM MALE	24931	CD-700161
FOR A3	5001-5093	9	PINIPC, BOARD EXTRACTOR	28480	5001-5093
FOR A3	5040-0848	5	EXTRACTOR	28480	5040-0848
FOR A3	0535-0009	10	SPRING, PC GROUND	28480	0535-0009
A4	05354-60004	1	BOARD ASSY 250/500 MHZ MULTIPLIER	28480	05354-60004
A4C1	0160-0694	4	CAPACITOR-FXD 1.5PF+-.1PF 100WVDC	28480	0160-0694
A4C2	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A4C3	0160-3873		CAPACITOR-FXD 4.7PF+-.5PF 200WVDC	28480	0160-3873
A4C4	0132-0067		CAPACITOR-VAR TRMR PSTNS .7/3PF	72982	535-033-4E
A4C5	0160-0694		CAPACITOR-FXD 1.5PF+-.1PF 100WVDC	28480	0160-0694
A4C6	0180-3210		CAPACITOR-FXDS 3.3UF+-20% 15VDC TA	56289	150D335X9015A2
A4C7	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A4C8	0160-3876		CAPACITOR-FXD 470PF+-20% 200WVDC	28480	0160-3876
A4C9	0180-0213		CAPACITOR-FXDS 3.3UF+-20% 15VDC TA	56289	150D335X9015A2
A4C10	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A4C11	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A4C12	0160-3873		CAPACITOR-FXD 4.7PF+-.5PF 200WVDC	28480	0160-3873
A4C13	0160-0695	4	CAPACITOR-FXD 1PF+-.1PF 100WVDC	28480	0160-0695
A4C14	0132-0067		CAPACITOR-VAR TRMR PSTNS .7/3PF	72982	535-033-4E

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4C17	[illegible]		CAPACITOR-FXD 2.2PF+-.25PF 200WVDC	28480	0160-3872
A4C18	0180-0116		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A4C19	0160-0576		CAPACITOR-FXD 1.5PF+-.1PF 100WVDC	28480	0160-0694
A4C20	0131-0337		CAPACITOR, VAR, TRMR, PSTN; 7.7PF	32997	535-033-4R
A4C21	0160-1814		CAPACITOR-FXD 10PF+-5% 200WVDC	28480	0160-1874
A4C22	0160-1870		CAPACITOR-FXD 47PF+-20% 200WVDC	28480	0160-1876
A4C23	0180-0116		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A4C24	0160-1870		CAPACITOR-FXD 47PF+-20% 200WVDC	28480	0160-1876
A4C25	0160-1870		CAPACITOR-FXD 47 PF+-20% 200WVDC	28480	0160-1876
A4C26	0160-1814		CAPACITOR-FXD 10PF+-5% 200WVDC	28480	0160-1874
A4C27	0160-1874		CAPACITOR-FXD 10PF+-5% 200WVDC	28480	0160-1874
A4CR1	1910-0040	3	DIODE, SWITCHING 4 15V MAX VRM 50MA	28480	1910-0040
A4L1	9100-1251	2	COIL, FXD, MOLDED RF CHOKE, .220UH 10%	24226	10/220
A4L2	9100-1251		COIL, FXD, MOLDED RF CHOKE, .220UH 10%	24226	10/220
A4Q1	1853-0020	5	TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A4Q2	1854-0371	4	TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A4Q3	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A4Q4	1854-0371		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A4Q5	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A4Q6	1854-0371		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A4Q7	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A4Q8	1854-0371		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A4R1	0757-0457	1	RESISTOR-FXD 75 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-75R0-G
A4R2	0757-0465	2	RESISTOR-FXD 750 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-7501-G
A4R3	0757-0465		RESISTOR-FXD 750 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-7501-G
A4R4	0757-0442		RESISTOR-FXD 100 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-1000-G
A4R5	0757-0440	2	RESISTOR-FXD 68.1 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-68R1-G
A4R6	0757-0444	1	RESISTOR-FXD 6.81K 2% .125W F TUBULAR	24546	C4-1/8-TO-6801-G
A4R7	0757-0466	2	RESISTOR-FXD 8.25K 2% .125W F TUBULAR	24546	C4-1/8-TO-8251-G
A4R8	0757-0442		RESISTOR-FXD 100 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-1000-G
A4R9	0757-0440		RESISTOR-FXD 68.1 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-68R1-G
A4R10	0757-0466		RESISTOR-FXD 8.25K 2% .125W F TUBULAR	24546	C4-1/8-TO-8251-G
A4R11	0757-0450	1	RESISTOR-FXD 121 2% .125W F TUBULAR	24546	C4-1/8-TO-1211-G
A4R12	0757-0442		RESISTOR-FXD 100 2% .125W F TUBULAR	24546	C4-1/8-TO-1000-G
A4R13	0757-0417		RESISTOR-FXD 510 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-511-G
A4R14	0757-0424	1	RESISTOR-FXD 1.21K 2% .125W F TUBULAR	24546	C4-1/8-TO-1211-G
A4R15	0757-0461		RESISTOR-FXD 5.11K 2% .125W F TUBULAR	24546	C4-1/8-TO-5111-G
A4R16	0757-0442		RESISTOR-FXD 100 2% .125W F TUBULAR	24546	C4-1/8-TO-1000-G
A4R17	0757-0804	1	RESISTOR-FXD 150 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-151-G
A4R18	0757-0453	1	RESISTOR-FXD 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-TO-51R0-G
FOR A4	5000-9043		FINGER, BOARD EXTRACTIR	28480	5000-9043
FOR A4	5040-6848		EXTRACTOR	28480	5040-6848
FOR A4	05354-00009		SPRING, RF GROUND	28480	05354-00009
A5	05354-60005	1	BOARD ASSY, 500 700 MHZ MULTIPLIER	28480	05354-60005
A5C1	0160-2201	5	CAPACITOR-FXD 51PF+-5% 300WVDC	28480	0160-2201
A5C2	0160-3878		CAPACITOR-FXD .0010UF+-20% 100WVDC	28480	0160-3878
A5C3	0160-3878		CAPACITOR-FXD .0010UF+-20% 100WVDC	28480	0160-3878
A5C4	0160-3875	1	CAPACITOR-FXD 22PF+-5% 200WVDC	28480	0160-3875
A5C5	0180-0116		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A5C6	0160-3872		CAPACITOR-FXD 2.2PF+-.25PF 200WVDC	28480	0160-3872
A5C7	0160-2201		CAPACITOR-FXD 51PF+-5% 300WVDC	28480	0160-2201
A5C8	0160-3876		CAPACITOR-FXD 47PF+-20% 200WVDC	28480	0160-3876
A5C9	0160-0326	2	CAPACITOR-FXD 2.2PF+-.1PF 200WVDC	28480	0160-0326
A5C10	0160-2201		CAPACITOR-FXD 51PF+-5% 300WVDC	28480	0160-2201
A5C11	0160-0659		CAPACITOR-FXD 1PF+-.1PF 100WVDC	28480	0160-0659
A5C12	0160-3872		CAPACITOR-FXD 2.2PF+-.25PF 200WVDC	28480	0160-3872
A5C13	0160-0659		CAPACITOR-FXD 1PF+-.1PF 100WVDC	28480	0160-0659
A5C14	0121-0488	2	CAPACITOR, VAR, AIR DIELE .6/8PF	91293	5701
A5C15	0121-0488		CAPACITOR, VAR, AIR DIELE .6/8PF	91293	5701
A5C16	0160-0659		CAPACITOR-FXD 1PF+-.1PF 100WVDC	28480	0160-0659
A5CR1	1910-0040		DIODE, SWITCHING 4 15V MAX VRM 50MA	28480	1910-0040
A5CR2	1901-0535		DIODE, SCHOTTKY 4	28480	1901-0535
A5CR3	1901-0535		DIODE, SCHOTTKY 4	28480	1901-0535
A5CR4	1910-0040		DIODE, SWITCHING 4 15V MAX VRM 50MA	28480	1910-0040
A5L1	9140-0159		COIL, FXD, MOLDED RF CHOKE, 1UH 10%	24226	10/101
A5L2	9100-2244	4	COIL, FXD, MOLDED RF CHOKE, .12UH 10%	24226	10/120
A5Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q2	1854-0371		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A5Q3	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A5Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A5Q5	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A5R1	C757-0941	7	RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R2	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R3	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R4	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R5	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R6	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R7	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R8	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R9	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R10	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R11	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R12	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R13	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R14	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A5R15	C757-0941		RESISTOR-FXD 5.1K OHM ,2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
FOR A5	5060-0941		FRAME,C, REAR EXTRACTOR	28480	5060-0941
FOR A5	5060-0868		EXTRACTOR	28480	5060-0868
FOR A5	0535A-00005		SPACING, PC BOARD	28480	0535A-00005
A6	0537A-00006	1	PC ASSY 10.240 MHZ MULTIPLIER	28480	0537A-00006
A6C1	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C2	0140-0209	4	CAPACITOR-FXD 1PF+-.1PF 500WVDC	72136	DM15C010D0R5B03WVICR
A6C3	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C4	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C5	0140-0201	2	CAPACITOR-FXD 27PF+-5% 500WVDC	72136	DM15C270J [illegible]
A6C6	0121-0059	2	CAPACITOR, VAR, TRMR, CER, 7/25PF	73899	9VE11P004
A6C7	0140-0209		CAPACITOR-FXD 1PF+-.1PF 500WVDC	72136	DM15C010D0R5B03WVICR
A6C8	0160-0565	5	CAPACITOR-FXD 910PF+-5% 100WVDC	28480	0160-0565
A6C9	0160-0565		CAPACITOR-FXD 910PF+-5% 100WVDC	28480	0160-0565
A6C10	0160-3872		CAPACITOR-FXD 2.2PF+-.25PF 200WVDC	28480	0160-3872
A6C11	0121-0059		CAPACITOR, VAR, TRMR, CER, 7/25PF	73899	9VE11P004
A6C12	0160-0654		CAPACITOR-FXD 1.5PF+-.1PF 100WVDC	28480	0160-0654
A6C13	0160-3874		CAPACITOR-FXD 10PF+-.5PF 200WVDC	28480	0160-3874
A6C14	0121-0059	5	CAPACITOR, VAR, TRMR, CER, 5.5/25PF	73899	9VE11P004
A6C15	0160-3874		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C16	0160-3566	1	CAPACITOR-FXD 5.6PF+-.5PF 100WVDC	28480	0160-3566
A6C17	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A6C18	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A6C19	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C20	0180-0210		CAPACITOR-FXD 3.3UF+-20% 15VDC TA	56289	150D335X0015A2
A6C21	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C22	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C23	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C24	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6C25	0160-3878		CAPACITOR-FXD .001UF+-20% 100WVDC	28480	0160-3878
A6L1	9100-1612	4	COIL, FXD, MOLDED RF CHOKE, .33UH 20%	24226	15/130
A6L2	9100-0144		COIL, FXD, MOLDED RF CHOKE, .47UH 20%	24226	9377
A6L3	9140-0158		COIL, FXD, MOLDED RF CHOKE, 1UH 10%	24226	10/101
A6L4	9100-2268		COIL, FXD, MOLDED RF CHOKE, .12UH 10%	24226	10/120
A6L7	9140-0158		COIL, FXD, MOLDED RF CHOKE, 1UH 10%	24226	10/101
A6L8	9100-2268		COIL, FXD, MOLDED RF CHOKE, .12UH 10%	24226	10/120
A6L9	9140-0158		COIL, FXD, MOLDED RF CHOKE, 1UH 10%	24226	10/101
A6L10	9100-2268		COIL, FXD, MOLDED RF CHOKE, .12UH 10%	24226	10/120
A6Q1	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A6Q2	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A6Q3	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A6Q4	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A6Q5	1853-0020		TRANSISTOR PNP SI CHIP PD=300MW	28480	1853-0020
A6Q6	1854-0345		TRANSISTOR NPN 2N5179 SI PD=200MW	04713	2N5179
A6R1	0757-0500	3	RESISTOR-FXD 100 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-101-G
A6R2	C757-0941		RESISTOR-FXD 5.1K 2% ,125W F TUBULAR	24546	C4-1/8-T0-5101-G
A6R3	C757-0942	7	RESISTOR-FXD 5.6K 2% ,125W F TUBULAR	24546	C4-1/8-T0-5601-G
A6R4	C757-0943		RESISTOR-FXD 51 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A6R5	C757-0533	1	RESISTOR-FXD 2.4K 2% ,125W F TUBULAR	24546	C4-1/8-T0-2401-G
A6R6	C757-0917		RESISTOR-FXD 510 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-511-G
A6R7	C757-0508	1	RESISTOR-FXD 180 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-181-G
A6R8	C757-0917		RESISTOR-FXD 510 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-511-G
A6R9	C757-0907	7	RESISTOR-FXD 200 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-201-G
A6R10	C757-0922		RESISTOR-FXD 820 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-821-G
A6R11	C757-0911	1	RESISTOR-FXD 301 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-301-G
A6R12	C757-0907		RESISTOR-FXD 200 OHM 2% ,125W F TUBULAR	24546	C4-1/8-T0-201-G

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A6-12	[illegible]	1	RESISTOR-FXD .01 OHM 5% .2W TC TUBULAR	01121	CB2005
A6-13	0757-0394		RESISTOR-FXD 10K .2% .1/2W F TUBULAR	24546	C4-1/8-T0-.002-G
A6-14	0757-0394		RESISTOR-FXD 1K .2% .1/2W F TUBULAR	24546	C4-1/8-T0-1001-G
A6-15	0757-0439		RESISTOR-FXD 2K 2% .125W F TUBULAR	24546	C4-1/8-T0-2001-G
A6-16	0757-0401		RESISTOR-FXD 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A6-17	0757-0394	2	RESISTOR-FXD 1K .1% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A6-18	0757-0401		RESISTOR-FXD 2K 2% .125W F TUBULAR	24546	C4-1/8-T0-2001-G
A6-19	0757-0394		RESISTOR-FXD 1K .1% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A6-20	0757-0439		RESISTOR-FXD 10K 2% .125W F TUBULAR	24546	C4-1/8-T0-1002-G
A6-21	0757-0401		RESISTOR-FXD 2K 2% .125W F TUBULAR	24546	C4-1/8-T0-2001-G
A6-22	0757-0394		RESISTOR-FXD 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A6-23	0757-0394		RESISTOR-FXD 10K 1% .125W F TUBULAR	24546	C4-1/8-T0-1002-G
A6-24	0757-0283		RESISTOR-FXD 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A6-25	0757-0283		RESISTOR-FXD 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A6-26	0757-0394		RESISTOR-FXD 1K 1% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A7U1	1854-0064	4	TRANSISTOR-NPN SILICON ARRAY	80009	CA3049
FOR A7	5060-9043		PINLESS, BOARD EXTRACTOR	28480	5000-9043
FOR A7	5060-9044		EXTRACTOR	28480	5060-8848
FOR A7	0535A-00009		SPRING, PC GROUND	28480	05334-00009
A7	05334-60007	1	BOARD ASSY, 10 MHZ MULTIPLIER	28480	05334-60007
A7C1	0160-2201		CAPACITOR-FXD 2200PF+-5% 300WVDC	28480	0160-2201
A7C2	0160-3879	1	CAPACITOR-FXD 1500PF+-5% 100WVDC	72136	DM15F152J0300WVICR
A7C3	0121-0109	1	CAPACITOR, VAR, TRMR, CER, 9/35PF	73899	9V11P9350
A7C4	0160-0161		CAPACITOR, V 5, TRMR, CER, 5.5/18PF	73899	9V11P918A
A7C5	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A7C6	0160-2201		CAPACITOR-FXD 220PF+-5% 300WVDC	28480	0160-2201
A7C7	0160-0161	3	CAPACITOR-FXD .01UF+-10% 200WVDC	56289	292P10392
A7C8	0160-0161		CAPACITOR-FXD .01UF+-10% 200WVDC	56289	292P10392
A7C9	0160-0161		CAPACITOR-FXD .01UF+-10% 200WVDC	56289	292P10392
A7C10	0160-3401		CAPACITOR-FXD 120PF+-5% 500WVDC	72136	DM15C121J05J00WVICR
A7C11	0121-0036		CAPACITOR, VAR, TRMR, CER, 5.5/18PF	73899	9V11P918A
A7C12	0140-0276		CAPACITOR-FXD 5PF+-10% 500WVDC	72136	DM15C050R0500WVICR
A7C13	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A7C14	0160-0368	2	CAPACITOR-FXD 180PF+-5% 500WVDC	28480	0160-0368
A7C15	0160-0326		CAPACITOR-FXD 2.2PF+-.1PF 200WVDC	28480	0160-0326
A7C16	0160-0368		CAPACITOR-FXD 180PF+-5% 500WVDC	28480	0160-0368
A7C17	0121-0036		CAPACITOR, VAR, TRMR, CER, 5.5/18PF	73899	9V11P918A
A7C18	0140-0276		CAPACITOR-FXD 5PF+-10% 500WVDC	72136	DM15C050R0500WVICR
A7L1	9100-0578	1	COIL, FXD, MOLDED RF CHOKE, 10UH 10%	24226	15/101
A7L2	9100-1617		COIL, FXD, MOLDED RF CHOKE, .330UH 20%	24226	15/330
A7L3	9100-1617		COIL, FXD, MOLDED RF CHOKE, .330UH 20%	24226	15/330
A7L4	9100-1617		COIL, FXD, MOLDED RF CHOKE, .330UH 20%	24226	15/330
A7L5	1854-0009	7	TRANSISTOR NPN 2N709 SI TO-30MW	28480	1854-0009
A7R1	0757-0283		RESISTOR-FXD 51 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-51R0-G
A7R2	0757-0394		RESISTOR-FXD 1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A7R3	0757-0427		RESISTOR-FXD 1.5K 2% .125W F TUBULAR	24546	C4-1/8-T0-1501-G
A7R4	0757-0311		RESISTOR-FXD 300 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-301-G
A7R5	0757-0311		RESISTOR-FXD 300 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-301-G
A7R6	0683-1505	1	RESISTOR-FXD 15 OHM 5% .25W CC TUBULAR	01121	CB1505
A7R7	0757-0280		RESISTOR-FXD 100 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-101-G
A7R8	0757-0442	2	RESISTOR-FXD 4.7K 2% .125W F TUBULAR	24546	C4-1/8-T0-4701-G
A7R9	0757-0439		RESISTOR-FXD 10K 2% .125W F TUBULAR	24546	C4-1/8-T0-1002-G
A7R10	0757-0394		RESISTOR-FXD 1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A7R11	0757-0419	1	RESISTOR-FXD 390 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-391-G
A7R12	0757-0280		RESISTOR-FXD 100 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-101-G
A7R13	0757-0442		RESISTOR-FXD 4.7K 2% .125W F TUBULAR	24546	C4-1/8-T0-4701-G
A7R14	0757-0439		RESISTOR-FXD 10K 2% .125W F TUBULAR	24546	C4-1/8-T0-1002-G
A7R15	0757-0394		RESISTOR-FXD 1K 2% .125W F TUBULAR	24546	C4-1/8-T0-1001-G
A7R16	0757-0419	1	RESISTOR-FXD 620 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-621-G
A7R17	0757-0442		RESISTOR-FXD 5.6K 2% .125W F TUBULAR	24546	C4-1/8-T0-5601-G
A7R18	0757-0438		RESISTOR-FXD 5.1K 2% .125W F TUBULAR	24546	C4-1/8-T0-5101-G
A7U1	1854-0064		SILICON TRANSISTOR ARRAY	80009	CA3049
FOR A7	5060-9043		PINLESS, BOARD EXTRACTOR	28480	5000-9043
FOR A7	5060-8848		EXTRACTOR	28480	5060-8848
FOR A7	0535A-00009		SPRING, PC GROUND	28480	05334-00009
A8	05334-60008	1	BOARD ASSY, FILTER SWITCH	28480	05334-60008
A8C1	[illegible]	7	CAPACITOR-FXD [illegible]	56289	[illegible]
A8C2	[illegible]		CAPACITOR-FXD .01UF+-20% 200WVDC	28480	0160-3880
A8C3	[illegible]		CAPACITOR-FXD [illegible]	56289	[illegible]

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4C4	[illegible]		CAPACITOR-FXD [illegible]	28480	[illegible]
A4C5	[illegible]	1	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C6	[illegible]	12	CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C7	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C8	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C9	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C10	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C11	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C12	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C13	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C14	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C15	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C16	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4C17	[illegible]		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A4Q1	1854-0009		TRANSISTOR NPN 2N709 SI PD=300mW	28480	1854-0009
A4Q2	1853-0015	6	TRANSISTOR PNP SI CHIP PD=200mW	28480	1853-0015
A4Q3	1854-0009		TRANSISTOR NPN 2N709 SI PD=300mW	28480	1854-0009
A4Q4	1853-0015		TRANSISTOR PNP SI CHIP PD=200mW	28480	1853-0015
A4Q5	1854-0009		TRANSISTOR NPN 2N709 SI PD=300mW	28480	1854-0009
A4Q6	1853-0015		TRANSISTOR PNP SI CHIP PD=200mW	28480	1853-0015
A4Q7	1854-0009		TRANSISTOR NPN 2N709 SI PD=300mW	28480	1854-0009
A4Q8	1853-0015		TRANSISTOR PNP SI CHIP PD=200mW	28480	1853-0015
A4Q9	1854-0009		TRANSISTOR NPN 2N709 SI PD=300mW	28480	1854-0009
A4Q10	1853-0015		TRANSISTOR PNP SI CHIP PD=200mW	28480	1853-0015
A4Q11	1854-0009		TRANSISTOR NPN 2N709 SI PD=300mW	28480	1854-0009
A4Q12	1853-0015		TRANSISTOR PNP SI CHIP PD=200mW	28480	1853-0015
A4Q13	1854-0071		TRANSISTOR NPN SI PD=310mW FT=250MHz	28480	1854-0071
A4Q14	1854-0071		TRANSISTOR NPN SI PD=310mW FT=250MHz	28480	1854-0071
A4R1	0683-1035	x1	RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CB1035
A4R2	0683-1045	1	RESISTOR-FXD 100K 5% .25W CC TUBULAR	01121	CB1045
A4R3	0683-2435	1	RESISTOR-FXD 24K 5% .25W CC TUBULAR	01121	CB2435
A4R4	0683-5135	1	RESISTOR-FXD 51K 5% .25W CC TUBULAR	01121	CB5135
A4R5	0683-2035	6	RESISTOR-FXD 20K 5% .25W CC TUBULAR	01121	CB2035
A4R6	0683-5125		RESISTOR-FXD 5.1K 5% .25W CC TUBULAR	01121	CB5125
A4R7	0683-5115	12	RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R8	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R9	0683-2035		RESISTOR-FXD 20K 5% .25W CC TUBULAR	01121	CB2035
A4R10	0683-5125		RESISTOR-FXD 5.1K 5% .25W CC TUBULAR	01121	CB5125
A4R11	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R12	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R13	0683-2035		RESISTOR-FXD 20K 5% .25W CC TUBULAR	01121	CB2035
A4R14	0683-5125		RESISTOR-FXD 5.1K 5% .25W CC TUBULAR	01121	CB5125
A4R15	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R16	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R17	0683-2035		RESISTOR-FXD 20K 5% .25W CC TUBULAR	01121	CB2035
A4R18	0683-5125		RESISTOR-FXD 5.1K 5% .25W CC TUBULAR	01121	CB5125
A4R19	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R20	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R21	0683-2035		RESISTOR-FXD 20K 5% .25W CC TUBULAR	01121	CB2035
A4R22	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R24	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R25	0683-2035		RESISTOR-FXD 20K 5% .25W CC TUBULAR	01121	CB2035
A4R27	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4R28	0683-5115		RESISTOR-FXD 510 OHM 5% .25W CC TUBULAR	01121	CB5115
A4S1	3101-1756	1	SWITCH: SLS SPST 5SE .1A 125VAC	28480	3101-1756
A4U1	1820-0588	4	IC:DGTL:GATE	27014	DM7413N
A4U2	1820-0414	1	IC:DGTL:DECODER/DECODER DRVR/DATA DIST	01295	SN7442N
A4U3	1820-0588	2	IC:DGTL:INVERTER	27014	DM7404N
A4U4	1820-0056	3	IC:DGTL:GATE	01295	SN7408N
A4U5	1820-0174	2	IC:DGTL:INVERTER	01295	SN7404N
FOR A8	5000-9043		FIXTR-CA, BCAFC EXTRACTOR	28480	5000-9043
FOR A8	5040-8851	4	EXTRACTOR	28480	5040-8851
A7	05354-60009	1	BCAFC ASSY, FILTER SELECT	28480	05354-60009
A5C1	0180-0174		CAPACITOR-FXD [illegible]	[illegible]	[illegible]
A5C2	0150-0121	1	CAPACITOR-FXD .01UF+80-20% 500VDC	28480	0150-0121
A5C3	0150-0050	1	CAPACITOR-FXD .001UF+80-20% 100VDC	28480	0150-0050
A5R1	0683-1035		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CB1035
A5R2	0683-1035		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CB1035
A5R3	0683-1035		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CB1035
A5R4	0683-3015	4	RESISTOR-FXD 150 OHM 5% .25W CC TUBULAR	01121	CB1535
A5R5	0683-3015	1	RESISTOR-FXD 150 OHM 5% .25W CC TUBULAR	01121	CB1535

Table 6-1 Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
[illegible]	[illegible]		[illegible]	01121	CR1035
[illegible]	[illegible]	1	[illegible]	01295	SN74107N
[illegible]	[illegible]		[illegible]	27014	DM74L20N
[illegible]	[illegible]		[illegible]	27014	DM74L20N
[illegible]	[illegible]	1	[illegible]	01295	SN15866N
[illegible]	[illegible]		[illegible]	01295	SN74107N
[illegible]	[illegible]	1	[illegible]	27014	DM74L00N
[illegible]	[illegible]		[illegible]	01295	SN15866N
[illegible]	[illegible]	1	[illegible]	01295	SN7402N
[illegible]	[illegible]	1	[illegible]	07263	9312DC
[illegible]	[illegible]		[illegible]	27014	DM74L20N
[illegible]	[illegible]		[illegible]	27014	DM74L04N
[illegible]	[illegible]		[illegible]	01295	SN74107N
[illegible]	[illegible]		[illegible]	01295	SN7400N
FOR A8	[illegible]		[illegible]	28480	5000-9063
FOR A8	[illegible]		[illegible]	28480	5040-6851
A10	[illegible]	1	BOARD ASSY, INPUT CONTROL	28480	05334-60010
A10C1	[illegible]		CAPACITOR-FXD .01UF+80-20% 50WVDC	28480	0150-0121
A10C2	[illegible]		CAPACITOR-FXD 100UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A10C3	[illegible]		CAPACITOR-FXD 100UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A10C4	[illegible]	1	CAPACITOR-FXD 150UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A10C5	[illegible]	1	CAPACITOR-FXD .0015UF+-10% 100WVDC	56289	292P33292
A10C6	[illegible]	2	CAPACITOR-FXD 270PF+-5% 300WVDC	28480	0160-2306
A10C7	[illegible]		CAPACITOR-FXD 270PF+-5% 300WVDC	28480	0160-2306
A10C8	[illegible]		CAPACITOR-FXD 4300PF+-5% 100WVDC	28480	0160-0965
A10CR1	[illegible]	2	DIODE, SWITCHING 1 50V MAX VRM 50MA	28480	1901-0044
A10CR2	[illegible]		DIODE, SWITCHING 1 50V MAX VRM 50MA	28480	1901-0044
A10Q1	[illegible]		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A10R1	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R2	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R3	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R4	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R5	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R6	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R7	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R8	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R9	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R10	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R11	[illegible]	2	RESISTOR-FXD 2.2K 5% .25W CC TUBULAR	01121	CR2225
A10R12	[illegible]	1	RESISTOR-FXD 120 OHM 5% .25W CC TUBULAR	01121	CR1215
A10R13	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R14	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R15	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R16	[illegible]		RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CR1035
A10R17	[illegible]	1	RESISTOR-FXD 240 OHM 5% .25W CC TUBULAR	01121	CR2415
A10R18	[illegible]		RESISTOR-FXD 2.2K 5% .25W CC TUBULAR	01121	CR2225
A10R19	[illegible]	1	RESISTOR-FXD 22K 5% .25W CC TUBULAR	01121	CR2235
A10U1	[illegible]	1	MICROCIRCUIT, MULTIVIBRATOR	34335	96L02DC
A10U2	[illegible]	1	MICROCIRCUIT, MULTIVIBRATOR	07263	9601PC
A10U3	[illegible]	1	INTEGRATED CIRCUIT, DCTL, FTL LP DUAL D	27014	DM74L74N
A10U4	[illegible]	1	MICROCIRCUIT, GATE	27014	DM74L10N
A10U5	[illegible]		MICROCIRCUIT, GATE	27014	DM74L00N
A10U6	[illegible]		INTEGRATED CIRCUIT, DCTL, FTL LP DUAL D	27014	DM74L74N
A10U7	[illegible]	1	MICROCIRCUIT, MULTIPLEXER	07263	93220C
A10U8	[illegible]		INTEGRATED CIRCUIT, DCTL, FTL LP DUAL D	27014	DM74L74N
A10U9	[illegible]		MICROCIRCUIT, GATE	27014	DM74L00N
A10U10	[illegible]		MICROCIRCUIT, MULTIVIBRATOR	34335	96L02DC
A10U11	[illegible]		MICROCIRCUIT, GATE	01295	SN7400N
A10U12	[illegible]	1	MICROCIRCUIT, GATE	01295	SN7420N
A10U13	[illegible]		MICROCIRCUIT, GATE	27014	DM74L00N
A10U14	[illegible]		MICROCIRCUIT, GATE	27014	DM74L10N
FOR A10	[illegible]		PRINTED BOARD EXTRACTOR	28480	5000-9063
FOR A10	[illegible]		EXTRACTOR	28480	5040-6851
A11	[illegible]	1	BOARD ASSY, COUNTER INTERFACE	28480	05334-60011
A11C1	[illegible]		CAPACITOR-FXD1 100UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A11C2	[illegible]		CAPACITOR-FXD .01UF+80-20% 50WVDC	28480	0150-0121
A11C3	[illegible]	1	CAPACITOR-FXD 100PF+-5% 300WVDC	72136	DM15F131J0300WVLCR

See introduction to this section for ordering information

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A11A4	0160-3873	1	CAPACITOR-FXD .033UF+80-20% 200WVDC	28480	0160-3873
A11A1	0698-3435		RESISTOR-FXD 1.21K OHM .1% .125W F TUBULAR	24546	C4-1/8-T0-1211-F
A11A2	0698-3435		RESISTOR-FXD 1.21K OHM .1% .125W F TUBULAR	24546	C4-1/8-T0-1211-F
A11A3	0698-3437		RESISTOR-FXD 1.5K OHM .1% .125W F TUBULAR	24546	C4-1/8-T0-1501-F
A11A4	0698-3435		RESISTOR-FXD 1.21K OHM .1% .125W F TUBULAR	24546	C4-1/8-T0-1211-F
A11U1	1820-0584	1	MICROCIRCUIT, DGTL, TTL LP J-K	27014	SN74L72N
A11U2	1820-0583		MICROCIRCUIT	27014	SN74L30N
A11U3	1820-0577	2	MICROCIRCUIT, FLIP-FLOP	01295	SN74266N
A11U4	1820-0699	1	MICROCIRCUIT, COUNTER	18324	SN74390N
A11U5	1820-0054	1	MICROCIRCUIT, GATE	34713	MC846P
A11U6	1820-0134		MICROCIRCUIT, INVERTER	01295	SN7416N
A11U7	1820-0810		MICROCIRCUIT, GATE	01295	SN54S03J
A11U8	1820-0877		MICROCIRCUIT, FLIP-FLOP	01295	SN74276N
A11U9	1820-0750		MICROCIRCUIT, MULTIVIBRATOR	34335	4011CPC
A11U10	1820-0699		MICROCIRCUIT, GATE	34713	MC846P
A11U11	1820-0567		MICROCIRCUIT, GATE	27014	DM74LS10N
A11U12	1820-0054		MICROCIRCUIT, GATE	34713	MC846P
FOR A11	1200-0083		SOCKET, DIP, BOARD EXTRACTOR	28480	1200-0383
FOR A11	5040-6951		EXTRACTOR	28480	5040-6951
A12			SEE REPLACEABLE PARTS LIST FOR OPT 011.		
A13			SEE REPLACEABLE PARTS LIST FOR OPT 011.		
A14	05354-60014	1	BOARD ASSY, MOTHER	28480	05354-60014
	0360-1514	1	TERMINAL, SLDR STUD	28480	0360-1514
	1200-0474	1	SOCKET, ELEC, IC 14-CONT DIP SLDR TERM	06776	ICN-143-S3
	1200-0491	1	SOCKET, IC, 10-POSITION DUAL-IN-LINE	01210	CA10S-1050-MC
	1250-0814	5	CONNECTOR-COAXIAL SM SCKT 50 OHM MALE	28497	700057
	1251-0055	1	CONNECTOR, 50-CONT, MALE, MICRO RIBBON	71785	57-10500-025
	1251-2026	6	CONNECTOR, PC EDGE, 18-CONT, DIP SOLDER	71785	252-13-30-306
	1251-2034	1	CONNECTOR, PC EDGE, 30-CONT, DIP SOLDER	71785	252-15-30-306
	1251-2035	2	CONNECTOR, PC EDGE, 36-CONT, DIP SOLDER	71785	252-15-30-306
	05354-00013	4	INSULATOR	28480	05354-00013
A15	05354-60024	1	BOARD ASSY, SUMMING AMPLIFIER	28480	05354-60024
A15C1	0160-2437		CAPACITOR-FXD .005UF+80-20% 200WVDC	28480	0160-2437
A15C2	0160-2437		CAPACITOR-FXD .005UF+80-20% 200WVDC	28480	0160-2437
A15C3	0160-2437		CAPACITOR-FXD .005UF+80-20% 200WVDC	28480	0160-2437
A15C4	0160-2437		CAPACITOR-FXD .005UF+80-20% 200WVDC	28480	0160-2437
A15C5	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15C6	0160-3874		CAPACITOR-FXD 10PF+-.5PF 200WVDC	28480	0160-3874
A15C7	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15C8	0160-3874		CAPACITOR-FXD 10PF+-.5PF 200WVDC	28480	0160-3874
A15C9	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15C10	0160-3873		CAPACITOR-FXD 4.7PF+-.5PF 200WVDC	28480	0160-3873
A15C11	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15C12	0160-3029		CAPACITOR-FXD 7.5PF+-.5PF 100WVDC	28480	0160-3029
A15C13	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15C14	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15C15	0160-3873		CAPACITOR-FXD 4.7PF+-.5PF 200WVDC	28480	0160-3873
A15C16	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15C17	0160-3879		CAPACITOR-FXD .01UF+-20% 100WVDC	28480	0160-3879
A15J1	1250-0829	2	CONNECTOR-COAX SMCE 50 OHM MALE	91293	50-065-4610
A15J2	1250-0829		CONNECTOR-COAX SMCE 50 OHM MALE	91293	50-065-4610
	05354-00015	1	COVER, HOUSING, TOP	28480	05354-00015
A15Q1	1853-0016		TRANSISTOR PNP SI CHIP PD=100MW	28480	1853-0016
A15R1	C698-7358		RESISTOR-FXD 1.1K 5% .125W CC TUBULAR	01121	BB1125
A15R2	0757-0957		RESISTOR-FXD 15K 2% .125W F TUBULAR	24546	C4-1/8-T0-1502-G
A15R3	C757-0922		RESISTOR-FXD 820 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-821-G
A15R4	C698-7358		RESISTOR-FXD 1.1K 5% .125W CC TUBULAR	01121	BB1125
A15R5	C757-0420	1	RESISTOR-FXD 750 OHM 1% .125W F TUBULAR	24546	C4-1/8-T0-751-F
A15R6	2100-2216	2	RESISTOR, VAR, TRMR, 5KOHM 10% C	28480	2100-2216
A15R7	C698-7358		RESISTOR-FXD 1.1K 5% .125W CC TUBULAR	01121	BB1125
A15R8	0757-0917		RESISTOR-FXD 510 OHM 2% .125W F TUBULAR	24546	C4-1/8-T0-511-G
A15R9	C675-1021		RESISTOR-FXD 1K 10% .125W CC TUBULAR	01121	BB1021
A15R10	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	BB5105

Table 6-1. Replaceable Parts, Standard Instrument (Con't)

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1R11	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A1R12	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A1R13	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A1R14	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A1R15	C698-8127		RESISTOR-FXD 22 OHM 5% .125W CC TUBULAR	01121	BB2205
A1R16	C698-3378		RESISTOR-FXD 51 OHM 5% .125W CC TUBULAR	01121	BB5105
A1R17	C698-5563	1	RESISTOR-FXD 180 OHM 5% .125W FC	01121	BB1815
A1R18	C698-3111		RESISTOR-FXD 30 OHM 5% .125W CC TUBULAR	01121	BB3005
A1R19	2100-2216		RESISTOR, VAR, TRMR, 5KOHM 10% C	28480	2100-2216
A1R20	C698-7101		RESISTOR-FXD 1K 5% .125W CC TUBULAR	01121	BB1025
A1R21	C757-0279	1	RESISTOR-FXD 3.16K 1% .125W F TUBULAR	24546	C4-1/8-T0-3161-F
A1R22	C757-0124	1	RESISTOR-FXD 39.2K 1% .125W F TUBULAR	24546	C4-1/8-T0-3922-F
A1U1	1820-0216		IC,LIN;OPERATIONAL AMPLIFIER	28480	1820-0216
A1U2	1826-0151		IC, AMPLIFIER	28480	1826-0151
			CHASSIS PARTS		
MP1	05354-00005	1	PANEL, BLANK	28480	05354-00005
MP2	06354-00003	1	PANEL, REAR	28480	06354-00003
MP3	06354-00002	1	PANEL, LEFT SIDE	28480	06354-00002
MP4	06354-00001	1	PANEL, RIGHT SIDE	28480	06354-00001
MP5	06354-00015	1	COVER, A15	28480	06354-00015
MP6	06354-00007	1	COVER, MULTIPLIER	28480	06354-00007
MP7	06354-20031	1	PANEL, SUB-FRONT	28480	06354-20031
MP8	05354-00008	1	BRACKET, PUSHBUTTON SWITCH	28480	05354-00008
MP9	05354-00014	1	PANEL, FRONT	28480	05354-00014
MP10	1460-1186	1	MINIFORM	28480	1460-1186
MP11	3050-0028	1	WASHER; DOME PL PRPHY; DOME PL PRPHY	28480	3050-0028
MP12	08621-20052	1	SCREW;DRAWER LATCH	28480	08621-20052
MP13	08621-20051	1	HANDLE;DRAWER LATCH	28480	08621-20051
S1	3101-1593	2	SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1593
FOR S1	3101-1671	2	SWITCH; PB ACCESS BUTTON CAP FOR	09353	A7527-2
S2	3101-1593		SWITCH; SL; DPDT NS; 1A 125VAC	28480	3101-1593
FOR S2	3101-1671		SWITCH; PB ACCESS BUTTON CAP FOR	09353	A7527-2
S3	3101-1800	2	SWITCH; PB 1-STA RECT DPDT	09353	P6221
S4	3101-1800		SWITCH; PB 1-STA RECT DPDT	09353	P6221
S5	3101-1787	1	SWITCH; SL; DPDT NS; .5A 125VAC/DC	28480	3101-1787
W1	8120-0628	1	CABLE ASSY	28480	8120-0628
W2	8120-0626	1	CABLE ASSY	28480	8120-0626
W3	8120-0625	1	CABLE ASSY	28480	8120-0625
W4			NOT ASSIGNED		
W5	8120-0629	1	CABLE ASSY	28480	8120-0629
W6	8120-0624	1	CABLE ASSY	28480	8120-0624
W7	8120-0627	1	CABLE ASSY	28480	8120-0627
W8	8120-0630	1	CABLE ASSY	28480	8120-0630
W10			PART OF OPTION 011		
W11			PART OF OPTION 011		
W12	8120-0634	1	CABLE ASSY	28480	8120-0634
W13	8120-0632	1	CABLE ASSY	28480	8120-0632
W14			NOT ASSIGNED		
W15	05354-60050	1	CABLE ASSY, INTERCONNECT	28480	05354-60050
FOR W9	1250-0887	2	CONNECTOR-COAX; SNC; 50 OHM FEMALE	98291	50-024-0159
FOR W9	1250-0888	2	CONNECTOR-COAX; SNC; 50 OHM FEMALE	98291	50-028-0139
FOR W9	1251-0179	2	CONNECTOR-INSERT (REQ), FOR SER	71785	DM-53140-5021
FOR W9	1251-2244	1	CONNECTOR, 17-CONT, MALE, D SERIES	71785	DCM-17W5P
FOR W9	8120-0789	2	CABLE, COAX, 50 OHM, .11 OD, 28AWG	28480	8120-0789
W16	05354-60026	1	CABLE ASSY, SCHMITT TRIGGER	28480	05354-60026
FOR W16	1250-0887		CONNECTOR-COAX; SNC; 50 OHM FEMALE	98291	50-024-0159
FOR W16	1250-0888		CONNECTOR-COAX; SNC; 50 OHM FEMALE	98291	50-028-0139
FOR W16	8120-0789		CABLE, COAX, 50 OHM, .11 OD, 28AWG	28480	8120-0789

See introduction to this section for ordering information

Note:

All numbers are prefixed with "MP". See chassis parts in Table 6-1 for descriptions and part numbers.

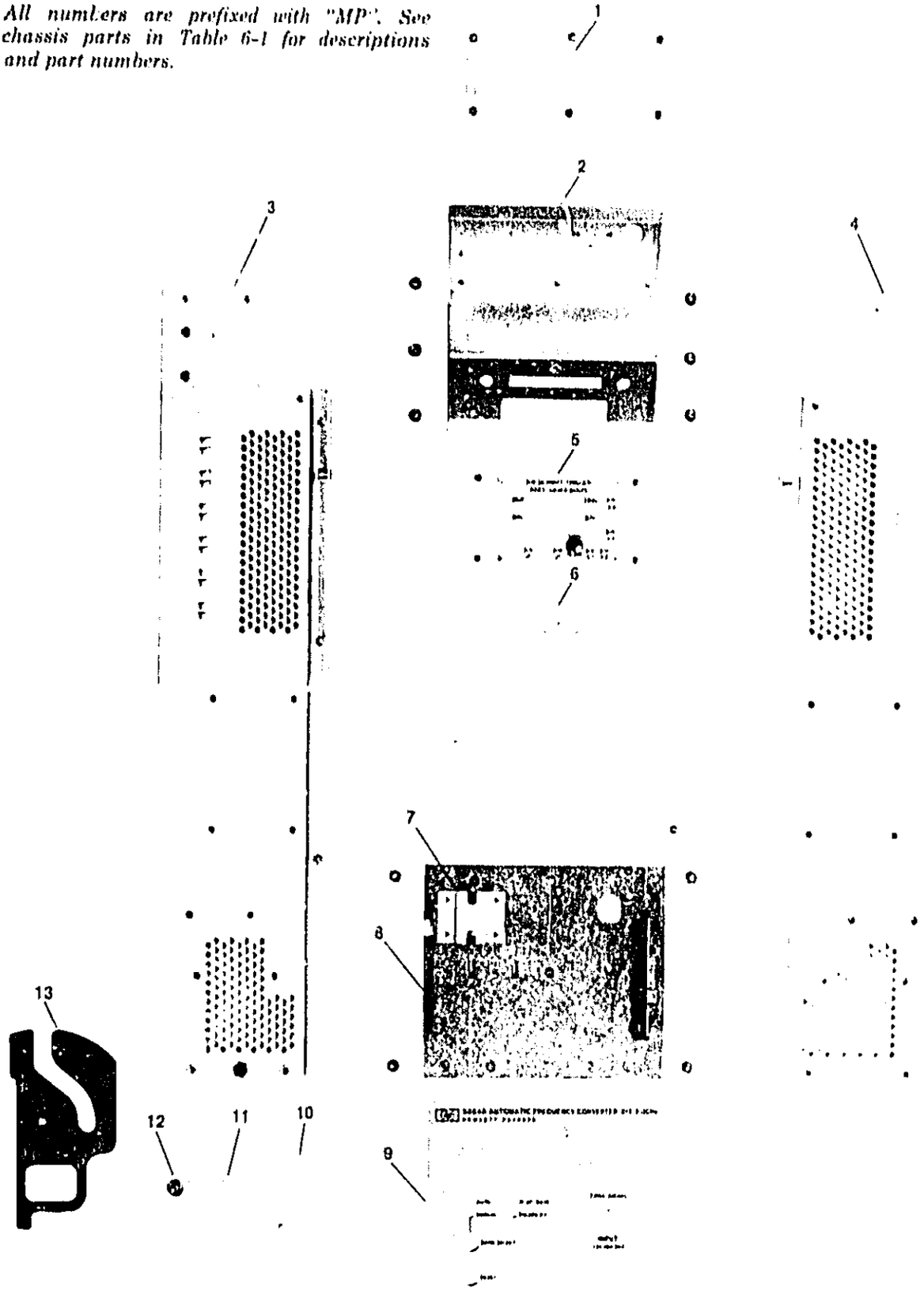


Figure 6-1. 5354A Mechanical Parts

Table 6-2. Replaceable Parts, Option 011

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
			OPTION 011		
A13	06364-60012	1	LOGIC ASSY	28480	06364-60012
A13C1	0160-0171	4	CAPACITOR-FXD .1UF±20% 50WVDC	28480	0160-0171
A13C2	0180-0374	1	CAPACITOR-FXD 10UF±10% 20VDC TA	56289	150D106X9020B2
A13R1	C683-4725	5	RESISTOR-FXD 4.7K 5% .25W CC TUBULAR	01121	CB4725
A13R2	C683-4725		RESISTOR-FXD 4.7K 5% .25W CC TUBULAR	01121	CB4725
A13R3	C683-4725		RESISTOR-FXD 4.7K 5% .25W CC TUBULAR	01121	CB4725
A13R4	C683-4725		RESISTOR-FXD 4.7K 5% .25W CC TUBULAR	01121	CB4725
A13R5	C683-4725		RESISTOR-FXD 4.7K 5% .25W CC TUBULAR	01121	CB4725
A13R6	C683-1035	1	RESISTOR-FXD 10K 5% .25W CC TUBULAR	01121	CB1035
A13U1	1820-0782	1	IC;DGTL;GATE	01295	SN74274
A13U2	1820-0876	1	IC;DGTL;LATCH	01295	SN74L75N
A13U3	1820-0564	1	IC;DGTL;GATE	27014	DM74L02N
A13U4	1820-0568	2	IC;DGTL;GATE	27014	DM74L20N
A13U5	1820-0328	1	IC;DGTL;GATE	01295	SN7400N
A13U6	1820-[illegible]76		IC;DGTL;LATCH	01295	SN74L75N
A13U7	1820-0876		IC;DGTL;LATCH	01295	SN74L75N
A13U8	1820-0563	1	IC;DGTL;GATE	27014	DM74L00N
A13U9	1820-0620	2	IC;DGTL;MEMORY	01295	SN7489N
A13U10	1820-0877	1	IC;DGTL;FLIP-FLOP	01295	SN7474N
A13U11	1820-0004	2	IC;DGTL;GATE	01295	SN7400N
A13U12	1820-0556	1	INTEGRATED CIRCUIT, DGTL, TTL LP DUAL D	27014	DM74L74N
A13U13	1820-0054	3	IC;DGTL;GATE	04713	MC846P
A13U14	1820-0054		IC;DGTL;GATE	04713	MC846P
A13U15	1820-0564		IC;DGTL;GATE	27014	DM74L02N
A13U16	1820-0620		IC;DGTL;MEMORY	01295	SN7489N
A13U17	1820-0054		IC;DGTL;GATE	04713	MC846P
A13U18	1820-0068	1	IC;DGTL;GATE	01295	SN7410N
FOR A13	5060-9043	2	PINETP.C. BOARD EXTRACTOR	28480	5000-9043
FOR A13	5040-6851	2	EXTRACTOR	28480	5040-6851
A11	05354-60013	1	BOARD ASSY, ASCII INTERFACE	28480	05354-60013
A13C1	C160-0156	3	CAPACITOR-FXD .005UF±10% 200WVDC	56289	292P56292
A13C2	0160-0156		CAPACITOR-FXD .005UF±10% 200WVDC	56289	292P56292
A13C3	0160-0156		CAPACITOR-FXD .005UF±10% 200WVDC	56289	292P56292
A13C4	0180-0210	1	CAPACITOR-FXD 3.3UF±20% 15VDC TA	56289	150D335X0015A2
A13CR1	1901-0044	1	DIODE; SWITCHING; 1 50V MAX VRM 50MA	28480	1901-0044
A13R1	1810-0136	2	RESISTIVE NETWORK	28480	1810-0136
A13R2	1810-0136		RESISTIVE NETWORK	28480	1810-0136
A13R3	C683-2725	5	RESISTOR-FXD 2.7K 5% .25W CC TUBULAR	01121	CB2725
A13R4	C683-2725		RESISTOR-FXD 2.7K 5% .25W CC TUBULAR	01121	CB2725
A13R5	C683-2725		RESISTOR-FXD 2.7K 5% .25W CC TUBULAR	01121	CB2725
A13R6	C683-2725		RESISTOR-FXD 2.7K 5% .25W CC TUBULAR	01121	CB2725
A13R7	C683-2725		RESISTOR-FXD 2.7K 5% .25W CC TUBULAR	01121	CB2725
A13R8	C683-1215	2	RESISTOR-FXD 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A13R10	C683-1215		RESISTOR-FXD 120 OHM 5% .25W CC TUBULAR	01121	CB1215
A13S1	3101-1820	1	SWITCH ASSY;ROCKER 0.1.P. (7) SPST	00779	435166-1
A13U1	1820-0568		IC;DGTL;GATE	27014	DM74L20N
A13U2	1820-0554	1	INTEGRATED CIRCUIT, DGTL, TTL LP J-K	27014	DM74L72N
A13U3	1820-1904	1	IC;DGTL;COMPARATOR	07263	93L24DC
A13U4	1820-0569	1	IC;DGTL;GATE	27014	DM74L30N
A13U5	1820-0568	2	IC;DGTL;INVERTER	27014	DM74L04N
A13U6	1820-0537	2	IC;DGTL;SCHMITT TRIGGER	01295	SN7413N
A13U7	1820-0564		IC;DGTL;GATE	27014	DM74L02N
A13U8	1820-0621	1	IC;DGTL;BUFFER/DRIVER/LINE DRIVER	01295	SN7438N
A13U9	1820-0568		IC;DGTL;INVERTER	27014	DM74L04N
A13U10	1820-0004		IC;DGTL;GATE	01295	SN7400N
A13U11	1820-0567	2	IC;DGTL;GATE	27014	DM74L10N
A13U12	1820-1047	1	IC;DGTL;DECODER/DECODER DRVR/DATA DISTR	27014	DM74L42AN
A13U13	1820-0457	1	IC;DGTL;SHIFT REGISTER	01295	SN74L95N
A13U14	1820-0567		IC;DGTL;GATE	27014	DM74L10N
A13U15	1820-0556		INTEGRATED CIRCUIT, DGTL, TTL LP DUAL D	27014	DM74L74N
A13U16	1820-0556		INTEGRATED CIRCUIT, DGTL, TTL LP DUAL D	27014	DM74L74N
A13U17	1820-0265	1	IC;DGTL;GATE	01295	SN7403N
A13U18	1820-0537		IC;DGTL;SCHMITT TRIGGER	01295	SN7413N
FOR A13	1200-0479	14	CONNECTOR;EL-CONT SKT .016 DIA	22526	75060-005
FOR A13	1200-0519	1	SOCKET; ELEC; IC 16-CONT DIP SLDR TERM	28480	1200-0519
FOR A13	5060-9043		PINETP.C. BOARD EXTRACTOR	28480	5000-9043
FOR A13	5040-6851		EXTRACTOR	28480	5040-6851
S6	3101-1787	2	SWITCH; SLE DPDT NSE .5A 125VAC/DC	28480	3101-1787
S7	3101-1787		SWITCH; SLE DPDT NSE .5A 125VAC/DC	28480	3101-1787

See introduction to this section for ordering information

Table 6-2. Replaceable Parts, Option 011 (Con')

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
W10	8120-0633	1	CABLE ASSY, 4-CONDUCTOR	28480	8120-0633
W11	8120-0635	1	CABLE ASSY, 16-CONDUCTOR	28480	8120-0635
FOR 011	05354-00006	1	PANEL, OPTION MOUNTING	28480	05354-00006
FOR 011	05354-00005	1	PANEL, BLANK	28480	05354-00005
FOR 011	05354-60067	1	P.C. B ASSY	28480	05354-60067

See introduction to this section for ordering information

Table 6-3. Manufacturers Code List

MFR NO.	MANUFACTURER NAME	ADDRESS	ZIP CODE
00779	AMP INC	HARRISBURG PA	17105
01121	ALLEN BRADLEY CO	MILWAUKEE WI	53212
01210	CIRCUIT ASSEMBLY CORP	SANTA ANA CA	92707
01295	TEXAS INSTR INC SEMICOND CMPNT DIV	DALLAS TX	75231
02735	RCA CORP SOLID STATE DIV	SOMMERVILLE NJ	08876
04713	MOTOROLA SEMICONDUCTOR PRODUCTS	PHOENIX AZ	85008
06776	ROBINSON NUGENT INC	NEW ALBANY IN	47150
07263	FAIRCHILD SEMICONDUCTOR DIV	MOUNTAIN VIEW CA	94040
09353	C AND K COMPONENTS INC	WATERTOWN MA	02172
19701	MEPCO/ELECTRA CORP INF RESI	MINERAL WELLS TX	76067
24655	CABLEWAVE SYSTEMS INC	NORTH HAVEN CT	06473
24826	MEPG ELECTRONIC INC	CUMBERLAND PA	17070
24931	GOWANDA ELECTRONICS CORP	GOWANDA NY	14070
24546	CORNING GLASS WORKS (C STYLE RESI	BRADFORD PA	16701
26654	VARADYNE INC	SANTA MONICA CA	90403
27014	NATIONAL SEMICONDUCTOR CORP	SANTA CLARA CA	95051
28480	HEWLETT-PACKARD CO CORPORATE HQ	PALO ALTO CA	94304
34335	ADVANCED MICRO DEVICES INC	SUNNYVALE CA	94086
56289	SPRAGUE ELECTRIC CO	NORTH ADAMS MA	01247
71785	TRW ELEK COMPONENTS CINCH DIV	ELK GROVE VILLAGE IL	60007
72136	ELECTRO MOTIVE MFG CO INC	WILLIMANTIC CT	06226
72982	ERIE TECHNOLOGICAL PRODUCTS INC	ERIE PA	16512
73899	J F D ELECTRONICS CORP	BROOKLYN NY	11219
0FE84	RCA CORP ELECTRONIC COMPONENTS	HARRISON NJ	07029
91293	JOHANSON MFG CO	BOONTON NJ	07005
96791	SEALECTRO CORP	MAMARONECK NY	10544

SECTION VII

MANUAL CHANGES AND OPTIONS

7-1. INTRODUCTION

7-2. This section contains information about manual changes and options available.

7-3. OPTIONS

7-4. Option 011 is available for the 5364A converter. This option is described below.

7-5. Option 011 adds two functions to the converter:

1. HP Interface Bus (HP-IB) direct to the converter through a rear panel connector.
2. LO±IF display of local oscillator signal frequency with IF signal frequency added (+) or subtracted (-).

7-6. Option 011 Remote Programming

7-7. Remote programming of the Option 011 is described in Section II.

7-8. Option 011 Operating Instructions

7-9. Operating instructions for Option 011 are given in Section III.

7-10. Option 011 Theory of Operation

7-11. Theory of operation is given in Section IV.

7-12. Option 011 Replaceable Parts

7-13. Replaceable Parts for Option 011 are listed in Table 6-2 of Section VI.

7-14. FIELD INSTALLATION OF OPTION 011

7-15. The parts and assemblies that are included in Option 011 are listed in Section VI in Table 6-2. Refer to Section VIII for the Option 011 locations, individual photographs, schematic diagrams, and wiring diagrams.

7-16. Perform the following steps to install the Option 011 parts and assemblies in the converter.

a. Remove the four screws holding the small blank panel on the back end of the converter.

b. Using the same screws and nuts removed in step (a), install the LO±IF panel in place of the blank panel. Refer to the rear panel photograph in Section VIII for orientation of the panel.

c. Cable W10 is connected to S6 and S7 (LO±IF switches) on one end; and to a plug, P1, on the other end. Insert the W10 plug, P1, into receptacle A14J6. Observe the black wire of W10 must be near the "BLK" lettering on the board.

d. Put the A13 printed circuit board into receptacle XA13 of the converter.

e. Cable W11 is connected to the INTERFACE BUS connector J3 on one end, and to a 16-pin plug on the other end. Insert the W11 plug into A13J1. Observe the W11 blue wire must be near the side of the converter.

f. Put the A12 printed circuit board into the XA12 receptacle of the converter.

g. Check proper operation of both options.

7-17. MANUAL CHANGES

7-18. This manual applies directly to Model 5354A Automatic Frequency Converters with serial prefix 1516A. See paragraph 1-10 for serial number identification. For newer instruments, change sheets are used to update the manual.

7-19. Newer Instruments

7-20. As production changes are made, newer instruments may have serial prefixes above 1516A. The manuals for these instruments are supplied with manual change sheets which contain the required updating information. If the change sheets are missing, contact the nearest HP Sales and Service Office listed at the back of this manual.

7-21. Older Instruments

7-22. To adapt this manual to instruments with serial prefixes below 1516A, refer to Table 7-1 for backdating that applies to your instrument serial prefix.

Table 7-1. Manual Backdating

If Your Instrument Has Serial Prefix	Make the Following Changes to this Manual
1504A	1
1412A	1,2
1404A	1,2,3
1332A	1,2,3,4

CHANGE 1

NOTE

Instruments with the following serial numbers have been modified to be identical with instruments having serial prefix 1516A; 1504A00210, 233, 241, 244, 246, 247, 258, 263, 265, 266, 268, 271.

Page 1-3, Table 1-2, Specifications:
Under ACQUISITION TIME, AUTO: CONT. WAVE, Change <2 msec to 160 μsec.

Page 3-2, Paragraph 3-9:
In second line, change 125 microseconds to 10 microseconds.

Page 3-7, Figure 3-3:
In step d, fourth line; change 125 microseconds to 10 microseconds.

In table for ACQUISITION TIME, under AUTO-CONT. WAVE, Change <2 milliseconds to <160 microseconds.

Page 4-2, Paragraph 4-10:
In first line, change 7.5 kHz to 85 kHz.

Page 4-7, Paragraph 4-64:
In second line, change 7.5 kHz to 85 kHz in two places.

Page 4-8, Paragraph 4-75:
In fifth line, change 7.5 kHz to 85 kHz.

Table 6-1:
Change A10C5 to 0160-0155, Capacitor-Fxd, .0033 UF +-20% 200WVDC Mfr Code 56289, Mfr Part No. 292P33252.

A10 Schematic Diagram:
Change A10C5 to .022 UF. Change stage description from 7.5 kHz to 100 kHz, period from 133 μs to 100 ns. Change board series no. to 1332A.

CHANGE 2

Table 6-1:
Change A9U2, U3, U10 to 1820-0588, Mfr Code 27014, Mfr Part No. DM74L20N.

Change A9U6 to 1820-0583, Mfr Code 27014, Mfr Part No. DM74L00N.

Change A9U7 to 1820-0310, Mfr Code 01295, Mfr Part No. SN15862N.

Change A9U11 to 1820-0586, Mfr Code 27014, Mfr Part No. DM74L04N.

Change A9R2 to 0683-1035 R:FXD 10K, 5%, .25W CC TUBULAR, Mfr Code 01121, Mfr Part No. CB1035.

Change A11U2 to 1820-0583, Mfr Code 27014, Mfr Part No. DM74L00N.

A9 Schematic Diagram:
Change A9R2 to 10K.

CHANGE 3

Table 6-1 and A7 Schematic Diagram:
Delete A7C19 10 PF.

Teble 6-1 and A5 Schematic Diagram:
Change A5R7 to 2100-2633 R:Variable, Trimmer, 1K, Mfr Code No. 19701, Mfr Part No. ET50X102.

Change A5C5 to 0180-0210 C:FXD 3.3 UF ±20% 15VDC TA, Mfr Code 56289, Mfr Part No. 150D335X0015A2.

Table 6-1 and A3 Schematic Diagram:
Delete A3R7 750Ω.
Change A3R5 to R:FXD 1100 OHMS HP Part No. 0683-1125.

CHANGE 4

Table 6-1 and A3 Schematic Diagram:
Change A3R5 to 0757-0917 R:FXD 510 OHMS, 2% .125W F Tubular, Mfr Code 24546, Mfr Part No. C4-1/8-TO-511-G.

Table 6-1 and A15 Schematic Diagram:
Change A15R20 to 0698-7101 R:FXD 3000 OHMS, 5%, .125W CC Tubular, Mfr Code 01121, Mfr Part No. BB3025.

SECTION VIII

SCHEMATIC DIAGRAMS

8-1. SCHEMATIC DIAGRAMS

8-2. This section contains schematic diagrams, assembly and chassis part locators, component locators, block diagrams, waveforms, test points, and troubleshooting information. The schematics are presented in assembly number order A1 through A15. The component, chassis, and assembly locators show the location by reference designator. The block diagrams give a simplified block of the corresponding schematic diagram.

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

8-4. Figure 8-1 shows the symbols used on the schematic diagrams. The bottom of Figure 8-1 shows the method for assigning reference designators, assembly numbers, and subassembly numbers.

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 identification 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 05354-60009) 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 1340A) 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.

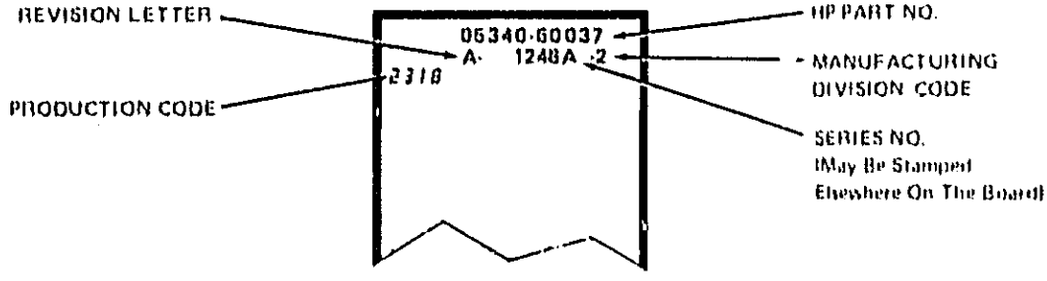
8-10. Revision letters (A, B, etc.) denote changes in printed-circuit layout. For example, if a capacitor type is changed (electrical value may remain the same) and requires different spacing for its leads, the printed-circuit board layout is changed and the revision letter is incremented to the next 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.

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

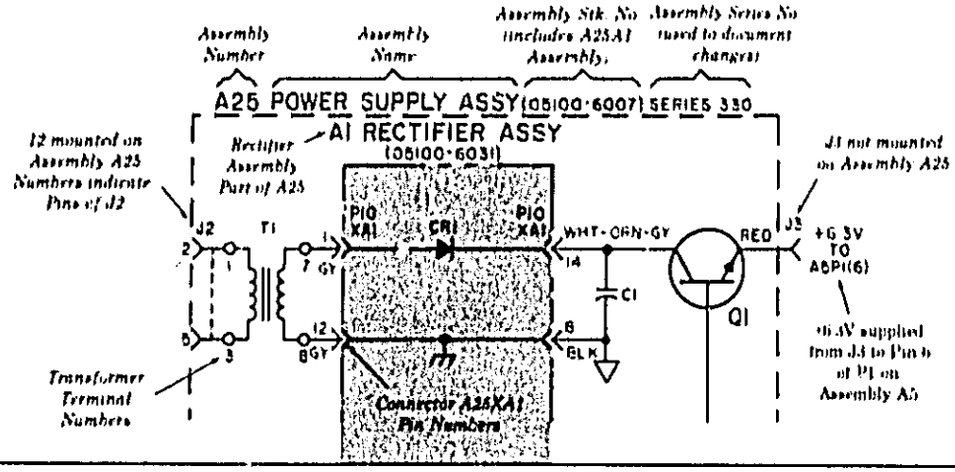


Figure 8-1. Schematic Diagram Notes

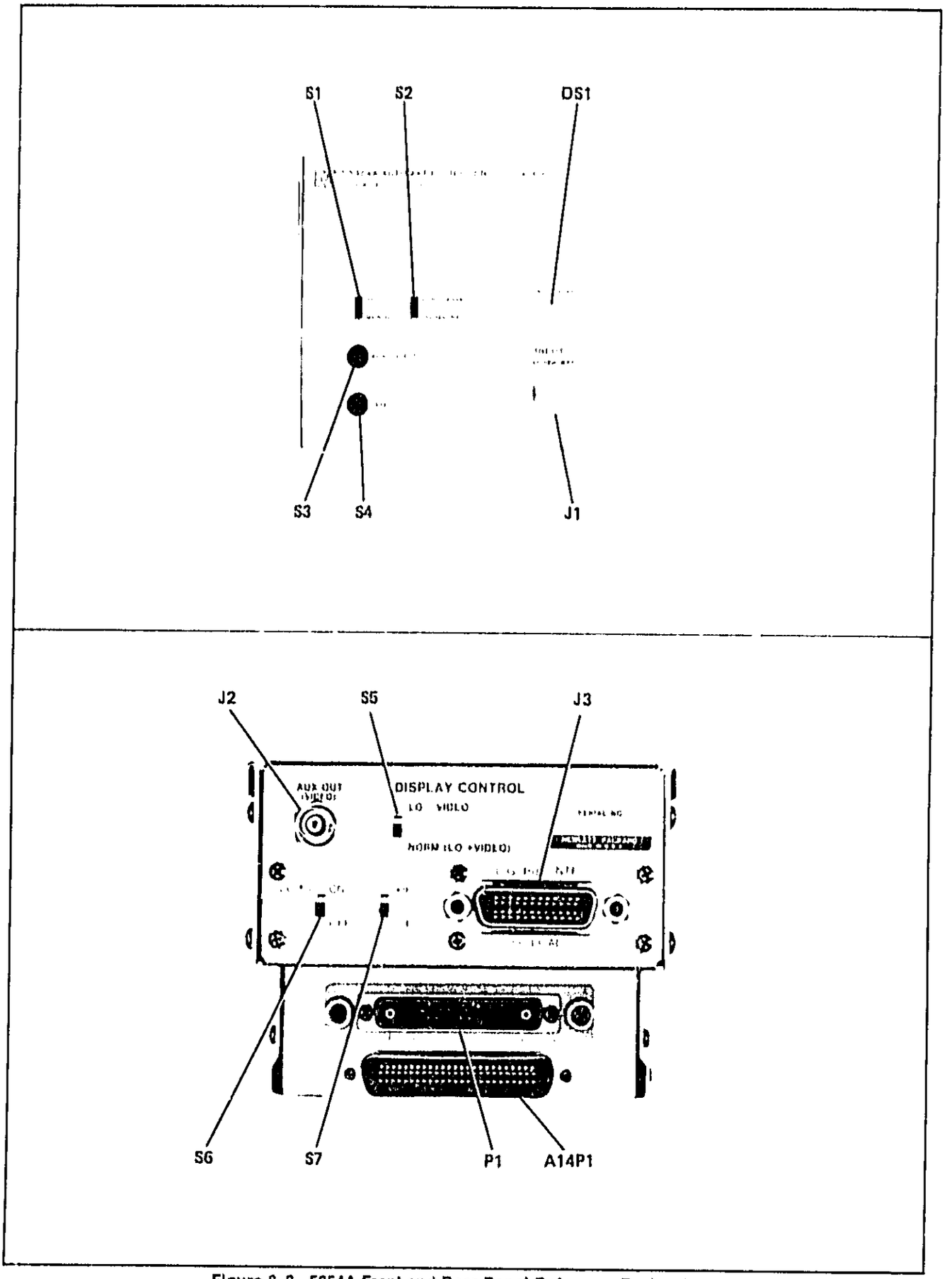


Figure 8-2. 5354A Front and Rear Panel Reference Designators

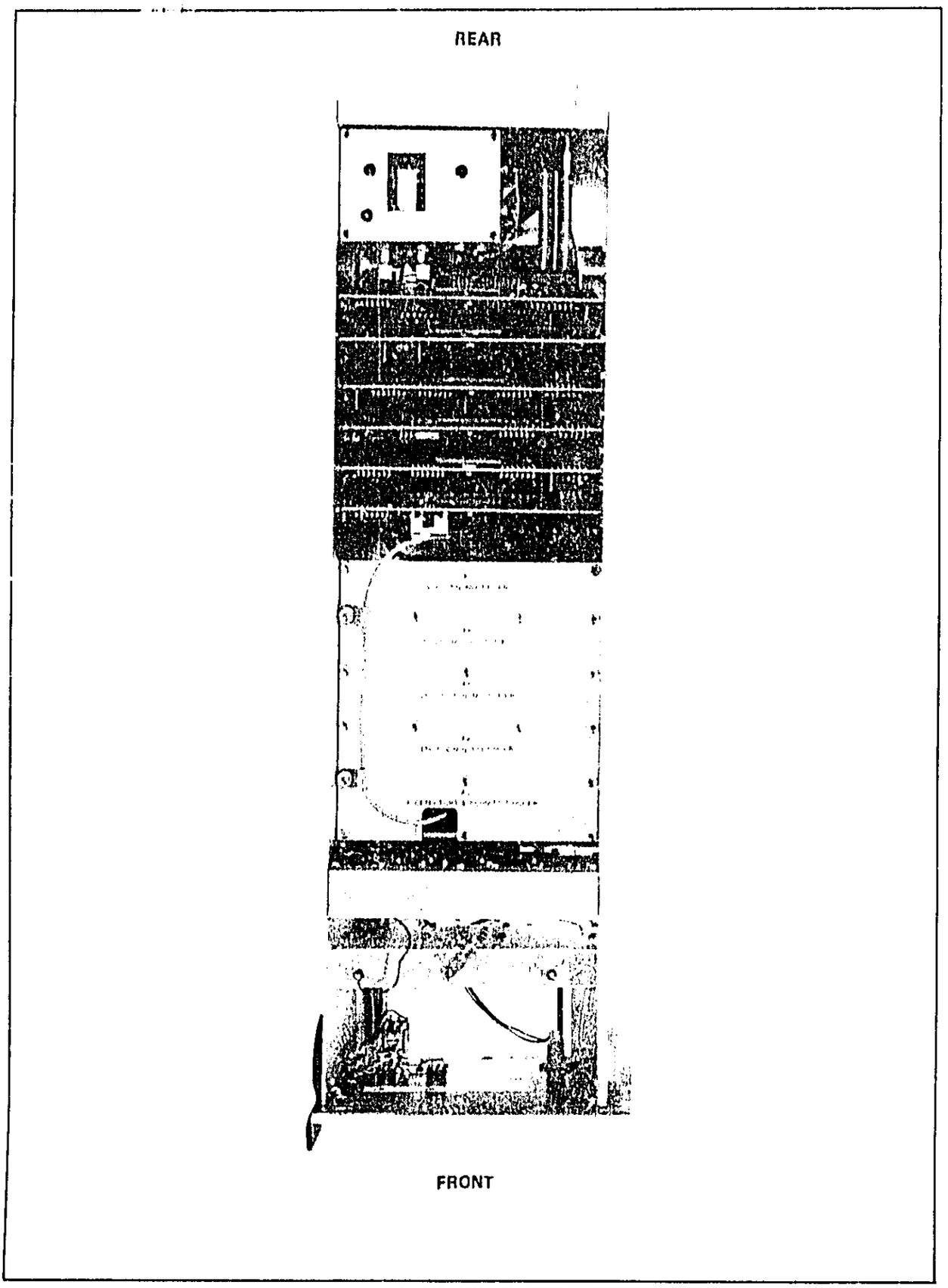


Figure 8-3. 5354A Top Internal View

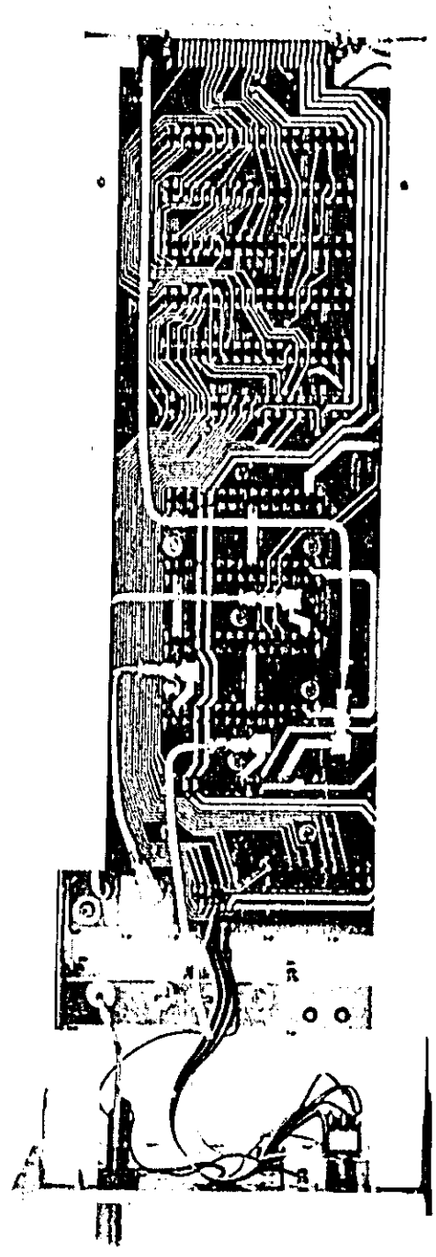


Figure 8-4. 5354A Bottom Internal View

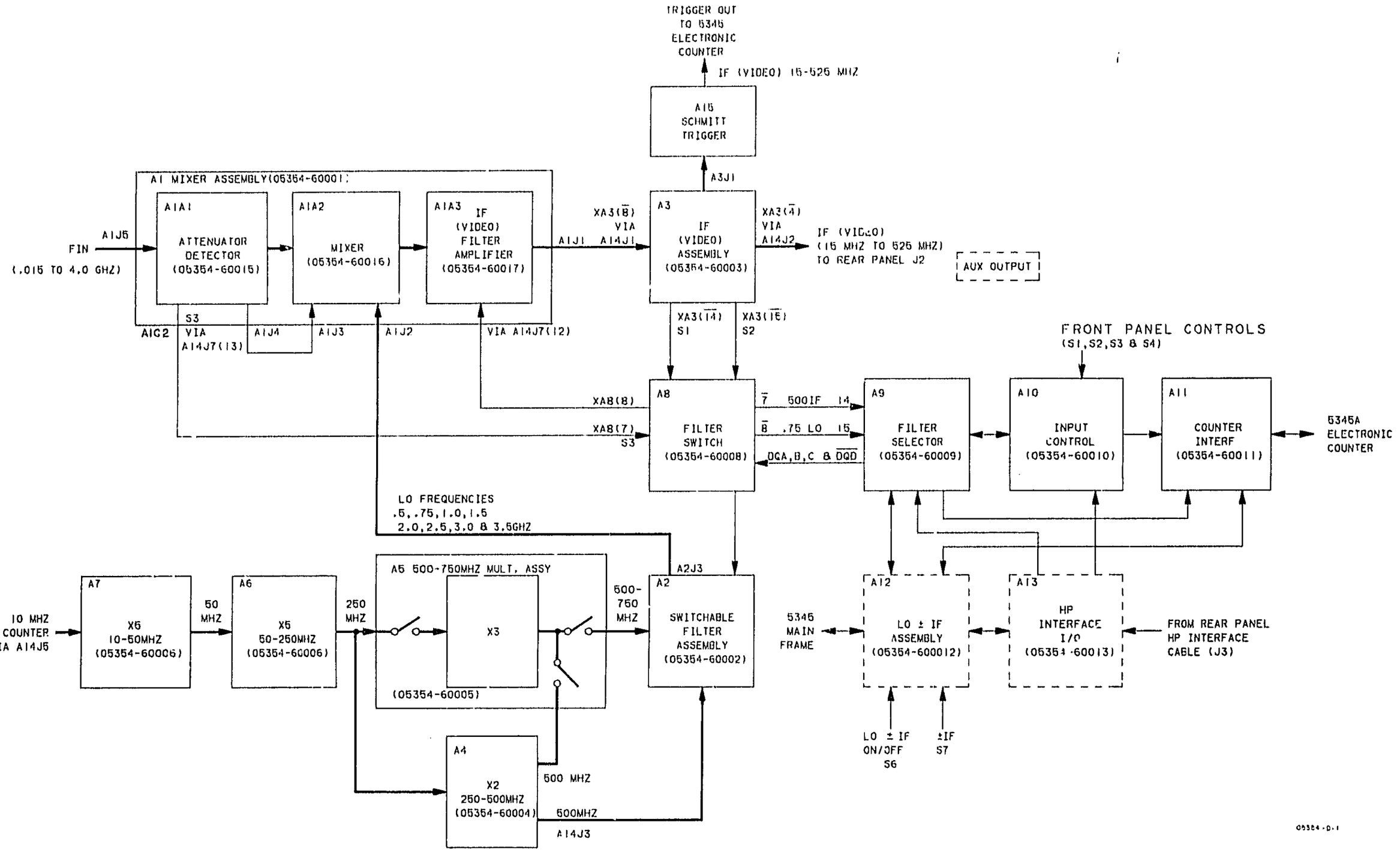
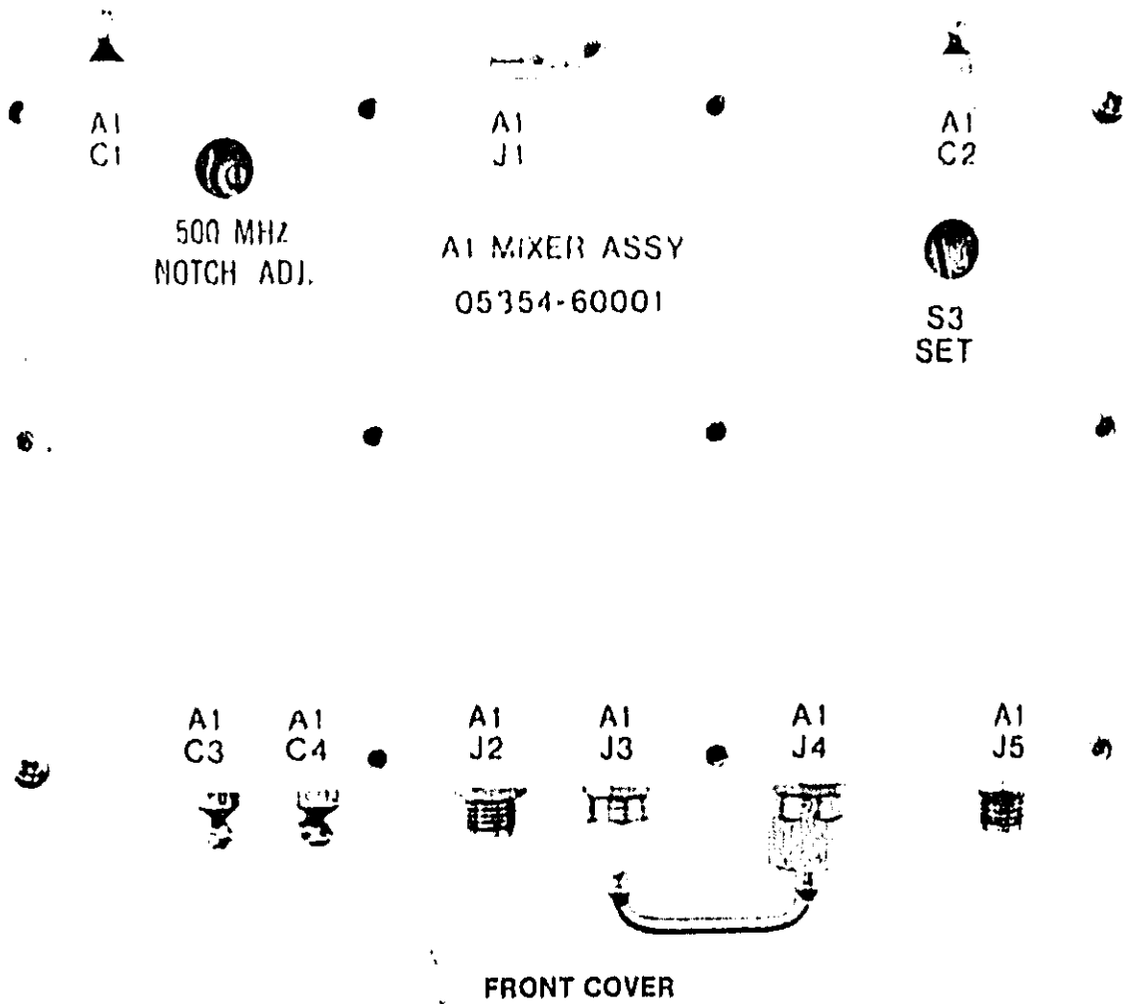
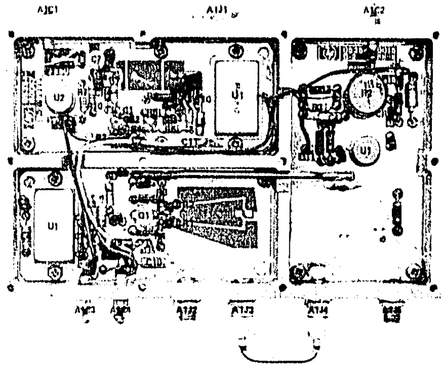


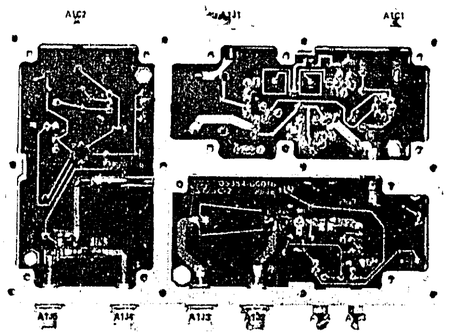
Figure 8-5. 5354A Block Diagram



Part of Figure 8-6. A1 Mixer Assembly



FRONT COMPONENT LOCATOR



REAR COMPONENT LOCATOR

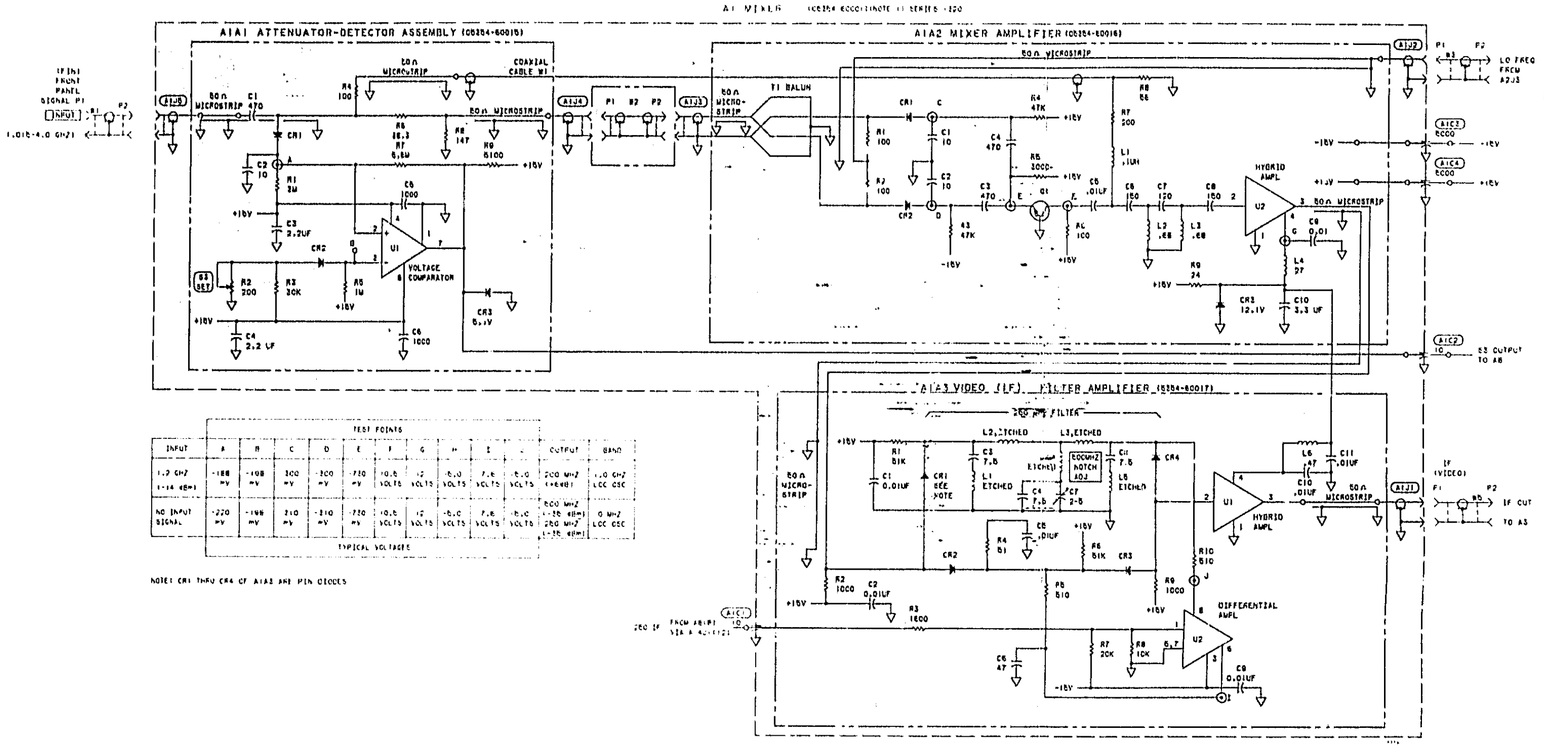
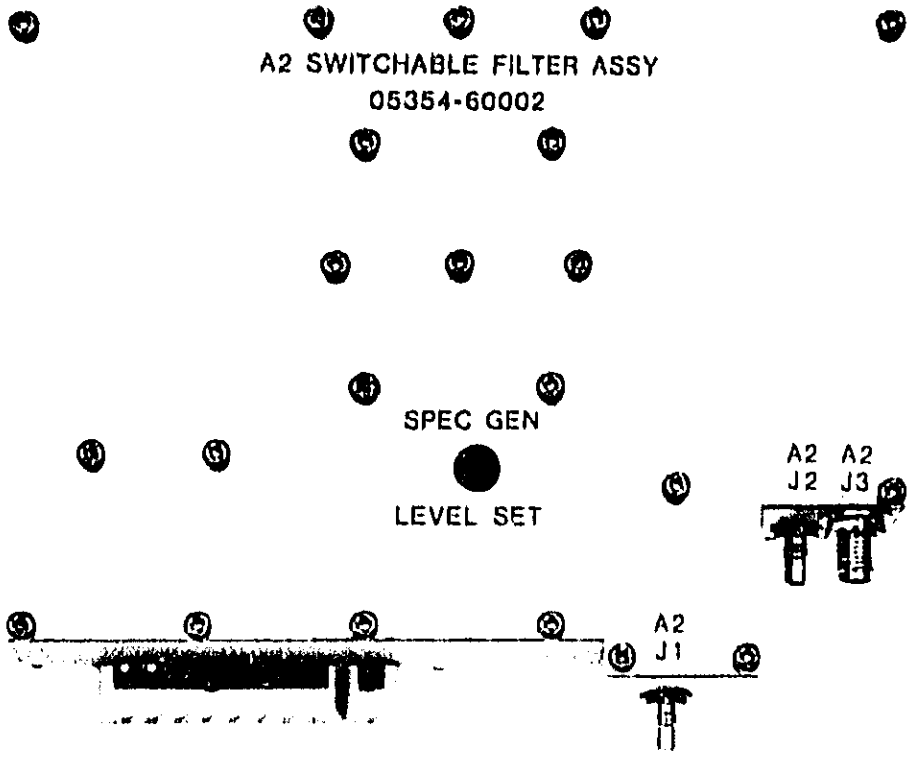
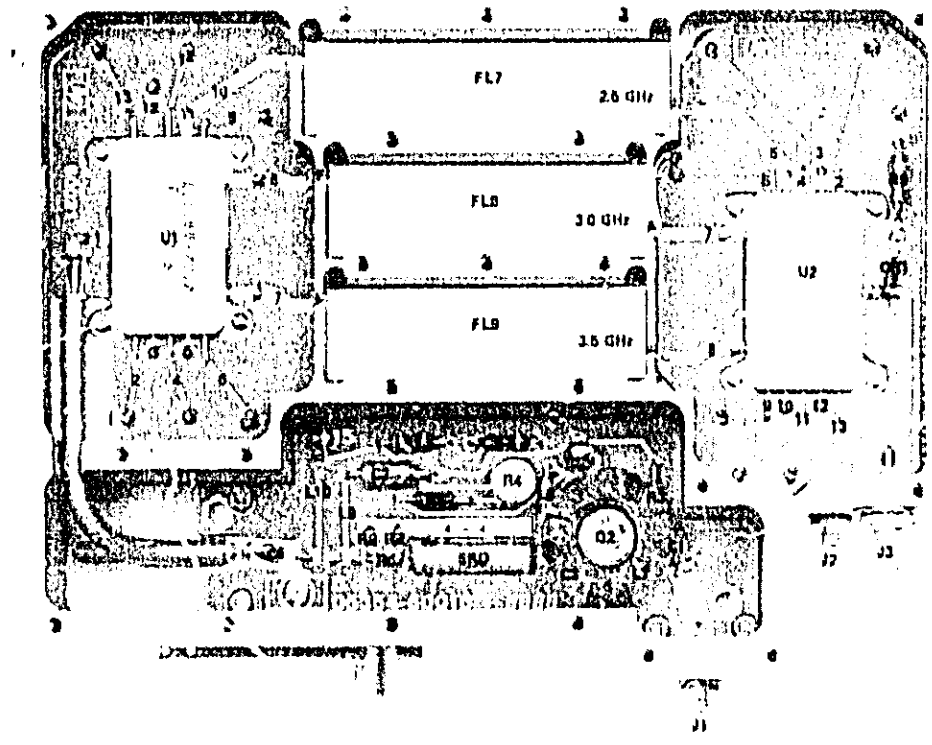


Figure 8-6. A1 Mixer Assembly

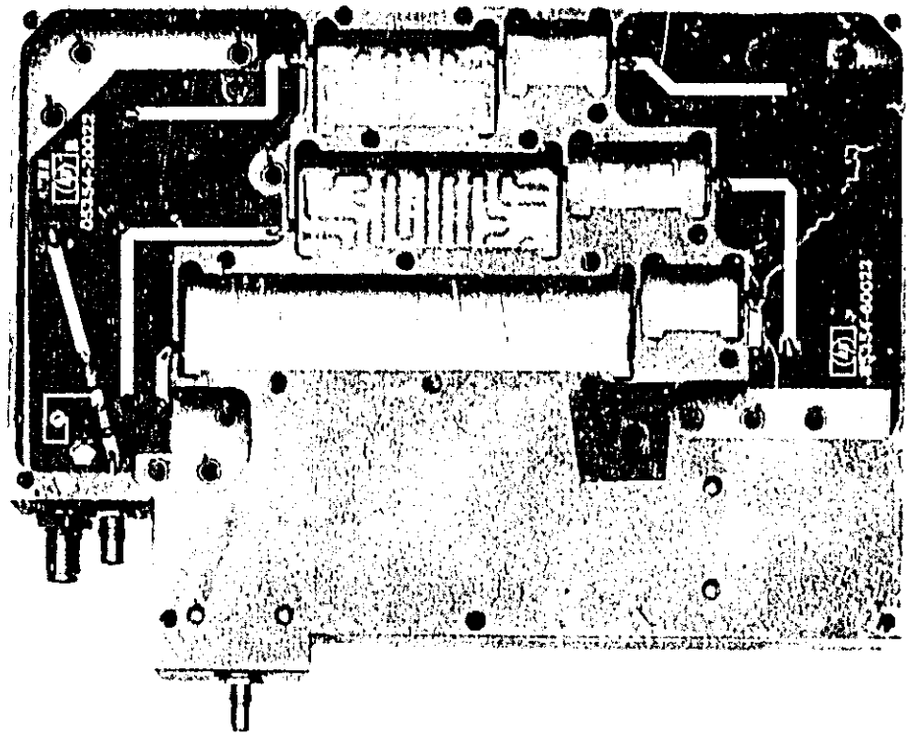


FRONT COVER

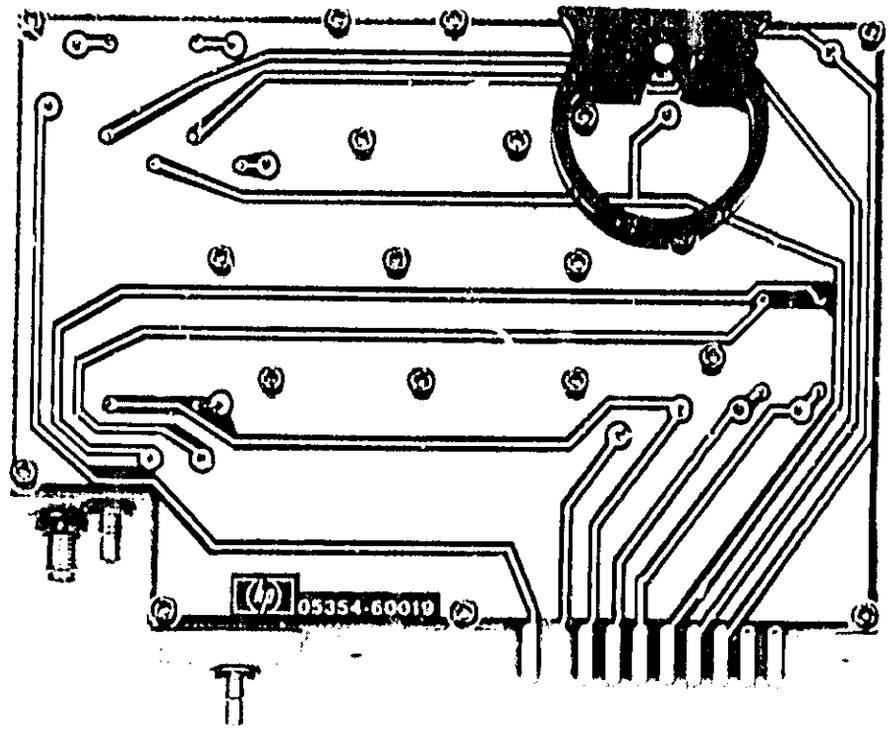


FRONT COMPONENT LOCATOR

Part of Figure 8-7. A2 Switchable Filter Assembly



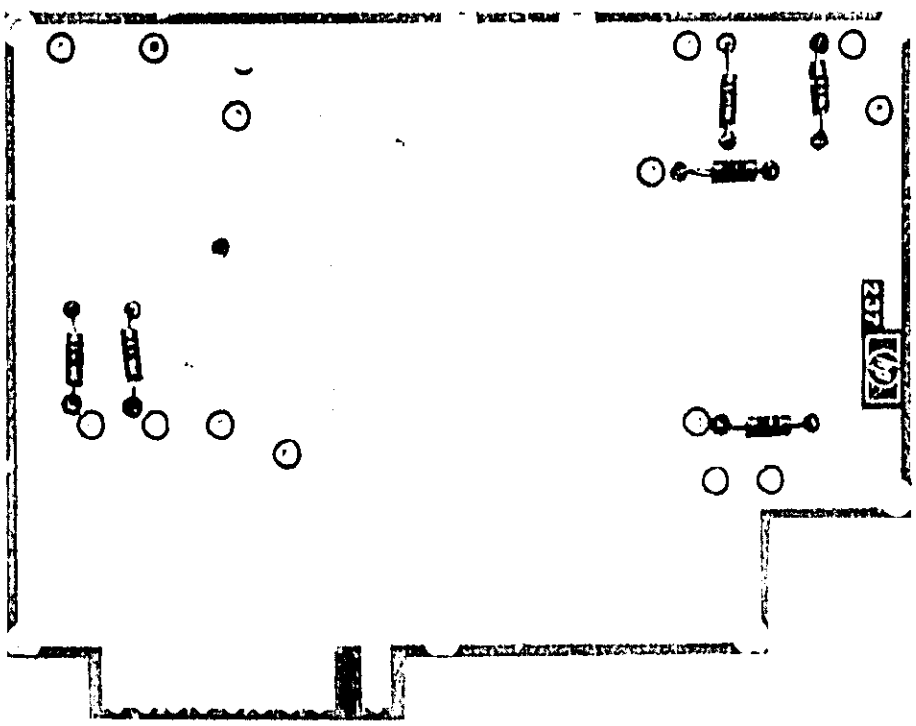
INTERNAL



REAR EXTERNAL

(NOTE: This board removable only by removing solder and screws.)

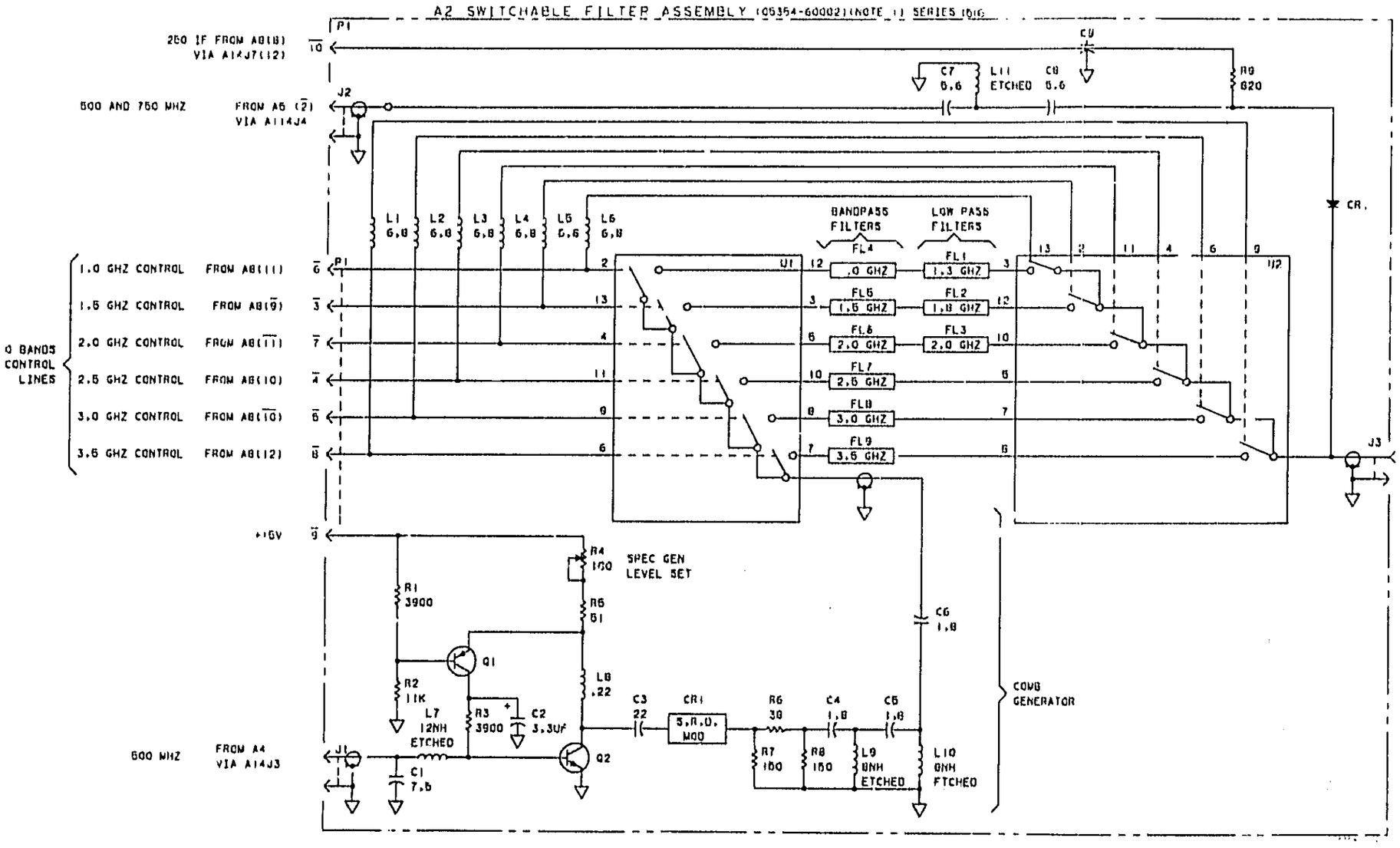
Part of Figure 8-7. A2 Switchable Filter Assembly



REAR INTERNAL

(NOTE: See rear external view.)

Part of Figure 8-7. A2 Switchable Filter Assembly



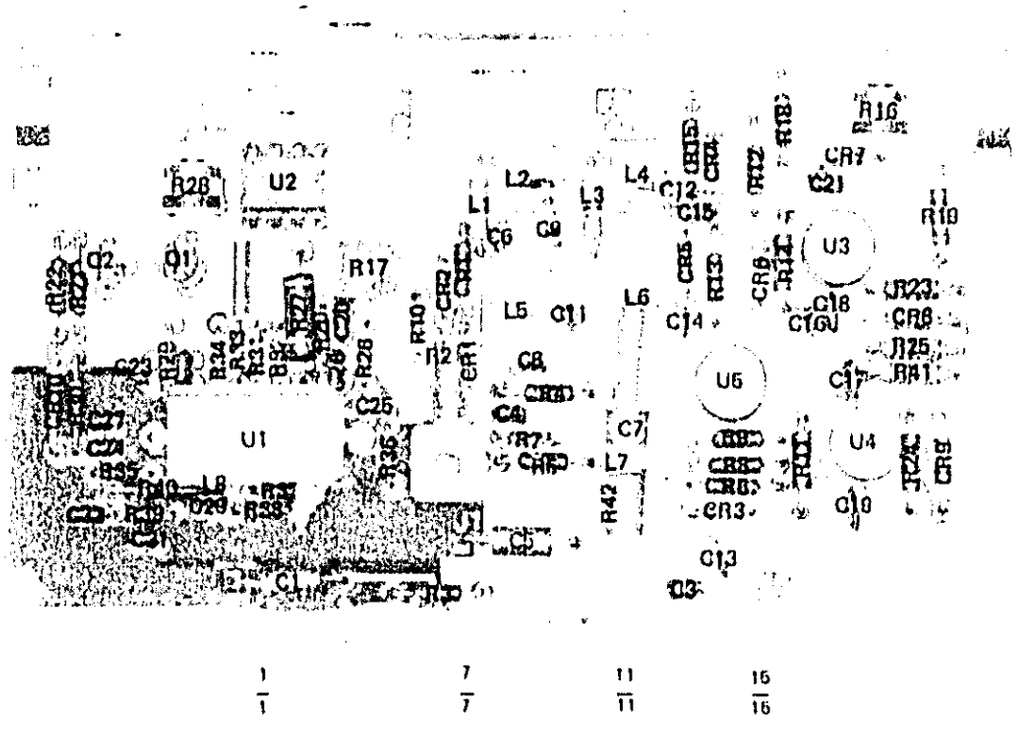
NOTES

1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.

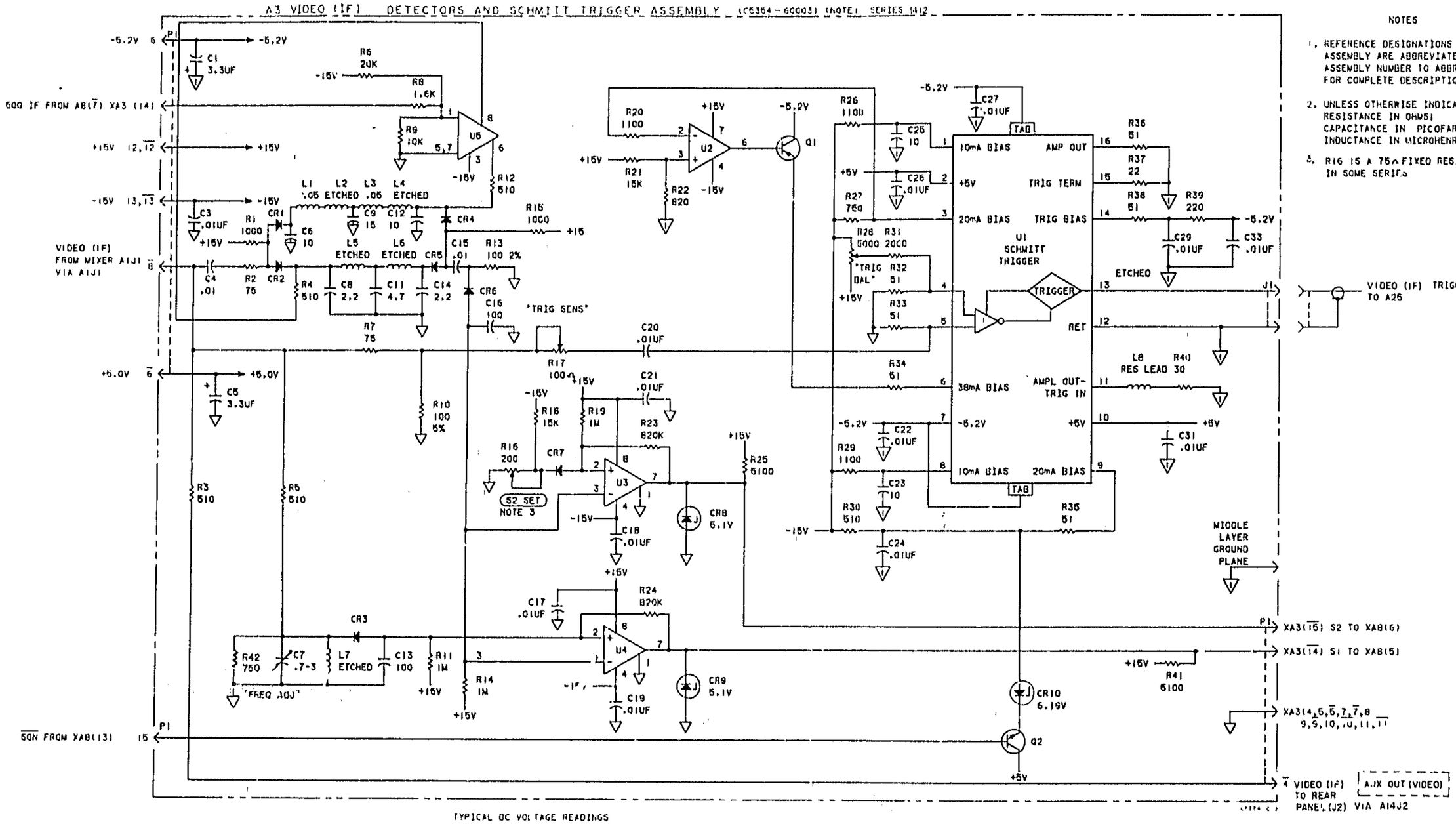
2. UNLESS OTHERWISE INDICATED:
   RESISTANCE IN OHMS;
   CAPACITANCE IN PICOFARADS;

3. CAUTION:
   THE A2 ASSEMBLY IS NOT FIELD REPAIRABLE. FOR REPLACEMENT, ORDER REBUILT ASSEMBLY 05354-60502. 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.

Figure 8-7. A2 Switchable Filter Assembly



Part of Figure 8-8. A3 Video (IF) Detectors and Schmitt Trigger Assembly

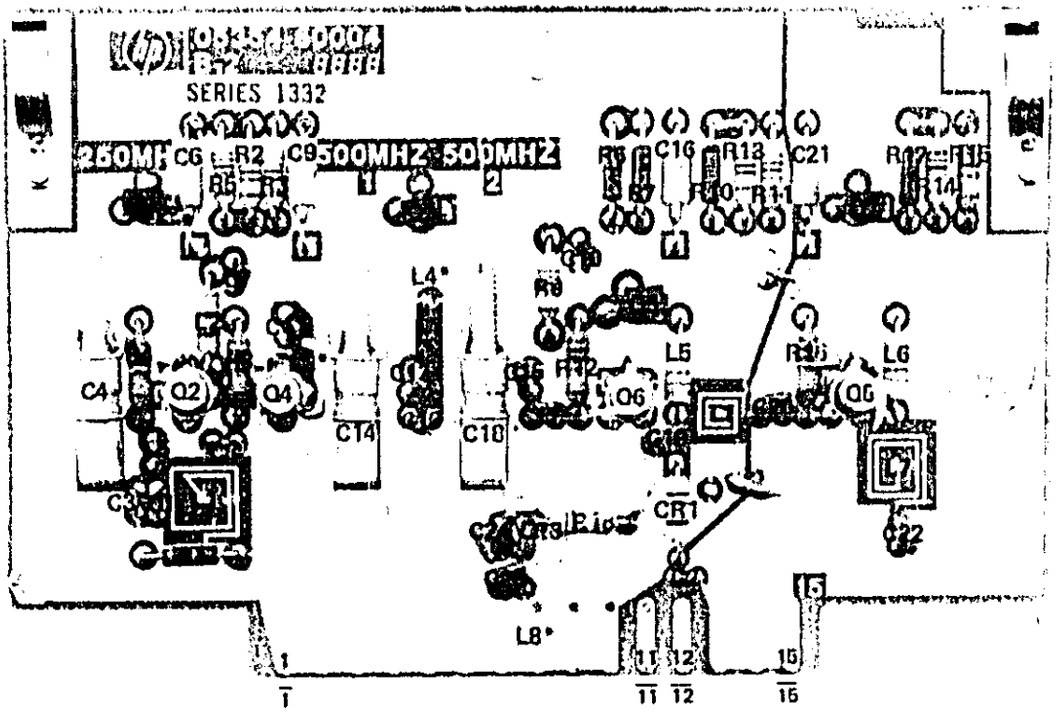


TYPICAL DC VOLTAGE READINGS

	U5(1)	U5(6)	U5(8)		U3(3)	U3(2)	U3(7)	U4(2)	U4(7)	U1(9)	U1(5)	Q2 EMITTER
500 & 750 MHZ LO BANDS	-0.9	+6.6	+10.8	NO INPUT SIGNAL 750 MHZ LO BAND)	+0.25	+0.169	+0.123	+0.25	+5	-3.0	-0.004	+3.0
ALL OTHER BANDS	+1.7	+10.6	+6.5		-0.4	+0.173	+3.87	+0.244	+5	-3.8	+0.004	+2.3

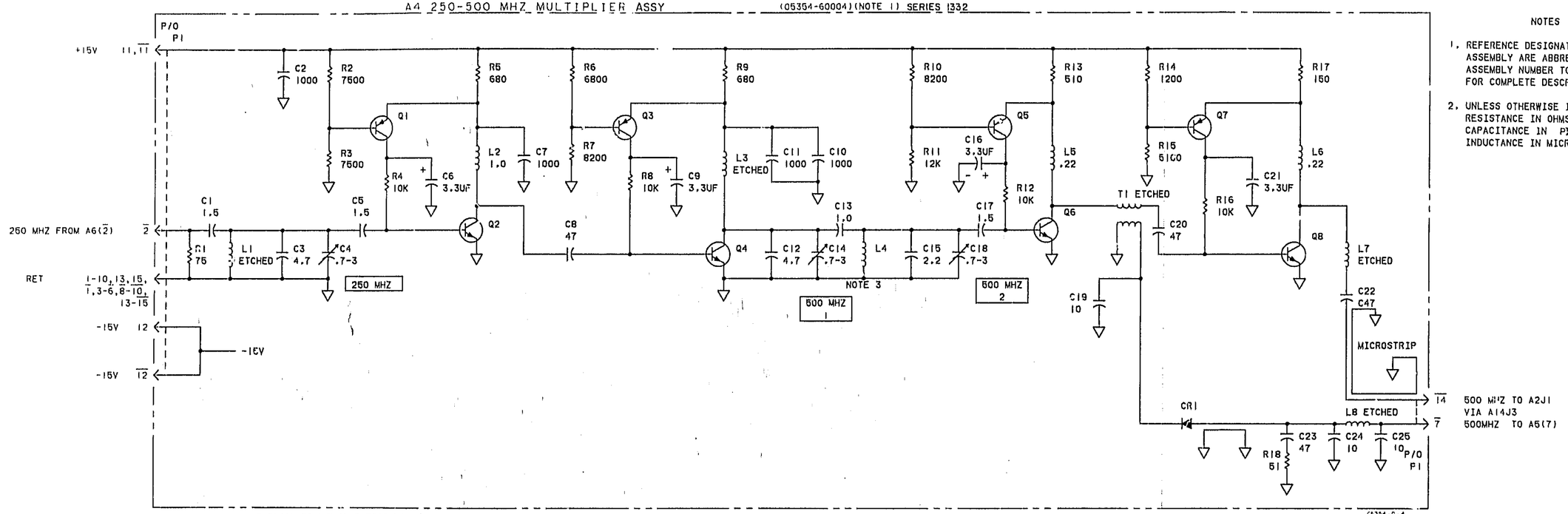
CR3,CR6 AND CR7 ARE A MATCHED SET OF PEAK DETECTOR DIODES. FAILURE OF ANY ONE DIODE CALLS FOR REPLACEMENT OF ALL THREE (HP 05354-80005).

Figure 8-8. A3 Video (IF) Detectors and Schmitt Trigger Assembly



*INDUCTORS ON OPPOSITE SIDE

Part of Figure 8-9. A4 250-500 MHz Multiplier Assembly



NOTES

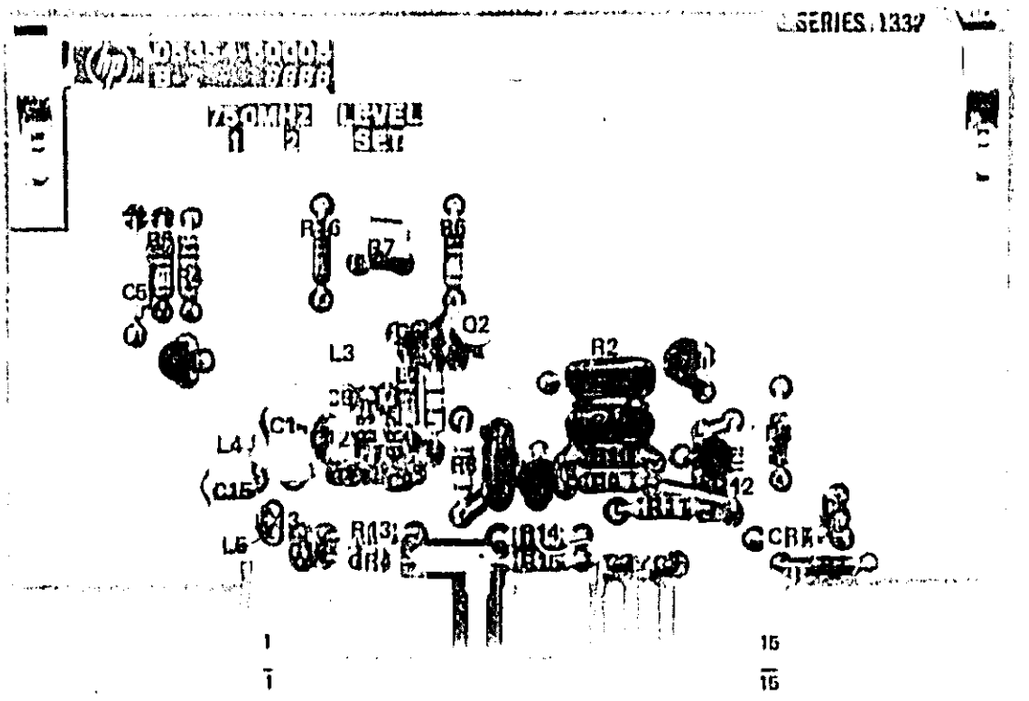
1. REFERENCE DESIGNATIONS WITHIN THIS ASSEMBLY ARE ABBREVIATED. ADD ASSEMBLY NUMBER TO ABBREVIATION FOR COMPLETE DESCRIPTION.
2. UNLESS OTHERWISE INDICATED: RESISTANCE IN OHMS; CAPACITANCE IN PICOFARADS; INDUCTANCE IN MICROHENRIES

TYPICAL DC VOLTAGE READINGS

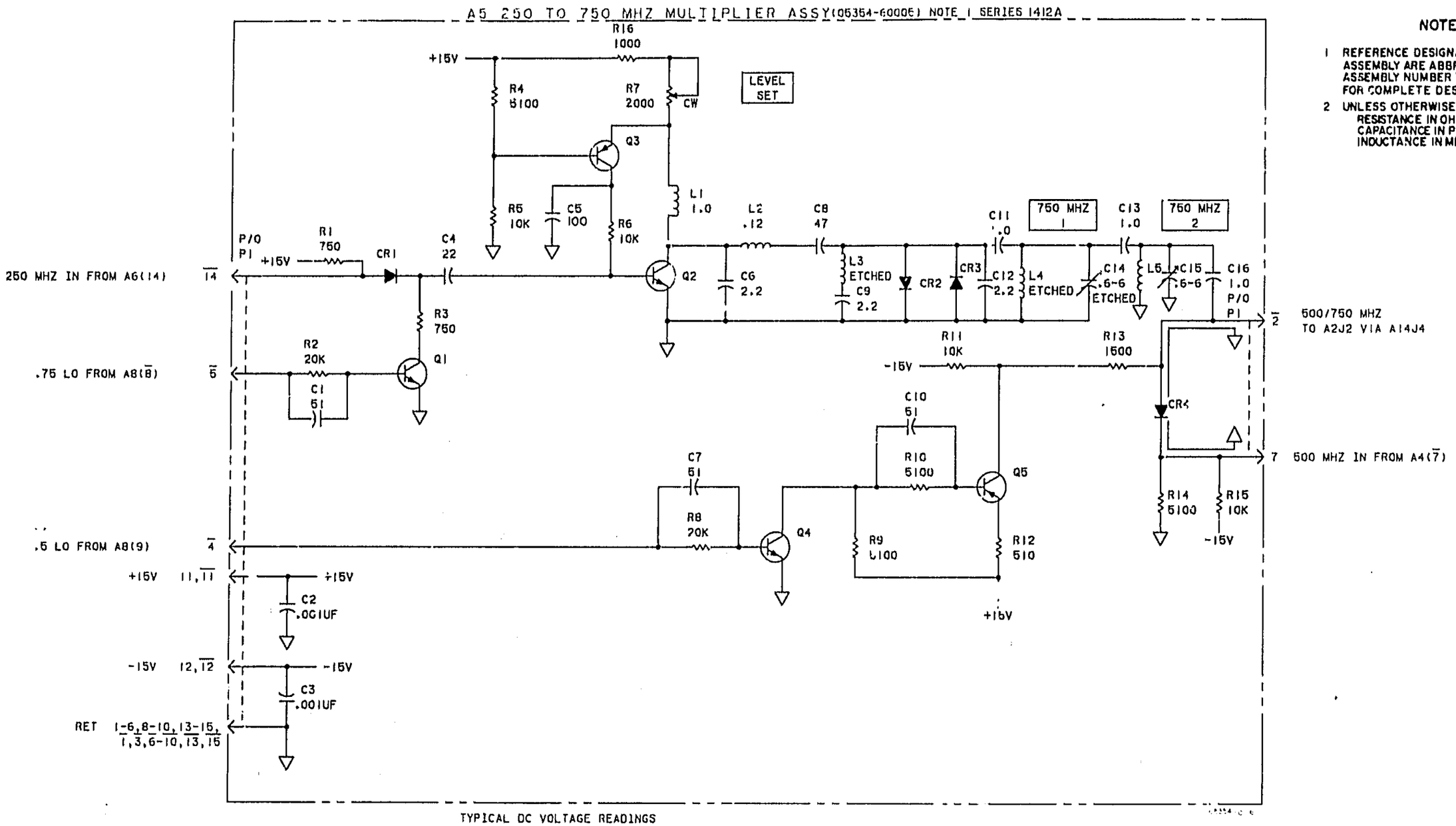
Q2		Q4		Q6		Q8	
B	C	B	C	B	C	B	C
+0.67	+8.1	+0.2	+8.7	+0.37	+9.5	+3.098	+12.6

Q1			Q3			Q5			Q7		
E	B	C	E	B	C	E	B	C	E	B	C
+8.1	+7.5	+2.1	+8.6	+8.[illegible]	+1.6	+9.5	+9	+2.3	+12.7	+12.2	+4.3

Figure 8-9. A4 250-500 MHz Multiplier Assembly



Part of Figure 8-10. A5 250-750 MHz Mutliplier Assembly



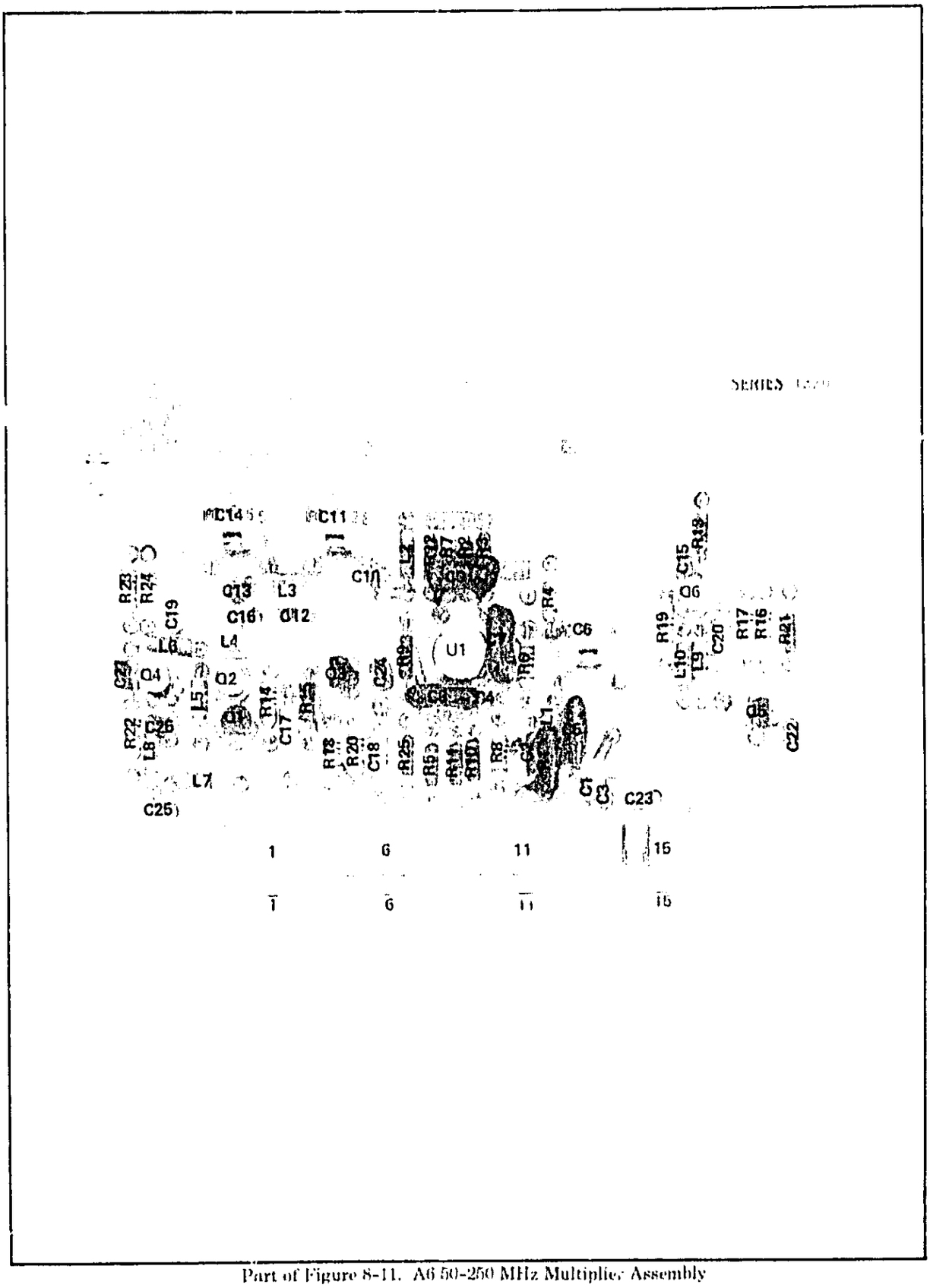
NOTES

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

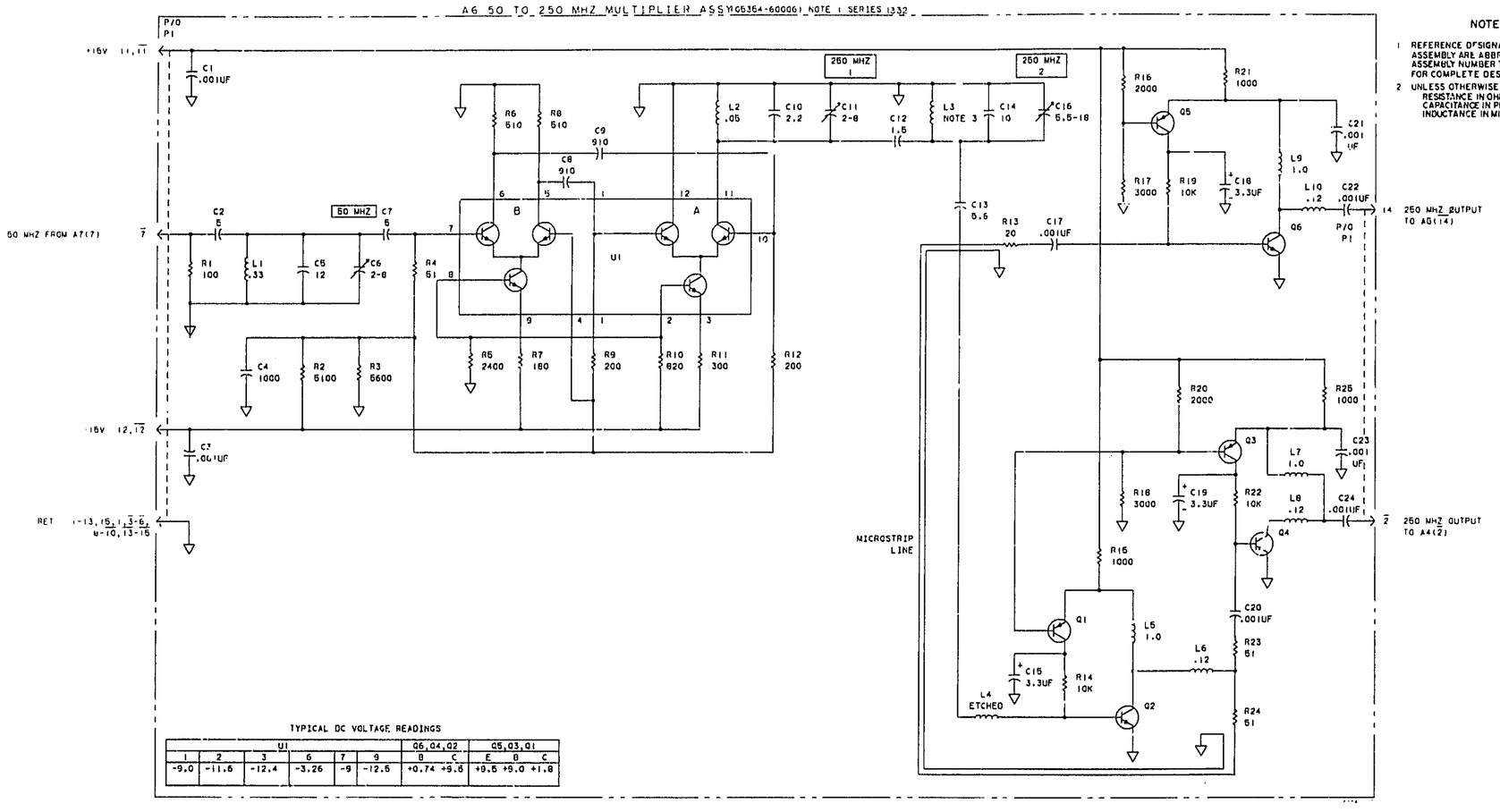
TYPICAL DC VOLTAGE READINGS

	Q2		Q3			Q5		
TPA	B	C	E	B	C	E	B	C
750 MHZ BAND = +7.39	+0.72	+10.5	+10.5	+10.0	+1.1	+9.7	+9.0	+9.8
ALL OTHER BANDS = +15.4						+15	+15	-15
500 MHZ BAND								
ALL OTHER BANDS								

Figure 8-10. A5 250-750 MHz Multiplier Assembly



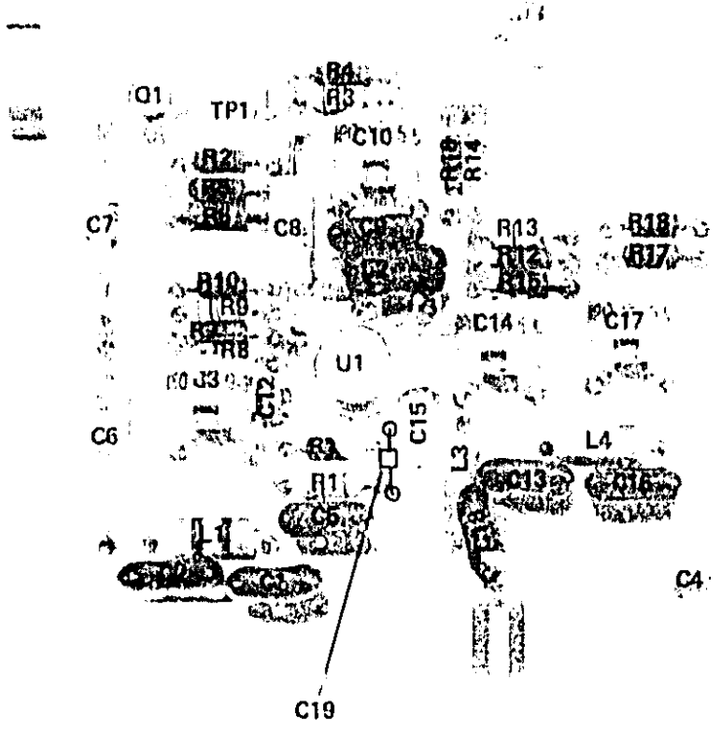
Part of Figure 8-11. A6 50-250 MHz Multiplier Assembly



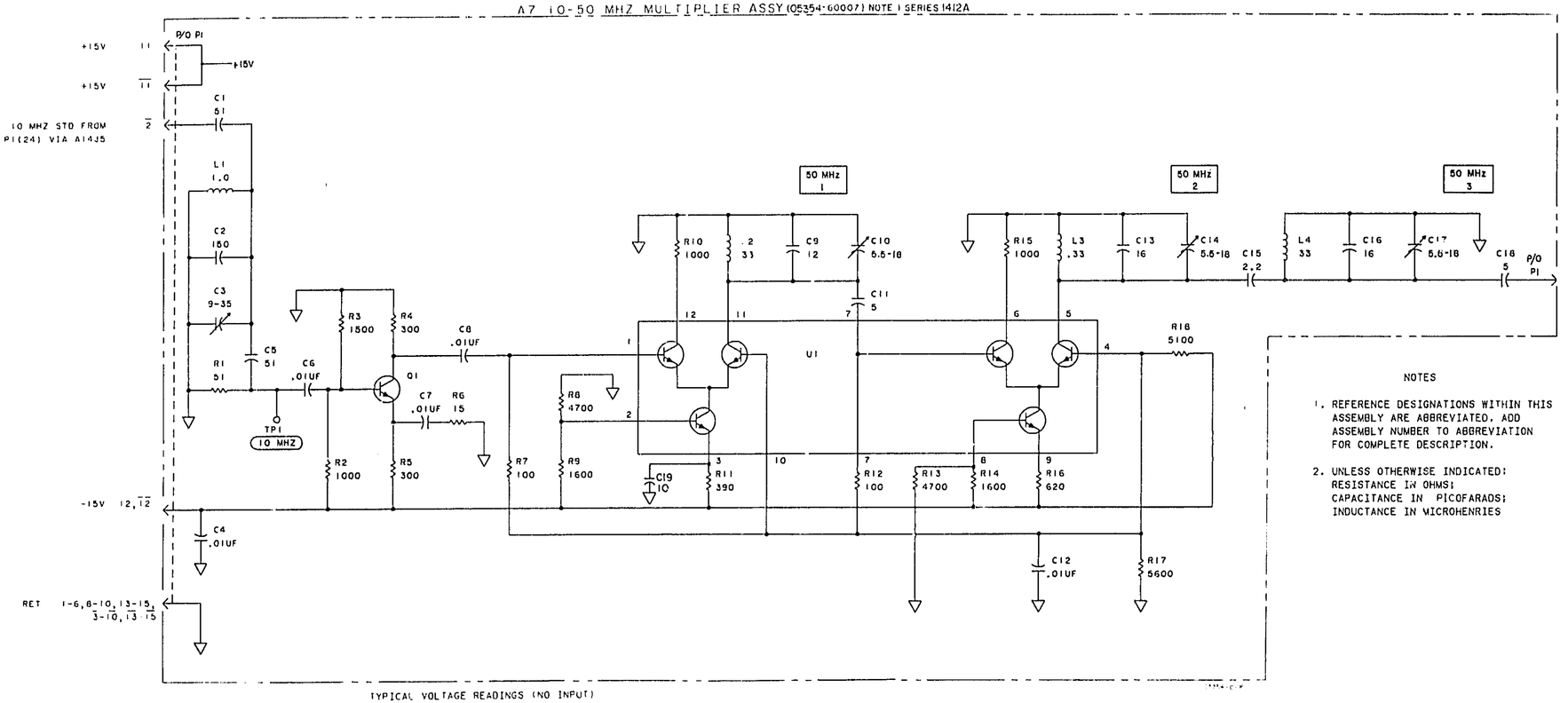
TYPICAL DC VOLTAGE READINGS

U1						Q6,Q4,Q2		Q5,Q3,Q1		
1	2	3	6	7	9	B	C	E	B	C
-9.0	-11.6	-12.4	-3.26	-9	-12.6	+0.74	+9.6	+9.6	+9.0	+1.8

Figure 8-11. A6 50-250 MHz Multiplier Assembly



Part of Figure 8-12. A7 10-50 MHz Multiplier Assembly



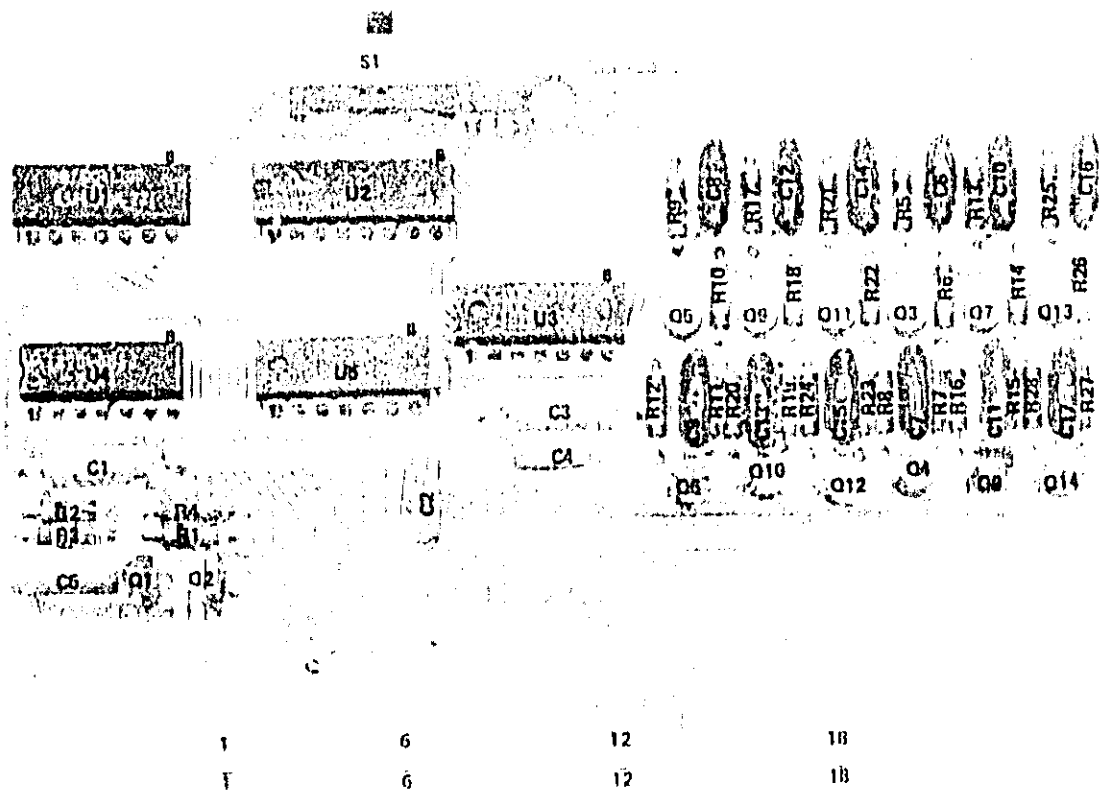
NOTES

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 PICOFARADS; INDUCTANCE IN MICROHENRIES

TYPICAL VOLTAGE READINGS (NO INPUT)

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	0	-1.8	-8.4	-11.3	-12.1	-8.4	0	-3.5

Figure 8-12. A7 10-50 MHz Multiplier Assembly



Part of Figure 8-13. A8 Filter-Switch Assembly

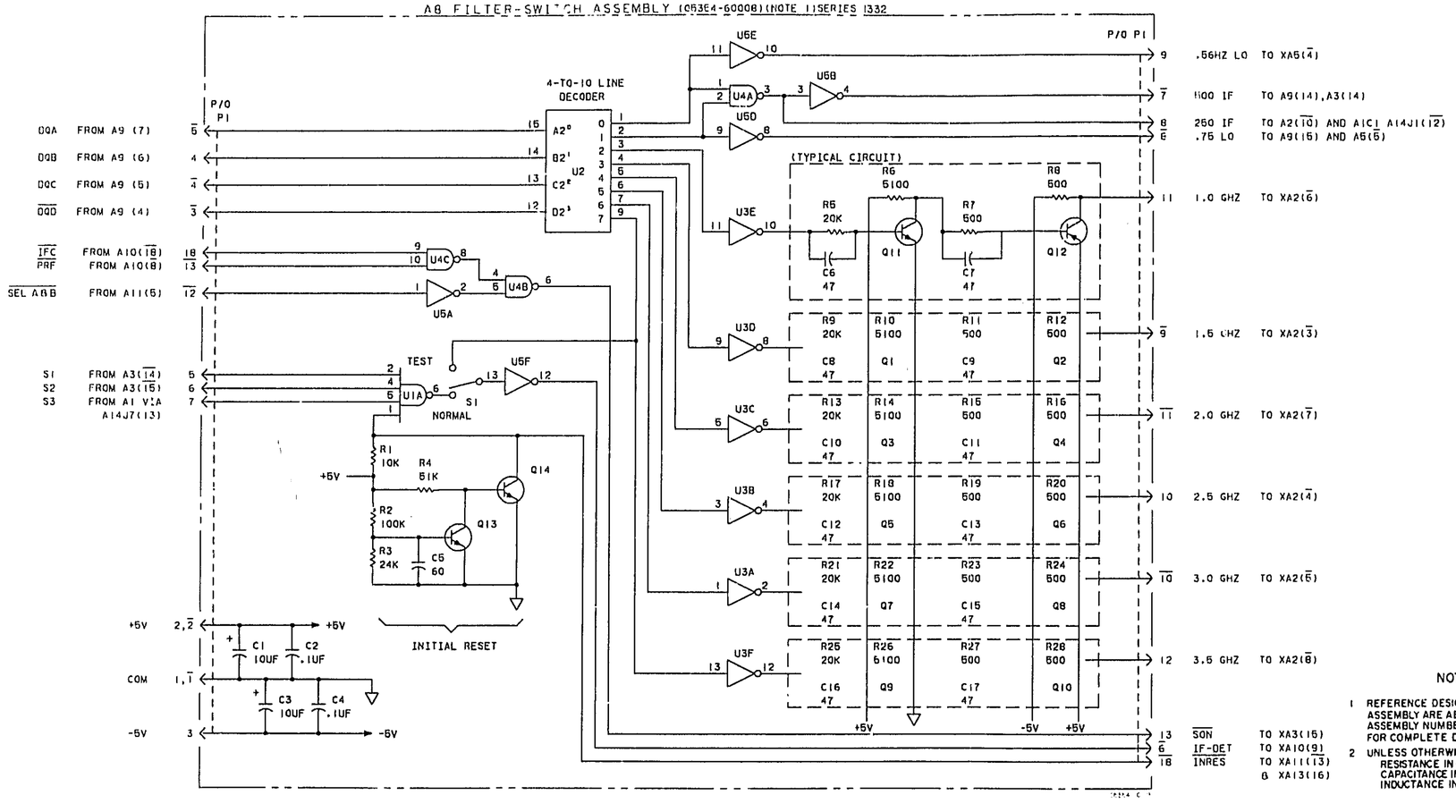
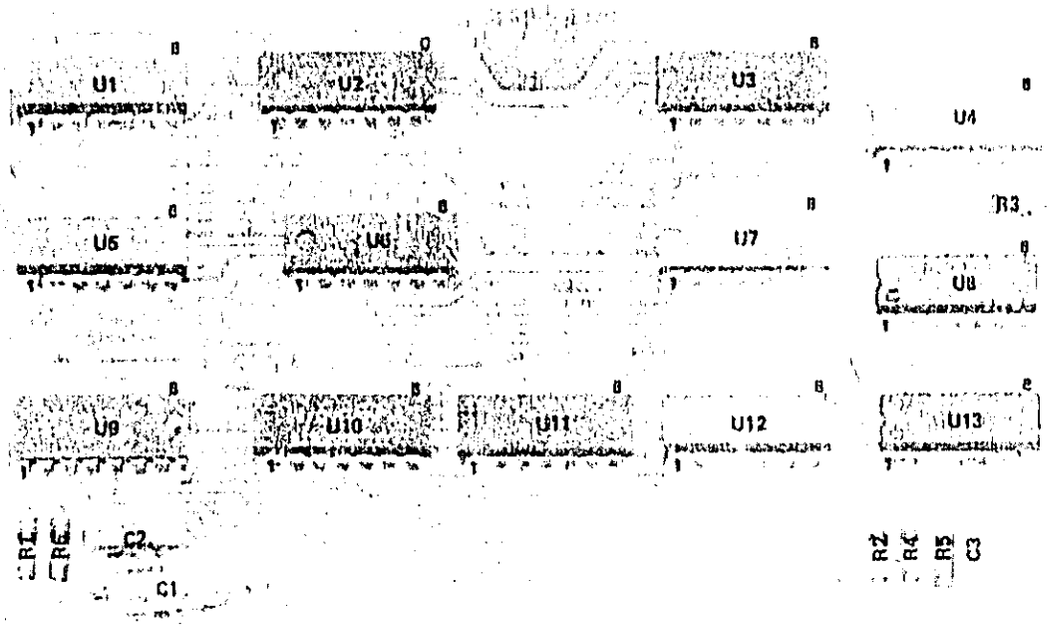


Figure 8-13. A8 Filter-Switch Assembly



Part of Figure 8-14. A9 Filter Selector Assembly

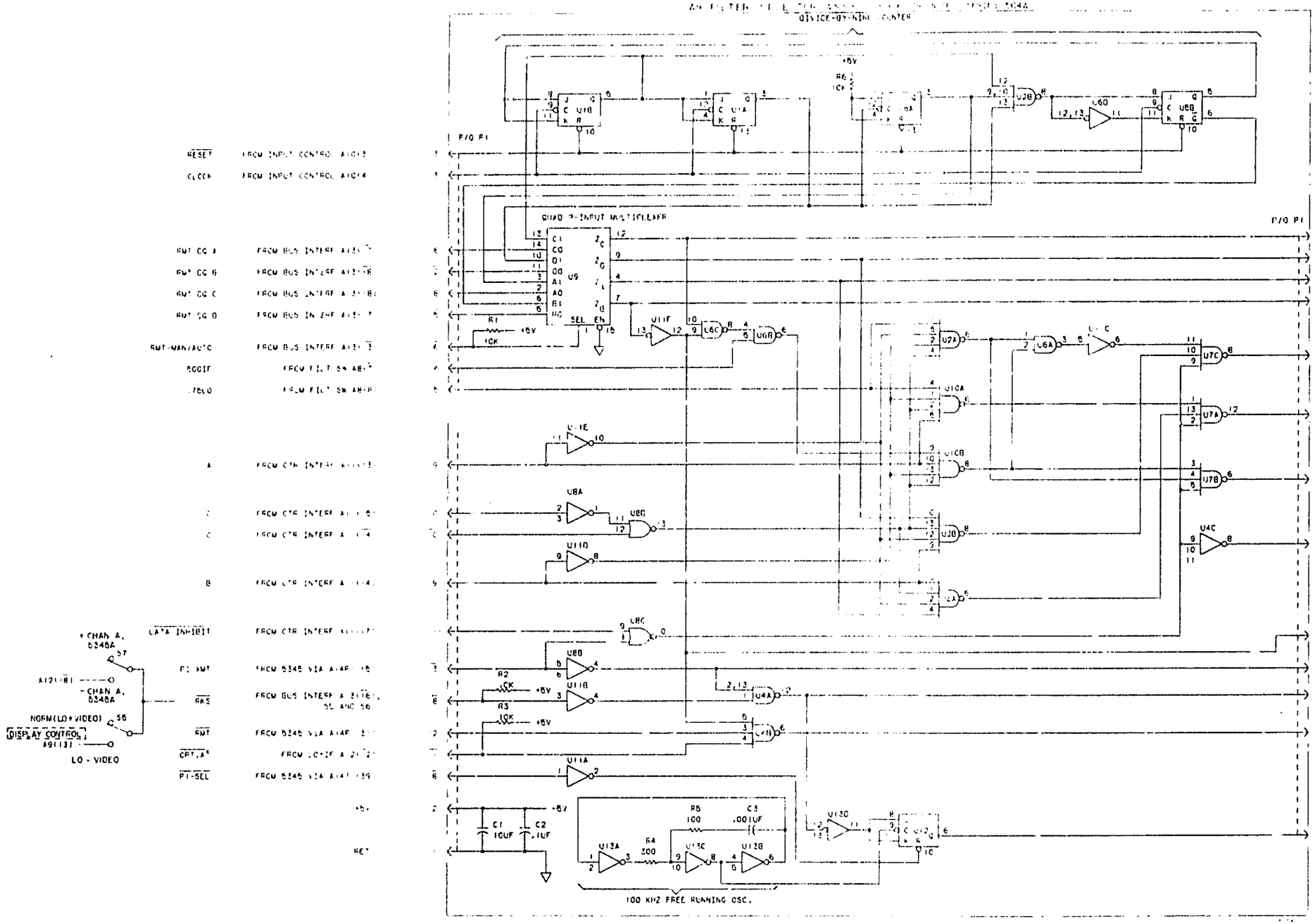
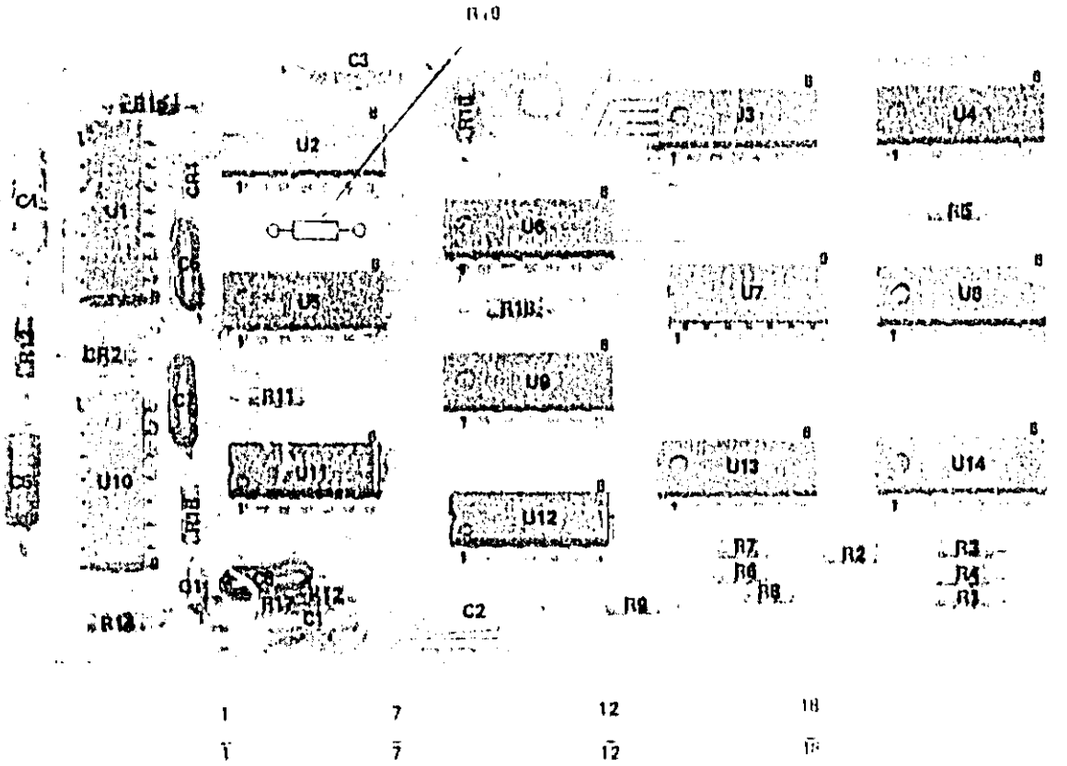


Figure 8-14. A9 Filter Selector Assembly



Part of Figure 8-15. A10 Input-Control Assembly

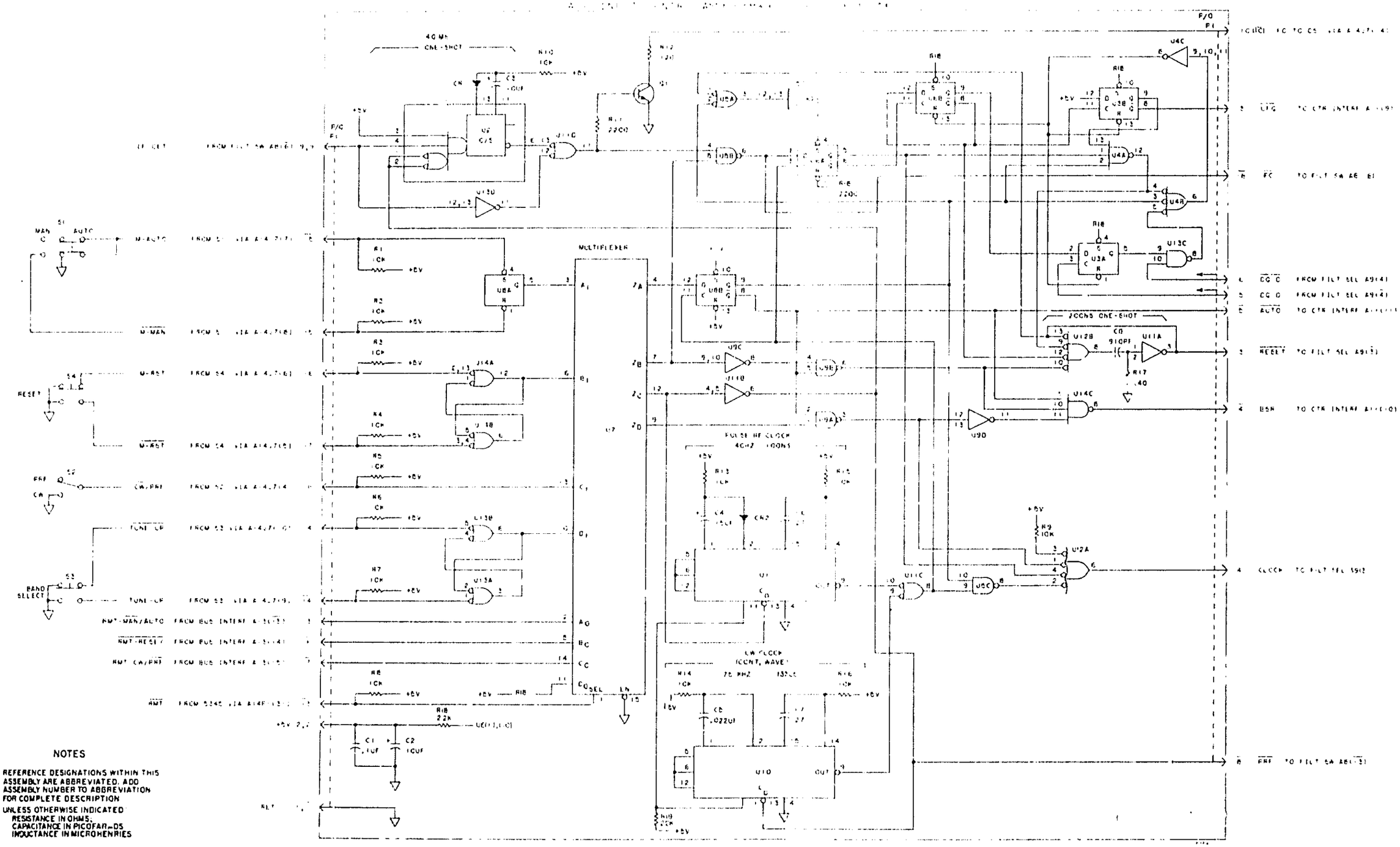
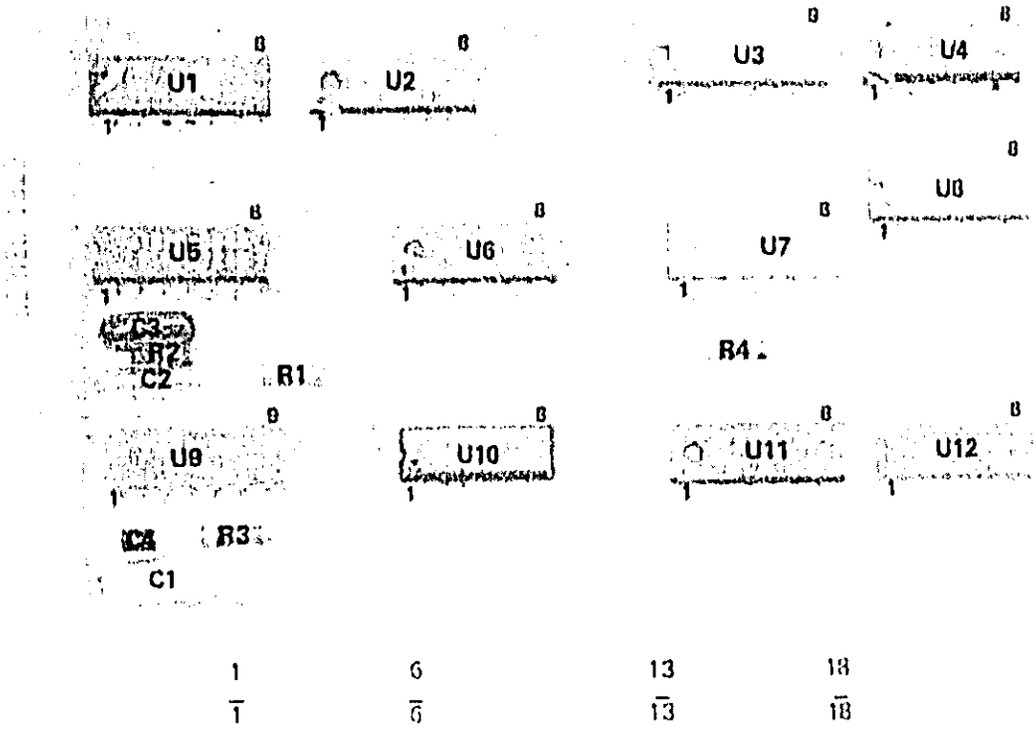
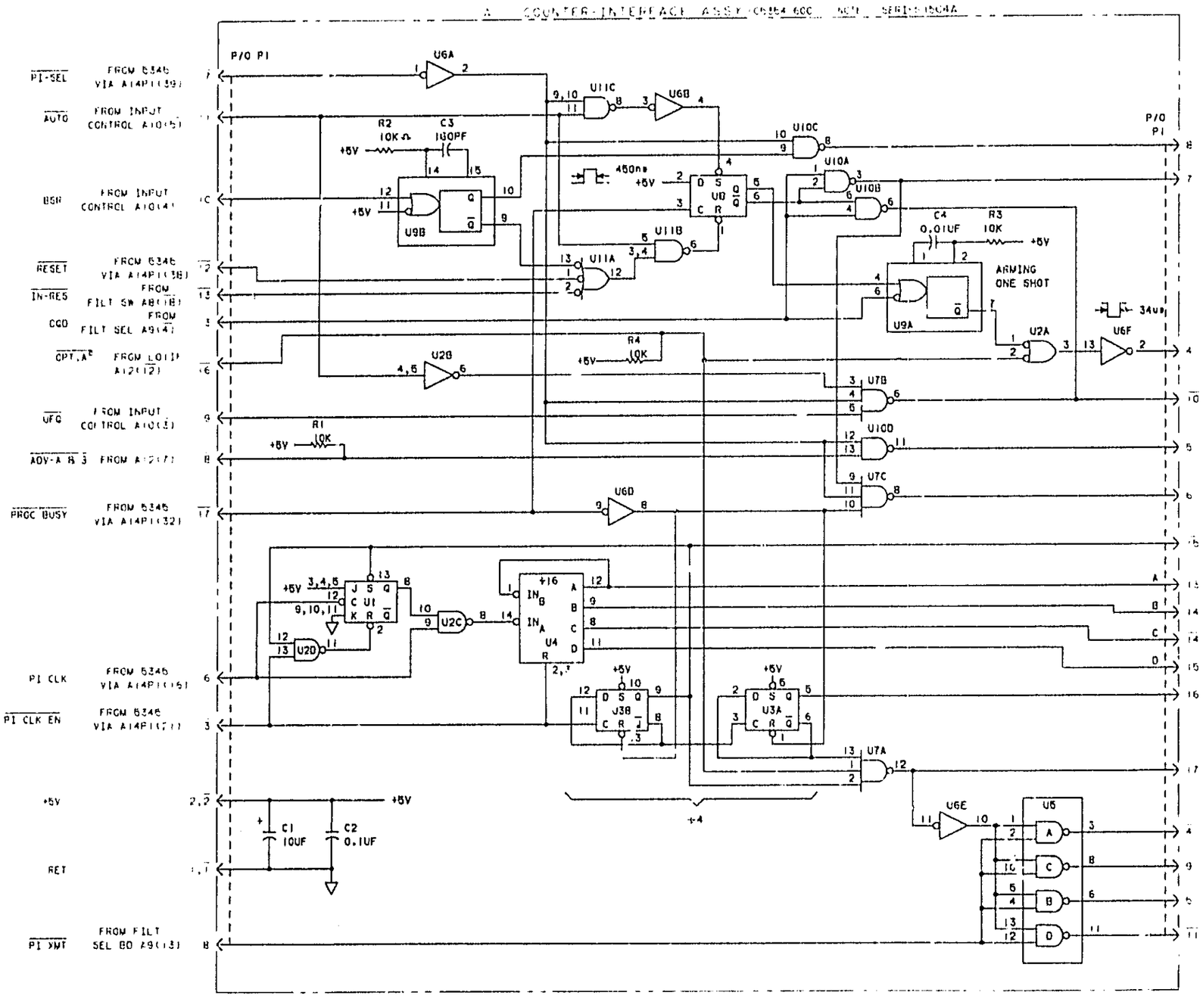


Figure 8-15. A10 Input-Control Assembly



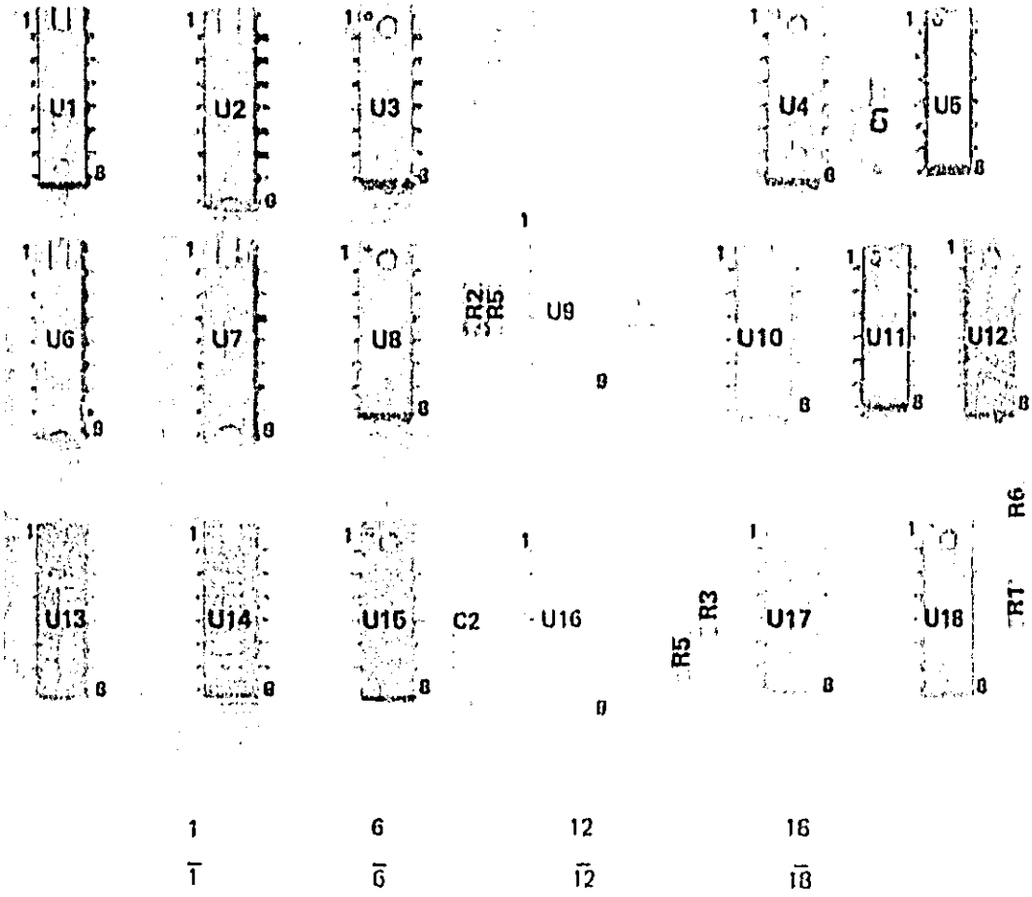
Part of Figure 8-16. A11 Counter-Interface Assembly



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

Figure 8-16. A11 Counter-Interface Assembly



Part of Figure 8-17. Option 001, A12 LO:IF Assembly

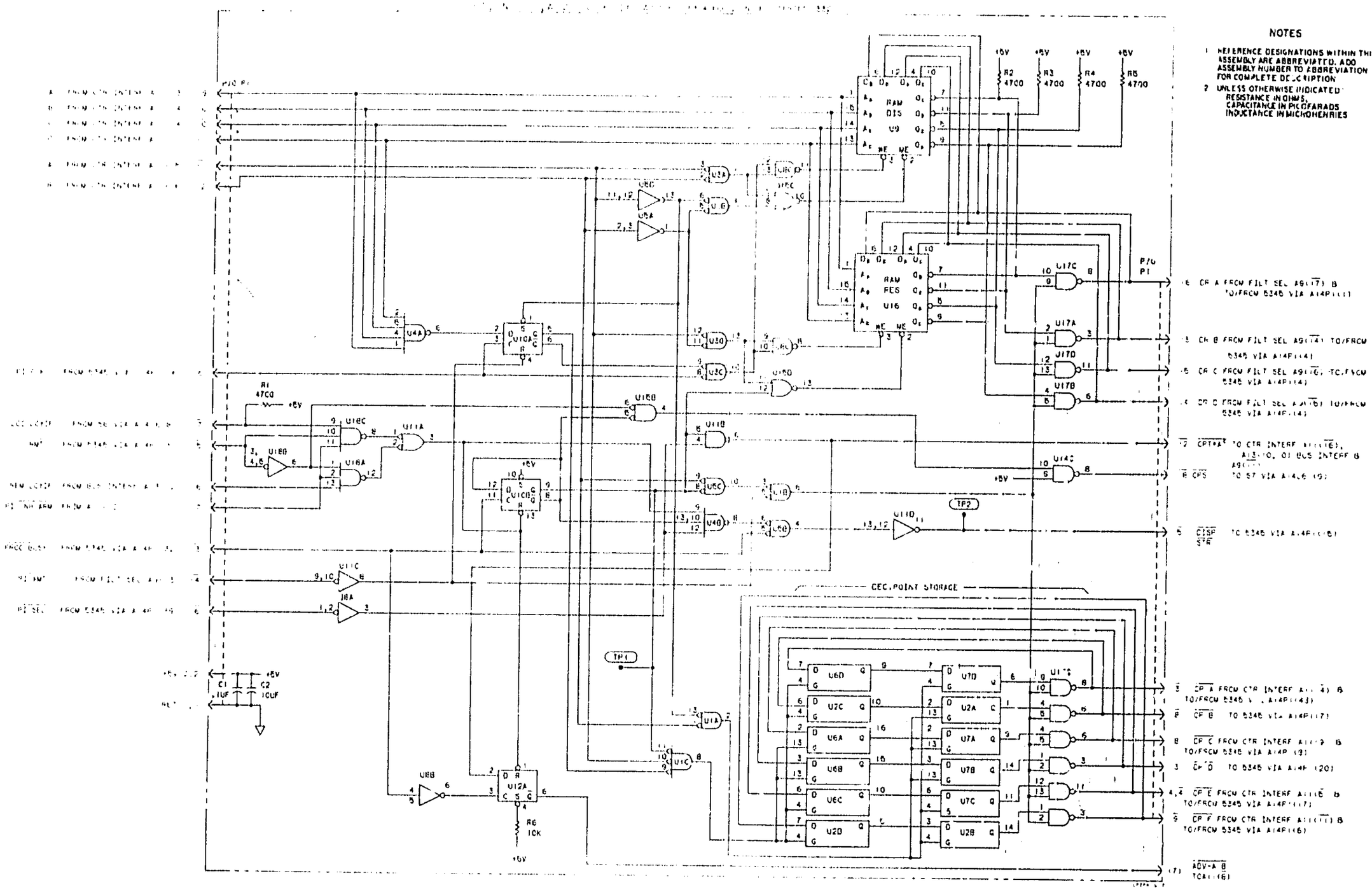
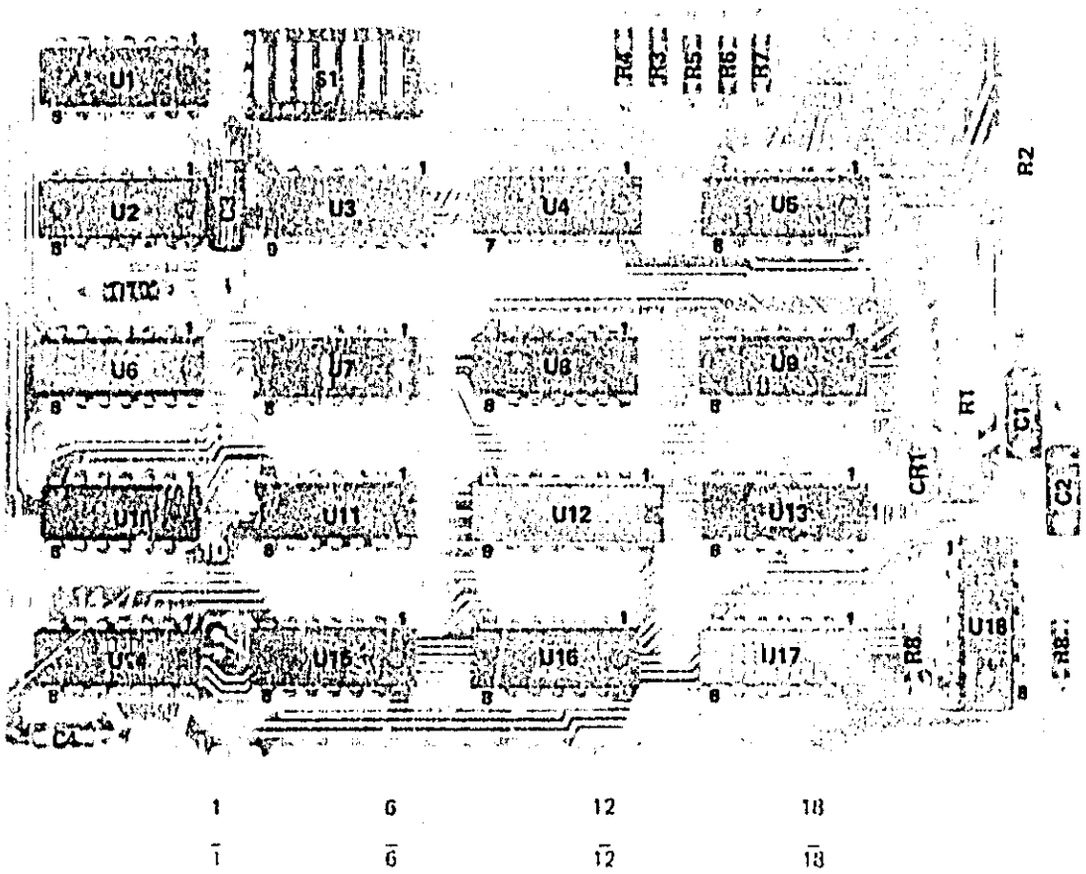


Figure 8-17. Option 001, A12 LO±IF Assembly



Part of Figure 8-18. Option 011, A13 Bus Interface Assembly

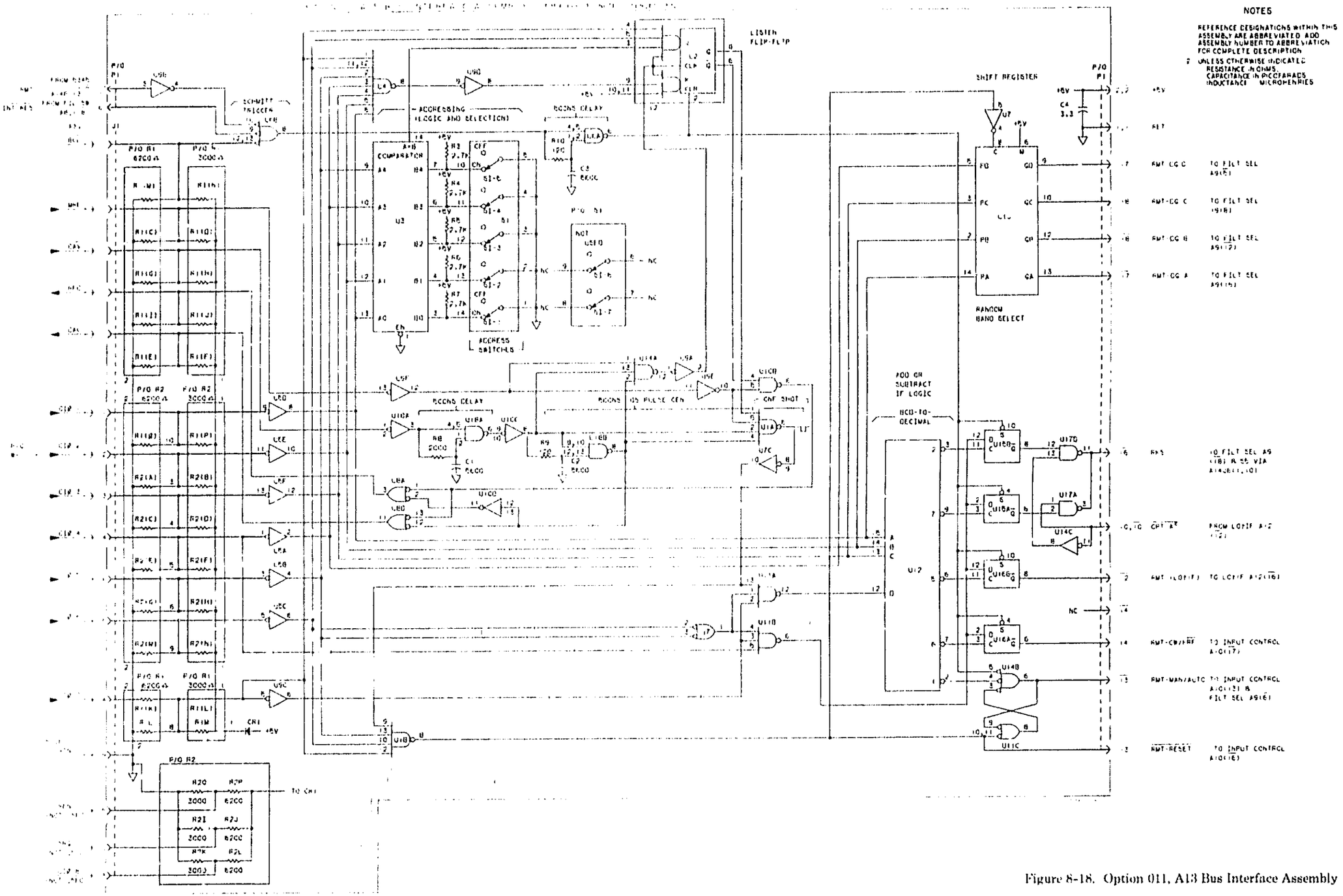
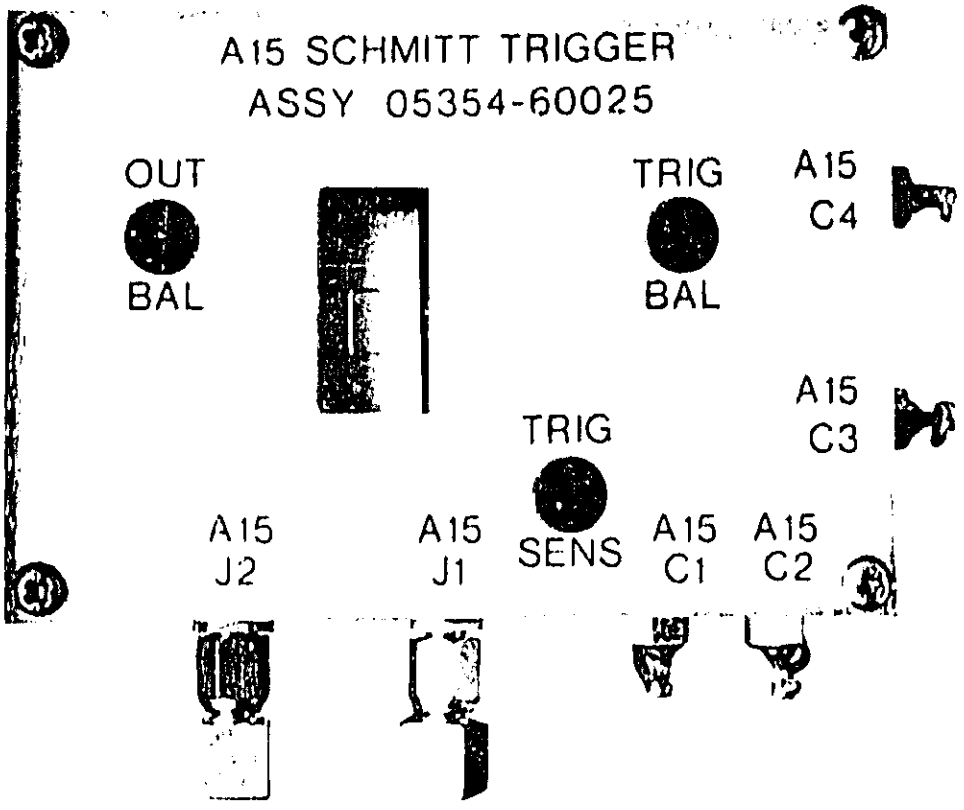
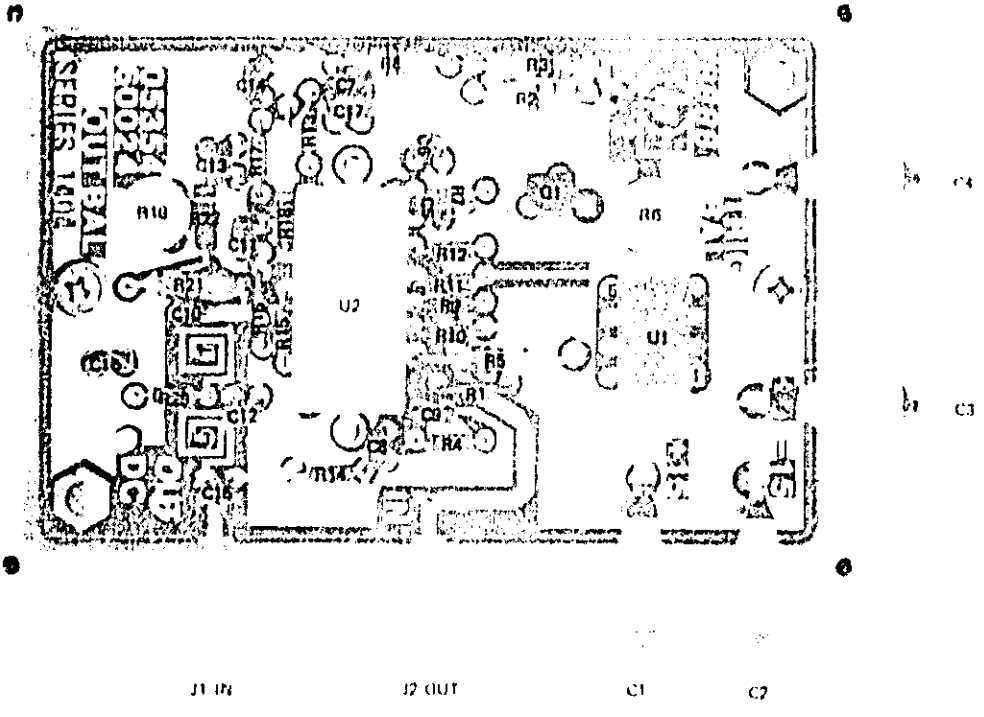


Figure 8-18. Option 011, A13 Bus Interface Assembly



FRONT COVER



COMPONENT LOCATOR

Part of Figure 8-19. A15 Schmitt Trigger Assembly

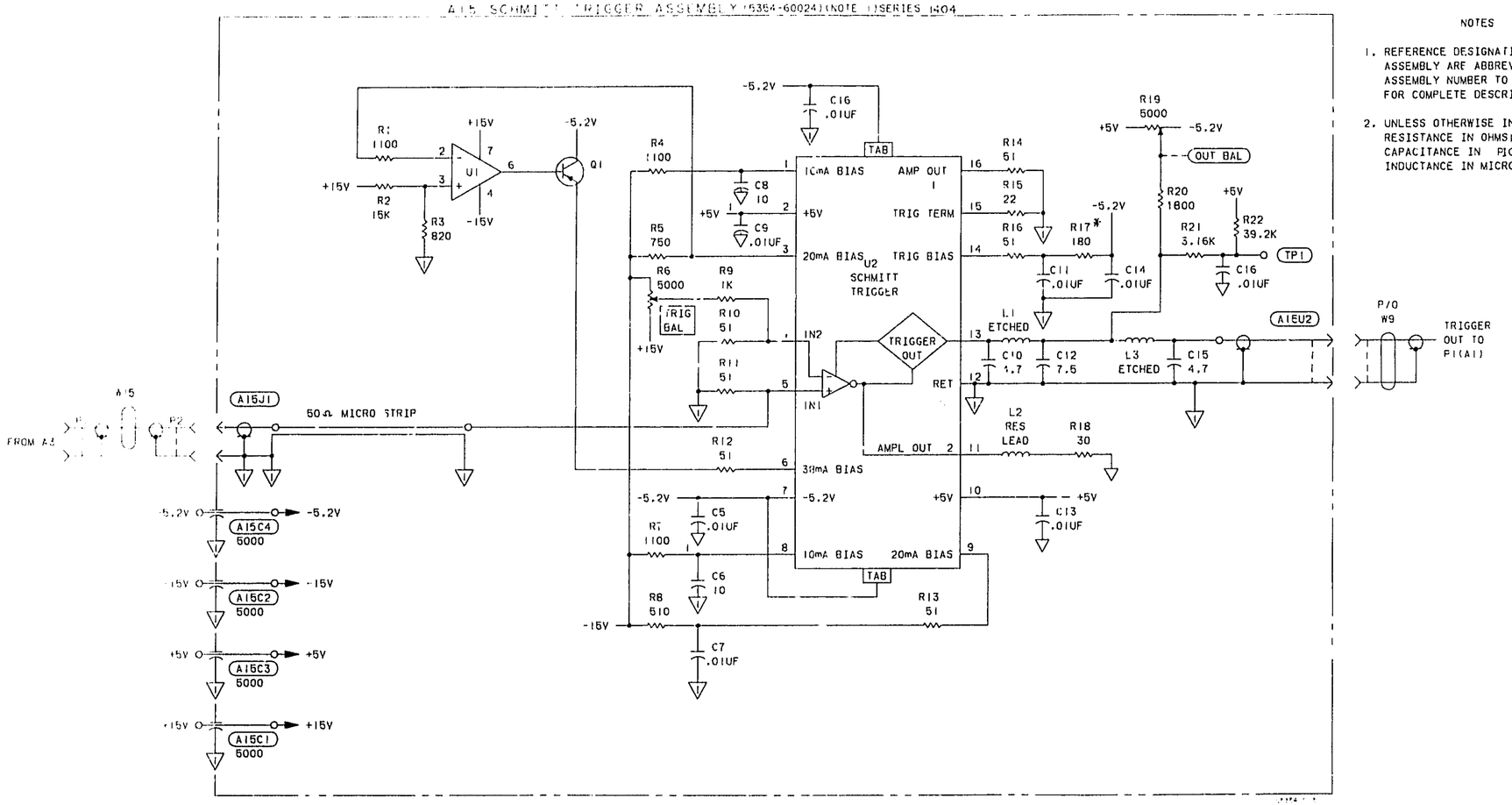
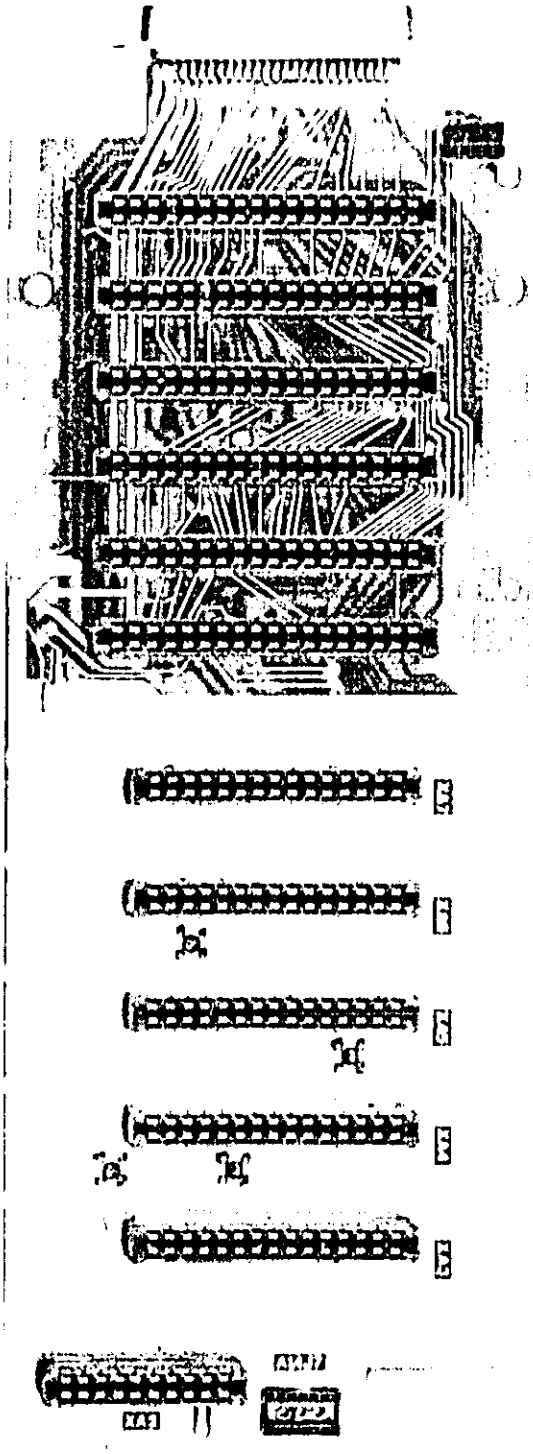


Figure 8-19. A15 Schmitt Trigger Assembly



Part of Figure 8-20. A14 Motherboard Interconnection Diagram

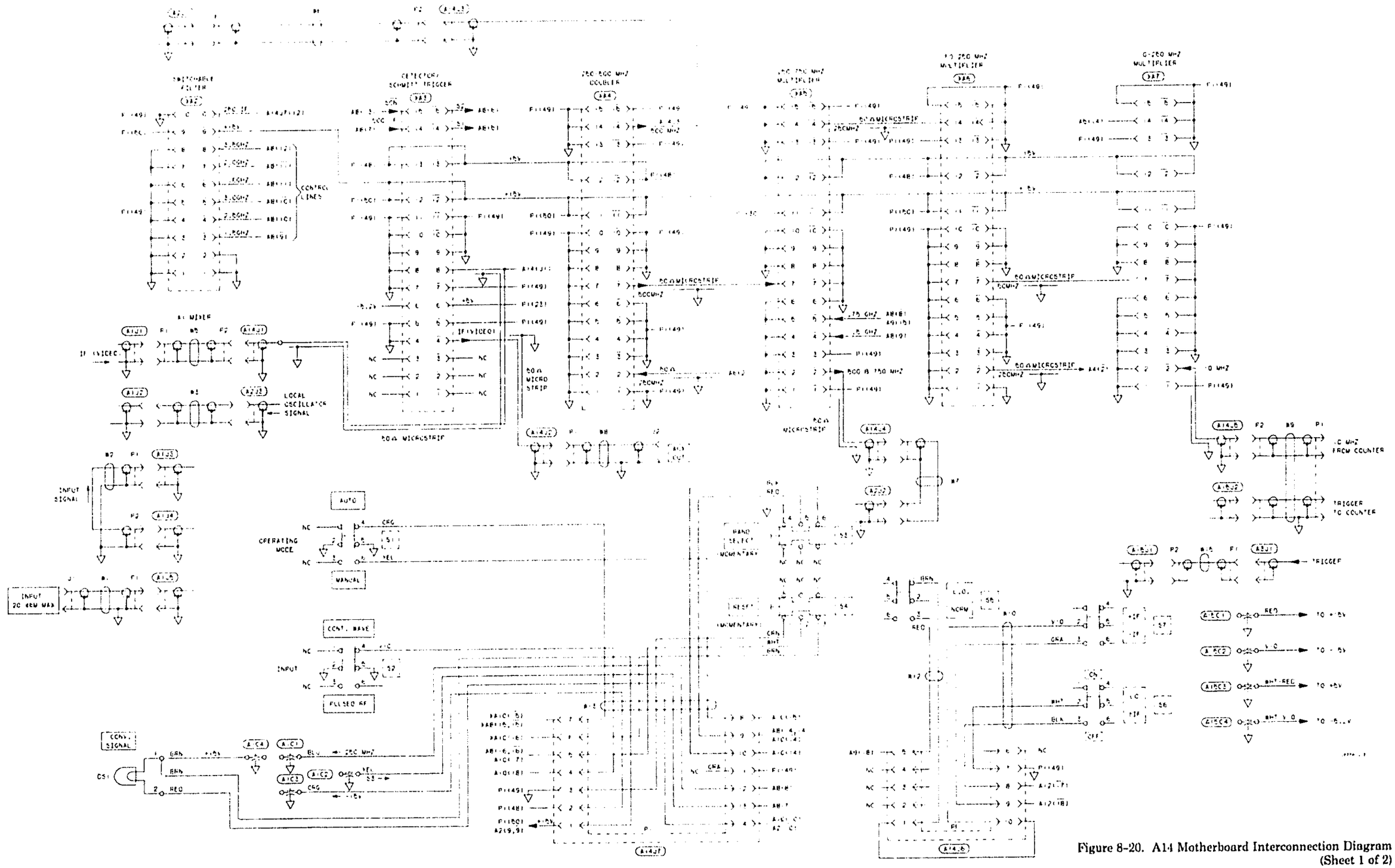


Figure 8-20. A14 Motherboard Interconnection Diagram (Sheet 1 of 2)

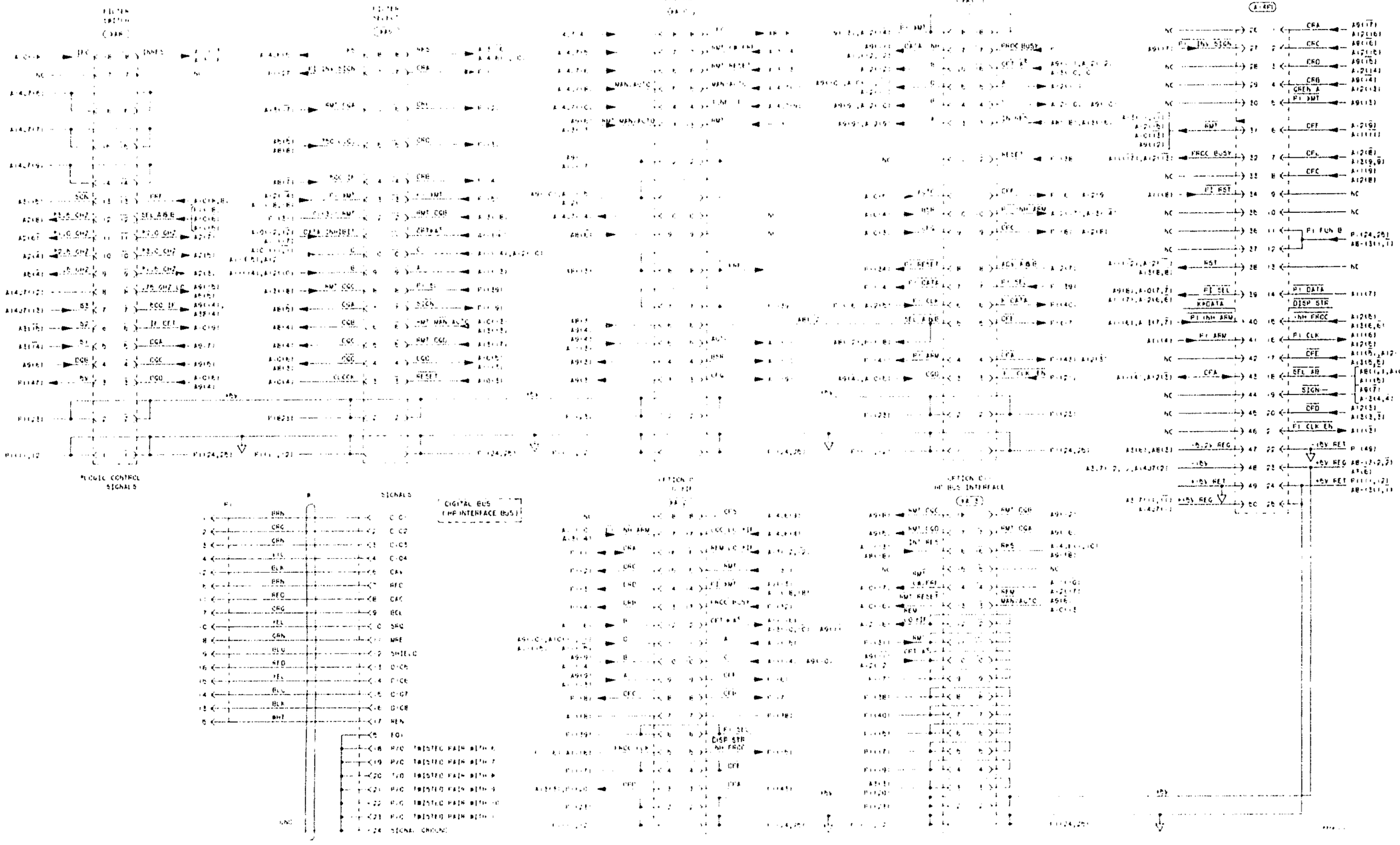


Figure 8-20. A14 Motherboard Interconnection Diagram (Sheet 2 of 2)

MANUAL CHANGES

CHANGE DATE: February 1, 1983
This change supersedes all earlier dated changes.

*** Make all corrections listed under ERRATA before making other changes.

*** Check following table for your instrument's serial prefix or series number and make listed change(s) to manual.

MANUAL DESCRIPTION

INSTRUMENT: 5354A
Automatic Frequency Converter
Operating and Service Manual

SERIAL PREFIX: 1516A

DATE PRINTED: OCT 1975
HP PART NO: 05354-90006
MICROFICHE NO: 05354-90007

# INDICATES NEW OR REVISED ITEM

> INDICATES ACTION TO BE TAKEN

SERIAL PREFIX OR SERIES NUMBER	MANUAL CHANGE(S)
1516A00351	1
1548A	1,2
1548A00451	1,2,3
1612A	1,2,3,4
1620A	1,2,3,4,5
1632A	1 thru 6
1744A	1 thru 7
1808A	1 thru 8
2012A	1 thru 9
2100A	1 thru 10
2116A	1 thru 11
#2116A	1 thru 12

SERIAL PREFIX OR SERIES NUMBER	MANUAL CHANGE(S)

Information for any optional circuit boards described in this manual agrees with the series numbers on the circuit board(s) for the option, which may not be the same as the Serial Prefix Number on the rear of the instrument.

(C5354AS)6089-6173-6386-6411-6654-6950-6954-6977-7005/7496/8=7920-7999/8402E/E/10272/10923/11=11563/12=12193

HEWLETT PACKARD

ERRATA

Page v, LIST OF FIGURES:
>Change caption for Figure 8-17 to read "Option 011, A12 LO±IF Assembly".

Page 1-2, Table 1-2. Specifications:
>Change SENSITIVITY to: -10dBm (70mVrms) Auto mode; typically -20dBm (22mVrms) in Manual and Pulse mode.

On the pages, tables, and figures listed below change the 5354A frequency bands to agree with Table 1:

Page 2-5, Table 2-1.
Page 3-1, Figure 3-1.
Page 4-1, Paragraph 4-9.
Page 4-6, Paragraph 4-58.
Page 4-7, Paragraphs 4-64 and 4-65.

Table 1.

Band	Frequency Range (MHz)
1	15-520
2	510-770
3	760-1020
4	1010-1520
5	1510-2020
6	2010-2520
7	2510-3020
8	3010-3520
9	3510-4020

Page 4-7, Paragraph 4-64:
>Change ".....PULSED R.F. (40kHz) mode." to .....PULSED R.F. (40Hz) mode.

Page 4-16, Table 4-2. 5354A Converter Program Code Set:
>Change the program code for "RESET" (near center of table) to the following:

	ASCII Character	D107	D106	D105	D104	D103	D102	D101	Octal
RESET	9	0	1	1	1	0	0	1	071

Page 5-3, Table 5-3. In-Cabinet Performance Test, Step 4, d:
>Change second column to read:

None
None
1
2
2
3
3
4
4
5
5
6
6
7
7
8
8
8

ERRATA (Cont'd)
Page 5-16, Table 5-8. Troubleshooting Checkout Procedure:
>Add the following step 10, in sequence:
10. If the instrument fails the preceding test, go to troubleshooting chart #4

After Page 5-16:
>Add Figures 5-3, 5-4, 5-5, 5-6, 5-7, and 5-8 in attached 5354A ADDENDUM.

Page 6-5, Table 6-1. Replaceable Parts, Standard Instrument:
>Add the following note to A1 (05354-60001) Mixer Assembly Description:
NOTE: A1A1 (05354-60015), A1A2 (05354-60016) and A1A3 (05354-60017) can only be ordered by ordering higher level assembly, A1 (05354-60001) or its restored version (05354-60501).

Page 6-7, Table 6-1. Replaceable Parts, Standard Instrument:
>Change A3U1 HP and Mfr Part Number to 1826-0298.

Page 6-12, Table 6-1. Replaceable Parts, Standard Instrument:
>Change A10C5 to 0170-0024; CAPACITOR-FXD .022UF 20% 200VDCW POLY; 28480
>Change A11C3 to 0160-0337 CAPACITOR-FXD 160PF +-1% 300VDC MICA
>Change A11U2 to 1820-1197; IC GATE TTL LS NAND QUAD 2-INPUT (SN74LS00N)

Page 6-13, Table 6-1. A14 Replaceable Parts:
>Delete 05354-00013 insulator.
>Add 3050-0079; WASHER-FLAT INSULATING.

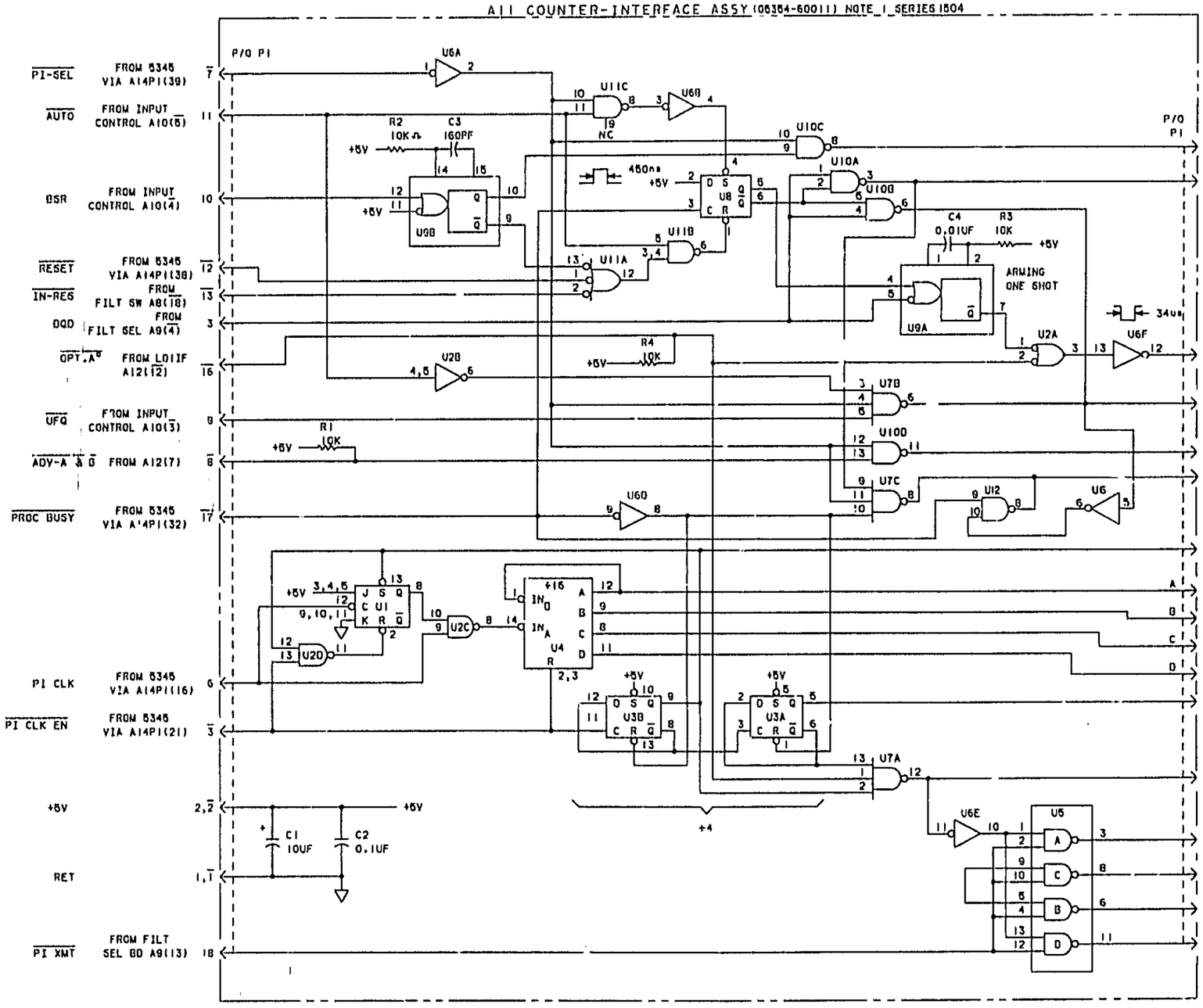
Page 6-14, Table 6-1. A15 Replaceable Parts, Standard Instrument:
>Add alternate part number for A15U2; 1826-0085; IC WIDEBAND AMPL NB
Under Replaceable CHASSIS PARTS:
>Add DS1; 05415-6017; LED LAMP ASSEMBLY; 28480; 05415-6017.
>Change MP11 from 3050-0028 to 3050-0071 in "HP" and "Mfr" part number columns.
>Add MP14; 10590-40001, PLUG-IN ALIGNMENT PLATE, PLASTIC; 28480; 10590-40001.
NOTE: This plate does not appear in Figure 6-1.
>Change "FOR S1" and "FOR S2" in Reference Designation column to "FOR S3" and "FOR S4", respectively.

Page 6-16, Table 6-2, Option 011 Replaceable Parts:
>Change A12U9 and A12U16 from HP Part No. 1820-0628 to 1820-1028.
NOTE: ONLY THE 7489 MEMORY UNDER HP PART NO. 1820-1028 SHOULD BE USED TO REPLACE A12U9 AND/OR A12U16.
>Change A13S1 from HP Part No. 3101-1826 to 3101-2162; SWITCH-RKR DIP-RKR-ASSY 7-1A .1A 5VDC PC; 28480; 3101-2162.

Page 8-9, Figure 8-6, A1 Schematic Diagram:
>Change reference designation of 47K-ohm resistor connected to junction of A1A2C2, A1A2C3, and A1A2CR2 from "43" to R3.

Page 8-24, Figure 8-13, A8 Component Locator:
>Change reference designators for Q1 thru Q14 on the component locator to agree with numbers 1 thru 14 on the printed circuit board.

Page 8-31, Figure 8-16. A11 Counter-Interface Assembly Schematic Diagram:
>Replace the schematic in the manual with Figure 1. A11 Counter-Interface Assembly Schematic Diagram in these Manual Changes.



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

Figure 1. A11 Counter-Interface Assembly Schematic Diagram

ERRATA (Co.)

Pages 8-32 and 8-33, Figure 8-17, A12 LO±IF Assembly Schematic Diagram:
>Change Option 001 to Option 011 in captions and schematic diagram.

Page 8-36, Part of Figure 8-19. A15 Schmitt Trigger Assembly Component Locator:
>Change J1 IN to J2 IN.
>Change J2 OUT to J1 OUT.

Page 8-37, Figure 8-19. A15 Schmitt Trigger Assembly Schematic Diagram:
>Show R6 connected to common ground instead of "+15V".

The following procedure replaces the procedure given on pages 5-6 through 5-13 of the 5354A Automatic Frequency Converter manual (HP P/N 05354-90006).

A3 IF (VIDEO) ASSEMBLY ADJUSTMENT PROCEDURE

- Disconnect rigid coaxial cable from A1J1 and insert a 530 MHz, 0 dBm CW signal into the rigid coax connected to the A3 assembly.
- Set the CONT WAVE/PULSED R.F. switch to PULSED R.F.
- Disconnect flexible coax from A15J1 and connect the A3 assembly output to sampling scope.
- Turn instrument on. Decrease 530 MHz input signal level and adjust A3R28 "TRIG BAL" for maximum sensitivity.
- Set signal generator to 530 MHz (0 dBm). Turn A3R17 "TRIG SENS" ccw. Turn A3R17 to the point where a clean and stable signal is observed on the sampling oscilloscope. The signal level should be approximately 600 mV peak-to-peak.
- Decrease input frequency to 500 MHz (0 dBm). Connect a TTL logic probe to XA3($\overline{15}$). Increase the signal level to the point where the logic level goes high. The 500 MHz input signal should be between 0 dBm and +1 dBm. If necessary adjust A3R16 "S2 SET" to obtain switching at proper signal level.
- Increase the input frequency to 521 MHz (0 dBm) and connect a logic probe to XA3($\overline{14}$). Push RESET switch. Adjust A3C7 "FREQ ADJ" until the logic level goes low. Readjust A3C7 to the point where the logic level first goes high.
- Disconnect signal generator and sampling oscilloscope. Return circuit connections to original state.

A15 SCHMITT TRIGGER ADJUSTMENT PROCEDURE

- Setup:
- Set 5354A CONT WAVE/PULSED R.F. switch to PULSED R.F., AUTO/MANUAL to MANUAL. Push 5354A RESET switch so converter is in the 15-525 MHz band.
- Set sweeper to sweep between 400 and 530 MHz, 0.01 second sweep time with an output level of 0 dBm.
- Connect signal generator SWEEP OUT to EXT INPUT of oscilloscope. Set oscilloscope to EXT DISPLAY and adjust EXT SENS control to get a horizontal trace 10 divisions wide centered vertically on the screen. Ground Channel A so display is midposition on screen. Set oscilloscope Channel A to dc coupling and vertical amp to 0.005 V/div.
- Using a 10:1 divider probe, connect Channel A of oscilloscope to A15TP1 (see Note 1). Ground oscilloscope probe to A14 assembly case.
- Disconnect rigid coaxial cable from A1J1 and connect the sweeper R.F. OUTPUT signal into the rigid coaxial cable.
- Connect sampling oscilloscope to A15J2.

NOTE 1: Addition of Test Point for adjustment of A15 Schmitter Trigger (for instruments with Serial Numbers 1332A00051 through 1332A00068.

In order to perform adjustments of assembly A15 and improve accuracy of calibration, a test point (A15TP1) must be added to the circuit.

A15 SCHMITT TRIGGER ADJUSTMENT PROCEDURE

- Setup:

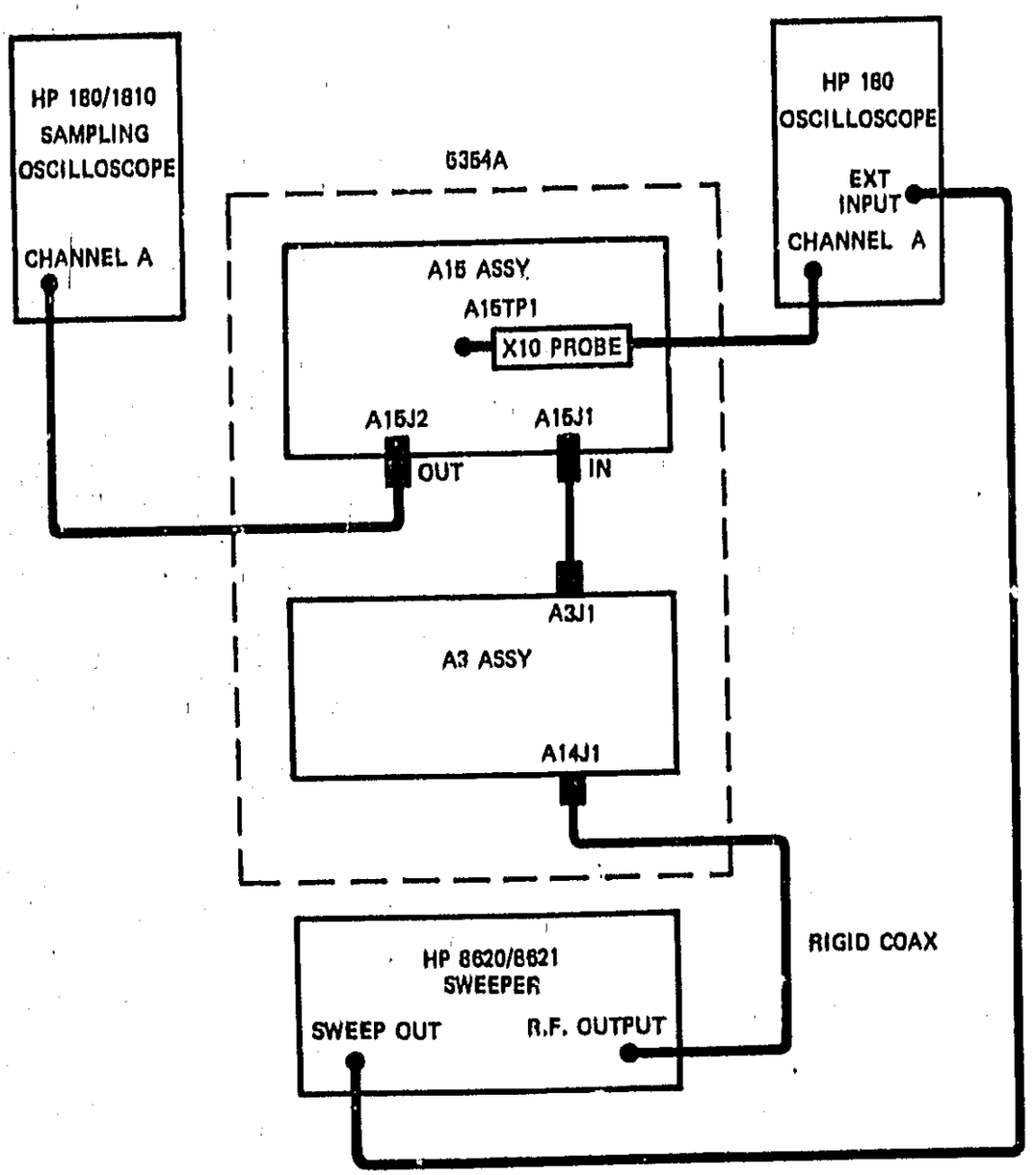


Figure 1

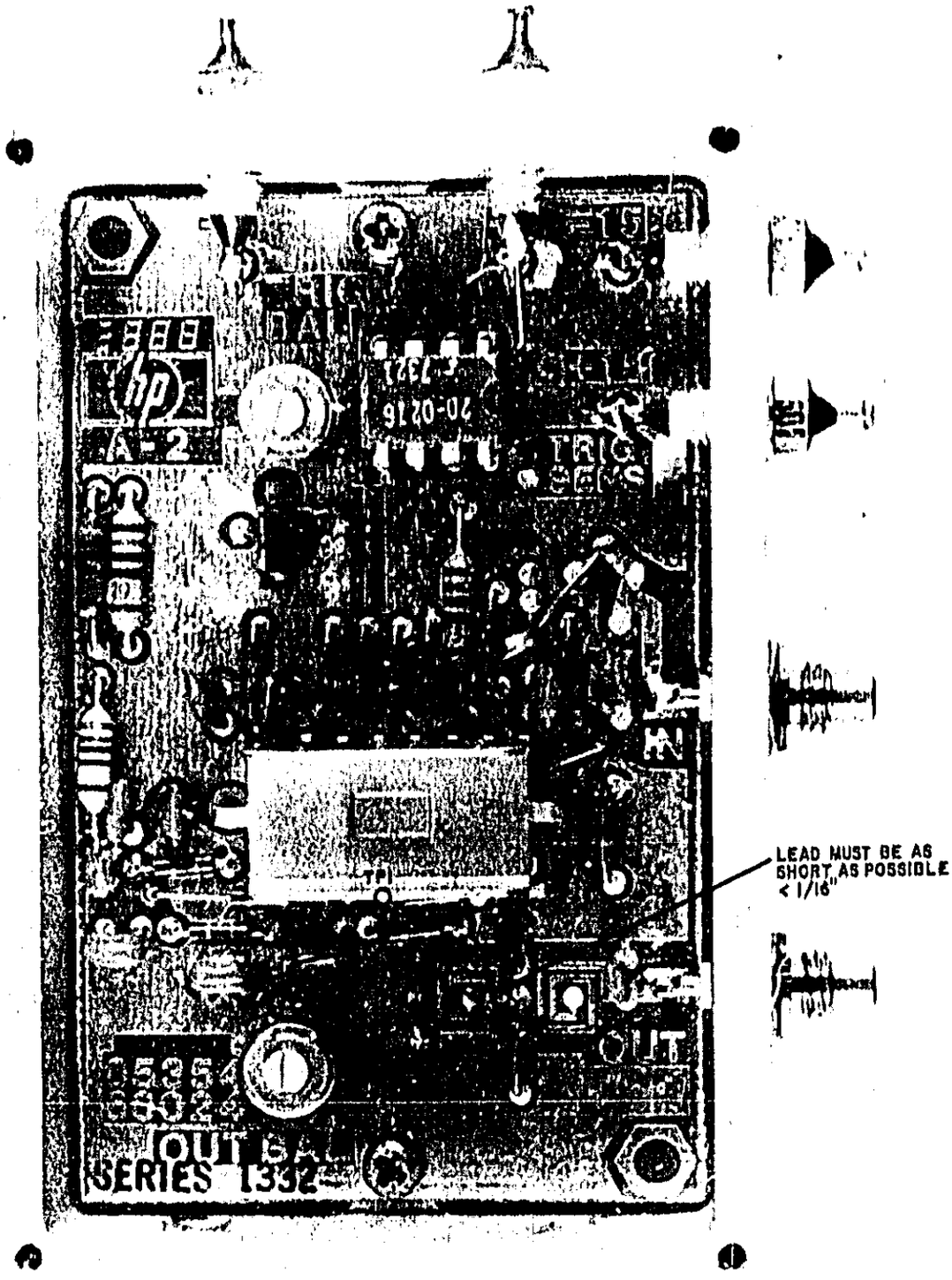


Figure 2

PARTS REQUIRED

Quantity	Ref. Desig.	Description	HP Part No.
1	A15R21	Resistor R.F. 3.16K 1%	0757-0279
1	A15R22	Resistor R.F. 39.2K 1%	0757-0124
1	A15C16	Capacitor 0.01 μF	0160-3879

INSTALLATION PROCEDURE

1. Remove A15 assembly casting cover.
2. Cut one lead of R21 (3.16K) 1/16" long.
3. Solder the 1/16" lead of R21 to the junction of A15L1, L3, and R20. (See Figure 2.)
4. Solder R22 (39.2K) to C13 (+5V side). (See Figure 2.)
5. Wrap one lead of C16 (0.01 μF) around fastening screw to ground. (See Figure 2.)
6. Connect the unsoldered leads of R21, R22, and C16 together. Solder thier junction.
7. The junction of R21, R22, and C16 is Test Point #1 (TP1).

- Adjust "TRIG BAL" (A15R6) for maximum linearity on scope display. Increase level to +10 dBm and readjust "TRIG BAL" again for maximum linearity. Maximum allowable display excursion is 80 mV (typically 50 mV) above or below ground between 400 MHz and 530 MHz for drive levels of 0 dBm and +10 dBm. If necessary, adjust A15R19 to center waveform about ground. See Figure 3 for typical waveshape.

Figure 3

*A X10 probe was used, therefore actual vertical scale is 0.05 V/div.

- Set signal generator to CW (250 MHz, 0 dBm). Center graticule of sampling oscilloscope should be at -400 mV. The displayed signal should have swings of at least 250 mV above and below -400 mV as seen on sampling oscilloscope. If necessary, adjust "OUT BAL" (A15R19) to obtain proper swings. See Figure 4 for typical waveshape.
- Slowly increase signal generator frequency from 400 MHz to 450 MHz (CW, 0 dBm) while observing output on sampling oscilloscope. Display should be approximately 650 mV ±50 mV peak-to-peak.

- Slowly increase signal generator frequency from 450 MHz to 530 MHz (CW, 0 dBm) while observing output on sampling oscilloscope. Display should be approximately 700 mV peak-to-peak, but less than 1.0V peak-to-peak.
- Return circuit to original configuration.

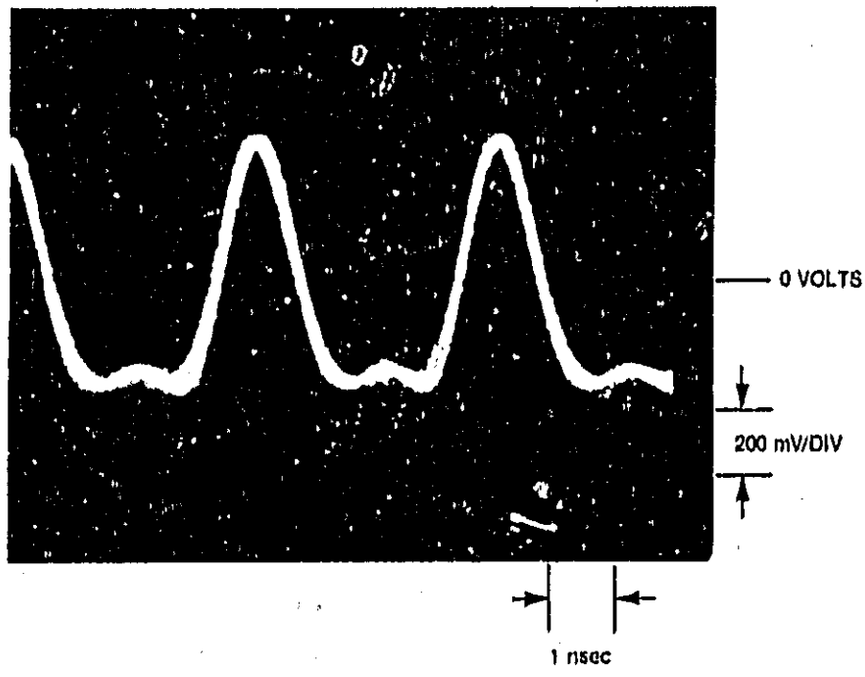


Figure 4

A1 MIXER ADJUSTMENT PROCEDURE

- Set signal generator frequency to CW, 1 GHz, and power level to -14 dBm.
- Connect signal generator to input connector of 5354A.
- Turn A1 "S3 SET" control fully counterclockwise.
- Connect a TTL Logic Probe to A14J7(13). The indication should be TTL low.
- Adjust A1 "S3 SET" clockwise until a TTL high is observed on the logic probe.
- Disconnect the signal generator from the input.
- Connect a spectrum analyzer to A1J1.
- Set the 5354A AUTO/MANUAL switch to MANUAL and push the 5354A RESET switch once and then the 5354A BAND SELECT switch once so the counter is in the 515-775 MHz band.
- Adjust A1C27 "500 MHz NOTCH ADJ" for a minimum level 500 MHz signal on the spectrum analyzer. The signal should be less than -25 dBm. If the level is less than -25 dBm do not adjust A1C27. Access to this adjustment is difficult.
- Insert a 2.3 GHz signal at -20 dBm to 5354A INPUT connector.
- Push 5354A BAND SELECT switch four times to the 2.0 GHz band. The signal as observed on spectrum analyzer should be 300 MHz at 0 dBm.
- Push 5354A RESET switch (15-525 MHz band) and insert 15 MHz at -20 dBm. Signal as observed on spectrum analyzer should be 15 MHz at -2 dBm ±1 dBm.

A7 10 TO 50 MHz MULTIPLIER ADJUSTMENT PROCEDURE

- Switch 5345A counter off and disconnect the 5345A 10 MHz input to the 5354A converter located in the counter 05345-60008 J3 "PLUG-IN".
- Insert a 10 MHz, +7 dBm signal to the converter by connecting the signal generator to the coaxial cable disconnected in the previous step.
- Switch 5345A on. Place spectrum analyzer with probe tip at XA6($\overline{7}$) with probe grounded at XA6(6).
- Tune the variable capacitors A7C10 "50 MHz 1", A7C14 "50 MHz 2", and A7C17 "50 MHz 3" for a maximum 50 MHz signal as observed on the spectrum analyzer. Repeat the procedure to obtain an optimum setting.
- Decrease the 10 MHz signal generator amplitude to -10 dBm and adjust A7C3 "10 MHz" for maximum 50 MHz output level.
- Increase the 10 MHz signal generator amplitude to 0 dBm. Adjust A7C14 "50 MHz 2" and A7C17 "50 MHz 3" for a maximum 50 MHz output. The 50 MHz signal should be approximately 0 dBm.
- Using a tuning wand or other insulated tool press lightly on the side of each variable capacitor. The output must remain constant.
- Disconnect signal generator and return circuit connections to original condition.

A6 50 TO 250 MHz MULTIPLIER ADJUSTMENT PROCEDURE

- Connect a spectrum analyzer with probe through a 50Ω load to XA4($\overline{2}$). Ground probe at XA4($\overline{3}$).
- Tune A6C6 "50 MHz", A6C11 "250 MHz 1", and A6C14 "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 dBm with the 200 and 300 MHz sidebands at least 40 dB below the 250 MHz level (allow for probe attenuation).
- Connect the spectrum analyzer probe to XA5($\overline{14}$) and ground probe at XA5($\overline{13}$). The 250 MHz signal should be at least +3 dBm.

A4 250 TO 500 MHz ADJUSTMENT PROCEDURE

- Disconnect rigid coaxial cable from A1J2. Connect spectrum analyzer to the rigid coaxial cable so as to observe A2 Filter assembly output at A2J3. Set the spectrum analyzer to 500 MHz.
- Place the 5354A in the MANUAL mode. Push the 5354A RESET switch once and then the 5354A BAND SELECT switch once.
- Adjust A4C4 "250 MHz", A4C14 "500 MHz 1", and A4C18 "500 MHz 2" for a 500 MHz signal at approximately -16 dBm.
- Return circuit connections to original state.

A5 500 TO 750 MHz MULTIPLIER ADJUSTMENT PROCEDURE

- Disconnect rigid coaxial cable from A1J2. Connect spectrum analyzer to the rigid coaxial cable so as to observe A2 Filter assembly output at A2J3. Set the spectrum analyzer to 750 MHz.
- Place the 5354A in the MANUAL mode. Push the 5354A RESET switch once and then the 5354A BAND SELECT switch twice. The instrument is now in the 750 MHz band.
- Adjust A5C14 "750 MHz 1" and A5C15 "750 MHz 2" for a maximum output level at 750 MHz as observed on the spectrum analyzer.

- Adjust A5R7 "LEVEL SET" for an output of approximately -16 dBm.
- Return circuit connections to original state.

A2 SWITCHABLE FILTER ADJUSTMENT PROCEDURE

- This particular adjustment procedure applies to those 5354A units which have A8 Filter Switch assemblies with Part Number 05354-60027. For units which have the older A8 assembly, Part Number 05354-60008, consult page 5-12 of the Operating and Service Manual for the adjustment procedure.
- Disconnect rigid coaxial cable from A1J2. Connect a spectrum analyzer to rigid coaxial cable so as to observe A2 Filter assembly output at A2J3.
- Place the 5354A in the MANUAL mode. Push the 5354A RESET switch once and then the 5354A BAND SELECT switch eight times to reach the 3.5 GHz band. The signal should be approximately -14 dBm. If not, follow A2R4 SPEC GEN LEVEL SET adjustment procedure outlined below.
- Place the 5354A in the MANUAL mode. Push the 5354A RESET switch once and then the 5354A BAND SELECT switch once. Set spectrum analyzer frequency to 500 MHz. The switchable filter signal should be approximately 500 MHz at -16 dBm. If necessary signal can be adjusted. Refer to A4 assembly adjustment procedure.
- Push the BAND SELECT switch once. Set the spectrum analyzer frequency to 750 MHz. The switchable filter signal should be approximately 750 MHz at -16 dBm. If necessary signal can be adjusted. Refer to A5 assembly adjustment procedure.
- Press BAND SELECT switch to the bands below and make adjustments as indicated.

Band	Signal Level on Spectrum Analyzer	Adjustment
1.0 GHz	-18 dBm, +0 -2 dBm	A8R29
1.5 GHz	-18 dBm, +0 -2 dBm	A8R30
2.0 GHz	-16 dBm, +0 -2 dBm	A8R31
2.5 GHz	-14 dBm, +0 -2 dBm	A8R32
3.0 GHz	-14 dBm, +0 -2 dBm	A8R33

A2R4 SPEC GEN LEVEL SET

Use the following procedure to adjust A2R4 for proper operation of the A2 comb generator (spectrum generator).

- Remove 5354A from 5345A counter.
- Disconnect rigid coaxial cable from A1J5, A1J1, and A1J2.
- Remove the 4 screws that secure the A1 Mixer to the converter chassis.
- Slide the A1 Mixer out through the top of the 5354A as far as possible without damaging its connecting wires.
- Connect the spectrum analyzer to A2J3.
- Set the 5354A AUTO/MANUAL switch to MANUAL.
- Switch the 5345A POWER switch to ON. Push 5354A RESET switch once and then the 5354A BAND SELECT switch eight times to 3.5 GHz band.
- Adjust A2R4 for a 3.5 GHz signal at -14 dBm.
- This completes the adjustment. Disconnect all test equipment, reconnect all cables in the 5354A.
- Perform adjustment of A2 assembly.

CHANGE 1 (Serial Number 1516A00351 and above)
Page 6-16, Table 6-2. Replaceable Parts, Option 011:
>Add (SERIES 1516) to A12 (05354-60012) LO+IF ASSY Description.
>Change A12U3 and A12U5 from 1820-0584 to 1820-1144; IC DGTL GATE; 01295; SN74LS02N.
>Change A12U4 from 1820-0588 to 1820-1204; IC DGTL GATE; 01295; SN74LS20N.
>Change A12U8 from 1820-0583 to 1820-1197; IC DGTL GATE; 01295; SN74LS00N.
>Change A12U12 from 1820-0596 to 1820-1112; IC DGTL TTL LP DUAL D; 01295; SN74LS74N.

CHANGE 2
Page 6-5, Table 6-1. A1A2 Replaceable Parts, Standard Instrument:
>Add (SERIES 1548) to A1A2 (05354-60016) Assembly Description.
>Delete A1A2CR3 Zener diode 1902-3182.
>Change A1A2R9 from 0686-2405 (24-ohm) to 0686-1005; RESISTOR-FXD 10 5% 1/2W CC TC=-0+412; 01121; EB1005.

Page 8-9, Figure 8-6. A1 Mixer Schematic Diagram:
>Add "(SERIES 1548)" at top edge of A1A2 schematic diagram.
>Delete Zener diode A1A2CR3.
>Change A1A2R9 from 24 to 10-ohm.

CHANGE 3 (Serial Number 1548A00451 and above)
The two mounting studs for the Option 011 HP-IB connector J3, on rear output assembly 05354-60052, are changed from 0380-1036 to 0380-0643. The 0380-0643 hex studs accommodate lockscrews with ISO metric thread M3.5 X 0.6, or equivalent Optimum Metric Fastener System (OMFS) thread 3.5 P06.

Metric hardware supplied by HP for HP-IB connectors can be identified by the black finish. If metric tools are not available, a 9/32-inch hex socket will fit the 7mm hex stud.

Conversion kits for converting earlier instruments to use the metric lockscrews 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.

CHANGE 4
Pages 6-6 and 6-7, Table 6-1. A3 Replaceable Parts, Standard Instrument:
>Add "(SERIES 1612)" to "Description" of A3 circuit board.
>Add A3R42; 0698-3113; RESISTOR-FXD 100 Ohm 5% 1/8W CC TUBULAR

Pages 6-13 and 6-14, Table 6-1. A15 Replaceable Parts, Standard Instrument:
>Add "(SERIES 1612)" to "Description" of A15 circuit board.
>Add A15R23; 0698-3113; RESISTOR-FXD 100 Ohm 5% 1/8W CC TUBULAR

Page 8-15, Figure 8-8. A3 Schematic Diagram:
>Change "SERIES 1412" at top of schematic to "SERIES 1612".
>Add resistor R42 (100-ohm) in series between U1(10) and the junction of C31 and the +5V-line.

CHANGE 4 (cont'd)
Page 8-37, Figure 8-19. A15 Schematic Diagram:
>Change "SERIES 1404" at top of schematic to "SERIES 1612".
>Add resistor R23 (100-ohm) in series between U2(10) and the junction of C13 and the +5V-line.

CHANGE 5
Page 6-6, Table 6-1. A3 (05354-60003) Replaceable Parts, Standard Instrument:
>Change SERIES 1612 to SERIES 1620.
>Change A3R40 from 0698-3111 (30-ohm) to 0698-3378; RESISTOR-FXD 51 5% .125W CC TUBULAR; 01121; BB5105.

Page 6-13, Table 6-1. A15 (05354-60024) Replaceable Parts, Standard Instrument:
>Change SERIES 1612 to SERIES 1620.
>Add A15R24; 0698-3380; RESISTOR-FXD 75-ohm 5% .125W CC TUBULAR
>Add A15R25; 0698-7213; RESISTOR-FXD 110-ohm 5% .125W CC TUBULAR
>Change A15U2 to 1826-0298; IC AMPLIFIER/SCHMITT; 28480; 1826-0298.

Page 8-15, Figure 8-8. A3 Schematic Diagram:
>Change SERIES 1612 at top of schematic to SERIES 1620.
>Change A3R40 from 30 to 51-ohm.

Page 8-37, Figure 8-19. A15 Schematic Diagram:
>Change SERIES 1612 at top of diagram to SERIES 1620.
>Add resistor R25 (110-ohm) in series between the "50-ohm MICRO STRIP" and the junction of R11 and U2(5).
>Add R24 (75-ohm) between the ground plane and the junction of (just added) R25 and the "50-ohm MICRO STRIP".
NOTE: Instruments with Serial Numbers 1612A00476, 00479, 00486, 00483, and 00487 through 00493 also have the above changes.

CHANGE 6
Pages 6-5 and 6-6, Table 6-1. Replaceable Parts:
>Add "SERIES 1632" to A1 (05354-60001) Mixer Assembly Description.
>Change A1A2 (05354-60016) from SERIES 1548 to SERIES 1632.
>Change A1A2U1 Part Number to 1813-0075 in "HP" and "Mfr" columns.
>Add (SERIES 1632) to A1A3 (05354-60017) Assembly Description.
>Change A1A3U1 Part Number to 1813-0076 in "HP" and "Mfr" columns.

CHANGE 7
Page 6-14, Table 6-1. Replaceable CHASSIS PARTS:
>Change S3 and S4 from 3101-1800 (DPDT) to 3101-1261.
NOTE: This switch can be used for replacement in all 5354A instruments.

CHANGE 8
Page 6-6, Table 6-1. A2 (05354-60002) Switchable Filter Assembly:
>Change A2 part number in HP and Mfr Part Number columns to 5088-7040.
>Add SERIES 1808 to A2 description.

Pages 6-10 and 6-11, Table 6-1. A8 (05354-60008) Replaceable Parts:
>Change A8 part number to 05354-60027 in HP and Mfr Part Number columns.
>Add "SERIES 1808" to A8 Assembly Description.
>Add A8R29, R30, R31, R32, & R33; 2100-2574; RESISTOR-VAR 500 10% C SIDE-ADJ 1-TURN; 30983; ET50X501.

CHANGE 8 (cont'd)
Page 8-10, Part of Figure 8-7. Front Cover View:
>Change A2 Switchable Filter Ass'y part number from 05354-60002 to 5088-7040.

Page 8-13, Figure 8-7. A2 Switchable Filter Assembly Schematic Diagram:
>Change A2 part number (top of diagram) to 5088-7040.
>Change A2 series number to 1808.

Page 8-25, Figure 8-13. A8 (05354-60008) Schematic Diagram:
>Change A8 part number at top of diagram to 05354-60027.
>Change A8 series number from 1332 to 1808.
>Add variable resistor R29, in series, between the collector of Q12 and load resistor R8, with the wiper end of R29 connected to Q12 collector; variable resistors R30, R31, R32 and R33 are connected in the same manner to the collectors of Q2, Q4, Q6 and Q8 respectively.
>Replace the A8 Component Locator with the illustration in attached Figure 2.

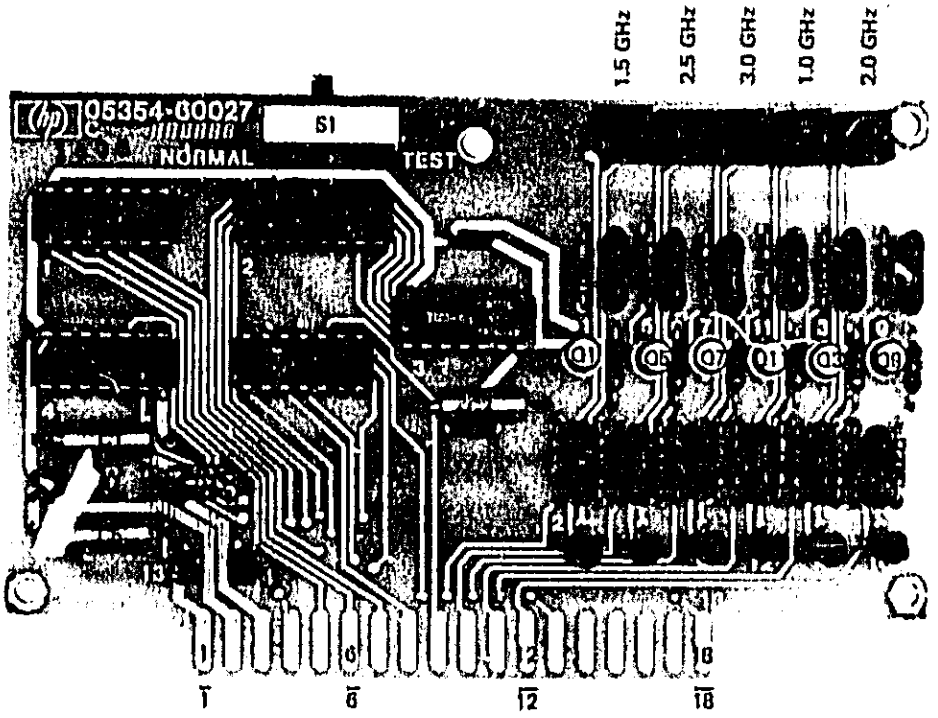


Figure 2. A8 Component Locator for 05354-60027 (SERIES 1808)

CHANGE 8 (Cont'd)

A8 FILTER-SWITCH ADJUSTMENT

To adjust the added controls on Filter Switch Assembly A8, perform the check-out procedure for A2 as given in paragraph 5-38 on page 5-12 of the Operating and Service Manual. If any of the signal levels are outside the tolerance limits given in steps f. through k., adjust the corresponding control in A8 to set the signal within limits. See Figure 2 in these Manual Changes for control location.

CHANGE 9

Pages 6-7 and 6-8, Table 6-1. A4 (05354-60004) Replaceable Parts:
>Add SERIES 2012 to A4 Description.
>Change A4C25 from 0160-3874 (10pF) to 0160-3029; CAPACITOR-FXD 7.5PF +-0.5PF 100VDC CER; 28480; 0160-3029.

Page 8-17, Figure 8-9. A4 Schematic Diagram:
>Change "SERIES 1332" to "SERIES 2012".
>Change A4C25 from 10 to 7.5 pF.

CHANGE 10

Page 6-5, Table 6-1. A1A1 (05354-60015) Replaceable Parts, Standard Instrument:
>Change A1A1CR1 from 1900-0023 to 1901-0920, Schottky barrier diode.
>Change A1R3 from 0757-0959, 30K to 0757-0968, RF 68K, 2%, 1/8W.
>Change the board series from 1332 to 2100.

Page 8-9, Figure 8-6. A1 Mixer Assembly Schematic Diagram:
>Change A1A1R3 from 30K to 68K.

CHANGE 11

Page 6-5, Table 6-1. A1A1 (05354-60015) Replaceable Parts, Standard Instrument:
>Add SERIES 2116 to A1A1 Board Assembly Description.
>Change A1A1CR2 to 1901-0040; DIODE-SWITCHING 30V 50MA 2NS DO-35.
>Change A1A1R2 to 2110-1773; RESISTOR-TRMR 1K 5% WW TOP-ADJ 1-TRN.
>Change A1A1R3 to 0757-0959; RESISTOR-FXD 30K 2% .125W F TUBULAR.

Page 8-9, Figure 8-6. A1 Mixer Assembly Schematic Diagram:
>Add Series Number 2116 to A1A1 ATTENUATOR-DETECTOR ASSEMBLY (05354-60015).
>Change A1A1 R2 to 1K.
>Change A1A1 R3 to 30K.

#CHANGE 12

Page 6-11, Table 6-1. A8 (05354-60027) Replaceable Parts:
>Change U1 to 1820-1204; IC GATE TTL LS NAND DUAL 4-INP; 74LS02N
>Change U3 to 1820-1199; IC INV TTL LS HEX; 74LS04N

Page 6-12, Table 6-1. A9 (05354-60009) and A10 (05354-60010) Replaceable Parts:
>Change A9U9 to 1820-1470; IC MUXR/DATA-SEL TTL LS 2-TO-1 LINE QUAD; 74LS157N.
>Change A10U4 and A10U14 to 1820-1202; IC GATE TTL LS NAND TPL 3-INP; 74LS10N.
>Change A10U5, U9, and U13 to 1820-1197; IC GATE TTL LS NAND QUAD 2-INP; 74LS00N.

Page 6-13, Table 6-1. A11 (05354-60011) Replaceable Parts:
>Change A11U11 to 1820-1202; IC GATE TTL LS NAND TPL 3-INP; 74LS10N.

#CHANGE 12 (cont'd)

Page 6-16, Table 6-2. Option 011 Replaceable Parts:

>Change A12U2, U6, and U7 to 1820-1411; IC LCH TTL LS D-TYPE 4 BIT; SN74LS75N.
>Change A13U1 to 1820-1204; IC GATE TTL LS NAND DUAL 4-INP; 74LS20N.
>Change A13U4 to 1820-1207; IC GATE TTL LS NAND 8-INP; 74LS30N.
>Change A13U5 and U9 to 1820-1199; IC INV TTL LS HEX; 74LS04N.
>Change A13U7 to 1820-1144; IC CONV TTL 3IN-TO-BCD 6-BIT; SN74LS02N.
>Change A13U11 and U14 to 1820-1202; IC GATE TTL LS NAND TPL 3-INP; 74LS10N.
>Change A13U12 to 1820-1418; IC DCDR TTL LS BCD-TO-DEC 4-TO-10 LINE; 74LS42N.
>Change A13U15 and U16 to 1820-1112; IC FF TTL LS D-TYPE POS-EDGE-TRIG; 74LS74N.