OPERATING AND SERVICE MANUAL

MODEL 312B/D
SELECTIVE VOLT/LEVEL METER

Serial Numbers: 312B-1534A00401
312D-1523A00101

IMPORTANT NOTICE

This loose leaf manual does not normally require a change sheet. All major change information has been integrated into the manual by page revision. In cases where only minor changes are required, a change sheet may be supplied.

If the Serial Number of your instrument is lower than the one on this title page, the manual contains revisions that do not apply to your instrument. Backdating information given in the manual adapts it to earlier instruments. See Section VIII, Backdating for further information.

WARNING

To help minimize the possibility of electrical fire or shock hazards, do not expose this instrument to rain or excess moisture.

-hp- Part No. 00312-90046
(Complete Manual including Binder)

-hp- Part No. 00312-90044
(Binder with Inserts, No Pages)

-hp- Part No. 00312-90045
(Loose-Leaf Pages Only)

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P.O. Box, 301, Loveland, Colorado 80537 U.S.A.

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HEWLETT hp PACKARD

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, except that in the case of certain components, if any, listed in Section I of this operating manual, the warranty shall be for the specified period. 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 proper preventive maintenance procedures as listed 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.

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LIST OF ILLUSTRATIONS

SECTION I
GENERAL INFORMATION

1-1. INTRODUCTION.

1-2. This manual contains operating, applications, and servicing information for the Hewlett-Packard Models 312B Selective Voltmeter and the 312D Selective Level Meter. The manual is divided into eight sections.

Section I	General Information
Section II	Installation
Section III	Operating Instructions
Section IV	Theory of Operation
Section V	Maintenance
Section VI	Replaceable Parts
Section VII	Schematic Diagrams
Section VIII	Backdating

1-3. Included in this section is a Table of Specifications, a general description of the 312B and 312D, and other general information. Since the 312B and 312D are very similar, the 312B will be discussed first and then the 312D will be discussed, covering only the differences.

1-4. GENERAL DESCRIPTION OF THE 312B SELECTIVE VOLTMETER.

1-5. The Model 312B measures the amplitude and frequency of signal components from 1 kHz to 18 MHz. It is calibrated to read amplitude in terms of power referenced to commonly used impedances. Frequency components are separated through the use of selectable bandpass filters. The frequency of the measured signal is displayed by a digital LED display.

1-6. The input can be applied either through a BNC connector or through the 11530A probe. The input circuits of the 312B contain a reference level attenuator that limits the input signal to a level necessary to prevent overloading of the input amplifier. Refer to Paragraphs 3-10 and 3-12 for the procedure for setting the attenuator to prevent overloading and to optimize signal-to-noise ratio.

1-7. The 312B will make both balanced and unbalanced measurements. These measurements can be made in either terminated or unterminated (bridged) modes. There are seven selectable impedances in the terminated mode; 50 ohms, 60 ohms, 75 ohms, 124 ohms, 135 ohms, 150 ohms, and 600 ohms. When in the bridged mode, the nominal input impedance is 10 kilohms in the unbalanced mode and 20 kilohms in the balanced mode.

1-8. There are three selectable bandwidths. The 3100 Hz bandwidth is provided for amplitude modulated (AM) and single sideband (SSB) measurements and for ease in tuning. The 1000 Hz bandwidth simplified calculation of noise power per hertz of bandwidth. The 200 Hz bandwidth permits separation of closely spaced signals and precise frequency measurements.

1-9. The frequency range switch and frequency tuning controls are used to tune the 312B across the frequency band. The frequency range switch selects one of eighteen ranges available, in 1 MHz increments. The frequency tuning controls tune the 312B in the range selected with a 180 kHz overlap. An internal frequency counter provides a digital display of the tuned frequency.

1-10. The five receiver modes of the 312B are AM, AM/AFC, BEAT, LSB, and USB. In the AM and AM/AFC modes, the 312B detects and measures the modulation envelope of an amplitude modulated signal. When the AM/AFC mode is used, an Automatic Frequency Control (AFC) circuit automatically fine tunes and locks the local oscillator to the input carrier frequency. In the BEAT mode, the 312B supplies an output signal whose frequency is equal to the difference between the input frequency and the center frequency of the instruments passband. This beat frequency produces an audio tone which can be monitored with headphones connected to the audio output jack. By adjusting for a "zero beat", the operator can precisely tune the 312B to the input signal. The LSB and USB modes provide carrier reinsertion ± 1.8 kHz away from the lower and upper single sideband, suppressed carrier signals.

1-11. The front panel Calibrated Output jack provides a square wave the fundamental amplitude of which is calibrated to - 40 dBm at 1 MHz, for amplitude calibration of the 312B.

1-12. GENERAL DESCRIPTION OF THE MODEL 312D SELECTIVE LEVEL METER.

1-13. The 312D Selective Levelmeter is very similar to the 312B Selective Voltmeter; therefore, only the differences will be discussed. The 312D is different from the 312B in the following respects:

a. Does not utilize an AFC circuit.

b. Contains a meter expand function for increased resolution.

c. Contains an input overload detector.

d. Terminated impedances of 75 ohms unbalanced, 124 ohms and 135 ohms balanced. These are always terminated.

e. Communications type input and output connectors.

f. Standard bandwidths of 50 Hz, 2300 Hz and 3100 Hz.

g. Has no probe input.

h. Has an internal speaker.

1-14. The 312D features an input overload detector which will cause a front panel indication to warn the operator that the input amplifier is overloaded. It also features a narrow 50 Hz bandwidth for highly selective measurements, a 2300 Hz bandwidth for general purpose in-channel noise measurements and a 3100 Hz bandwidth for voice channel noise measurements at carrier frequencies. Another unique feature of the 312D is the meter expand circuit, which expands the meter indication to a 0.02 dB resolution.

1-15. OPTIONS.

1-16. The 312B Option 01 contains a low pass, active filter that provides notches in the passband at plus and minus 2 kHz from the tuned frequency. These notches allow the noise to be measured in a single sideband telephone channel at carrier frequencies without pickup of adjacent carriers. This is standard on the 312D. The 312B Option 908 is a Rack Mounting Kit.

1-17. The 312D Option 001 contains a 150 Hz bandwidth instead of the 50 Hz bandwidth.

1-18. SPECIFICATIONS.

1-19. Table 1-1 is a complete list of the Model 312B/D critical specifications that are controlled by tolerances.

Table 1-1. Specifications.

Model 312B Selective Voltmeter

FREQUENCY

Accuracy: ± 10 Hz + time base accuracy. Frequency indicated by in-line digital readout with ± 10 Hz resolution.
Range: 1 kHz to 18 MHz in 18 overlapping bands; 200 kHz overlap between bands.
Time Base Stability:
Aging Rate: ± 10 parts in 10^6 per mo.
As a Function of Ambient Temperature at 25°C ± 10C: 20 ppm.
As a Function of Line Voltage: ± 0.1 ppm for a change of ± 10%.

Selectivity:

Bandwidth	3 dB	60 dB
200 Hz	200 Hz ± 10%	426 Hz ± 10%
1000 Hz	1 kHz ± 10%	2135 Hz ± 10%
3100 Hz	3.1 kHz ± 10%	6.2 kHz ± 10%

Flatness within passband: < 0.1 dB
Flatness within passband (Option 01): < 0.2 dB

Automatic Frequency Control:
Dynamic Hold-In Range: ± 3 kHz at 3.1 kHz Bandwidth
Tracking Speed: 100 Hz/sec
External Reference Input Requirements: 0 dBm ± 10 dBm into 50 ohms.

AMPLITUDE

Range:
50 - 150 ohms: - 120 dBm to + 23 dBm
600 ohms: - 130 to + 13 dBm
Voltage (50 ohm reference): .2 μV to 3 V
Accuracy:
Amplitude Range Attenuator
0 thru - 50 dB Range: ± 0.1 dB
- 60 dB Range: ± 0.2 dB
Reference Level Attenuator (1 MHz): ± 0.2 dB
Frequency Response (75 ohm Internal Termination):
1 kHz to 10 kHz: ± 0.5 dB
10 kHz to 10 MHz: ± 0.2 dB
10 MHz to 18 MHz: ± 0.5 dB

Internal Calibrator Output
Frequency: 1 MHz Square Wave
Amplitude: - 40 dBm into 75 ohms
Amplitude Stability: ± 0.1 dB
Output Connector: BNC

Bridging Impedance

Reference Level Attenuator	Balanced	Unbalanced
- 40 dB	20 kΩ ± 3% Shunted by < 30 pF.	10 kΩ ± 3% Shunted by < 60 pF.
- 30 dB thru + 20 dB	20 kΩ ± 3% Shunted by < 18 pF.	10 kΩ ± 3% Shunted by < 35 pF.

Common-Mode Rejection (Balanced Input):
1 kHz to 5 MHz: > 40 dB
5 MHz to 18 MHz: > 30 dB
Distortion
Harmonic: 1 kHz to 1 MHz, > 55 dB below 0 dB reference.
5 MHz to 18 MHz, > 65 dB below 0 dB reference.
Residual Response (No Input): > 72 dB below 0 dB reference
Noise Floor (75 Ω 1 kHz Bandwidth): < - 120 dB
Recorder Output Level: 1 V ± 0.1 V with full scale meter deflection, across an open circuit. Tracking accuracy is better than ± 0.1 dB to 20 dB below full scale reference on 0 dB position of AMPLITUDE RANGE switch. Better than ± 0.2 dB to 30 dB below full scale reference. Output resistance is 1 kΩ.
Auxiliary Outputs
1 MHz: >.5 V p-p sine wave into 1 kΩ: output connector is BNC.
30 MHz: 40 mV to 70 mV rms into 50 Ω: output connector is BNC.
Local Oscillator (30 - 48 MHz): 60 mV to 90 mV rms into 50 Ω; connector is BNC.

MODEL 312B, OPTION 01 SPECIFICATIONS

Same as standard Model 312B with the following exceptions:

Bandpass: 3100 Hz with carrier rejection notches ± 2 kHz from center of passband.
Rejection Notches: > 55 dB down at ± 2 kHz above and below the center of passband.

Table 1-1. Specifications (Cont'd).

Model 312D Selective Levelmeter

FREQUENCY

Accuracy: ± 10 Hz + time base accuracy. Frequency indicated by in-line digital readout with ± 10 Hz resolution.
Range: 1 kHz to 18 MHz in 18 overlapping bands; 200 kHz overlap between bands.
Time Base Stability:
Aging Rate: ± 10 ppm/month
As a Function of Ambient Temperature at 25°C ± 10°C: 20 ppm.
As a Function of Line Voltage: ± 1 part in 10^7 for a change of ± 10%.

Selectivity

Bandwidth	3 dB	60 dB
50 Hz	50 Hz ± 10%	106 Hz ± 10%
2300 Hz	2.3 kHz ± 10%	4.8 kHz ± 10%
3100 Hz	3.1 kHz ± 10%	6.2 kHz ± 10%

Flatness within passband: < 0.2 dB
External Reference Input Requirement: 0 dBm ± 10 dBm into 50 ohms.

AMPLITUDE

Range: - 120 dBm to + 23 dBm
Accuracy
Amplitude Range Attenuator
0 thru - 50 dB Range: ± 0.1 dB
- 60 dB Range: ± 0.2 dB
Reference Level Attenuator (1 MHz): ± 0.2 dB
Frequency Response (75 ohm Internal Termination):
1 kHz to 10 kHz: ± 0.5 dB
10 kHz to 10 MHz: ± 0.2 dB
10 MHz to 18 MHz: ± 0.5 dB

Internal Calibrator Output
Frequency: 1 MHz Square Wave
Amplitude: - 40 dBm into 75 ohms
Amplitude Stability: ± 0.1 dB
Output Connector: BNC
Common-Mode Rejection (Balanced Input):
1 kHz to 1 MHz: > 40 dB
1 MHz to 18 MHz: > 30 dB
Distortion
Harmonic: 1 kHz to 1 MHz, > 55 dB below 0 dB reference.
5 MHz to 18 MHz, > 65 dB below 0 dB reference.
Residual Response (No Input): > 72 dB below 0 dB reference
Noise Floor (75 Ω 2.3 kHz Bandwidth): < - 117 dBm
Recorder Output Level: 1 V ± 0.1 V with full scale meter deflection, across an open circuit. Tracking accuracy is better than ± 0.1 dB to 20 dB below full scale reference on 0 dB position of AMPLITUDE RANGE switch. Better than ± 0.2 dB to 30 dB below full scale reference. Output resistance is 1 kΩ.
Auxiliary Outputs
1 MHz: > .5 V p-p sine wave into 1 kΩ: output connector is BNC.
30 MHz: 40 mV to 70 mV rms into 50 Ω: output connector is BNC.
Local Oscillator (30 - 48 MHz): 60 mV to 90 mV rms into 50 Ω; connector is BNC.

Table 1-2 contains general information describing the operating characteristics of the 312B/D.

1-20. Any changes in specifications due to manufacturing, design or traceability to the U.S. National Bureau of Standards are included in Table 1-1 of this manual. Specifications listed in this manual supersede all previous specifications for the Model 312B/D.

1-21. ACCESSORIES SUPPLIED.

1-22. The Model 312B/D is supplied with a power cord.

1-23. INSTRUMENT AND MANUAL IDENTIFICATION.

1-24. The instrument serial number is located on the rear panel. Hewlett-Packard uses a two-section serial number consisting of a four-digit prefix and a five-digit suffix. A letter between the suffix and prefix identifies the country in which the instrument was manufactured (A = USA, G = West Germany, J = Japan, U = United Kingdom). All correspondence with Hewlett-Packard should include the complete serial number.

1-25. If the serial number of your instrument is lower than the one on the title page of this manual, refer to Section VIII for backdating information that will adapt this manual to your instrument.

Table 1-2. General Information.

Model 312B Selective Voltmeter

RECEIVER CHARACTERISTICS

Receiver Mode Outputs:
AM and AM/AFC: Diode demodulated audio
BEAT: Beat frequency audio centered at f_o
LSB: Product demodulated audio, carrier reinserted at f_o + 1.8 kHz
USB: Product demodulated audio, carrier reinserted at f_o, - 1.8 kHz
Audio Output Levels: 0.5 V rms into 10 kΩ with full scale meter deflection.
Input Connectors: BNC
Meter: - 20 dBm to + 3 dBm with back lighted scales
Matching Impedances: 50, 60, 75, 124, 135, 150 or 600 ohm, balanced or unbalanced.
Operating Temperature: 15°C to 35°C
Power: 115 V or 230 V, 48 to 66 Hz, < 100 VA
Furnished: Power Cord, 7 1/2 ft. (2290 mm) long.
Accessory Available: 11530A Probe
Complementary Equipment: -hp- Model 313A Tracking Oscillator. A signal source whose output automatically tracks the tuning of the Model 312B.
Option: Option 908 Rack Mounting Kit -hp- Part No. 5060-8743.

Table 1-2. General Information (Cont'd).

Model 312D Level Meter

RECEIVER CHARACTERISTICS

Receiver Mode Outputs
- AM: Diode Demodulated audio
- BEAT: Beat frequency audio centered at f_o
- LSB: Product demodulated audio carrier reinserted at f_o + 1.8 kHz
- USB: Produce demodulated audio, carrier reinserted at f_o - 1.8 kHz. Output level is > + 14 dBm into 600 ohms with full scale meter deflection. Sufficient to drive a 52 type operators headset. Jack accepts 464A and 310 plugs.

Audio Output Levels: 0.5 V rms into 10 kΩ with full scale meter deflection.

Input Connectors: BNC

Meter: - 20 dBm to + 3 dBm with back lighted scales

Matching Impedances: 75 Ω unbalanced; 124 and 135 Ω balanced.

Speaker: Normally in circuit. Disconnected whenever any plug is inserted into front panel audio output jack.

Jacks:
- 75 Ω jack accepts 358A plug
- 124 Ω jack accepts 408A plug
- 135 Ω jack accepts 241A plug

Operating Temperature: + 15°C to + 35°C.

Power: 115 or 230 V ac, 48 to 66 Hz

Option: Option 001 is a 150 Hz bandwidth instead of the 50 Hz bandwidth.

SECTION II
INSTALLATION

2-1. INTRODUCTION.

2-2. This section of the manual contains information and instructions necessary to prepare the instrument for use. Included are initial inspection procedures, power and grounding requirements, environmental information, installation instructions and instructions for repackaging for shipment.

2-3. INITIAL INSPECTION.

2-4. This instrument was carefully inspected both mechanically and electrically before shipment. It should be free of mars or scratches and in electrical working order upon receipt. To confirm this, the instrument should be inspected for physical damage that may have incurred in transit. If the instrument was damaged, file a claim with the carrier.

2-5. POWER REQUIREMENTS.

2-6. The Models 312B/D operate from either 115 or 230 volts, ± 10%, 48 Hz to 66 Hz. A switch for selecting 115 V or 230 V ac is located in the power module located on the rear panel (see Figure 2-2). For 115 V operation, a 1.5 A slow-blow fuse should be used. For 230 V operation use a .75 A slow-blow fuse. Power dissipation is approximately 100 VA. Refer to Section III for the Instrument turn-on procedure.

2-7. POWER CORDS AND RECEPTACLES.

2-8. Figure 2-1 illustrates the standard power plug configurations that are used throughout the world. The -hp- part number directly below each illustration is the part number

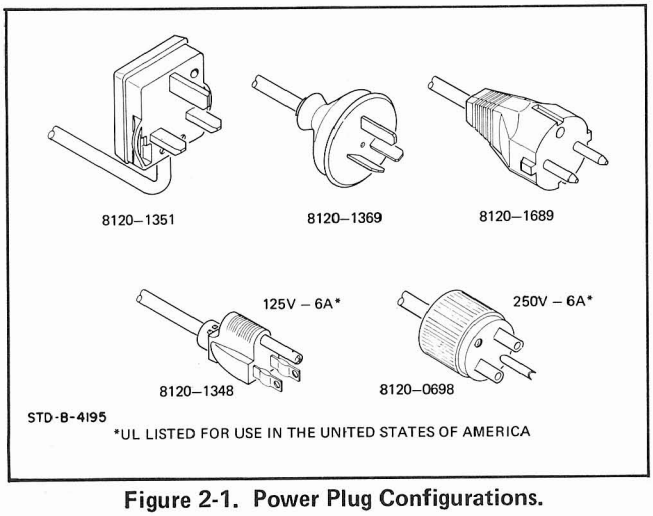
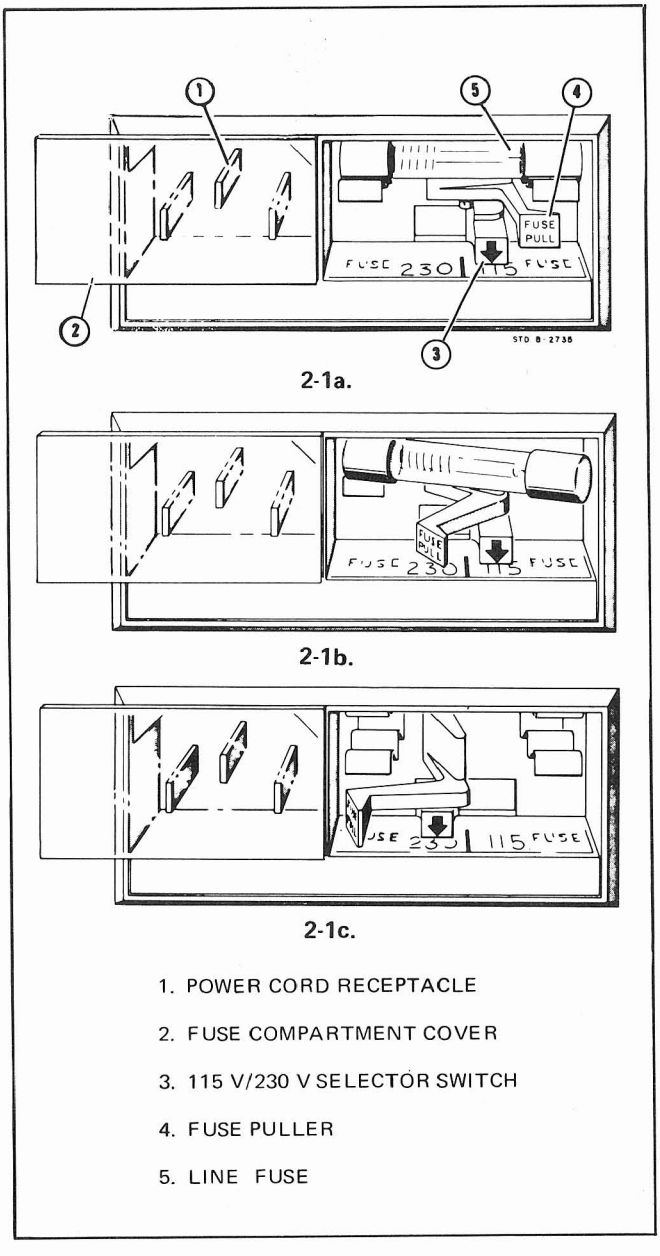


Figure 2-1. Power Plug Configurations.



2-1a.

2-1b.

2-1c.

1. POWER CORD RECEPTACLE
2. FUSE COMPARTMENT COVER
3. 115 V/230 V SELECTOR SWITCH
4. FUSE PULLER
5. LINE FUSE

Figure 2-2. Power Module.

for that power cord. If the appropriate power cord is not included with the instrument, notify the nearest -hp- Sales and Service Office and a replacement cord will be provided.

2-9. Grounding Requirements.

2-10. To protect operating personnel, the National Electrical Manufacturers' Association (NEMA) recommends that

the instrument panel and cabinet be grounded. This instrument is equipped with a three conductor power cable which, when plugged into an appropriate power receptacle, grounds the instrument. The offset pin on the connector is the ground connection.

2-11. ENVIRONMENTAL REQUIREMENTS.

2-12. The Models 312B/D should not be operated outside the temperature range of + 15°C to + 35°C, at a maximum relative humidity of 95%. Storage temperature range is - 40°C to + 75°C.

2-13. INSTALLATION.

2-14. The Models 312B/D are fully transistorized; therefore, no special cooling is required. However, the instrument should not be mounted in such a manner that it will obstruct the circulation of free air.

2-15. Bench Use.

2-16. The instrument is shipped with plastic feet and tilt stand in place, ready for use as a bench instrument. For convenience of viewing, the front of the instrument can be elevated by lowering the tilt stand. The plastic feet are shaped to permit placing the instrument on top of other full-module Hewlett-Packard instruments.

2-17. Rack Mounting.

2-18. The instrument may be rack mounted using the rack mount kit (Option 908). Instructions are included with the kit. The rack mount is an EIA standard width of 19 inches. When rack mounted, there should be a minimum of 2 inches clearance between the top, bottom and sides, and the rack, or other instruments.

2-19. REPACKAGING FOR SHIPMENT.

2-20. The following describes the general guidelines for repackaging the instrument for shipment.

NOTE

If the instrument is to be shipped to Hewlett-Packard for service or repair, attach a tag to the instrument identifying the owner and indicating the service or repair to be accomplished. Include the model number and full serial number of the instrument. In any correspondence, identify the instrument by model number and full serial number. If you have any questions, contact your nearest -hp- Sales and Service Offices. Addresses are listed at the back of this manual.

SECTION III
OPERATING INSTRUCTIONS

3-1. INTRODUCTION.

3-2. This section of the manual contains operating instructions and some typical applications for the Model 312B Selective Voltmeter and the Model 312D Selective Levelmeter. Since both instruments are very similar, no distinction will be made in the procedures and descriptions that are common to both models. Procedures will be integrated where only minor differences occur between models. Procedures and features that are unique to a particular model will be discussed separately. Before operating the instrument, be sure to read the Preliminary Operating Information.

3-3. PRELIMINARY OPERATING INFORMATION.

3-4. Input Connections.

3-5. In order to minimize the effects of extraneous noise and to prevent signal loss, the cables used for input connections should be shielded and as short as possible.

3-6. Meter Mechanical Zero.

3-7. Before accurate readings can be made, the meter must be mechanically zeroed. The meter is properly zeroed when the pointer rests exactly over the two zeroes at the left-hand side of the scale (312B) or to the left of the minus (-) sign for the 312D, with the instrument in its normal environment and position and no input applied. To zero the meter, proceed as follows:

a. Turn the instrument on and allow thirty minutes for it to reach normal operating temperature.

b. After it has reached normal operating temperature, turn it off and allow thirty seconds for all capacitors to discharge.

c. Rotate the meter adjustment screw counterclockwise until the pointer is to the left of the scale.

d. Rotate the adjustment clockwise until the pointer rests exactly over the two zeroes on the left edge of the scale (312B) or to the left edge of the minus (-) sign for the 312D. See Figure 3-1 for a properly zeroed 312D Meter.

e. When the pointer is properly placed, rotate the adjustment screw slightly counterclockwise to relieve the tension on the pointer suspension. If the pointer moves, repeat Steps c through e.

3-8. Preliminary Calibration.

3-9. Turn the instrument on and allow it to warm up for thirty minutes. While the instrument is warming up, read the remainder of the Operating Section. After the instrument has warmed up, perform the following procedure:

a. Set the applicable 312B/D controls as follows:

312B/D

REFERENCE LEVEL -dBm	-40
RECEIVER MODE	AM
BANDWIDTH Hz	3100
FREQUENCY RANGE -MHz	1
AUDIO AMPLITUDE	Any Position
AMPLITUDE RANGE -dB	0

312B ONLY

INPUT MODE	TERMINATED
IMPEDANCE Ω	75
BAL/UNBAL	UNBAL
RECEIVER MODE	AM
FREQUENCY TUNING	1 MHz ± 40 Hz

312D ONLY

INPUT IMPEDANCE OHMS	75
METER	NORMAL
METER EXPAND	Any Position
FREQUENCY TUNING	1 MHz ± 40 Hz

b. Connect the CALIBRATED OUTPUT to the input (left-hand BNC for the 312B, 75 ohm connector for the 312D). The meter should indicate 0 dB (-40 dBm). If not, adjust the front panel CAL ADJ until it does. For the

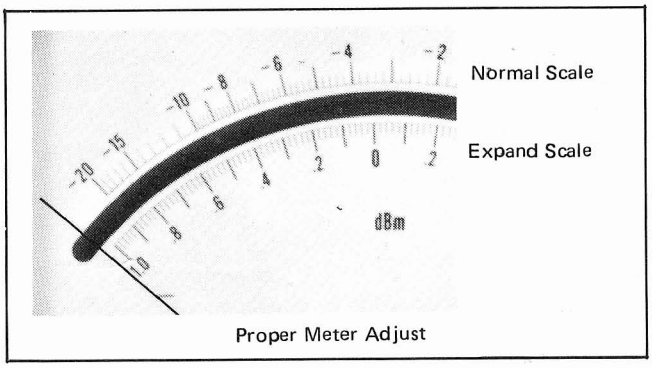


Figure 3-1. Proper Zero Adjustment of Model 312D Meter.

312D, change the METER switch to EXPAND and the METER EXPAND - dB switch to 0. Adjust EXPAND CAL for 0 dB indication.

3-10. Input Overloading.

3-11. Since the input circuits are untuned, the instrument is susceptible to overloading by strong signals, thus causing distortion and erroneous indications. It is important to know the amplitude of the largest signal present at the input. The REFERENCE LEVEL -dBm switch must be set to the first level above the largest signal present.

EXAMPLE:

Level of largest signal present - 21 dBm
Level of signal to be measured - 45 dBm

Correct Settings

REFERENCE LEVEL -dBm	- 20	Optimum Signal to
AMPLITUDE RANGE -dB	- 20	noise without overloading

Incorrect Settings

REFERENCE LEVEL -dBm	- 10	Poor signal to
AMPLITUDE RANGE -dB	- 30	noise ratio
REFERENCE LEVEL -dBm	- 30	Overload
AMPLITUDE RANGE -dB	- 10	

3-12. To avoid overloading the input, the following procedure should be followed:

a. Set the REFERENCE LEVEL -dBm to + 20, AMPLITUDE RANGE -dB to 0 and the RECEIVER MODE to AM.

CAUTION

Signal levels greater than + 23 dBm may damage the instrument.

b. Insert the signal to be analyzed.

c. Determine the amplitude of the largest signal present in the frequency range of 1 kHz to 18 MHz.

d. Set the REFERENCE LEVEL -dBm to the level of the largest signal present.

e. Without changing the REFERENCE LEVEL -dBm switch, tune to the desired frequency and if necessary, adjust only the AMPLITUDE RANGE -dB switch for an on-scale indication.

f. To analyze harmonics of the fundamental frequency, tune the instrument to that frequency and downrange only the AMPLITUDE RANGE -dB switch for an on-scale indication.

3-13. Optimizing Signal-to-Noise Ratio.

3-14. In general, optimum signal-to-noise ratio can be obtained by using the lowest setting of the REFERENCE LEVEL -dBm control without overloading the input and using the AMPLITUDE RANGE -dB control to obtain an on-scale indication. Optimum signal-to-noise will be obtained by following the procedure outlined in Paragraph 3-10, Input Overloading.

3-15. Counter Characteristics.

3-16. When the FREQUENCY RANGE -MHz switch is set to either of the two blank positions between 0 and 17, the entire display will blank. When the switch is on the 0 position and the instrument is tuned below the zero frequency response, the two most significant digits will be 15 and all digits will flash. To aid in interpretation of the display, the most significant digits are blanked whenever they are zero (any display less than 1 MHz).

(1) AMPLITUDE RANGE INDICATOR: Indicates the dBm range set up by the REFERENCE LEVEL and AMPLITUDE RANGE controls. The indicated range corresponds to 0 dBm on the front panel meter. The Amplitude Range Indicator also indicates voltage ranges when the 312B IMPEDANCE Ω switch is set to 50. The voltage range indicated corresponds to full scale indication. When 600 IMPEDANCE is selected the Amplitude Range Indicator will decrease by 10 dB.

(2) REFERENCE LEVEL -dBm: A passive attenuator that sets up the maximum input level to the 312B. This attenuator should always be set to prevent overloading the input amplifier and to maximize signal-to-noise ratio (see Paragraphs 3-10 and 3-12).

(3) AMPLITUDE RANGE -dB: Adjusts the sensitivity of the 312B to the level of the input signal so that an on-scale indication can be achieved on the 312B Meter.

(4) Meter: Indicates absolute power levels in dBm for any impedance selected by the IMPEDANCE Ω switch (17) control. Also indicates voltage level when 50 Ω is selected.

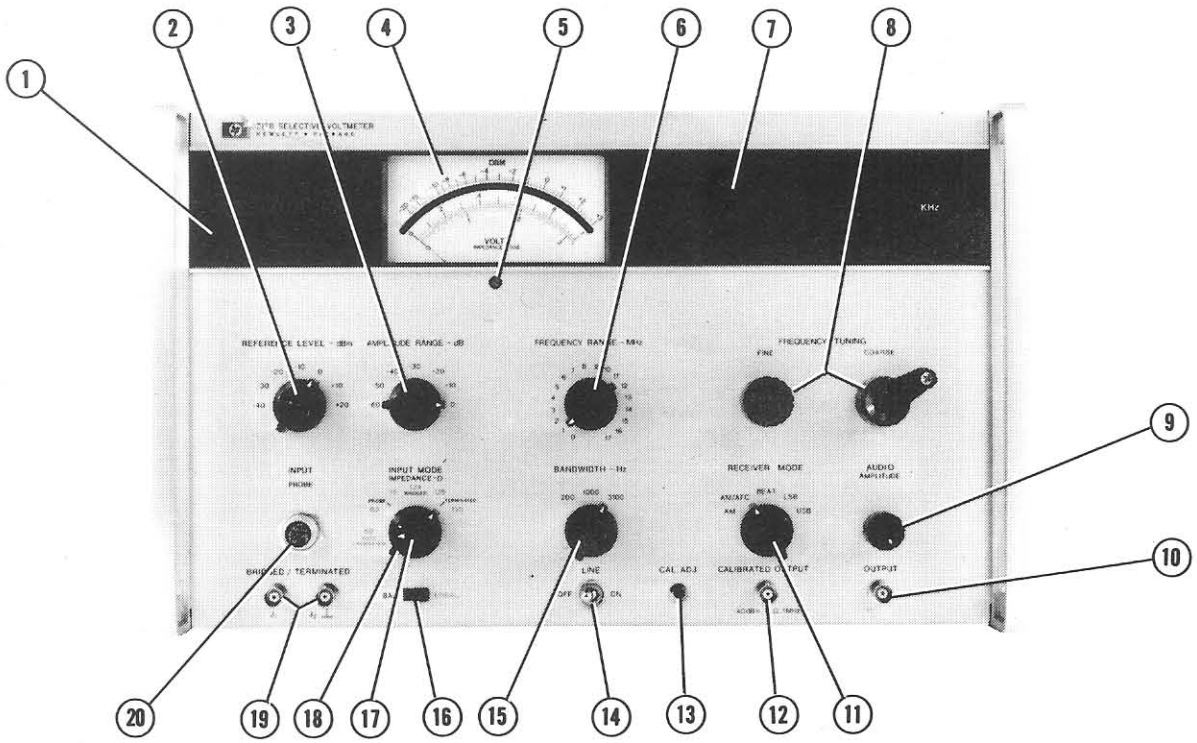
(5) Zero Set Control: Adjusts the mechanical zero position of the meter pointer.

(6) FREQUENCY RANGE -MHz: Selects frequency ranges from 0 to 17 MHz in 1 MHz steps.

(7) Frequency Indicator: Indicates the center frequency of the 312B passband in kHz. When the 312B is tuned to the input signal, the counter indicates the frequency of that signal with a 10 Hz resolution.

(8) FREQUENCY TUNING: Provides continuously variable tuning within the range set up by the FREQUENCY

Figure 3-2. Model 312B Front Panel Controls, Indicators and Connectors.



RANGE -MHz control (6). Both a coarse and fine control are provided.

(9) AUDIO AMPLITUDE: Adjusts the amplitude of the audio signals at the AUDIO jack (10).

(10) OUTPUT: Provides audio signals for aural monitoring in any of the five receiver modes.

(11) RECEIVER MODE: Sets up the instrument to match the type of signal being measured.

a. In the AM position, amplitude modulated signals are detected. These signals drive the meter and are coupled to the AUDIO OUTPUT jack for monitoring.

b. The AM/AFC position differs from AM only in that the local oscillator is locked to the input signal by an AFC circuit. CW signals can also be measured in either position.

c. In the BEAT position, the local oscillator frequency is mixed with the input signal frequency. The difference audio frequency is coupled to the AUDIO OUTPUT jack. This beat frequency can be used as a tuning aid.

d. The LSB and USB positions of the RECEIVER MODE switch are used when measuring single sideband signals. The LSB position is used when measuring lower sideband signals and will reinsert the carrier at f_o - 1.8 kHz. The USB position is used for measuring the upper sideband and will reinsert the carrier at f_o + 1.8 kHz.

(12) CALIBRATED OUTPUT: Provides a square wave calibration signal at 1 MHz whose fundamental amplitude is -40 dBm into 75 ohms to be used to calibrate the instrument.

(13) CAL. ADJ.: When the CALIBRATED OUTPUT (12) is connected to the input (19) the CAL. ADJ. is used to calibrate the instrument to the -40 dBm calibration signal.

(14) ON/OFF: Switches instrument power on or off.

(15) BANDWIDTH Hz: Selects a band of frequencies centered around the frequency to which the instrument is tuned.

(16) BAL/UNBAL Switch: In the UNBAL position, the center conductor of the right-hand BNC connector is grounded. In the BAL position the ground is removed.

(17) IMPEDANCE Ω: Selects internal terminations when the INPUT MODE switch is in the TERMINATED position. It also normalizes the input circuits so that the meter always indicates in dBm regardless of the impedance selected.

(18) INPUT MODE Selector: When the TERMINATED mode is selected, internal terminations are provided and are selected by the IMPEDANCE Ω (17) control. When the BRIDGED position is selected, the input resistance is nominally 10 kilohms unbalanced and 20 kilohms balanced. When the PROBE position is selected, the input comes from the 11530A Probe. The input BNC connectors are switched out of the circuit in the PROBE position.

(19) BRIDGED/TERMINATED Inputs: Permit either balanced or unbalanced measurements. To make unbalanced measurements J1 (left-hand BNC) is used and the BAL/UNBAL switch (16) is placed in the UNBAL position. This shorts the right-hand BNC to ground. For balanced measurements, the BAL/UNBAL switch should be in the BAL position and the signal connected between the two BNC connectors.

(20) INPUT PROBE: Provides operating voltages for the 11530A probe and receives input signals from the probe.

Figure 3-2. Model 312B Front Panel Controls, Indicators and Connectors (Cont'd).

312B OPERATING INSTRUCTIONS

3-17. GENERAL OPERATING INFORMATION (MODEL 312B ONLY).

3-18. The following paragraphs describe some general operating considerations, using the Model 312B. Included are procedures for measuring amplitude modulated (AM), continuous wave (CW), and single sideband (SSB) signals. Refer to Figure 3-2 and 3-3 for an illustration and descriptions of front and rear panel features.

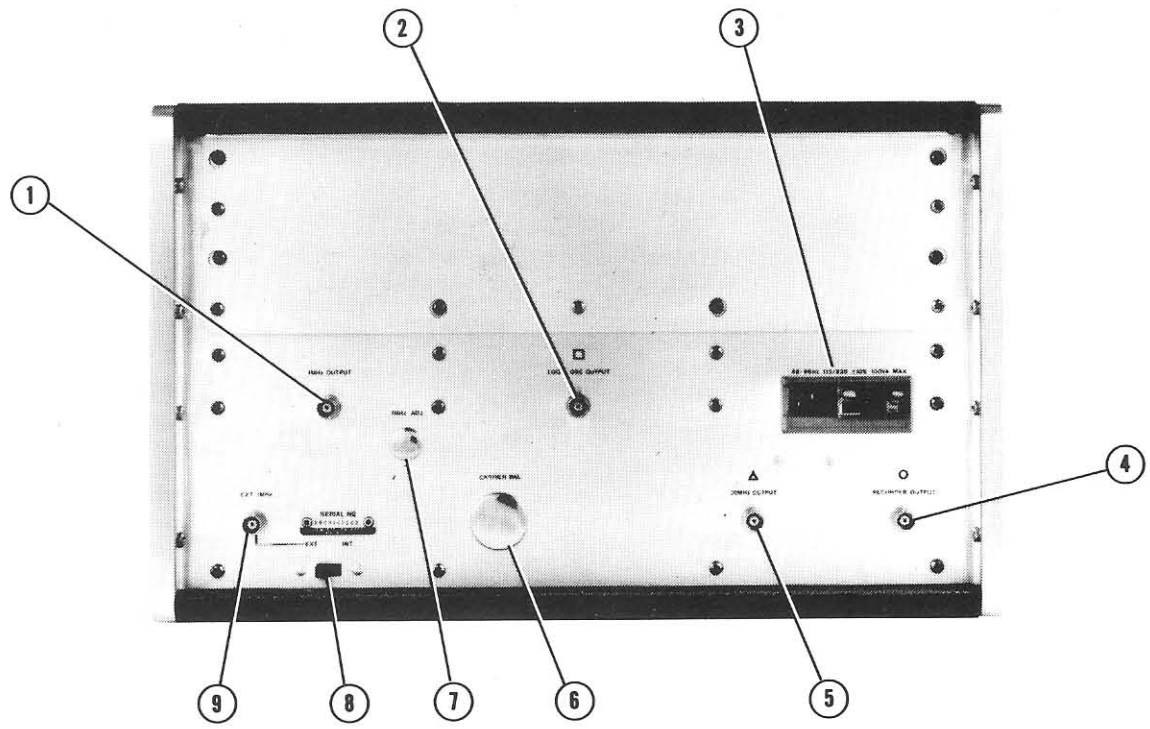
3-19. Before a signal of unknown amplitude is applied to the instrument, set the REFERENCE LEVEL -dBm control to + 20 and the AMPLITUDE RANGE - dB control to 0.

CAUTION

Signal levels greater than + 23 dBm may damage the instrument.

3-20. To make an unbalanced measurement, connect the input signal to the left-hand BNC connector (J1) and set the BAL/UNBAL switch to the UNBAL position. For balanced measurements, connect the input between the two BNC connectors and set the BAL/UNBAL switch to the BAL position.

3-21. Whenever measurements are made in the Balanced Mode, the effects of common-mode voltage can be greatly



(1) 1 MHZ OUTPUT: A 1 MHz signal, 340 mV to 570 mV rms into 1 kΩ, derived from the 312B time base.

(2) LOCAL OSC OUTPUT: The 30 to 48 MHz (50 to 90 mV into 50 Ω) Local Oscillator Frequency is used primarily with the 313A tracking oscillator.

(3) Power Module: Accepts ac power cord for applying power to the instrument. Also contains the fuse and a switch for selecting 115 V or 230 V ac. For 115 V operation, a 1.5 amp slow-blow fuse is installed; for 230 V operation, a 0.75 amp slow-blow fuse is provided in a separate envelope attached to your instrument.

(4) RECORDER OUTPUT: A dc voltage proportional to input level. For a full-scale deflection of the 312B Meter, this dc voltage is 1 volt ± 0.1 volt.

(5) 30 MHz OUTPUT: A 30 MHz signal, 40 mV - 70 mV rms into 50 Ω, is phase locked to the 1 MHz time base. This signal is provided for the 313A Tracking Oscillator.

(6) CARRIER BAL: Access to two carrier balance adjustments.

(7) 1 MHz ADJ: Access to the 1 MHz time base adjustment.

(8) Internal/External Reference Switch: Selects either the EXT 1 MHz external reference or the internal 1 MHz reference.

(9) EXT 1 MHz Connector: Accepts a 1 MHz external reference for the internal Local Oscillator.

Figure 3-3. Rear Panel Controls and Connectors (Model 312B).

reduced. Figure 3-4(a) shows the instrument in the unbalanced mode, connected to an unbalanced source. Any common-mode currents generated in the earth ground line will flow in Channel B but not in Channel A because of the high resistance of R1. Common-mode currents in Channel B will develop a voltage drop across the lead resistance and inductance that is effectively in series with the signal source. Unequal current flow in the two Channels causes a differential voltage across R1 and R2. This differential voltage affects the meter indication. In critical readings this error can be significant.

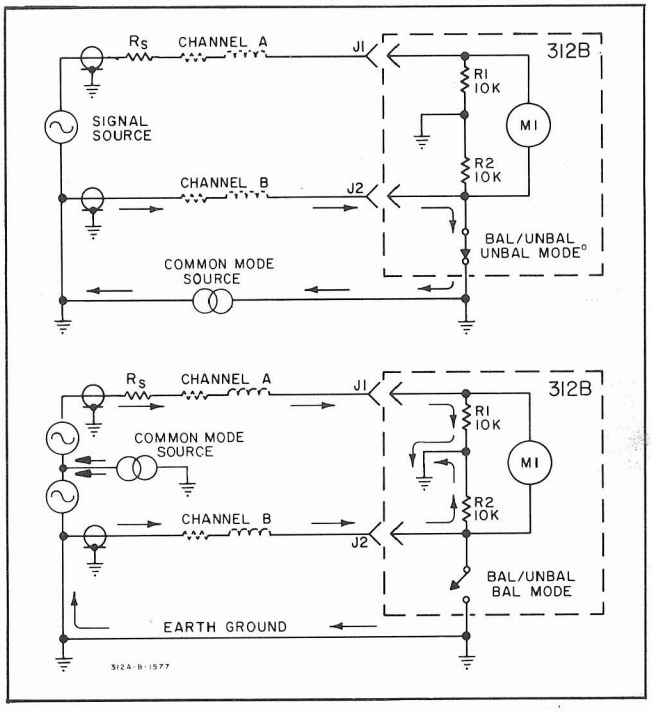


Figure 3-4. Analysis of Common-Mode Currents.

3-22. Figure 3-4(b) shows the instrument in a balanced mode connected to a balanced source. Common-mode currents in the ground line affect both Channels equally. Common-mode currents are suppressed by the high resistance of R1 and R2. Any small currents that do flow through R1 and R2 will be equal in magnitude, opposite in phase, and will be reduced by the common-mode rejection of the instrument.

3-23. If a bridging measurement is to be made, set the INPUT MODE to BRIDGED. If a terminated measurement is to be made, set the INPUT MODE to TERMINATED. In either case, the 312B meter will indicate in dBm provided the impedance Ω switch is set to match the impedance of the circuit under test.

3-24. The instrument is calibrated to indicate volts when the IMPEDANCE -Ω switch is set to 50 VOLTS CALIBRATED. If it is desirable to measure voltage at any other line impedance, set the INPUT MODE to 50 Ω BRIDGED and use an external termination to match the impedance of the circuit under test. Keep in mind, however, that when this is done, the meter will indicate correctly only in volts and not in dBm, and an attenuation insertion loss calibration factor must be used.

3-25. If the approximate frequency of the input signal is not known, set the BANDWIDTH -Hz control to 3100. Set the RECEIVER MODE to AM and use the FREQUENCY RANGE -MHz and FREQUENCY TUNING to tune to the input signal frequency. It may be necessary to downrange the AMPLITUDE RANGE -dB control for an on-scale indication. Once the signal has been located, placing the RECEIVER MODE switch to AM/AFC will keep the Local Oscillator locked to the input signal. If the signal being measured is in the presence of other signals, change the BANDWIDTH -Hz control to a narrower bandwidth so that adjacent signals will not influence the measurement.

3-26. As an additional aid in tuning to an unknown signal frequency, a pair of headphones can be used to monitor the AUDIO output. When the RECEIVER MODE switch is in the BEAT position, an audible signal will be heard when tuned near the input signal. This method allows faster tuning since the signal can be more easily detected in the headphones than on the meter. When tuned to the exact input frequency, a dip will be noted on the meter and a zero beat will be detected in the headphones. The counters will indicate the input frequency with 10 Hz resolution.

3-27. After the signal has been located, place the RECEIVER MODE in AM/AFC. The absolute power level of this signal can now be determined. This level is determined by the setting of the REFERENCE LEVEL -dBm and AMPLITUDE RANGE -dB controls plus the indication on the meter. The REFERENCE LEVEL -dBm and AMPLITUDE RANGE -dB control settings are algebraically added and displayed on the Amplitude Range Indicator. For example, the REFERENCE LEVEL - dBm is set to - 20 dBm, the AMPLITUDE RANGE -dB is set to + 10 and the meter indicates - 7 dBm. The Amplitude Range Indication should indicate a - 10 range. Under these conditions, a 0 dBm on the meter actually corresponds to - 10 dBm. Since the meter indicates - 7 dBm, the actual measured power is - 17 dBm. When measuring low-level signals, the BANDWIDTH -Hz control should be set to 200 Hz provided that the input signal is not drifting more than ± 200 Hz. By using this narrow bandwidth, the effects of wideband noise is reduced by more than a factor of 10.

3-28. The frequency of the input signal can be read from the counters to within approximately ± 35 Hz when the RECEIVER MODE is in AM/AFC. This is true because the bandpass has a very narrow notch in its center and the Local Oscillator frequency is offset by 35 Hz in order to keep the signal out of this notch. If the instrument is set to the AM/AFC RECEIVER MODE and is tuned up toward the signal, the 35 Hz offset will be below the center of the passband. Therefore, the counter will indicate a frequency 35 Hz lower than the frequency of the signal being measured. If tuned down toward the input signal, the 35 Hz offset will appear above the center of the passband. The

counter will indicate 35 Hz above the frequency of the input signal.

3-29. The notch in the center of the passband offers a distinct advantage in that it can be used as an indicator in frequency measurements. To measure frequency more precisely, place the RECEIVER MODE switch to AM and fine tune for a dip in the meter indication. The instrument is then tuned to the center of the passband and the counters will indicate the input signal frequency with a 10 Hz resolution.

3-30. AM MEASUREMENTS.

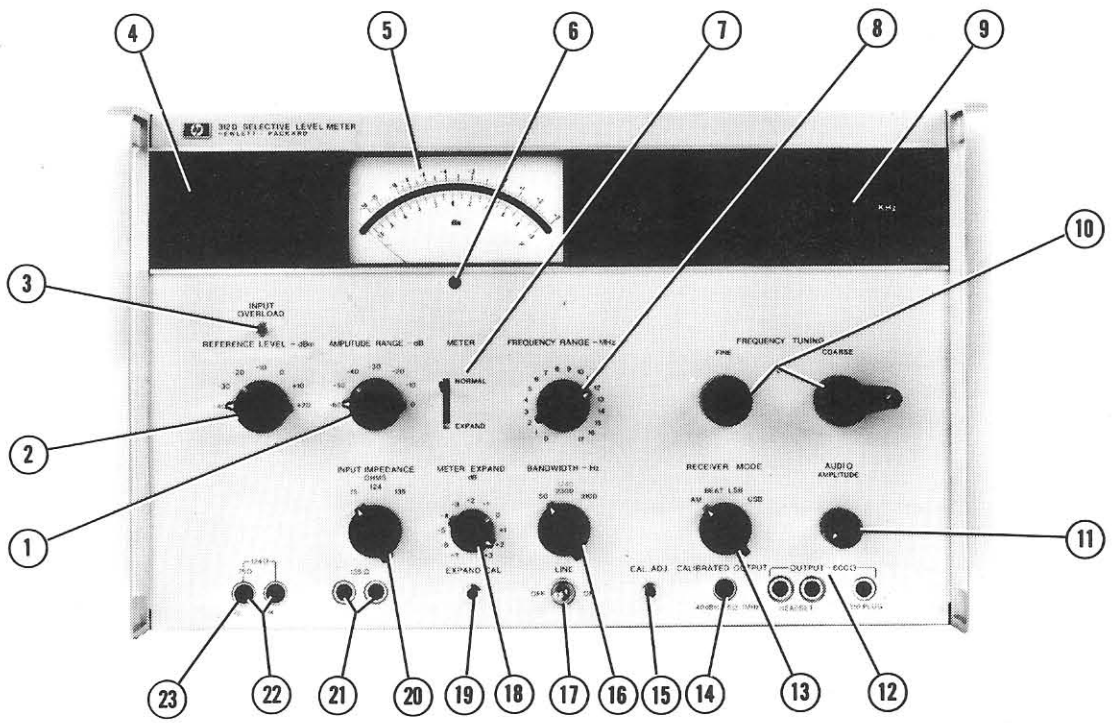
3-31. The procedure for making AM measurements is identical to that for making general measurements. When measuring AM signals, a pair of headphones can be used to monitor the AUDIO OUTPUT. The AUDIO OUTPUT can also be used as an aid in tuning.

3-32. A typical use of the AM position of the RECEIVER MODE switch is to measure the balance of the sideband power in a single tone AM signal. To do this, tune to the carrier frequency plus the modulation frequency and measure the upper sideband power. Now tune to the carrier frequency minus the modulating frequency and measure this signal. The difference between these two readings is an indication of non-linear modulation or the presence of undesirable frequency components.

3-33. SINGLE SIDEBAND MEASUREMENTS.

3-34. The first two requirements in measuring a sideband signal are that the channel carrier frequency must be known and whether the signal is an upper sideband or a lower sideband.

3-35. If an upper sideband measurement is to be made, the RECEIVER MODE switch must be set to the USB position. Next, tune to the channel carrier frequency + 1.8 kHz. For example, assume that an upper sideband measurement is to be made at a channel carrier frequency of 64 kHz. Set the RECEIVER MODE switch to USB. Set the BANDWIDTH -Hz to 3100, the REFERENCE LEVEL -dBm to + 20, and the AMPLITUDE RANGE -dB to 0. Tune to 65.8 kHz (64 kHz + 1.8 kHz) and downrange the REFERENCE LEVEL -dBm for an on-scale indication. If desired, a pair of headphones can be used to monitor the signal. Fine tune for best reception.



(1) RANGE -dB: Adjusts the sensitivity of the instrument to the level of the input signal so an on-scale reading is obtained.

(2) REFERENCE LEVEL -dBm: A passive attenuator that sets up the maximum input level to the instrument. This attenuator controls the INPUT OVERLOAD light and should be set to the lowest range where the OVERLOAD light does not come on.

(3) INPUT OVERLOAD: An input overload of +9 dB or greater turns on the OVERLOAD light. Uprange the REFERENCE LEVEL -dBm (2) until the OVERLOAD light goes out.

Figure 3-5. Model 312D Front Panel Controls, Indicators and Connectors.

3-36. Lower sideband signals can be monitored and measured in the same manner as upper sideband signals except the frequency must be tuned to 1.8 kHz below the channel carrier frequency and the RECEIVER MODE switch placed in the LSB position.

312D OPERATING INSTRUCTIONS

3-37. GENERAL OPERATING INFORMATION (312D ONLY).

3-38. The following paragraphs describe some general operating considerations using the 312D. Although most of the features of the Models 312B and 312D are similar, some procedures will be repeated for simplicity, utilizing features and front panel names as they apply only to the Model 312D. Figures 3-5 and 3-6 illustrate and describe the front and rear panel features of the 312D.

3-39. Before performing any measurements, familiarize yourself with the Preliminary Operating Information as described in Paragraphs 3-3 through 3-15.

3-40. General Measurements.

3-41. The following procedures describe the basic steps in making general frequency and amplitude measurements.

3-42. If the frequency and amplitude of the input signal is unknown, begin by setting the REFERENCE LEVEL control to +20, the RANGE dB control to 0, and the BANDWIDTH to 3100. Tune over the frequency range of interest until an indication is noted on the meter. If there is no indication, downrange the REFERENCE LEVEL -dBm control and again tune over the frequency range of interest. When an indication is noted on the meter, downrange the REFERENCE LEVEL -dBm control to the lowest range where the OVERLOAD light does not come on. Fine tune the frequency control for a maximum indication. If there is a possibility that broadband noise or extraneous signals are present at the input, change the BANDWIDTH control to the narrowest bandwidth that will yield a steady on-scale indication.

3-43. As an additional aid in tuning to an unknown signal frequency, use the built-in speaker or plug a pair of headphones into the AUDIO OUTPUT jack. When the RECEIVER MODE switch is set to the BEAT position, an

(4) AMPLITUDE RANGE INDICATOR: Indicates the dBm range set up by the REFERENCE LEVEL and RANGE controls. The indicated range corresponds to 0 dBm on the meter.

(5) METER: The top scale indicates absolute power levels at any INPUT IMPEDANCE OHMS (20) position. The bottom scale is an expanded scale with a 2 dB full scale swing.

(6) ZERO SET: Mechanically sets the meter. Adjust this until the meter pointer rests on the left edge of the minus (-) sign.

(7) METER NORMAL/EXPAND: Determines whether the top or bottom scale on the meter is used.

(8) FREQUENCY RANGE -MHz: Selects frequency ranges from 0 thru 17 in 1 MHz steps.

(9) FREQUENCY COUNTER: Indicates the center frequency of the bandpass in kHz with 10 Hz resolution.

(10) FREQUENCY TUNING: Provides continuously variable tuning within the range set up by the FREQUENCY RANGE -MHz (8) control.

(11) AUDIO AMPLITUDE: Adjusts the level of the audio output at the jacks or speaker.

(12) OUTPUT - 600 Ω: Interrupts the speaker and transfers the audio output to an external receiver. Maximum output level is at least +14 dBm into 600 ohms.

(13) RECEIVER MODE: Conditions the input circuits to match the type of signal being measured.

a. In the AM mode, Amplitude modulated signals are detected. These detected signals drive the meter. They are also coupled to the speaker or the audio output jacks.

b. In the BEAT mode the local oscillator frequency is mixed with the input signal frequency. The resulting audio can be used as an aid in tuning.

c. The LSB (Lower Sideband f_o - 1.8 kHz), and USB (Upper Sideband f_o + 1.8 kHz) are used to reinsert the carrier when measuring single sideband signals.

(14) CALIBRATED OUTPUT: Provides a square wave output signal at 1 MHz whose fundamental amplitude is -40 dBm into 75 Ω, used to calibrate the instrument.

(15) CAL. ADJ.: When the CALIBRATED OUTPUT (14) is connected to the 75 Ω input (23), the CAL. ADJ. is used to calibrate the instrument to -40 dBm into 75 Ω.

(16) BANDWIDTH -Hz: Determines the selectivity of the instrument.

(17) LINE: LINE Switch turns the instrument power on or off.

(18) METER EXPAND dB: Steps the Expand Meter Mode in 1 dB steps.

(19) EXPAND CAL: Calibrates the expand portion of the meter.

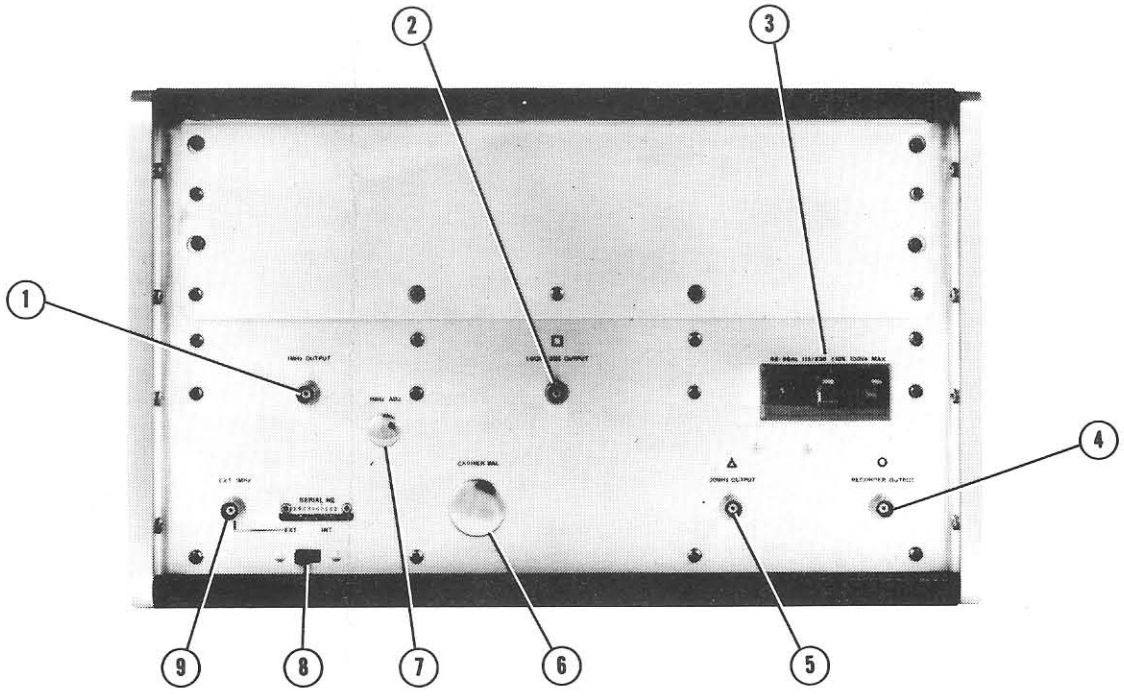
(20) INPUT IMPEDANCE OHMS: Selects termination impedances provided internally. It also normalizes the input circuits so that the meter always indicates in dBm regardless of the impedance selected.

(21) 135 Ω: Balanced, terminated signal input.

(22) 124 Ω: Balanced, terminated signal input.

(23) 75 Ω: Unbalanced, terminated signal input connector.

Figure 3-5. Model 312D Front Panel Controls, Indicators and Connectors (Cont'd).



(1) 1 MHz OUTPUT: A 1 MHz signal, 340 mV to 570 mV rms into 1 kΩ, derived from the 312D time base.

(2) LOCAL OSC OUTPUT: The 30 to 48 MHz (50 to 90 mV into 50 Ω) Local Oscillator Frequency is used primarily with the 313A tracking oscillator.

(3) Power Module: Accepts ac power cord for applying power to the instrument. Also contains a fuse and a switch for selecting 115 V or 230 V operation. For 115 V operation, a 1.5 amp slow-blow fuse is installed; for 230 V operation, a 0.75 amp slow-blow fuse is provided in a separate envelope attached to your instrument. 115 V/230 V Switch sets up the input power circuitry to accept either 115 V ac or 230 V ac. The selected line voltage will be indicated.

(4) RECORDER OUTPUT: A dc voltage proportional to input level. For a full-scale deflection of the 312D Meter, this dc voltage is 1 volt ± 0.1 volt.

(5) 30 MHz OUTPUT: A 30 MHz signal, 40 mV - 70 mV rms into 50 Ω, is phase locked to the 1 MHz time base. This signal is provided for the 313A Tracking Oscillator.

(6) CARRIER BAL: Access to two carrier balance adjustments.

(7) 1 MHz ADJ: Access to the 1 MHz time base adjustment.

(8) Internal/External Reference Switch: Selects either the EXT 1 MHz external reference or the internal 1 MHz reference.

(9) EXT 1 MHz Connector: Accepts a 1 MHz external reference for the internal Local Oscillator.

Figure 3-6. Rear Panel Controls and Connectors.

audible tone will be heard when the 312D is tuned near the input signal. This method allows faster tuning since the beat note can be more easily detected than the meter deflection.

3-44. To determine the absolute power level of this signal, first switch the RECEIVER MODE switch to AM and tune for the maximum meter reading. Add the resulting meter indication to the indication on the Amplitude Range Indicator (to the left of the meter). This sum is the absolute power level. If, for example, the meter reads - 7 dBm, and the - 10 Range Indicator is lit, the power level is - 17 dBm. Use the narrowest practical BANDWIDTH -Hz setting to exclude as much wideband noise as possible.

3-45. To measure frequency, set the RECEIVER MODE switch to AM and tune for the sharp dip in the center of its passband. The counter will then indicate the input signal frequency with 10 Hz resolution.

3-46. AM Measurement.

3-47. A typical use of the AM position of the RECEIVER MODE switch is to measure the balance of the sideband power in a single tone AM signal. To do this, tune to the carrier frequency plus the modulation frequency and measure the upper sideband power. Now tune to the carrier frequency minus the modulating frequency and measure this signal. The difference between these two readings is an indication of non-linear modulation or the presence of undesirable frequency components.

3-48. Single Sideband Telephone Channel Measurements.

3-49. The first two requirements in measuring a sideband signal are that the channel carrier frequency must be known and whether the signal is an upper sideband or a lower sideband.

3-50. If an upper sideband measurement is to be made, the RECEIVER MODE switch must be placed in the USB position. Next, tune to the channel carrier frequency plus 1.8 kHz. For example, assume that an upper sideband measurement is to be made at a channel carrier frequency of 64 kHz. First, set the RECEIVER MODE switch to the USB position. Set the BANDWIDTH -Hz control to 3100 and set the REFERENCE LEVEL -dBm attenuator as described in Paragraph 3-43. Tune to 65.8 kHz (64 kHz + 1.8 kHz) and if necessary, downrange the RANGE -dB control until an on-scale indication is obtained on the meter.

3-51. If desired, a pair of headphones can be used to monitor the signal. Fine tune for the best reception.

3-52. Lower sideband signals can be monitored and measured in the same manner as upper sideband signals except the frequency must be tuned to 1.8 kHz below the channel carrier frequency and the RECEIVER MODE switch placed in the LSB position.

3-53. APPLICATIONS.

3-54. The following paragraphs describe some typical applications using the Model 312B Selective Voltmeter and the Model 312D Selective Levelmeter. Some of the applications apply to both models, while others are unique to a particular model. The applicable model number(s) will be listed in the paragraph heading.

3-55. Harmonic Distortion Tests (312B/D).

3-56. One of the most important tests of an amplifier is its ability to faithfully reproduce its input waveshape at the output. Nonlinear operation of an amplifier causes frequency components to appear in the output that were not present at the input signal.

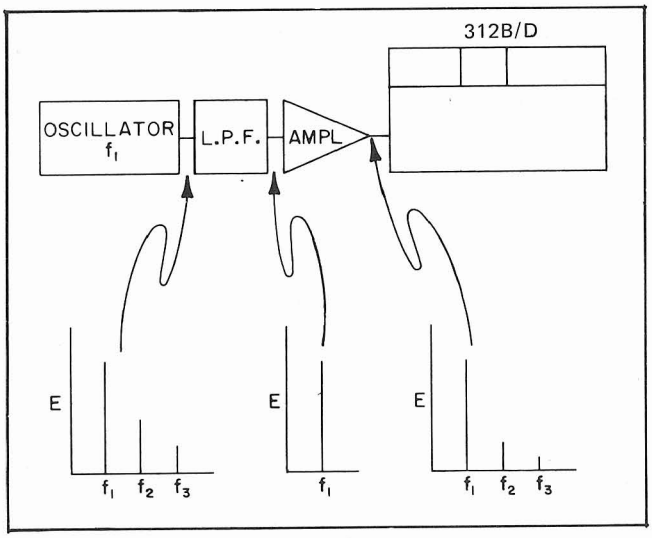


Figure 3-7. Harmonic Distortion Test.

3-57. Figure 3-7 shows a simple test setup for checking harmonic distortion. In this setup, the oscillator is used to supply the fundamental frequency f_1. The low pass filter provides sharp cutoff just above f_1 to insure that the input signal to the amplifier is clean and free of higher order harmonics. Any harmonics present in the output are contributed by the amplifier.

3-58. First tune to f_1 to establish a reference. Next tune to f_2, f_3, f_4, etc., and the amplitude of these harmonics measured. Total harmonic distortion can be computed by the equation:

$$\text{Harmonic Distortion} = 100 \frac{\sqrt{E_2^2 + E_3^2 + E_4^2 + \ldots .}\ \%}{E_1}$$

3-59. Intermodulation Distortion (312B/D).

3-60. Another method of testing an amplifier for distortion is the intermodulation method. There are two widely used methods of measuring intermodulation distortion, the CCIF (International Telephonic Consultive Committee) method and the SMPTE (Society of Motion Picture and Television Engineers) method.

3-61. In the CCIF method of measuring intermodulation distortion, two signals of equal amplitude but slightly different in frequency are used. These two signals, f_a and f_b, are applied to the input of the amplifier under test through a 6 dB pad as shown in Figure 3-8. Frequency components of the two signals will mix due to nonlinearity of the amplifier.

3-62. Use the 312B/D to measure the result of this mixing (as shown graphically in Figure 3-9). Intermodulation distortion is defined by the equation.

$$\%\ \text{Distortion} = 100 \frac{E_d}{E_a + E_b}$$

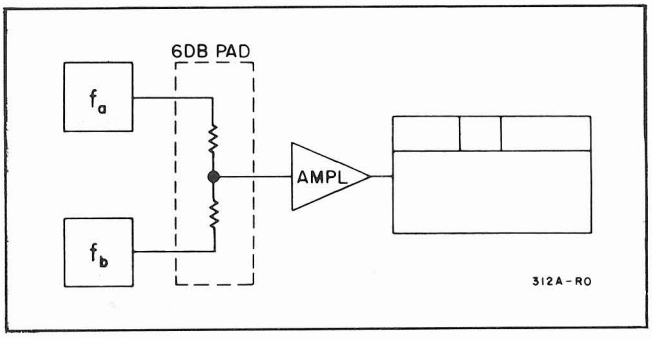


Figure 3-8. Intermodulation Distortion Test Setup.

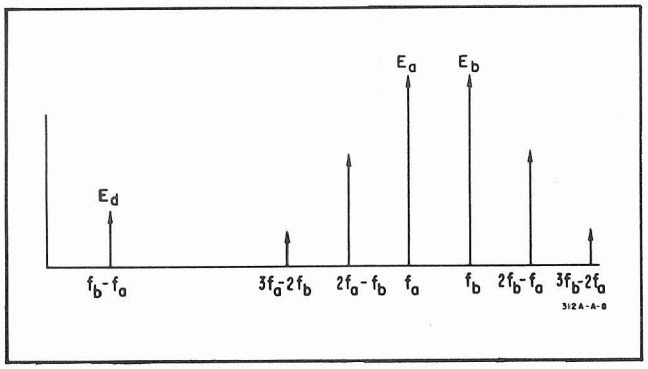


Figure 3-9. Intermodulation Distortion Products CCIF Method.

3-63. In the SMPTE method of measuring distortion, two signals are used, one approximately 50 times higher in frequency than the other. Nonlinearity in the amplifier causes mixing of the two fundamental frequencies. Harmonics of the lower frequency will also be generated, which mix with the higher frequency. These intermodulation products are shown in Figure 3-10. Intermodulation distortion is defined as:

$$\% \text{ Distortion} = 100 \frac{\sqrt{(a_1 + a_2)^2 + (b_1 + b_2)^2 + \ldots\ldots}}{E_2}$$

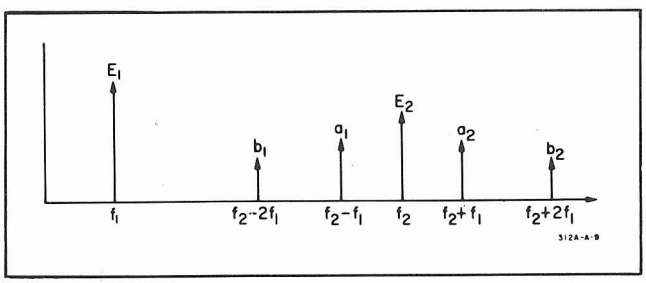


Figure 3-10. Intermodulation Distortion SMPTE Method.

3-64. Flatness Test (312B/D).

3-65. The flatness of an amplifier or even an entire system can be accurately determined to within 0.1 dB when utilizing the 313A Tracking Oscillator and 312B/D. To test the flatness of a system, connect the equipment as shown in Figure 3-11 and set up the 313A to track the 312B/D meter indication (refer to the 313A Operating and Service Manual). If using a 312D, the meter switch must be set to NORMAL.

a. Place S1 (Figure 3-11) in the measure position and tune the 312B/D to the reference frequency.

b. Adjust the 313A and 312B/D attenuators for a reference indication on the 312B/D meter.

c. Adjust the 313A SCALE OFFSET for a zero center scale reference.

d. Place S1 in the COMPARE position and use the precision attenuator to bring the 312B/D and 313A Meter back to the reference indication. The system gain will be that indicated on the precision attenuator.

e. Repeat Steps a through d at each frequency of interest.

3-66. For less critical applications flatness can be measured directly using the 312B/D and 313A. Set up the 313A for tracking operation and tune the 312B/D through the desired frequency range. Use the 313A attenuators in place of the precision attenuators in Figure 3-11.

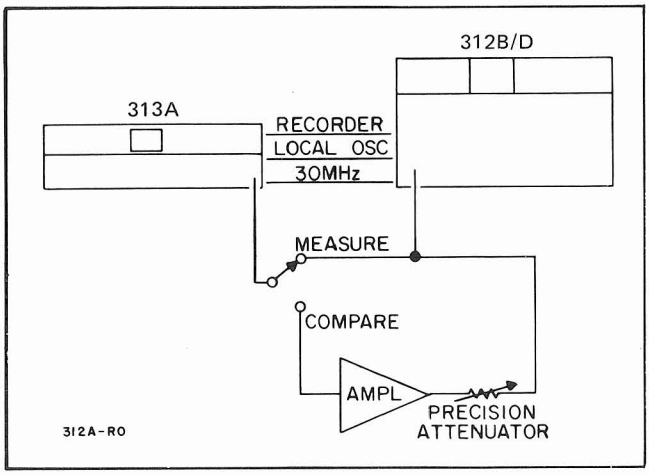


Figure 3-11. Flatness Test Setup.

3-67. Noise Measurements (Model 312B).

3-68. The 312B is particularly useful in making noise measurements. The low internal noise of the 312B allows noise measurements down to typically - 130 dBm on the 200 Hz bandwidth, 600 Ω impedance or - 120 dBm on all other impedances. The 312B Option 01 offers the advantage of being able to measure noise on the telephone carrier channels without interference or influence from adjacent channel carrier. This is accomplished by "notching out" the adjacent channel carriers at plus and minus 2 kHz from the 312B tuned frequency (Figure 3-12). The following paragraphs describe the method of measuring the noise on telephone carrier channels.

3-69. Measuring Noise on Telephone Carrier Channels (Model 312B Only).

3-70. In long haul telephone transmission, signals are constantly being introduced from various sources. It is therefore very important that a capability exist for measuring the noise on telephone carrier channels. The 312B Option 01 was designed for this purpose.

3-71. To measure the noise on a telephone carrier channel, first choose a channel that is not occupied and determine its frequency. It should also be determined whether this channel is erect or inverted.

3-72. Set the 312B BANDWIDTH -Hz to 3100, RECEIVER MODE to AM and the INPUT MODE to BRIDGED. Set the remainder of the controls for level measurements.

3-73. Connect the 312B to the circuit under test and tune the 312B. If the channel under test utilizes the upper sideband, tune the 312B to exactly 2 kHz above the channel carrier frequency. Conversely, if the channel under test utilizes the lower sideband, tune the 312B 2 kHz below the channel carrier frequency. For example, assume that noise is to be measured on the carrier channel at 100 kHz. Since this channel normally utilizes the upper sideband, tune the 312B to exactly 102 kHz. Downrange the AMPLITUDE RANGE -dB and REFERENCE LEVEL -dBm controls as required for an on-scale meter indication.

3-74. Steady Noise Measurements in dBrnC0 (Model 312D Only).

3-75. The 312D incorporates a 2.3 kHz bandwidth (at the 3 dB points) which allows direct "C" Message noise measurements in a voice channel. Noise measured in dB above - 90 dBm in expressed in dBrn, and when it is "C" Message weighted and referenced to a 0 TLP (Transmission Level Point) is expressed in dBrnC0 measurement. The following is a technique for dBrnC0 measurements.

a. Place a 1 kHz tone at the proper TLP in the transmit side of the voice channel under test.

b. Select the proper channel in the frequency plan and offset the 312D by 1 kHz.

1. In lower sideband mode, subtract 1 kHz.

2. In upper sideband mode, add 1 kHz.

c. Measure the level of the tone using the 2300 bandwidth.

d. Record the 1 kHz tone; then remove the tone.

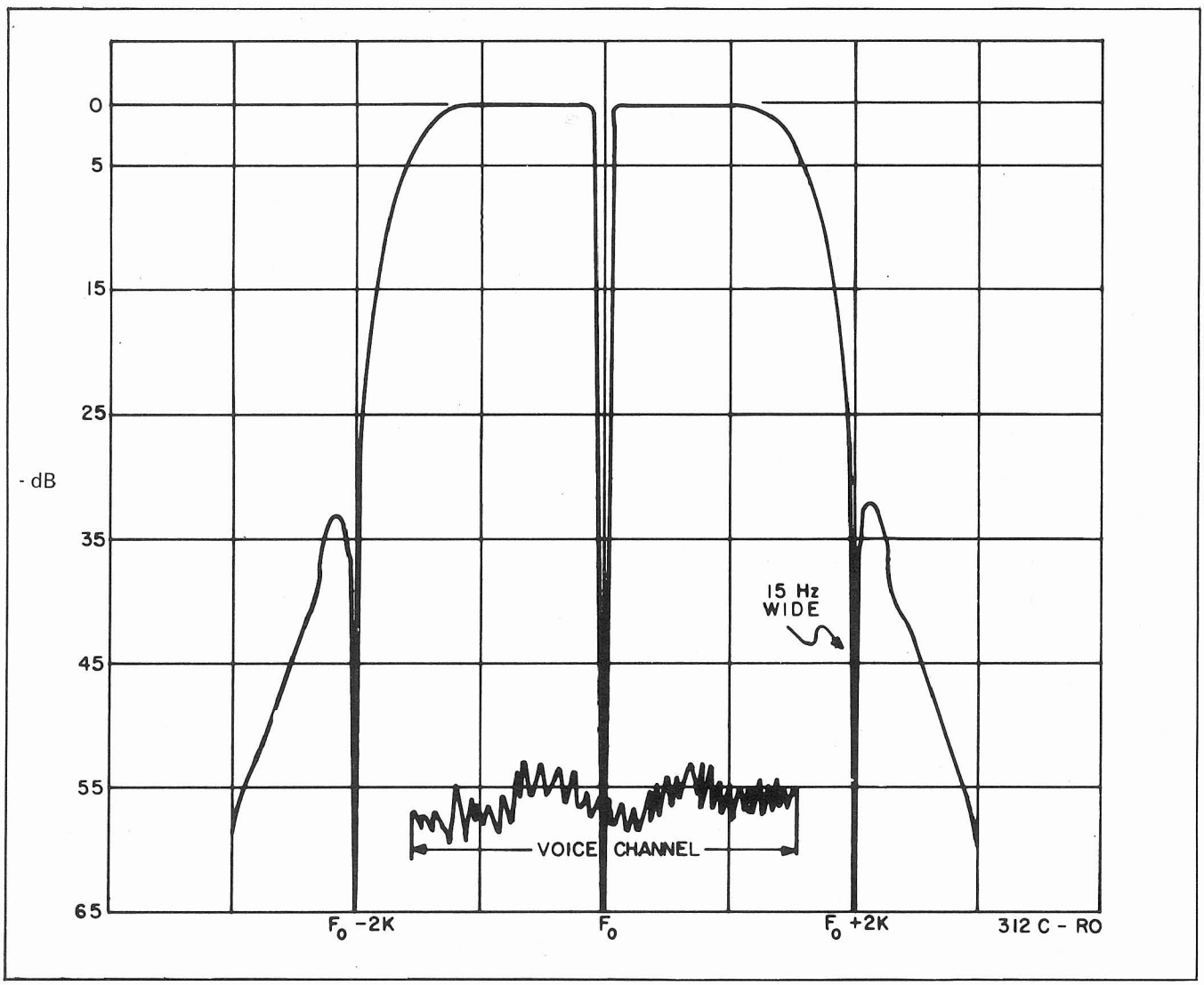


Figure 3-12. Model 312B Option 01 and Standard Model 312D Bandpass Characteristics.

e. Downrange the 312D attenuators until an on-scale noise measurement is obtained.

NOTE

It is best to avoid the upper one-third of the meter scale during noise measurements since clipping can occur in the meter detector.

f. Record the noise reading.

g. Subtract the signal reading from the noise reading algebraically; then add the result to 90.5 to obtain the answer in dBrnC0.

Example:

Noise reading	- 86.5
Signal reading	(-) - 32.2 dBm
S/N Ratio	- 54.3
Conversion factor	90.5
S/N Ratio	54.3
dBrnC0	36.2

3-76. Impulse Noise Measurement.

3-77. Impulse noise should be measured after completing a steady noise measurement.

a. Follow the procedure outlined in the STEADY NOISE MEASUREMENTS in dBrnC0.

b. Be sure the meter reading is in the lower one-third of the meter scale to avoid noise peak clipping.

c. Connect an external NMS (Noise Measuring Set) to the audio output (310 plug) and adjust the AMPLITUDE control for the proper input to the external NMS.

d. Follow the procedures on the NMS for measuring impulse noise.

3-78. Phase Jitter Measurement.

3-79. Place a 1 kHz tone at the proper TLP in the voice channel under test and proceed as follows:

a. Obtain an on-scale meter reading (use the 2300 bandwidth and BEAT receiver mode).

b. Offset the 312D frequency by 800 Hz so that the audio output tone is shifted from 1800 Hz to 1000 Hz.

1. In upper sideband subtract 800 Hz.

2. In lower sideband add 800 Hz.

c. Connect an external Phase Jitter Meter Test Set to the output jack (310 plug) and adjust the AMPLITUDE control for the proper output level.

d. Follow the phase jitter measurement procedure outlined by the phase jitter test set manufacturer.

3-80. Expand Meter Reading (Model 312D Only).

3-81. Follow this procedure to better perceive small level variations of a signal. In the METER EXPAND mode, it is possible to resolve changes of .02 dB on the 312D Meter.

a. Obtain an on-scale NORMAL meter reading.

b. Set the METER EXPAND attenuator to within 1 dB of the NORMAL meter reading.

c. Switch the METER NORMAL/EXPAND switch to EXPAND. The lower meter scale will light and the reading will be on-scale.

3-82. If, for example, the meter reading of Step a were 4.3 dB, set the METER EXPAND switch to either 4 or 5 dB. Next, set the METER EXPAND/NORMAL switch to EXPAND. Variations in signal level as small as .02 dB can now be resolved.

SECTION IV
THEORY OF OPERATION

4-1. INTRODUCTION.

4-2. This section of the manual contains information necessary for an understanding of the theory of operation of the Models 312B/D. Included is a block diagram description and detailed circuit description. Since both models are very similar, the theory will be integrated, calling out those areas that are different for a specific instrument.

4-3. GENERAL DESCRIPTION.

4-4. The Model 312B/D measures the frequency and amplitude of continuous wave (CW), amplitude modulated (AM), and single sideband (SSB) signals in the frequency range of 1 kHz to 18 MHz. The instrument functions very much like a tuned receiver, i.e., the input signal is mixed with a local oscillator frequency to produce an intermediate frequency (IF). The resulting amplitude is displayed on a meter and the frequency is displayed by an internal frequency counter.

4-5. BLOCK DIAGRAM DESCRIPTION.

4-6. Refer to Figure 4-1 for the following description.

4-7. Input Circuits (312B Only).

4-8. The input circuitry (Figure 4-2) is necessary to condition the signal for processing. The input circuitry allows a choice of balanced or unbalanced inputs that can be either terminated or bridged. Provisions are included for the use of the -hp- Model 11530A probe. When operated in the terminated mode a choice of any one of the popular impedances is available. The input attenuator (REFERENCE LEVEL) provides the necessary attenuation to prevent overloading the input amplifier.

4-9. The input can be applied either through BNC connector or through the 11530A Probe. When utilizing the BNC inputs, set the INPUT MODE switch to any position except PROBE.

4-10. For unbalanced inputs, the signal is applied to the left BNC connector. The BAL/UNBAL switch should be in the UNBAL position. This grounds the center conductor on the right BNC. For balanced inputs, the BAL/UNBAL switch should be set to BAL and the balanced input signal applied to both BNC connectors.

4-11. When the INPUT MODE switch is set to TERMINATED, the input signal is terminated in the impedance selected by the IMPEDANCE Ω switch. In the 50 position of the IMPEDANCE Ω switch, the voltage level of the input signal can be read on the meter. When the INPUT MODE is set to BRIDGED, the input impedance is 10 kΩ unbalanced and 20 kΩ balanced. When the PROBE mode is selected an impedance should be selected to match the impedance of the circuit under test.

4-12. The REFERENCE LEVEL attenuator adjusts the level of the input signal to prevent overloading of the

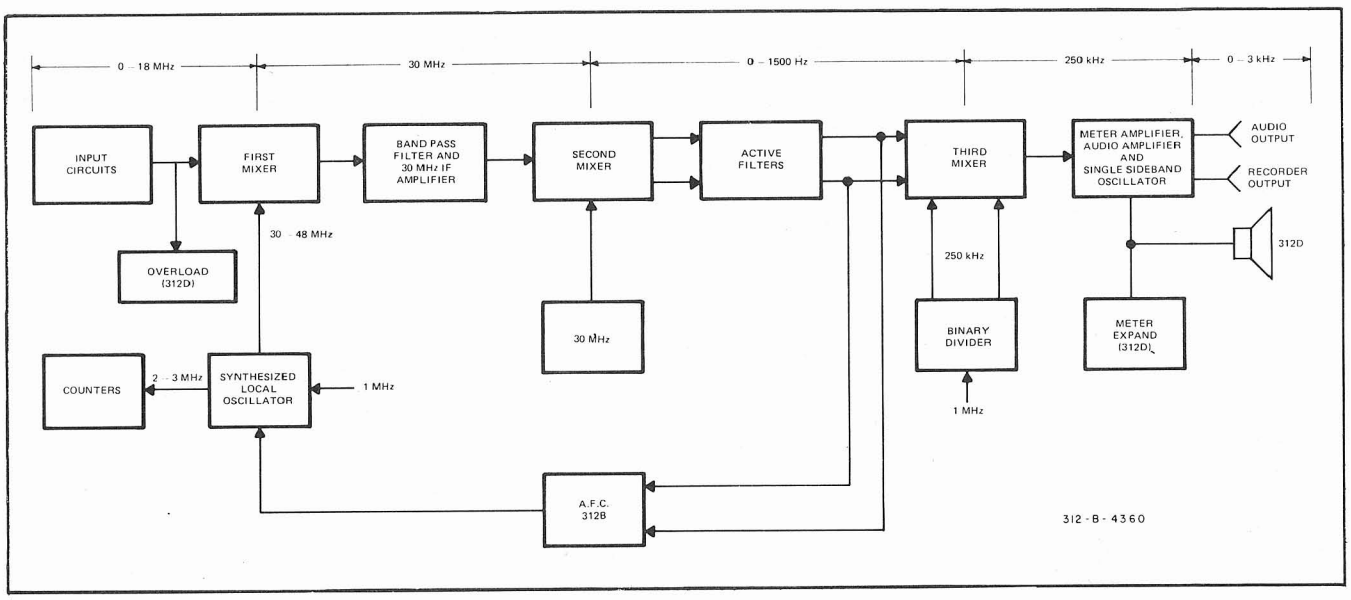


Figure 4-1. 312B/D Simplified Block Diagram.

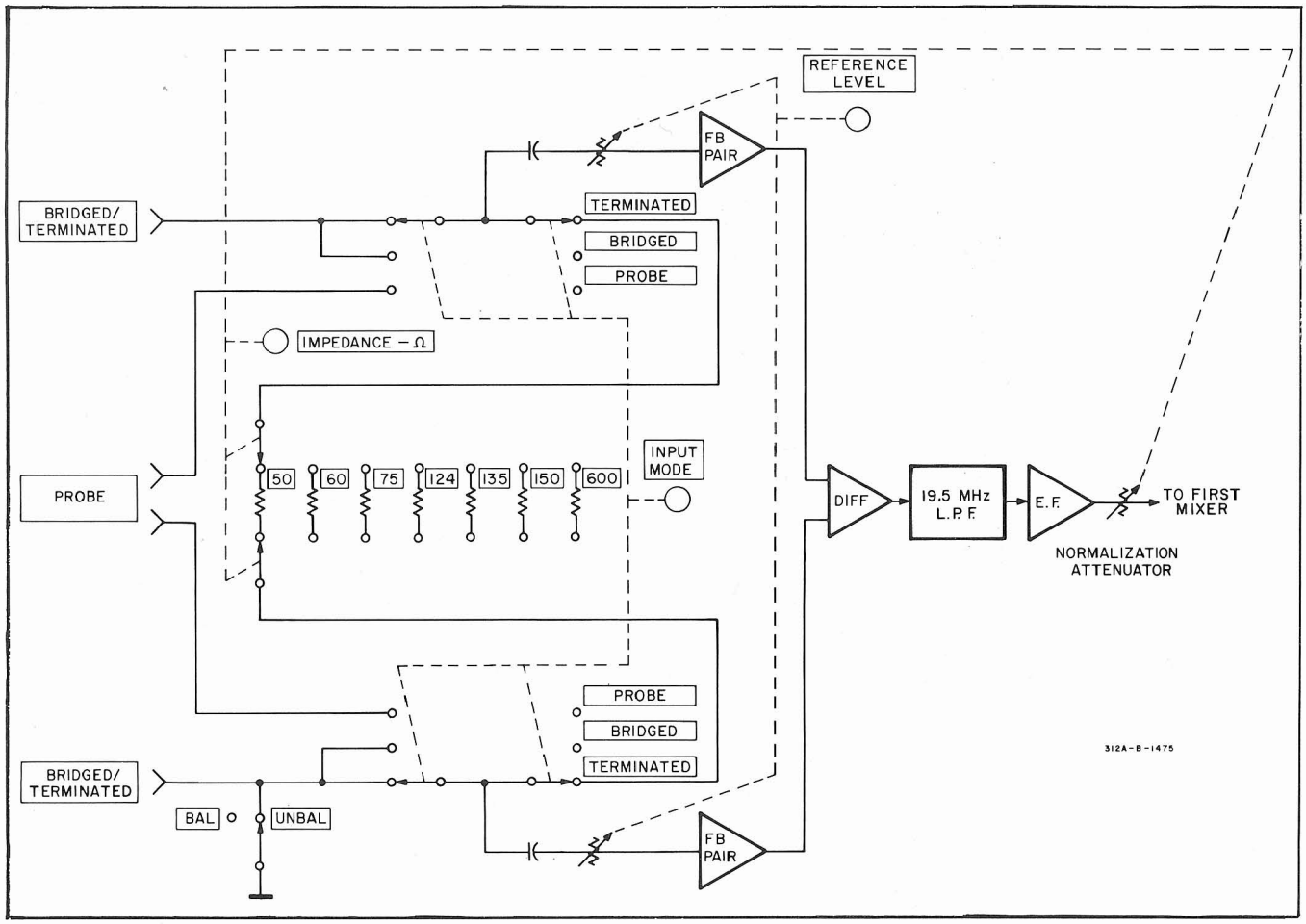


Figure 4-2. Simplified Input Circuit (312B Only).

untuned input amplifier. Since the input amplifier is untuned it is susceptible to overloading by extraneous signals. For this reason the REFERENCE LEVEL attenuator should be set to the level of the highest signal expected to be present. To check for overloading, refer to Paragraph 3-10.

4-13. The output of the REFERENCE LEVEL attenuator is coupled to the Input Amplifier Assembly which is untuned. The input to this amplifier can be either balanced or unbalanced depending upon the setting of the BAL/ UNBAL switch. The output is single ended and drives the 19.5 MHz Low Pass Filter.

4-14. The output of the 19.5 MHz Low Pass filter is coupled through the impedance switch where normalizing attenuators can be selected to match the impedance of the source being measured. These attenuators are required so that the meter will always indicate DBM.

4-15. Input Circuits (312D Only).

4-16. The input circuits for the 312D (Figure 4-3) are similar to the input circuits for the 312B. The primary differences are:

a. Available input impedances are 75 ohms, 124 ohms and 135 ohms. These are always terminated. The 75 ohm input is always unbalanced. Balanced measurements can only be made at 124 ohm and 135 ohm impedances.

b. There is no capability for using the Model 11530A Input probe.

c. The 312D has an overload detector prior to the first mixer, which warns the operator of an overload when the input to the Input Amplifier and Mixer exceeds a fixed level.

4-17. First Mixer.

4-18. After processing by the input circuits the signal is coupled to the First Mixer Assembly, A31. Here the input signal (1 kHz to 18 MHz) is mixed with the LOCAL OSCILLATOR (30 MHz - 48 MHz) to produce a 30 MHz IF. The First Mixer Assembly also contains an output amplifier which couples the Local Oscillator signal to an output jack located on the rear panel. This signal is one of three signals used by the 313A Tracking Oscillator.

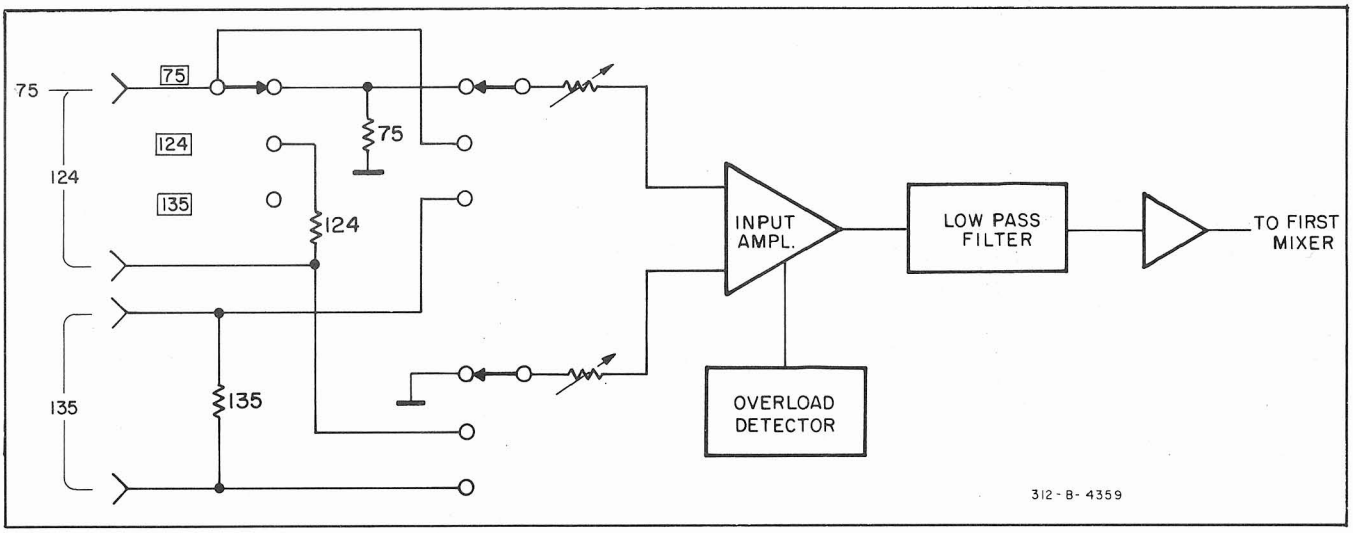


Figure 4-3. Simplified Input Circuit (312D Only).

4-19. Local Oscillator.

4-20. The purpose of the Local Oscillator is to produce a range of frequencies between 30 MHz and 48 MHz. The oscillator operates at a frequency 30 MHz above the input signal, which is in the range of 1 kHz to 18 MHz.

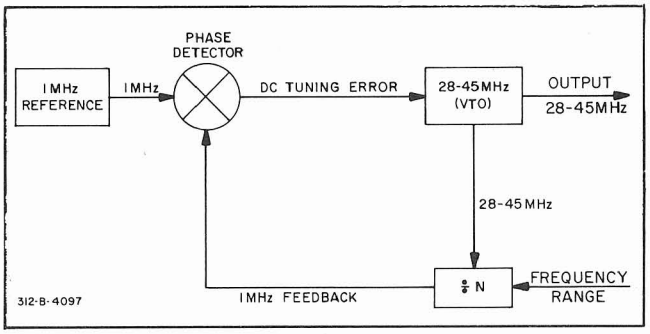


Figure 4-4.Simplified Block Diagram of the Step Lock Loop.

4-21. The Local Oscillator consists of two phase lock loops, a summation Loop and a Step Lock Loop. The Step Lock Loop is phase locked to a 1 MHz reference frequency. The Summation Loop is referenced to the Step Lock Loop and a Variable Frequency Oscillator.

4-22. Figure 4-4 illustrates a simplified block diagram of the Step Lock Loop. When the loop is phase locked, the 1 MHz feedback will be exactly equal in frequency to the 1 MHz reference. Therefore the VTO can be tuned to any integer multiple of the reference frequency. As shown in Figure 4-4, the VTO oscillates at an exact multiple of 1 MHz, in the frequency range of 28 to 45 MHz. The 28 to 45 MHz signal is divided by the number N (determined by the setting of the frequency range switch) such that the ÷ N Counter output is always 1 MHz when the loop is stabilized. When the two inputs to the Phase Detector are not at the same frequency, an error signal is produced to tune the VTO until they are at the same frequency.

4-23. Figure 4-5 illustrates a simplified block diagram of the Summation Loop. Basic operation of this loop is the same as the Step Lock Loop. The primary difference is that the 2 - 3 MHz difference frequency between the 28 - 45 MHz oscillator and the 30 - 48 MHz oscillator is phase locked to the 2 - 3 MHz VFO.

4-24. The reference frequency for the Summation Loop comes from the 2 - 3 MHz VFO. Tuning within the 2 - 3 MHz range is accomplished by the front panel frequency tuning control. The offset frequency comes from the Step Lock Loop. The 2 - 3 MHz feedback signal is derived by mixing the 28 - 48 MHz signal from the Step Lock Loop with the 30 - 48 MHz signal from the First Local Oscillator. The difference frequency is in the range of 2 - 3 MHz. The phase detector provides the signal information required to ensure that the Local Oscillator frequency is the sum of the 28 - 45 MHz Step Lock frequency and the 2 - 3 MHz VFO frequency, thus providing an oscillator with essentially infinite resolution in the range of 30 to 48 MHz.

4-25. The Step Lock Loop functions as already described. Figure 4-6 has been expanded to show more detail. The 1 MHz reference frequency is derived from the 1 MHz Crystal Oscillator. Thus, the entire Local Oscillator is

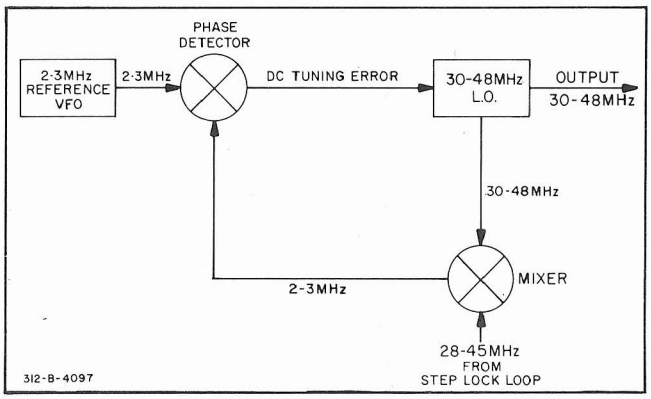


Figure 4-5.Simplified Block Diagram of the Summation Loop.

referenced to this stable oscillator. A low pass filter has been added to the output of the Step Lock Phase Detector to filter the dc control voltage. The ÷ N Counter divides the VTO frequency by some number (determined by setting of the frequency range switch) such that the output is always 1 MHz when the loop is locked.

4-26. The Summation Loop in Figure 4-6 has been expanded to show low pass filters at the output of the Phase Detector, the Summation Loop Mixer, the Summing Amplifier, and the pretune line from the Step Lock Loop. The low pass filter at the output of the Summation Loop Mixer passes only the difference frequency from the Summation Loop Mixer. The filter at the output of the Summation Amplifier filters the dc tuning voltage before being applied to the First Local Oscillator. Any noise or frequency components on the tuning voltage can cause sidebands or FM on the Local Oscillator output. The Summation Amplifier combines the dc error voltage from the Summation Loop with the dc pretune voltage from the Step Lock Loop. If either of these error voltages change, the Local Oscillator frequency will change. The error voltage from the Summation Loop changes when the frequency tuning control is changed. The pretune voltage from the Step Lock Loop changes when the frequency range is changed.

4-27. To illustrate how the loops function, assume that the range switch is changed. This changes the ÷ N number and the feedback signal in the Step Loop Loop is no longer equal to the 1 MHz reference. The tuning signal from the Step Lock Loop Detector tunes the Step Lock VTO to a new frequency to satisfy the loop. At the same time, this dc signal (pretune) is sent to the Summation Amplifier in the Summation Loop. This error signal pretunes the First Local Oscillator to a new frequency to ensure that the Local Oscillator runs at 2 - 3 MHz above the Step Lock Oscillator instead of 2 - 3 MHz below it.

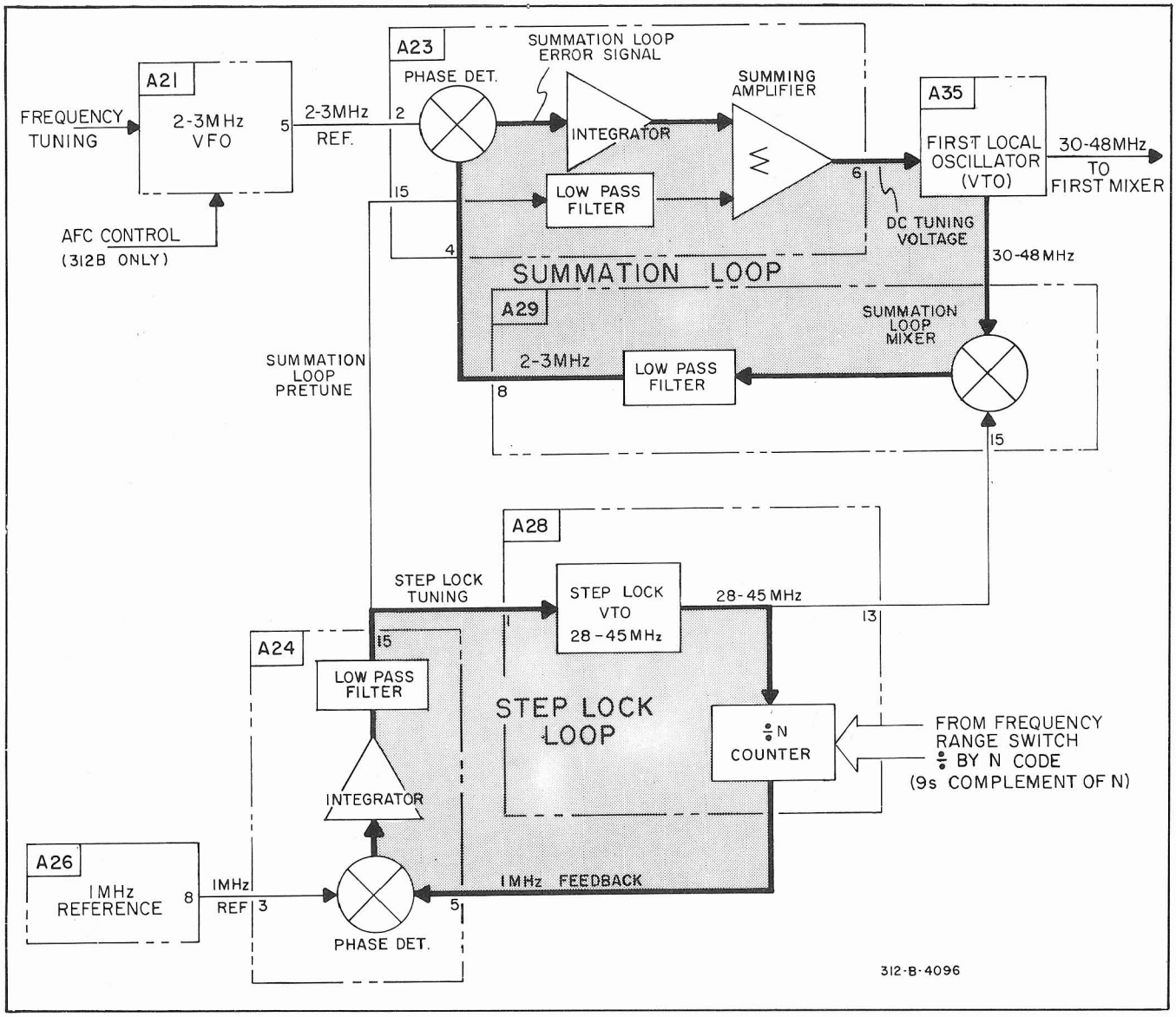


Figure 4-6. Local Oscillator Block Diagram.

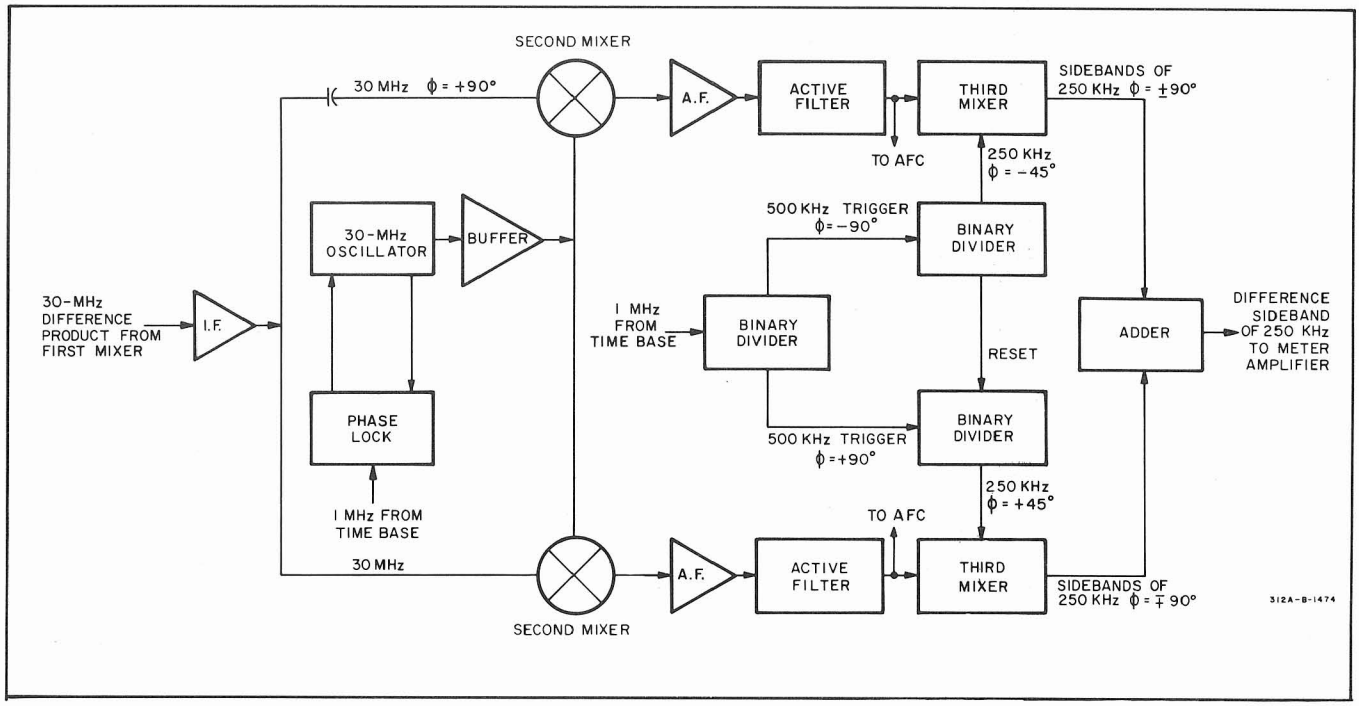


Figure 4-7. Active Filter Block Diagram.

4-28. 30 MHz Bandpass Filter and IF Amplifier.

4-29. The 30 MHz IF signal is coupled through a 30 MHz Bandpass Filter and to the input of one section of the AMPLITUDE RANGE attenuator. Up to 40 dB of attenuation can be selected before the signal is coupled to the IF Amplifier. The IF Amplifier provides the gain required to drive the Second Mixer.

4-30. Second Mixer.

4-31. The Second Mixer combines the 30 MHz IF signal with a signal from the 30 MHz Oscillator Assembly. When mixed, a sum and difference frequency is generated. Since the difference frequency is desired the sum frequency is rejected. The difference frequency will be zero plus and minus the information present in the input signal. The Second Mixer has two outputs. The phase relationship between these two outputs depends on whether the Local Oscillator is tuned above, below or exactly to the input frequency. The two outputs of the Second Mixer must first go through a series of active filters where the bandpass of the instrument is determined.

4-32. Active Filters.

4-33. The purpose of the Active Filters is to help in shaping the bandpass. A front panel BANDWIDTH selector provides a choice of either 200 Hz, 1000 Hz or 3100 Hz bandwidths for the 312B or 50 Hz, 2300 Hz or 3100 Hz for the 312D.

4-34. Referring to Figure 4-7, the split 30 MHz IF signal is phase shifted by 90° and drives two balanced bridges in the Second Mixer. The second input to the Second Mixer is 30 MHz which is phase locked to the 1 MHz time base. The outputs of the second mixer are two audio signals.

4-35. The two audio outputs from the Second Mixer are amplified by a preamplifier to drive the active filter. The active filters consist of two channels of six amplifiers in cascade, each producing a 12 dB per octave roll off for a total of 72 dB per octave roll off in each channel. The bandwidth of these amplifiers is controlled by switching resistors and capacitors in the feedback circuit.

4-36. The audio information, having a channel phase difference of 90° is coupled from the active filters to the Third Mixer. The second input to the Third Mixer is two 250 kHz signals also at 90° with respect to each other. These two signals are also derived from the 1 MHz time base.

4-37. Third Mixer.

4-38. The Third Mixer combines the phase shifted audio from the Active Filters with the phase shifted 250 kHz signal from the Binary Dividers in two balanced bridges. The sum components having been phase shifted 180° (90° in the Second Mixer and 90° in the Third Mixer) cancel in the output. The difference components having undergone an additional 180° phase shift are in phase and add. The 250 kHz signal from the Third Mixer is coupled to the Meter Amplifier. The net result is to restore the sideband information to the proper relationship with the carrier.

4-39. The output of the Third Mixer is coupled through the 250 kHz IF Attenuator (part of the AMPLITUDE RANGE switch) to drive the Meter Amplifier.

4-40. Audio Amplifier and Single Sideband Oscillator.

4-41. The Audio Amplifier and Single Sideband Oscillator serves a dual purpose. When used in either AM or AM/AFC, the audio information is amplified and coupled to the AUDIO OUTPUT jack on the front panel. When operated in the BEAT receiver mode, the audio signal produced when the Local Oscillator is tuned near the input signal is also amplified by the Audio Amplifier and coupled to the AUDIO OUTPUT jack. When operated in LSB or USB, the 250 kHz signal from the Meter Amplifier is first amplified and then split in phase. After being split in phase, it is summed with a Carrier Oscillator frequency either 1.8 kHz above or 1.8 kHz below 250 kHz. The difference frequency is coupled to the Audio Amplifier, amplified and then coupled to the AUDIO OUTPUT jack.

4-42. Automatic Frequency Control (312B Only).

4-43. The purpose of the AFC circuit is to lock the 312 Local Oscillator Frequency to the input signal frequency. The input to the AFC circuit consists of two channels of information. The phase relationship of the signals in these two channels determines the direction in which the Local Oscillator Frequency must change. The phase relationship is established in the Second Mixer but the AFC circuit determines which direction and how far the Local Oscillator Frequency must change.

4-44. The AFC circuit also senses the level of the signal in one channel to determine if the level is high enough to track. When the level is too low for the AFC circuit to track, the error signal from the AFC to the input of the Variable Frequency Oscillator is disabled.

4-45. Counters.

4-46. The purpose of the counter is to display the frequency of the input signal to which the instrument is tuned. The frequency displayed depends on the setting of the Frequency Range switch and the frequency of the 2 - 3 MHz VFO. The Frequency Range switch determines the particular range, while the 2 - 3 MHz VFO frequency determines the frequency within each range.

4-47. The 2 - 3 MHz VFO signal (Figure 4-8) first passes through an amplifier, where it is squared to drive the Count Gate. The 1 MHz input signal is also squared to drive the decade dividers (÷ 10 K) whose output is a 5 Hz square wave to drive the Count Gate. The output of the Count Gate is a gated 2 - 3 MHz signal that is counted to provide a frequency display for all digits except the MHz digits. The MHz digits are controlled by the setting of the frequency Range switch. The Measurement Control provides timing for latch and reset operations.

4-48. Figure 4-9 is a more detailed block diagram of the counter. It has been expanded to show in more detail how the MHz digits are selected.

4-49. The 0 - 18 MHz input frequency range is divided into 18 ranges (0 through 17), each covering a 1 MHz range, with approximately 200 Hz overlap. If the instrument is tuned above or below its normal range, i.e., into the overlap, the 2 - 3 MHz VFO frequency will be above 3 MHz or below 2 MHz respectively. This means that the MHz digit in the display must change.

4-50. If the VFO is tuned into the overlap range, up/down

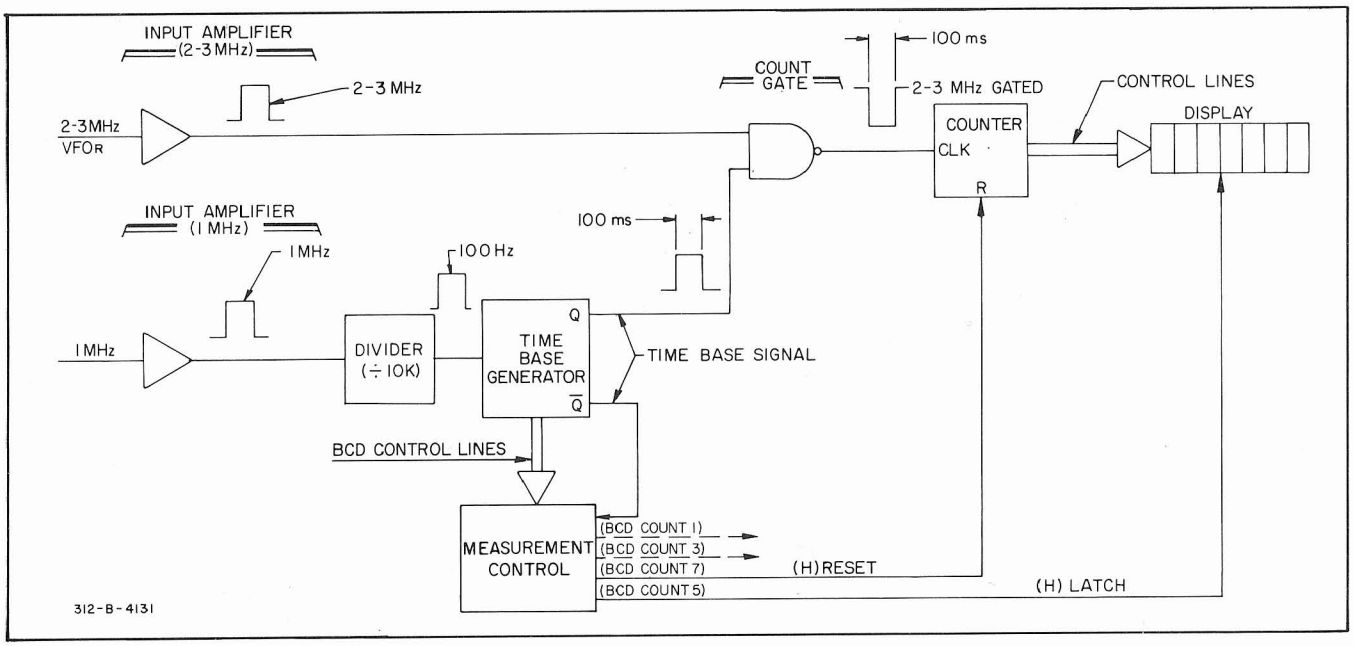


Figure 4-8. Counter Block Diagram.

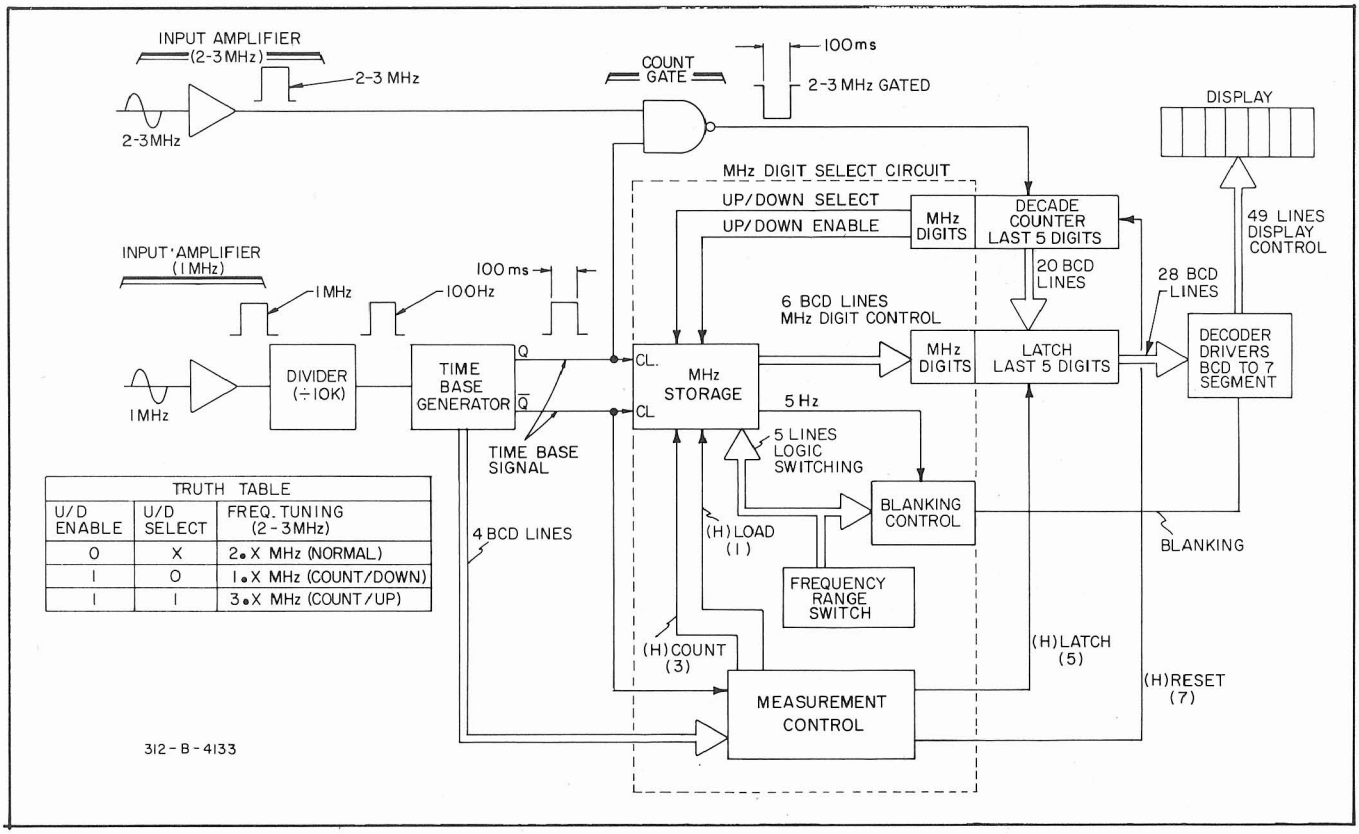


Figure 4-9. Complete Counter Block Diagram.

select and up/down enable signals are sent to the MHz Select Circuit to either add or subtract one digit of information from the information from the Frequency Range Switch.

4-51. The blanking circuit causes the display to flash if the Frequency Range is set to 0 and the 2 - 3 MHz VFO is tuned below 2 MHz. This is an invalid condition since the instrument cannot operate in a negative frequency domain.

4-52. Meter Amplifier.

4-53. The Meter Amplifier provides the gain necessary to drive several circuits. In the 312B, it drives the detector for the meter and recorder output. It also supplies an audio signal to the audio output jack by way of Audio Amplifier A10. In the 312D, it drives the meter through the Meter Expand Amplifier A101. An audio signal is also supplied to the Audio Amplifier A101, to drive an internal speaker, or external headphones.

4-54. Meter Expand Amplifier A101 (Model 312D Only).

4-55. The Model 312D has the additional capability of expanding the meter indication for increased resolution. When used in the EXPAND function, the Meter Expand Amplifier has the capability of expanding the meter indication for 2 dB full scale (± 1 dB). This can be done for any meter indication between - 7 dB and + 3 dB. The expand amplifier provides the gain necessary for this function.

4-56. DETAILED CIRCUIT DESCRIPTION.

4-57. Input Selector A38 Schematic No. 1 (312B Only).

4-58. The Input Selector is the first step in processing the input signal before any frequency and amplitude measurements can be made. The Input Selector provides a choice of balanced or unbalanced measurements, which can be either bridged or terminated.

4-59. For unbalanced measurement, the signal is applied to J1, the left-hand BNC connector. The BAL/UNBAL switch S2 should be in the UNBAL position, which grounds the center conductor of J2. For balanced measurements, the signal is applied between J1 and J2, and S2 must be in the BAL position.

4-60. The INPUT MODE switch selects either terminated, bridged or probe inputs. In the terminated mode, any of the popular impedances can be selected by the IMPEDANCE Ω switch to terminate the input. These terminating resistors (R5 thru R11), being in parallel with the 10 kilohm bridging impedance, provide the proper terminating impedance.

4-61. In the BRIDGED position of the input mode switch, the input resistance is 10 kilohms in the unbalanced mode and 20 kilohms in the balanced mode.

4-62. When the PROBE position is selected, connector J3

supplies power to the 11530A Probe. It also accepts the balanced output of the probe. The BAL/UNBAL switch does not affect circuit operation in the PROBE mode. Resistors R2 and R3 act as collector loads for the probe output amplifier.

4-63. Input Selector A38, Schematic No. 1 (312D Only).

4-64. The Input Selector permits a choice of balanced or unbalanced measurements. These inputs are always terminated in the impedance selected by the INPUT IMPEDANCE switch. For unbalanced measurements the 75 ohm connector must be used. For balanced measurements, either the 124 ohm or 135 ohm connectors are used, depending on the impedance of the source. These inputs are always terminated.

4-65. Reference Level Attenuator A39, Schematic No. 1.

4-66. The Reference Level Attenuator provides attenuation of the input signal before the Input Amplifier. This is necessary to prevent overloading the Input Amplifier and to optimize signal-to-noise ratio.

4-67. The attenuator consists of two identical channels, each channel providing from 0 to 60 dB of attenuation in 10 dB steps. The attenuator consists of four 30 dB L pads, one 20 dB pad and one 10 dB pad. These are selected in combinations to provide 10 dB steps. Each pad contains a variable capacitor for frequency compensation.

4-68. Input Amplifier.

4-69. The Input Amplifier consists of two identical broadband amplifiers, driving a differential amplifier output stage. Since both channels are identical, only channel two will be discussed.

4-70. The positive input is applied to the gate of Q3. Since the input impedance of Q3 is high, the input impedance of this amplifier is determined primarily by the value of R3. The negative feedback is applied to the source of Q3, with the gain of the stage being determined by one plus the ratio of R18 and R10. Capacitor C10 is a common-mode adjustment to match the two channels.

4-71. The output of Q6 drives one input of the differential amplifier stage. The bias for Q8 is provided by a voltage divider consisting of R38, R39 and R40. The gain of the differential amplifier stage is determined by the impedance between the emitters of Q7 and Q8. Capacitor C19 is a gain adjustment to peak the amplifier at high frequencies. The differential pair is driven by current source Q9, with the total current in the amplifier being determined by R43 and R44. The total current is divided equally between Q7 and Q8.

4-72. The output from the collector of Q7 drives the First Mixer A31 in both the Models 312B/D. The output from the collector of Q8 is used in the Model 312D only and is used to drive the Overload Detector A100.

4-73. Overload Detector A100 (312D Only).

4-74. The purpose of the Overload Detector is to warn the operator when the input level to the Input Amplifier and First Mixer is too large, resulting in possible intermodulation and harmonic distortion.

4-75. The Overload Detector consists of two amplifiers, a peak detector, a comparator and a lamp driver. The input comes from the Input Amplifier. An input level of approximately 30 mV or greater will cause an overload indication. The signal is amplified by a 20 dB amplifier and by a 12 dB amplifier, producing approximately 1.2 V peak at the input of the Peak Detector. Pin 2 of the Comparator will have a dc level which is compared with the reference voltage at pin 3, which is set by R25. If the input signal exceeds approximately 30 mV peak, the voltage at pin 2 of the Comparator will be more positive than the reference voltage at pin 3, driving the output of the Comparator negative. This turns on CR6, Q7 and the overload lamp.

4-76. Input Mixer Assembly (A31, Schematic No. 3).

4-77. Transistors A31Q6 and A31Q8 amplify the 1 kHz - 18 MHz signal before application to the Input Mixer Assembly, Buffer Amplifier A31Q1 and A31Q4 provides isolation between the output of the First Local Oscillator Assembly and the input of the Mixer Driver Assembly. The 30 MHz to 48 MHz Local Oscillator signal is amplified by A31Q2 and A31Q5 to drive the Input Mixer Assembly.

4-78. The Input Mixer consists of A31CR1 through A31CR4. Since the Input Mixer is balanced, the output contains only the sum and difference frequencies. The two original signal frequencies are cancelled. The difference frequency of 30 MHz has been chosen as the IF. Capacitor A31C17 and Resistor A31R36 are balance adjustments to balance the bridge so that a minimum of the two original frequencies appears in the output.

4-79. IF Amplifier A31Q7 amplifies the 30 MHz IF signal before application to the 30 MHz Bandpass Filter and Amplitude Range Attenuator.

4-80. Step Lock VTO and ÷ N Counter A28 (Schematic No. 14).

4-81. The purpose of the Step Lock VTO is to produce a frequency in the range of 28 to 45 MHz. This signal is used in two places. First, it is utilized by the Summation Loop Mixer A29 where it is compared to the 30 - 48 MHz signal from the First Local Oscillator A35. Secondly, it is utilized by the ÷ N Counter, where it is divided by the number N (N determined by setting of frequency range switch) such that a 1 MHz signal will always be produced when the loop is stabilized.

4-82. The Step Lock VTO consists of Q1, Q2 and associated circuitry. Transistors Q1 and Q2 form a differential amplifier with L1, C11, C12 and CR1 being the

frequency determining components. Diode CR1 is a varactor diode, whose capacitance and thus the frequency of the VTO, is determined by the dc tuning signal from the Step Lock Phase Detector A24. Positive feedback is provided from the tap on L1 through C6 to the base of Q2 to sustain oscillations.

4-83. The output of the VTO is coupled through Q5 where it is split. One output is coupled through buffer amplifier Q3 to the Summation Loop Mixer A29. The second output is coupled through buffer amplifier Q4 to the ÷ N Counter.

4-84. The signal from Q4 is coupled through Q6 and Q7 where it is squared in order to drive the counter. The ÷ N Counter is a presettable variable modulus counter that counts from some preset number to 99. The preset number is a 9's complement of the number to be counted and is determined by the setting of the frequency range switch. For example, if a frequency of 28 MHz is to be counted, the 9's complement of 28, which is 71, is set into the counter. The counter will then count from 71 to 99, or 28 counts before one output pulse occurs. Thus 28 becomes the ÷ N Number. The preset number is binary coded by the frequency range switch and applied to A28U2 and U5.

4-85. IC's U2 and U5 are decade counters that count from the preset number to 99. When the counter is counting, pins 2 and 13 of U1B are high and all pulses from U1A are coupled into the counter, which begins counting at the preset number. When the counter reaches 95, all three J inputs (pins 3, 4, and 5) to U3 go high. At a count of 96, U3 pin 8 (Q output) goes high and supplies a pulse to the output pin 13. At the same time, pin 6 of U3 (Q) goes low, turning off U1B, and the presettable number is loaded into the counter again. On count 97, Q of U4A goes high. On count 98, Q of U4B goes high. On count 99, Q of U3 goes high (Q goes low) turning on U1B, allowing the counter to begin counting again. Thus for every 28 pulse from U1A, one pulse appears at the output.

4-86. Step Lock Phase Detector A24 (Schematic No. 15).

4-87. The purpose of the Step Lock Phase Detector is to compare the 1 MHz signal from the Step Lock VTO to the 1 MHz reference signal. When the two signals are of the same phase and frequency, the Step Lock VTO A28 will be tuned to an exact integer multiple of 1 MHz, between 28 and 45 MHz inclusive. The particular multiple to which the VTO is tuned is determined by the setting of the Frequency Range Switch.

4-88. The 1 MHz reference signal at A24 pin 3 comes from the 1 MHz Reference Oscillator A26. It is first coupled through Q1 and Q2, where it is squared in order to drive TTL Logic and applied to U1 pin 1 of the Phase Detector. The 1 MHz signal from the Step Lock VTO is applied to U1 pin 3. Here, the two signals are compared for phase and frequency. When the two signals are of the same frequency, U1 pin 13 will be high and pin 2 will have a small 1 MHz signal, whose low average value is equal to the divided high output at pin 13. When the loop is locked, the - and + inputs to Q3 and Q4 will be equal in value.

4-89. Transistors Q3 and Q4 and associated components form an integrator, with C14 being the integrating capacitor. In order to minimize phase noise which would produce sidebands in the VTO output, low noise transistors are used for Q3 and Q4. The amplifier has a gain of approximately 20 dB for driving U2. Diodes CR1, CR2, CR6 and CR7 limit the swing of the integrator from - 5 V to + 13 V. Diodes CR2 and CR6 limit the negative swing and CR3 and CR7 limit the positive swing. The output of the integrator will decrease (less positive) if the VTO frequency is too high and increase if it is too low. The output is always positive when the loop is locked. The integrator output is passed through part of a 1 MHz Low Pass Filter, consisting of L2, C10, C11 and C8.

4-90. Operational Amplifier U3 and transistor Q6 make up a special + 5 V regulated supply for Phase Detector A24U1, A28U1 and U2. This supply is necessary because any noise or ac components on the supply for U1 could cause side bands on the VTO output because of lower negative supply rejection of U2. The regulator is an operational amplifier, driving an output stage Q6. Feedback through R32 keeps the negative input to the operational amplifier equal to the positive input. Transistor Q5 and associated components make a special - 9.5 V supply for U2 for the same reasons already mentioned.

4-91. Summation Loop Phase Detector A23 (Schematic No. 19).

4-92. The purpose of the Summation Loop Phase Detector is to compare the 2 - 3 MHz signal from the Summation Loop Mixer A29, with the reference 2 - 3 MHz from the VFO, A22.

4-93. The reference 2 - 3 MHz signal input on pin 2 comes from VFO A21. It is first passed through a squaring circuit Q1 and Q2, to drive the TTL logic of the Phase Detector. The other 2 - 3 MHz signal input on pin 4 comes from A29 Summation Loop Mixer. This signal is also squared by Q3, Q4 and associated components before being applied to pin 3 of the Phase Detector. When both signals are equal in frequency, the average value of the outputs on pins 2 and 13 will be equal. If the signal from the Summation Loop Mixer is higher in frequency than the reference signal, the output of the integrator will be negative. If it is lower than the reference, the output will be positive. The integrator output is applied to one input of the Summation Amplifier, where it is summed with the pretune error voltage from the Step Lock Phase Detector A24.

4-94. The dc tuning signal comes from A24, pin 15. This signal changes when the Frequency Range Switch is changed, requiring a large frequency change in the 28 - 45 MHz VTO and the First Local Oscillator. The pretune signal is first passed through a low pass active filter U2 and associated circuitry. The filter has a cutoff frequency of approximately 100 Hz. The output of the low

pass filter is inverted by U3 and applied to the Summing Amplifier. The Summing Amplifier output is attenuated by R28, C15 and R26 and coupled to the First Local Oscillator A35.

4-95. The + 5 V Regulator Q5 and associated components provides the regulation necessary for the Phase Detector and the Squaring circuits. The - 9.5 V Regulator Q6 provides supply regulation for the Integrator.

4-96. First Local Oscillator A35 (Schematic No. 13).

4-97. The purpose of the First Local Oscillator is to generate frequencies in the range of 30 to 48 MHz. This range of frequencies, when mixed with the 28 to 45 MHz signal from the 28 - 45 MHz VTO, produces a 2 to 3 MHz signal to be compared in frequency to the output of the 2 - 3 MHz VFO.

4-98. The oscillator consists of a differential amplifier Q3 and Q4, L1 and CR1. Diode CR1 is a varactor, which is the primary capacitive element in the tank circuit. Since the oscillator operates at 2 to 3 MHz above the 28 - 45 MHz VTO, a small dc bias (approximately - .6 V) is applied to the varactor to provide this frequency offset. For this reason, the collector of Q3 is returned to ground through L2 instead of L1 in the tank circuit. The signal from the collector of Q3 is coupled to the tank circuit by C11. Feedback for the oscillator is from the tap on L1 back to the base of Q4. Resistor R9 determines the Q of the tank circuit.

4-99. The output of the oscillator is coupled through an isolation stage Q5 to a gain stage consisting of Q6 and associated components. Transistor Q7 provides isolation between Q6 and the output stages Q1 and Q2. The output of Q1 drives one input to the First Mixer A31. The output of Q2 provides one drive signal for the Summation Loop Mixer A29.

4-100. 1 MHz Reference Oscillator A26 (Schematic No. 23).

4-101. The 1 MHz Reference Oscillator Assembly provides a very stable time base to which the Local Oscillator is referenced. It also provides a - 40 dBm, 1 MHz calibrated square wave signal for calibrating the instrument.

4-102. The 1 MHz reference can originate from one of two sources, depending on the setting of the reference switch on the rear panel. When set to EXT, an external reference can be used to provide the time base. When an external reference is used, the internal reference oscillator is turned off. When the switch is set to INT, the reference is provided by a stable 1 MHz internal oscillator.

4-103. The internal oscillator is a crystal controlled 1 MHz multivibrator, consisting of Q1, Q2, Y1 and associated components. The frequency of the oscillator is controlled primarily by crystal Y1, although the frequency can be varied around 1 MHz by approximately 100 Hz by C21. Feedback is through C2, R3, Q2 and back to the crystal.

4-104. The output of the oscillator is taken from the collector of Q2 and routed through the INT/EXT reference switch on the rear panel and to the base of Q12. When an external reference is used, the - 15 V supply is removed from the oscillator by part of the INT/EXT reference switch.

4-105. Transistors Q12 and Q13, CR2 and CR3 act as a limiter. No matter what the amplitude of the oscillator signal or external signal is, the signal at the collector of Q13 will always be constant at approximately 1 V peak-to-peak. The output of Q13 passes through a filter, consisting of R43 and C29, to the input of Q11. A 1 MHz tuned circuit in the collector circuit of Q11 restores the squared signal (produced by CR2 and CR3) to a sine wave. Transistor Q9 provides the necessary drive for output transistors Q3 through Q7.

4-106. One of the outputs from Q9 is used to provide the calibrated output signal. This signal is coupled through buffer amplifier Q8, to the external calibrator Q10, where the signal is squared by CR1 and the base to emitter junction of Q10. Adjustment R35 sets the level of the output signal. The output of Q10 is coupled through an impedance matching circuit R37 through R40, to provide a 75 ohm output at the front panel connector.

4-107. Variable Frequency Oscillator (A21, A22) Schematic No. 17.

4-108. The Variable Frequency Oscillator has a frequency range of 1.99 MHz to 3.2 MHz. The frequency of this oscillator is controlled by A42C1, front panel FREQUENCY TUNING control. The frequency is also controlled by two varactor diodes A21CR1 and A21CR2. The AFC circuit controls the capacitance of these diodes and thus the frequency of the VFO.

4-109. Transistor A21Q4 serves as the oscillator with A21CR1/A21CR2, A21L1, A21C3/A21C4/A21C5 and A42C1 controlling the frequency of oscillation. Inductor A21L1 and capacitor A21C5 set up the upper and lower calibration frequencies of the oscillator.

4-110. When operated in AM/AFC, the output of the AFC circuit controls the voltage across the varicap diodes A21CR1 and A21CR2. A positive going dc voltage from the AFC circuit causes the voltage across the diodes to increase, their capacitance to decrease and the frequency of the VFO to increase. The output of the oscillator is isolated from the load by Buffer Amplifier A22Q7 and Emitter Follower A22Q6.

4-111. When tuned out of range of the AFC circuit (approximately ± 3 kHz in 3000 Hz BANDWIDTH), the AFC must be relieved of any control. For this reason, A22Q8 monitors the AFC control voltage. If the AFC

control voltage goes too positive, the voltage at the emitter of A22Q1 goes positive and is coupled through A22CR8 to the base of A22Q2. If the AFC voltage goes too negative, the positive going voltage at the collector of A22Q1 will be coupled through A22CR7 and A22CR6 to the base of A22Q2.

4-112. Transistors A22Q2 and A22Q3 form a Schmitt trigger to provide one input to "OR" gate, A22CR5 and A22CR4. The other input to the "OR" gate is a level sense voltage from the A8 AFC assembly. If the input signal is too low, the level sense voltage will cause A22CR4 to conduct and turn on switch A22Q5. When A22Q5 conducts relay A22K1 will energize and ground the AFC control voltage. When operated in any mode other than AM/AFC, a ground is connected to A22K1 to keep it energized. Therefore, the AFC circuit has no control over the VFO.

4-113. 30 MHz BP Filter/Attenuator Assembly (P/O A40, Schematic No. 4).

4-114. The purpose of the 30 MHz Bandpass Filter is to prevent harmonics of the First Local Oscillator from entering the Second Mixer and to keep harmonics of the 30 MHz signal in the Second Mixer from feeding back into the First Mixer. The filter has a bandpass of approximately 15 MHz.

4-115. The output of the 30 MHz Bandpass Filter is coupled to a section of the AMPLITUDE RANGE attenuator where 0 to 40 dB of attenuation can be selected in 10 dB steps.

4-116. Second Balanced Mixer Assembly (A34, Schematic No. 5).

4-117. The purpose of the Second Balanced Mixer is to mix the 30 MHz IF signal from the First Mixer A31 with the 30 MHz Oscillator signal from A30.

4-118. The 30 MHz IF signal from the First Mixer is first amplified by A34Q1 and A34Q2. Broadband tuning is accomplished by A34T3/A34C6/A34C8 and A34T4/A34C12/A34C13. The output of the Amplifier is coupled through A34C15 to drive the balanced modulator in Channel A and through A34C17 to drive the balanced modulator in Channel B.

4-119. The 30 MHz signal from the 30 MHz Oscillator is amplified by push-pull amplifier A34Q4 and A34Q5. Capacitor A34C33 is used to tune the LO signal for maximum signal at the LO test point TP4.

4-120. Two identical balanced mixers are utilized to provide two channels of information. Two channels are required for the AFC circuit (312B) and for the active filters. Both 30 MHz signals are phase shifted and applied to the two balanced mixers 90° out of phase. The 30 MHz IF signal is phase advanced 90° by A34C15 and A34C14. The 30 MHz Oscillator is phase shifted by A34T5. When the 30 MHz IF signal is higher than 30 MHz (Local Oscillator tuned too high) Channel A leads Channel B. When the 30 MHz IF signal is below 30 MHz, Channel B leads Channel A. The phase difference between these two signals is utilized by the AFC circuit (312B) in determining which direction to tune the Local Oscillator. Adjustment TUNE 3 (A34C16) and TUNE 4 (A33C18) are adjusted so that when the IF frequency is above 30 MHz, Channel B will lead Channel A. For more information about how this phase difference is utilized refer to the AFC circuit description, Paragraph 4-152.

4-121. 30 MHz Oscillator Assembly A30 and 30 MHz Lock Assembly (A25) Schematic No. 20.

4-122. The purpose of the 30 MHz Oscillator is to provide a second local oscillator signal to mix with the 30 MHz IF frequency from the First Mixer A31. The 30 MHz Oscillator also provides a signal for the 313A Tracking Oscillator.

4-123. The purpose of the 30 MHz Lock Assembly is to phase lock the 30 MHz Oscillator signal to the 1 MHz time base frequency.

4-124. The 30 MHz Oscillator A30Q1 frequency is controlled by A30L1, A30C4, A30C3 and the capacitance of varicap diodes A30CR1 and A30CR2. The capacitance of the varicap diodes is controlled by the A25, 30 MHz Lock Assembly to keep the 30 MHz Oscillator phase locked to the 1 MHz time base. When the 30 MHz Oscillator is not phase locked to the 1 MHz time base, the 30 MHz Lock Assembly will provide a search signal to sweep the 30 MHz Oscillator until phase lock does occur.

4-125. The Search Oscillator consists of A25Q7 and A25Q2 and provides an 8 Hz search signal through the Difference Amplifier and Emitter follower to varicap diodes A30CR1 and A30CR2. The sweeping oscillator frequency is amplified by A30Q2, A25Q5 and coupled to the Sampler Circuit.

4-126. The 1 MHz time base frequency is coupled to the trigger circuit A25Q3 and A25Q4. This trigger circuit converts the 1 MHz sine wave to essentially a square wave. This square wave is differentiated by A25C4 to provide a sharp spike for the sampler circuit. This positive spike at the junction of A25T1, A25C4 and A25C6 will cause a negative spike at the junction of A25T1 and A25C5. These spikes will forward bias A25CR4 and A25CR3. When the diodes conduct, A25C10 will be grounded and charge to the instantaneous value of the 30 MHz signal from A25Q5. At the end of the 1 MHz spikes, capacitor A25C10 becomes ungrounded and must discharge through A25Q1. This discharge signal is coupled through the Emitter Follower to the varicap diodes in the A30 assembly. When the 30 MHz oscillator frequency reaches a frequency such that it is going through zero voltage each time a 1 MHz spike occurs, capacitor A25C10 will take on zero charge each time it is grounded. This constant zero dc potential at the base of A25Q1 holds the base of A25Q2 at a steady potential.

Phase lock has now been achieved and the Search Oscillator stops.

4-127. One of the 30 MHz outputs is taken from the collector of A30Q2 and coupled to a connector (J9) on the rear panel. The other 30 MHz is taken from A30Q3 to drive the Second Mixer.

4-128. The TEST switch A30S1 is provided for calibration and troubleshooting purposes. When switch A30S1 is in the TEST position, a fixed voltage is applied to the varicap diodes and A30C4 is adjusted for an output frequency of 30 MHz ± 60 Hz.

4-129. Active Filter Preamplifier Assembly (A4, Schematic No. 6).

4-130. The Active Preamplifier Assembly consists of two identical amplifiers, one for Channel A and one for Channel B. These amplifiers amplify the audio signals from the Second Mixer to drive the Active Filters. Resistor A4R3 (for Channel A) and A4R15 (for Channel B) are selected for system gain to provide 10 mV ± 1 mV at the input of A7 Meter Amplifier Assembly. This amplifier has approximately an 18 dB voltage gain.

4-131. Active Filters (A3, A2, Schematic No. 7, 8 and 9).

4-132. The purpose of the Active Filters is to shape the bandpass. The Active Filters consist of two identical channels. Each channel consists of six filters, each producing a 12 dB per octave rolloff.

4-133. The basic operation of all the filters is the same. Therefore, only one will be discussed in detail. Referring to Schematic 7, the audio signal from the Active Preamplifier A4 is first coupled through the BANDWIDTH selector when different values of R and C are selected to control the bandwidth. At lower frequencies, both sides of A3C3 are subject to the same ac change. Therefore, maximum positive feedback is provided and the amplifier has a unity gain. At higher frequencies capacitor A3C2 and the resistors selected by the BANDWIDTH control begin to attenuate the input signal. This attenuation of the input signal results in less positive feedback and further reduction in input level to A3Q9. At still higher frequencies, the amplifier gain rolls off at 12 dB per octave. Sharp cut-off is obtained by using six of these filters in cascade to produce a total of 72 dB per octave rolloff. By changing the R's and C's in the feedback circuit, selected attenuation causes the filter to begin rolloff at different frequencies.

4-134. Third Mixer and Binary Divider (A9, Schematic No. 10).

4-135. The purpose of the Third Mixer and Binary Divider Assembly is to divide the 1 MHz signal from A26 Assembly down to 250 kHz to mix with the audio output of the active filters. The frequency of 250 kHz was chosen as convenient for processing by the metering circuit.

4-136. The 1 MHz signal is first applied to Pulse Shaper A9Q7 where the sine wave input is converted to a square wave whose negative-going edge triggers the 500 kHz Binary Divider. The 500 kHz Binary Divider drives two 250 kHz Binary Dividers whose outputs are 90° out of phase with each other.

4-137. For the purpose of explanation, refer to Figure 4-10 and assume that A9Q2, A9Q4 and A9Q5 are in a conducting state at T_0. At T_0, the positive-going signal at the collector of A9Q2 triggers A9Q3 into a conducting state. Transistors A9Q5 and A9Q6 remain as they were since the input is negative-going. At T_1, A9Q2 conducts and A9Q1 turns off. The positive-going signal from the collector of A9Q1 is coupled through A9CR13 to turn on A9Q6 and turn off A9Q5. At T_2 the positive-going signal from the collector of A9Q2 triggers A9Q4 and A9Q3 off. The positive-going signal from the collector of A9Q3 is coupled through A9CR11 to keep A9Q6 in a conducting state. At T_3 the positive-going signal from A9Q1 is coupled through A9CR15 to turn on A9Q5. Therefore, the output of Binary A is 90° out of phase with the output of Binary B.

4-138. The two 250 kHz signals from Binary A and Binary B are coupled to two identical balanced bridge mixers where they are mixed with the two audio signals from the Active Filters. These audio signals are also at 90° with respect to each other.

4-139. The output signals from Channel A and Channel B are combined in transformer T_3. The output across terminals 7 and 8 of A9T3 is made up of the sum and difference components. The two sum components having been shifted 90° two times (once in the Second Mixer and

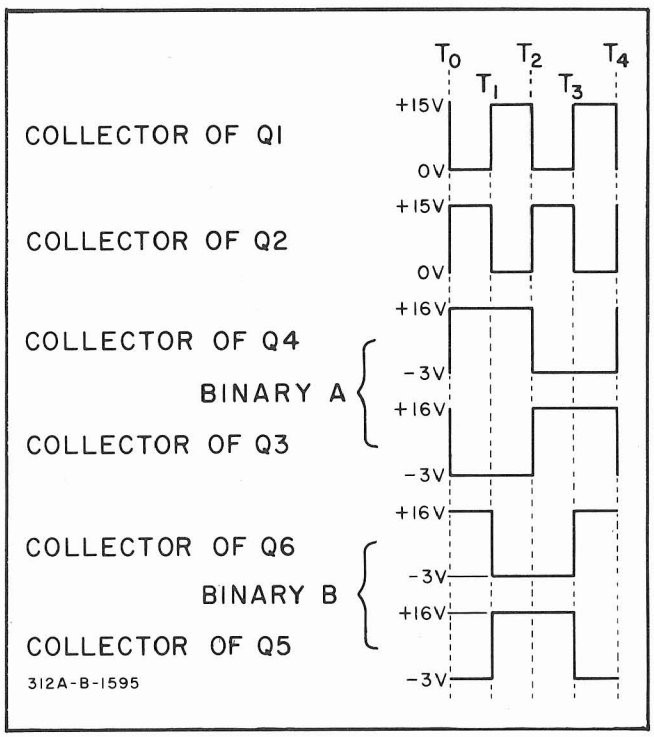


Figure 4-10. A9 Binary Divider Waveforms.

again in the Third Mixer) are 180° out of phase and cancel. The difference components having undergone an additional 180° phase shift are in phase and add.

4-140. The output is taken from terminal 8 of A9T3 and coupled through a section of the 250 kHz IF attenuator to Meter Amplifier A7.

4-141. Meter Amplifier (A7, Schematic No. 11).

4-142. The 250 kHz signal from the Third Mixer first passes through the 250 kHz IF Attenuator which is part of the AMPLITUDE RANGE control. This attenuator provides either 10 dB or 20 dB of attenuation in addition to the 0 - 40 dB of attenuation provided by the first section of the Amplitude Range attenuator.

4-143. The 250 kHz signal then passes through a 250 kHz bandpass filter on the Meter Amplifier circuit board. This filter provides attenuation of noise and undesirable harmonics from the Third Mixer.

4-144. The signal is amplified by A7Q3, A7Q2 and A7Q1 to drive the detector. The overall gain of the Meter Amplifier is controlled by the front panel CAL ADJ R11. The audio output is taken from the junction of A7CR2/A4C15 to drive the Audio Amplifier A10 and to drive Meter M1. Capacitor A7C17 provides additional filtering for the meter. A 250 kHz signal is taken from the emitter of A7Q2 for carrier reinsertion by the Single Sideband Oscillator Assembly when the instrument is used in either the USB or LSB RECEIVER MODE. A RECORDER OUTPUT having a source impedance approximately 1000 ohms is provided to drive external dc recorders and the 313A meter expand circuit (312B) or the Audio and Expand amplifier A101 in the Model 312D.

4-145. Audio Amplifier/Single Sideband Oscillator (A10, Schematic No. 12).

4-146. The purpose of the Audio Amplifier is to amplify either the audio signal from the Meter Amplifier, the beat frequency signal from the active filters or the single sideband signals from the Sideband Oscillator Assembly. The particular signal to be amplified will depend upon the setting of the RECEIVER MODE switch.

4-147. The Single Sideband Oscillator Assembly consists of two crystal controlled carrier oscillators, one for upper sideband reinsertion and one for lower sideband reinsertion. The lower sideband oscillator consists of A10Q4 and A10Q5. This oscillator produces a frequency of 1.0072 MHz when the RECEIVER MODE switch is in the LSB position. The upper sideband oscillator consists of A10Q3 and A10Q5. This oscillator produces a frequency of .9928 MHz when the RECEIVER MODE switch is in the USB position. Selection of either the LSB or USB oscillator is made by the application of - 15 V through the RECEIVER MODE switch.

4-148. The output of the Carrier Oscillator is coupled to a multivibrator A10Q6 and A10Q8 whose nominal frequency is 250 kHz. This multivibrator is triggered by the Carrier Oscillator signal and will oscillate at a frequency of 251.8 kHz (LSB) or 248.2 kHz (USB). The multivibrator is turned on by the application of + 20 volts when the RECEIVER MODE switch is in either the LSB or USB position.

4-149. Transistors A10Q7 and A10Q9 switch at a frequency 1800 Hz above or below the 250 kHz carrier signal from the Meter Amplifier A7Q2. The difference frequency between the two signals is an audio signal developed across A10R15 and A10R19. This audio signal is coupled through the RECEIVER MODE switch to the Audio Amplifier.

4-150. Amplitude Range Indicator (A36, Schematic No. 24).

4-151. The Amplitude Range Indicator is used to indicate the meter range. The input to the Amplitude Range Indicator is a combination of the settings of the AMPLITUDE RANGE switch, REFERENCE LEVEL Attenuator and the IMPEDANCE Ω switch in the 312B. When the 600 Ω position is selected by the IMPEDANCE Ω switch, an additional 10 dB of attenuation is added to correspond to the change in power sensitivity between 60 Ω and 600 Ω (312B only).

4-152. AFC Circuit (A8, Schematic No. 18) 312B Only.

4-153. The purpose of the AFC circuit is to lock the Local Oscillator to the input signal and to track the input signal if it should drift.

4-154. The Local Oscillator must first be tuned to within the lock-in range of the AFC circuits. This lock-in range will depend on the bandwidth being used. When tuning for a signal the bandwidth selector will normally be set to 3100. In this case, the Local Oscillator must be tuned to within 3.3 kHz of the input signal frequency. During this initial tuning the AFC tracking circuit is inoperative. When the Local Oscillator is tuned to within 3.3 kHz of the input frequency the level of the input signal will be sufficient to cause the tracking circuits to energize and pull the Local Oscillator to the input signal frequency.

4-155. The input (A8 pin 8) to the level sense circuit comes from Channel A output of the active filters (A2-3). After being amplified by A8Q11, A8Q10 and A8Q9, the sense signal is coupled through a peak-to-peak detector to the input of A22Q5 (Schematic No. 17). During initial tuning, A22Q5 is turned on and A22K1 is energized thus shorting the tracking voltage to ground. At the same time the base of A22Q8 is grounded, and there is no level sense gate to trigger A22Q5. When the level of the sense voltage becomes high enough, A22CR4 will become reverse biased by the negative voltage from the detector (A8CR17 and A8CR18) and A22Q5 will cease to conduct. When A22Q5 turns off, A22K1 deenergizes and removes the ground from

the tracking control voltage at the junction of A22R12 and A22R13, and from the base of A22Q8. Relay A22K1 can also be controlled by a second input to the Level Sense Gate. This input to the Level Sense Gate comes from Amplifier A22Q1/A22Q8 and Trigger Circuit A22Q2/A22Q3. When the AFC voltage at the junction of A22R12/A22R13 gets either too high or too low, the Level Sense Gate will turn on Switch A22Q5 and cause A22K1 to energize. If the AFC voltage gets too high, for example, when the Local Oscillator is locked to the input signal by the AFC and Local Oscillator is manually tuned away, A22Q8 will increase in conduction. The positive-going signal at the emitter of A22Q8 causes A22Q1 to conduct. When the emitter voltage goes positive enough to forward bias A22CR8, A22Q2/A22Q3 will produce a trigger through A22CR5 to turn on A22Q5. Relay A22K1 will energize and disable the AFC control voltage. When the AFC relinquishes control of the VFO, the Local Oscillator suddenly changes to the frequency selected by the manual tuning control. The Level Sense voltage is now too small to keep A22CR4 reverse biased. Switch A22Q5 will remain in a conducting state due to the forward bias through A22CR4 and A22R30.

4-156. If for some reason the AFC voltage goes too low (less positive), the collector of A22Q8 and A22Q1 will go in a positive direction. When the collector voltage of A22Q1 exceeds the breakdown voltage of A22CR6, A22Q2 and A22Q3 will produce a trigger to turn on A22Q5.

4-157. During the time the AFC is locked (A22Q5 turned off) the AFC tracking signal at the junction of A22R12 and A22R13 is applied to varicap diodes A22CR1 and A22CR2 to control the oscillator frequency.

4-158. The AFC tracking voltage comes from the AFC Assembly A8 and is derived from the audio information supplied by the Active Filters. This AFC control voltage is a square wave whose dc average tunes the 2 MHz - 3 MHz Variable Frequency Oscillator.

4-159. When the AFC loop is locked, the IF will be either 30 MHz + 35 Hz or 30 MHz - 35 Hz. (Refer to Table 4-1.) If the input signal frequency should increase, the IF would begin to decrease; likewise if the input signal frequency should decrease, the IF would begin to increase. However, the frequency change of the audio signal depends not only on the input signal frequency change, but also on whether the 35 Hz offset is above or below the 30 MHz IF. If the input signal frequency increases, the audio frequency will increase when the offset is below 30 MHz and decrease if the offset is above 30 MHz. In a similar manner, if the input signal frequency decreases, the audio signal frequency will decrease when the offset is below 30 MHz and increase when the offset is above 30 MHz. If the input signal frequency decreases, the audio frequency will increase if the 35 Hz offset is above 30 MHz.

4-160. For the purpose of explanation, assume that the Local Oscillator is too high. Channel B leads Channel A by 90°. Channel B is limited to 1.2 volts peak-to-peak by A8CR1 and A8CR2 before being applied to saturation amplifier A8Q3 and A8Q2. The square wave output of this amplifier is applied to tunnel diode A8CR5 to produce a fast rise and fall time. Transistor A8Q1 amplifies the square wave and applies it to a differentiator consisting of A8C4 and A8R11. The positive pulses from the differentiator are used to trigger the variable symmetry amplifier (one shot) A8Q4 and A8Q5. The negative pulses are decoupled by A8CR15. The positive pulses will turn on A8Q4 and rapidly discharge A8C5. At the end of the trigger pulse, capacitor A8C5 must charge exponentially through A8R12.

4-161. When the collector of A8Q4 reaches a positive value sufficient to forward bias A8CR16, A8Q5 will conduct. The time that A8Q5 is turned off is determined by the fixed time constant of A8C5 and A8R12. The time that A8Q5 is turned on is determined by the frequency of the audio input to Channel B. Therefore, the symmetry of the signal at the collector of A8Q5 is dependent upon frequency.

4-162. The positive signal at the collector of A8Q5 will either be conducted through A8CR22, A8CR24 and A8CR25 to the output or inverted by A8Q6, depending upon which direction the Local Oscillator must be tuned. The original assumption was that the Local Oscillator was too high. Therefore, Channel B leads Channel A by 90° as shown in Figure 4-11. During the time that A and B are both positive, diodes A8CR19 and A8CR20 are reverse biased. Nothing will happen since the phase switch is only affected by negative pulse.

4-163. Channel B will go negative first, removing the reverse bias from A8CR19. Channel A now goes negative and A8C7 which is charged to 20 volts, is grounded and turns on A8CR19. The negative-going pulse is coupled through A8CR19 to the base of A8Q8 to turn A8Q8 off and A8Q7 on. When A8Q7 is on, A8CR21 is grounded

Table 4-1. Locked Condition of AFC.

Input Frequency	IF 30 MHz - 35 Hz	IF 30 MHz + 35 Hz	Audio Level	Channel A*
Increases	X		Increases	Leads
Increases		X	Decreases	Lags
Decreases	X		Decreases	Leads
Decreases		X	Increases	Lags

*Referenced to Channel B

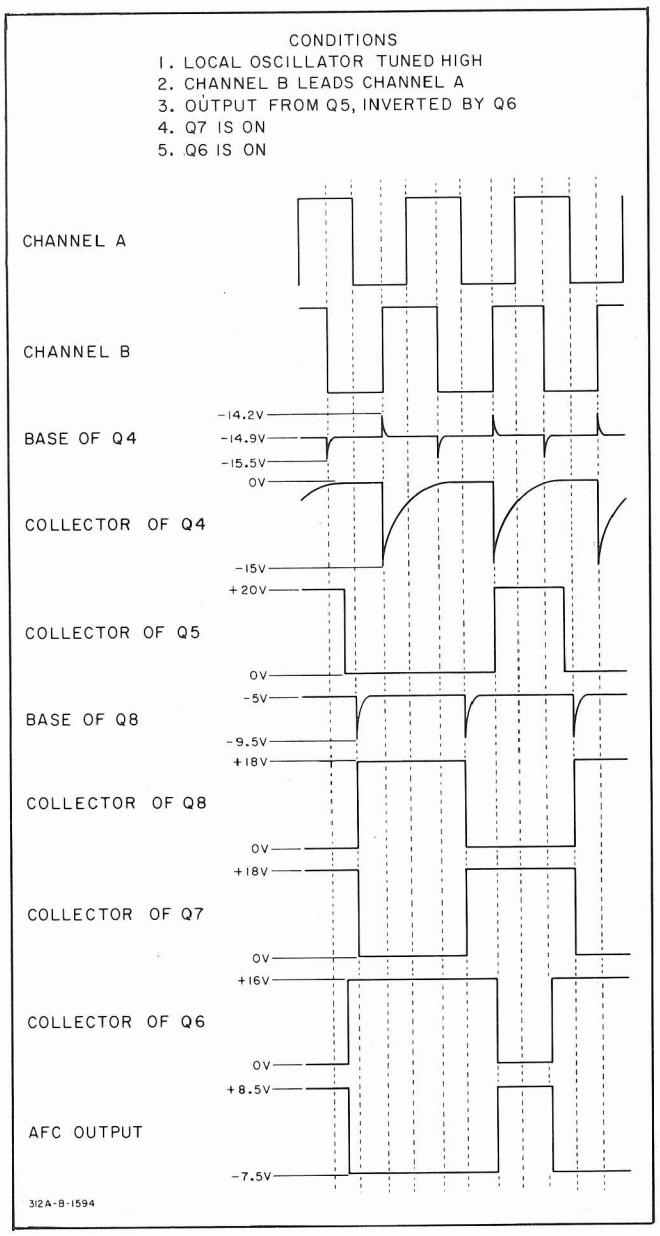


Figure 4-11. AFC Waveforms.

through A8Q7 and becomes forward biased. Therefore, the positive signal from the collector of A8Q5 must go through A8R36 to the base of phase inverter A8Q6. The inverted signal goes through A8CR23 and A8CR25 to the output. The output is filtered by A22C13. This negative output will decrease the oscillator frequency to match the input signal frequency.

4-164. The offset voltage produced by A8CR25 determines the frequency by which the Local Oscillator is offset from the input signal plus 30 MHz. This offset is nominally 35 Hz. The output of the phase inverter goes from about + 18 volts to ground. On the output side of A8CR25, the signal goes from about - 7.5 volts to + 8 volts. When filtered, a + 0.5 volt offset is applied to the varicap diodes.

4-165. Expand and Audio Amplifier A101 (312D Only) Schematic No. 11.

4-166. The Expand and Audio Amplifiers serve two purposes. The Expand portion of the circuit allows the normal meter indication to be expanded for increased resolution. The Audio Amplifier provides the necessary gain to drive the internal speaker or an external set of headphones.

4-167. The detected input to the Expand Amplifier comes from the Meter Amplifier A7. Here, the dc level is passed through a unity gain amplifier U1. In the normal meter function, the output of U1 drives meter M1. In the expand function the output of U1 is routed through an attenuator by the METER EXPAND dB switch, where any level between - 7 dB and + 3 dB can be expanded over a 2 dB (± 1 dB) full scale. The 0 dB position of the switch is equivalent to a 0 dB meter indication in the NORMAL meter function. If the input level is too low to be expanded over the 2 dB full scale range, the METER EXPAND dB switch can be down ranged or the input level can be increased.

4-168. Since the meter has a 2 dB full scale sensitivity, the output of the attenuator must be amplified to obtain this sensitivity. This is provided by Expand Amplifier U2. This amplifier has a gain of approximately 30 dB but is adjustable by R9. The coarse offset adjustment R14 is a tracking adjustment so that the meter also reads accurately at low input levels or down scale.

4-169. The Audio Amplifier, consisting of U3, Q1 and Q2, provides the current gain necessary to drive the internal speaker or an external set of headphones. Transistors Q1 and Q2 form a class AB output stage with CR1, CR2, and R17 included to prevent crossover distortion. The amplifier has a gain of approximately 20 dB. When headphones are used, the speaker is disconnected from the output of the amplifier. The output transformer has a primary impedance of 45 ohms, driving the 3.2 ohm voice coil of the speaker.

4-170. COUNTERS A13 (Schematics 21 and 22).

4-171. The purpose of the counters is to display the input frequency to which the instrument is tuned. This is performed by counting the 2 - 3 MHz VFO frequency for a fixed 100 ms period.

4-172. Count Gate U22A (Schematic No. 21) performs the function of turning on the 2 - 3 MHz VFO signal with a 100 ms gate which is derived from the 1 MHz time base A26. The 2 - 3 MHz VFO signal from A29 first passes through an amplifier consisting of Q3 and Q4 where it is squared. It is then applied to Schmitt Trigger U31B to produce a fast rise time to trigger TTL logic. The 1 MHz time base reference is also squared by an amplifier consisting of Q1 and Q2 and then applied to Schmitt Trigger U31C. The output of U31C is divided by a series of decade counters consisting of U37, U36, U32, U33, U27

and U34 to produce a 5 Hz count gate for U22A. The output of U22A is a gated 2 - 3 MHz signal.

4-173. The gated 2 - 3 MHz signal is applied to the decade counters U15 through U20 where the 2 - 3 MHz signal is counted. At the end of 100 ms, all digits are displayed except the MHz digits. These digits depend not only on the frequency of the 2 - 3 MHz VFO but also on the setting of the Frequency Range Switch. The MHz digit selection will be discussed later.

4-174. After the 2 - 3 MHz is counted by the decade counters, a latch signal from U31E stores the contents of the decade counters in latches U8 through U12. After the count is latched, it is decoded by the decoder-drivers U1 through U5 and is used to pull the cathode of the respective segment in the LED display low for all digits except the MHz digits.

4-175. MHz Digit Select. The 0 to 18 MHz input frequency is selected by an 18 position (0 through 17) Frequency Range Switch, each position covering a 1 MHz band. The specific frequency within each band is determined by the frequency of the 2 - 3 MHz VFO. Since each band has an overlap, it is possible for the VFO to be tuned below 2 MHz or above 3 MHz. If this happens, the MHz digit must change. For example, if the Frequency Range Switch is set to 1, the normal frequency range of the instrument is 1 MHz to 2 MHz on this band. If the instrument is tuned below 1 MHz, the 2 - 3 MHz VFO will be tuned below 2 MHz and the 1 MHz digit will be dropped from the display. If the instrument is tuned above 3 MHz (VFO greater than 3 MHz), then one digit must be added to the display. This borrow and carry function is performed by the Up/Down counter U23, which receives binary Frequency Range information from the Frequency Range Switch, and information from the decade counter output U20 which determines whether the 2 - 3 MHz signal below 2 MHz, between 2 and 3 MHz, or above 3 MHz.

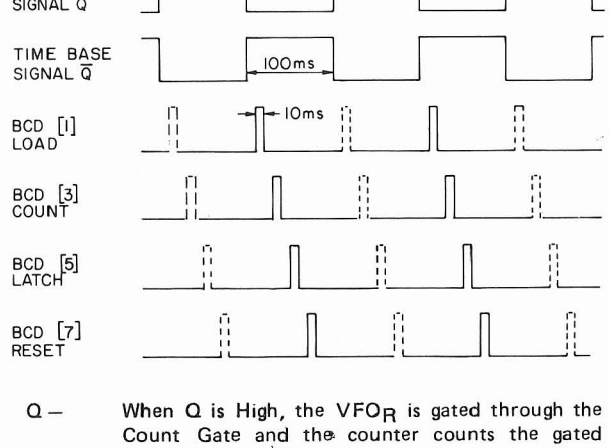
4-176. When the VFO frequency is below 2 MHz, the Up/Down Select signal from U20 will be a logic 0 and the Up/Down Enable signal will be a Logic 1. NAND gate U21B will turn on, producing a low signal at U23 input, subtracting 1 or borrowing from the range information provided by the Frequency Range Switch. If the VFO frequency is between 2 and 3 MHz, the Up/Down Select will be a 1 and the Up/Down Enable will be a 0 and neither of the NAND gates U21A and U21B will be turned on. If the VFO frequency is at 3 MHz or above, Up/Down Select will be a 1 and Up/Down Enable will be a 1. NAND gate U21A will turn on, and a carry signal will be supplied to U23 to be added to the information from the Frequency Range Switch.

4-177. Dual Flip-Flop U35 is used as an extention of the Up/Down Counter U23 to provide five line binary information for ranges 16 and 17. This is necessary since U23 is only a four line binary counter and can only provide range information up to 15. The MHz range information is decoded by U24 and applied to latches U13 and U14 in the counter. This information is decoded and pulls the cathode of the respective MHz digit segment low.

4-178. The timing of the Up/Down Counter, latches, and reset is controlled by the BCD-to-Ten Decoder U28. All of these functions take place when U22A is not on (refer to timing diagram, Figure 4-12). When $\overline{Q}$ is high, U22A will be on, Q will be low to inhibit NAND gates U22B, U30A, U30B, and U30C. When the BCD information from U27 (input to U28) is a BCD 1 (H) and Q is high, the output of U22B is low and frequency range information is loaded into the Up/Down counter U23. When the output of U27 is a BCD 3, the output of U29C is high, enabling the Up/Down code to be applied to U23. When the BCD code from U27 is a 7, U31A output is high to provide a reset for the counters. When the output of U27 is a BCD 5, the output of U31A is high, providing a latch for the counters.

4-179. Blanking.

4-180. When the Frequency Range Switch is set to the 0 position and the instrument is tuned below 0 Hz (2 - 3 MHz below 2 MHz) an illegal condition exists. This will be noted by a flashing of the counter display. This is accomplished by U25 and U26. When the Frequency Range Switch is set to 0, all inputs to U25 will be true except the input to pin 1. If the instrument is tuned below 0 Hz (2 - 3 MHz VTO below 2 MHz) U21B will be turned on, supplying a count down signal to U23. The output of U23 will clock Dual



Q – When Q is High, the VFO$_R$ is gated through the Count Gate and the counter counts the gated signal. The MHz select circuit is cleared to accept data.

$\overline{Q}$ – When $\overline{Q}$ is High it becomes a second clear pulse to the MHz Select circuit and the MHz Digits and Display Controller is enabled to send data.

Load – The Load line enables the MHz Select circuit to accept the Up/Down input lines.

Count – The Up/Down lines are counted within the MHz Select circuit at this time.

Figure 4-12. Timing Sequence.

Flip-Flop U35, causing a 0.1 Hz signal output (pins 5 and 11) to be applied to the remaining input to U25. The output of U25 goes alternately high and low at a 0.1 Hz rate, causing the counter display to flash.

4-181. + 20 Volt Regulator A1.

4-182. The + 20 volt Regulator is the series type with Q4 being the series pass element. Diode A1CR4 is a temperature compensated reference for the supply. Operational amplifier A1U1 compares the sense voltage from pin 15 with the reference voltage to control the amount of current flowing in A1Q2, A1Q3 and series element Q4. Transistor Q1 and its associated components form a current source for the supply. Transistor A1Q4 is a current limit for the supply.

4-183. When the output of the supply is at its correct level of + 20 volts, the voltages at pins 2 and 3 of A1U1 will be equal. Current from current source A1Q1 will be split between A1U1 and A1Q2, A1Q3 and the series element Q4. If the output voltage should rise above + 20 volts, pin 2 of A1U1 will also rise, causing more current to be drawn by A1U1 and less current available for A1Q2, A1Q3 and Q4. This reduction in current through Q4 brings the output level down to + 20 volts and the input to pin 2 of A1U1 will again be equal to the voltage at pin 3.

4-184. Current limit is accomplished by A1Q4 and A1R11. When the current flowing through A1R9 causes a voltage drop across it equal to the base-emitter voltage drop of A1Q4, A1Q4 begins to turn on, limiting the amount of current available to the series element thus limiting the amount of current that can be drawn by the load. Diode CR5 is a transient recovery diode.

4-185. The load switch S1 is included for troubleshooting purposes so that the load can be removed. When in the OFF position, the sense voltage is supplied to pin 2 of A1U1 through the switch. When switching ON or OFF, A1R9 supplies the sense voltage when the switch is between contacts.

4-186. - 15 Volt Regulator A12.

4-187. The - 15 Volt Regulator operates in exactly the same manner as the + 20 Volt Regulator. The only differences are in the types of transistors used, the voltage levels and polarities.

Table 5-1. Required Test Equipment.

Instrument Type	Required Characteristics	Recommended Model
Tracking Oscillator	Frequency Range: 10 kHz to 22 MHz Level Range: - 99.9 dBm to + 10 dBm ± 0.1 dB	-hp- Model 313A
Signal Generator	Frequency Range: 50 kHz to 50 MHz Level Range: - 110 dB to + 20 dB	-hp- Model 606A/B
Function Generator	Frequency: 0.01 Hz to 100 kHz (with DC Offset Function)	-hp- Model 3312A
Oscilloscope	Bandwidth: DC to 50 MHz	-hp- Model 180A with 1801 Vertical and 1820A Horizontal Plug-ins
Storage Oscilloscope	Bandwidth: DC to 100 kHz Sensitivity: .005 V/dm	-hp- Model 181A/AR
Vertical Amplifier for Storage Oscilloscope	Sensitivity: .005 V/cm with dc offset	-hp- Model 1805A
Counter, frequency	Frequency Range: DC to 50 MHz Accuracy: $< \pm 2 \times 10^{9}$	-hp- Model 5245L
Voltmeter, Digital	4½ Digit AC and DC Functions	-hp- Model 34740A/34702A
Filter, Bandpass	Frequency: 48 kHz, at least 40 dB down at 96 kHz and 144 kHz Frequency: 3 MHz, at least 40 dB down at 6 MHz and 9 MHz	Hisonics Inc. No. 20-0100-00 Hisonics Inc. No. 20-0014-00
Attenuator Pad	Impedance: 75:50 Ω	See Figure 5-4
Feedthru Termination	Impedance: 50 Ω ± 1%	-hp- Model 11048C
Feedthru Termination	Impedance: 75 Ω ± 1%	-hp- Model 11094B
Feedthru Termination	Impedance: 191 Ω ± 1%	See Figure 5-2
Attenuators	Range: 0 to 120 dB in 10 dB steps	355D with known error
Probe	Divider: 10:1	-hp- Model 10001A
Cable	BNC-to-Banana	-hp- Model 11001A
Adapter	BNC-to-Banana	-hp- Model 11037A
Resistor	1 kHz ± 1%	-hp- Part No. 0757-0280
Adapter	BNC-to-clip leads	Pomona 2631
Resistor	2.0 kΩ ± 1%	-hp- Part No. 0683-2025
Capacitor	4700 pF	-hp- Part No. 0160-0157
Capacitor	10 μF	-hp- Part No. 0180-0183
Shorting Connector	Male BNC	-hp- Part No. 1250-0045 with shorting wire
Telephone Adapter Kit	4, WECO Type 358 or 470 Plugs. To be used with unbalanced 75 Ω system or balanced 124 Ω, -hp- Part No. 1250-0591. 4, WECO Type 347. Two 347 Plugs provide a 241 or 289 for balanced systems, -hp- Part No. 1251-3759. 2, WECO Type 309 for audio frequency, -hp- Part No. 1251-3758. 2, WECO Type 310 for audio frequency, -hp- Part No. 1251-3757	5061-0743
Cable	75 Ohms	-hp- Model 15525A

SECTION V
MAINTENANCE

5-1. INTRODUCTION.

5-2. This section of the manual contains information necessary to determine if your instrument is operating within its published specifications. This information can be found in Paragraph 5-3 entitled Performance Tests. Adjustment and Calibration Procedures are also included (Paragraph 5-32), followed by General Maintenance Procedures (Paragraph 5-56) and Troubleshooting (Paragraph 5-62).

5-3. Specials.

5-4. Many 312B Wave Analyzers and 312B Selective Level Meters have special modifications (designated 312B/D-Hxx or 312B/D-Cxx). Information about these can be obtained by contacting any Hewlett-Packard Sales and Service Office.

PERFORMANCE TESTS

5-5. PERFORMANCE TESTS.

5-6. The following Performance Tests are designed to determine if your instrument is operating within its specifications. If it is determined that any test does not meet these specifications, refer to Paragraph 5-32 for Adjustment and Calibration of the instrument.

5-7. Preliminary Tests.

5-8. Before the Performance Tests are performed the following steps should be accomplished.

a. Insure that the 115 V/230 V ac power switch is in a position corresponding to the line voltage to be used.

b. Turn the instrument ON and allow 2 hours for the inside cabinet temperature to stablize.

CAUTION

Do not remove or install printed circuit boards with power applied to the 312B/D. Failure to comply can result in a short-circuit and/or damage to the instrument.

5-9. Frequency Response – 312B.

a. Connect the 75 Ω cable between the 313A output and the J1 input of the 312B. Place a BNC short on the J2 connector. Connect the LOCAL OSCILLATOR, 30 MHz, and RECORDER OUTPUT on the rear panel of the 312B to the corresponding inputs on the 313A. (See Figure 5-1(a).) Set the 312B and 313A controls as follows:

312B

INPUT MODE	TERMINATED
IMPEDANCE	75
BAL/UNBAL	BAL
REFERENCE LEVEL	+ 20 dB
AMPLITUDE RANGE	- 10 dB
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	1000 kHz

313A

MAX OUTPUT	+ 10
OSCILLATOR MODE	TRACK 312
METER MODE	EXPAND
ATTENUATORS	00.0 dB

b. Set the SCALE OFFSET adjustment for 313A meter indication of 0 dB. Tune the 312B from 10 kHz up to 10 MHz. The 313A meter should not deviate more than ± 0.2 dB over this frequency range.

c. Tune the 312B from 10 MHz to 18 MHz. The 313A Meter should not deviate more than ± 0.5 dBm.

d. Repeat Steps b and c at each setting of the REFERENCE LEVEL attenuator. Insert 10 dB of attenuation in the 313A Attenuator each time the REFERENCE LEVEL is down ranged.

e. Move the 313A output signal from J1 to J2. Place the shorting BNC on J1. Repeat Steps b through d.

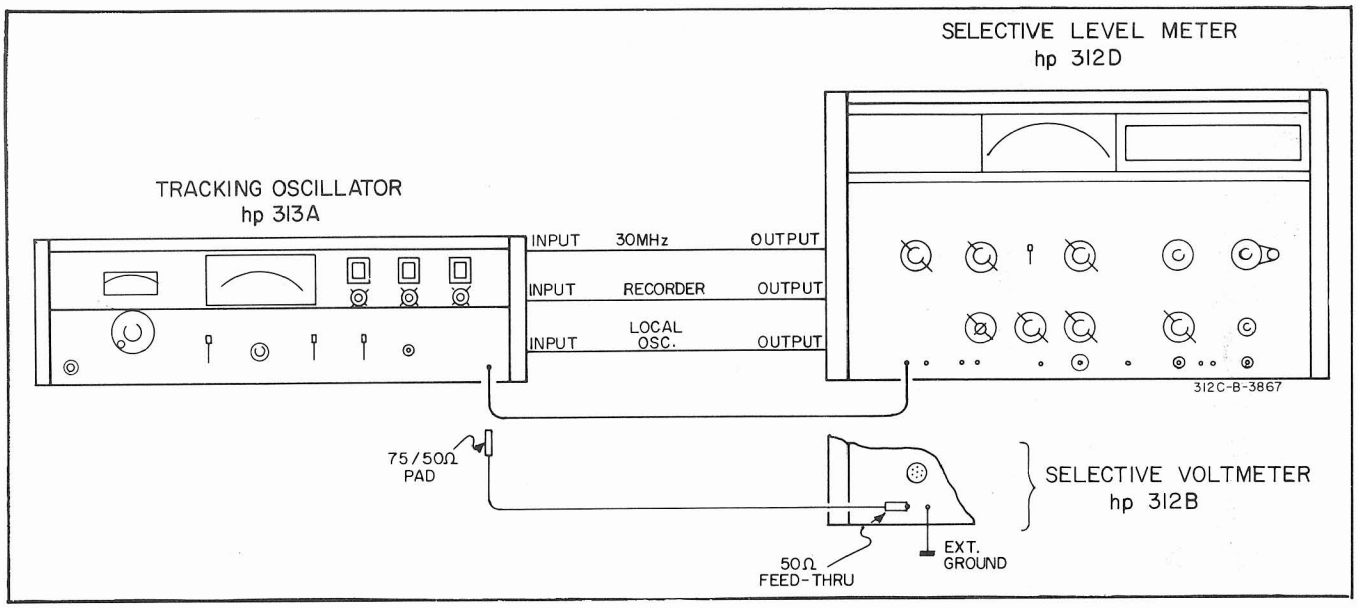


Figure 5-1(a). Frequency Response.

5-10. Frequency Response – 312D.

a. Set the 312D controls as follows:

312D

INPUT IMPEDANCE	124
REFERENCE LEVEL	+ 20
AMPLITUDE RANGE	- 10 dB
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	1 MHz

313A

OSCILLATOR MODE	TRACK 312
METER MODE	312 EXPAND
ATTENUATORS	00.0
MAX OUTPUT	+ 10 dBm

b. Connect the 313A output to the J3 input of the 312D and a short across J4 as shown in Figure 5-1(b). The construction of the 190 ohm termination is shown in Figure 5-2.

c. Perform Steps b through e of Paragraph 5-9.

5-11. Frequency Accuracy – 312B/D.

a. Turn the 312B/D on and allow at least 4 hours for temperature stabilization within the cabinet before checking the time base accuracy.

b. Connect 1 MHz OUTPUT on the rear panel of the 312B/D to the input of the 5245L.

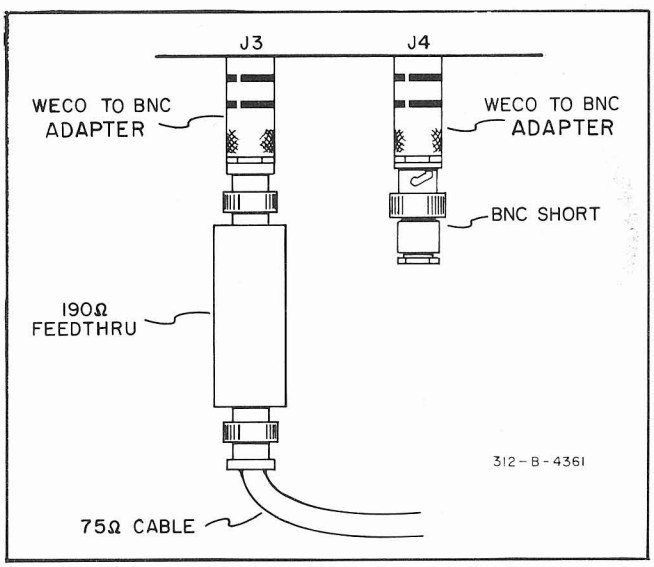


Figure 5-1(b). Use of Adapters – 312D.

c. Measure and record the time base frequency to the nearest Hz. Time base accuracy = time base frequency minus 1 MHz.

d. Set the 312B/D controls as follows:

312B

INPUT MODE	TERMINATED
IMPEDANCE	50
BAL/UNBAL	UNBAL
REFERENCE LEVEL	0 dB
AMPLITUDE RANGE	0 dB
RECEIVER MODE	AM
BANDWIDTH	3100

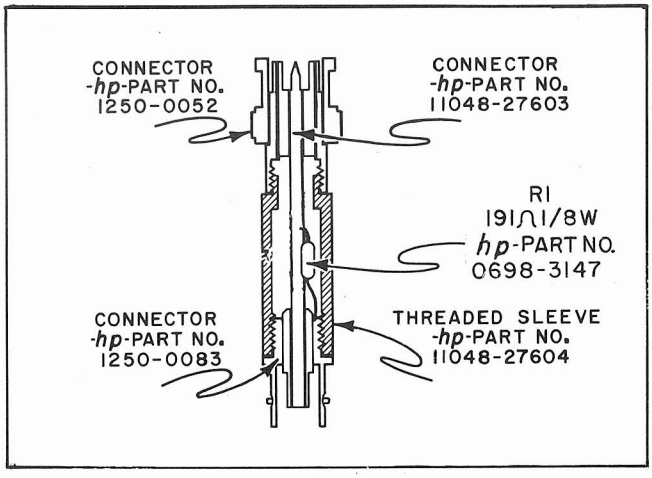


Figure 5-2. 190 Ohm Termination.

312D

INPUT IMPEDANCE	75
REFERENCE LEVEL	0 dB
AMPLITUDE RANGE	0 dB
RECEIVER MODE	AM
BANDWIDTH	3100

NOTE

The 50 Ω/75 Ω Adapter should be used when testing Frequency Accuracy of the 312D. (See Figure 5-4.)

e. Set the 312B/D FREQUENCY and FREQUENCY TUNING to any frequency between 50 kHz and 18 MHz.

f. Set the Signal Generator to the same frequency as the 312B/D. Set the output level of the 606A/B to an output level of 0 dBm.

g. Connect the Signal Generator output through a tee connector to J1 (J3 on the 312D). Connect the frequency counter to the other tee connection.

h. Tune the Signal Generator very carefully to the notch in the 312B/D bandpass and record the 312B/D frequency indication.

i. Determine if the 312B/D is within specifications as follows:

FREQUENCY ACCURACY $<\pm 10$ Hz + time base accuracy

5-12. Time Base Stability — 312B/D.

a. Connect the 5245L to the 30 MHz output on the rear of the 312B/D. The 5245L should read 30 MHz ± 60 Hz.

NOTE

Temperature must be kept constant, or compensation for temperature difference must be made whenever a frequency difference is recorded. Unless a record of the temperature and date of last calibration is available, the frequency offset should not be considered drift or aging rate of the 1 MHz crystal.

b. Vary the line voltage ± 10%. The 5245L indication should not vary more than ± 3 Hz.

c. Stability as a function of temperature may be checked using the setup of Paragraph 5-12(a) while varying the operating temperature of the 312B/D.

5-13. External 1 MHz Input Test — 312B/D.

NOTE

Model 312B's with serial numbers 1442A00400 and below do not have an external 1 MHz input and do not require this test.

a. Connect the Signal Generator to the 5245L Counter and adjust the output frequency to 1 MHz ± 10 Hz.

b. Set the Signal Generator output level to 0 dB and connect this signal to the EXT 1 MHz input on the rear panel of the 312B/D.

c. Connect the CALIBRATED OUTPUT to the front panel input and adjust the 312B/D controls for an indication of - 40 dBm.

d. Set the rear panel 1 MHz switch to EXT. The 312B/D Meter reading should return to - 40 dBm after a brief settling period. The frequency indication may change slightly.

5-14. Selectivity — 312B/D.

NOTE

Insure that the Frequency Accuracy Test is performed and within specifications before this test is performed.

a. Connect the CALIBRATED OUTPUT of the 312B/D to the appropriate front panel input shown below. Set the 312B/D controls as follows:

312B

INPUT MODE	TERMINATED
IMPEDANCE	75
BAL/UNBAL	UNBAL
REFERENCE LEVEL	- 40
AMPLITUDE RANGE	0

RECEIVER MODE . . . . . AM
BANDWIDTH. 3100
FREQUENCY RANGE - MHz 1
FREQUENCY TUNING . . . . . 999.96 kHz
Front Panel Input J1

312D

IMPEDANCE 75
REFERENCE LEVEL . . . . . - 40
AMPLITUDE RANGE 0
RECEIVER MODE . . . . . AM
BANDWIDTH. 3100
FREQUENCY RANGE - MHz 1
FREQUENCY TUNING . . . . . 999.96 kHz
Front Panel Input J3
METER. . . . . .Normal

b. With the 312B/D counter indicating 999.96 kHz, the 312B/D meter should indicate 0 dBm. If it does not, adjust the CAL ADJ until it does.

c. Measure the upper and lower 3 dB and 60 dB points. This is accomplished by tuning the 312B/D above and below the passband center frequency until the desired amplitude is indicated on the meter. The frequency at which each amplitude occurs must be within the tolerances listed in Table 5-2 or Table 5-3.

Table 5-2. 312B Bandwidth Tolerances.

Tuning	200 Hz Bandwidth	1000 Hz Bandwidth	3100 Hz Bandwidth
Upper 3 dB Point	1000.10 kHz ± 1 counts	1000.50 kHz ± 5 counts	1001.55 kHz ± 15 counts
Lower 3 dB Point	999.90 kHz ± 1 counts	999.50 kHz ± 5 counts	998.45 kHz ± 15 counts
Upper 60 dB Point	1000.22 kHz ± 2 counts	1001.07 kHz ± 10 counts	1003.10 kHz ± 30 counts
Lower 60 dB Point	999.78 kHz ± 2 counts	998.93 kHz ± 10 counts	996.90 kHz ± 30 counts

5-15. Automatic Frequency Control – 312B Only.

a. Set the 312B controls as follows:

INPUT MODE . . . . . TERMINATED
IMPEDANCE 75
BAL/UNBAL . . . . . UNBAL
REFERENCE LEVEL . . . . . - 40
AMPLITUDE RANGE 0
RECEIVER MODE . . . . . AM
BANDWIDTH. 3100
FREQUENCY RANGE -MHz . . . . . .1 MHz
FREQUENCY TUNING . . . . . 1000.04 kHz

b. Connect the CAL OUTPUT of the 312B directly to J1 input connector. The 312B should indicate 0 dBm. If not, adjust the CAL ADJ until it does.

c. Fine tune the 312B to the notch in the center of the passband. This should be at 1000.00 kHz.

d. Place the RECEIVER MODE switch in the AM/AFC position and slowly tune the 312B frequency away from 1 MHz. Watch the frequency counter and note the frequency after the 312B loses lock (noted by a loss in 312B Meter indication). This frequency must be at least 3 kHz away from the reference frequency of 1 MHz.

Table 5-3. 312D Bandwidth Tolerances.

Tuning	50 Hz Bandwidth	2300 Hz Bandwidth	3100 Hz Bandwidth
Upper 3 dB Point	1000.03 kHz ± 1 count	1001.15 kHz ± 11 counts	1001.55 kHz ± 15 counts
Lower 3 dB Point	999.97 kHz ± 1 count	998.85 kHz ± 11 counts	998.45 kHz ± 15 counts
Upper 60 dB Point	1000.06 kHz ± 1 count	1002.40 kHz ± 23 counts	1003.10 kHz ± 30 counts
Lower 60 dB Point	999.94 kHz ± 1 count	997.60 kHz ± 23 counts	996.90 kHz ± 30 counts

e. Repeat Steps c and d except tune the 312B frequency off in the opposite direction from 1 MHz.

f. Place the RECEIVER MODE switch in the AM position. Tune the frequency to 1004.00 kHz. Down range the AMPLITUDE RANGE switch to - 60. Now place the RECEIVER MODE switch in the AM/AFC position. Slowly tune the frequency towards 1000.00 kHz while watching the 312B Meter. The AFC pull should activate before the meter reads 0 dB. This verifies that the AFC will lock to a signal 60 dB below the reference level.

g. Repeat Step f except tune the frequency to 996.00 kHz before down ranging the AMPLITUDE RANGE switch to - 60.

h. Place the RECEIVER MODE switch in the AM position. Set the frequency tuning to 1001.00 kHz. Place AMPLITUDE RANGE switch in the 0 position. Turn the RECEIVER MODE switch to the AM/AFC position, the AFC should activate and pull the 312B frequency to 1000.04 kHz ± 0.01 kHz.

i. Tune the 312B to 999.00 kHz and repeat Step h. The AFC should pull the frequency to 999.96 kHz ± 0.01 kHz.

5-16. Attenuator Accuracy Tests – 312B/D.

a. Connect the equipment as shown in Figure 5-3 and set the 312B/D as follows:

312B

INPUT MODE . . . . . TERMINATED
INPUT IMPEDANCE 50
BAL/UNBAL . . . . . UNBAL

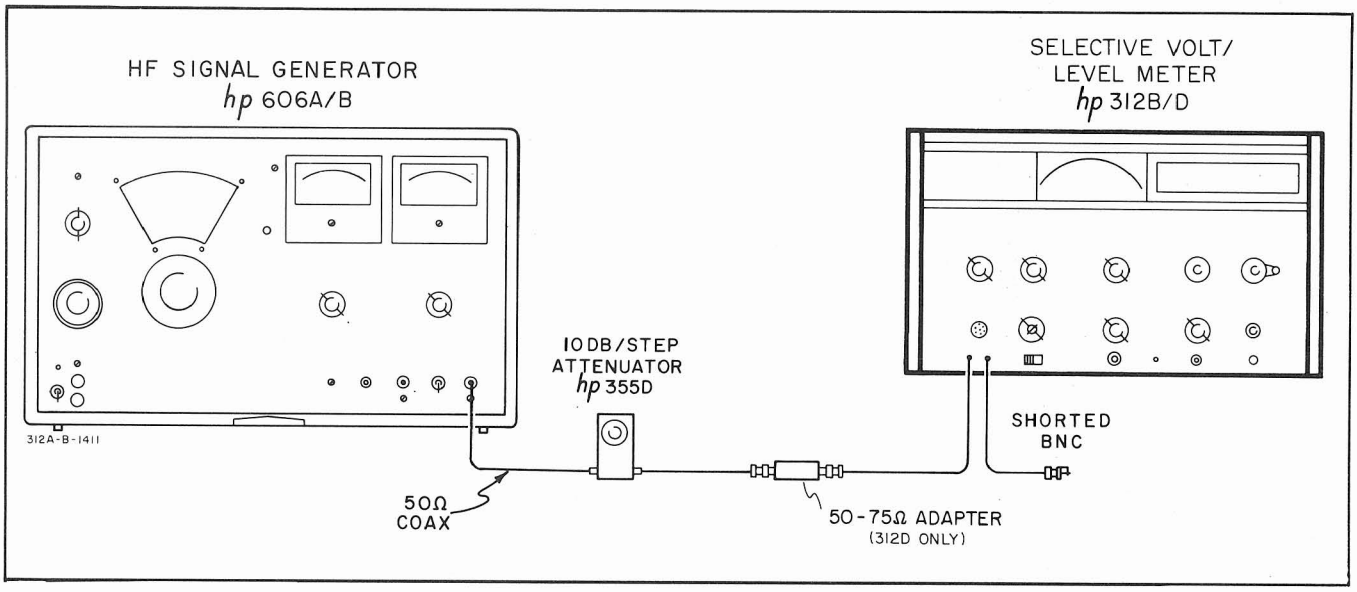


Figure 5-3. Attenuator Accuracy Test Setup.

REFERENCE LEVEL . . . . . + 10 dBm
AMPLITUDE RANGE . . . . . 0 dB
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 1 MHz
RECEIVER MODE . . . . . AM/AFC

312D

INPUT IMPEDANCE 75
REFERENCE LEVEL . . . . . + 10 dBm
AMPLITUDE RANGE . . . . . 0 dB
FREQUENCY TUNING . . . . . 1 MHz
FREQUENCY RANGE - MHz 0
RECEIVER MODE . . . . . AM
METER . . . . . .Normal

b. Set the 355D to 0 dB. Set the Signal Generator to 1 MHz and adjust its output level for an indication of + 2.0 dBm on the 312B/D Meter.

c. Insert 10 dB of attenuation with the 355D and down range the AMPLITUDE RANGE control by 10 dB. The 312B/D meter should indicate 2.0 ± 0.1 dB.

d. Continue this procedure for each position of the AMPLITUDE RANGE control. For each step the 312B/D Meter should indicate 2.0 ± 0.1 dB (± 0.2 dB in the - 60 dB position).

e. Set the REFERENCE LEVEL control to + 20 and the AMPLITUDE RANGE control to - 10. (Set the 355D Attenuator to 0 dB.) Adjust the Signal Generator output for a + 2.0 dB indication on the 312B/D Meter.

f. Insert 10 dB of attenuation in the 355D and at the same time change the REFERENCE LEVEL attenuator to + 10. The 312B/D Meter should indicate 2.0 dBm ± .2 dBm.

g. Continue this procedure throughout the entire range of the REFERENCE LEVEL attenuator. In each step the 312B/D Meter should indicate 2.0 dBm ± 0.2 dBm.

h. For 312B only, move the shorting connector from J2 to J1. Connect the 606A/B output cable to J2. Repeat Steps e through g.

5-17. Bridging Impedance Tests – 312B Only.

a. Set the 312B and 313A controls as follows and connect the output of the 313A through a 75 ohm feedthru termination to the input of the 312B J1. Connect the 30 MHz, LOCAL OSCILLATOR, and RECORDER outputs on the rear panel of the 312B to the corresponding inputs on the rear panel of the 313A.

312B

INPUT MODE . . . . . BRIDGED
IMPEDANCE 75
BAL/UNBAL . . . . . UNBAL
REFERENCE LEVEL 0
AMPLITUDE RANGE 0
BANDWIDTH 3100
RECEIVER MODE . . . . . AM
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 10 kHz

313A

OSCILLATOR MODE . . . . . TRACK 312
METER MODE . . . . . OUTPUT MONITOR
ATTENUATORS 00.0
MAX OUTPUT . . . . . 0 dBm

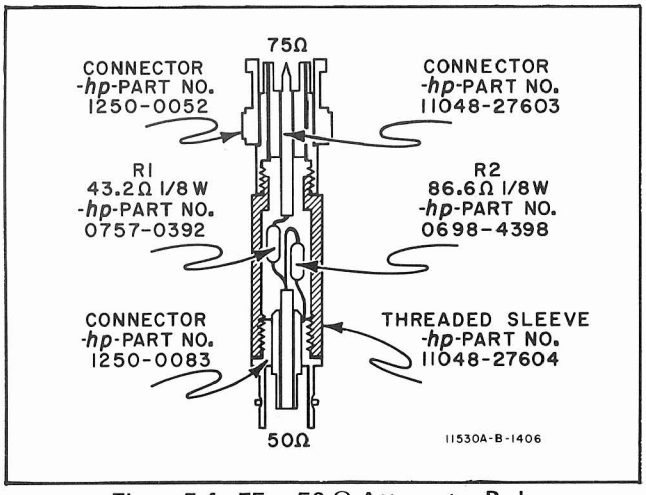


Figure 5-4. 75 – 50 Ω Attenuator Pad.

b. Connect a 10 kΩ ± 1% resistor in series with the input lead to J1 on the 312B as shown in Figure 5-5. The 312B Meter indication should drop by 6 dB or less indicating an input bridging impedance to ground of 10 kΩ or greater.

c. With the 10 kΩ resistor still connected, readjust the 313A Attenuators for 0 dB indication on the 312B Meter.

d. Increase the 312B frequency until the 312B Meter drops by 3 dB. The frequency at which this occurs should be greater than 900 kHz, thus indicating an input capacitance to ground of 35 pF or less.

e. Repeat Steps b through d at each setting of the REFERENCE LEVEL attenuator. The input capacity to ground should be less than 35 pF at all settings of the REFERENCE LEVEL attenuator except - 40 dBm position. On the - 40 dBm position the frequency at which the 312B Meter drops by 3 dBm must be 500 kHz or greater, indicating an input capacitance to ground of 60 pF or less.

f. Remove the shorting BNC from J2 and put it on J1. Repeat Steps a through e with the signal applied to J2.

g. An input impedance of 10 kΩ to ground from each input terminal indicates an input impedance of 20 kΩ between input terminals. An input capacitance of 35 pF or less to ground from each input terminal indicates an input capacitance of 18 pF or less between input terminals.

5-18. Common Mode Rejection – 312B/D.

a. Connect the 312B/D and 313A as shown in Figure 5-6. On the 312D, use WECO-to-BNC adapters (-hp- Part No. 1250-0591) and the 191 ohm feedthru termination shown in Figure 5-2.

b. Set the 312B/D controls as follows:

312B

INPUT MODE	TERMINATED
IMPEDANCE	75
BAL/UNBAL	BAL
REFERENCE LEVEL	- 40
AMPLITUDE RANGE	- 10
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	10 kHz

312D

INPUT IMPEDANCE	124
REFERENCE LEVEL	- 40
AMPLITUDE RANGE	- 10
BANDWIDTH	3100
METER	NORMAL
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	10 kHz
RECEIVER MODE	AM

313A

OSCILLATOR MODE	TRACK 312
METER MODE	OUTPUT MONITOR
MAX OUTPUT	+ 10 dBm
ATTENUATORS	- 60.0

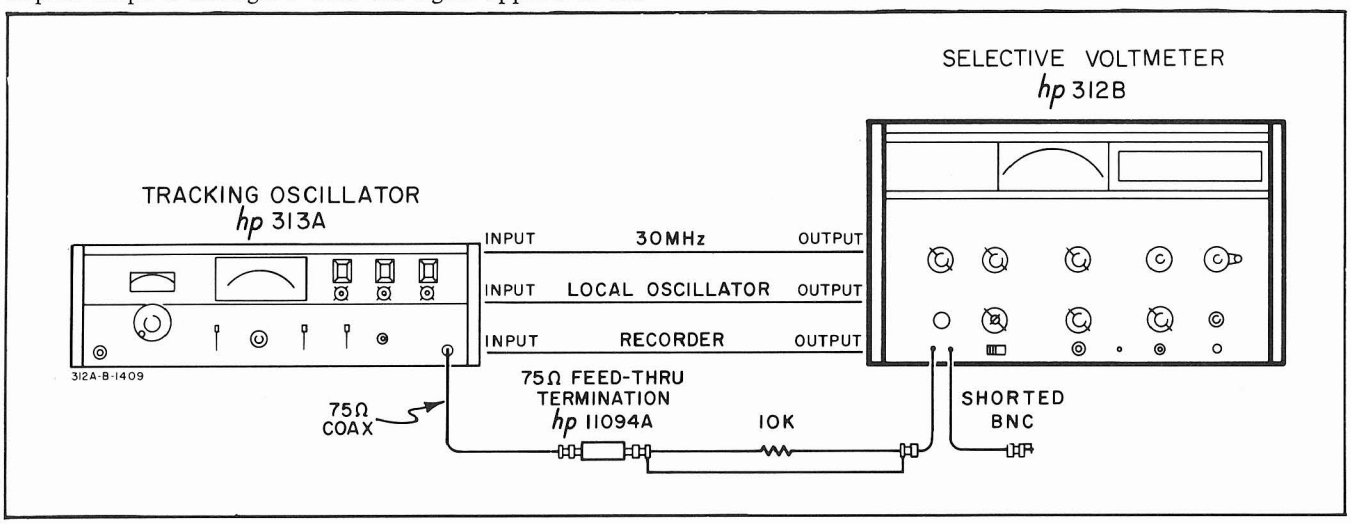


Figure 5-5. Bridging Impedance Test Setup – 312B.

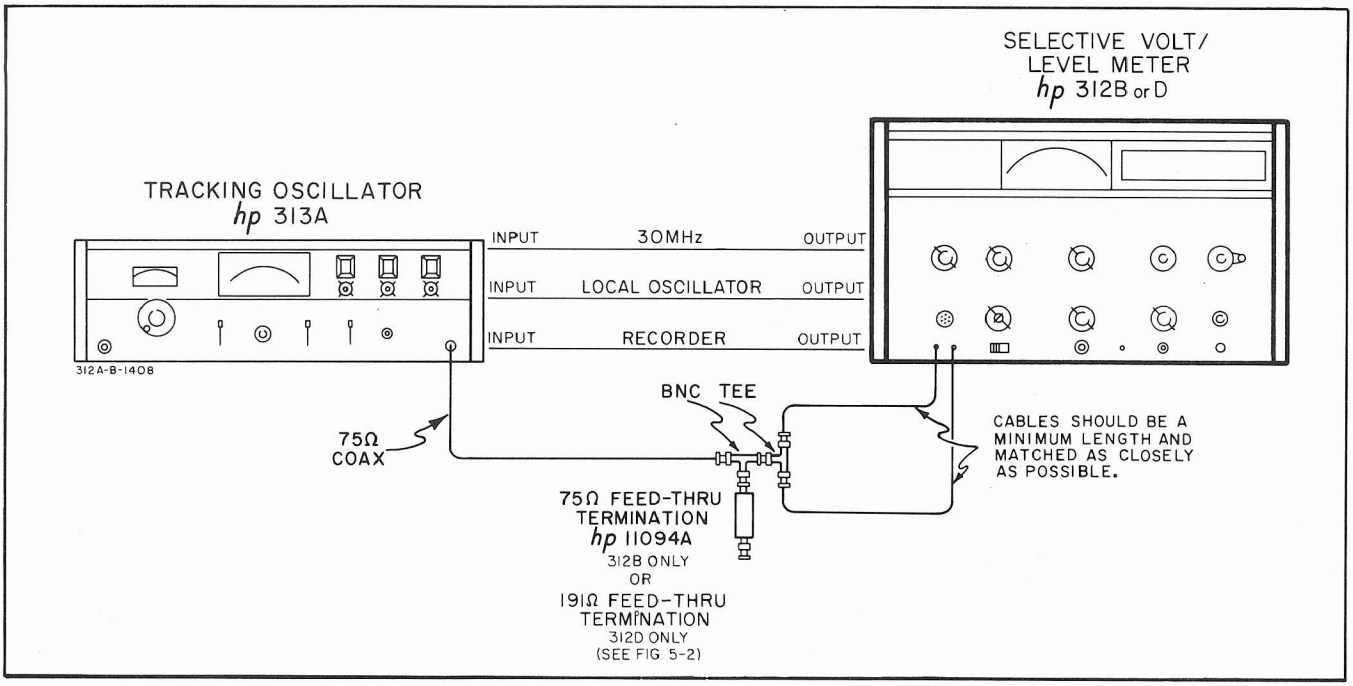


Figure 5-6. Common Mode Rejection – 312B/D.

c. Remove the input cable from the right hand connector (J2, 312B; J4, 312D) and install a BNC short on the connector.

d. Adjust CAL ADJ control for an indication of 0 dB on the 312B/D Meter.

e. Remove the BNC short and reinstall the input cable on the right hand connector. For the 312D remove the 191 ohm termination and install the 75 ohm termination.

f. The meter reading must be at least 34 dB below the reading of Step d (in this case – 84 dB).

NOTE

The test limits in this procedure are 6 dB less than specifications because of the amplifier gain difference when setting up the reference level in the UNBAL mode and when checking common mode in the BAL mode.

g. Tune the frequency of the 312B/D from 10 kHz to 5 MHz. The common mode reading must be 34 dB less than the reference established in Step d for all frequencies between 10 kHz and 5 MHz.

h. Tune the frequency of the 312B/D from 5 MHz to 18 MHz. The common mode reading must be 24 dB less than the reference for all frequencies between 5 MHz and 18 MHz.

i. Repeat Steps c through h at each setting of the reference level attenuator. Remove 10 dB of attenuation in the 313A attenuator each time the reference level is up-ranged.

5-19. Distortion – 312B/D.

a. Connect the equipment as shown in Figure 5-7 and set the 312B/D controls as follows:

312B

INPUT MODE	TERMINATED
IMPEDANCE	50
BAL/UNBAL	UNBAL
REFERENCE LEVEL	0
AMPLITUDE RANGE	0
BANDWIDTH	200
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	48 kHz

312D

IMPEDANCE	75
REFERENCE LEVEL	0
AMPLITUDE RANGE	0
BANDWIDTH	50
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	48 kHz

b. Tune the Signal Generator to the 312B/D frequency (48 kHz) and adjust the Signal Generator output level for 0 dBm indication on the 312B/D meter.

c. Tune the 312B/D to the second harmonic (96 kHz) of the Signal Generator output and down range the AMPLITUDE RANGE control as required for an on-scale indication on the 312B/D Meter. The 312B/D indication

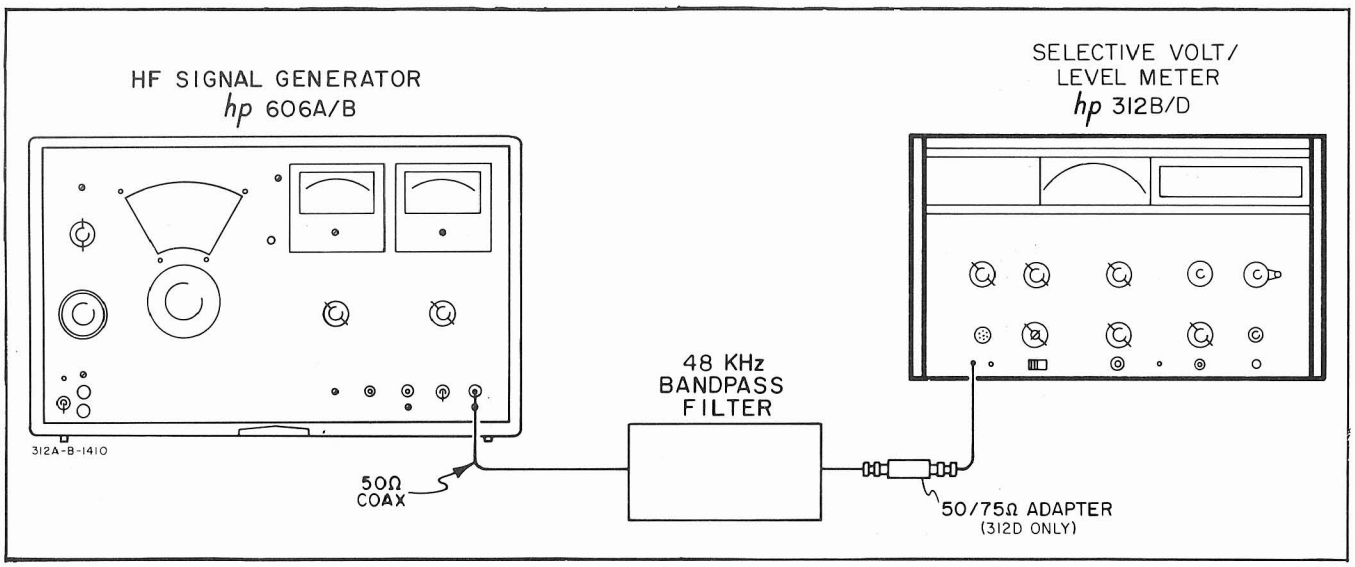


Figure 5-7. Harmonic Distortion Test Setup.

(meter indication + change in AMPLITUDE RANGE control) should be down at least 55 dB below the fundamental frequency.

d. Tune the 312B/D to 144 kHz and measure the amplitude of the third harmonic. This harmonic must also be down at least 55 dB from the fundamental frequency.

e. Reset the 312B/D controls as in Step a except change the frequency to 3 MHz. Replace the 48 kHz filter with a 3 MHz bandpass filter.

f. Tune the Signal Generator to the 312B/D frequency and adjust the amplitude control for 0 dBm indication on the 312B/D Meter.

g. Tune the 312B/D to the second harmonic (6 MHz) of the Signal Generator output and down range the AMPLITUDE RANGE control as required for an on-scale indication. The second harmonic signal must be down at least 65 dB from the fundamental frequency.

h. Tune the 312B/D to the third harmonic (9 MHz) of the Signal Generator output frequency. This harmonic must be down at least 65 dB from the fundamental frequency.

5-20. Noise Level and Residual Response Test – 312B/D.

a. Leave the 312B/D inputs open and set the controls as follows:

312B

INPUT MODE	TERMINATED
IMPEDANCE	75
REFERENCE LEVEL	-40
AMPLITUDE RANGE	-60
BANDWIDTH	1000

312D

INPUT IMPEDANCE	75
REFERENCE LEVEL	-40
AMPLITUDE RANGE	-60
BANDWIDTH	2300
METER	NORMAL

b. Tune the 312B/D from 10 kHz to 18 MHz while observing the 312B/D Meter indication. The 312B should indicate below - 120 dB in the 1000 Hz bandwidth except when tuned to a residual response. (The 312D should indicate below - 117 dBm in the 2300 Hz bandwidth.) All residual responses must be - 112 dB or lower.

5-21. Meter Tracking and Recorder Output Level Accuracy – 312B/D.

a. Connect the 313A output to the 312B/D input and connect the 30 MHz, local oscillator, and recorder outputs on the rear panel of the 312B/D to the corresponding inputs on the rear panel of the 313A. Also connect a 34740A/34702A voltmeter to the 312B/D recorder output. Set the 313A and the 312B/D as follows:

312B

INPUT MODE	TERMINATED
INPUT IMPEDANCE	75
BAL/UNBAL	UNBAL
REFERENCE LEVEL	0
AMPLITUDE RANGE	0
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	1
FREQUENCY TUNING	999.96 kHz

312D

INPUT IMPEDANCE	75
REFERENCE LEVEL	0

AMPLITUDE RANGE . . . . . 0 dB
BANDWIDTH. 3100
RECEIVER MODE . . . . . AM
FREQUENCY RANGE - MHz 1
FREQUENCY TUNING . . . . . 999.96 kHz

313A

OSCILLATOR MODE . . . . . TRACK 312
METER MODE. . . . . 312 EXPAND
ATTENUATORS 07.0
MAX OUTPUT . . . . . + 10 dBm

b. Adjust the CAL ADJ control until the 312B/D Meter reads + 3 dB.

c. Use the 313A attenuators to check the meter tracking of the 312B/D according to Table 5-4.

d. Set the 313A attenuators to 7 dB. The 312B/D Meter should read + 3 dB. The voltmeter should indicate + 1 V dc ± 0.001 V. Set the CAL ADJ for a voltmeter indication of + 1 V dc ± 0.001 V.

e. Using the 313A Attenuators, check the RECORDER OUTPUT tracking of the 312B/D according to Table 5-4.

Table 5-4. Meter Tracking and Recorder Output Level Accuracy Test.

313A Attenuators	312B/D Meter Indication	34740A/34702A Indication
07.0	+ 3 dBm (Reference)	1 V ± .001 V
08.0	+ 2 dBm ± 0.1 dBm	891 mV ± 9 mV
09.0	+ 1 ± 0.1 dBm	794 mV ± 8 mV
10.0	0 dBm ± 0.1	707 mV ± 7 mV
11.0	- 1 dBm ± 0.1	631 mV ± 6 mV
12.0	- 2 dBm ± 0.1	562 mV ± 6 mV
13.0	- 3 dBm ± 0.1	501 mV ± 5 mV
14.0	- 4 dBm ± 0.1	447 mV ± 5 mV
15.0	- 5 dBm ± 0.1 dBm	398 mV ± 4 mV
16.0	- 6 dBm ± 0.1 dBm	355 mV ± 4 mV
17.0	- 7 dBm ± 0.1 dBm	316 mV ± 3 mV
18.0	- 8 dBm ± 0.1 dBm	282 mV ± 3 mV
19.0	- 9 dBm ± 0.1 dBm	251 mV ± 3 mV
20.0	- 10 dBm ± 0.1 dBm	224 mV ± 2 mV

5-22. Auxiliary Outputs – 312B/D.

a. Connect a 1 kΩ resistive load to the 1 MHz output on the rear panel of the 312B/D. Use a 10:1 probe and connect a Model 180A Oscilloscope across the 1 kΩ load and measure the amplitude of the 1 MHz signal. This signal should be at least 1 V peak-to-peak.

b. Connect a 50 ohm load to the 30 MHz output on the rear panel of the 312B/D. Use a 10:1 probe and connect the 180A oscilloscope across the 50 ohm load and measure the amplitude of this signal. The amplitude should be between 113 mV peak-to-peak and 197 mV peak-to-peak.

c. Connect the 50 ohm load to the LOCAL OSCILLATOR output jack. Connect the oscilloscope across the 50 ohm load and measure the amplitude of this signal. The amplitude should be between 150 mV peak-to-peak and 250 mV peak-to-peak.

d. Connect a frequency counter to the 30 MHz output on the rear panel of the 312B/D. Set the FREQUENCY RANGE - MHz switch to 0 and adjust the FREQUENCY TUNING so that the Frequency Counter indicates approximately 30.5 MHz. Step the FREQUENCY RANGE - MHz switch from 0 to 17. The Frequency Counter should indicate an exact 1 MHz increase with each step.

5-23. Receiver Mode Output Tests.

5-24. Beat Output – 312B/D.

a. Connect the Signal Generator output to J1 of 312B or J3 of 312D. The 312D will require the 75/50 Ω Adapter (Figure 5-4). Set the 312B/D controls as follows:

312B

INPUT MODE . . . . . TERMINATED
IMPEDANCE 50
BAL/UNBAL . . . . . UNBAL
REFERENCE LEVEL . . . . . - 40
AMPLITUDE RANGE 0
BANDWIDTH. 3100
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 999.96 kHz
RECEIVER MODE . . . . . BEAT
AUDIO AMPLITUDE . . . . . MAX CW

312D

INPUT IMPEDANCE 75
REFERENCE LEVEL . . . . . - 40
AMPLITUDE RANGE 0
BANDWIDTH. 3100
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 1 MHz
RECEIVER MODE . . . . . BEAT
AUDIO AMPLITUDE . . . . . MAX CW

b. Tune the Signal Generator to 1 MHz and adjust it for an indication of + 3 dB on the 312B/D Meter (- 37 dBm). Tune the 312B/D to 980.00 kHz.

c. Connect a 10 kilohm load across the AUDIO OUTPUT connector. Connect a digital voltmeter across the 10 kilohm load. The voltmeter should indicate less than 0.03 V rms.

d. Slowly tune the 312B/D up in frequency and note the indication on the voltmeter. At approximately 997 kHz, the indication on the voltmeter should start to increase.

e. Tune the 312B/D very slowly for a maximum indication on the voltmeter. This maximum should be greater than 0.5 volts rms for the 312B. The 312D maximum should be greater than 4.0 volts rms.

f. Fine tune the 312B/D to exactly 1 MHz. A dip should be noted in the voltmeter indication.

5-25. LSB and USB Outputs – 312B/D.

a. Disconnect the voltmeter from the previous test set-up and substitute the 5245L Electronic Counter in its place.

b. Change the RECEIVER MODE switch to AM and tune the 312B/D to 1000.30 kHz. Note the indication on the 312B/D Meter.

c. Slowly tune the 312B/D up in frequency until the 312B/D Meter indication drops by exactly 3 dB.

d. Change the RECEIVER MODE switch to LSB. The Counter should indicate 3.3 kHz ± 10%.

e. Change the RECIEVER MODE switch to USB. The Counter should indicate 330 Hz ± 10%.

f. Tune the 312B/D below 1 MHz until the 312B/D Meter indication drops by 3 dB. In the LSB position of the RECEIVER MODE switch, the counter should indicate 330 Hz ± 10%. In the USB position, the counter should indicate 3.3 kHz ± 10%.

5-26. AM/AFC Output – 312B.

a. Change the equipment setup as follows:

1. Remove all front panel connections to the 312B except the 10 kilohm load on the AUDIO OUTPUT.

2. Connect the output of a Signal Generator to the J1 connector on the 312B.

3. Connect the Voltmeter across the 10 kilohm load connected to the AUDIO OUTPUT jack.

b. Tune the 312B to 1 MHz. Change the RECEIVER MODE switch to AM/AFC and leave the remainder of the controls set as before.

c. Set up the Signal Generator for 100% modulation at 1 MHz and adjust the amplitude for 0 dBm indication on the 312B Meter. The Voltmeter should indicate between 0.4 and 0.7 volts rms.

5-27. AM Output – 312D.

a. Repeat Steps a through c of Paragraph 5-26 for the 312D except set the RECEIVER MODE switch to AM. The voltmeter should indicate at least 4.0 volts rms.

b. Verify proper speaker operation by removing the plug from the audio OUTPUT jack. The speaker should be audible when the plug is removed.

5-28. Meter Expand Test – 312D Only.

a. Connect the 312D and 313A as shown in Figure 5-1(a).

b. Set the 312D and 313A as follows:

312D

INPUT IMPEDANCE	75
REFERENCE LEVEL	0
RANGE -dB	- 10
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	10 kHz
METER	NORMAL

313A

OSCILLATOR MODE	TRACK 312
METER MODE	OUTPUT MONITOR
ATTENUATORS	- 20 dB
MAX OUTPUT	10 dBm

c. The reading on the 312D should be about 0 dBm. Set the METER EXPAND dB switch on the 312D to 0 and the METER switch to EXPAND. Note the meter reading on the 312D.

d. Switch the 0.1 dB switch on the 313A from 0 dB to - 0.9 dB while checking the meter reading on the 312D at each position.

e. Refer each reading to the reading noted in Step c. Each indication should be accurate to within .05 dB.

f. Set the METER EXPAND dB switch to - 1 and note the reading on the 312D Meter.

g. Switch the 0.1 dB switch on the 313A from - 0.9 dB to 0 dB while checking the 312D Meter reading at each position.

h. Each meter indication should be accurate to within .05 dB. Refer to the reading noted in Step f.

5-29. Overload Detector Test – 312D Only.

a. Connect the 312D and 313A as shown in Figure 5-1(a).

b. Set the controls as follows:

312D

REFERENCE LEVEL - dBM	- 40
RANGE - dB	0
INPUT IMPEDANCE	75
METER	NORMAL
FREQUENCY RANGE - MHz	1
BANDWIDTH	3100

RECEIVER MODE . . . . . AM
FREQUENCY TUNING . . . . . 1000.04 kHz

313A

OSCILLATOR MODE . . . . . TRACK 312
METER MODE . . . . . OUTPUT MONITOR
ATTENUATORS . . . . . - 33 dB
MAX OUTPUT . . . . . 0 dB

c. Sweep the oscillator from 18 MHz to 1 kHz with the oscillator set at - 33 dB. The overload light should not come on.

d. Sweep the oscillator from 1 kHz to 18 MHz with the Oscillator Attenuator set to - 31 dB. The overload light should stay on.

5-30. Phase Jitter Test – 312D Only (Optional).

Required Test Equipment

*HLI Phase Jitter Meter Model 56

a. Set the Phase Jitter Meter input switch to the 990 – 1030 Hz position; RANGE to 3° p-p and LEVEL to 0 dBm.

312D

INPUT IMPEDANCE 75
REFERENCE LEVEL . . . . . - 40
AMPLITUDE RANGE 0
BANDWIDTH 3100
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 1001.00 kHz
RECEIVER MODE . . . . . BEAT

c. Connect the 312D CALIBRATED OUTPUT to J3.

d. Connect the Phase Jitter Meter input to the 312D AUDIO OUTPUT labeled "310 PLUG."

e. Adjust the AUDIO OUTPUT control for an indication of 0 dBm on the Phase Jitter Meter.

f. Set the Phase Jitter Meter to MEASURE. The CAUTION light should be off. If not, adjust the 312D FREQUENCY TUNING until it goes off.

g. The phase jitter indication should be less than 0.6 degrees.

5-31. 2 kHz Notch Test – 312B Option 001, 312D.

a. Set 312B/D controls as follows:

312B

REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
INPUT MODE . . . . . TERMINATED
IMPEDANCE 75
BANDWIDTH (Hz) 3100
FREQUENCY RANGE - MHz 1
RECEIVER MODE . . . . . .Beat
FREQUENCY TUNING . . . . . 1000.04 kHz
AUDIO AMPLITUDE . . . . . .Max

312D

REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
INPUT IMPEDANCE 75
BANDWIDTH 3100
FREQUENCY RANGE - MHz 1
RECEIVER MODE . . . . . .Beat
FREQUENCY TUNING . . . . . 1000.04 kHz
AUDIO AMPLITUDE . . . . . .Max
METER . . . . . .Normal

b. Connect the 312B/D CALIBRATED OUTPUT to the 312B/D input and set the CAL ADJ to obtain a 0 dBm indication.

c. Connect the 312B/D AUDIO OUTPUT to the oscilloscope vertical input. Connect the output of the oscillator to the input of the counter and to the external trigger of the oscilloscope.

d. Set the oscillator frequency to obtain a counter period measurement of 500.00 μs ± 0.03 μs.

e. Set the 312B/D FREQUENCY TUNING to 1.00200 MHz and adjust the FINE tuning control so that the externally triggered oscilloscope display does not drift. Increase the oscilloscope sensitivity as necessary to obtain a suitable display.

f. Downrange the 312B/D AMPLITUDE RANGE to obtain an on-scale reading. The indication should be down greater than 55 dB from the - 40 dBm reference setting.

g. Set the oscillator frequency to obtain a counter period measurement of first 498.1 microseconds + 0 - 0.1 microseconds and then 501.9 microseconds + 0.1 - 0 microseconds. Adjust the 312B/D FINE tuning control for each frequency to stop the oscilloscope display drift and note the 312B Meter reading. The meter indication for both frequencies should be down > 45 dB from the - 40 dBm reference setting.

*NOTE: Phase Jitter Meter is very sensitive to vibrations and should be located away from vibrational sources.

ADJUSTMENT PROCEDURES

5-32. ADJUSTMENT AND CALIBRATION PROCEDURES.

5-33. Paragraphs 5-33 through 5-55 contain the adjustment procedures for both the 312B and the 312D. Procedures which apply to both 312B and the 312D are labeled "312B/D". Those which are different for each model are labeled "312B" or "312D". Procedures which are required for only one model are labeled "312B Only" or "312D Only". Table 5-1 lists required test equipment for these adjustment procedures.

5-34. Power Supply Adjustment – 312B/D.

a. Set the 115/230 volt switch on the rear panel to 115 volts.

b. Adjust the output voltage of an autotransformer for 115 volts and connect the 312B/D power cord to the output of the autotransformer.

c. Connect a 34740A/34702A Digital Voltmeter between + 20 V main and ground and adjust A1R7 to obtain an indication of + 20 ± 0.01 volts.

d. Connect the Digital Voltmeter to - 15 V main and adjust A12R7 to obtain an indication of - 15 ± 0.01 volts.

5-35. 1 MHz Oscillator Adjustment – 312B/D.

NOTE

Install all covers before making the following adjustment.

a. Connect an Electronic Counter to the 30 MHz output on the rear panel of the 312B/D. The 30 MHz signal is phase locked to the 1 MHz time base signal and is used as an indicator since it provides better resolution.

b. Turn the 312B/D on and allow at least 2 hours for stabilization.

c. Remove the filler button covering the 1 MHz ADJ hole on the rear panel of the 312B/D.

d. Use a non-metallic tuning tool to adjust A26C21 for a count of 30 MHz - 0 Hz + 60 Hz on the Electronic counter.

5-36. Variable Frequency Oscillator Adjustment – 312B/D.

a. Turn the FREQUENCY RANGE - MHz switch to 2.

b. Turn the FREQUENCY TUNING control maximum counterclockwise.

c. Use a non-metallic tuning tool to adjust the 1.99 MHz ADJ coil A21L1 to obtain a 312B/D frequency indication between 1980.00 kHz and 1985.00 kHz.

d. Turn the FREQUENCY TUNING control maximum clockwise.

e. Use a non-metallic tuning tool to adjust the 3.2 MHz ADJ capacitor A21C5 for a 312B/D frequency indication between 3205.00 kHz and 3210.00 kHz.

f. Repeat Steps b through e until no further adjustment is required.

5-37. Local Oscillator Adjustments – 312B/D.

NOTE

For 312B Serial Numbers 1442A00400 and below, see backdating for this procedure.

Required Test Equipment:

Counter – 5245L
Digital Voltmeter – 34740A/34702A

a. Set the controls as follows:

312B/D

FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 00000.00 kHz

On the 312D, remove A100 (00312-66502).

b. Connect the counter to the LOCAL OSC output on the rear panel of the 312B/D. Connect the voltmeter to A24TP1.

c. Adjust the 312B/D Frequency Tuning for a counter indication of 30.0000 MHz.

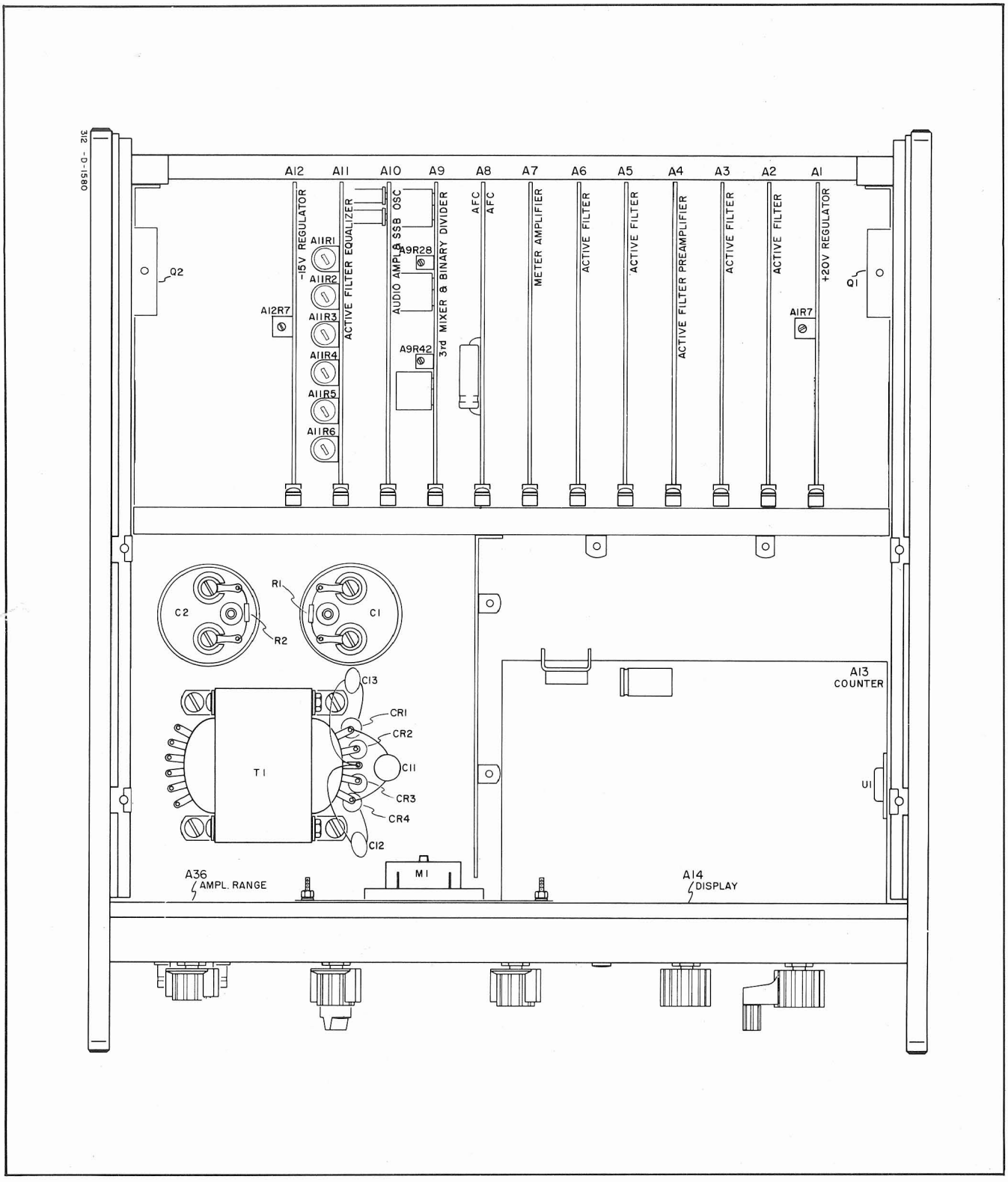


Figure 5-8. 312B Top View and Component Location.

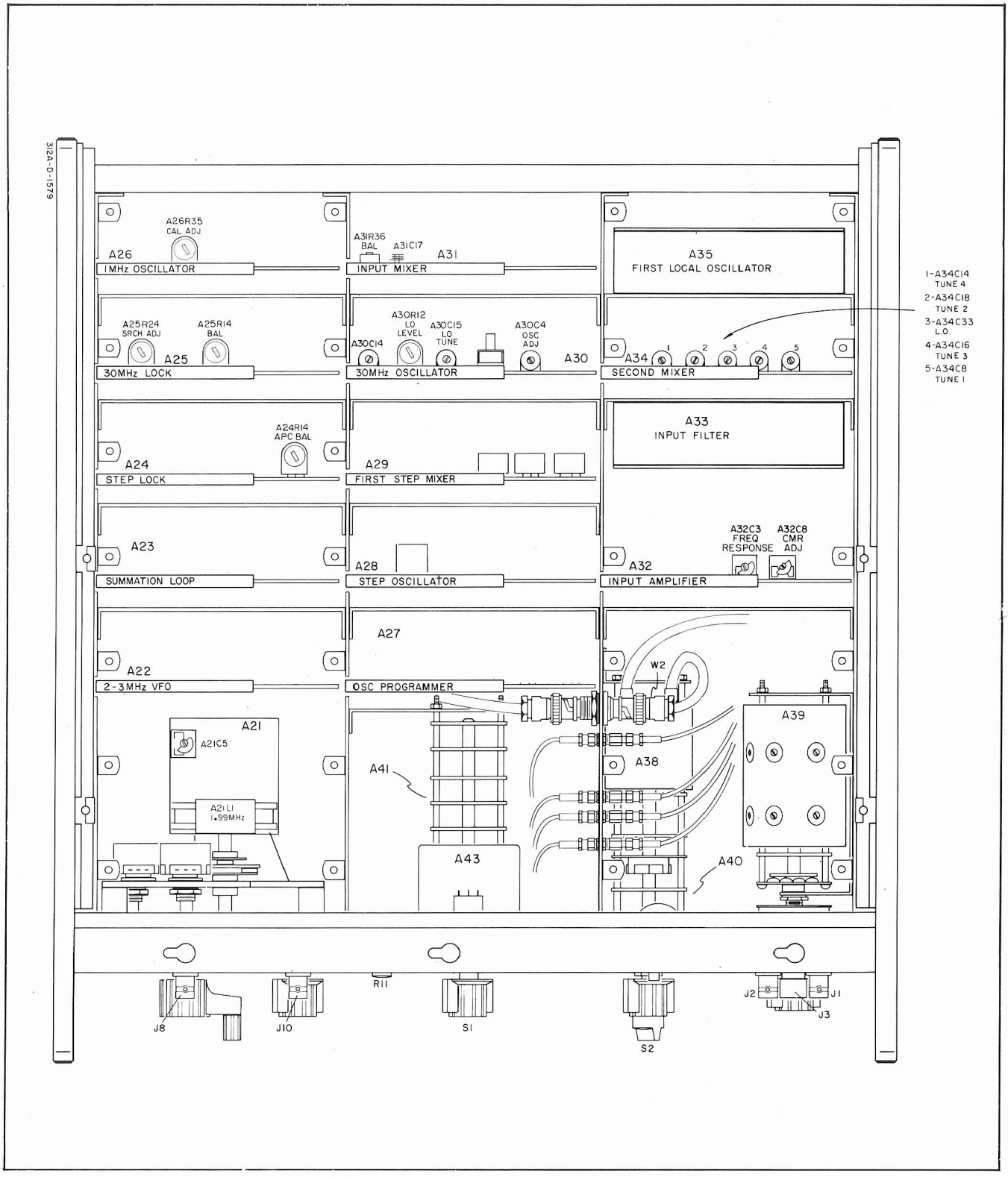


Figure 5-9. 312B Bottom View and Component Location.

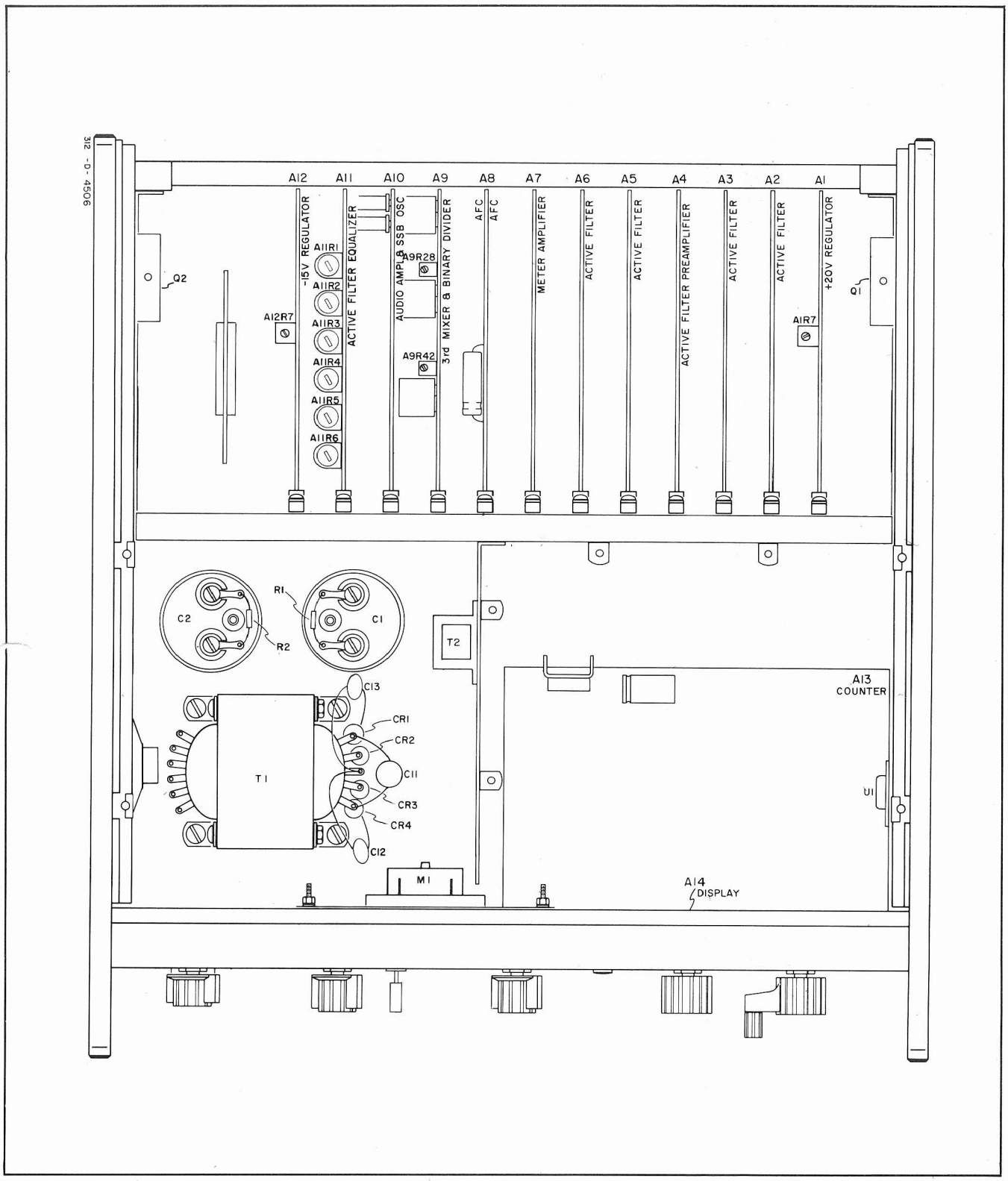


Figure 5-10. 312D Top View and Component Location.

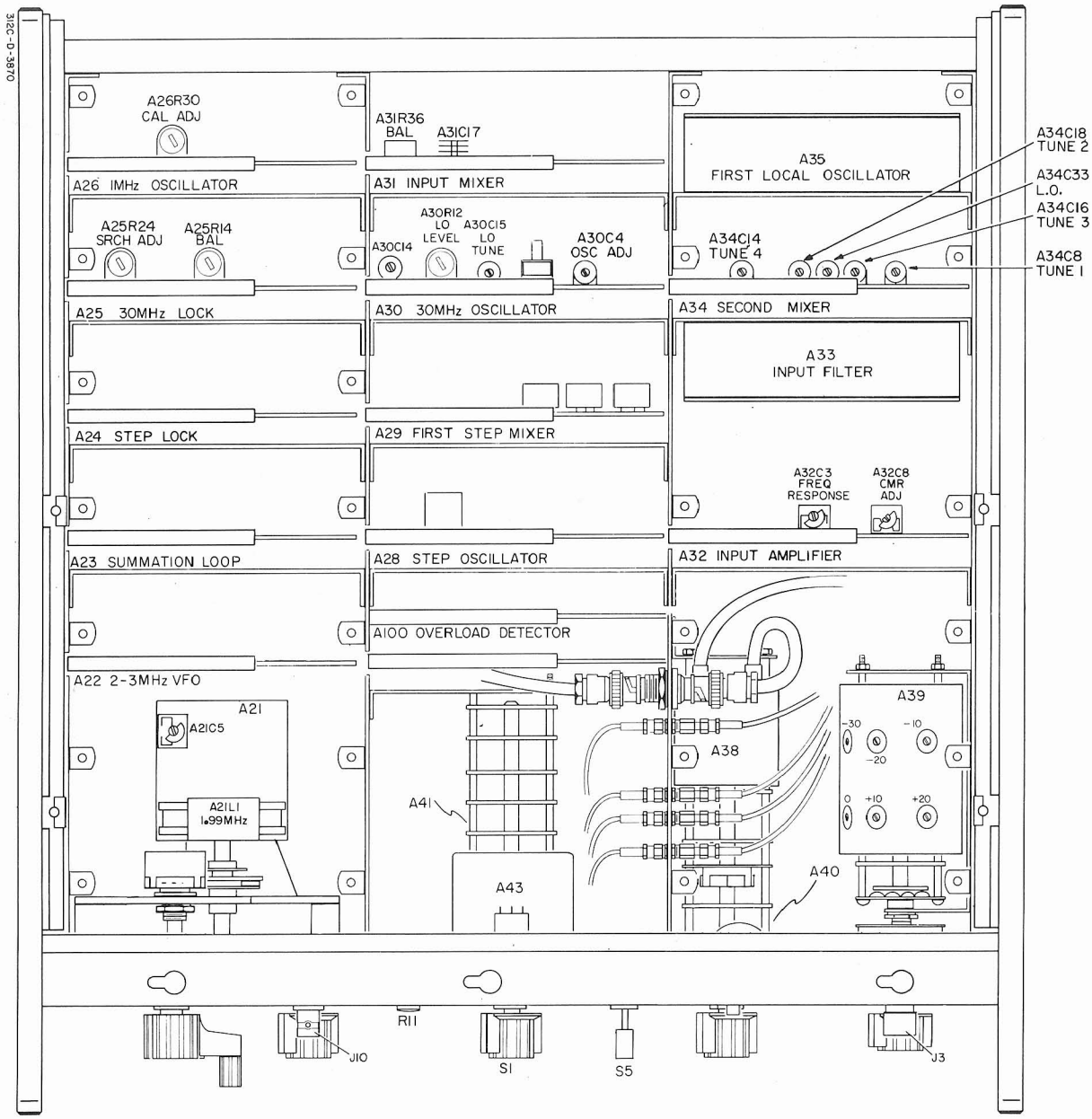


Figure 5-11. 312D Bottom View and Component Location.

d. Adjust A28L1 for + 2.00 V dc on the voltmeter.

e. Connect the voltmeter to A23TP1.

f. Adjust A35L1 for 0.0 V dc on the voltmeter.

g. Switch the FREQUENCY RANGE - MHz switch through each position between 0 and 17. The voltmeter should indicate between - 50 mV and + 300 mV at each position between 0 and 16. Position 17 should be ± 50 mV. Proceed to Step i if all positions are within these specifications.

h. Adjust A28C11 for a voltmeter indication of 0.0 V dc with the FREQUENCY RANGE - MHz switch set to 17. Adjust A28L1 for 0.0 V dc in the 0 position of the FREQUENCY RANGE - MHz switch. Repeat Step g. If necessary, adjust the padding capacitor A28C12 to meet this requirement.

Table 5-5. Padding List for A28C12.

Capacitance	Part Number
.68 pF	0150-0046
1.0 pF	0150-0029
2.0 pF	0150-0031
3.3 pF	0150-0022
6.8 pF	0150-0043
10 pF	0150-0055

NOTE

If the padding capacitor does not have sufficient range, it may be necessary to replace the varicaps on A28 and A35.

i. Adjust the FREQUENCY TUNING across its range. The voltmeter indication should be ± 600 mV for any setting of the FREQUENCY RANGE - MHz switch.

5-38. 30 MHz Oscillator Adjustment – 312B/D.

5-39. 30 MHz Frequency Adjustment – 312B/D.

a. Connect the Counter to the 30 MHz output on the rear panel of the 312B/D.

b. Set A30S1 to the "TEST" position. Use a non-metallic tuning tool to adjust A30C4 for counter indication of between 30.000 MHz and 30.010 MHz.

c. Leave A30S1 in the "TEST" position.

5-40. Varicap Bias Adjustment – 312B/D.

a. Connect the Digital Voltmeter to the APC IN test point on the A30 Assembly. The indicated voltage should be 6.2 V ± 2.0 V dc. Note this indication and connect the digital voltmeter to the APC test point on the A25 Assembly.

b. Disable the search oscillator by connecting a clip lead from the B+ test point on A25 to the SEARCH test point on the A25 Assembly.

c. Adjust A25R14 (BAL) to obtain a voltmeter indication with ± 0.2 V dc of the reading noted in Step a.

d. Change A30S1 to OPERATE and remove the clip lead from the A25 Assembly.

5-41. 30 MHz Amplitude Adjustment – 312B/D.

a. Set A30S1 to the "OPERATE" position.

b. Connect the Oscilloscope to the LO LEVEL test point on the 30 MHz Lock Assembly A25. Connect the ground lead to the GND test point nearby.

c. Use a non-metallic tuning tool to adjust A25L1 (LO ADJ) for maximum amplitude on the scope. The amplitude of the signal should be approximately 3.4 volts p-p.

5-42. Search Oscillator Adjustment – 312B/D.

a. Connect the Oscilloscope to the APC test point on the A25 Assembly, using a 10:1 probe (ac coupled).

b. Touch the 30 MHz Oscillator Coil A30L1 with a finger to detune the oscillator. A search signal should appear on the oscilloscope.

c. The search signal should be 3.5 V p-p ± .5 V and should have a period of 0.14 sec ± 0.02 sec.

d. If necessary, adjust A25R24 (SEARCH ADJ) to meet the above amplitude limits.

e. When finger is removed from A30L1, the search signal should stop.

5-43. 30 MHz Output Amplitude Adjustment – 312B/D.

a. Connect a 50 ohm termination to the 30 MHz OUTPUT of the 312B/D. Measure the 30 MHz OUTPUT with the oscilloscope.

b. Adjust A30C14 for a 140 mV p-p ± 25 mV p-p indication on the oscilloscope.

5-44. Second Mixer Tuning – 312B/D.

a. Connect the Oscilloscope to the LO test point on the A34 Assembly using a 10:1 divider.

b. Adjust A34C33 (LO) and A30C15 (LO TUNE) for maximum amplitude on the oscilloscope. Since these controls interact, it may be necessary to alternate between them until a maximum amplitude is indicated.

c. Adjust A30R12 (LO LEVEL ADJ) for an indication of 17.5 V p-p ± .5 V p-p.

d. Repeat Paragraph 5-39, Steps a and b. Return the switch to "OPERATE" when finished.

5-45. First Mixer 30 MHz Tuning.

a. Set the 312B/D controls as follows:

312B

INPUT MODE . . . . . TERMINATED
IMPEDANCE 75
BAL/UNBAL . . . . . UNBAL
REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 999.96 kHz
RECEIVER MODE . . . . . AM/AFC
BANDWIDTH. 3100

312D

INPUT IMPEDANCE 75
REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 999.96 kHz
RECEIVER MODE . . . . . AM
BANDWIDTH. 3100
METER. . . . . .NORMAL

b. Connect the CALIBRATED OUTPUT to J1 (J3, 312D).

c. Adjust A31C19 and A31C26 for a maximum 312B/D Meter indication.

5-46. First Mixer Carrier Balance Adjustment – 312B/D.

a. Remove all inputs to the 312B/D. Set the front panel controls as follows:

312B

REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
BAL/UNBAL . . . . . UNBAL
BANDWIDTH. 3100
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 0000.20 kHz
RECEIVER MODE . . . . . AM

312D

REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
INPUT IMPEDANCE 75
BANDWIDTH. 3100
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 000.20 kHz
RECEIVER MODE . . . . . AM

b. Remove CARRIER BAL filler button on the rear panel of 312B/D.

c. Alternately adjust A31R36 and A31C17 (CARRIER BAL) for minimum indication on the 312B/D Meter. The meter must read below - 12 dBm.

5-47. Third Mixer Adjustments – 312B/D.

a. Remove the A11 Equalizer Assembly.

b. Set the AMPLITUDE RANGE control to - 60 dB.

c. Adjust A9R28 (BAL A) and A9R42 (BAL B) for a minimum reading on the 312B/D Meter. The meter should read less than 2 percent of full scale on the 312B. The 312D should read below - 1.0 dB on the expand scale (meter switch set to NORMAL).

5-48. Second Mixer Gain and Phase Adjustments–312B/D.

a. Set up the 180A Oscilloscope as follows:

VERTICAL DISPLAY . . . . . CHOP
MAGNIFIER X10
HORIZONTAL DISPLAY. . . . . .EXT CAL
CHANNEL A . . . . . 1 V/cm
CHANNEL B . . . . . .005 V/cm
(.05 V/cm for 312D)

Connect a 1:1 probe to the ext. horizontal input and a 10:1 probe to Channel A and B.

b. Set the 312B/D as follows:

312B

REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
BANDWIDTH. 3100
RECEIVER MODE . . . . . AM/AFC
INPUT MODE . . . . . TERMINATED
IMPEDANCE 75
BAL/UNBAL . . . . . UNBAL
AUDIO AMPLITUDE . . . . . .Fully Clockwise
CAL ADJUST. . . . . .Fully Counterclockwise
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . .1000.04 kHz

312D

REFERENCE LEVEL . . . . . - 40 dBm
AMPLITUDE RANGE . . . . . 0 dB
BANDWIDTH. 3100
RECEIVER MODE . . . . . AM
INPUT IMPEDANCE 75
AUDIO AMPLITUDE . . . . . .Fully Clockwise
CAL ADJ. . . . . .Fully Counterclockwise
METER. . . . . .Normal
FREQUENCY RANGE - MHz . . . . . .0 MHz
FREQUENCY TUNING . . . . . 1000.04 kHz

Install a 4700 pF capacitor (-hp- Part No. 0160-0157) across the audio output for 312B only.

c. Connect CAL OUTPUT (-40 dBm) to J1 (J3 for 312D). The meter should indicate 0 dBm.

d. Connect horizontal 1:1 probe to A11R4 (TP17) of the Active Filter Equalizer Assembly (A11). Connect oscilloscope Channel A 10:1 probe to A11R1 (TP14) of the A11 Active Filter Equalizer Assembly. Adjust display on oscilloscope to obtain a 8 cm horizontal straight line. Connect horizontal 1:1 probe to A11R2 (TP15) of the Active Filter Equalizer Assembly (A11). Connect oscilloscope Channel A 10:1 probe to A11R1 (TP15) of A11 Active Filter Equalizer Assembly. Adjust Channel A on oscilloscope to obtain a 45° straight line. This procedure pre-sets the oscilloscope for the following steps.

e. Remove the external horizontal input from A11R2 (TP15) and connect it to A11R4 (TP17). Connect the 312B/D audio output to Channel B, of the oscilloscope, using a BNC cable. Set A11R1-R6 fully clockwise. Adjust A34C8 (Tune 1) and A34C18 (Tune 2) of the A34 assembly for maximum display on the 312B/D meter.

f. Adjust A34C16 (TUNE 3) and A34C14 (TUNE 4) for the best circle display on Channel A of the oscilloscope and for a flat line on Channel B of the oscilloscope. (It may be necessary to adjust A34C18 (TUNE 2) again).

Table 5-6. Padding List for A4R3 and A4R15.

Value	Part Number
1.82 K	0757-0429
1.91 K	0698-4430
2.0 K	0757-0283
2.1 K	0698-4432
2.26 K	0698-4434

g. The 312B/D Meter should be within ± .5 dB of 1 dB. If it is lower than - 1.5 dB, change A4R3 and A4R15 of the A4 Active Filter Preamplifier Assembly equally down in value to obtain a reading on the 312B/D Meter between - 1.5 and - .5 dB. If the 312B/D Meter reads higher than - .5 dB, change A4R3 and A4R15 equally up in value to obtain a 312B/D Meter reading between - 1.5 and - .5 dB. (See Table 5-6.)

h. Adjust A11R1 (3 kHz) and A11R4 (3 kHz) of the A11 Active Filter Preamplifier Assembly for a 312B/D Meter reading of exactly - 2.2 dB and for a flat line on Channel B of the oscilloscope.

i. Repeat Step h using A11R2 (1 kHz) and A11R5 (1 kHz) in the 1000 Hz bandwidth and A11R3 (.2 kHz) and A11R6 (.2 kHz) in the 200 Hz bandwidth.

j. Set bandwidth to 3100 and RECEIVER MODE to AM. With fine frequency tuning, adjust frequency above and below 1 MHz until circle disappears. Channel B of the oscilloscope should not exceed 80 millivolts p-p. (See dimension labeled "h" in Figure 5-12.) Repeat this for the 1000 Hz and 200 Hz bandwidths (2300 Hz and 50 Hz bandwidths for 312D).

k. Set front panel controls as follows:

312B

BANDWIDTH. 3100
RECEIVER MODE . . . . . AM/AFC
FREQUENCY TUNING. . . . . 1000.04 kHz

312D

BANDWIDTH. 3100
RECEIVER MODE . . . . . AM
FREQUENCY TUNING. . . . . 1000.04 kHz

l. Adjust CAL ADJ fully clockwise. The 312B/D Meter should read approximately full scale. Set 312B/D Meter using CAL ADJ to 0 dB.

m. Remove input to 312B/D from the 313A. Connect CAL OUT to J1 (J3, 312D). Adjust A26R30 (CAL ADJ) for a 312B/D Meter reading of 0 dB.

5-49. Frequency Response Adjustments – 312B/D.

CAUTION

The frequency response adjustments are very critical and should be avoided unless you are thoroughly familiar with the adjustment procedures.

a. Perform the frequency response tests (Paragraphs 5-9 and 5-10) and note which positions of the Reference Level Attenuator do not meet specifications.

b. If the - 40 dBm position is out of specifications, the Input Filter (A33) must be adjusted. Table 5-7 shows the ideal frequency response of the - 40 dB position.

c. If the - 30, - 20, - 10, 0, + 10 or + 20 dBm positions do not meet specifications, it may be necessary to adjust only the Reference Level Attenuator.

d. If the + 20 dBm position of the Reference Level cannot be adjusted to specifications, it may be necessary to adjust the Input Filter (A33).

5-50. Test Equipment.

a. The technique used for frequency response sweeps the Local Oscillator of the 312B/D from about 31 MHz to about 49 MHz. The oscilloscope provides a display of the frequency response with up to 0.1 dB per centimeter resolution when correctly adjusted. The following equipment is required:

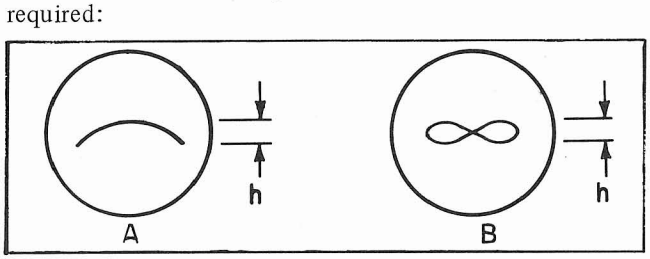


Figure 5-12. Second Mixer Adjustment Waveforms.

Tracking Oscillator, -hp- Model 313A
50 MHz Electronic Counter, -hp- Model 5245L or equiv.
Function Generator, -hp- Model 3312A
Storage Oscilloscope, -hp- Model 181A
Vertical Amplifier with DC Offset, -hp- Model 1805A
Time Base, -hp- Model 1820C or equiv.
Low Pass Filter, 10 μF Capacitor (-hp- P/N 0180-0183)
2.0 kΩ Resistor (-hp- P/N 0683-2025)
BNC Short, -hp- Part No. 1250-0045 with shorting wire
2 male WECO Type 358, -hp- Part No. 1250-0591 Connectors (312D only)
1, 75 Ohm Feedthru Termination, -hp- Model 11094B
1, 190 Ohm Feedthru Termination, See Figure 5-2

b. If an oscilloscope with DC Offset is not available, adjustment of the Input Filter should not be attempted.

c. If a storage oscilloscope is not available, a non-storage oscilloscope may be used. However, visualizing the frequency response will be difficult due to the slow sweep rate.

5-51. Input Filter Adjustments – 312B/D.

a. Remove A23 from the 312B/D. Connect the equipment as shown in Figure 5-13.

NOTE

Connect 313A output to J1. Place a BNC short on J2 (J3 and J4 on 312D). For the 312D's use WECO-to-BNC Adapters and 190 ohm Feedthru as shown in Figure 5-1(b).

b. Set the controls as follows:

3312A

FREQUENCY	0.1 Hz
FUNCTION	⊓⊔
SYM	CAL
TRIGGER PHASE	Free Run
AMPLITUDE	10

312B/D

BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	1

c. Adjust the 3312A OFFSET and AMPLITUDE VERNIER controls until the counter indication is switching between about 31 MHz and about 49 MHz. Do not allow the Local Oscillator output to go lower than 30 MHz. Disconnect the counter when finished. Do not leave the counter cable connected to the 312B/D.

d. Set the controls as follows:

312D

REFERENCE LEVEL	- 40 dBm
AMPLITUDE RANGE	- 10 dB
INPUT IMPEDANCE	124
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY RANGE - MHz	0
FREQUENCY TUNING	Fully CW

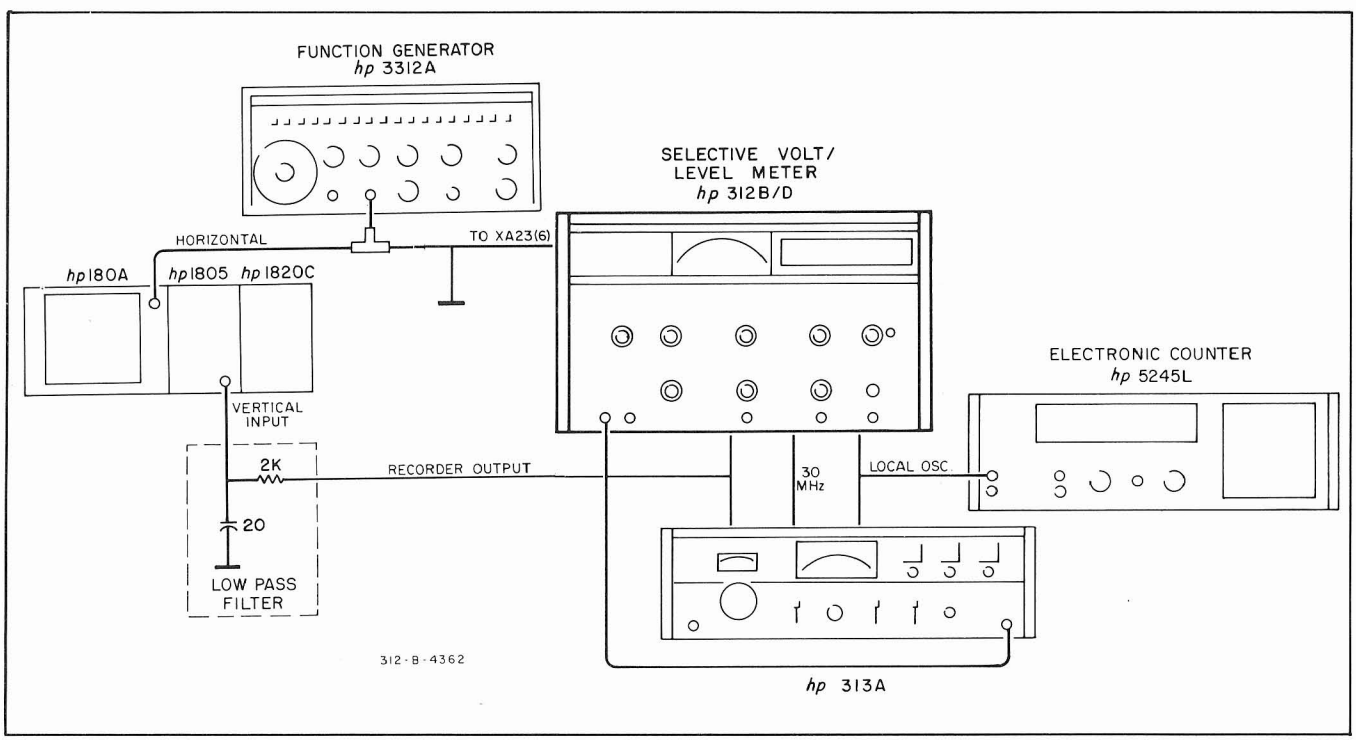


Figure 5-13. Frequency Response – A33 Adj. – 312B/D.

312B

FREQUENCY RANGE - MHz	0
REFERENCE LEVEL	- 40 dBm
AMPLITUDE RANGE	- 10 dB
INPUT MODE	TERMINATED
IMPEDANCE	75
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY TUNING	Fully CW

3312A

FUNCTION . . . . . ~

e. Adjust the oscilloscope controls for a display which looks like Figure 5-17. The display gives relative frequency response with frequency increasing from left to right. The display is meaningful only when the trace moves from left to right. The retrace (right to left motion) should be ignored. Use the offset control for vertical positioning. Set the storage persistance so that each sweep fades out before the next one starts.

NOTE

The waveform of Figure 5-17 is ideal for the 312B. For the 312D the same waveform is ideal but the response should not peak more than + 0.1 dB at high frequencies.

f. The effects of adjusting each control are illustrated in Figures 5-18 through 5-22. Before adjusting any of the controls, study each figure to see if any of the waveforms resemble the frequency response curve on the oscilloscope.

g. If the filter (A33) is grossly out of adjustment, proceed with Step 1 below. If it is only slightly out of adjustment, go to Step h.

1. Preset all capacitors except C14 to half open. Open C14 completely.

2. Twist the L2 slug completely to the top but not far enough to remove it. Set L1 and L3 three turns from the top.

3. Set R1 in the middle of its range.

4. Adjust L1 and L3 for the display shown in Figure 5-14. Make sure that the frequency response is still increasing at 18 MHz. Try to minimize the bumps at 7 and 12 MHz.

NOTE

If the response shown in Figures 5-14 or 5-15 cannot be achieved, it will be necessary to adjust C14, C3 and C7. Preset the controls as described in Steps 1, 2 and 3. Adjust C14, C3 and C7 for the type of waveform shown in Figure 5-14. Then proceed with Step 4.

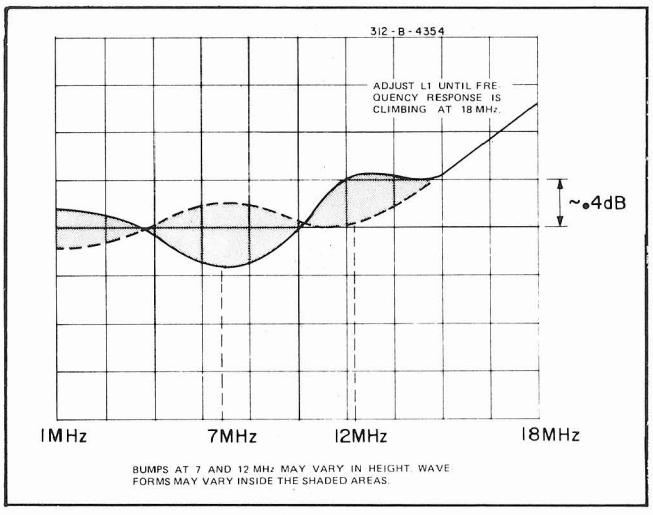


Figure 5-14. A33L1 and A33L3 Adjustments.

5. Adjust R1 for low frequency flatness as shown in Figure 5-15. This adjustment is very sensitive.

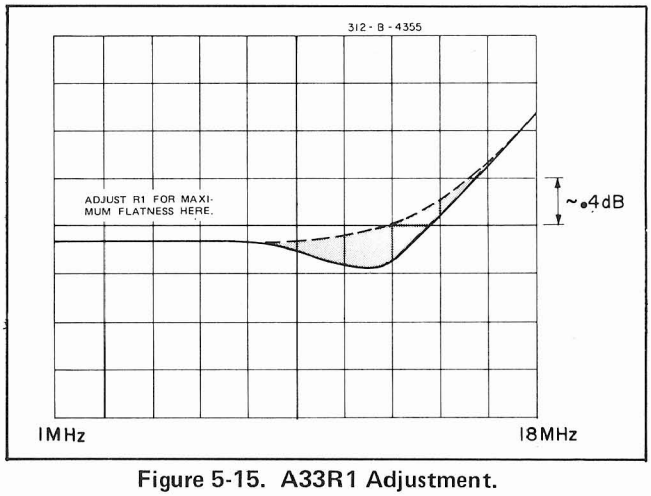


Figure 5-15. A33R1 Adjustment.

6. Adjust C11 and C10 for the frequency response curve shown in Figure 5-16. Start by opening C11 and then closing C10 (these adjustments interact).

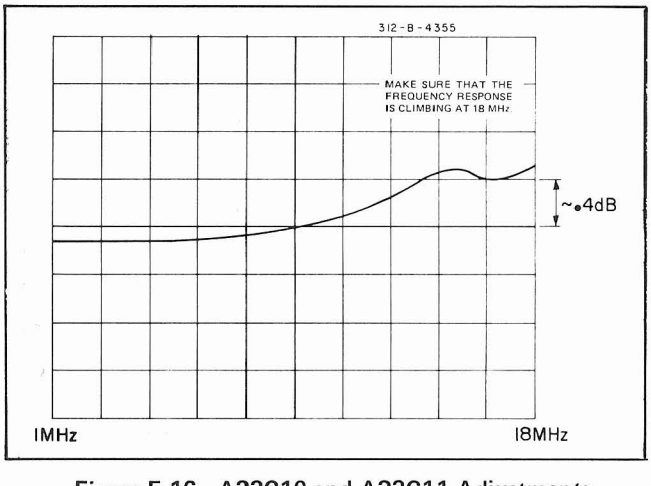


Figure 5-16. A33C10 and A33C11 Adjustments.

7. Adjust C2. Reduce the slope of the frequency response as shown in Figure 5-17. If necessary, readjust C11 and L2 to achieve this response. If the frequency response cannot be adjusted, return to Step 1 and repeat the procedure using different settings for L1 and L3. If the response is correct, proceed to Step i.

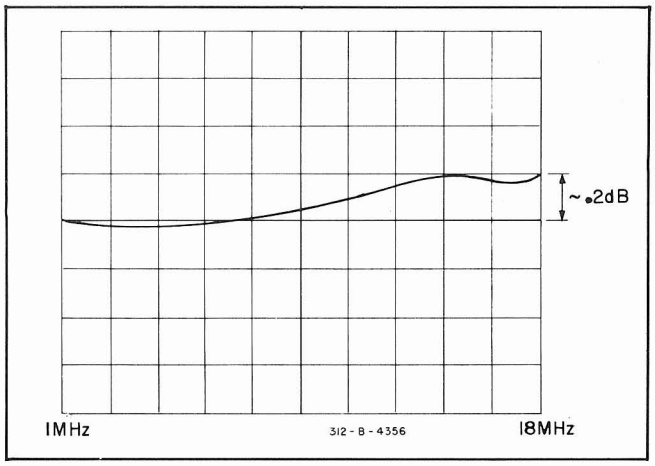


Figure 5-17. Optimum Adjustment of A33 – 312B.

h. After comparing the frequency response display to Figures 5-18 through 5-22, adjust the corresponding controls for the best response.

i. Remove the function generator output from XA23 pin 6 and reinstall A23.

j. Test the frequency response in 1 MHz steps by using the frequency range switch of the 312B/D and the expand meter of the 313A.

k. Adjust C11 so that 18 MHz reads + 0.2 dB (+ 0.1 dB for the 312D).

l. Adjust C6 so that 15 MHz reads + 0.2 dB (+ 0.1 dB for the 312D). Steps l and m may interact. Repeat them until both 15 MHz and 18 MHz read approximately the same.

m. Retest the frequency response. The specifications are shown in Table 5-7.

n. Adjusting to the ideal tolerances gives the best frequency response on the other positions of the reference level attenuator. (For some instruments it may be necessary to depart from the tolerances of Table 5-7 to achieve proper frequency response on all positions of the REFERENCE LEVEL attenuator.)

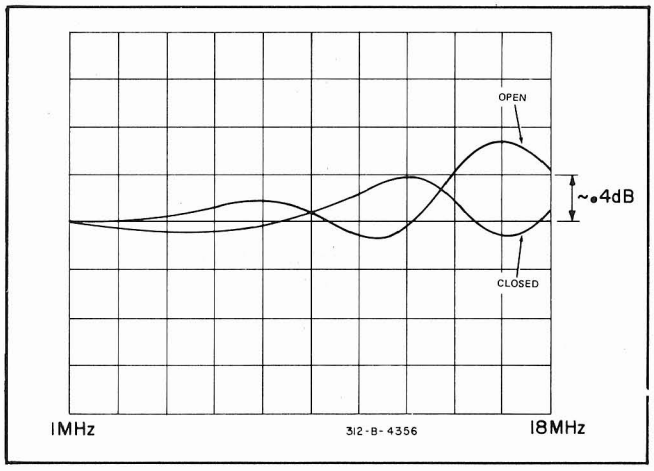


Figure 5-18. Relative Effect of A33C10 with all Other Controls Set Correctly.

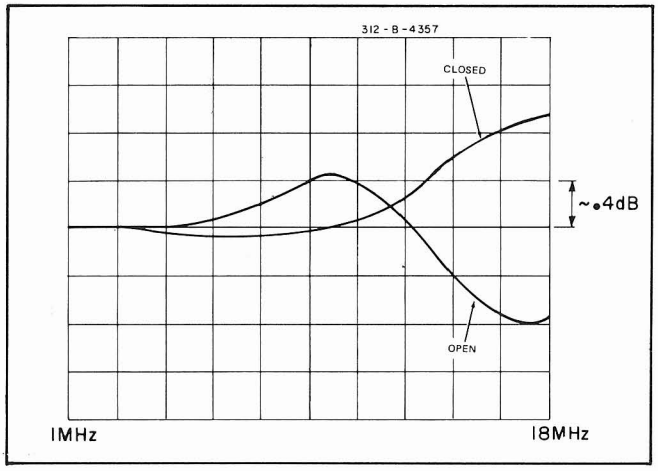


Figure 5-19. Relative Effect of A33C6 with all Other Controls Set Correctly.

5-52. Input Amplifier Adjustments.

a. Using the same test setup as Step i of Paragraph 5-51 connect the 313A output to J2 of the 312B (J4 on 312D). Connect the BNC short to J1 of the 312B or J3 of the 312D.

b. Set the Reference Level Attenuator to - 40 and the 313A Attenuators to - 60.0 dB.

Table 5-7. Ideal Frequency Response for A33.

		Ideal for - 40 Position	
Frequency	Overall	312B	312D
10 kHz – 10 MHz	± 0.2 dB	± 0.05 dB	± 0.05 dB
10–14 MHz	± 0.5 dB	+ 0.1 dB ± 0.1 dB	+ 0.1 dB ± 0.1 dB
15–18 MHz	± 0.5 dB	+ 0.2 dB ± 0.1 dB	+ 0.1 dB ± 0.1 dB

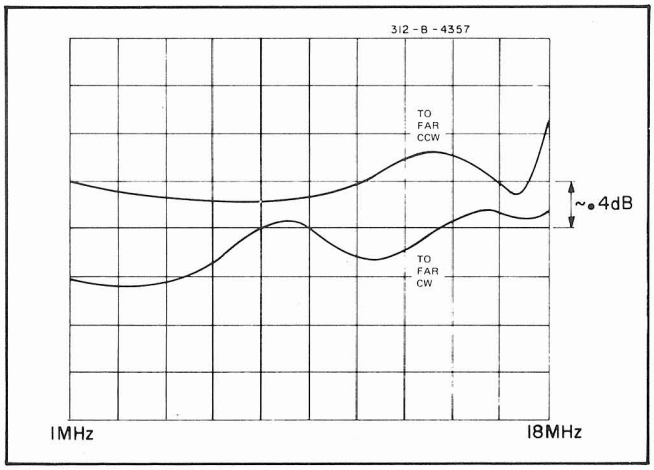


Figure 5-20. Relative Effect of A33R1 with all Other Controls Set Correctly.

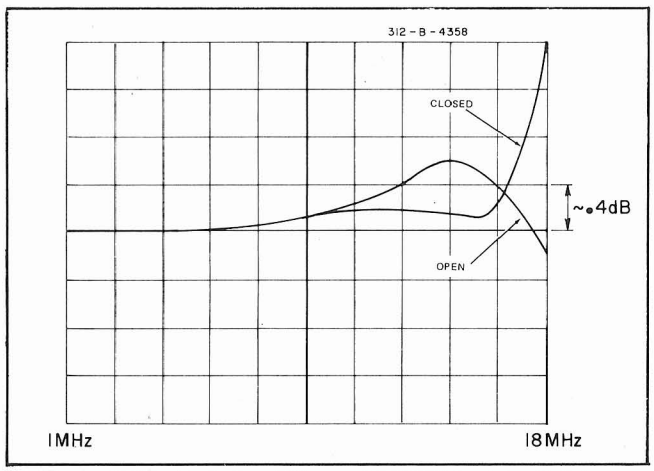


Figure 5-21. Relative Effect of A33C11 with all Other Controls Set Correctly.

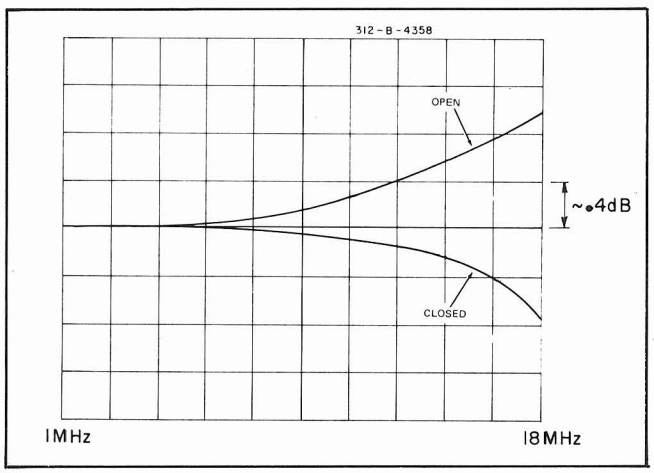


Figure 5-22. Relative Effect of A33C2 with all Other Controls Set Correctly.

c. Adjust A32C10 for the same frequency response characteristic shown in Figure 5-17.

d. Reverse the input connectors and test the frequency response in the - 40 dB position. Readjust the filter box (A33) if necessary.

e. Set up the 312B/D for testing Common Mode Rejection as described in Paragraph 5-18.

f. Adjust A32C10 for maximum common mode rejection at 18 MHz (- 40 dB position of the REFERENCE LEVEL ATTENUATOR).

g. Retest the frequency response of - 40 dB position of the Reference Level Attenuator on both J1 and J2 (J3 and J4 of the 312D). Readjust the frequency response if necessary. (Try Paragraph 5-51 Steps k and l first.)

NOTE

Capacitor A32C19 is not normally adjusted. It has the same effect as C2 of A33. If desired, A32C19 may be used to adjust the slope of the frequency response in the - 40 dB position of the Reference Level Attenuators.

5-53. Reference Level Attenuator Adjustments.

a. Set up the equipment as shown in Figure 5-13.

b. Set the 312B/D and 313A controls as follows:

312B

FREQUENCY RANGE - MHz	0
REFERENCE LEVEL	- 30 dBm
AMPLITUDE RANGE	- 10 dBm
INPUT MODE	BRIDGED
IMPEDANCE	75
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY TUNING	Fully CW

313A

OSCILLATOR MODE	TRACK 312
METER MODE	312 EXPAND
MAX OUTPUT	+ 10 dBm
ATTENUATORS	- 50.0

312D

FREQUENCY RANGE - MHz	0
REFERENCE LEVEL	- 30 dB
AMPLITUDE RANGE	- 10 dB
INPUT IMPEDANCE	75
BANDWIDTH	3100
RECEIVER MODE	AM
FREQUENCY TUNING	Fully CW
METER	NORMAL

c. Connect the 313A output to J1 of the 312B or J3 of the 312D. Place a BNC short on J2 (J4 of the 312D).

d. Adjust the "- 30" capacitor on A39A2 (see Figure 5-23) for an oscilloscope display which is the same as the - 40 dBm position (A33 Adjustments).

e. Set the Reference Level switch to - 20 dBm and the 313A Attenuators to - 40.0 dB.

f. Adjust the "- 20 " capacitor on A39A2 for an oscilloscope display which is the same as the - 40 dBm position.

g. Repeat Steps e and f for the - 10, 0, + 10 and + 20 dBm positions of the Reference Level switch. Reduce the 313A attenuators by 10 dB for each step. The + 10 and + 20 positions of the Reference Level Attenuator will not have a frequency response which is identical to the - 40 dBm position. Adjust these two positions for the flattest response possible.

h. Connect the 313A output to J2 of the 312B (J4 of the 312D) and the BNC short to J4 (J3 of the 312D).

i. Repeat Steps d through g for A39A1.

j. Remove the function generator and reinstall A23.

k. Manually test each position of all Reference Level Attenuators for frequency response.

l. Adjust each range as necessary to achieve best frequency response. Always adjust the capacitors in the following order: - 30, - 20, - 10, 0, + 10, + 20.

m. Test the Common Mode Rejection of the 312B/D as described in Paragraph 5-18. If the Common Mode Rejection is out of specifications on any Reference Level Attenuator position, readjust the frequency response on that position until both the frequency response and Common Mode Rejection specifications are satisfied.

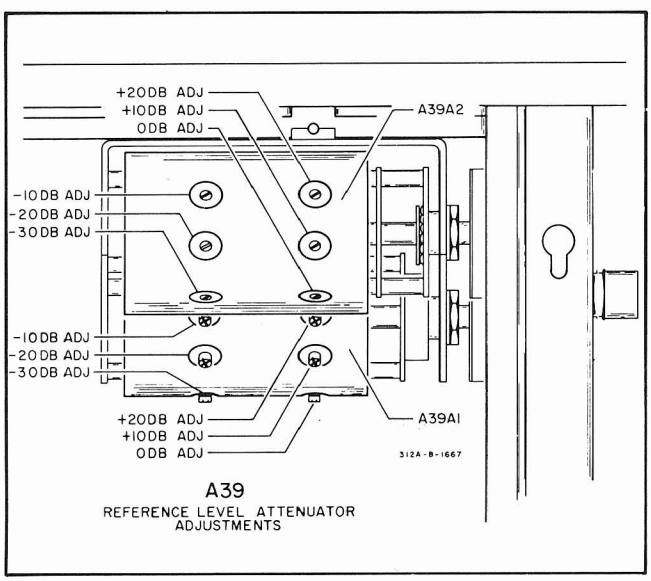


Figure 5-23. Reference Level Attenuator Adjustment Location.

5-54. 2 kHz Notch Adjustments — 312B Option 001, 312D.

a. Set 312B/D controls as follows:

312B

REFERENCE LEVEL	- 40 dBm
AMPLITUDE RANGE	0 dB
INPUT MODE	TERMINATED
IMPEDANCE	75
BANDWIDTH (Hz)	3100
FREQUENCY RANGE - MHz	1
RECEIVER MODE	BEAT
FREQUENCY TUNING	1000.04 kHz
AUDIO AMPLITUDE	MAX

312D

REFERENCE LEVEL	- 40 dBm
AMPLITUDE RANGE	0 dB
INPUT IMPEDANCE	75
BANDWIDTH	3100
FREQUENCY RANGE - MHz	1
RECEIVER MODE	BEAT
FREQUENCY TUNING	1000.04 kHz
AUDIO AMPLITUDE	MAX
METER	NORMAL

b. Connect the 312B/D CALIBRATED OUTPUT to the 312B/D input and set the CAL ADJ to obtain a 0 dBm indication.

c. Remove the 312B/D top and rear covers and place the A4 (00312-60042) board on an extender board. Remove the A34 Second Balanced Mixer board.

d. Set the oscillator frequency to 200 Hz and the amplitude to approximately 1 mV. Connect the output to the counter and to pin 10 of the A4 board.

e. Turn the 312B/D on and adjust the oscillator amplitude to obtain a 312B/D indication of exactly 0 dB.

f. Set the oscillator frequency to 2 kHz and increase the output amplitude by 40 dB. Adjust the oscillator frequency to obtain a counter period measurement of 500.00 microseconds ± 0.03 microseconds.

g. Adjust A4R27 and A4R31 alternately to obtain a minimum 312B/D Meter indication. Downrange the AMPLITUDE RANGE switch as necessary to maintain an on-scale indication.

h. Turn the 312B/D off and repeat Steps b through f. Except in Step c, connect the oscillator output to pin 6 and in Step f adjust A4R40 and A4R44 alternately.

5-55. Final Adjustments.

NOTE

The 312B/D should be turned on for at least four hours before performing the final adjustments.

a. Adjust A26C3 (1 MHz ADJ) as described in Paragraph 5-35.

b. Perform the CAL ADJ as described in Steps k and l of Paragraph 5-48.

c. Perform the FIRST MIXER CARRIER BALANCE ADJUSTMENT as described in Paragraph 5-46.

5-56. GENERAL MAINTENANCE PROCEDURES – 312B/D.

5-57. Cleaning the Amplitude Range Switch – 312B/D.

a. The Amplitude Range switch (00312-60031) will inject noise in the - 50 and - 60 positions if it is dirty. Test for switch noise as follows:

1. Set the 312B/D and 313A controls as follows:

312B

REFERENCE LEVEL . . . . . 0 dBm
AMPLITUDE RANGE . . . . . - 60 dB
RECEIVER MODE . . . . . AM
INPUT MODE . . . . . TERMINATED
IMPEDANCE 75
BANDWIDTH. 3100

313A

OSCILLATOR MODE . . . . . TRACK 312
METER MODE. . . . . 312 EXPAND
MAX OUTPUT . . . . . 0 dB
ATTENUATORS . . . . . - 60.0

312D

REFERENCE LEVEL . . . . . 0 dBm
AMPLITUDE RANGE . . . . . - 60 dB
INPUT IMPEDANCE 75
BANDWIDTH. 3100
RECEIVER MODE . . . . . AM
METER. . . . . .NORMAL

2. Connect the 312B/D to the 313A in the normal manner. The 312B/D Meter should read approximately 0 dB. (The 312B/D may be tuned to any frequency for this test.)

3. Adjust the 313A Scale Offset for an indication of 0 dB ± 0.1 dB. (The - 60 position of the 312B/D normally exhibits ± 0.1 dB of noise.)

4. Strike the 312B/D Amplitude Ramp switch knob with a screwdriver handle. The 313A Meter indication should jump less than 1.0 dB when the switch is struck, it not, the AMPLITUDE RANGE switch is dirty and should be cleaned.

b. Remove the Amplitude Range switch from the 312B/D and remove the shield from the switch assembly.

c. Spray each contact with Sprayon Freon T.F. Degreaser (-hp- Part No. 8500-0232). Twist the switch through all of its positions during this process. Be careful not to spring any of the contacts.

d. After cleaning the switch, lubricate each contact with Beacon 325 Switch grease.

e. Reinstall the shield and remount the switch.

f. When fastening the switch in place, tighten the front panel mounting nut securely before tightening the rear mounting bracket. This will prevent twisting the switch along its axis when tightening the front panel nut.

5-58. Reference Level Attenuator Removal – 312B/D.

a. Remove the right side cover (4 screws).

b. Remove the REFERENCE LEVEL attenuator selector knob.

c. Note the input and output connections so that replacement is simplified. The input wires are blue to Channel B and green to Channel A. The output of Channel A is a twisted pair consisting of a green wire and black wire. Channel B output is a twisted pair consisting of a blue wire and a black wire. Remove all input and output connections and all ground connections.

d. Remove the three screws securing the attenuators to the inside housing.

5-59. Low Pass Filter (A33) Removal – 312B/D.

a. Remove the Second Mixer (A34) Assembly.

b. Remove the two screws securing the Low Pass Filter to the sectional divider.

c. Disconnect the coax cables from the input and output. Note each cable color and its respective connector. If these cables are accidentally reversed during installation, the 312B/D frequency response will not meet specifications.

5-60. Amplitude Indicator Lamp Replacement – 312B/D.

WARNING

Disconnect the 312B/D from ac power source before attempting to remove the Amplitude Range Indicator assembly.

NOTE

To service the Amplitude Range Indicator Assembly, it will be necessary to remove the printed circuit board housing the indicator lamps.

a. Use some long object like a pencil or screwdriver to alternately push down on each end of the connector. This jack is supported only by contact with the printed circuit board connector.

b. Remove the four nuts and lockwasher securing the board to the screws. The screws are captive and will not turn. The two top nuts can be easily removed using a 1/4" nut driver. The two bottom screws can be removed using a 1/4" open end wrench.

c. Remove the circuit board from the screws and lift it from the instrument. If the circuit board is to be out of the instrument for an extended period of time, remove the spacers from the screws to keep them from becoming lost.

d. To replace the circuit board, reverse the procedure. It may be easier to replace the connector before the board is replaced on the mounting screws.

5-61. Tuning Assembly Removal.

a. Remove the wires connected to the 2 – 3 MHz VFO (00312-66504). Note the destination of each wire to facilitate reassembly. Remove A22 (00312-66508).

b. Remove the wires connected to the audio amplitude control. Also note the colors of these wires and their destination.

c. Remove the knobs from the COARSE TUNING, FINE TUNING and AUDIO AMPLITUDE controls. Remove the nuts securing these controls.

d. Lift out the mechanical tuning assembly.

e. Replace the assembly in the reverse order.

TROUBLESHOOTING

5-62. TROUBLESHOOTING.

5-63. Preliminary Troubleshooting (see Figure 5-24).

5-64. Step 3 Instructions – Local Oscillator Test.

a. Connect a counter to the LOCAL OSCILLATOR output on the rear panel of the 312B/D.

b. Set the FREQUENCY RANGE - MHz switch to 0.

c. Adjust the FREQUENCY TUNING for a counter indication of about 30 MHz.

d. Measure the amplitude of the LOCAL OSCILLATOR output. It should be about 175 mV p-p when terminated in 50 ohms at 30 MHz (150 mV p-p at 47 MHz).

NOTE

The LOCAL OSCILLATOR output waveform will contain significant amounts of harmonic distortion.

e. Reconnect the counter to the LOCAL OSCILLATOR output.

f. Set the FREQUENCY RANGE - MHz switch to each position between 0 and 17. The counter indication should increase exactly 1 MHz each time the frequency range setting is increased by 1 MHz. The counter indication should be stable in each switch position. (Do not disturb the FREQUENCY TUNING control during this step.)

g. Adjust the FREQUENCY TUNING control over its entire range. The counter indication should vary approximately 1.2 MHz over the tuning range.

h. The LOCAL OSCILLATOR is defective if any of the requirements of Steps d, f or g are not met.

5-65. Step 4 Instructions – Counter Test.

a. Connect a counter to the 30 MHz output on the rear panel of the 312B/D.

b. Adjust the 1 MHz ADJ control on A26 for a counter indication of 30 MHz ± 60 Hz.

c. Connect the counter to the LOCAL OSCILLATOR output.

d. Turn the FREQUENCY RANGE - MHz switch through all of its positions while observing the 312B/D counter and the local oscillator frequency. The indication of the external counter should always be 30 MHz higher than the 312B/D display.

e. Set the FREQUENCY RANGE - MHz switch to 2. Tune the 312B/D below 2 MHz and above 3 MHz. The most significant digit of the 312B/D display must switch accordingly.

f. The counter is defective if any of the requirements of Steps d or e are not met.

5-66. Local Oscillator Troubleshooting (see Figure 5-25).

5-67. Step 1 Instructions – Step Oscillator Test.

a. Remove A29 and attach the counter to XA29 pin 15.

b. Rotate the FREQUENCY RANGE - MHz switch through each position between 0 MHz and 17 MHz.

c. The counter should indicate the FREQUENCY RANGE - MHz switch setting (in MHz) plus 28 MHz.

Example:

If the FREQUENCY RANGE switch setting is 5 MHz, the Step Oscillator output should be 33.0000 MHz.

d. The Step Lock is defective if the counter indication for any switch position is off by an integer multiple of 1 MHz or is unstable. The amplitude at XA29 pin 15 is approximately 500 mV p-p.

5-68. Step 2 Instructions – A35 Test.

a. Reinstall A29. Remove A23 and A24.

b. Connect the positive terminal of the dc power supply to XA23 pin 6. Connect the negative terminal to the 312B/D chassis.

c. Measure the LOCAL OSCILLATOR output frequency while varying the dc power supply voltage. The output frequency should increase with voltage.

d. Test the LOCAL OSCILLATOR frequency vs. voltage at 30 MHz and 48 MHz.

30 MHz 2.0 ± 0.5 V dc
48 MHz 10.0 ± 1.0 V dc

e. A35 is defective if no output is present or the voltage to frequency characteristic is not as stated in Step d.

f. Correct amplitude at LOCAL OSCILLATOR output is between 200 mV and 300 mV p-p. To change the voltage to frequency characteristic, replace the Varicap A35CR1.

5-69. Step 3 Instructions – A29 Test.

a. Reinstall A24. A23 should already be removed.

b. Connect the dc power supply to XA23 pin 6. Connect the counter to the LOCAL OSCILLATOR output.

c. Using the power supply, set the LOCAL OSCILLATOR output frequency to about 40.5 MHz. Note the exact frequency.

d. Turn off the 312B/D and connect the counter to XA23 pin 4. Set the FREQUENCY RANGE - MHz switch to 10. Turn on the 312B/D.

e. The counter should indicate about 2.5 MHz (exact local oscillator frequency minus 38 MHz).

f. Adjust the dc supply over a small range. The counter indication should vary with the dc voltage.

g. A29 is defective if there is no output or the wrong frequency is present at XA 23 pin 4. The amplitude should be approximately 3.5 V p-p.

5-70. Step 4 Instructions – VFO Test (A22).

a. Remove the dc power supply from XA23 pin 6.

b. Connect the counter to XA23 pin 2.

c. The counter should indicate between 1.98 MHz and 3.2 MHz depending on the setting of the FREQUENCY TUNING knob. (The 312B/D frequency display is not meaningful during this test because the Summation Loop is disconnected.)

d. A22 is defective if no signal is present at XA23 pin 2. The amplitude is approximately 2.5 V p-p at 3.2 MHz and 1.3 V p-p at 1.98 MHz. End points of the VFO frequency can be adjusted according to Paragraph 5-36.

5-71. Step 6 Instructions – A28 VTO Test.

a. Remove A23, A24 and A29.

b. Connect the positive terminal of the dc power supply to XA24 pin 15 and the negative terminal to the 312B/D chassis. Connect the counter to XA29 pin 15.

c. The Step Oscillator frequency (XA29 pin 15) should increase with the positive voltage applied to XA24 pin 15.

d. Check the voltage-to-frequency transfer characteristic at 28 MHz and 45 MHz.

FREQUENCY	VOLTAGE APPLIED
28 MHz	2.0 ± 0.5 V dc
45 MHz	10.0 ± 1.0 V dc

e. The A28 VTO is defective if there is no output or the voltage-to-frequency characteristic is wrong. The amplitude should be approximately 1 V p-p. (Do not measure amplitude with a counter connected.)

5-72. Step 7 Instructions — ÷ N Programming.

a. Remove A28 and test the logic levels from the FREQUENCY RANGE switch according to the A28 Schematic (Figure 7-17).

b. The FREQUENCY RANGE switch and associated circuits are working if the logic levels from the switch agree with the A28 schematic.

5-73. Test for ÷ N Circuits on A28.

a. The objective of this procedure is to drive the A28 VTO to a known frequency; set the ÷ N circuits to a known N and verify that the output of the ÷ N circuits is 1 MHz.

Examples (both indicate correct ÷ N results):

FREQUENCY RANGE - MHz 13
(A28 Output = 41 MHz)
A28 VTO (measure at A29 pin 15) . . . 41 MHz
÷ N Setting. 41
÷ N Output Frequency . . . . . 1 MHz
(Measure at A24 pin 5)
or
FREQUENCY RANGE 12
÷ N Setting. 40
A28 VTO Frequency . . . . . 41 MHz
÷ N Output (41 MHz/40) . . . . . 1.0250 MHz

e. Set the FREQUENCY RANGE - MHz switch to the desired range.

f. Adjust the dc power supply for a counter indication 28 MHz higher than the frequency range selected.

g. Connect the counter to XA24 pin 5.

h. The counter indication should be very close to 1 MHz. Some error may occur due to inaccuracy of the A28 VTO frequency established in Step f.

5-74. Main Counter Troubleshooting — 312B/D (see Figure 5-26).

NOTE

If the problem is confined only to the two most significant digits of the frequency display, proceed to Paragraph 5-85. For Paragraphs 5-75 thru 5-84, trigger on the negative-going edge of U34 pin 3.

5-75. Step 1 Instructions — Gated 2 — 3 MHz.

a. Connect the oscilloscope to U22 pin 3.

b. Check the waveform against Figure 5-27(a).

c. If the oscilloscope will not trigger, proceed to Step 11.

5-76. Step 2 Instructions — Basic Control Commands. Test for the correct waveforms at the following pins.

a. U22 pin 6 (see Figure 5-27(b)).
b. U29 pin 6 (see Figure 5-27(c)).
c. U31 pins 10 and 12 (see Figure 5-27(d)).
d. U31 pin 2 (see Figure 5-27(e)).

5-77. Step 3 Instructions — Decade Counters (U19).

a. Set the FREQUENCY TUNING to xx.850.00.

b. Check the waveform at U19 pin 11 (see Figure 5-27(f).

5-78. Step 4 Instructions — Latch Test. Verify the output of the latches U8 thru U14 by comparing against Table 5-8.

Table 5-8. Latch Truth Table, U8 — U14.

BCD Weighting	Input Pin	Output Pin
1	2	16
2	3	15
4	6	10
8	7	9

5-79. Step 5 Instructions — Decoder/Driver Test. Test the Decoder/Drivers according to Table 5-9.

Table 5-9. Decoder/Driver Truth Table (U1 thru U7).

Decimal Number	Input Pins				Output Pins						
— — —	6	2	1	7	13	12	11	10	9	15	14
0	L	L	L	L	L	L	L	L	L	L	H
1	L	L	L	H	H	L	L	H	H	H	H
2	L	L	H	L	L	L	H	L	L	H	L
3	L	L	H	H	L	L	L	L	H	H	L
4	L	H	L	L	H	L	L	H	H	L	L
5	L	H	L	H	L	H	L	L	H	L	L
6	L	H	H	L	H	H	L	L	L	L	L
7	L	H	H	H	L	L	L	H	H	H	H
8	H	L	L	L	L	L	L	L	L	L	L
9	H	L	L	H	L	L	L	H	H	L	L

5-80. Step 6 Instructions – Decade Counters.

a. Observe the waveforms at the outputs of decade counters U15 thru U20.

b. Compare them against Figure 5-27(g).

c. The input for the decade counters is pin 14. Table 5-10 gives the output pin weighting.

Table 5-10. Output Weighting for Decade Counters (U15 thru U20).

BCD Weighting	Output Pin
1	12
2	9
4	8
8	11

Example:

U18 pin 11 will be high for 70 ms if a BCD 8 bit is required for the DS4 display (xxx8x.xx or xxx9x.xx).

5-81. Step 10 Instructions – Gate Signal. Check the waveform at U34 pin 3 (see Figure 5-27(h).

5-82. Step 16 Instructions. U30 pins 3, 6 and 11 should be the logical inverse of U29 pin 6 or U31 pins 2, 11 or 12.

5-83. Step 17 Instructions. Observe the waveforms at the following pins.

a. U28 pin 12 (see Figure 5-27(i)).
b. U28 pin 10 (see Figure 5-27(j)).
c. U28 pin 3 (see Figure 5-27(k)).
d. U28 pin 5 (see Figure 5-27(l)).

5-84. Step 22 Instructions U28 Inputs. Observe the waveforms at the following pins.

a. U27 pin 12 (see Figure 5-27(m)).
b. U27 pin 9 (see Figure 5-27(n)).
c. U27 pin 8 (see Figure 5-27(o)).
d. U27 pin 11 (see Figure 5-27(p)).

5-85. Counter Troubleshooting, MHz Digits – 312B/D. (For Paragraphs 5-86 through 5-91, trigger the oscilloscope on the negative-going edge of U34 pin 3.)

5-86. Step 1 Instructions – UP/DOWN Circuits.

a. Set the FREQUENCY TUNING fully clockwise.

b. Check U21 pin 4 for the waveform shown in Figure 5-29(a) (UP/DOWN enable).

c. Check the UP/DOWN select waveform at U21 pin 5 (see Figure 5-29(b)).

d. If either waveform is incorrect proceed to Step 8.

5-87. Step 2 Instructions – Frequency Range Switch. Test the FREQUENCY RANGE switch outputs according to Table 5-11.

Table 5-11. Frequency Range Selection.

Frequency Range Switch Position	U23 Pin 15	U23 Pin 1	U23 Pin 10	U23 Pin 9	U22 Pin 13
0	L	L	L	L	L
1	H	L	L	L	L
2	L	H	L	L	L
3	H	H	L	L	L
4	L	L	H	L	L
5	H	L	H	L	L
6	L	H	H	L	L
7	H	H	H	L	L
8	L	L	L	H	L
9	H	L	L	H	L
10	L	H	L	H	L
11	H	H	L	H	L
12	L	L	H	H	L
13	H	L	H	H	L
14	L	H	H	H	L
15	H	H	H	H	L
16	L	L	L	L	H
17	H	L	L	L	H

5-88. Step 3 Instructions.

a. The output of U23 should correspond to the inputs except when up or down ranging is required.

Table 5-12. UP/DOWN Counter U23.

Input Pin	Corresponding Output Pin
U23 pin 15	U23 pin 3
U23 pin 1	U23 pin 2
U23 pin 10	U23 pin 6
U23 pin 9	U23 pin 7

b. A typical output waveform is shown in Figure 5-29(c).

c. Monitor each output of U23 to verify proper operation.

d. The "carry" and "borrow" outputs of U23 (pins 13 and 12) are used only for switching between MHz indications of 15 and 16. Figure 5-29(d) indicates the correct waveform for these lines.

e. Carry occurs if the FREQUENCY RANGE switch is set to 15, but 16 must be indicated. Borrow occurs if the FREQUENCY RANGE switch is set to 16, but 15 must be indicated.

5-89. Step 4 Instructions. U35 and part of U22 is good if U22 pin 8 exhibits the waveform shown in Figure 5-29(e).

5-90. Step 5 Instructions – U24, Binary-to-BCD Decoder. Test U24 according to Table 5-13.

Table 5-13. U24 Truth Table.

Input Pins				Output Pins				
13	12	11	10	5	4	3	2	1
L	L	L	L	L	L	L	L	L
L	L	L	H	L	L	L	L	H
L	L	H	L	L	L	L	H	L
L	L	H	H	L	L	L	H	H
L	H	L	L	L	L	H	L	L
L	H	L	H	L	H	L	L	L
L	H	H	L	L	H	L	L	H
L	H	H	H	L	H	L	H	L
H	L	L	L	L	H	L	H	H
H	L	L	H	L	H	H	L	L
H	L	H	L	H	L	L	L	L
H	L	H	H	H	L	L	L	H

5-91. Step 8 Instructions. Test U20 according to Paragraph 5-80 (decade counter test).

5-92. Main Signal Path Troubleshooting – 312B/D (see Figure 5-30).

5-93. Step 2 Instructions.

a. Insert the CAL OUTPUT signal into W2 (see Figure 5-9). Set the BANDWIDTH to 3100 and the FREQUENCY TUNING to 1000.40 kHz.

b. The meter will indicate between - 2 dB and - 4 dB if the main signal path is working from the first mixer (A31) to the meter.

5-94. Step 3 Instructions.

a. Remove the second mixer (A34). Set the 3312A Function Generator to 500 Hz at 1 mV rms.

b. Connect the Function Generator output to either XA34 pin 11 or XA34 pin 12.

c. The 312B/D Meter should indicate between 0 dB and + 3 dB with the Function Generator connected to either pin. Pin 11 drives Channel A (A2 and A3) and pin 12 drives Channel B (A5 and A6).

5-95. Step 4 Instructions.

a. Remove the third mixer (A9). Set the Function Generator to 250 kHz, 160 mV rms.

b. Set the amplitude range switch to 0 dB. Connect the Function Generator to XA9 pin 8.

c. If the meter amplifier and meter are working, the 312B/D Meter will indicate between + 1 dB and - 1 dB.

5-96. Troubleshooting the AFC Circuit – 312B Only.

5-97. Before troubleshooting the AFC circuit, it is advisable to read the circuit description in Section IV of this manual. After this has been done, complete the following procedure.

a. Connect the CALIBRATED OUTPUT of the 312B to J1 input. Set the 312B controls as follows:

312B

REFERENCE LEVEL . . . . . - 40 DBM
AMPLITUDE RANGE . . . . . 0 DB
BAL/UNBAL . . . . . UNBAL
INPUT MODE . . . . . TERMINATED
IMPEDANCE 75
BANDWIDTH. 3100
RECEIVER MODE . . . . . AM
FREQUENCY RANGE - MHz 0
FREQUENCY TUNING . . . . . 1000.00 kHz

b. Connect an oscilloscope through a 10:1 probe to A8 pin 12 and the 412A DC Voltmeter to the collector of A8Q7 (PHASE).

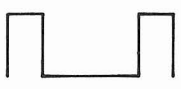
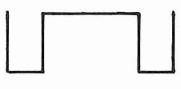
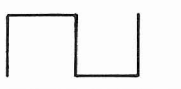
c. Tune the 312B to 1000.06. The conditions should be as shown in Table 5-14.

b. If the AFC will not lock on either side, check to see that A22K1 is deenergized. If A22K1 is energized, check A22Q5, A8CR17/CR18, A3Q9/Q10/Q11. If A22K1 is deenergized, check A8Q1 through A8Q5.

e. If the AFC locks on one side only, check A8Q7, A8Q8 and A8Q6.

f. If the Local Oscillator is offset by more than 35 Hz ± 10 Hz, check A8CR25.

Table 5-14. AFC Troubleshooting.

Local Oscillator Tuning	A8Q7	A8Q8	A8Q6	AFC OUTPUT (A8, pin 12)	A22K1	Channel A
Receiver Mode: AM 1000.06 kHz	ON	OFF	ON	+8V, −7.5V 	Energized	Lags
Receiver Mode: AM 999.94 kHz	OFF	ON	OFF	+8V, −7.5V 	Energized	Leads
Receiver Mode: AM/AFC	*			+8V, −7.5V 	Deenergized	†

If the AFC pulls the Local Oscillator down to the input signal, Q7 will be conducting and Q8 will be off. If the AFC pulls the Local Oscillator up to the input signal, Q7 will be cut off and Q8 will be conducting.

If the AFC pulls the Local Oscillator down to the input signal, Channel A and Channel B will be 180° out of phase. If the AFC pulls the Local Oscillator up to input signal, Channel A and Channel B will be in phase.

NOTE

Check + 20, - 15 and + 5 volt supplies before proceeding.

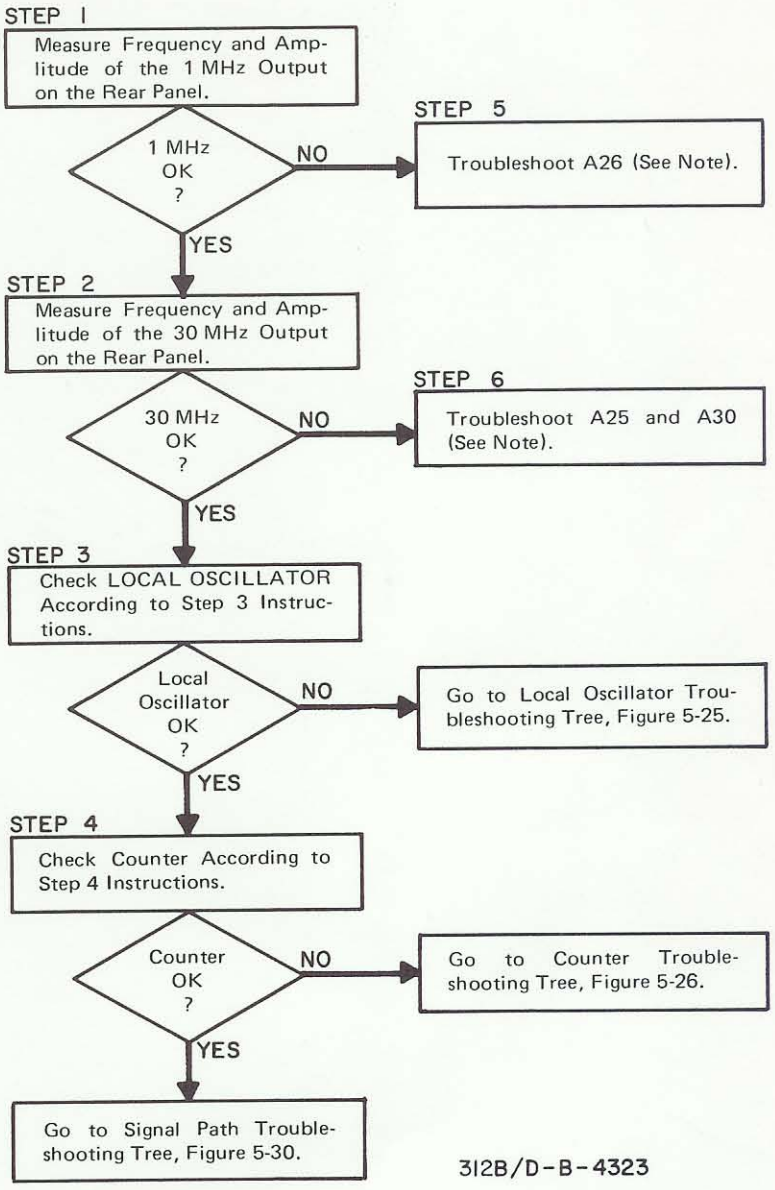
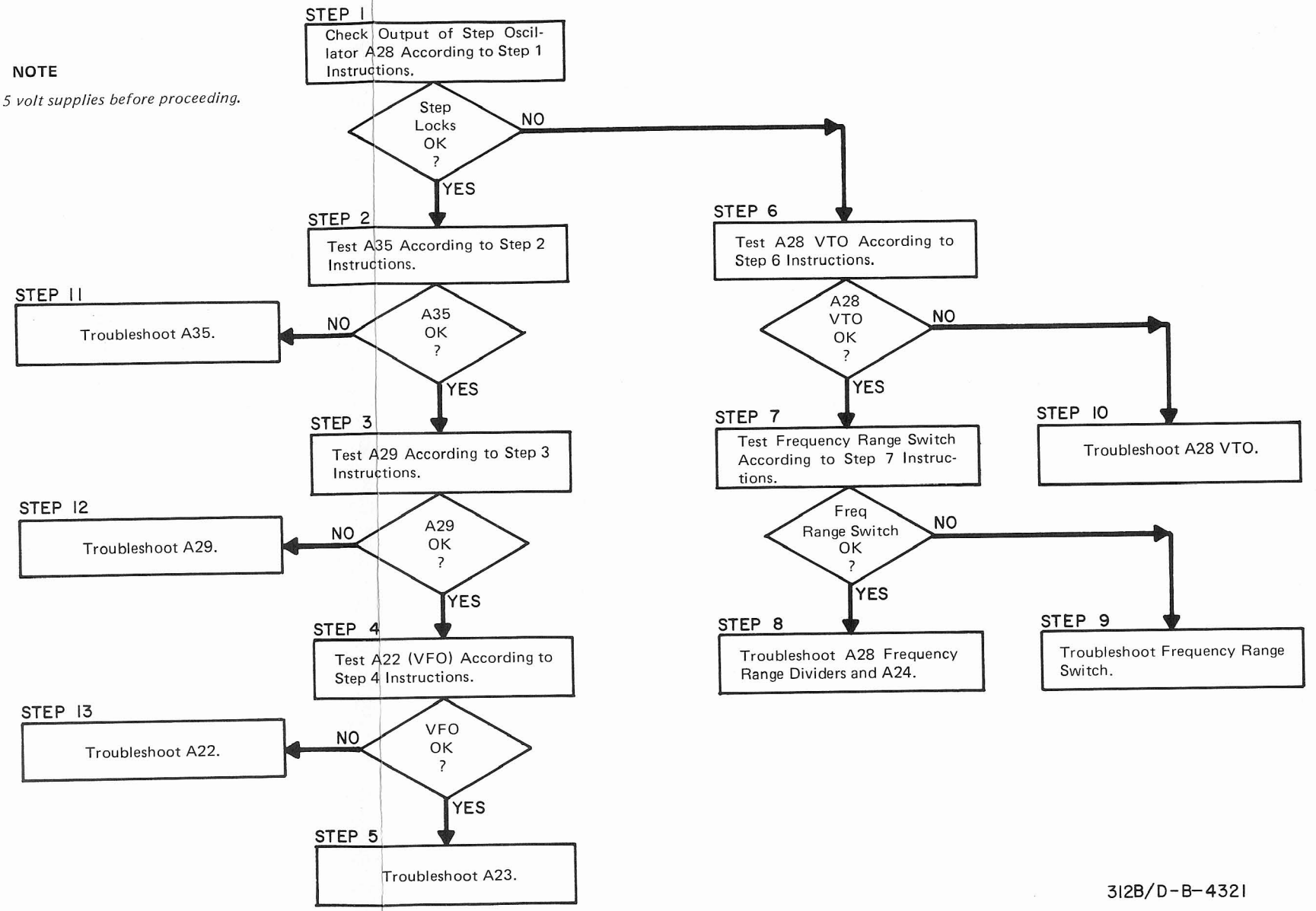


Figure 5-24. Preliminary Troubleshooting Tree.

NOTE

Check + 20, - 15 and + 5 volt supplies before proceeding.



312B/D-B-4321

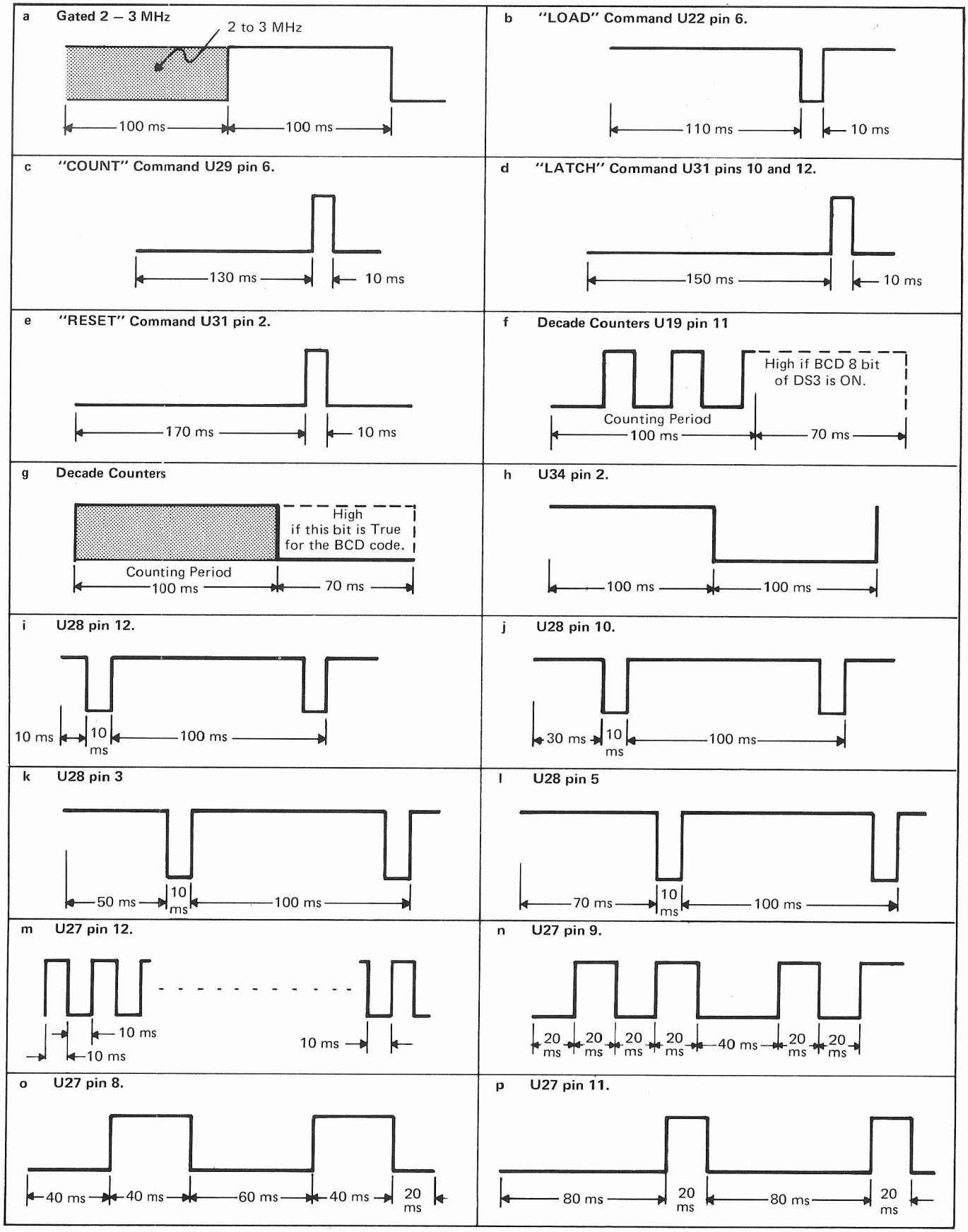
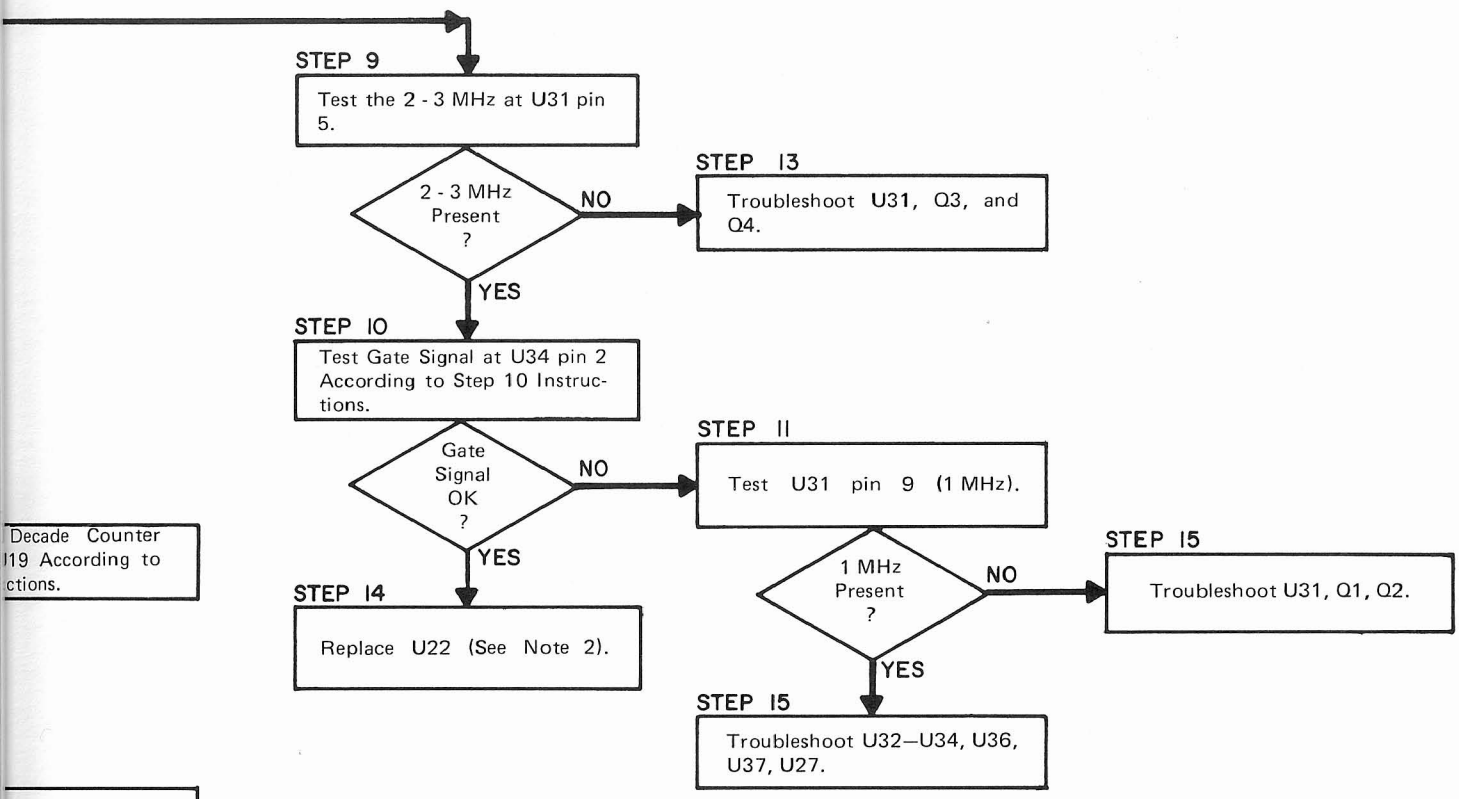


Figure 5-27. Main Counter Waveforms.

Figure 5-25. Local Oscillator Troubleshooting Tree (cont'd).



Decade Counter
119 According to
ctions.

ective Latch (See

efective Decoder

NOTE 1

If the problem is confined to the two most significant digits, refer to the MHz Digit Selection Troubleshooting Tree.

NOTE 2

In situations where a logic line is stuck low, any IC tied to that line may be at fault.

ting Tree.

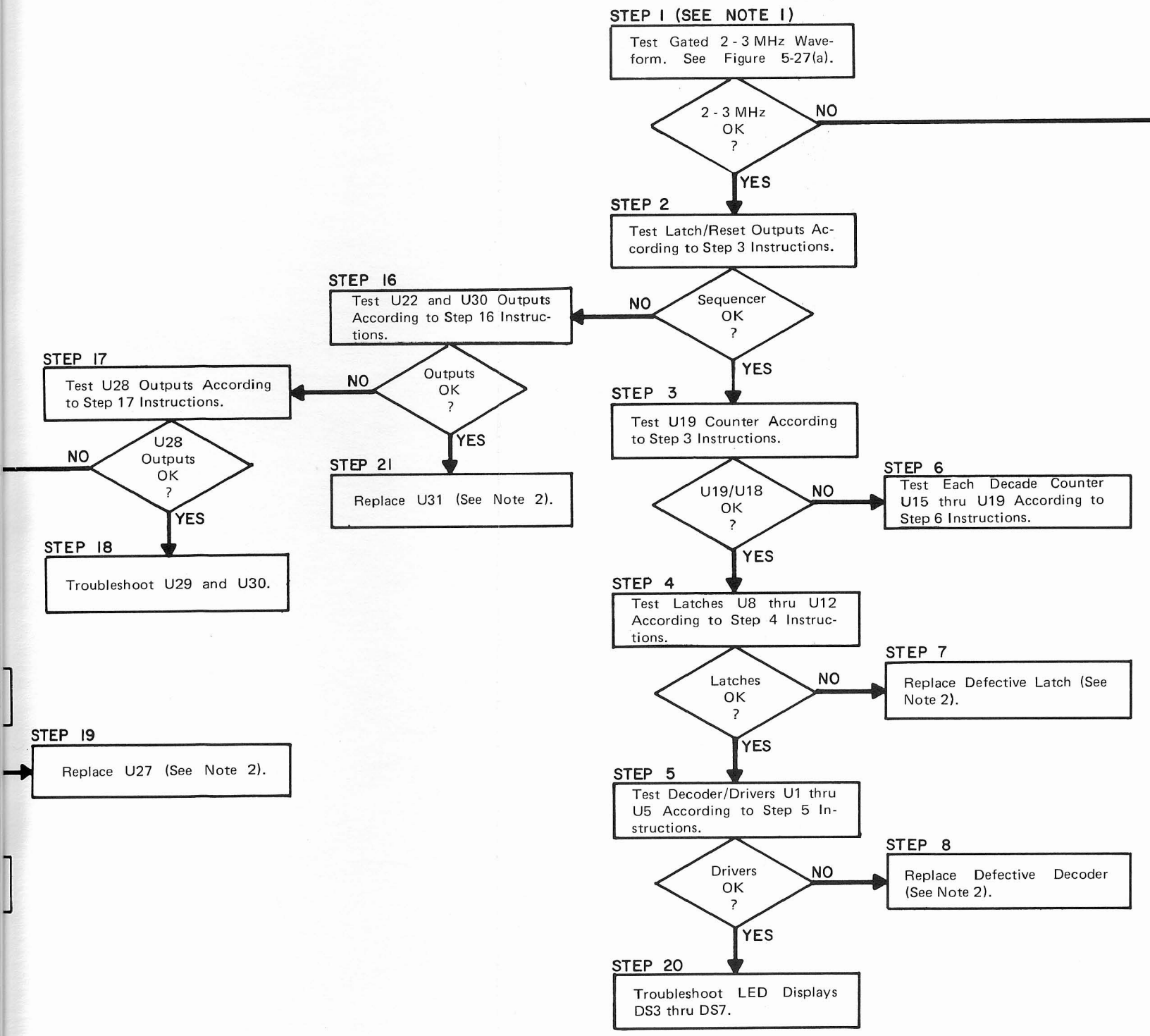
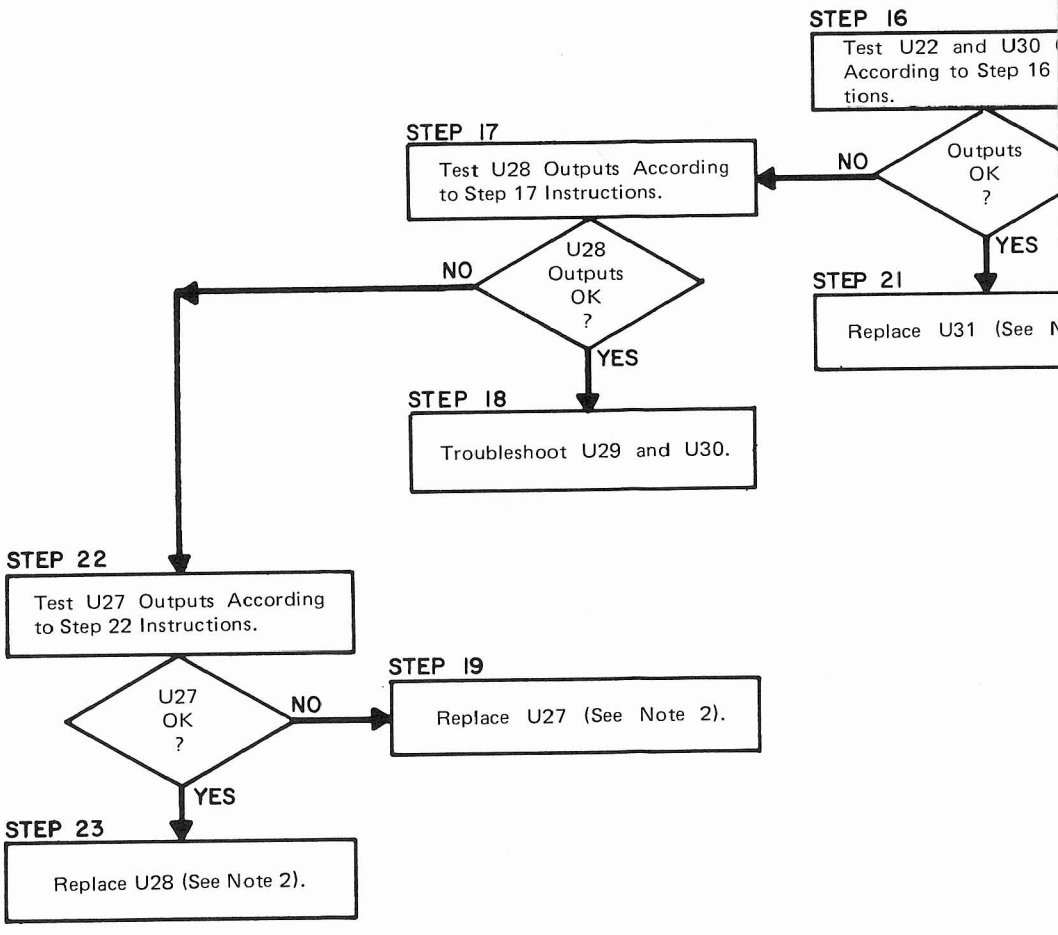


Figure 5-26. Main Counter Troubleshooting Tree.


STEP 16
Test U22 and U30
According to Step 16
tions.
Outputs
OK
?
NO
YES
STEP 17
Test U28 Outputs According
to Step 17 Instructions.
U28
Outputs
OK
?
NO
YES
STEP 21
Replace U31 (See
STEP 18
Troubleshoot U29 and U30.
STEP 22
Test U27 Outputs According
to Step 22 Instructions.
U27
OK
?
NO
YES
STEP 19
Replace U27 (See Note 2).
STEP 23
Replace U28 (See Note 2).

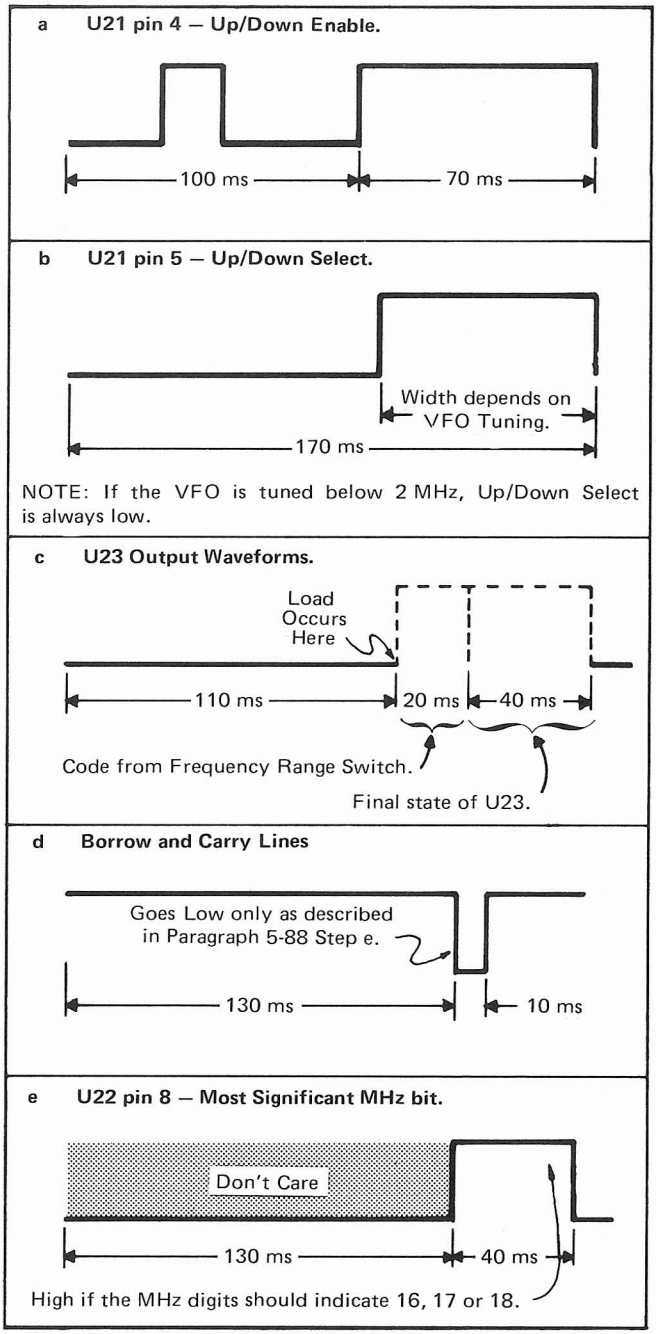


Figure 5-29. MHz Digit Waveforms.

Figure 5-25. Local Oscillator Troubleshooting Tree (cont'd).

NOTE 1

In situations where a Logic line is stuck low, any IC tied to that line may be at fault.

NOTE 2

If the problem is confined to one digit of the display, the LED display in question should be checked by substitution before proceeding.

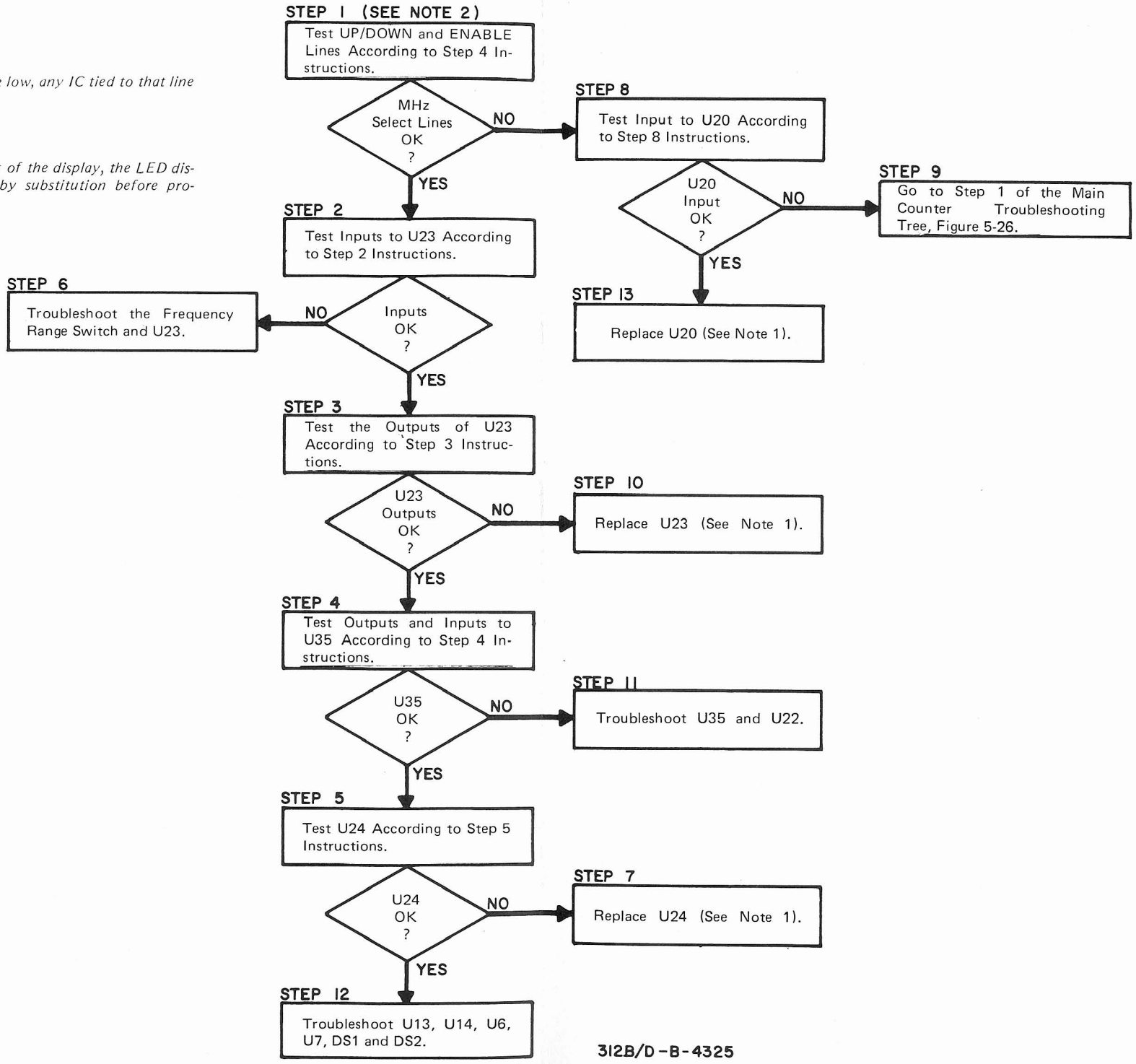


Figure 5-28. MHz Digits Troubleshooting Tree.

312-B-4325

NOTE

Check + 20 and - 15 volt supplies before proceeding.

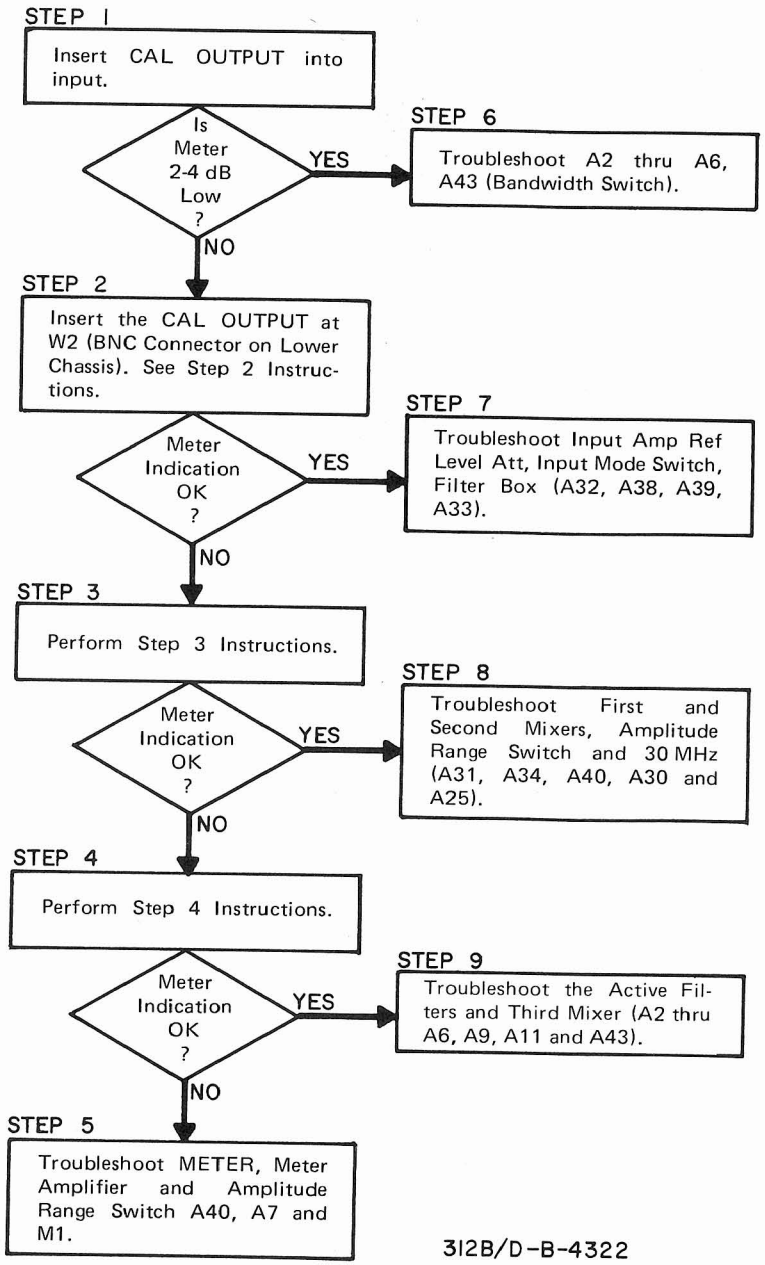


Figure 5-30. Main Signal Path Troubleshooting Tree.

PERFORMANCE TEST CARD

Hewlett-Packard Model 312B/D
Selective Volt/Level Meter
Serial No. _____

Tests Performed by _____

Date _____

DESCRIPTION	TESTS
1. FREQUENCY RESPONSE	
Reference Level 20 dBm	
10 kHz – 10 MHz	_____ Max Deviation ± 0.2 dB
10 MHz – 18 MHz	_____ Max Deviation ± 0.5 dB
Reference Level + 10	
10 kHz – 10 MHz	_____ Max Deviation ± 0.2 dB
10 MHz – 18 MHz	_____ Max Deviation ± 0.5 dB
Reference Level 0 dBm	
10 kHz – 10 MHz	_____ Max Deviation ± 0.2 dB
10 MHz – 18 MHz	_____ Max Deviation ± 0.5 dB
Reference Level - 10 dBm	
10 kHz – 10 MHz	_____ Max Deviation ± 0.2 dB
10 MHz –18 MHz	_____ Max Deviation ± 0.5 dB
Reference Level – 20 dBm	
10 kHz – 10 MHz	_____ Max Deviation ± 0.2 dB
10 MHz – 18 MHz	_____ Max Deviation ± 0.5 dB
Reference Level – 30 dBm	M
10 kHz – 10 MHz	_____ Max Deviation ± 0.2 dB
10 MHz – 18 MHz	_____ Max Deviation ± 0.5 dB
Reference Level – 40 dBm	
10 kHz – 10 MHz	_____ Max Deviation ± 0.2 dB
10 MHz – 18 MHz	_____ Max Deviation ± 0.5 dB
2. FREQUENCY ACCURACY	_____ < 10 Hz + time base accuracy
3. TIME BASE STABILITY	_____ 1 part in 10 > (2 ppm per week) drift on oscilloscope
4. SELECTIVITY	
a. 3100 Hz Bandwidth – 312B/D	
(1) Lower 3 dB point	_____ 998,450 ± 150 Hz
(2) Upper 3 dB point	_____ 1,001,550 ± 150 Hz
(3) Upper 60 dB point	_____ 1,003,100 ± 300 Hz
(4) Lower 60 dB point	_____ 996,900 Hz ± 300 Hz
b. 200 Hz Bandwidth – 312B Only	
(1) Upper 3 dB point	_____ 1,000,100 ± 10 Hz
(2) Lower 3 dB point	_____ 999,900 ± 10 Hz
(3) Lower 60 dB point	_____ 999,780 Hz ± 20 Hz
(4) Upper 60 dB point	_____ 1,003,100 Hz ± 20 Hz
c. 1000 Hz Bandwidth – 312B Only	
(1) Upper 3 dB point	_____ 1,000,500 ± 50 Hz
(2) Lower 3 dB point	_____ 999,500 ± 50 Hz
(3) Lower 60 dB point	_____ 998,930 Hz ± 100 Hz
(4) Upper 60 dB point	_____ 1,001,070 Hz ± 100 Hz
d. 2300 Hz Bandwidth – 312D Only	
(1) Upper 3 dB point	_____ 1,001, 150 Hz ± 110 Hz
(2) Lower 3 dB point	_____ 998,850 Hz ± 110 Hz
(3) Lower 60 dB point	_____ 997,600 Hz ± 230 Hz
(4) Upper 60 dB point	_____ 1,002,400 Hz ± 230 Hz
e. 50 Hz Bandwidth – 312D Only	
(1) Upper 3 dB point	_____ 1,000, 025 Hz ± 5 Hz
(2) Lower 3 dB point	_____ 999,975 Hz ± 5 Hz
(3) Lower 60 dB point	_____ 999,950 Hz ± 5 Hz
(4) Upper 60 dB point	_____ 1,000,050 Hz ± 5 Hz

PERFORMANCE TEST CARD (cont'd)

5. AUTOMATIC FREQUENCY CONTROL		
a. Hold-In Range	_____	> 3 kHz from reference
b, Lock-In	_____	At least 60 dB down
6. AMPLITUDE RANGE AND ACCURACY TEST		
a. Amplitude Range Attenuator		
(1) 1 MHz		
(a) 0 dB	_____	2.5 dBm ± 0.1 dBm
(b) - 10 dB	_____	2.5 dBm ± 0.1 dBm
(c) - 20 dB	_____	2.5 dBm ± 0.1 dBm
(d) - 30 dB	_____	2.5 dBm ± 0.1 dBm
(e) - 40 dB	_____	2.5 dBm ± 0.1 dBm
(f) - 50 dB	_____	2.5 dBm ± 0.1 dBm
(g) - 60 dB	_____	2.5 dBm ± 0.2 dBm
b. Reference Level Attenuator		
Channel A		
(1) 1 MHz		
(a) + 20 dB	_____	2.5 dBm ± 0.2 dBm
(b) + 10 dB	_____	2.5 dBm ± 0.2 dBm
(c) 0 dB	_____	2.5 dBm ± 0.2 dBm
(d) - 10 dB	_____	2.5 dBm ± 0.2 dBm
(e) - 20 dB	_____	2.5 dBm ± 0.2 dBm
(f) - 30 dB	_____	2.5 dBm ± 0.2 dBm
(g) - 40 dB	_____	2.5 dBm ± 0.2 dBm
Channel B		
(1) 1 MHz		
(a) + 20 dB	_____	2.5 dBm ± 0.2 dBm
(b) + 10 dB	_____	2.5 dBm ± 0.2 dBm
(c) 0 dB	_____	2.5 dBm ± 0.2 dBm
(d) - 10 dB	_____	2.5 dBm ± 0.2 dBm
(e) - 20 dB	_____	2.5 dBm ± 0.2 dBm
(f) - 30 dB	_____	2.5 dBm ± 0.2 dBm
(g) - 40 dB	_____	2.5 dBm ± 0.2 dBm
7. BRIDGING IMPEDANCE — 312B Only		
a. Input Resistance		
(1) Channel A	_____	> 10 kΩ (6 dB down from reference)
(2) Channel B	_____	> 10 kΩ (6 dB down from reference)
b. Input Capacitance		
(1) Channel A	_____	< 35 pF (> 900 kHz)
(2) Channel B	_____	< 35 pF (> 900 kHz)
c. Input Capacitance (- 40 dBm position of REFERENCE LEVEL)		
(1) Channel A	_____	< 60 pF (> 500 kHz)
(2) Channel B	_____	< 60 pF (> 500 kHz)
8. COMMON MODE REJECTION		
a. 10 kHz to 5 MHz	_____	≥ 34 dB
b. 5 MHz to 18 MHz	_____	> 24 dB
9. DISTORTION		
a. 96 kHz Harmonic	_____	down > 55 dB
b. 144 kHz Harmonic	_____	down > 55 dB
c. 6 MHz Harmonic	_____	down > 65 dB
d. 9 MHz Harmonic	_____	down > 65 dB

PERFORMANCE TEST CARD (cont'd)

10. NOISE LEVEL AND RESIDUAL RESPONSE		
a. 312B Noise Level	_____	< -120 dB
b. 312D Noise Level	_____	< -117 dB
c. 312B/D Residual Response	_____	< -112 dB
11. METER TRACKING AND RECORDER OUTPUT LEVEL ACCURACY		
a. Recorder Output	_____	1 V ± 0.1 V
b. Meter Tracking		
(1) 07.0	_____	1 V ± 0.1 V
(2) 08.0	_____	891 ± 1 mV
(3) 09.0	_____	794 ± 8 mV
(4) 10.0	_____	707 ± 7 mV
(5) 11.0	_____	631 ± 6 mV
(6) 12.0	_____	562 ± 6 mV
(7) 13.0	_____	501 ± 5 mV
(8) 14.0	_____	447 ± 5 mV
(9) 15.0	_____	398 ± 4 mV
(10) 16.0	_____	355 ± 4 mV
(11) 17.0	_____	316 ± 3 mV
(12) 18.0	_____	282 ± 3 mV
(13) 19.0	_____	251 ± 3 mV
(14) 20.0	_____	224 ± 2 mV
12. AUXILIARY OUTPUTS		
a. 1 MHz Output Level	_____	1 V p-p
b. 30 MHz OUtput Level	_____	113 mV – 197 mV p-p
c. Local Oscillator Output Level	_____	170 mV – 250 mV p-p
d. Local Oscillator Output Frequency	_____	30 MHz – 48 MHz
13. RECEIVER MODE OUTPUTS		
a. Beat Output – 312B	_____	> 0.5 V rms
b. Beat Output – 312D	_____	> 4.0 V rms
c. LSB and USB Outputs		
(1) Above 1 MHz		
(a) LSB	_____	3.3 kHz ± 10% at 3 dB down
(b) USB	_____	330 Hz ± 10%
(2) Below 1 MHz		
(a) LSB	_____	330 Hz ± 10% at 3 dB down
(b) USB	_____	3.3 kHz ± 10% at 3 dB down
(c) AM Output – 312D	_____	> 4.0 V rms
(d) AM/AFC Output – 312B	_____	0.4 – 0.7 V rms
14. METER EXPAND TEST–312D ONLY	_____	0.1 dB ± 0.05 dB
15. OVERLOAD DETECTOR TEST–312D ONLY		
a. OFF	_____	< -33 dB
b. ON	_____	> -31 dB
16. PHASE JITTER–312D ONLY	_____	< 0.6 degrees
17. 2 kHz NOTCH TEST–312B Option 001, 312D	_____	> 55 dB

SECTION VI
REPLACEABLE PARTS

6-1. INTRODUCTION.

6-2. This section contains information for ordering replacement parts. Table 6-3 lists the parts in alphameric order of their reference designators and provides the following information:

a. -hp- Part Number.

b. Total quantity used in the instrument (Qty column). The total quantity of a part is given the first time the part number appears.

c. Description of the part. (See Table 6-1 for abbreviations.)

d. Typical manufacturer of the part is a five-digit code. (See Table 6-2 for list of manufacturers.)

e. Manufacturer's part number.

6-3. Chassis Mounted and Miscellaneous Parts.

6-4. Chassis mounted components, mechanical parts and miscellaneous parts not having reference designators are listed near the end of Table 6-3.

6-5. ORDERING INFORMATION.

6-6. To obtain replacement parts, address your order or inquiry to the nearest Hewlett-Packard Sales and Service Office (see Appendix A). Identify parts by their -hp- Part Numbers. Include the instrument model and serial number.

6-7. Non-Listed Parts.

6-8. To obtain a part that is not listed, include:
a. Instrument model number.
b. Instrument serial number.
c. Description of the part.
d. Function and location of the part.

Table 6-1. Standard Abbreviations.

ABBREVIATIONS

Ag .....silver
Al .....aluminum
A .....ampere(s)
Au .....gold

C .....capacitor
cer .....ceramic
coef .....coefficient
com .....common
comp .....composition
conn .....connection

dep .....deposited
DPDT .....double-pole double-throw
DPST .....double-pole single-throw

elect .....electrolytic
encap .....encapsulated

F .....farad(s)
FET .....field effect transistor
fxd .....fixed

GaAs .....gallium arsenide
GHz .....gigahertz = 10^{+9} hertz
gd .....guard(ed)
Ge .....germanium
gnd .....ground(ed)

H .....henry(ies)
Hg .....mercury

Hz .....hertz (cycle(s) per second)

ID .....inside diameter
impg .....impregnated
incd .....incandescent
ins .....insulation(ed)

kΩ .....kilohm(s) = 10^{+3} ohms
kHz .....kilohertz = 10^{+3} hertz

L .....inductor
lin .....linear taper
log .....logarithmic taper

mA .....milliampere(s) = 10^{-3} amperes
MHz .....megahertz = 10^{+6} hertz
MΩ .....megohm(s) - 10^{+6} ohms
met flm .....metal film
mfr .....manufacturer
ms .....millisecond
mtg .....mounting
mV .....millivolt(s) = 10^{-3} volts
μF .....microfarad(s)
μs .....microsecond(s)
μV .....microvolt(s) = 10^{-6} volts
my .....Mylar®

nA .....nanoampere(s) = 10^{-9} amperes
NC .....normally closed
Ne .....neon
NO .....normally open

NPO .....negative positive zero (zero temperature coefficient)
ns .....nanosecond(s) = 10^{-9} seconds
nsr .....not separately replaceable

Ω .....ohm(s)
obd .....order by description
OD .....outside diameter

p .....peak
pA .....picoampere(s)
pc .....printed circuit
pF .....picofarad(s) 10^{-12} farads
piv .....peak inverse voltage
p/o .....part of
pos .....position(s)
poly .....polystyrene
pot .....potentiometer
p-p .....peak-to-peak
ppm .....parts per million
prec .....precision (temperature coeffient, long term stability and/or tolerance)

R .....resistor
Rh .....rhodium
rms .....root-mean-square
rot .....rotary

Se .....selenium
sect .....section(s)
Si .....silicon

sl .....slide
SPDT .....single-pole double-throw
SPST .....single-pole single-throw

Ta .....tantalum
TC .....temperature coefficient
TiO_2 .....titanium dioxide
tog .....toggle
tol .....tolerance
trim .....trimmer
TSTR .....transistor

V .....volt(s)
vacw .....alternating current working voltage
var .....variable
vdcw .....direct current working voltage

W .....watt(s)
w/ .....with
wiv .....working inverse voltage
w/o .....without
ww .....wirewound

* .....optimum value selected at factory, average value shown (part may be omitted)
** .....no standard type number assigned selected or special type

® Dupont de Nemours

DECIMAL MULTIPLIERS

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

STD-B-2734

DESIGNATORS

A .....assembly
B .....motor
BT .....battery
C .....capacitor
CR .....diode
DL .....delay line
DS .....lamp
E .....misc electronic part
F .....fuse

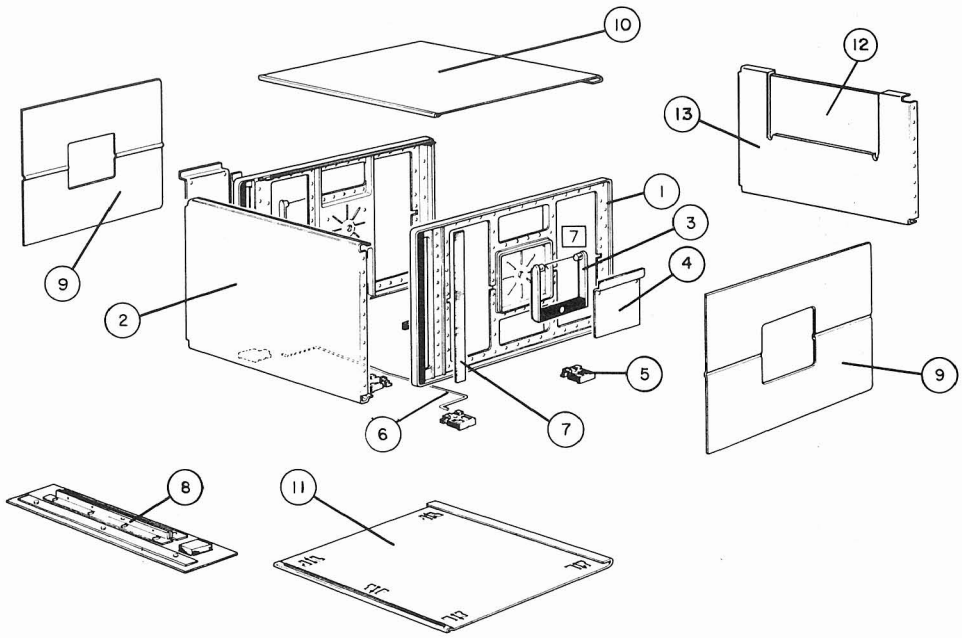
FL .....filter
HR .....heater
IC .....integrated circuit
J .....jack
K .....relay
L .....inductor
M .....meter
MP .....mechanical part
P .....plug

Q .....transistor
QCR .....transistor-diode
R .....resistor
RT .....thermistor
S .....switch
T .....transformer
TB .....terminal board
TC .....thermocouple
TP .....test point

TS .....terminal strip
U .....microcircuit
V .....vacuum tube, neon bulb, photocell, etc.
W .....cable
X .....socket
XDS .....lampholder
XF .....fuseholder
Y .....crystal
Z .....network

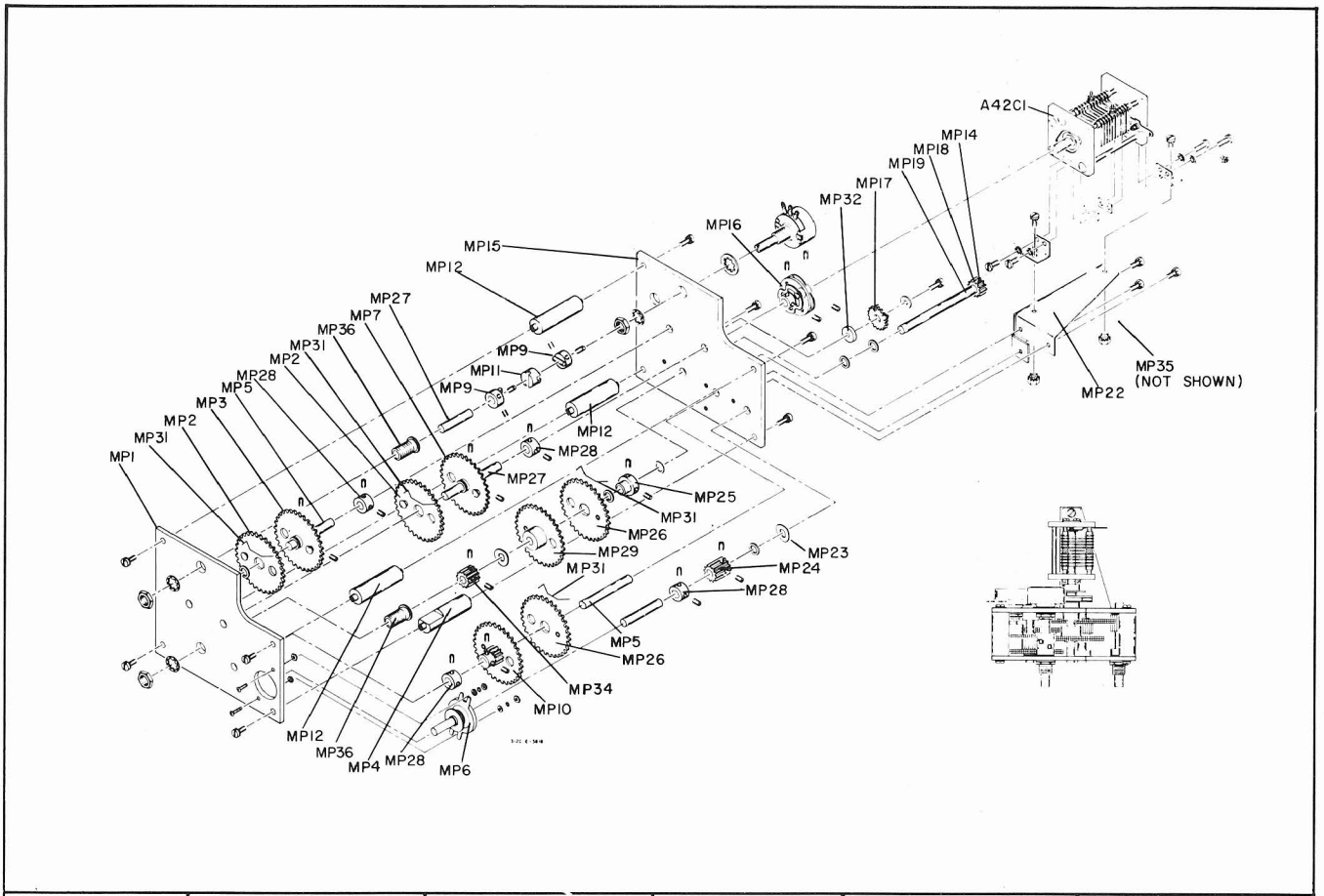
Table 6-2. Code List of Manufacturers.

Mfg. No.	Manufacturer	Address
GB027	No M/F Description for this Mfg Number	
00000	U.S.A. Common	Any Supplier of USA
0086S	Stettner—Trush Inc.	Cazenovia, N.Y. 13035
01121	Allen Bradley Co.	Milwaukee, Wi. 53212
01295	Texas Instr Inc Semicond Component Div.	Dallas, Tx 75231
02114	Ferroxcube Corp.	Saugerties, N.Y. 12477
02735	RCA Corp. Solid State Div.	Sommerville, N.J. 08876
03508	GE Co. Semiconductor Prod. Dept.	Syracuse, N.Y. 13201
03888	Pyrofilm Corp.	Whippany, N.J. 07981
04347	Hysol Div. Dexter Corp	Olean, N.Y. 14760
04713	Motorola Semiconductor Products	Phoenix, Az 85008
05464	Industrial Electronic Engineers, Inc.	Van Nuys, Ca. 91405
06560	Airco Speer Elek Div. Air Rdcn Co.	Nogales, Az 85621
07263	Fairchild Semiconductor Div.	Mountain View, Ca. 94040
08028	Woodhill Chemical Sales Corp.	Cleveland, Oh. 44128
09250	Electro Assemblies, Inc.	Chicago, Il. 60641
15818	Teledyne Semiconductor	Mountain View, Ca. 94040
16299	Corning Gl Wk Elec Component Div.	Raleigh, N.C. 27604
17419	Deutsch Co. The	Los Angeles, Ca. 90009
19701	Mepco/Electra Corp.	Mineral Wells, Tx 76067
24226	Gowanda Electronics Corp.	Gowanda, N.Y. 14070
24546	Corning Glass Works (Bradford)	Bradford, Pa. 16701
27014	National Semiconductor Corp.	Santa Clara, Ca. 95051
27264	Molex Products Co.	Downers Grove, Il. 60515
28480	Hewlett-Packard Co. Corporate HQ	Palo Alto, Ca. 94304
28499	Chemelec Products Inc.	Cherry Hill, N.J. 08034
30983	Memco/Electra Corp.	San Diego, Ca. 92121
32997	Bourns, Inc. Trimpot Prod. Div.	Riverside, Ca. 92507
38360	Markem Corp.	Keene, N.H. 03431
53021	Sangamo Electric Co.	Springfield, Il. 62705
56289	Sprague Electric Co.	North Adams, Ma. 01247
71584	Columbus Coated Fabrics Co.	Columbus, Oh. 43201
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
73138	Beckman Instruments, Inc. Helipot Div.	Fullerton, Ca. 92634
73168	Fenwal, Inc.	Ashland, Ma. 01721
73899	J F D Electronics Corp.	Brooklyn, N.Y. 11219
74970	Johnson E. F. Co.	Waseca, Mn 56093
75042	TRW, Inc. Philadelphia Div.	Philadelphia, Pa. 19108
81073	Grayhill, Inc.	La Grange, Il. 60525
82142	No M/F Description for this Mfg Number	
82389	Switchcraft, Inc.	Chicago, Il. 60630
84048	TRW, Inc. St. Petersburg Div.	St. Petersburg, Fl. 33702
84411	TRW Capacitor Div.	Ogallala, Ne. 69153
92194	Alpha Wire Corp.	Elizabeth, N.J. 07207
95121	Quality Components, Inc.	ST. Marys, Pa. 15857
95566	Arnold Engineering Co.	Marengo, Il. 60152
98291	Sealectro Corp.	Mamaroneck, N.Y. 10544



Description	-hp- Part No.	Qty
1. Frames	00312-20101	2
2. Front Panel 312B	00312-00203	1
Front Panel 312D	00312-00205	1
3. Side Handle	5060-0222	2
4. Handle Retainer	5060-8735	2
5. Foot Assembly	5060-0767	5
6. Stand, Tilt	1490-0030	(1)
7. Trim Strip	5000-0054	(2)
8. Rack Mounting Kit	5060-8743	(1)
9. Side Covers 312B, right 312D	5000-8729	(2)
Side Cover, left 312D	00312-00327	(1)
10. Top Cover	5060-8589	(1)
11. Bottom Cover	5060-8713	(1)
12. Rear Panel Cover 312B/D	00312-00006	(1)
13. Rear Panel	00312-00220	(1)

Figure 6-1. Chassis and Cover Component Location.



Designator	Description	-hp- Part No.	Designator	Description	-hp- Part No.
MP1	Plate, Gear Box Front	00312-20302	MP19	Shaft	00312-20053
MP2	Gear	00312-20060	MP20	Bracket	Part of A42C1
MP3	Gear	00312-60057	MP21	Washer	Part of A42C1
MP4	Spacer	00312-20300	MP22	Bracket	00312-00021
MP5	Shaft	5020-0341	MP23	Washer, Spring	5000-0206
MP6	Drive Mechanism	1500-0783	MP24	Gear	00312-20052
MP7	Gear	00312-60059	MP25	Collar	00312-20045
MP8	Shaft	5020-0319	MP26	Gear	00312-20058
MP9	Spacer	1500-0253	MP27	Shaft	5020-0343
MP10	Gear	00312-60055	MP28	Collar	5020-0233
MP11	Coupling	1500-0004	MP29	Gear	00312-60056
MP12	Spacer	00312-20054	MP30	Shaft	5020-3351
MP14	Pins, Stop	1410-0116	MP31	Spring, Thrust	1460-0114
MP15	Plate, Gear Box Rear	00312-20301	MP32	Hub	08614-218
MP16	Coupling	1500-0455	MP34	Gear, Spur	00312-20051
MP17	Gear, Stop	00692-247	MP35	Bracket	00312-20304
MP18	Gear, Stop	00692-242			

Figure 6-2. 312B/D Frequency Drive Assembly, A42, Exploded View.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A1	00312-66516	1	+20V REGULATOR ASSEMBLY	28480	00312-66516
A1C1	0180-0230	2	CAPACITOR-FXD; 1UF+-20% 50VDC TA-SOLID	56289	150D105X0050A2
A1C2	0140-0207	1	CAPACITOR-FXD 330PF +-5% 500WVDC MICA	72136	DM15F331J0500WV1CR
A1C3	0180-1746	22	CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A1C4	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A1CR1	1901-0040	50	DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A1CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A1CR3	1902-3182	1	DIODE-ZNR 12.1V 5% DO-7 PD=.4W TC=+.064%	04713	SZ 10939-206
A1CR4	1902-0777	2	DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.25W	04713	1N825
A1CR5	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A1Q1	1853-0010	22	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A1Q2	1854-0071	63	TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1Q3	1854-0039	4	TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A1Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A1R1	0684-3331	1	RESISTOR 33K 10% .25W FC TC=-400/+800	01121	CB3331
A1R2	0683-1815	5	RESISTOR 180 5% .25W FC TC=-400/+600	01121	CB1815
A1R3	0683-1535	1	RESISTOR 15K 5% .25W FC TC=-400/+800	01121	CB1535
A1R4	0698-3154	6	RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A1R5	0757-0429	6	RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1821-F
A1R6	0757-0289	8	RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A1R7	2100-3352	2	RESISTOR-VAR TRMR 1KOHM 10% C SIDE ADJ	73138	72XR1K
A1R8	0698-4445	2	RESISTOR 5.76K 1% .125W F TC=0+-100	16299	C4-1/8-TO-5761-F
A1R9	0684-1011	5	RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A1R10	0684-4711	4	RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A1R11	0811-0548	2	RESISTOR .47 5% .5W PW TC=0+-300	75042	BW20-5/10-.47R-J
A1U1	1820-0203	2	IC, AMPLIFIER, 741C	15818	741CE009
	1205-0033	4	HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0033
A2	00312-60002	2	ACTIVE FILTER ASSEMBLY	28480	00312-60002
A2C1, 2	0160-4408		CAPACITOR-FXD .063UF +-1% 100WVDC	28480	0160-4408
A2C3	0160-0162	12	CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A2C4	0180-0106	11	CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A2C5	0180-0197	29	CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C6, 7	0160-4408		CAPACITOR-FXD .063UF +-1% 100WVDC	28480	0160-4408
A2C8	0160-0162		CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A2C9	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C10	0160-4408		CAPACITOR-FXD .063UF +-1% 100WVDC	28480	0160-4408
A2C11	0160-4408		CAPACITOR-FXD .063UF +-1% 100WVDC	28480	0160-4408
A2C12	0160-0162		CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A2C13	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A2C14	0180-0159	4	CAPACITOR-FXD; 220UF+-20% 10VDC TA	56289	150D227X0010S2
A2CR1	1901-0025	35	DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A2CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A2Q1	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A2Q2	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A2Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q4	1853-0001	2	TRANSISTOR PNP SI TO-39 PD=600MW	28480	1853-0001
A2Q5	1854-0045	10	TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A2Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2Q8	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A2Q9	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A2Q10	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A2Q11	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A2R1	0698-3150	11	RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2371-F
A2R2	0757-0280	37	RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A2R3	0757-0346	16	RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A2R4	0698-4100	6	RESISTOR 1.26K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1261-F
A2R5	0757-0421	18	RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A2R6	0757-0441	12	RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A2R7	0698-3152	11	RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3481-F
A2R8	0698-3449	8	RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2872-F
A2R9	0698-3155	24	RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A2R10	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A2R11	0698-0083	12	RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A2R12	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A2R13	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A2R14	0698-3437	6	RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-TO-133R-F
A2R15	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A2R16	0757-0439	10	RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A2R17	0698-3151	10	RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2871-F
A2R18	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2371-F
A2R19	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A2R20	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A2R21	0698-4100		RESISTOR 1.26K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1261-F
A2R22	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A2R23	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A2R24	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3481-F
A2R25	0698-3440	13	RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-TO-196R-F
A2R26	0757-0159	2	RESISTOR 1K 1% .5W F TC=0+-100	19701	MF7C1/2-TO-1R0-F
A2R27	0757-0442	41	RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A2R28	0698-4123	71	RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-TO-499R-F
A3	00312-60003	2	ACTIVE FILTER ASSEMBLY	28480	00312-60003
A3C1	0180-0197		CAPACITOR-FXD: 2.2UF +-10% 20VDC TA	56289	150D225X9020A2
A3C2, 3	0160-4408		CAPACITOR-FXD .063UF +-1% 100WVDC	28480	0160-4408
A3C4	0160-0162		CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A3C5	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3C6, 7	0160-4408		CAPACITOR-FXD .063UF +-1% 100WVDC	28480	0160-4408
A3C8	0160-0162		CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A3C9	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X000682
A3C10	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3C11, 12	0160-4408		CAPACITOR-FXD .063UF +-1% 100WVDC	28480	0160-4408
A3C13	0160-0162		CAPACITOR-FXD .022UF +-10% 200WVDC POLYE	56289	292P22392
A3C14	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A3CR1	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A3CR2	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A3CR3	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A3Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q3	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3Q4	1854-0045		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A3Q5	1853-0086	5	TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086
A3Q6	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q8	1854-0045		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A3Q9	1854-0087	6	TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A3Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A3Q11	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A3R1	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A3R2	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A3R3	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A3R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R5	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A3R6	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-TO-133R-F
A3R7	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A3R8	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A3R9	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2871-F
A3R10	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2371-F
A3R11	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R12	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A3R13	0698-4100		RESISTOR 1.26K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1261-F
A3R14	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A3R15	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A3R16	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3481-F
A3R17	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2872-F
A3R18	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A3R19	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A3R20	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A3R21	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A3R22	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-TO-10R0-F
A3R23	0698-3437		RESISTOR 133 1% .125W F TC=0+-100	16299	C4-1/8-TO-133R-F
A3R24	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A3R25	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-6811-F
A3R26	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2871-F
A3R27	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A3R28	0698-4123		RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-TO-499R-F
A3R29	0698-4123		RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-TO-499R-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4	00312-60042	1	ACTIVE FILTER PREAMPLIFIER ASSEMBLY (FOR 312D INSTRUMENT ONLY)	28480	00312-60042
A4C1	0180-0137	5	CAPACITOR-FXD; 100UF+-20% 10VDC TA	56289	150D107X0010R2
A4C2	0170-0066	4	CAPACITOR-FXD .027UF +-10% 200WVDC POLYE	56289	292P27392
A4C3	0160-0157	4	CAPACITOR-FXD 4700PF +-10% 200WVDC POLYE	56289	292P47292
A4C4	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A4C5	0180-0137		CAPACITOR-FXD; 100UF+-20% 10VDC TA	56289	150D107X0010R2
A4C6	0170-0066		CAPACITOR-FXD .027UF +-10% 200WVDC POLYE	56289	292P27392
A4C7	0160-0157		CAPACITOR-FXD 4700PF +-10% 200WVDC POLYE	56289	292P47292
A4C8	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A4C9	0140-0172	2	CAPACITOR-FXD 3000PF +-1% 100WVDC MICA	72136	DM19F302F0100WV1CR
A4C10	0160-3156	2	CAPACITOR-FXD 750PF +-1% 300WVDC MICA	28480	0160-3156
A4C11	0160-2424	2	CAPACITOR-FXD 5700PF +-1% 100WVDC MICA	28480	0160-2424
A4C12	0160-3155	2	CAPACITOR-FXD 549PF +-1% 300WVDC MICA	28480	0160-3155
A4C13	0150-0122	2	CAPACITOR-FXD 2000PF +-20% 500WVDC CER	28480	0150-0122
A4C14	0140-0172		CAPACITOR-FXD 3000PF +-1% 100WVDC MICA	72136	DM19F302F0100WV1CR
A4C15	0160-3156		CAPACITOR-FXD 750PF +-1% 300WVDC MICA	28480	0160-3156
A4C16	0160-2424		CAPACITOR-FXD 5700PF +-1% 100WVDC MICA	28480	0160-2424
A4C17	0160-3155		CAPACITOR-FXD 549PF +-1% 300WVDC MICA	28480	0160-3155
A4C18	0150-0122		CAPACITOR-FXD 2000PF +-20% 500WVDC CER	28480	0150-0122
A4C19	0150-0093	73	CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A4C20	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A4C21	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A4CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A4CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A4Q1	1854-0045		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A4Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q3	1853-0020	10	TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q4	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q6	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q7	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q9	1854-0045		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A4Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q11	1853-0086		TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086
A4Q12	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q13	1853-0086		TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086
A4Q14	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q15	1853-0086		TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086
A4Q16	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4Q17	1853-0086		TRANSISTOR PNP SI PD=310MW FT=40MHZ	28480	1853-0086
A4Q18	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4R1	0698-3157	8	RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A4R2	0698-3156	9	RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A4R3	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A4R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R6	0757-0394	11	RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R7	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A4R8	0757-0418	13	RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4R9	0757-0199	10	RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4R10	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4R11	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4R12	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A4R13	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A4R14	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A4R15	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A4R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4R17	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4R18	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4R19	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A4R20	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4R21	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4R22	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4R23	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4R24	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A4R25	0698-6762	2	RESISTOR 26.7K 1% .125W F TC=0-100	03888	PME55S
A4R26	0698-6761	2	RESISTOR 107K 1% .125W F TC=0-100	03888	PME55S
A4R27	2100-1761	2	RESISTOR-TRMR 10K 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A4R28	0698-6763	2	RESISTOR 4.42K 1% .125W F TC=0-100	03888	PME55S
A4R29	0698-3228	7	RESISTOR 49.9K 1% .125W F TC=0+-100	03888	PME55S
A4R30	0698-6764	2	RESISTOR 3.92K 1% .125W F TC=0-100	03888	PME55S

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4R31	2100-1756	8	RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A4R32	0698-3497	4	RESISTOR 6.04K 1% .125W F TC=0+-100	16299	C4-1/8-T0-604R-F
A4R33	0757-0284	5	RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A4R34	0757-0401	42	RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R35	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4R36	0698-3497		RESISTOR 6.04K 1% .125W F TC=0+-100	16299	C4-1/8-T0-604R-F
A4R37	0757-0383	2	RESISTOR 18.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-18R2-F
A4R38	0698-6762		RESISTOR 26.7K 1% .125W F TC=0-100	03888	PME55S
A4R39	0698-6761		RESISTOR 107K 1% .125W F TC=0-100	03888	PME55S
A4R40	2100-1761		RESISTOR-TRMR 10K 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A4R41	0698-6763		RESISTOR 4.42K 1% .125W F TC=0-100	03888	PME55S
A4R42	0698-3228		RESISTOR 49.9K 1% .125W F TC=0+-100	03888	PME55S
A4R43	0698-6764		RESISTOR 3.92K 1% .125W F TC=0-100	03888	PME55S
A4R44	2100-1756		RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A4R45	0698-3497		RESISTOR 6.04K 1% .125W F TC=0+-100	16299	C4-1/8-T0-604R-F
A4R46	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A4R47	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A4R48	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4R49	0698-3497		RESISTOR 6.04K 1% .125W F TC=0+-100	16299	C4-1/8-T0-604R-F
A4R50	0757-0383		RESISTOR 18.2 1% .125W F TC=0+-100	19701	MF4C1/8-T0-18R2-F
A4R51	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	25546	C4-1/8-T0-101-F
A4R52	0757-0449	7	RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A4	00312-60004	1	ACTIVE FILTER PREAMPLIFIER ASSEMBLY (FOR 312B INSTRUMENT ONLY)	28480	00312-60004
A4 C1	0180-0137		CAPACITOR-FXD; 100UF+-20% 10VDC TA	56289	150D107X0010R2
A4 C2	0170-0066		CAPACITOR-FXD .027UF +-10% 200WVDC POLYE	56289	292P27392
A4 C3	0160-0157		CAPACITOR-FXD 4700PF +-10% 200WVDC POLYE	56289	292P47292
A4 C4	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A4 C5	0180-0137		CAPACITOR-FXD; 100UF+-20% 10VDC TA	56289	150D107X0010R2
A4 C6	0170-0066		CAPACITOR-FXD .027UF +-10% 200WVDC POLYE	56289	292P27392
A4 C7	0160-0157		CAPACITOR-FXD 4700PF +-10% 200WVDC POLYE	56289	292P47292
A4 C8	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A4 CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A4 CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A4 Q1	1854-0045		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A4 Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4 Q3	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4 Q4	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4 Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4 Q6	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4 Q7	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A4 Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4 Q9	1854-0045		TRANSISTOR NPN SI TO-18 PD=500MW	28480	1854-0045
A4 Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A4 R1	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A4 R2	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A4 R3	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A4 R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4 R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4 R6	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4 R7	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A4 R8	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4 R9	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4 R10	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4 R11	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4 R12	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A4 R13	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A4 R14	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A4 R15	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A4 R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A4 R17	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A4 R18	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A4 R19	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A4 R20	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A4 R21	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4 R22	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A4 R23	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A4 R24	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A4 R25	0757-0447	2	RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A4 R26	0757-0447		RESISTOR 16.2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1622-F
A5	00312-60003		ACTIVE FILTER ASSEMBLY SAME AS A3, USE PREFIX A5	28480	00312-60003
A6	00312-60002		ACTIVE FILTER ASSEMBLY SAME AS A2, USE PREFIX A6	28480	00312-60002
A7	00132-60005	1	METER AMPLIFIER ASSEMBLY	28480	00132-60005
A7C1	0160-2389	3	CAPACITOR-FXD 2600PF +-2% 300WVDC MICA	28480	0160-2389
A7C2	0160-2389		CAPACITOR-FXD 2600PF +-2% 300WVDC MICA	28480	0160-2389
A7C3	0160-2389		CAPACITOR-FXD 2600PF +-2% 300WVDC MICA	28480	0160-2389
A7C4	0180-0100	3	CAPACITOR-FXD; 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A7C5	0180-0100		CAPACITOR-FXD; 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A7C6	0160-2263	2	CAPACITOR-FXD 18PF +-5% 500WVDC CER	28480	0160-2263
A7C7	0160-0127	1	CAPACITOR-FXD 1UF +-20% 25WVDC CER	28480	0160-0127
A7C8	0180-0161	2	CAPACITOR-FXD; 3.3UF+-20% 35VDC TA	56289	150D335X0035B2
A7C9	0180-0161		CAPACITOR-FXD; 3.3UF+-20% 35VDC TA	56289	150D335X0035B2
A7C10	0150-0050	37	CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A7C11	0160-0174	3	CAPACITOR-FXD .47UF +80-20% 25WVDC CER	56289	5C1187-CML
A7C12	0180-0291	7	CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A7C13	0180-0100		CAPACITOR-FXD; 4.7UF+-10% 35VDC TA	56289	150D475X9035B2
A7C14	0180-1747	2	CAPACITOR-FXD; 150UF+-20% 15VDC TA	56289	150D157X0015
A7C15	0180-0195	2	CAPACITOR-FXD; .33UF+-20% 35VDC TA	56289	150D334X0035A2
A7C16	0180-0195		CAPACITOR-FXD; .33UF+-20% 35VDC TA	56289	150D334X0035A2
A7C17	0180-1747		CAPACITOR-FXD; 150UF+-20% 15VDC TA	56289	150D157X0015
A7CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A7CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A7L1	9100-1451	3		28480	9100-1451
A7L2	9100-1451			28480	9100-1451
A7L3	9100-1451			28480	9100-1451
A7L4	9140-0138	3	COIL-FXD MOLDED RF CHOKE 180UH 5%	24226	15/183
A7L5	9140-0138		COIL-FXD MOLDED RF CHOKE 180UH 5%	24226	15/183
A7L6	9140-0114	1	COIL-FXD MOLDED RF CHOKE 10UH 10%	24226	15/102
A7Q1	1854-0215	2	TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A7Q2	1853-0015	4	TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A7Q3	1854-0092	1	TRANSISTOR NPN SI PD=200MW FT=600MHZ	28480	1854-0092
A7R2	0757-0277	19	RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A7R3	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A7R4	0757-0279	12	RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A7R5	0698-3444	12	RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A7R6	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A7R7	0698-3432	1	RESISTOR 26.1 1% .125W F TC=0+-100	03888	PME55-1/8-T0-26R1-F
A7R8	0757-0274	6	RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A7R9	0698-3136	1	RESISTOR 17.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1782-F
A7R10	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1961-F
A7R11	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R12	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A7R13	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A7R14	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A7R15	0757-0873	1	RESISTOR 1.62K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1624-F
A7R16	0698-3447	2	RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-T0-422R-F
A7R17	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A7R18	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A7R19	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A7R20	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A7R21	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-T0-196R-F
A7R22	0757-0200	1	RESISTOR 5.62K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5621-F
A7R23	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A8	00312-66527	1	AUTOMATIC FREQUENCY CONTROL ASSEMBLY (FOR 312D INSTRUMENT ONLY)	28480	00312-66527

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8R1	0698-4417	1	RESISTOR 174 1% .125W F TC=0+-100	16299	C4-1/8-TO-174R-F
A8R2	0757-0123	3	RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-TO-3482-F
A8	00312-60006	1	AUTOMATIC FREQUENCY CONTROL ASSEMBLY (FOR 312B INSTRUMENT ONLY)	28480	00312-60006
A8 C1	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A8 C2	0180-0063	2	CAPACITOR-FXD; 500UF+75-10% 3VDC AL	56289	30D507G003DF2
A8 C3	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A8 C4	0160-2146	2	CAPACITOR-FXD .02UF +80-20% 100WVDC CER	28480	0160-2146
A8 C5	0170-0040	1	CAPACITOR-FXD .047UF +-10% 200WVDC POLYE	56289	292P47392
A8 C6	0160-2204	7	CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A8 C7	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A8 C8	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A8 C9	0180-0063		CAPACITOR-FXD; 500UF+75-10% 3VDC AL	56289	30D507G003DF2
A8 C10	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A8 C11	0180-0116	20	CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A8 C12	0180-0106		CAPACITOR-FXD; 60UF+-20% 6VDC TA-SOLID	56289	150D606X0006B2
A8 C13	0160-2197	2	CAPACITOR-FXD 10PF +-5% 300WVDC MICA	28480	0160-2197
A8 C14	0160-2197		CAPACITOR-FXD 10PF +-5% 300WVDC MICA	28480	0160-2197
A8 C15	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A8 C16	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A8 C17	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A8 C18	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A8 C19	0160-2146		CAPACITOR-FXD .02UF +80-20% 100WVDC CER	28480	0160-2146
A8 CR1	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR2	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR3	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR4	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR5	1912-0009	1	DIODE-TNL 1N3712 IP=.9MA IF=5MA	03508	1N3712
A8 CR6	1910-0016	6	DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A8 CR7	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR8	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR9	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR10	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR11	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR13	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A8 CR14	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR15	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR16	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR17	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR18	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR19	1901-0033	2	DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A8 CR20	1901-0033		DIODE-GEN PRP 180V 200NA DO-7	28480	1901-0033
A8 CR21	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR22	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR23	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR24	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR25	1902-0064	1	DIODE-ZNR 7.5V 5% DO-7 PD=.4W TC=+.05%	04713	SZ 10939-146
A8 CR26	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR27	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR28	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR29	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 CR30	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A8 L1	9140-0137	7	COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A8 L2	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A8 Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q11	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 Q12	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A8 R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A8 R2	0757-0438	14	RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A8 R3	0698-4383	2	RESISTOR 53.6 1% .125W F TC=0+-100	16299	C4-1/8-TO-53R6-F
A8 R4	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A8 R5	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A8 R6	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A8 R7	0698-3450	5	RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A8 R8	0757-0440	10	RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A8 R9	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A8 R10	0698-0084	4	RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A8 R11	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2151-F
A8 R12	0757-0473	1	RESISTOR 221K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2213-F
A8 R13	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8 R14	0698-3439	4	RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A8 R15	0757-0458	2	RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8 R16	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8 R17	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8 R18	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A8 R19	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A8 R20	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4222-F
A8 R21	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A8 R22	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A8 R23	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A8 R24	0698-4383		RESISTOR 53.6 1% .125W F TC=0+-100	16299	C4-1/8-T0-53R6-F
A8 R25	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A8 R26	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8 R27	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2152-F
A8 R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8 R29	0698-3457	5	RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A8 R30	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A8 R31	0698-3452	2	RESISTOR 147K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1473-F
A8 R32	0698-3452		RESISTOR 147K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1473-F
A8 R33	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8 R34	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A8 R35	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A8 R36	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A8 R37	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A8 R38	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A8 R39	0757-0458		RESISTOR 51.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5112-F
A8 R40	0698-3160	2	RESISTOR 31.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3162-F
A8 R41	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A8 R42	0757-0465	3	RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A8 R43	0757-0476	1	RESISTOR 301K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3013-F
A8 R44	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A9	00312-60008	1	THIRD MIXER/ DIVIDERS ASSEMBLY	28480	00312-60008
A9C1	0150-0096	10	CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A9C2	0180-1743	2	CAPACITOR-FXD; .1UF+-10% 35VDC TA-SOLID	56289	150D104X9035A2
A9C3	0140-0191	6	CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A9C4	0180-1743		CAPACITOR-FXD; .1UF+-10% 35VDC TA-SOLID	56289	150D104X9035A2
A9C5	0160-2198	2	CAPACITOR-FXD 20PF +-5% 300WVDC MICA	28480	0160-2198
A9C6	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A9C7	0160-0356	6	CAPACITOR-FXD 18PF +-5% 300WVDC MICA	28480	0160-0356
A9C8	0160-0356		CAPACITOR-FXD 18PF +-5% 300WVDC MICA	28480	0160-0356
A9C9	0160-2198		CAPACITOR-FXD 20PF +-5% 300WVDC MICA	28480	0160-2198
A9C10	0160-0356		CAPACITOR-FXD 18PF +-5% 300WVDC MICA	28480	0160-0356
A9C11	0160-0356		CAPACITOR-FXD 18PF +-5% 300WVDC MICA	28480	0160-0356
A9C12	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A9C13	0160-0186	1	CAPACITOR-FXD 10.7PF +-.5PF 300WVDC MICA	28480	0160-0186
A9C14	0160-0356		CAPACITOR-FXD 18PF +-5% 300WVDC MICA	28480	0160-0356
A9C15	0160-0356		CAPACITOR-FXD 18PF +-5% 300WVDC MICA	28480	0160-0356
A9C16	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A9C17	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A9C18, C19	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A9C30	0160-0127		CAPACITOR-FXD CER 1.0UF +-20% 25VDCW	56289	5C13CS-CML
A9C31	0160-0128		CAPACITOR-FXD CER 2.2UF +-20% 25VDCW	56289	5C152C2S-CML
A9C32	0160-0127		CAPACITOR-FXD CER 1.0UF +-20% 25VDCW	56289	5C13CS-CML
A9CR1-CR3	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR4	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR5	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR6	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR7	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR8	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR9	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR10	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR11	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR12	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR13	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR14	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR15	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A9CR16	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR17	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR18	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9CR19	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A9L1	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A9L2	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A9Q1	1854-0005	22	TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A9Q2	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A9Q3	1853-0034	4	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A9Q4	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A9Q5	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A9Q6	1853-0034		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0034
A9Q7	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A9Q10	1854-0215		TRANSISTOR NPN Si	04713	SPS 3611
A9R1	0757-0317	5	RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A9R2	0698-3442	1	RESISTOR 237 1% .125W F TC=0+-100	16299	C4-1/8-T0-237R-F
A9R3	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A9R4	0757-0416	29	RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A9R5	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A9R6	0757-0290	5	RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A9R7	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A9R8	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A9R9	0757-0419	6	RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A9R10	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A9R11	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1962-F
A9R12	0698-3435	1	RESISTOR 38.3 1% .125W F TC=0+-100	16299	C4-1/8-T0-38R3-F
A9R13	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A9R14	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A9R15	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-6191-F
A9R16	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A9R17	0757-0422	8	RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A9R18	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A9R19	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A9R20	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A9R21	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A9R22	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A9R23	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A9R24	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A9R25	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A9R26	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A9R27	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A9R28	2100-3119	2	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006Y-1-201
A9R29	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A9R30	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A9R31	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A9R32	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A9R33	0698-3449		RESISTOR 28.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2872-F
A9R34	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A9R35	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A9R36	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4221-F
A9R37	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A9R38	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A9R39	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A9R40	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A9R41	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A9R42	2100-3119		RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006Y-1-201
A9R43, R44	0698-3438	8	RESISTOR 147 1% .125W F TC=0+-100	16299	C4-1/8-T0-147R-F
A9R50	0757-0291		RESISTOR: FXD 24.9 1% .125W TC=0+-100	19701	MF4C1/8-T0-2492-F
A9R51	0757-0280		RESISTOR: FXD 1K 1% .125W TC=0+-100	24546	C4-1/8-T0-1001-F
A9R52	0698-4380		RESISTOR: FXD 45.3 1% .125W TC=0+-100	16299	C4-1/8-T0-45R3-F
A9R53	0757-0283		RESISTOR: FXD 2K 1% .125W TC=0+-100	24546	C4-1/8-T0-2001-F
A9R54	0757-0401		RESISTOR: FXD 100 1% .125W TC=0+-100	24546	C4-1/8-T0-101-F
A9R55	0698-3441		RESISTOR: FXD 215 1% .125W TC=0+-100	16299	C4-1/8-TO-215R-F
A9T1, T2	9100-1784	2	TRANSFORMER	28480	9100-1784
A9T3	9100-3492	1	TRANSFORMER	28480	9100-3492
A10	00312-60009	1	AUDIO AMPLIFIER/SSB OSCILLATOR ASSEMBLY	28480	00312-60009
A10C1	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C2	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C3	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C4	0160-2200	2	CAPACITOR-FXD 43PF +-5% 300WVDC MICA	28480	0160-2200
A10C5	0160-2200		CAPACITOR-FXD 43PF +-5% 300WVDC MICA	28480	0160-2200

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A10C6	0160-2206	3	CAPACITOR-FXD 160PF +-5% 300WVDC MICA	28480	0160-2206
A10C7	0160-2206		CAPACITOR-FXD 160PF +-5% 300WVDC MICA	28480	0160-2206
A10C8	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C9	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C10	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C11	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C12	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10C13	0160-2193	1	CAPACITOR-FXD .12UF +-5% 200WVDC POLYE	28480	0160-2193
A10C14	0170-0019	1	CAPACITOR-FXD .1UF +-5% 200WVDC POLYE	56289	292P10452
A10C15	0180-0159		CAPACITOR-FXD; 220UF+-20% 10VDC TA	56289	150D227X0010S2
A10C16	0180-0159		CAPACITOR-FXD; 220UF+-20% 10VDC TA	56289	150D227X0010S2
A10C17	0180-0098	1	CAPACITOR-FXD; 100UF+-20% 20VDC TA	56289	150D107X0020S2
A10C18	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A10L1	9100-1744	1	COIL-FXD MOLDED RF CHOKE 1.81MH 2%	06560	10120-9G
A10L2	9100-1765	1	COIL-FXD MOLDED RF CHOKE 4.95MH 2%	06560	10125-4G
A10L3	9100-1764	1	COIL-FXD MOLDED RF CHOKE 4.37MH 2%	06560	10125-5G
A10L4	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A10Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A10Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A10Q3	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q4	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q5	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q6	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q7	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q8	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q9	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q10	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10Q11	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A10R1	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A10R2	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A10R3	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A10R4	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A10R5	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A10R6	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A10R7	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2371-F
A10R8	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A10R9	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1962-F
A10R10	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A10R11	0698-0082	3	RESISTOR 464 1% .125W F TC=0+-100	16299	C4-1/8-TO-4640-F
A10R12	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A10R13	0698-3157		RESISTOR 19.6K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1962-F
A10R14	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A10R15	0698-3443	4	RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-TO-287R-F
A10R16	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-TO-287R-F
A10R17	0757-1094	3	RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A10R18	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	16299	C4-1/8-TO-4640-F
A10R19	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-TO-287R-F
A10R20	0698-3443		RESISTOR 287 1% .125W F TC=0+-100	16299	C4-1/8-TO-287R-F
A10R21	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A10R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A10R23	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A10R24	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A10R25	0757-0443	2	RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1102-F
A10R26	0757-0443		RESISTOR 11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1102-F
A10R27	0757-0427	3	RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1501-F
A10R28	0698-3447		RESISTOR 422 1% .125W F TC=0+-100	16299	C4-1/8-TO-422R-F
A10R29	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-TO-909R-F
A10R30	0757-0444	8	RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A10R31	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A10Y1	0410-0128	1	CRYSTAL:QUARTZ	28480	0410-0128
A10Y2	0410-0129	1	CRYSTAL:QUARTZ	28480	0410-0129
A11	00312-60034	1	ACTIVE FILTER EQUALIZER ASSEMBLY	28480	00312-60034
A11J1	1251-0494	1	CONNECTOR-PC EDGE 15-CONT/ROW 2-ROWS	71785	251-15-30-390
A11R1	2100-1756		RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A11R2	2100-1756		RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A11R3	2100-1756		RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A11R4	2100-1756		RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A11R5	2100-1756		RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A11R6	2100-1756		RESISTOR-TRMR 200 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A12	00312-66515	1	-15V REGULATOR ASSEMBLY	28480	00312-66515
A12C1	0140-0149	6	CAPACITOR-FXD 470PF +-5% 300WVDC MICA	72136	DM15F471J0300WV1CR
A12C2	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A12C3	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A12C5	0180-0230		CAPACITOR-FXD; 1UF+-20% 50VDC TA-SOLID	56289	150D105X0050A2
A12CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A12CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A12CR3	1902-0025	5	DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A12CR4	1902-0777		DIODE-ZNR 1N825 6.2V 5% DO-7 PD=.25W	04713	1N825
A12CR5	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A12Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A12Q2	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A12Q3	1853-0051	2	TRANSISTOR PNP 2N4037 SI TO-5 PD=1W	02735	2N4037
A12Q4	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A12R1	0684-2731	1	RESISTOR 27K 10% .25W FC TC=-400/+800	01121	CB2731
A12R2	0683-1815		RESISTOR 180 5% .25W FC TC=-400/+600	01121	CB1815
A12R3	0683-1035	2	RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A12R4	0698-4441	4	RESISTOR 3.74K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3741-F
A12R5	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A12R6	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A12R7	2100-3352		RESISTOR-VAR TRMR 1KOHM 10% C SIDE ADJ	73138	72XR1K
A12R8	0698-4445		RESISTOR 5.76K 1% .125W F TC=0+-100	16299	C4-1/8-T0-5761-F
A12R9	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A12R10	0811-0548		RESISTOR .47 5% .5W PW TC=0+-300	75042	BW20-5/10-.47R-J
A12R11	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A12U1	1820-0203		IC, AMPLIFIER, 741C	15818	741CE009
	1205-0033		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0033
A13	00312-66505		COUNTER ASSEMBLIES (A13 AND A14 MUST BE ORDERED TOGETHER AS A REPLACEMENT ASSEMBLY)	28480	00312-66505
A13C1-C10	0150-0084		CAPACITOR: FXD .1UF +80-20% 100VDCW	28480	0150-0084
A13C11	0160-0128		CAPACITOR: FXD 2.2UF 25V +-20%	28480	0160-0128
A13C12-C17	0150-0084		CAPACITOR: FXD .1UF +80-20% 100VDCW	28480	0150-0084
A13C18	0180-2101		CAPACITOR: FXD 4000UF 15V	56289	390408G015JL4
A13C19, C20	0150-0084		CAPACITOR: FXD .1UF +80-20% 100VDCW	28480	0150-0084
A13CR1	1901-0638		DIODE: ASSY-Si	28480	1901-0638
A13L1	9100-1631		COIL: CHOKE 56UH	24226	15/562
A13Q1-Q4	1854-0019		TRANSISTOR: SI NPN	28480	1854-0019
A13R1-50	0698-4123		RESISTOR: FXD 499 OHM .01 1/8W	16299	C4-1/8-TO-499R-F
A13R51-60	0698-3279	10	RESISTOR: FXD 4990 OHM .01	16299	C4-1/8-TO-4991-F
A13R61	0698-4441		RESISTOR: FXD 3740 OHM .01 1/8W	16299	C4-1/8-T0-3741-F
A13R62	0698-3223		RESISTOR: FXD 1240 OHM .01 1/8W	16299	C4-1/8-T0-1241-F
A13R63	0757-0284		RESISTOR: FXD 150 OHM .01 1/8W	24546	C4-1/8-T0-151-F
A13R64	0757-0384		RESISTOR: FXD 20 OHM .01 1/8W	30983	MF4C1/8-T0-20R0-F
A13R65	0757-0284		RESISTOR: FXD 150 OHM .01 1/8W	24546	C4-1/8-T0-151-F
A13R66	0757-0449		RESISTOR: FXD 20 K .01 1/8W	24546	C4-1/8-T0-2002-F
A13R67	0757-0442		RESISTOR: FXD 10 K .01 1/8W	24546	C4-1/8-T0-1002-F
A13R68	0698-4441		RESISTOR: FXD 3740 OHM .01 1/8W	16299	C4-1/8-T0-3741-F
A13R69	0698-3223		RESISTOR: FXD 1240 OHM .01 1/8W	16299	C4-1/8-T0-1241-F
A13R70	0757-0410		RESISTOR: FXD 301 OHM .01 1/8W	24546	C4-1/8-T0-301R-F
A13R71	0757-0384		RESISTOR: FXD 20 OHM .01 1/8W	30983	MF4C1/8-T0-20R0-F
A13R72	0757-0284		RESISTOR: FXD 150 OHM .01 1/8W	24546	C4-1/8-T0-151-F
A13R73	0757-0449		RESISTOR: FXD 20 K .01 1/8W	24546	C4-1/8-T0-2002-F
A13R74	0757-0442		RESISTOR: FXD 10 K .01 1/8W	24546	C4-1/8-T0-1002-F
A13U1-U7	1820-1233		IC: DIGITAL DECODER	01295	SN74L47N
A13U8-14	1820-1411	7	IC: SN47LS 75 N LATCH	01295	SN741.S75N
A13U15-20	1820-1490	6	IC: SN74LS 90 N COUNTER	01295	SN74LS90N
A13U21	1820-1202		IC: SN74LS 10 N GATE	01295	SN74LS10N
A13U22	1820-1197	2	IC: SN74LS 00 N GATE	01295	SN74LS00N
A13U23	1820-0233		IC: SN74 193 N COUNTER	01295	SN74193N
A13U24	1820-1141		IC: CONVERTER	01295	SN74185AN
A13U25	1820-1207		IC: SN74LS 30 N GATE	01295	SN74LS30N
A13U26	1820-1199	2	IC: SN74LS 04 N INV	01295	SN74LS04N
A13U27	1820-1490		IC: SN74LS 90 N COUNTER	01295	SN74LS90N
A13U28	1820-0627		IC: DIGITAL DECODER	07263	93L01DC
A13U29	1820-1199		IC: SN74LS 04 N INV	01295	SN74LS04N
A13U30	1820-1197		IC: SN74LS 00 N GATE	01295	SN74LS00N
A13U31	1820-1416		IC: SN74LS 14 N SCHMITT	01295	SN74LS14N
A13U32, 33	1820-1490	2	IC: SN74LS 90 N COUNTER	01295	SN74LS90N
A13U34, 35	1820-0281		IC: DIGITAL FLIP-FLOP	01295	SN74107N
A13U36, 37	1820-1490	2	IC: SN74LS 90 N COUNTER	01295	SN74LS90N

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14	00312–66506	1	COUNTER DISPLAY SUBASSEMBLY TO A13 (A13 AND A14 MUST BE ORDERED TOGETHER AS A REPLACE–MENT ASSEMBLY)	28480	00312–66506
A14DS1	1990-0540	7	DISPLAY, 7-SEGMENTS	28480	1990-0540
A14DS2	1990-0540		DISPLAY, 7-SEGMENTS	28480	1990-0540
A14DS3	1990-0540		DISPLAY, 7-SEGMENTS	28480	1990-0540
A14DS4	1990-0540		DISPLAY, 7-SEGMENTS	28480	1990-0540
A14DS5	1990-0540		DISPLAY, 7-SEGMENTS	28480	1990-0540
A14DS6	1990-0540		DISPLAY, 7-SEGMENTS	28480	1990-0540
A14DS7	1990-0540		DISPLAY, 7-SEGMENTS	28480	1990-0540
	1200–0474	7	SOCKET: 14 PIN	28480	1200–0474

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A14R64	0757-0384	2	RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A14R65	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A14R66	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A14R67	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14R68	0698-4441		RESISTOR 3.74K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3741-F
A14R69	0698-3223		RESISTOR 1.24K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1241-F
A14R70	0757-0410	2	RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A14R71	0757-0384		RESISTOR 20 1% .125W F TC=0+-100	19701	MF4C1/8-T0-20R0-F
A14R72	0757-0284		RESISTOR 150 1% .125W F TC=0+-100	24546	C4-1/8-T0-151-F
A14R73	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A14R74	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A14U1	1820-1233	7	IC SN74L 47 N DECODER	01295	SN74L47N
A14U2	1820-1233		IC SN74L 47 N DECODER	01295	SN74L47N
A14U3	1820-1233		IC SN74L 47 N DECODER	01295	SN74L47N
A14U4	1820-1233		IC SN74L 47 N DECODER	01295	SN74L47N
A14U5	1820-1233		IC SN74L 47 N DECODER	01295	SN74L47N
A14U6	1820-1233		IC SN74L 47 N DECODER	01295	SN74L47N
A14U7	1820-1233		IC SN74L 47 N DECODER	01295	SN74L47N
A14U8	1820-0876	7	IC SN74L 75 N LATCH	01295	SN74L75N
A14U9	1820-0876		IC SN74L 75 N LATCH	01295	SN74L75N
A14U10	1820-0876		IC SN74L 75 N LATCH	01295	SN74L75N
A14U11	1820-0876		IC SN74L 75 N LATCH	01295	SN74L75N
A14U12	1820-0876		IC SN74L 75 N LATCH	01295	SN74L75N
A14U13	1820-0876		IC SN74L 75 N LATCH	01295	SN74L75N
A14U14	1820-0876		IC SN74L 75 N LATCH	01295	SN74L75N
A14U15	1820-0055	1	IC:SN7490N	01295	SN7490N
A14U16	1820-0600	10	IC DM85L 90N COUNTER	27014	DM74L90N
A14U17	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U18	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U19	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U20	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U21	1820-0587	1	IC DM74L 10N GATE	27014	DM74L10N
A14U22	1820-0054	1	IC:SN7400N	01295	SN7400N
A14U23	1820-0912	1	IC SN74L 193 N COUNTER	01295	SN74L193N
A14U24	1820-1141	1	IC SN74 185AN CONV	01295	SN74185AN
A14U25	1820-0589	1	IC DM74L 30N GATE	27014	DM74L30N
A14U26	1820-0586	2	IC DM74L 04N INV	27014	DM74L04N
A14U27	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U28	1820-0627	1	IC DECODER	07263	93L01DC
A14U29	1820-0586		IC DM74L 04N INV	27014	DM74L04N
A14U30	1820-0583	1	IC DM74L 00N GATE	27014	DM74L00N
A14U31	1820-1053	1	IC SN74 14 N SCHMITT	01295	SN7414N
A14U32	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U33	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U34	1820-0281	2	IC SN74 107 N FLIP-FLOP	01295	SN74107N
A14U35	1820-0281		IC SN74 107 N FLIP-FLOP	01295	SN74107N
A14U36	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14U37	1820-0600		IC DM85L 90N COUNTER	27014	DM74L90N
A14XA1	1200-0474	7	SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
A14XA2	1200-0474		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
A14XA3	1200-0474		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
A14XA4	1200-0474		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
A14XA5	1200-0474		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
A14XA6	1200-0474		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
A14XA7	1200-0474		SOCKET; ELEC; IC 14-CONT DIP SLDR TERM	28480	1200-0474
			A14 MISCELLANEOUS		
	1205-0295	1	HEAT-DISSIPATOR SGL PLSTCPWR PKG	28480	1205-0295
A15			NOT ASSIGNED		
A16			NOT ASSIGNED		
A17			NOT ASSIGNED		
A18			NOT ASSIGNED		
A19			NOT ASSIGNED		

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A20			NOT ASSIGNED		
A21	00312-66504	1	VFO ASSEMBLY	28480	00312-66504
A21C2	0160-2229	2	CAPACITOR-FXD 3000PF +-5% 300WVDC MICA	28480	0160-2229
A21C3	0160-2435	2	CAPACITOR-FXD 5PF +-.25PF 500WVDC CER	28480	0160-2435
A21C4	0160-2435		CAPACITOR-FXD 5PF +-.25PF 500WVDC CER	28480	0160-2435
A21C5	0121-0127	1	CAPACITOR-V TRMR-AIR 1.7/14.1PF 350V	74970	189-0505-005
A21C6	0160-2266	2	CAPACITOR-FXD 24PF +-5% 500WVDC CER	28480	0160-2266
A21C7	0140-0210	1	CAPACITOR-FXD 270PF +-5% 300WVDC MICA	72136	DM15F271J0300WV1CR
A21C8	0160-2229		CAPACITOR-FXD 3000PF +-5% 300WVDC MICA	28480	0160-2229
A21C14	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	56289	5C11B7-CML
A21C20	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A21C21	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A21CR1	0122-0235	2	DIODE-VVC 47PF 10% C4/C25-MIN=1.9	04713	SMV315-235
A21CR2	0122-0235		DIODE-VVC 47PF 10% C4/C25-MIN=1.9	04713	SMV315-235
A21L1	00312-60083	1	COIL, VFO	28480	00312-60083
A21Q4	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A21R1	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A21R2	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A21R3	0698-3154		RESISTOR 4.22K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4221-F
A21R4	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A21R14	0698-3454	1	RESISTOR 215K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2153-F
A22	00312-66508	1	VFO AMPLIFIER ASSEMBLY	28480	00312-66508
A22C9	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A22C10	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A22C11	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A22C12	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A22C13	0180-0113	1	CAPACITOR-FXD 100UF +20-15% 20VDC TA-WET	56289	109D107C2030T2
A22C15	0180-0058	1	CAPACITOR-FXD; 50UF+75-10% 25VDC AL	56289	30D506G025CC2
A22C16	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A22C17	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A22C18	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A22C19	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A22CR3	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A22CR4	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A22CR5	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A22CR6	1902-0589	1	DIODE-ZNR 10V 2% DO-7 PD=.4W TC=+.066%	28480	1902-0589
A22CR7	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A22CR8	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025
A22K1	0490-0044	1	RELAY-REED 1A .125A 250V CONT 12V-COIL	28480	0490-0044
A22Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A22R5	0757-0417	3	RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-TO-562R-F
A22R6	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7501-F
A22R7	0698-3153	1	RESISTOR 3.83K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3831-F
A22R8	0757-0428	1	RESISTOR 1.62K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1621-F
A22R9	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A22R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A22R11	0698-3457		RESISTOR 316K 1% .125W F TC=0+-100	03888	PME55S
A22R12	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A22R13	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1472-F
A22R15	0757-0199		RESISTOR 21.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2152-F
A22R16	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4222-F
A22R17	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A22R18	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A22R19	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1472-F
A22R20	0757-0464	2	RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-TO-9092-F
A22R21	0698-3158	3	RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2372-F
A22R22	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A22R23	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A22R24	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2372-F
A22R25	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A22R26	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A22R27	0698-3158		RESISTOR 23.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2372-F
A22R28	0757-0123		RESISTOR 34.8K 1% .125W F TC=0+-100	24546	C5-1/4-T0-3482-F
A22R29	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A22R30	0757-0464		RESISTOR 90.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-9092-F
A23	00312-66524	1	SUMMATION LOOP & PHASE DETECTOR ASSY	28480	00312-66524
A23C1	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A23C2	0140-0195	1	CAPACITOR-FXD 130PF +-5% 300WVDC MICA	72136	DM15F131J0300WV1CR
A23C3	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A23C4	0160-3622	31	CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C5	0160-0168	6	CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A23C6	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A23C7	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C8	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C9	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A23C10	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C11	0160-0181	2	CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-0181
A23C12	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A23C13	0160-0938	4	CAPACITOR-FXD 1000PF +-5% 100WVDC MICA	53021	D15C1F102J
A23C14	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C15	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A23C16	0160-0174		CAPACITOR-FXD .47UF +80-20% 25WVDC CER	56289	5C11B7-CML
A23C17	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C18	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C19	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C20	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A23C21	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C22	0160-2035	1	CAPACITOR-FXD 750PF+-5% 300WVDC MICA	72136	NSN
A23C23	0160-0181		CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-0181
A23C24	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C25	0180-0228	2	CAPACITOR-FXD; 22UF+-10% 15VDC TA-SOLID	56289	150D226X9015B2
A23C26	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C27	0170-0038	2	CAPACITOR-FXD .22UF +-10% 200WVDC POLYE	28480	0170-0038
A23C28	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23C29	0180-1779	3	CAPACITOR-FXD; 18UF+-10% 35VDC TA-SOLID	56289	150D186X9035R2
A23C30	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A23C31	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A23CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A23CR2	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A23CR3	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A23CR4	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A23CR5	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A23CR6	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A23CR7	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A23CR8	1902-3054	1	DIODE-ZNR 3.65V 5% DO-7 PD=.4W TC=-.055%	04713	SZ 10939-56
A23CR9	1902-3104	1	DIODE-ZNR 5.62V 5% DO-7 PD=.4W TC=+.016%	04713	SZ 10939-110
A23CR10	1902-0041	5	DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A23CR11	1902-0041		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A23L1	9140-0138		COIL-FXD MOLDED RF CHOKE 180UH 5%	24226	15/183
A23L2	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A23L3	9100-3559	2	COIL-FXD MOLDED RF CHOKE 5.1UH 5%	24226	9502
A23L4	9100-3559		COIL-FXD MOLDED RF CHOKE 5.1UH 5%	24226	9502
A23L5	9140-0137		COIL-FXD MOLDED RF CHOKE 1MH 5%	24226	19/104
A23L6	9140-0210	8	COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A23L7	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A23Q1	1853-0203	4	TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0203
A23Q2	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A23Q3	1853-0203		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0203
A23Q4	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A23Q5	1854-0039		TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A23Q6	1853-0066	2	TRANSISTOR PNP SI TO-92 PD=200MW	28480	1853-0066
A23R1	0757-0291	4	RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A23R2	0683-3925	4	RESISTOR 3.9K 5% .25W FC TC=-400/+700	01121	CB3925
A23R3	0683-8215	4	RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A23R4	0683-4715	4	RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A23R5	0683-1025	20	RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A23R6	0698-3160		RESISTOR 31.6K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3162-F
A23R7	0698-4480	2	RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R8	0698-4480		RESISTOR 15.8K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1582-F
A23R9	0683-1015	21	RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A23R10	0683-1815		RESISTOR 180 5% .25W FC TC=-400/+600	01121	CB1815

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23R11	0698-3558	5	RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A23R12	0757-0291		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A23R13	0683-3925		RESISTOR 3.9K 5% .25W FC TC=-400/+700	01121	CB3925
A23R14	0683-8215		RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A23R15	0683-1005	2	RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A23R16	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A23R17	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A23R18	0698-4123		RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-T0-499R-F
A23R19	0698-4123		RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-T0-499R-F
A23R20	0757-0283	6	RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A23R21	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A23R22	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A23R23	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A23R24	0683-1815		RESISTOR 180 5% .25W FC TC=-400/+600	01121	CB1815
A23R25	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A23R26	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A23R27	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A23R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R29	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A23R30	0698-4486	3	RESISTOR 24.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2492-F
A23R31	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A23R32	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A23R33	0698-3629	1	RESISTOR 270 5% 2W MO TC=0+-200	24546	FP42-2-T00-270R-J
A23R34	0686-1525	1	RESISTOR 1.5K 5% .5W CC TC=0+647	01121	EB1525
A23R35	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A23U1	1820-0630	2	IC MC 4044P DIGITAL	04713	MC4044P
A23U2	1826-0066	4	IC AMPL	07263	777HC
A23U3	1826-0043	6	IC LM307H AMPL	27014	LM307H
A23U4	1826-0066		IC AMPL	07263	777HC
A23U5	1826-0043		IC LM307H AMPL	27014	LM307H
			A23 MISCELLANEOUS		
	1205-0033		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0033
	5020-2045	7	EXTRACTOR CARD	28480	5020-2045
A24	00312-66521	1	STEP LOCK PHASE DETECTOR ASSEMBLY	28480	00312-66521
A24C1	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C2	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C3	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A24C4	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C5	0160-0938		CAPACITOR-FXD 1000PF +-5% 100WVDC MICA	53021	D15C1E102J
A24C6	0160-0938		CAPACITOR-FXD 1000PF +-5% 100WVDC MICA	53021	D15C1E102J
A24C7	0150-0121	5	CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A24C8	0160-2209	2	CAPACITOR-FXD 360PF +-5% 300WVDC MICA	28480	0160-2209
A24C9	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C10	0140-0149		CAPACITOR-FXD 470PF +-5% 300WVDC MICA	72136	DM15F471J0300WV1CR
A24C11	0160-2202	1	CAPACITOR-FXD 75PF +-5% 300WVDC MICA	28480	0160-2202
A24C12	0180-1779		CAPACITOR-FXD; 18UF+-10% 35VDC TA-SOLID	56289	150D186X9035R2
A24C13	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C14	0170-0038		CAPACITOR-FXD .22UF +-10% 200WVDC POLYE	28480	0170-0038
A24C15	0160-0154	1	CAPACITOR-FXD 2200PF +-10% 200WVDC POLYE	56289	292P22292
A24C16	0140-0214	2	CAPACITOR-FXD 60PF +-5% 300WVDC MICA	72136	DM15E600J0300WV1CR
A24C17	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C18	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C19	0180-0228		CAPACITOR-FXD; 22UF+-10% 15VDC TA-SOLID	56289	150D226X9015R2
A24C20	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C21	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A24C22	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24C23	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A24C24	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A24CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A24CR2	1902-0041		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A24CR3	1902-3190	1	DIODE-ZNR 13V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-215
A24CR4	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A24CR5	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A24CR6	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A24CR7	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A24CR8	1902-0041		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A24L1	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A24L2	9100-1644	2	COIL-FXD MOLDED RF CHOKE 330UH 5%	24226	19/333
A24L3	9100-0541	4	COIL-FXD MOLDED RF CHOKE 250UH 10%	28480	9100-0541
A24L4	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A24L5	9100-0541		COIL-FXD MOLDED RF CHOKE 250UH 10%	28480	9100-0541

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24Q1	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A24Q2	1853-0203		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0203
A24Q3	1854-0226	2	TRANSISTOR NPN 2N4384 SI TO-18 PD=500MW	28480	1854-0226
A24Q4	1854-0226		TRANSISTOR NPN 2N4384 SI TO-18 PD=500MW	28480	1854-0226
A24Q5	1853-0066		TRANSISTOR PNP SI TO-92 PD=200MW	28480	1853-0066
A24Q6	1854-0039		TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A24R1	0683-3925		RESISTOR 3.9K 5% .25W FC TC=-400/+700	01121	CB3925
A24R2	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A24R3	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A24R4	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R5	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A24R6	0683-8215		RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A24R7	0757-0291		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
A24R8	0683-1815		RESISTOR 180 5% .25W FC TC=-400/+600	01121	CB1815
A24R9	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A24R10	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A24R11	0698-4123		RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-T0-499R-F
A24R12	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R13	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A24R14	0698-3228		RESISTOR 49.9K 1% .125W F TC=0+-100	03888	PME55S
A24R15	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R16	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R17	0698-4123		RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-T0-499R-F
A24R18	0698-3228		RESISTOR 49.9K 1% .125W F TC=0+-100	03888	PME55S
A24R19	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R20	0698-4436	1	RESISTOR 2.8K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2801-F
A24R21	0698-3228		RESISTOR 49.9K 1% .125W F TC=0+-100	03888	PME55S
A24R22	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A24R23	0698-4123		RESISTOR 499 1% .125W F TC=0+-100	16299	C4-1/8-T0-499R-F
A24R24	0683-1035		RESISTOR 10K 5% .25W FC TC=-400/+700	01121	CB1035
A24R25	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A24R26	0698-4486		RESISTOR 24.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2492-F
A24R27	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A24R28	0698-3620	1	RESISTOR 100 5% 2W MO TC=0+-200	24546	FP42-2-T00-100R-J
A24R29	0757-0462	1	RESISTOR 75K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7502-F
A24R30	0698-4486		RESISTOR 24.9K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2492-F
A24R31	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A24R32	0698-4483	1	RESISTOR 18.7K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1872-F
A24R33	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A24R34	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A24U1	1820-0630		IC MC 4044P DIGITAL	04713	MC4044P
A24U2	1826-0066		IC AMPL	07263	777HC
A24U3	1826-0043		IC LM307H AMPL	27014	LM307H
			A24 MISCELLANEOUS		
	1205-0033		HEAT-DISSIPATOR SGL TO-5/TO-39 PKG	28480	1205-0033
	5020-2045		EXTRACTOR CARD	28480	5020-2045
A25	00312-60025	1	PHASE LOCK ASSEMBLY	28480	00312-60025
A25C1	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A25C2	0140-0205	1	CAPACITOR-FXD 62PF +-5% 300WVDC MICA	72136	DM15E620J0300WV1CR
A25C3	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A25C4	0160-2206		CAPACITOR-FXD 160PF +-5% 300WVDC MICA	28480	0160-2206
A25C5	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A25C6	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A25C7	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A25C8	0160-2205	1	CAPACITOR-FXD 120PF +-5% 300WVDC MICA	28480	0160-2205
A25C9	0160-0134	1	CAPACITOR-FXD 220PF +-5% 300WVDC MICA	28480	0160-0134
A25C10	0140-0196	4	CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A25C11	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A25C12	0170-0078	1	CAPACITOR-FXD .47UF +-5% 150WVDC POLYE	84411	663UW474515
A25C13	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A25C14	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A25C15	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A25C16	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A25C17	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A25C18	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A25C19	0160-2143	23	CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A25C20	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A25CR1	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A25CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A25CR3	1901-0179	10	DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A25CR4	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A25CR5	1901-0025		DIODE-GEN PRP 100V 200NA DO-7	28480	1901-0025

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A25CR6	1902-0188	1	DIODE-ZNR 4.12V 5% DO-7 PD=.4W TC=-.041%	04713	SZ 10939-71
A25L1	9140-0042	1	COIL-VAR 270NH/410NH BSHG MTG	09250	18-378
A25L2	9100-1620	5	COIL-FXD MOLDED RF CHOKE 15UH 10%	24226	15/152
A25L3	9100-1620		COIL-FXD MOLDED RF CHOKE 15UH 10%	24226	15/152
A25L4	9100-1620		COIL-FXD MOLDED RF CHOKE 15UH 10%	24226	15/152
A25L5	9100-1620		COIL-FXD MOLDED RF CHOKE 15UH 10%	24226	15/152
A25L6	9100-1620		COIL-FXD MOLDED RF CHOKE 15UH 10%	24226	15/152
A25Q1	1854-0087		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A25Q2	1854-0087		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A25Q3	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A25Q4	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A25Q5	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A25Q6	1854-0087		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A25Q7	1854-0087		TRANSISTOR NPN SI PD=360MW FT=75MHZ	28480	1854-0087
A25R1	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A25R2	0698-3445	1	RESISTOR 348 1% .125W F TC=0+-100	16299	C4-1/8-TO-348R-F
A25R3	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A25R4	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A25R5	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A25R6	0698-4037	5	RESISTOR 46.4 1% .125W F TC=0+-100	16299	C4-1/8-TO-46R4-F
A25R7	0757-0395	1	RESISTOR 56.2 1% .125W F TC=0+-100	24546	C4-1/8-TO-56R2-F
A25R8	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A25R9	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	16299	C4-1/8-TO-147R-F
A25R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A25R11	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1472-F
A25R12	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A25R13	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A25R14	2100-1759	2	RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A25R15	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A25R16	0757-0459	1	RESISTOR 56.2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5622-F
A25R17	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4222-F
A25R18	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8251-F
A25R19	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A25R20	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A25R21	0698-3450		RESISTOR 42.2K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4222-F
A25R22	0698-3159	1	RESISTOR 26.1K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2612-F
A25R23	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5811-F
A25R24	2100-1759		RESISTOR-TRMR 2K 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A25R25	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A25R26	0757-0290		RESISTOR 6.19K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-6191-F
A25R27	0698-0083		RESISTOR 1.96K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1961-F
A25R28	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-TO-562R-F
A25R29	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1212-F
A25R30	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-TO-1332-F
A25T1	9100-1770	1	TRANSFORMER	28480	9100-1770
			A25 MISCELLANEOUS		
	5020-2045		EXTRACTOR CARD	28480	5020-2045
A26	00312-66526	1	1 MHZ REFERENCE OSCILLATOR ASSEMBLY	28480	00312-66526
	00312-80003	1	EXTRACTOR CARD	28480	00312-80003
A26C1	0140-0109	2	CAPACITOR-FXD 209PF +-2% 500WVDC MICA	72136	DM15E209RG0500WV1CR
A26C2	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C3	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A26C4	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A26C5	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C6	0140-0191		CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A26C7	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C8	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C9	0140-0191		CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A26C10	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C11	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C12	0140-0191		CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A26C13	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C14	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C15	0140-0191		CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A26C16	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C17	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C18	0140-0191		CAPACITOR-FXD 56PF +-5% 300WVDC MICA	72136	DM15E560J0300WV1CR
A26C19	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C20	0160-2263	5	CAPACITOR-FXD 18 PF +-5% 500WVDC CER	28480	0160-2263

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A26C21	0130-0016	1	CAPACITOR-V TRMR-CER 5/25PF 350V PC-MTG	72982	557-610-39A
A26C22	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C23	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A26C24	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C25	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C26	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C27	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C28	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C29	0160-0205	2	CAPACITOR-FXD 10PF +-5% 500WVDC MICA	28480	0160-0205
A26C30	0140-0109		CAPACITOR-FXD 209PF +-2% 500WVDC MICA	72136	DM15E209RG0500WV1CR
A26C31	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C32	0160-0938		CAPACITOR-FXD 1000PF +-5% 100WVDC MICA	53021	D15C1E102J
A26C33	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26C34	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A26C35	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A26CR1	1910-0016		DIODE-GE 60V 60NA 1US DO-7	28480	1910-0016
A26CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A26CR3	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A26L1	9100-2459	2	COIL-FXD MOLDED RF CHOKE 121UH 1%	06560	10176-38F
A26L2	9100-2459		COIL-FXD MOLDED RF CHOKE 121UH 1%	06560	10176-38F
A26Q1	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q2	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q3	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q4	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q5	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q6	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q7	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q8	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A26Q10	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A26Q11	1854-0215		TRANSISTOR NPN SI PD=350MW FT=300MHZ	04713	SPS 3611
A26Q12	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A26Q13	1853-0020		TRANSISTOR PNP SI PD=300MW FT=150MHZ	28480	1853-0020
A26R1	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R2	0698-4423	1	RESISTOR 1.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1371-F
A26R3	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R4	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A26R5	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A26R6	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A26R7	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A26R8	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R9	0698-4474	2	RESISTOR 8.45K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8451-F
A26R10	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A26R11	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A26R12	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R13	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A26R14	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A26R15	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A26R16	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R17	0757-0430	1	RESISTOR 2.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2211-F
A26R18	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A26R19	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A26R20	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A26R21	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R22	0698-4474		RESISTOR 8.45K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8451-F
A26R23	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A26R24	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A26R25	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R26	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A26R27	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A26R28	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R28	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A26R30	0757-0465		RESISTOR 100K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1003-F
A26R31	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A26R32	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R33	0698-3225	2	RESISTOR 1.43K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1431-F
A26R34	0757-0439		RESISTOR 6.81K 1% .125W F TC=0+-100	24546	C4-1/8-T0-6811-F
A26R35	2100-1760	1	RESISTOR-TRMR 5K 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A26R36	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R37	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3161-F
A26R38	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-51R1-F
A26R39	0757-0420	3	RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A26R40	0757-0399	1	RESISTOR 82.5 1% .125W F TC=0+-100	24546	C4-1/8-T0-82R5-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A26R41	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26R42	0698-4438	1	RESISTOR 3.09K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3091-F
A26R43	0698-3279	3	RESISTOR 4.99K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4991-F
A26R44	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4021-F
A26R45	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A26R46	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R47	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A26R48	0698-3225		RESISTOR 1.43K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1431-F
A26R49	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A26R50	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A26R51	0698-4435	2	RESISTOR 2.49K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2491-F
A26R52	0757-0440		RESISTOR 7.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-7501-F
A26R53	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A26Y1	0410-0133	1	CRYSTAL:QUARTZ	28480	0410-0133
	1251-3305	1	CONNECTOR 4-PIN M POST TYPE	27264	09-65-1041(2244-4A)
A27			NOT ASSIGNED		
A28	00312-66520	1	28-45 MHZ OSCILLATOR & DIV. N COUNTER	28480	00312-66520
A28C1	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A28C2	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A28C3	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A28C4	0180-1779		CAPACITOR-FXD; 18UF+-10% 35VDC TA-SOLID	56289	150D186X9035R2
A28C5	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C6	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C7	0140-0149		CAPACITOR-FXD 470PF +-5% 300WVDC MICA	72136	DM15F471J0300WV1CR
A28C8	0140-0149		CAPACITOR-FXD 470PF +-5% 300WVDC MICA	72136	DM15F471J0300WV1CR
A28C9	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A28C10	0160-2209		CAPACITOR-FXD 360PF +-5% 300WVDC MICA	28480	0160-2209
A28C11	0121-0430	3	CAPACITOR-V TRMR-AIR 1.4/9.2PF 350V	74970	189-0503-125
A28C12	0150-0042	1	CAPACITOR-FXD 4.7PF +-5% 500WVDC TI DIOX	95121	TYPE QC
A28C13	0160-0363	1	CAPACITOR-FXD 620PF +-5% 300WVDC MICA	28480	0160-0363
A28C14	0140-0149		CAPACITOR-FXD 470PF +-5% 300WVDC MICA	72136	DM15F471J0300WV1CR
A28C15	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C16	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C17	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C18	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A28C19	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A28C20	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C21	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C22	0180-1715	1	CAPACITOR-FXD; 150UF+-10% 6VDC TA-SOLID	56289	150D157X9006R2
A28C23	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C24	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C25	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C26	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C27	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C28	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A28C29	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A28C30	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A28CR1	0122-0083	2	DIODE-VVC 36.7PF 5% BVR=20V DO-7	28480	0122-0083
A28L1	9100-3482	2	TRANSFORMER, RF	28480	9100-3482
A28L2	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A28L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A28L4	9100-1644		COIL-FXD MOLDED RF CHOKE 330UH 5%	24226	19/333
A28L5	9100-0541		COIL-FXD MOLDED RF CHOKE 250UH 10%	28480	9100-0541
A28L6	9100-3333	1	COIL-FXD MOLDED RF CHOKE 2.2UH 5%	24226	9404
A28L7	9100-0541		COIL-FXD MOLDED RF CHOKE 250UH 10%	28480	9100-0541
A28Q1	1854-0345	12	TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A28Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A28Q3	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A28Q4	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A28Q5	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A28Q6	1853-0203		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0203
A28Q7	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A28R1	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A28R2	0698-4419	1	RESISTOR 210 1% .125W F TC=0+-100	24546	C4-1/8-T0-210R-F
A28R3	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A28R4	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A28R5	0757-0453	2	RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3012-F
A28R6	0757-0453		RESISTOR 30.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3012-F
A28R7	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A28R8	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A28R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A28R10	0698-3279		RESISTOR 4.99K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4991-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A28R11	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A28R12	0683-2025	11	RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28R13	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A28R14	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A28R15	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A28R16	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A28R17	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28R18	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A28R19	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A28R20	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A28R21	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A28R22	0683-1015		RESISTOR 100 5% .25W FC TC=-400/+500	01121	CB1015
A28R23	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A28R24	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A28R25	0683-3925		RESISTOR 3.9K 5% .25W FC TC=-400/+700	01121	CB3925
A28R26	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A28R27	0683-4715		RESISTOR 470 5% .25W FC TC=-400/+600	01121	CB4715
A28R28	0683-2715	2	RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A28R29	0683-2715		RESISTOR 270 5% .25W FC TC=-400/+600	01121	CB2715
A28R30	0683-5125	2	RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A28R31	0683-5125		RESISTOR 5.1K 5% .25W FC TC=-400/+700	01121	CB5125
A28R32	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A28R33	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28R34	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28R35	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28R36	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28R37	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28R38	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A28U1	1820-0686	1	IC SN74S 11 N GATE	01295	SN74S11N
A28U2	1820-0751	2	IC SN74 196 N COUNTER	01295	SN74196N
A28U3	1820-0469	1	IC SN74H 102 N FLIP-FLOP	01295	SN74H102N
A23U4	1820-0629	1	IC SN74S 112 N FLIP-FLOP	01295	SN74S112N
A28U5	1820-0751		IC SN74 196 N COUNTER	01295	SN74196N
			A28 MISCELLANEOUS		
A29	00312-66519	1	FIRST SUMMANTION LOOP MIXER	28480	00312-66519
A29C1	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C2	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C3	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C4	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C5	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C6	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C7	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C8	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C9	0160-2240	2	CAPACITOR-FXD 2PF +-.25PF 500WVDC CER	28480	0160-2240
A29C10	0160-2240		CAPACITOR-FXD 2PF +-.25PF 500WVDC CER	28480	0160-2240
A29C11	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C12	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A29C13	0160-2259		CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-2259
A29C14	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C15	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A29C16	0160-2259		CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-2259
A29C17	0140-0214		CAPACITOR-FXD 60PF +-5% 300WVDC MICA	72136	DM15E600J0300WV1CR
A29C18	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A29C19	0160-0376	1	CAPACITOR-FXD 68PF +-5% 500WVDC MICA	28480	0160-0376
A29C20	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C21	0150-0096		CAPACITOR-FXD .05UF +80-20% 100WVDC CER	28480	0150-0096
A29C22	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C23	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C24	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C25	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C26	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C27	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A29C28	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A29CR1	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A29CR2	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A29CR3	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A29CR4	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A29L1	9140-0129	1	COIL-FXD MOLDED RF CHOKE 220UH 5%	24226	15/223
A29L2	9100-0539	2	COIL-FXD MOLDED RF CHOKE 10UH 5%	24226	15/102-5%
A29L3	9100-0539		COIL-FXD MOLDED RF CHOKE 10UH 5%	24226	15/102-5%
A29Q1	1853-0016	1	TRANSISTOR PNP SI TO-92 PD=300MW	28480	1853-0016
A29Q2	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A29Q3	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A29Q4	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A29Q5	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A29Q6	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A29Q7	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A29Q8	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A29Q9	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A29Q10	1854-0071		TRANSISTOR NPN SI PD=300MW FT=200MHZ	28480	1854-0071
A29R1	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	16299	C4-1/8-TO-46R4-F
A29R2	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	16299	C4-1/8-TO-46R4-F
A29R3	0698-0085	5	RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2611-F
A29R4	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-TO-196R-F
A29R5	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2151-F
A29R6	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	16299	C4-1/8-TO-46R4-F
A29R7	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2611-F
A29R8	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-TO-196R-F
A29R9	0698-0084		RESISTOR 2.15K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2151-F
A29R10	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A29R11	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-TO-196R-F
A29R12	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-TO-196R-F
A29R13	0757-1094		RESISTOR 1.47K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1471-F
A29R14	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A29R15	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1213-F
A29R16	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A29R17	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-TO-909R-F
A29R18	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-TO-909R-F
A29R19	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F
A29R20	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F
A29R21	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F
A29R22	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F
A29R23	0757-0397	5	RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-68R1-F
A29R24	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A29R25	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4641-F
A29R26	0757-0402	2	RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-TO-111-F
A29R27	0698-0082		RESISTOR 464 1% .125W F TC=0+-100	16299	C4-1/8-TO-4640-F
A29R28	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A29R29	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-TO-316R-F
A29R30	0698-3440		RESISTOR 196 1% .125W F TC=0+-100	16299	C4-1/8-TO-196R-F
A29R31	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-TO-681R-F
A29R32	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-TO-101-F
A29R33	0757-0417		RESISTOR 562 1% .125W F TC=0+-100	24546	C4-1/8-TO-562R-F
A29R34	0698-3446	3	RESISTOR 383 1% .125W F TC=0+-100	16299	C4-1/8-TO-383R-F
A29R35	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2611-F
A29R36	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-TO-178R-F
A29R37	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-TO-2371-F
A29R38	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A29R39	0757-0279		RESISTOR 3.16K 1% .125W F TC=0+-100	24546	C4-1/8-TO-3161-F
A29R40	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A29R41	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A29T1	9100-1766	1	TRANSFORMER	82142	JE1052211
A29T2	9100-1767	1	TRANSFORMER	28480	9100-1767
A29T3	9100-1768	1	TRANSFORMER	28480	9100-1768
A29T4	9100-1769	1	TRANSFORMER	28480	9100-1769
			A29 MISCELLANEOUS		
	5020-2045		EXTRACTOR CARD	28480	5020-2045
A30	00312-60021	1	30 MHZ OSCILLATOR ASSEMBLY	28480	00312-60021
A30C1	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A30C2	0150-0121		CAPACITOR-FXD .1UF +80-20% 50WVDC CER	28480	0150-0121
A30C3	0160-2266		CAPACITOR-FXD 24PF +-5% 500WVDC CER	28480	0160-2266
A30C4	0121-0036	5	CAPACITOR-V TRMR-CER 5.5/18PF 350V	73899	DV11PR18A
A30C5	0160-2150	1	CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-2150
A30C6	0160-2207	1	CAPACITOR-FXD 300PF +-5% 300WVDC MICA	28480	0160-2207
A30C8	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A30C9	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A30C10	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A30C11	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A30C12	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A30C13	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A30C14	0121-0059	3	CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304324 2/8PF NPO
A30C15	0121-0059		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304324 2/8PF NPO
A30C16	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A30C17	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A30CR1	0122-0211	2	DIODE-VVC 39PF 10% C4/C25-MIN=1.9	04713	SMV315-211
A30CR2	0122-0211		DIODE-VVC 39PF 10% C4/C25-MIN=1.9	04713	SMV315-211
A30L1	9100-1789	1	COIL-FXD NON-MOLDED RF CHOKE .3UH 5%	73899	LF2W030
A30L2	9140-0112	2	COIL-FXD MOLDED RF CHOKE 4.7UH 10%	24226	15/471
A30L3	9140-0112		COIL-FXD MOLDED RF CHOKE 4.7UH 10%	24226	15/471
A30Q1	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A30Q2	1854-0053	7	TRANSISTOR NPN 2N2218 SI TO-5 PD=800MW	04713	2N2218
A30Q3	1854-0053		TRANSISTOR NPN 2N2218 SI TO-5 PD=800MW	04713	2N2218
A30R1	0757-0289		RESISTOR 13.3K 1% .125W F TC=0+-100	19701	MF4C1/8-T0-1332-F
A30R2	0757-0441		RESISTOR 8.25K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8251-F
A30R3	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A30R4	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A30R5	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A30R6	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A30R7	0698-3403	2	RESISTOR 348 1% .5W F TC=0+-100	24546	NA6
A30R8	0757-0180	4	RESISTOR 31.6 1% .125W F TC=0+-100	24546	C5-1/4-T0-31R6-F
A30R9	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A30R10	0757-1092	1	RESISTOR 287 1% .5W F TC=0+-100	19701	MF7C1/2-T0-287R-F
A30R11	0698-0090	3	RESISTOR 464 1% .5W F TC=0+-100	24546	NA6
A30R12	2100-1755	1	RESISTOR-TRMR 100 5% WW SIDE-ADJ 1-TURN	GB027	CT-106-4
A30R13	0757-0397		RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A30R14	0698-3102	2	RESISTOR 237 1% .5W F TC=0+-100	24546	NA6
A30R15	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A30R16	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	24546	C5-1/4-T0-31R6-F
A30R17	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A30S1	3101-1169	1	SWITCH-SL DPDT-NS STD .5A 125VAC/DC	82389	11A-1144
			A30 MISC&LLANEOUS		
	5020-2045		EXTRACTOR CARD	28480	5020-2045
A31	00312-60179	1	INPUT MIXER ASSEMBLY	28480	00312-60179
A31C1	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A31C2	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A31C3	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A31C4	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A31C5	0160-2263		CAPACITOR-FXD 18PF +-5% 500WVDC CER	28480	0160-2263
A31C6	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A31C7	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C8	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C9	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A31C10	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A31C11	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A31C12	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A31C13	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A31C14	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C15	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C16	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A31C17	0121-0162	1	CAPACITOR-V TRMR-AIR 1.2/3.5PF 350V	74970	189-351-5
A31C18	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A31C19	0121-0105	2	CAPACITOR-V TRMR-CER 9/35PF 200V PC-MTG	0086S	304324 9/35PF N650
A31C20	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C21	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C22	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C23	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A31C24	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A31C25	0140-0196		CAPACITOR-FXD 150PF +-5% 300WVDC MICA	72136	DM15F151J0300WV1CR
A31C26	0121-0105		CAPACITOR-V TRMR-CER 9/35PF 200V PC-MTG	0086S	304324 9/35PF N650
A31C27	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A31C28	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A31C29	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C30	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C31	0160-2143		CAPACITOR-FXD 2000PF +80-20% 1000WVDC	28480	0160-2143
A31C32	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A31C33	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A31CR1	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A31CR2	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A31CR3	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A31CR4	1901-0179		DIODE-SWITCHING 15V 50NA 750PS DO-7	28480	1901-0179
A31L1	9140-0120	1	COIL-FXD MOLDED RF CHOKE .1UH 20%	24226	9411
	9170-0029	3	CORE-SHIELDING BEAD	02114	56-590-65A2/4A
A31Q1	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A31Q2	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A31Q3	1854-0005		TRANSISTOR NPN 2N708 SI TO-18 PD=360MW	28480	1854-0005
A31Q4	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A31Q5	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A31Q6	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A31Q7	1854-0305	1	TRANSISTOR NPN SI TO-18 PD=400MW	28480	1854-0305
A31Q8	1854-0019		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0019
A31R1	0757-0405	1	RESISTOR 162 1% .125W F TC=0+-100	24546	C4-1/8-T0-162R-F
A31R2	0698-3156		RESISTOR 14.7K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1472-F
A31R3	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A31R4	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A31R5	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	24546	C5-1/4-T0-31R6-F
A31R6	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R7	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R8	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	16299	C4-1/8-T0-147R-F
A31R9	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A31R10	0757-0402		RESISTOR 110 1% .125W F TC=0+-100	24546	C4-1/8-T0-111-F
A31R11	0698-3403		RESISTOR 348 1% .5W F TC=0+-100	24546	NA6
A31R12	0698-3439		RESISTOR 178 1% .125W F TC=0+-100	16299	C4-1/8-T0-178R-F
A31R13	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R14	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R15	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A31R16	0757-1078	2	RESISTOR 1.47K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1471-F
A31R17	0757-1078		RESISTOR 1.47K 1% .5W F TC=0+-100	19701	MF7C1/2-T0-1471-F
A31R18	0757-0180		RESISTOR 31.6 1% .125W F TC=0+-100	24546	C5-1/4-T0-31R6-F
A31R19	0757-0317		RESISTOR 1.33K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1331-F
A31R20	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A31R21	0757-0398	3	RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A31R22	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A31R23	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R24	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A31R25	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A31R26	0698-3155		RESISTOR 4.64K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4641-F
A31R27	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A31R28	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A31R29	0757-0274		RESISTOR 1.21K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1213-F
A31R30	0757-0398		RESISTOR 75 1% .125W F TC=0+-100	24546	C4-1/8-T0-75R0-F
A31R31	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A31R32	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A31R33	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A31R34	0698-3444		RESISTOR 316 1% .125W F TC=0+-100	16299	C4-1/8-T0-316R-F
A31R35	0698-3441	2	RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
A31R36	2100-0875	1	RESISTOR-TRMR 200 10% MG TOP-ADJ 1-TURN	84048	150-4
A31R37	0698-3441		RESISTOR 215 1% .125W F TC=0+-100	16299	C4-1/8-T0-215R-F
A31R38	0698-0085		RESISTOR 2.61K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2611-F
A31R39	0757-0422		RESISTOR 909 1% .125W F TC=0+-100	24546	C4-1/8-T0-909R-F
A31R40	0698-3401	1	RESISTOR 215 1% .5W F TC=0+-100	24546	NA6
A31R41	0757-0403	1	RESISTOR 121 1% .125W F TC=0+-100	24546	C4-1/8-T0-121R-F
A31R42	0757-0418		RESISTOR 619 1% .125W F TC=0+-100	24546	C4-1/8-T0-619R-F
A31R43	0757-0410		RESISTOR 301 1% .125W F TC=0+-100	24546	C4-1/8-T0-301R-F
A31R44	0698-3152		RESISTOR 3.48K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3481-F
A31R45	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A31R46	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A31R47	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A31R48	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	16299	C4-1/8-T0-147R-F
A31RT1	0837-0060	1	THERMISTOR NEG TC 500 OHM DISC	73168	KB25J1
A31T1	9100-1771	1	TRANSFORMER, TOROID	28480	9100-1771
A31T2	9100-1772	2	TRANSFORMER, TOROID	28480	9100-1772
A31T3	9100-1772		TRANSFORMER, TOROID	28480	9100-1772
A31T4	00312-60106	1	TRANSFORMER, 30 MHZ INPUT	28480	00312-60106
A31T5	00312-60105	1	TRANSFORMER, 30 MHZ OUTPUT	28480	00312-60105
			A31 MISCELLANEOUS		
	5020-2045		EXTRACTOR CARD	28480	5020-2045
	00312-61667	1	CABLE, POWER SWITCH	28480	00312-61667

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A32	00312-66514	1	INPUT AMPLIFIER ASSEMBLY	28480	00312-66514
A32C1	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A32C2	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C3	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A32C4	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C5	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C6	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A32C7	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A32C8	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A32C9	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C10	0121-0453	1	CAPACITOR-V TRMR-AIR 1.3/5.4PF 250V	74970	187-0103-195
A32C11	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C12	0150-0015	1	CAPACITOR-FXD 2.2PF +-10% 500WVDC TI	95121	TYPE QC
A32C13	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C14	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A32C15	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A32C16	0180-0374	6	CAPACITOR-FXD; 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A32C17	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C18	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C19	0121-0430		CAPACITOR-V TRMR-AIR 1.4/9.2PF 350V	74970	189-0503-125
A32C20	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C21	0180-0374		CAPACITOR-FXD; 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A32C22	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32C23	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A32C24	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A32C25	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A32CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A32Q1	1854-0351	6	TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0351
A32Q2	1855-0096	2	TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0096
A32Q3	1855-0096		TRANSISTOR J-FET N-CHAN D-MODE SI	28480	1855-0096
A32Q4	1854-0351		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0351
A32Q5	1853-0089	2	TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q6	1853-0089		TRANSISTOR PNP 2N4917 SI PD=200MW	07263	2N4917
A32Q7	1854-0354	2	TRANSISTOR NPN SI TO-52 PD=360MW	28480	1854-0354
A32Q8	1854-0354		TRANSISTOR NPN SI TO-52 PD=360MW	28480	1854-0354
A32Q9	1854-0296	1	TRANSISTOR NPN SI TO-92 PD=310MW	28480	1854-0296
A32R1	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A32R2	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R3	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R4	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A32R5	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R6	0698-4489	2	RESISTOR 28K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2802-F
A32R7	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A32R8	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A32R9	0698-7092	2	RESISTOR 186 .1% .125W F TC=0+-25	24546	NE55
A32R10	0698-7092		RESISTOR 186 .1% .125W F TC=0+-25	24546	NE55
A32R11	0698-3151		RESISTOR 2.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2871-F
A32R12	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A32R13	0698-4489		RESISTOR 28K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2802-F
A32R14	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R15	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R16	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A32R17	0698-7649	2	RESISTOR 383 .1% .125W F TC=0+-25	19701	MF4C1/8-T9-383R-B
A32R18	0698-7649		RESISTOR 383 .1% .125W F TC=0+-25	19701	MF4C1/8-T9-383R-B
A32R19	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2001-F
A32R20	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R21	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A32R22	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A32R23	0757-0434	2	RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A32R24	0757-0346		RESISTOR 10 1% .125W F TC=0+-100	24546	C4-1/8-T0-10R0-F
A32R25	0698-3150		RESISTOR 2.37K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2371-F
A32R26	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A32R27	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R28	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R29	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R30	0757-0385	2	RESISTOR 22.1 1% .125W F TC=0+-100	19701	MF4C1/8-T0-22R1-F
A32R31	0757-0434		RESISTOR 3.65K 1% .125W F TC=0+-100	24546	C4-1/8-T0-3651-F
A32R32	0757-0397		RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A32R33	0757-0397		RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A32R34	0698-4421	2	RESISTOR 249 1% .125W F TC=0+-100	16299	C4-1/8-T0-249R-F
A32R35	0698-4421		RESISTOR 249 1% .125W F TC=0+-100	16299	C4-1/8-T0-249R-F
A32R36	0757-0385		RESISTOR 22.1 1% .125W F TC=0+-100	19701	MF4C1/8-T0-22R1-F
A32R37	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R38	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R39	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A32R40	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A32R41	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	16299	C4-1/8-T0-147R-F
A32R42	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-4992-F
A32R43	0757-0389	1	RESISTOR 33.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-33R2-F
A32R44	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1001-F
A32R45	0757-0444		RESISTOR 12.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1212-F
A32R46	0757-0291		RESISTOR 24.9 1% .125W F TC=0+-100	19701	MF4C1/8-T0-2492-F
			A32 MISCELLANEOUS		
	1250-1339	1	CONNECTOR-RF SM SLD M PC	98291	52-051-0000
A33	00312-60015	1	LOW PASS FILTER ASSEMBLY	28480	00312-60015
A33C1	0160-2201	1	CAPACITOR-FXD 51PF +-5% 300WVDC MICA	28480	0160-2201
A33C2	0121-0147	4	CAPACITOR-V TRMR-AIR 2/19.3PF 350V	74970	189-507-5
A33C3	0121-0131	2	CAPACITOR-V TRMR-AIR 1.2/4.2PF 350V	74970	189-0501-005
A33C5	0140-0193	1	CAPACITOR-FXD 82PF +-5% 300WVDC MICA	72136	DM15E820J0300WV1CR
A33C6	0121-0147		CAPACITOR-V TRMR-AIR 2/19.3PF 350V	74970	189-507-5
A33C7	0121-0131		CAPACITOR-V TRMR-AIR 1.2/4.2PF 350V	74970	189-0501-005
A33C8	0160-2251	1	CAPACITOR-FXD 5.6PF +-.25PF 500WVDC CER	28480	0160-2251
A33C9	0140-0192	1	CAPACITOR-FXD 68PF +-5% 300WVDC MICA	72136	DM15E680J0300WV1CR
A33C10	0121-0147		CAPACITOR-V TRMR-AIR 2/19.3PF 350V	74970	189-507-5
A33C11	0121-0128	1	CAPACITOR-V TRMR-AIR 1.4/9.2PF 350V	74970	189-0503-005
A33C12	0160-2261	1	CAPACITOR-FXD 15PF +-5% 500WVDC CER	28480	0160-2261
A33C14	0121-0147		CAPACITOR-V TRMR-AIR 2/19.3PF 350V	74970	189-507-5
A33L1	00312-60082	1	COIL, VARIABLE, 2.171 UH	28480	00312-60082
A33L2	00312-60081	1	COIL, VARIABLE, 1.968 UH	28480	00312-60081
A33L3	00312-60080	1	COIL, VARIABLE, 1.146 UH	28480	00312-60080
A33R1	2100-1738	1	RESISTOR-TRMR 10K 10% C TOP-ADJ 1-TURN	30983	ET50W103
A34	00312-60020	1	SECOND MIXER ASSEMBLY	28480	00312-60020
A34C1	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C2	0160-2204		CAPACITOR-FXD 100PF +-5% 300WVDC MICA	28480	0160-2204
A34C3	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C4	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C5	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C6	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C7	0160-3379	1	CAPACITOR-FXD 56PF +-5% 1000WVDC CER	28480	0160-3379
A34C8	0121-0036		CAPACITOR-V TRMR-CER 5.5/18PF 350V	73899	DV11PR18A
A34C9	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C10	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C11	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C12	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C13	0160-0357	1	CAPACITOR-FXD 85PF +-5% 500WVDC CER	28480	0160-0357
A34C14	0121-0059		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304324 2/8PF NPO
A34C15	0150-0022	1	CAPACITOR-FXD 3.3PF +-10% 500WVDC TI	95121	TYPE QC
A34C16	0121-0165		CAPACITOR-V TRMR-CER 7/25PF 350V	73899	304324 2/25PF N300
A34C17	0140-0194	9	CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A34C18	0121-0036		CAPACITOR-V TRMR-CER 5.5/18PF 350V	73899	DV11PR18A
A34C19	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C20	0140-0190	4	CAPACITOR-FXD 39PF +-5% 300WVDC MICA	72136	DM15E390J0300WV1CR
A34C21	0140-0190		CAPACITOR-FXD 39PF +-5% 300WVDC MICA	72136	DM15E390J0300WV1CR
A34C22	0140-0190		CAPACITOR-FXD 39PF +-5% 300WVDC MICA	72136	DM15E390J0300WV1CR
A34C23	0140-0190		CAPACITOR-FXD 39PF +-5% 300WVDC MICA	72136	DM15E390J0300WV1CR
A34C24	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C25	0160-2247	2	CAPACITOR-FXD 3.9PF +-.25PF 500WVDC CER	28480	0160-2247
A34C26	0160-2247		CAPACITOR-FXD 3.9PF +-.25PF 500WVDC CER	28480	0160-2247
A34C27	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C28	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C29	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C30	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C31	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C32	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C33	0121-0036		CAPACITOR-V TRMR-CER 5.5/18PF 350V	73899	DV11PR18A
A34C34	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34C35	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A34CR1	1901-0340	8	DIODE-SCHOTTKY	28480	1901-0340
A34CR2	1901-0340		DIODE-SCHOTTKY	28480	1901-0340
A34CR3	1901-0340		DIODE-SCHOTTKY	28480	1901-0340
A34CR4	1901-0340		DIODE-SCHOTTKY	28480	1901-0340
A34CR5	1901-0340		DIODE-SCHOTTKY	28480	1901-0340

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A34CR6	1901-0340		DIODE-SCHOTTKY	28480	1901-0340
A34CR7	1901-0340		DIODE-SCHOTTKY	28480	1901-0340
A34CR8	1901-0340		DIODE-SCHOTTKY	28480	1901-0340
A34Q1	1854-0053		TRANSISTOR NPN 2N2218 SI TO-5 PD=800MW	04713	2N2218
A34Q2	1854-0053		TRANSISTOR NPN 2N2218 SI TO-5 PD=800MW	04713	2N2218
A34Q3	1854-0053		TRANSISTOR NPN 2N2218 SI TO-5 PD=800MW	04713	2N2218
A34Q4	1854-0053		TRANSISTOR NPN 2N2218 SI TO-5 PD=800MW	04713	2N2218
A34Q5	1854-0053		TRANSISTOR NPN 2N2218 SI TO-5 PD=800MW	04713	2N2218
A34R1	0698-4037		RESISTOR 46.4 1% .125W F TC=0+-100	16299	C4-1/8-T0-46R4-F
A34R2	0757-0816	3	RESISTOR 681 1% .5W F TC=0+-100	19701	MF7C1/2-T0-681R-F
A34R3	0757-0397		RESISTOR 68.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-68R1-F
A34R4	0757-0814	1	RESISTOR 511 1% .5W F TC=0+-100	19701	MF7C1/2-T0-511R-F
A34R5	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A34R6	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A34R7	0757-0816		RESISTOR 681 1% .5W F TC=0+-100	19701	MF7C1/2-T0-681R-F
A34R8	0757-0816		RESISTOR 681 1% .5W F TC=0+-100	19701	MF7C1/2-T0-681R-F
A34R9	0757-1090	1	RESISTOR 261 1% .5W F TC=0+-100	19701	MF7C1/2-T0-261R-F
A34R10	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R11	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R12	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R13	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R14	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R15	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R16	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R17	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R18	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R19	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R20	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R21	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A34R22	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	16299	C4-1/8-T0-383R-F
A34R23	0698-0090		RESISTOR 464 1% .5W F TC=0+-100	24546	NA6
A34R24	0698-0090		RESISTOR 464 1% .5W F TC=0+-100	24546	NA6
A34R25	0698-3446		RESISTOR 383 1% .125W F TC=0+-100	16299	C4-1/8-T0-383R-F
A34R26	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A34R27	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A34R28	0757-0198	1	RESISTOR 100 1% .5W F TC=0+-100	19701	MF7C1/2-T0-101-F
A34R29	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A34R30	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A34R31	0757-0429		RESISTOR 1.82K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1821-F
A34T1	00312-60109	1	TRANSFORMER, 30 MHZ, IF	28480	00312-60109
A34T2	00312-60111	1	TRANSFORMER, 30 MHZ IF	28480	00312-60111
A34T3	00312-60181	2	TRANSFORMER ASSEMBLY	28480	00312-60181
A34T4	00312-60181		TRANSFORMER ASSEMBLY	28480	00312-60181
A34T5	00312-60110	4	TRANSFORMER, LO AND MIXER	28480	00312-60110
A34T6	00312-60110		TRANSFORMER, LO AND MIXER	28480	00312-60110
A34T7	00312-60110		TRANSFORMER, LO AND MIXER	28480	00312-60110
A34T8	00312-60110		TRANSFORMER, LO AND MIXER	28480	00312-60110
A34T9	00312-60180	2	TRANSFORMER ASSEMBLY	28480	00312-60180
A34T10	00312-60180		TRANSFORMER ASSEMBLY	28480	00312-60180
A35	00312-66523	1	FIRST LOCAL OSCILLATOR ASSEMBLY	28480	00312-66523
A35C1	0140-0200	2	CAPACITOR-FXD 390PF +-5% 300WVDC MICA	72136	DM15F391J0300WV1CR
A35C2	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C3	0180-1746		CAPACITOR-FXD; 15UF+-10% 20VDC TA-SOLID	56289	150D156X9020B2
A35C4	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A35C5	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A35C6	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C7	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C8	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C9	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C10	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C11	0140-0149		CAPACITOR-FXD 470PF +-5% 300WVDC	72136	DM15F47150300WV1CR
A35C12	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C13	0160-3622		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0160-3622
A35C14	0140-0149		CAPACITOR-FXD 470PF +-5% 300WVDC MICA	72136	DM15F471J0300WV1CR
A35C15	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A35C16	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C17	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C18	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C19	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35C20	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A35CR1	0122-0083		DIODE-VVC 36.7PF 5% BVR=20V DO-7	28480	0122-0083
A35L1	9100-3482		TRANSFORMER, RF	28480	9100-3482
A35L2	9100-1622	1	COIL-FXD MOLDED RF CHOKE 24UH 5%	24226	15/242
A35L3	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A35L4	9140-0210		COIL-FXD MOLDED RF CHOKE 100UH 5%	24226	15/103
A35Q1	1854-0351		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0351
A35Q2	1854-0351		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0351
A35Q3	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A35Q4	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A35Q5	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A35Q6	1854-0351		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0351
A35Q7	1854-0351		TRANSISTOR NPN SI TO-18 PD=360MW	28480	1854-0351
A35R1	0757-0161	1	RESISTOR 604 1% .125W F TC=0+-100	24546	C4-1/8-T0-6040R-F
A35R2	0698-4307	1	RESISTOR 14.3K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1432-F
A35R3	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A35R4	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-49R9-F
A35R5	0698-4390	1	RESISTOR 66.5 1% .125W F TC=0+-100	16299	C4-1/8-T0-66R5-F
A35R6	0683-1025		RESISTOR 1K 5% .25W FC TC=-400/+600	01121	CB1025
A35R7	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A35R8	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-49R9-F
A35R9	0698-3242	2	RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-T0-357R-F
A35R10	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-49R9-F
A35R11	0698-4453	1	RESISTOR 402 1% .125W F TC=0+-100	24546	C4-1/8-T0-402R-F
A35R12	0757-0450	2	RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A35R13	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-49R9-F
A35R14	0757-0450		RESISTOR 22.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2212-F
A35R15	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A35R16	0698-3279		RESISTOR 4.99K 1% .125W F TC=0+-100	16299	C4-1/8-T0-4991-F
A35R17	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-49R9-F
A35R18	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1002-F
A35R19	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A35R20	0683-2025		RESISTOR 2K 5% .25W FC TC=-400/+700	01121	CB2025
A35R21	0683-1525	2	RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A35R22	0698-4396	1	RESISTOR 80.6 1% .125W F TC=0+-100	16299	C4-1/8-T0-80R6-F
A35R23	0757-0277		RESISTOR 49.9 1% .125W F TC=0+-100	24546	C4-1/8-T0-49R9-F
A35R24	0683-1525		RESISTOR 1.5K 5% .25W FC TC=-400/+700	01121	CB1525
A35R25	0683-1225	1	RESISTOR 1.2K 5% .25W FC TC=-400/+700	01121	CB1225
A35R26	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A35R27	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1501-F
A35R28	0683-7515	1	RESISTOR 750 5% .25W FC TC=-400/+600	01121	CB7515
A35R29	0683-2425	1	RESISTOR 2.4K 5% .25W FC TC=-400/+700	01121	CB2425
A35R30	0683-1005		RESISTOR 10 5% .25W FC TC=-400/+500	01121	CB1005
A35R31	0683-1835	1	RESISTOR 18K 5% .25W FC TC=-400/+800	01121	CB1835
A35R32	0683-8215		RESISTOR 820 5% .25W FC TC=-400/+600	01121	CB8215
A35R33	0683-1325	1	RESISTOR 1.3K 5% .25W FC TC=-400/+700	01121	CB1325
A36	00312-66507	1	AMPLITUDE RANGE INDICATOR ASSEMBLY	28480	00312-66507
A36DS1	00312-40001	15		28480	00312-40001
A36DS1	2140-0043	14	LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS1	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS2	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS2	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS3	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS3	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS4	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS4	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS5	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS5	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS6	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS6	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS7	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS7	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS8	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS8	00312-40001		MATRIX, LIGHT	28480	00312-40001

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A36DS9	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS9	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS10	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS10	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS11	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS11	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS12	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS12	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS13	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS13	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36DS14	00312-40001		MATRIX, LIGHT	28480	00312-40001
A36DS14	2140-0043		LAMP-INCAND T-1-3/4 BULB 6V	28480	2140-0043
A36R1	0698-3102		RESISTOR 237 1% .5W F TC=0+-100	24546	NA6
A37	00312-60037	1	EXTENDER BOARD ASSEMBLY	28480	00312-60037
A38	00312-61901	1	MODE SELECTOR SWITCH ASSEMBLY (FOR 312D INSTRUMENT ONLY)	28480	00312-61901
A38C1	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A38C2	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A38C5	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A38C6	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A38C7	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A38C8	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A38C9	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A38Q1	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A38R1	0698-5873	2	RESISTOR 125.8 1% .5W F TC=0+-100	24546	NA6
A38R2	0698-5872	2	RESISTOR 75.6 1% .5W F TC=0+-100	24546	NA6
A38R3	0698-4410	2	RESISTOR 137 1% .125W F TC=0+-100	16299	C4-1/8-T0-137R-F
A38R4	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A38R5	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A38R9	0698-3333	2	RESISTOR 137 1% .5W F TC=0+-100	24546	NA6
A38R14	0757-0368	1	RESISTOR 34 1% .125W F TC=0+-100	24546	C4-1/8-T0-34R0-F
A38R15	0757-0411	1	RESISTOR 332 1% .125W F TC=0+-100	24546	C4-1/8-T0-332R-F
A38R16	0757-0392	1	RESISTOR 43.2 1% .125W F TC=0+-100	24546	C4-1/8-T0-43R2-F
A38R17	0698-4413	1	RESISTOR 154 1% .125W F TC=0+-100	16299	C4-1/8-T0-154R-F
A38R18	0698-4380	1	RESISTOR 45.3 1% .125W F TC=0+-100	16299	C4-1/8-T0-45R3-F
A38R19	0698-4410		RESISTOR 137 1% .125W F TC=0+-100	16299	C4-1/8-T0-137R-F
A38R24	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	16299	C4-1/8-T0-147R-F
A38R25	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A38R26	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A38R27	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A38R28	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A38S1	3100-2744	1	SWITCH, SELECTOR	28480	3100-2744
A38	00312-60032	1	MODE SELECTOR SWITCH ASSEMBLY (FOR 312B INSTRUMENT ONLY)	28480	00312-60032
	00312-00035	1	STRIP, CLAMPING	28480	00312-00035
	00312-00036	1	COVER, IMPEDANCE SWITCH	28480	00312-00036
	00312-60099	1	CABLE, OUTPUT	28480	00312-60099
	00312-60100	1	CABLE, INPUT	28480	00312-60100
A38 C1	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A38 C2	0180-0291		CAPACITOR-FXD; 1UF+-10% 35VDC TA-SOLID	56289	150D105X9035A2
A38 C3	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A38 C4	0160-0168		CAPACITOR-FXD .1UF +-10% 200WVDC POLYE	56289	292P10492
A38 C5	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A38 C6	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A38 C7	0180-0116		CAPACITOR-FXD; 6.8UF+-10% 35VDC TA	56289	150D685X9035B2
A38 C8	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A38 C9	0150-0050		CAPACITOR-FXD 1000PF +80-20% 1000WVDC	28480	0150-0050
A38 Q1	1853-0015		TRANSISTOR PNP SI PD=200MW FT=500MHZ	28480	1853-0015
A38 R1	0757-0424	1	RESISTOR 1.1K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1101-F
A38 R2	0698-5195	2	RESISTOR 75 .5% .125W F TC=0+-100	03888	PME55-1/8-T0-75R0-D
A38 R3	0698-5195		RESISTOR 75 .5% .125W F TC=0+-100	03888	PME55-1/8-T0-75R0-D
A38 R4	0757-0419		RESISTOR 681 1% .125W F TC=0+-100	24546	C4-1/8-T0-681R-F
A38 R5	0698-5871	1	RESISTOR 50.3 1% .5W F TC=0+-100	24546	NA6
A38 R6	0698-4823	1	RESISTOR 60.4 1% .5W F TC=0+-100	24546	NA6
A38 R7	0698-5872		RESISTOR 75.6 1% .5W F TC=0+-100	24546	NA6
A38 R8	0698-5873		RESISTOR 125.8 1% .5W F TC=0+-100	24546	NA6
A38 R9	0698-3333		RESISTOR 137 1% .5W F TC=0+-100	24546	NA6
A38 R10	0757-1067	1	RESISTOR 152 1% .5W F TC=0+-100	19701	MF7C1/2-T0-152R-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A38 R11	0698-5874	1	RESISTOR 639 1% .5W F TC=0+-100	24546	NA6
A38 R12	0698-5188	2	RESISTOR 13.05 .5% .125W F TC=0+-100	03888	PME55S
A38 R13	0698-5417	2	RESISTOR 1.572K .5% .125W F TC=0+-100	03888	PME55-1/8-T0-1572R-D
A38 R14	0757-0387	1	RESISTOR 27.4 1% .125W F TC=0+-100	19701	MF4C1/8-T0-27R4-F
A38 R15	0698-5406	1	RESISTOR 667 .5% .125W F TC=0+-100	24546	C4-1/8-T0-667R-D
A38 R16	0698-5190	1	RESISTOR 54.76 .5% .125W F TC=0+-100	03888	PME55S
A38 R17	0698-5402	1	RESISTOR 261 .5% .125W F TC=0+-100	03888	PME55-1/8-T0-261R-D
A38 R18	0698-5191	1	RESISTOR 58.7 .5% .125W F TC=0+-100	24546	C4-1/8-T0-58R7-D
A38 R19	0698-5200	1	RESISTOR 233 .5% .125W F TC=0+-100	24546	C4-1/8-T0-233R-D
A38 R20	0698-5193	1	RESISTOR 63.45 .5% .125W F TC=0+-100	03888	PME55-1/8-T0-63R45-D
A38 R21	0698-5199	1	RESISTOR 204.9 .5% .125W F TC=0+-100	24546	C4-1/8-T0-204R9-D
A38 R22	0698-5188		RESISTOR 13.05 .5% .125W F TC=0+-100	03888	PME55S
A38 R23	0698-5417		RESISTOR 1.572K .5% .125W F TC=0+-100	03888	PME55-1/8-T0-1572R-D
A38 R24	0698-3438		RESISTOR 147 1% .125W F TC=0+-100	16299	C4-1/8-T0-147R-F
A38 R25	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A38 R26	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A38 R27	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-T0-511R-F
A38 R28	0757-0420		RESISTOR 750 1% .125W F TC=0+-100	24546	C4-1/8-T0-751-F
A38 R29	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A38 R30	0757-0401		RESISTOR 100 1% .125W F TC=0+-100	24546	C4-1/8-T0-101-F
A38 S1	3100-1865	1	SWITCH, ROTARY	28480	3100-1865
			A38 MISCELLANEOUS(3128)		
A38J3	1251-0466	1	CONNECTOR 7-PIN F CIRC MDR	17419	MDR04-7S-090
	1251-0471	7	CONTACT-CONN FEM CRP	17419	800-20/30-1
A39	00312-60041	1	REFERENCE LEVEL ATTENUATOR ASSEMBLY	28480	00312-60041
	00312-00024	1	BRACKET, SWITCH	28480	00312-00024
A39A1	00312-60029	1	REFERENCE LEVEL ATTENUATOR ASSEMBLY	28480	00312-60029
	00312-00023	1	COVER, REFERENCE ATTENAUTOR	28480	00312-00023
A39A1C1	0121-0060	10	CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A1C2	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A1C3	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A1C4	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A1C5	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A1C6	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A1C7	0121-0061	2	CAPACITOR-V TRMR-CER 5.5/18PF 350V	0086S	304322 5.5/18PF NPO
A39A1C8	0160-2250	2	CAPACITOR-FXD 5.1PF +-.25PF 500WVDC CER	28480	0160-2250
A39A1C9	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A1C10	0160-0179	3	CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-0179
A39A1C11	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A1C12	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A1C13	0160-2259		CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-2259
A39A1R1	0698-5415	8	RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A1R2	0698-5403	8	RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A1R3	0698-5415		RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A1R4	0698-5403		RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A1R5	0698-5415		RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A1R6	0698-5403		RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A1R7	0698-5413	2	RESISTOR 6.838K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-6838R-C
A39A1R8	0698-5412	2	RESISTOR 4.624K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-4624R-C
A39A1R9	0698-5414	2	RESISTOR 9K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9001-C
A39A1R10	0698-5408	2	RESISTOR 1.111K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-1111R-C
A39A1R11	0698-5415		RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A1R12	0698-5403		RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A1S1	3100-1862	1	SWITCH-RTRY 1.25 IN CTR SPCG IDX-ANG=30	28480	3100-1862
A39A2	00312-60030	1	REFERENCE LEVEL ATTENUATOR ASSEMBLY	28480	00312-60030
A39A2C1	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A2C2	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A2C3	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A2C4	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A2C5	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A2C6	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A2C7	0121-0061		CAPACITOR-V TRMR-CER 5.5/18PF 350V	0086S	304322 5.5/18PF NPO
A39A2C8	0160-2250		CAPACITOR-FXD 5.1PF +-.25PF 500WVDC CER	28480	0160-2250
A39A2C9	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A2C10	0160-0179		CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-0179
A39A2C11	0121-0060		CAPACITOR-V TRMR-CER 2/8PF 350V PC-MTG	0086S	304322 2/8PF NPO
A39A2C12	0140-0194		CAPACITOR-FXD 110PF +-5% 300WVDC MICA	72136	DM15F111J0300WV1CR
A39A2C13	0160-2259		CAPACITOR-FXD 12PF +-5% 500WVDC CER	28480	0160-2259

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A39A2J1	1251-0131	2	CONNECTOR-SGL CONT SKT .064-DIA RED TFE	28499	69026-I165 (RED)
A39A2J2	1251-0131		CONNECTOR-SGL CONT SKT .064-DIA RED TFE	28499	69026-1165 (RED)
A39A2R1	0698-5415		RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A2R2	0698-5403		RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A2R3	0698-5415		RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A2R4	0698-5403		RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A2R5	0698-5415		RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A2R6	0698-5403		RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A2R7	0698-5413		RESISTOR 6.838K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-6838R-C
A39A2R8	0698-5412		RESISTOR 4.624K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-4624R-C
A39A2R9	0698-5414		RESISTOR 9K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9001-C
A39A2R10	0698-5408		RESISTOR 1.111K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-1111R-C
A39A2R11	0698-5415		RESISTOR 9.684K .25% .125W F TC=0+-100	03888	PME55-1/8-T0-9684R-C
A39A2R12	0698-5403		RESISTOR 326.6 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-326R6-C
A39A2S1	3100-1863	1	SWITCH-RTRY 1.25 IN CTR SPCG IDX-ANG=30	28480	3100-1863
A39A2X1	608D-34E	1	PULLEY, ATTENUATOR DRIVE	28480	608D-34E
A40	00312-60031	1	30 MHZ BP FILTER,250 KHZ ATTENUATOR ASSY	28480	00312-60031
A40C1	0160-0952	2	CAPACITOR-FXD 220PF +-1% 300WVDC MICA	28480	0160-0952
A40C2	0160-0179		CAPACITOR-FXD 33PF +-5% 300WVDC MICA	28480	0160-0179
A40C3	0160-0952		CAPACITOR-FXD 220PF +-1% 300WVDC MICA	28480	0160-0952
A40L1	9100-1610	2	COIL-FXD MOLDED RF CHOKE .15UH 20%	24226	15/150
A40L2	9140-0096	1	COIL-FXD MOLDED RF CHOKE 1UH 10%	24226	15/101
A40L3	9100-1610		COIL-FXD MOLDED RF CHOKE .15UH 20%	24226	15/150
A40R1	0698-5196	6	RESISTOR 96.25 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-96R25-C
A40R2	0698-5194	3	RESISTOR 71.15 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-71R15-C
A40R3	0698-5196		RESISTOR 96.25 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-96R25-C
A40R4	0698-5196		RESISTOR 96.25 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-96R25-C
A40R5	0698-5194		RESISTOR 71.15 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-71R15-C
A40R6	0698-5196		RESISTOR 96.25 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-96R25-C
A40R7	0698-5192	4	RESISTOR 61.11 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-61R11-C
A40R8	0698-5401	2	RESISTOR 247.5 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-247R5-C
A40R9	0698-5192		RESISTOR 61.11 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-61R11-C
A40R10	0698-5196		RESISTOR 96.25 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-96R25-C
A40R11	0698-5194		RESISTOR 71.15 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-71R15-C
A40R12	0698-5196		RESISTOR 96.25 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-96R25-C
A40R13	0698-5192		RESISTOR 61.11 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-61R11-C
A40R14	0698-5401		RESISTOR 247.5 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-247R5-C
A40R15	0698-5192		RESISTOR 61.11 .25% .125W F TC=0+-100	03888	PME55-1/8-T0-61R11-C
A40S1	3100-1864	1	SWITCH-RTRY 1.25 IN CTR SPCG IDX-ANG=30	28480	3100-1864
A40W3	00312-60049	1	CABLE, 30 MHZ INPUT	28480	00312-60049
A40W5	00312-60050	1	CABLE, 0/ MHZ OUTPUT	28480	00312-60050
A40W8	00312-60051	1	CABLE, 200 KHZ INPUT	28480	00312-60051
A40W9	00312-60052	1	CABLE, 200 KHZ OUTPUT	28480	00312-60052
A41	00312-61906	1	FREQUENCY RANGE SWITCH ASSEMBLY	28480	00312-61906
A41	00312-61665	1	CABLE ASSEMBLY, BINARY	28480	00312-61665
A41S1	3100-3350	1	SWITCH, ROTARY	28480	3100-3350
A42	00312-63601	1	FREQUENCY TUNING & AUDIO AMPLITUDE ASSY*	28480	00312-60035
A42C1	0121-0164	1	CAPACITOR: VAR A1R 99 PF	80583	VUS-99(9433-88-50007)
A42R2	2100-2461	1	RESISTOR: VAR CARBON COMP 2500 OHM+-20% 1.12W	01121	TYPE J OBD
A43	00312-61902	1	BANDWIDTH SELECTOR ASSEMBLY	28480	00312-61902
	00312-00316	1	BRACKET, SWITCH MOUNTING (FOR 312D INSTRUMENT ONLY)	28480	00312-00316
A43R1	0698-5410	48	RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43R2	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43R3	0698-4429	24	RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1871-F
A43R4	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1871-F
A43R5	0698-4510	24	RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8452-F
A43R6	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-T0-8452-F
A43R7	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43R8	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43R9	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1871-F
A43R10	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-T0-1871-F

See introduction to this section for ordering information

*Note: See Figure 6-2 for illustrated parts breakdown and part numbers.

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A43R11	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R12	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R13	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R14	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R15	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R16	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R17	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R18	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R19	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R20	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R21	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R22	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R23	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R24	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R25	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R26	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R27	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R28	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R29	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R30	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R31	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R32	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R33	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R34	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R35	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R36	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R37	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R38	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R39	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R40	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R41	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R42	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R43	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R44	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R45	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R46	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R47	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R48	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R49	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R50	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R51	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R52	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R53	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R54	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R54	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R55	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R56	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R57	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R58	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R59	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R60	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R61	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R62	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R63	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R64	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R66	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R67	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R68	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43R69	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R70	0698-4429		RESISTOR 1.87K 1% .125W F TC=0+-100	16299	C4-1/8-TO-1871-F
A43R71	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43R72	0698-4510		RESISTOR 84.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-8452-F
A43S1	3100-1867	2	SWITCH, ROTARY	28480	3100-1867
A43	00312-60038	1	BANDWIDTH SELECTOR ASSEMBLY (FOR 312B INSTRUMENT ONLY)	28480	00312-60038
A43 R1	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43 R2	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43 R3	0698-5411	24	RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4271-F
A43 R4	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4271-F
A43 R5	0698-5416	24	RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-21351-F
A43 R6	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-21351-F
A43 R7	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43 R8	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-TO-1423R-F
A43 R9	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4271-F
A43 R10	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-TO-4271-F

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A43 R11	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R12	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R13	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R14	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R15	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R16	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R17	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R18	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R19	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R20	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R21	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R22	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R23	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R24	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R25	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R26	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R27	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R28	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R29	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R30	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R31	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R32	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R33	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R34	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R35	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R36	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R37	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R38	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R39	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R40	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R41	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R42	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R43	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R44	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R45	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R46	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R47	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R48	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R49	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R50	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R51	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R52	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R53	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R54	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R55	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R56	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R57	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R58	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R59	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R60	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R61	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R62	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R63	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R64	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R65	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R66	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R67	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R68	0698-5410		RESISTOR 1.423K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-1423R-F
A43 R69	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R70	0698-5411		RESISTOR 4.27K 1% .125W F TC=0+-100	24546	C4-1/8-T0-4271-F
A43 R71	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 R72	0698-5416		RESISTOR 21.35K 1% .125W F TC=0+-100	03888	PME55-1/8-T0-21351-F
A43 S1	3100-1867		SWITCH, ROTARY	28480	3100-1867
A44-A99			NOT ASSIGNED		
A100	00312-66502	1	OVERLOAD DETECTOR ASSEMBLY (FOR 312D INSTRUMENT ONLY)	28480	00312-66502
A100C1	0180-0374		CAPACITOR-FXD; 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A100C2	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A100C3	0180-0374		CAPACITOR-FXD; 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A100C4	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A100C5	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A100C6	0180-0197		CAPACITOR-FXD; 2.2UF+-10% 20VDC TA	56289	150D225X9020A2
A100C8	0160-0128		CAPACITOR-FXD 2.2UF +-20% 25WVDC CER	28480	0160-0128
A100C9	0160-0205		CAPACITOR-FXD 10PF +-5% 500WVDC MICA	28480	0160-0205
A100C10	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A100C11	0180-1735	1	CAPACITOR-FXD; .22UF+-10% 35VDC TA	56289	150D224X9035A2
A100C12	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A100C13	0180-0374		CAPACITOR-FXD; 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A100C14	0150-0093		CAPACITOR-FXD .01UF +80-20% 100WVDC CER	28480	0150-0093
A100C15	0180-0374		CAPACITOR-FXD; 10UF+-10% 20VDC TA-SOLID	56289	150D106X9020B2
A100C16	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A100C17	0121-0430		CAPACITOR-V TRMR-AIR 1.4/9.2PF 350V	74970	189-0503-125
A100C18	0150-0084		CAPACITOR-FXD .1UF +80-20% 100WVDC CER	28480	0150-0084
A100CR1	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A100CR2	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A100CR3	1902-0041		DIODE-ZNR 5.11V 5% DO-7 PD=.4W TC=-.009%	04713	SZ 10939-98
A100CR4	1901-0518	2	DIODE-SCHOTTKY	28480	1901-0518
A100CR5	1901-0518		DIODE-SCHOTTKY	28480	1901-0518
A100CR6	1902-0025		DIODE-ZNR 10V 5% DO-7 PD=.4W TC=+.06%	04713	SZ 10939-182
A100Q1	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A100Q2	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A100Q3	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A100Q4	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A100Q5	1854-0345		TRANSISTOR NPN 2N5179 SI TO-72 PD=200MW	04713	2N5179
A100Q6	1853-0010		TRANSISTOR PNP SI TO-18 PD=360MW	28480	1853-0010
A100Q7	1853-0012	1	TRANSISTOR PNP 2N2904A SI TO-5 PD=600MW	01295	2N2904A
A100R1	0698-3700	1	RESISTOR 715 1% .125W F TC=0+-100	16299	C4-1/8-TO-715R-F
A100R2	0698-3242		RESISTOR 357 1% .125W F TC=0+-100	16299	C4-1/8-TO-357R-F
A100R3	0684-1031	2	RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A100R4	0684-2211	1	RESISTOR 220 10% .25W FC TC=-400/+600	01121	CB2211
A100R5	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5111-F
A100R6	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A100R7	0757-0427		RESISTOR 1.5K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1501-F
A100R8	0684-1031		RESISTOR 10K 10% .25W FC TC=-400/+700	01121	CB1031
A100R9	0757-0442		RESISTOR 10K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1002-F
A100R10	0684-1001	4	RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A100R11	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A100R12	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A100R13	0698-3558		RESISTOR 4.02K 1% .125W F TC=0+-100	16299	C4-1/8-TO-4021-F
A100R14	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A100R15	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A100R16	0757-0394		RESISTOR 51.1 1% .125W F TC=0+-100	24546	C4-1/8-TO-51R1-F
A100R17	0757-0416		RESISTOR 511 1% .125W F TC=0+-100	24546	C4-1/8-TO-511R-F
A100R18	0757-0283		RESISTOR 2K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2001-F
A100R19	0698-3228		RESISTOR 49.9K 1% .125W F TC=0+-100	03888	PME55S
A100R20	0698-4471	1	RESISTOR 7.15K 1% .125W F TC=0+-100	24546	C4-1/8-TO-7151-F
A100R21	0698-4441		RESISTOR 3.74K 1% .125W F TC=0+-100	16299	C4-1/8-TO-3741-F
A100R22	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A100R23	0684-1011		RESISTOR 100 10% .25W FC TC=-400/+500	01121	CB1011
A100R24	0698-4532	1	RESISTOR 280K 1% .125W F TC=0+-100	24546	C4-1/8-TO-2803-F
A100R25	2100-3353	1	RESISTOR-VAR TRMR 20KOHM 10% C SIDE ADJ	73138	72XR20K
A100R26	0698-4498	1	RESISTOR 53.6K 1% .125W F TC=0+-100	24546	C4-1/8-TO-5362-F
A100R27	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A100U1	1826-0043		IC LM307H AMPL	27014	LM307H
A101	00312-66501	1	METER EXPAND AMPLIFIER ASSEMBLY (FOR 3120 INSTRUMENT ONLY)	28480	00312-66501
A101C1	0160-2199	1	CAPACITOR-FXD 30PF +-5% 300WVDC MICA	28480	0160-2199
A101C2	0180-1794	1	CAPACITOR-FXD; 22UF+-10% 35VDC TA-SOLID	56289	150D226X9035R2
A101C3	0180-0097	2	CAPACITOR-FXD; 47UF+-10% 35VDC TA-SOLID	56289	150D476X9035S2
A101C4	0180-0137		CAPACITOR-FXD; 100UF+-20% 10VDC TA	56289	150D107X0010R2
A101C5	0180-0097		CAPACITOR-FXD; 47UF+-10% 35VDC TA-SOLID	56289	150D476X9035S2
A101C6	0180-0283	1	CAPACITOR-FXD; 60UF+75-10% 10VDC AL	28480	0180-0283
A101C7	0140-0200		CAPACITOR-FXD 390PF +-5% 300WVDC MICA	72136	DM15F391J0300WV1CR
A101CR1	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A101CR2	1901-0040		DIODE-SWITCHING 30V 50NA 2NS DO-35	28480	1901-0040
A101CR3	1902-0579	1	DIODE-ZNR 5.11V 5% DO-15 PD=1W TC=-.009%	28480	1902-0579
A101Q1	1854-0039		TRANSISTOR NPN 2N3053 SI TO-5 PD=1W	04713	2N3053
A101Q2	1853-0051		TRANSISTOR PNP 2N4037 SI TO-5 PD=1W	02735	2N4037
A101R1	0757-0280		RESISTOR 1K 1% .125W F TC=0+-100	24546	C4-1/8-TO-1001-F
A101R2	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-TO-825R-F
A101R3	0698-4539	1	RESISTOR 402K 1% .125W F TC=0+-100	03888	PME55S
A101R4	2100-3161	1	RESISTOR-TRMR 20K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-203
A101R5	0698-6362	1	RESISTOR 1K .1% .125W F TC=0+-25	24546	NE55

See introduction to this section for ordering information

Table 6-3. Replaceable Parts

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A101R6	0757-0388	1	RESISTOR 30.1 1% .125W F TC=0+-100	24546	C4-1/8-T0-30R1-F
A101R7	0757-0446	1	RESISTOR 15K 1% .125W F TC=0+-100	24546	C4-1/8-T0-1502-F
A101R8	0698-6326	1	RESISTOR 500 1% .125W F TC=0+-25	24546	NE55
A101R9	2100-3095	1	RESISTOR-TRMR 200 10% C SIDE-ADJ 17-TURN	32997	3006P-1-201
A101R10	0698-6619	1	RESISTOR 15K .1% .125W F TC=0+-25	24546	NE55
A101R11	0757-0421		RESISTOR 825 1% .125W F TC=0+-100	24546	C4-1/8-T0-825R-F
A101R12	0687-1521	1	RESISTOR 1.5K 10% .5W CC TC=0+647	01121	EB1521
A101R13	0698-4435		RESISTOR 2.49K 1% .125W F TC=0+-100	16299	C4-1/8-T0-2491-F
A101R14	2100-3056	1	RESISTOR-TRMR 5K 10% C SIDE-ADJ 17-TURN	32997	3006P-1-502
A101R15	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A101R16	0698-4440	1	RESISTOR 3.4K 1% .125W F TC=0+-100	16299	C4-1/8-T0-3401-F
A101R17	0683-2005	1	RESISTOR 20 5% .25W FC TC=-400/+500	01121	CB2005
A101R18	0757-0431	1	RESISTOR 2.43K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2431-F
A101R19	0684-4711		RESISTOR 470 10% .25W FC TC=-400/+600	01121	CB4711
A101R20	0683-5105	1	RESISTOR 51 5% .25W FC TC=-400/+500	01121	CB5105
A101R21	0683-7505	1	RESISTOR 75 5% .25W FC TC=-400/+500	01121	CB7505
A101R22	0684-1001		RESISTOR 10 10% .25W FC TC=-400/+500	01121	CB1001
A101R23	0757-0449		RESISTOR 20K 1% .125W F TC=0+-100	24546	C4-1/8-T0-2002-F
A101R24	0757-0438		RESISTOR 5.11K 1% .125W F TC=0+-100	24546	C4-1/8-T0-5111-F
A101R25	0698-3228		RESISTOR 49.9K 1% .125W F TC=0+-100	03888	PME55S
A101U1	1826-0043		IC LM307H AMPL	27014	LM307H
A101U2	1826-0066		IC AMPL	07263	777HC
A101U3	1826-0043		IC LM307H AMPL	27014	LM307H
A102	00312-61903	1	METER EXPAND SWITCH ASSEMBLY (FOR 312D INSTRUMENT ONLY)	28480	00312-61903
A102R1	0698-8442	1	RESISTOR 108.74 .25% .125W F TC=0+-50	24546	NC55
A102R2	0698-8443	1	RESISTOR 96.92 .25% .125W F TC=0+-50	24546	NC55
A102R3	0698-8444	1	RESISTOR 86.38 .25% .125W F TC=0+-50	24546	NC55
A102R4	0698-8445	1	RESISTOR 76.98 .25% .125W F TC=0+-50	24546	NC55
A102R5	0698-8446	1	RESISTOR 68.61 .25% .125W F TC=0+-50	24546	NC55
A102R6	0698-8447	1	RESISTOR 61.15 .25% .125W F TC=0+-50	24546	NC55
A102R7	0698-8448	1	RESISTOR 54.5 .25% .125W F TC=0+-50	24546	NC55
A102R8	0698-8449	1	RESISTOR 48.58 .25% .125W F TC=0+-50	03888	PME55S
A102R9	0698-8450	1	RESISTOR 43.3 .25% .125W F TC=0+-50	03888	PME55S
A102R10	0698-8451	1	RESISTOR 38.58 .25% .125W F TC=0+-50	03888	PME55S
A102R11	0698-8452	1	RESISTOR 316.2 .25% .125W F TC=0+-50	24546	NC55
A102S1	3100-3243	1	SWITCH-RTRY SP12T-PS .562 IN CTR SPCG	81073	71B30-01-1-12S-C
A103	00312-66503	1	METER SCALE LAMP ASSEMBLY (FOR 312D INSTRUMENT ONLY)	28480	00312-66503
A103DS1	2140-0246	10	LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS2	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS3	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS4	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS5	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS6	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS7	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS8	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS9	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103DS10	2140-0246		LAMP-INCAND T-1-3/4 BULB 6.3V	05464	1739D
A103R1	0698-3624	1	RESISTOR 150 5% 2W MO TC=0+-200	24546	FP42-2-T00-150R-J

Table 6-3. Replaceable Parts (Cont'd)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
			CHASSIS MOUNTED COMPONENTS		
C1, C2	0180-0346		C: Fxd Al 3900 μF 50 VDC	28480	0180-0346
C6	0150-0093		C: Fxd cer .01μF 100 VDCW	28480	0150-0093
C11	0160-0318		C: Fxd Polye .39 μF 100 VDCW	84411	663UW39492W
C12, C13	0160-0168		C: Fxd Polye .1 μF 200 VDCW	56289	292P10492
C15, C16	0150-0024		C: Fxd cer .02 μF 600 VDCW	71590	DD203-Z5U-+80-20
C17	0140-0164		C: Fxd mica 6800 pF 500 VDCW	72136	DM30F682J0500WV1CR
C51–C55	0160-0345		C: Fxd cer 1000 pF 500 VDCW	01121	FB2B-102W
C59	0160-0345		C: Fxd cer 1000 pF 500 VDCW	01121	FB2B-102W
C62–C70	0160-0345		C: Fxd cer 1000 pF 500 VDCW	01121	FB2B-102W
C72, C73	0160-0345		C: Fxd cer 1000 pF 500 VDCW	01121	FB2B-102W
C75–C87	0160-0345		C: Fxd cer 1000 pF 500 VDCW	01121	FB2B-102W
C101, C102	0160-0345		C: Fxd cer 1000 pF 500 VDCW	01121	FB2B-102W
CR1–CR4	1901-0410		Diode: Pwr Rect 1N4720 100 V 1.5 A	04713	1N4720
CR9, CR10	1901-0418		Diode: Pwr Rect 400 V 1.5 A	04713	SR1846-12
DS1	2140-0253		Lamp: Incandescent 0.030 A 28V (overload)	08717	FB38
F1	2110-0033		Fuse: .75A (230V)	75915	F02CR750A
	2110-0043		Fuse: Cartridge 1.5A (115V)	75915	31201.5
FL1	00312-80001		Filter: 1 MHz	28480	00312-80001
FL2	00312-80002		Filter: 50 MHz	28480	00312-80002
J1, J2 (312B)	1250-0083		Conn: RF BNC fem sgl hole fr	24931	28JR-130-1
J3, J4 (312D)	1251-1053		Conn: 12 pin F Circ 165	9D949	165-12
J5 (312B/D)	1250-0149		Conn: RF BNC fem sgl hole fr	24931	28JR137-2
J6–J9 (312B/D)	1250-0083		Conn: RF BNC fem sgl hole fr	24931	28JR-130-1
J10 (312B)	1250-0083		Conn: RF BNC fem sgl hole fr	24931	28JR-130-1
J10 (312D)	1251-1053		Conn: 12 pin F Circ 165	9D949	165-12
J11 (312B/D)	1250-0083		Conn: RF BNC fem sgl hole fr	24931	28JR-130-1
J13, J14 (312B/D)	1250-0212		Conn: RF BNC fem sgl hole fr	02660	31-221-1026
J15 (312B/D)	1250-0829		Conn: RF screw-on type	98291	50-045-4610
J16 (312D)	1251-0651		Conn: Tel jack 3-ckts .25-shk-dia	82389	MT-333B
J16 (312B)	1250-0083		Conn: RF BNC FEM SGC Hole FR	24931	28 JR - 130 - 1
J17, J18 (312D)	1251-0065		Conn: Tel Jack 2-ckts .25-shk-dia	82389	MT-331
J19 (312B/D)	1251-0650		Conn: Tel Jack 2-ckts .25-shk-dia	82389	MT-333E
J20 (312B/D)	1251-0065		Conn: Tel Jack 2-ckts .25-shk-dia	82389	MT-331
L1–L4			Not Assigned		
L5, L6	9100-1620		Coil: Fxd molded RF choke 15 UH 10%	24226	15/152
L7, L8			Not Assigned		
L9	9100-1620		Coil: Fxd molded RF choke 15 UH 10%	24226	15/152
L10–L12			Not Assigned		
L13	9100-0541		Coil: Fxd molded RF choke 250 UH 10%	28480	9100-0541
L14, L15	9100-1620		Coil: Fxd molded RF choke 15 UH 10%	24226	15/152
L16–L18	9140-0137		Coil: Fxd molded RF choke 1000 UH	24226	19/104
L19	9100-1620		Coil: Fxd molded RF choke 15 UH 10%	24226	15/152
L20–L22			Not Assigned		
L23	9100-1620		Coil: Fxd molded RF choke 15 UH 10%	24226	15/152
L24			Not Assigned		
L25–L31	9100-1620		Coil: Fxd molded RF choke 15 UH 10%	24226	15/152
L32, L33	9140-0137		Coil: Fxd molded RF choke 1000 UH	24226	19/104
L34–L37	9100-1620		Coil: Fxd molded RF choke 15 UH 10%	24226	15/152
L38–L41			Not Assigned		
L42–L44	9100-0541		Coil: Fxd molded RF choke 250 UH 10%	28480	9100-0541
LS1	9160-0227		Speaker	28480	9160-0227
M1 (312B)	1120-1250		Meter: 1 mA	28480	1120-1250
M1 (312D)	1120-0985		Meter: 1 mA	28480	1120-0985
PM1	5060-1188		Power Module	28480	5060-1188

Table 6-3. Replaceable Parts (Cont'd)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
			CHASSIS MOUNTED COMPONENTS (cont'd)		
Q2	1853-0053		TSTR: PNP Si T0-3 PD = 150W FT = 3 MHz	28480	1853-0053
Q4	1854-0063		TSTR: NPN 2N3055 Si T0-3 PD = 115W	28480	1854-0063
R1, R2	0698-3162		R: Fxd 46.4K 1% .125W F TC = 0 ± 100	16299	C4-1/8-T0-4642-F
R11	2100-2131		R: Var 250 Ω 10%	71450	Series 70
R20	0698-4435		R: Fxd 2.49K 1% .125W F TC = 0 ± 100	16299	C4-1/8-T0-2491-F
R21	0757-0277		R: Fxd 49.9 Ω 1%	24546	C4-1/8-T0-4992-F
R22	2100-2492		R: Var con cc lin 5K 20%	12697	382
S1	3101-0036		Switch: tgl spst ns 3A 250VAC/DC Sldr-lug	28480	3101-0036
S2 (312B)	3101-1235		Switch: Bal/Unbal	28480	3101-1235
S3	3101-1235		Switch: Slide Ext. Reference	28480	3101-1235
S4	3130-0081		Switch: Receiver Mode	28480	3130-0081
S5	3100-3246		Switch: Lever Normal/Expand	28480	3100-3246
T1	9100-3461		Transformer: Pwr	28480	9100-3461
T2 (312D)	9100-3434		Transformer: Audio	28480	9100-3434
U1	1820-0181		IC:	04713	MC1433L
			MISCELLANEOUS PARTS		
	00312-00006		Cover: Rear Panel 312D		
	00312-00007		Deck: Rear 312B/D		
	00312-00033		Shield: Bandwidth Switch 312B/D		
	00312-00039		Cover: Input Filter Housing 312B/D		
	00312-00103		Deck: Main 312B/D		
	00312-00115		Deck: Counter 312B/D		
	00312-00201		Cover: Rear Panel 312B		
	00312-00203		Panel: Front 312B		
	00312-00205		Panel: Front 312D Std		
	00312-00220		Panel: Rear 312B/D		
	00312-00225		Panel: Front 312D Opt. 001		
	00312-00031		Cover: Front 312B		
	00312-00322		Cover: Front 312D		
	00312-00602		Cover: Side 312B/D		
	00312-01202		Plate: Meter Mounting 312B/D		
	00312-04101		Cover: Counter (312B/D)		
	00312-04103		Cover: Rear 312B/D		
	00312-04301		Trim: Top 312B/D		
	00312-04302		Trim: Bottom 312B/D		
	00312-04304		Trim: Front 312B/D		
	00312-09302		Window: LT Panel 312B/D		
	00312-20043		Housing: Filter 312B/D		
	00312-20069		Housing: First LO 312B/D		
	00312-20101		Frame Assy: Side L & R 312B/D		
	00312-60061		Cable Assy: 1 MHz Front Panel 312B/D		
	00312-60063		Cable Assy: 2nd Step, 1st LO 312B/D		
	00312-60064		Cable Assy: 1st Step, 1st LO 312B/D		
	00312-60065		Cable Assy: A 312B/D		
	00312-60066		Cable Assy: B 312B/D		
	00312-60069		Cable Assy: 1st Mixer, Ampli. Attn 312B/D		
	00312-60070		Cable Assy: RF "A" 312B/D		
	00312-60071		Cable Assy: RF "B" 312B/D		
	00312-60072		Cable Assy: RF "C" 312B/D		
	00312-60073		Cable Assy: RF "D" 312B/D		
	00312-60084		Cable Assy: Input Mixer, 1st LO 312B/D		
	00312-60095		Cable Assy: Power 312B/D		
	00312-60097		Cable Assy: 30 MHz Output 312B/D		
	00312-60098		Cable Assy: Input Amplifier (312B)		
	00312-60099		Cable: Impedance Switch Output 312D		
	00312-60100		Cable: Impedance Switch Input 312D		
	00312-60101		Cable Assy: Input Mixer 312B/D		

Table 6-3. Replaceable Parts (Cont'd)

REFERENCE DESIGNATOR	-hp- PART NO.	TQ	DESCRIPTION	MFR.	MFR. PART NO.
			MISCELLANEOUS PARTS (cont'd)		
	00312-60103		Cable Assy: 2nd Mixer, Ampl. Attn 312B/D		
	00312-60112		Cable Assy: RF 312B/D		
	00312-60190		Shield Assy: Bottom 312B/D		
	00312-61630		Cable Assy: Meter 312D		
	00312-61631		Cable Assy 312B/D		
	00312-61650		Cable: Main 312B		
	00312-61667		Cable Assy: Power Switch 312B/D		
	00312-61668		Cable: Step Lock 312D		
	00312-61669		Cable Assy: "C" 312B/D		
	00312-61670		Cable Assy 312D		
	00312-61671		Cable: 1 MHz Reference 312B/D		
	00312-61675		Cable: 3rd Mixer Main 312B/D		
	0370-0026		Knob: Audio 312B/D		
	0370-0028		Knob: Frequency Tuning (Fine) 312B/D		
	0370-0104		Knob: Expand CAL DB 312B/D		
	0370-0149		Knob: Frequency Range, Bandwidth, Amplitude Range, Reference Level, Input Impedance, Receiver Mode, Frequency Tuning Crank 312B/D		
	0370-0432		Knob: Normal/Expand Lever (312B/D)		

SECTION VII
CIRCUIT DIAGRAMS

7-1. INTRODUCTION.

7-2. This section of the manual contains all the necessary schematic diagrams for servicing and troubleshooting the models 312B and 312D. A functional block diagram is included for each model.

7-3. Since both models are similar, the same schematic diagrams are used whenever possible for both. The differences will be noted on the schematic. When major differences occur between models, a separate schematic is included.

7-4. COMPONENT LOCATION DIAGRAMS.

7-5. Included with the schematic are diagrams showing the location of components on the boards. The first and last pin number of each board connector is identified for each in locating components. It should be noted that on some assemblies, the connectors are identified beginning with 1 on the left and some connectors are identified with 1 on the right side.

Assembly No.	Description	Common Part No.	312B Only	312D Only	Schematic Number and Page Number
A1	+ 20 V Regulator	03312-66516			**25** 7-59/7-60
A2	Active Filter	00312-60002			
A3	Active Filter	00312-60003			**7** 7-23/7-24
A4	Active Filter Preamp		00312-60004	00312-60042	**6** 7-19/7-20(B) **6** 7-21/7-22(D)
A5	Active Filter	00312-60003			
A6	Active Filter	00312-60002			
A7	Meter Amplifier	00312-60005			**11** 7-31/7-32
A8	AFC (312B)		00312-60006	00312-66527	**18** 7-45/7-46
A9	Third Mixer/Dividers	00312-60008			**10** 7-19/7-30
A10	Audio Ampl/SSB Osc.	00312-60009			**12** 7-33/7-34
A11	Active Filter Equalizer	00312-60034			**10** 7-29/7-30
A12	- 15 V Regulator	00312-66515			**25** 7-59/7-60
A13	Counters	00312-66505			**21** 7-51/7-52 **22** 7-51/7-52
A14	Counter Display	00312-66506			
A15—A20	Not Assigned				
A21	Variable Freq. Osc.	00312-66504			**17** 7-43/7-44
A22	VFO Amplifier	00312-66508			
A23	Summation Loop and Phase Detector	00312-66524			**19** 7-47/7-48
A24	Step Lock Phase Det	00312-66521			**15** 7-39/7-40
A25	Phase Lock Assy	00312-60025			**20** 7-49/7-50
A26	1 MHz Ref. Osc.	00312-66526			**23** 7-55/7-56
A27	Not Assigned				
A28	28 – 45 MHz Osc and ÷N Counter	00312-66520			**14** 7-37/7-38
A29	Summation Loop Mixer	00312-66519			**16** 7-41/7-42
A30	30 MHz Oscillator	00312-60021			**20** 7-49/7-50
A31	Input Mixer	00312-60179			**3** 7-13/7-14
A32	Input Amplifier	00312-66514			**2** 7-11/7-12
A33	Low Pass Filter	00312-60015			**2** 7-11/7-12
A34	Second Mixer	00312-60020			**5** 7-17/7-18
A35	First Local Oscillator	00312-66523			**13** 7-35/7-36
A36	Amplitude Range Ind.	00312-66507			
A37	Extender Board	00312-60037			
A38	Mode Selector Switch		00312-60032	00312-61901	**1** 7-9/7-10 **2** 7-11/7-12 **24** 7-57/7-58
A39	Reference Level Attn	00312-60041			**24** 7-57/7-58
A39A1	Reference Level Attn	00312-60029			
A39A2	Reference Level Attn	00312-60030			
A40	30 MHz BP Filter 250 kHz Atten.	00312-60031			**4** 7-15/7-16 **24** 7-57/7-58 **11** 7-31/7-32
A41	Frequency Range Switch Assy.	00312-61906			**21** 7-51/7-52 **22** 7-53/7-54
A42	Frequency Tuning and Audio Amplitude	00312-60035			
A43	Bandwidth Selector		00312-60038	00312-61902	**7** 7-23/7-24
A100	Overload Detector			00312-66502	**2** 7-11/7-12
A101	Meter Expand Amplifier			00312-66501	**11** 7-31/7-32
A102	Meter Expand Switch Assy			00312-61903	
A103	Meter Scale Lamp Assy			00312-66503	

GENERAL SCHEMATIC NOTES

1. PARTIAL REFERENCE DESIGNATIONS ARE SHOWN. PREFIX WITH ASSEMBLY OR SUBASSEMBLY DESIGNATION(S) OR BOTH FOR COMPLETE DESIGNATION.

2. COMPONENT VALUES ARE SHOWN AS FOLLOWS UNLESS OTHERWISE NOTED.
   RESISTANCE IN OHMS
   CAPACITANCE IN MICROFARADS
   INDUCTANCE IN MILLIHENRYS

3. DENOTES EARTH GROUND. USED FOR TERMINALS WITH NO LESS THAN A NO. 18 GAUGE WIRE CONNECTED BETWEEN TERMINAL AND EARTH GROUND TERMINAL OR AC POWER RECEPTACLE.

4. DENOTES FRAME GROUND. USED FOR TERMINALS WHICH ARE PERMANENTLY CONNECTED WITHIN APPROXIMATELY 0.1 OHM OF EARTH GROUND.

5. DENOTES GROUND ON PRINTED CIRCUIT ASSEMBLY. (PERMANENTLY CONNECTED TO FRAME GROUND).

6. DENOTES ASSEMBLY.

7. DENOTES MAIN SIGNAL PATH.

9. DENOTES FEEDBACK PATH.

10. DENOTES FRONT PANEL MARKING.

11. DENOTES REAR PANEL MARKING.

12. DENOTES SCREWDRIVER ADJUST.

13. * AVERAGE VALUE SHOWN, OPTIMUM VALUE SELECTED AT FACTORY. THE VALUE OF THESE COMPONENTS MAY VARY FROM ONE INSTRUMENT TO ANOTHER. THE METHOD OF SELECTING THESE COMPONENTS IS DESCRIBED IN SECTION V OF THIS MANUAL.

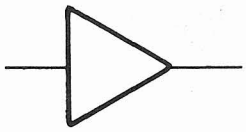
14. DENOTES SECOND APPEARANCE OF A CONNECTOR PIN.

15. \924/ DENOTES WIRE COLOR: COLOR CODE SAME AS RESISTOR COLOR CODE. FIRST NUMBER IDENTIFIES BASE COLOR, SECOND NUMBER IDENTIFIES WIDER STRIP, THIRD NUMBER IDENTIFIES NARROWER STRIP. (e.g. \924/ = WHITE, RED, YELLOW.)

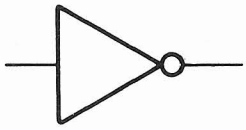
17. ALL RELAYS ARE SHOWN DEENERGIZED.

18. WAVEFORM AND VOLTAGE MEASUREMENTS WERE MADE WITH RESPECT TO CHASSIS GROUND USING A HIGH INPUT IMPEDANCE OSCILLOSCOPE AND TRANSISTOR VOLTMETER. VOLTAGE LEVELS ARE NOMINAL AND MAY VARY SOMEWHAT FROM ONE INSTRUMENT TO ANOTHER.

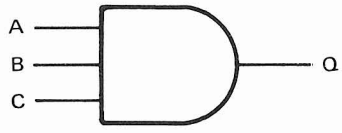
19. DC VOLTAGE LEVELS WERE MEASURED WITH RESPECT TO CIRCUIT GROUND USING A VTVM WITH 10 MEGOHM INPUT IMPEDANCE. THE VOLTAVE LEVELS SHOWN ARE NOMINAL AND MAY VARY FROM ONE INSTRUMENT TO ANOTHER DUE TO CHANGE IN TRANSISTOR CHARACTERISTICS. A VARIATION OF ±10% SHOULD BE ALLOWED.



DENOTES BUFFER

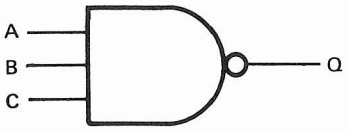


DENOTES INVERTER



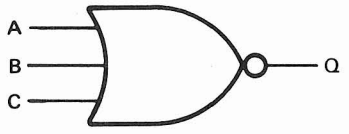
DENOTES AND GATE

A	B	C	Q
0	0	0	0
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	1



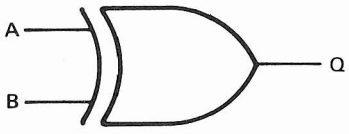
DENOTES NAND GATE

A	B	C	Q
0	0	0	1
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0



DENOTES NOR GATE

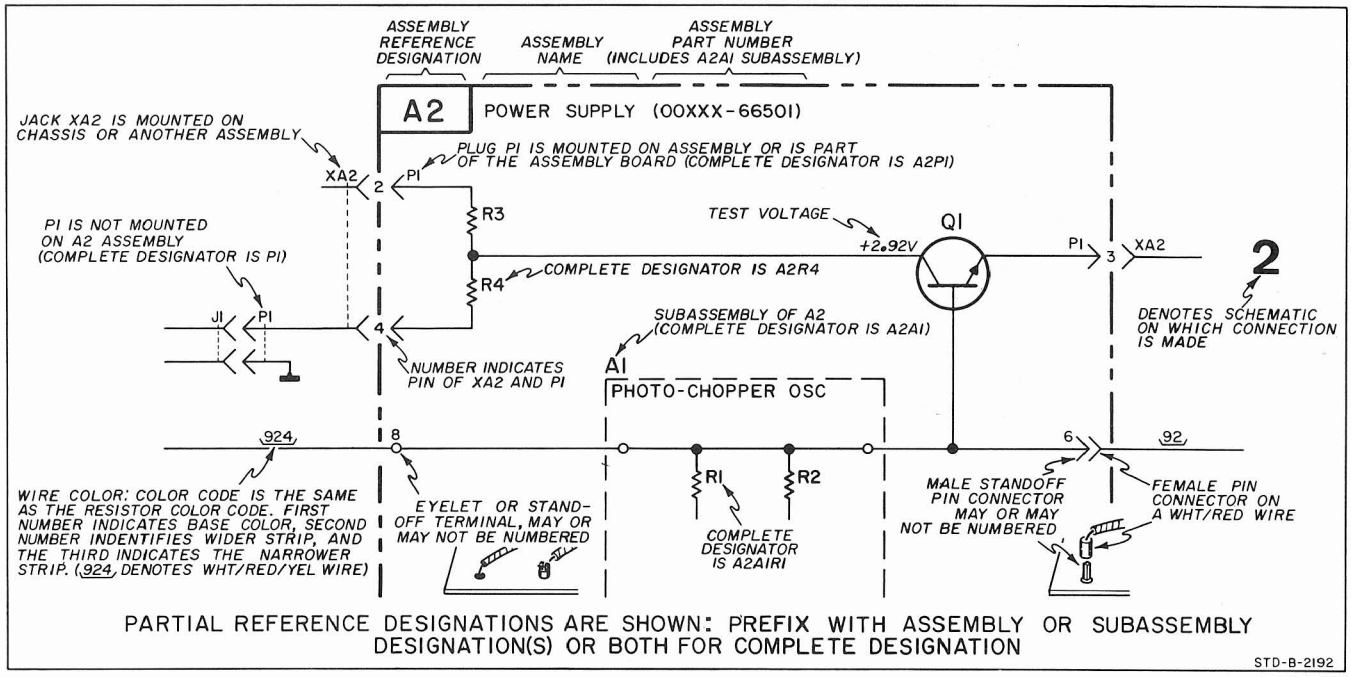
A	B	C	Q
0	0	0	1
0	0	1	0
0	1	0	0
0	1	1	0
1	0	0	0
1	0	1	0
1	1	0	0
1	1	1	0



DENOTES EXCLUSIVE OR GATE

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

REFERENCE DESIGNATIONS

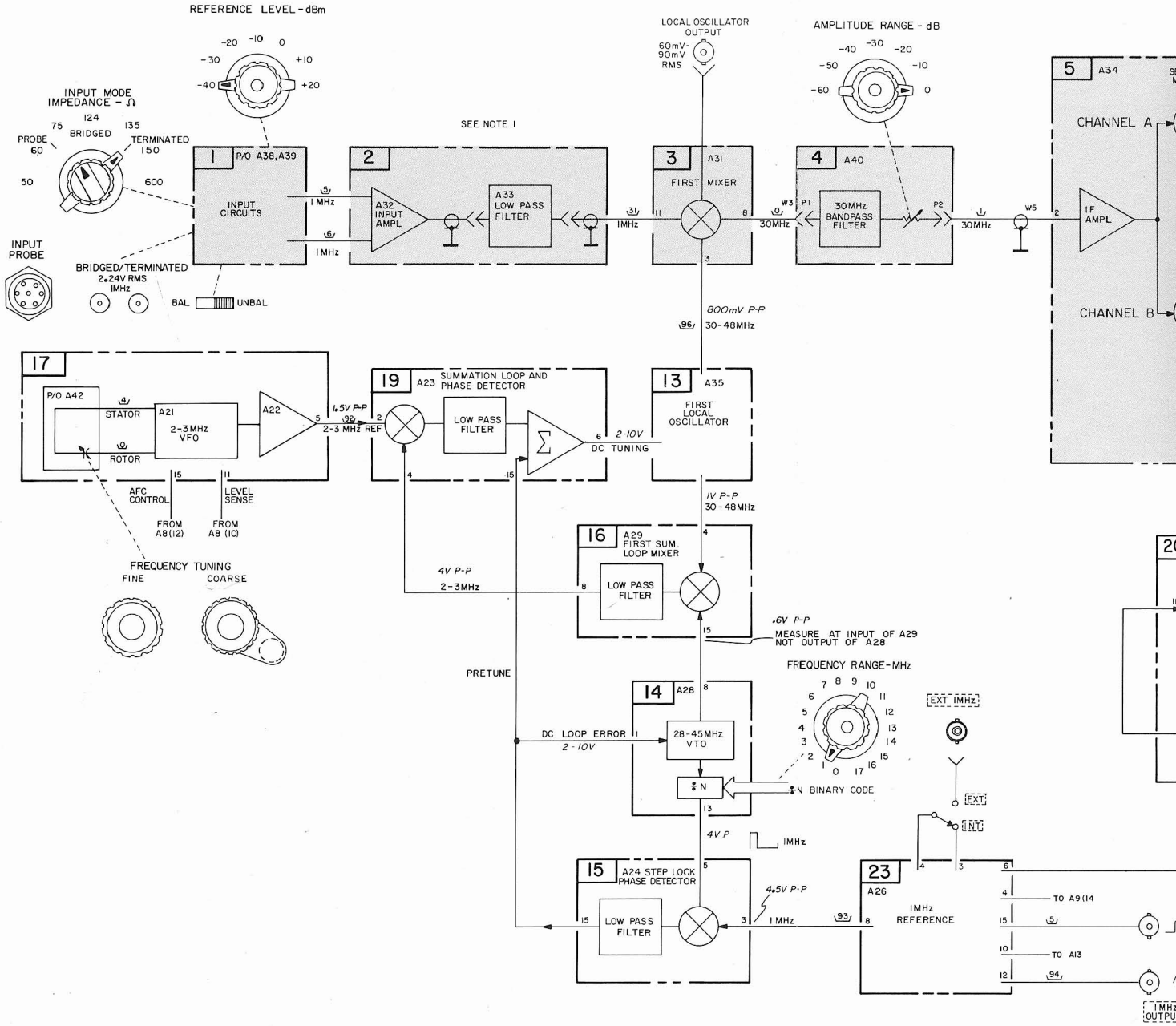


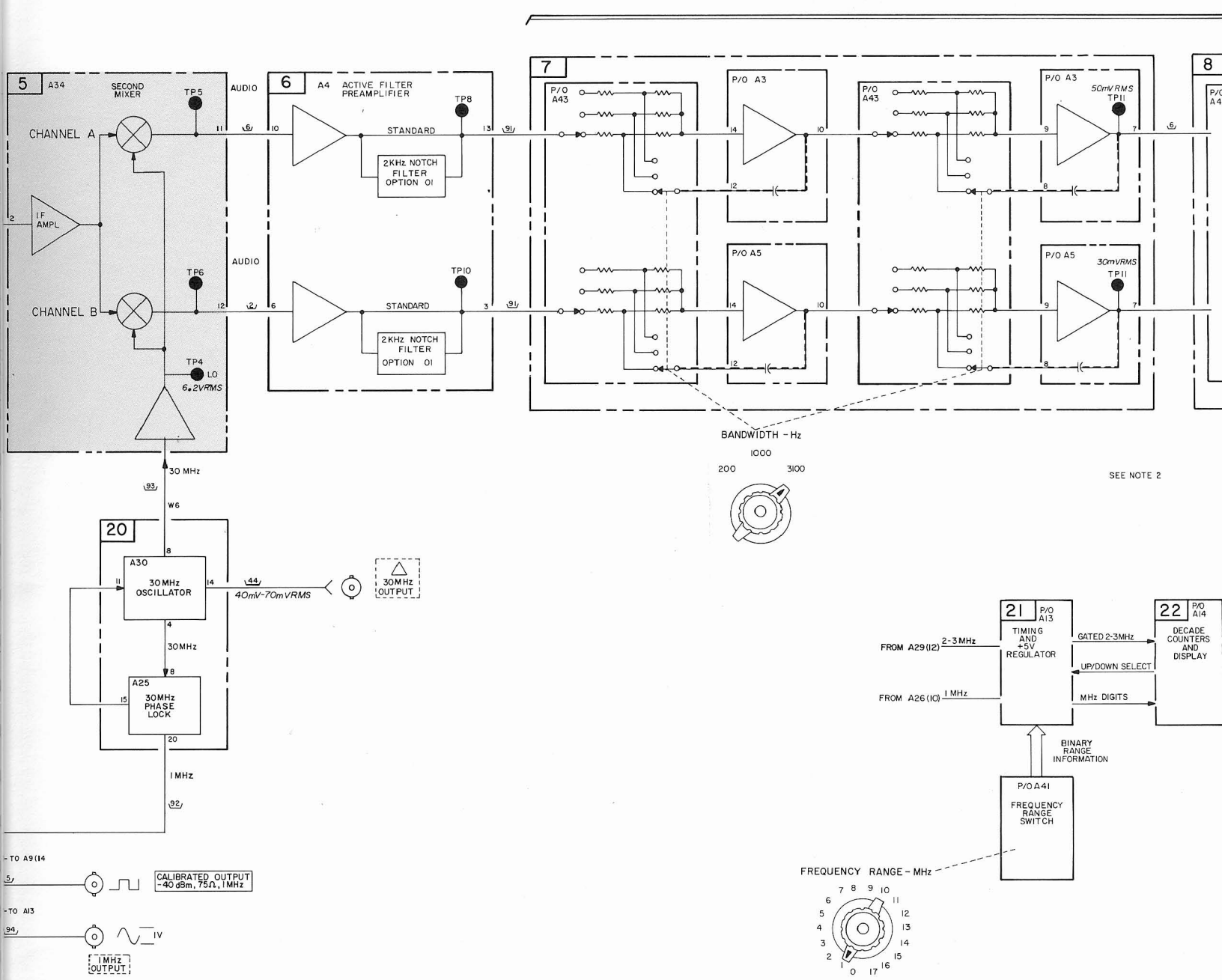
NOTE 1

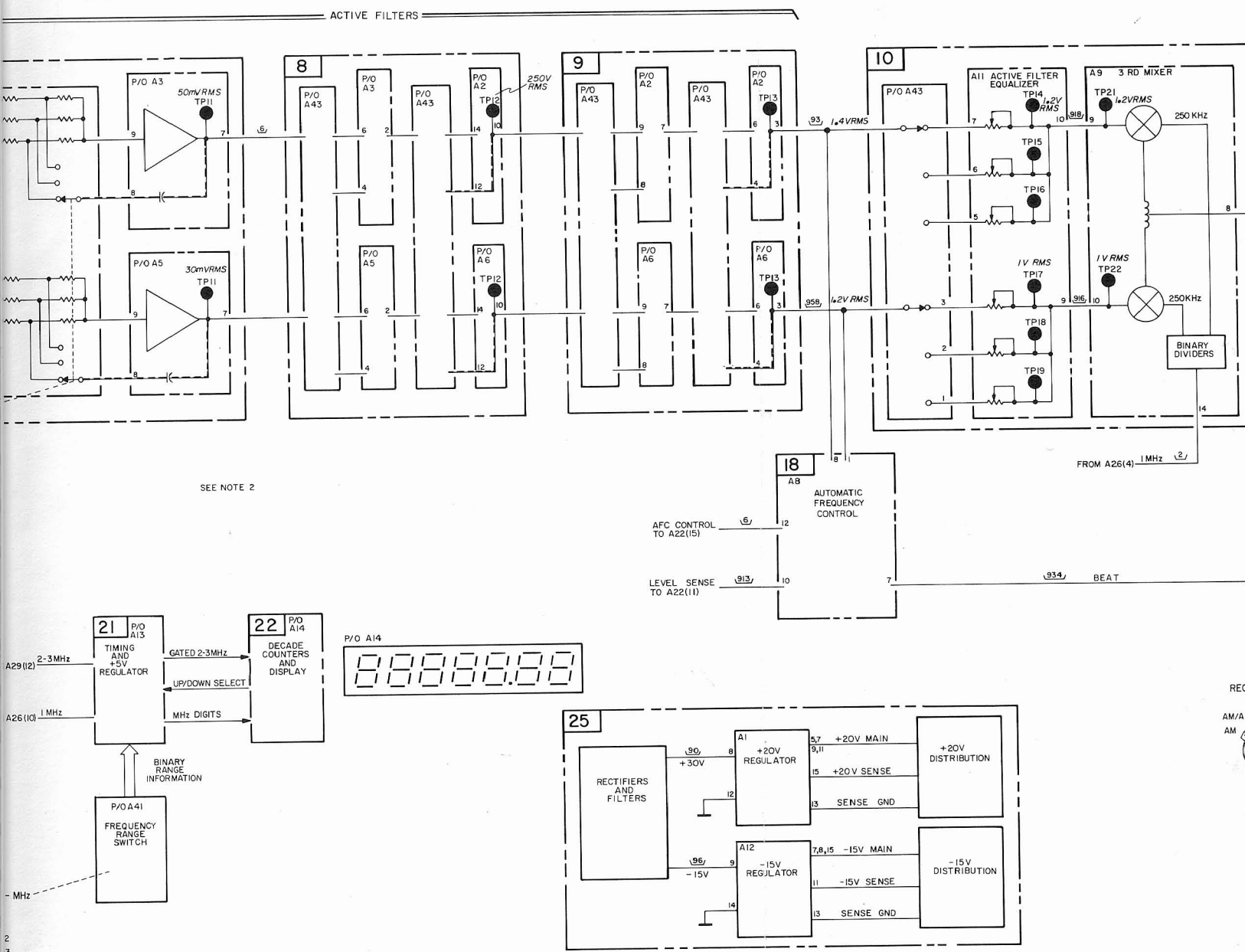
SIGNAL LEVELS ON CIRCUIT BOARDS, WHICH ARE SHADED, CANNOT BE EASILY MEASURED DUE TO THE EXTREME LOW LEVELS AND HIGH FREQUENCIES. TO TROUBLESHOOT THIS SECTION OF THE INSTRUMENT, REFER TO PARA-GRAPH 5-92.

NOTE 2

THE MODEL 312B INSTRUMENTS ARE INDIVIDUALLY CALIBRATED FOR A CORRECT METER READING FOR A GIVEN INPUT SIGNAL. SIGNAL LEVELS AT TEST POINTS MAY VARY AS MUCH AS 25% BETWEEN INSTRUMENTS. FOR THIS REASON, VOLTAGES ON THE BLOCK DIAGRAM ARE NOMINAL VALVES AND ARE INTENDED FOR REFERENCE ONLY.







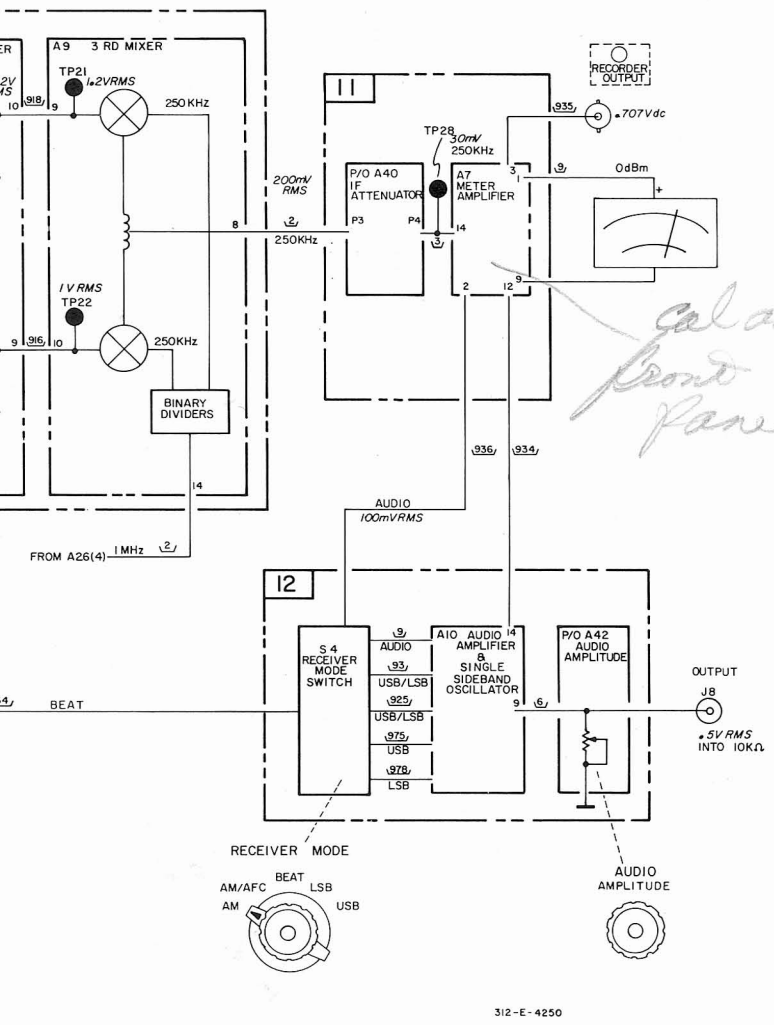
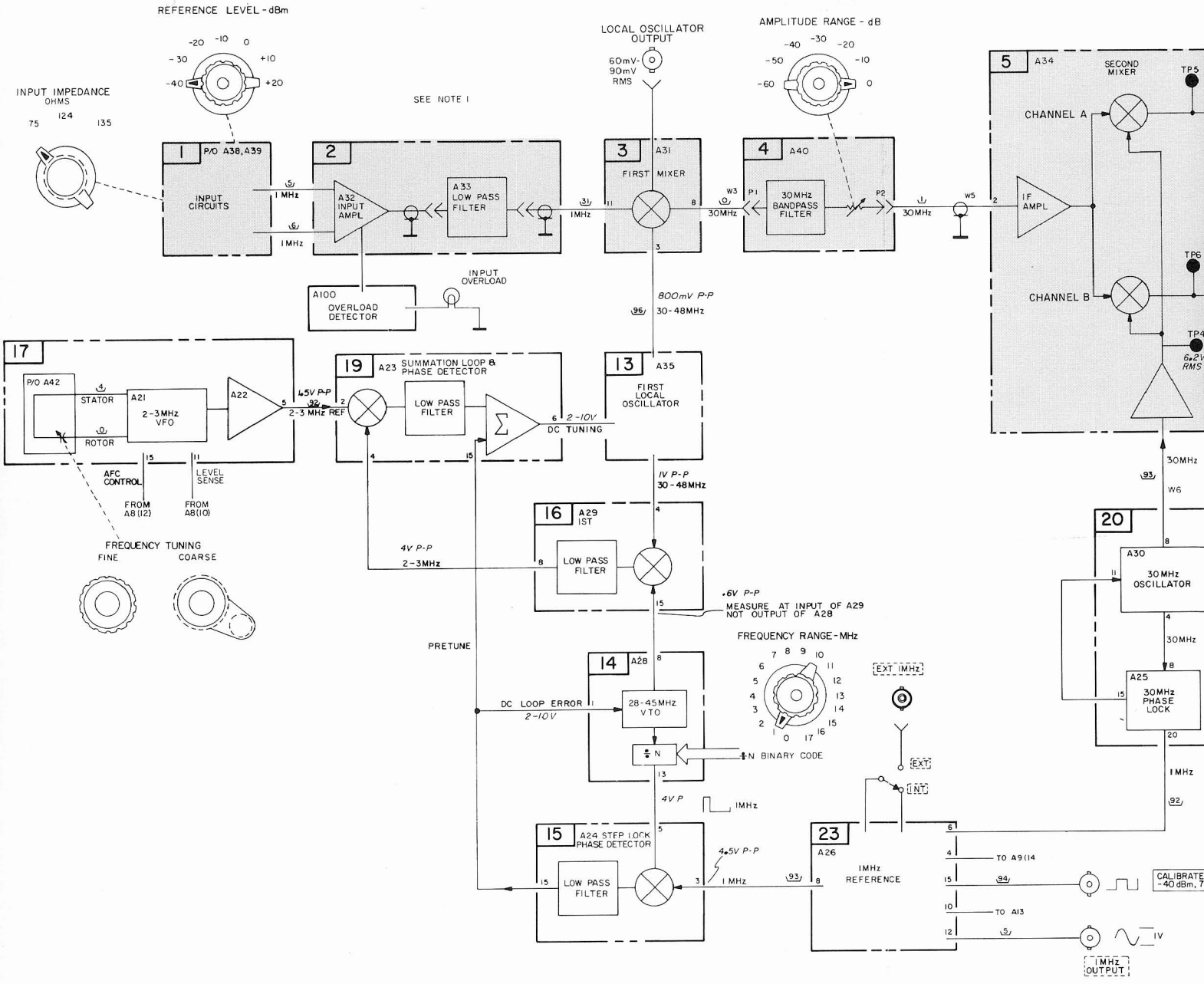
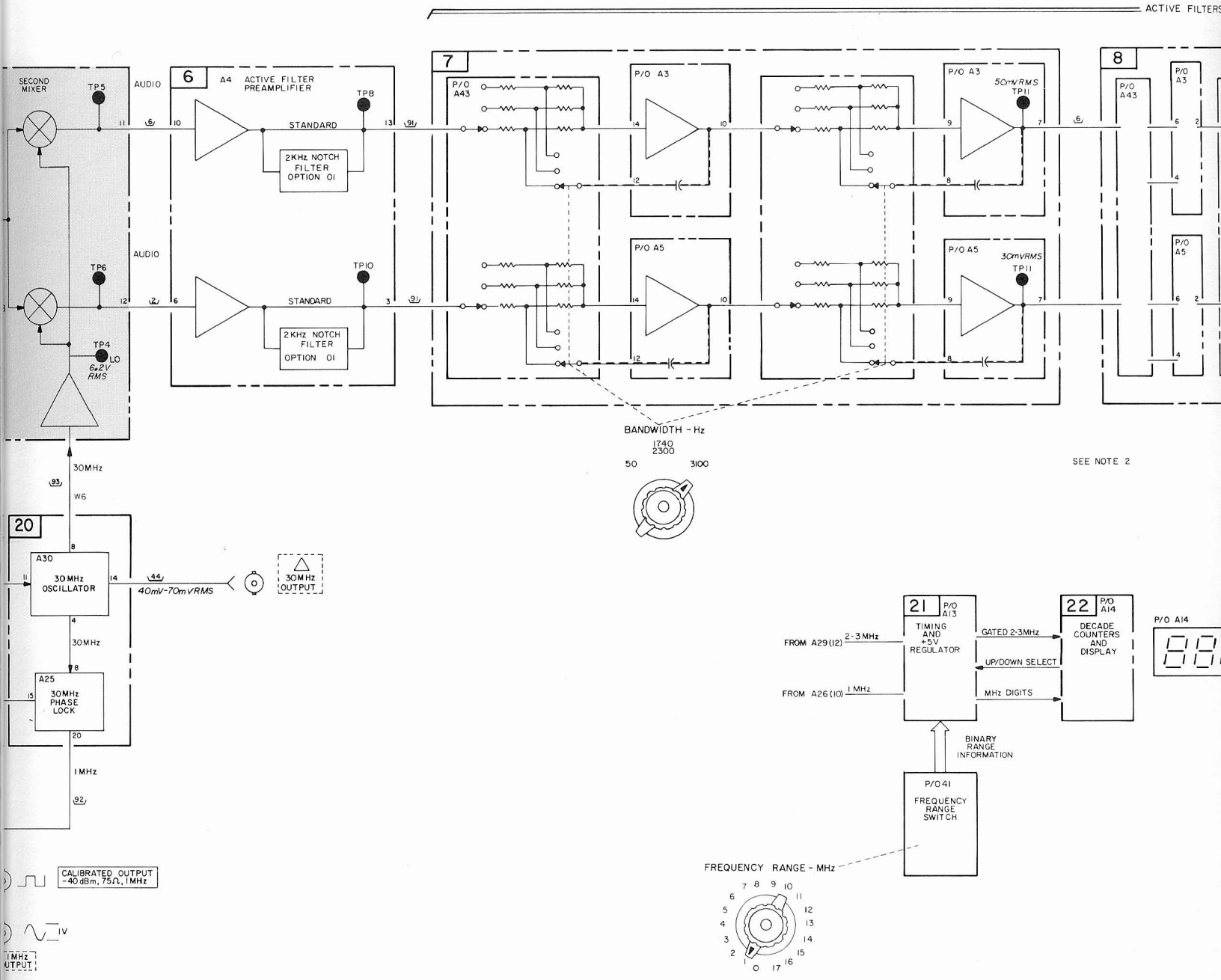
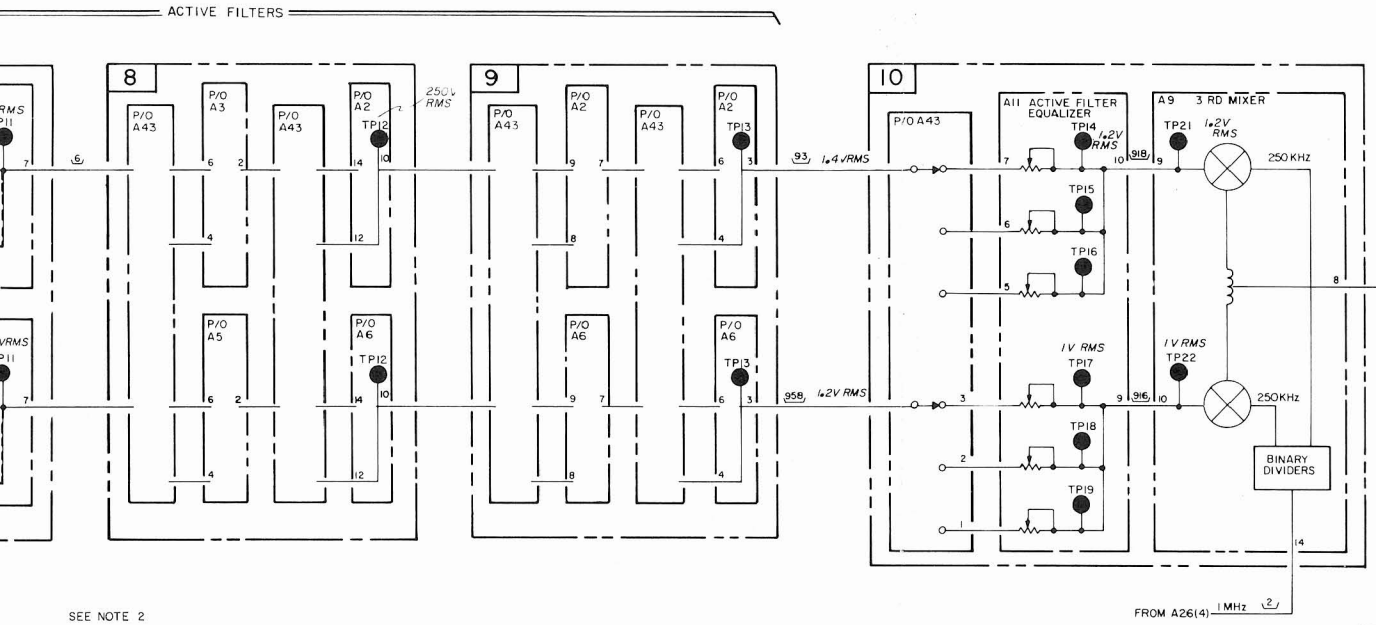
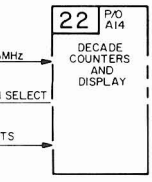


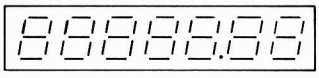
Figure 7-1. Block Diagram (312B Only).

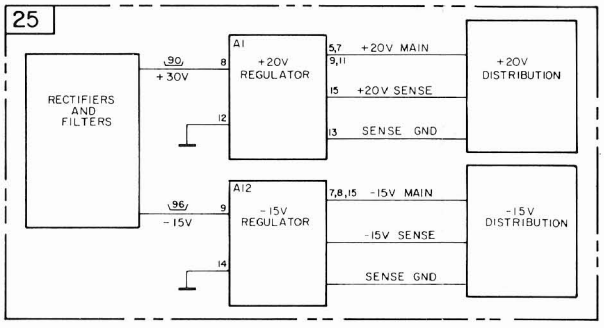












RECEIV
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3120-E-4376

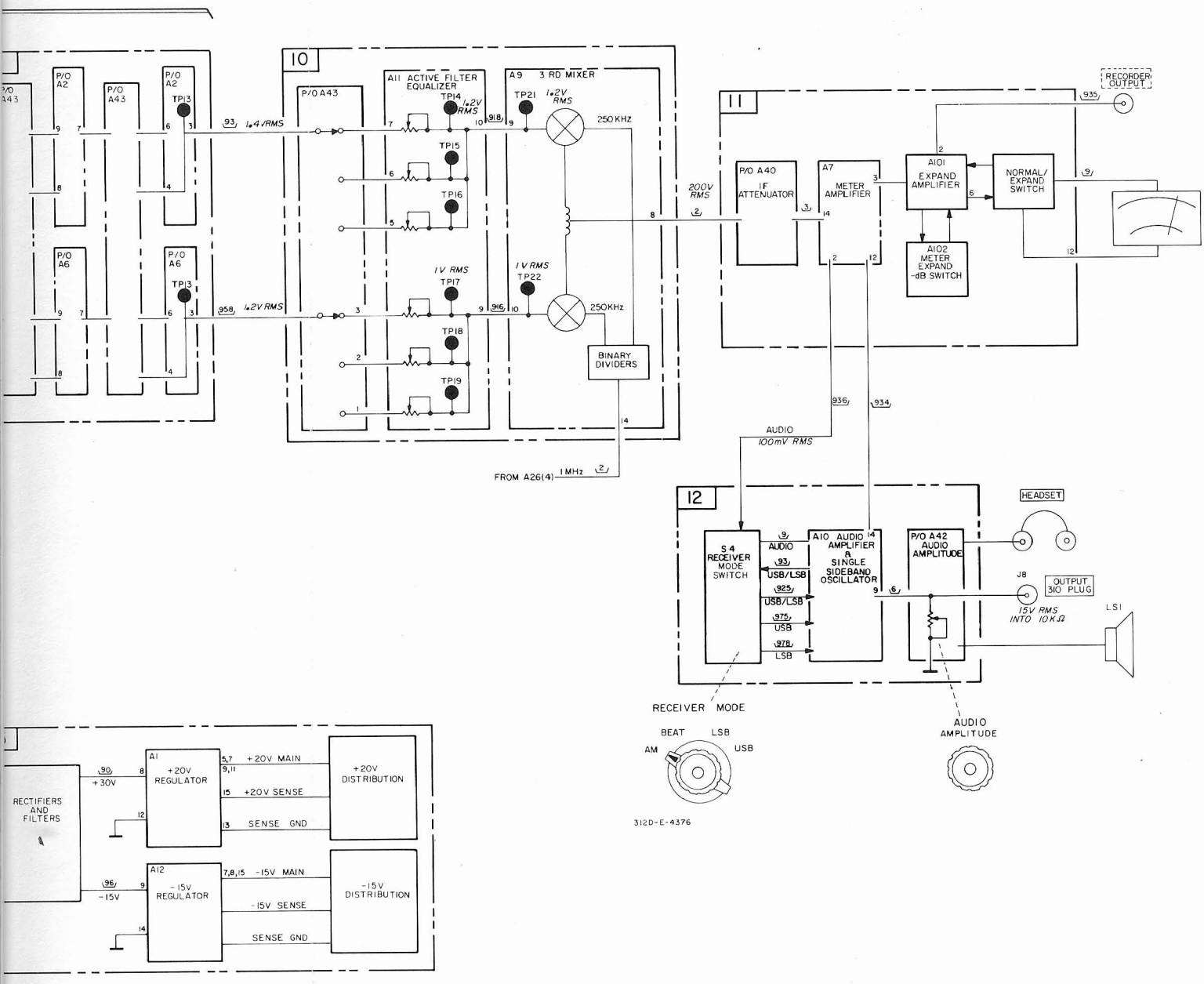
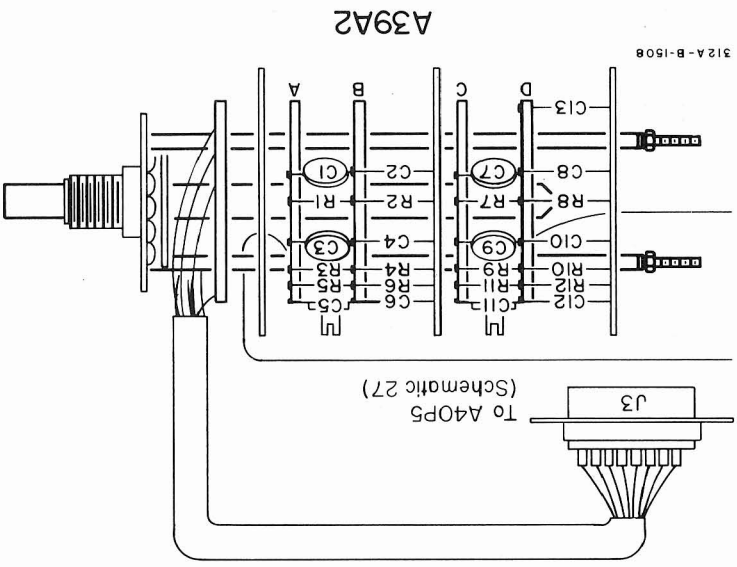
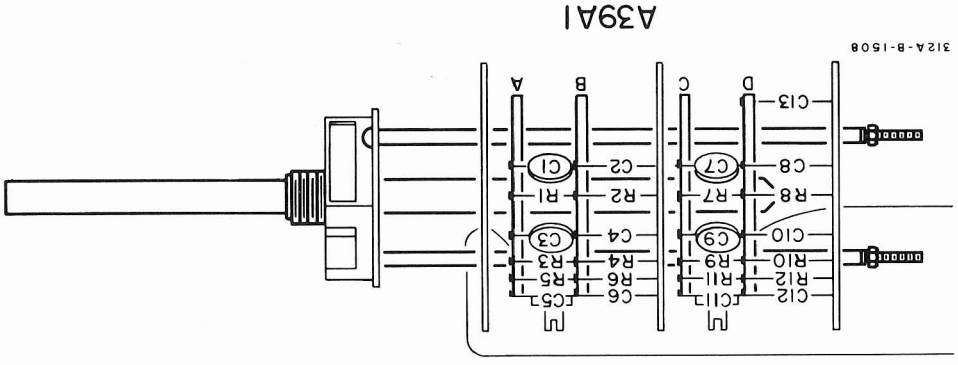
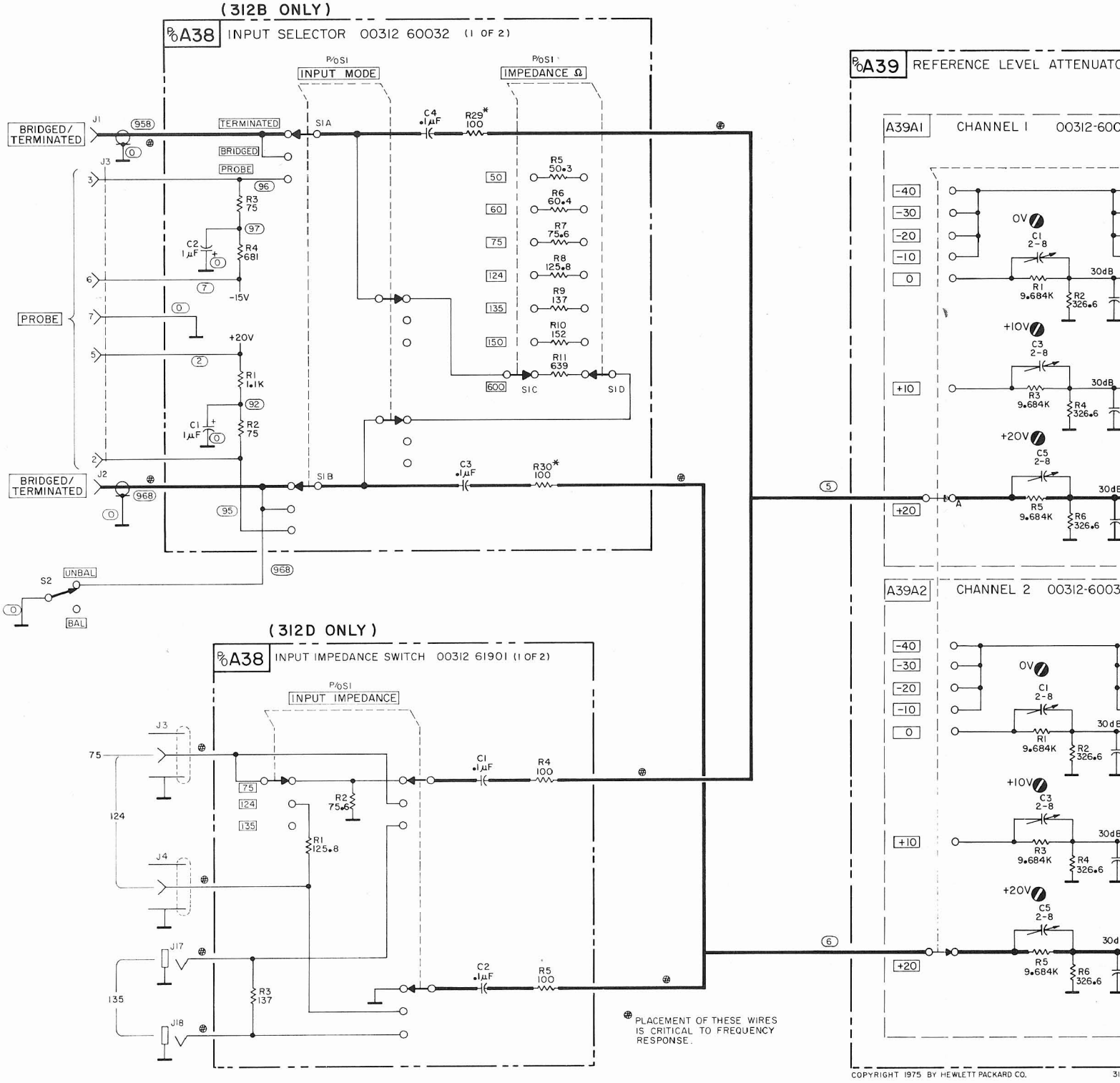


Figure 7-2. Block Diagram (312D Only).







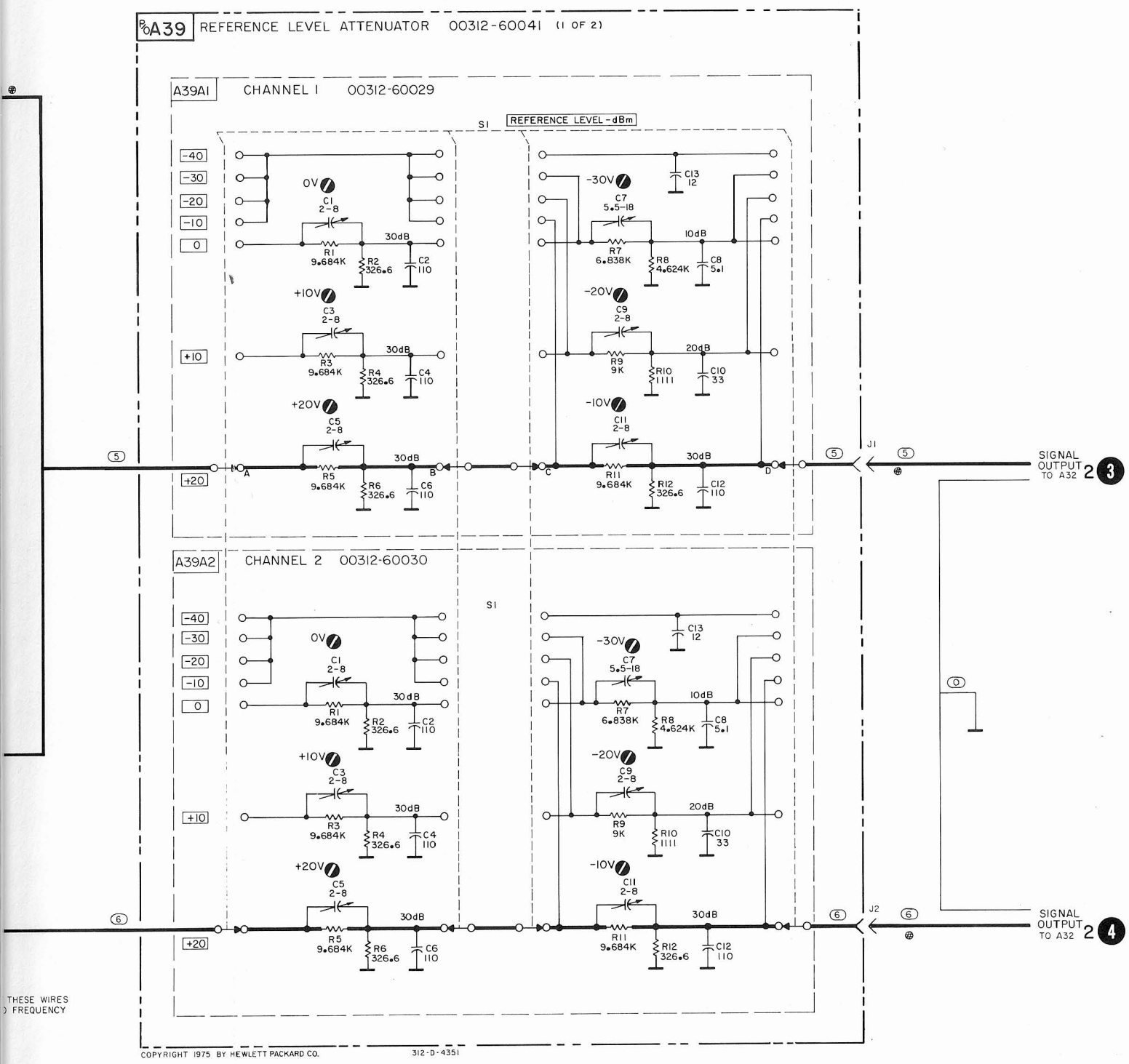
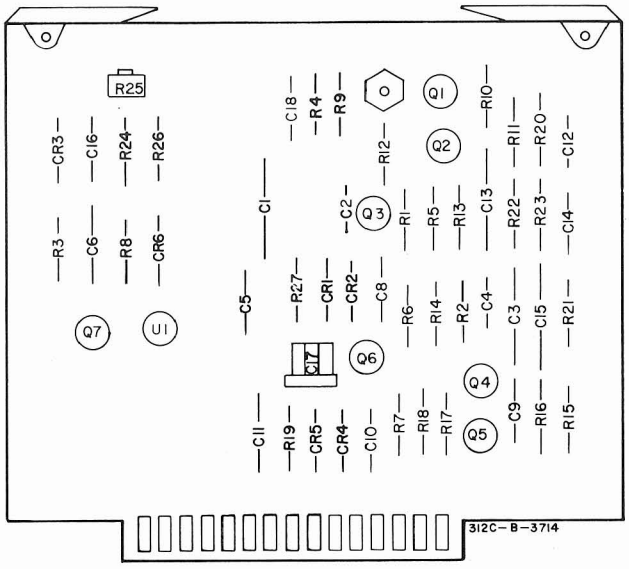
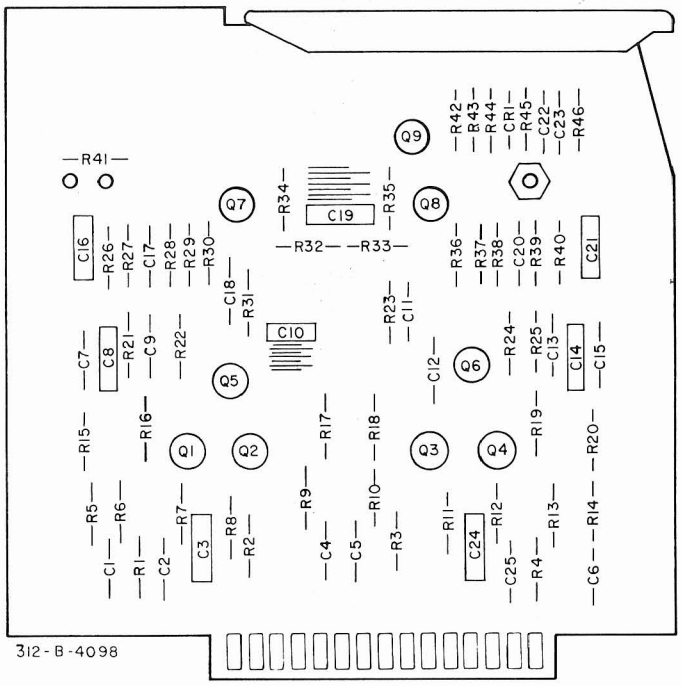


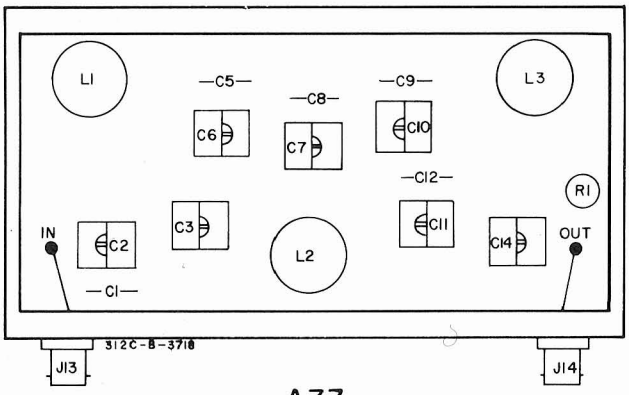
Figure 7-3. Mode Selector Switch and Reference Level Attenuator.



A100
hp Part No 00312-66502
Rev A

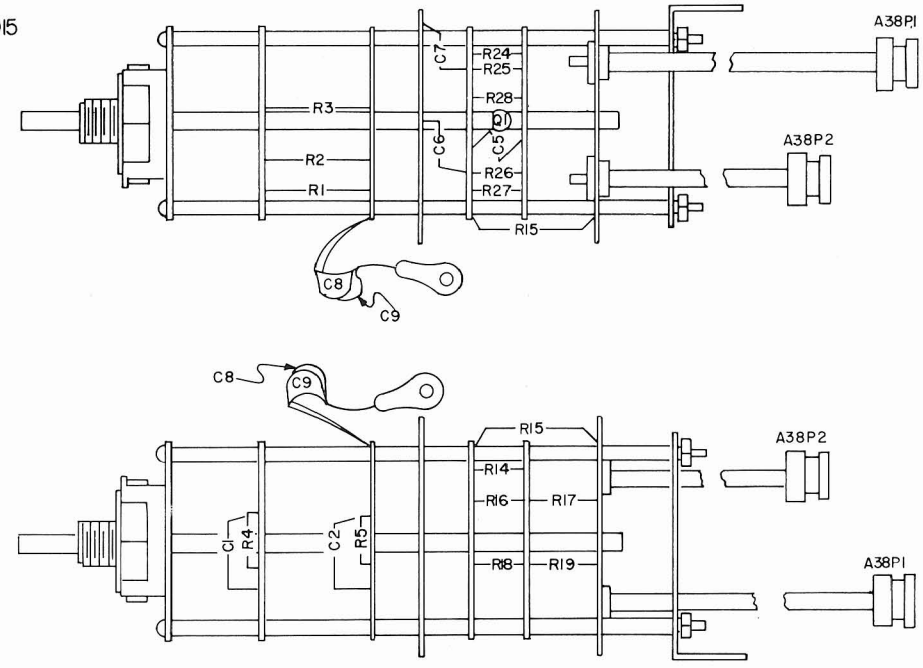


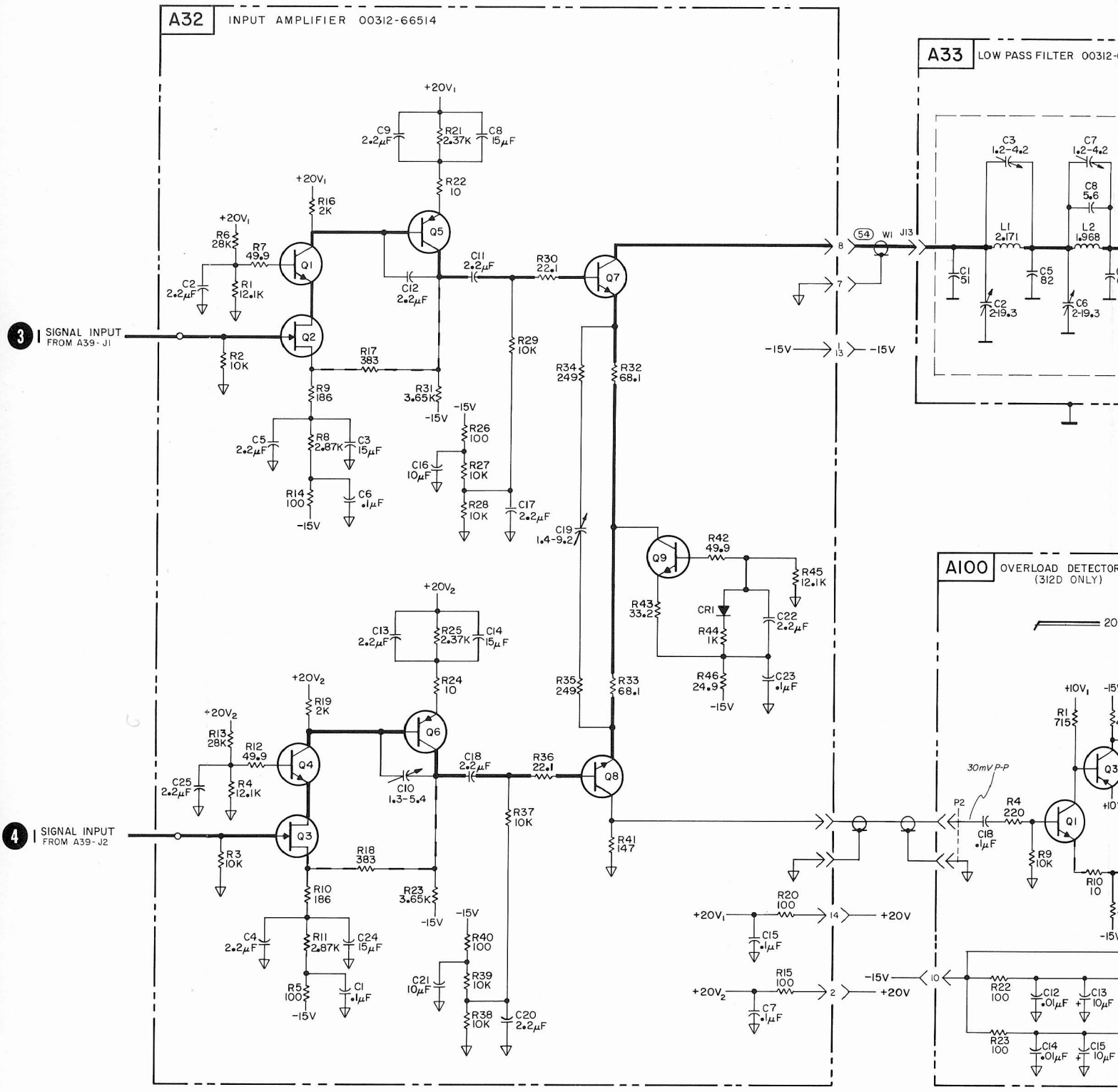
A32
hp Part No. 00312-66514

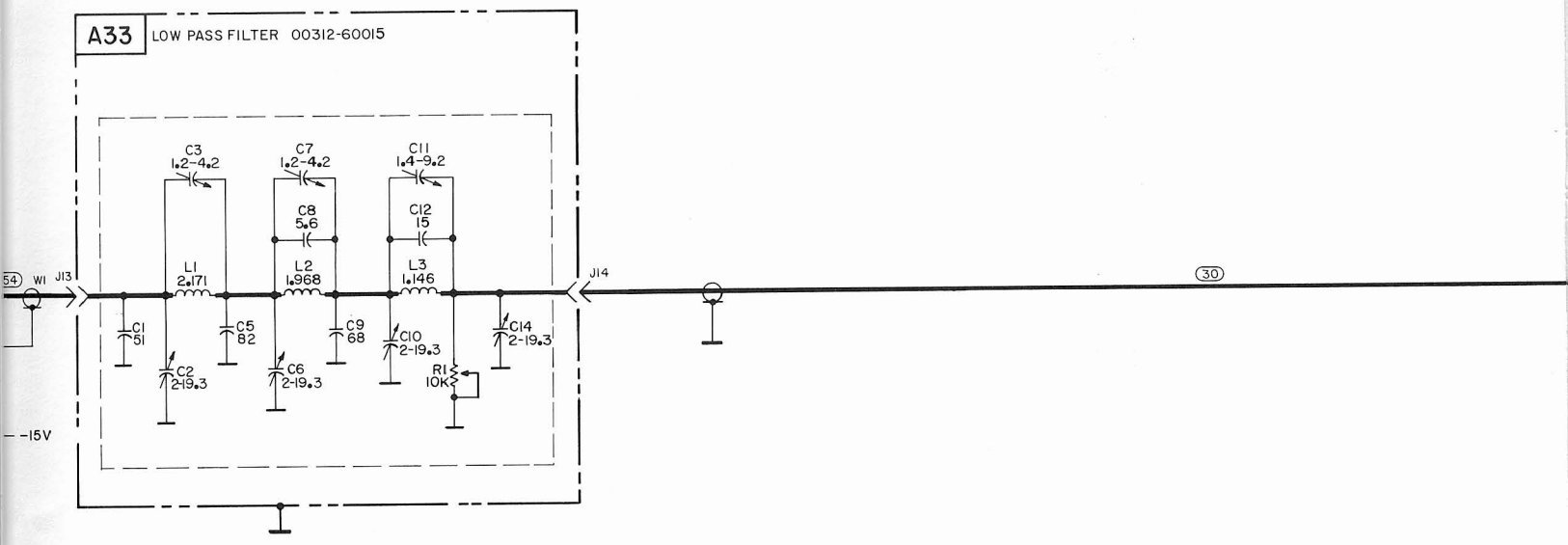


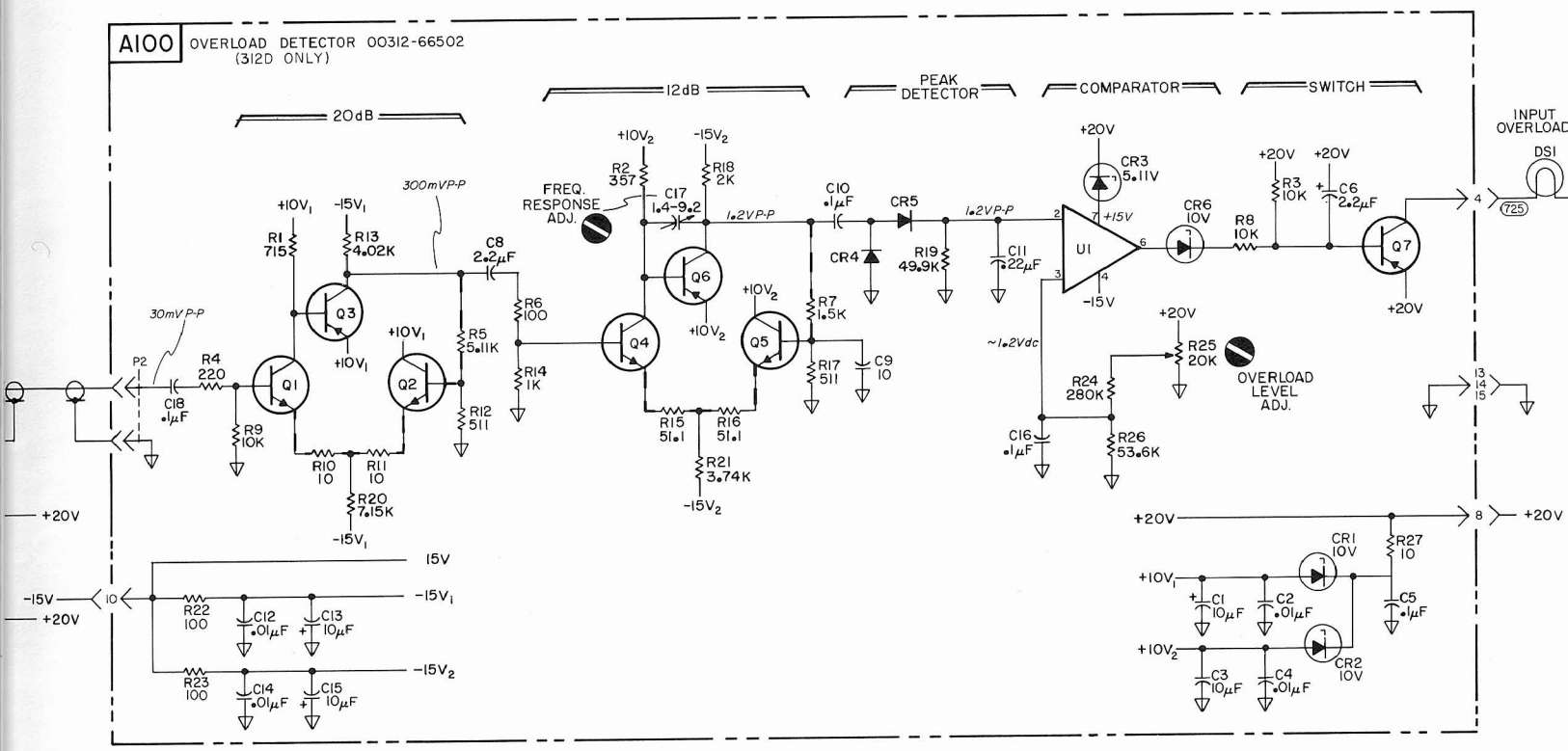
A33
hp Part No 00312-60015

A38
INPUT SWITCH









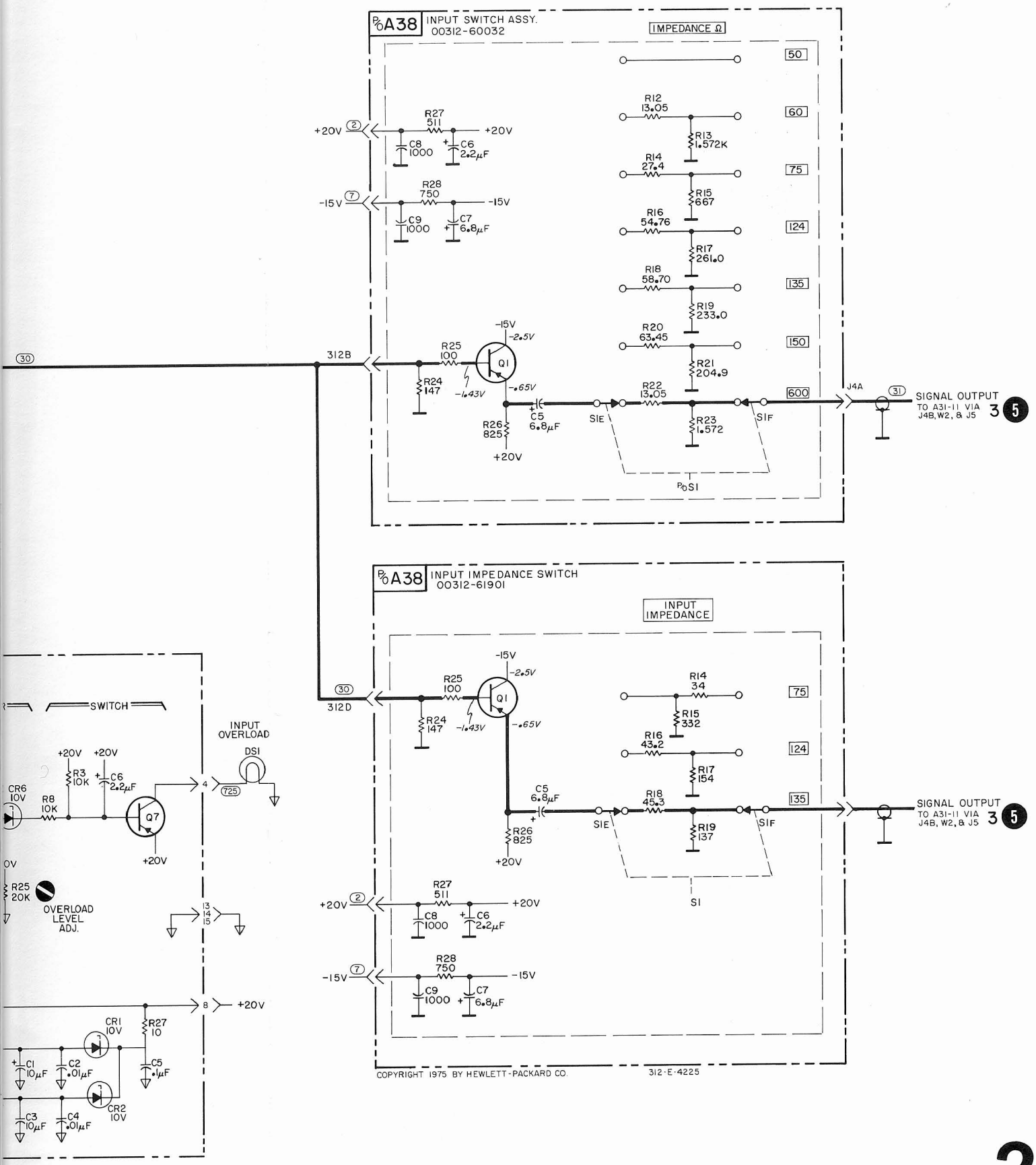
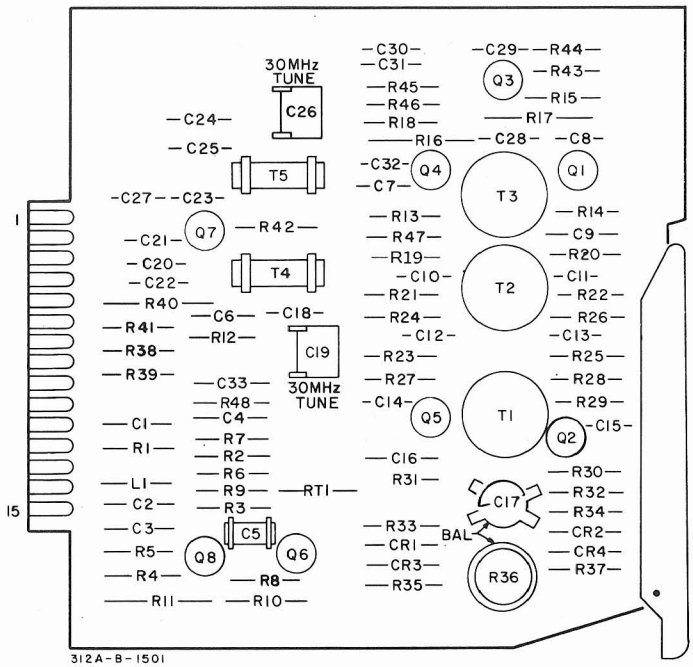


Figure 7-4. Input Amplifier, Low Pass Filter and Mode Selector Switch.

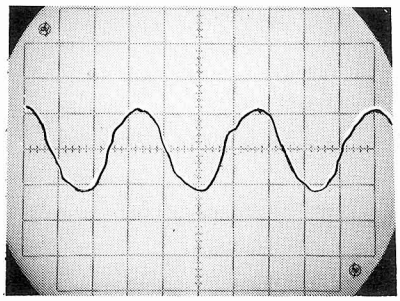


A31

hp Part No. 00312-60179

Rev B

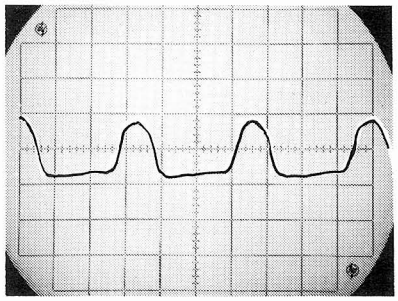
1



2 V/cm

10 ns/cm

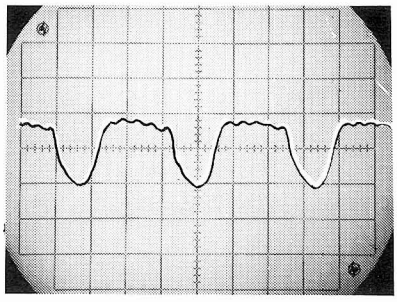
2



1 V/cm

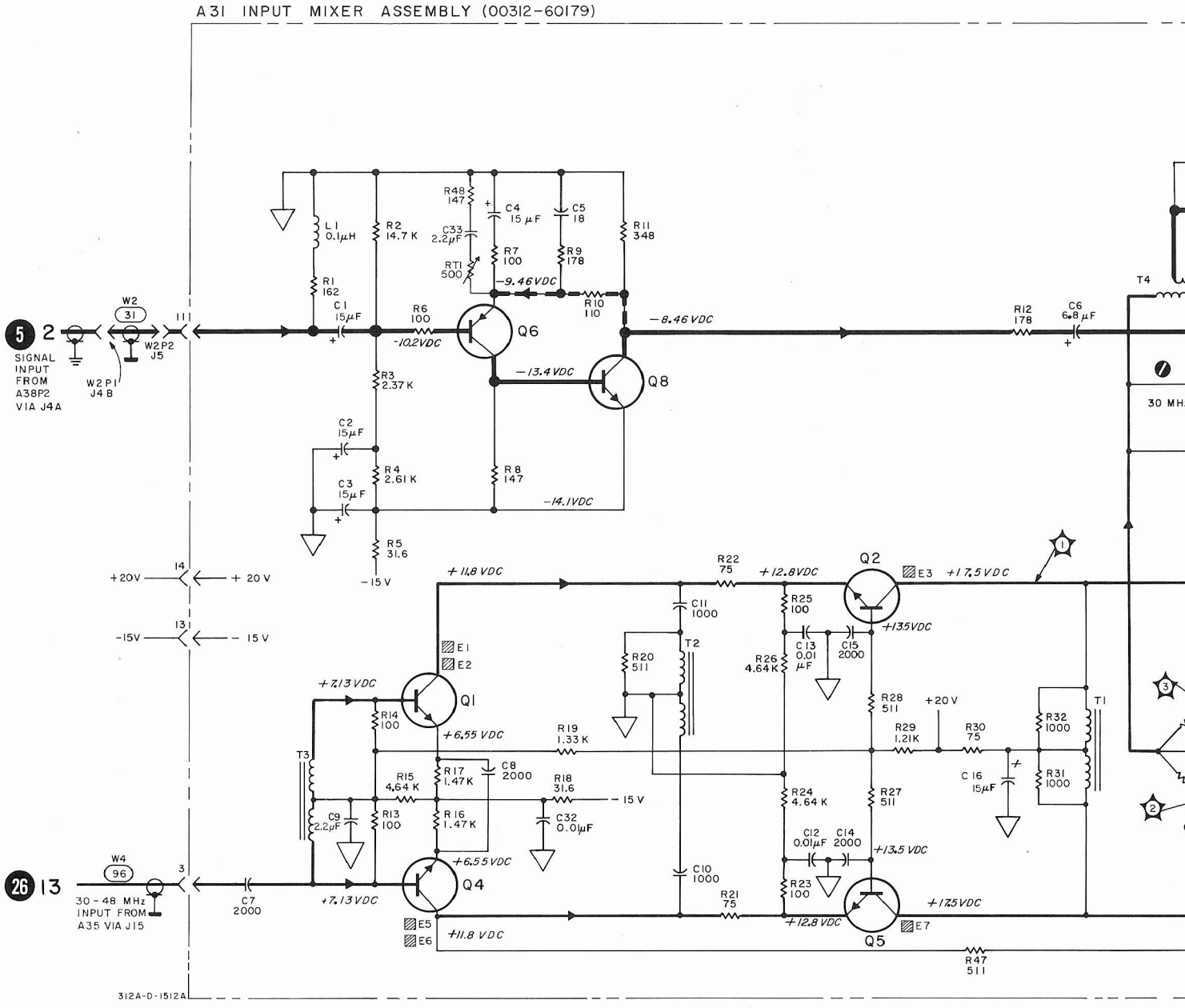
10 ns/cm

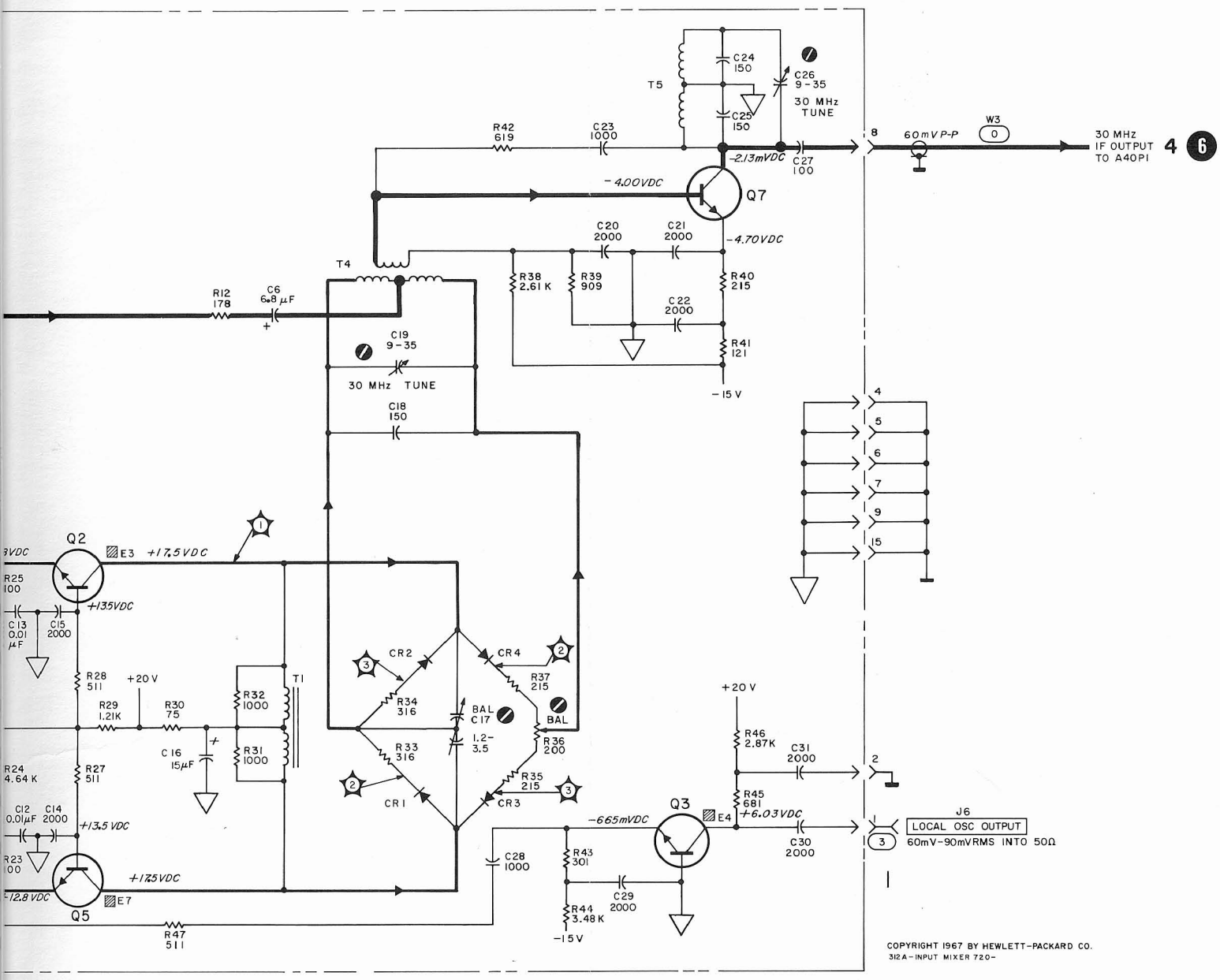
3



1 V/cm

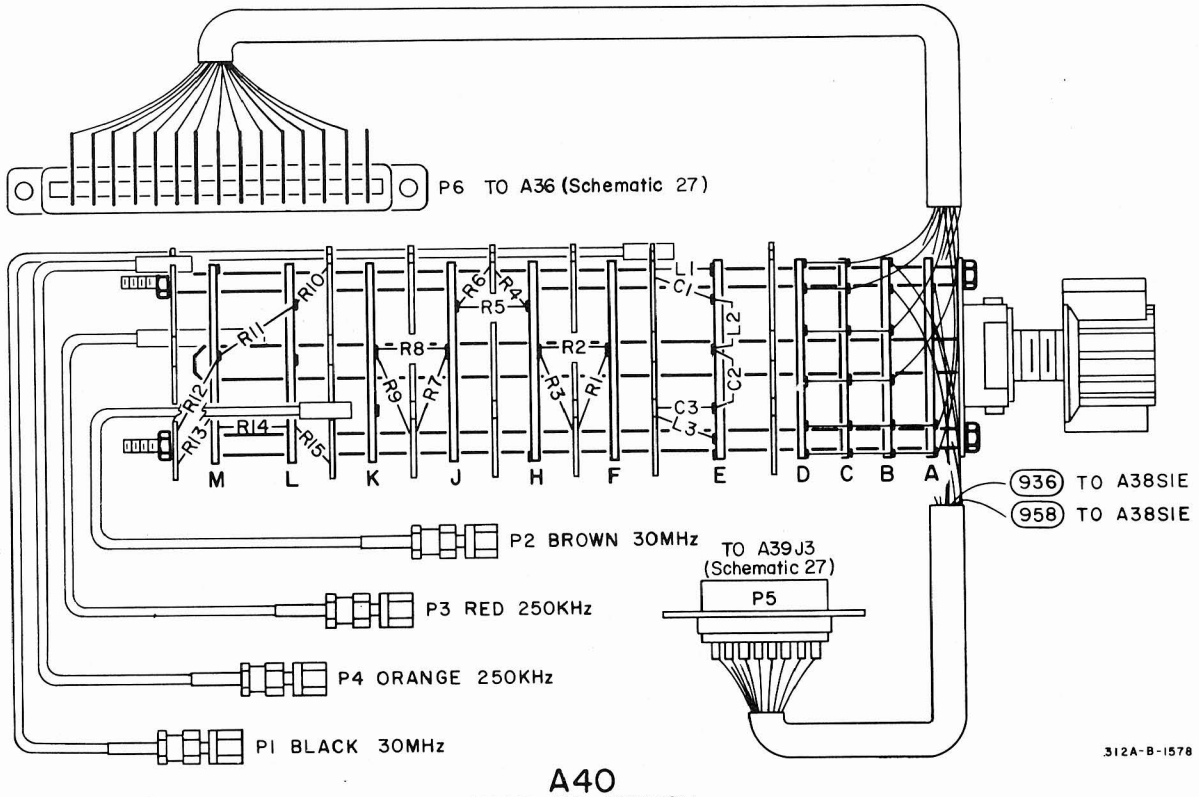
10 ns/cm



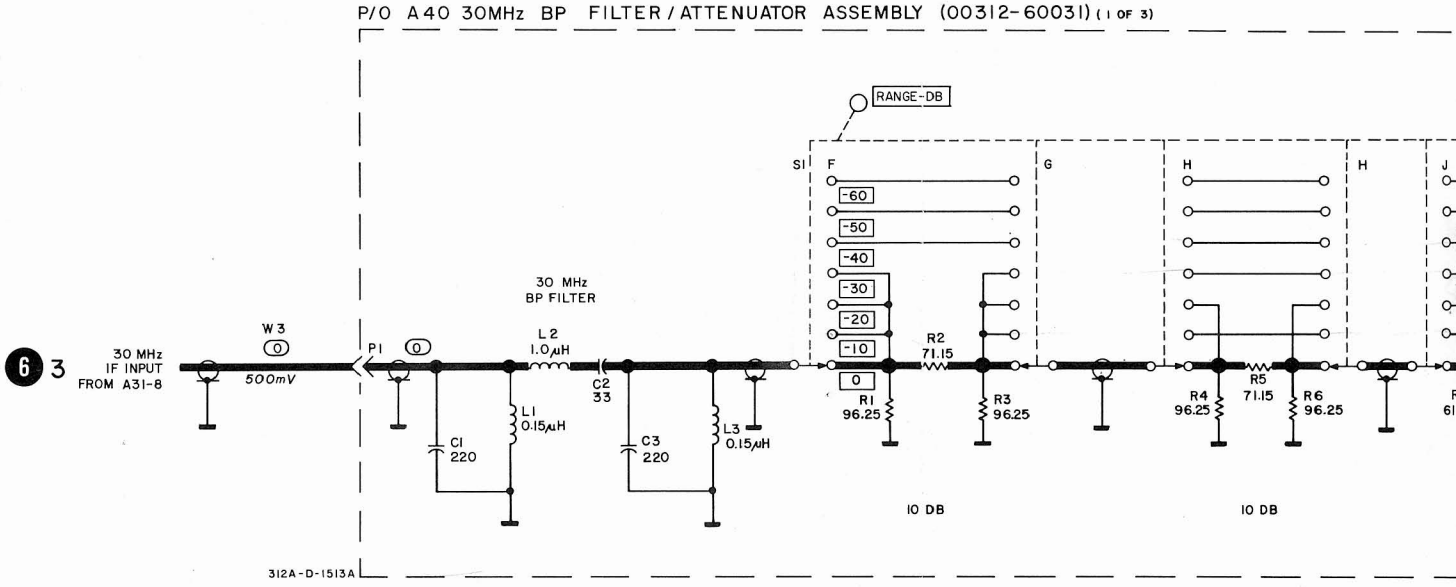


3

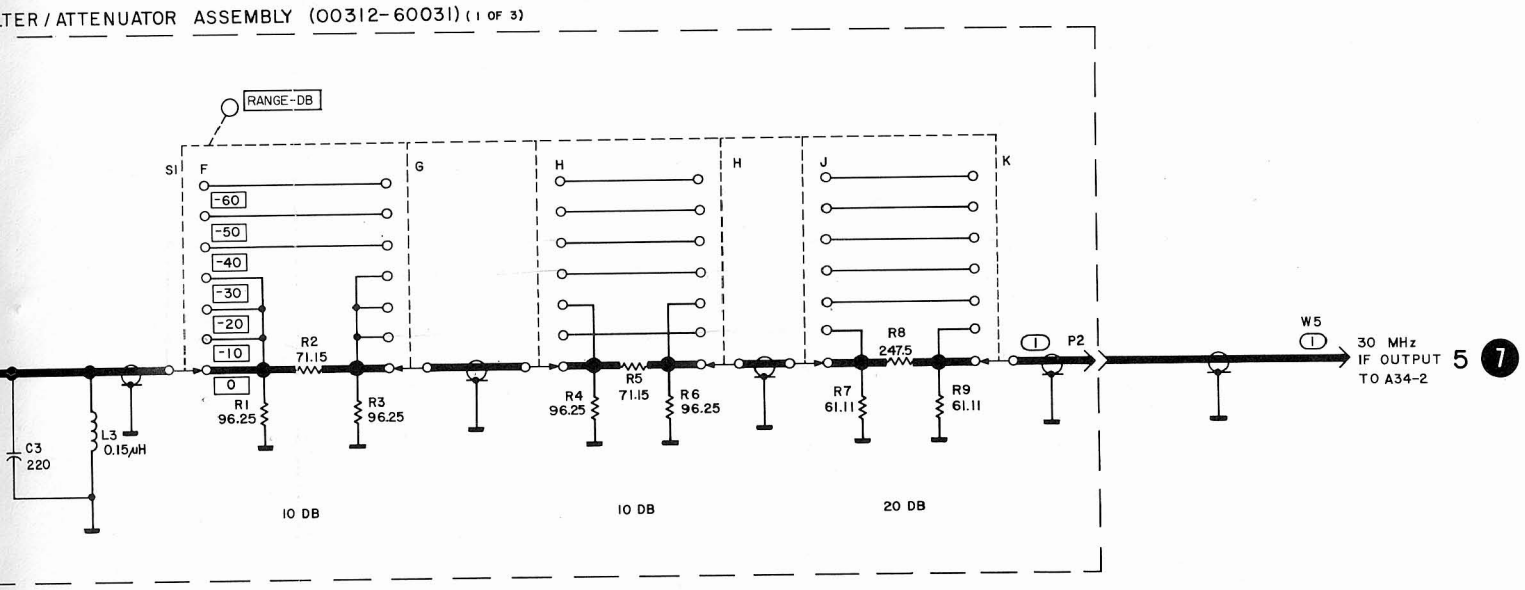
Figure 7-5. Input Mixer.



A40
RANGE-DB SWITCH

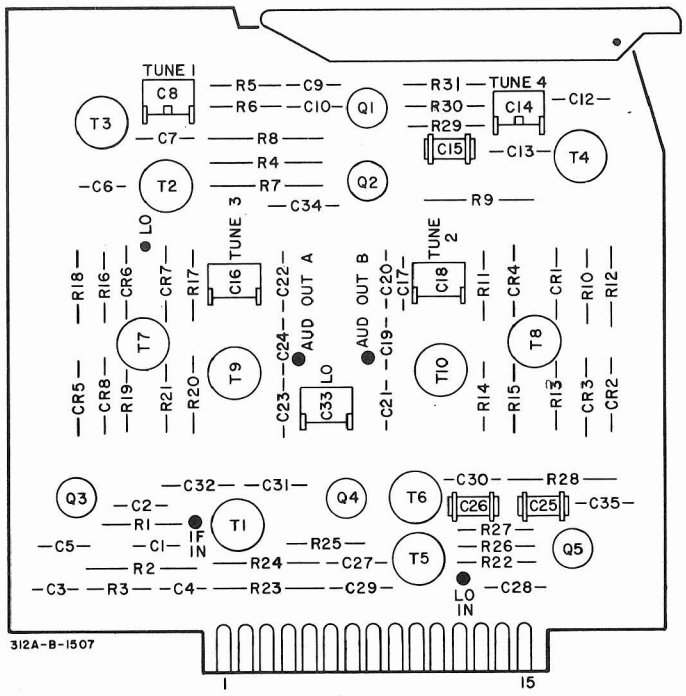


312A - 30 MHz BANDPASS FILTER AND ATTENUATOR 720-



4

Figure 7-6. 30 MHz Bandpass Filter.

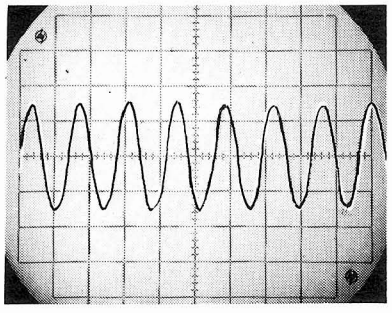


A34

hp Part No. 00312-60020

Rev B

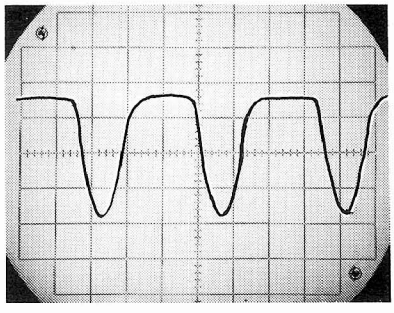
4



5 V/cm

20 ns/cm

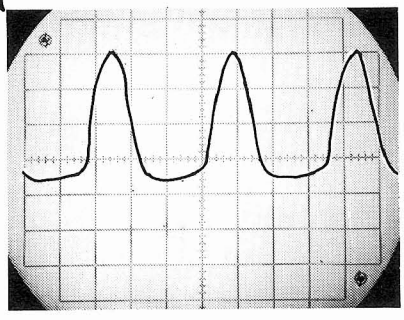
5



2 V/cm

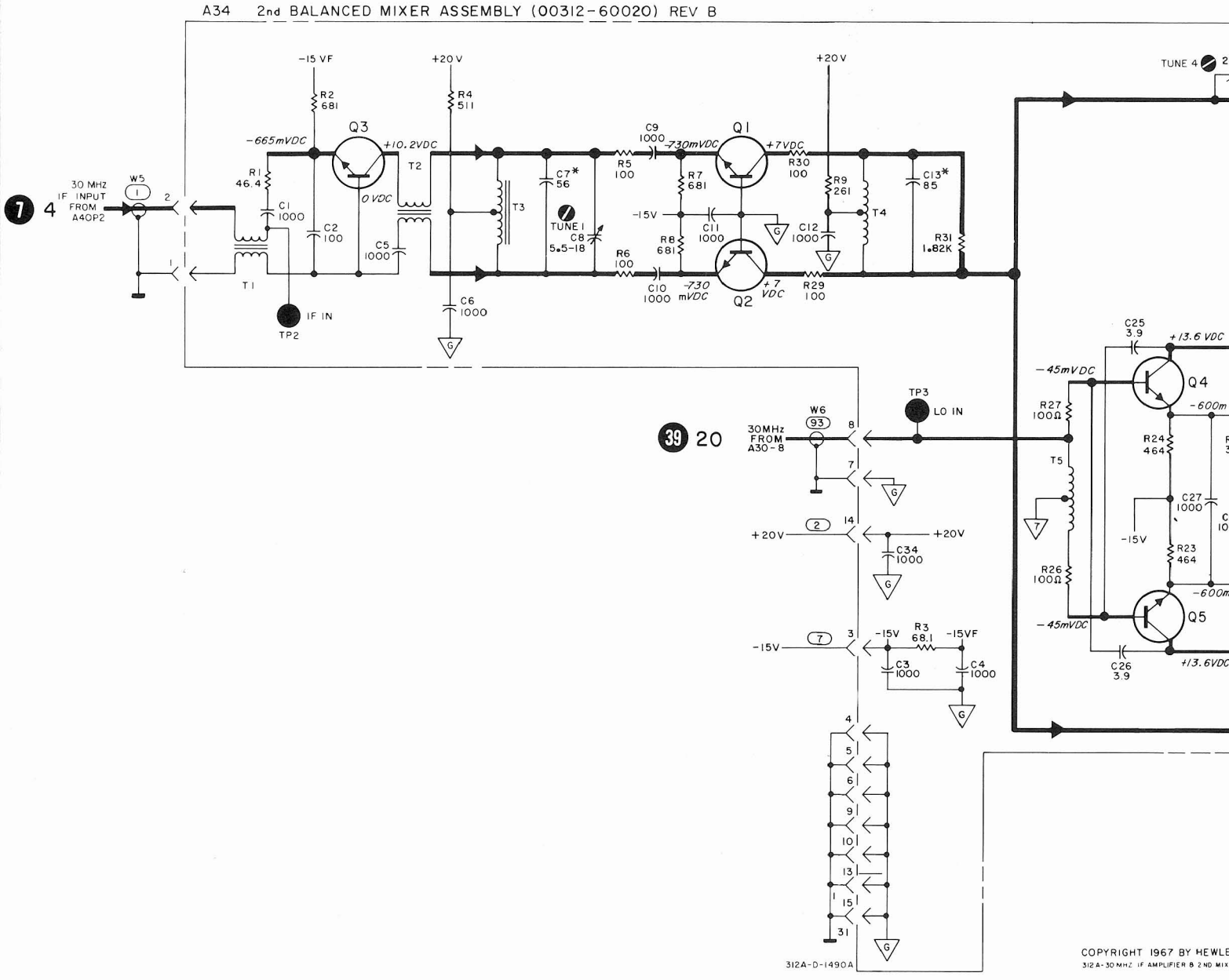
10 ns/cm

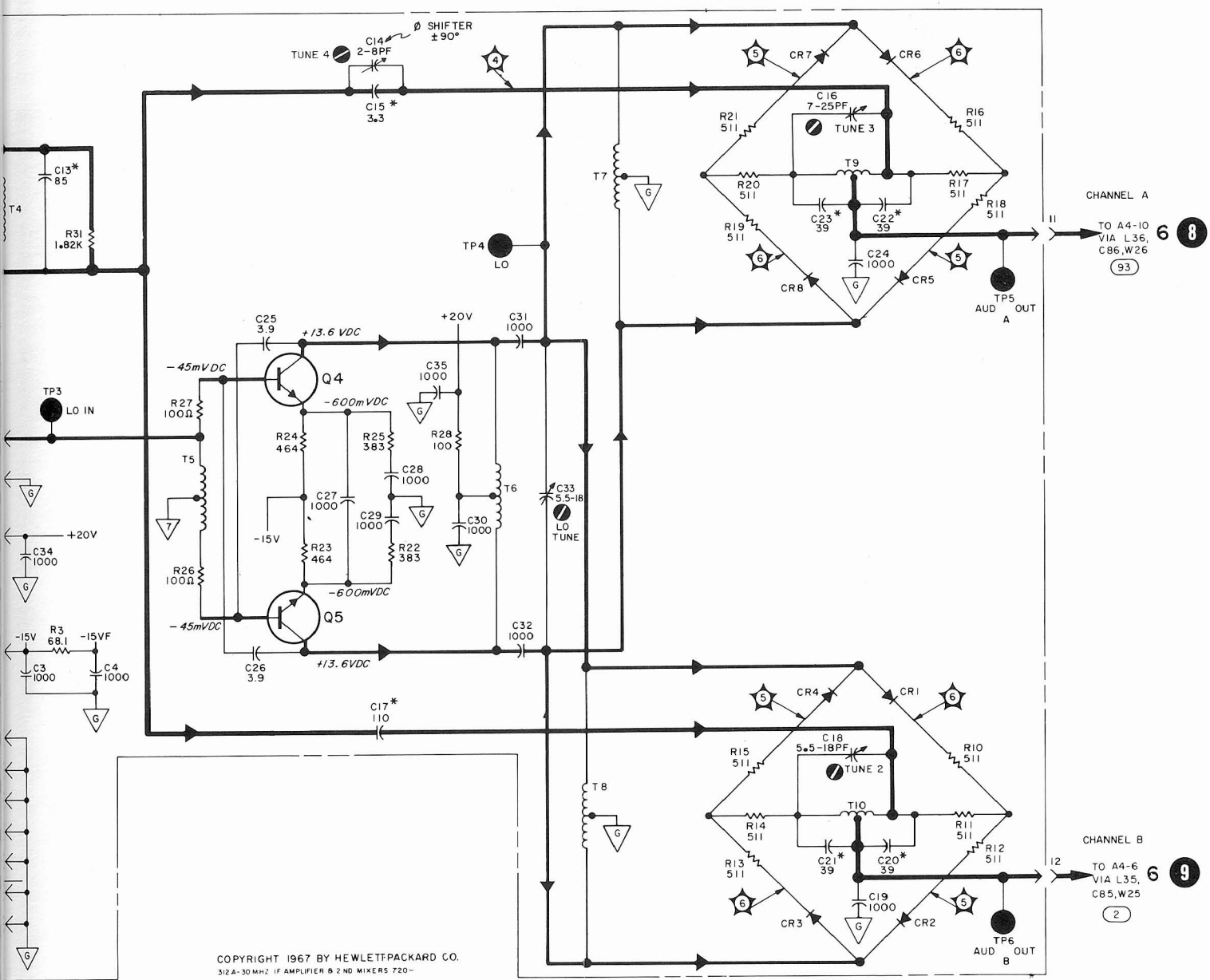
6



2 V/cm

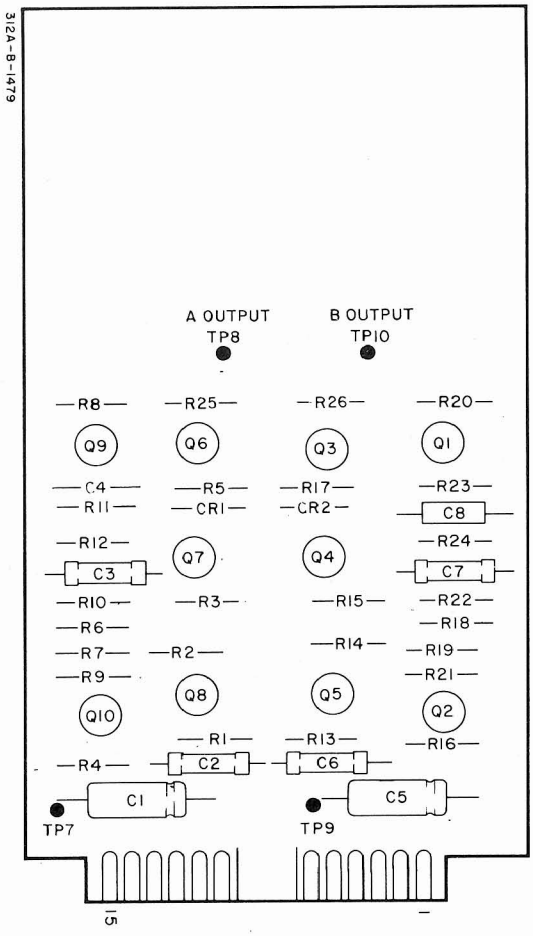
10 ns/cm





5

Figure 7-7. Second Mixer.

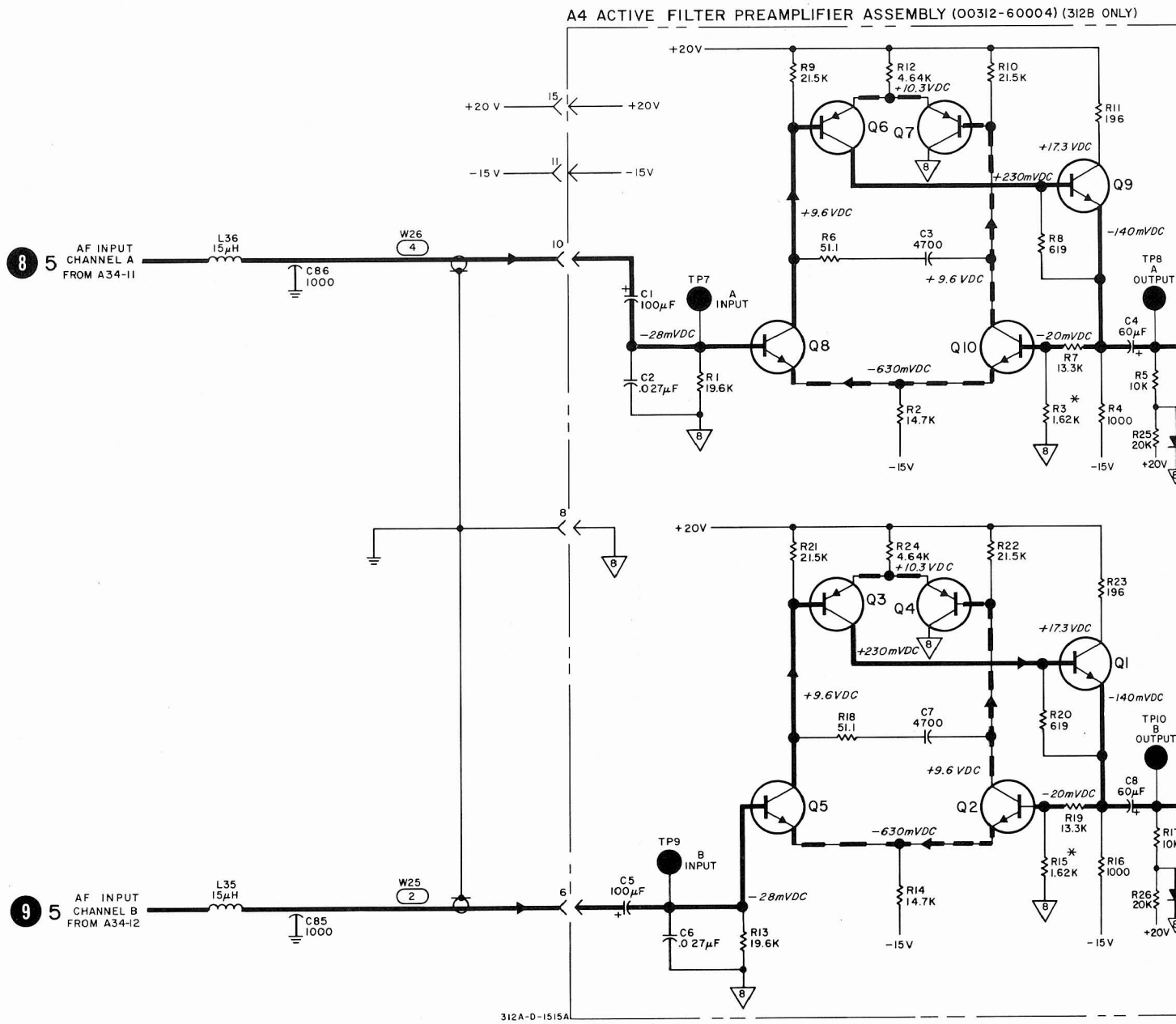


A4

hp Part No. 00312-60004

NOTE

R3 AND R15 ARE SELECTED FOR SYSTEM GAIN. WITH FULL SCALE INPUT APPLIED (0 dBm ON METER) R3 AND R15 ARE SELECTED TO PROVIDE 10 mV RMS AT A7TP28 METER AMPLIFIER.



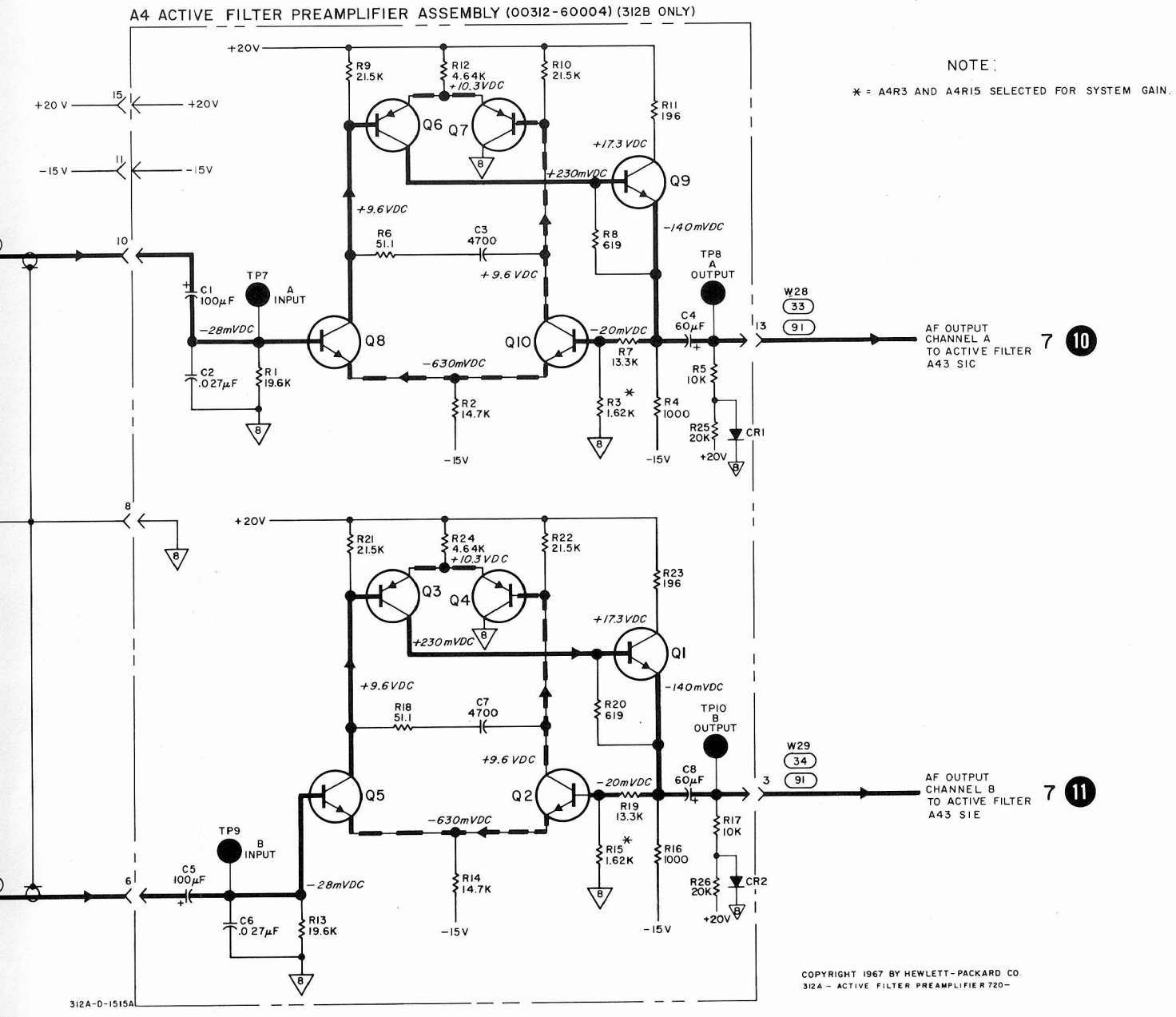
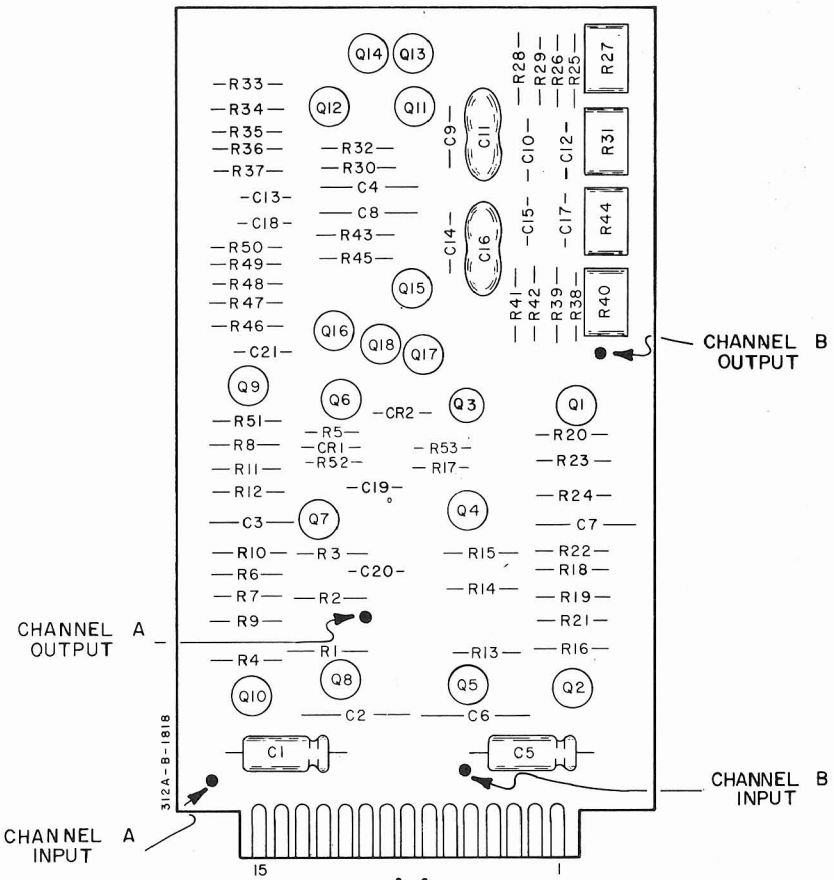


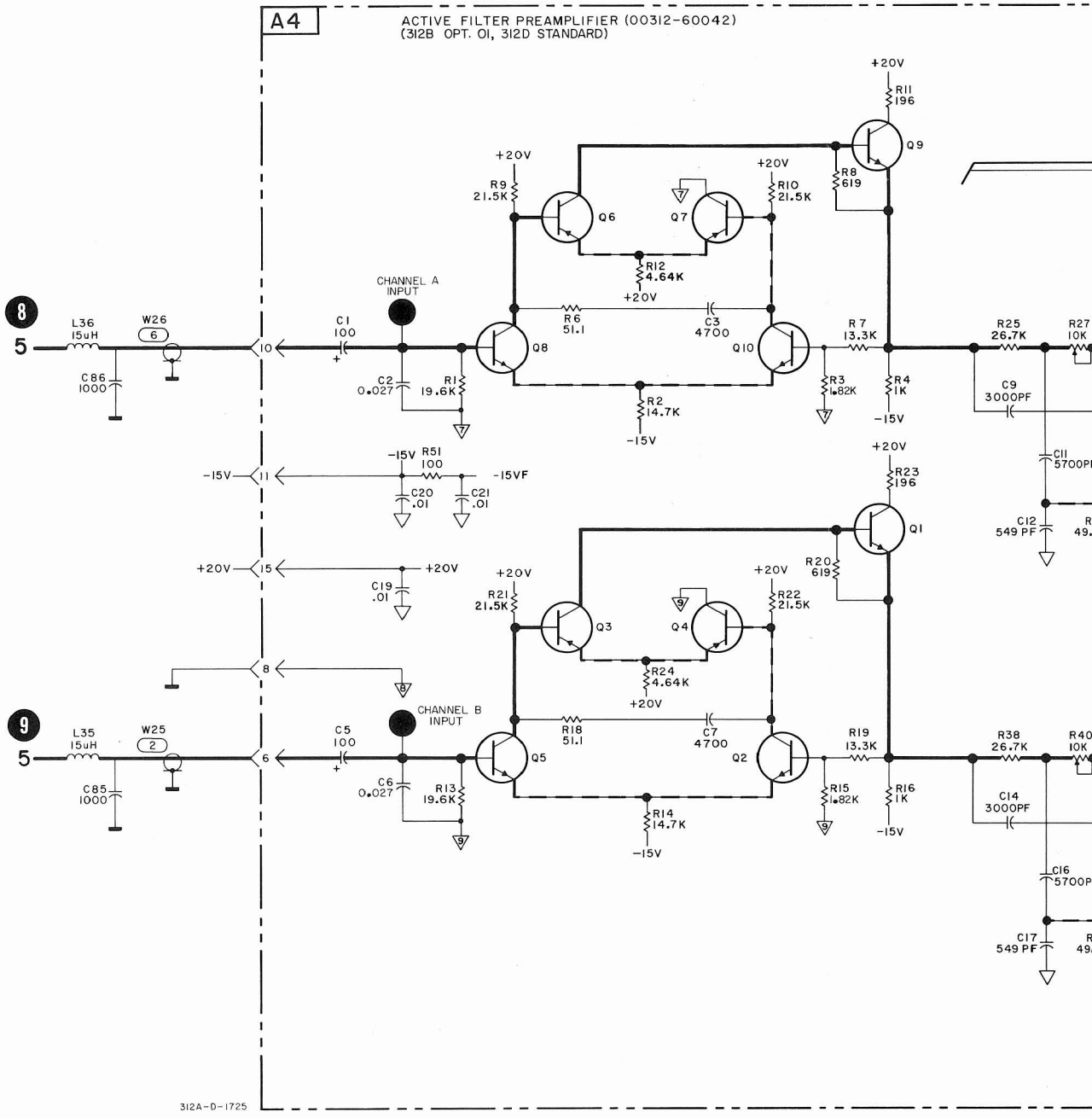
Figure 7-8. Active Filter Preamplifier (312B Only).

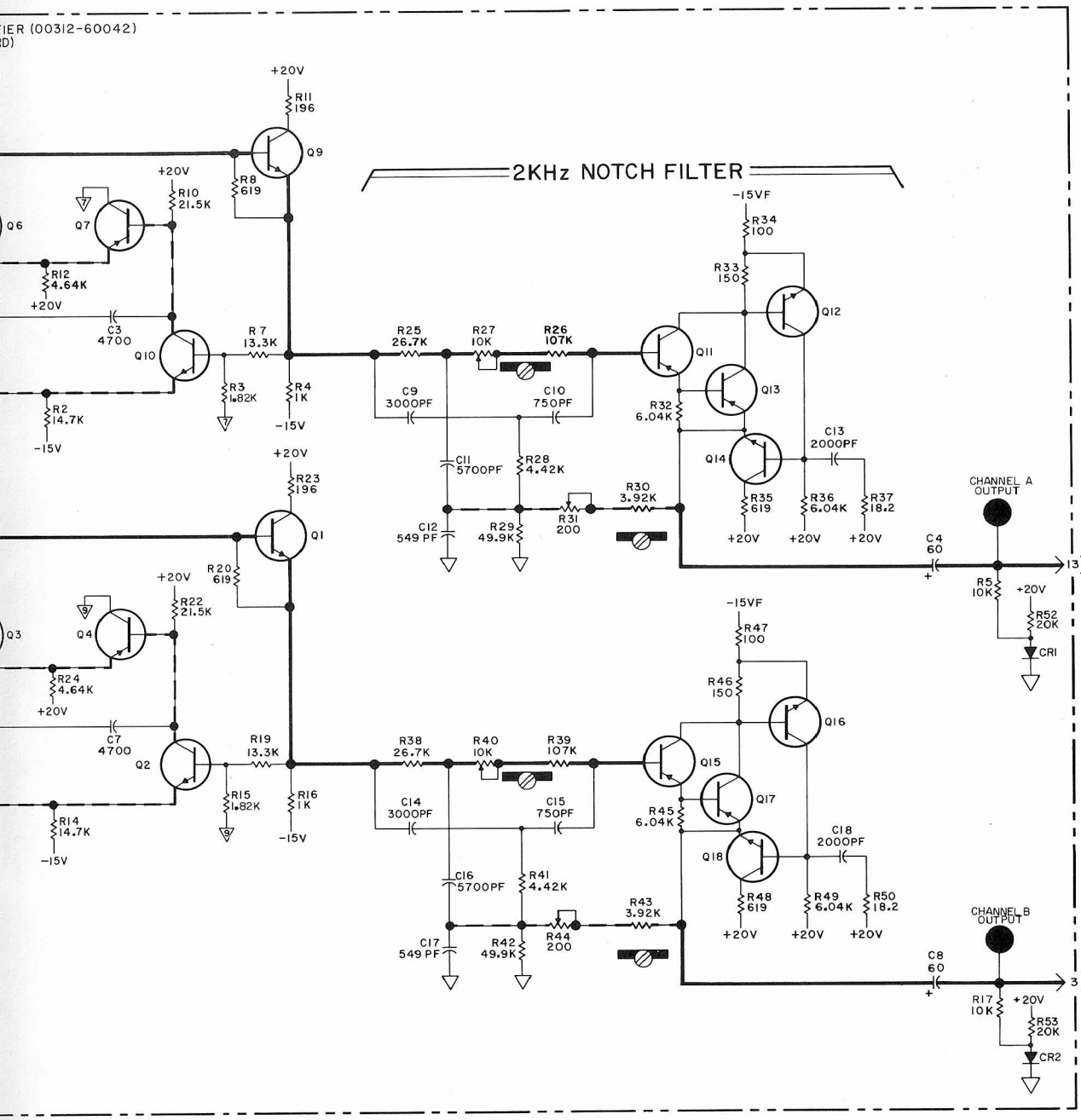


hp Part No. 00312-60042
Rev A

NOTE

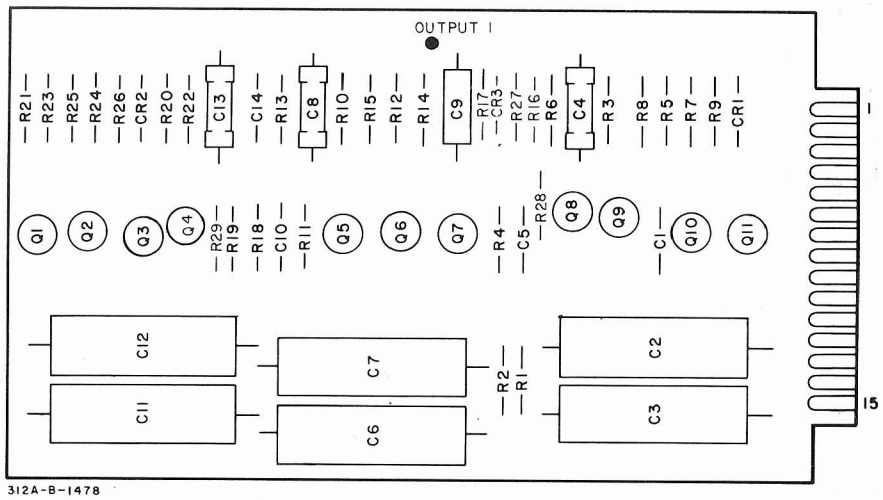
R3 AND R15 ARE SELECTED FOR SYSTEM GAIN. WITH FULL SCALE INPUT APPLIED (0 dBm ON METER) R3 AND R15 ARE SELECTED TO PROVIDE 10 mV RMS AT A7TP28 METER AMPLIFIER.





6

Figure 7-9. Active Filter Preamplifier (312D Only, Std, and Opt. 01).



A3-A5

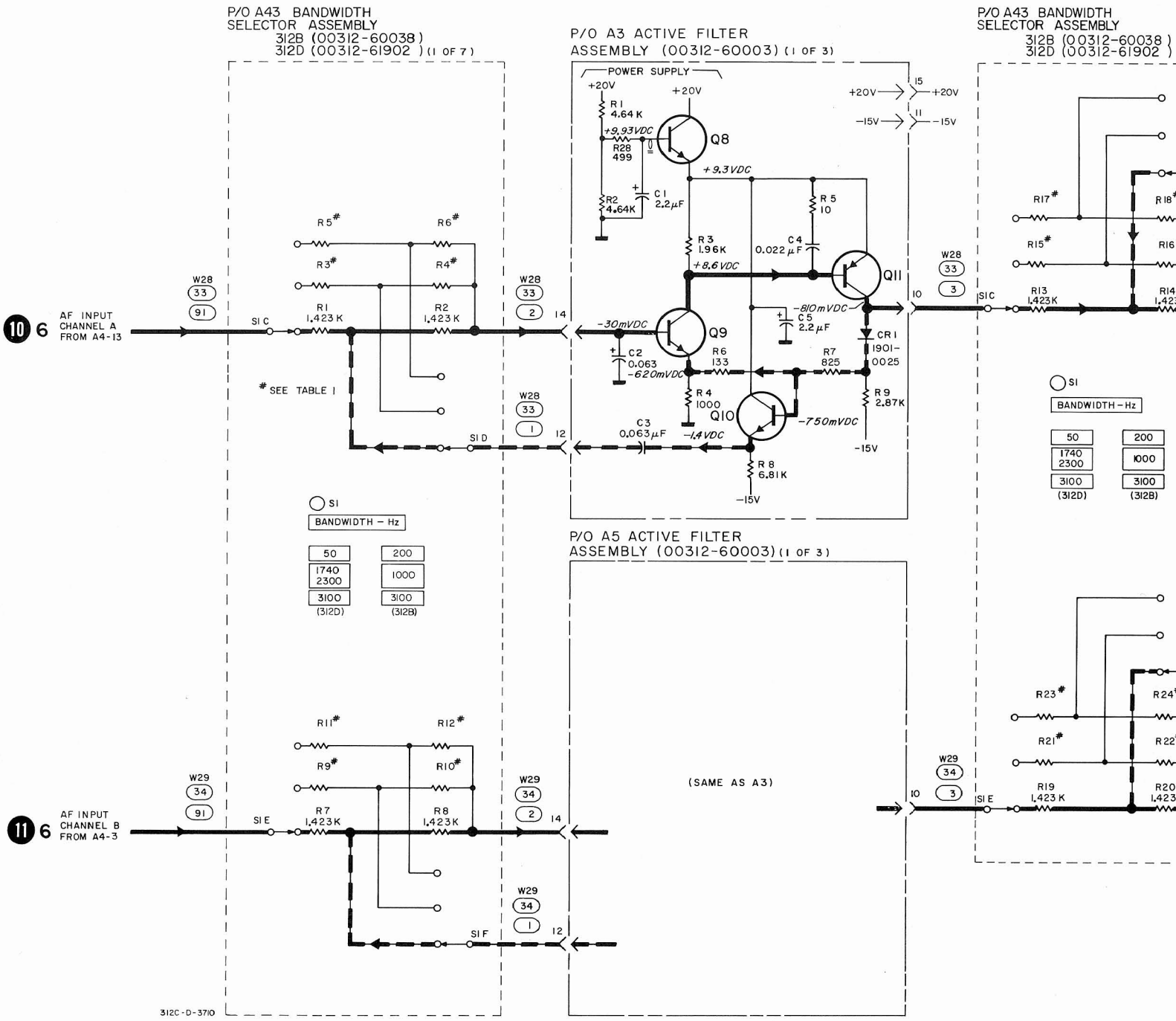
hp Part No. 00312-60003

Rev. C

Table 1.

R Designator	R Value in 312B	R Value in 312D
3, 4, 9, 10, 15, 16, 21, 22, 27, 28, 33, 34, 39, 40, 45, 46, 51, 52, 57, 58, 63	4.27 K (1000 Hz Bandwidth)	1.87 K (1740 / 2300 Hz Bandwidth)
5, 6, 11, 12, 17, 18, 23, 24, 29, 30, 35, 36, 41, 42, 44, 48, 53, 54, 59, 60	21.35 K (200 Hz Bandwidth)	84.5 K (50 Hz Bandwidth)

3100 Hz Bandwidth same for both instruments.



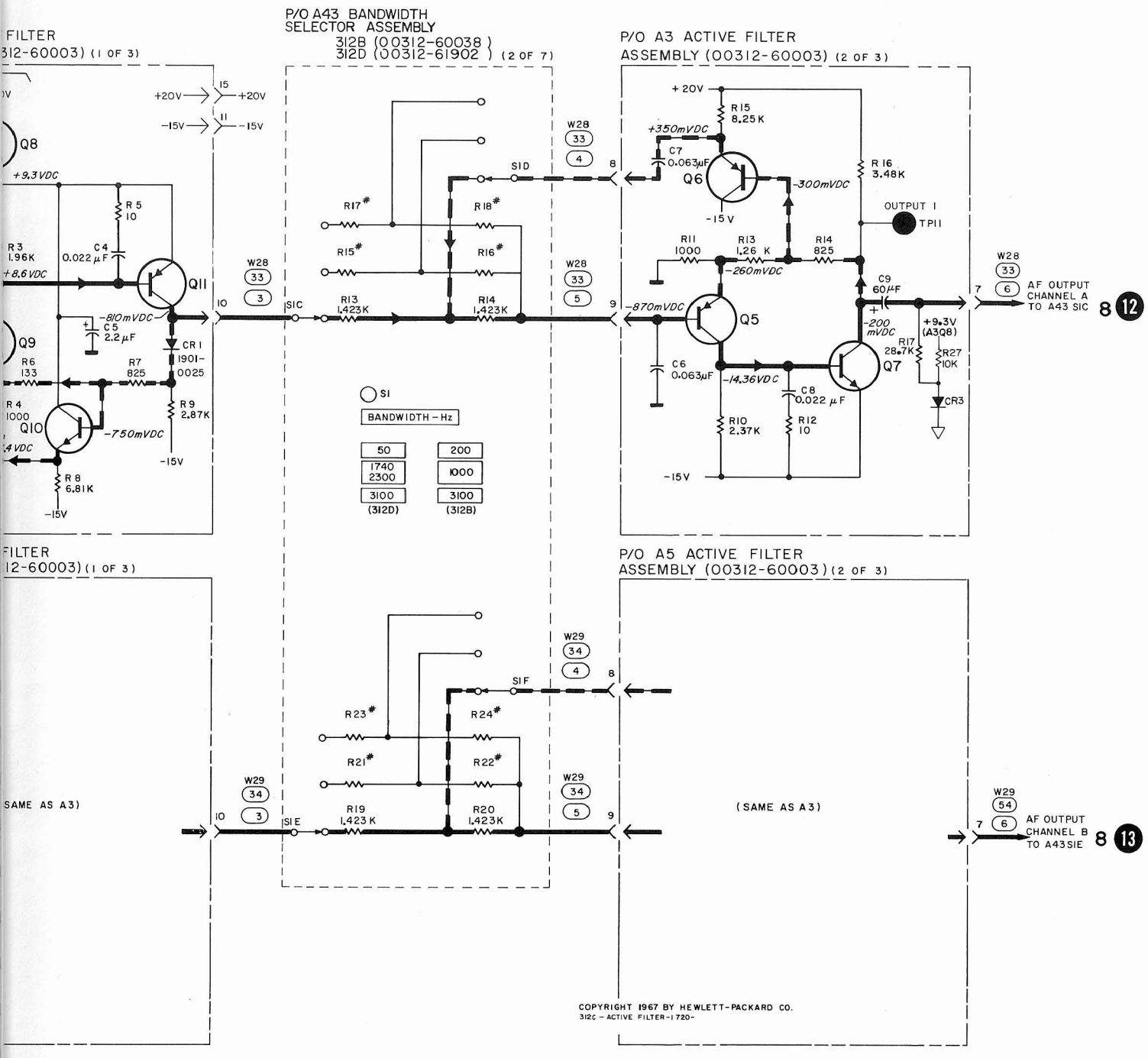
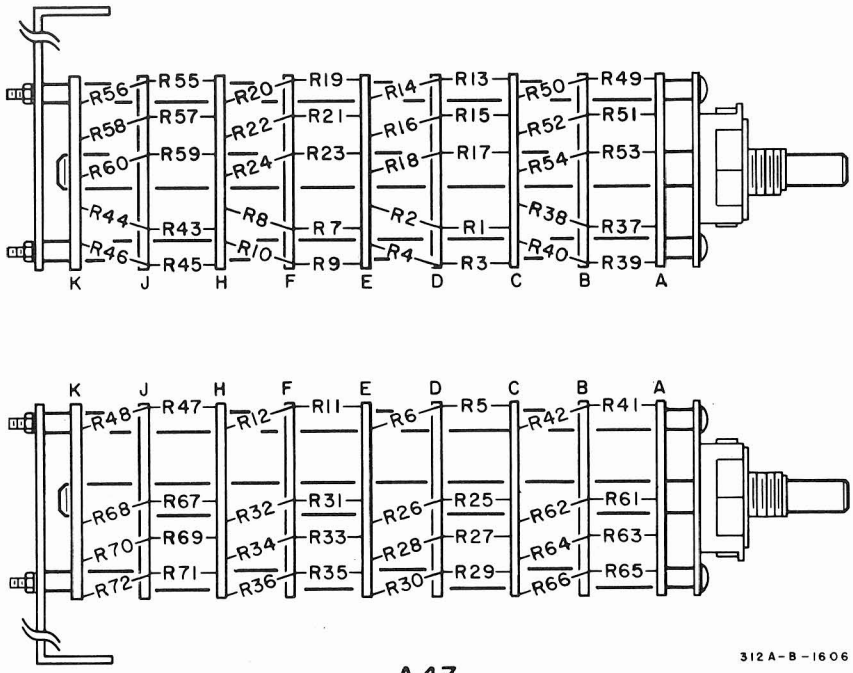


Figure 7-10. Bandwidth Selector and Active Filter.

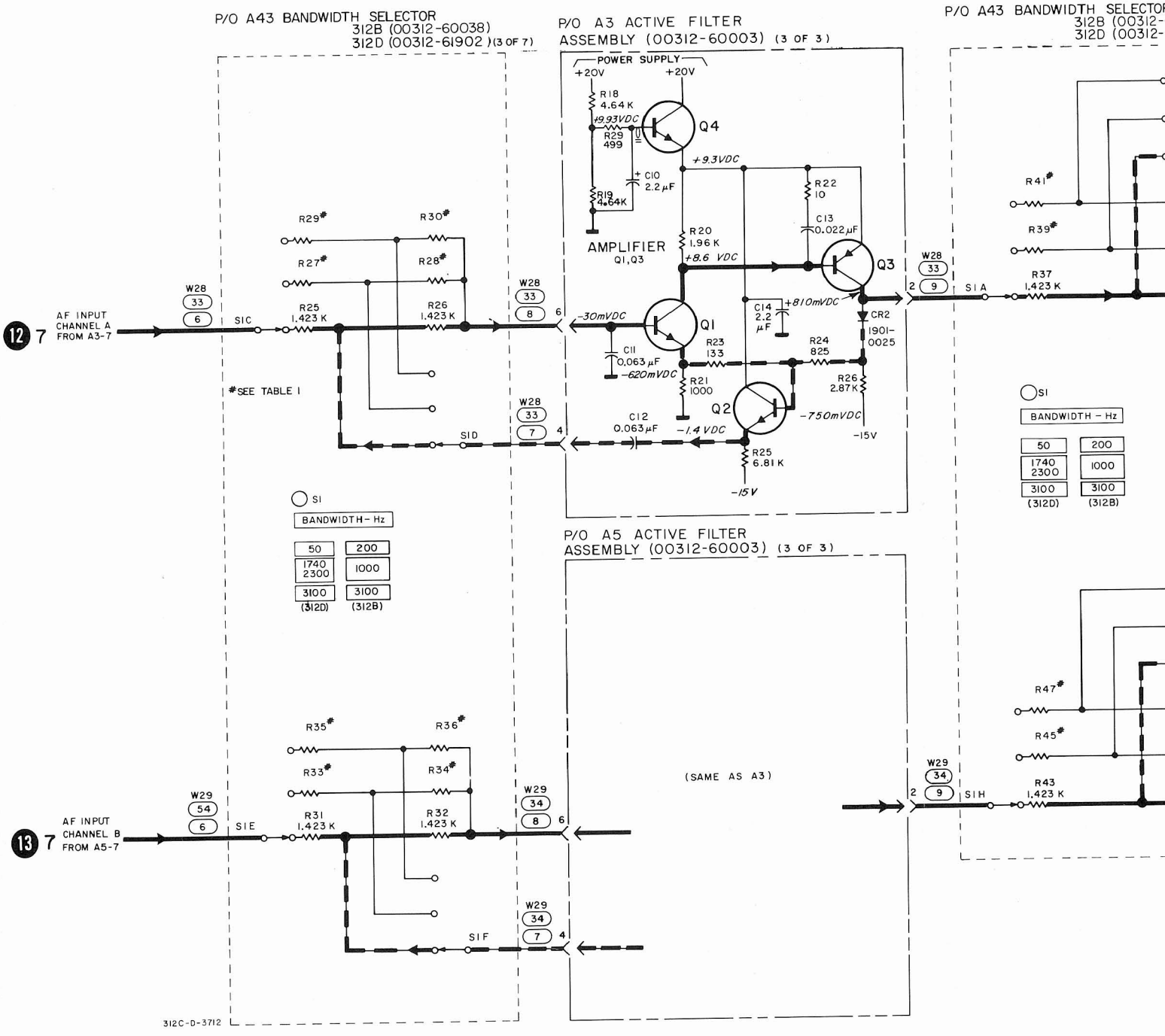


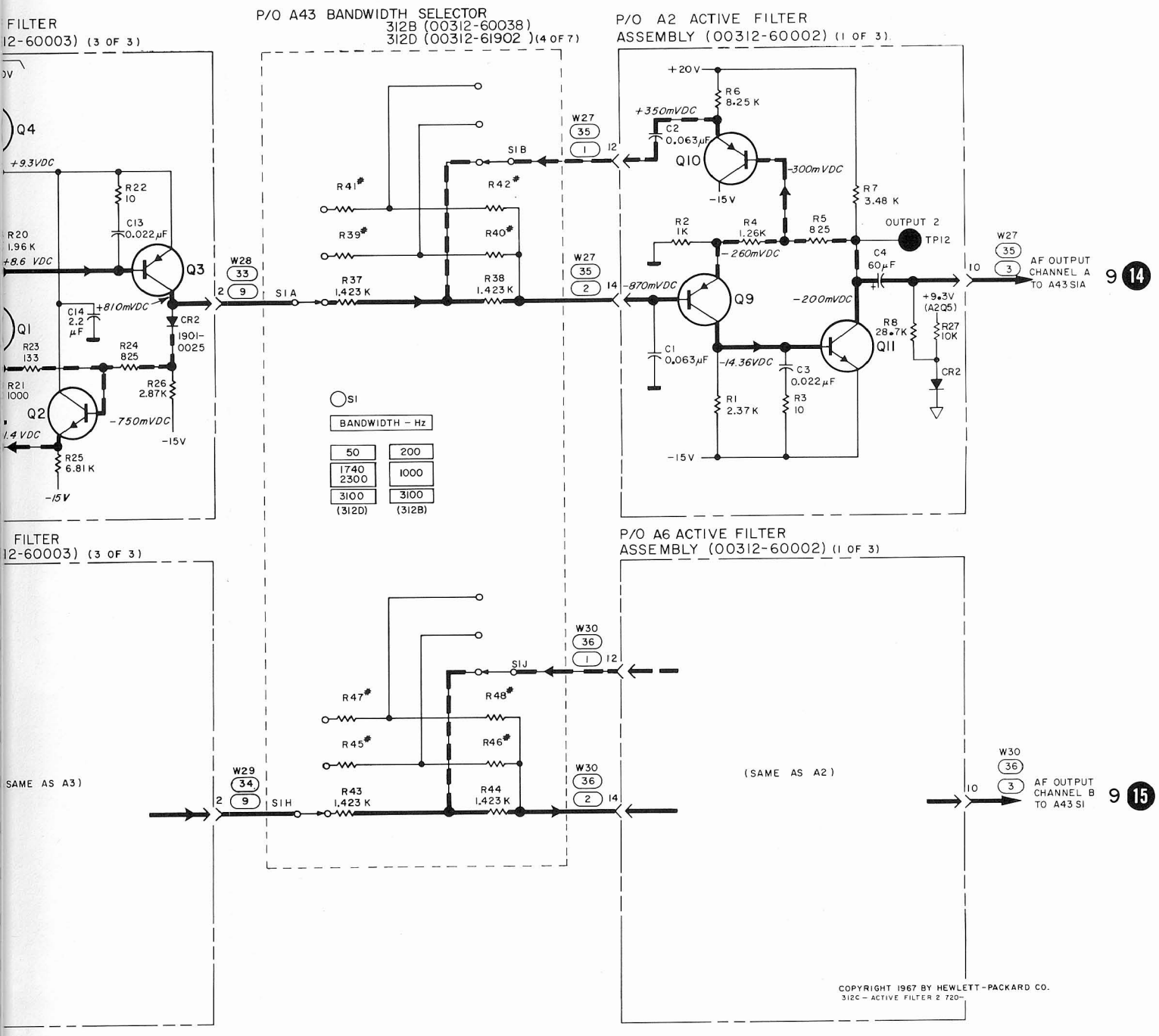
A43
BANDWIDTH
SELECTOR SWITCH
hp Part No. 00312-61902

Table 1.

R Designator	R Value in 312B	R Value in 312D
3, 4, 9, 10, 15, 16, 21, 22, 27, 28, 33, 34, 39, 40, 45, 46, 51, 52, 57, 58, 63	4.27 K (1000 Hz Bandwidth)	1.87 K (1740 / 2300 Hz Bandwidth)
5, 6, 11, 12, 17, 18, 23, 24, 29, 30, 35, 36, 41, 42, 44, 48, 53, 54, 59, 60	21.35 K (200 Hz Bandwidth)	84.5 K (50 Hz Bandwidth)

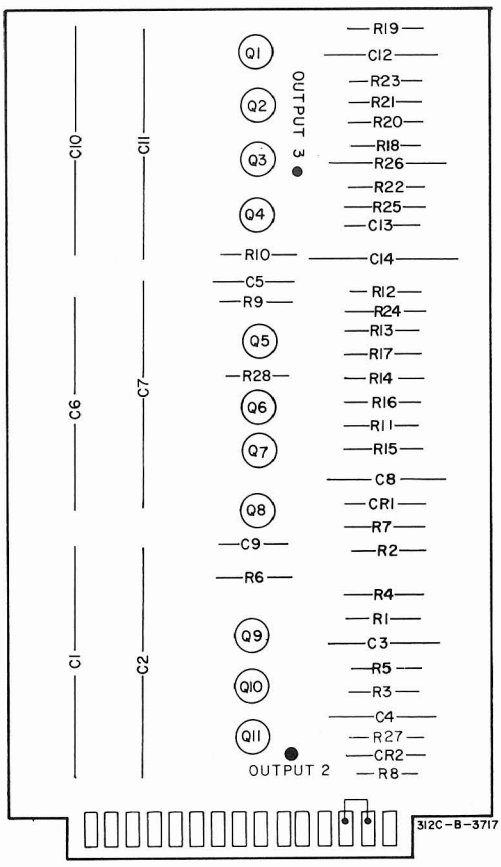
3100 Hz Bandwidth same for both instruments.





8

Figure 7-11. Active Filter and Bandwidth Selector.



A2–A6

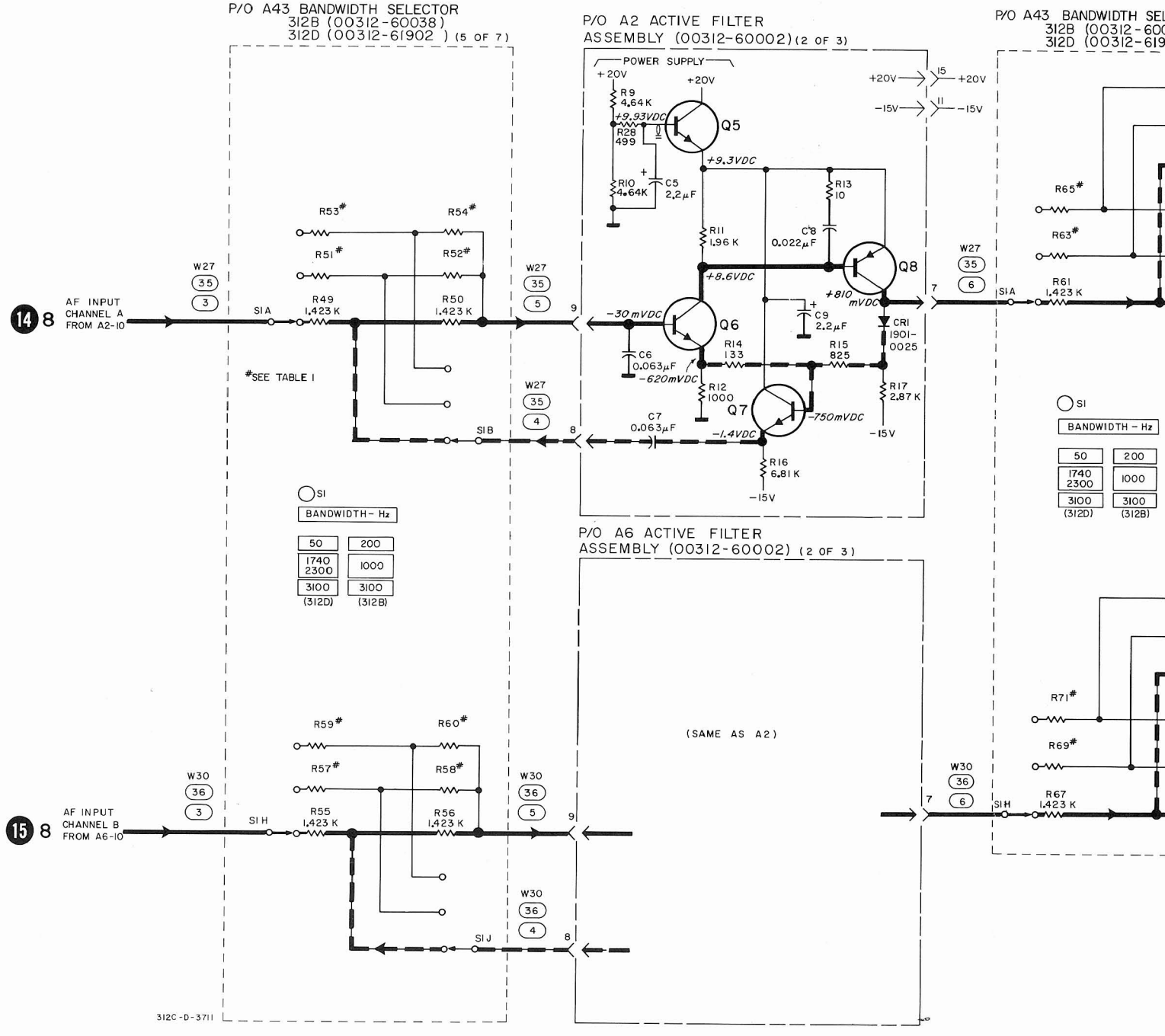
hp Part No 00312–60002

Rev C

Table 1.

R Designator	R Value in 312B	R Value in 312D
3, 4, 9, 10, 15, 16, 21, 22, 27, 28, 33, 34, 39, 40, 45, 46, 51, 52, 57, 58, 63	4.27 K (1000 Hz Bandwidth)	1.87 K ($\begin{matrix}1740\\2300\end{matrix}$ Hz Bandwidth)
5, 6, 11, 12, 17, 18, 23, 24, 29, 30, 35, 36, 41, 42, 44, 48, 53, 54, 59, 60	21.35 K (200 Hz Bandwidth)	84.5 K (50 Hz Bandwidth)

3100 Hz Bandwidth same for both instruments.



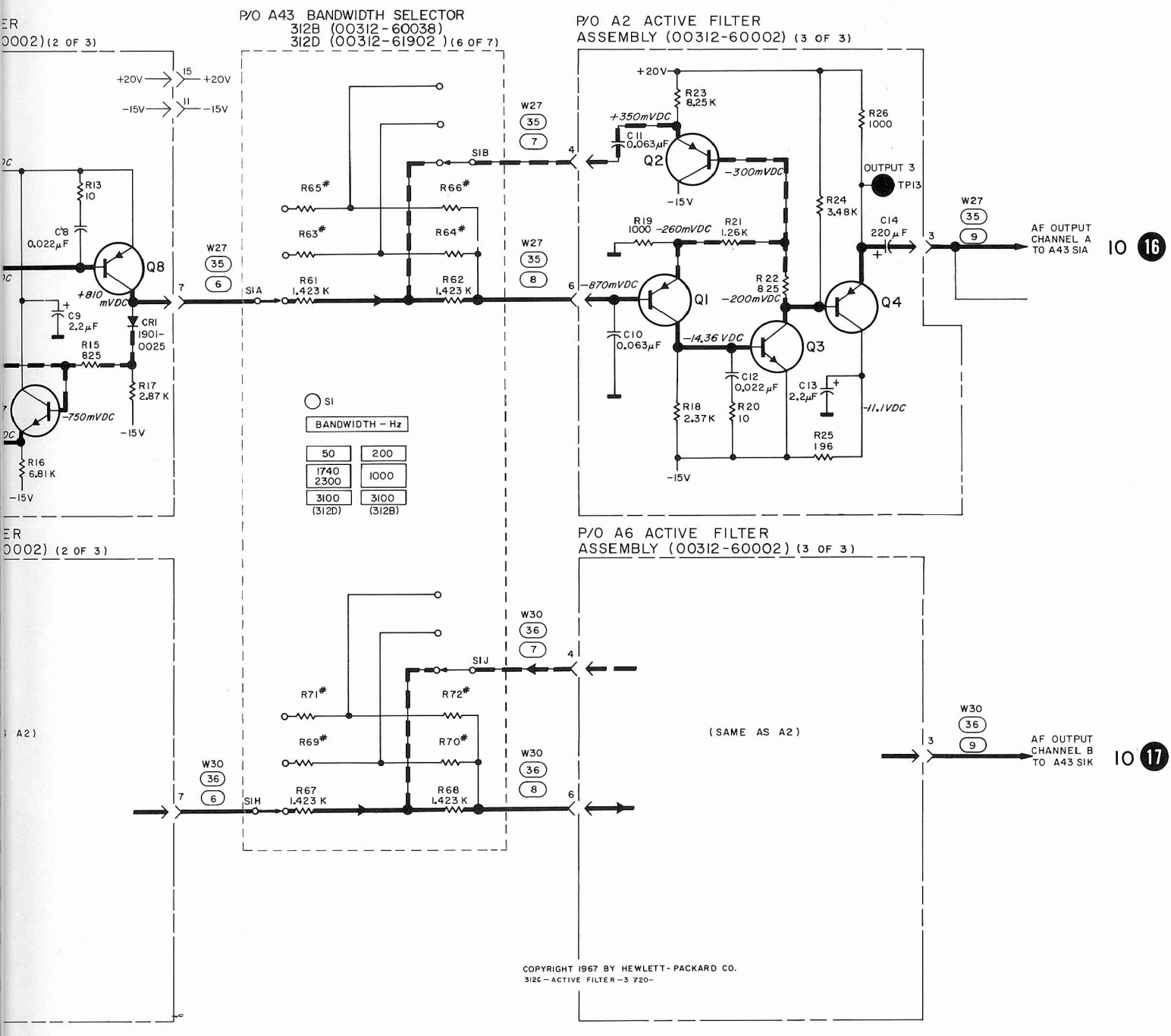
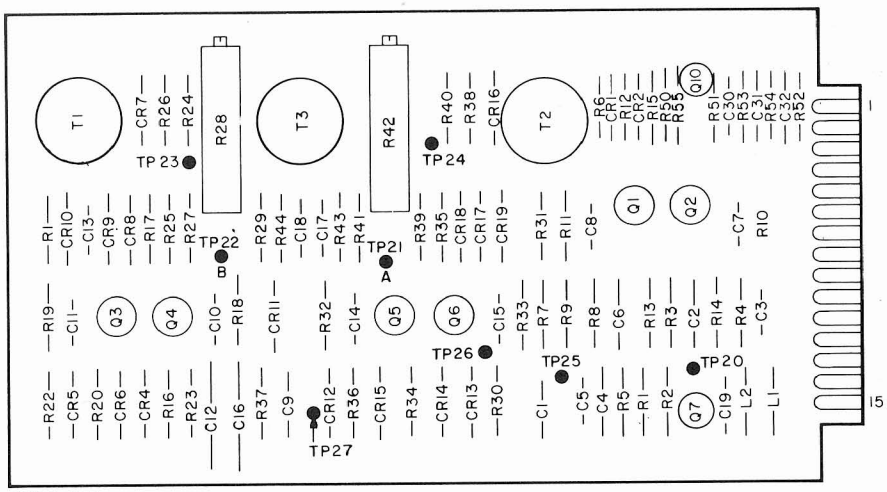
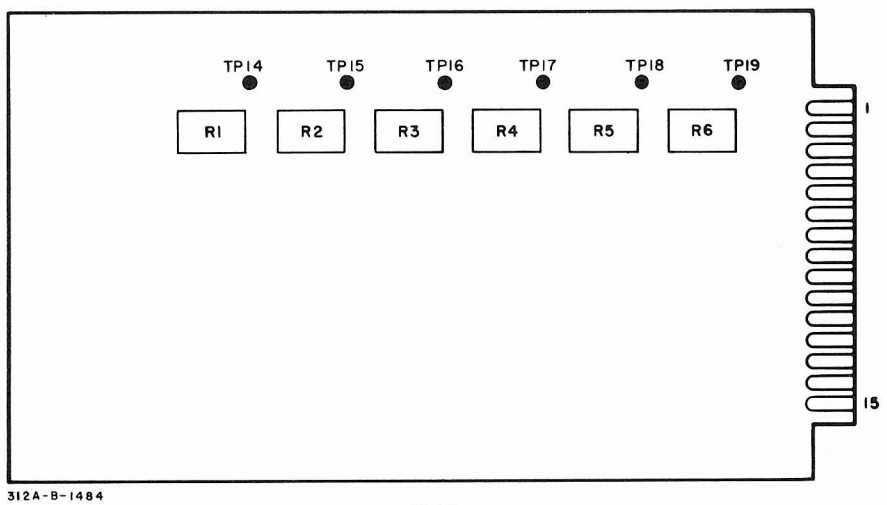


Figure 7-12. Active Filter and Bandwidth Selector.



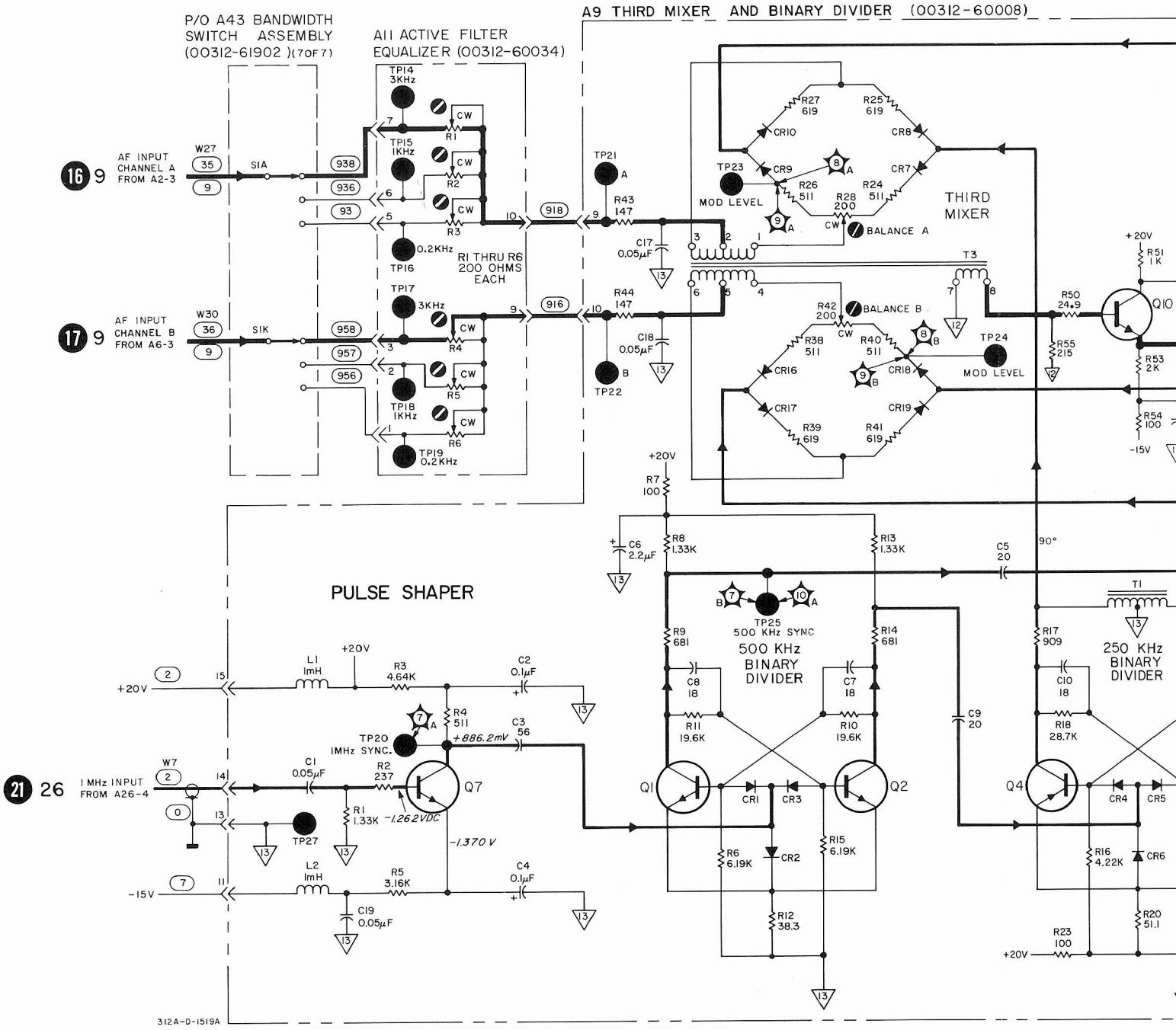
A9

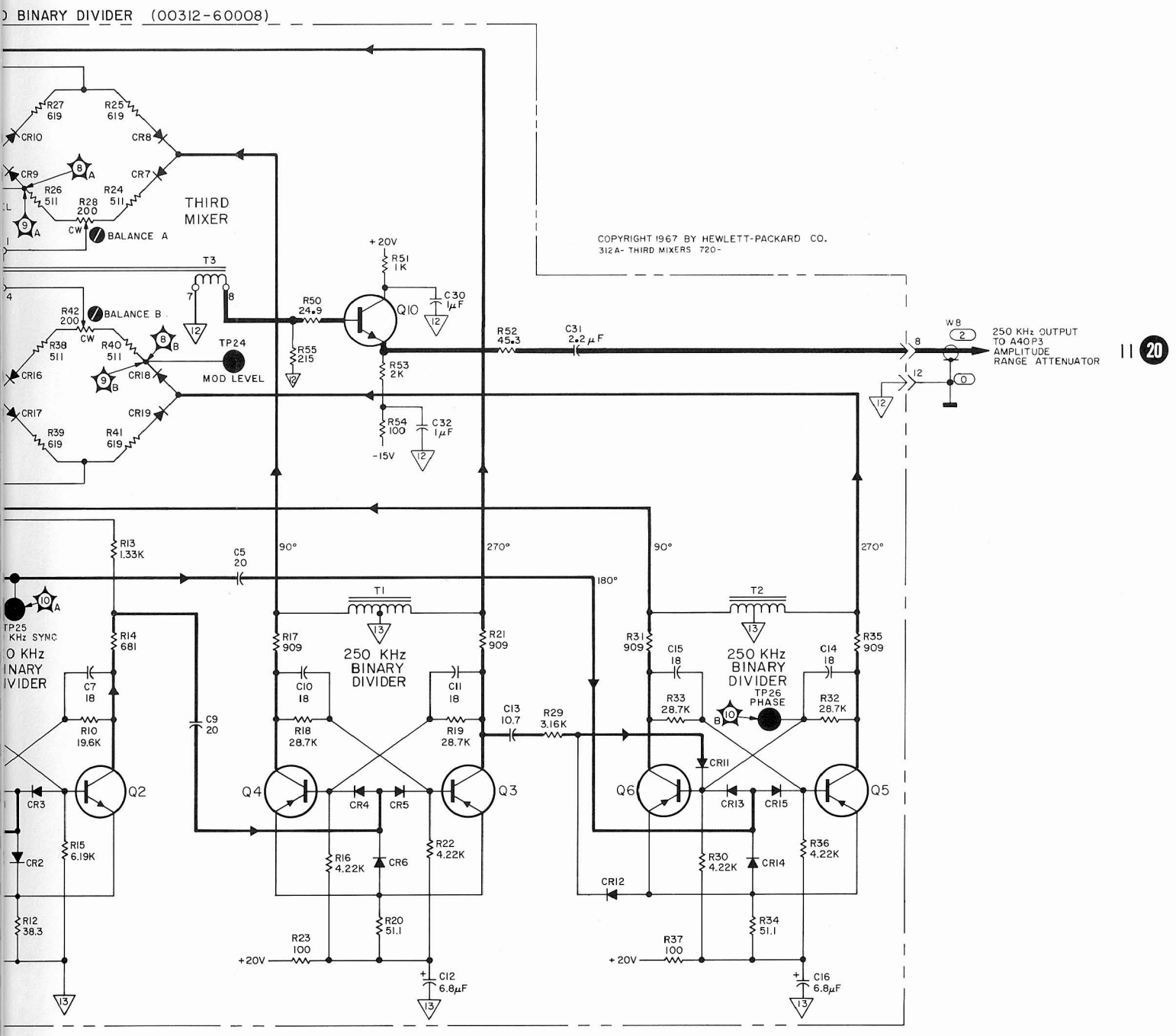
hp Part No. 00312-60008



A11

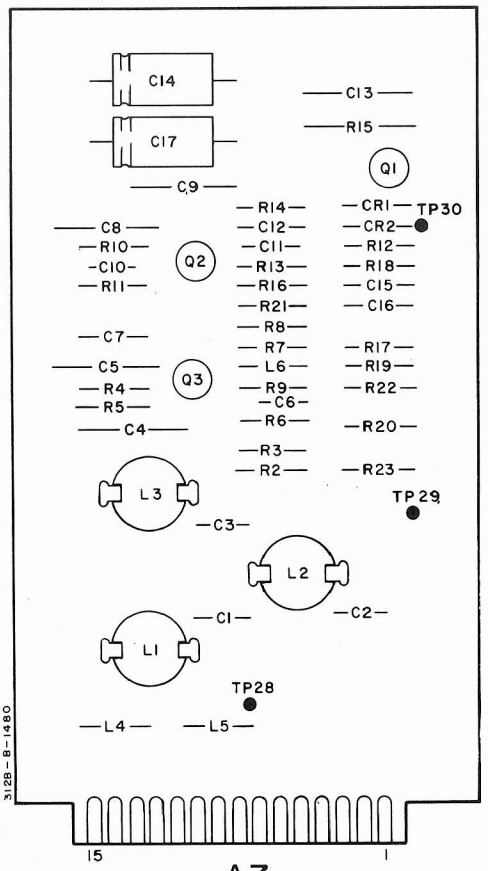
hp Part No. 00312-60034



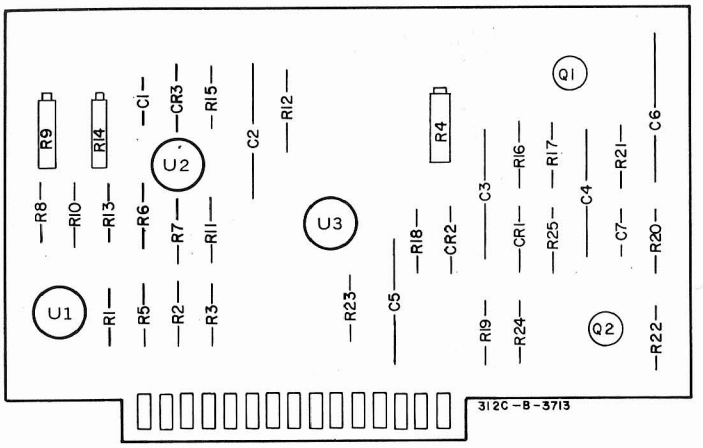


10

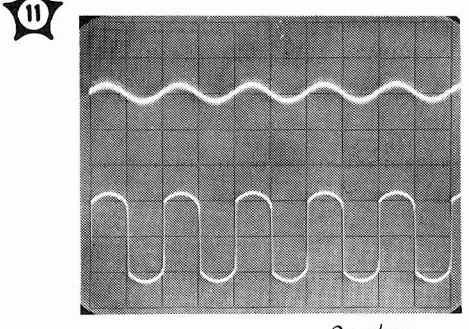
Figure 7-13. Active Filter Equalizer and Third Mixer/Dividers.



A7
hp Part No. 00312-60005
Rev C



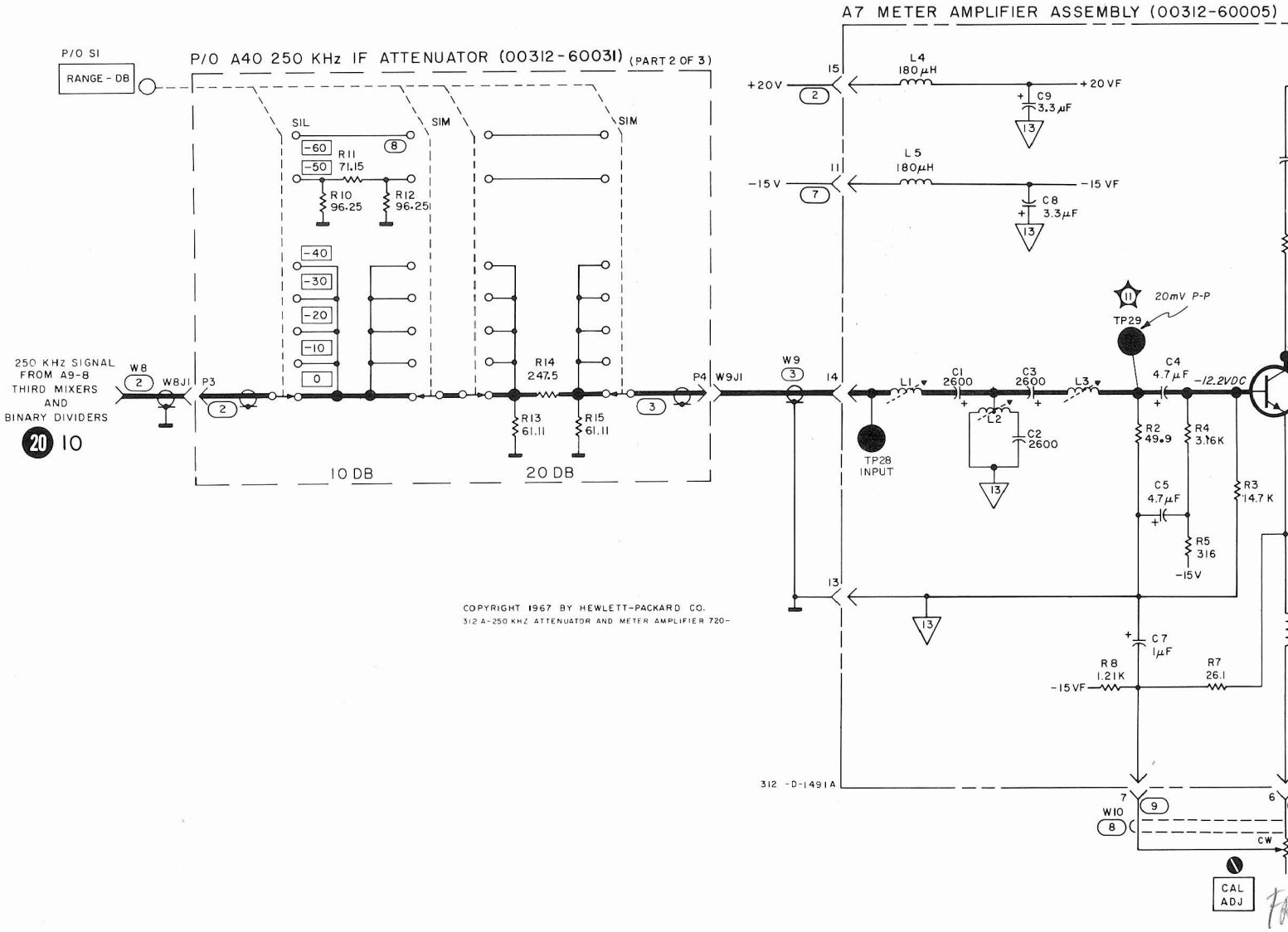
A101
hp Part No 00312-66501
Rev A



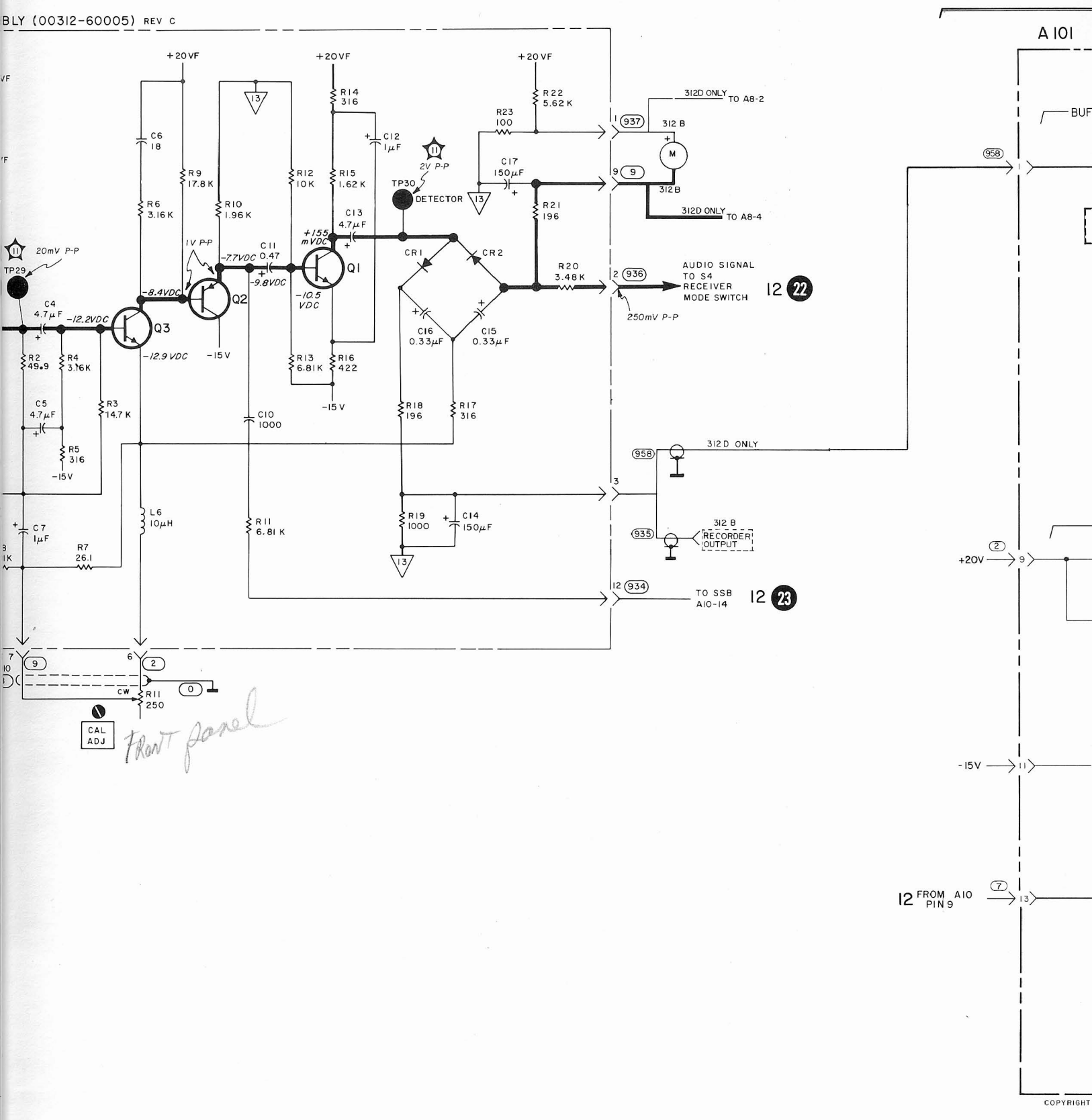
A 50 mV/cm

B 1 V/cm

2 μs/cm



312 A-250 KHZ ATTENUATOR AND METER AMPLIFIER 720-



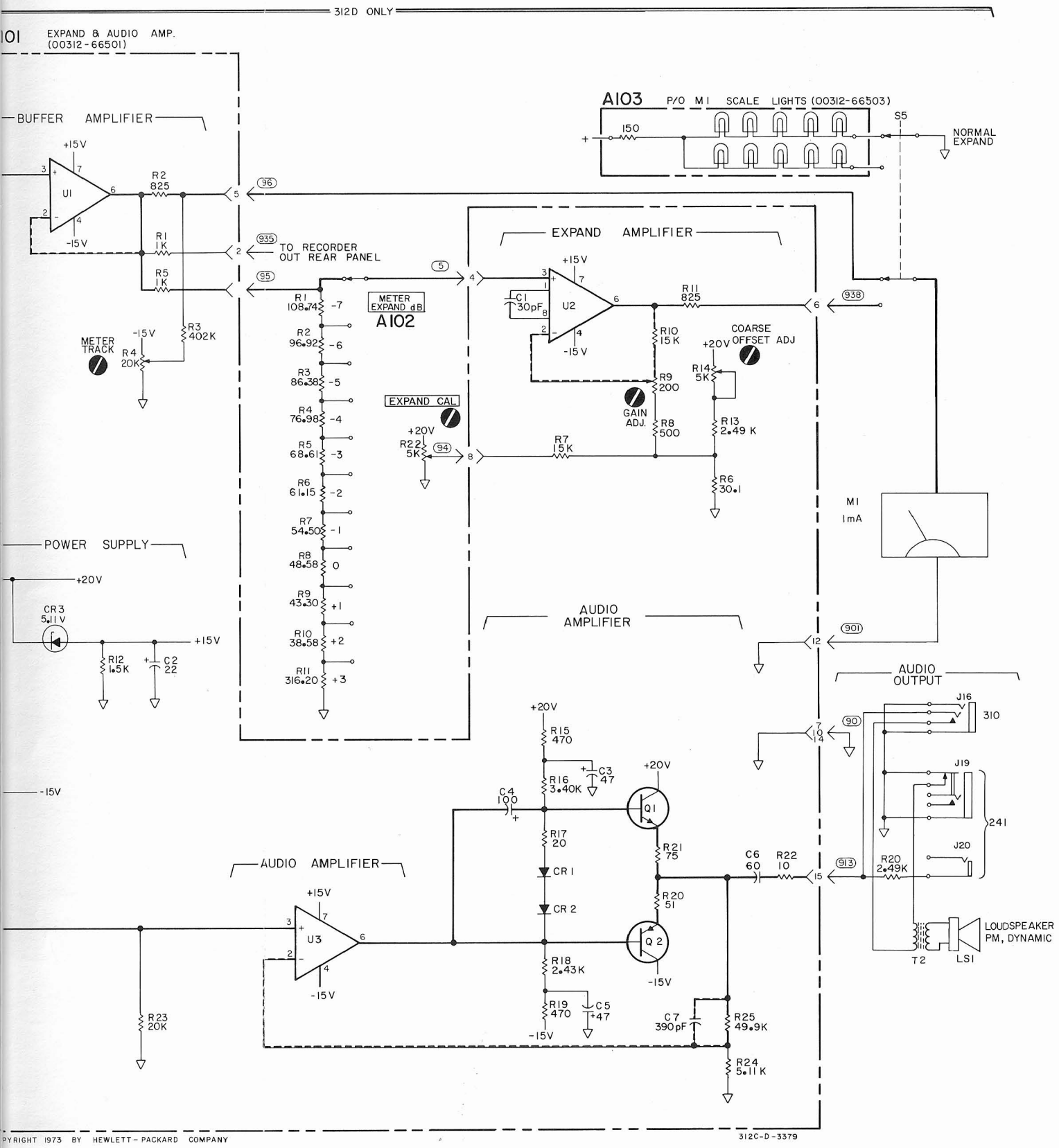
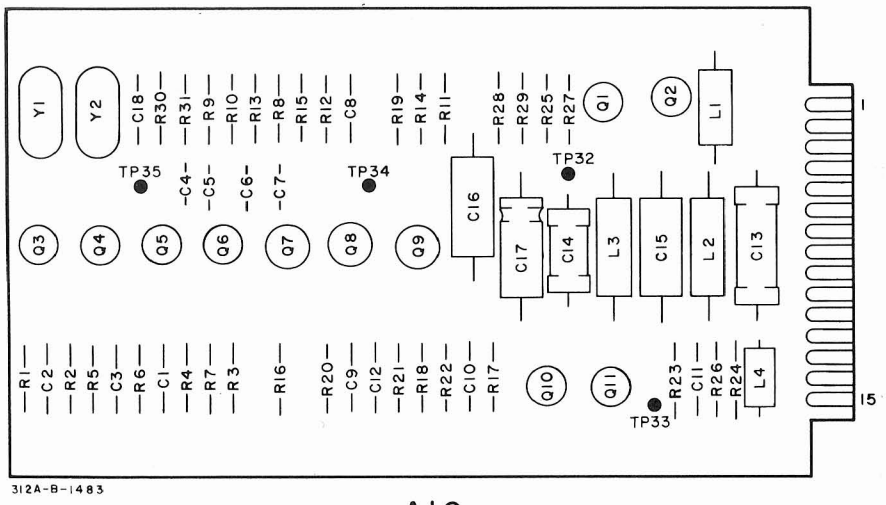
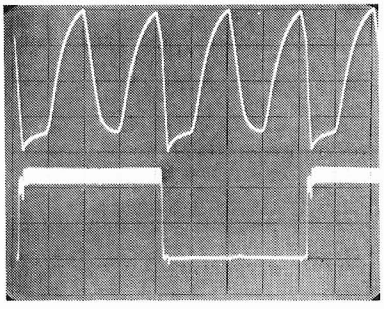


Figure 7-14. 250 kHz Attenuator and Meter Amplifier.



A10
hp Part No. 00312-60009

12

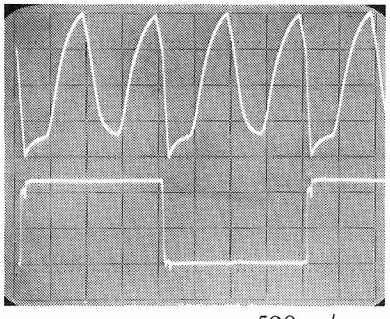


A 2 V/cm

B 200 mV/cm

500 ns/cm
(0 dBm signal)

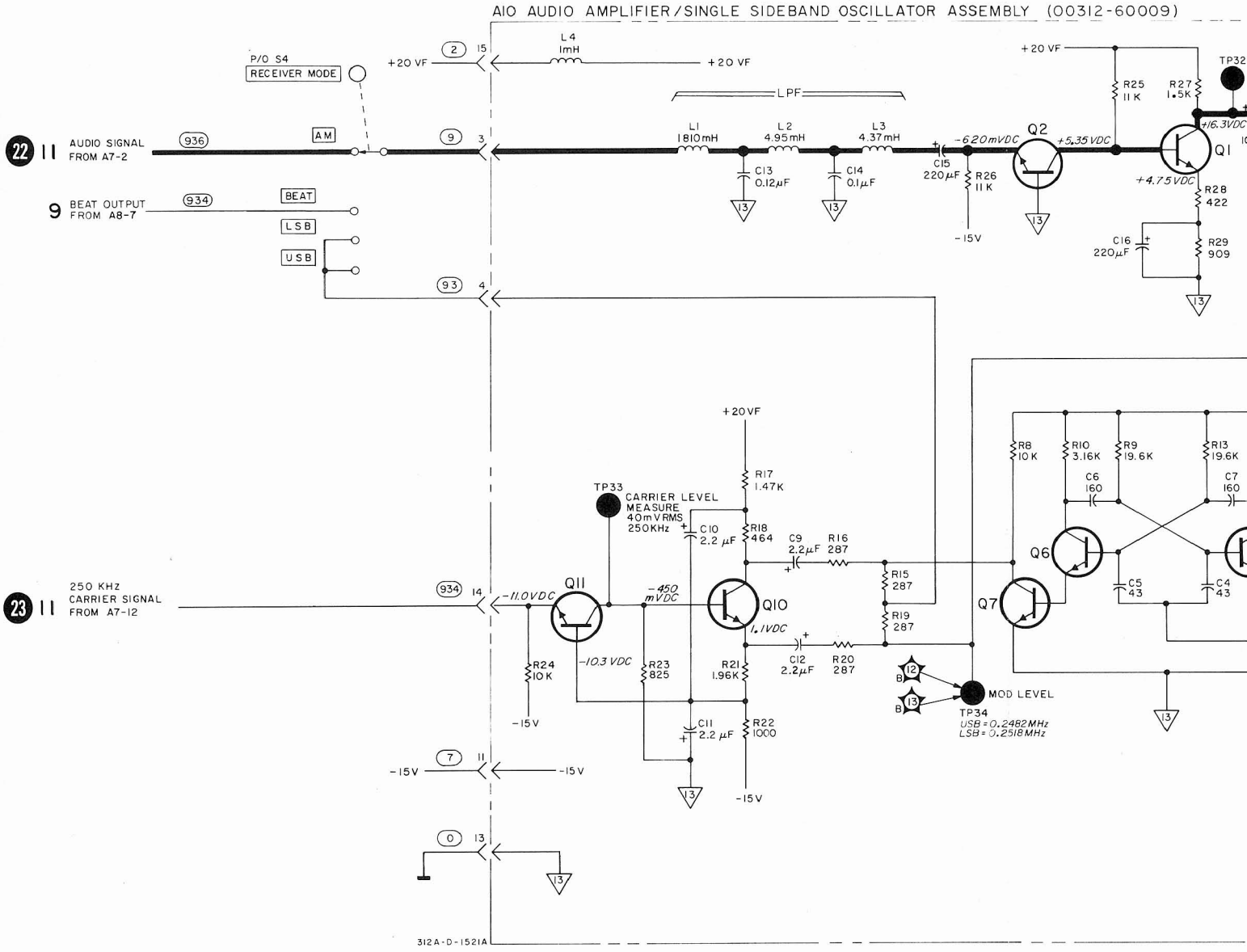
13



A 2 V/cm

B 200 mV/cm

500 ns/cm
(No signal)



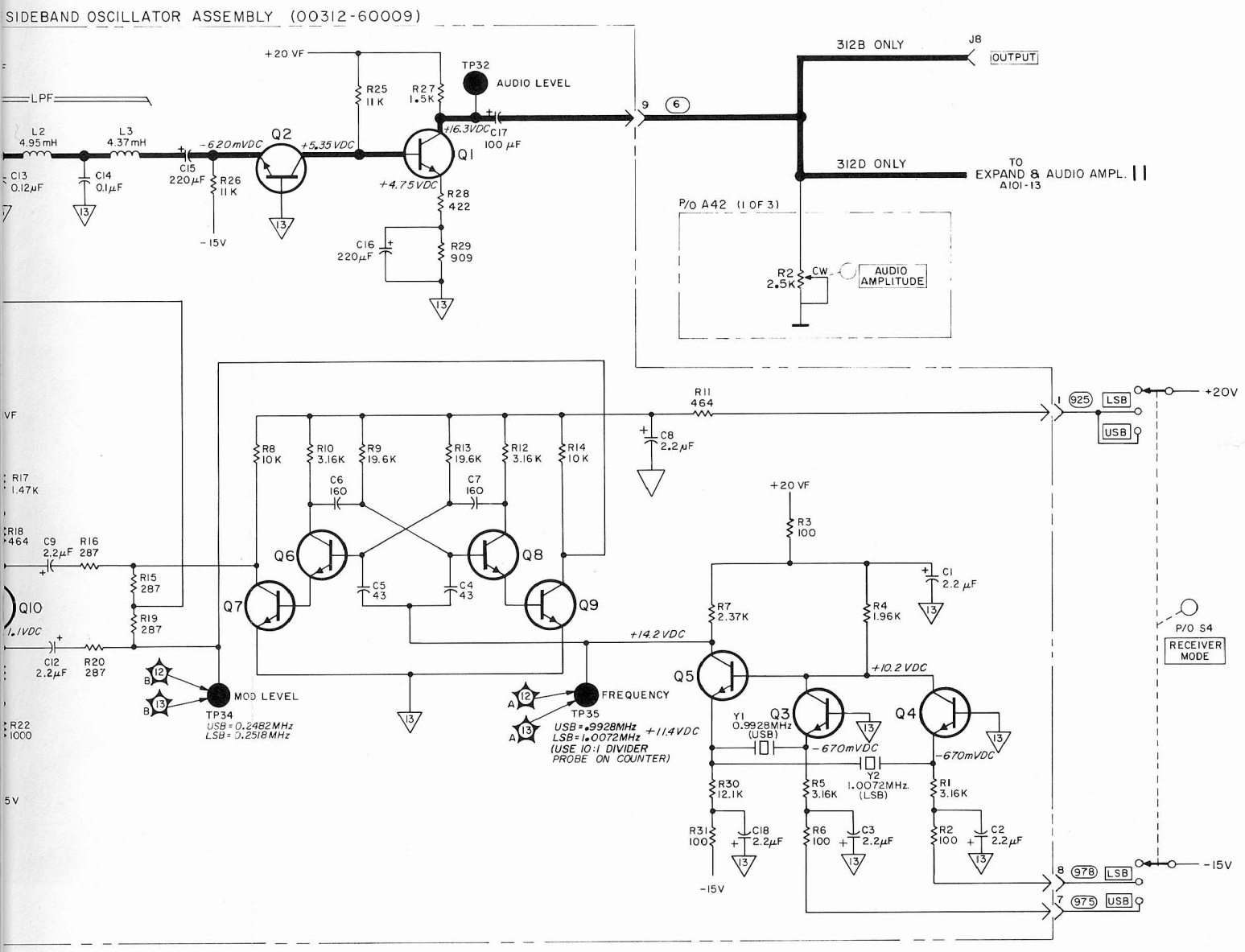
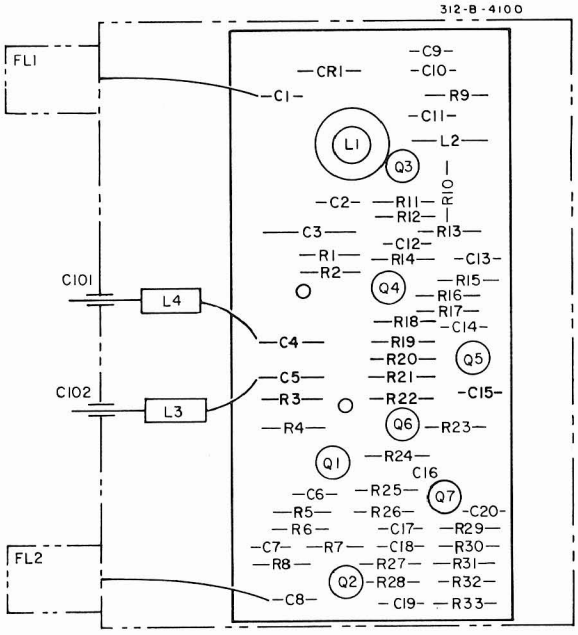
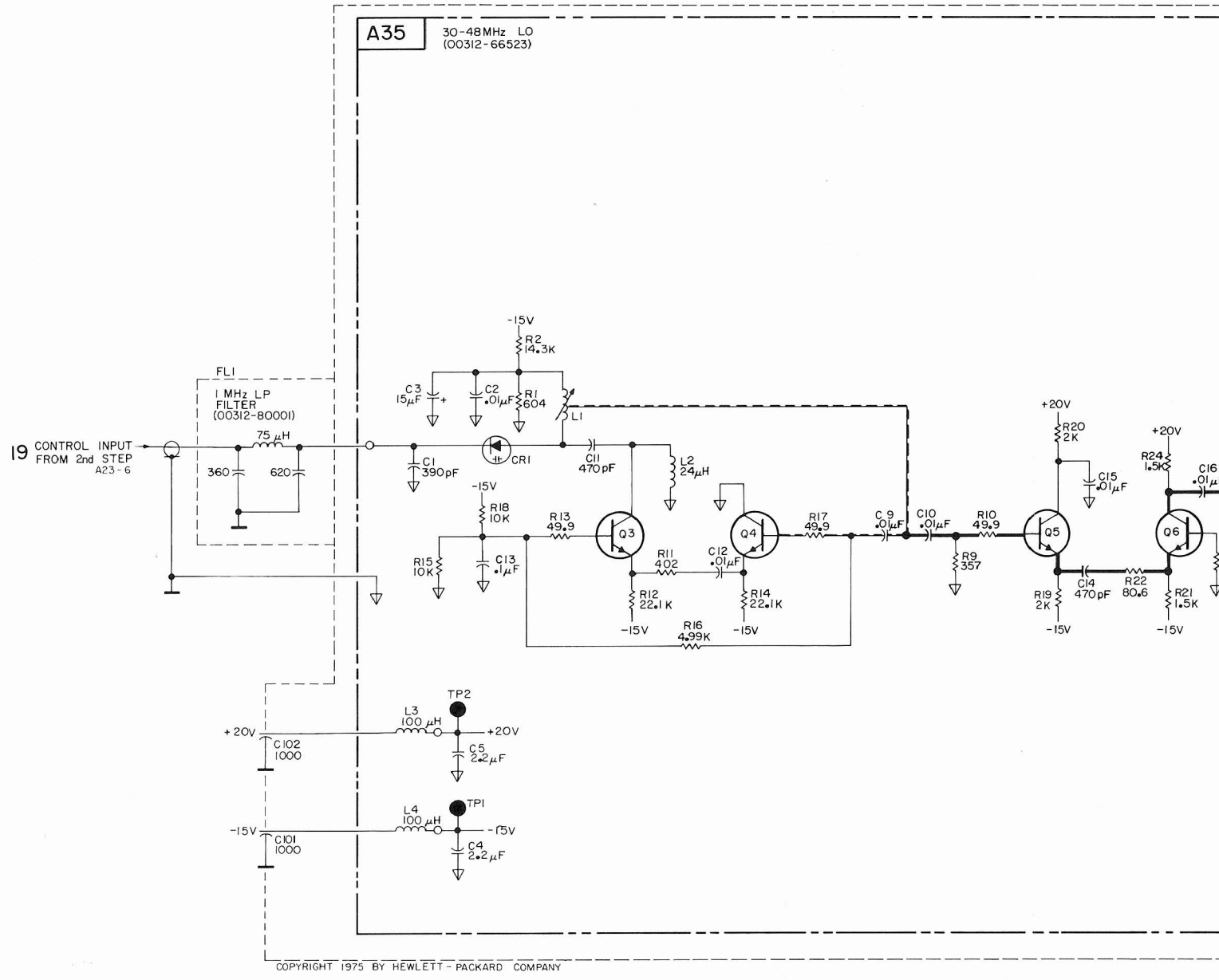


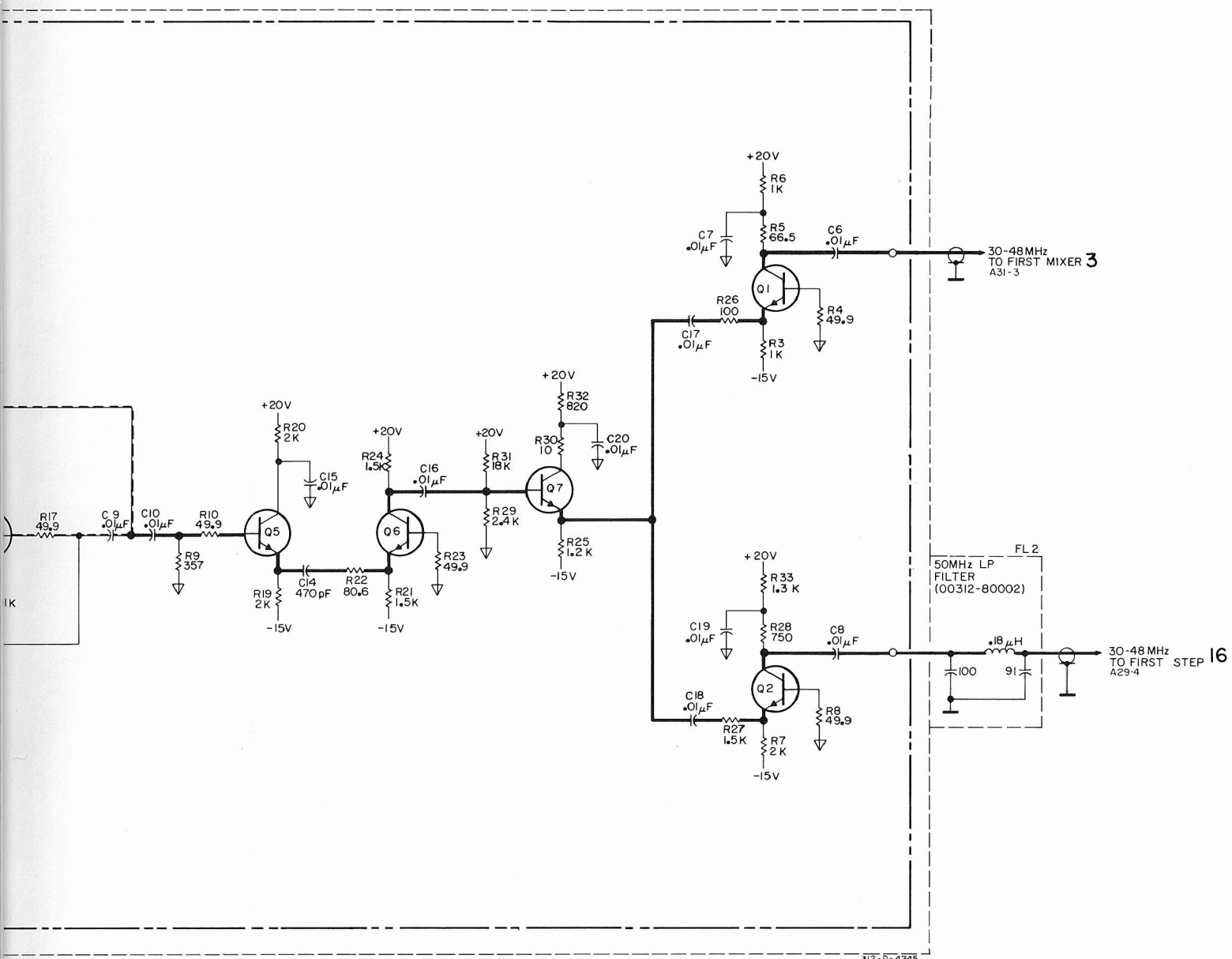
Figure 7-15. Audio Amplifier and Single Sideband Oscillator.



A35

hp Part No. 00312-66523





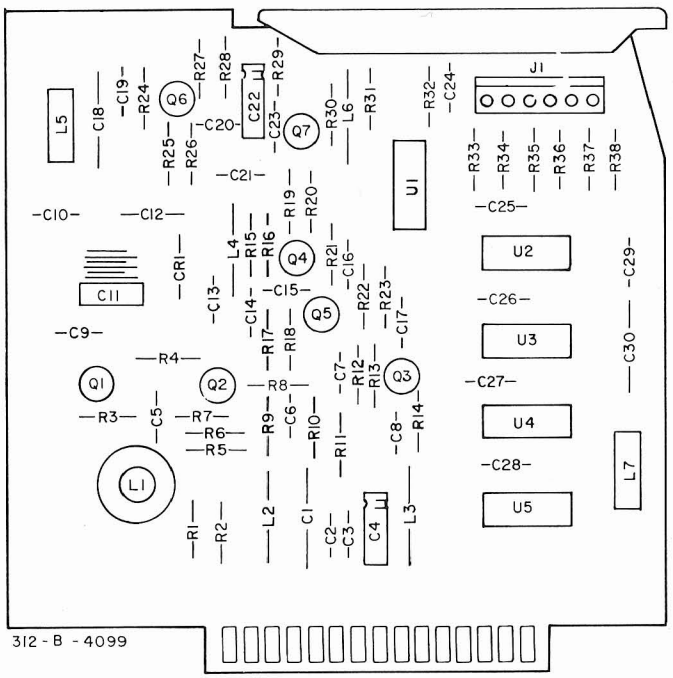
13

Figure 7-16. First Local Oscillator.

Freq Range Setting	Step Lock Freq	1's Digit D C B A	10's Digit D C B A
0	28	0 0 0 1	0 1 1 1
1	29	0 0 0 0	0 1 1 1
2	30	1 0 0 1	0 1 1 0
3	31	1 0 0 0	0 1 1 0
4	32	0 1 1 1	0 1 1 0
5	33	0 1 1 0	0 1 1 0
6	34	0 1 0 1	0 1 1 0
7	35	0 1 0 0	0 1 1 0
8	36	0 0 1 1	0 1 1 0
9	37	0 0 1 0	0 1 1 0
10	38	0 0 0 1	0 1 1 0
11	39	0 0 0 0	0 1 1 0
12	40	1 0 0 1	0 1 0 1
13	41	1 0 0 0	0 1 0 1
14	42	0 1 1 1	0 1 0 1
15	43	0 1 1 0	0 1 0 1
16	44	0 1 0 1	0 1 0 1
17	45	0 1 0 0	0 1 0 1

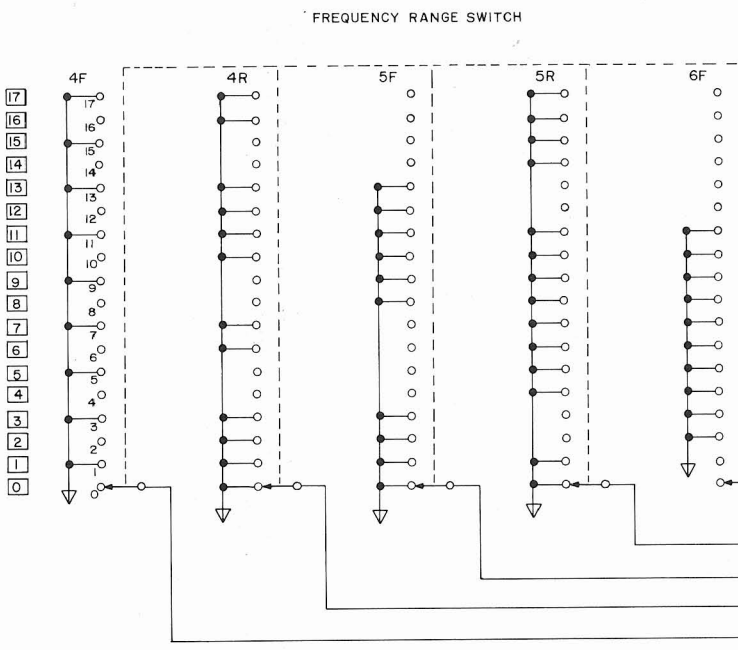
8 (GRY)
4 (YEL)
2 (RED)
1 (BRN)

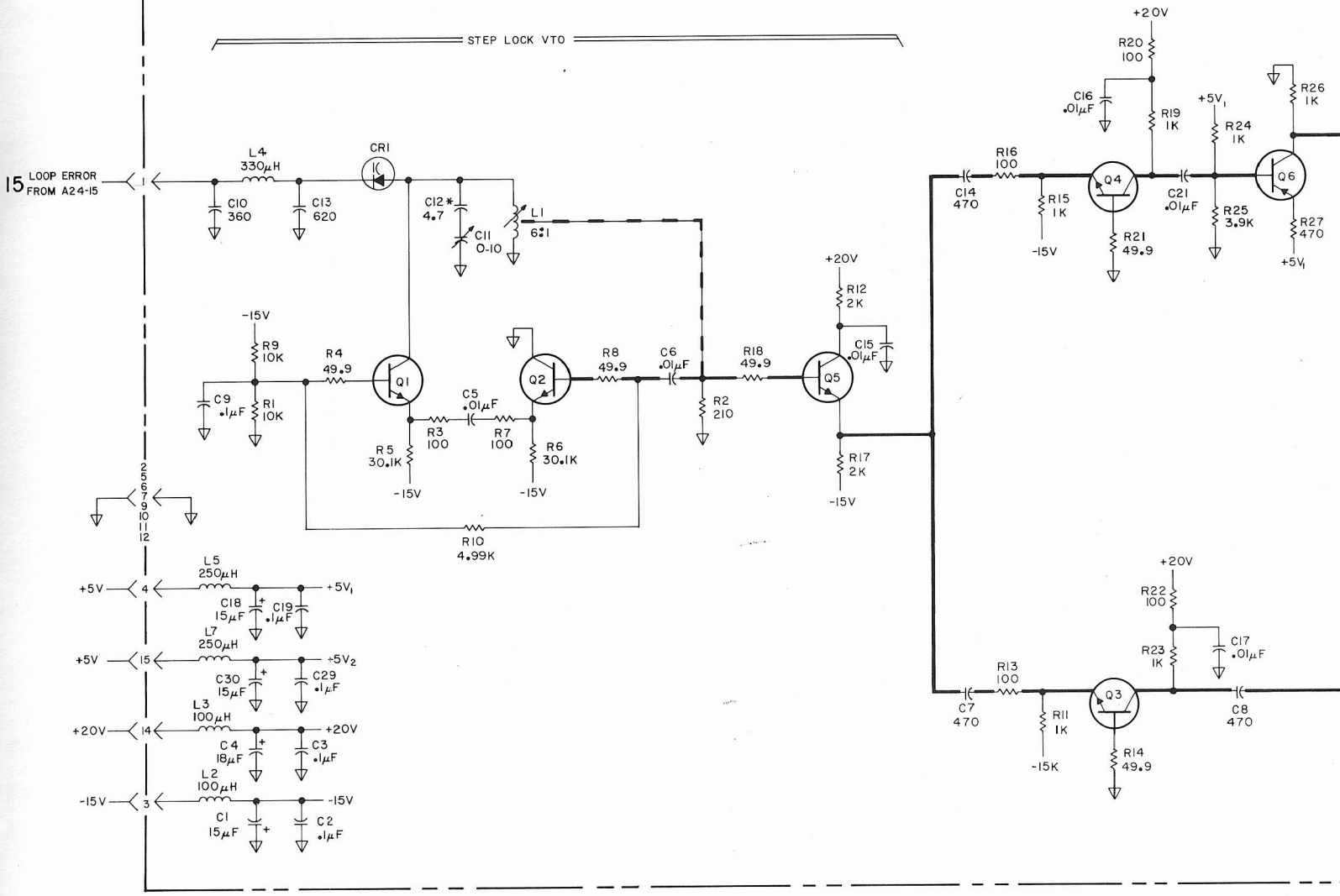
HARD WIRED
HARD WIRED
92 (WHT/RED)
91 (WHT/BRN)



A28
hp Part No. 00312-66520

A28 28-45 MHz VTO AND ÷N COUNTER 00312-66520





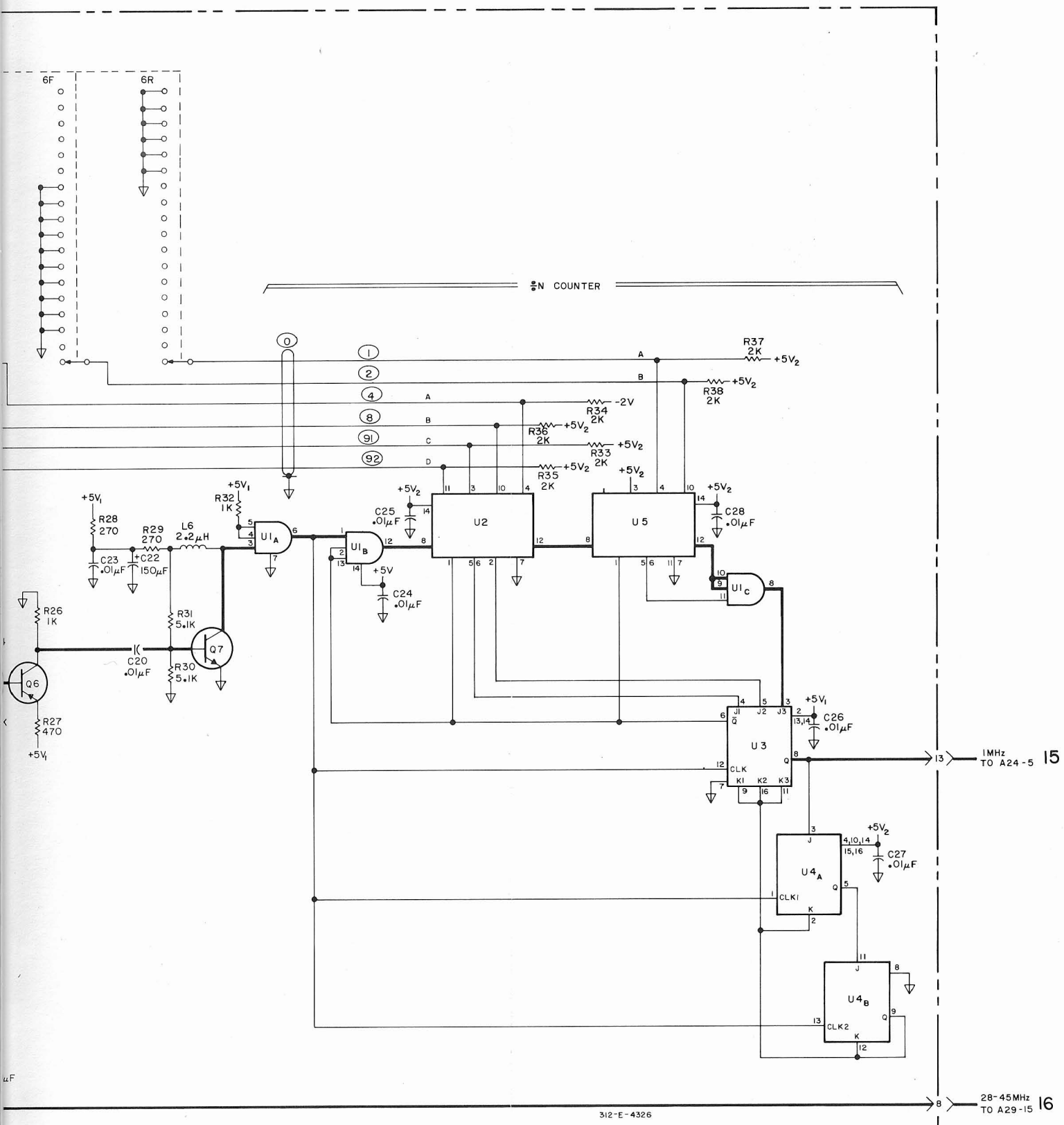
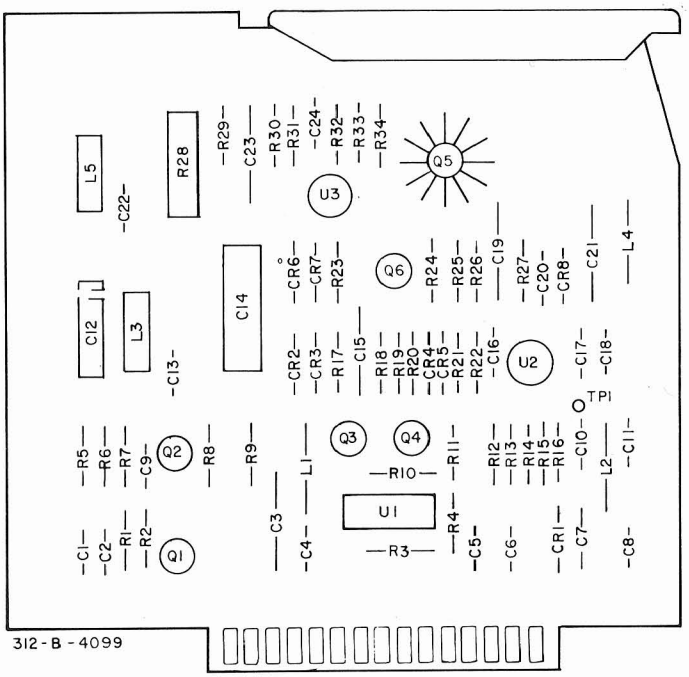
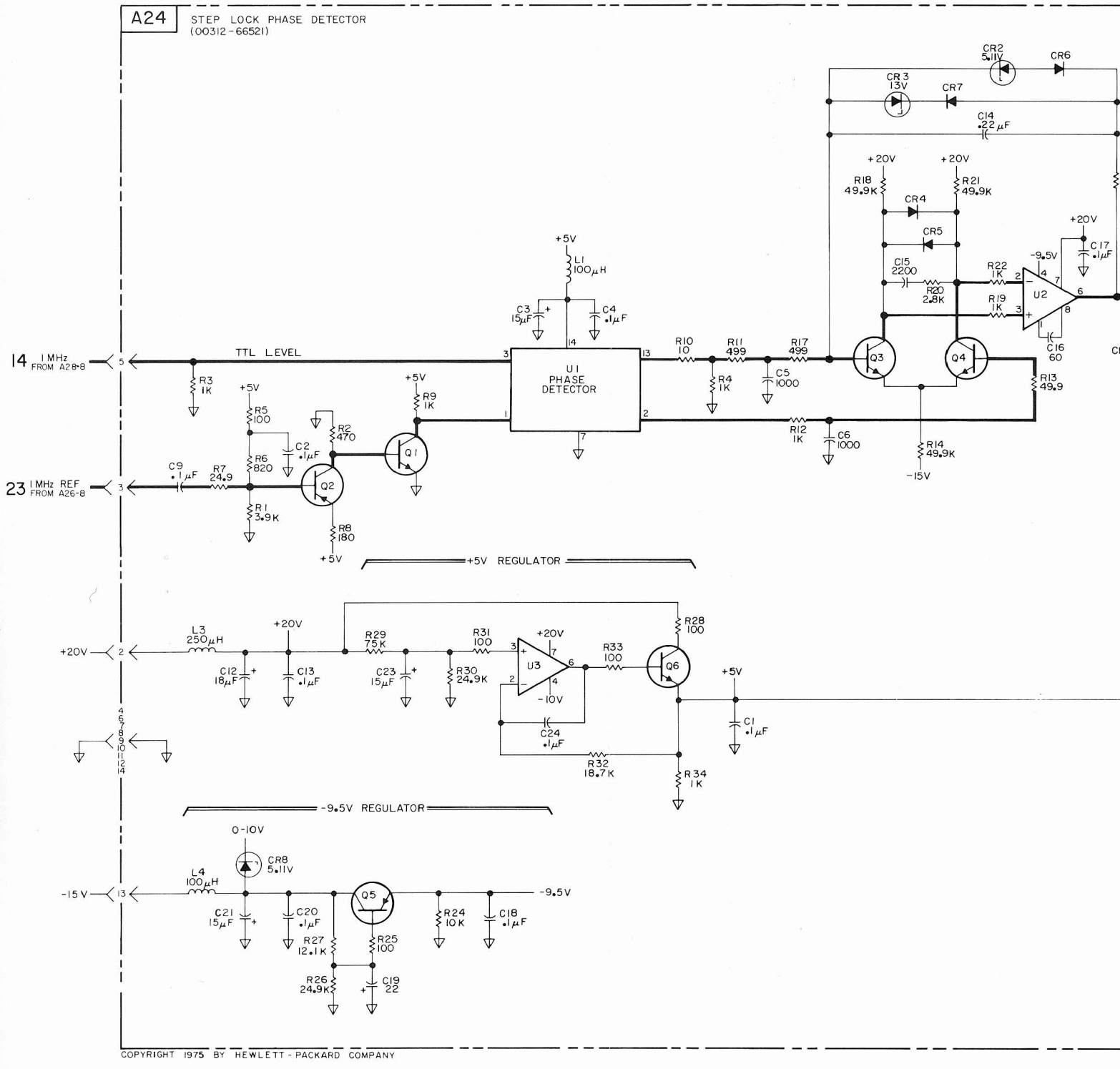
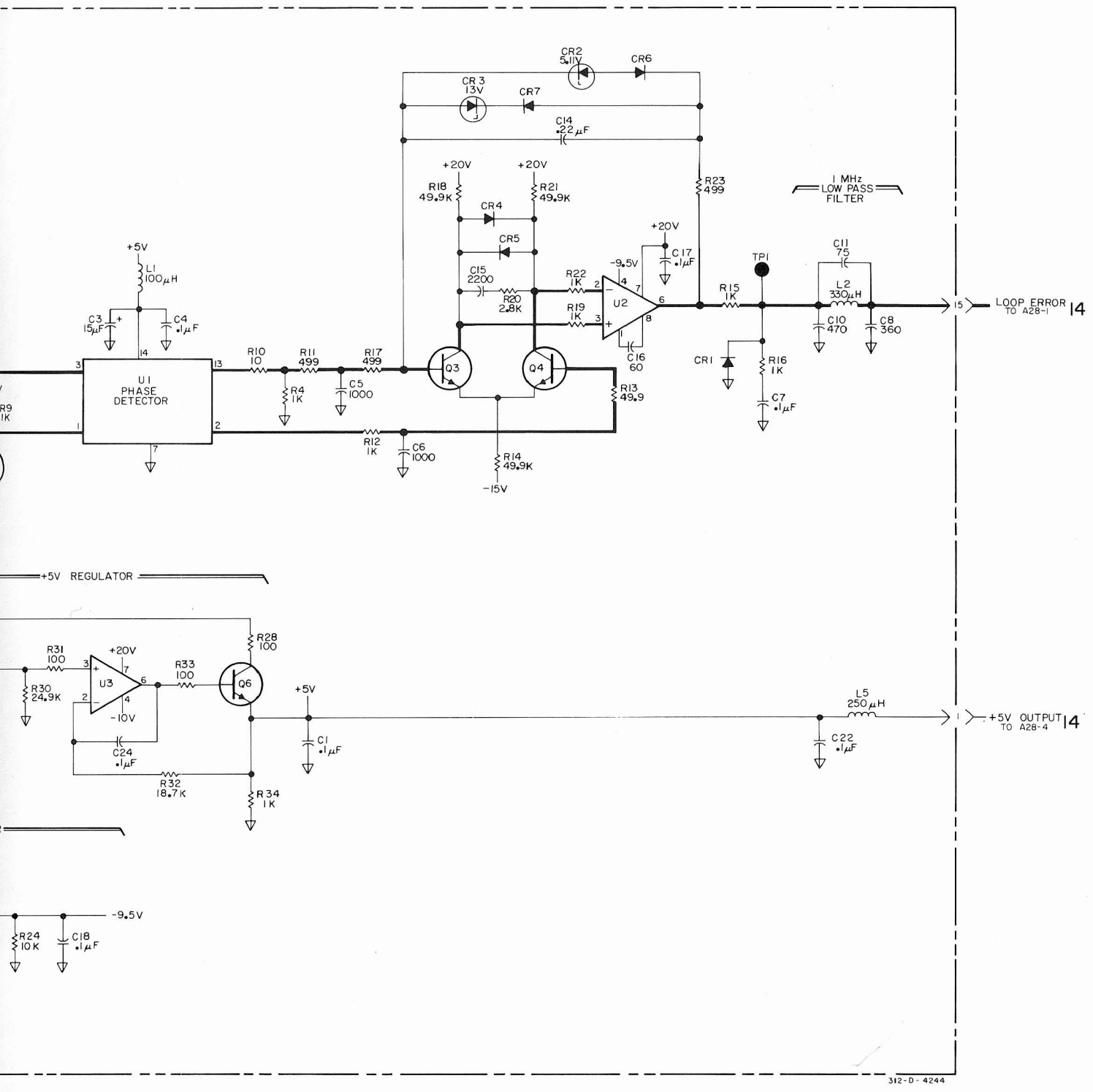


Figure 7-17. 28 – 45 MHz Oscillator and ÷N Counter.



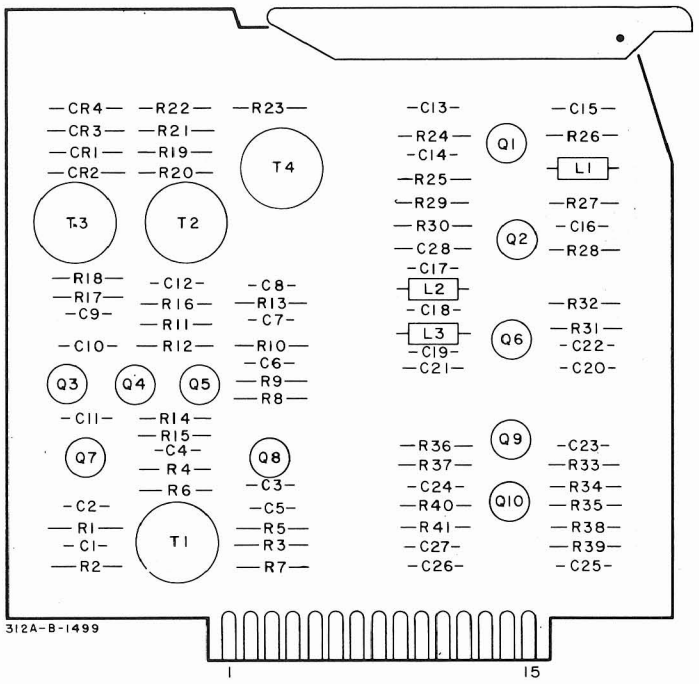
A24
hp Part No. 00312-66521





15

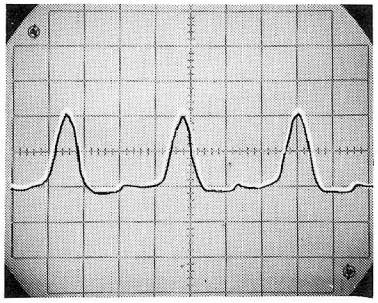
Figure 7-18. Step Lock Phase Detector.



A29

hp Part No. 00312-66519

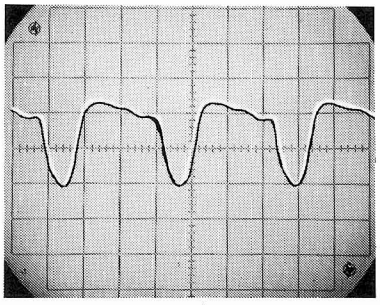
20



200 mV/cm

10 ns/cm
(A23 and A28 removed)

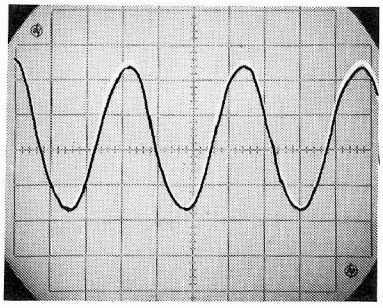
21



200 mV/cm

10 ns/cm
(A23 and A28 removed)

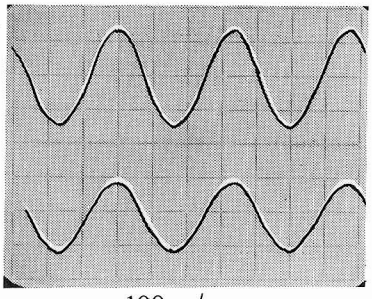
22



200 mV/cm

10 ns/cm
(A23 and A28 removed)

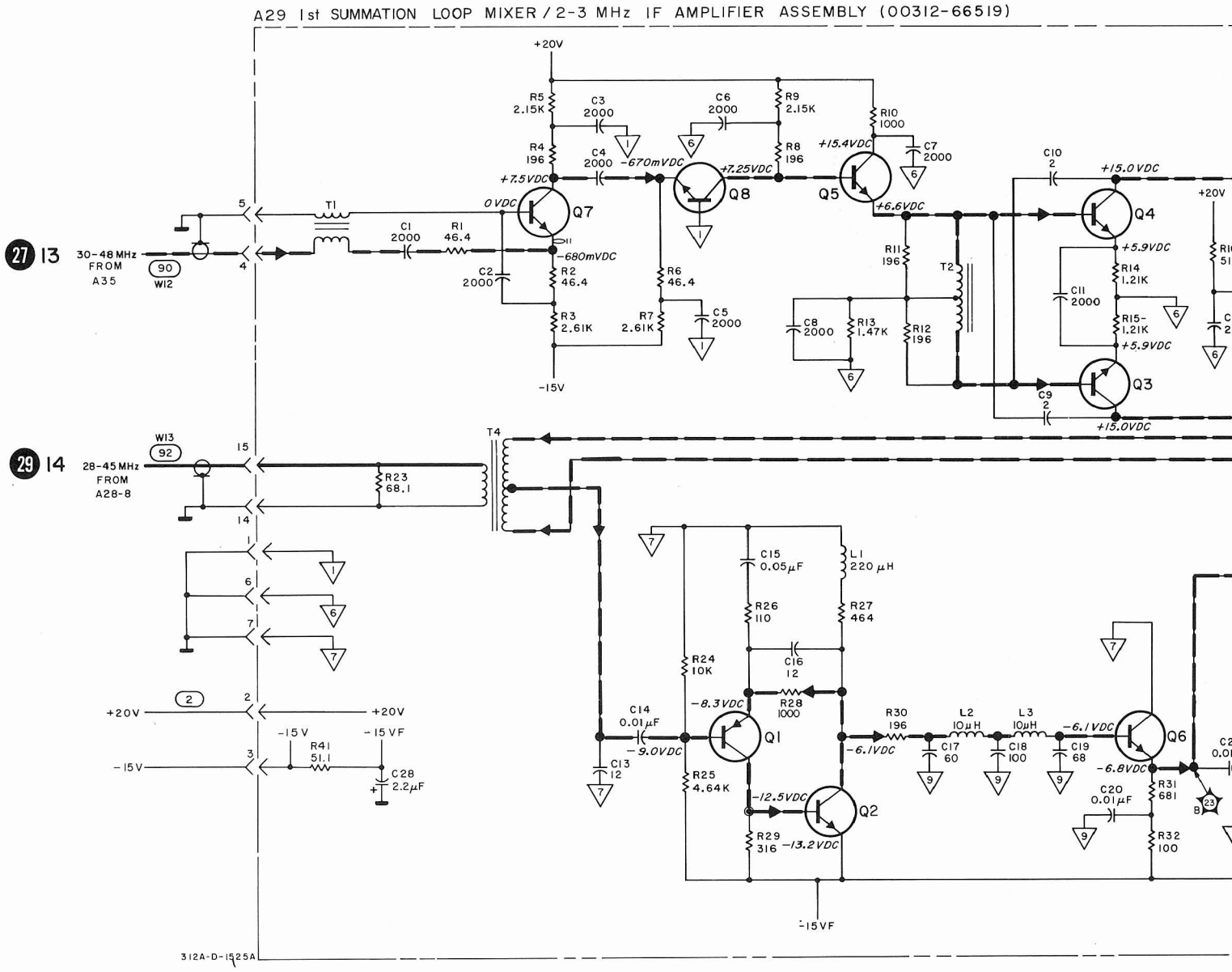
23

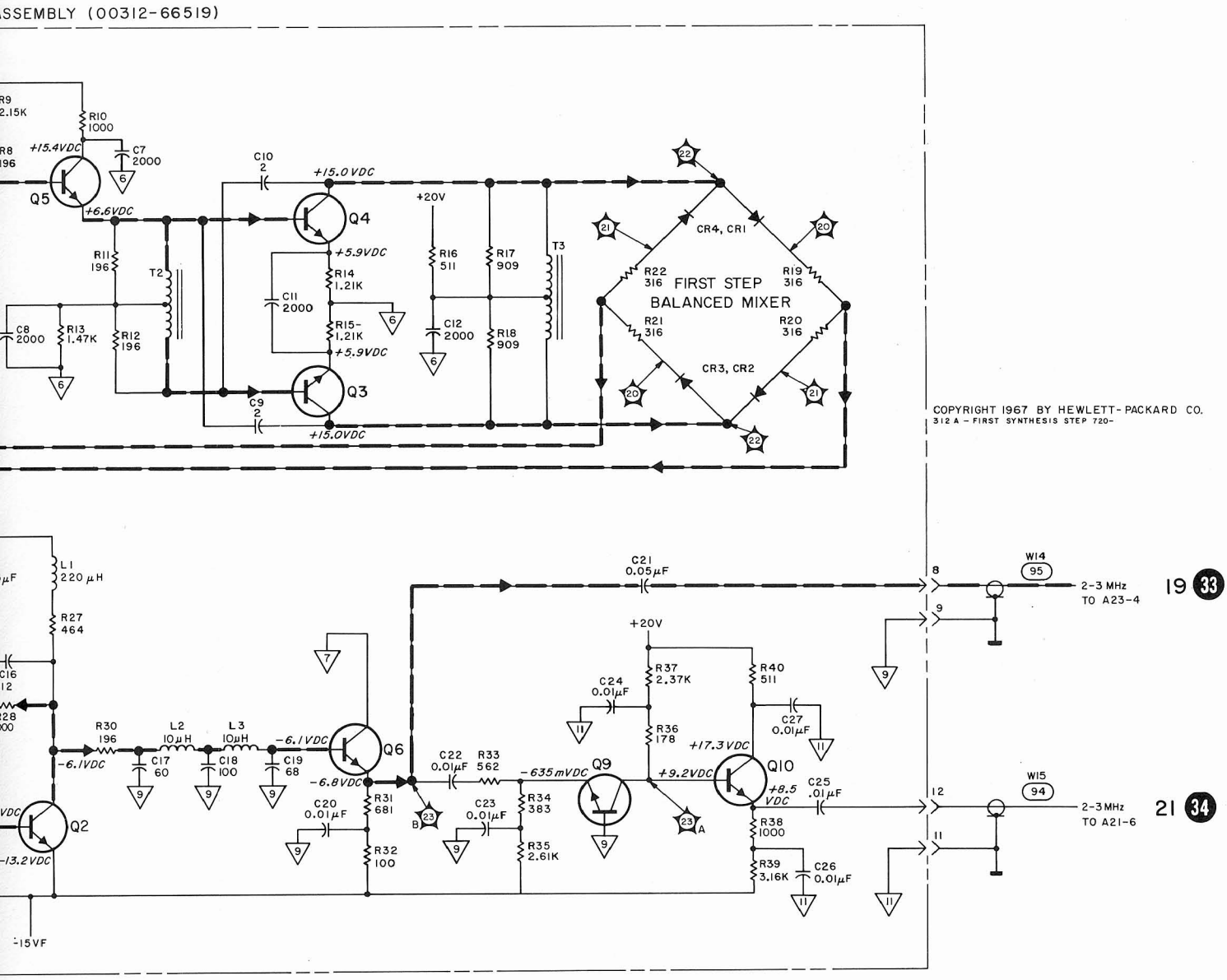


A 200 mV/cm

B 500 mv/cm

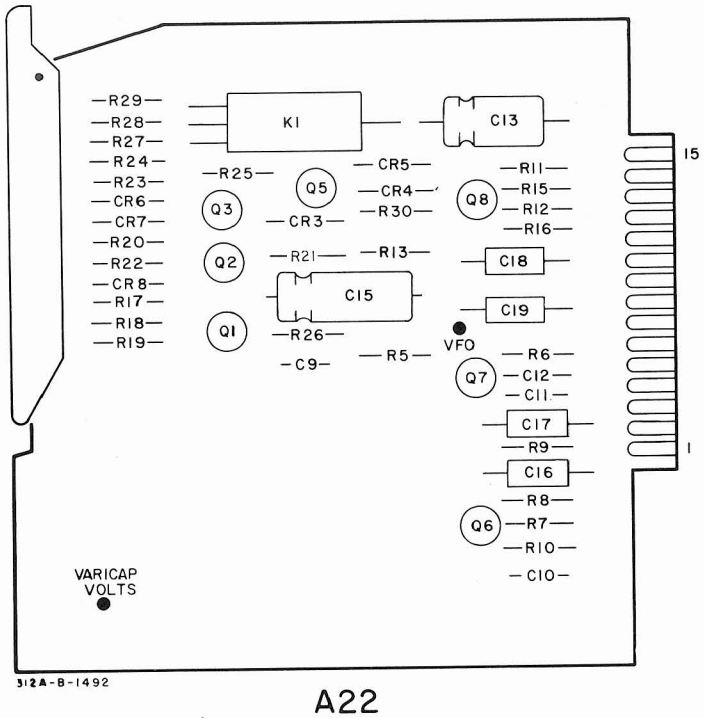
100 ns/cm



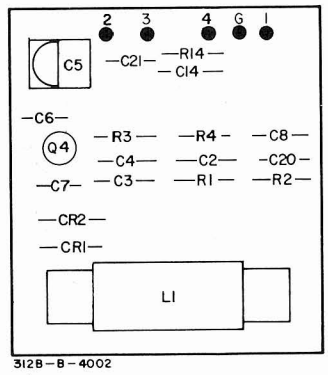


16

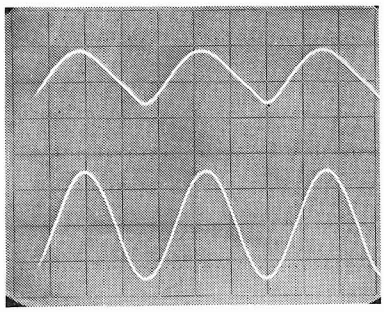
Figure 7-19. Summation Loop Mixer.



A22
hp Part No. 00312-66508



A21
hp Part No. 00312-66504



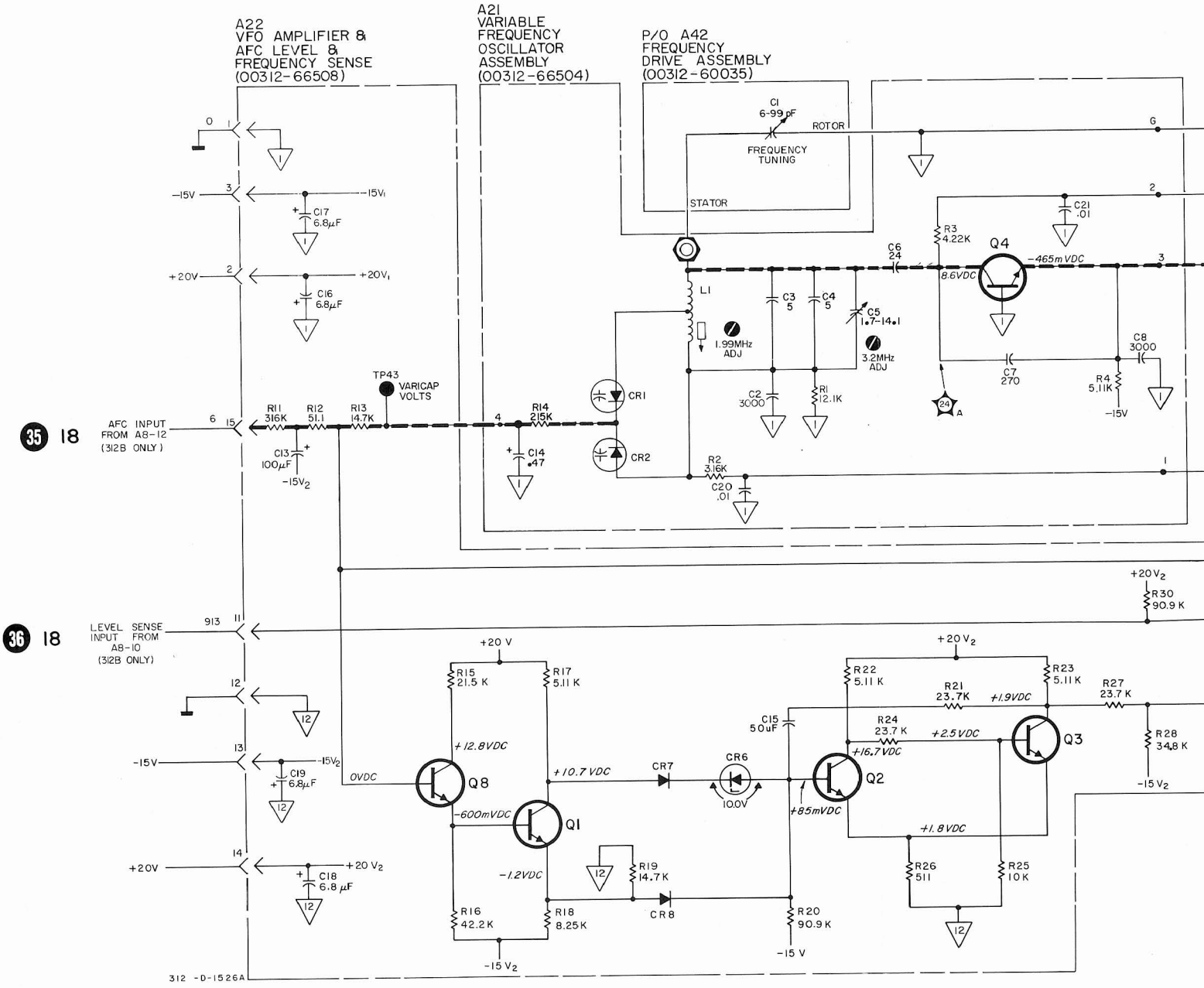
A 5 V/cm

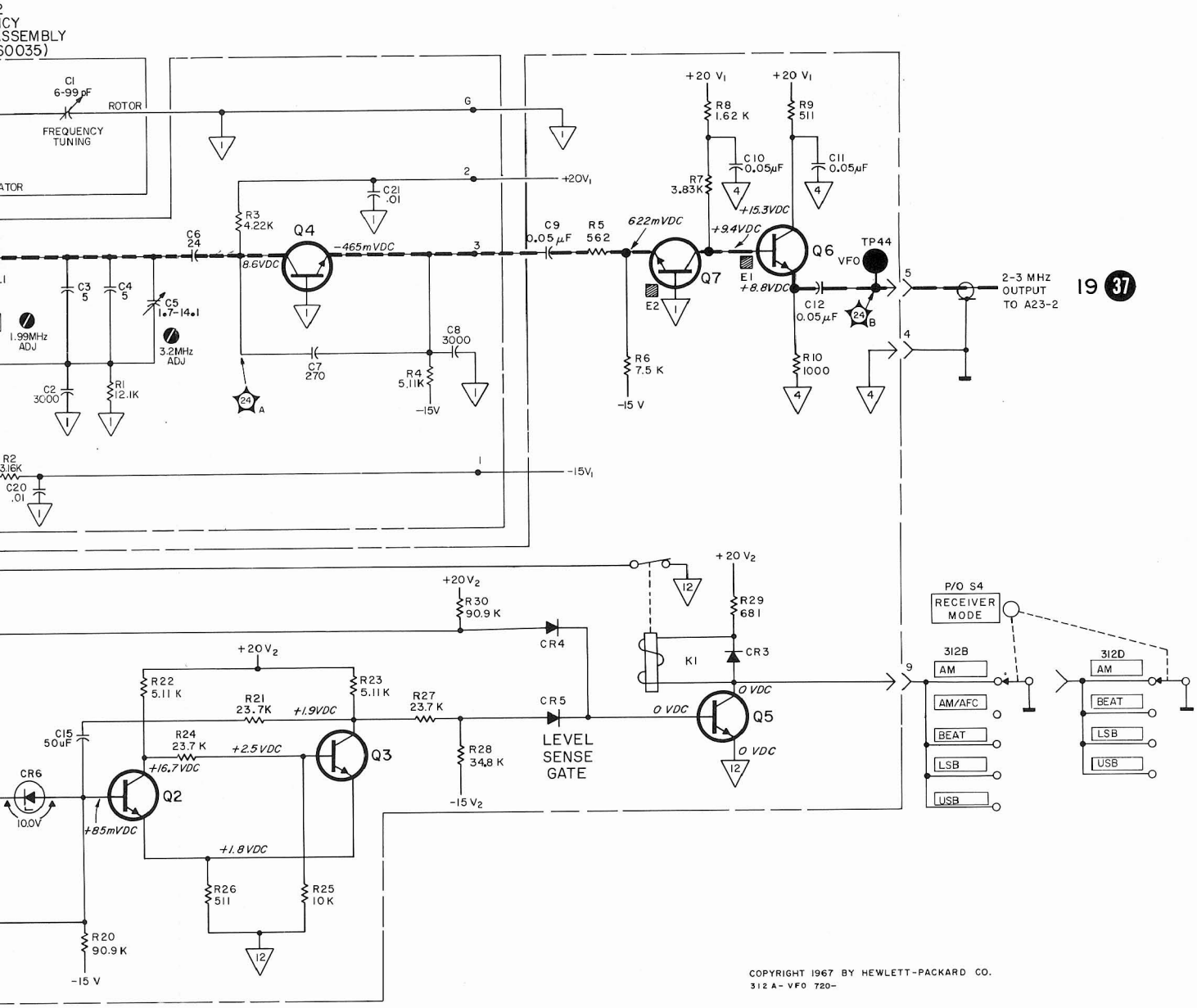
B 1 V/cm

100 ns/cm

NOTE

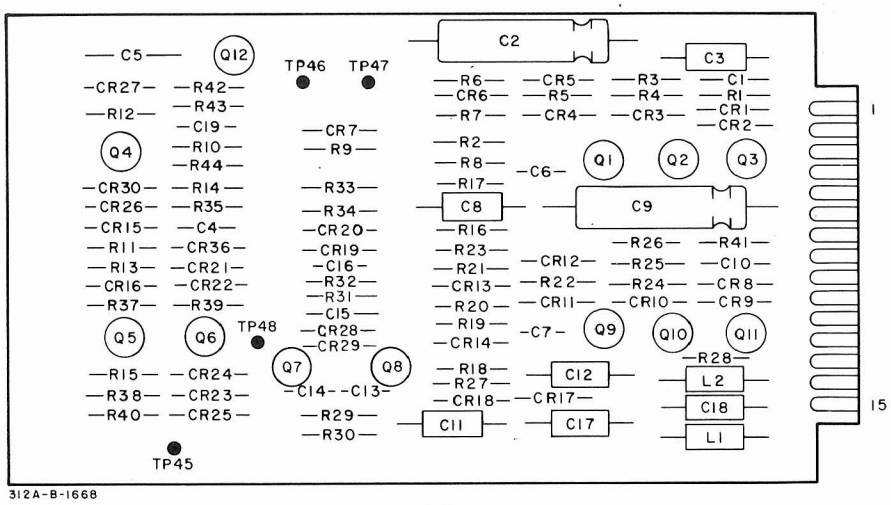
THE LEVEL SENSE CIRCUIT IS USED ONLY ON THE 312C-H47 BUT IF K1 IS NOT CLOSED ON THE STANDARD MODEL, THE 2–3MHZ SIGNAL WILL BE UNSTABLE.





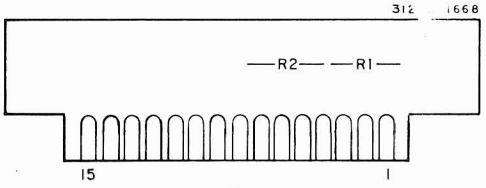
17

Figure 7-20. Variable Frequency Oscillator.



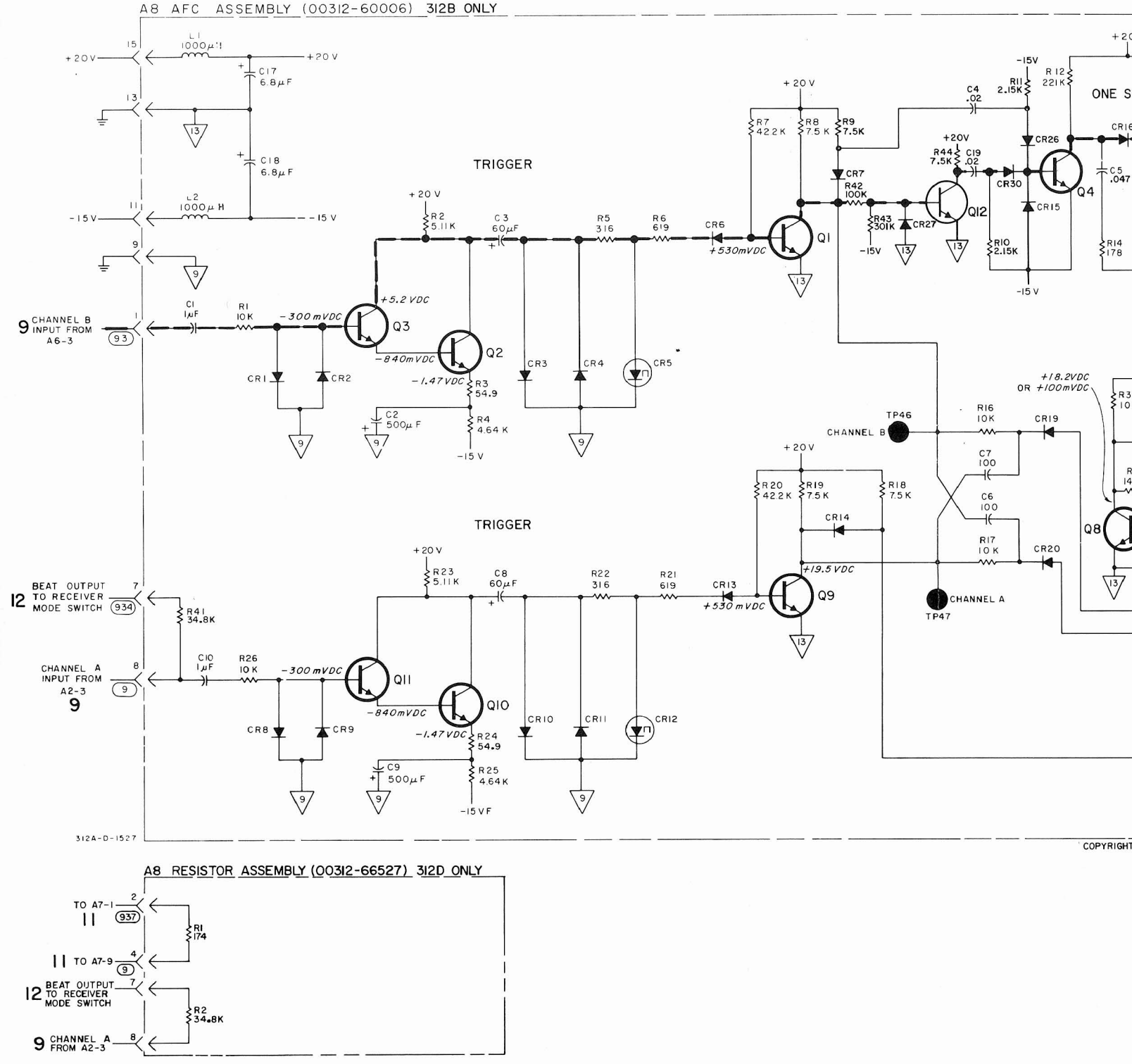
A8

hp Part No. 00312-60006



A8

hp Part No. 00312-66527



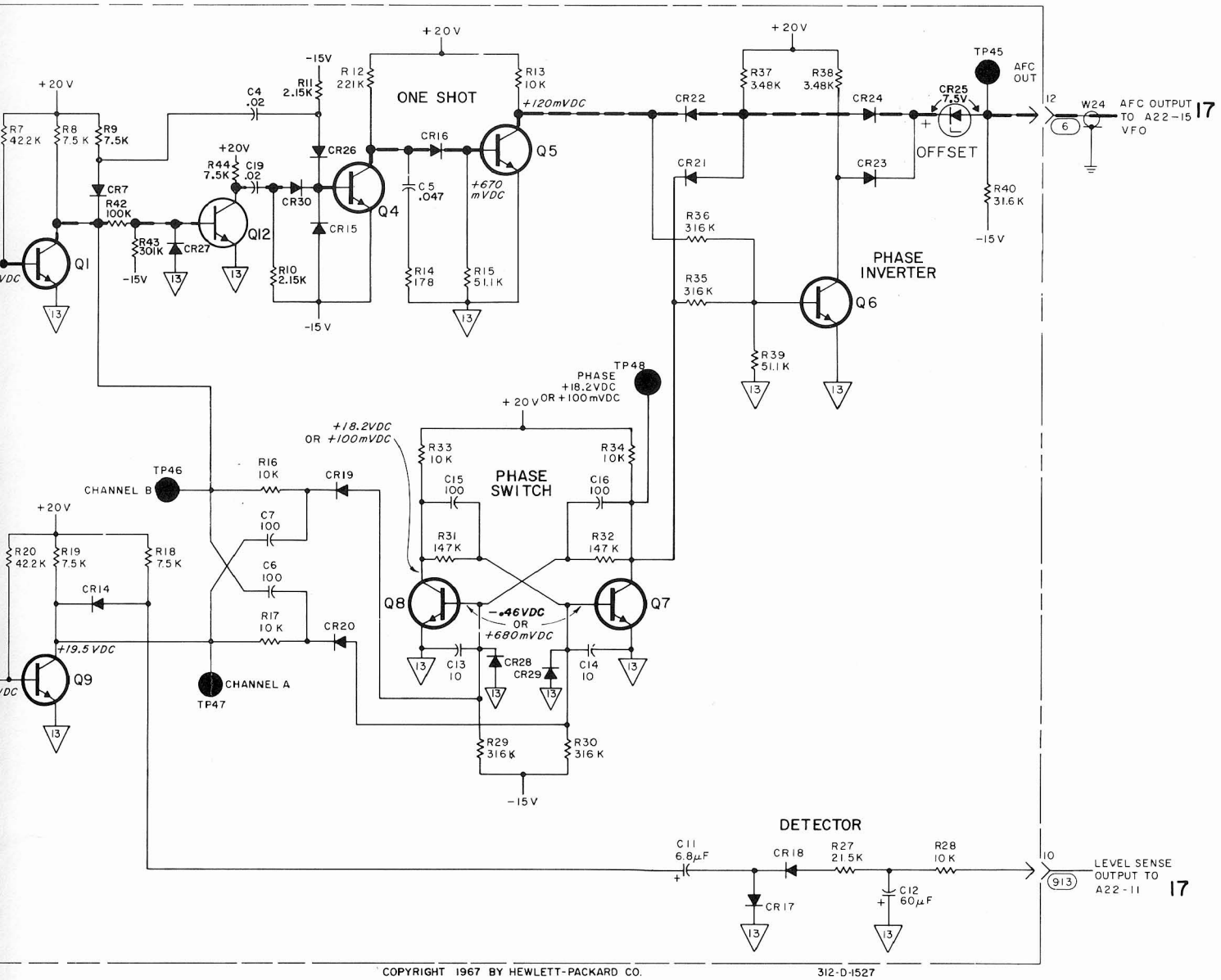
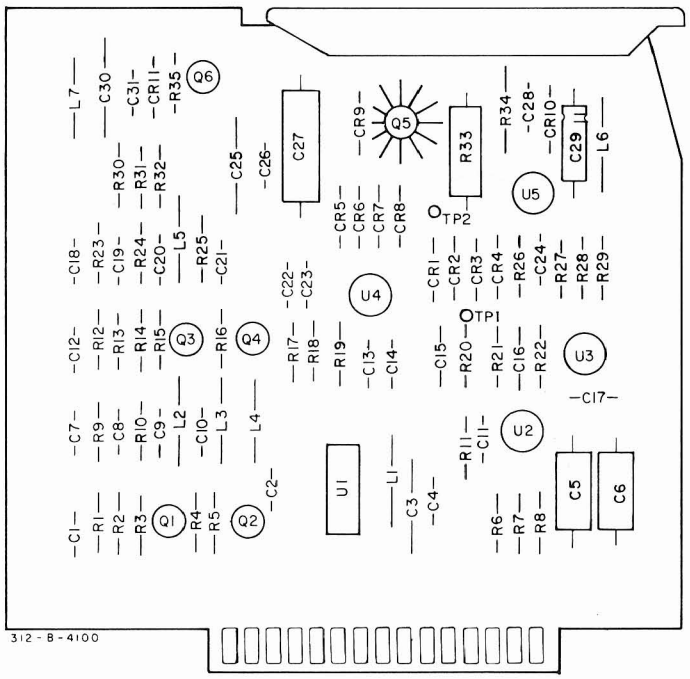
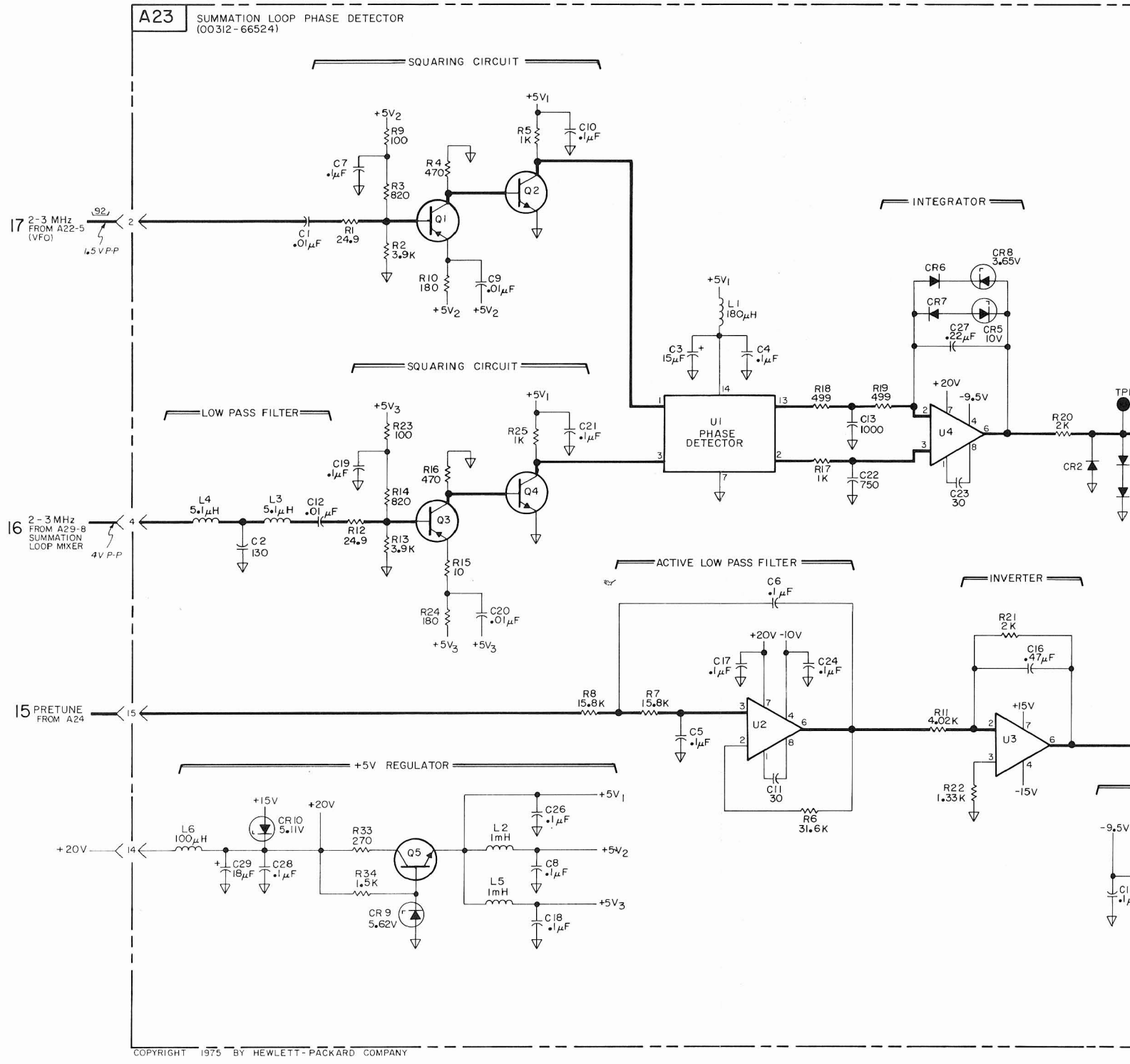


Figure 7-21. Automatic Frequency Control.



A23

hp Part No. 00312 66524



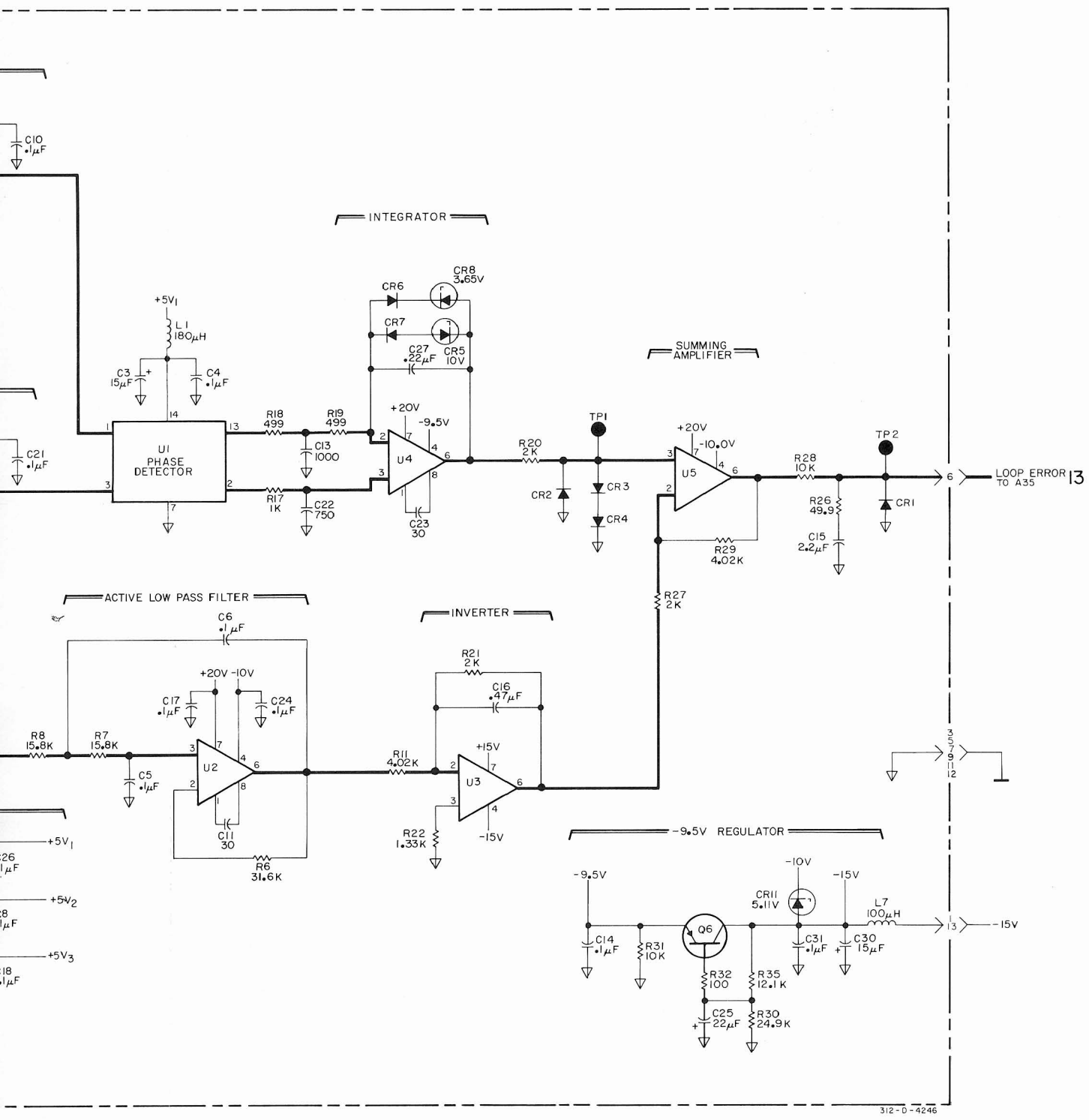
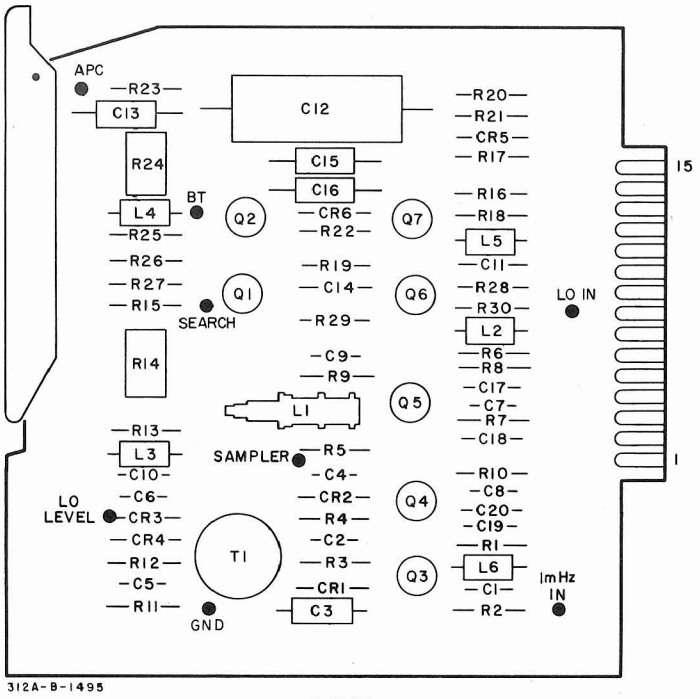
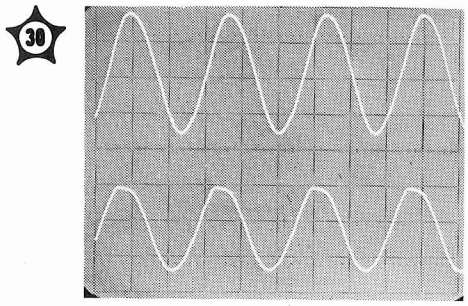


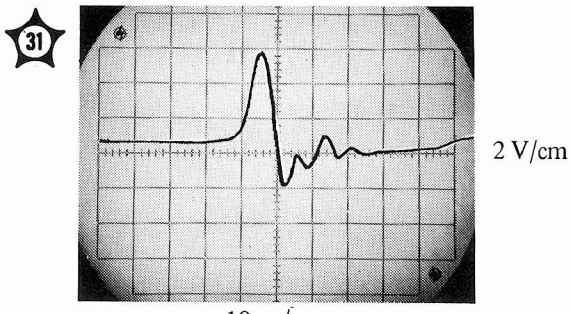
Figure 7-22. Summation Loop and Phase Detector.



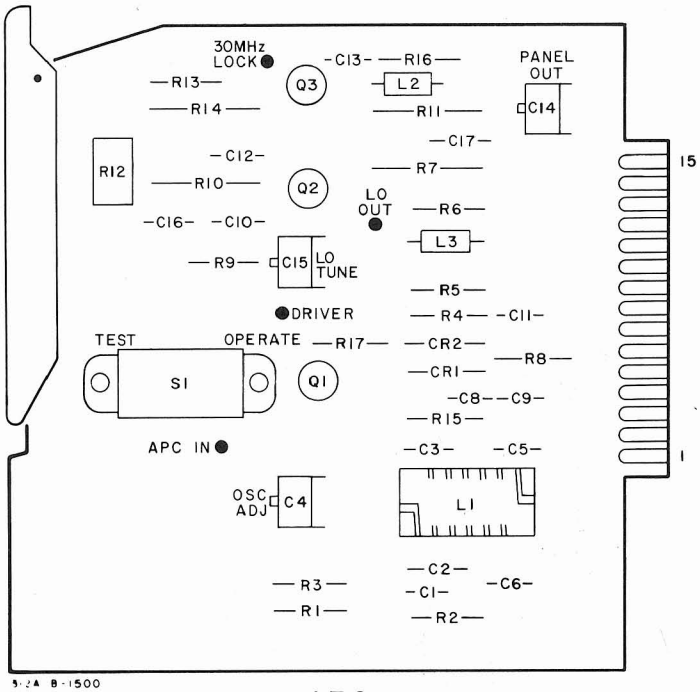
A25
hp Part No. 00312-60025



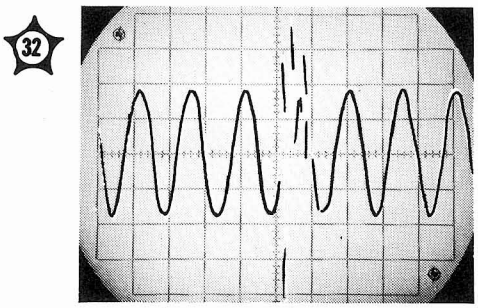
50 ms/cm
(A30 removed)



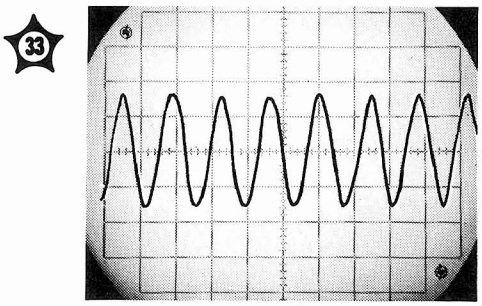
10 ns/cm



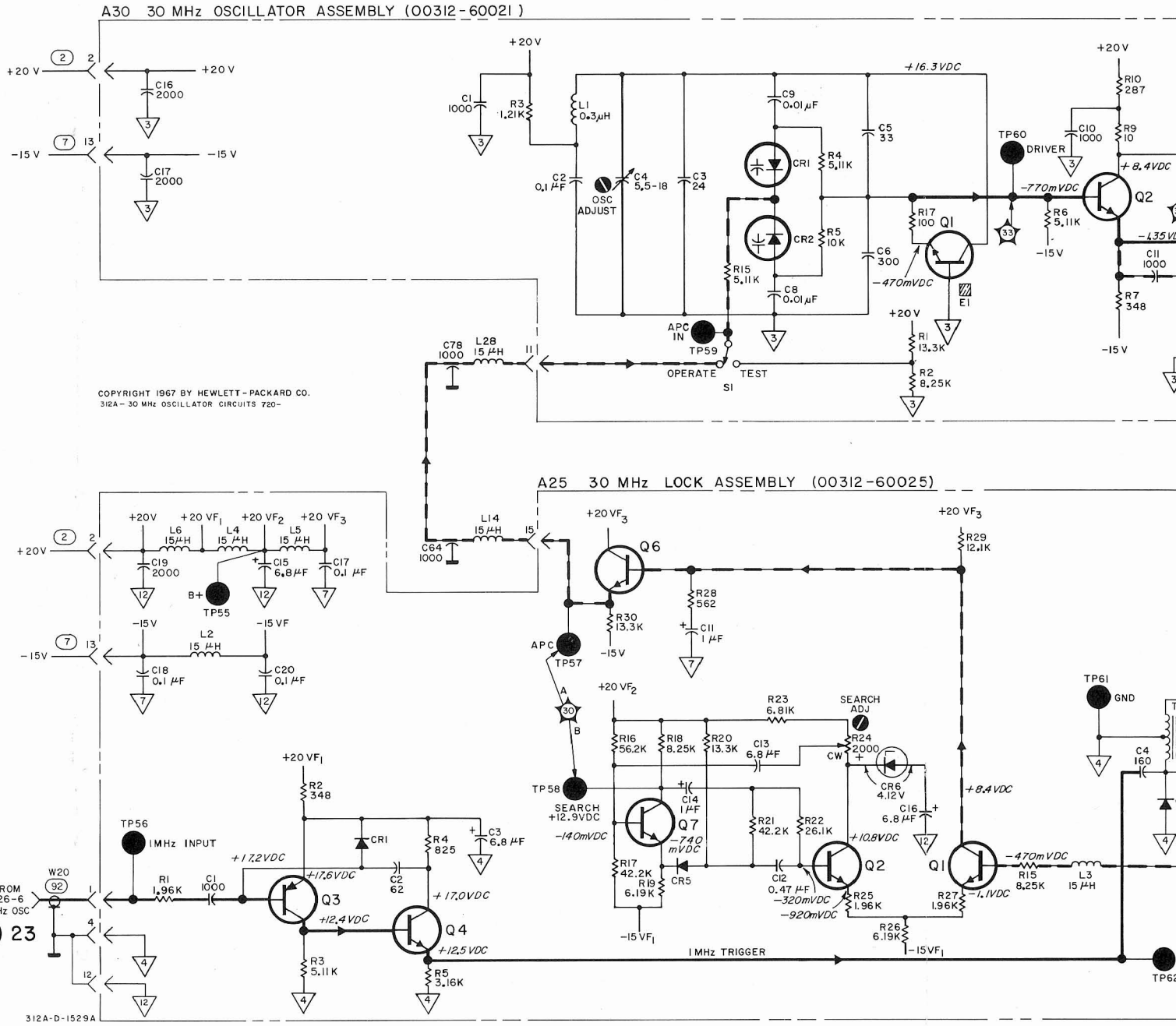
A30
hp Part No. 00312-60021
Rev C



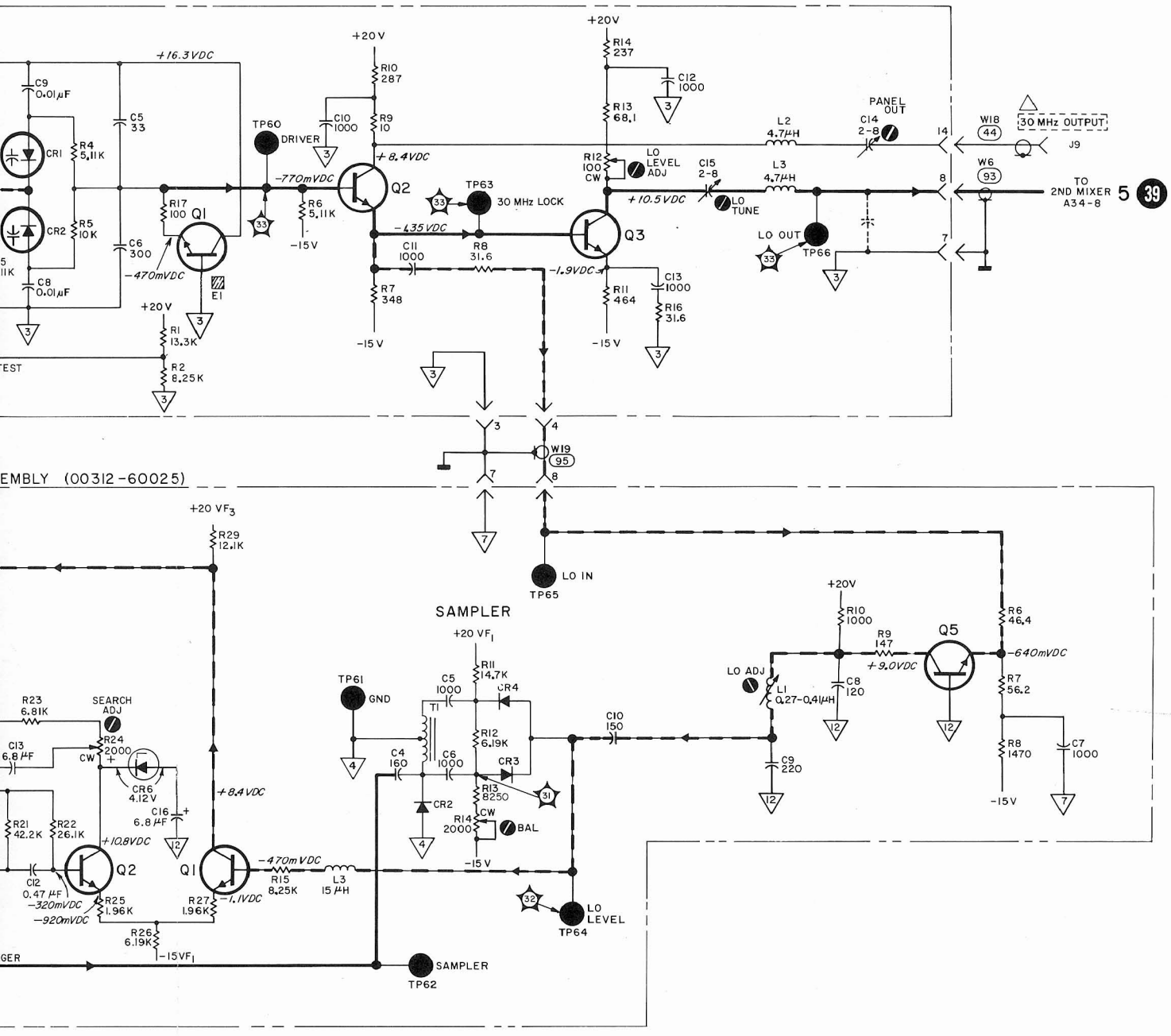
25 ns/cm



25 ns/cm



—NOTE—
MAX SEARCH AMPLITUDE IS 4.0V
PEAK TO PEAK AT A25TP57

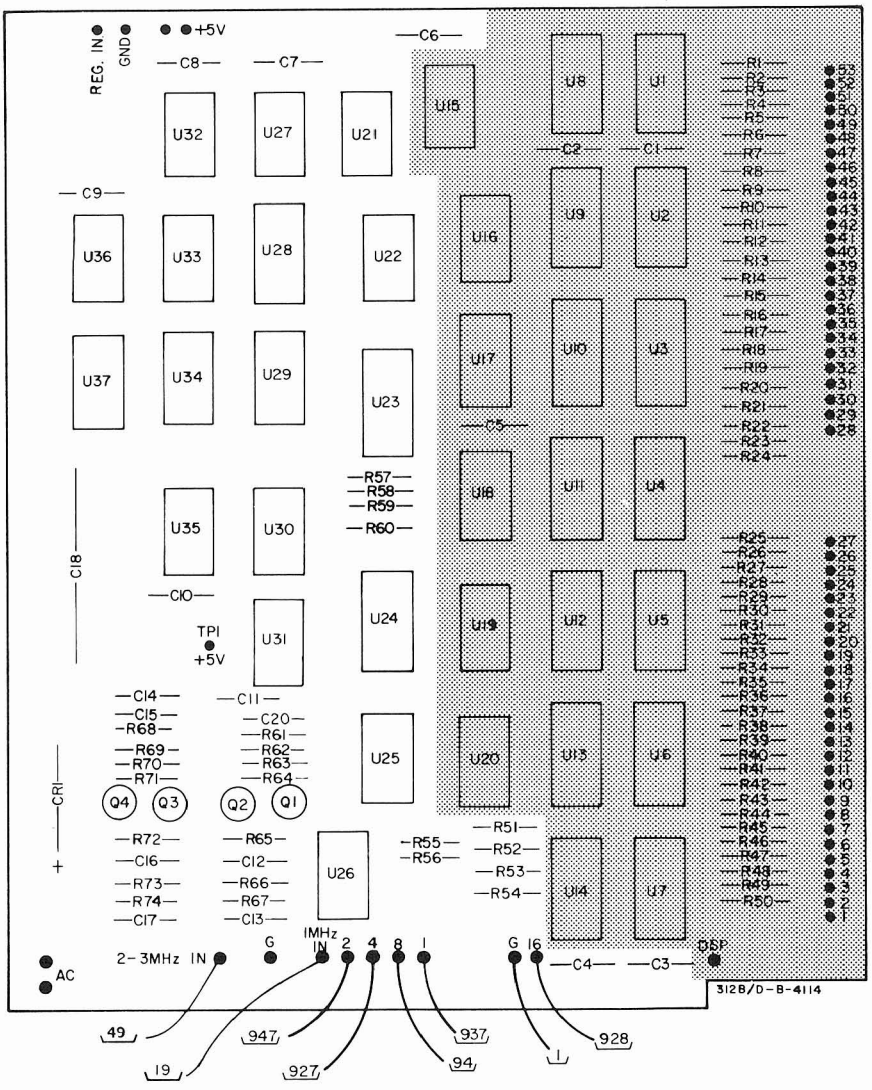


EMBLY (00312-60025)

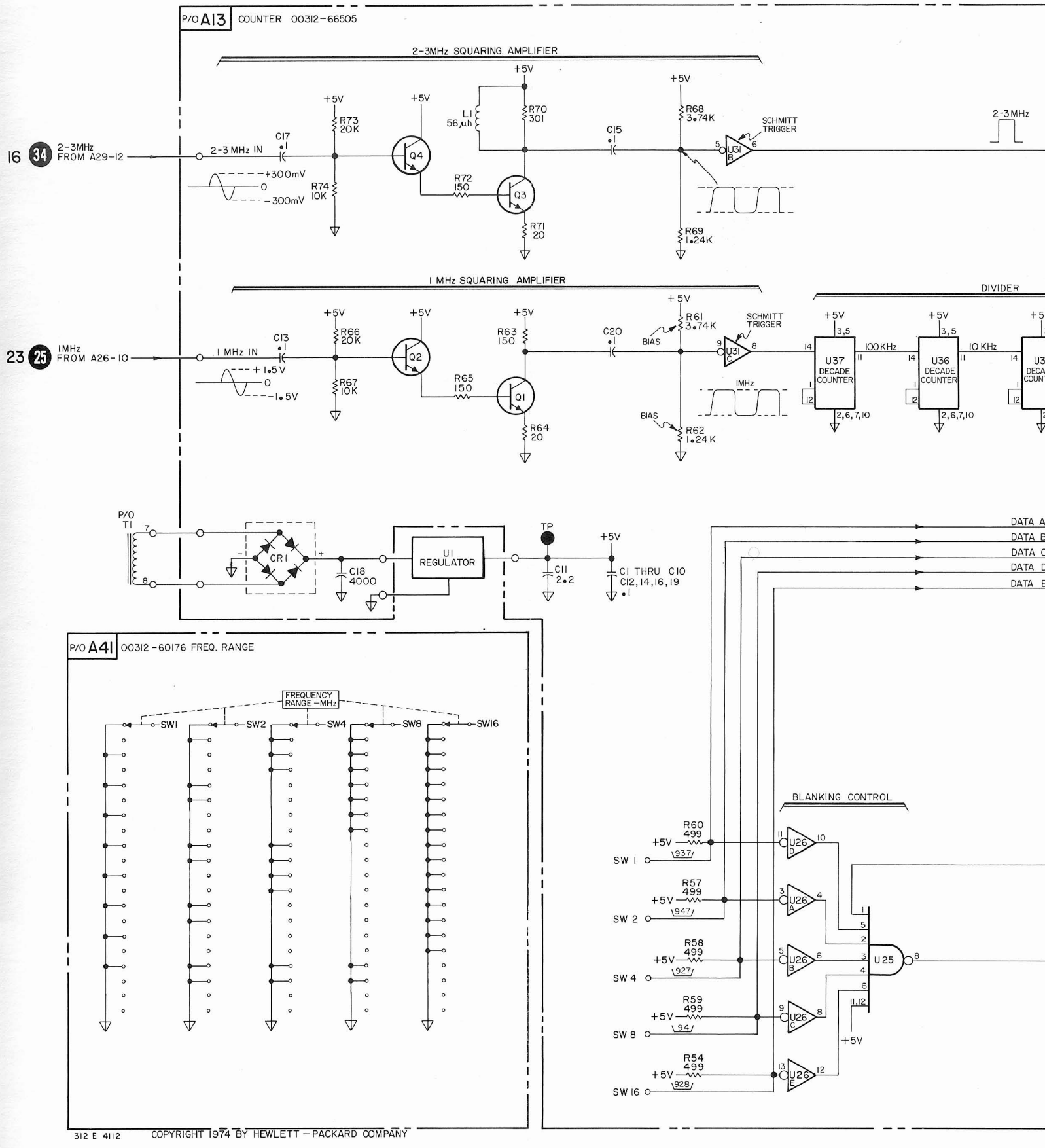
—NOTE—
MAX SEARCH AMPLITUDE IS 4.0V
PEAK TO PEAK AT A25TP57

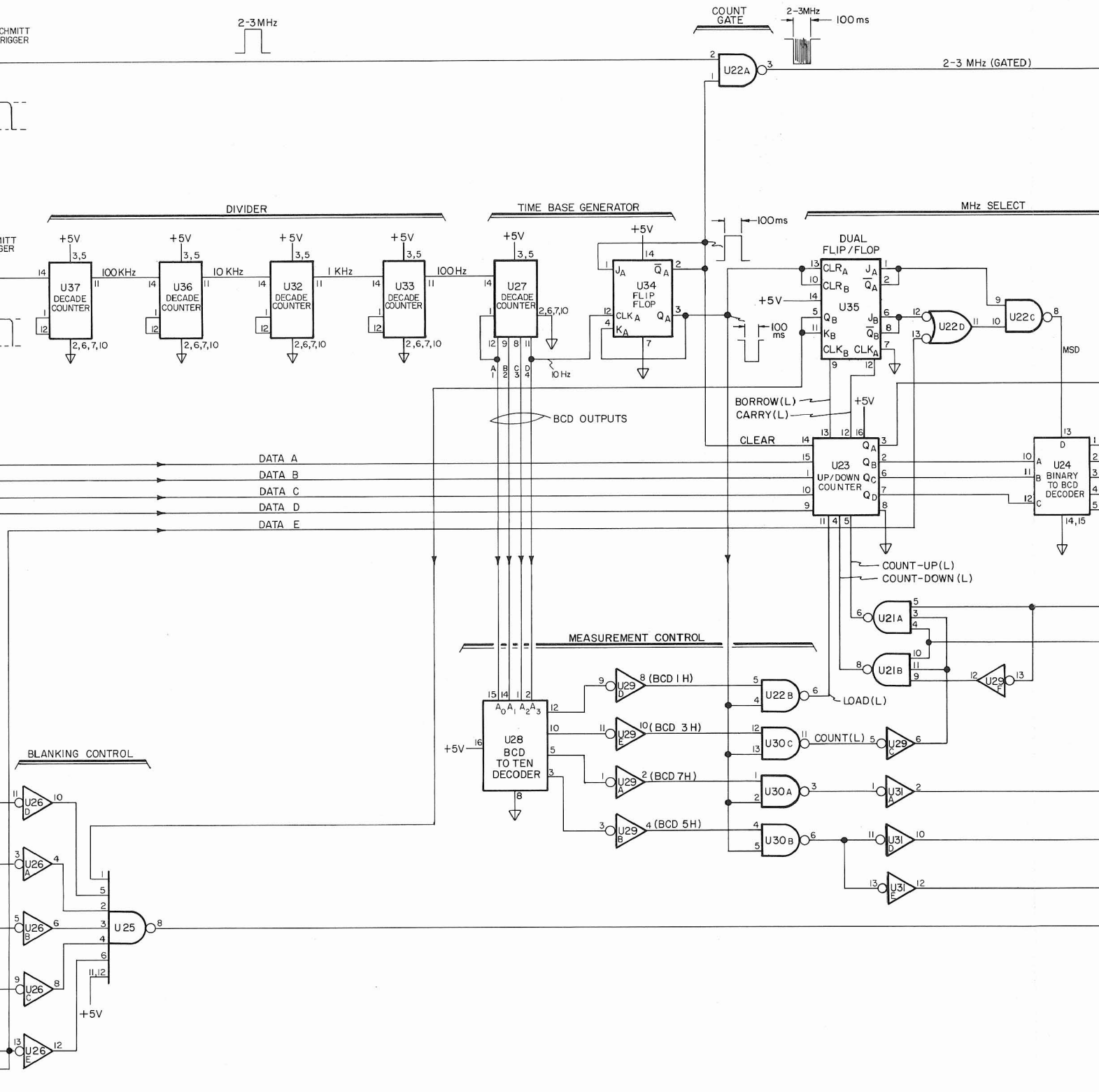
20

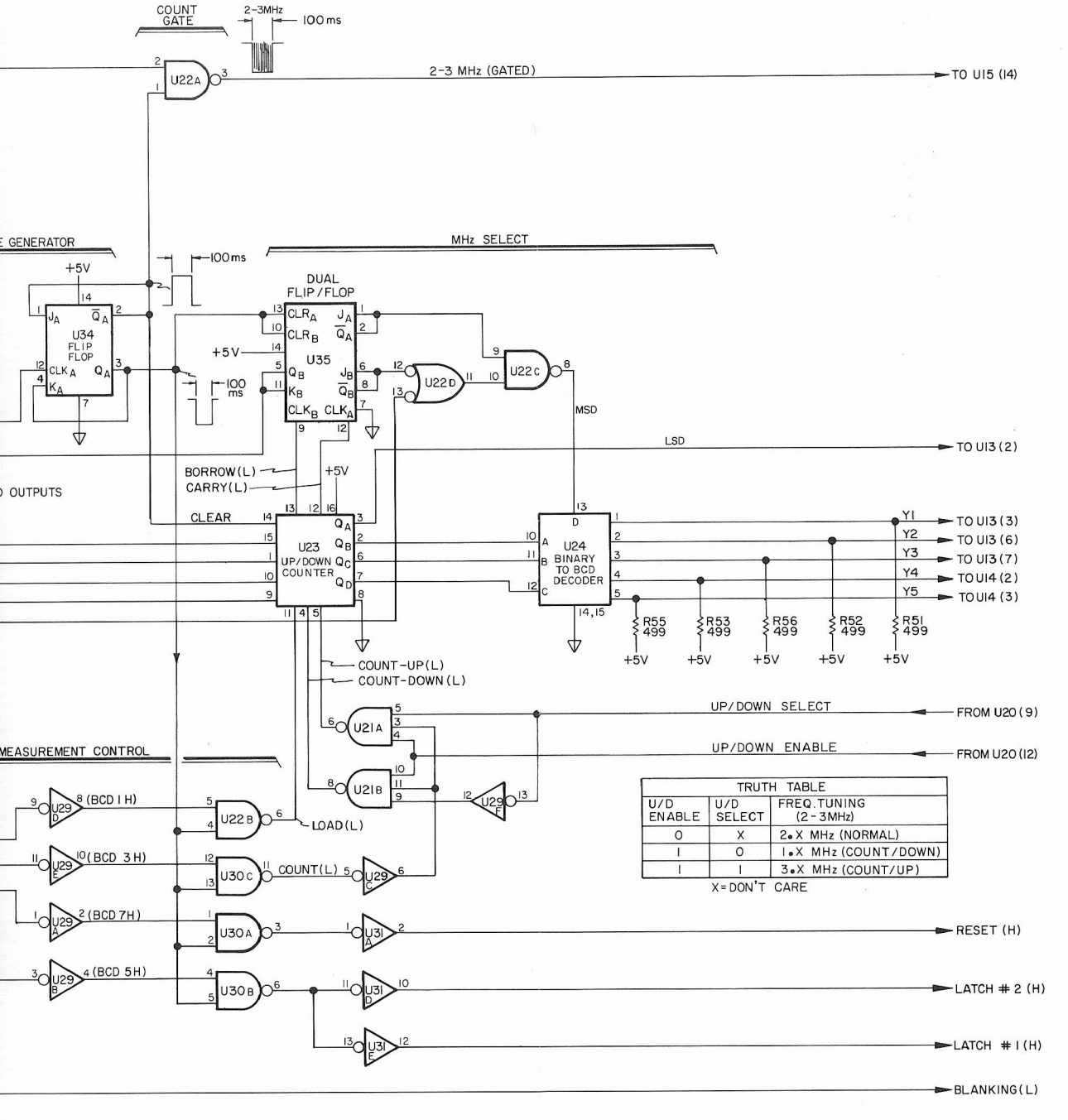
Figure 7-23. 30 MHz Oscillator and Phase Lock Assembly.



A13
hp Part No. 00312-66505





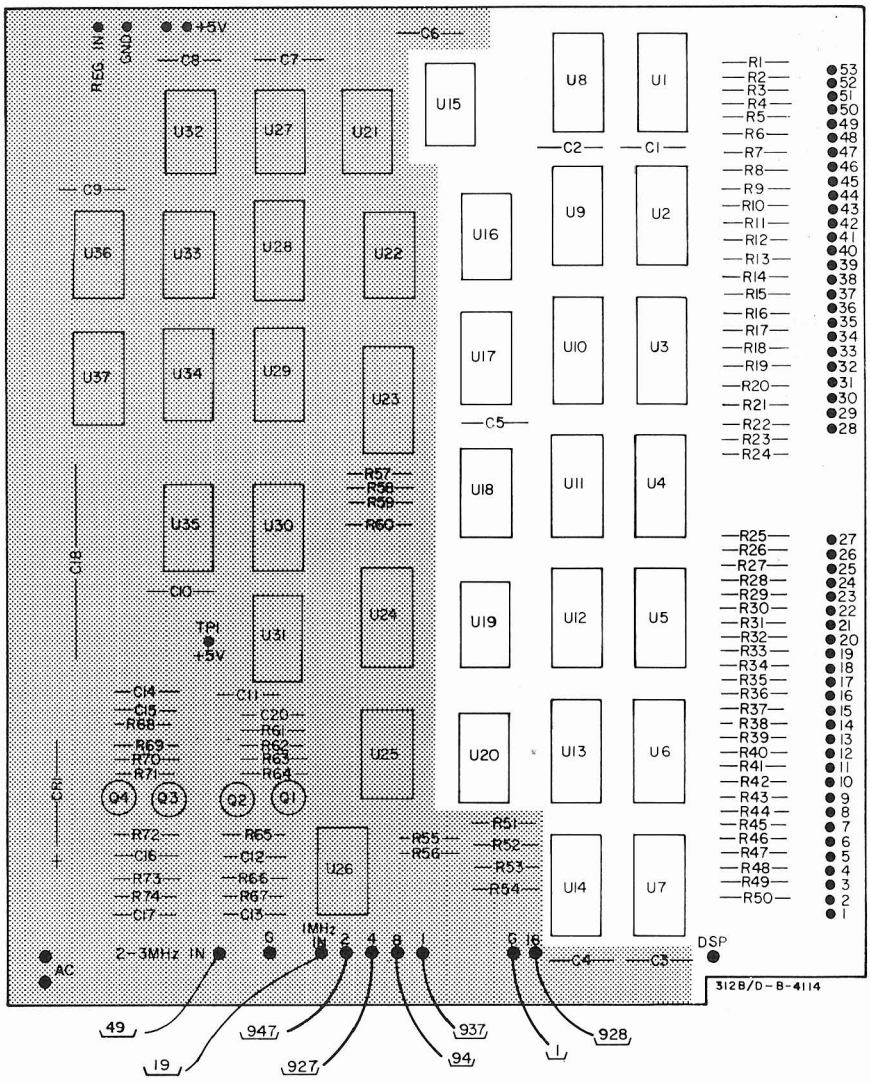


TRUTH TABLE		
U/D ENABLE	U/D SELECT	FREQ. TUNING (2-3MHz)
0	X	2.X MHz (NORMAL)
1	0	1.X MHz (COUNT/DOWN)
1	1	3.X MHz (COUNT/UP)

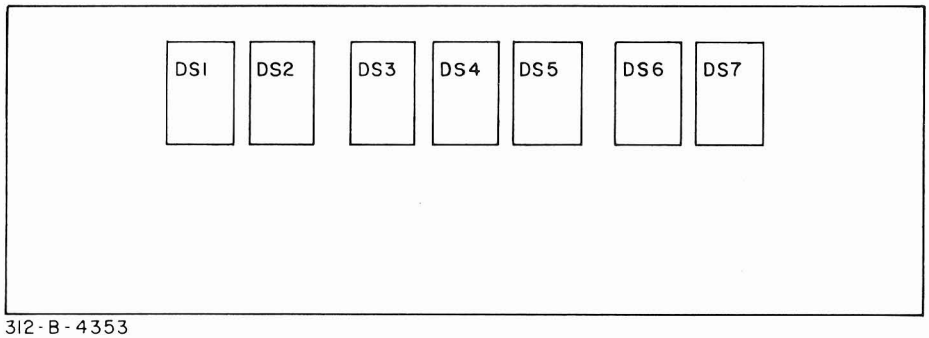
X = DON'T CARE

21

Figure 7-24. Counters and Frequency Range Switch.



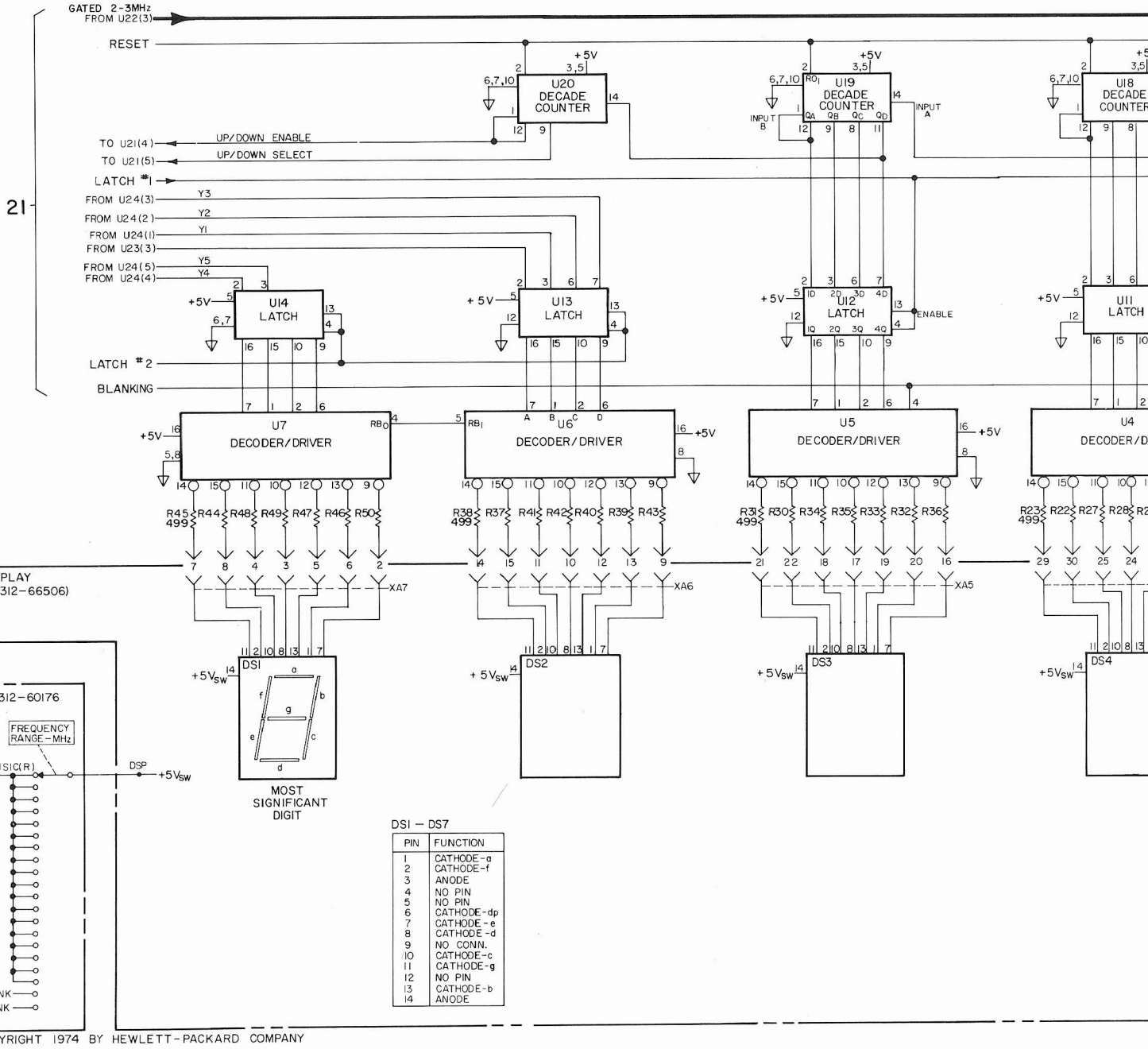
A13
hp Part No. 00312-66505



312-B-4353

A14
hp 00312-66506
Rev. A

P/O A13 DISPLAY CONTROLLER (00312-66505)

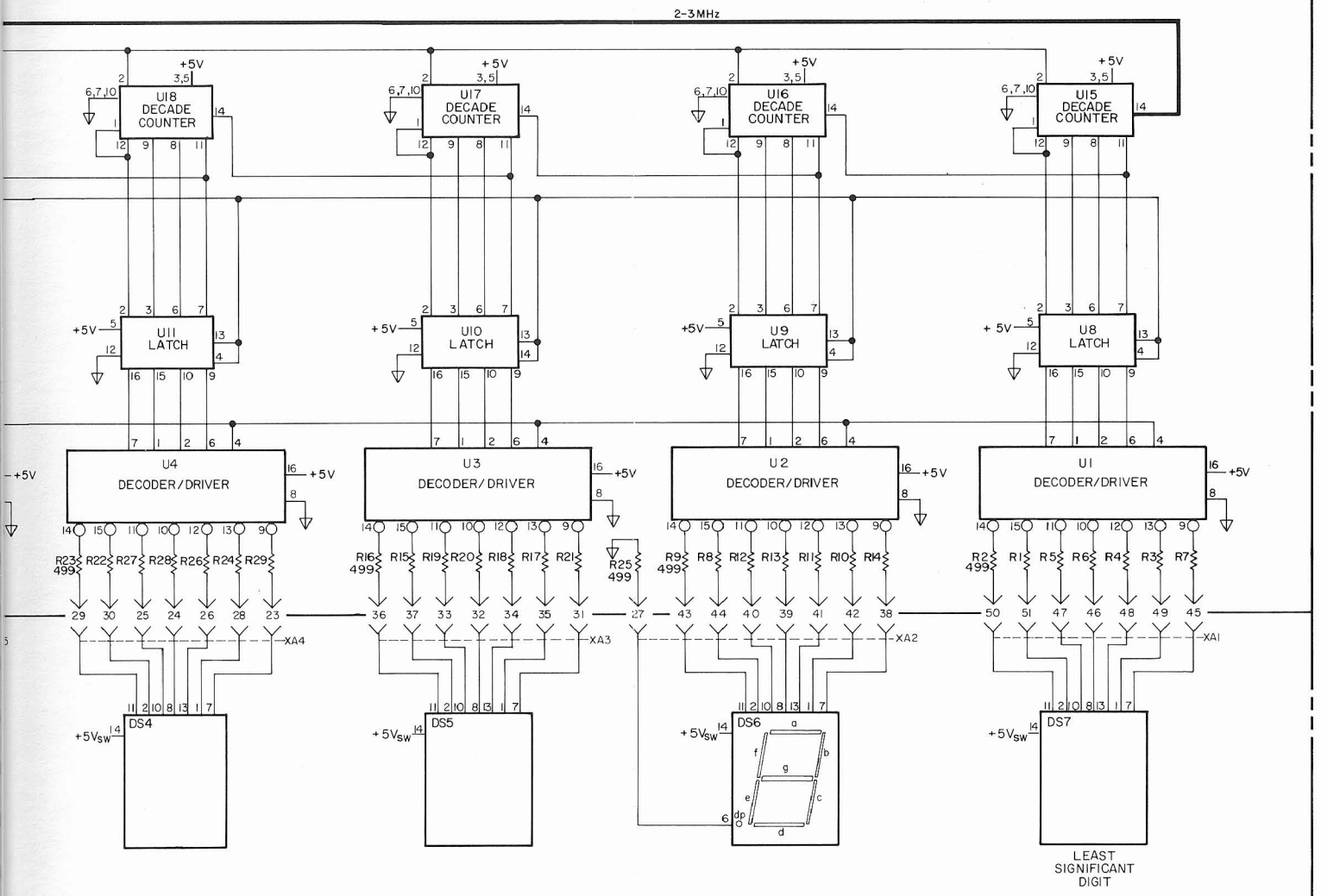


A14 DISPLAY (00312-66506)

P/O A41 00312-60176

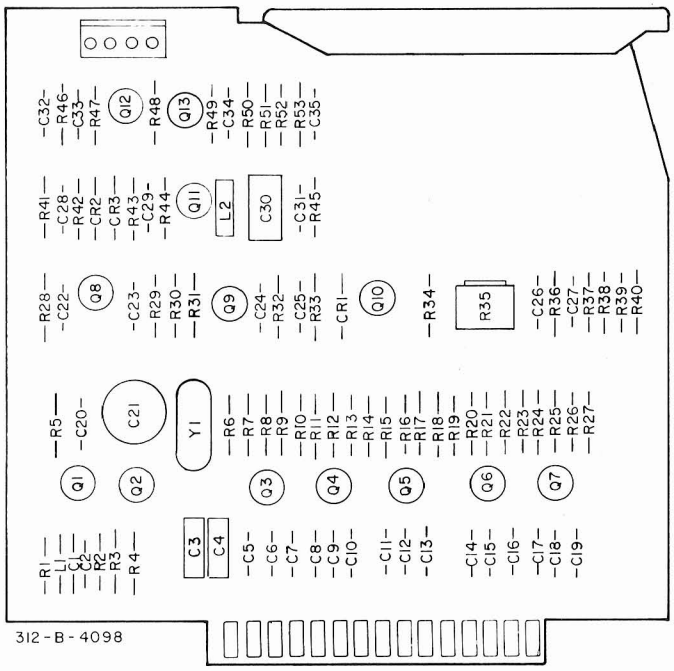
DS1 – DS7

PIN	FUNCTION
1	CATHODE-a
2	CATHODE-f
3	ANODE
4	NO PIN
5	NO PIN
6	CATHODE-dp
7	CATHODE-e
8	CATHODE-d
9	NO CONN.
10	CATHODE-c
11	CATHODE-g
12	NO PIN
13	CATHODE-b
14	ANODE



312B-E-4003

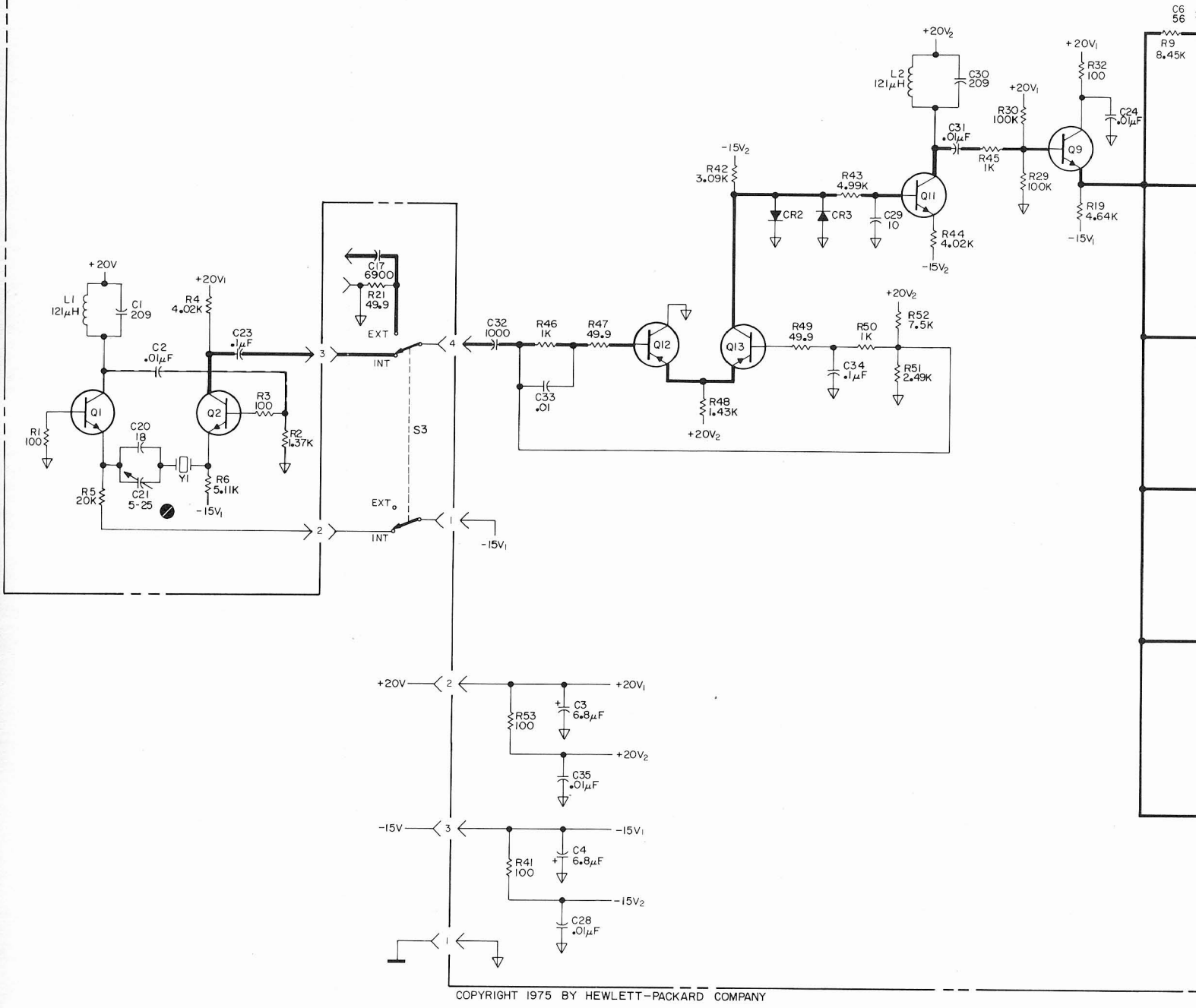
Figure 7-25. Counter Display and Frequency Range Switch.

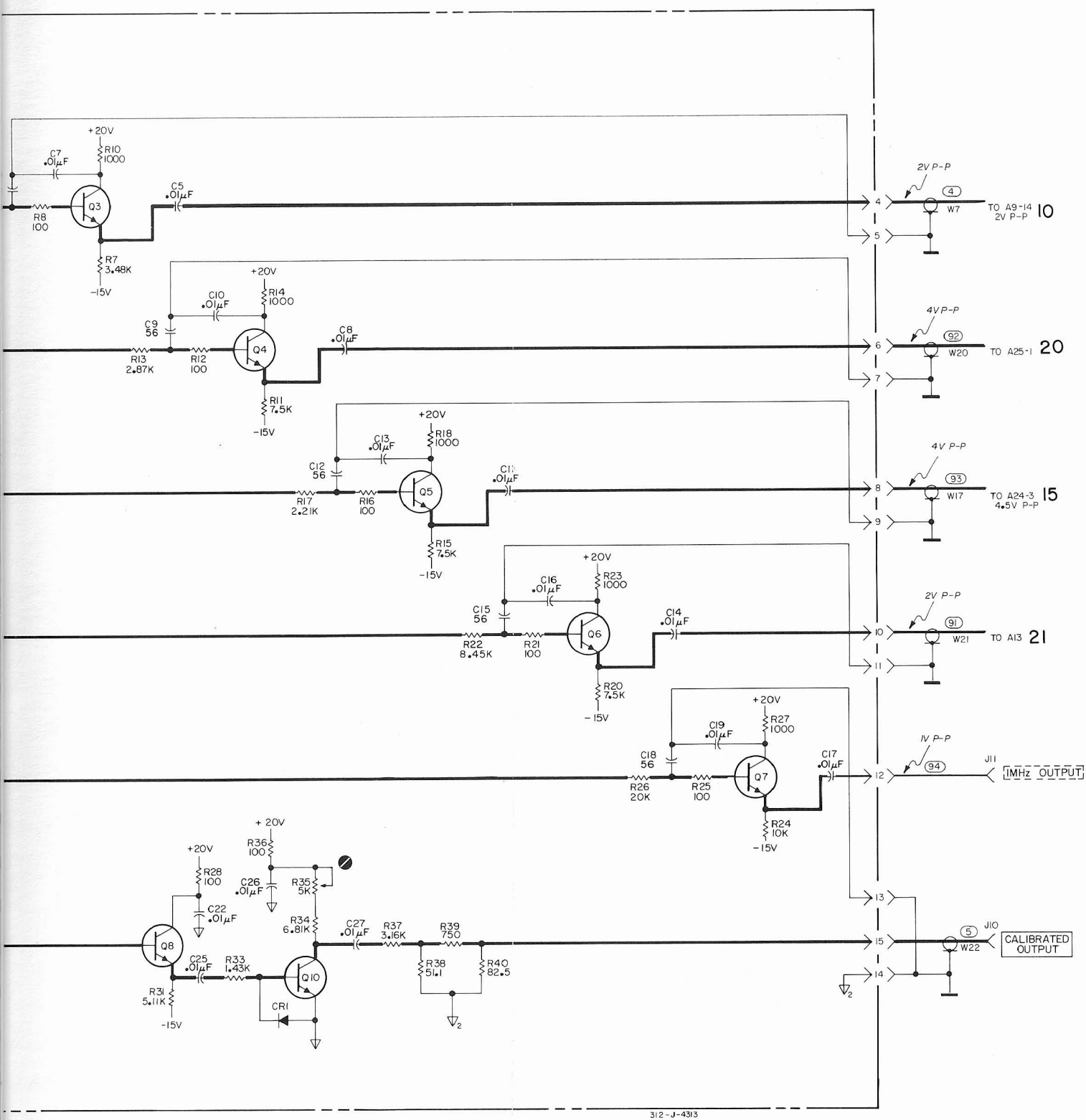


A26

hp Part No. 00312-66526

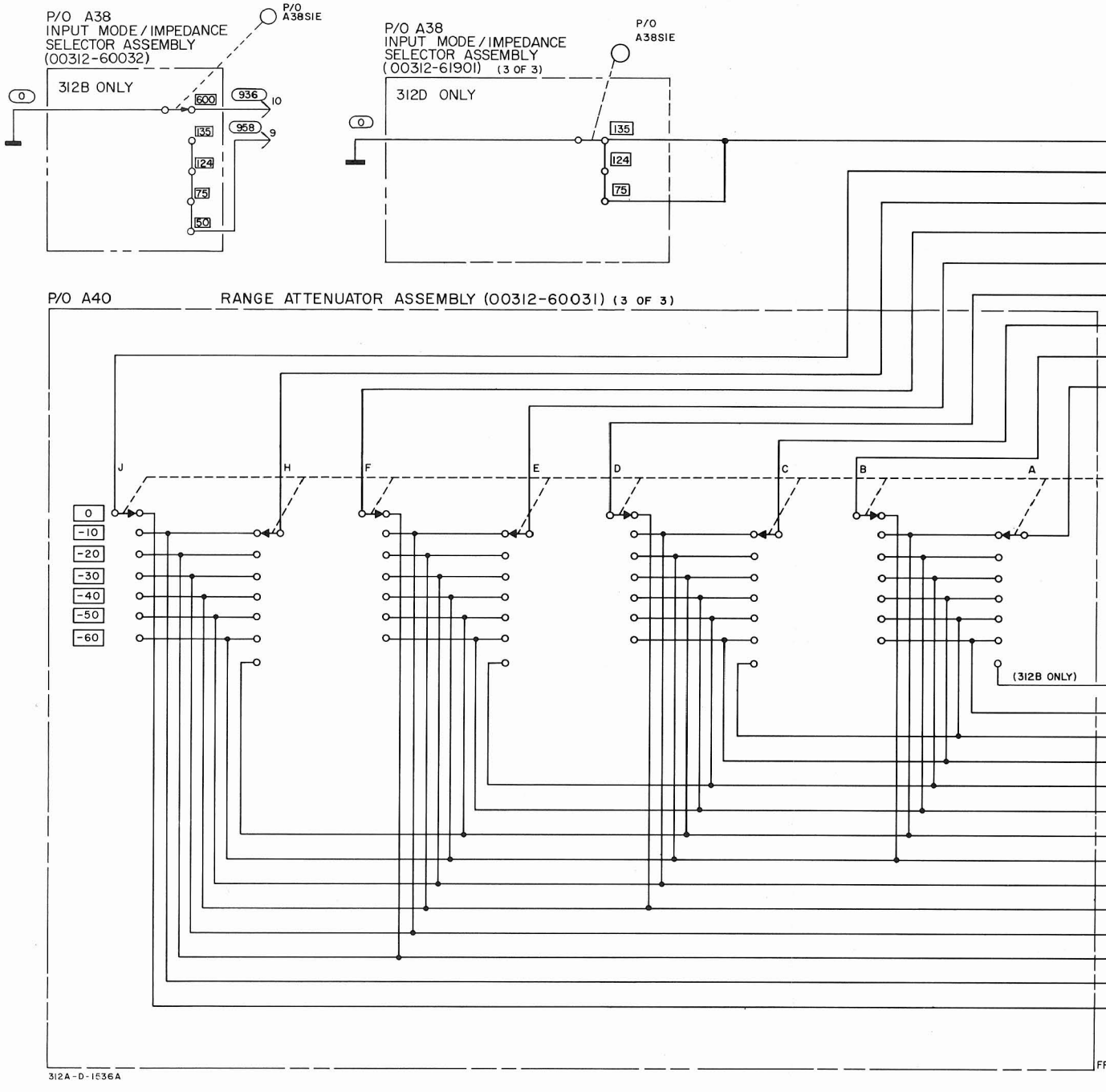
A26 1MHz REFERENCE OSCILLATOR & CAL OUTPUT
00312-66526





23

Figure 7-26. 1 MHz Reference Oscillator.



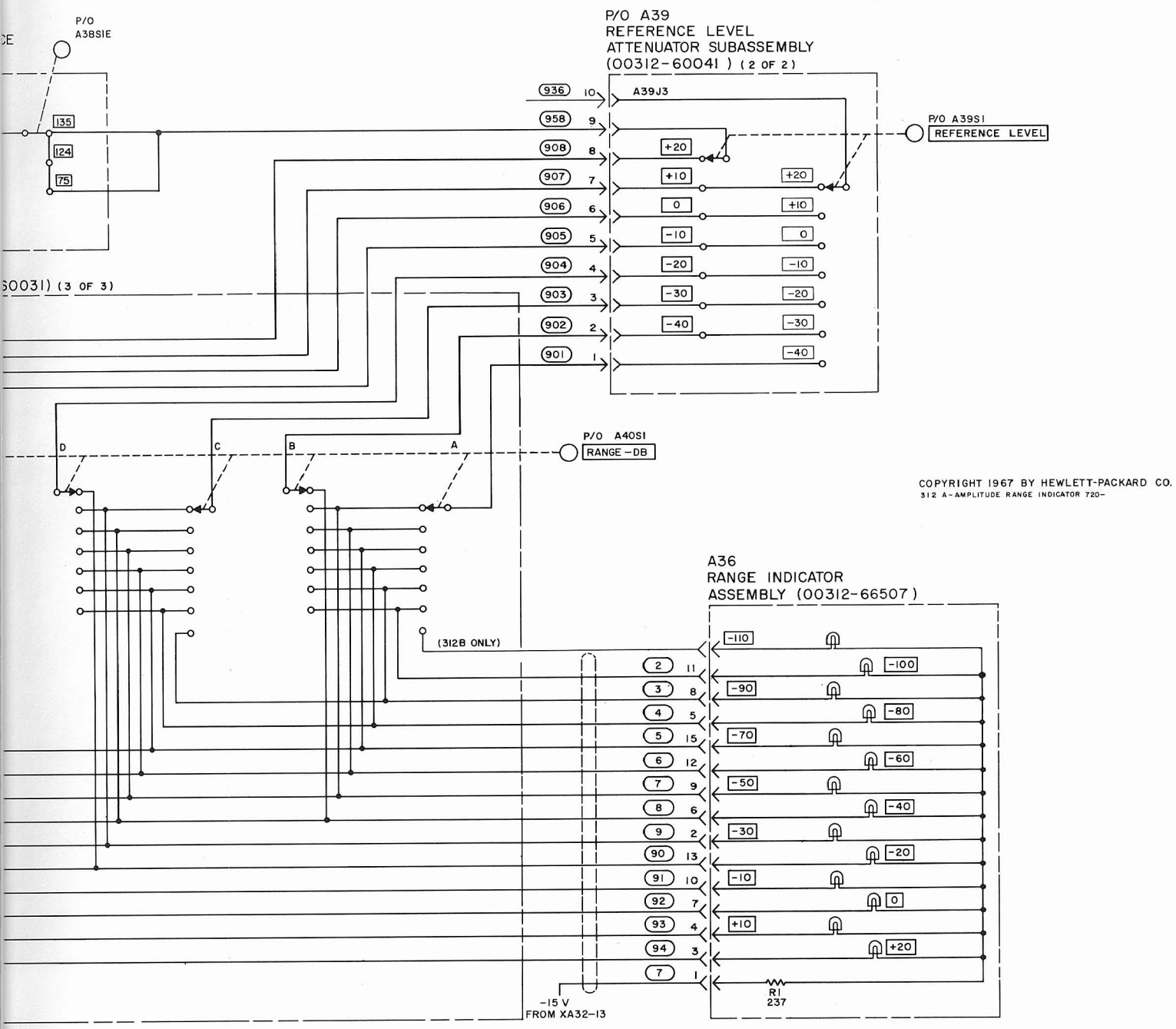
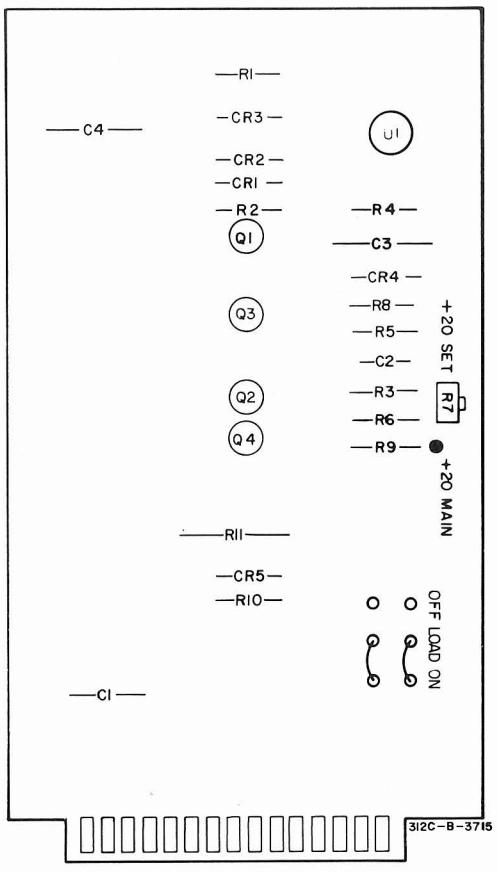
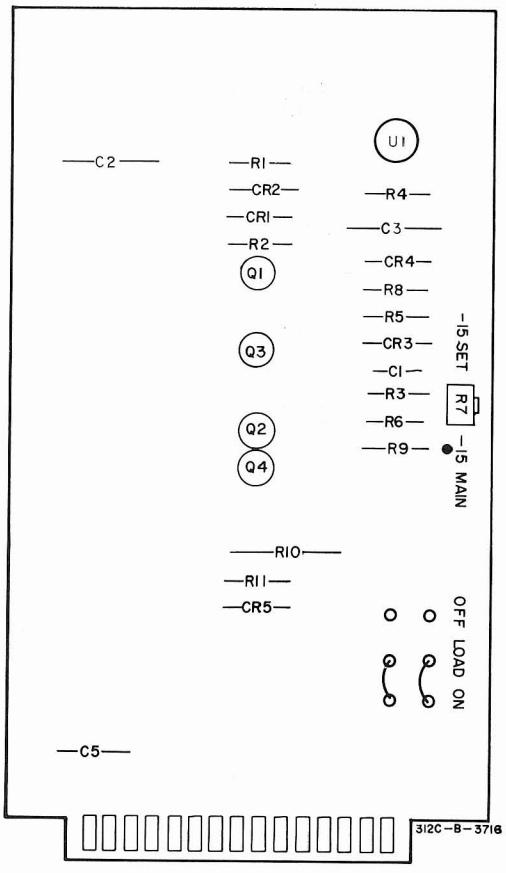


Figure 7-27. Amplitude Range Indicator, Mode Selector Switch, Reference Level Attenuator and 30 MHz Bandpass Filter.



A1
hp Part No 00312-66516
Rev A



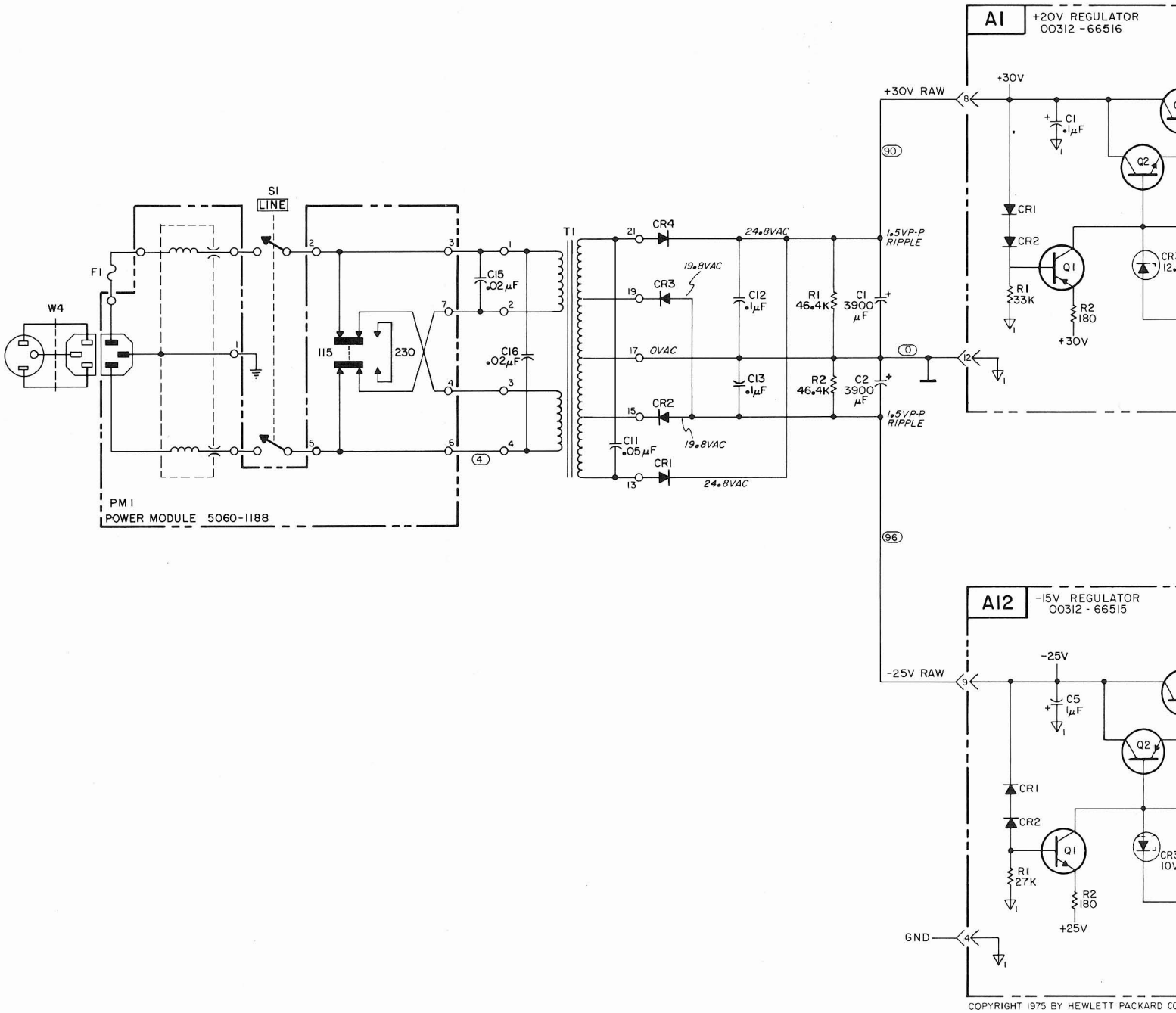
A12
hp Part No 00312-66515
Rev A

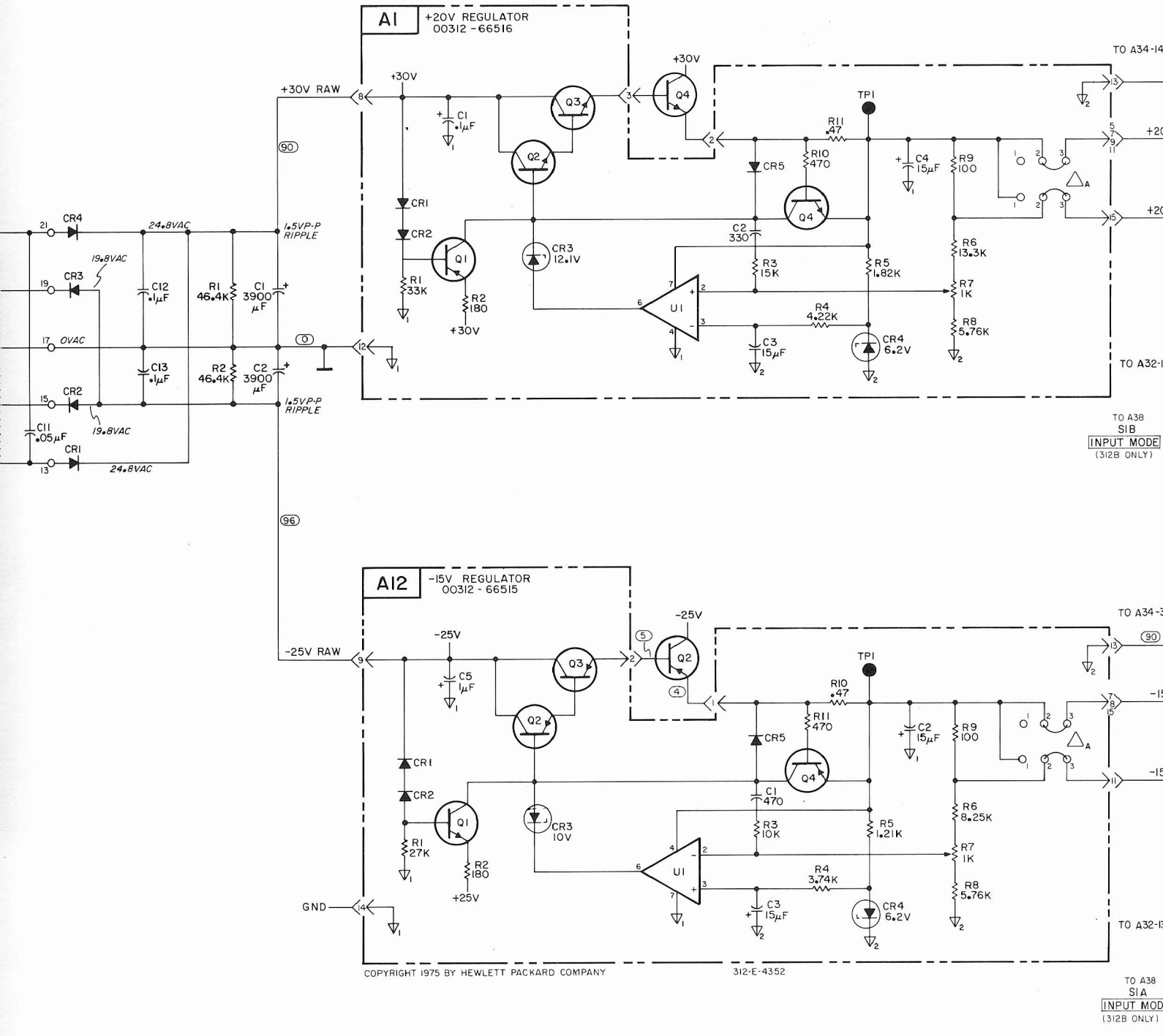
Δ_A A SLIDE SWITCH WAS INSTALLED IN THE FOLLOWING INSTRUMENTS:

312B SERIAL NO's. 1534A00425 AND BELOW
312D SERIAL NO's. 1523A00155 AND BELOW

S1 SWITCH: SLIDE -hp- PART NO. 3101-1235 QUANTITY - 2.

NOTE: *TO IMPROVE RELIABILITY, REPLACE S1 WITH TWO PIECES OF NO. 14 WIRE AS INDICATED IN SCHEMATIC.*





312-E-4352

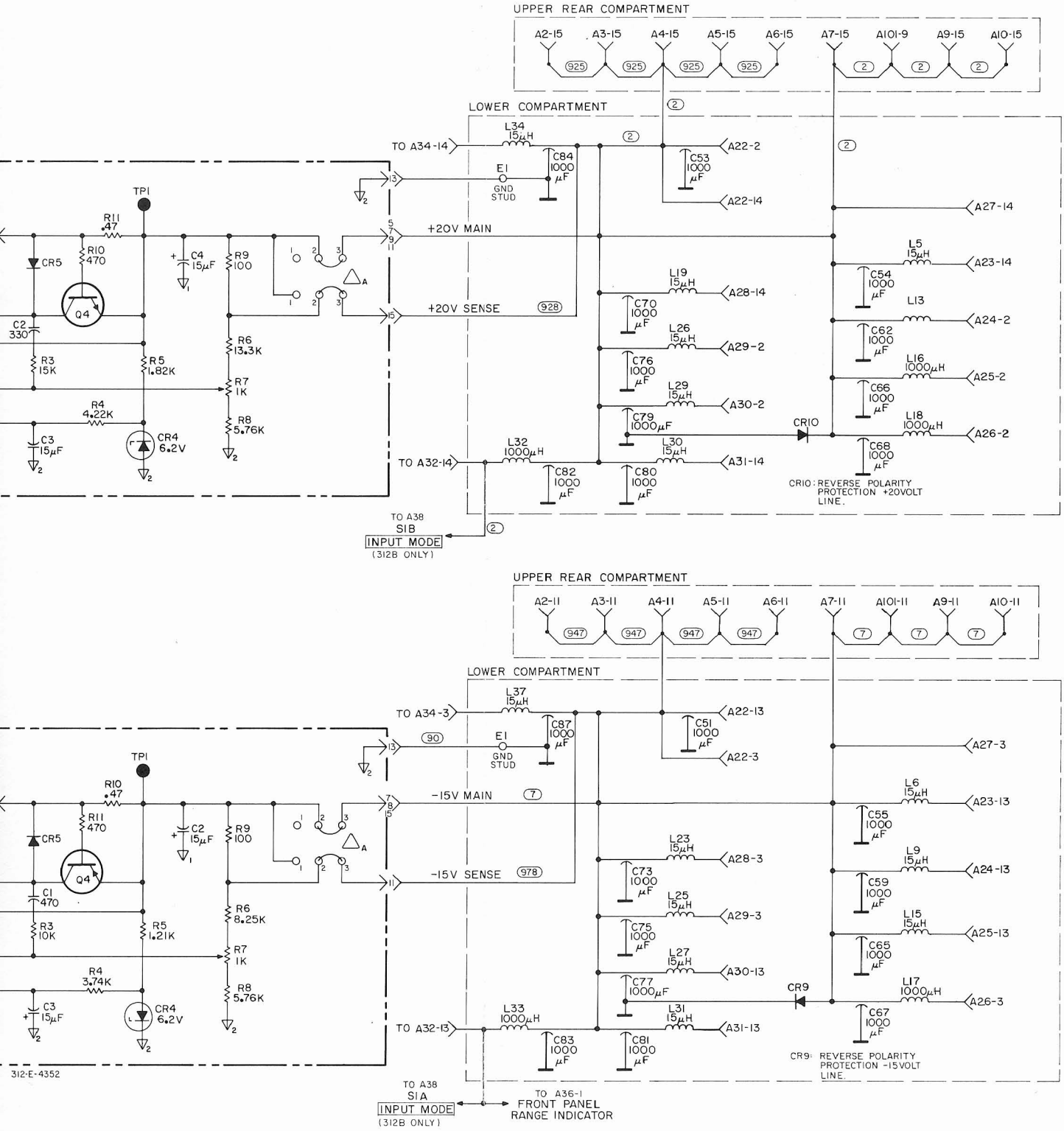


Figure 7-28. + 20 V Regulator and - 15 V Regulator.

SECTION VIII
BACKDATING

8-1. INTRODUCTION.

8-2. This section makes this manual applicable to instruments with serial numbers lower than the ones on the title page of this manual. Where applicable, the backdating has been integrated into the text, parts list or schematics. This type of change is denoted by an open delta (Δ) or a lettered delta (Δ_B). The delta refers to the corresponding backdating note on that page. If the backdating change is too long or otherwise impractical to incorporate into the text, the change will be denoted by a numbered delta (Δ_1). The numbered delta refers to the corresponding numbered delta in this section.

8-3. Only those changes which cannot be adapted to earlier instruments or which do not benefit the operation or specification of earlier instruments are listed. If a component value or a component part number differs from the value or part number listed in the replaceable parts list, yet is not listed in this section or integrated into the text, the value and part number listed in the replaceable parts list is to be used if replacement is necessary. The new component is to be considered as an improvement to instrument operation or specifications.

Δ_1 S/N 1442A00400 and Below (Model 312B ONLY)

8-4. ADJUSTMENT PROCEDURES.

8-5. Frequency Response Adjustment (312B Only).

8-6. The frequency response adjustment for the 312B's with serial numbers 1442A00400 and below can be accomplished by modification of the procedure in Paragraphs 5-49 through 5-52.

a. The sweeping voltage for A33 Assembly adjustments (Paragraph 5-51) is between + 4 volts and - 10 volts.

b. The frequency response display will be backwards (frequency will increase from right to left rather than left to right).

c. In Paragraph 5-52 Step c, adjust A32C3 rather than A32C10. Adjust A32C8 for best common mode rejection in Step f of Paragraph 5-52.

d. Reference Level Attenuator adjustments in Paragraph 5-53 do not require any modification.

8-7. Oscillator Adjustments.

8-8. Paragraphs 8-9 through 8-12 replace Paragraph 5-37 in this manual for 312B, S/N 1442A00400 and below.

8-9. Step Oscillator Adjustments.

8-10. APC Balance Adjustments.

a. Set the FREQUENCY RANGE-MHz switch to one of the blank positions between 0 and 17.

b. Set the oscilloscope for a vertical sensitivity of .01 V/cm dc coupled. Use a 10:1 divider probe and the 50 kHz Low Pass Filter shown in Figure 8-1. Connect the probe to TP36 (APC LOCK 0V) on the A24 Assembly.

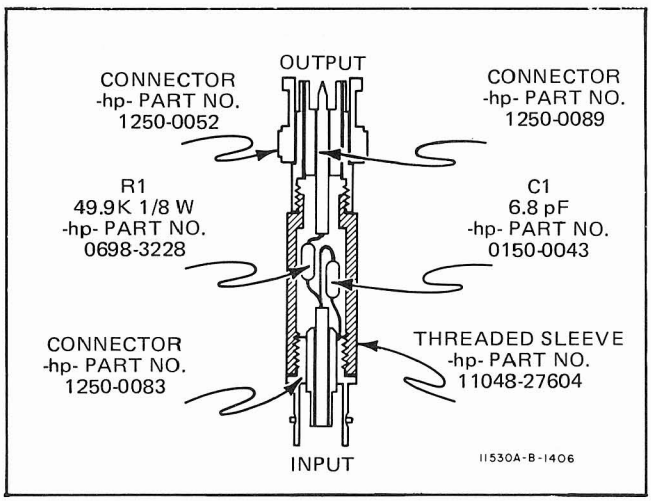


Figure 8-1. Low Pass Filter.

c. Adjust A24R14 (APC BALANCE) for a search signal with symmetrical swing. The amplitude should be greater than 500 mV peak-to-peak.

8-11. Oscillator Programming.

a. Leave the oscilloscope connected as in the APC BALANCE ADJUSTMENTS. Remove the A29 Assembly. Using a 50 Ω cable with clip leads, connect the input of the 5245L Electronic Counter to XA29 pin 15 (cable W13). Terminate the 5245L counter input with a 50 Ω feedthru.

b. Place the Step Oscillator Assembly (A28) on an extender board (P/N 00312-60024). Position A27R1 through A27R6 at the center of their range.

c. Set the FREQUENCY RANGE-MHz switch to 0 and adjust A28T1 (28 – 32 TUNE) for 0 volts dc on the oscilloscope. The 5245L counter should indicate 28 MHz.

d. Set the FREQUENCY RANGE-MHz switch to 7 and adjust A28T2 (33 – 38 TUNE) for 0 volts dc on the oscilloscope. The 5245L counter should indicate 35 MHz.

e. Set the FREQUENCY RANGE-MHz switch to 12 and adjust A28T3 (39 – 45 TUNE) for 0 volts dc on the oscilloscope. The 5245L counter should indicate 40 MHz.

f. Remove A28 from extender board and reinstall it. Set the FREQUENCY RANGE-MHz switch to 0.

g. Adjust A27R1 (0/28 MHz) for 28 MHz on the 5245L counter and 0 volts dc on the oscilloscope.

h. Set the FREQUENCY RANGE-MHz to 4. Adjust A27R2 (4/32 MHz) for 32 MHz on the 5245L counter and 0 volts dc on the oscilloscope.

i. Repeat Steps g and h until both switch positions give 0 volts dc on the oscilloscope. For positions 1, 2 and 3 the oscilloscope should indicate 0.0 ±0.1 volts dc.

j. Using the procedure of Steps g, h and i, adjust A27R3 through R6. Table 8-1 gives the FREQUENCY RANGE-MHz switch settings, counter indications and reference designators.

Table 8-1. Oscillator Programming Adjustments.

Frequency Setting	Adjustment	Counter Indication	Instructions
5 10	A27R3 (5/33 MHz) A27R4 (10/38 MHz)	33 MHz 38 MHz	Alternate between these two.
11 17	A27R5 (11/39 MHz) A27R6 (17/45 MHz)	39 MHz 45 MHz	Alternate between these two.

k. Check the oscilloscope indications for each FREQUENCY RANGE-MHz switch position not listed in Table 8-1. Each position should be within 100 mV dc of zero.

l. Remove the cable connected to XA29 pin 15 and reinstall the A29 Assembly.

NOTE

Table 8-2 gives the output levels into 50 Ω for A28. These will not normally require any adjustment after being set at the factory. The output should not exceed 150 mV on any frequency range.

Table 8-2. A28 Output Levels (XA29 Pin 15).

FREQUENCY RANGE–MHz Switch Position	ADJUSTMENT	TEST LIMITS
0 7 12	A28R3 A28R8 A28R13	95–115 mV rms 105–140 mV rms 115–140 mV rms

8-12. First Local Oscillator Adjustment.

a. Using the same oscilloscope setup as the Step Oscillator Adjustments, connect the oscilloscope probe to A23TP51 (APC LOCK 0V).

b. Connect the 5245L counter to the LOCAL OSC OUTPUT on the 312B rear panel.

c. Set the FREQUENCY RANGE-MHz switch to 0 and the COARSE FREQUENCY TUNING to midrange (5 turns from either end).

d. Adjust A27R7 (30 – 31 MHz) for 0 volts dc on the oscilloscope display. The 5245L counter should indicate a frequency between 30 MHz and 31 MHz.

e. Set the FREQUENCY RANGE-MHz switch to 8 and adjust A27R8 (38 – 39 MHz) for an indication of + 100 mV on the oscilloscope. The 5245L counter should indicate between 38 MHz and 39 MHz.

f. Repeat Steps d and e until both conditions are satisfied.

g. Check the positions between 0 and 8. These should have oscilloscope indications between - 0.05 volts and + 0.25 volts.

h. Repeat Steps d through g for FREQUENCY RANGE-MHz switch positions 9 and 17. The adjustment for 9 is A27R9 (39 – 40 MHz) and A27R10 (47 – 48 MHz) is for 17.

NOTE

AMPLITUDE CHECK: Connect the LOCAL OSC OUTPUT to the 180A Oscilloscope via a 50 ohm feedthru. The output should be between 170 mV and 250 mV p-p on each frequency range.

Replaceable Parts (312B Only) for S/N 1442A00400 & Below.

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A23	00312-60157		SECOND SYNTHESIS STEP ASSEMBLY	-hp-	
	5020-2045		Extractor: cord	-hp-	
	1480-0116		Pin: Grooved 1/16" diam x 1/4 lg cad. plated	73957	obd GP24-063
C1	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
C2	0160-2393		C: fxd my 0.33 μF ± 5% 100 vdcw	84411	603UW
C3	0160-2392		C: fxd my 0.22 μF ± 5% 100 vdcw	84411	663UW
C4	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	150D685X9035B2-DY DYS
C5	0160-2204		C: fxd mica 100 pF ± 5%	72136	RDM15F101J3C
C6	0180-1735		C: fxd Ta elect 0.22 μF ± 10% 35 vdcw	56289	150D224X9035A2-DYS
C7 thru C9	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
C10	0180-1746		C: fxd Ta elect 15 μF ± 10% 20 vdcw	56289	150D156X9020B2-DYS
C11, C12	0150-0096		C: fxd cer 0.05 μF +80% -20% 100 vdcw	91418	Type TA obd
C13	0140-0194		C: fxd mica 110 pF ± 5% 300 vdcw	72136	RDM15F111J3C
C14	0150-0096		C: fxd cer 0.05 μF +80% -20% 100 vdcw	91418	Type TA obd
C15	0180-0197		C: fxd Ta elect 2.2 μF ± 10% 20 vdcw	56289	150D225X9020A2-DYS
CR1 thru CR7	1901-0025		Diode: Si 100 wiv 12 pF 100 mA	49956	RD1526
CR8 thru CR11	1901-0040		Diode: Si 30 wiv 30 mA 2 pF 2 ns	07263	FDG 1088
CR12 thru CR15	1901-0025		Diode: Si 100 wiv 12 pF 100 mA	49956	RD 1526
L1, L2	9140-0137		Coil: molded choke 1000 μH ± 5%	82142	19-1331-35J
Q1 thru Q4	1854-0071		TSTR: Si NPN**	-hp-	
Q5, Q6	1853-0016		TSTR: Si PNP 2N3638	07263	obd
Q7, Q8	1854-0071		TSTR: Si NPN**	-hp-	
R1	0698-3136		R: fxd met flm 17.8 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R2	0698-3151		R: fxd met flm 2.87 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R3	0757-0290		R: fxd met flm 6.19 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R4	0757-0439		R: fxd met flm 6.81 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R5	0698-3158		R: fxd met flm 23.7 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R6	0698-3157		R: fxd met flm 19.6 kΩ ± 1% 1/8 W	75042	CEA T-O obd'
R7, R8	0698-0084		R: fxd met flm 2.15 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R9	0757-0439		R: fxd met flm 6.81 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R10	0757-0444		R: fxd met flm 12.1 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R11	0757-0447		R: fxd met flm 16.2 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R12	0698-3439		R: fxd met flm 178Ω ± 1% 1/8 W	75042	CEA T-O obd
R13	0757-0199		R: fxd met flm 21.5 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R14	0757-0279		R: fxd met flm 3.16 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R15	0757-1094		R: fxd met flm 1.47 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R16	0757-0442		R: fxd met flm 10 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R17	0698-3445		R: fxd met flm 348Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R18	0757-0460		R: fxd met flm 61.9 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R19	0698-3136		R: fxd met flm 17.8 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R20	0698-3152		R: fxd met flm 3.48 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R21	0698-3153		R: fxd met flm 3.83 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R22	0757-1094		R: fxd met flm 1.47 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R23	0698-3152		R: fxd met flm 3.48 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R24	0698-3153		R: fxd met flm 3.83 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R25	0757-1094		R: fxd met flm 1.47 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R26 thru R29	0757-0280		R: fxd met flm 1000Ω ± 1% 1/8 W	75042	CEA T-O obd
R30	0757-0394		R: fxd met flm 51.1Ω ± 1% 1/8 W	75042	CEA T-O obd
R31	0757-0200		R: fxd met flm 5.62 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R32	0757-0461		R: fxd met flm 68.1 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R33	0757-0444		R: fxd met flm 12.1 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R34	0698-3157		R: fxd met flm 19.6 kΩ ± 1% 1/8 W	75042	CEA T-O obd
T1	00312-60077		Transformer assembly 2-3 MNZ Input	-hp-	
T2	00312-60078		Transformer assembly 2-3 MHZ Output	-hp-	
A24	00312-60024		STEP OSCILLATOR LOCK ASSEMBLY	-hp-	
	5020-2045		Extractor: cord	-hp-	
C1 thru C3	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C4	0140-0190		C: fxd mica 39 pF ± 5% 300 vdcw	72136	RDM15E390J3C

Replaceable Parts (312B Only) for S/N 1442A00400 & Below (cont'd).

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A24	00312-60024		STEP OSCILLATOR LOCK ASSEMBLY (cont'd)		
C5	0150-0093		C: fxd cer 0.01 μF +80% -20% 100 vdcw	91418	TA obd
C6	0140-0205		C: fxd mica 62 pF ± 5% 300 vdcw	72136	RDM15E620J3C
C7	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
C8	0160-2307		C: fxd mica 47 pF ± 5% 300 vdcw	72136	RDM15E470J3C
C9, C10	0150-0050		C: fxd cer 0.001 μF 600 vdcw		Type E obd
C11	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
C12	0160-2393		C: fxd my 0.33 μF ± 5% 100 vdcw	84411	683 UW
C13	0160-2392		C: fxd my 0.22 μF ± 5% 100 vdcw	84411	663 UW
C14	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
C15	0160-0134		C: fxd mica 220 pF ± 5% 300 vdcw	72136	RDM15F221J3C
C16	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	120D685X9035B2-DYS
C17	0180-0218		C: fxd Ta elect 0.15 μF ± 10% 35 vdcw	56289	150D154X9035A2-DYS
C18, C19	0180-0116		C: fxd Ta elect 6.8 μF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
CR1	1910-0016		Diode: Ge 60 wiv 1 ns	03877	S3 185G
CR2	1901-0040		Diode: Si 30 wiv 30 mA 2 pF 2 ns		
CR3, CR4	1901-0179		Diode: Si 0.75 ns 0.8 pF 15 wiv	07263	FD 7018
CR5 thru CR10	1901-0025		Diode: Si 100 wiv 12 pF 100 mA	49956	RD 1526
Q1	1854-0071		TSTR: Si NPN **	-hp-	
Q2, Q3	1853-0020		TSTR: Si PNP **	-hp-	
Q4	1854-0071		TSTR: Si NPN **	-hp-	
Q5	1853-0009		TSTR: Si PNP **	-hp-	
Q6	1854-0005		TSTR: Si NPN 2N708	07263	obd
Q7, Q8	1854-0071		TSTR: Si NPN **	-hp-	
Q9	1853-0016		TSTR: Si PNP 2N3638	07263	obd
Q10	1854-0005		TSTR: Si NPN 2N708	07263	obd
Q11, Q12	1854-0071		TSTR: Si NPN **	-hp-	
R1	0757-0394		R: fxd met flm 51.1Ω ± 1% 1/8 W	75042	CEA T-O obd
R2	0698-3438		R: fxd met flm 147Ω ± 1% 1/8 W	75042	CEA T-O obd
R3	0757-0821		R: fxd met flm 1.21 kΩ ± 1% 1/2 W	91627	MFF 1/2 T-1
R4	0757-0401		R: fxd flm 100 Ω ± 1% 1/8 W	75042	CEA T-O obd
R5	0698-3406		R: fxd met flm 1.33 kΩ ± 1% 1/2 W	91637	MFF 1/ T-1
R6	0698-0084		R: fxd met flm 2.15 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R7	0698-3445		R: fxd met flm 348Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R8	0757-0421		R: fxd met flm 825Ω ± 1% 1/8 W	75042	CEA T-O obd
R9	0757-0438		R: fxd met flm 5.11 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R10	0698-3152		R: fxd met flm 3.48 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R11	0757-0444		R: fxd met flm 12.1 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R12	0757-0290		R: fxd met flm 6.19 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R13	0698-3136		R: fxd met flm 17.8 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R14	2100-1760		R: var ww lin trim 5 kΩ ± 10% 1/2 W	75042	Type 506 obd
R15	0757-0442		R: fxd met flm 10 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R16	0757-0465		R: fxd met flm 100 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R17	0698-3156		R: fxd met flm 14.7 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R18	0757-0289		R: fxd met flm 13.3 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R19	0698-3151		R: fxd met flm 2.87 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R20	0698-3154		R: fxd met flm 4.22 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R21	0757-0200		R: fxd met flm 5.62 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R22	0698-3158		R: fxd met flm 23.7 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R23	0698-3157		R: fxd met flm 19.6 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R24	0757-0442		R: fxd met flm 10 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R25	0698-3150		R: fxd met flm 2.37 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R26	0698-3156		R: fxd met flm 14.7 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R27	0698-3440		R: fxd met flm 196Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R28	0757-0439		R: fxd met flm 6.81 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R29	0757-0419		R: fxd met flm 681Ω ± 1% 1/8 W	91637	MFF T-1
R30	0698-3157		R: fxd met flm 19.6 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R31	0757-0288		R: fxd met flm 9.09 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R32	0698-3157		R: fxd met flm 19.6 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R33	0698-3153		R: fxd met flm 3.83 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R34	0757-0438		R: fxd met flm 5.11 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R35	0698-3152		R: fxd met flm 3.48 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R36	0757-0438		R: fxd met flm 5.11 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R37	0698-3447		R: fxd met flm 422Ω ± 1% 1/8 W	75042	CEA T-O obd
R38	0757-0278		R: fxd met flm 1.78 kΩ ± 1 1/8 W	75042	CEA T-O obd
R39, R40	0757-0401		R: fxd met flm 100Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
T1	9100-1770		Transformer	98734	Z-3174

Replaceable Parts (312B Only) for S/N 1442A00400 & Below (cont'd).

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A26	00312-60026		1MHz OSCILLATOR ASSEMBLY	-hp-	
	5020-2045		Extractor: card	-hp-	
	1480-0116		Pin: grooved 1/16" diam x 1/4 lg cad.plated	73957	GP24-063
C1	0180-0116		C: fxd Ta elect 6.8 µF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
C2	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
C3	0130-0016		C: var cer 5-25 pF	72982	557-610-39A
C4	0160-2259		C: fxd cer 12 pF ± 5% 500 vdcw	72982	301-000GOPO120J
C5, C6	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
C7	0140-0191		C: fxd mica 56 pF ± 5% 300 vdcw	72136	RDM15E560J3C
C8	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
C9	0140-0191		C: fxd mica 56 pF ± 5% 300 vdcw	72136	RDM15E560J3C
C10	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
C11	0140-0191		C: fxd mica 56 pF ± 5% 300 vdcw	72136	RDM15E560J3C
C12	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
C13	0140-0191		C: fxd mica 56 pF ± 5% 300 vdcw	72136	RDM15E560J3C
C14	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
C15	0140-0191		C: fxd mica 56 pF ± 5% 300 vdcw	72136	RDM15E560J3C
C16 thru C21	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
C22	0180-0116		C: fxd Ta elect 6.8 µF ± 10% 35 vdcw	56289	150D685X9035B2-DYS
C23 thru C26	0150-0093		C: fxd cer 0.01 µF +80% -20% 100 vdcw	91418	TA obd
CR1	1910-0016		Diode: Ge 60 wiv 1 ns	03877	S3 185G
Q1, Q2	1854-0071		TSTR: Si NPN	01295	SKA1124
Q3	1854-0005		TSTR: Si NPN 2N708	07263	obd
Q4 thru Q10	1854-0071		TSTR: Si NPN**	-hp-	
R1	0698-3154		R: fxd met flm 4.22 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R2	0757-0438		R: fxd met flm 5.11 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R3	0757-0281		R: fxd met flm 2.74 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R4	0757-0438		R: fxd met flm 5.11 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R5	0757-0274		R: fxd met flm 1.21 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R6, R7	0757-0465		R: fxd met flm 100 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R8	0757-0401		R: fxd met flm 100Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R9	0698-3155		R: fxd met flm 4.64 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R10	0698-3136		R: fxd met flm 17.8 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R11	0757-0280		R: fxd met flm 1000Ω ± 1% 1/8 W	75042	CEA T-O obd
R12	0698-3152		R: fxd met flm 3.48 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R13	0757-0288		R: fxd met flm 9.09 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R14	0757-0280		R: fxd met flm 1000Ω ± 1% 1/8 W	75042	CEA T-O obd
R15	0757-0440		R: fxd met flm 7.50 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R16	0757-0288		R: fxd met flm 9.09 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R17	0757-0280		R: fxd met flm 1000Ω ± 1% 1/8 W	75042	CEA T-O obd
R18	0757-0440		R: fxd met flm 7.50 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R19	0698-3136		R: fxd met flm 17.8 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R20	0757-0280		R: fxd met flm 1000Ω ± 1% 1/8 W	75042	CEA T-O obd
R21	0757-0440		R: fxd met flm 7.50 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R22	0757-0123		R: fxd met flm 34.8 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R23	0757-0280		R: fxd met flm 1000Ω ± 1% 1/8 W	75042	CEA T-O obd
R24	0757-0442		R: fxd met flm 10 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R25	0757-0401		R: fxd met flm 100Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R26	0757-0438		R: fxd met flm 5.11 kΩ ± 1% 1/8 W	91637	MFF 1/8 T-1
R27	0698-3151		R: fxd met flm 2.87 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R28	0757-0401		R: fxd met flm 100Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R29	0757-0439		R: fxd met flm 6.81 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R30	2100-1760		R: var ww lin trim 5 kΩ ± 10% 1/2 W	75042	Type 506 obd
R31	0757-0279		R: fxd met flm 3.16 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R32	0757-0394		R: fxd met flm 51.1Ω ± 1% 1/8 W	75042	CEA T-O obd
R33	0757-0420		R: fxd met flm 750 Ω ± 1% 1/8 W	75042	CEA T-O obd
R34	0757-0399		R: fxd met flm 82.5 kΩ ± 1% 1/8 W	75042	CEA T-O obd
Y1	0410-0133		Crystal: Quartz 1 MHz CR 18A/U	13835	obd

Replaceable Parts (312B Only) for S/N 1442A00400 & Below (cont'd).

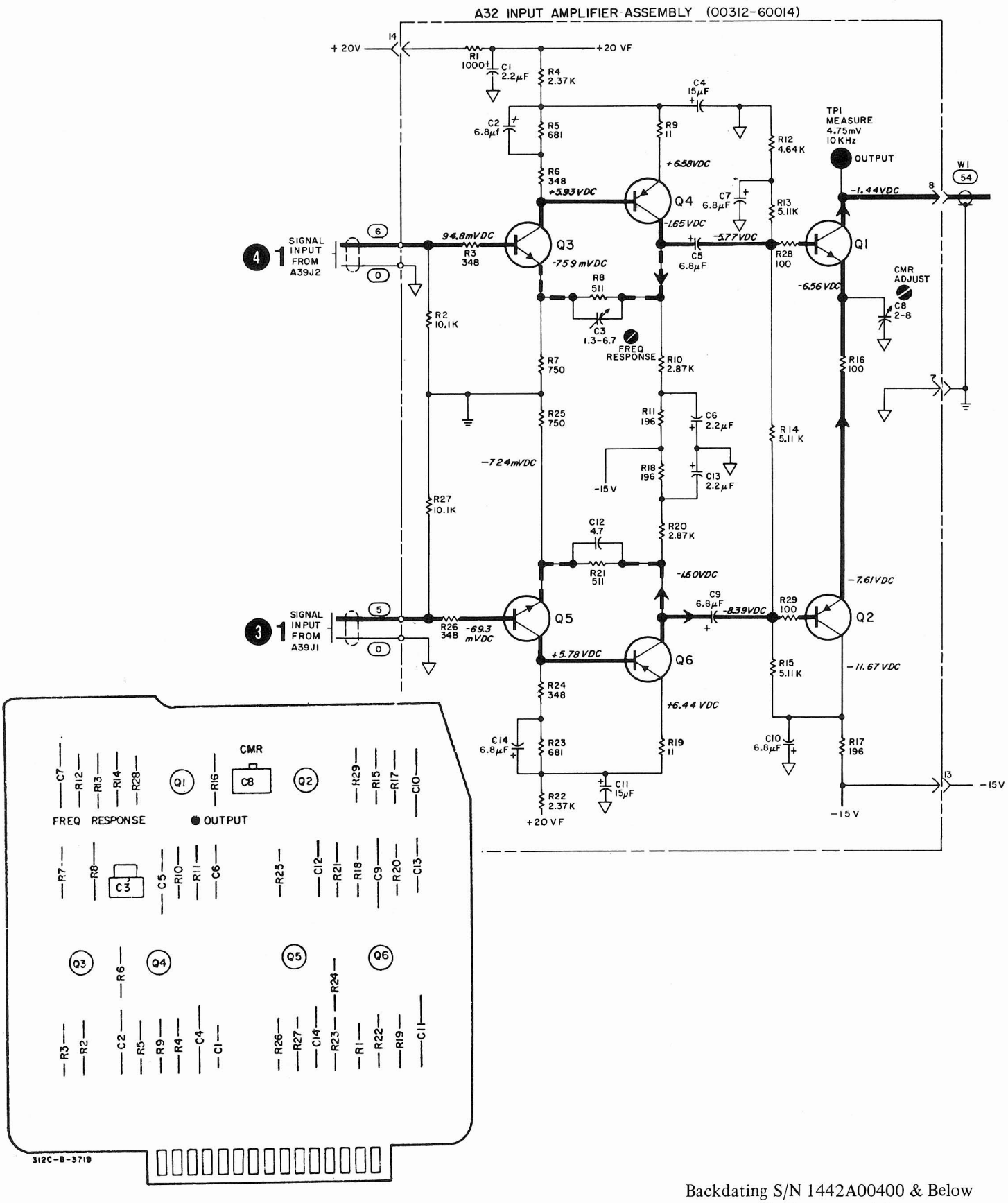
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A28	00312-60177		STEP OSCILLATOR ASSEMBLY		
	5020-2045		Extractor: card	-hp-	
	9170-0105		Core: slug iron	95566	A1-464
	1480-0116		Pin: grooved 1/16" diam x 1/4 lg cad. plated	73957	GP24-063X250-12
C1	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C2	0160-2202		C: fxd mica 75 pF ± 5%	72136	RDM15E750J3C
C3	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C4	0140-0205		C: fxd mica 62 pF ± 5% 300 vdcw	72136	RDM15E620J3C
C5	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C6	0160-2201		C: fxd mica 51 pF ± 5%	72136	RDM15E510J3C
C7, C8	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C9	0150-0093		C: fxd cer 0.01 μF +80% -20% 100 vdcw	91418	TA obd
C10 thru C12	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C13	0150-0093		C: fxd cer 0.01 μF +80% -20% 100 vdcw	91418	TA obd
C14	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
CR1 thru CR6	0122-0215		C: voltage var 56 pF ± 10% 30 V	04713	MV 837
CR7	1901-0025		Diode: Si 100 wiv 12 pF 100 mA	49956	RD 1526
L1 thru L3	9140-0179		Coil: molded choke 22.0 μH ± 10	82142	15-4445-7J
L4, L5	9170-0029		Core: ferrite bead	02114	56-590-65A2 4A
Q1 thru Q5	1854-0215		TSTR: Si NPN 2N3904	04713	SPS 3611
R1	0757-0290		R: fxd met flm 6.19 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R2	0757-0444		R: fxd met flm 12.1 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R3*	0757-		R: fxd met flm 5.62 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R4	0757-0401		R: fxd met flm 100Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R5	0698-0084		R: fxd met flm 2.15 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R6	0757-0290		R: fxd met flm 6.19 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R7	0757-0444		R: fxd met flm 12.1 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R8*	0698-4471		R: fxd 7150Ω .01%	-hp-	
R9	0757-0401		R: fxd met flm 100Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R10	0698-0084		R: fxd met flm 2.15 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R11	0757-0290		R: fxd met flm 6.19 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R12	0757-0444		R: fxd met flm 12.1 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R13*	0757-		R: fxd met flm 5.62 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R14	0757-0401		R: fxd met flm 100Ω ± 1% 1/8 W	91637	MFF 1/8 T-1
R15	0698-0084		R: fxd met flm 2.15 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R16	0757-0199		R: fxd met flm 21.5 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R17 thru R19	0757-0405		R: fxd met flm 162Ω ± 1% 1/8 W	75042	CEA T-O obd
R20	0757-0280		R: fxd met flm 1000Ω ± 1% 1/8 W	75042	CEA T-O obd
R21	0698-3151		R: fxd met flm 2.87 kΩ ± 1% 1/8 W	75042	CEA T-O obd
R22	0757-0439		R: fxd met flm 6.81 kΩ ± 1% 1/8 W	19701	MF5C T-O obd
R23	0757-0278		R: fxd met flm 1.78 kΩ ±1% 1/8 W	75042	CEA T-O obd
R24	0698-3438		R: fxd met flm 147Ω ±1% 1/8 W	75042	CEA T-O obd
R25 thru R27	0757-0398		R: fxd met flm 75Ω ±1% 1/8 W	19701	MF5C T-O obd
R28	0757-0416		R: fxd met flm 511Ω ±1% 1/8 W	75042	CEA T-O obd
R29	0698-3151		R: fxd met flm 2.87 kΩ ±1% 1/8 W	75042	CEA T-O obd
R30	0757-0439		R: fxd met flm 6.81 kΩ ±1% 1/8 W	19701	MF5C T-O obd
R31	0757-0421		R: fxd met flm 825Ω ±1% 1/8 W	75042	CEA T-O obd
R32	0698-3438		R: fxd met flm 147Ω ±1% 1/8 W	75042	CEA T-O obd
T1	00312-60074		Transformer: Assy 28-32 MHz	-hp-	
T2	00312-60075		Transformer: Assy 33-38 MHz	-hp-	
T3	00312-60076		Transformer: Assy 39-45 MHz	-hp-	

Replaceable Parts (312B Only) for S/N 1442A00400 & Below (cont'd).

Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A32	00312-60014		INPUT AMPLIFIER ASSEMBLY	-hp-	
	5020-2045		Extractor: cord	-hp-	
	1251-0324		Connector: test point 0.187" diam.	00373	69026-1064
C1	0180-0197		C: fxd Ta elect 2.2 μF ±10% 20 vdcw	56289	150D225X9020A2-DYS
C2	0180-0116		C: fxd Ta elect 6.8 μF ±10% 35 vdcw	56289	150D685X9035B2-DYS
C3	0121-0149		C: var air trim 1.3 - 6.7 pF	74970	180-502-53
C4	0180-1746		C: fxd 15 μF ± 10 % 20 vdcw	56289	150D156X9020B2DYS
C5	0180-0116		C: fxd 6.8 μF ± 10 % 35 vdcw	56289	150D685X9035BDYS
C6	0180-0197		C: fxd Ta elect 2.2 μF ±10% 20 vdcw	56289	150D225X9020A2DYS
C7	0180-0116		C: fxd 6.8 μF ± 10 % 35 vdcw	56289	150D685X9035B2DYS
C8	0121-0059		C: var cer 2 - 8 pF 300 vdcw	72982	538-006-C0P0-89R
C9	0180-0116		C: fxd 6.8 μF ± 10 % 35 vdcw	56289	150D685X9035B2-DYS
C10	0180-0116		C: fxd 6.8 μF + 10 % 35 vdcw	56289	150D685X9035B2-DYS
C11	0180-1746		C: fxd elect. 15 μF ± 10% 20 vdcw	-hp-	
C12	0150-0042		C: fxd TiO_2 4.7 pF ±5% 500 vdcw	78488	Type GA obd
C13	0180-0197		C: fxd Ta elect 2.2 μF ±10% 20 vdcw	56289	150D225X9020A2-DYS
C14	0180-0116		C: fxd Ta elect 6.8μF ±10% 35 vdcw	56289	150D685X9035B2-DYS
Q1	1854-0337		TSTR: Si NPN 250 MHz 20 V	73445	SM1570 obd
Q2	1853-0015		TSTR: Si PNP 2N3640	07263	obd
Q3	1854-0337		TSTR: Si NPN 250 MHz 20 V	73445	obd
Q4	1853-0015		TSTR: Si PNP 2N3640	07263	obd
Q5	1854-0337		TSTR: Si NPN 250 MHz 20 V	73445	obd
Q6	1853-0015		TSTR: Si PNP 2N3640	07263	obd
R1	0757-0280		R: fxd met flm 1000Ω ±1% 1/8 W	75042	CEA T-O obd
R2	0698-3109		R: fxd met flm 10.1 kΩ ±1% 1/8 W	75042	CEA T-O obd
R3	0698-3445		R: fxd met flm 348Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R4	0698-3150		R: fxd met flm 2.37 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R5	0757-0419		R: fxd met flm 681Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R6	0698-3445		R: fxd met flm 348Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R7	0698-5407		R: fxd met flm 750Ω ±1/4% 1/8 W	75042	CEA T-O obd
R8	0698-5404		R: fxd met flm 511Ω ±1/4% 1/8 W	75042	CEA T-O obd
R9	0757-0378		R: fxd met flm 11Ω ±1% 1/8 W	75042	CEA T-O obd
R10	0698-3151		R: fxd met flm 2.87 kΩ ±1% 1/8 W	75042	CEA T-O obd
R11	0698-3440		R: fxd met flm 196Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R12	0698-3155		R: fxd met flm 4.64 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R13 thru R15	0757-0438		R: fxd met flm 5.11 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R16	0757-0401		R: fxd met flm 100Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R17, R18	0698-3440		R: fxd met flm 196Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R19	0757-0378		R: fxd met flm 11Ω ±1% 1/8 W	75042	CEA T-O obd
R20	0698-3151		R: fxd met flm 2.87 kΩ ±1% 1/8 W	75042	CEA T-O obd
R21	0698-5404		R: fxd met flm 511Ω ±1/4% 1/8 W	75042	CEA T-O obd
R22	0698-3150		R: fxd met flm 2.37 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R23	0757-0419		R: fxd met flm 681Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R24	0698-3445		R: fxd met flm 348Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R25	0698-5407		R: fxd met flm 750Ω ±1/4% 1/8 W	75042	CEA T-O obd
R26	0698-3445		R: fxd met flm 348Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R27	0698-3109		R: fxd met flm 10.1 kΩ ±1% 1/8 W	75042	CEA T-O obd
R28, R29	0757-0401		R: fxd met flm 100Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd

Replaceable Parts (312B Only) for S/N 1442A00400 & Below (cont'd).

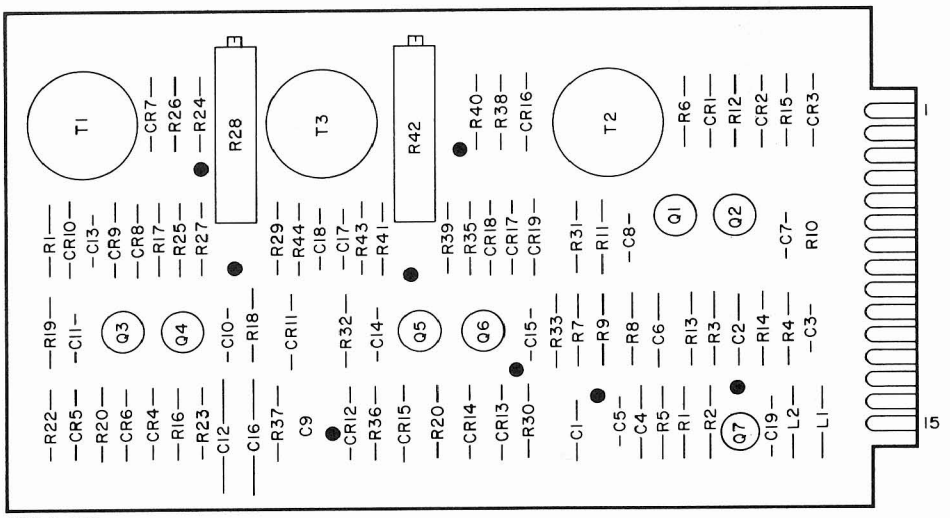
Reference Designation	HP Part Number	Qty	Description	Mfr Code	Mfr Part Number
A35	00312-60028		FIRST LOCAL OSCILLATOR ASSEMBLY	-hp-	
C1	0150-0096		C: fxd cer 0.05 μF +80% -20% 100 vdcw	91418	Type TA obd
C2	0150-0093		C: fxd cer 0.01 μF +80% -20% 100 vdcw	91418	TA obd
C3	0150-0050		C: fxd cer 0.001 μF 600 vdcw	91418	Type E obd
C4	0180-0197		C: fxd Ta elect 2.2 μF ±10% 20 vdcw	56289	150D225X9020A2-DYS
C5, C6	0150-0050		C: fxd cer 0.001 μF 600 vdcw	91418	Type E obd
C7	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C8	0150-0093		C: fxd cer 0.01 μF +80% -20% 100 vdcw	91418	TA obd
C9, C10	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C11	0150-0050		C: fxd cer 0.001 μF 600 vdcw	91418	Type E obd
C12 thru C14	0160-2143		C: fxd cer 2000 pF +80% -20% 1000 vdcw	91418	Type B obd
C15	0150-0093		C: fxd cer 0.01 μF +80% -20% 100 vdcw	91418	TA obd
CR1, CR2	0122-0040		C: voltage var 82 pF ±2%at - 4 Vdc 30 vdcw	04713	obd
L1	9100-1620		Coil: molded choke 15.0 μH ±10%	82142	15-4445-4K
Q1	1854-0337		TSTR: Si NPN 250 mc 30 V 4 pF	73445	obd
Q2	1853-0016		TSTR: Si PNP 2N3638	07263	obd
Q3	1854-0337		TSTR: Si NPN 250 mc 30 V 4 pF	73445	obd
Q4	1854-0019		TSTR: Si NPN 2N2369	07263	S-6516 obd
Q5	1854-0005		TSTR: Si NPN 2N708	07263	obd
R1	0757-0465		R: fxd met flm 100 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R2	0757-0438		R: fxd met flm 5.11 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R3	0757-0442		R: fxd met flm 10 kΩ ±1% 1/8 W	19701	MF5C T-O obd
R4	0757-0180		R: fxd met flm 31.6Ω ±1% 1/8 W	19701	MF5C T-O obd
R5	0698-0084		R: fxd met flm 2.15 kΩ ±1% 1/8 W	75042	CEA T-O obd
R6, R7	0757-1078		R: fxd met flm 1.47 kΩ ±1% 1/2 W	19701	MF7C T-O obd
R8, R9	0757-0280		R: fxd met flm 1000Ω ±1% 1/8 W	75042	CEA T-O obd
R10, R11	0757-0398		R: fxd met flm 75Ω ±1% 1/8 W	19701	MF5C T-O obd
R12	0698-3444		R: fxd met flm 316Ω ±1% 1/8 W	75042	CEA T-O obd
R13	0757-0401		R: fxd met flm 100Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R14	0698-3155		R: fxd met flm 4.64 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R15	0757-0274		R: fxd met flm 1.21 kΩ ±1% 1/8 W	75042	CEA T-O obd
R16	0757-0317		R: fxd met flm 1.33 kΩ ±1% 1/8 W	75042	CEA T-O obd
R17	0698-3155		R: fxd 4.64 kΩ ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R18	0757-0401		R: fxd met flm 100Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R19	0757-0398		R: fxd met flm 75Ω ±1% 1/8 W	19701	MF5C T-O obd
R20	0698-3441		R: fxd met flm 215Ω ±1% 1/8 W	75042	CEA T-O obd
R21	0757-0401		R: fxd met flm 100Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R22	0698-3152		R: fxd met flm 3.48 kΩ ±1% 1/8 W	75042	CEA T-O obd
R23	0698-3151		R: fxd met flm 2.87 kΩ ±1% 1/8 W	75042	CEA T-O obd
R24	0757-0419		R: fxd met flm 681Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
A41	00312-60176		FREQUENCY RANGE SWITCH	-hp-	
CR1 thru CR3	1901-0029		Diode: Si 0.75 A 0.36 by 0.15 body	04713	SR1358-10
R1 thru R5	0757-0401		R: fxd met flm 100Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R6	0757-0400		R: fxd met flm 90.9Ω ±1% 1/8 W	75042	CEA T-O obd
R7 thru R16	0757-0399		R: fxd met flm 82.5Ω ±1% 1/8 W	19701	MF5C T-O obd
R17	0698-3447		R: fxd met flm 422Ω ±1% 1/8 W	75042	CEA T-O obd
R18	0757-0416		R: fxd met flm 511Ω ±1% 1/8 W	75042	CEA T-O obd
R19	0757-0417		R: fxd met flm 562Ω ±1% 1/8 W	75042	CEA T-O obd
R20	0757-0419		R: fxd met flm 681Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R21	0698-3444		R: fxd met flm 316Ω ±1% 1/8 W	75042	CEA T-O obd
R22	0698-3446		R: fxd met flm 383Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R23	0698-0082		R: fxd met flm 464Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R24	0757-0416		R: fxd met flm 511Ω ±1% 1/8 W	75042	CEA T-O obd
R25	0757-0418		R: fxd met flm 619Ω ±1% 1/8 W	75042	CEA T-O obd
R26	0698-3443		R: fxd met flm 287Ω ±1% 1/8 W	19701	MF5C T-O obd
R27	0698-3445		R: fxd met flm 348Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R28	0698-3446		R: fxd met flm 383Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R29	0698-3447		R: fxd met flm 422Ω ±1% 1/8 W	75042	CEA T-O obd
R30	0698-0082		R: fxd met flm 464Ω ±1% 1/8 W	91637	MFF 1/8 T-1 obd
R31	0757-0417		R: fxd met flm 562Ω ±1% 1/8 W	75042	CEA T-O obd
S1	3100-1866		Switch: rotary	76854	obd



A32
hp Part No 00312 - 60014
Rev C

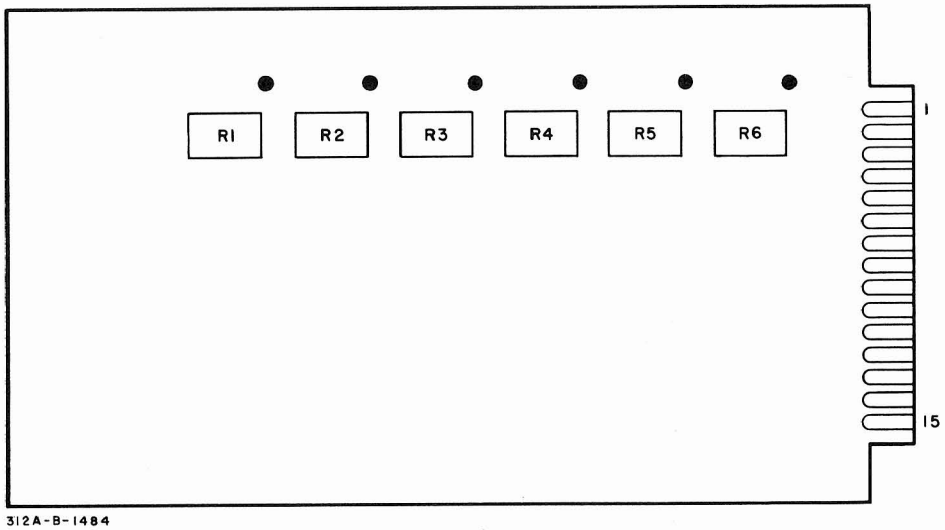
Backdating S/N 1442A00400 & Below
A32 Input Amplifier
Schematic and Component Location

8-9/8-10



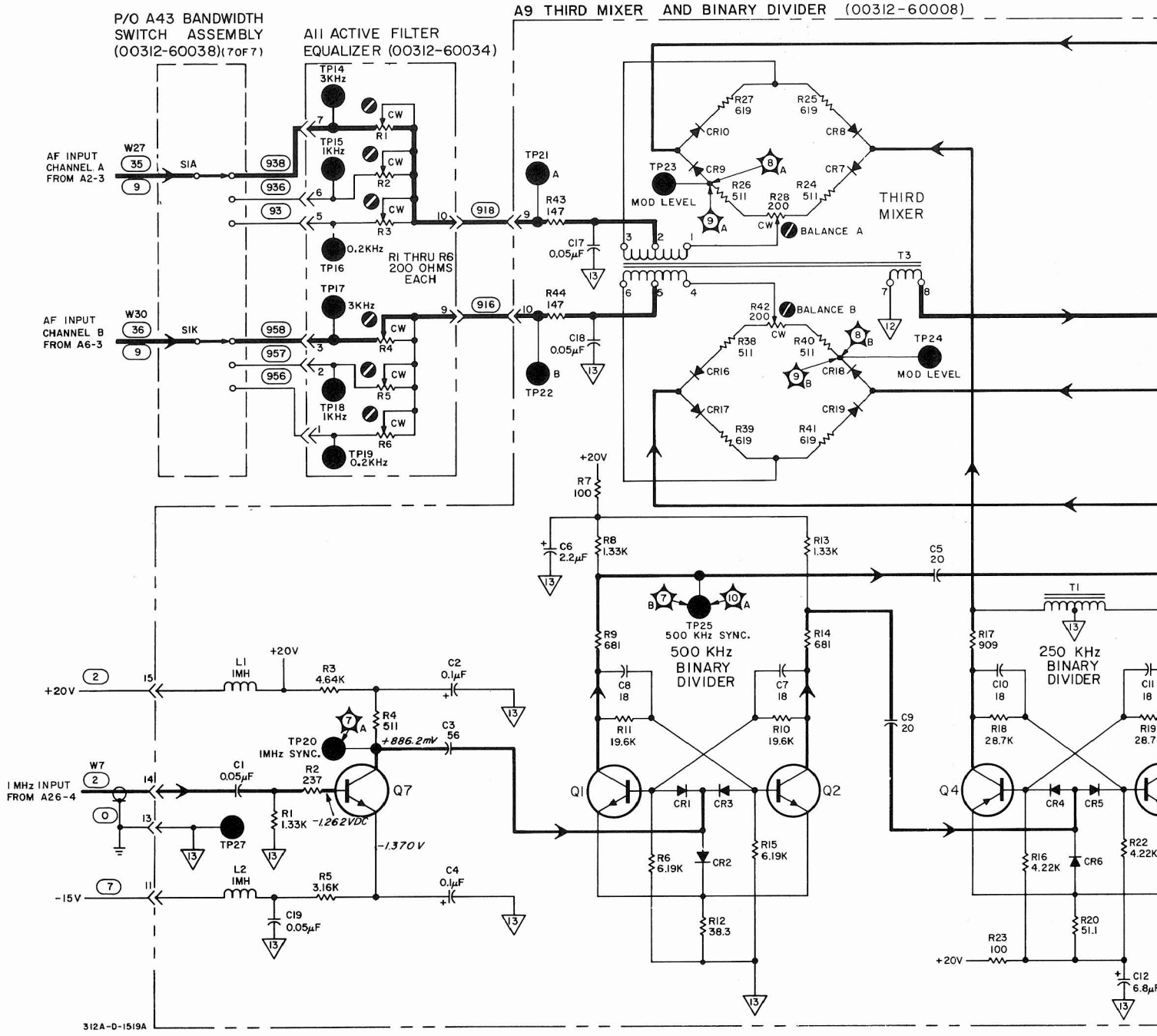
A9

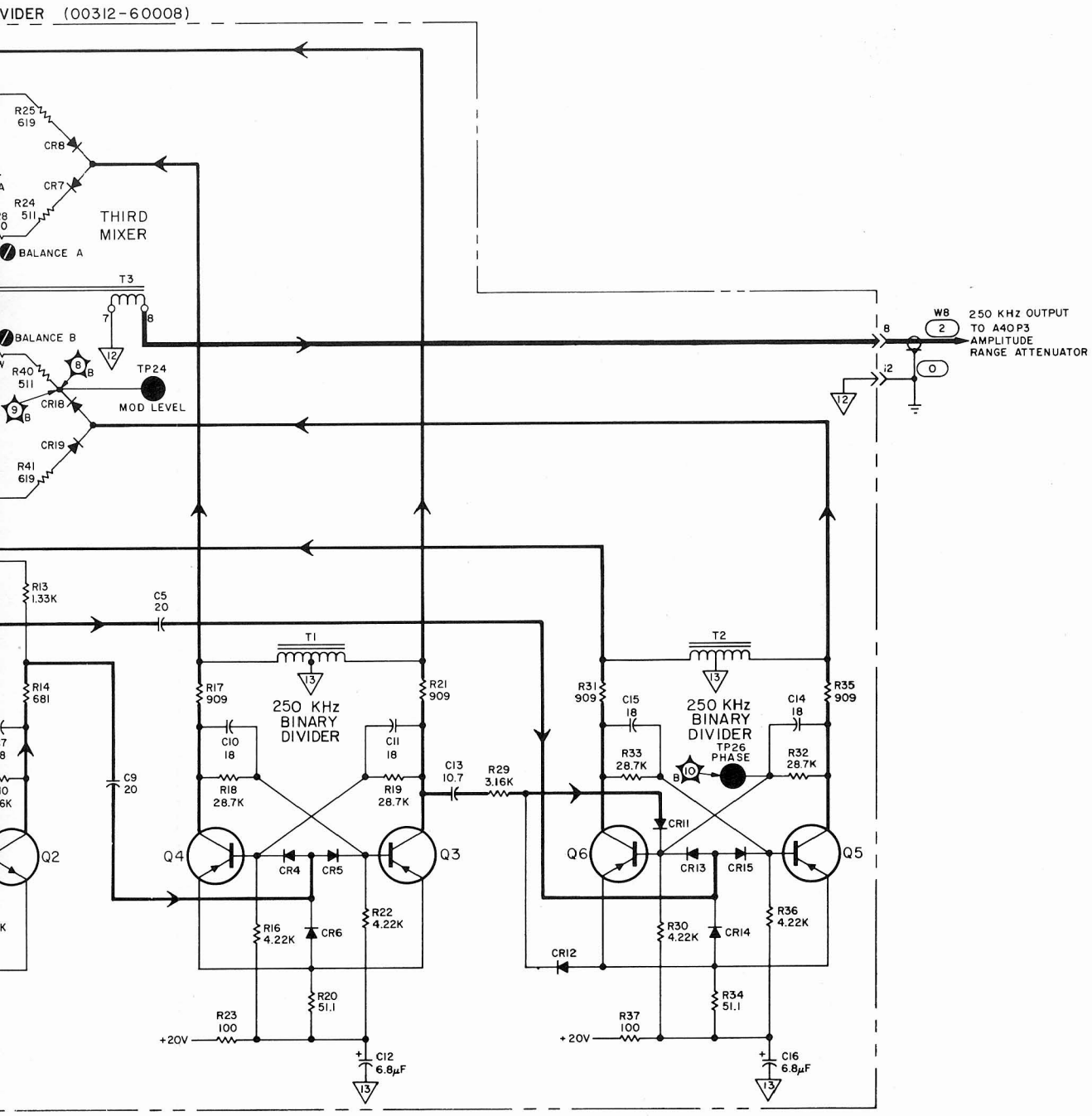
hp Part No. 00312-60008



A11

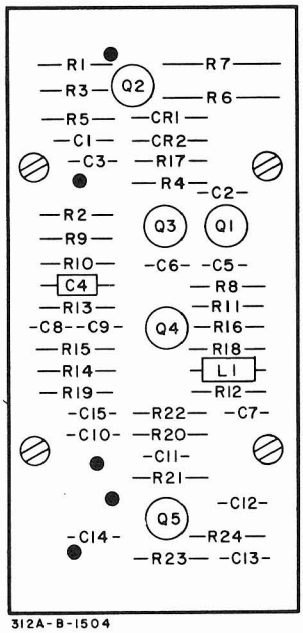
hp Part No. 00312-60034





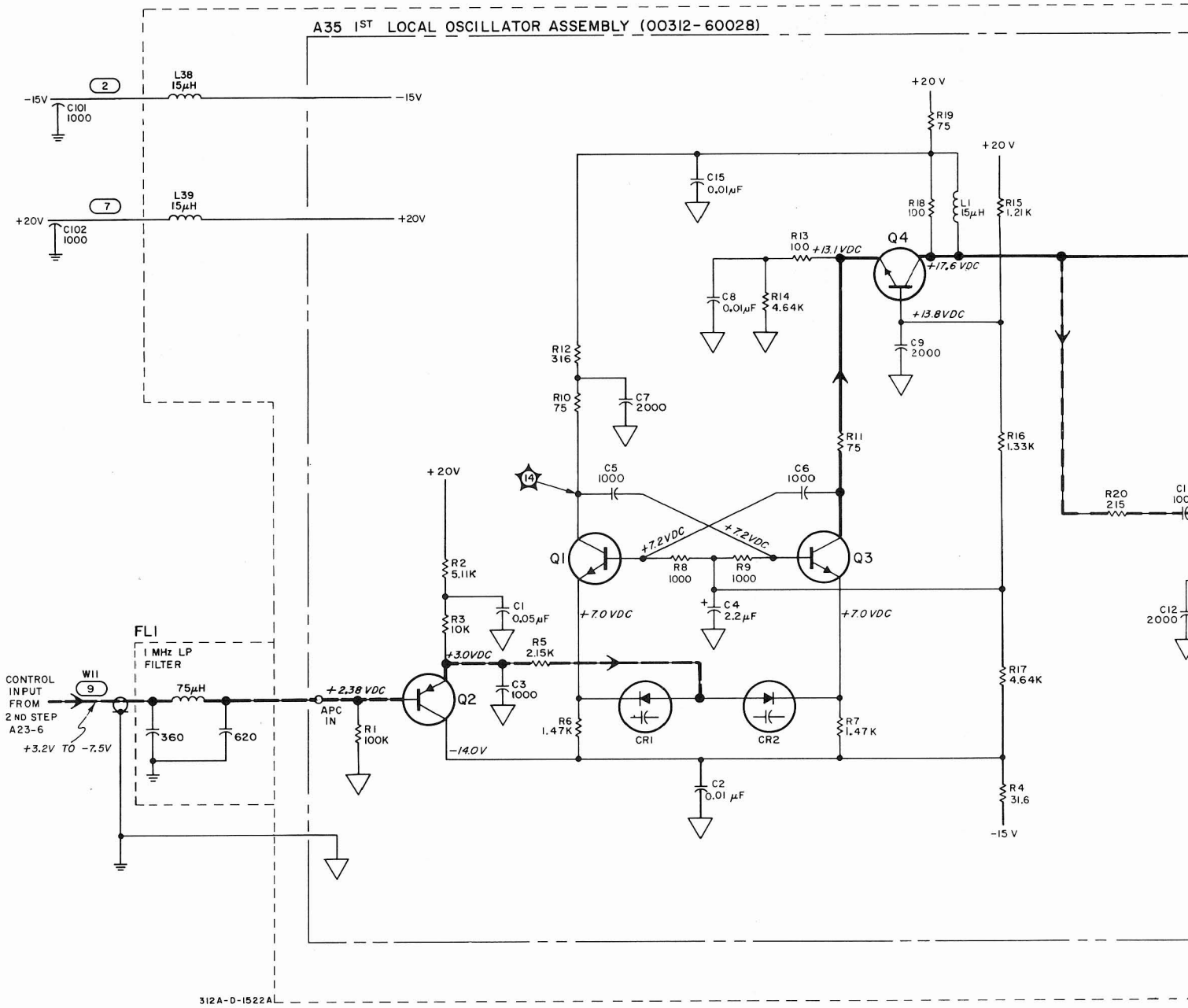
312B ONLY

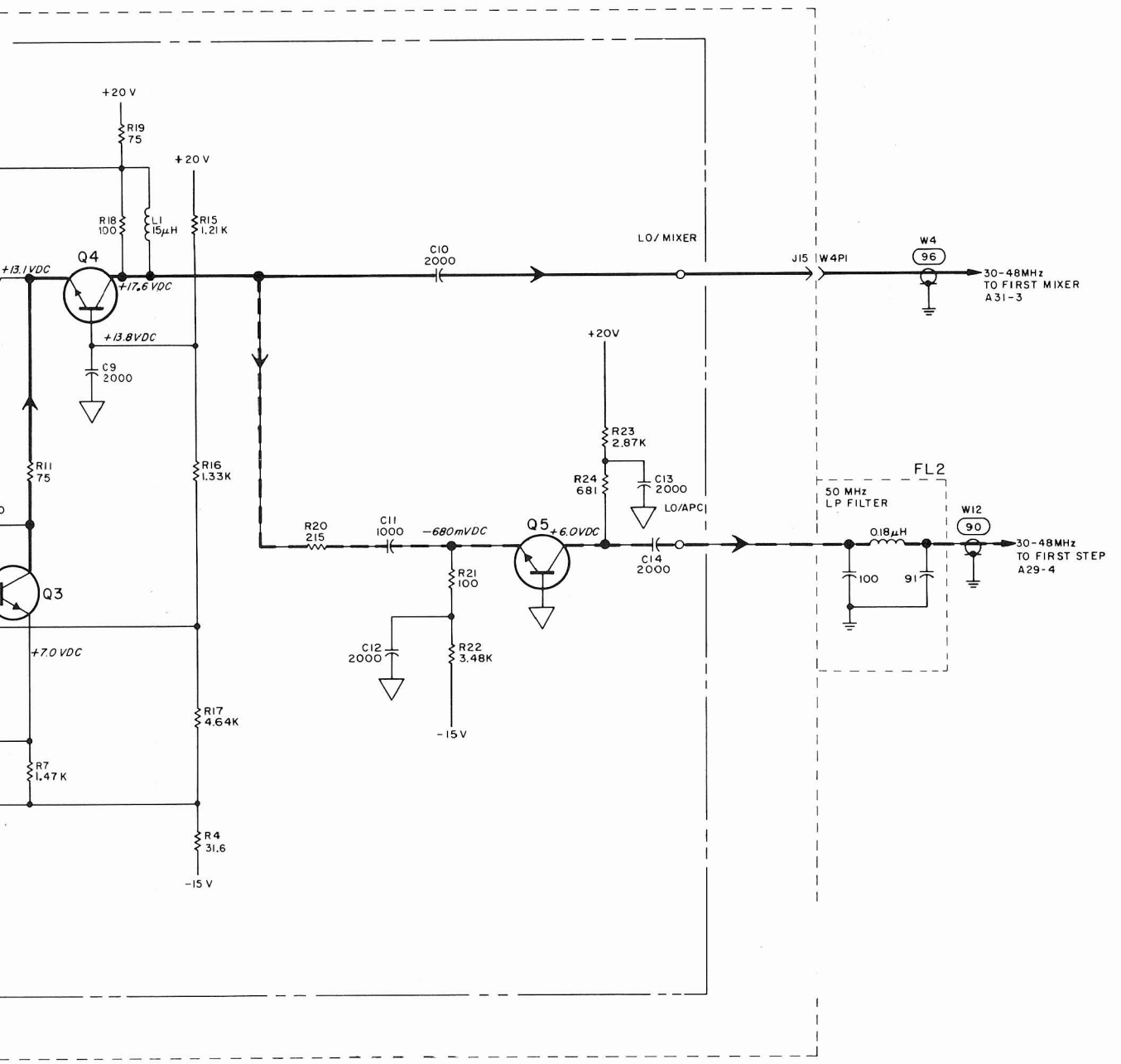
Backdating S/N 1442A00400 & Below
A11 Active Filter Equalizer, A9 Third Mixer and Binary Divider
Schematic and Component Location



A35

hp Part No. 00312-60028

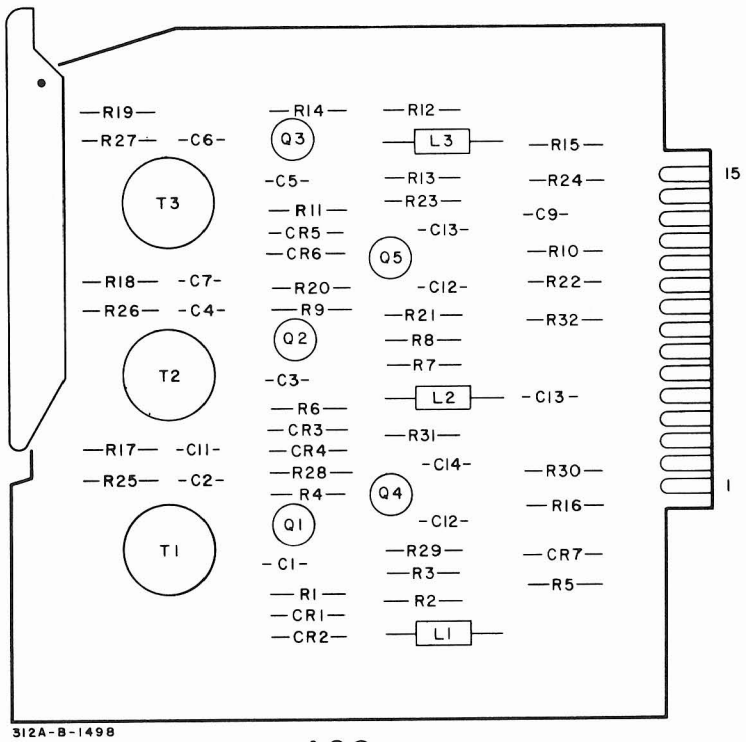




312B ONLY

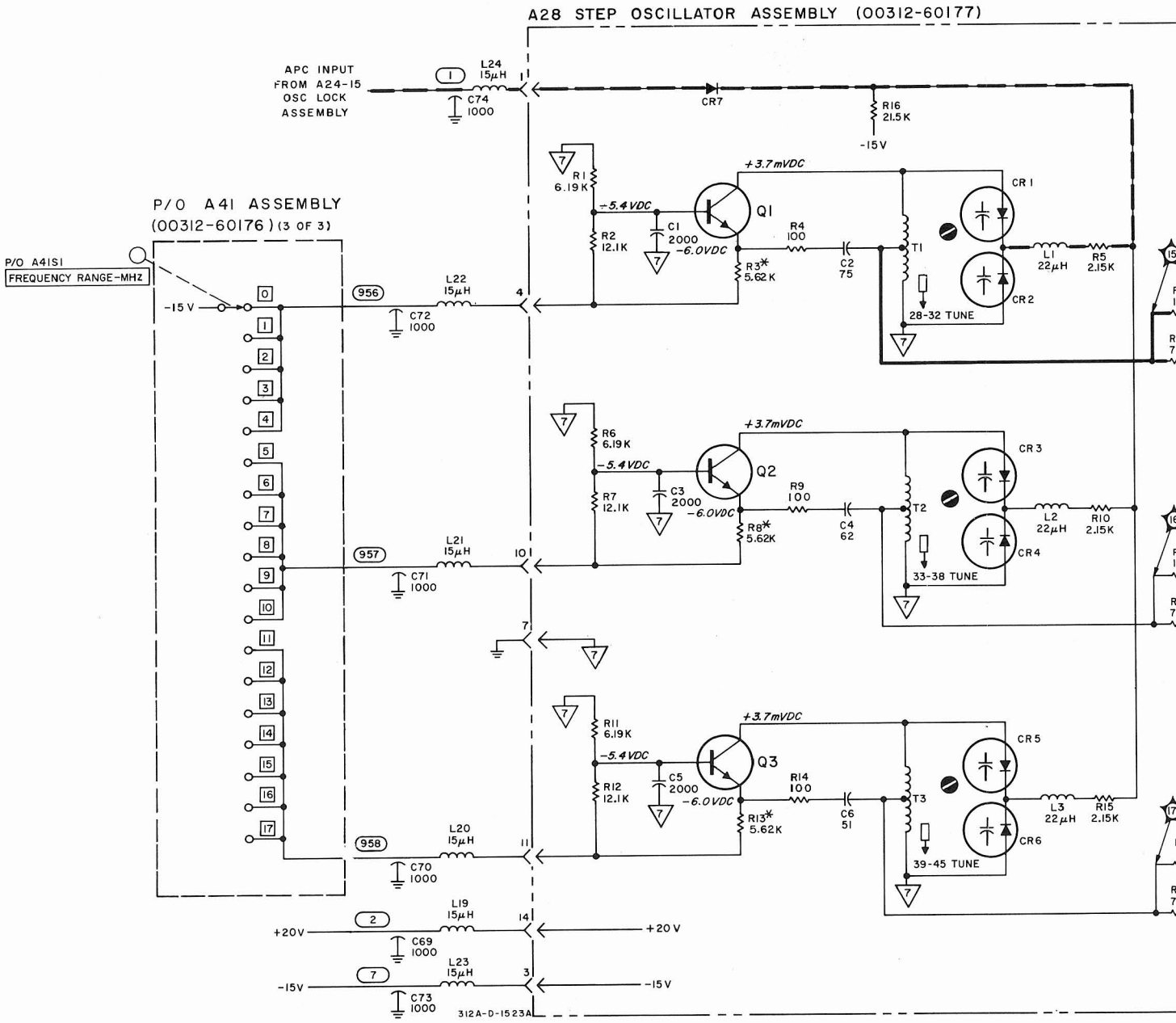
Backdating S/N 1442A00400 & Below
A35 First Local Oscillator
Schematic and Component Location

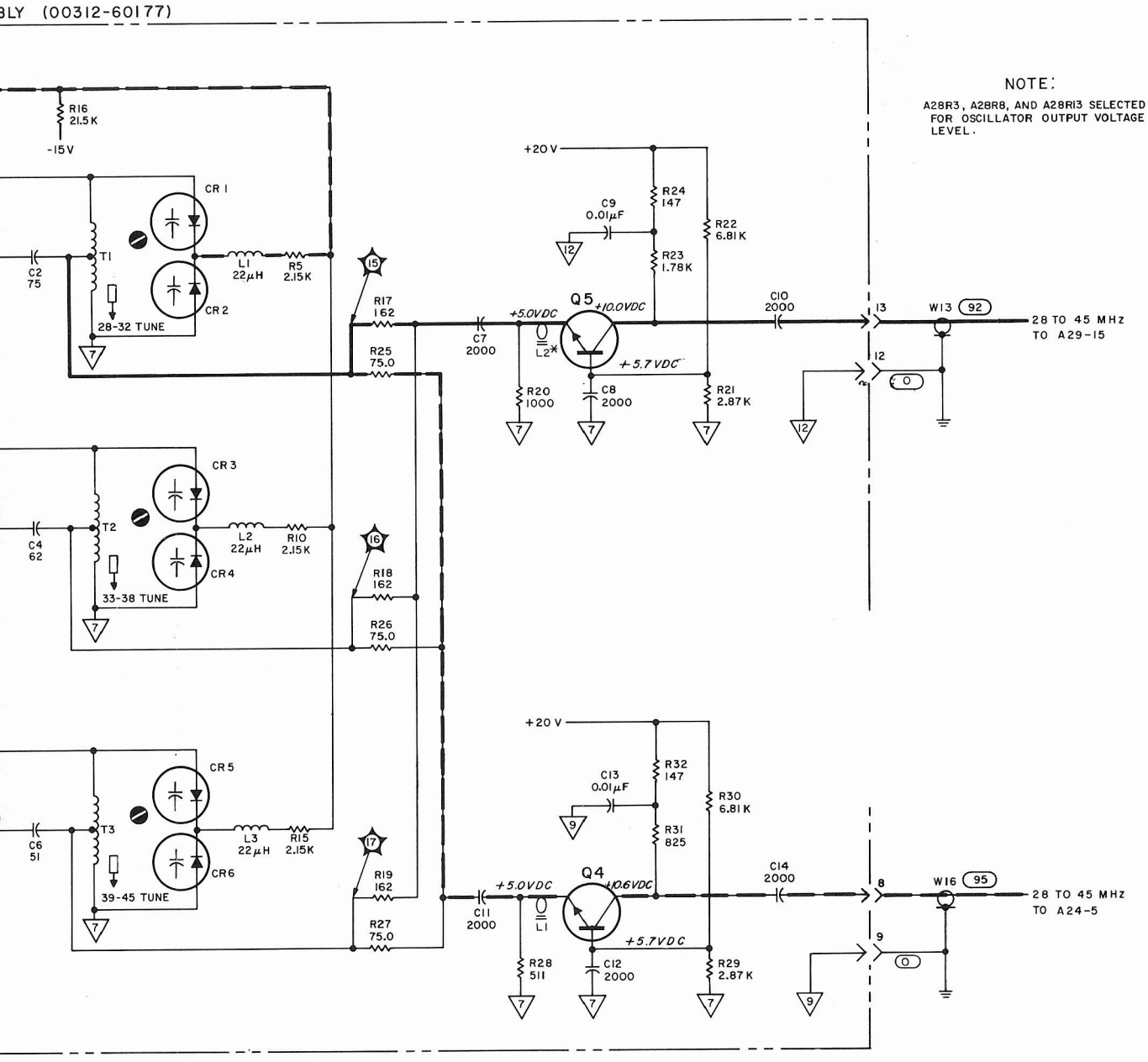
8-13/8-14



A28

hp Part No. 00312-60177

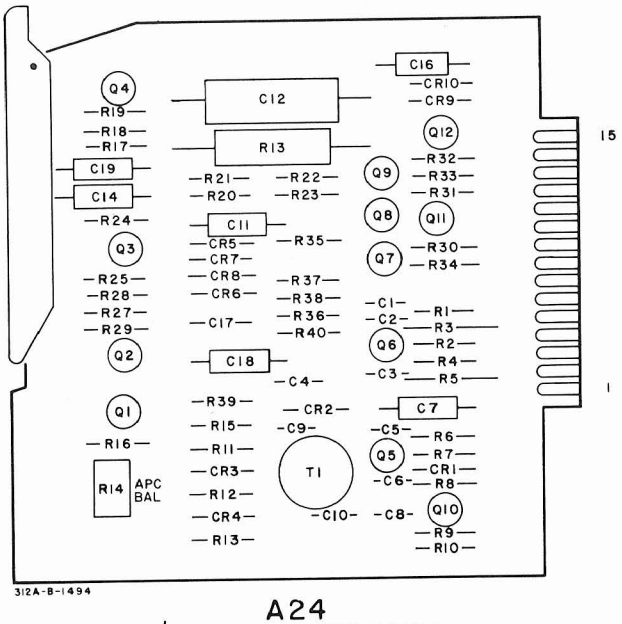




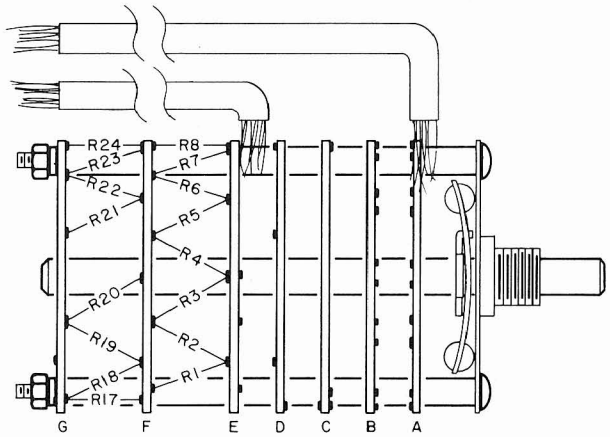
312B ONLY

Backdating S/N 1442A00400 & Below
A28 Step Oscillator
Schematic and Component Location

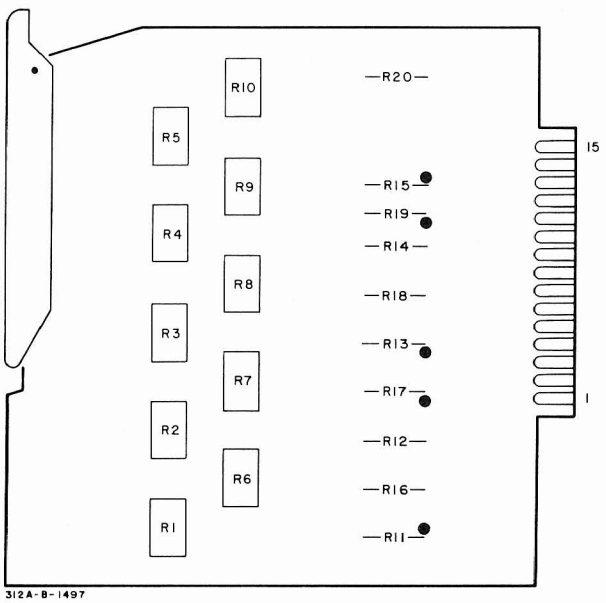
8-15/8-16



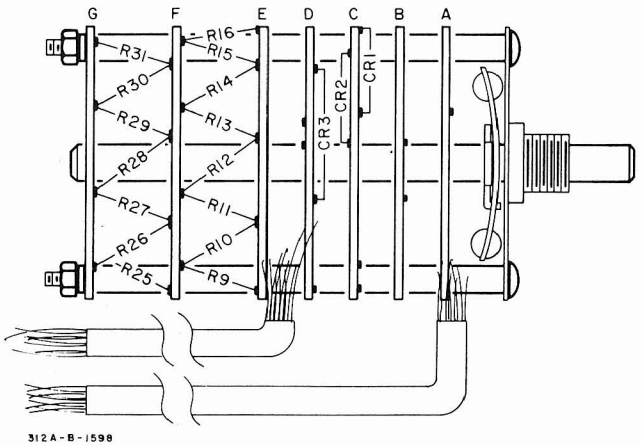
A24
hp Part No. 00312-60024

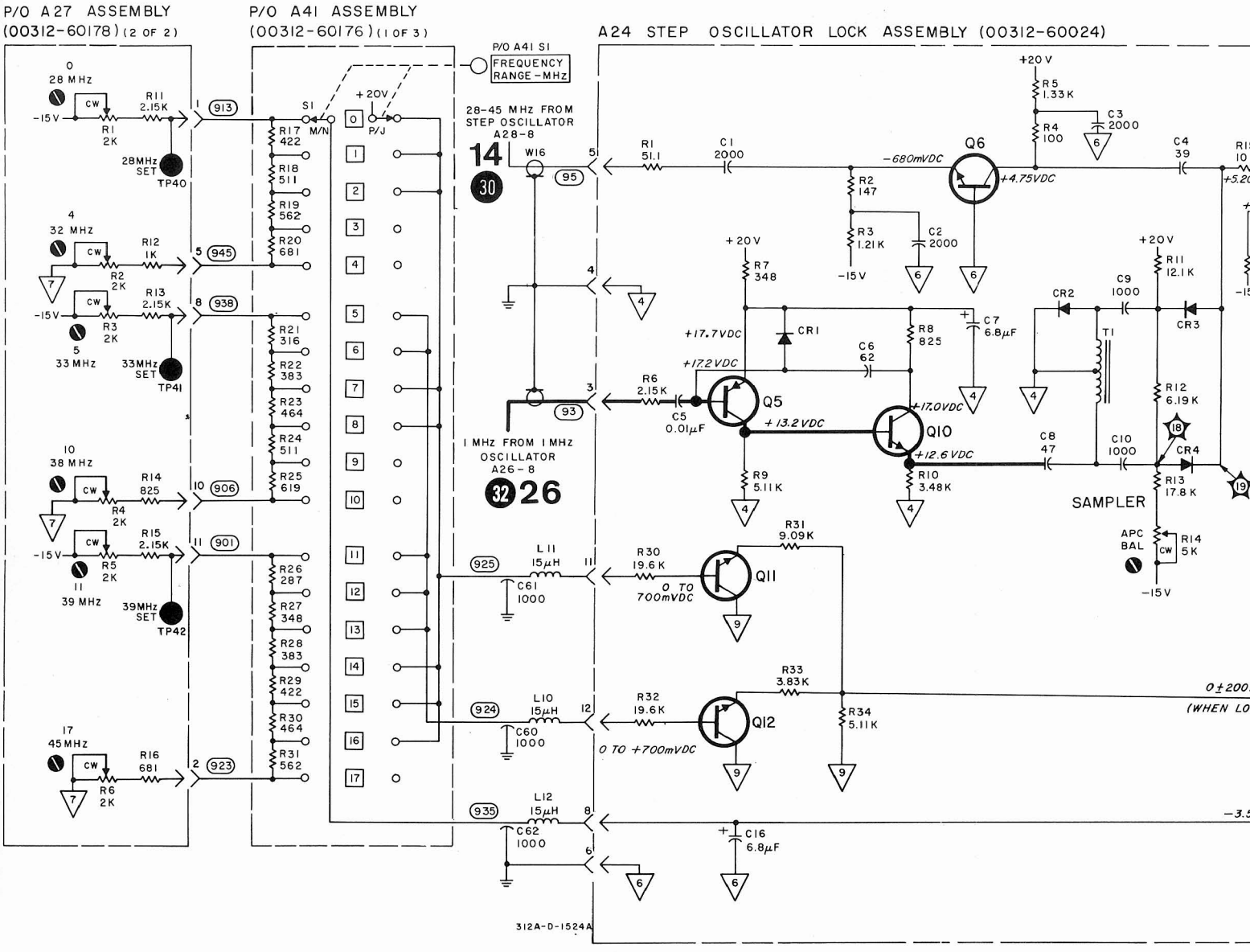


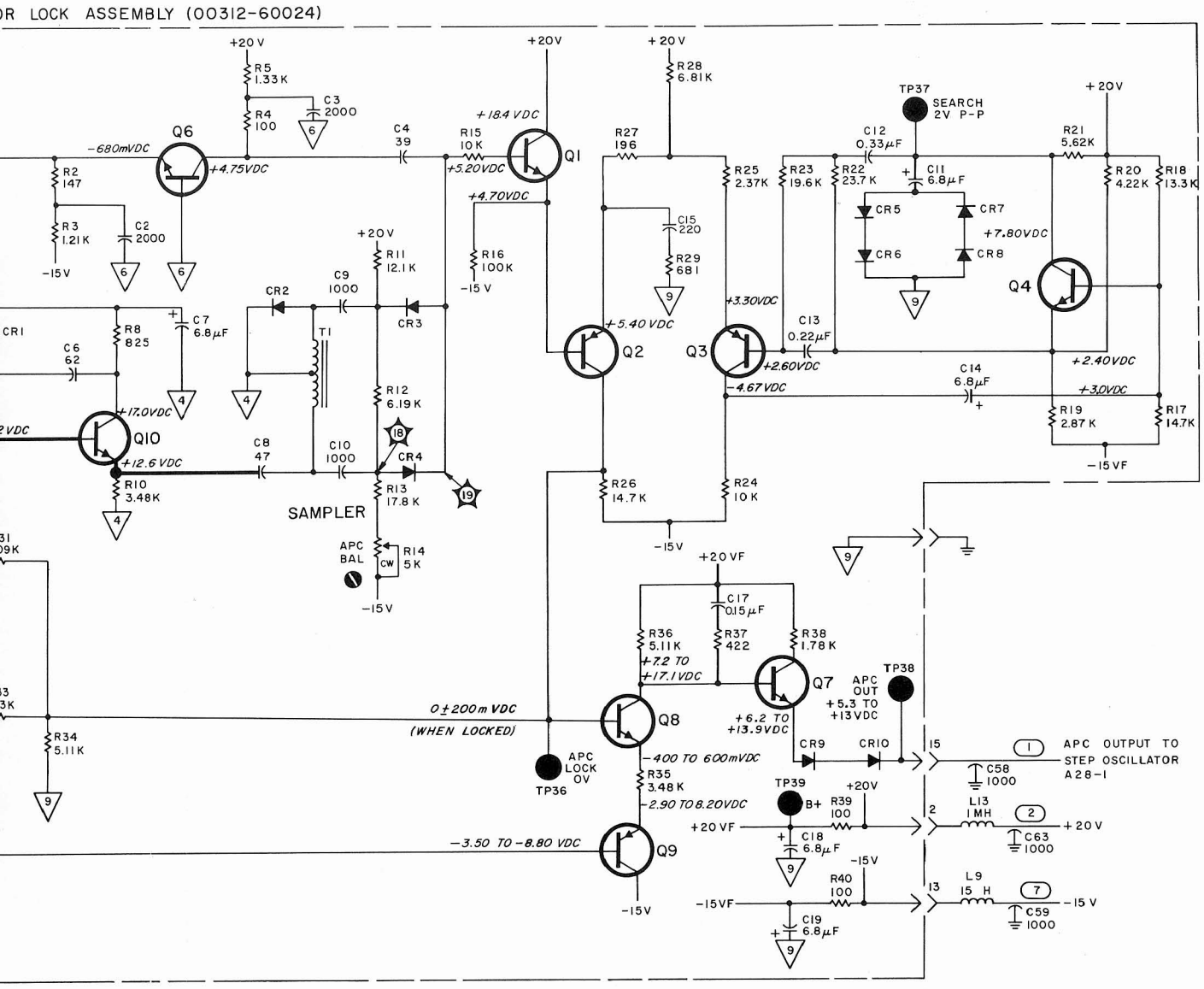
A41
FREQUENCY RANGE SWITCH



A27
hp Part No. 00312-60178





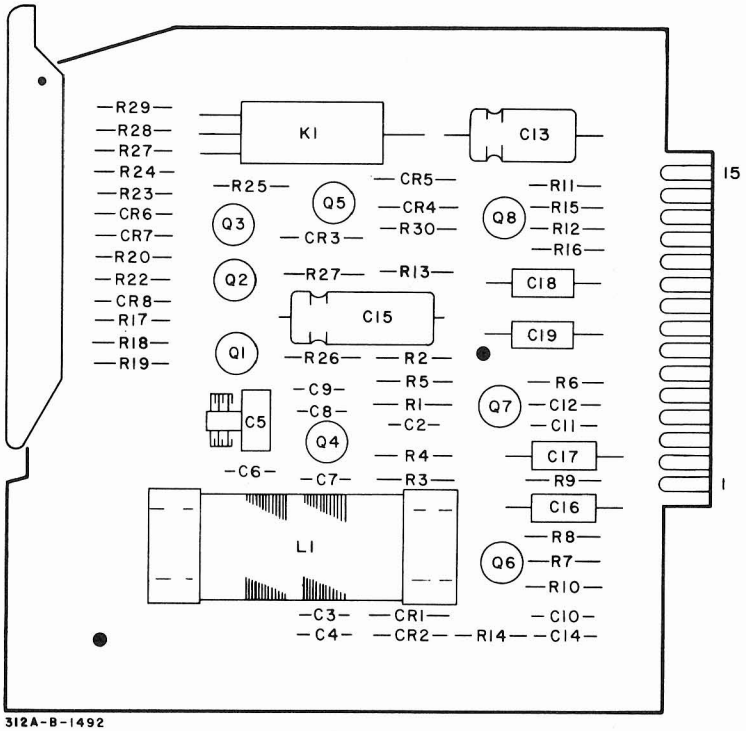


T-PACKARD CO.

312B ONLY

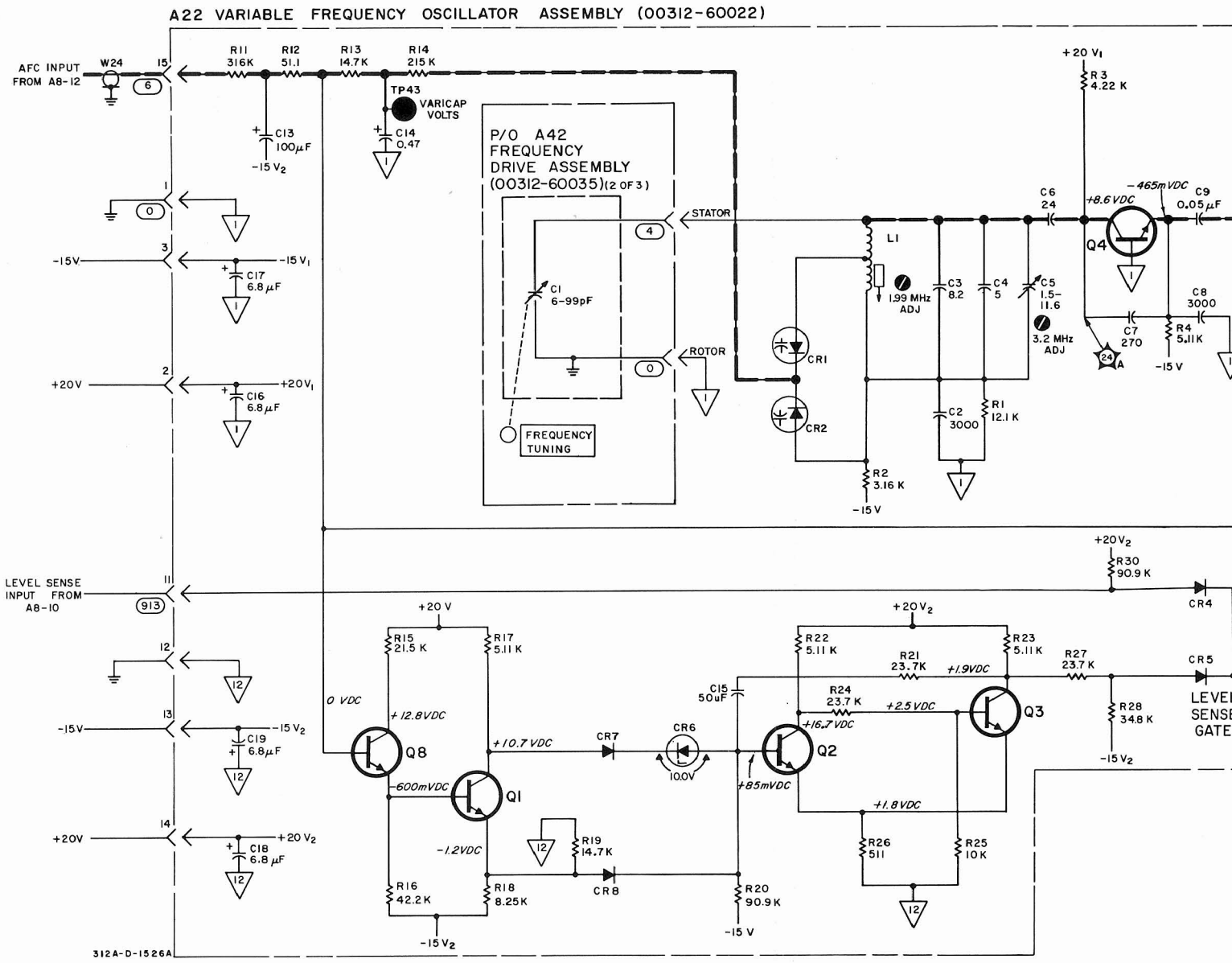
Backdating S/N 1442A00400 & Below
A24 Step Oscillator Phase Lock Loop
Schematics and Component Location

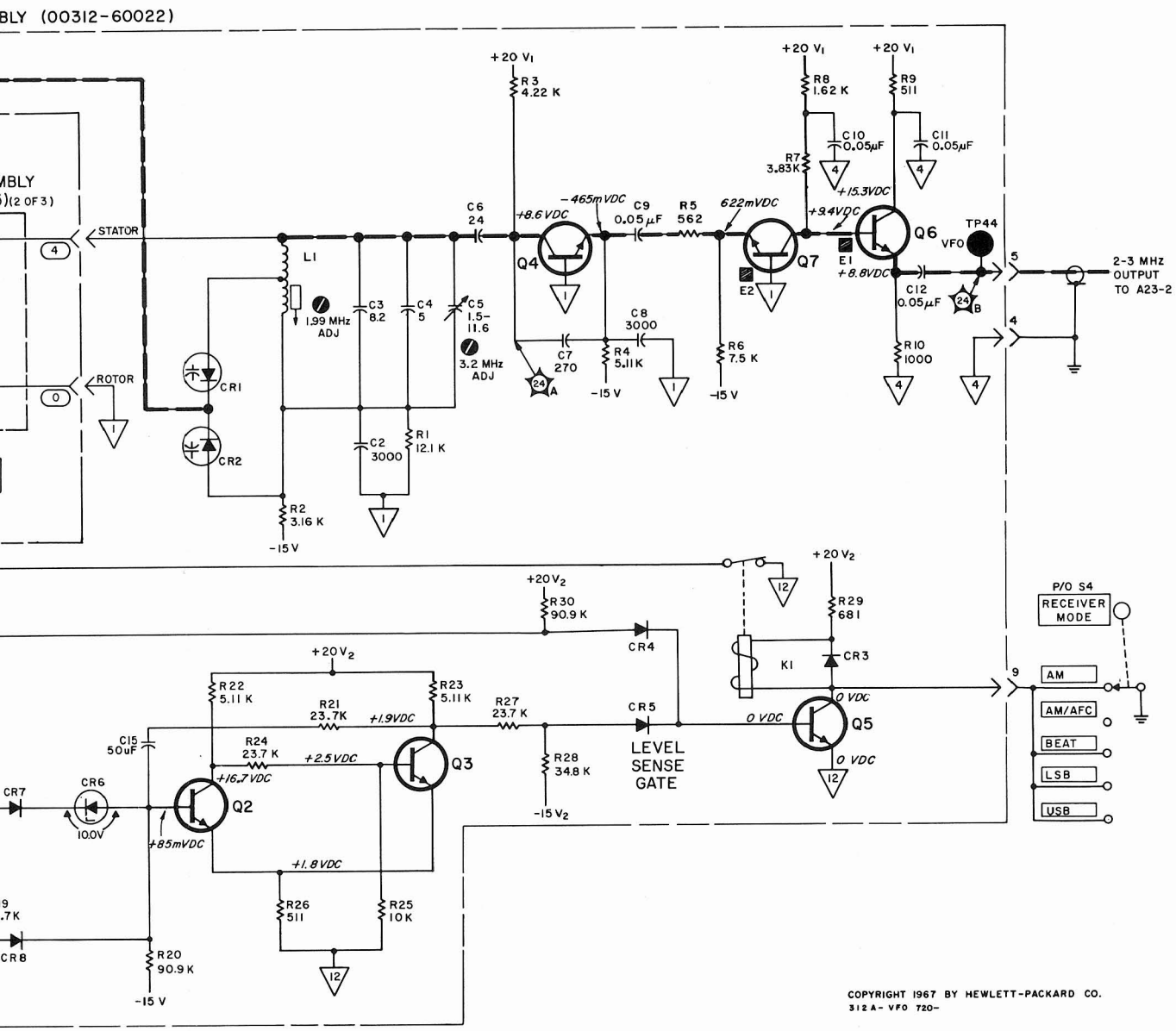
8-17/8-18



A22

hp Part No. 00312-60022

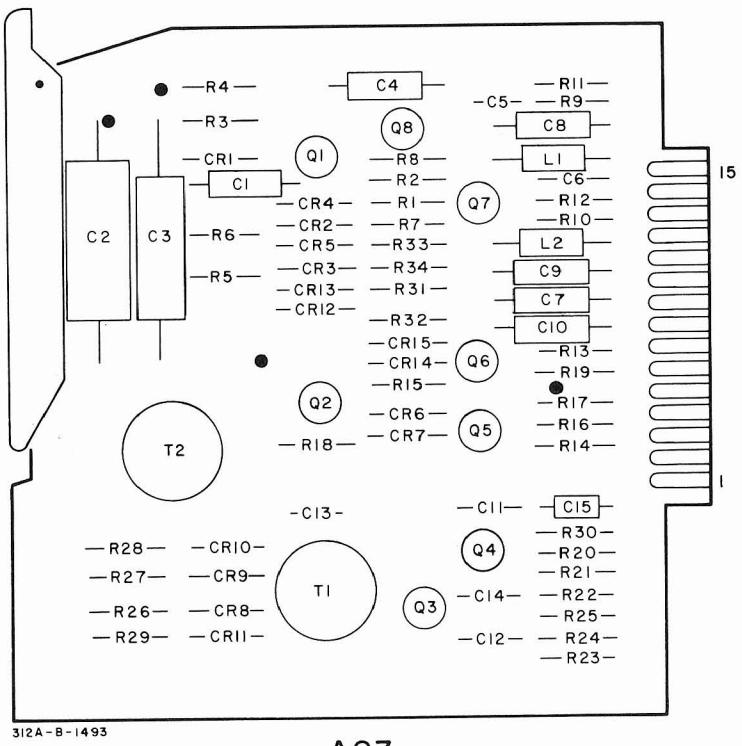




312B ONLY

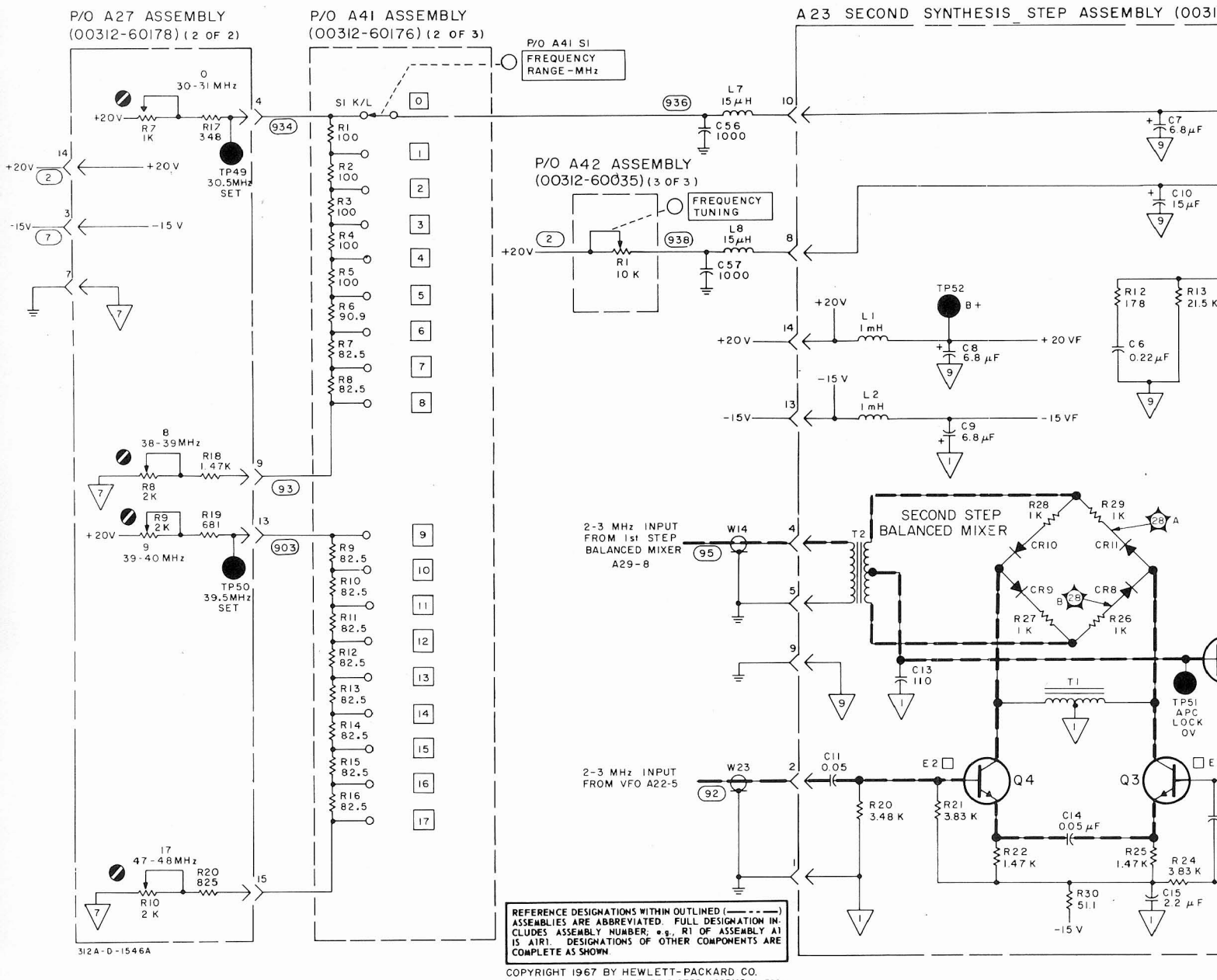
Backdating S/N 1442A00400 & Below
A22 Variable Frequency Oscillator
Schematic and Component Location

8-19/8-20

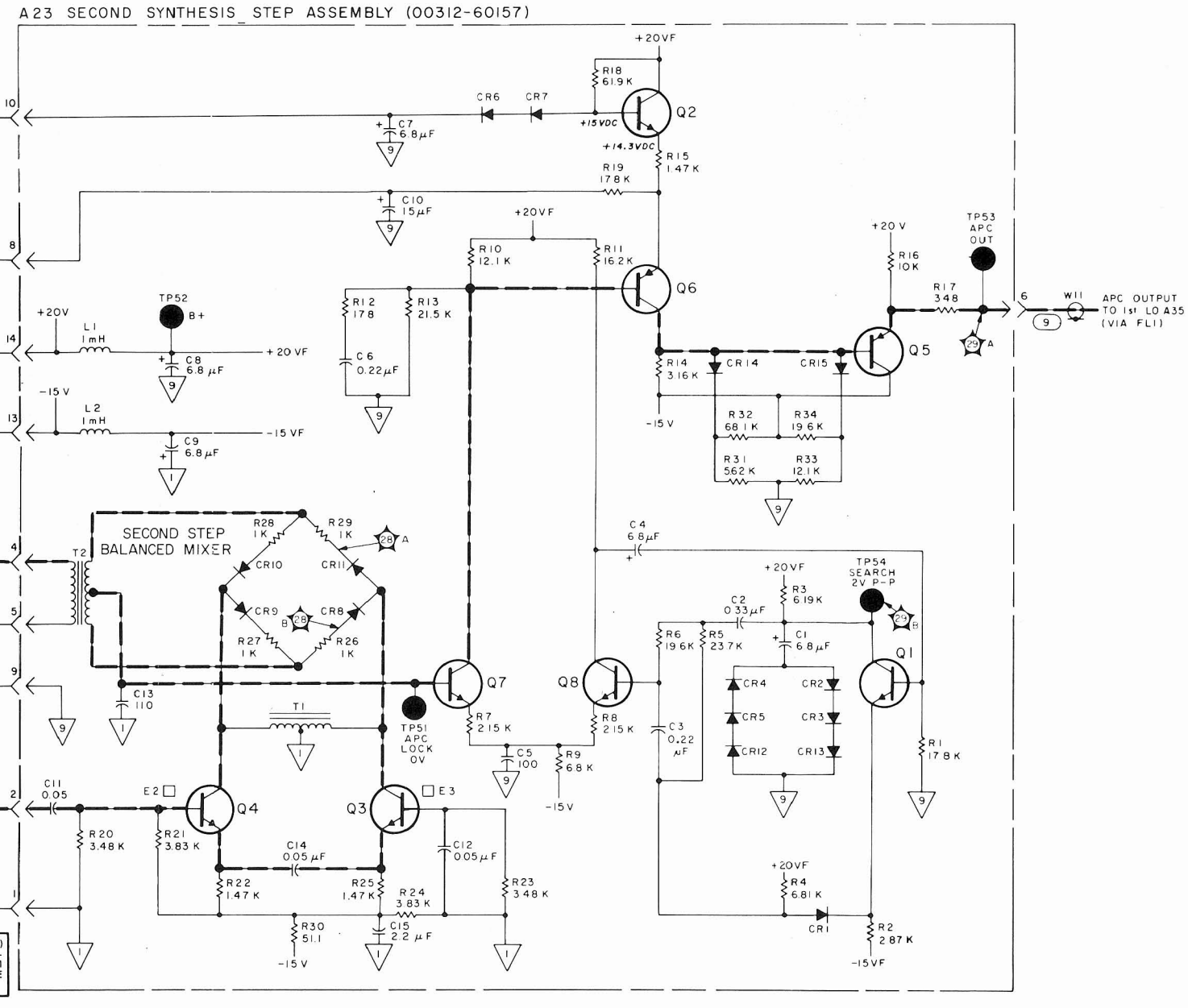


A23

hp Part No. 00312-60157



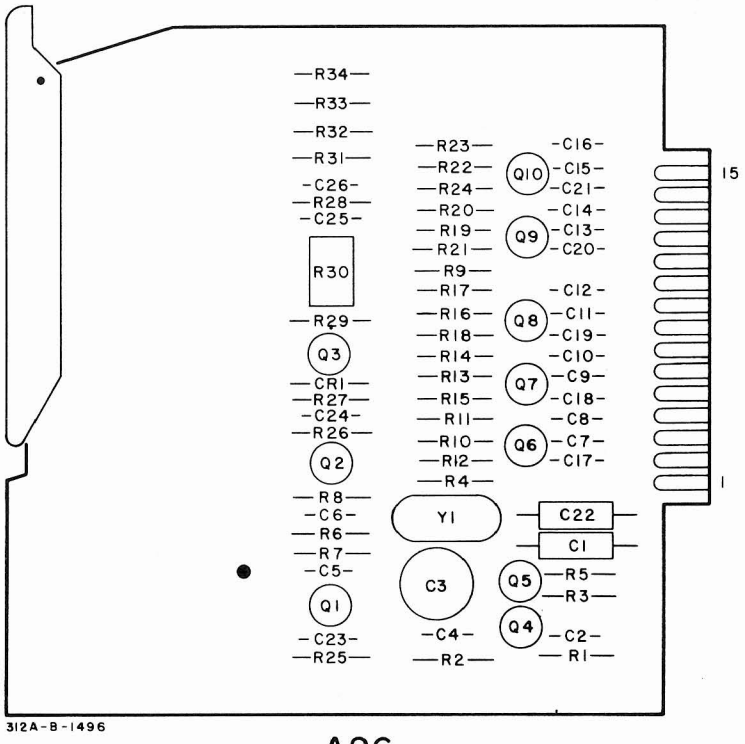
REFERENCE DESIGNATIONS WITHIN OUTLINED (— - - —) ASSEMBLIES ARE ABBREVIATED. FULL DESIGNATION INCLUDES ASSEMBLY NUMBER; e.g., R1 OF ASSEMBLY A1 IS A1R1. DESIGNATIONS OF OTHER COMPONENTS ARE COMPLETE AS SHOWN.



312B ONLY

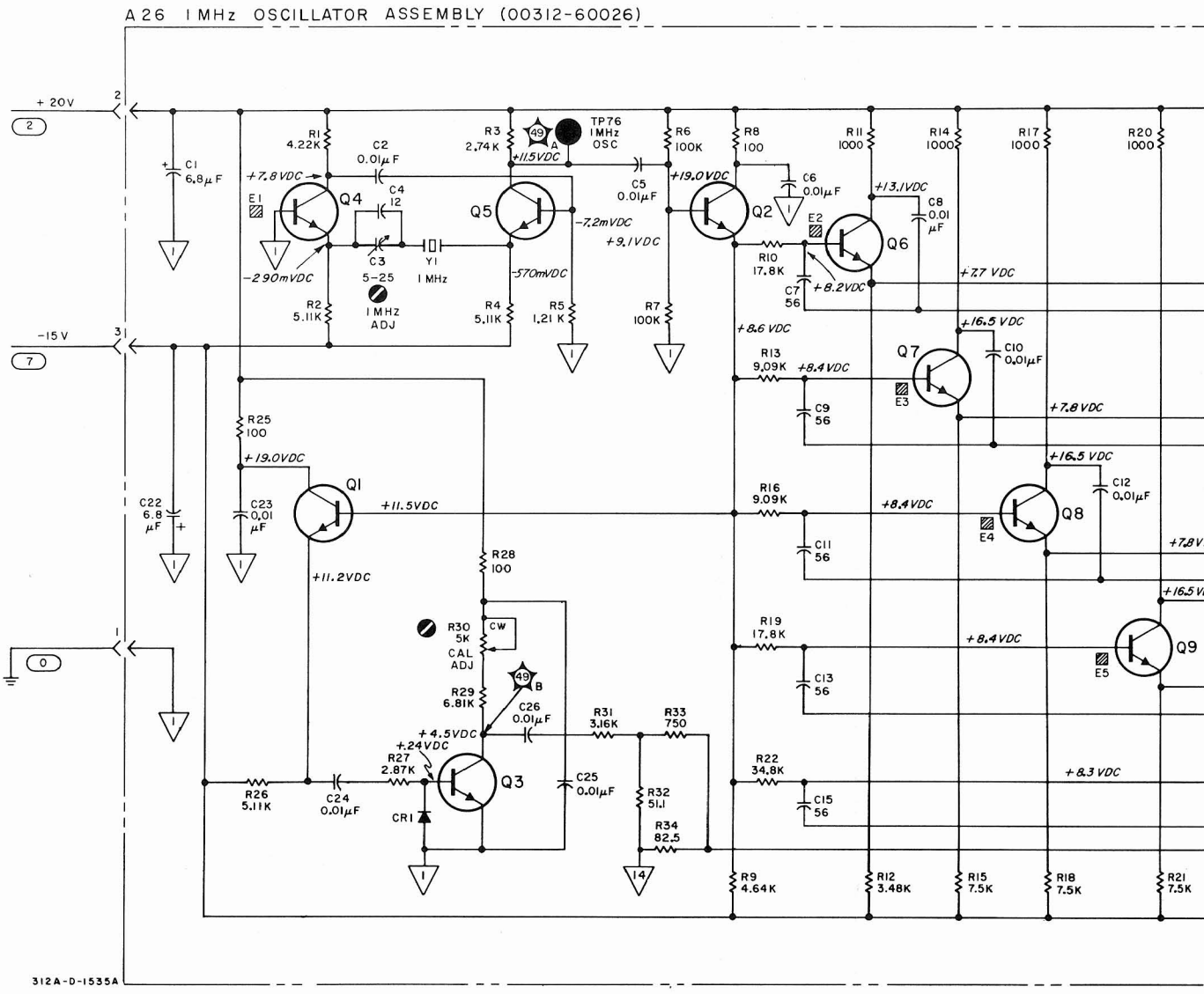
Backdating S/N 1442A00400 & Below
A23 Second Synthesis Step
Schematic and Component Location

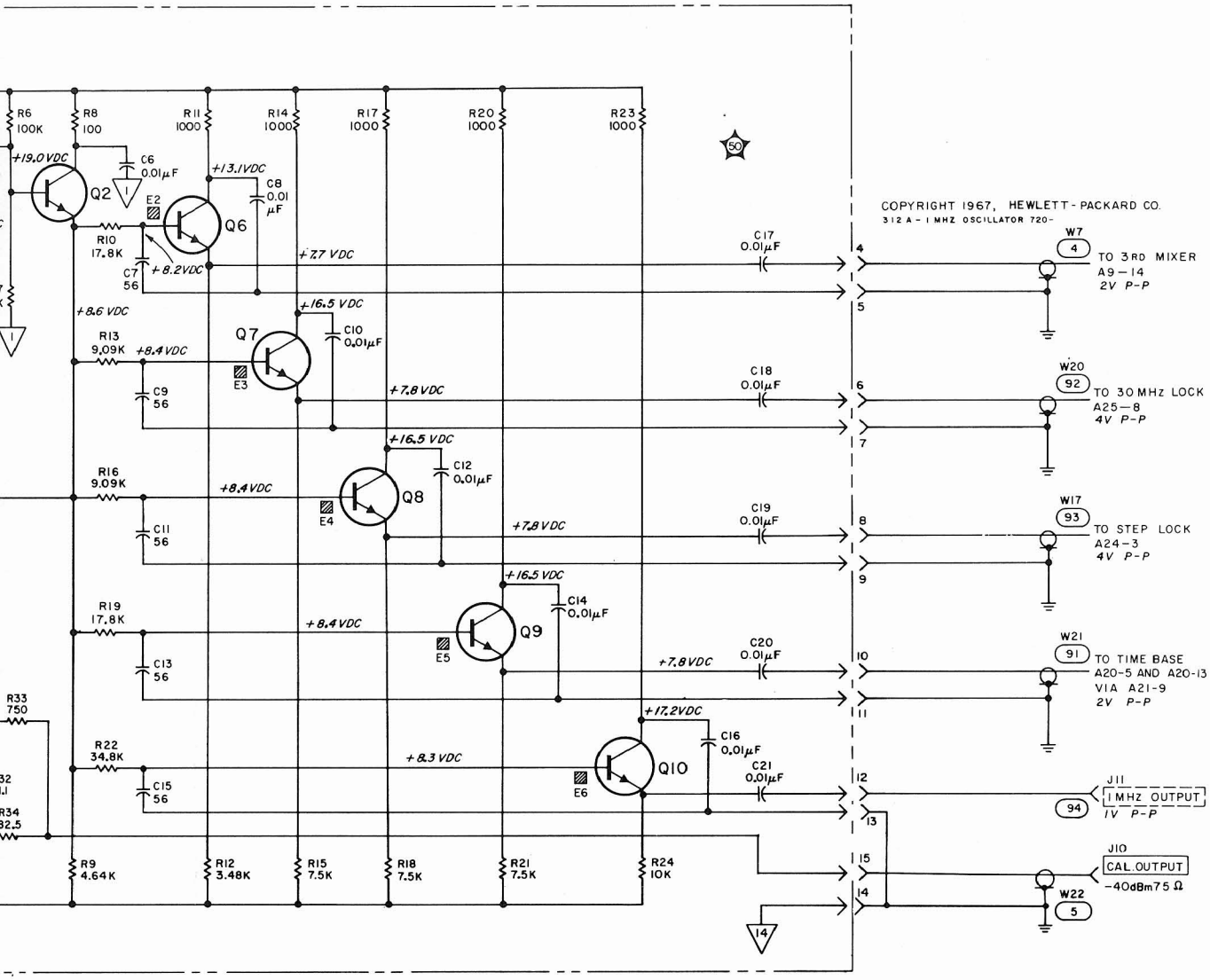
8-21/8-22



A26

hp Part No. 00312-60026





312B ONLY

Backdating S/N 1442A00400 & Below
A26 1 MHz Oscillator
Schematic and Component Location

8-23/8-24

MANUAL CHANGES

MODEL 312B/D

SELECTIVE VOLT/LEVEL METER

Manual Part Number 00312-90046

New or Revised Item

CHANGE NO. 1 for all Serial Numbers.

Page 1-2, Paragraph 1-16 and Table 1-1. Add 312B/D Option 910 additional Operating and Service Manual, -hp- Part No. 00312-90046.

Pages 1-2 and 1-3, Table 1-1. Change the Common Mode Rejection (Balance Input) specification for 312B and 312D to the following:

For all Ranges except + 20 dB Range:
1 kHz to 5 MHz: > 40 dB
5 MHz to 18 MHz: > 30 dB
For + 20 dB Range only:
1 kHz to 18 MHz: > 30 dB

Performance Test Card, Page 3, Part II, Step b (1). Change reading from 1 V ± 0.1 V to 1 V ± 0.05 V.

Page 5-9, Table 5-4. Change 34740A/34702A indication from 1 V ± .001 V to 1 V ± 0.05 V.

Page 5-5, Paragraph 5-16, Step h. Delete Step h.

Page 6-35, Table 6-3. Add A43R65, -hp- Part No. 0698-4510, Resistor 84.5 K 1% .125W.

Page 6-40, Table 6-3. Change S1 and S2 to -hp- Part No. 3101-0110, Switch:Slide.

Page 5-19, Paragraph 5-48, Steps c, d, and e. Change Steps c, d, and e so they read as follows:

c. Set the 313A to Internal, 1 MHz and - 40 dBm. Connect the 313A output to J1 of 312B (J3, 312D).

d. Connect horizontal 1:1 probe to A11R4 (TP17) of the Active Filter Equalizer Assembly (A11). Connect oscilloscope Channel A 10:1 probe to A11R1 (TP14) of the A11 Active Filter Equalizer Assembly. Connect oscilloscope Channel B 10:1 probe to the 312B/D audio out. Set A11R1—R6 of the A11 Active Filter Equalizer Assembly fully clockwise.

e. Adjust A34C8 (TUNE 1) and A34C18 (TUNE 2) of the A34 Assembly for maximum display on the 312B/D Meter.

Page 5-19. Add Table 5-6(B) padding list for A26C20.

Value	Part No.
12 pF	0160-2259

CHANGE NO. 2: for Serial Numbers 1534A00546 and greater (312B) and 1523A00216 and greater (312D).

Page 6-29, Table 6-3. Change A34C14 and A34C16 to -hp- Part No. 0121-0453 Capacitor VTRMR CER 1.3/5.4 350 V. Add A34C36* -hp- Part No. 0160-2198, Capacitor Fxd 20 pF 300 V.

Pages 7-17 and 7-18, Figure 7-7. Change value of A34C14 and A34C16 to 1.3—5.4 pF. Add A34C36 by revising schematic as follows:

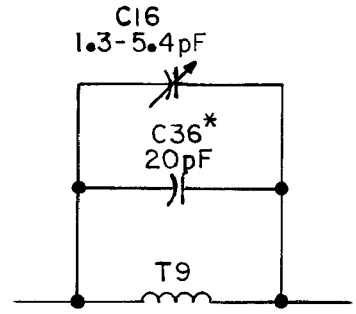


Figure CS-1. Schematic Diagram.

Page 5-19, Paragraph 5-48, Step f. Add Note: "The range of A34C16 may be altered by changing the value of padding capacitor *C36. See padding list Table 5-6(A)."

Page 5-19. Add Table 5-6(A) padding list for A34C36.

Value	Part No.
12 pF	0140-0201
15 pF	0140-0202
18 pF	0160-0356

CHANGE NO. 3 for Serial Numbers 1534A00596 and greater (312B) and 1523A00231 and greater (312D).

Page 6-25, Table 6-3. Under A29 Miscellaneous, add Label:Information, -hp- Part No. 7120-4920.

CHANGE NO. 4 for Serial Numbers 1534A00646 and greater (312B) and 1523A00231 and greater (312D).

Page 6-19, Table 6-3. Change A23R21 to -hp- Part No. 0698-4123 Resistor 499 ohm 1% .125W. Change A23R22 to -hp- Part No. 2100-3109 Resistor-Var 2 K .1% .125W. Add A23R36, -hp- Part No. 2100-3273, R
Resistor 499 1% .125W. Change A23R22 to -hp- Part No. 2100-31—
Page 6-19, Table 6-3.
Page 6-19, Table 6-3. Change A23R21 to -hp- Part No. 0698-4123 Resistor 499 1% .125W. Change A23R22 to -hp- Part No. 2100-3109 Resistor-Var 2 K .1% .125W. Add A23R36, -hp- Part No. 2100-3273, Resistor-Var 2 K 1% .125W. Add A23R37, R38, -hp- Part No. 0757-0442, Resistor 10 K 1% .125W.

Page 7-47/7-48, Figure 7-22. Revise Figure 7-22 as follows:

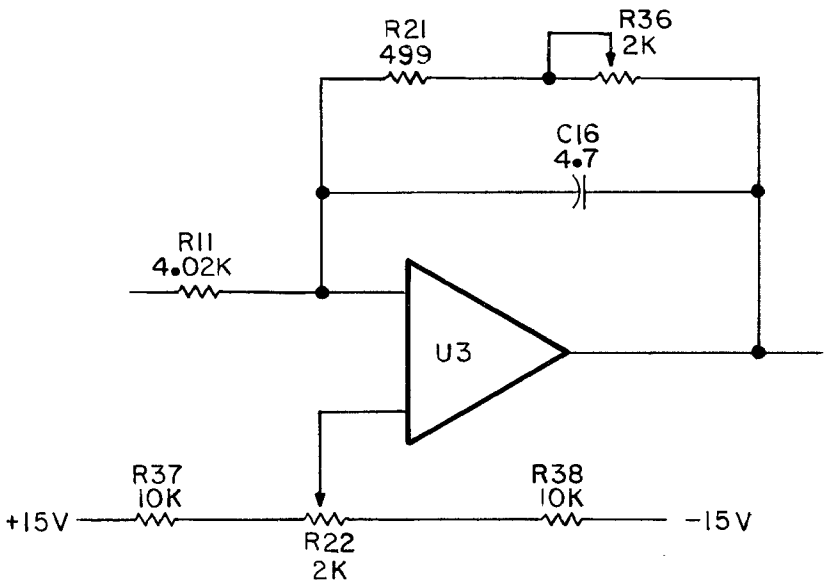


Figure CS-2. Schematic Diagram.

CHANGE NO. 5 for all serial number

Page 1-3, Table 1-1. Change the 312D Recorder output level to:

1 V ± 0.1 V with full scale meter deflection, across an open circuit. Tracking accuracy is better than ± .15 dB to −10 dB below full scale reference on 0 dB position of AMPLITUDE RANGE switch.

Page 1-4, Table 1-2. Change the power requirements to:

Power: 115 V or 230 V ± 10% 48 Hz to 440 Hz, < 100 vA.

Page 6-15, Table 6-3. Delete socket: 14 pin.

CHANGE NO. 6 for serial number 1534A00621 and greater (312B) and serial number 1523A00231 and greater (312D).

Page 6-31, Table 6-3. Add A35*R26, -hp- Part No. 0757-0398 (R-Fxd 75 ohm .01).

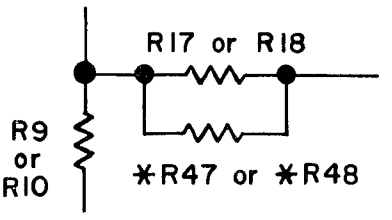
CHANGE NO. 7 for serial number 1534A00645 and greater (312B) and serial number 1523A00230 and greater (312D).

Page 6-28, Table 6-3. Change A32Q2, Q3 to -hp- Part No. 1855-0410 (JFET NCHAN SBF7885).

Page 6-29, Table 6-3. Add A32*R47, *R48. The starred value resistors enable equalizing the input amplifier channel gains. A padding list follows:

Value	Part No.
20 K	0757-0449
21 K	0698-4205
22.1 K	0757-0450
23.2 K	0698-4485
24.9 K	0698-4486
27.4 K	0757-0452
30.9 K	0698-4491
32.4 K	0698-4492
34.8 K	0757-0123
37.4 K	0698-4495
40.2 K	0698-3499
44.2 K	0698-4207
48.7 K	0698-4497
53.6 K	0698-4498
59 K	0698-4501
75 K	0757-0462
100 K	0757-0465
200 K	0757-0472

Page 7-11/7-12, Figure 7-4. Add A32*R47, *R48 as follows:



CHANGE NO. 8 for serial number 1534A00756 and greater (312B) and 1523A00266 and greater (312D).

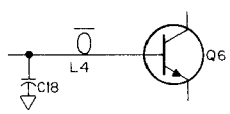
Page 6-39, Table 6-3. Add below PM1 (Power Module) the following part:

-hp- Part No. 7120-3094 INFO LABEL (Line Voltage)

CHANGE NO. 9 for serial number 1534A00786 and greater (312B) and 1523A00271 and greater (312D).

Page 6-25, Table 6-3. Add A29L4, -hp- Part No. 9170-894 (Core, Magnetic).

Page 7-41/7-42, Figure 7-19. Add A29L4 to schematic as follows:



CHANGE NO. 10 for serial number 1534A00801 and greater (312B) and 1523A00281 and greater (312D).

Page 6-5, Table 6-3. Replace the parts lists for the A2 Active Filter Assembly with the following parts lists:

A2	PC ASSY-FILTER	00312-66528
A2 C1	0160-3548	C-F .01 100V
A2 C2	0160-3548	C-F .01 100V
A2 C3	0160-3548	C-F .01 100V
A2 C4	0160-3548	C-F .01 100V
A2 C5	0160-3548	C-F .01 100V
A2 C6	0180-0283	C-F 60UF 10V
A2 C7	0180-0104	C-F 200UF 15V
A2 C8	0180-1746	15UF 20V
A2 C9	0160-3548	C-F .01 100V
A2 CR1	1902-0579	DIO-BKDN 5.11V
A2 R1	0698-3499	R-F 40.2K .01
A2 R2	0698-3228	R-F 49.9K .01
A2 R3	0698-4507	76.8K .01
A2 R4	0757-0442	R-F 10K .01 1/8W
A2 R5	0698-3499	R-F 40.2K .01
A2 R6	0698-3228	R-F 49.9K .01
A2 R7	0698-3158	R-F 23.7K .01
A2 R8	0698-3158	R-F 23.7K .01
A2 U1	1826-0312	OPAMPL MC3403P

Page 6-6, Table 6-3. Replace the parts list for the A3 Active Filter Assembly with the following parts list.

A3	PC ASSY-FILTER	00312-66529
A3 C1	0160-3548	C-F .01UF 100V
A3 C2	0160-3548	C-F .01UF 100V
A3 C3	0160-3548	C-F .01UF 100V
A3 C4	0160-3548	C-F .01UF 100V
A3 C5	0160-3548	C-F .01UF 100V
A3 C6	0180-1746	C-F 15UF 20V
A3 C7	0160-3548	C-F .01UF 100V
A3 CR1	1902-0579	DIO-BKDN 5.11V
A3 R1	0698-4507	R-F 76.8K .01
A3 R2	0757-0442	R-F 10K .01 1/8W
A3 R3	0698-3499	R-F 40.2K .01
A3 R4	0698-3228	R-F 49.9K .01
A3 R5	0698-4507	R-F 76.8K .01
A3 R6	0757-0442	R-F 10K .01 1/8W
A3 U1	1826-0312	OPAMPL MC3403P

Page 6-7, Table 6-3. Replace the parts list for the A4 Active Filter Peramplifier Assembly)for the 312D instrument only) with the following parts list:

A4	PC ASSY-PREAMP	00312-66531
A4 C1	0180-0137	C-F 100UF 10V
A4 C2	0170-0066	C-F .027UF 200V
A4 C3	0140-0172	C-F 3000PF .01
A4 C4	0160-3156	C-F 750PF 300V
A4 C5	0180-0106	C-F 60UF 6V
A4 C6	0160-2424	C-F 5700PF 100V
A4 C7	0140-0225	C-F 300PF 300V
A4 C8	0180-0137	C-F 100UF 10V
A4 C9	0170-0066	C-F .027UF 200V
A4 C10	0140-0172	C-F 3000PF .01
A4 C11	0160-3156	C-F 750PF 300V
A4 C12	0180-0106	C-F 60UF 6V
A4 C13	0180-0098	C-F 100UF 200V
A4 C14	0160-0127	C-F 1UF 26V
A4 C15	0160-2424	C-F 5700PF 100V
A4 C16	0140-0225	C-F 300PF 300V
A4 C17	0180-0098	C-F 100UF 200V
A4 C18	0160-0127	C-F 1UF 26V
A4 CR1	1902-0579	DIO-BKDN 5.11V
A4 R1	0757-0280	R-F 1000 OHM .01
A4 R2	0757-0442	R-F 10K .01 1/8W
A4 R3	0698-3157	R-F 19.6K .01
A4 R4	0698-6762	R-F 26.7K .01
A4 R5	2100-3103	R-V 10K .10
A4 R6	0698-6761	R-F 107K .01
A4 R7	0757-0280	R-F 1000 OHM .01
A4 R8	0757-0442	R-F 10K .01 1/8W
A4 R9	0757-0442	R-F 10K .01 1/8W
A4 R10	0757-0442	R-F 10K .01 1/8W
A4 R11	0698-6763	R-F 4420 OHM .01
A4 R12	0698-3228	R-F 49.9K .01
A4 R13	2100-3095	R-V 200 OHM .1
A4 R14	0698-4438	R-F 3090 OHM .01
A4 R15	0757-0280	R-F 1000 OHM .01
A4 R16	0757-0280	R-F 1000 OHM .01
A4 R17	0757-0442	R-F 10K .01 1/8W
A4 R18	0698-6762	R-F 26.7K .01
A4 R19	2100-3103	R-V 10K .10
A4 R20	0698-6761	R-F 107K .01
A4 R21	0757-0280	R-F 1000 OHM .01
A4 R22	0757-0442	R-F 10K .01 1/8W
A4 R23	0698-3157	R-F 19.6K .01
A4 R24	0698-6763	R-F 4420 OHM .01
A4 R25	0698-3228	R-F 49.9K .01
A4 R26	2100-3095	R-V 200 OHM .1
A4 R27	0698-4438	R-F 3090 OHM .01
A4 R28	0757-0442	R-F 10K .01 1/8W
A4 R29	0757-0280	R-F 1000 OHM .01
A4 R30	0757-0442	R-F 10K .01 1/8W
A4 U1	1826-0331	OPAMPL 4741 1MHZ

Page 6-8, Table 6-3. Replace the parts list for the A4 Active Filter Preamplifier Assembly (for the 312B instrument only) with the following parts lists:

A4	A4 ASSY-PREAMP	00312-66530
A4	11153-01302	WIRE JUMPER
A4 C1	0180-0137	C-F 100UF 10V
A4 C2	0170-0066	C-F .027UF 200V
A4 C5	0180-0106	C-F 60UF 6V
A4 C8	0180-0137	C-F 100UF 10V
A4 C9	0170-0066	C-F .027UF 200V
A4 C12	0180-0106	C-F 60UF 6V
A4 C13	0180-0098	C-F 100UF 20V
A4 C14	0160-0127	C-F 1UF 25V
A4 C17	0180-0098	C-F 100UF 20V
A4 C18	0160-0127	C-F 1UF 25V
A4 CR1	1902-0579	DIO-BKDN 5.11V
A4 R1	0757-0280	R-F 1000 OHM .01
A4 R2	0757-0442	R-F 10K .01 1/8W
A4 R3	0698-3157	R-F 19.6K .01
A4 R7	0757-0280	R-F 1000 OHM .01
A4 R8	0757-0442	R-F 10K .01 1/8W
A4 R10	0757-0442	R-F 10K .01 1/8W
A4 R16	0757-0280	R-F 1000 OHM .01
A4 R17	0757-0442	R-F 10K .01 1/8W
A4 R21	0757-0280	R-F 1000 OHM .01
A4 R22	0757-0442	R-F 10K .01 1/8W
A4 R23	0698-3157	R-F 19.6K .01
A4 R30	0757-0442	R-F 10K .01 1/8W
A4 U1	1826-0323	OPAMPL 4741 1MHZ

Page 6-34, Table 6-3. Replace the parts list for the A43 Bandwidth Selector Assembly (for the 312D instrument only) with the following parts lists:

A43	SW ASSY-BW	00312-61908
A43	00312-00316	BRKT-SW MTG
A43R1	0698-8060	R-F 8.64K .001T9
A43R2	0698-8060	R-F 8.64K .001T9
A43R3	0698-3264	R-F 11.8K .01
A43R4	0698-3264	R-F 11.8K .01
A43R5	0698-7802	R-F 523K OHM .01
A43R6	0698-7802	R-F 523K OHM .01
A43R7	0698-8060	R-F 8.64K .001T9
A43R8	0698-8060	R-F 8.64K .001T9
A43R9	0698-3264	R-F 11.8K .01
A43R10	0698-3264	R-F 11.8K .01
A43R11	0698-7802	R-F 523K OHM .01
A43R12	0698-7802	R-F 523K OHM .01
A43R13	0698-8060	R-F 8.64K .001T9
A43R14	0698-8060	R-F 8.64K .001T9
A43R15	0698-3264	R-F 11.8K .01
A43R16	0698-3264	R-F 11.8K .01
A43R17	0698-7802	R-F 523K OHM .01
A43R18	0698-7802	R-F 523K OHM .01
A43R19	0698-8060	R-F 8.64K .001T9
A43R20	0698-8060	R-F 8.64K .001T9
A43R21	0698-3264	R-F 11.8K .01
A43R22	0698-3264	R-F 11.8K .01
A43R23	0698-7802	R-F 523K OHM .01
A43R24	0698-7802	R-F 523K OHM .01
A43R25	0698-8060	R-F 8.64K .001T9
A43R26	0698-8060	R-F 8.64K .001T9
A43R27	0698-3264	R-F 11.8K .01
A43R28	0698-3264	R-F 11.8K .01
A43R29	0698-7802	R-F 523K OHM .01
A43R30	0698-7802	R-F 523K OHM .01
A43R31	0698-8060	R-F 8.64K .001T9
A43R32	0698-8060	R-F 8.64K .001T9
A43R33	0698-3264	R-F 11.8K .01
A43R34	0698-3264	R-F 11.8K .01
A43R35	0698-7802	R-F 523K OHM .01
A43R36	0698-7802	R-F 523K OHM .01
A43R37	0698-8060	R-F 8.64K .001T9
A43R38	0698-8060	R-F 8.64K .001T9
A43R39	0698-3264	R-F 11.8K .01
A43R40	0698-3264	R-F 11.8K .01
A43R41	0698-7802	R-F 523K OHM .01
A43R42	0698-7802	R-F 523K OHM .01
A43R43	0698-8060	R-F 8.64K .001T9
A43R44	0698-8060	R-F 8.64K .001T9
A43R45	0698-3264	R-F 11.8K .01
A43R46	0698-3264	R-F 11.8K .01
A43R47	0698-7802	R-F 523K OHM .01
A43R48	0698-7802	R-F 523K OHM .01
A43R49	0698-8060	R-F 8.64K .001T9
A43R50	0698-8060	R-F 8.64K .001T9
A43R51	0698-3264	R-F 11.8K .01
A43R52	0698-3264	R-F 11.8K .01
A43R53	0698-7802	R-F 523K OHM .01
A43R54	0698-7802	R-F 523K OHM .01
A43R55	0698-8060	R-F 8.64K .001T9
A43R56	0698-8060	R-F 8.64K .001T9
A43R57	0698-3264	R-F 11.8K .01
A43R58	0698-3264	R-F 11.8K .01
A43R59	0698-7802	R-F 523K OHM .01
A43R60	0698-7802	R-F 523K OHM .01
A43R61	0698-8060	R-F 8.64K .001T9
A43R62	0698-8060	R-F 8.64K .001T9
A43R63	0698-3264	R-F 11.8K .01
A43R64	0698-3264	R-F 11.8K .01
A43R65	0698-7802	R-F 523K OHM .01
A43R66	0698-7802	R-F 523K OHM .01
A43R67	0698-8060	R-F 8.64K .001T9
A43R68	0698-8060	R-F 8.64K .001T9
A43R69	0698-3264	R-F 11.8K .01
A43R70	0698-3264	R-F 11.8K .01
A43R71	0698-7802	R-F 523K OHM .01
A43R72	0698-7802	R-F 523K OHM .01
A43S1	3100-1867	SW ROTARY

Page 6-35, Table 6-3. Replace the parts lists for the A43 Bandwidth Selector Assembly (for the 312B instrument only) with the following parts list:

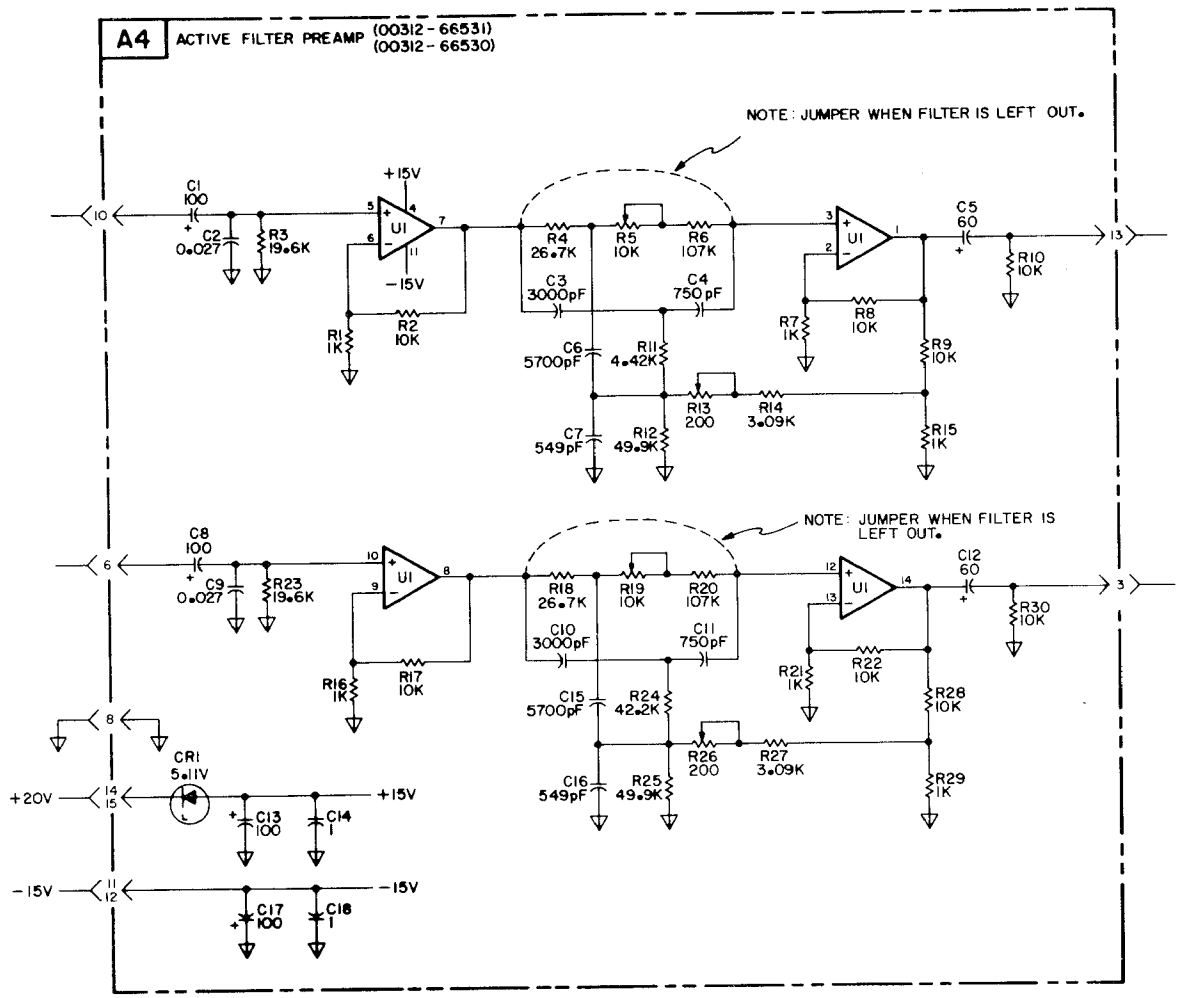
A43	SW ASSY-BW	00312-61907
A43R1	0698-8060	R-F 8.64K .001T9
A43R2	0698-8060	R-F 8.64K .001T9
A43R3	0698-4488	R-F 26.7K .01
A43R4	0698-4488	R-F 26.7K .01
A43R5	0698-3451	R-F 133K .01
A43R6	0698-3451	R-F 133K .01
A43R7	0698-8060	R-F 8.64K .001T9
A43R8	0698-8060	R-F 8.64K .001T9
A43R9	0698-4488	R-F 26.7K .01
A43R10	0698-4488	R-F 26.7K .01
A43R11	0698-3451	R-F 133K .01
A43R12	0698-3451	R-F 133K .01
A43R13	0698-8060	R-F 8.64K .001T9
A43R14	0698-8060	R-F 8.64K .001T9
A43R15	0698-4488	R-F 26.7K .01
A43R16	0698-4488	R-F 26.7K .01
A43R17	0698-3451	R-F 133K .01
A43R18	0698-3451	R-F 133K .01

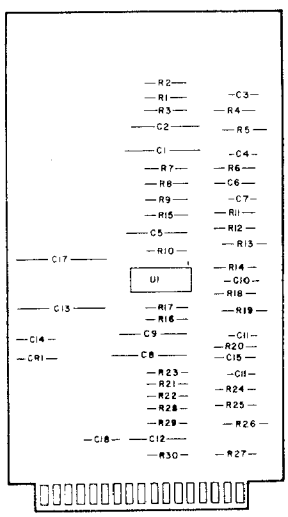
A43R19	0698-8060	R-F 8.64K .001T9
A43R20	0698-8060	R-F 8.64K .001T9
A43R21	0698-4488	R-F 26.7K .01
A43R22	0698-4488	R-F 26.7K .01
A43R23	0698-3451	R-F 133K .01
A43R24	0698-3451	R-F 133K .01
A43R25	0698-8060	R-F 8.64K .001T9
A43R26	0698-8060	R-F 8.64K .001T9
A43R27	0698-4488	R-F 26.7K .01
A43R28	0698-4488	R-F 26.7K .01
A43R29	0698-3451	R-F 133K .01
A43R30	0698-3451	R-F 133K .01
A43R31	0698-8060	R-F 8.64K .001T9
A43R32	0698-8060	R-F 8.64K .001T9
A43R33	0698-4488	R-F 26.7K .01
A43R34	0698-4488	R-F 26.7K .01
A43R35	0698-3451	R-F 133K .01
A43R36	0698-3451	R-F 133K .01
A43R37	0698-8060	R-F 8.64K .001T9
A43R38	0698-8060	R-F 8.64K .001T9
A43R39	0698-4488	R-F 26.7K .01
A43R40	0698-4488	R-F 26.7K .01
A43R41	0698-3451	R-F 133K .01
A43R42	0698-3451	R-F 133K .01
A43R43	0698-8060	R-F 8.64K .001T9
A43R44	0698-8060	R-F 8.64K .001T9
A43R45	0698-4488	R-F 26.7K .01
A43R46	0698-4488	R-F 26.7K .01
A43R47	0698-3451	R-F 133K .01
A43R48	0698-3451	R-F 133K .01
A43R49	0698-8060	R-F 8.64K .001T9
A43R50	0698-8060	R-F 8.64K .001T9
A43R51	0698-4488	R-F 26.7K .01
A43R52	0698-4488	R-F 26.7K .01
A43R53	0698-3451	R-F 133K .01
A43R54	0698-3451	R-F 133K .01
A43R55	0698-8060	R-F 8.64K .001T9
A43R56	0698-8060	R-F 8.64K .001T9
A43R57	0698-4488	R-F 26.7K .01
A43R58	0698-4488	R-F 26.7K .01
A43R59	0698-3451	R-F 133K .01
A43R60	0698-3451	R-F 133K .01
A43R61	0698-8060	R-F 8.64K .001T9
A43R62	0698-8060	R-F 8.64K .001T9
A43R63	0698-4488	R-F 26.7K .01
A43R64	0698-4488	R-F 26.7K .01
A43R65	0698-3451	R-F 133K .01
A43R66	0698-3451	R-F 133K .01
A43R67	0698-8060	R-F 8.64K .001T9
A43R68	0698-8060	R-F 8.64K .001T9
A43R69	0698-4488	R-F 26.7K .01
A43R70	0698-4488	R-F 26.7K .01
A43R71	0698-3451	R-F 133K .01
A43R72	0698-3451	R-F 133K .01
A43S1	3100-1867	SW ROTARY

Page 6-36, Table 6-3. Add the following parts list for the A43 Bandwidth Selector Assembly (312D Option 001 instrument only):

A43	SW ASSY-BW 00312-61909	
A43	00312-00316	BRKT-SW MTG
A43R1	0698-8060	R-F 8.64K .001T9
A43R2	0698-8060	R-F 8.64K .001T9
A43R3	0698-3264	R-F 11.8K .01
A43R4	0698-3264	R-F 11.8K .01
A43R5	0698-3243	R-F 178K .01
A43R6	0698-3243	R-F 178K .01
A43R7	0698-8060	R-F 8.64K .001T9
A43R8	0698-8060	R-F 8.64K .001T9
A43R9	0698-3264	R-F 11.8K .01
A43R10	0698-3264	R-F 11.8K .01
A43R11	0698-3243	R-F 178K .01
A43R12	0698-3243	R-F 178K .01
A43R13	0698-8060	R-F 8.64K .001T9
A43R14	0698-8060	R-F 8.64K .001T9
A43R15	0698-3264	R-F 11.8K .01
A43R16	0698-3264	R-F 11.8K .01
A43R17	0698-3243	R-F 178K .01
A43R18	0698-3243	R-F 178K .01
A43R19	0698-8060	R-F 8.64K .001T9
A43R20	0698-8060	R-F 8.64K .001T9
A43R21	0698-3264	R-F 11.8K .01
A43R22	0698-3264	R-F 11.8K .01
A43R23	0698-3243	R-F 178K .01
A43R24	0698-3243	R-F 178K .01
A43R25	0698-8060	R-F 8.64K .001T9
A43R26	0698-8060	R-F 8.64K .001T9
A43R27	0698-3264	R-F 11.8K .01
A43R28	0698-3264	R-F 11.8K .01
A43R29	0698-3243	R-F 178K .01
A43R30	0698-3243	R-F 178K .01
A43R31	0698-8060	R-F 8.64K .001T9
A43R32	0698-8060	R-F 8.64K .001T9
A43R33	0698-3264	R-F 11.8K .01
A43R34	0698-3264	R-F 11.8K .01
A43R35	0698-3243	R-F 178K .01
A43R36	0698-3243	R-F 178K .01
A43R37	0698-8060	R-F 8.64K .001T9
A43R38	0698-8060	R-F 8.64K .001T9
A43R39	0698-3264	R-F 11.8K .01
A43R40	0698-3264	R-F 11.8K .01
A43R41	0698-3243	R-F 178K .01
A43R42	0698-3243	R-F 178K .01
A43R43	0698-8060	R-F 8.64K .001T9
A43R44	0698-8060	R-F 8.64K .001T9
A43R45	0698-3264	R-F 11.8K .01
A43R46	0698-3264	R-F 11.8K .01
A43R47	0698-3243	R-F 178K .01
A43R48	0698-3243	R-F 178K .01
A43R49	0698-8060	R-F 8.64K .001T9
A43R50	0698-8060	R-F 8.64K .001T9
A43R51	0698-3264	R-F 11.8K .01
A43R52	0698-3264	R-F 11.8K .01
A43R53	0698-3243	R-F 178K .01
A43R54	0698-3243	R-F 178K .01
A43R55	0698-8060	R-F 8.64K .001T9
A43R56	0698-8060	R-F 8.64K .001T9
A43R57	0698-3264	R-F 11.8K .01
A43R58	0698-3264	R-F 11.8K .01
A43R59	0698-3243	R-F 178K .01
A43R60	0698-3243	R-F 178K .01
A43R61	0698-8060	R-F 8.64K .001T9
A43R62	0698-8060	R-F 8.64K .001T9
A43R63	0698-3264	R-F 11.8K .01
A43R64	0698-3264	R-F 11.8K .01
A43R65	0698-3243	R-F 178K .01
A43R66	0698-3243	R-F 178K .01
A43R67	0698-8060	R-F 8.64K .001T9
A43R68	0698-8060	R-F 8.64K .001T9
A43R69	0698-3264	R-F 11.8K .01
A43R70	0698-3264	R-F 11.8K .01
A43R71	0698-3243	R-F 178K .01
A43R72	0698-3243	R-F 178K .01
A43S1	3100-1867	SW ROTARY

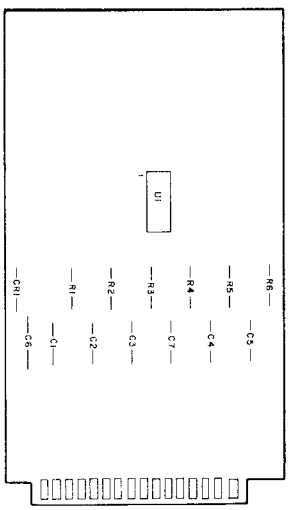
Page 7-21/722, Figure 7-9. Replace A4 schematic and component locator with the following:



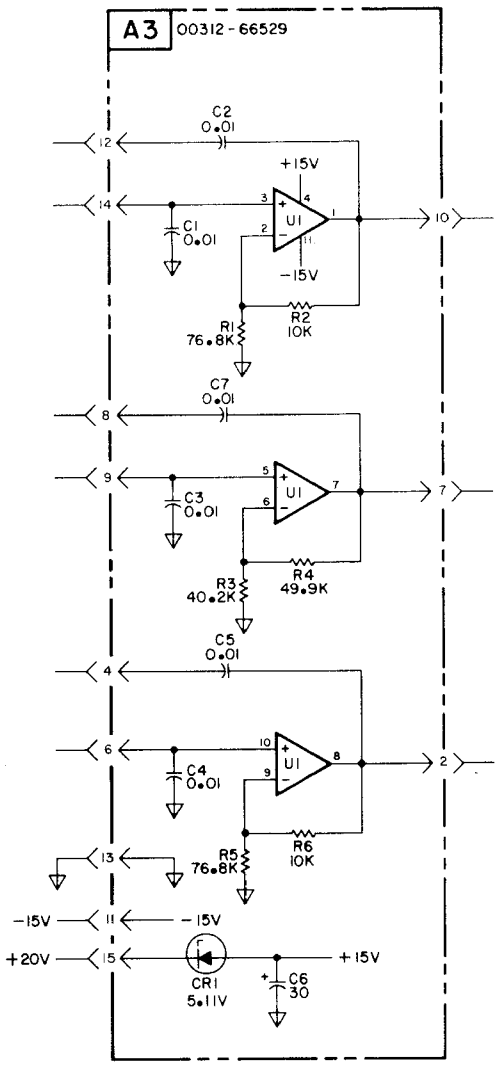


A4
Hp Part No 00312-66531
00312-66530

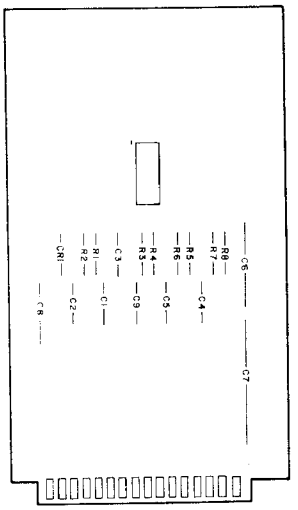
Page 7-23/7-24, Figure 7-10. Replace A3 schematic and component locator with the following:



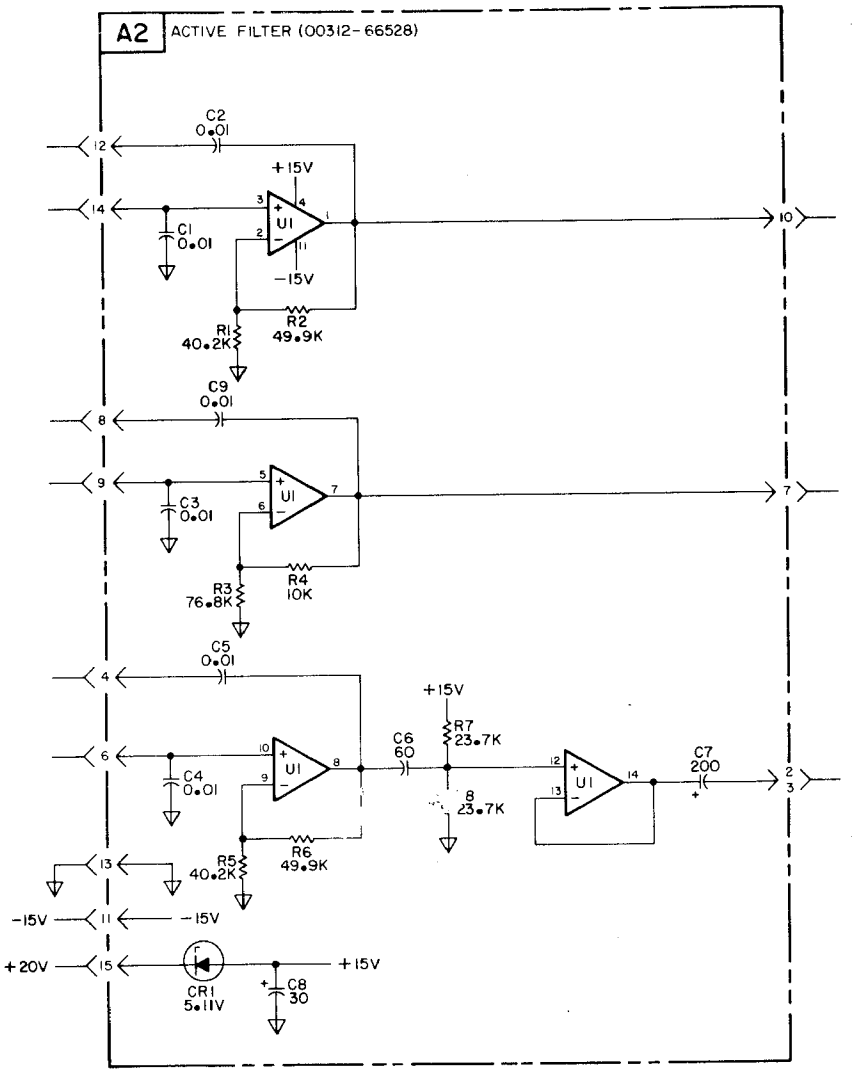
A3
hp Part No 00312-66529



Page 7-27/7-28, Figure 7-12. Replace A2 schematic and component locator with the following:



A2
hp Part No 00312-66528



ERRATA.

Page 6-40, Table 6-3. Change the part number of U1 to 1826-0181

Page 7-11/7-12, Figure 7-4. Change value of A32C12 to 2.2 pF.